Bridging gaps towards *other disciplines and end-users*

Federaal Wetenschapsbeleid

Vera Van Lancker, Renard Centre of Marine Geology (RCMG)

Officers and crew
RV Belgica - RV Zeeleeuw

Marine Sand Fund
FPS Economy et al.

Ministry of the
Flemish Community

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Jaak Monbaliu
Jesus Portilla
Alessio Giardino
Jean Lanckneus
Geert Moerkerke
Steven Degraer

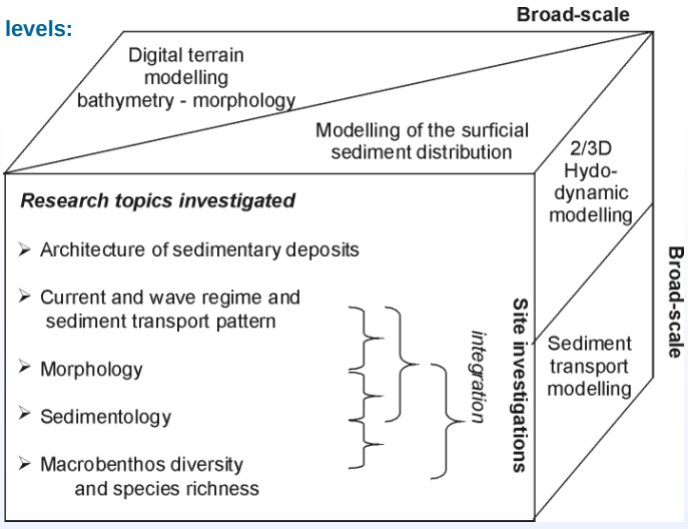
- Internationale steun -

EU-RTN FP5 Eumarsand

Interreg IIIB MESH

MAnagement, REsearch and Budgetting of Aggregates in Shelf Seas related to End-Users

Research at 3 spatial levels:
° scale BCS
° regional scale
° site specific scale



Multidisciplinary partnerschip with data -integration as central goal

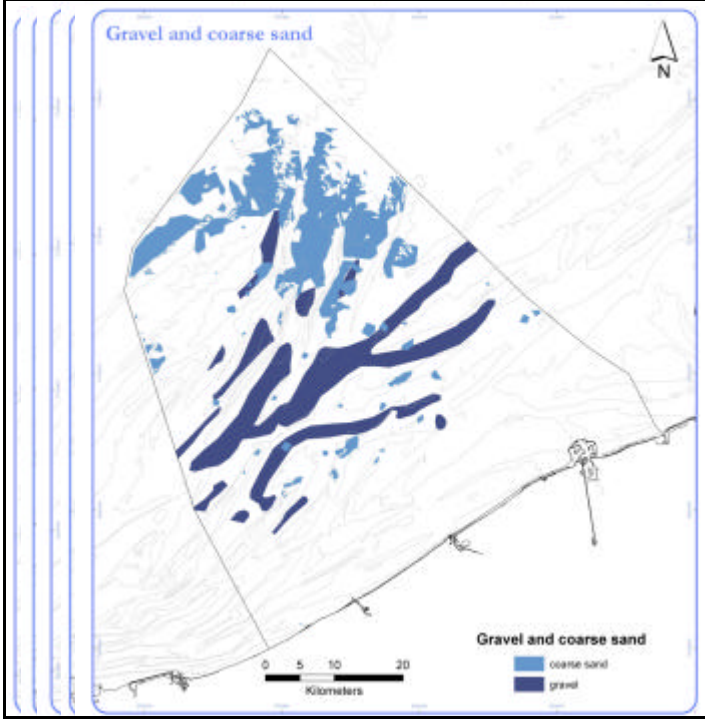
Universiteit Gent
Sectie Mariene Biologie

