



Deltas in Times of
Climate Change
Rotterdam 2010

Connecting world science and deltas



Meeting report

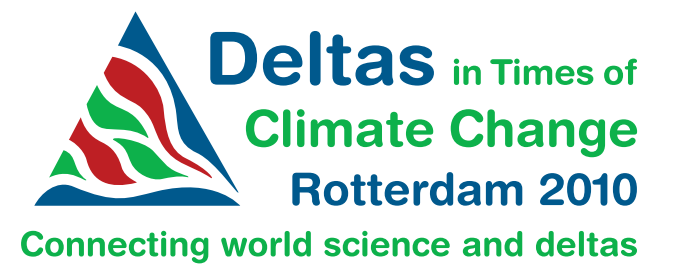
International conference
Rotterdam, the Netherlands
29 September – 1 October 2010

Meeting report

Deltas in Times of Climate Change

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We are proud to present the comprehensive report of the first international delta conference Deltas in Times of Climate Change in Rotterdam. The three day conference that took place in Rotterdam from 29 September - 1 October 2010 was a tremendous success. The conference attracted over 1.150 participants from all over the world and from different backgrounds: science, policy and practice. The participants debated climate adaptation strategies for deltas and delta cities and exchanged knowledge, which was widely offered in 70+ sessions. Many contacts between scientists, policy makers and practitioners were established, refreshed and deepened. Relations between delta cities in and outside Connecting Delta Cities (CDC) were strengthened and the Delta Alliance was launched.

High profile guests during the opening session included His Royal Highness the Prince of Orange, who gave the opening speech, Nguyen Thai Lai (Vice Minister, Ministry of Natural Resources and Environment, Vietnam), Ahmed Aboutaleb (Mayor of Rotterdam), Delta Commissioner Wim Kuijken and Cedric Grant (Deputee Mayor of New Orleans), who gave a moving presentation on the state of New Orleans five years after Katrina. The audience was updated on the state of climate change research by Michael Oppenheimer (Princeton University, USA) and Martin Parry (Imperial College London, United Kingdom). Pavel Kabat (Climate changes Spatial Planning, the Netherlands) gave a presentation on Dutch climate research and Malcom Smith (architect at ARUP, United Kingdom) triggered the audience with a few challenging thoughts. The opening session was closed with the Deltas of the Future Award Ceremony.

New ideas were shared and innovative thoughts surfaced during the three day conference. These include:

- An integrative approach is essential for deltas to adapt to climate change
- Climate adaptation offers an abundance of economic opportunities, i.e. mass retrofitting and innovative building and architecture
- Megacities with subsidence are extra vulnerable to climate change
- Competing land claims will continue
- We already have the techniques, we should focus on their application
- We do not lack knowledge as much as skilled people who can practically apply adaptation measures
- Health issues related to climate change are neglected
- Delta cities refuse to wait for their governments to take action: they set up their own bilateral, urban and private initiatives
- Delta cities demand a formalised position in the allocation of international funds

The conference was hosted by two Dutch research programmes, Climate changes Spatial Planning and Knowledge for Climate, and the City of Rotterdam. It was supported by C40 Large Cities Climate Leadership Group (a group of the world's largest cities committed to tackling climate change) and the Co-operative Programme on Water and Climate (CPWC).

We would like to thank all sponsors, presenters and participants for their contribution to a successful conference.

For a complete overview of session reports, photos, audio and video transcripts please visit our website at www.climatedeltaconference.org.

On behalf of the Organising Committee,

Florrie de Pater
Chair Organising Committee





Plenary opening session

Chair **Baroness Barbara Young of Old Scone, member of the House of Lords, UK Parliament, United Kingdom**

Speakers
Ahmed Aboutaleb, Mayor of Rotterdam, the Netherlands
His Royal Highness the Prince of Orange, the Netherlands
Dr. Nguyen Thai Lai Minister of Environment, Vietnam
Wim Kuijken, Delta Commissioner, the Netherlands
Cedric Grant, Deputy Mayor New Orleans, United States
Prof. Michael Oppenheimer, Princeton University, United States
Prof. Martin Parry, Imperial College London, United Kingdom
Prof. Pavel Kabat, Wageningen University, the Netherlands
Malcolm Smith, architect ARUP, United Kingdom

Presentation **Award Ceremony Delta City of the Future**

Over 1.200 participants engaged in the opening session of the conference Deltas in Times of Climate Change on Wednesday 29 September. The conference focused on exchanging knowledge, strengthening relations between delta cities and exploring links of science-policy-practice.

The plenary session was moderated by Baroness Barbara Young of Old Scone – “moderating means telling people that they must not run over their time”, she joked. Seriously she continued: “Collaboration and action is important to prepare and become more resilient in the case of climate change”. She gave the floor to Ahmed Aboutaleb, Mayor of Rotterdam.

He welcomed the participants in his city. He said that “networking is not the same as not working”. On the contrary. “The problems we face are global, beyond our own disciplines and they call for a multidisciplinary and international approach”. He is glad with the choice of the organization to hold the conference in his city “because this is a recognition of the ambition of Rotterdam to become the world’s leading blue-green economy. If you’re looking for knowledge of or different types of water management, and you cannot find it in Rotterdam, it simply does not exist.”

After the Mayor, his Royal Highness the Prince of Orange gave the audience a view in his commitment with the subject. He spoke about the importance of the conference at this moment. He was delighted with “the new Deltaprogramme that enables the Dutch to face the future with confidence.” He emphasized the importance of managing water in the deltas by pointing at water related disasters just recently in European, Asian and South American countries. And not only flooding, “also the shortage of water”, he said. “Look at Russia that is hit by devastating fires, caused by drought”. The Prince mentioned the Dutch National Waterplan with its special chapter about global water problems, called Water Mondiaal, with three themes that play a central role. “Exchanging knowledge, helping solving problems

in other countries and strengthening the Dutch Water sector.” He focused on the challenge of adaptation to climate change – “urgently needed”– in which “water plays a pivotal role that many politicians have yet to recognize”. The costs of adaptation are high but are greatly “outweighed by the benefits”. He made links with the UN Framework on Climate Change and spoke out his hope of a success in Cancun. “We have to develop adaptation strategies, tailored to the need of each delta. We can get started with no regret measures which have a positive impact on development and are climate proof. To do this we have to create innovative funding mechanisms as a foundation for adaptation in water management. And that requires political will”. He ended his speech by inspiring the participants to work together, “joint efforts of this conference will bring us a step closer to a safe and prosperous future of the worlds’ deltas.”

Nguyen Thai Lai, vice minister of the Ministry of Natural Resources and the Environment of Vietnam told the conference participants about the situation in the Delta of Vietnam. He said he was delighted with the progress that is already made in cooperation with the Netherlands. “I would like to encourage everybody here to make this conference a platform for global partnership of delta countries, where knowledge and technology for adaptation measures meet.” He made a pledge for more international collaboration.

The first Dutch Delta Commissioner Wim Kuijken spoke of his worries about the development of the worlds delta’s. Delta cities all over the world are expanding enormously, in terms of economical values as well as in terms of population. He focused on the Netherlands and said that the main issues in Holland are flood risk management and fresh drinking water supply. He explained his role as Deltacommissioner, the importance of the Deltaprogramme “which is not a programme to respond to disasters, but to avoid them.” This requires political courage. There is time, but the Dutch have to start now to prepare the Netherlands for climate change. Measures will not only involve dikes or barriers, but will also have to do with sustainability that integrates spatial planning. “Measures on safety but also on environmental qualities.” Kuijken talked about dealing with uncertainties about climate change. “This requires knowledge, science and a new way of planning: adapted delta management.” The results are maximizing flexibility, keeping options open and avoiding lock-in. Before he introduced the audience to the Deltaprogramme film, he stated that the Netherlands work with the five dutch d’s: “Deltaprogramme, Delta decisions, Delta fund, Delta act and the Delta commissioner. It appears to be a nice and valuable export product.”

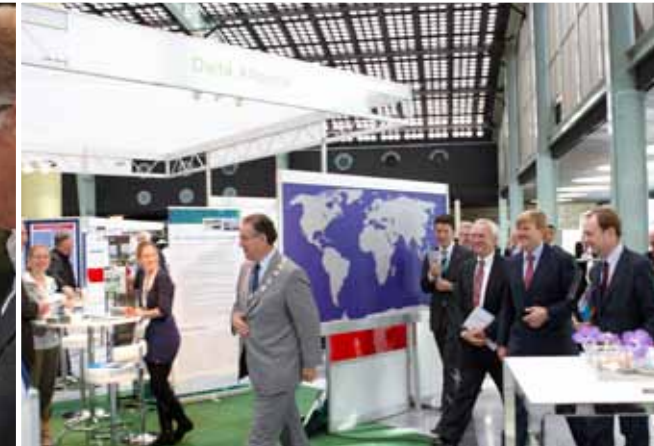


Cedric Grant, Deputy Mayor of New Orleans, gave an, on occasions emotional speech about New Orleans, five years after the city was hit by a hurricane and was completely flooded. He opened quite direct: "It is often been said that the only thing we learn from history is that we do not learn from history. We, meaning the audience, have the power to change that, the question is: are we willing in doing so?" He memorized what happened five years ago in New Orleans after Cathrina and talked about the weather and hurricane extremes that are ahead of New Orleans. "Looking to the future, we must prepare for the unpredictable impact climate change will have on coastal communities like New Orleans (...) It is not only a matter of our way of life, it is a matter of life and death. The dangers are so clear." Grant stated that for all coastal communities it is not only a question of survival, it is about sustainability, about redemption, it is about getting things right, for now and for generations to come. He remembered 1965 "Hurricane Betsy in 1965 was the last storm" with great impact. "Hurricane Cathrina was a rude awakening to the dangers we face." Three years later hurricane Gustav showed how little was learned. New Orleans was spared but communities further inland were hit; Louisiana's wetlands are the fastest disappearing in the world. With this, a natural defense is vanishing. Since 1930 over 100.900 square miles of wetlands is gone. "By the time I finish this speech, another acre will have vanished." He said the solutions are known but "now we need the will and the resources. The world's economy cannot exist without coastal and delta communities; we are gateways." About climate change he is very clear: "As the earth warms, water level rise. That is a matter of science, not an opinion". He ended his speech almost in a moral pledge: "We have been here before, we faced challenges as large and difficult and we have overcome. Again and again the world has been tested. And together we will find a way to make one."

After the presentations of politicians, directors and royals, the scientific world gave a state of the art. Michael Oppenheimer explained the increasing risks for delta's caused by melting ice sheets and sea level rise. Martin Parry gave the IPCC perspective on delta's in times of climate change. And Pavel Kabat talked about climate proofing in the Netherlands – how a country below sea level can adapt to climate change.

The plenary opening session ended after the words of Malcolm Smith, director of ARUP, and with the presentation of the Delta City of the Future award. Journalist Tracy Metz was the chair of the jury. She explained the way this 24-hours contest was held "it ended in a pressure cooker in Rotterdam". She invited Malcolm Smith to be her assistant and he opened the envelop with the name of the winning team: the team of David Garcia Studio, Denmark. The price entails support till 2011 by a creative team to help developing the teams concept. Metz: "And you will have access to the state of the art knowledge in Holland on water management till 2012. And you will be giving a key-note presentation in 2012 in Rotterdam during the international water festival Dutch Delta Design."

The team designed floating residential areas outside the dikes of 50 x 50 meters, several levels high. Parcs are situated in the lower levels and modular elements can be attached to these floating residential areas. The floating platforms can easily be transported to other delta areas. Metz: "The jury was particularly taken by the flexible floating plug-ins, incremental, multipurpose, static and dynamic at the same time – one of the true characteristics of future proof design."





Deltas in Depth Theme 1: **Regional climate, sea level rise, storm surges, river run-off and coastal flooding**

DD 1.1

Session DD 1.1: Sea level rise, storm surges and coastal processes (part 1)

Chair

Prof.dr. Wilco Hazeleger, Royal Netherlands Meteorological Institute, KNMI, the Netherlands

Keynote speaker

Dr. Jonathan Gregory, Hadley Centre and University of Reading, United Kingdom

Speakers

Dr. Aimée Slangen, IAMU, the Netherlands

Dr. Douglas Meffert, Tulane University, United States

Prof.dr. Roger Falconer, Cardiff University, United Kingdom

Dr. Kathleen McInnes, CSIRO, Australia

Dr. Caroline Katsman, KNMI, the Netherlands

Prof.dr. Hans von Storch, GHSS Research Center, Germany

Dr. Gladys Bernal, National University of Colombia

This theme promises to be an exiting journey, predicts chairman Wilco Hazeleger (Royal Netherlands Meteorological Institute, KNMI), with ‘visits’ of deltas all over the world to investigate and discuss regional sea level rise, storm surges and coastal flooding. Jonathan Gregory of the Hadley Centre (University of Reading, United Kingdom) kicks off with a keynote on the projection of global and regional sea level change for the 21st century. The various graphs and figures displayed by Gregory indicate that, no matter what models are being used, sea levels are expected to rise and glaciers to melt. While budgets for research are being cut, phenomena like the so-called ‘ice sheet processes’ appear to be very promising in explaining sea level rise. Gregory advises that, given the expectation that researchers will not be able to make precise projections by the time of writing the IPCC AR5 report, options are to be kept open. Aimée Slangen argues that sea level change is not a uniform process and there are several causes for variability. As a consequence cities located in deltas should be well aware of their specific circumstances, projections and measures. This argument of spatial variability sets the stage for the other presentations and discussions in today’s session and that of the day after.

Caroline Katsman highlights another intriguing phenomenon, by asking herself why upper ocean heat content rise pauses. She argues that the heat goes into the deep and into space. She predicts, however, that these pauses will become rarer as time goes by. In a lively discussion that follows, possibilities and effects of aerosols, evaporation and precipitation, as well as other time scales for the model are being discussed with the audience.

Today's session features a wide variety of deltas and regions, ranging from the Mississippi Delta (Douglas Meffert), the Severn Estuary (Roger Falconer), Tasmania (Kathleen McInnes), and Hamburg (Hans von Storch) to the Caribbean Coast of Colombia (Gladys Bernal).

The session is concluded with pitch presentations of the posters that are available in the main hall of the conference venue, 23 floors below. In the mean time, many of this session's presentations have made it to the twitter fountain, before the presentations were even finished.

DD 1.2 **Session DD 1.2: Sea level rise, storm surges and coastal processes (part 2)**

Chair **Prof.dr. Wilco Hazeleger, Royal Netherlands Meteorological Institute, KNMI, the Netherlands**

Speakers **Sarafat Khan, Bangladesh Water Development Board, Bangladesh**
Kellie Adlam, University of Sydney, Australia
Dr. Maarten Kleinhans, Utrecht University, the Netherlands

Sarafat Khan points out how the vulnerable delta of Bangladesh is being affected by inundation, drainage congestion in the polders and increased salt intrusion and urges immediate action by researchers and policy makers.

The other two presentations in today's short session highlight the historical perspective. Kellie Adlam gives an interesting overview and analysis of how the Tiber Delta has developed through time and how the present shoreline came into being, concluding that much uncertainty will remain about the future development.

Maarten Kleinhans then explains why river bifurcations are unstable, except for unexceptional and dangerous conditions. With a fascinating presentation, including beautiful historical maps and instructive graphs, Kleinhans points at the effects of bifurcations that must be found both downstream and upstream.

Looking back at today's (part 2) and yesterday's (part 1) session on regional sea level rise, storm surges and coastal flooding, it can be concluded that each region and delta has its unique circumstances, threats and solutions and that a historical perspective really does contribute to understanding the dynamics of those deltas.

DD 1.3 **Session DD 1.3: Precipitation, discharge and flooding (part 1)**

Chair **Andreas Sterl, Royal Netherlands Meteorological Institute, KNMI, the Netherlands**

Speakers **Tim Reeder, Environment Agency, United Kingdom**
Sa'adatu O. Abatemi-Usman, University College London, United Kingdom
Dr. Kim Cohen, Utrecht University, the Netherlands

The session starts off with a keynote speech by Tim Reeder (United Kingdom Environment Agency) on the Thames estuary. After a fascinating historical perspective, Reeder goes into the TE2100 project. This project focuses on managing flood risks in the Thames and is the first major project in the United Kingdom to put adaptation to climate change into practice. Uncertainties will remain and play an even greater role in the future, but Reeder is convinced nonetheless that the plan is adaptable to future climate change.

Sa'adatu O. Abatemi-Usman (University College London) then gives a presentation on the climate extremes and flood occurrence in the coastal areas of Nigeria. Passionately, she illustrates and explains how and why adaptation to climate change in this region is connected with food security, health and poverty. Moreover, it becomes clear that these are not things of the future, but they are real and urgent. Immediate action is required. The audience is touched and intrigued.

With the help of a richly illustrated presentation, Kim Cohen (Utrecht University) takes the audience to the Rhine Delta and looks at it from a historical perspective. It shows the 'life' of this major river, that runs through the city in which the presentation is being held, and supplies a look into the future of other deltas.

The session is closed off with pitch presentations of the posters.



DD 1.4**Session DD 1.4: Precipitation, discharge and flooding (part 2)****Chair**

Prof.dr. Wilco Hazeleger, Royal Netherlands Meteorological Institute, KNMI, the Netherlands

Keynote speaker

Dr. Klaus Görgen, CRP – Gabriel Lippmann, Luxembourg

Speakers

Otto de Keizer, Deltares, the Netherlands
Alexander Bakker, Royal Netherlands Meteorological Institute, the Netherlands
Dr. Elena Dolgoplova, Institute of Water Problems, Russian Academy of Sciences, Russian Federation
Miga Julian, Institut Teknologi Bandung, Indonesia
Herbert ter Maat, Alterra, Wageningen UR, the Netherlands

Keynote speaker Klaas Görgen (CRP – Gabriel Lippmann) presents the Reinblick2050 project, in which an assessment of climate change impact on the Rhine river basin is made. An ensemble is composed, in which different projections are combined in order to develop a common, consistent research framework and compile heterogeneous information from different models into applicable knowledge. Whereas among the individual models the variation in outcome was large, now, according to Rheinblick2050, a general tendency can be observed. The relative change in mean discharge resulting from this ensemble is as follows: in the near (until 2050) and far future (until 2100), an increase in precipitation is expected, and while winter discharge is predicted to increase, summer discharge might decrease because of future climate change. Of course a certain band width needs to be considered.

In predicting the influence of climate change on river regimes, it is often assumed that the relative change in mean discharge can be extrapolated to determine the change in extreme peak discharge. However, this assumption might be incorrect. In his study Otto de Keizer (Deltares) analyses these extremes by running an ensemble of regional climate models for the Rhine basin. Series of precipitation and temperature have been generated within the Rheinblick2050 project. The results showed a general tendency in discharge increase, in particular in the far future. Of course uncertainties become larger towards the far future and towards more extreme discharge. An active discussion about bias correction arises from the audience.

Alexander Bakker (Royal Netherlands Meteorological Institute) presents different ways to cope with biases in a model. He explains what the possibilities are: corrections can be made to the model output, and observed climate data and/or a stochastic weather generator can be transformed according to a climate change scenario (A1B). No firm conclusion is drawn about whether one of these methods is the best; in directly correcting output, hidden biases will remain and statistic properties can be biased. Correcting for one bias can thus give raise to another. The same accounts for transformation of observed data, although it is said that generally this contains fewer biases than the previous method. Weather generators are very flexible and can easily be adapted to new climate conditions. However, more complex relations in weather systems are hard to include. A preferable solution on how to deal with biases in a model has not been found.

Elena Dolgoplova (Institute of Water Problems) takes the audience on a small excursion away from the Rhine basin to climate influence in a totally different river setting: what is the influence of global climate change on the river mouths of the Arctic rivers of Russia? Briefly the factors controlling the Arctic rivers are discussed. Based on this we learn that warm water brought from upstream could cause the permafrost to partly melt, destabilising the river beds. Although at

the moment a large change in air temperature has not been observed, but still, further warming is expected to have a large effect on the Arctic river regime in the future. A suggestion from the audience: hydropower dams should be built in the rivers in order to regulate river discharge and keep the river beds as stable as possible.

Finally, another model study is presented by Herbert ter Maat (Alterra), in which the influence of changes in sea surface temperatures on precipitation is simulated. However, when running for the current situation, the model shows a constraint: especially in the summer months, during which precipitation consists mainly of convective showers, the amount of precipitation is underestimated.

It is discussed whether higher resolution modelling will contribute to better results in simulating the amount of summer rainfall in the Netherlands. Downscaling by using finer grid cells should capture these convective showers. However, although the model has been downscaled using several methods and some results are more consistent with reality than others, a very good match to current precipitation in the Netherlands has not been simulated yet.

As chairman Wilco Hazeleger (Royal Netherlands Meteorological Institute) points out, a returning subject in several presentations during this session seems to be that bias is obscuring the model results. Instead of refining models by adding processes which influence the climate, more attention should be paid to removing these biases in order to make our models applicable. Therefore a complicated and challenging task lies ahead of us.

DD 1.5**Session DD 1.5: Adaptation, risk and vulnerability****Chair**

Prof.dr. Marcel Stive, Delft University of Technology, the Netherlands

Keynote speaker

Prof.dr. Robert Nicholls, University of Southampton, United Kingdom

Speakers

Marten Hillen, Royal Haskoning, the Netherlands
Prof. Mohamed Abdrabo, Institute of Graduate Studies and Research - University of Alexandria, Egypt
Dr. Valentino Ciriello, University of Bologna, Italy
Freek van Leijen, Hansje Brinker BV, the Netherlands
Prof.dr. Jan Vermaat, Institute for Environmental Studies, the Netherlands
Prof.dr. Mohammed Rhaman, Chittagong University, Bangladesh
Niels Roode, Rijkswaterstaat Waterdienst, the Netherlands
Leo Kerpen, Province of Zuid-Holland, the Netherlands

The session kicks off by taking a closer look at three important delta areas: the Netherlands, New Orleans and Vietnam. The threats within these three areas, explains Marten Hillen (Royal Haskoning), are more or less similar. The costs of dikes per meter height vary (NL: 8 – 23 million euro, New Orleans: 5 – 8 million euro, Vietnam: 1 million euro). Real data show that costs hardly go up for increased sea level rise, as design costs and such are already the majority of the costs and these do not increase. Costs per country can best be estimated using real costs and adjustments for local indicators, such as economic factors.

In the discussion the linearity of costs is questioned. It might be the assumptions used. It would be interesting to perform an analysis with different assumptions. Data from the Delta Commission also show there might be a small non-linearity but not much.

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Land use in the area of Danietta in Egypt is very diverse: housing, agriculture, nature, etc. Mohamed Abdrabo (University of Alexandria) takes the diversity into account. In his study he includes not only the direct and indirect impacts of up to 0.45 m sea level rise, but also two population growth scenarios and two land use (built area) scenarios. Vulnerability increases with higher population growth and an increase in concentrated built up areas along the coast.

Subsidence is about 1 cm/year in in the area of Emilia-Romagna, says Valentino Cirello (University of Bologna). The scenario for a sea level rise of 220 cm in 100 years time includes tides, storm surges and subsidence. The correlation between rainfall and tide is found to be significant. It is thus concluded that expansion areas are needed to reduce peak discharges at the outlet of the river in order to reduce vulnerability. Current design plans already include these required expansions. Furthermore, it is shown that subsidence is the most important factor for the effects of sea level rise. Radar and satellites are used to measure the deformations of dikes in the Netherlands in millimeters per year, tells Freek van Leijen (Hansje Brinker BV). This is a new technique to measure the security of defense systems. Up to now the security of the defense systems was measured using sensors and visual inspections. 'Old style' five yearly evaluations of the dykes of the Netherlands show that 44 percent of the dikes meet the legal standard, 22 percent do not and on 34 percent insufficient information is available. The new satellite technique can cover all (above ground or sea) defense systems. Analysis of two years of data shows deformations of minus 10 to minus 6.5 mm or 7 to 10 mm per year. Moreover, deformation is shown to be a good indicator for dyke stability. The locations that show large deformations can easily be identified. After visual inspections measures can be taken very locally, saving expenses. The Dutch government wants to use this new technique for dyke monitoring. The technique could be applied all over the world. It can also be used to measure upcoming landslides.

From a number of studies it can be concluded that flooding itself is not worsening, but the impacts and consequences are, due to an increase of capital goods in flood prone areas, says Jan Vermaat (Institute for Environmental Studies). Vermaat looks at subsidence and vulnerability using two socio-economic indicators: population density and land area. Vulnerability can be measured with only a few system indicators. Not the flooding itself but the way we cope with flooding is decisive for the impacts.

In his knowledge exchange project Niels Roode (Rijkswaterstaat, Waterdienst) focuses on coastal erosion and flooding. It appears the precautionary principle is much more used in The Netherlands than in the United Kingdom. It is the perception of people that defines what is perceived as a safe coast. Lessons learned are: focus on existing dykes; management and development of the foreland; and make use of secondary dykes to use a risk based approach. The messages are: learn more from other countries; don't forget the questions of today; reduce uncertainties and make them explicit; and internalize probabilistic risk methods.

26 percent of the Netherlands is located below sea level and protected by the Deltaworks. Parts of the province of Zuid-Holland (South-Holland) are about 6.5 meters below sea level, while it is the most economic developed area in The Netherlands. There are six weak links in the dyke system that need strengthening, says Leo Kerpen (Province of Zuid-Holland). The weak links are strengthened right now by using a sand engine. The sand engine not only protects the hinterland, but also creates new land in a natural way. This is done by placing a super dune of sand, positioned keenly in sea. The sea will spread the sand to where it is needed. In this project it is important that governments at different levels, universities, private companies and nature organisations cooperate. The sand engine will replace regular artificial sand suppletion and will exploit natural forces instead of technical solutions. The sand engine creates new opportunities for recreation and nature. It is called 'building with nature'.



Deltas in Depth Theme 2: Freshwater availability under sea level rise and climate change

DD 2.1

Session DD 2.1: General picture

Chair Prof.dr. Eelco van Beek, Deltares/Technical University Twente, the Netherlands

Keynote speaker Prof. Gerald Galloway, University of St Maryland, United States

Speakers
Jill Slinger, Delft University of Technology, the Netherlands
Ruud Bartholomeus, KWR Watercycle Research Institute, the Netherlands
Lodewijk Stuyt, Alterra, Wageningen UR, the Netherlands
Marcel Paalman, KWR Watercycle Research Institute, the Netherlands
Rob Speets, Royal Haskoning, the Netherlands
Pauline Mollema, University of Bologna, the Netherlands
Jan Smits, Water Board Hollandse Delta, the Netherlands

In his keynote Gerald Galloway (University of St Maryland) explains the challenges for freshwater resources management in the United States. One third of the people live near the coast and is exposed to sea level rise. The threat of sea level rise for coastal freshwater supply is invisible for the public. As a result it is difficult to trigger change in attitudes and create the will to reduce withdrawals. In New York more water is needed in periods of drought from the Hudson River due to sea level rise. Sea level rise means also loss of coastal wetlands, such as areas near the Mississippi River. What are the adaptation strategies in coastal zone freshwater resources management? (a) Retreat, don't develop, go back; (b) Accommodation of salt water intrusion; (c) Protection. Galloway prefers to use a risk based approach in order to select the correct/best/acceptable strategy. The final decision should be based upon the trade offs of the strategy. Also other perspectives should be taken into account. Water supply solutions may be the correct one from the supply perspective but may not be the best solution from other perspectives.

Jill Slinger (Delft University of Technology) explains that estuaries in South Africa are situated in three climates: cool temperate, sub tropical and Mediterranean. It is a semi-arid region, and as a result water is scarce. In the study ecological freshwater requirements were assessed for various freshwater inflow scenarios. A dynamic model approach was used to model salinity and freshwater inflow in selected estuaries under climate change. A preliminary conclusion was that South African estuaries probably are more vulnerable to changes in waves and less to incremental sea level rise. More freshwater inflow is needed in future to maintain the current ecological quality.

Ruud Bartholomeus (KWR Watercycle Research Institute) states that groundwater recharge in dunes is currently poorly modeled, because the role of vegetation patterns and feedback mechanisms are not well taken into account. He stresses the importance of feedback mechanisms between increased CO₂ uptake and evaporation dynamics on vegetation level as described in the paper of Kruijt et al. (2008). Despite future droughts due to climate change the groundwater recharge in the Dutch dunes increases. This is due to feedbacks via vegetation patterns within the Dutch KNMI W+ scenario. Does this mean the drinking water supply companies are happy with climate change? It was questioned whether the study took into account the (positive) effect of eutrophication (vegetation growth), that reduces the assumed decline of vegetation. In the scenarios it was assumed that the level of eutrophication in future is comparable with the current situation.

The realization of the Delta Works did not only result in increased safety levels for the Rotterdam region, explains Jan Smits (Water Board Hollandse Delta). In addition freshwater reservoirs were created and the accessibility of the islands in the South West of the Netherlands was improved. The increase of freshwater availability has led to the cultivation of economically interesting crops such as bulbs. Horticulture in the delta area creates up to € 7 billion/yr euro income for the island and € 20 billion/yr around Rotterdam (greenhouse horticulture). Freshwater resources are one of the main assets of the Rotterdam Port. Freshwater inflow in the Netherlands is used for (a) sprinkling, (b) keeping water levels stable and (c) combatting salinisation. Freshwater shortage in the Netherlands is a distribution problem. In future Rotterdam has to fight against (embankments/dykes) and for water (water shortage).

Agriculture and water managers face EU Directives and climate change. In the Netherlands land drainage systems are too effective, says Lodewijk Stuyt (Alterra). As a result agriculture and water management have to cope with water shortages in summer, salinisation and leaching nutrients. A drainage contractor and a committed farmer introduced 'controlled, composite drainage systems'. However, scientists never believe a system, until research has proved its effectiveness. The claimed success of this controlled drainage is (a) water conservation, (b) higher crop yields, (c) groundwater storage and (d) improved use of nutrients. Alterra developed a model to verify these claims and monitored to verify the model. Farmers are enthusiastic about controlled drainage, also because they don't depend on the regional and national institutions for water management. The policy makers like it because of the positive impact on the EU Water directive. Policy makers want to use controlled drainage also to combine agriculture with nature. However, we have not yet enough field scale measurements to verify the success of this new policy. The costs of controlled drainage are higher for the farmer but crop yields go up.

The polders between the coastal dunes and secondary dunes (inland) in the Po Delta are more or less comparable with Dutch polders, however the climate is different, explained Pauline Mollema (University of Bologna). She took that into account in her model approach by comparing a continuous recharge rate a year and a discontinuous recharge rate (0 in summer and .4mm/d in winter (both total 136 mm/d). The discontinuous recharge rate is characteristic for a Mediterranean climate.

Rob Speets (Royal Haskoning): Water balances were made for pilot regions, including local insights from stakeholders regarding solutions for a climate proof freshwater supply in the Dutch fen meadow area and deep lying reclaimed areas in the Randstad and surroundings. Water management can be made more flexible in the deep lying reclaimed areas compared to the fen meadow areas. The study shows a knowledge gap regarding impacts of climate change on water quality.

