



**Intergovernmental Coordination  
Group for the Tsunami Early  
Warning and Mitigation System  
in the North-eastern Atlantic,  
the Mediterranean and connected  
seas (ICG/NEAMTWS)**

**Fifth Session**

Athens, Greece

3–5 November 2008

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### **Abstract**

The Fifth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas (ICG/NEAMTWS-V) was held in Athens, Greece, on 3-5 November, 2008 under the Chairmanship of Prof. Stefano Tinti. It was attended by 55 participants from 17 ICG/NEAMTWS Member States, and 10 observers.

The ICG reviewed the progress made during the intersessional period and adopted updates to the NEAMTWS Implementation Plan which is available online on the NEAMTWS website. The plenary asked (i) Member States to nominate national Tsunami Warning Focal Points (TWFP) and Tsunami National Contacts (TNC) and to (ii) openly share and exchange all tsunami-relevant real-time observational data for the purposes of the NEAMTWS in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy. The ICG decided (iii) for tsunami alert messages from Regional Tsunami Watch Centres (RTWCs) to use watch and advisory solely for the two classes of alert in the decision matrix while warning will be used by the NTWCs only (iv) to extend the duration and mandate of the Task Team on the Regional Tsunami Warning System (RTWS) architecture until the next ICG session to prepare an RTWC operations plan for NEAMTWS and (v) that sea level data from the NEAMTWS core network will be freely available for the regional and national tsunami warning centres. In the meantime, these data can be provided to the IOC sea level monitoring facility as an interim solution.

The four Working Groups on (i) hazard assessment, risk and modelling; (ii) seismic and geophysical measurements; (iii) sea level data collection and exchange, including offshore tsunami detection and instruments; and (iv) advisory, mitigation and public awareness as well as the task team each met during a break out session and provided the ICG with a summary of future activities and the requested update on infrastructure, functionalities and architecture of the TWS. The ICG confirmed the four intersessional Working Groups and encouraged them to continue their work in the context of the Implementation Plan.

The ICG decided to organize its Sixth Session in November 2009 and accepted the kind offer of Turkey to host it.

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## Résumé exécutif

La cinquième session du Groupe intergouvernemental de coordination du Système d'alerte rapide aux tsunamis et de mitigation dans l'Atlantique du Nord-Est, la Méditerranée et les mers adjacentes (GIC/NEAMTWS-V) s'est tenue à Athènes (Grèce), du 3 au 5 novembre 2008, sous la présidence de M. Stefano Tinti. Elle a réuni 55 participants de 17 États membres du GIC/NEAMTWS, ainsi que 10 observateurs.

**Le GIC a examiné** les progrès accomplis pendant l'intersession et a adopté les mises à jour du Plan de mise en œuvre du NEAMTWS disponible en ligne sur le site Web du NEAMTWS. La plénière a demandé aux États membres (i) de désigner des points focaux nationaux pour l'alerte aux tsunamis (TWFP) et des points de contact nationaux pour les tsunamis (TNC) et (ii) de partager et d'échanger ouvertement toutes les données d'observation en temps réel relatives aux tsunamis intéressant le NEAMTWS, conformément à la politique de la COI/UNESCO en matière d'échange de données océanographiques. Le GIC a décidé (iii) que les messages d'alerte aux tsunamis émis par les Centres régionaux d'alerte aux tsunamis (RTWC) ne devaient utiliser les termes « veille » et « avis » que pour les deux catégories d'alerte de la matrice de décision tandis que le terme « alerte » ne devra être utilisé que par les centres nationaux (NTWC), (iv) de proroger la durée et le mandat de l'Équipe spéciale sur l'architecture du système régional d'alerte aux tsunamis (RTWS) jusqu'à la prochaine session du GIC afin de mettre au point un plan opérationnel du RTWC pour le NEAMTWS et (v) que les données relatives au niveau de la mer provenant du réseau de base du NEAMTWS seraient gratuitement mises à la disposition des centres régionaux et nationaux d'alerte aux tsunamis. En attendant, et à titre provisoire, ces données pourront être fournies au dispositif de surveillance du niveau de la mer de la COI.