Studiebureau
Magelas bvba

Universiteit Gent
Renard Centre of Marine Geology

Beheerseenheid van het Mathematisch Model van de Noordzee

Katholieke Universiteit Leuven
Lab. Voor Hydraulica

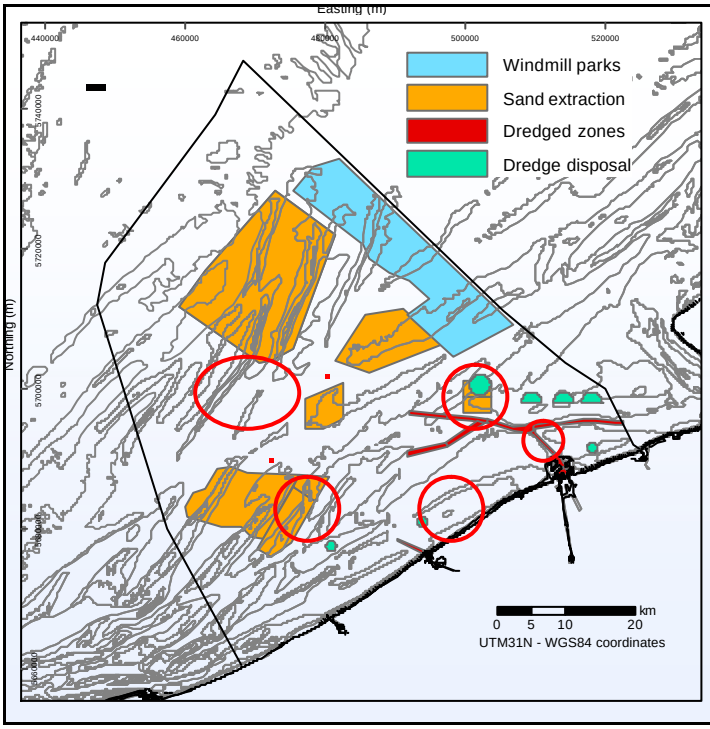


Full-coverage maps
at the scale of the BCS

GIS
Thematic Maps
(250 m grid resolution)

Geology
Bathymetry
Morphology
Sedimentology
Sediment dynamics

Reference framework
in support of multiple studies



Site specific research
Sediment type driven
and accounting for
End-users' needs

Reference material/
Base lines
for future studies

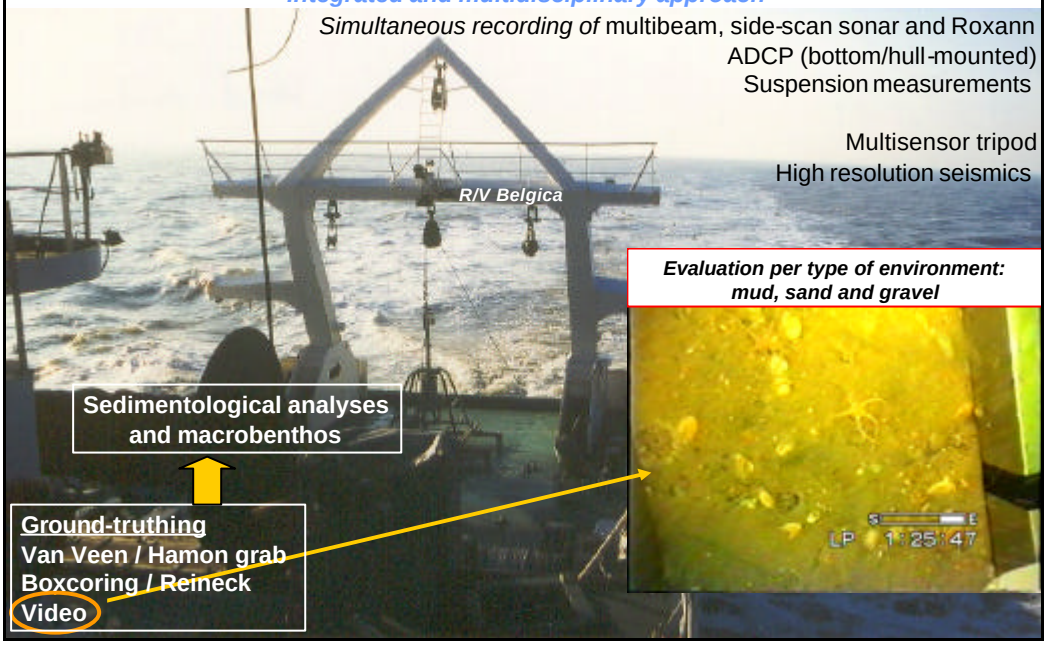
in samenwerking met economie

Regional scale

Validation of techniques
Development of evaluation strategies following an
Integrated and multidisciplinary approach

Simultaneous recording of multibeam, side-scan sonar and Roxann ADCP (bottom/hull-mounted)
Suspension measurements

Multisensor tripod
High resolution seismics



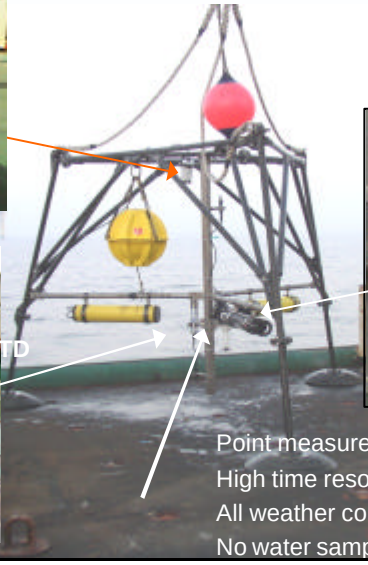
Evaluation per type of environment: mud, sand and gravel