DD 2.2**Session DD 2.2: Freshwater availability under sea level rise and climate change: Freshwater supply and salinisation in developing countries****Chair** Prof. Gerald Galloway, University of St. Maryland, United States**Keynote speaker** Dr. Asif Mohammed Zaman, Institute of Water Modelling, Bangladesh

Speakers

Zahidul Mamun, Concern Universal, Bangladesh
 Dr. Samia El. Guindy, Egypt
 Mohammed El Bastawesy, NARSS, Egypt
 Wouter Wolters, Alterra, the Netherlands
 Prof.dr. Pieter Stuyfzand, KWR Watercycle Research Centre, the Netherlands

In the Khulna region salt water is coming further inland, stated Asif Mohammed Zaman (Institute of Water Modelling). Salinity peaks in summer and then flushes out during the monsoon. On yearly average the salinity is 140 days above the threshold for freshwater supply (1 ppt Chloride). The Asian Development Bank started a project to make salinity projections under climate change up to 2050. Integrated socio-economic and climate scenarios were developed, feedbacks were excluded. They used three models, a regional climate model (RCM), a salinity model and an urban drainage model. Data collection included physical but also socio-economic variables. The results: freshwater inflow slightly decreases but not significantly. However, the salinity levels increase significantly in the region under business as usual and more rapidly under climate change scenarios. They focused on 15 percent probability values: the number of days that the threshold (1 ppt chloride) is exceeded. Measures for solutions were evaluated by cost benefit analysis, also social criteria were included. The best option was the construction of a pipeline (based on economic and social criteria) and reallocation of some inlets. A freshwater reservoir was more expensive and a lot of people would have to move. Recently also new research was started at Dhaka for underground (aquifer) storage of rain water. The preliminary idea is to catch rainfall from the roofs.

Zahidul Mamun (Concern Universal) presents a NGO action programme for water supply in a disaster-prone area, the coastal zone of Bangladesh. Local people have to cope with cyclones, salinity intrusion and flush floods. In a new study it was stated that there are 4.5 million Climate Refugees in Bangladesh. The objective of the NGO is to develop disaster friendly water and sanitation measures. The project is paid by governments and international NGO's but also by some private entrepreneurs (for example Coca Cola). The action programme wants to provide water and sanitation facilities at schools and promote 'community based water supply'. Zahidul shows pictures of very simple measures to improve sanitation infrastructure at community/household level, such as pumps (without electricity supply) to pump water to reservoirs that are above the flood level. Up to fifty people can make use of such a pump. They developed a calendar with options for disaster proof water sanitation and distributed that among the local people.

Egypt is a gift from the Nile: 95 percent of the people live on 5.5 percent of the land, the delta. It is a challenge to maintain the current agricultural land in operation, says Wouter Wolters (Alterra). Agriculture is the main water user (>80 percent), but drinking water and industry have higher priority in the water management. Egypt faces the following challenges: population increase, expansion of agriculture and economic development. Freshwater demand exceeds supply. The presented project includes a Dutch-Egyptian co-operation, which started in 1976. It started as a technical

project. However, currently the project also includes policy advice and training programmes. Water quality is a major issue in Egypt. When the water quality is bad, water scarcity is high.

The water supply in Egypt is 55.5 billion cubic meters (BCM) from the Nile and 1.3 BCM from precipitation. Climate change impacts include floods, droughts, sea level rise and deterioration of water quality. In the Nile basin a 10 percent rainfall reduction results in 30 percent lower river discharge of the Nile. Under different scenarios water for agriculture may remain stable, increase or decrease. However, Egyptians should take into account that there are limited options to cultivate more agricultural land. Productivity should increase but even then import of food remains necessary.

Mohammed El Bastawesy (NARSS) uses satellite images to map the water ditches and the land use. The maps make a distinction between irrigation and drainage ditches. Some ditches disappear during time (silted up). Farmers make alternative ditches. Also 'paleo ditches' were traced down by both satellite images and in research. Those 'paleo ditches' still influence local hydrology and ground water quality. About 6.1 BCM/yr are annually extracted from the aquifer for irrigation, municipal and industrial freshwater supplies.

Aquifers are a natural storage vessel and a natural mixing vessel, explained Pieter Stuyfzand (KWR Watercycle Research Centre). A 'cure all' because they are safe from earthquakes, nuclear waste, etc. The water quality can easily be maintained at a (high) constant level compared to surface water. Aquifer storage recovery (ASR) can be coupled with geothermal heat exploitation. Aquifer storage can be applied in brackish aquifers. Aquifer water passage and infiltration can replace chemical and physical water quality treatment. Several ASR techniques are applied in the Netherlands, and used even more in other areas in the world. However, there are also problems: clogging of recharge basins and wells, rise of ground water tables, damage to cellars of houses. Use of ASR may result in anoxic conditions and formation of iron-clogs. Another issue is the accumulation of pollutants in (coastal dune) systems, for example heavy metals. We should also avoid the leaching of valuable aquifer compounds such as CaCO₃, a buffer for acidification. Some leaching processes are speeded up by ASR. Message: Aquifer storage is a very nice solution, but... you should do it in a very proper way.



DD 2.3**Session DD 2.3: Salinisation in South-West Netherlands****Chair** Prof.dr. Eelco van Beek, Deltares/Technical University Twente, the Netherlands**Keynote speaker** Prof.dr. Sybe Schaap, Delft University of Technology, the Netherlands

Speakers

les de Vries, Deltares, the Netherlands
 Steven Visser, Province of Zuid-Holland, the Netherlands
 Gualbert Oude Essink, Deltares, the Netherlands
 Stephanie Janssen, Deltares, the Netherlands
 Perry de Louw, Deltares, the Netherlands
 Sara Eeman, Wageningen University, the Netherlands

Currently Sybe Schaap is professor at Delft University of Technology, but in his previous function he was president of Water Board Groot Salland. Drawing from the experience of his former job, he talks about the strategy of the past and how it compares to new strategies. The old strategy included discharge water in times of water (over)abundance and pumping it in in times of scarcity. In 1998 there was heavy rainfall: the system could not handle the excess amount of water, which resulted in inundations. Old landscapes were less damaged compared to recently created agricultural land. This was due to the fact that in the older landscapes differences in height were created in the past. The inundations resulted in a new Water Act in 1998. The objective of this new act was to store the water (in the soil) as long as possible. Is this Water Act EU proof and/or climate proof? Sybe Schaap shows some pictures of the city Kampen that illustrate the impacts of 1:10, 1:25 and 1:100 year flood risks. The water board decided to change the ditch profiles to increase storage. The new profiles are beneficial to agriculture in periods of drought. The new ditches were ecological friendly designed and should also result in improved biodiversity values. In order to construct the new ditches agricultural land was used, the entrepreneurs were compensated by paying 50.000 Euro an acre. The project taught us that there is need for a better institutional structure and leadership to implement climate change adaptation measures.

The Provinces Zuid-Holland (South-Holland) and Noord-Brabant (North-Brabant) benefit from freshwater reservoirs in the southwest delta, says Steven Visser (Province of Zuid-Holland). Before 1970 it was only possible to produce grain. Recently fruit, flower bulbs and so on have been successfully cultivated. Farmers and horticulturists became more depended on freshwater. However, the freshwater reserves in the South-West Delta are salinating. Freshwater inflow from the rivers should prevent external salt water intrusion (via the sea) at the local freshwater inlet points (for example Bernisse and Gouda). Lake Volkerak-Zoom has a problem with blue algae. The best way to combat the blue algae is salinisation combined with the return of tidal movement. This is the view of the national policy makers. However, a new salt lake in the area has a major impact on freshwater intake. Extensive consultation with stakeholders and (co) decision makers was done in 2008/2009. The result was a report (June 2009), which includes 18 measures to maintain freshwater dependent functions in the areas around the lake. These measures ensure freshwater availability in the region for the coming decades. In the long run more measures are necessary but we have some time to think about it.

Are the presented measures climate proof, is the question posed by les de Vries (Deltares). Schouwen-Duiveland represents the old situation. The areas of the Volkerak-Zoommeer are fed with water from elsewhere (Rhine water), up to 100 percent. Currently there is no water shortage. The regions have a high service level at low costs. Now what

about the future? In this study the researchers composed a scenario analysis for the years 2003, 2015 and 2050. Major conclusion: flushing the system with freshwater is very inefficient: only 3 percent is used for sprinkling. Climate change is not the problem for water managers. The problem is the inefficiency of the system. The 'Resisting strategy' and 'living with salt water' strategy can both be made climate proof. The resisting strategy will require big investments in infrastructure and the water supply remains a public service. The 'living with water' strategy may lead to a private market for freshwater. In the latter one we have two sub-choices: (1) more salt tolerant crops, or (2) implement water technology.

Guy Oude Essink, (Deltares: flood.firetree.net), states that from a ground water perspective the past determines the future. Past reclamation of polders will determine the future characteristics of salinisation. The future boundary conditions are sea level rise, groundwater recharge and land subsidence. The researchers would like to assess the (un) feasibility of regional measures to stop salinisation. Local solutions are easier to embed than regional measures.

Stephanie Janssen (Deltares) presents a case study of freshwater resources in Zuid-Beveland/Zuid-Brabant (both impacted by a decision to make lake Volkerak-Zoommeer salt). Field trips are essential for social learning. It is important to take time to get commitment. People participating in stakeholder processes should be aware of the role of the process and the role of the participants. The regional solutions were taken up in the advisory report (June 2009). les de Vries states the researchers were successful to legitimate the salinisation of Lake Volkerak-Zoommeer towards farmers. The current problems are not with the farmers but with the regional policy makers and the drinking water sector.

What is the impact of salinisation on surface water and on water in the root zone, asks Perry de Louw (Deltares) in his presentation. His study delivered chlorinity profiles (e.g. soil depths) for different areas, also profiles with time steps. The study included EM measurements to map the fresh-saline interface with a helicopter jointly with Germany. Model analysis included the use of KNMI scenarios (W+). Also calculations about the thickness of the rain water lenses under climate change were done. Rain water lenses are very vulnerable to climate change.

Sarah Eeman (Wageningen University) presents her research findings. In her research she first did a steady state model exercise to assess the dynamics in freshwater lenses. But the system is not dynamic (second part of the research). That is why a SWAP analysis was done in addition. Crop damage in this study is defined as a decrease in plant transpiration compared to potential transpiration. No irrigation was done in the simulation (e.g. comparable with Schouwen-Duiveland). Analysis was done for a dry and wet year. The results were compared with a case study in the North of Italy. Sensitivity to oxygen and salinity stress seems to increase strongly when the climate gets warmer. Solutions for disappearing rain water lenses are part of new research within the Knowledge for Climate programme.



Deltas in Depth Theme 3: Climate change and estuarine ecosystems

DD 3.1

Session DD 3.1: Climate change and estuarine ecosystems

Chair

Prof.dr. Peter Herman, Netherlands Institute of Ecology, NIOO, the Netherlands

Keynote speaker

Prof.dr. Hans Paerl, University of North Carolina at Chapel Hill, United States

Speakers

Manfred Meine, Hamburg Port Authority, Germany

Dr. Shadananan Nair, Nansen Environmental Research Centre India, India

Eva-Maria Bauer, Federal Institute of Hydrology, Germany

Mick van der Wegen, UNESCO-IHE, the Netherlands

Dr. Maminul Sarker, CEGIS, Bangladesh

Prof.dr. Karl Flessa, University of Arizona, United States

Henriette Stoop, CSO Adviesbureau, the Netherlands

Dr. Verónica Zagare, Delft University of Technology, Argentina



Estuaries are alike in many aspects, but differ in many others as well. During this session the different problems of estuaries worldwide are discussed.

The river Neuse system in the United States drains half of North Carolina's land. The coastline is shaped by the many storms it faces. Prof.dr. Hans Paerl (University of North Carolina) explains that it is a challenge to study climate disturbances and their impacts on human interests. For example, climate change leads to more storms, which will negatively affect water quality. The storms supply the river with many nutrients, but so do human activities. The resulting algae bloom leads to decreased water quality. Natural buffers have proven to be a solution to this problem.

The Elbe estuary in Germany is changing too, naturally and by human causes. A part of the tidal area is lost due to diking, which means more tidal energy reaches the harbor. The upstream flows are stronger, which means sediment is transported upstream. If you add that up the intensified periods of drought due to climate change, a bigger dredging effort in the port of Hamburg is required. Giving the estuary more space may be part of the solution. Another alternative is to catch the sediment in so called sediment traps before it reaches the harbor.

The main issue in India is the fact that the economy and rural life are closely tied to the climate sensitive natural resource base. The country faces numerous environmental problems. Unfortunately the implementation and regulation of environmental policy add to those problems, says dr. Shadananan Nair (Nansen Environmental Research Centre India).

In Germany, Eva-Maria Bauer (Federal Institute of Hydrology) is researching vegetation shifts in estuaries due to climate change. The focus lies on key species, and the effect natural and anthropogenic disturbance might have on them. Further research will show whether mowing can be used as a tool to strengthen reed vitality, and thus control erosion.

Mick van der Wegen (UNESCO-IHE) is modelling the morphodynamic evolution of estuarine rivers. Starting with a basic model river (almost linear) he modeled the evolution of a river. He showed the results using a film of how the river evolved into a stable system. Van der Wegen also studied the effect of sea level rise on his model river. After 500 years the river evolved in an importing system, with sandbanks moving upstream and a deepening of the basin.

Sea level rise is also the subject of a study in Bangladesh. With a low slope gradient one would conclude Bangladesh is very vulnerable to sea level rise. Maminul Sarker (CEGIS) explains that in the past there have also been sea level rises. Historical sea level rise caused the river to respond. When the sea level rises, the rivers deposit sediment to keep up with the rise. This sounds like a perfect solution, however, there has to be enough sediment available. Also rivers have a response time which is not instantaneous.

The Colorado river estuary faces problems of a different nature. The river water does not reach the estuary. The river has been dry since 1960, caused by dams and the use of water mainly by agriculture. Prof.dr. Karl Flessa (University of Arizona) used carbon and oxygen isotope measurements on historical, skeletal remains of fish. The success of fish species *Totoaba* indicated historical differences in available water. Calculations have been made for the amount of water needed to restore the riparian zone and for the entire habitat. Five percent of the total river discharge is needed for full restoration, an amount of water which is not (yet) available.

In Bangladesh, the problems of a rising sea level could be tackled by the natural response of the river by sedimentation. In The Netherlands, that is much more difficult. The river and sea do not get the chance to reach the subsiding soil. Henriette Stoop (CSO Adviesbureau) therefore researches an ambitious idea: whether it is possible to change land functions over time to give the low lying areas the chance to accumulate sedimentation. To kick-start the sedimentation process, low lying areas are opened up, changing their function from traditional agriculture to nature or marine agriculture. After sedimentation the area can turn back to agriculture. If this process is gradually done around the entire coast, a great reduction of salinisation can be accomplished.

Where sediment is a (potential) solution to the problem of sea level rise in the Netherlands and in Bangladesh, it poses a problem in Buenos Aires. The sediment flow from the Parana river hardly reaches the harbor of Buenos Aires. Other problems are intensified by climate change. Every year there are floods, caused by river discharge, or by El Nino. Adding this up to relevant socio-economic issues makes adapting to climate change in the estuary a complex problem.

The chair, prof.dr. Peter Herman (NIOO), concludes the session very strikingly. In all the different presentations of the estuaries we have seen many different problems. Not one estuary was the same, there is not one delta. Furthermore, not only the hydrological/physical aspects play a role. The relevance of these aspects differs in different deltas, but in every case it is clear that the social aspects play a major role.

DD 3.2

Session DD 3.2: Impact of climate change on estuaries round the world (part 2)

Chair

Dr. Hans Paerl, University of North Carolina at Chapel Hill, United States

Keynote speaker

Prof. Thomas S. Bianchi, Texas A&M University, United States

Speakers

Prof.dr. Patrick Meire, University of Antwerp, Belgium

Jyotiraj Patra, Centre for the Environment and Global Sustainability, India

Jason Rubens, University of Tasmania, Australia

Marijn van der Velde, IIASA, Austria

Andreas Schöl, Federal Institute of Hydrology, Germany

Estuaries provide major sources of sediments for the oceans. These delta systems are getting more and more vulnerable because of anthropogenic influences. 'We're holding a lot of water with hydraulic engineering. What does this do to our deltas?' Prof. Thomas S. Bianchi (Texas A&M University) answers his own question. It alters the nature of our system. In the Chanjiang River (China) decreases in sediments appear to change the production of CO₂ and fluxes because of phytoplankton in the accumulated mud. This is reflected in the color of the water which varies from brown to green to blue. Hydraulic engineering also causes a lot of wetland loss. Possible solutions are to break the levies of the river at different spots. However this method is quite controversial. A more dynamic model is needed to adapt to this challenge. The Mississippi river seems to be a clear example of what the Chanjiang River will look like if human activities continue to affect the deltas. The question is: will China learn from this case?

Patrick Meire (University of Antwerp) tells the audience about the consequences of global change on the Schelde Estuary, which has changed a lot over time, particularly the last few years as a cause of sea level rise. Tidal range is increasing not only in this estuary but in many others in Europe as well. There seems to be a reduction in freshwater discharge to the system, because a lot of the water is deviated to other canals in the basin. Climate change impacts include higher winter discharges and lower summer discharges. Marshes cannot grow when sea level rise is occurring, except when there is enough sediment available. But freshwater 'squeeze' might lead to a reduction in nutrient retention. The loss of marshes will negatively affect the biogeochemical functioning of a system. This leads to the conclusion that habitat restoration and maintenance is of great importance.

The Bhitarkhenika area in India contains many mangroves and has a high genetic diversity. Climate change has impacted this region in the past decade, especially with a systematic rise in cyclones: the Orissa Super Cyclone of 1999, for example, killed about 10.000 people. Jyotiraj Patra (Centre for the Environment and Global Sustainability) adds that not only cyclones, but also sea level rise in this region is getting more severe. An ecosystem-based approach presented by this speaker combines Disaster Risk Management, Ecosystem Management, Climate Change adaptation and Development planning and takes the 'livelihood' of people as entry point. Opportunities of this Disaster Risk Reduction system include an integrated and boundary approach, community ownership and resilience. The system offers good opportunities to the realization of the Millennium Development Goals 1, 7 and 8.

Also the World Wildlife Fund takes people as an entry point. It is working in Cameroon, Tanzania and Fiji to build local people's capacity to adapt to climate change, in particular in maintaining mangrove diversities. The aim of the

project, says Jason Rubens (University of Tasmania), is to develop a general method by testing different approaches on three locations; 'from vulnerability to adaptivity'. All locations have similar levels of mangrove biodiversity. Rubens particularly focuses on the Tanzanian site, which has over 20.000 inhabitants. There are several impacts of climate change affecting the mangroves: sea level rise, rise in air temperature and CO₂, and changes in precipitation. Especially sea level rise will eventually have major impacts. The leading question in this project is, however, the other way round: 'What do mangrove species tell us about climate change?' This means that the research focus on these sites is on species diversity. The main adaptation strategy that proves to be effective, is to work with local communities to re-plant the mangroves, while combining this with their biggest source of income: growing rice.

Marijn van der Velde (IIASA) brings the audience back to the Netherlands. The management of Dutch water systems by coastal infrastructure measures goes back more than a century. This way of managing water has had several impacts on transfer and retention times of river deltas. The transfer and retention times of the Lower Rhine delta have been examined by measuring discharges in Lobith and salinity in the Wadden Sea from 1900 to 2008. The Wadden Sea is a very important area because of its rich biodiversity, but has been under pressure by changing freshwater fluxes and sea level rise. The Lobith discharges and salinity in the Wadden Sea are measured respectively on a daily and monthly basis, for the periods 1901-1931, 1932-1971 and 1972-2005. Results show that transfer time decreases over time and that there is a change in seasonal salt-fresh water dynamics in the Wadden Sea.

The oxygen content of an estuary is a useful descriptor of its water quality. Drivers of the oxygen budget in the estuary are river runoff and the loads of organic matter. Andreas Schöl (Federal Institute of Hydrology) presents the research on the impacts of climate change on the oxygen budget of the Elbe estuary. By using a hydraulic model and a water quality model it is possible to calculate transport and utilization rates of carbon, oxygen and phytoplankton biomasses. The model uses three scenarios of climate change: a wet scenario, a mean scenario and a dry scenario. Outcomes show that scenario dry leads to an increase of oxygen deficit because of algal growth in the upstream river. Phytoplankton populations seem to be sensitive to discharges.

After these presentations two posters are briefly presented. Tomoya Hashuichi (DN Urbland BV) tells about Sanbanze National Park – a project for the Final Tideland Area of Tokyo Bay (From global to local). Sanbanze National Park is a beautiful area with a lot of shellfish. However, recent developments in Tokyo Bay cause eutrophication and the occurrence of the harmful algae 'red tide'. How is it possible to regenerate the lovely Sanbanze tideland? Hashuichi has three solutions: topographic change, pollution control and ecological enhancement. New measures are needed to protect the Rhine from flooding. Ton de Nijs (RIVM) presents the Rhine estuary 'Closeable but Open' alternative to dike-building. The research studies results on future flooding levels of dike strengthening versus positioning closeable dams.



Deltas in Depth Theme 4: Climate change and climate proofing urban areas

DD 4.1

Session DD 4.1: Climate change and climate proofing urban areas: adaptation strategies in urban areas

Chairs

Ronald Albers, TNO, the Netherlands (first part) and prof. Simin Davoudi, Newcastle University, United Kingdom (second part)

Keynote speaker

Prof. Simin Davoudi, Newcastle University, United Kingdom

Speakers

Bianca Stalenberg, Delft University of Technology, the Netherlands
 Jeroen Rijke, UNESCO-IHE, the Netherlands
 Dr. David Major, Columbia University, United States
 Anthony Bigio, The World Bank, United States
 Dr. Khan Rahaman, Khulna University, Bangladesh
 Dr. Hens Runhaar, Utrecht University, the Netherlands
 Debra Lam, ARUP, Vietnam

Recently we've seen a change from the exact science of climate change (what is happening) towards the science of decision making regarding climate change actions (what should we do). Decision theory is nothing new, but it needs to be extended for climate adaptation, says Simin Davoudi (Newcastle University) in her keynote speech 'extending the rational choice model of decision making in climate adaptation'. She elaborates on the three main perspectives in decision theory: (1) the rational perspective, in which we see people as utility maximisers; (2) the psychological perspective, which acknowledges the fact that people's rationality is bound by their cognitive abilities and (3) the sociological perspective, in which rationality is bound by social processes. Regarding these social processes, Davoudi notes three social pressures on decision makers: coercive pressures (social sanctions: what we have to do), mimetic pressures (imitating others: what others do) and normative pressures (values and norms: what should we do). Davoudi concludes that decisions can be effective even when not everything that we want to know is known. When it comes to adaptation policies, we should recognise the fact that people are at the same time naive economists, naive rationalists and naive sociologists.

To facilitate decision making in urban renewal Bianca Stalenberg (Delft University of Technology) introduces the AFD concept (Adaptable Flood Defenses) wherein urban functions (living, working, recreation) are integrated in the flood defense systems of a city. Stalenberg presents an example from Nijmegen where a car park and recreational activities are incorporated in the city's flood defense wall. AFD, states Stalenberg, has the potential to create synergetic riverfronts by combining technical (flood defense) structures with urban functions.

Jeroen Rijke (UNESCO-IHE) sticks to urban renewal in his presentation, urging that we have to adapt not where we should, but where we can. In a recent vulnerability assessment Rijke and others found that it is hard to quantify the sensitivity of urban areas, since these assessments do not provide the needed answers because of uncertainties. Jeroen sees three pathways for adaptation: business as usual, active adaptation and opportunistic adaptation: free rides with ongoing (re)developments. Rijke states that by now, 43 percent of our houses, offices etc. have reached their (economic) expected end of life span. Instead of trying to start new (costly, complicated and time consuming) adaptation plans we should take all opportunities to adapt when buildings and sites are redeveloped. If we do so, by 2050 as much as 92 percent of our building stock can be climate proof.

For Dutch cities, Hens Runhaar (Utrecht University) found that government strategies do take flood risks into account, but that heat stress in cities is often completely overlooked.

In the following presentations David Major (Columbia University), Anthony Bigio (The World Bank), Khan Ramahan (Khulna University) and Debra Lam (ARUP) take us to New York City, Egypt, Bangladesh and Ho Chi Minh City respectively and give us useful insights and lessons learned in the adaptation processes in these cities. For Bangladesh, there are many initiatives already, and the country even has its own adaptation fund, but there is a strong need for these initiatives to have a place where knowledge and experiences can be exchanged. Major, Bigio and Lam stress the need to involve all stakeholders in the process and work on institutional capacity.

DD 4.2

Session DD 4.2: Climate change and climate proofing urban areas: flood risks and water management in the urban environment

Chair

Prof.dr. Tejo Spit, Utrecht University, the Netherlands

Keynote speaker

Prof.dr. John Handley, University of Manchester, United Kingdom

Speakers

Ellen Tromp, Deltares, the Netherlands
 Eric Luyendijk, Grontmij Nederland BV, the Netherlands
 Berry Gersonius, UNESCO-IHE, the Netherlands
 William Veerbeek, Deltares, the Netherlands
 Anika Narsa Haque, Erasmus University, the Netherlands
 Tom van der Voorn, University of Osnabrück, Germany

Following the millennium ecosystem assessment, the number of floods worldwide is rising, and urbanization is a large contributor to flood risk, says John Handley (University of Manchester) in his keynote speech on 'Water and the city: Risk, Resilience and Planning for a Sustainable Future'. The nature of flood risk is changing and these changes alter our flood risk management strategies from 'defending the line' towards management of floods (acceptance). The question now is how to deal with uncertainty and Handley mentions that we should therefore separately look at hazard, exposure and vulnerability. Handley gives the example of the greater Manchester region, where a social vulnerability analysis was conducted and vulnerable groups were identified. The identification of these vulnerable groups leads to a

more effective evacuation plan for the region. Handley concludes that given the level of uncertainty regarding climate change effects, city planners will be our flood managers of the future. Multi-actor engagement is needed to make all this happen.

To enable decision makers to identify and choose from solutions for problems with flooding and heat in the city Eric Luyendijk (Grontmij Nederland BV) introduces a three step approach for water robust building. Eric mentions that there are a lot of solutions readily available. Multiple stakeholder processes however, often make it difficult to define the appropriate measures; the three step approach helps to identify these. First, a vulnerability assessment is done by using a layer approach (subsoil, network and occupational layer), and then a strategy to reduce the vulnerabilities is defined. Thirdly, the appropriate measures are selected. The most important experiences Eric has had with this approach are a) local knowledge must be available for all parties and b) all parties should be involved in all steps.

Ellen Tromp (Deltares) elaborates on the three-step approach and focuses on water robust building for vital and vulnerable objects in the province of Utrecht. In this Dutch province vital and vulnerable objects are located throughout the province. The three step approach helps in defining which of these sites and objects will be protected and which measures are needed to accomplish that.

Berry Gersonius (UNESCO-IHE) introduces us to the MARE project, where Dordrecht, Hannover, Bergen and Sheffield worked together in a community of practice to develop a multi-level safety concept (in line with the EU flood directive) with 3 p's: protection (dike system), prevention (spatial lay-out of the city) and preparedness (development of an emergency/evacuation plan). The implementation of this concept was done by the development of a risk map, the development of an area perspective map which was followed by the identification of measures, the assessment of measures by making a cost benefit-analysis and finally the selection of measures was done. As one of the most appropriate measures Berry introduces the concept of overflowing (Delta) dikes.

William Veerbeek (Deltares) and his colleagues worked together in Rotterdam to estimate flood damages on Noordereiland. Amongst other research methods William used Google Streetview to do this. Historical sites are often under threat from extreme events. One of the interesting findings of the project is that furnishing of a house makes up about 50 percent of potential damage.

Anika Nasra Haque (Erasmus University) assessed flood measures in Dhaka. She states that an early warning system for floods in East Dhaka is the best option. The biggest challenge for implementing this system is lack of funding. 'We have options enough, but because of lack of budget these are still on paper' Nasra Haque says.

Linking to John Handley's keynote speech, Tom van der Voorn (University of Osnabrück) states that the command-and-control paradigm within which we have worked regarding flood risks doesn't combine very well with the uncertainties of climate change effects. Van der Voorn stresses the need for a guiding vision (not a fixed goal). To make this a reality Van der Voorn introduces the method of back casting, defining a desired outcome on the long term and then defines the needed steps to achieve that outcome. He gives the example of New Orleans where this has worked out well.

DD 4.3

Session DD 4.3: Climate change assessment and adaptation methods

Chair

Prof.dr. Jim Hall, Newcastle University, Tyndall Centre for Climate change Research, United Kingdom

Keynote speaker

Prof.dr Jim Hall, Newcastle University, Tyndall Centre for Climate change Research, United Kingdom

Speakers

Fransje Hooimeijer, Delft University of Technology/TNO, the Netherlands
Dr. Jeroen Kluck, Tauw BV, the Netherlands
Frederik Treuel, Technical University of Hamburg, Germany
Aart Overeem, Wageningen University, the Netherlands
Jaap Kortman, IVAM UvA BV research and consultancy on sustainability, the Netherlands
Peter Bosch, TNO, the Netherlands

A city should be seen as a system, according to Jim Hall (Newcastle University). His study looks at the drivers for long-term change, the results of which are already used for revising the London City plans. Important drivers are population and economic circumstances. Average heat emissions will increase to 60 – 140 W/m² in the city centre, freshwater demand is calculated to increase by 20 percent in 2020 and even 35 percent by 2035. Flood risk related damage due to sea level rise is estimated to increase by a factor 5-10 in 2100 without adaptation. The damages mainly depend on socio-economic developments and much less on climate scenarios. The good news is that many mitigation options also lead to adaptation and vice versa.

Fransje Hooimeijer (Delft University) works on integrating climate tasks into city development. The framework she uses, sees the city as a clear build up system and includes both mitigation and adaptation measures. Vulnerability, impacts and responses (mitigation and adaptation) are calculated and presented in simple tables. The tables can be used as a stakeholder participation tool.

What kind of measures can be taken to adapt the coast to climate change? Frederik Treuel (Technical University of Hamburg) explains the audience that coastal revetments of gravel can be reinforced with the innovative elastocoast. It is a material that consists of two components polyurethane. It is often used in embankments and dykes. The material is tested on a field test site located in a sandy beach in Germany with high dunes and strong wave impacts. The elastocoast looks a promising innovation for coastal protection.

Aart Overeem (Wageningen University): Using cellular telephone networks for rainfall measurement would increase the rainfall measurement network immensely. Tests results in the Netherlands for 18 day measurements on 27 commercial microwave links compared to radar data shows a good fit. Hence, the technique looks very promising and tests will be expanded in the coming year.

According to Jaap Kortman (IVAM) the DPL (sustainability profile in an urban district) tool offers a language for dialogue between stakeholders. It contains nine indicators, such as energy consumption, car ownership, renewable energy generation, rain water catchment and delayed water drainage. The model gives flood risk and intensity, heat stress,

drought prevention and climate robust ecology. The tool is to be used as a monitoring and gauging tool. The research into integrated assessment of possibilities for climate change adaptations in cities is part of the Climate Proof Cities Project, tells Peter Bosch (TNO). In the study an integrated approach is used including issues such as urban city systems, sensitivity of the systems, impacts and vulnerability, policy and governance and mitigation and adaptation measures. Four case studies all layers from the buildings up to the city region. While using the tool it became clear that communication of uncertainties is an important issue for the end-users such as policy makers and decision makers.