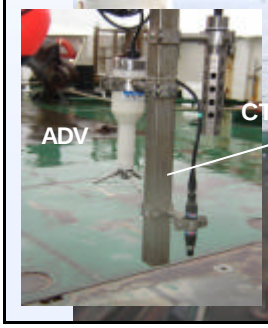
Sedimentological analyses and macrobenthos

Ground-truthing
Van Veen / Hamon grab
Boxcoring / Reineck
Video

In-situ measurements
dedicated 13hrs cycles
+
long-term measurements (tripod)

Coupling of different initiatives



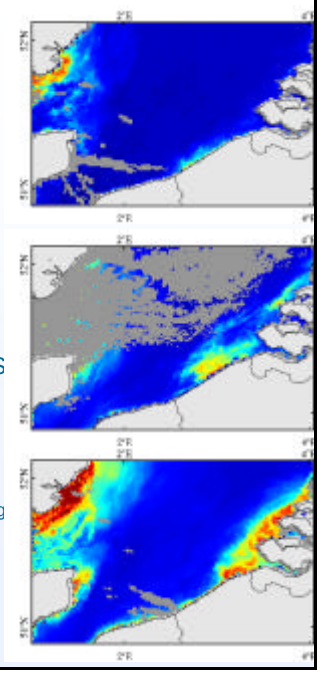


Point measurements, vertical profiles,
High time resolutions, up to several weeks
All weather conditionsa
No water samples

Measurements >>> Modelling

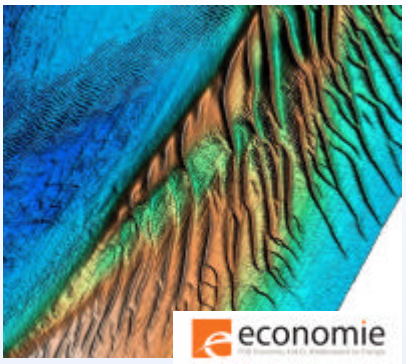
Coupling of different initiatives

*Boundary conditions, seafloor conditions, parameters from **real data***



- Measurements
  In situ & remote sensing
- Hydrodynamic Model
  - Coupling of different models
  - Refinement up to 250*250 m² 2D/3D
- Combination Models - Measurements
  - hydrodynamic model - ADCP meas. → validation
  - hydrodynamic model - satellite images → mud transport NS
  - hydrodynamic model – LISST, OBS → flocculation
- BCS Mud transport model
  - Model development (advection/diffusion eq.)
  - Application related to dredging/dumping (tide dependent dumping
- BCS Sand transport model
  - Application related to aggregate extraction

Sustainable exploitation ???
renewable versus non-renewable resources



Impact of aggregate extraction – *case study Kwinte Bank*

Joint research initiatives Marebasse – Eumarsand in coop. with the Marine Sand Fund
Interaction Belspo SPEEK

The facts:	**- creation of a depression of 5 m, still extraction per time unit max 50 cm**
since 1999	**- now depression to the north of the Kwinte Bank**
	- extraction up to 0.20 m³/m² (Marine Sand Fund)

Geology
- almost complete dredging of upper unit of the bank

Morphology
- +/- stabilisation of the sandbank after cessation of dredging, **no** regeneration
- recovery of the bedforms, though smaller in height (results Marine Sand Fund)

Sedimentology
- complex distribution; evolution similar as the swale sediments
- flood: depression acts as a corridor for shells; ebb: deposition of fines
- sediments seem to be only locally reworked; no major exchange of sediments

Sediment dynamics
- Kwinte Bank shows a distinct erosion-deposition pattern
- impact scenario's do not seem to destabilise the sandbank, but merely indicate regeneration mechanism, BUT availability of sand?
- *modelling remains however subdued to important uncertainties*
- *impact of waves and storms on sediment transport ?*

On the short- to medium term: impact rather local and only very slow to no regeneration
On the long-term: EROSION (De Moor, 2002; Norro et al. 2006)

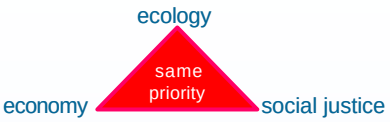
Imposes problems on monitoring strategies: time- and space scale issues