DD 4.4

Session DD 4.4: Urban adaptation in Rotterdam and other Dutch cities

Chair

Prof.dr. Tejo Spit, Utrecht University, the Netherlands

Keynote speaker

Prof.dr. Chris Zevenbergen, UNESCO-IHE, Institute for Water Education, the Netherlands

Speakers

Dr. Jaap Kwadijk, Deltares, the Netherlands
Maya van den Berg, University of Twente, the Netherlands
Sandra Junier (instead of Eric van Nieuwkerk, dr. Marleen Maarleveld), Delft University of Technology, the Netherlands
Judit Bax, City of Dordrecht, the Netherlands
Dr. Lisette Klok, TNO Built Environment and Geosciences, the Netherlands
Dr. Bert van Hove, Wageningen University, the Netherlands

Looking at the Roof park in Rotterdam we see a multiple use climate proof building. However, Chris Zevenbergen (UNESCO-IHE) adds, the design of this building dates from 1999. We must understand that we live in cities that we designed years ago. In his keynote speech on 'Adaptation tipping points and pathways for Rotterdam on different spatial scales' Chris touches upon some recent structural shifts. First of all, when we look at the EU framework programmes we see a shift from 'assessing the problem' towards 'managing the problem'. In water management we see a change from flood defense towards the management of flood risks. We are leaving the prediction and control regime and moving towards an integrated and adaptive regime with learning environments and working together with stakeholders. Furthermore Chris mentions a structural change in driving forces in our economy. New driving forces are the knowledge and social economy, instead of the classical drivers (retail, construction, leisure).

Jaap Kwadijk (Deltares) coins the concept of adaptation tipping points. By defining tipping points for different scenarios decision makers are able to take long term decisions. Jaap mentions that we shouldn't ask the question 'How much sea level rise can we expect?' but instead 'How much sea level rise can I handle?'.

Maya van den Berg (University of Twente) has studied the Dutch civil protection system and whether or not climate change has been taken into account by the Dutch safety regions (of which there are 25 in the Netherlands). For the safety region Rotterdam-Rijnmond she concludes that the civil protection system is not inspired by climate change and its (possible) effects.

The urban water system and the possible effects on this system are analyzed by Sandra Junier (Delft University of Technology) and colleagues. Parts of the city were modeled for flood risks of surface water and sewer systems. For the southern part of the city high surface water levels are expected and in the community of Spangen it was calculated that 1,5 times the amount of rain results in 3 times as much water in the streets. Citizens are absolutely unaware of climate change effects. Sandra concludes that water management and climate change and its effects should be incorporated in urban development and that tailor made solutions and public support are needed.

In the Urban Flood Management Project of the City of Dordrecht, Judit Bax works together with the City of Saint Louis in Senegal. The two cities, although different, have a lot of similarities when it comes to flood protection and water management. During this project an effective exchange of ideas and methods has taken place which leads Judit to conclude that the tools we use in developed countries are equally useful in developing countries.

Sabine Jansen and Lisette Klok (TNO) are involved in research on urban heat in Rotterdam and its effects on public health. Effects of heat are increased risk of heart stroke, excess mortality, sleep disturbance and loss of work productivity (decreased wellbeing). Possible no regret measures for Rotterdam are e.g. small scale green and sprinklers on roofs.

Bert van Hove (Wageningen University) and his research team have been working in Rotterdam on the order of magnitude of UHI in the city and whether or not thermal comfort will become a problem. To measure temperatures throughout the city cargo bikes were used that carried all kinds of meteorological equipment. On a hot day in 2009 three runs of two loops in the city were biked by the team. The measurements show that there are no large differences in temperature in the city and surroundings during the daytime, but at night the city centre and other built environments are significantly warmer than the surroundings (up to 6 or 7 degrees Celsius). These observations were also made by hobby meteorologists. Bert concludes that nocturnal Urban Heat Island effect is substantial in Dutch cities. This research has a follow-up in the Dutch research programme Knowledge for Climate which will render more substantial data.



Deltas in Depth Theme 5: Competing claims and land use in deltas under climate change

DD 5.1

Session DD 5.1: Impacts and adaptation strategies

Chair

Prof.dr. Martin Wassen, University of Utrecht, Copernicus institute for sustainable development and innovation, the Netherlands

Keynote speaker

Dr. Saleemul Huc, Director of the International Centre for Climate Change and Development (ICCCAD), Bangladesh

Speakers

Ashbindu Singh, United Nations Environmental Programme (UNEP), United States

Iñaki Gili, Catalan Office for Climate Change, Spain

Arne Harms, institute of social Anthropology, Germany

Dr. Pytrik Reitsma, Wageningen University, the Netherlands

Michiel van Eupen, Wageningen University, the Netherlands

Dr. Tom Kuhlman, LEI, the Netherlands

Adaptation gets a bigger role in both the IPCC and the UNFCCC. In Bali the Conference of Parties (COP) decided that adaptation and mitigation were building blocks to the Copenhagen UN Summit (COP15). The Copenhagen agreement states that there has to be a balance between the funding for mitigation and adaptation. According to the agreement there are two stages of funding. This means that adaptation is recognized as a key challenge in the debate on climate change and that funding is available for action. As a result the need for scientific information on adaptation is essential. The IPCC 5th assessment report is planned to be published in 2014. Papers that are published before early 2013 form the scientific bases for the assessment. Saleemul Huq invites the adaptation scientists to publish.

According to Saleemul Huq (ICCCAD) research on adaptation should be done in close cooperation with stakeholders, such as policy makers and NGO's. And more attention should be given to the bottom up approach. The traditional top down model should be linked to a bottom up approach. Community based adaptation is the key focal point in the International Center of Climate Change and Development, which is based in Bangladesh. The importance of community based adaptation is explained by Arne Harms. As an anthropologist he examined the social structures on islands in India. These islands shrink as a result of climate change. The social structures are a condition that should be taken into account by climate adaptation.

In the northern part of the Netherlands an interesting project shows us the importance of adaptation actions at different scales. Dutch farming is vulnerable to weather extremes. The frequency and intensity of these extremes will increase as

a result of climate change. In close cooperation with farmers the sensitivity of various crops for climate change impacts is examined. Adaptation measures are defined at different scales (farm level, water management, etc.).

Adaptation to climate change should be placed in the context of the future. Dutch agriculture changed dramatically over the last 40 years. Scenarios can help us examine future land use and agricultural systems. Scenarios are also a tool for dealing with uncertainty. The farm systems will look differently in a Global Economy scenario than in a Regional Marked scenario. In a global economy scenario production in the Netherlands needs to increase to be competitive at the global market. In a Regional Marked scenario agriculture will become multifunctional.

Climate change seems to bring interesting opportunities to agriculture, such as the production of crops for energy or fuel. However Europe cannot produce straw for ethanol in a profitable way, but there are opportunities for the production of biodiesel from oilseeds. The opportunities for the Netherlands seem very limited for the production of biomass, because the Dutch farm system is not fitted for bulk production. Ton Kuhlman sees potential for reed production in the Netherlands. Reed can grow in the Netherlands and is not vulnerable to projected climate changes. Reed production in the Netherlands can be profitable on peat soils if the oil prices increase and if policies are implemented aimed at soil conservation.

The Netherlands are crowded and there are a lot of land use claims. The Land Use Scanner predicts future land use under different scenarios. Nature is not yet well integrated in this model, because the location of nature is purely based on policy decisions. The model can be improved when eco-hydrological information is included. If the model can predict where nature will be located, the Dutch nature policy can be evaluated. However, hydrological models are not yet specific enough for this analysis. In Knowledge for Climate research on this issue is planned.

A Spanish study shows an example of local adaptation research. In the Ebro Delta (Cataluna, Spain) climate change will have severe impacts. The delta is important for the production of rice, fishery, fish/shellfish farms and as a nature reserve (bird migration routes). The main climate related risks are related to sea level rise. As a result the risks of flooding increase and rice production decreases. An adaptation strategy has been developed for sustainable spatial development.



DD 5.2**Session DD 5.2: Generating and evaluating potential solutions**

Chair **Dr. Saleemul Huq, Director of the International Centre for Climate Change and Development (ICCCAD), Bangladesh**

Keynote speaker **Prof.dr. Peter Verburg, Institute for Environmental Studies, the Netherlands**

Speakers **Prof.dr. Han Meyer, Delft University of Technology, the Netherlands**
Wim van der Knaap, Wageningen University, the Netherlands
Geoff Darch, Atkins, United Kingdom
MSc. Karina Czapiewska, DeltaSync, the Netherlands
Dr. Claire Vos, Alterra Wageningen UR, the Netherlands
Msc. Gerard Jan Ellen, Deltares, the Netherlands
Robert Barker, Baca Architects, United Kingdom
Karin Thomas, Thomas Consulting/Tilburg University, the Netherlands

Land use plays a central role in climate adaptation, since land use can cause climate change and climate change impacts on land use. Climate change influences the vulnerability of the area and adaptation measures are strongly related with land use planning. The effects of land use on flood related risks can be found at a local scale. At larger scales the effect is quite small. Apart from its hydrological effect, land use also influences the vulnerability to floods. The damage from such an event will increase as a result of urbanization.

Land use planning also plays an important role in adaptation measures. Spatial planning can, for example, introduce vulnerable zones, water retention areas and create safe places. In a multifunctional landscape ecosystem services are important instruments to a climate proof landscape. Society pays for ecosystem services taken by land owners.

Science is important in assessing the risks in terms of chances and damage and to define adaptation measures and their effects. The advice: use existing 'building blocks' to link models and methods. Don't build a one size fits all model, because the knowledge of the system will be lost.

Wim van der Knaap (Wageningen University) shows the aspect of time in climate change problems. These time aspects play an important role. Society may change more rapidly than the climate. An example is how society is affected by the introduction of the mobile phone. In planning and design one should deal with time aspects, for example procedures (length, sequence and frequency of actions), life cycle and resilience should be placed in the context of time.

Although deltas have much in common, they also are very different. After hurricane Katrina in New Orleans the Americans and the Dutch started the project Delta Dialogues. The project looked at the similarities and differences between the Rhine and Mississippi Delta and what can be learned from the water safety approach in the Netherlands and in the United States. Although the measures can be very different, in both systems it's very important to pay attention to the interaction between different spatial scales, different planning layers (examples soil/hydrology, infrastructure, and urbanization) and to involve governments at local, regional and national level. Climate change has a huge impact on nature. Claire Vos tells the audience that the nature adaptation strategy has three pillars:

1. Increase connectivity by enlarging and linking ecological networks.
2. Increase the heterogeneity of nature areas and the surrounding landscapes.
3. Improve the abiotic conditions and facilitate natural processes.

In the Netherlands this strategy has been made applicable to wetland-, forest-, heather- and coastal ecosystems. Ecosystem services can stimulate elements in the landscape that improve the connectivity between nature areas.

In England the coastal area is vulnerable to sea level rise. The Lincolnshire area is one of the most productive agricultural areas and some towns have significant flood risks. Hazard maps of the area are developed. Together with stakeholders principles to reduce flood risks are defined. Development in the most vulnerable areas is restricted to business related investments (tourism, farming). Urban development is restricted to the areas with low risks. The hazard maps are an important instrument in stakeholder participation.

Climate change offers new opportunities to society. Extra water brings interesting new possibilities for public transport. Transport speed is limited in small water ways. Water busses need large surface water areas. Climate change may also stimulate innovative ways of multifunctional planning, such as interwoven urban and rural functions. Another example is the area around Little Hampton. This city can build a climate robust new area. This can only be profitable when the development of new residential areas is funding the development of the area. The final example is provided by the city of Borth along the British coast. A new reef may provide safety and surfing opportunities.

DD 5.3**Session DD 5.3: Implementation and design**

Chair **Prof.dr. Peter Verburg, Institute for Environmental Studies, the Netherlands**

Keynote speaker **Prof.dr. Paul Opdam, Wageningen University, the Netherlands**

Speakers **Oswald Legendijk, Deltares, the Netherlands**
Prof. Jorg Sieweke, Virginia School of Architecture, United States
Dr. Roland Goetgeluk, ABF Research, the Netherlands
Jaap Flikweert, Royal Haskoning, United Kingdom
Ben Schaap, Wageningen University and Research centre, the Netherlands
Ann Karina Lassen, Delft University of Technology, the Netherlands

Landscapes can play an important role in adapting to climate change according to Paul Opdam (Wageningen University). Landscapes link the social system with the physical system. Landscape services are incentives for land owners to implement adaptation options. These services aim at ecological networks, water retention and purifying water, pest and disease control and can improve the visual quality of the landscape. In cost benefit analyses (CBA) these measures have a high added value because they combine benefits. The challenge is that the investments have to be done by a different group than the group that benefits. This means that society needs to pay for these services. CBA shows that landscape services are profitable. An example of landscape services is the construction of landscape elements that increase the ecologic conductivity and recover water retention in nature areas.

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Ben Schaap (Wageningen University) shows us an example of landscape services in the Dutch meadows, in the Ronde Venen. He worked with stakeholders in a project to develop a green/blue network of landscape elements. The network improves connectivity for ecosystems and the robustness to inundations and pests. The Common Agriculture Policy (CAP) provides a framework for these services. Close cooperation of scientists, stakeholders and the local governments proved itself. According to Oswald Lagendijk this cooperation between participants is the key to adaptation. Research by design brings together participants (stakeholders, scientists and policy officers). They share their knowledge by visualisation techniques. Focus on the questions of adaptation in river basins comes down to: 'WHAT-WHERE-HOW' and 'What does it look like?'

Climate robust building generates interesting housing concepts. Houses built along the waterfront can move up and down with the water level. Houses built on poles have flood robust first floors and can be protected by mini dikes. These concepts can create new residential environments. They can also be used at attractive locations near water. Building near water increases the value of property. According to Roland Goetgeluk (ABF Research) this effect is often overrated. Calculations show that the added value of houses is between 2 – 5 per cent instead of the 20 percent often proclaimed. He also warns that demand can not be stimulated by supply. Economic prospects of new houses are driven by demographic changes and job opportunities. Or, as he states: 'It's all about the economics'.

England has flood events every six years. As a result of climate change the chance of a flood event increases by four times. The risks are reduced by land use planning and by flood defense structures. The Department of Environment Food and Rural Affairs (DEFRA) develops shoreline development plans. The Wash is an area in the east of England. The shore development plan should protect the ecological system from habitat loss and protect the high productive farmland. The salt marsh protects the farmland as a buffer. Compensation will be paid if farmland is lost.



Deltas in Depth Theme 6: Governance and economics of climate adaptation

DD 6.1

Session DD 6.1: The governance of climate adaptation: international comparison

Chairs

Prof.dr. Katrien Termeer, Wageningen UR, the Netherlands and Elizabeth Wilson, Oxford Brookes University, United Kingdom

Speakers

Dr. Francois Gemenne, IDDRI - Sciences Po Paris, France
Dr. Arjen Ruijs, Royal Haskoning, the Netherlands
Valentin Przluski, CIRED, France

Elisabeth Wilson (Oxford Brookes University) and Katrien Termeer (Wageningen UR) open the session, stating that spatial planning needs to become less specialized planning and to incorporate more future thinking in its further development. The close relations between agricultural sciences, rural development and climate adaptation governance become especially salient from an international developmental perspective.

Francois Gemennes (IDDRI - Sciences Po Paris) presentation throws a fresh light on climate related migration. It presents an option to cope with the impacts of climate change instead of frequent victimization of climate migrants. The EACH FOR project, supported by the European Commission, found that often the most vulnerable populations do not have migration opportunities, since this requires social and economic capital, concluding that better governance of climate induced migration is needed. This would be better than negative interpretations of migration which hamper migrants' ability to adapt. Self perception of (seasonal) climate migration is quite different, he found.

Arjan Ruijs (Royal Haskoning) presents results of a World Bank study on adaptation strategies and support by extension institutions. This study of Mali and Ethiopia found that household adaptation strategies varied considerably, depending on household wealth, willingness to participate in communal strategies and the availability of extension officers. Poor rural households face the most climate change hazards. As to vulnerability, the sensitivity and coping capacity of households is more important than their exposure. More tailored interventions are thus needed. He confirms Gemennes findings that migration is viewed as a traditional diversification strategy (for instance, some household members migrate). He stresses that the role of human capital is essential in adaptation for communal strategies long term commitment.

Valentin Przluski (CIRED) focuses on the case and experiences of Bangladesh. He stresses the contribution of Disaster Risk Reduction (DRR) that enables a focus on the long term and indirect effects. His suggestion is to look at the indirect benefits of DRR instead of its indirect costs. He is critical of the general view of no regret measures. To manage adaption to climate change only as a risk tends to overview its complexity and uncertainty. He argues for

inclusion of indirect costs in measures and for an integrated view on measures, which takes into account their flexibility or maintenance costs. He challenges the use of the no regret notion, for instance if this leads to capital intensive measures. The crucial question to him is, who decides what is no regret? This is relevant in infrastructural projects being advocated where it also is important to look at direct and indirect benefits of DRR strategies.

DD 6.2

Session DD 6.2: Regional strategies of climate adaptation: concepts and Dutch examples

Chairs

Prof.dr. Katrien Termeer, Wageningen UR, the Netherlands and Elizabeth Wilson, Oxford Brookes University, United Kingdom

Keynote speaker

Prof.dr. Stefan Kuks, School of Management and Governance, University of Twente, the Netherlands

Speakers

Jeroen Rijke, UNESCO-IHE, the Netherlands
Dr. Rutger de Graaf, DeltaSync, the Netherlands
Prof.dr. Joyeeta Gupta, VU University, the Netherlands
Prof.dr. Bernd Siebenhüner, Carl-von-Ossietzky University Oldenburg, Germany
Saskia Hommes, Deltares, the Netherlands
Dr. Saskia Werners, Wageningen UR, the Netherlands
Ingmar van Meerkerk, Erasmus University Rotterdam, the Netherlands

Often when contemplating important steps for the future, we look at the past. So does keynote speaker Stefan Kuks (School of Management and Governance, University of Twente, the Netherlands) when he leads the audience into historical Enschede, a city in the east of the Netherlands. Enschede used to be a city of creeks. In 2010 those blue nerves are long gone and water quickly disappears in the sewers. The inhabitants of Enschede forgot to make room for water and now pay the price: floods are all too common and likely to increase in the future due to climate change. The area surrounding Enschede, Twente, needs to make room for 12.000 ha of water retention. Twente also needs to prepare for shortage of water and improve citizen risk awareness. To solve the water problem creeks are brought back in the area. Enschede has rolled up its sleeves to bring back the old creek Roombeek into the city.

Some international examples shown during this session include Germany and Australia. German city planners are obliged to take rainwater storage into account when planning new buildings. Australia experiments with decentralized 'water markets', where stormwater sewers are disconnected, buildings are flood-proofed and local water harvesting and reuse are alternatives to a combined sewage system.

A truly inspiring concept is presented by Ruther de Graaf (DeltaSync) who aims at building the first self-supporting floating city in the world. De Graaf stresses the importance of making space in current institutions for unrestricted, innovative thinking. His point is backed up by one of the poster presenters, Tineke Ruigh-van der Ploeg (Delft University of Technology, the Netherlands): 'Constraints are mostly in the institutional sphere. But people find ways to circumvent the institutions.'

The envisioning project Rotterdam Watercity 2035 created enough space to surface crazy and innovative ideas, like building a ‘Chinese wall’ measuring 6 meters around Rotterdam to protect the city from the water. Many ideas made it into policy, like the floating pavilion and the water plazas. Urban water structures of the future should be flexible, reversible and if possible, decomposable.

Let’s get back from 2035 to 2010. How are the Netherlands doing right now in terms of adaptation? The Adaptive Capacity Wheel is a method to see how adaptive different sectors are. The wheel is not an objective measuring tool, but points out probable weaknesses and strengths and a basis for taking action. The Dutch water sector scores well, but the Dutch nature sector, including Nature 2000 regulations, has low adaptive capacity. Another method of analyzing adaptation strategies is provided by the Climate Adaptation Navigator, a 3x4 matrix. The matrix describes the institutional structure for the three layers of the traditional physical planning approach: the base layer, the network layer and the occupation layer. The navigator can show implementation routes for the ideals of the National Water Plan.

Adaptation however is only one side of the coin when dealing with climate adaptation. The other side is provided by the reduction of greenhouse gases and mitigating climate change. ‘Adaptation is not an excuse strategy for failure in effective mitigation’, says Bernd Siebenhüner (Carl-von-Ossietzky University Oldenburg, Germany).

Saskia Werners (Wageningen UR, the Netherlands) grabs the accordion to get across a pressing point – singing. It’s all good and well that we talk about methods and implementation, but do we know who in the end has the power to decide? The Dutch Delta Programme focuses on what kind of things we should adapt to and what kind of measures we should take, but pays very little attention to the question: who adapts?

By several speakers it has been stressed how important cooperation with different stakeholders is for an integrated approach to adaptation. As Ingmar van Meerkerk (Erasmus University Rotterdam, the Netherlands) puts it: ‘We need good leaders, who don’t push their own opinions, but connect stakeholders.’

The session ended with a positive note from poster presenter Stephan de Boer (DHV). He has an optimistic view on adaptation. De Boer: ‘It’s positive! We have more opportunities for recreation and housing.’

The presentations include different results, retrieved from modelling, literature surveys and empirical research. Whilst Tatian Filatova (Deltares) stresses the role of incentives, Peter Pol (Erasmus University) reflects on the role of regional and local knowledge as chance vs. barrier to innovation. The presentation of Pieter van Eijk (Wetlands International) differentiates between hard and soft measures for adaptation and discusses their implications. An estimate of costs for inland water way transport for the Rhine as shown by Olaf Jonkeren (VU University) is comparably low as to the costs experienced in the Shatt al Arab, where whole sectors such as date palm plantations are suffering, presented by Remi Drouin (Oxford University). The most impressive and positive example comes from Taiwan, where stakeholder consultation was combined with regionalized projections of water level rise and land subsidence, with specialized local maps of impacts on water level and water usage possibilities. The researcher presents his own house in a picture to illustrate the gravity of land subsidence, which is very impressive. The use of small group workshops, conferences and a series of conferences were vital in identifying the pilot sites. Now houses will not be flooded every two years on average, but only every 50 years on average. This example is a very positive manner of concluding the session.

DD 6.3

Session DD 6.3: The economics of climate adaptation

Chairs

Prof.dr. Ekko van Ierland, Wageningen UR, the Netherlands and Stéphane Hallegatte, CIRED and Météo-France, France

Speakers

Dr. Tatian Filatova, Deltares, the Netherlands
 Dr. Peter Pol, Erasmus University, the Netherlands
 Dr. Pieter van Eijk, Wetlands International, the Netherlands
 Dr. Olaf Jonkeren, VU University, the Netherlands
 Remi Drouin, St. John’s College, Oxford University, United Kingdom
 Dr. Sinite Yu, TIWE, Taiwan

This session is organized to discuss the economics of adaptation, to examine which forms of governance could increase the implementation of behavioral changes and infrastructural adjustments and to discuss how the transition towards climate proof regional development can be fostered.



Deltas in Depth Theme 7: Decision support instruments for climate adaptation policy

DD 7.1 Session DD 7.1: DSS – improving their communicative power

Chairs Dr. Eric Koomen, VU University, the Netherlands

Keynote speaker Dr. Christopher Pettit, Department of Primary Industries Victoria, Australia

Speakers Marjolein Haasnoot, Deltares, the Netherlands
Anne Leskens, Nelen en Schuurmans, the Netherlands
Dr. Asif Zaman, Institute of Water Modelling, Bangladesh
Alfred Wagtendonk, VU University Amsterdam, the Netherlands

Christopher Pettit (Department of Primary Industries Victoria) kicks off Theme 7 with a presentation on visualizing climate change adaptation futures, focusing on Australia. The presentation is very visual with, amongst others, a demonstration of a tool which shows in 3D how a farmer walks through different scenarios for his farm. One of the key challenges to be addressed by the IPCC is communication: How do we communicate key messages? We can use visualization to paint the future to make the policy maker understand. Pettit has an example of policy makers who did not understand why you should downscale your models; 'They have no idea.' Some of the challenges in visualization are to determine how realistic visualization products should be (photorealistic vs abstract), how to communicate uncertainty and to determine what tool works best with which audience.

Marjolijn Haasnoot (Deltares) gives a presentation of a sort of game created to develop storylines or pathways for river management. Her hypothesis is that in order to develop sustainable adaptation pathways into an uncertain future the interaction between the water system and society needs to be taken into account. Societal perspectives influence decisions made in the policy arena. Depending on the public support individual players and coalitions receive, they will be able to implement a strategy or not. With the game it is possible to get insight in different responses under different circumstances. Beliefs of people can change and they will act according to their beliefs. In sustainable water management there is a risk of taking ineffective measures, because you tend to choose middle of the road decisions: win-win becomes lose-lose!

Anne Leskens (Nelen en Schuurmans) presents her companies efforts to improve the level of detail of the type of simulation used for decision support systems. By improving the level of detail she hopes to bridge the gap between models and decision making. Decision makers often don't trust models and often don't understand the results. Asif Zaman (Institute of Water Modelling, Bangladesh) and his team developed a water resources Decision Support System that can use output of numerical models to predict likely impacts on key sectors in a region in Bangladesh, such as

agriculture, infrastructure, environment, fisheries and navigation. This tool will assist policy makers and planners in climate proofing investments made in this area in Bangladesh.

The amount and quality of open space are diminishing rapidly, affecting both quality of life and viability of ecosystems. Alfred Wagtendonk (VU University) presents a new method to analyze the landscape impacts on open space that are associated with the large-scale production of biofuels (second generation). Especially in countries such as the Netherlands, open landscapes are very vulnerable to clutter. 'A cluttered landscape is a landscape that contains an increased level of variety, combined with a lack of coherence, making a disorderly impression and having several to many visual intrusive elements, both green and artificial'. Biofuel crops can reduce clutter by sheltering intrusive elements and preventing more intrusive agricultural activities. However, Alfred lacks empirical data concerning the likes and the dislikes of biofuel crops: 'It could all be a matter of taste!'

DD 7.2 Session DD 7.2: DSS – enhancing decision making

Chairs Dr. Eric Koomen, VU University, the Netherlands

Speakers Ingrid Coninx, Alterra, Wageningen University, Belgium/the Netherlands
Rianne Wood (instead of dr. Claudia Kuenzer), German Aerospace Centre, DLR, Germany
Dr. John Hunter, Antarctic Climate and Ecosystems Cooperative Research Centre, Australia
Niels van der Vaart, Utrecht University, the Netherlands

According to Ingrid Coninx (Alterra), there are several challenges in the development of decision support systems: integration of climate change projections, integration of socio-economic scenarios, integrating social and non-monetary impacts, integrating micro scale information, the spatial distribution of risks and the integration of the knowledge of uncertainties. Intangible impacts are often not considered due to their complexity as well as the difficulty with monetizing these impacts. The unilateral focus on material impacts is likely to safeguard wealthy people. The decision support tool described by Ingrid is a methodology for quantifying these intangible impacts to individuals, who are flood victims.

Rianne Wood (German Aerospace Centre) takes care of the presentation of the WISDOM (Water related Information System for the Sustainable Management of the Mekong Delta) project instead of Claudia. WISDOM is a very large project with 60 researchers and 14 PhD students from 18 different institutes, who work on a system that can support decision making and planning at institutes and ministries, of relevance for the water sector in Vietnam. Rianne explains the concept of the 'WISDOM restaurant'. In the 'restaurant' you can ask your question, the answer is 'cooked' in the kitchen which uses ingredients (information) from the storage room. Up till now there is no experience with end users. The project team is still working on the identification of who the stakeholders and decision makers are. The plan is to make different interfaces (different menus in the restaurant) for different users.

John Hunter (Antarctic Climate and Ecosystems Cooperative Research Centre) presents a method that has been implemented as a decision support tool for the Australian coastline. The method provides the user with the likelihood

of one or more flooding events by sea level rise, for a given location, period of time during the 21st century and emission scenario. According to John, changes in sea level extremes have been, and will be (at least for the next few decades) dominated by sea level rise. He can therefore estimate future sea level extremes from knowledge of 1) the statistics of present extremes, and 2) projections of rise in mean sea level and their uncertainties.

Niels van der Vaart (Utrecht University) just started working on a project within the CESAR research programme (Climate and Environmental change and Sustainable Accessibility of the Randstad). His research goal is to contribute to the attainment of sustainable spatial planning by bringing knowledge of climate change and mobility behavior into planning processes. This literature research will result in an overview of best practices in Planning Support systems that are adapted to climate change. It will also result in functional requirements and specifications for a Planning Support system.

DD 7.3

Session DD 7.3: Methods – CBA/MCA

Chairs

Prof.dr. Piet Rietveld, VU University, the Netherlands

Keynote speaker

Prof.dr. Jim Hall, Newcastle University, United Kingdom

Speakers

Karianne de Bruin, Wageningen University, the Netherlands
Dr. Marija Bockarjova, VU University, the Netherlands
Poh-Ling Tan, Griffith University, Nathan, Queensland, Australia
Stelios Grafakos, Erasmus University, the Netherlands

Jim Hall (Newcastle University) starts this afternoon with a presentation on a quantified analysis of flood risk at Taihu Basin in China. The challenge here is to have sustainable flood risk management in a rapidly developing region. How are the risks of flooding affecting the basin over the next 50 years if you take into account urbanization, economic development and climate change. The audience was wondering if the socio-economic drivers are not much stronger drivers in this region than climate change. According to Jim, they are both very important for development. It is very difficult to take the past into account, because there have been made so many investments, it is difficult to disentangle the different factors. Therefore the exact relationship between economic growth and flood risk is hard to determine.

Karianne de Bruin (Wageningen University) explains how to develop an optimal investment strategy in flood projection measures under climate change uncertainty. She is proposing that by choosing between structural and non-structural protection measures you can minimize expected costs. With this model you take into account developing knowledge and thus less uncertainty in the future. Bart van den Hurk (KNMI) asked if De Bruin considered the time delay between the decision of the investment and doing the investment. Also extreme events or disasters are an incentive to invest. Up till now these two factors are not taken into account in the model. Piet Rietveld isn't sure if uncertainty will be less in the future, that is a big assumption.

Risk valuation of immaterial damage in the context of flooding is new in the literature and in the Netherlands. Currently a value of statistical life (VOSL) is borrowed from transport research and is 2.5 million. Basically, VOSL is a trade-off

between some amount of money (to be paid) and a change (reduction) in fatality risk. Marija Bockarjova (Wageningen University) gives a very clear presentation on how to value risk of fatality, injury and evacuation (VOSL, VOSI and VOSE) in the context of flooding. From here research the VOSL in the context of flooding is 7 million which is much higher than in transport. They also found a difference between flooding from rivers and flooding at the coast. The audience questioned whether or not people are willing to pay more for prevention if they have been exposed to flooding in the past. According to Bockarjova they are willing to pay more but not much more.

Poh-Ling Tan (Griffith University) explains the opportunities of Multi Criteria Decision Analysis as a decision support tool for the assessment of adaptation and measures. It provides a structure for breaking down a complex problem into workable units and it allows a group of people to understand each other's views and for each individual to 'reset' his or her own view after listening to others. Poh-Ling had positive experiences with bringing different voices to the table but there was some doubt in the audience if it would work in a real conflicting case.

DD 7.4

Session DD 7.4: Methods – scenarios

Chairs

Prof.dr. Piet Rietveld, VU University, the Netherlands

Speakers

Kelly Levin, World Resources Institute, United States
Dr. Bert Enserink, Delft University of Technology, the Netherlands
Marjolijn Haasnoot, Deltares, the Netherlands
Prof.dr. Jörg Knieling, HafenCity University, Hamburg, Germany

The World Resource Report 2010, a joint publication of the UN Development Programme, UN Environment Programme, the World Bank and the World Resources Institute, will explore the topic of 'decision making in a changing climate' in the course of 2010. It will shed light upon how decision making processes can be designed to both anticipate and respond to climate change impacts, and policy making processes in developing countries.

Bert Enserink (Delft University of Technology) gives a provoking presentation about the use and misuse of scenarios in the climate change debate. According to Bert, climate scientists tend to forget about other truths (and other disciplines). 'A scenario is NOT a prediction of the future.' 'Scenarios and model outcomes are NOT the same.' 'Some uncertainties ARE uncertain'. The Dutch Delta Commission based their advise on the worst case scenario but there is no evidence that this scenario is more likely to occur. Pieter Bloemen in the audience responds that this was the request from the Dutch government; they wanted to be prepared for the worst. Another member of the audience responds that if the worst case scenario happens, you get maximum benefits from your investments. 'There is another way of looking at it.' Climate change is probably not the biggest uncertainty, that is socio-economic development!

Exploring adaptation pathways into an uncertain future can support decision making to achieve sustainable water management in a changing environment. The objective of Marjolijn Haasnoot (Deltares) is to develop and test a method to identify such pathways for sustainable water management by including dynamics such as interaction between water and society. By including the dynamics of the water system and society, the influence of uncertainties in both systems becomes clearer.

There is a strong tendency to focus on decision support systems for the public sector. It would be nice to see some more focus on the private sector or an optimal mix for both sectors.

DD 7.5**Session DD 7.5: Methods – Novel approaches****Chairs****Dr. Christopher Pettit, Department of Primary Industries, Victoria, Australia****Keynote speaker****Prof.dr. Renaat de Sutter, University of Gent, Belgium****Speakers****Dr. Leendert van Bree, Netherlands Environmental Assessment Agency, the Netherlands****Simone de Groot, Geodan Next, the Netherlands****Vincent Marchau (instead of prof.dr. Warren Walker), Delft University of Technology, the Netherlands****Dr. Tineke Ruijgh-van der Ploeg, Delft University of Technology, the Netherlands****Prajal Pradhan, Potsdam Institute for Climate Impact Research, Germany****Dr. Joop de Boer, Institute for Environmental Studies, VU University Amsterdam, the Netherlands**

Officially Belgium doesn't have an adaptation strategy, but there is more than meets the eye. Renaat de Sutter (University of Gent) explains the situation in Flanders. There are already a lot of studies and research in the field of climate change adaptation, but they are not coordinated or focused on existing research gaps. The development of an adaptation strategy or plan has some advantages: it promotes exchange of information, it generates commitment, it generates national as well as international visibility, and the activities on adaptation and mitigation will be coordinated.

The Netherlands is very densely built and populated and has been adapting to water influences for centuries. The adaptive ability of the Netherlands is influenced by choices in spatial and non-spatial developments and the political and societal willingness to adapt. The Dutch Ministry of Housing, Spatial Planning and the Environment (VROM) has therefore requested the Netherlands Environmental Assessment Agency (PBL) to develop a roadmap for climate proofing the Netherlands. Adaptation strategies are discussed in terms of co-benefits with existing and new urban and health policies. Leendert van Bree (Netherlands Environmental Assessment Agency) elaborates on the theme of climate change and health. The two most important health issues are heat stress and allergy and infection diseases.

Simone de Groot (Geodan Next) starts her presentation very nicely by asking in which fields the audience is working. Apparently there is no spatial planner in the room. Strategic Environmental Assessment (SEA) is a useful method to help address the interrelations between climate change and spatial planning in a consistent manner. SEA aims to integrate environmental and sustainability considerations in strategic decision making. According to Simone, Regional Spatial Strategies are an essential step in translating relatively abstract global and national level developments and regulations to more practical local level. In the audience there is some doubt if the provinces are the right geographical level to discuss climate change measures.

Vincent Marchau (instead of Warren Walker, Delft University of Technology) argues that adaptive policy making is the best approach to make more robust plans by not ignoring uncertainty and acknowledging that we cannot know the future. Policies are needed that are flexible and adaptable, enabling learning to take place on the relationship between climate change and sea level rise. Someone in the audience suggests that adaptive policy making might be synonym

for 'we don't have the money now, we will invest later'. Prajal Pradhan (Potsdam Institute for Climate Impact Research) shows that, based on similarities of socio-economic and ecological features, and climate change impacts, he can identify locations from which adaptation experiences may be transferred to comparable locations. A prototype of his tool has been presented at COP15. At COP16 they hope to be ready to show a final version of the tool. It is not yet tested with end-users.

It is important for decision makers to be made aware that frames, including the frames that are 'built-in' in decision tools, which can subtly shape their concept of reality. Joop de Boer (Institute for Environmental Studies) explains that frames can be expressed by various representations, such as how a problem is stated, who is expected to make the statement about it, what question appears relevant and what range of answers might be appropriate. Interaction with a number of adaptation projects showed that frame analysis works as an eye-opener for actors involved in decision making; introducing a contrasting frame can be used to open up the process of decision making.



Deltas in Depth Theme 8: Climate change and health in delta areas

DD 8.1

Session DD 8.1: Climate change and health in delta areas

Chair

Prof.dr. Pim Martens, Maastricht University, ICIS, the Netherlands

Keynote speaker

Dr. Andrew Githeko, Climate and Human Health Research Unit, Kenya Medical Research Institute, Kenya

Speakers

Simone Boër, Federal Institute of Hydrology, Germany

Dr. Elsa Casimiro, Infotox, Portugal

Dr. Sofia de Almeida, FSC, Portugal

Su-Mia Akin, Maastricht University, the Netherlands

Dr. Emil Augustiono, Deputy Minister Coordinator for People's Welfare, Indonesia

Dr. Eva Kunseler, Netherlands Environmental Assessment Agency, the Netherlands

Ali Akanda, Tufts University, United States

The keynote by Andrew Githeko (Climate and Human Health Research Unit, Kenya) starts with projections of zero fuel consumption and emissions. Examples are given from New Orleans, Pakistan and the Bay of Bengal about floods and water pollution, food shortage and people. Githeko argues that we need to reduce the vulnerability and increase the adaptive capacity since we cannot change the hazards of health impacts of floods. For example, floods include a tripling of suicide rates in New Orleans, and cities that depend on wells are during floods vulnerable to diarrhea and water borne diseases such as cholera, typhoid and salmonella. Vector borne diseases such as malaria, rift valley fever, dengue fever, leishmaniasis and plague increase with climate change as well. Dengue fever has doubled in south-east Asia this year. Food borne diseases also increase. But it is not only diseases that increase. Also health infrastructure is damaged. We need to take the precautionary principle, especially in developing countries. Stepwise, incremented adaptation seems the best option, however in some cases (especially when the risks are clear) more radical measures are necessary. Protection of coastal cities must be included in the development agenda and adaptation strategies. The Kenya Medical Research Institute still has to start adaptation.

According to Simone Boër (Federal Institute of Hydrology), fecal contaminated water led to 100.000 cholera infected people and 4230 deaths in Zimbabwe in 2008/2009 alone. This can be prevented by good sanitation and water pipes for freshwater supply. Since 1994 there have been repeated reported instances of *Vibrio* spp in Northern Europe, especially around brackish water areas (Baltic Sea) and the North Sea. This observation leads to a study along the coast of the North of The Netherlands and Germany. First results show that *Vibrio Algorolyticus* and *Vibrio Paraharmdyticus* are more frequently seen with high temperatures. The organisms are found in all sampling sites

with higher concentrations in sediments than in water. Positive *Vibrio Vulnificus* concentrations are only found at water temperatures of 20 degrees Celcius. Hotspots are the estuaries. The study still has to show if the organisms are damaging for health.

Three municipalities of Cascais are developing climate change strategic plans including adaptation, says Elsa Casimiro (Infotox, Portugal). They concentrate on heat stress, air pollution impacts and vector borne diseases. The region has a history of heat waves. The excess deaths in 1981 and 2003 were around 1900 against a population of 190.000. This is 1 percent of the population, where especially the elderly are hit. The elderly are around 17 percent of the population. Thresholds in temperature were established by which an action plan comes operational. With climate scenarios for 2097 these thresholds would be exceeded 100 percent of the days of the whole summer and in 50 percent of the days in 2047. Apart from heat stress, malaria is reported every year as are various vectors of West Nile Fever and other vector borne diseases. The study shows that Mediterranean Spotted Fever and Leishmaniasis are a high risk for the region.

Sofia Almeida (FSC) explains how cardiovascular diseases and respiratory diseases increase with apparent temperature increase at around 2,1 percent in all population and up to 3 percent in elderly people. The study separated the effects of PM10 and ozone from the effects of temperature itself. Results in the Netherlands show that around 20-30 percent of the mortality increase in warm periods is due to combined heat stress and pollution levels. This would be interesting to study in Portugal.

The focus of the project of Si Mun Akin (Maastricht University) is on pathogens that are sensitive to climate factors. Since they are also sensitive to non-climate factors these are also included in the study using a multilevel/systems approach. The framework includes the contextual, indirect and direct drivers which have different timeframes. Hence, measures taken at the contextual level will take decades to render effect while direct drivers have instant effects. Climate change is seen as part of the indirect drivers, also including land-use change. The framework will be used for scenario development and for identifying adaptation measures. The health community has an important contribution in the climate change context.

Health effects are observed during El-Nino as well as during dry seasons. Moreover, malnutrition amongst children under 5 years old becomes important, explains Emil Augustine (Deputy Minister Coordinator for People's Welfare). Mangrove destruction in delta areas leads to higher instances of water borne diseases. Malaria is responsible for 45 percent of vector borne diseases in Indonesia. The health system in general needs improvement in delta areas, especially with the threats of climate change. Priority has to be given to implement sustainable public health intervention policies such as strengthening food security and increase the commitment of local communities and private actors. One of the measures to take is to inform people not to cut mangrove.

According to Eva Kunseler (Netherlands Environmental Assessment Agency) the study 'Assessment of adaptation options on climate change related health impacts' includes a wide range of morbidity and mortality effects. Adaptation options identified were changes in exposure such as cool buildings, proper clothing in summer against tick bites, but also changes in the medical sector. In 2010 a lot of work was done including analyzing the WHO recommendations and expert surveys. Policy themes identified include health in all mitigation and adaptation policies, measures and strategies: Health systems should be strengthened to cope, prevent and prepare for climate change; awareness raising and research information systems should be strengthened. The study thus far identified seven measures which are still to be analyzed on their political and practical implementation potential. An example is including climate change in curricula of medical studies. It showed that curricula are so full that this proved impossible. However, students found it interesting and developed their own study group in their free time. This might be something to stimulate.

The chairman concludes that it is good to see that from the second assessment report of IPCC, when only a handful of scientists were working in the field of health, the attention for climate change and health research is growing. Health experts and climate change experts should work together more on impact research and with health practitioners for identification and implementation of adaptation measures.



Deltas in Depth Theme 9: Managing risks of extreme climate events

DD 9.1

Session DD 9.1: Quantifying climate risks

Chairs

Prof.dr. Jeroen Aerts, VU University, the Netherlands and prof.dr. Reimund Schwarze, DIW Berlin, Germany

Keynote speaker

Dr. Robert Muir Wood, RMS, United Kingdom

Speakers

Jessica Ludy, University of California, Berkley, United States
 Laurens Bouwer, VU-IVM, the Netherlands
 H.F. Treur, Netherlands Insurers Association, the Netherlands
 Dr. Heidi Kreibich, German Research Centre for Geosciences, Germany
 Wouter Botzen, VU University, the Netherlands
 Hans Waals, Waterboard Hollandse Delta, the Netherlands

Robert Muir Wood (RMS) opens this session with a keynote speech about how to quantify the risks of extreme climate events and how to use tools to explore risk management options. Even though a hazard like hurricane Katrina could be expected in view of previous occurrences in new Orleans, it is not possible to know what will happen in the future. A next catastrophe will be different. With regards to climate change, extreme events are expected to occur more often. When using catastrophe models it is possible to consider the probability of climate extremes, to make damage and vulnerability assessments. The models can be used to explore climate change risks, adaptation scenarios and alternatives. With these models the pricing of risks can also be explored. It is important to know how much to invest each year to pay for future potential losses.

Laurens Bouwer (VU University) looks into the dynamics of weather risks in the future. Projecting economic losses requires both insight in changes in the weather hazard as well as insight in the exposure and vulnerability to such hazards. With two cases he shows the dynamics of weather risks in the future. He applies different climate scenarios as well as socio-economic scenarios to show potential losses. Most studies show that the socio-economic changes have a higher effect on future risk than climate change. Climate change may amplify the effect of socio-economic change.

H.F. Treur (Netherlands Insurers Association) discusses the question of how much climate change will cost insurance companies. Therefore, the effects of heavy rainfall events on the related losses for insurers is researched. His study shows that there is a clear relation between insurers' losses and heavy rainfall. The intensity of rainfall is more important than the total amount. Climate change scenarios for the Netherlands indicate that the rainfall intensity will increase during heavy rains in the summer. This implies that insurers can expect more claims due to climate change. The study also showed regional differences regarding the number of claims and the damage amount per claim. As of yet the Netherlands do not offer an insurance against flood damage. The government can compensate for losses

in case of natural catastrophes. However it is uncertain if and how much the government will compensate after an event. A flood insurance could be a good measure to increase economic resilience, according to Wouter Botzen (VU University). The question is whether households would be interested in buying such an insurance. Because of the high costs in case of a hazard, it may not be possible for private insurers to offer an insurance. Therefore a public-private scheme is tested in which part of the damage is compensated by the government. The results indicate that opportunities exist for a (partly) private insurance market.

Jessica Ludy (University of California) deals with the public perception of flood risk in the Sacramento San Joaquin Delta in California where a flood insurance exists. The United States National Flood Insurance Programme (NFIP) intends to minimize flood risk by demanding flood insurance coverage for residents of areas situated in floodplains with a return period of floods up to 100 years. These residents also have to take measures to flood-proof their houses. Areas situated behind levees are not considered as floodplains and therefore no insurance is required. Most residents believe that they would not be allowed to live behind a levee if it were not safe. A survey in a newly developed area showed that residents are not aware of the flood risk, have not been told that they are at risk and are unprepared for a flood. It is recommended that the land behind the levees should also be treated as floodplains, and to base the insurance rate on the actual risk. It is important to inform people of the risks to increase awareness.

Heidi Kreibich (German Research Centre for Geosciences) shows that experience is a strong motivator for better preparedness. She presents a study of households and businesses along the Elbe river in Germany to investigate changes in flood preparedness a few years before and after flood events in 2002 and 2006. All interviewed subjects were affected by both floods. People in the affected area had little flood experience prior to the 2002 event. The study shows that flood awareness has increased significantly for both households and businesses since the 2002 event. Ninety percent of households had taken precautionary measures before the 2006 floods. However, almost a third of the businesses had not taken precautionary measures to reduce damage before the 2006 flood. Particularly for businesses regulatory programmes and programmes encouraging proactive behavior should be implemented.

The final presentation in this session is given by Hans Waals (Waterboard Hollandse Delta). He demonstrates how options for a new governmental arrangement are researched in a pilot study area: the Island of Dordrecht. The area is located between the rivers Meuse and Rhine nearby the North Sea. Large parts of the area lie behind the levees. In the light of climate change the safety situation has to be reevaluated. The new policy concept, the 'multi layer safety' (MLS) was issued in the Water Plan (2009). Even though the probability of flooding is low, the occurrence of floods has to be taken into account. Therefore it is important not only to focus on preventing the area from flooding (the first layer). The second and third layer of the policy are developed to mitigate the effects of flooding. The second layer aims at the urban and regional planning and the building codes. The third layer consists in safety plans for flooding and evacuation plans. The Waterboard Hollandse Delta, the municipality of Dordrecht and the regional safety authority Zuid-Holland-Zuid are each responsible for one layer of the policy. By joining forces more economic effective and social acceptable solutions can be found.

DD 9.2

Session DD 9.2: Managing climate extremes in practice

Chairs

Prof.dr. Jeroen Aerts, VU University, the Netherlands and dr. Swenja Surminski, Association of British Insurers, United Kingdom

Keynote speaker

Dr. Thomas Loster, Munich Re, Germany

Speakers

Dr. Albert Klein Tank, KNMI, the Netherlands
Prof. dr. Reimund Schwarze, UfZ Potsdam, Germany
Prof. dr. Elizabeth English, University of Waterloo, Canada
Philip Bubeck, VU University, the Netherlands
Wouter Jonkhoff, TNO, the Netherlands
Dr. Aris Marfai, University of Joghjakarta, Indonesia
Jan-Moritz Müller, LSBG Hamburg, Germany
Yu-tzu Lin, Architecture and building Research Institute, Taiwan
Camille Manning-Broome, Centre of Planning Excellence, Baton Rouge, United States

Thomas Loster (Munich Re) starts off in this session with a keynote speech about insurance arrangements for climate change and extreme events. In his presentation he discusses the insurability of climate change and extreme events. Events have to be sudden, unforeseeable and calculable. He compares arrangements in the 'insured world', such as in United States and European countries and in the 'uninsured world', mostly the poor countries. In the insured world private companies have highly sophisticated tools to assess the risks of extreme events of a certain area. When risks and potential losses are too high the companies or households cannot get insured. In the poor world hardly any insurance is available, even though these areas are also prone to risks and extremes. A few examples of small scale initiatives in the uninsured world show how on a small scale good and simple arrangements can be made. New initiatives are on the way to try to insure extreme events.

The second presentation in this session focuses on the monitoring of European changes in extreme weather and climate events. Because of climate change it is likely that there will be changes in extremes that are beyond the normal variability. At the moment global datasets are used to assess extreme events such as Moscow's heat wave in 2010. Albert Klein Tank (KNMI) argues the need for more robust data and of a high resolution. He presents two projects that monitor climate extremes on a European scale.

Several presentations in this session focus on flood risk and damage. Philip Bubeck (VU University) explains about the development of a flood risk model to get a better insight into the current and future flood risk. Climate change and socio-economic development are taken into account as important drivers. The model is also a tool for assessing the effectiveness of adaptation strategies. Outcomes show that the increase of flood risk in the Rhine-Basin ranges between 53 and 230 percent (2000-2030). Probabilities of extremes and the impact of climate change are very uncertain. Damage reduction seems to be a robust adaptation measure.

For the assessment of flood damage it is important not only to look at the direct damage of economic objects, but also to look at a wider spatial and time frame. Wouter Jonkhoff (TNO) studied the regional economic effects of floods in the

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Rotterdam area. His study estimates that the total damage increases with 15 to 55 percent when taking into account the region outside the flooded area and the long term effects. Inclusion of long term effects in flood risk assessment can contribute to improved water safety policy, spatial planning and insurance.

Aris Marfai (University of Joghjakarta) introduces us to an ongoing study in the coastal area of Jakarta, an area that is regularly flooded. Urgent adaptation measures are required to address the flood problem in this area. The high rate of subsidence also has to be taken into account. The Jakarta city government is working on a plan for flood risk management. In a study current and future flood risk will be assessed. This study also looks into the governance structure to assess the potentials and the bottlenecks for integrated flood risk management.

Yu-Tzu Lin (Architecture and building Research Institute) shows us the importance of a good disaster management system for Taiwan. More than three third of the Taiwanese population live concentrated in an area exposed to natural hazards, mostly earthquakes, landslides and typhoons. The country is highly vulnerable to the effects of climate change. She explains how the government of Taiwan has established a spatial planning system for urban disaster prevention. This spatial planning system integrates all hazards and uses a pro-active approach in which public participation plays an important role.

Jan-Moritz Müller (LSBG Hamburg) gives a short overview of the present coastal protection strategies applied by cities along the North Sea coast and how these countries deal with future sea level rise. He found that the time frame considered differ between countries. The applied strategies include a variety of different technical measures. The future strategy of Hamburg will focus on technical flood protection.

Reimund Schwarze (UfZ Potsdam) looks into how to economically motivate households to take precautionary measures against floods. This study was undertaken in two catchments in Germany after recent floods. The study shows that large investments are only economically efficient if a building is flooded regularly. Small investments are still profitable if a building is flooded only every 50 years. Financial incentives, such as conditional government aid, can motivate households to invest in precautionary measures. In this case the government compensates damage only when a household has taken 'reasonable' precautionary measures.

Elizabeth English (University of Waterloo) explains the work of the Buoyant Foundation Project (BFP) to reduce people's vulnerability to extreme flooding. BFP was founded after hurricane Katrina. Its mission is to support the recovery of New Orleans' unique and endangered traditional cultures. Within the project homes are created that float in a flood, a so-called amphibious home. The concept of amphibious homes has also been applied elsewhere, also in the Netherlands. A prototype of a low-cost amphibious home has been constructed in 2009 in Dhaka, Bangladesh by an architecture student. Empty water bottles were used to construct the flotation blocks of this LIFT (low income flood proof technology) home.

The final presentation in this session also focuses on the New Orleans area. After hurricane Katrina the possibilities for protection and restoration of the Louisiana coastline were studied. The Netherlands contributed to this study by identifying best practices in the Netherlands that are applicable in Louisiana. Camille Manning-Broome (Centre of Planning Excellence) explains how with the help of the Netherlands the first regional land use planning for Louisiana was developed in 2007. Louisiana has no office for state planning and had no land use planning so far. Following this, a best practices manual is prepared with local, national and international experts to give the local governments, developers and coastal communities ideas for sustainable land use planning and to empower them to make wise decisions.



Deltas in Practice Theme 1: Finance and economy

DP FE 1.1 Session DP FE 1.1: Emerging new modalities for financing

Chair Hugo von Meijenfeldt, Ministry of Housing, Spatial Planning and the Environment, the Netherlands

Speakers Monica Scatasta, European Investment Bank, Luxembourg
Julia Bucknall, World Bank, United States
Pieter Bloemen, Delta Commission, the Netherlands
Dr. Ainun Nishat, International Union for Conservation of Nature, Bangladesh
Simon Reddy, C-40, United Kingdom

Short description of the session topic and the objective of the session

The developed countries committed in COP15 to collectively provide new and additional resources through international institutions approaching USD 30 billion for the period 2010-2012 with balanced allocation between adaptation and mitigation. Developed countries commit to a goal of mobilizing USD 100 billion annually by 2020 to address the needs of developing countries. This funding will come from a variety of sources, public and private, bilateral and multilateral, including alternative sources of finance. New multilateral funding for adaptation will be delivered through effective and efficient fund arrangements. But, financing should not be seen as simply money. Rather, financing is a strategic function to pursue long term visions and targets for sustainable development of societies in an efficient manner whether presently rich or less so.

Most exciting insight, moment or outcome

- Cities should have a better understanding when implementing adaptation and new solutions
- Coordination across different levels is highly necessary
- Replicate projects in other countries can definitely help

Main conclusions, themes, insights or messages

- Adaptation is broad. All sectors are busy with it and have a common challenge
- It is important to apply an integrated approach
- Build flexibility in the programme. Try to get other projects integrated. Compare different scenarios, theories of added value, social costs and benefits

Key phrases or quotes

- How do you spend the money well on projects which will benefit the local communities? 'Money is not the problem, the problem is the priorities of governments'. They often don't want to spend money in areas of need
- 'Governments do not act at all'. Organisations and communities do
- 'Prevention is a fundamental aspect of an integrated approach'

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session

- Cities need data transparency, political leadership and partnership
- We need a Climate Smart development

DP FE 1.2 Session DP FE 1.2: Methodologies for costs and effects of adaptation options at global, national and local level

Chair Msc. Willem Ligtoet, Netherlands Environmental Assessment Agency, the Netherlands

Speakers Dr. Marloes Bakker, Netherlands Environmental Assessment Agency, the Netherlands
Joost Knoop Netherlands Environmental Assessment Agency, the Netherlands
Prof. Pavel Kabat, Wageningen University, the Netherlands

Short description of the session topic and the objective of the session

This session discusses the usefulness of cost benefit analysis in determining the maximum effects of investments in adaptation on different levels of scale in different regions around the world.

The objective of the session is to use a model to predict the risk of flooding and the cost and benefits of avoiding or mitigating that risk. This can help to calculate the necessary and optimal investments in flood protection on different scales and in different regions around the world.

Most exciting insight, moment or outcome

- **Global assessment of the costs and effects of adaptation on different scales**
In reaction to the presentation of dr. Bakker, Saleemul Huq commented that the contributions of donor countries, even if well thought through, are of no consequence if the receiving countries government is not prepared to invest in the safety of their citizens. And if they are prepared to invest, the donations of other countries are mostly not necessary.
- **Costs and effects of adaptation strategies for flood protection in the Netherlands**
Joost Knoop (Netherlands Environmental Assessment Agency) concluded that maximum safety does not have to mean absolute safety. Controlled flooding can be a very good alternative, that is much more cost effective (it costs approx.10 times less) at almost the same risk levels than the risk aversion goals set by the second Delta Commission.
- **Climate proofing for water services for the city of Khulna in Bangladesh**
Pavel Kabat (Wageningen University) concluded that it is not so much the risk of flooding as it is the ever increasing threat of salinization that will effect the city of Khulna most in the future.

Main conclusions, themes, insights or messages**Global assessment of the costs & effects of adaptation on different scales:**

It is possible to model environmental risks of different problems like flooding, drought salinization for different region and on different scales to advice on the most useful investments in prevention.

The model is a useful tool for both the donating party and the receiving country to decide on where to invest the money with the biggest impact. This knowledge will help all parties in justifying the investments. Saleemul Huc concluded that the willingness of governments to invest in the safety of its people is a much more important indicator of the end result than a model based assessment of the impact of investments. Even if the model is a great tool in determining the right strategy.

Costs and effects of adaptation strategies for flood protection in the Netherlands

There are more ways to secure the Netherlands from floods than the solutions brought forward by the 2nd. Deltacommission that are both more cost effective, more spatially responsible and much more easy to realize.

Climate proofing for water services for the city of Khulna in Bangladesh

Local Knowledge should not be discounted and should be utilized as much as possible.

In Bangladesh it is not so much the risk of flooding that is the problem as is the ever increasing level of salinization.

Key phrases or quotes

- The conclusion on the necessary investments (that are very high) in Dutch water protection by the Delta commission seem to be in part motivated by the need to make a political statement to show the need to act – Jim Hall
- It is not so much the cost (.. of the investment in water safety) as it is the way we have to pay for it that is the central question – Laurens Bouwer
- Cost Benefit analysis is not as important as is the political will to act- Stéphane Hallegatte

**DP FE 1.3****Session DP FE 1.3: Economic concepts for socio-economic vitality and biodiversity****Chair**

Tom Podany, US Army Corps of Engineers, United States

Speakers

Patrick ten Brink, IEEP, Belgium
Eric Schellekens ARCADIS, the Netherlands

Short description of the session topic and the objective of the session

Climate change will impact the physical and socio-economic characteristics of deltas worldwide. Valuing ecosystem services is one of the possibilities to deal with this impact integrally, by tackling biodiversity loss and also improve socio-economic liveability. A study on 'The Economics of Ecosystems and Biodiversity (TEEB)' was launched by Germany and the European Commission in response to a proposal by the G8+5 Environment Ministers (Potsdam, Germany 2007) to develop a global study on the economics of biodiversity loss. In this session the final results of the end-user reports are presented, offering tailored insights and advice for national and international policy makers, local and regional administrators, businesses and consumers and citizens. The results will also be translated into possible actions for climate change adaptation in the world's deltas. Tidal Economy will be presented as a concept, using the power of the tide to introduce a new and sustainable way of living in deltas.

Most exciting insight, moment or outcome

- Investment in ecological infrastructure is highly important
- Biodiversity and climate should be a win-win situation. It is impossible to address climate without biodiversity. Both Mitigation and adaptation are necessary
- We are moving to a low-carbon economy
- Move to resource efficient economy and work with natural resource and ecosystem

Main conclusions, themes, insights or messages

- 'Avoid partial solutions'
- 'A tidal economy vision is needed' - 'A tidal way of life is a tidal economy'
- Challenges: safety, sustainable water and agriculture

Key phrases or quotes

- 'Systematic use of windows of opportunities at global and local levels, and realize policy synergies. Avoid policy disconnection'
- 'Are we really spending the money in the right place or project?'

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session

- ARCADIS is working on an innovative concept for Delta development: Tidal terrace: nature, agriculture, recreation, wellness and other economic activities are involved

Deltas in Practice Theme 2: Urban planning and infrastructure

DP UP 2.1 Session DP UP 2.1: Adapting to Urban Heat Island effects

Chair Ronald Albers, TNO, the Netherlands

Speakers Baldiri Salcedo, Delft University of Technology, the Netherlands/Spain
Alex Nickson, City of London, United Kingdom
Heleen Mees, University of Utrecht, the Netherlands
Lissy Nijhuis, City of Rotterdam, the Netherlands

Short description of the session topic and the objective of the session

During the day cities collect solar energy, which makes them warmer than their surroundings. In the night the surroundings cool down, but the cities keep the heat (glow in the dark).

This session aims to show possibilities for cities to adapt to the Urban Heat Island effect.

Most exciting insight, moment or outcome

The size of the problem London needs to cope with.

Main conclusions, themes, insights or messages

Cities collect more heat during daytime than their surroundings due to dark surfaces and a limited amount of green. This difference in temperature can go up to a maximum of 10°C. Most citizens enjoy this rise of temperature, although some complain. The problem caused by increasing temperatures, however, is that people don't recover during night time, which makes them more vulnerable in terms of health. The huge fires which threatened Russia made clear that nature also struggles with increased temperatures.

Another effect is that the electricity network is hard to control. There are cases known of the electricity network being overloaded by the use of air conditioning. Warm cities are also more comfortable for bacteria, which might lead to diseases.

Above all the greatest risk is yet to come, when the temperature reaches the critical point of 24°C. At this point people will start to buy air-conditioners and the city system will warm up by the use of them.

To cope with these effects there are four main types of measures:

- Absorption: a lot of heat in cities is absorbed by buildings. The colour of roofs makes a huge difference, so painting the roof white or changing it to a green roof will make it absorb less heat
- Efficient cooling: creating an airflow through the building is also an effective measure; it allows the heat to move out when necessary. Another way to improve the efficiency of cooling is to remove cooling machines from the roof, where they get heated by the sunlight, and bring them underground

- City options: in the city structure the options are limited, but valuable on more than just the heat aspect. Increasing the amount of trees and green zones in the city will reduce the temperature up to 5°C. If the pavement will be changed as well, the temperature can be decreased by 2,5°C. Another aspect that influences the temperature, is the amount of water in a city; water may lead to a decrease of 2,5°C, as a Japanese ritual proved. In the Netherlands there is a new design called 'water plazas' which are places to store rainwater in times of excessive rainfall. They can be combined with a childrens' playground or a footballfield. Finally the city structure can influence the airflow and the amount of shade/sun
- Public: last but not least the public part. According to the experience in Toronto, two hours of cooling off increases the survival chance of people. In addition, informing the public through the government or its partners of possible heat danger makes a difference

The city of Rotterdam introduced a recreation beach alongside the river; citizens no longer need to move to the beach outside town by car. Car traffic also heats the city.

Key phrases or quotes

- 'Help your pet beat the heat' - Heleen Mees (University of Utrecht)
- '30 percent of the heat in Hong Kong is generated by there own air-conditioning' - Alex Nickson (City of London)

DP UP 2.2a Session DP UP 2.2a: Urban Levees, Integration of water safety and spatial planning

Chair Prof.dr.msc. Han Meyer, Delft University of Technology, the Netherlands

Speakers MSc. Peter van Veelen, Department of Urban Planning Rotterdam, the Netherlands
MSc. Joep van Leeuwen, Public Works, City of Rotterdam, the Netherlands
Jan-Moritz Müller, Agency of Roads, Bridges and Water Hamburg, Germany
Jan de Goei, Movares, the Netherlands

Short description of the session topic and the objective of the session

Delta cities are threatened by water from the sea and from the river. In most delta cities, conflicts can arise between safety measures against flooding (increased elevation and size of levees) and space onstraints for city development. In this session strategies and experiences of combining safety to flooding and spatial development will be presented. Stakeholder involvement will be discussed as well.