Modelling of impacts: strong cooperation MUMM-KUL

MUMM	KUL
Hydrodynamic models << 3D model COHERENS Node distance now 250*250 m²	Hydrodynamic models TELEMAC 2D models: Non structured grid; finite elements Node distance : 70 km ~ 150 m
Wave models 2nd generation HYPAS model: GKSS Implementation 50 km x 50 km North Sea 5 km x 5 km southern North Sea	Wave models 3rd generation models PRO-WAM: 4 nested grids; finite elements SWAN: only the finest grid; finite elements TOMAWAC: non-structured grid; finite elements
Sediment transport models Mu-SEDIM model Bed shear stress: revised Bijker formula (C+W) Bottom roughness: Engelund-Hansen ('67); Grant & Madsen ('82) Shields-criterium initiation of sed. transport Sediment transport: Ackers-White (1973) with revision Swart (1976, 1977) Bottom continuity equation: erosion/sedimentation	Sediment transport models Sisyphe model Soulsby – Van Rijn (1997)

Sustainable exploitation => Sustainable development ? - guidelines

(Ref. Wellmer & Becker-Platen 2002)



Renewable resources

Use of renewable resources:
The rate of consumption should not exceed the rate at which they are regenerated

Non-renewable resources

Use of non-renewable resources:
The consumption should not exceed the amount that can be replaced by functionally equivalent renewable resources or by attaining a higher efficiency in the use of renewable or non-renewable resources

Resilience of the system: Material and energy input into the environment should not exceed the capacity of the environment to absorb them with minimal detrimental effects

Carying capacity of the Earth's system: The rate of anthropogenic input and environmental interference should be measured against the time required for natural processes to react and cope with environmental change

All of these issues are utmost difficult to address in the marine environment

NEED FOR A STRATEGIC FRAMEWORK *incl.*

Detailed resource and environmental maps, both on a large- and small-scale and **criteria** to avoid detrimental effects have been proposed

SET UP OF MULTICRITERIA MAPS

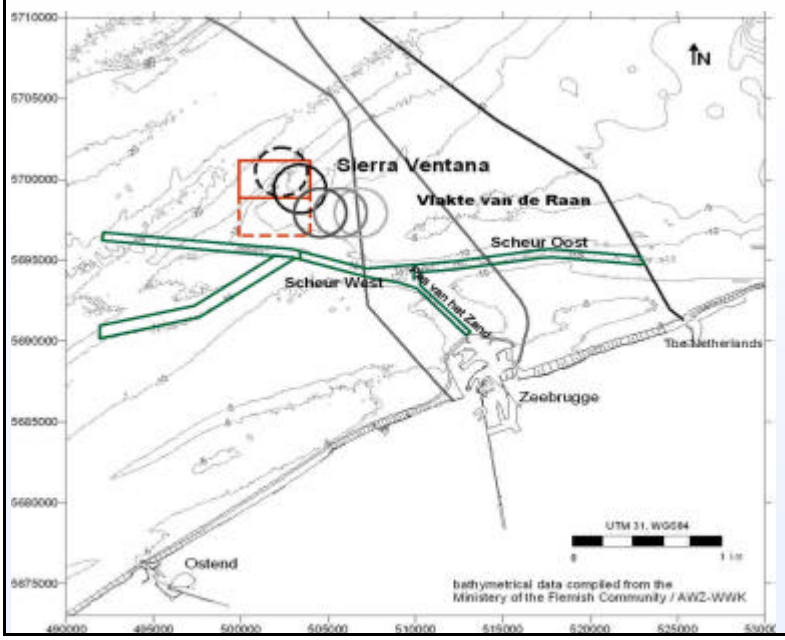
	TO	
- grain-size maps		*target the right quality*
- thickness and suitability of the Quaternary deposits		*ensure long-term availability*
- sediment transport/ erosion-deposition maps		*maximise the chance of regeneration minimise detrimental physical impact*
- maps on wave energy distribution		*evaluate a possible impact on the coast*
- maps on ecological functioning		*avoid sensitive areas or important habitats*
- (maps on other seabed users) (NA if zones are predefined)		

Capacity / resilience of the system ?