Sharing knowledge about the way urban levees can be integrated on an attractive and sustainable way in the urban structure, even when the levees have to be reinforced related to climate change.

Most exciting insight, moment or outcome

- Huge variety of measures can be taken to protect area's against flooding and the spatial quality that can be reached not despite but thanks to reinforcement of levees and other types of element that have to provide against flooding

Main conclusions, themes, insights or messages

Hamburg is very inspiring, but also not comparable with many other areas that are vulnerable for flooding because of the huge tide level differences. Every area has to invent their own solutions!

Urban planners has to be worked early in the process together with the water boards

Thinking about levees is not alone about physical infrastructure and creating of spatial innovative solutions, but has a lot to do with responsibilities, money, dealing with uncertainties. etc. Also on this topics innovations are needed to achieve new types of levees integrated in the urban structure.

DP UP 2.2b Session DP UP 2.2b: Sustainable coastal protection

Chair Prof.dr. Marcel Stive, Delft University of Technology, the Netherlands

Speakers Piet Dircke, ARCADIS, The Netherlands
 Nathalie Balcaen, Maritieme Dienstverlening en Kust, Belgium
 Denis Vandenbossche, THV Vlaamse Baaien, Belgium
 Tom Podany, Protection and Restoration office, US Army Corps of Engineers, United States

Short description of the session topic and the objective of the session

In this session examples of coastal management plans are given, focusing on short term actions and long term perspectives. The session aims to obtain new insights in the impacts of climate change on deltas and in guidelines on how to move forward.

Most exciting insight, moment or outcome

- There are many types of measures available to protect deltas against potential floods. These measures vary from hard, concrete constructions to soft measures such as sand refill. Innovation in techniques and materials broaden the range of potential measures
- Also, attention must be paid to ecosystems, such as the wetlands around New Orleans, as these are the most vulnerable systems that cannot be protected with hard measures. By building with nature, it is possible to protect ecosystems and at the same time protect the delta against flooding

Main conclusions, themes, insights or messages

Katrina woke up the world and showed what can happen if we ignore the risks of flooding. Because of the events, many countries are now developing a flood risk programme to protect their coastlines. The speakers show with their examples that there are various new and innovative ways of improving coastal protection. However, each coastline requires a custom approach, based on the specific characteristics of the area. The presentations show that combining coastal protection with local opportunities and functions is very promising to improve the spatial quality.

Key phrases or quotes

- Various new and innovative ways to improve flood protection
- An integrated approach can improve spatial quality
- Characteristics of the area are the most important in choosing what type of measure to use

DP UP 2.3a Session DP UP 2.3a: Innovations in water infrastructure and urban design (part 1)

Chair Dr. Frans van de Ven, Deltares, the Netherlands

Speaker Prof.dr. Tony Wong, Chief Executive and Director, Centre for Water Sensitive Cities, Monash University Melbourne, Australia
 Hiltrud Pötz, Partner op MAAT sustainable architecture an urbanism, Delft, the Netherlands

Panellists Abby Hall, Office of Sustainable Communities, EPA, United States

Short description of the session topic and the objective of the session

The session focuses on urban design possibilities for water management in cities in the developed world, including Australia, the EU and the United States. The objective of the session is to obtain insight in the implications of a water sensitive design on the urban structure, building, site planning and street layout. An overview of best practice case studies is provided.

Most exciting insight, moment or outcome

- There are already many examples of sustainable architecture and urban designs which have proven to be profitable solutions on the scale of a building or a small neighborhood. Upscaling these examples to a city is still complex
- The most important goal is to create a place people want to live in. The best technical solution only remains if it is accepted in social life

Main conclusions, themes, insights or messages

The ongoing pressure to accommodate growing populations and urbanization focuses the discussion on the issue of increasing urban densities and associated impacts on the livability of future urban environments. Livability is related to good urban design and sufficient financial investment in public spaces. High density communities could be build around well designed open spaces that serves multiple functions.

Open public space in a water sensitive city has to serve multiple functions. The integration of urban water management solutions into urban design creates climate responsive designs for climate change adaptation and mitigation. Arable land is decreasing and pressures on food production to support a growing population increase. These challenges could be met with water sensitive cities concepts, particularly the nexus of water recycling and urban productive landscapes. Public spaces should therefore have multiple ecological functions including water cleansing and recycling, promotion of local energy generation and exploiting the nexus of energy production and production of hot water services for heating and domestic uses, transportation, and providing green infrastructure for biodiversity. Many lessons from natural systems can be learned to enable biomimicry of constructed urban spaces. There are many technical solutions to make the engineered system of a city functioning as a more natural system.

The presentations showed that sanitary and storm water treatment at the site, electricity generation, district heating, multiple water sources for potable and non-potable use, green walls and roofs can be combined if you take local opportunities and functions into account. Water sensitive cities are the cities of the future.

Key phrases or quotes

- In nature it looks simple to be water sensitive, in urban design it's a complex simplicity
- Global warming will result in increases in soil moisture deficit and, coupled with higher rainfall uncertainties, will increase uncertainties and therefore vulnerability in water supply security
- Urban catchments can be managed as water supply catchments as storm water runoff from impervious surfaces are less vulnerable
- Innovative technologies are available to cleanse urban storm water runoff when incorporated into public spaces
- Future cities would need to develop the structural and social infrastructure to function as water supply catchments
- An integrated approach can improve spatial quality and deliver ecological landscapes for improving climate resilience, environmental protection and livability

DP UP 2.3b Session DP UP 2.3b: Innovations in water infrastructure and urban design (part 2)

Chair Karin Stone, Deltares, the Netherlands

Speakers Prof. Vicki Elmer, University of California/Berkeley, United States
Ms. Virna Bussadori, ECTP-CEU, Italy

Main conclusions, themes, insights or messages

Prof. Vicki Elmer (University of California / Berkeley) presents some interesting ideas on the integration of urban design and water and energy saving efforts in a concept 'Eco block', which has been designed as part of a study on sustainable urban development in China. The concept of integrating water and energy in existing PRC's or super blocks proved to be an efficient way of dealing with climate change in emerging countries, like China or India. One of the most interesting ideas Vicky Elmer presented was a completely closed system of recycling waste water, grey water and fresh drinking water supply, within the boundaries of the Eco block.

The second half of her presentation focuses on different ways in which recycled water systems can be integrated in community planning. This recycled water system has already been implemented in some cases in California. The re-use of domestic or recycled water is particularly suitable to be implemented in countries with similar climatologically conditions like California.

Ms. Virna Bussadori, president of the ECTP-CEU presents a comprehensive climate adaptation planning approach for her hometown. The main message of her presentation is that planning has a key role in helping to tackle climate change. This can be done by mitigations tools, reducing greenhouse emissions and adaptations tools, reducing vulnerability and risks.

Ms. Karin Stone (Deltares) presents some locally implemented measures of climate change adaptation in developing countries. These cases prove that also in countries with a weak economy or a reluctant government, climate change efforts can be implemented by using local groups and integrating solutions. The most successful cases are integrated solutions, where climate change solutions were combined with the need for public space or urban agriculture. During the discussion the main topics discussed are the difference between water use in the United States and Europe and the challenge of re-using water in urban areas. This task is especially large in the United States and the presented

solutions can be interesting for emerging countries. In Europe, many of the proposals have already been implemented or are less valuable because of the high level of water use reductions. The generally shared conclusion of this session is that small locally implemented and comprehensive solutions for water and energy saving efforts are probably the most feasible strategies.

DP UP 2.4 Session DP UP 2.4: Planning for ports and waterways

Chair Tiedo Vellinga, Port of Rotterdam, the Netherlands

Speakers Prof.dr. Darryn Mc Evoy, Climate Change Adaptation Programme, Global Cities Institute, RMIT University, Australia
Prof.dr. Nicole von Liebermann, Hamburg Port Authority, Germany
Chung Chen Kun, Delft University of Technology, the Netherlands
Rinske van der Meer, Port of Rotterdam, the Netherlands

Short description of the session topic and the objective of the session

This session will explore various approaches to management of ports operations, hinterland connections and waterways under climate change. Presentations will be given about Melbourne, Rotterdam, Taiwan and Hamburg. Pros and cons of the different approaches will be discussed and lessons learned so far shared. The session is also meant to initiate and strengthen cooperation between port cities.

Most exciting insight, moment or outcome

The worldwide variety in climatic conditions causes ports across the globe to have quite different priorities in adaptation to climate change effects.

Main conclusions, themes, insights or messages

Moving a port (such as the ones in Melbourne and Rotterdam) may solve many problems in one go, including adaptation to climate change.

The Hamburg strategy comprises: Attenuation of tidal energy by river engineering (mouth of Elbe), giving more space to floods (upper part of Elbe), and optimization of sediment management (whole Elbe system).

Today, public and scientific discussion on port development in times of climate change focuses mainly on rising high water levels and adaptation potentials. But, we are forced to take the **sediment management** into account! It will be absolutely necessary to care about morphological dynamics in our estuaries and thus harbours!

Port development in times of climate change needs additional protection and adaptation strategies. This may lead to increased costs. But, with an **integrated approach combining different interests** like defense, economy, tourism, urban planning etc. costs can be shared and even lead to win-win solutions.

Economic and political developments in China led to a decrease in freight of the Kaohsiung Harbour in Taiwan. Port and city have to deal with a shrinking economy along with adaptation to climate change (water level rises up to 3 m).

The main spatial problems are the vast obsolete waterfront and the water issues in the highly dense port city. Summer is the main season of rainfall mainly coming with storm in Taiwan. There is apparent rise of extreme rainfall in the last decade. There has been four incidences of extreme rainfall (up to 1200 mm in a month) in the past ten years. This causes devastating peak floods in the Kaohping river basin, and the depositing of huge amounts of sediment and tree trunks in the downstream parts. In order to plan the future of port and city, the relation between the port and the Kao Ping River delta is analysed in a spatial study.

Specific interests Port of Rotterdam:

- Open access is key. Some climate change adaptation measures have negative effects on accessibility
- Freshwater is currently available. In the future salt intrusion during extreme conditions may cause temporary freshwater inlet stops
- Flood risk is limited, though one should use climate proofing solutions as they materialize
- Determining and using a climate solution is reassuring to investors

DP UP 2.6 Session DP UP 2.6: Developing Delta Cities, Strategies for climate change in developing countries

Chair Bert Smolders, ARCADIS, the Netherlands

Speakers Sheikh Bamba Dieye, Mayor of St. Louis, Senegal
 Christophe Nuttall, Director of the Hub for Innovative Partnerships, UNDP, Switzerland
 Marie Dariel Scognamillo, Consultant, Cities and Climate Change Initiative UN HABITAT, Kenya
 Robbert Steijn, Director Coasts and Marine Systems, Alkyon/ARCADIS, the Netherlands

Short description of the session topic and the objective of the session

The focus of this session is on mega delta cities in less developed countries. This decade, for the first time in history, the majority of people worldwide are living in towns and cities. By 2050, this is even estimated to be over 6 billion people, two thirds of humanity. 93% of this urban growth is expected to take place in Asia and Africa. The majority of these cities are located at vulnerable locations near the sea and in deltas. The problems are even bigger in the urban areas in Asia, Africa and South America. Especially the poorest part of the population is living in flood prone areas. As such, climate change, sea level rise and flooding rivers are directly linked to the problems of development and the access to affordable housing and urban services in mega cities. In this session, two case studies illustrated the constraints and opportunities. First the city of St Louis in Senegal, which is vulnerable for floods from inland (the Senegal River) and from offshore (high water levels and coastal erosion). And secondly Haiti where the earthquake has led to a number of flood problems, adding to existing problems.

Goal of the discussion is to find answers on the question how to develop strategies for delta cities in the least developed countries. How to cope on a long term, with short term action. The strategies will have to be very cost effective and flexible, and adapted to the local conditions: physical, social and economical.

Most exciting insight, moment or outcome

“Water a threat? No, water is an opportunity. As long as we’re building with nature instead of fighting against nature.”

Main conclusions, theme’s, insights or messages

- Look at nature and copy the solution nature gives you. You’ll loose the fight with nature anyway. Further, it’s arrogant to assume that you know what’s going to happen. So instead of fixed systems, it is preferred to use flexible systems.
- Water is an attractive asset for a city; therefore integrate water in the solution and make it more appealing.
- The scale of a solution is often related to the scale of the problem it addresses. Regional or local problems can be solved on regional or local level. On a higher scale, effective cooperation and coordination is hard to reach. Although there is a strong will among the several parties to act successful, that just isn’t enough. The foundation has to be laid by those who experience or feel ownership of the problems.
- At the end of the day, the politicians in charge are responsible for the long term safety of their population. This can conflict with their short term political goals. The lack of acknowledgement for this contrast is a serious threat.



Deltas in Practice Theme 3: Governance

DP GV 3.1 **Session DP GV 3.1: Dealing with uncertainties in planning. From concepts to tools and the needs for capacity building**

Chairs	Karin Roelofs, Directorate General International Corporation and Joost Buntsma, Ministry of Transport, Public Works and Watermanagement, the Netherlands
Speakers	Dr. Jeroen van der Sluijs, Copernicus Institute, University of Utrecht, the Netherlands Aalt Leusink, Loasys, Wageningen UR, the Netherlands Dr. Janette Bessembinder, Royal Netherlands Meteorological Institute, the Netherlands Rob Verheem, MER Commission, the Netherlands Francesca Bernardini, UN ECE, Switzerland Pieter van Eijk, Wetlands International, the Netherlands

Short description of the session topic and the objective of the session:

Climate change adds a driver of change to water, land and energy management and operations - on top of drivers such as population growth and economic development. Each of these drivers increases the uncertainty. Dealing with these uncertainties in a robust and responsible manner requires open and transparent planning and decision making processes, both top down (information driven) and bottom up (socio-economically acceptable). Dealing with uncertainty is something we can't avoid. In this session different kind of tools to cope with uncertainty are presented.

Most exciting insight, moment or outcome

- The good news is: the tools have already been tested and people are already working with it
- Crucial in dealing with uncertainties is knowing and sharing the different futures. When dealing with uncertainties different stake-holders get together

Key phrases or quotes

Jeroen van der Sluijs mentions three kinds of framing uncertainty:

- 1) deficit view
- 2) evidence and evaluation
- 3) complex system view

Van der Sluijs: 'We have to go from 'speaking truth to power' towards working deliberately within imperfection', because scenarios can be wrong and 'Never climb to high on the ladder of quantification'.

Janette Bessembinder concludes: 'Hydrological knowledge may very well be not as developed as the meteorological knowledge'. During discussion she raises the question if we need an international debate to combine and integrate knowledge.

Rob Verheem explains everyone should install safeguards on:

- 1) information
- 2) dialogue
- 3) enforcement
 - a. transparency
 - b. accountability
 - c. law !!!

Verheem: 'Information by itself will not change anything.'

DP GV 3.2 **Session DP GV 3.2: Governance capacity for climate adaptation**

Chair	Prof.dr. Geert Teisman, Erasmus University Rotterdam, the Netherlands
Speakers	Herman Kasper Gilissen, Centre for Environmental Law and Policy Utrecht University, the Netherlands Prof.dr. Marleen van Rijswijk, University of Utrecht, the Netherlands Dr. Matthijs Kok, Delft University of Technology/HKV Lijn in water, the Netherlands

Short description of the session topic and the objective of the session:

A couple of scholars from different disciplinary perspectives (law, policy sciences, water governance, economics, risk management, innovation studies) reflect upon the case study Noordwijk-Netherlands. The Dutch approach of coastal defense is being discussed by focusing upon the Zwakke Schakel (=Weak Links) programme. This session aims to distill the most important governance lessons out of the case study. In addition this session will focus on the governance capacity to realize innovative and robust adaptation strategies which integrate various agendas, domains and interests.

Most exciting insight, moment or outcome

- Adaptation requires a sense of urgency and strong commitment
- In the case 'Noordwijk' the authorities were fearless in taking responsibility. In theory there is a clear role for every authority. Climate change however adds something to this discussion and will likely result in new roles for the different authorities. From a legal point of view the water authority should solve the political question of who is responsible for the new roles

Main conclusions, themes, insights or messages

Highlights of the first part of the session

Aspects that contributed to the success of the project from a legal point of view:

- Because the project focused on safety, it was widely publicly supported
- Clear agreements on which government actor was responsible for what action
- Clear and structured procedure in which public participation was of high importance

Highlights of the second part of the session

The project has been successful from a legal point of view. Reasons for this are:

- The provision of flood protection is received positively by the citizens
- A clear division of responsibilities between the central government, the province, the water boards and the municipalities
- A government organisation that performs its task seriously and adequately
- The decisions-making process went well from a legal point of view, legal procedures were followed.
- Implementation of the plan so as to cause as little damage as possible
- Bringing compensation regulations to people's attention in advance and assisting them with the application for compensation
- A sufficient degree of legal protection

Highlights of the third part of the session

Key success factors from Flood Risk Management point of view:

- The Wateract demands a five-yearly update of hydraulic load and strength of flood defenses
- Technical analysis about the safety gap was supported by an independent committee Technical Advisory Committee (TAW). There is consensus in the TAW about the problem
- The Minister of Public Works and Water management has budget to solve the 'safety gap'
- Local interest is incorporated in the design

Highlights of the last part of the session

The case Noordwijk from a water governance point of view:

- The project is developed and implemented in a relatively short period of time
- The project got a broad programmatic approach
- The project team aimed for a broad support by residents, NGO's and land/property owners
- Adaptive water management evolved: the maintenance of the area in the development of plans and solutions with a certain degree of flexibility
- There is a trade-off between efficiency and innovation

Key phrases or quotes

- Adaptation requires a sense of urgency and strong commitment

DP GV 3.3 Session DP GV 3.3: Adaptation Strategies in delta cities**Chair**

Tom Smit, Royal Haskoning, the Netherlands

Speakers

Alex Nickson, Greater London Authority, United Kingdom

Jan Rasmussen, City of Copenhagen, Denmark

Lissy Nijhuis, Department of Public Works Rotterdam, the Netherlands

Short description of the session topic and the objective of the session

Many delta cities prepared regional adaptation strategies. In this session, strategies of three delta cities (London, Copenhagen and Rotterdam) are being compared and discussed. Representatives of these delta cities have tell about their experiences and discuss success factors. The session aims to give insight in differences and resemblances in adaptation strategies of large cities.

Most exciting insight, moment or outcome

The adaptation strategy of the three cities differs at the following points:

- the way governments communicate their strategy with the inhabitants
- the flexibility versus robustness of the measures

Main conclusions, themes, insights or messages**London**

- Focus is on a flexible adaptation pathway by choosing and combining optimal measures
- Combines measures for flooding, water resources and overheating as much as possible.
- Starting point of flood risk measures is the definition of acceptable risk levels
- To decrease water demand, London started a programme for saving water to be able to fulfill the increasing demand of a growing population. Saving water is done by combining the installation of water saving equipment with an existing retrofitting programme for energy efficiency in urban dwellings (1,2 million by 2015)
- To reduce overheating an urban greening programme is in progress. In this project greenery is increased with 5 percent in 2030 and a further 5 percent in 2050. Tree cover will increase with 5 percent in 2025, 100.000 m2 green roofs will be built in 2012 and a 280 ha greenspace will be enhanced in 2012.

Copenhagen

- Strategy incorporates: risk assessment, flexible solutions, added value, planning and ongoing review of adaptation plans
- The rainwater management is up to date (but risks still exist)

Rotterdam

- Target: a climate proof city in 2025
- Characteristics of strategy: integration of adaptation measures with other policy fields, e.g. spatial/urban planning, economic policy
- Research and execution of the strategy is done within five themes: flood management, urban water system, adaptive building, urban climate and accessibility
- Development of a climate toolbox: an adaptation strategies matrix with examples of potential measures. This helps to choose what decision has to be taken at which level (region, city, district or building)
- Communication is needed for acceptance of different usage of public space

Discussion

What is leading in the choice of adaptation measures?

- London: cost-benefit calculations are very difficult because of the large differences between issues and kind of benefits (life-savings, damage), short and long term risks, prevention or responding strategy. The impact on the community is important. There has to be trust in the acting of the government
- Rotterdam: the benefit for the economy is also an important issue

How do you work on the awareness in the communities of adaptation needs?

- London: you have to sell it and be clear ('I'm sorry, this is your future, but we will help you to take your responsibility'). Challenge people by exposing them to examples. Ask people their ideas. Explain where responsibility for the government ends
- Rotterdam: this is still in the starting phase and we are learning by doing. For instance the first water plaza project had to be stopped because of resistance of local residents of the ward

Is there cooperation between your city and researchers and private companies?

- Copenhagen: an elaborate part of budgets is spend on research
- Rotterdam: in general the focus lies on mitigation. On mitigation the links with the private sector are more solid than on adaptation. It seems that the feeling of urgency is less on adaptation
- London: it works with CO₂ because there is a currency. Not with adaptation. How do we get investment money for adaptation? We have to make more clear what the benefits are to invest
- London: large scale development seldom leads to more resilient buildings

What do we learn from historic (flooding) events?

- We have to start with communication. People have to understand we can't protect everything in every case
- We lost the feeling that water can be a threat and we don't act in a proper way anymore. We can't visualize it anymore (tragedy of the commons). Acceptance and raising funds are problems
- Part of a solution: look for a more emotional bond with the protection measure. For example Hamburg: dike park project (landscape modelling)

Key phrases or quotes

- Flood helps to increase the urgency - Jan Rasmussen
- There is a difference between political risks and engineering (calculated) risks. Time will tell how we will deal with these risks and which is the most important factor - Rebecca Brown (Australia)

What were the messages?

- Start defining acceptable levels of risk instead of focusing on a 100 percent climate proof city
- The cities actions have to result in trust by the inhabitants and businesses
- Climate change adaptation offers new opportunities to strengthen the economy of Rotterdam
- We are learning by (argued) doing
- There is no direct visible urgency. There is water annoyance rather than a water threat

Overall conclusion

These cities are dealing with the same issues and the main line of their approach is the same. Each city approaches the issues from a different angle. Flexible and integral solutions on adaptation are needed and acceptance and trust by the public in taken measures is essential.

DP GV 3.4 **Session DP GV 3.4: Transitions and the role of change management**

Chair

Liesbeth Schipper, Royal Haskoning, the Netherlands

Speakers

Pieter Bloemen, Staff Delta Commissioner, the Netherlands
Pepijn de Visscher, Brainrack, the Netherlands

Short description of the session topic and the objective of the session

Central in this session are governance transitions and the role of knowledge and innovation management. The objective is to define success factors that might be applied in the work field of the participants, by discussing the complexity of the transition process in a delta that needs to be future proof but takes into consideration the complexity of the context.

Most exciting insight, moment or outcome

- Bridge the gap between policy and science: flexibility over robustness
- Coherence, transparency and consistency are important if you govern a complex transition process
- Ask experts and visionary people to sketch the future and ask stakeholders about their future in this scenario. You have to stimulate people to think beyond their lifespan

Main conclusions, themes, insights or messages

- To govern a challenge, we are in need of: adaptive approach, innovative processes, knowledge development and implementation, co-creation with all stakeholders, solidarity and integrated governance. There are five principles to govern innovation within delta transitions:
 1. ambitions are leading
 2. think big, search for details
 3. room for experiments
 4. celebrate success and failure
 5. sustain results
- Applicable knowledge has to be developed in unison with all stakeholders. Joint fact finding is essential in all phases, from problem definition to realizing measures
- Some pre-conditions are also needed: consistency, a set of basic values, a decision making framework and one joint delta model
- Climate proofing is not a technical programme, it is about social management. Both technological and social innovation are needed
- Crowd sourcing is a tool, but don't make it part of a formal structure
- One has to be alert for large gaps between old and new scenarios
- The fact that the economy might change in ways we haven't anticipated yet needs to be taken into consideration

Key phrases or quotes

- Don't structure the transition process, society chooses
- How to separate decision making and co-creation? Are you, in a political context, able to deal with the fact that:
 - o you are responsible for the transition process, but not in charge?
 - o ideas have power of their own?
 - o to accept uncertainty?

- Accountability and responsibility is very important for decision makers.
- There is a danger of overemphasis on cooperation in knowledge creation. Make sure you also get access to the isolated ideas, which might be really innovative. You have to avoid negotiated nonsense.
- Keep asking: is there a problem?

DP GV 3.5 **Session DP GV 3.5: Climate adaptation conclusions, recommendations and applications**

Chairs Bert Satijn, Living with Water / Water governance centre, the Netherlands
Rob Bonte, Royal Haskoning, Strategy and Management Consultants, the Netherlands

Speakers Michael van der Valk, CPWC, the Netherlands
Lissy Nijhuis, City of Rotterdam, the Netherlands
Prof.dr. Geert Teisman, Erasmus University Rotterdam, the Netherlands
Liesbeth Schipper, Royal Haskoning, the Netherlands
Liang Xiong, Delft University of Technology, the Netherlands

Short description of the session topic and the objective of the session

In this session the main outcomes of the governance sessions are presented and conclusions, key recommendations and actions for policy-makers, scientists and practitioners in delta cities around the world are formulated. The goal is to build and strengthen the governance of climate adaptation.

Most exciting insight, moment or outcome

- Moving to resilience does not change the level of hazard
- The responsibility question opposes multifunctional solutions
- Governance: details at low level matter and influence decisions at high level
- Outcome: build on alliances. Working together on adaptation is much more productive than working alone
- Time scale and sense of urgency are the most important challenges of adaptation

Main conclusions, themes, insights or messages

- Regional adaptation strategies of delta cities differ from each other. The focus of adaptation strategies differ mainly on robustness and resilience. Recommendation: find a dynamic balance between robustness and resilience
- Deal with uncertainties and risks in a robust and responsible manner. Open and transparent planning and decision making processes, both top down and bottom up, are needed. Good communication with the media is essential
- Adaptation requires a sense of urgency and strong commitment
- Climate adaptation requires a long term perspective (step by step) and co-operation among national, regional and local government, between the public and private sector and between science and practice. Manage co-creation and manage all the stakeholders
- Deal with multi-level problems. Manage all multi-level and multi-scale processes in ways leading towards climate proof development. If you really want to make policy, you need general information at large scale and more detailed information at small scale. Higher level decisions influences the lower level and local knowledge influences decisions at the higher level

- Deal with the problem of multi-functionality. Combine different functionalities as much as possible and solve the problem of responsibility
- Money plays an important role in the governance of adaptation. The lack of money contributes to the challenge of co-creation, co-operation and innovation
- Try to balance communication so that people are aware of the risks but not afraid
- Cost benefit analyses of adaptation measures. Adaptation has no currency
- Choose who you are going to protect. Why everybody?

Key phrases or quotes

- Uncertainties are there to stay. Take uncertainties into account
- Stop fighting the water. Live with water
- Be aware of the different levels of spatial scale: building, street/neighbourhood, city, region

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session

- Generate an adaptive governance system
- Deal with uncertainties and risks in a robust and responsible manner. Good communication with the media is essential
- Deal with the problem of multi-functionality
- Find a dynamic balance between robustness and resilience of the adaptation strategies
- Manage co-creation and manage all the stakeholders
- To be able to make policies, you need general information at a large scale and more detailed information at smaller scale
- Choose who you are going to protect



Deltas in Practice Theme 4: Flood risk management

DP FR 4.1 Session DP FR 4.1: Smart Flood control in Deltas

Chair Murray Starkel, NGP Global Adaptation Partners, United States

Speakers Michiel van Haersma Buma, Water board Delftland, the Netherlands
Piet Dircke, ARCADIS, the Netherlands
Leo Zwang, Fugro, the Netherlands

Panelists Dan Hitching, ARCADIS, United States
Djeevan Schiferli, IBM, the Netherlands

Short description of the session topic and the objective of the session:

This session discusses methods of smart flood control in Deltas. The aim is to define what a Smart Delta is and to discover the latest Smart technology.

Most exciting insight, moment or outcome

More and more data on water safety will be available in the future. This means there can be total transparency of water safety information and the public will gain insight in water safety issues, creating more awareness. On the other hand more information does not mean that we get smarter.

Main conclusions, themes, insights or messages

Van Haersma Buma defines Smart as 'the complete knowledge of the complex water system'. There are three trends that lead to Smart Water management:

1. Reliable and cost effective/efficient government
2. Water management is becoming information management
3. Cooperation and communication

With a 3D presentation of model results Michel van Haersma Buma demonstrates how the public can be made aware of flood risks.

Piet Dircke gives a real comprehensive overview of Smart Delta Cities. Examples are Smart Dutch national flood protection, Smart Barriers, Smart Coastal reinforcement (combining a dike with a dune), Smart use of sediment, innovative materials (BASF), levee testing facility, Smart urban water management solutions (green roofs, water plazas and under ground storage), integrations of coastal protection, Smart sharing of knowledge, Smart climate adaptation in the San Francisco bay.

How Smart will the future solutions be? Combining flood control and energy supply?

Leo Zwang talks about Smart Levee Control and starts with a cartoon of a manager shouting to an IBM technician who is testing a gigantic wave: 'Oke, and now back!' Smart Levee Control is a process of data acquisition, safety assessment, risk mapping and monitoring.

Dan Hitching from the United States was a member of the Core of Engineers during and after hurricane Katrina. Hitching thinks things through in advance and consider the consequences. More quality assessment and constant communication of hazards are important.

Djeevan Schiferli takes us on a short trip through the history of the world wide web to show how fast information management has developed in the last few decades. First e-mail in 1971, first web browser in 1991, 600 websites in 1993, 600 million in 2001 and 1 trillion devices expected to be connected to internet in 2013. The questions is: how many people can handle an explosion of information?

Insight: People are sensors!

Round table discussion

- Should monitoring of levees be mandatory? It's only a question of time until this information is a standard. More data will be available in the future as well as smarter sensors. An example of a future smart sensor: people.
- Who should determine the normative flood protection standards? Engineers, accountants, the public or politicians? It should be a combination
- 3D presentations of flood hazards creates awareness and insight
- Is there an evacuation plan for The Dutch Randstad region? No, it's almost impossible to evacuate this region in a short time span. The Dutch completely rely on the high protection level
- What effect will total transparency have on the public? Knowledge and awareness, no panic

DP FR 4.3 Session DP FR 4.3: Strengthening resilience of delta communities

Chair Bruno Haghebaert, Netherlands Red Cross, the Netherlands

Speakers Bruno Haghebaert, Netherlands Red Cross, the Netherlands
Marie-José Vervest, Wetlands International, the Netherlands
Sasja Kamil, Cordaid, the Netherlands

Short description of the session topic and the objective of the session

Partners for Resilience is a new alliance between five Dutch organisations in the developmental, humanitarian and environmental sectors. The partner organisations collaborate to reduce vulnerability and strengthen the resilience of local communities worldwide. They focus on communities exposed to the impacts of disasters, such as floods. This session focuses on community-based disaster risk reduction, climate adaptation and ecosystem restoration and management activities in river deltas and coastal areas in Africa and Latin-America. The objective of the session is to learn to effectively share knowledge and collaborate with practitioners, scientists and policy makers.

Main conclusions, themes, insights or messages**Bruno Haghebaert:**

- Mission of Partners for Resilience Alliance: strengthen the resilience of vulnerable communities. There are three intervention strategies: strengthening community resilience, civil society capacity building and policy dialogue
- Problem in Colombia: increasing sea level combined with water threat from a large lagoon after heavy rainfall. It is predicted that the village will disappear in 2030. Pueblo Viejo was struck by 28 extreme weather events in 2010 alone (floods, wind, swell/tide, heavy rain)
- Action: awareness raising by capacity building on disaster response, training disaster preparedness with school teachers and children, solid waste management, early warning systems, micro adaptation project (water storage above flooding level)
- There is a gap between science and practice: a regular dialogue between researchers and villagers is needed to get useful results from research and give researchers insight in local issues

Sasja Kamil:

- The approach for Dire Dawa (Ethiopia) consists of mitigation, prevention, preparing for disasters and resilience building
- There was not a proper early warning system nor a policy for acting when disasters occur (flooding). Jeccco, a small NGO, worked closely with other stakeholders, such as the municipal county and upstream communities, to develop an approach
- The communities play an important role by taking responsibility. The communities work on risk reduction measures to safeguard their lives and livelihoods. Communities restore their environment. In addition an early flood warning system is developed and discussions with the government are held about government plans and community ideas
- Special: the government considered the approach of Dire Dawa a useful model for the whole country. The people experience it as a joint responsibility, they take action. The municipality starts supporting after seeing people in action

Marie-José Vervest:

- In the inner Niger Delta in Mali over 1 million people depend on annual flooding of the Niger river for their livelihoods (fisheries, agriculture and cattle herding). However, 10 years of drought in the nineties led to land degradation and overexploitation of natural resources. Upstream developments such as large dams have a major impact on downstream beneficial flooding of the area
- The major climate impacts are: severe droughts and uncertain future projections. How to adapt to this uncertainty?
- A Flood prediction tool is developed by several consultancy and knowledge institutes to support government authorities and communities in predicting height and duration of floods for a single year. Extrapolation to other places and times is possible
- The flood prediction tool for communities (OPIDIN) links knowledge on flood regimes to model predictions. Model results are presented to villagers to identify local needs and see the effects of certain measures. After successful piloting in two villages, OPIDIN will now be further developed for large scale implementation
- Wetlands International is also providing support to communities for more longterm adaptation to climate change: ecosystem rehabilitation and replanting a flood forest by communities using micro-credits as incentive (this approach is called 'bio-rights'). When survival rate is more than 75 percent people don't have to pay back their loan
- Conclusion: flood prediction in a single year can help communities to adapt. Community knowledge is linked to scientific insights. Long term adaptation by communities is successfully piloted by Wetlands International

What can be concluded about the role of the government and/or knowledge institutes in these different cases?

- Colombia: governments have different priorities for specific regions or specific villages. Include them in the discussion from the start
- Ethiopia: the attitude of the government changed through the actions of the people. Again: include them in the discussion from the start
- Mali: it is difficult to analyse what the role of the government has to be. What's in for them? In Mali technological information from knowledge institutes is needed

Key phrases or quotes

Community building has to be combined with help and information from knowledge institutes, the government, and experts from outside. This can lead to effective measures.

DPFR 4.4**Session DPFR 4.4: Sinking Deltas****Chair**

Dr. Rien Dam, Deltares, the Netherlands

Speakers

Dr. Peter Fokker, TNO, the Netherlands

MSc. Freek van Leijen, Hansje Brinker BV, the Netherlands

Miguel Caro Cuenca and Ramon F. Hanssen, Delft University of Technology, the Netherlands

Dimmie Hendriks, Deltares, the Netherlands

Ger de Lange, Deltares, the Netherlands

Aljosja Hooijer, Deltares, the Netherlands

Short description of the session topic and the objective of the session

Land subsidence in Delta regions is an often neglected cause of flooding and associated problems and poses an even more potent threat for the mid and longer term. In this session the various processes leading to subsidence are explored. The interrelated causes of subsidence are discussed, as well as the impacts of sinking deltas on environmental and socio-economic development.

Most exciting insight, moment or outcome

In some areas the speed of subsidence is significantly higher than the speed of sea level rise. Subsidence and its related damage or costs of measures are therefore important spatial planning and flood mitigation problems.

Main conclusions, themes, insights or messages

Subsidence can be caused by people: changes in water management, groundwater mining, land use, sediment depletion, aggregate and salt mining. In addition, there are natural causes, such as compaction, geologic processes. The causes can be complex, an integral approach is therefore needed.

Satellite monitoring of water defenses can help in the monitoring and leads to better insight in causes of subsidence. It can lower costs of maintenance of vital flood defenses. Satellite monitoring (spaceborne radar) enables construction

of time series analysis of subsidence by so-called Persistent Scatterer Interferometry (PSI). This method avoids the problem of blurring by growing vegetation. The detection of minor changes is possible with these techniques. It has been revealed that the land surface level is affected by seasonal changes in groundwater level. Results further show that in the Krimpenerwaard (The Netherlands) subsidence is much greater than sea level rise: 7.67 mm/year versus 3 mm/year.

Climatic change (temperature rise, pronounced seasonal droughts) leads to higher velocities of peat oxidation, thus leading to more subsidence. This process takes place especially in peat meadow areas of The Netherlands. On the whole, oxidation of peat is a large contributor to subsidence and greenhouse gases emissions (CO₂, CH₄, NO₂). For example: 100 years of consecutive oxidation in the Netherlands is comparable to the CO₂ emissions of industry of the United States in half a year, or 50 times the recent volcanic eruption in Iceland. Reversing this process is possible but depends on land use and type of green house gas. Even individual plant species can influence emissions.

In South East Asia peat burning and peat drainage (leading to oxidation) are very large contributors to peat decomposition and to the emission of greenhouse gases. In the present situation the emissions are even larger than historic emissions of The Netherlands. Costs of subsidence are rising because of flooding of subsided land. New policy is needed. It is advised to take measures, for example by changing land use, improving water management, amake djustments to forestry and the economic use of forests, fertilisation. But there's still a large knowledge gap about how to take measures. It's a complex problem.

Key phrases or quotes

- Land subsidence in delta areas is very widespread and an order of magnitude higher than the anticipated sea level rise. Consequently, the costs and damages inflicted by subsidence are very high. Therefore, there is a need for reprioritising or a new focus: addressing subsidence is more important than mitigating sea level rise. By changing watermanagement practices subsidence can be slowed down or even reversed
- Although much insight in subsidence of peat land in The Netherlands is available, there's still need for further research of this complex process, especially in the peat forest areas of South East Asia

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session
Session convenor and participants are preparing a thematic work package on subsidence. This work package will be proposed to the Delta Alliance, to be part of the forthcoming Delta Alliance working programme (or alternatives).

DP FR 4.5

Session DP FR 4.5: Preparing for an uncertain future

Chair

Prof.dr. Hans Middelkoop, Utrecht University, the Netherlands

Speakers

Marjolein Haasnoot, Deltares, the Netherlands
Astrid Offermans, Maastricht University, the Netherlands
Michael van Lieshout, the Netherlands
Pieter Valkeringen, the Netherlands

Short description of the session topic and the objective of the session

Sustainable water management copes with uncertainties in the natural and social environment. Ideally, a strategy is robust under different climate change scenarios, socio-economic developments and societal perspectives, or the strategy is flexible enough to adapt. Uncertainties inherent to these developments lead to different potential pathways of water management into the future. The importance of interactions between the water system and society can be experienced in this session with an interactive simulation tool. The workshop aims at providing participants with a transdisciplinary approach to improve their decision making processes for an uncertain future.

Most exciting insight, moment or outcome

Deltares, University Maastricht University Utrecht and others developed a game with the main question: 'The future is uncertain, and what is the best watermanagment strategy? There are two teams. Each team has different beliefs. There is one chair and one writer. Each group has to follow seven steps:

- 1) Rethink group perspective
- 2) Define maximum two measures for the fictive area
- 3) Create a white paper: Defining reasons to do so (see 2)
- 4) Check society support (society was played by team member)
- 5) Negotiate
- 6) Veto or not to veto
- 7) Calculate of risk indicator, economic costs and nature indicator

Main conclusions, themes, insights or messages

- The game generates a lot of energy. The players were very enthusiastic about the game. It gave a clear insight in the relationship between the watersystem measures and the connection with society
- It also cleary showed the participants that stategies are of no use for 'ever lasting times'. In other words: each strategy has its own short or long term that it is effective in
- The third major lesson is that playing this game gives the participants insight into the most robust pathway for an adaptation strategy. By exploring different strategies players are able to find out robust measurments. Adaptation is a pathway
- The game also includes a warning: policy makers tend to react on events rather than anticipate climate variabilty

Key phrases or quotes

Advice to improve the game:

- Limit the amount of money players are able to spend in the game
- Add a tool for making decisions
- Add a desk-tool to visualise information build into the system during the game
- Add community resilience

DPFR 4.6**Session DPFR 4.6: The need for flexibility in engineering systems and processes to deal with climate change: perspectives from the private sector****Chair****Msc. Ferdi Timmermans, Movares Netherlands B.V., the Netherlands****Speakers****Prof.dr. Chris Zevenbergen, Dura Vermeer Business Development, the Netherlands****Djeevan Schiferli, IBM, the Netherlands****Dr. Marcel Hertogh, AT Osborne B.V., the Netherlands****Referee****Prof. Richard Ashley, University of Sheffield, United Kingdom****Short description of the session topic and the objective of the session**

How to cope with increasing extremes (frequency, amplitude) and dynamics of water systems, especially in densely populated delta areas? The conventional methods of protection mostly consist of static defense works. Due to increasing dynamics, the safety margins of these structures will reach their limits. Therefore, there is a tendency to gradually shift towards incremental adaptations of existing structures in combination with enlargement of the flexibility of the system. Urban development centered in a dynamic water context, using smart, flexible systems, 'outside the dikes' is the direction of view that is further explored in this session.

Most exciting insight, moment or outcome

Climate change adaptation needs a flexible, incremental, multidisciplinary, multi-actor approach. By overlooking current systems and standards, and by crossing boundaries, great solutions can evolve.

Main conclusions, themes, insights or messages

Chris Zevenbergen sets the scene: 'We see dynamics increasing and uncertainties surface. Not only in the physical world, but also in economics.' The current flood defense systems are under pressure. Action must start today. Old economic drivers of retail, housing, leisure and construction are replaced by new drivers such as knowledge economy, entrepreneurship and social economy. Housing construction will have to focus on improving the existing stock, energy efficiency and climate adaptation.

New collaborations must be formed between public and private sectors to make things possible. Preferably by following an integral approach (multivalued). Uncertainties can be dealt with by 1) reducing decision making time (lead time), 2) taking small steps (adaptable systems) 3) no regret measures on the short term.

Sectoral solutions (provoked by policy directives) can be a threat for implementing multivalued, multifunctional and sustainable measures. Larger companies should take the lead in new strategies, because smaller companies cannot carry risk.

The world is changing fast, resulting in hypercompetition and commoditization, says Djeevan Schiferli. Because everything is becoming connected or related, things are becoming complex and even wishes for changes become complex. Things get stuck or become expensive. In the IT sector this problem is tackled by enterprise architecture: introduction of decoupling, standards, guiding principles for design and evolution. Two new visions on learning that surfaced the past 20 years are:

- 1) network communication, which enable self organisation
- 2) swarm intelligence. Collaboration is leading to a higher level of development, even if the individual elements are not conscious of these effects, as we see in insects

Especially for governmental organisations it is a major challenge to make use of these new forms of communication. However decoupling, standards, guiding principles and self organisation can ultimately lead to robust networking and new forms of organisational behaviour. Several examples are given to illustrate these new phenomena, such as netcentered organisation.

Discussion: flood safety may be one of the last subjects a government is prepared to undergo such an approach or to outsource. On the other hand: Hafencity in Hamburg is a good example that selforganisation and communications systems based on network in stead of hierarchy can be efficient.

The Deltaworks in the Netherlands are a good example of a grand design. But it is also an example of a very rigid, not flexible design, argues Marcel Hertogh. Flexible solutions are needed when adapting to uncertain climate change. These solutions are characterized by incremental steps which incorporate living with uncertainty and variability. And also by multidisciplinary and multiactor steps. Examples are Overdiepse Polder and IJburg (both in the Netherlands).

The new Deltaprogramme may become business as usual, using the sectoral approach. The new challenge is not to design a sectoral solution but to widen it. For example to develop an exportable knowledge economy. Try to move from the short term profit thinking, because it will prevent us from other more greater goods or goals. Lateral thinking can be a major tool, but a lot of debate is still necessary.

Key phrases or quotes

- Lateral thinking can be a major tool to achieve a greater goal, but a lot of debate is still necessary.

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session

- Commonly shared recognition of the described phenomena, as well as the conviction that existing methods, structures and approaches will not be sufficient
- New protocols and interactive instruments for decision support will be necessary

Deltas in Practice Theme 5: Resources and Ecology

DP RE 5.1a Session DP RE 5.1a: Guidance on water related adaptation

Chair Joost Buntsma, Ministry of Transport, Public Works and Water Management, the Netherlands

Speakers Frits Holwarth, BMU, Germany
Erik van Slobbe, Wageningen UR, Netherlands
Dejan Komatina, International Sava River Basin Commission, Croatia
Francesca Bernardini, United Nations Economic Commission for Europe, Switzerland

Short description of the session topic and the objective of the session

The UN ECE Meeting of Parties adopted the Guidance on Water and Adaptation to Climate Change in its fifth meeting in November 2009 and presently applies the Guidance in several pilots in the UN ECE region. The session discusses and recommends on how to further the use of the UN ECE Guidance within the UN ECE region and beyond.

Most exciting insight, moment or outcome

Erik van Slobbe shows that application of policy becomes rather 'messy' when it is applied in real projects. The different interests, continually changing conditions and constraints require good process management and flexibility. Francesca Bernardini therefore stresses that a flexible legal framework is necessary to ensure application of policy and the UNECE guidance for adaptation.

Main conclusions, themes, insights or messages

Fritz Holzwarth covers some of the benefits of cooperation between upstream and downstream areas within river basins. The United Nations Economic Commission for Europe (UNECE) convention and adaptation guidance paper is very much discussed within the different communities. Yet we need to apply a broad perspective in which water resource management is just a single part. Other important elements are energy, wealth distribution, short term long term perspectives, competing requirements, different interests and different institutions. This also applies to regional differences. The upstream and downstream communities in a basin often consist of different stakeholders, interests and cultures. Many water resource related problems in Southern Europe are not due to lack of water availability but to bad water management and bad governance. One of the typical obstacles in Europe for a coherent integrated water resources management (IWRM) is agricultural interests (for example in Germany and France). This hinders the application of operational structural and non-structural measures. Vital in good IWRM policy is the incorporation of horizons (short term and long term planning). A methodological obstacle is the difficulty to assess the adaptive capacity of regions.

Francesca Bernardini discusses the UNECE Guidance on Water and Adaptation to Climate Change. Main aim is to

develop guidance for a transboundary adaptation strategy on basin level. The target group consist of water managers and decision makers and focuses especially on basin level across national boundaries. The UNECE provides a stepwise approach: assess impacts of climate change, develop a response policy and implement projects strategic and operational. Bernardini observes that it is important to mainstream climate adaption with other pressures and drivers in society. The legal framework therefore has to be flexible to accommodate both.

Dejan Komatina describes the development of joint adaptation strategies for the Sava River basin in former Yugoslavia. Until 2000 no formal agreements existed on integrated water management (IWM) or adaptation on basin level. After the war the Sava River Basin Commission was installed with participants from Bosnia and Herzegovina, Croatia, Serbia and Slovenia. The commission focuses on (flood) protection issues and development. Although not within the European Union, the commission included the EU regulations (water directive) and UNECE Water convention. UNECE provides a strong basis for adaptation strategies and actual projects.

Erik van Slobbe presents his findings on the river restoration project 'Doorbraak' close to Almelo in the Netherlands. Many of these findings are communicated through a community of practice consisting of policy makers, water managers, scientists and other stakeholders within the Rhine river basin. The Doorbraak-project consists of a bypass to overcome the encroached river section. The project combines flood control with 'new nature'. The project has been underway for a long period, mainly because of the complexity and the number of stakeholders involved. The plan is continually being changed because of stakeholder interests and different conditions at a local level. The result therefore is that the translation of regional, national and EU policies becomes rather 'messy'. Contrary to popular belief, the main problem is not the science-policy gap, but dealing with many stakeholders for a longer period. Consistent process management skills are therefore crucial for actual implementation. An interesting observation is that adaptation is often interpreted as going back to 'ancient times'.

Conclusions:

- Integrated Water Resouce Managment and adaptation are part of a bigger scope that combines problems, disciplines, institutions and different horizons
- The UNECE Water Convention tries to mainstream a consistent adaptation strategy across Europe with a focus on developing economies
- Scientists need to share and create joint models, information and scenarios to ensure a coherent cross boundary assesemnt and a solid base for policy
- The UNECE provides strong guidance for adaptation, crossing disciplines, geographic boundaries and institutions
- The implementation of adaptation is often a long and complex process. This is due to the local character of implementing actual projects. Large numbers of stakeholders are involved with different interests. This makes the translation of policy rather 'messy'

Key phrases or quotes

- We need to take on a pro-active role in repositioning water in the climate change debate
- Think outside of the 'waterbox'
- Focus on climate change in relation to other drivers/pressures
- The science-policy gap is not the main problem in adaptation
- Often is it not clear to which policy is addressed
- Guidance is one thing, but capacity building and pilot projects are equally important
- Adaptation is often framed as 'going back' to the original conditions
- Whatever adaptation is trying to achieved, it is almost exclusively 'sold' as flood protection

- Application of the UN ECE in actual pilot projects is the real test case for policy
- The UN ECE guidance has practical relevance. No systematic way to apply adaptation was available prior to the guidance

DP RE 5.1b Session DP RE 5.1b: Guidance on water related adaptation (2)

Chair Aart van der Horst, Directorate General for International Cooperation, the Netherlands

Speakers Maria Witmer, Ministry of Foreign Affairs, the Netherlands
Fulco Ludwig, Alterra, Wageningen UR, the Netherlands
Maarten Hofstra, UNESCO-IHE, the Netherlands
Peter Droogers, Futurewater, the Netherlands

Short description of the session topic and the objective of the session

The OECD adopted the OECD policy guidance document 'Integrated Climate Change Adaptation into Development Co-operation'. The OECD has called for specific sectoral Guidances. The first OECD sectoral Guidance that is being considered is a Guidance on Water. The session aims at drawing perspectives and views on the main elements of this Guidance that have not been addressed in other Guidances.

Most exciting insight, moment or outcome

Climate change adaptation is about doing things different instead of doing different things.

Main conclusions, themes, insights or messages

- Development cooperation and climate change adaptation may have conflicting goals
- Instead of focusing on a top-down adaptation approach, find entries in the regular planning process and add a climate lens
- Some sectors are more vulnerable to climate change than others. Water is the most important sector
- Theory is not the same as practice. We are dealing with complex multi-actor systems, where planning doesn't go the way you want
- Due to uncertainties in climate change:
 - o Actions need to be postponed where possible
 - o Adaptation is hard to 'sell' to the people
 - o Knowledge has a short lifespan and can suddenly be out of date
- The language in the water sector is different from the language in development cooperation. We need a common language
- An inventory of adaptation methods/tools is presented, categorized into:
 - o Downscaling climate change, impact models and vulnerability assessment
 - o Design and selection of adaptation options
 - o Evaluation of adaptation options

Most methods and tools only fit into one of the three above categories

- A distinction is made between top-down and bottom-up adaptation approaches. Most methods and tools focus

on a top-down approach. There is a need for more integrated tools, guidance on using the tools and guidance on mainstreaming adaptation. Different tools will always be needed, there is no 'one size fits all' option. But because decisions need to be made in little time with little knowledge, there is a need for guidance on which tools to use in which context

- To prevent a sectoral approach, integrality needs to be taken into account. Good governance is needed as institutional solid soil in which foundations rest
- To prevent a lock-in situation, a step-by-step policy approach is needed
- With a certain future, big policy steps are possible. With an uncertain future, either take no action at all or set the direction and follow a step-by-step approach
- The cost of adaptation is estimated at an annual USD 7-25 per capita globally. In developed countries, it averages USD 6-30 per capita per year, while in developing countries the annual per capita average is USD 8-19. With a family of five, this translates to USD 100 per year, which is a lot for developing countries
- People in developing countries are aware of climate change risks, but are more concerned with having something to eat than to spend money on adaptation. Most policies and strategies are climate-driven. An alternative road to climate change adaptation is to mainstream adaptation. For example: take a USD 50 million water basin project, put a climate change lens on and spend USD 2 million to make the project climate proof. This approach reduces the financial dimension of the adaptation problem

Key phrases or quotes

- Climate change adaptation is about doing things different instead of doing different things
- There is no need to convince people in developing countries about the need for climate change adaptation, they already have the willingness to survive

DP RE 5.2 Session DP RE 5.2: Green Adaptation – optimal use of ecosystem services to adapt to the effects of climate change in transition countries

Chair: Arjan Berkhuisen, World Wildlife Fund, the Netherlands

Speakers Helena Hulsman Mindert de Vries, Deltares, the Netherlands
Hoang Viet, WWF Greater Mekong Programme, Vietnam
Prof.dr. Marcel Stive, Delft University of Technology, the Netherlands
Prof.dr. Le Quang Minh, Vietnam National University – Ho Chi Minh City, Vietnam

Short description of the session topic and the objective of the session

Over the past centuries human interventions have in many places paralyzed the systems inherent resilience to climate change. For long, technical 'hard line' solutions in deltas to protect land were dominant. Meanwhile coastal and delta development and rapid urbanisation have diminished natural defense lines against flooding such as mangroves. In this session, an overview is given of various Green Adaptation concepts. The session aims to share thoughts, lessons learned and best practices in deltas with respect to Green Adaptation measures.

Main conclusions, themes, insights or messages

- We can no longer ignore the impacts of a changing climate on our people
- Adaptation is likely to fail if it does not integrate ecosystem and community approaches
- We must work together to reduce climate impacts and increase resilience of our people and nature
- Green adaptation, an integrated approach with low cost investment and multiple benefits, is a must and not a luxury for a transition country, like Vietnam
- No general definition of green adaptation exists
- There may not be enough sediment available to protect a delta against sea level rise
- Most green adaptation measures allow extensive forms of agricultural production and fisheries. This limits the carrying capacity of the delta in terms of food production. The rapid population growth in delta cities on the other hand calls for intensive production methods
- The Mekong Delta has a long tradition of flexible response to extreme climatic events, especially flooding
- The alternative to green adaptation in Vietnam entails the construction of thousands of kilometers of dikes along the river and the marine coast

Key phrases or quotes

- The poorest people are the most vulnerable to climate change, they are not always in a position to adapt to climate change in a green way
- For green adaptation measures the starting situation has to be taken into account. In a situation which is already much altered, much more effort is required and less results may be expected
- The cost of maintaining a manmade defense against flooding is actually very low, especially compared to the economic value that can be (and already has been) developed behind the dikes
- Green adaptation techniques have always been available traditionally, and are now rediscovered as a sustainable way of adaptation

DP RE 5.3**Session DP RE 5.3: Mekong at the crossroads****Chair**

Jim Stefanov, USGS Deputy Regional Executive, South Central Area, United States

Speakers

Duong Van Ni, Can Tho University, Vietnam
Anond Snidvongs, START Southeast Asia, Thailand
Jeremy Bird, Mekong River Commission, Laos
Cindy Thatcher, U.S. Geological Survey, United States
Juliane Huth, WISDOM project, Germany

Short description of the session topic and the objective of the session

The Mekong is an example of a river basin that is vulnerable to climate change. Existing and proposed anthropogenic changes to the hydrology may not be able to reduce this vulnerability. The Delta Research and Global Observation Network (DRAGON) seeks to harmonize natural landscapes and ecosystem functions with human development in the Mekong basin. This session brings together researchers and policy makers to share information on projected impacts

of climate change on the ecology and food security in the region.

Most exciting insight, moment or outcome

It's hard to train the prime minister, it's easy to train students who will later be prime minister.

Main conclusions, themes, insights or messages

- The Mekong delta is characterized by a diverse land use system. The lower area is dominated by shrimp farming, the intermediate area by rice and fish farming and the higher area by irrigated rice farming
- Central government can realize land use changes within two years because of top-down government structure
- Five environmental threats are identified:
 - o Habitat alteration (cutting forest or mangrove)
 - o Over-exploitation (dams and fishing)
 - o Pollution (waste water)
 - o Invasive species (apple snails and mimosa pigra)
 - o Global climate change (flooding and salt water intrusion)
- Five developmental threats are identified: social differentiation, migration, urbanization, diseases and cultural degradation
- Three strategies are implemented:
 - o Use legislation to control over-exploitation or to prevent migration to towns and cities
 - o Provide direct assistance (land and credit) to prevent increasing poverty
 - o Use technology and education to change behavior
- Examples of climate change adaptation strategies are provided:
 - o Reduce stressors that cause subsidence, land loss and erosion. Halt activities that alter delta processes and destroy habitats
 - o Restore natural coastal defenses
 - o Restore natural flow regimes that create and maintain deltas
 - o Accommodate sea level rise and natural processes in human development and restoration planning
 - o Remove impediments to inland migration of delta ecosystems (restored and natural)
 - o Enhance organic sedimentation rates and mineral sediment availability
 - o Acquire coastal lowlands for storm protection and flood water retention
 - o Factor understanding of natural processes and trends into management and inform by monitoring
- People need time
- Technology supports change
- Until 2050, the average annual rainfall will remain the same in most regions
- Extreme rainfall shows higher variability, so adaptation has to focus on extreme rainfall
- In the Mekong delta the (freshwater) flood depth and duration will be slightly higher, but people have been adapting to the floods for centuries already
- Future patterns for storm surges remain uncertain
- Modelling changing locations for the 1997 Linda storm surge shows highly changing impacts
- Within the area, there is a high variability between seasons and regions
- There are opportunities for renewable energy, fisheries, irrigation, tourism and biodiversity, but rural poverty is high, environmental degradation occurs and there is a loss of sediment and nutrient supply
- 20-year plan developments (dams etc.) should be reconsidered. Should they be realized at all and, if so, under which conditions?
- Food security is reduced, not only due to climate change but also due to mainstream dams (reduced sediment and nutrient load)
- Uncertainties remain (data, models, climate change impacts), but there is an emerging understanding

- Many issues we have to address anyway due to Mekong area variability
- The Mississippi delta is still recovering from Katrina, which exposed vulnerabilities
- Levees divert sediments away from farmland, which leads to high rates of land loss
- Subsidence in New Orleans is up to 28mm per year. It is uncertain how this works
- Human activities make deltas even more vulnerable, restoration of natural coastal defenses is necessary
- Climate change results in delta flooding, coastal erosion and saltwater intrusion
- With 1 meter sea level rise, 31 percent of the area will be flooded
- A monitoring, warning and information system is needed

Key phrases or quotes

- Climate change offers not only risks but also opportunities
- When trying to convince government, people or policy makers, work with the media. They are always hungry for information and contradictions
- The construction of a new dam was impeding irrigation possibilities for local farmers. 'Don't worry, the project managers live far away' a farmer said to his neighbor. As soon as construction had finished and the project managers returned home, the dam was destroyed
- It's hard to train the prime minister, it's easy to train students who will later be prime minister

DP RE 5.4 Session DP RE 5.4: Freshwater storage in brackish groundwater: how can we make it work?

Chair Dr. Koos Groen, Acacia Water/VU University Amsterdam, the Netherlands

Speakers Prof.dr. Pieter Stuyfzand, KWR Water cycle Research Institute / VU University Amsterdam, the Netherlands
Jouke Velstra, Acacia Water, the Netherlands
Prof.dr. Kazi Matin Ahmed, Geology Department, Dhaka University, Bangladesh

Short description of the session topic and the objective of the session

In coastal areas the groundwater in the shallow aquifers is often brackish and the availability of fresh water in dry periods mainly depends on available surface water storage. Impacts of climate change in coastal areas are expected to aggravate the situation and will put a heavy burden to water managers to secure fresh water availability. A challenging alternative is the infiltration and storage of fresh water (rainwater, river water) in shallow brackish aquifers. The session provides an overview of the state of knowledge and main issues and challenges and presents the results of ongoing action research in Bangladesh and the Netherlands.

Most exciting insight, moment or outcome

The technique of storing freshwater in brackish groundwater is already in use. At this moment, the technique is tested in Bangladesh and if successful, it will be applied in the many more regions of the country. This proves that it is a low cost alternative for surface water storage, which also takes up much space, which isn't available in countries like Bangladesh.

Main conclusions, themes, insights or messages

Although it is in an initial stage in many countries, storing freshwater in brackish groundwater is a proven technique. It is being applied in different countries with success. There are however some points of attention that must be dealt with to make storage successful. The experts agree that for new projects, it is wise to start with a small well and test it for a while. When the well seems to operate without any problems, the well can be expanded.

Key phrases or quotes

- It's necessary to be well informed about the characteristics of the area and the dimensions of the storage
- Site selection is important. Not all areas are suited for freshwater storage
- Use models to test the feasibility for designs and circumstances. Only 3D-models will provide reliable outcomes, although a model is only as good as the available data and knowledge
- Freshwater is lighter than salt water, so freshwater floats on salt water. This may cause water bubbles to drift away which is important when pumping out the freshwater
- By selecting appropriate water sources or by pretreating the freshwater that will be stored, clogging of the well can be prevented
- Quality of the intake water must be well managed to ensure the operation of the well
- Good well management is important to make sure the well can be kept operational in the future

DP RE 5.5 Session DP RE 5.5: Deltas in Europe opportunities for research and policy collaboration

Chair Dr. Rob Swart, Wageningen UR, the Netherlands

Speakers Tiago Capela Lourenço, Foundation Faculty of Sciences, University of Lisbon, Portugal
Joao Pedro Costa, University of Lisbon, Portugal
Roxana Bojariu, National Meteorological Administration of Romania, Romania
François Sabatier, Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement (CEREGE), France
Patrick Meire, Ecosystem Management Research Group, University of Antwerp, Belgium

Short description of the session topic and the objective of the session

There are many deltas in Europe that are already or will be affected by climate change. In this session presentations are given about vulnerabilities and adaptation in some European Deltas. Comparisons and differences are discussed. This session will lay a base for a possible new programme on delta research in Europe.

Most exciting insight, moment or outcome

The CIRCLE-programme (Climate Impact Research and Response Coordination for a Larger Europe) is a European Network committed to fund research and share knowledge on climate adaptation. The programme opens a call on deltas, estuaries and coastal wetlands, which means that funding is available for joint research on these topics.

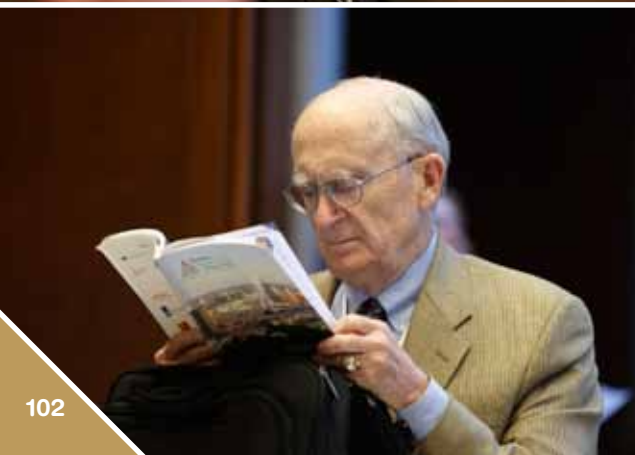
Main conclusions, themes, insights or messages

The session consists of a short description of the CIRCLE programme and reviews of various estuaries in Europe. Conclusions that can be drawn are that all estuaries are different. Each area has its own problems which means climate change manifests in various ways. However comparing different estuaries can lead to additional and mutual understanding of the behavior and effects of those ecosystems. It is important to obtain reliable information about the estuary system (by monitoring) to be able to develop a good adaptation strategy for climate change. Also, an integral approach is needed to develop consistent plans to adapt to climate change. Examples are to relate research to planning and link climate change sciences to territorial sciences.