- need to quantify the natural evolution of the (sub)system

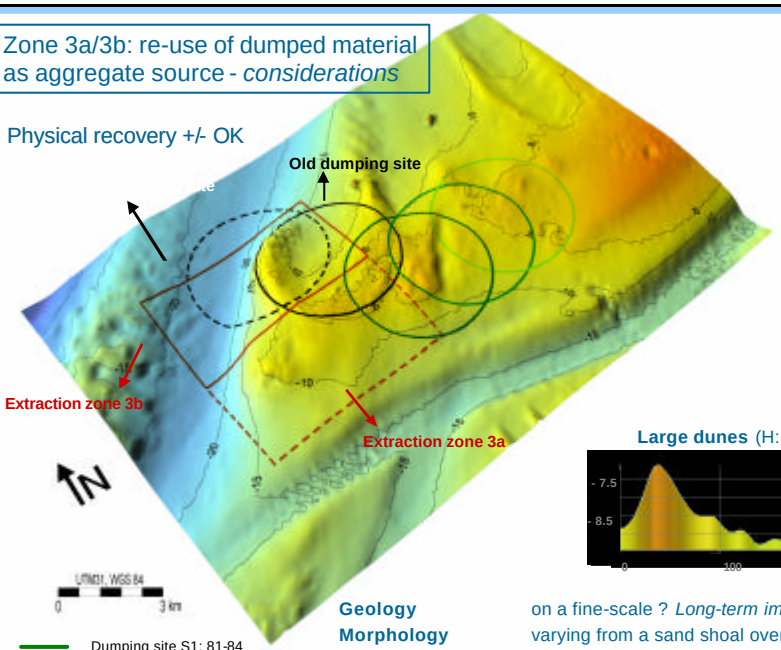
but is this possible within a anthropogenically steered environment ???

Nieuwe extractiezones 3a/3b Sierra Ventana regio

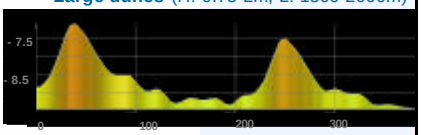


Zone 3a/3b: re-use of dumped material as aggregate source - *considerations*

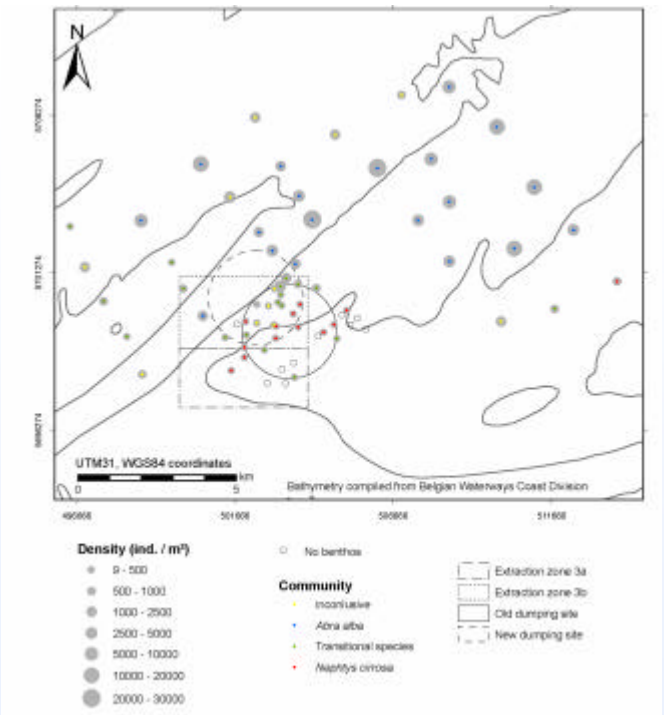
Physical recovery +/- OK

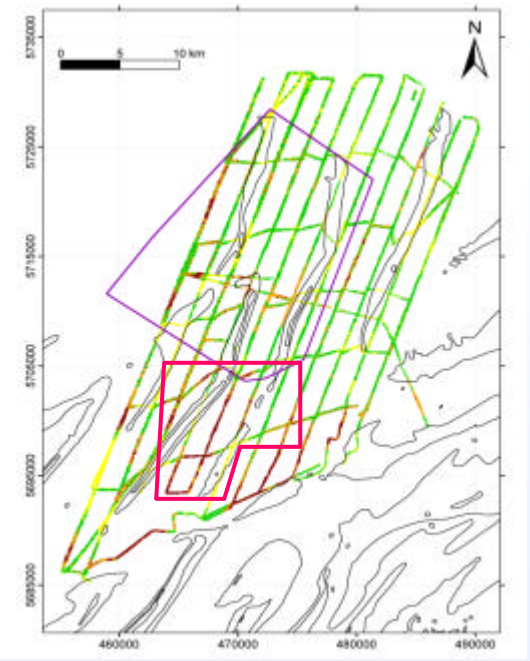


Large dunes (H: 0.75-2m, L: 1500-2000m)



Geology	on a fine-scale ? *Long-term impact of dredging ?*
Morphology	varying from a sand shoal over a slope towards a swale
Sedimentology	strongly varying
Sediment dynamics	discrepancy modelling results and field observations
Biology/Ecology	on the old dump site, often ***no fauna*** is found





New exploration zone Hinder Banken
Evaluation of gravel resources

>> a rough estimate of the exploitation potential can be derived from a large-scale MB acoustic seabed classification study

-Higher gravel amount in swales than on banks

-Higher gravel amounts near southern parts of the Westhinder and Oosthinder

-Exploration zone and northern part of Hinder Banks region is characterized by lower gravel amounts and more dunes

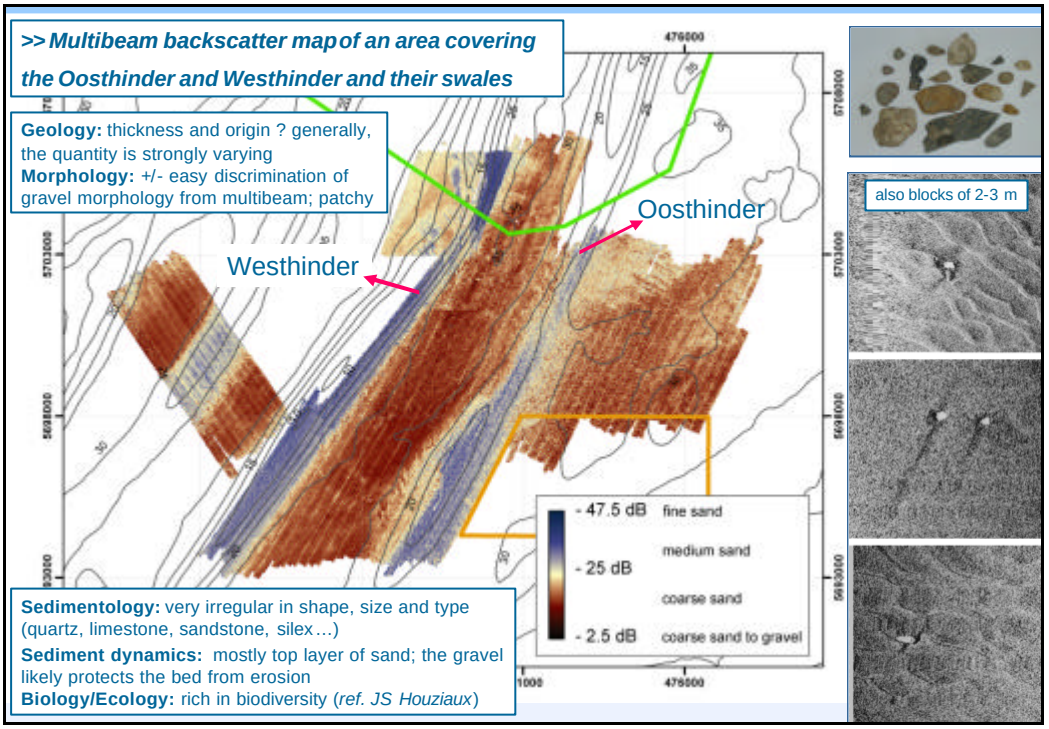
exploration zone Hinder Banks

fine sand

medium sand

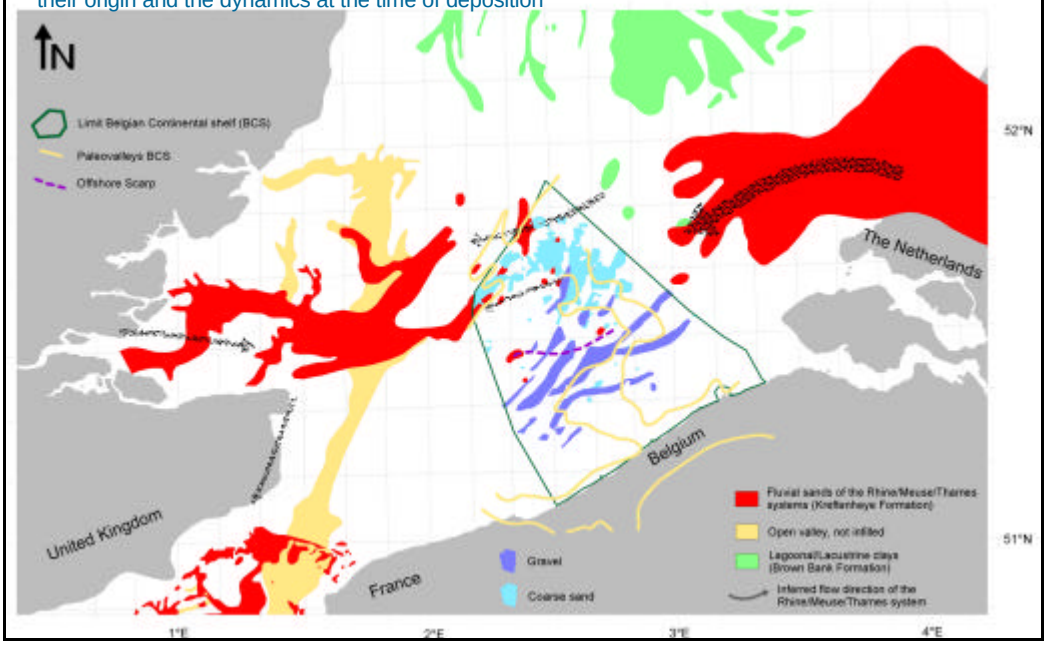
medium/coarse sand

gravel



Coarse sand – gravel exploitation potential on the BCS ?