Key phrases or quotes

- Ecosystems services have an important impact on human wellbeing
- Estuaries are influenced by many factors. Climate change only adds to these existing factors

Main recommendations, commitments, proposals, new initiatives or key follow-up actions agreed in the session
Recommendations are made in the following session DP C 6.2.



Deltas in Practice Theme 6: Cooperation

DP C 6.1**DP C 6.1: Delta Alliance electronic board room session****Chair**

Rob Schoonman, Ministry of Housing, Spatial Planning and the Environment, the Netherlands

Why is the Delta Alliance established?

- Delta's worldwide are facing serious challenges
- Delta's have similar problems (fragmented information)
- Speaking with a united voice (more support)
- International network (share and develop knowledge)

The Delta Alliance network works across wings, across disciplines, across sectors.

During this session the report 'Comparative overview of Delta's' is announced. The final version will be published in November. Each Delta presents a comprehensive overview of the problems and challenges the delta's are coping with. The presentations were focusing on delta issues, research gaps and knowledge exchange challenges. Each presentation was structured along the approach taken in the study 'Comparative Overview of Deltas', combining the DPSIR framework (drivers, pressures, state, impact, and response) with the 3-layer spatial planning model (base, network and occupation layer). Using the same structure for all 7 deltas appeared to be a step forward in jointly exploring and identifying common themes of interest, taking into account the respective national socio-economic and cultural contexts.

Objective: (1) exchange knowledge and (2) stimulating collaborative (research) projects.

Part 1: Brief presentations of draft Delta descriptions(delta issues, research gaps, needs for knowledge exchange)

1. Rhine-Meuse

- Drivers of change: stable population, economic activity, technology
Natural drivers: sea level rise, subsidence
- Approach: base layer, network layer, occupation layer
- There is not enough space in the occupation layer. The area is vulnerable to flooding and there is shortage freshwater
- Government: governmental cooperation, public-private partnerships, involving stakeholders, risk-approach
- Knowledge gaps: spatial planning, efficient water use, use of natural processes, morphological and ecological changes. From a governance perspective: dealing with uncertainties, cost of water treatment, responsibilities in management, financial arrangements

2. Ganges-Brahmaputra

- Drivers of change: high population density, sea level rise (east coast already rising)
- Pressures: land water use (critical flow conditions in rivers), ageing infrastructure, natural resources (erosion, biodiversity, salinity, cyclones and storms)
- Governance: highly centralized, ppp's increasing, dealing with risks and uncertainties (flood forecasting and cyclone warning)
- Lessons learned: adverse climate change impact already being experienced, delta people have indigenous coping measures
- Challenge for Delta management: monitor system, variation in salinity, spatial planning, adapting infrastructure
- Gaps: cheaper methods for potable drink water, research on (soil) salinity, salinity tolerant crops for food production, monitoring system

3. Mekong Delta

Population and area similar compared to the Netherlands, but the economy grows much faster

- Drivers of change: Population growth (pressure on food demand and land use), urbanization, industrialization. Upstream development and sea level rise as external pressures on Delta
- Pressures:
 - Base layer: floods (floods do benefit farmers, natural fertility), saline water intrusion, extreme events
 - Network layer: water control projects, changes land-use
 - Occupation layer: increase agriculture activity, de- and reforestation
- Government: lack of regional collaboration, no common strategies and master plans, lack mechanisms from central government to avoid conflicts in policy implementation, lack capacity provinces, weak ppp.
- Challenge: poverty reduction and environmental protection

4. California Bay

- Precipitation mainly in the north and freshwater demand in the south (infrastructure solution)
- System vulnerabilities: fishing declines, subsidence (due to agriculture), catastrophic events, climate change. Snow into rainfall needs additional reservoirs.
- New housing has taken place in Delta bay and is not high above sea level
- Leadership role: climate change is taken very seriously (governor)
- Alliance California with the Netherlands on climate change and adaptation

5. Ciliwung Delta

- Drivers of change: population and urbanization, economic growth, climate change (intensity raining season), sea level rise, subsidence (ground water extraction), technological developments (contributes economy)
- Pressures:
 - Occupation layer: out-of-control urbanization, flood vulnerability, freshwater Shortage (requires management)
 - Network layer: ageing and inadequate infrastructure
 - Base layer: water quality (salinization)
- Governance: centralization to decentralization, lack of coordination and cooperation between level and sectors of government, increasing cooperation between government and private sector, apply risk assessment, cooperation civil society at local level
- Gaps: Downscale climate change scenarios (make operational), socio-economic development projections, scenario based risk assessment, ecosystem based planning, data sharing, communication government

6. Mississippi Delta

- Technological development: infrastructure developed after earlier floods, engineering landscape
- Man-made changes: effect on floods and storms, city at risk, natural habitat alterations, increased salt water intrusion, wetlands are disappearing
- How to deal with this?:
 - Projects to transfer water from river to wetlands
 - Delta building dynamics (engineering)
 - Complex system (natural and man-made)
- Economic development: agriculture, port, recreation/tourism, gas and oil industry. Side effect oil industry (making canals is danger for wetlands)
- Drivers of change: climate change: Sea level rise, hurricanes (rising sea temperature) Subsidence (extraction gas and oil, channelization of the river)
- Governance: coastal wetland planning
- Lessons learned: river is vast natural asset, natural dynamic river
- Gaps: soft infrastructure (flexible, dynamic, adaptive), freshwater diversions and sediment related infrastructure, effects on population and economy, database for future planning

7. Yangtze Delta

- Drivers of change: GDP, climate change, subsidence (groundwater extraction)
- Pressure:
 - Occupation layer: pressure on space (urbanization, reclamation), freshwater shortage
 - Network layer: infrastructure
 - Base layer: sediment loss and serious erosion (loss of biodiversity and environmental quality)
- Governance: lack of platform for stakeholders (WWF initiated platform Estuary Partnership)
- Adaptive measures: vulnerability report, natural solution water resource, natural solution biodiversity restoration, natural solution for navigation development, low carbon city
- Lessons learned:
 - (1) knowledge gap between ecologists and engineers
 - environmental awareness of engineers is low, do not have knowledge
 - ecologists want to bring solutions to engineers
 - (2) Integrated River Basin Management
 - conscious but not able how to manage

Conclusions

Evidently, all deltas are facing similar drivers of change, like demographic developments, ever increasing urbanization, economic activities and envisaged impacts of climate change.

Common themes of concern in all deltas are sea level rise, floods and droughts, salinization, freshwater shortages, subsidence and infrastructure problems, be it with varying magnitudes and accents. But there are also clear differences, like the beneficial flooding for farmers in Vietnam, or concern for landslides in western United States. The speakers, and also the subsequent electronic board room session, highlight the need and mutual interest for exchanging knowledge and experiences in adaptive approaches addressing the themes mentioned above. Innovative and surely integrated multi-sector and multi-stakeholder approaches are favored. Lack of capacities, various governance issues and insufficient financing options were regularly indicated as bottlenecks for successful implementation of existing (incl. indigenous) knowledge.

Some of the suggestions made on remaining challenges include:

- Taking the leadership role in adaptation processes by local/regional government, like the California State Governor did
- Champions and/or celebrities may be instrumental in reaching out to the public

- Establish long-term adaptation programming adopted through parliaments, as to overcome the short-term life span of many politicians (ref. Dutch Delta programme)
- Provide guidance and transparent communications on risk perception, dealing with uncertainties, and stepwise approaches in adaptive water management (not too little, not too much; not too early, not too late) at various levels of scale and time
- Link national water management adaptation programmes to major global agenda's where the use of water is an important factor, such as Disaster Risk Reduction, Food Security, Energy
- Provide local solutions: think globally, act locally

Issues mentioned (much more than summarized above) are prioritized during the electronic board room session, which are elaborated further during a working session the next day.

Next to further improve the comparative overview, it is envisaged this joint exercise will provide a common ground for selecting thematic issues to be included in the workprogramme (knowledge exchange, defining joint projects, etc) for the 3rd phase of the Delta Alliance. The outcome may also be instrumental in structuring the web-based Delta Alliance platform.

DP C 6.3

Session DP C 6.3: The Business Case for Resilient Buildings

Chair

Mark Watts, Director, ARUP/C40 UrbanLife, programme director, United Kingdom

Speaker

**Chris Jofeh, ARUP, United Kingdom
Julia Prescott, Meridian, United Kingdom**

Short description of the session topic and the objective of the session

Retrofitting existing buildings and designing low-carbon new buildings will be critical to achieving both carbon reduction targets and to adapting cities to the impact of climate change. But the conventional business case for change is weak – energy costs are a small proportion of most businesses' operating costs, and major climate risks appear to be only in the long-term. On the basis of international best practice and the views of a cross-section of building industry and public policy practitioners, this session consider a few questions with regards to the business case for resilient buildings.

Most exciting insight, moment or outcome

Chris Jofeh announces that lawyers in the United Kingdom treat climate change as a foreseeable problem. This means that engineers are liable for the potential impacts. This creates real urgency to implement climate mitigation and adaptation measures.

Main conclusions, themes, insights or messages

- Retrofitting goes beyond the typical energy saving measures. It changes the way a company operates. The gain (both financial and in sustainability) is in the operation of a building instead of in the initial construction phase
- Sustainable buildings create value since workprocesses are optimized. This value is way beyond the initial investment costs and is therefore profitable. An increasing number of companies acknowledge this

- Public-private partnerships are 'natural' vehicles for the incorporation of sustainability issues because they embrace a long term perspective instead of the quick gains

Key phrases or quotes

- Political will is critical in public-private partnerships along with long term commitment
- In the United Kingdom lawyers now say that climate change is relatively foreseeable. This means engineers will have to deal with a liability issue. So, there's a drive to really implement retrofitting measures
- Public-private partnerships are difficult because of trust issues between partners. Big or small many public-private partnerships take an equal amount of effort. Therefore one can argue larger projects are better since effort and costs are relatively less

Chris Jofeh is discussing the attractiveness of retrofitting buildings. This is first of all an engineering challenge. Scientists provide the background but engineers in the end have to implement it. Jofeh is convinced that our future cities are similar to the current ones (so no utopian visions) except for the fact that sustainability will play a much bigger role. Yet, there is currently only a downwards spiral perceivable: although the United Kingdom has committed itself to Kyoto, current CO₂ emissions are only on the rise. In terms of natural hazard impacts he notes that during catastrophes it's mostly the 'systems' that collapse: a cascading set of failures including financial arrangements to provide aid and relief.

ARUP has published a set of 'user guides' for retrofitting buildings. An important aspect in retrofitting is that projects are often perceived from the initial investment costs. Jofeh poses that one has to create 'value beyond cost saving'. The (obvious) energy saving measures will only provide 20 percent of the reduction in CO₂. Important is therefore to 'integrate' sustainability into the building lifecycle. This is also sensible since the ratio for building initiation costs and operation is 1 to 10. The 'value' of sustainability for a company is estimated in the order of 200 to 1 (public value, enterprise value, investment value, market value). Especially the enterprise value (such as productivity) is now slowly recognized as being positively influenced by a 'sustainable approach'.

Julia Prescott focuses on public-private partnerships (PPP) and their role in getting large retrofitting schemes off the ground. This focuses on the scale and financing in which retrofitting really makes a business. Meridian focuses on long term equity financing and investment as a business for pension funds and the insurance industry. This encompasses a financial prospect combined with a social agenda: improving social services and sustainability. Meridian only invests in public project by setting up PPPs. These are robust. Even during the financial crisis PPP projects attract EUR 300 billion in the EU. Generally a Local Joint Venture is started in which different partners from the public and private sector take place. One of the attractive assets of PPP is that debt is cheaper than equity (normal project financing): 5 percent to 14 percent. Furthermore, because of the uncertainties in the financing market, many investors seek 'safe havens'. PPPs provide a structure to invest in retrofitting now instead of waiting for government investments, tax reductions and policy.

Delta Sessions

DS 1

Delta Session DS 1: Regional Elbe/Hamburg

Chair

Hans von Storch, Institute for Coastal Research, GKSS, Geesthacht, Germany and Heinz Glindemann, Hamburg Port Authority, Germany

In the Elbe estuary large changes have taken place in the past, are presently going on and are to be expected in the future. Changes related to societal use and management, natural causes and climate change. Important issues in the Elbe estuary are the tidal regime, sediment regime, ecosystem functioning and storm surge risk.

The city and the population of Hamburg are broadly aware of these changes. A well cooperating network of basic and applied science institutions and of decision- and policy makers has been established, dealing with climate change and scenarios, estuary and port management, landscape and urban planning, engineering as well as social and cultural sciences. Regional climate services, including the assessment of available scientifically legitimate knowledge (Hamburg climate report), are supporting these policy-science interactions.

Efforts for developing better governance tools and processes are needed, e.g. with respect to planning, timing and implementing coastal defense measures or adaptive estuarine management (such as dyke relocations).

In doing so, knowledge about beliefs, perceptions and preferences hold by the population as well as among key social actors, is needed as an important component of the challenge of future development is beginning to emerge in Hamburg.

DS 2

Delta Session DS 2: Po Delta and the Venice Lagoon

Chair

Antonio Paruzzolo, Councillor of the Venice Municipality, Italy

The Po Delta and the Venice Lagoon session discusses a number of key issues related to climate change impacts and response strategies in the delta. First, the most recent sea level rise scenarios and the vulnerability of the whole delta region to sea level rise are presented. Then, the management plan of the Po Delta Park and the measures for safeguarding the Venice lagoon are illustrated.

The most recent sea level rise scenarios for the north Adriatic Sea foresee between -16 cm (lower bound) and +70 cm (upper bound with the ice sheets melting playing a major role) by 2100. Wide areas of the delta region are already experiencing flooding, erosion, and loss of habitats. Sea level rise is expected to exacerbate current trends.



The Po Delta is part of the European Natura 2000 network. The Natura 2000 management plan can provide a contribution to climate protection policies which have recently entered the agenda. However, the development of a management plan of the park has been debated for more than ten years without coming to the definition of the plan and the perimeter of the park. The constellation of small local authorities (73.000 inhabitants in 9 municipalities) and the presence of two regional governments makes it difficult to agree on priorities to pursue.

In the Venice Lagoon, a wide programme including local and coastal defense, morphological reconstruction measures and pollution abatement measures have been implemented since the early 80s. To protect the urban areas from flooding, an integrated system of storm surge mobile barriers at the lagoon inlets (called MOSE Modulo Sperimentale Elettromeccanico or electromechanical module) and local defenses in the lagoon urban centers is under construction. The barriers consist of 78 independent floating gates placed at the bottom of the lagoon inlet channels. Every time a tide of +110 cm (so called safeguarding level) is forecasted the barriers are raised up to separate the lagoon from the sea for the duration of the tidal event. The system is designed to stand +60 cm sea level rise. In the urban areas, local defenses consist of raising as much as possible up to +110 cm public pavements and lagoon banks. The level to which it is possible to raise the urban areas, however, depends on the architectural structure of the historical centers. The coastal defenses consist of soft measures such as beach nourishment and dune reconstruction and hard measures like breakwater embankments and sea walls. Coastal defenses have also been built considering +60 cm SRL in the project design. Finally, the morphological restoration include measures such as protection and reconstruction of mudflats and salt marshes, raising of the lagoon bed to reduce wave motion, dredging of lagoon channels and planting eel grass. In the recently updated morphological plan sea level rise is considered when planning these measures.

The storm surge barriers are expected to be completed by 2014. At present, one of the issues being discussed by local actors is the management strategy of the barriers. In particular, to keep the number of full closures as few as possible as sea level rises, two possible management strategies according to different sea level rise scenarios were presented by the designer of the barriers. In both cases initially the number of full closures will increase as sea level rises. However, because the barriers are made up of independent gates, it is possible to introduce partial closures. By using partial closures the water level in the lagoon can be reduced by 10-20 cm or even more without permanent negative impacts on the lagoon ecosystems. Then, to further bring down the number of full closures in case of eustatic scenarios above +20 cm sea level rise, it is possible to increase the level of the local defenses. This costly solution can wait until +50 cm sea level rise, which may occur by at the earliest 2070-2080. Up to +50 cm sea level rise the proper functioning of the barriers is ensured and thanks to the partial closures the number of full closures would remain limited. This would reduce the impacts on the ecosystems (e.g. anoxia phenomena) and on the port activities. Against this background, according to the current climate knowledge, the mobile barriers and the local defenses being built in Venice will be able to fully protect the city at least up to the second half of the 21st century and probably beyond. Later on, with more than +50 cm sea level rise, raising the pavements would buy extra time for the functioning of the barriers to plan further actions.

In both areas of the water and environmental governance, arrangements are fragmented and not fully effective. This may hinder adaptive capacity of society to deal with climate change in the coming decades. In particular, a climate change adaptation strategy for the whole delta region has not entered the agenda yet.

Concluding, the delta region is dealing with climate change by implementing different types of soft and hard coastal defense infrastructures, particularly in the Venice lagoon. What seems to be missing are adequate institutional arrangements allowing effective water and environmental management of the whole delta and in particular an adaptation strategy for the whole region.

DS 3

Delta Session DS 3: Nile

Chairs

Dr. Hussein El Atfy, Egypt and Cees van der Wildt, the Netherlands

Speakers

Dr. Hussein El Atfy, Ministry of Water Resources and Irrigation, Egypt
Henk Tankink, Ministry of Economic Affairs, the Netherlands
Prof.dr. Shaden Abdel Gawad, Ministry of Water Resources and Irrigation, Egypt
Koen Roest, Alterra, Wageningen UR, the Netherlands
Dr. Samia El Guindy, APP Central Office, MWRI, Egypt
Dr. Ibrahim El Shinawy, Director Coastal Research Institute, NWRC, Egypt
Dr. Mohamed Bayoumi, UNDP, Egypt

Egypt is preparing for climate change. This session focuses on what needs to be done to climate proof Egypt.

First of all it is important to generate awareness. Not just among politicians and decision makers, but also among children and students. People must realise water is precious. Egyptian agriculture is already used to water being scarce and water is very efficiently used. It may have already reached it's efficiency limit. Still water productivity remains an important strategy when coping with climate change. Innovations are needed to further boost water productivity. A transition of the farming systems may be also necessary. These kind of system changes take a lot of time. It is important to facilitate the farmers with these changes and cooperate with other deltas. When investing in awareness one mustn't forget to educate the next generation. Climate change education should be incorporated in schools. Education is needed on all levels.

There is an urgent need to mobilise short and long term funding for the implementation of adaptation strategies. The investments required may exceed the government's budget. Egypt urges the international community to help fund the cost of adapting to climate change. A financial system to get funding may have to move to public private projects. In all cases it is important that planning takes into account all relevant sectors: urban areas, landscape, water. There is a need for continuous international dialogue, sharing knowledge, networking and exchange of best practices. An adaptation strategy to face climate change impacts should be integrated within the National Plans. This requires: awareness, political will and commitment. It is advisable to develop an Integrated Coastal Zone management plan for the Nile Delta Coast, consulting and including all relevant stakeholders. Within this plan the maximum sea defense capacity of natural ecosystems should be determined. Monitoring and observation systems should be put in place.

With respect to knowledge exchange there is a real need to link science and research with policy. Decision makers should consider the messages from the scientific community on climate change and no longer wait and see. A robust science-policy interface is a must and the panel model is worth replicating. There is a need for continuous international dialogue, sharing knowledge, integrated networking and exchange of best practices. The advise is to learn from best practices elsewhere and maintain working links with international water institutions. It is important to work on knowledge-sharing and capacity building on complex water management issues. To quickly gain applicable knowledge it is wise to review best practices and upscale successful initiatives. Create show-cases of innovations and the way forward through pilots. Joint delta research is 'value for money' and as such the Delta Alliance provides Egypt with an excellent opportunity to quickly gain knowledge.

For coastal protection: keep environmentally friendly solutions in mind. Convince the people with practical examples and communication.

So what's next for Egypt?

- Learn from best practices elsewhere
- Create tailor-made solutions
- A robust science-policy interface is a must
- Research priorities are needed because of limited financial and human resources.
- Joint delta research is 'value for money'
- In addition to all technical work, social science is needed to deal with the complexity
- There is a need for knowledge-sharing and capacity building on complex water management issues

DS 4

Delta Session DS 4: Thames Estuary

Chair

Robert Nicholls, University of Southampton, United Kingdom

Speakers

Alex Nickson, Greater London Authority, United Kingdom
Jason Lowe, Met Office Hadley Centre, United Kingdom
Jim Hall, Newcastle University and Tyndall Centre for Climate Change Research, United Kingdom
Tim Reeder, Environment Agency, United Kingdom
MSc. Marnix de Vriend, Royal Haskoning, the Netherlands
Dr. Jelle van Minnen, Netherlands Environmental Assessment Agency, the Netherlands
Swenja Surminski, London School of Economics, Association of British Insurers, United Kingdom

This session focuses on the Thames Estuary 2100 project, which has developed a strategy for protecting London from tidal flood risk during the 21st century and beyond. Many researchers, consultants and government officials have been involved in TE2100. The TE2100 strategy promotes a flexible approach to adaptation planning. It makes use of an extreme 'high++' sea level rise scenario.

The session was also set in the context of London's Climate Change Adaptation Plan, which is currently in consultation. Adaptation is complex and involves many actors. This raises challenges of communication, for which London is a useful test case. Development of indicators proves to be a real challenge.

Robert Nicholls (University of Southampton) introduces the session by pointing to the strategic significance of London and the Thames Estuary. He identifies the TE2100 project (with the Delta Commission in the Netherlands) as an exemplary example of decision making about adaptation.

London is not well adapted to the current climate and is already experiencing the impacts of climate change. The Greater London Authority (GLA) is prioritizing adaptation. London's adaptation priorities are flooding, water resources, overheating, air quality, subsidence and heave, wind storms, and global climate events. Flood risk includes tidal,

fluvial (from the Thames and tributaries) and local surface water flooding. A hierarchy of responses is being developed: prevent, prepare, respond, recover. An ambitious urban greening programme aims to tackle heat, runoff and improve attractiveness and livability of the city.

Jim Hall (Newcastle University and Tyndall Centre for Climate Change Research) discusses the flood risk in the Thames estuary and the Thames tidal defenses. Hall works on an analysis of uncertainties in tidal flood risk analysis and on modelling land use change and its impact on flood risk. Interesting in this respect is the Tyndall Center cities research programme.

Tim Reader (Environment Agency) gives a presentation on the Thames Estuary 2100 project which has developed a strategy for protecting London from tidal flood risk during the 21st Century and beyond.

Different options for decision making were considered: scenario planning, decision pathways and adaptable options. The project is implemented in phases: the first 25 years, then to 2070 and from 2070 and beyond. Uncertainties in the failure probability of the storm surge barrier are taken into account. Even with one gate failing, the Thames barrier will provide good protection.

Physiography and culture shape policies, leading to differing standards of protection in the United Kingdom and the Netherlands, says Marnix de Vriend. It is important to reducing probability and consequences of climate impacts. Stakeholders should be given an important role. Between stakeholders there should be trust and cooperation, although sometimes there are conflicting interests. When communicating with stakeholders it is important to visualise impacts and options.

To successfully implement adaptation strategies we need adaptation indicators. These indicators target and monitor adaptation policies, measures and actions, communicate adaptation and compare adaptation achievements (across sectors, regions and countries). The development of an indicator framework consists of three steps:

1. indicators for the adaptation policy process
2. indicators to monitor the implementation of adaptation measures
3. Indicators to evaluate the effectiveness of policy actions

Swenja Surminski (London School of Economics) discusses climate risks versus opportunities and mechanisms for involving the private sector in decision making. She also discusses the relationship between the insurance industry and the government.

DS 6**Delta Session DS 6: Vietnam / Mekong Delta****Chair**

Raimond Hafkenscheid, Cooperative Programme on Water and Climate (CPWC), the Netherlands

Speakers

Prof. Tran Thuc, Vietnam Institute for Meteorology, Hydrology, and Environment (IMHEN), Vietnam
Nguyen Ngoc Anh, Southern Institute for Water Resources Planning, Vietnam
Paul Rabé, Pacific Rim Forum on Urban Development (PRFUD), the Netherlands

Prof. Tran Thuc (Vietnam Institute for Meteorology) explains about the current status of climate change in Vietnam, including the climate scenarios (rainfall events, drizzle days, sea level rise). From 2011-2015 the National Target Programme to respond to climate change will be implemented. Difficulties with implementation are: poor awareness, weak condition for mainstreaming, and lack of tools for methodologies for policy development. The main priority is awareness raising on climate change and adaptation, aiming at a 100 percent coverage amongst policy makers by 2015. However, there is a mainstreaming overload (too many top priority issues pressed by external parties) causing stagnation in the policy development.

There are climate change scenarios available which get an upgrade every six months. However, the scenarios are not applicable on local level, since the spatial resolution is insufficient.

To raise awareness among people the Institute for Meteorology, Hydrology, and Environment (IMHEM) in Vietnam uses the tools described in the Target programme. Vietnamese civil servants will be reached, but people in urban areas are difficult to reach. That's unfortunate because in urban areas people hold a lot of adaptation experience. The governance recognizes the importance of this local knowledge.

IMHEM is doing research and develop guidelines for actions plans, under the responsibility of the Vietnamese Ministry of Natural Resources and Environment.

Nguyen Ngoc Anh (Southern Institute for Water Resources Planning) explains about the Master plan on Water Resources development in the Mekong delta. To execute the Climate Adaptation Master Plan funding of USD 10 billion is needed.

Paul Rabé (Pacific Rim Forum on Urban Development) looks at the challenges awaiting Ho Chi Minh City and the surrounding region. In the area there are plans for a new harbour and housing area. Soil characteristics and flooding make it very costly to develop housing, more holistic planning is required. For district 6 climate adaptation measures can only be implemented structurally with total redevelopment of the area, including its economic activities. One of the members of the audience poses the following question: considering that already a lot of studies and recommendations have been conducted, Rotterdam has started a cooperation with Ho Chi Minh City to assist with an integrated climate change strategy. Where should Rotterdam start? Apparently there is no lack of planning or technical assistant reports, but Ho Chi Minh City has difficulties implementing the plans, or find a way to connect the separate masterplans and reports. A total holistic viewpoint is lacking. Rotterdam could help here.

Franscesca Bernadini (UNECE guidance) states that a transboundary approach for guidance is relevant. The government of Vietnam is invited to start an exercise with the EU project to share experience on this topic, and the UNECE is willing to assist.

Peter Kerssens (Deltares) replies that he is curious what the role of China is in the Mekong. In his opinion the Chinese receive all the data and information, because they are observers in the Mekong River Commission, but they have no obligations in providing data themselves. Activities related to information exchange, collection, validation and distribution will have to increase drastically over the coming years. Jeremy Bird (CEO MRC) reflects that China is indeed an observer, but that China is also a dialogue partner and that there is an exchange of information between the modelling teams. It is not yet an optimal situation, but far better than years ago.

Rohit Aggarwala (advisor C40 cities affairs) says that Ho Chi Minh City is facing great achievements today. He advises to use the Connecting Deltas cities network and peer to peer connections between city officials. Mayors will take strategic advice from other mayors, and officials from officials.

Chris Zevenbergen (Dura Vermeer) thinks that it is possible to involve the private sector when cities come up with good plans. He wonders whether it is possible for Ho Chi Minh City to involve Chinese investors, like in Rotterdam. Arnoud Molenaar replies that this would be possible.

Viet Hoang (WWF Vietnam) reflects on green adaptation strategies. 70/80 percent of the people in the Mekong Delta live in rural areas and are heavily dependent on the national resources. People cannot benefit from ecosystems with technical structures, like what happened in District 7. A Singapore project changed the area from mangrove to an urban area. Water (run off) is not able to be absorbed, which causes large floods. The delta dynamics must be maintained.

Lies Janssen (Netherlands Water Partnership) asks if policy makers in the Mekong delta look at the lessons learned like New Orleans. Arjen Berkhuisen replies that Marcel Stive has concluded that the biggest lessons learned are that once you interfere, there is no way back. When you have destroyed the ecosystem it is too expensive to turn in back into the old system. That is why economic value studies needs to be done and natural dynamics must be safeguarded.

Rob Verheem (MER Commissie) explains that Strategic Environmental Assessment (SEA) are already a key tool for the Vietnamese government that they are going to apply in there efforts to implement policies related to water resources and climate adaptation. There are two important needs: get the data right and make sure that data is mainstreamed into social society. SEA is legally mandatory within strategic decision making in Vietnam on national and local level. But there is a need for local capacity. That is why a support programme is started with assistance of the Dutch Embassy in Hanoi.

This programme will:

- o Develop technical guidance how to apply SEA in case of policy development for Water resources management and climate change
- o Create awareness how to deal with Climate Change
- o Field test this guidance in the Mekong provinces

Relevance for international exchange is extremely important. CEI MER is willing to assist in this.

The question is asked whether SEA could be an instrument to break through the thematic silos that appear to be present? SEA can contribute, but cannot solve this problem, but can help to team up with other approaches.

Vice Minister dr. Nguyen Thai Lai from the Ministry of Natural Resources and Environment (MoNRE) closes the session:

- o All comments are very relevant for Vietnam, not only in the Mekong delta but also for the Red River delta in the North
- o Vietnam is dealing with uncertainties and would like to cooperate with others to tackle the problems. The strategic partnership arrangement that has been signed by the prime ministers of the Netherlands and Vietnam is an excellent example
- o Good data is important for adequate scenarios, without proper data on climate and water resources we are blind
- o Do not rush: if changes are made, make them right. Flexibel approaches and no regret measures towards climate change are required
- o Everybody is welcome to Vietnam to help us but if you all do not work together you only create much more problems for us. Coordination needs to take place, and organisations have to look beyond their own individual objectives
- o The government is very much in favor of organizing a conference like this one, to exchange the views, as long as they really add to further cooperation

DS 7

Delta Session DS 7: Rhine Delta

Chair

Bouke Ottow, Deltares, the Netherlands

Speakers

Otto de Keyzer, Deltares, the Netherlands

Lenie Dwarshuis, Province of Zuid-Holland, the Netherlands

Jules Beersma, Royal Netherlands Meteorological Institute (KNMI), the Netherlands

Jaap Graveland, Waterdienst, the Netherlands

Evert van der Meide, Province of Zuid-Holland, the Netherlands

We want to hear from policy makers: What do policy makers need from science, how can they effectively deal with uncertainties? And we want to get from scientists some clues for policy-makers how to handle the results from science, including the accompanying uncertainties.