Knowledge on the occurrence and thickness of gravel is difficult to predict and calls for research on their origin and the dynamics at the time of deposition



End-user interaction

6-monthly end-user meetings with governmental and industry representatives related to aggregate extraction, dredging/dumping, windmills (+- > 20 people);

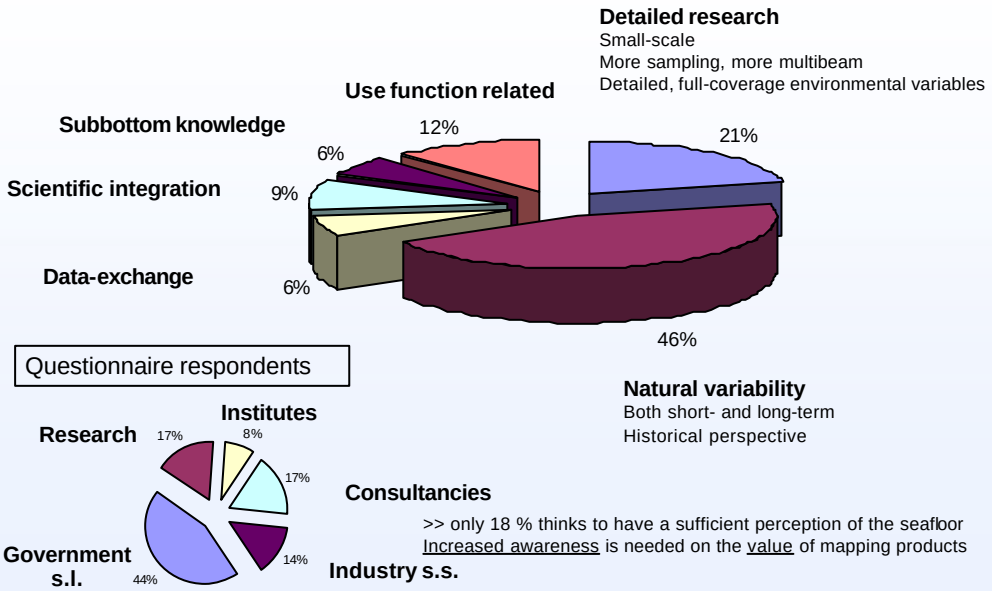
Very difficult to get acquainted with end-users needs;

Increasing awareness was needed on the possibilities of nowadays seabed mapping and modelling;

A succesful final stakeholder workshop was held with 77 registrations of which 13% represented the industry sector s.s., 44% various governmental organisations , 18 % private/consultancy firms and 25% was university related.

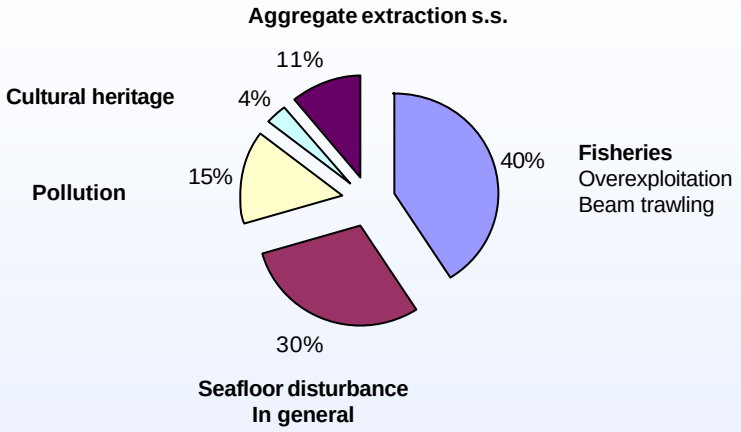
Stakeholder Workshop Marebasse/MESH, September 28 2006

End-user identified most important research needs



>> only 18 % thinks to have a sufficient perception of the seafloor
Increased awareness is needed on the value of mapping products

End-user identified general concern related to seabed habitats



End-user identified view on optimal seafloor mapping

- Active exchange of data – easy and free
- Coordination/communication of sampling/observations ! *omit redundancy*
- Continuity in research and long-term planning
- Sufficient budgets – sharing of costs
- Workshops and technical meetings
- Protocols and standards
- International (EU) cooperation