During the session, policy makers, policy officers and scientists were brought together. The following points struck attention:

- Policy makers communicate in pictures, events and clear visions. Scientists on the other hand focus on maps, schemes and figures. At the same time, scientists don't put much emphasis on how unique their research is
- Time horizons differ between policy makers, policy implementers and scientists
- Scientists reflect on all uncertainties. Policy officers focus on eliminating uncertainties to facilitate decision making processes
- There exists a dilemma between either taking a flexible adaptation path and a need for clear long term decisions on the part of developers
- It is crucial to take into account all (KNMI06) climate scenarios in decision making processes; only then the uncertainties in climate change will be taken into account

- Be careful not to be too perfect, uncertainties will always remain
- How to deal with changing risks at different time scales?

Though water is a threat, it also provides many (market) opportunities. The history of the Netherlands from the Golden Ages until now exemplifies that. The climate is changing, that is no discussion. What is under discussion is the degree and the speed. The people trust the government to ensure safety now and in the future. With the Deltaworks the Dutch learned that the Delta became safe but not sustainable, as the natural system was eliminated. Current problems include soil subsidence, salinization, water shortage, scarcity of space and insufficient water quality. The Netherlands consider re-opening the barriers against the sea. There is an obvious need for more space but this cannot be at the cost of safety. Casualties are not acceptable. Only further investments can assure that our children will be safe. A new Delta Programme is necessary.

There are large uncertainties in emission scenarios and climate models, and thus in climate model projections (for the Rhine basin). Uncertainty in projections is somewhat larger for the far future (2100) than for the near future (2050). The uncertainty in discharge projections for the Rhine basin is large. Except for a clear increase in average discharge in winter in the far future, both increases and decreases are projected. As a result, one should be careful considering only the ensemble mean change, the majority of the projections or single-model results, since this ignores the fact that there is also a (small) probability for a change in the opposite direction. The full information is in the full range of climate projections.

Jaap Graveland (Waterdienst) presents one of the six regional programmes within the Dutch Delta Programme: the Rijnmond Drechtsteden. The main problem is that the area is low-lying and is subsiding; this in combination with urbanization, salinisation and safety issues. It is important to adapt before disaster strikes. In 2013 the Advice from the Steering Committee will be presented and in 2014 a political decision is expected. There is uncertainty in climate change, but uncertainty with regard to economic development is even larger. There is a tendency to postpone decisions, but people and investors need clarity on measures that are going to be taken as soon as possible.

Evert van der Meide (Province of Zuid-Holland) presents a detailed provincial decision framework to evaluate if specific unembanked areas are suitable for building. The probability of casualties and social disruption is central in this framework. The climate factor is introduced in the decision framework. A decision has to be taken which climate scenario has to be used in this framework. Van der Meide expects it will be clear in 2013/2014 which measures de Rijnmond-Drechtsteden need to take.

Questions by the audience

- Who do you recognize as your partners in addressing the problems of climate change on water management?
- What can be the role of private actors? What scale level? The Rhine in the Netherlands is a sink in relation with Germany
- Some consequences of the higher and lower discharges of the Rhine in the future
- How uniform are the hydrological models for climate change studies in the Rhine basin? Are the models objective?
- How can citizens be self-reliant with regard to climate change?
- Already the Maeslantkering is not up to Deltastandard. It is operational once every 12 years, one failure per 200 times means 1 failure per 2400 years
- Why use many climate models and only one hydrological model?
- How does the 'strictness' of 16.000 m³/s relate to all the uncertainty in the catchment modelling?
- What is an appropriate time horizon for spatial planning/development? And for flood safety? 1/10.000 year? 1/100 years? Sea level rise 0,5 m, 1 m, >2m?
- What sort of certainties are required for policy making?

DS 9**Delta Session DS 9: The lowland deltas of Indonesia****Chair****Dr. Aart Schrevel, Alterra, Wageningen UR, the Netherlands****Speakers**

MSc. Jos Houterman, Euroconsult MottMacDonald, Indonesia
Prof. Jan Sopaheluwakan (Chairman ICIAR-LIPI), Indonesia
Dr. Henk Wösten, Alterra, Wageningen UR, the Netherlands
MSc. Ton Bresser, UNESCO-IHE, the Netherlands

Panel

Dr. W. Giesen, EC Mott MacDonald, the Netherlands
Dr. Heru Santoso, ICIAR-LIPI, Indonesia
Dr. Jan Verhagen, PRI, Wageningen UR, the Netherlands

The coastal and near coastal lowlands of Indonesia (approximately 21 million ha) are rural deltas with unique eco-physical and socio-ecological qualities. Their soils often consist of thick layers of peat and need to be carefully managed. Their indigenous inhabitants have developed unique livelihood systems based on the potential of the areas' natural resources. Starting a few decades ago, Indonesia's lowland deltas have become the scene of increasingly intensive economic activities, leading to a reduction in forest cover and lowering of water levels in order to use the peat soils for food and energy crops. This has resulted in the peat to be exposed, which allows it to oxidize and to contribute to global emissions of greenhouse gases, and thus to global warming.

In addition, climate change affects the lowland deltas: sea levels rise, salt water intrudes further inland, prolonged droughts occur, or floods become more frequent. The indigenous livelihood systems have to adapt to these changes.

The session on rural deltas in Indonesia takes off with an introduction by Jos Houterman (Euroconsult MottMacDonald). He explained the practice and policies of rural delta development in Indonesia and gives an overview of the different phases of lowland development. Each rural delta is unique in as far as its bio-physical and eco-social conditions are concerned. Understanding the actual potential of sub-areas within deltas is a first condition to successfully strike a balance between conservation and development. Hydrology is a key to that understanding. Rural deltas are invariably difficult to develop, with a high risk of failure. Failure will lead to unsuccessful agricultural projects and degraded lands. Climate change challenges include fire-risks, the need to adapt established agricultural practices, and changes in coastal ecosystems.

Jan Sopaheluwakan (Chairman ICIAR-LIPI) zooms in on the case of the Mahakam Delta, East Kalimantan and explains how delta development takes place in practice. The delta's natural resources are scavenged and current practices boil down to 'harvesting disasters'. The case of the Mahakam delta is not unique in Indonesia. Sopaheluwakan remarks that climate change is but one of the factors at work that shape the rural deltas, and not necessarily the most important when it concerns sustainable ecosystems and livelihoods.

Getting the hydrology right is of crucial importance for many reasons, including effectively managing carbon dioxide (CO₂) emissions. The levels of CO₂ emissions from Indonesia's rural deltas are felt even on a global scale; the deltas contribute directly to increased levels of CO₂ in the atmosphere, and therefore to global warming. Dr. Henk Wösten,

senior researcher at Alterra, Wageningen UR, discusses the potential to mitigate CO₂ emissions by restoring degraded peat lands through optimizing hydrological conditions. He presents his experiences in a recent REDD (Reduced emissions from Deforestation and Degradation) scheme in Central Kalimantan. He observes that 'the more you drain, the more emissions you get'. Pertinent questions include: 'Who owns the carbon stocks?', and 'How to monitor the carbon stock and its growth correctly?'.

The fourth speaker is Ton Bresser (UNESCO-IHE). He argues climate change comes on top of other developments (e.g. changes in land use, infrastructure). He further points out that a lot of uncertainty still surrounds climate change and how it affects Indonesia's rural deltas. Especially there is a lot of uncertainty with respect to rainfall in the future, and the onset of the rainy season is expected to be delayed and its length to be diminished. Combined with increased rainfall this means more intensive rainfall in a shorter period. The main bottleneck for adaptation is the institutional capacity to effectively deal with climate change at local and provincial levels.

It is said that we have to deal with the limits and uncertainties associated with climate change, but that, at the same time, we have to start science and policy dialogues so that policies become acceptable, because we cannot afford to wait until all uncertainties have been turned into certainties. Scenario thinking and thinking about extreme conditions is the way out of this dilemma. The need was stressed to translate conclusions to local levels and to introduce approaches that are effective even after projects have come to an end. It is further stressed that an ecosystem approach could link conservation to development aspects (e.g. DPSIR framework). Furthermore, everyone agrees on the notion that doing things right now means that costs in the future will be avoided, which is indeed an important consideration. And that relying only on the government is perhaps not sufficient. The private sector needs to be involved. Educating stakeholders, including government officials is important. With regard to REDD, to generate funds and make it available at local level is a very complex issue. There are no standard approaches, because 'carbon ownership' patterns differ from one area to the next and have much to do with local access-to-resources patterns. It is also said that REDD deals tend to be made at national level, not at local level, and that price setting is particularly important as this directly relates to the potential to achieve results on the ground. Finally, effectively linking national policies to provincial and district policies, while allowing things to be done at the lowest appropriate level, is a major challenge in Indonesia's rural deltas today. Plus getting rural deltas on the agenda of policy makers.

Round Tables

RT1

Round Table RT1: Financing adaptation

Chair

Dr. Ger Bergkamp, World Water Council, France

Panel

Gordon Hughes, World Bank, United Kingdom

Ana Fornells de Frutos, Adaptation Fund, Spain

Monica Scatasta, European Investment Bank, Luxembourg

Murray Starkel, Natural Gas Partners, United States

David Miller, City of Toronto, Canada and C-40, Canada

Martin Parry, Imperial College, United Kingdom

Collin Herron, Conagua, Mexico

Karin Lexén, Stockholm International Water Institute, Sweden

Julia Bucknall, World Bank, United States

Dr. Ger Bergkamp (Director General of the World Water Council) opens the session and poses the questions for discussions:

- What do we know about the costs for adaptation?
- What are the perspectives on and resources for financing with financiers?
- How do 'clients' (countries, cities) consider financing of adaptation?

What do we know about the costs for adaptation?

As a percentage of gross domestic product (GDP) the costs to preserve welfare under climate change turn out to be relatively low: less than 0.6 percent of the GDP as global average, but up to between 2 and 4 percent for the least developed countries in Sub-Saharan Africa. Most of the costs will have to be made at the start of adaptation, and are water-related (up to 70 percent of an estimated USD 100 billion per year by 2020), especially in coastal zone protection, infrastructure, drinking water and flood management).

Martin Perry (Imperial College) was a member of Working Group 2 of IPCC. He states that many do not agree with the World Bank study, as the costs for the restoration of natural areas have not been included. New calculations show that for New Orleans alone, already 20 billion would be required. There is a gap between financing and repairing the damage. Barrier reefs cannot be adapted, for example. Humility is needed, as the numbers might be bigger. If it is 10 times cheaper to adapt, why then mitigate?

Julia Bucknall (World Bank) emphasizes the needs of the poor. In 2009 6.2 billion was spent on water. It was not monitored, but a lot of these investments are spent on adaptation. 60-70 Percent went to cities. The value of ecosystems is missing in this story. Nevertheless, ecosystems become more and more involved. There is a need to mainstream adaptation into development planning, rather than have separate adaptation plans. The innovation should also address institutional arrangements and communication.

What are the perspectives on and resources for financing with financiers?

Ana Fornells de Frutos (Adaptation Fund) explains about the Adaptation Fund and how it functions. The Board consists mostly of developing countries, with 16 members and 16 alternates. Two representatives from each of the five UN regional groups, one representative of the small island developing states, one representative of the least developed



country Parties, two other representatives from Annex I Parties and two other representatives from non-Annex I parties. There are two committees and a panel, a secretary and a trustee (the World Bank). Presently there is USD 156.28 M available in the Adaptation Fund. By the end of 2012, it is estimated that the Adaptation Fund will contain USD 372 M. Presently two projects have been endorsed:

- Coastal protection and livelihoods in Senegal: USD 8,619,000 (direct access)
- Water management in Honduras (UNDP, 1-step process): USD 5,698,000

There are ongoing efforts to include water adaptation to climate change in the 16th UN Climate Summit in Mexico in 2010 (COP-16); a regional document as part of a global initiative is to be presented in Cancún. Karin Lexén addresses governing and coordinating mechanisms. As water is not on the COP-16 agenda, we should look for hooks to involve water in the negotiations such as partnerships with governments. A strong uniform and concrete message should be produced. The objective of the Water and Climate Coalition is to provide a joint platform for placing water management at the heart of international policy responses to climate change and to identify hooks and language for this.

How do 'clients' (countries, cities) consider financing of adaptation??

David Miller, mayor of Toronto speaks of the challenges in establishing a fit for financing adaptation with cities. There is a lack of knowledge about how high the cost of adaptation will be. The mayors, organized in C-40, are aware of the urgency to develop adaptation capacity because of climate change. On another note, 'additionality' drives him crazy, Miller says.

At the end of the session Ger Bergkamp concludes that there is a need to be more creative regarding developments in financing. He is eager to see how a new instrumentarium for financing adaptation can be developed. An observer participant notices that there are no Africans in the room, although a lot of this is about Africa.

RT2

Round Table RT2: Role building community in climate adaptation

Chair

Rory McLeod, journalist, media entrepreneur and media trainer, United Kingdom

Panel

Chris Jofeh, Director ARUP, United Kingdom
Prof.dr. Chris Zevenbergen, Director Dura Vermeer Business Development, the Netherlands
Mariet Schoenmakers, Director Concepts, AM, the Netherlands
Erik Staal, Director Vestia Housing corporation, the Netherlands
Klaas Strijbis, Director Movares engineering, the Netherlands
Luck Westerbaan, Director Special Market Solutions IMTECH, the Netherlands

Stakeholders from the building community are invited to comment on their role in climate adaptation, the opportunities and barriers they perceive and the main issues at stake. As the amiable chair Rory McLeod puts it, we are here for two things: how are we going to make money? And: how are we going to make the world a better place? McLeod presents five topics for discussion.

Are we still building in deltas and if so, why?

The extreme floods in Pakistan in July 2010 testify to the looming danger of living in a delta. We take these dangers for granted and are still building in deltas worldwide. Why do we do this? 'There is enormous population growth, people migrate to cities and to delta cities as well', says Chris Zevenbergen (Dura Vermeer). 'In delta cities is everything you need, they are the engines on which commerce operates.'

What are our defenses? How safe are people?

Delta cities have defenses in place, but not enough. The chance of a delta city flooding is once per one hundred years. There are over one hundred delta cities worldwide, so we can expect disaster every year. Another challenge is posed by the fast expansion of delta cities. Delta cities expand too fast, cross natural borders, like in Hong Kong, and flood defenses can't keep up. Implementation cannot be instantaneously. We have to plan now to implement 30 years later.

What's the size of the market for the building sector?

With respect to adaptation the building sector is barely scratching the surface. 'There are rules and regulations, but we have to appeal to the better nature of people', Zevenbergen says. Some of the other panel members disagree. Erik Staal: 'In the Netherlands numerous pilot projects have surfaced that present economical sound business cases, such as heating based on salt water.' Other examples include an innovative heating system in the Hague, where drills tap into a hot water reservoir (57 degrees Celsius) used for heating homes. However, as is mentioned in the panel, this refers to mitigation and not to adaptation. Another building sector opportunity presents itself when 80 percent of the current building stock in the Netherlands will be replaced before 2050.

Do we have sufficient skills and knowledge?

In the United Kingdom there are only four universities doing serious environmental studies including economics and technology. This begs the question whether or not adaptive building is a sexy sector to have a career in? Apparently, it is, as students are eager to make a contribution to society when building their careers.

As it turns out, alleged lack of sexiness for university students seems to be the least of the problems of the building sector. 'We need skills in the delivery part, not in university', explains Chris Jofeh, Director ARUP, United Kingdom. 'We need a practical level of skill to upgrade and improve housing. We don't have enough builders.' Apparently as a builder you can take classes on gilding in museums, but not in adaptive building. So how do builders get into adaptive building? In the Netherlands there is an organisation comprised of 10,000 small businesses that work together and learn from each other. Another obvious opportunity is provided by the 1.4 million Dutch houses that need retrofitting to energy level B within the next ten years. The biggest player in retrofitting handles 4,000 a year max. So demand is high, but the capacity to deliver isn't available.

What are the obstacles for the building sector? What do you think you need as adaptive building sector?

'Energy is too cheap', says Luck Westerbaan. Cheap energy prices are a huge barrier to implement new green technologies, which are relatively expensive. If environmental costs were part of the energy price energy, green technologies would be able to compete with traditional technologies.

The importance of a broad social movement is also stressed. We should change the way we think about climate change and sea level rise. 'Characterising climate change and water as an opportunity instead of a threat', says Mariet Schoenmakers, Director Concepts, AM, the Netherlands. She pleads for advocates in the importance of adapting to climate change and the opportunities it provides for improving the quality of the environment.

It's still difficult for Joe Blow to figure out who talks sense and nonsense. Chair Rory McLeod thinks the scientists have lost the war of words to win the hearts of the public. 'People are more interested in Robby Williams and glamour models than in this.' Staal disagrees. 'In the Netherlands we have a Delta Commission and Delta Commissioner Wim Kuijken supersedes the other government layers.'

What does the building sector need? This question is posed to each panel member individually:

Jofeh: 'Get energy prices up.'

Westerbaan: 'Incorporate costs of transport in energy. We spill lots of megawatt transporting it.'

Schoenmakers: 'Get much more experiments working, much more pilots.'

Zevenbergen: 'More pilot projects.'

Staal: 'Deregulation.'

Strijbis: 'Make adaptation sexy to the public. Create other incentives for doing the right thing.'

Jofeh adds: 'We need as many pilots as possible to make all the mistakes we can make as soon as possible and try a hundred new things.'

On the verge of closing the round table discussion some interesting points on regulation surface. The builders find that too much regulation with respect to spatial planning hinders the adaptive building sector. However good regulation can stimulate adaptation. Therefore the old regulations that hinder adaptation need to be replaced by new, flexible regulations that stimulate adaptation.

RT3

Round Table RT3: Role of cities

Chair

Barbara Groom, world duty editor of the BBC, United Kingdom

Panel

Ahmed Aboutaleb, Mayor of the City of Rotterdam, the Netherlands

Fauzi Bowo, Governor of Jakarta, Indonesia

Cedric Grant, Deputy Mayor New Orleans, United States

David Miller, Mayor of Toronto and chair C40, Canada

Van Phuoc Nguyen, Vice Director of Department of Natural Resources and Environment, Ho Chi Minh City, Vietnam

Porntep Techapaibul, Deputy Governor of Bangkok, Thailand

The Round Table 'Role of cities' brings climate adaptation in deltas into the limelight. The session is meant to give the audience the opportunity to learn about the different approaches of adaptation taken by a selected number of major (delta) cities worldwide. And more important: to inform the audience about the opinion of the city leaders when it comes to the importance and urgency of climate adaptation.

Considering the mixed results of the international climate meetings on a high level, cities may have to take the lead. Not only because they feel the consequences of climate change directly, but also because most measures have to be taken on a local scale. Maybe a new message can be conveyed to COP16 in Mexico on behalf of the (delta) cities? In the meantime, delta cities worldwide have to organize themselves in international alliances, such as Connecting Delta Cities. What does this mean for urban politics? And what can be the role for the inhabitants of these cities? All these

issues and questions and more will be discussed by mayors and top delegates of cities as Bangkok, Ho Chi Minh City, Jakarta, New Orleans, Rotterdam and Toronto.

All participants agree that it is important to act now and exchange knowledge. Also they agree that action should be taken quickly. Delta cities are vulnerable and therefore it is important to ally with other cities. The community has to be involved. Therefore sharing information and knowledge is necessary. Also countries have to ally with other cities by bringing policies together. 'An integrated plan' should be put in place. Guidelines from governments in connection with the needs of the local people have to be made.

Deputy Mayor New Orleans and Ahmed Aboutaleb, Mayor of the City of Rotterdam will in the near future work together on a several Delta issues. The Delta Alliance Agreement is signed.



DA Delta Alliance Cooperation: Showcasing Inter-Delta Cooperation

Chair	Lies Janssen, Senior Project Officer of the Netherlands Water Partnership, the Netherlands
Presentations	Dr. Scott Wilson, US Geological Survey, DRAGON Partnership, United States David Waggoner, Waggoner and Ball Architects New Orleans, United States, Dutch collaboration with New Orleans, United States WISDOM – Mekong Delta

During this session several projects on inter-delta cooperation are showcased: the DRAGON partnership, the Dutch collaboration with New Orleans and the WISDOM project.

DRAGON partnership

DRAGON (Delta Research and Global Observation Network) facilitates analysis, guides decision makers and drives decision making. DRAGON does this by creating a community of practice focusing more on the science side than on policy. Better models and visualisation tools are developed for decision making and management. A platform is created with new data integration tools to support ecological forecasting. Right now DRAGON focuses on the Mekong and the work in the Louisiana region and is planning further expansion of the project in the future.

Louisiana and the Mississippi delta provide some interesting challenges. There are 38 states involved in decision making for the Mississippi river. River rights and navigation rights are controlled by the individual states, not by the national government. Louisiana is a working coast – not just nature, but also economics of the area depend on the delta. New Orleans is 100 kilometers from a huge under water cliff. sediments actually run off the edge and aren't staying in the delta. People are trying to harmonize limited resources to move forward – balancing natural and human landscapes. Levees and flood control projects have dramatically squeezed the flood plains, causing problems in the delta downstream. New Orleans has become a peninsula. Without intervention it is very likely to become an island. In the Mekong Delta in Vietnam the goal is to supplement other international support for managing the Mekong delta – relatively new engagement, just finishing the first year. US Geological Survey (USGS) provides satellite data and thematic map data and developing automated monitoring capabilities Handing over tools to the experts in the area, building their capacity to take on this sort of research activity

When comparing the two deltas, the Netherlands and New Orleans there are similarities, but also lots of differences. Louisiana is good at evacuation, but doesn't have polders. The Dutch have prioritised safety in their 'Safety First' approach. Louisiana has learned a lot regarding sustainable urban water management from the Dutch, following the adagium 'retain before drain'.

The urgency in New Orleans has increased with the recent oil spills. Sediment flow is also a real problem in the Mississippi delta. New Orleans doesn't want to go back to the city that was. 'We drained the city and it sunk'. Amsterdam learned how to use its water as a added value, New Orleans is just a series of 'collective mistakes'. New Orleans now wants to create more space for water. Still water is feared in New Orleans. An inhabitant from New Orleans testifies she was terrified seeing Dutch houses in the delta with water inches from their doorstep.

WISDOM – Mekong Delta

WISDOM is a German – Vietnamese partnership. It started its second period of three years. In the Mekong delta flooding comes in from the north, carrying sediments into the basin. There is a high population pressure from the cities. In the WISDOM project researchers are looking beyond hydrology at the integration of many fields – water quality, quantity, vulnerability analysis, landuse changes, legal system analysis, social change, etc. The results include:

- Population distribution
- Delivery of information, flood situations
- Hydrological measurements and modelling
- Time-series analyses
- Remote sensing
- Land cover mapping
- Methodologies and fieldwork for social-economic sciences
- Water quality analyses
- Household level adaptation (capacities)
- Legal framework mapping – who's really responsible

Everything is integrated into the Mekong Information System – website portal, information sharing.

DA DeltaCompetition 2010 Awards

Chair	Prof.dr Sybe Schaap, Professor Water Policy and Governance at TU Delft and former Chairman of the Union of Water Boards, the Netherlands
Presentations	New Inspiration for Adapting Deltas to Climate Change 3 winning teams of the DeltaCompetition 2010

Royal Haskoning, the Delta Alliance and the City of Rotterdam invited students from all over the world to enter the third edition of the DeltaCompetition and develop practical, innovative, sustainable solutions to the threats facing delta cities.

Innovative ideas from five continents

The competition organisers asked for original, practical, and scientifically-supported ideas for responding to increasing threats facing delta cities and their inhabitants. Entries came from across a number of disciplines, including spatial planning, infrastructure and buildings, governance, economics, hydraulics and water management. Students from Indonesia and the USA impressed audiences at the Rotterdam Deltas in Times of Climate Change conference with their creative solutions for adapting the delta cities of the world to climate change impacts. The winners of the 2010 DeltaCompetition received prizes of USD 3.000 and a trip to Rotterdam to present their work.

The winning subjects and students were:

- Ecology as Industry
Haerin Lee, Gyoung Tak Park, and Soomin Shin, Harvard University, Landscape Architecture, USA
- Groundwater zoning as spatial planning in Semarang
Novi Rahmawati, Gadjah Mada University, Water Resource Management, Indonesia
- The Big Leak: Adaptive responses to New Orleans' land subsidence crisis
David Wooden, Virginia University, Landscape Architecture, USA

PL The Benefit of International Delta Cooperation Launch of the Delta Alliance

Master of Ceremony Tracy Metz, Editor at NRC Handelsblad and former member of the Delta Commission, the Netherlands

Presentations Tineke Huizinga, Dutch Minister of Housing, Spatial Planning and the Environment, the Netherlands
Kees Slingerland, Chairman of the Delta Alliance, the Netherlands
Interactive session with high-level representatives a.o. Fauzi Bowo (Governor Jakarta, Indonesia), dr. Nguyen Thai Lai (Vice Minister, Ministry of Natural Resources and Environment), Vietnam, dr. Wenwei Ren (WWF China)
New inspiration for adapting deltas to climate change: presenting the winners of the DeltaCompetition 2010
Prof.dr. Cees Veerman, former Chair of the Delta Commission and former Minister of Agriculture, Nature and Food Quality, the Netherlands
Signing the Delta Alliance Declaration

Launch ceremony of the Delta Alliance

On the second day of the conference the Delta Alliance is launched. Tineke Huizinga, the Dutch Minister of Housing, Spatial Planning and Environment, kicks-off the launch. She talks about the importance of international cooperation in adaptation to climate change, stating that 'International cooperation, sharing knowledge, and exchanging ideas about water management and policy are vital for peace, security, and prosperity in our deltas.'

Subsequently Kees Slingerland, chairman of Delta Alliance, introduces the Delta Alliance to the conference participants by explaining its mission, objectives and activities. He illustrates his presentation from personal experiences with examples of challenges, deltas are currently facing.

The challenges and opportunities of deltas are discussed by a panel of stakeholders from deltas worldwide: Governor Fauzi Bowo of Jakarta, Deputy Minister Hussein El Atfy of Egypt, Le Quang Minh of Vietnam National University, Wenwei Ren of WWF China, and Mr. Will Travis of the San Francisco Bay Conservation and Development Commission. The panel is chaired by Ms. Tracy Metz. Fauzi Bowo talks about adaptive measures which have been taken and continue to be taken to anticipate climate change, specifically on the issue of urban flooding.

Subsequently, the three winning teams of the DeltaCompetition2010 'Delta City of the Future' are presented by Prof dr. Cees Veerman, former chair of the Delta Committee. Students from Indonesia and the United States win USD 3.000 and a trip to Rotterdam to present their ideas on how urbanized deltas can respond to climate change.

Finally, the official launch of Delta Alliance takes place by Minister Huizinga and the five panel members signing the Delta Alliance Declaration, a statement on the value of the world's deltas and the importance of international cooperation for improving their resilience. Conference participants are invited to sign the declaration during the reception following the ceremony.



PL Plenary closing session

- Chair** **Paula Verhoeven, director Climate Director of Climate Affairs, City of Rotterdam, the Netherlands**
- Speakers**
- Henk van Schaik, Programme Co-ordinator International, Co-operative Programme on Water and Climate, the Netherlands**
 - Rory McLeod, journalist, media entrepreneur and media trainer, United Kingdom**
 - Barbara Groom, World Duty Editor of the BBC, United Kingdom**
 - Ana Fornells de Frutos, Chair of the Ethics and Finance Committee of the Adaptation Fund Board, Spain**
 - Prof. Carlos C.A. Nobre, National Institute for Space Research – INPE, Brasil**
 - Prof.dr. Pier Vellinga, chairman Steering Committee conference, the Netherlands**
 - Prof.dr. Cees Veerman, chairman Dutch Delta Commission, the Netherlands**

Over 1.150 participants engaged in discussions, presentations and excursions during the three days delta conference Deltas in Times of Climate Change. The conference focused on exchanging knowledge, strengthening relations between delta cities and exploring links of science-policy-practice. A total of 72 parallel session were organized, the 2nd anniversary of Connecting Delta Cities was celebrated and the Delta Alliance was launched.

‘Mayors and governors from all over the world conclude that they need to Act Now’, Henk van Schaik (CPWC) reports back from the Round Table on the role of cities. Central governments don’t move fast enough and delta cities should take care of themselves. Rotterdam intends to have as many people working in the environmental sector as in other sectors in the near future. Cities don’t see adaptation as a social cost, but as an investment. One city alone doesn’t have all the knowledge and skills to invest in adaptation, but all delta cities combined do.

Barbara Groom (World Duty Editor of the BBC) informs the audience of the conclusions by the Round Table on Financing adaptation. The will and knowledge to act alone isn’t enough. Investments are sorely needed. The amount of money required for adaptation is 70-100 billion dollar annually. The COP15 negotiations in 2009 resulted in a pledge for 30 billion dollar by 2012 and another 100 billion dollar by 2020. A disquieting 372 million dollar has been put into the Adaptation Fund in the last year. The Adaptation Fund has been established by the Parties to the Kyoto Protocol of the UN Framework Convention on Climate Change (UNFCCC) to finance concrete adaptation projects and programmes in developing countries that are Parties to the Kyoto Protocol. The Fund is financed with 2 percent of the Certified Emission Reduction (CERs), issued for projects of the Clean Development Mechanism (CDM) and other sources of funding. It is unrealistic that the donor countries will come up with the pledged amount of money by 2012 or 2020. Cities take their own measures and bilateral partnerships such as *Water Mondiaal*, urban partnerships such as C40 and private initiatives grow ever more important. Sparking the interest of private parties interest in climate adaptation may be essential to the success of it.



The building sector has but a smouldering interest in adaptation, is one of the conclusions from the Round Table on the role of the Building sector in adaptation, facilitated by Rory McLeod (media entrepreneur and media trainer).

An impetus could be created by a rise in fuel prices. Starting lots of experimental projects could trigger quick learning: let's make all the mistakes we can as soon as possible. A major opportunity is presented by the 1.4 million Dutch homes that need retrofitting within ten years. The biggest player in retrofitting can only handle 4.000 a year. To improve involvement of the building, sector climate proofing must be made sexy. Jargon isn't sexy. A message to all scientists: think about the language you use.

During the plenary closing session some interesting conclusions of the conference are brought before the spotlight by Pier Vellinga (chair Steering Committee Delta conference):

- an integrative approach is essential for deltas to adapt to climate change
- climate adaptation offers an abundance of economic opportunities, e.g. mass retrofitting and innovative building and architecture
- megacities with subsidence are extra vulnerable to climate change
- competing land claims will continue
- we already have the techniques, we should focus on its application
- we do not lack knowledge as much as skilled people who can practically apply adaptation measures
- health issues related to climate change are neglected
- delta cities refuse to wait for their governments to take action: they set up their own bilateral, urban and private initiatives
- delta cities demand a formalised position in the allocation of international funds

During the Award Ceremony for Best Young Delta Scientist of the Conference Carlos Nobre (National Institute for Space Research – INPE) awarded two PhD students for their excellent presentation and poster during the conference. Stephanie Janssen (Deltares) won the prize for the best oral presentation on social learning for freshwater scenarios. Michelle van Vliet (Wageningen UR) won the prize for best poster on the risks of high river temperatures for energy production.

In the closing statements of the conference Delta Commissioner Cees Veerman (chairman Dutch Delta Commission) recalls the criticism voiced by climate skeptics this year: minor mistakes are motive to throw everything about climate change out of the window. 'Our only reaction can be: do better research and communicate results better', says Veerman.

Climate change is one of the list of problems that include hunger, poverty and terror. At the moment climate change may be at the bottom of priorities. Therefore it's important to convey the message from this conference to the COP16 later this year in Mexico. Veerman: 'Climate change is not just a threat. It's an opportunity in many ways. It's about how we use natural resources and take care of our fellow creatures. To govern well what has been given to us by our ancestors to give to the next generations.'



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