End-user identified view on interaction science/policy/industry

100 % regards this important

Some remarks:

Mutual feedback is important
Industry can provide data
Need for a policy "with a vision"

BUT can only work if there are good reasons for such a cooperation

A C O M M O N G O A L SHOULD BE DEFINED
BENEFICIAL FOR EACH PARTY

For 100 %, sustainable exploitation is a priority
Present maps can guide sustainability

End-user identified ideal view on seafloor observation

In an ideal world ... The seafloor should not be monitored !
if in favour of environment and economy,
every one should encourage permanent observations

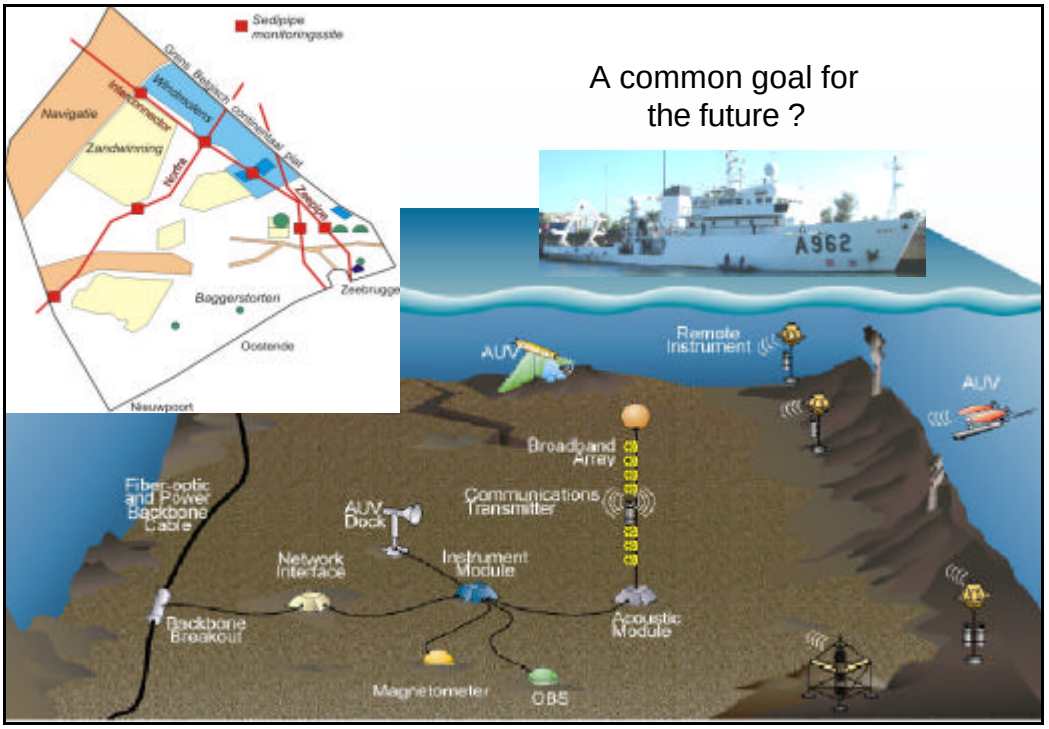
Suggestions

balancing detail and frequency against coverage
satellite observations coupled to a number of **permanent stations**
yearly observations of detailed zones; 5 yearly **full coverage MB** mapping
weekly sailing **AUV** and measuring differences
multiple ships /personnel
monitoring on a very regular basis > **4 times/year**
seafloor observations should be tuned to the needs of the use functions
monitoring according to **dynamics** --> optimal frequency of spatially diversified measurements
permanent loggers of dynamically changing variables;
grid sampling instead of opportunistic sampling

Cooperation between all scientific disciplines !

Need for **targeted, economically feasible** , permanent observations

Need for permanent observations: 19 Yes; 3 No Realistic ?: 3 explicitely No; 3 Uncertain



Suggestion for discussion

- **Ambitions and possibilities are high - *Defining priorities in the time- and scale domain***
- **Value of mapping products- accuracy/confidence**
  Value of measurements- accuracy/confidence – coordinated efforts ?
  Value of impact modelling – accuracy/confidence
- **<u>Sustainable exploitation</u> – *is it only a theoretical concept ? Practical/realistic definitions ?***
- **Seafloor observation**
- **Data management – data upgrades – spin-offs from data integration – scale/resolution problems**

Role of Belgian scientists in an international context – *Belgian shelf as an experimental laboratory*

Interaction science/policy/industry – need for a common goal ?

Continuity in measurements – continuity in research – budget constraints – juniors & seniors

Efforts in multidisciplinarity – time and budget constraints

Sustainable management: research – data integration/application – validation ifo policy/industry