**Les quatre groupes de travail** sur (i) l'évaluation et la modélisation des risques, (ii) les mesures sismiques et géophysiques, (iii) la collecte et l'échange de données relatives au niveau de la mer, y compris les instruments de détection en mer des tsunamis, et (iv) le conseil, la mitigation et la sensibilisation de la population, **ainsi que l'équipe spéciale, se sont chacun réunis** en séance de démarrage et ont présenté au GIC un récapitulatif des activités futures ainsi que les mises à jour de l'infrastructure, des fonctions et de l'architecture du TWS qui avaient été demandées. Le GIC a confirmé les quatre groupes de travail intersessions et les a encouragés à poursuivre leurs travaux dans le cadre du Plan de mise en œuvre.

**Le GIC a décidé** d'organiser sa sixième session en novembre 2009 et a accepté l'aimable invitation de la Turquie qui a proposé de l'accueillir.

## Resumen dispositivo

La quinta reunión del Grupo Intergubernamental de Coordinación del Sistema de Alerta Temprana contra los Tsunamis y Atenuación de sus Efectos en el Atlántico Nororiental y el Mediterráneo y Mares Adyacentes (ICG/NEAMTWS-V) se celebró en Atenas (Grecia) del 3 al 5 de noviembre de 2008, bajo la presidencia del Prof. Stefano Tinti. Asistieron a ella 55 participantes de 17 Estados Miembros del ICG/NEAMTWS y 10 observadores.

**El ICG pasó revista** a los avances realizados durante el periodo entre reuniones y aprobó las actualizaciones del Plan de Implantación del NEAMTWS, que se puede consultar en línea en el sitio web del NEAMTWS. La plenaria pidió a los Estados Miembros i) que designaran Puntos Focales Nacionales de Alerta contra los Tsunamis (TWFP) y Contactos nacionales para los casos de tsunami (TNC), y ii) que compartieran e intercambiaran sin restricciones todos los datos de observación pertinentes y en tiempo real sobre tsunamis, a los efectos del NEAMTWS, de conformidad con la política de intercambio de datos oceanográficos de la COI de la UNESCO. El ICG decidió: iii) que en los mensajes de alerta de los Centros regionales de alerta contra los tsunamis (RTWC) se utilizaran los términos “aviso” y “advertencia” únicamente para las dos clases de alerta en la matriz de decisión, mientras que el término “alerta” fuera utilizado únicamente por los NTWC; iv) prorrogar la duración y el mandato del Equipo de Trabajo sobre la arquitectura del Sistema Regional de Alerta contra los Tsunamis (RTWS) hasta la próxima reunión del ICG para preparar un plan de operaciones del RTWC para el NEAMTWS, y v) que los datos sobre el nivel del mar obtenidos por la red básica del NEAMTWS estuviesen disponibles gratuitamente para los centros nacionales y regionales de alerta contra los tsunamis. Mientras tanto, como solución provisional, esos datos pueden comunicarse al servicio de observación del nivel del mar de la COI.

**Los cuatro grupos de trabajo** sobre i) evaluación de peligros, riesgos y modelos; ii) mediciones sísmicas y geofísicas; iii) recopilación e intercambio de datos sobre el nivel del mar, comprendidos la detección en alta mar de los tsunamis y los instrumentos correspondientes; y iv) asesoramiento, atenuación de los efectos y sensibilización, **así como el equipo de trabajo**, se reunieron durante una reunión subsidiaria y facilitaron al ICG un resumen de las futuras actividades y la actualización pedida sobre la infraestructura, funciones y organización del sistema de alerta contra los tsunamis. El ICG confirmó los cuatro grupos de trabajo entre reuniones y los instó a continuar su labor en el marco del Plan de Implantación.

**El ICG decidió** organizar su sexta reunión en noviembre de 2009 y aceptó el amable ofrecimiento de Turquía de acogerla.

## Рабочее резюме

Пятая сессия Межправительственной координационной группы по Системе раннего предупреждения о цунами и смягчения их последствий в Северо-Восточной Атлантике, Средиземном море и прилегающих морях (МКГ/СПЦСВАСМ-V) состоялась 3-5 ноября 2008 г. в Афинах (Греция) под председательством проф. Стефано Тинти. На ней присутствовали 55 участников из 17 государств – членов МКГ/СПЦСВАСМ и десять наблюдателей.

**МКГ рассмотрела** прогресс, достигнутый в межсессионный период, и приняла обновленный План осуществления СПЦСВАСМ, который размещен на веб-сайте СПЦСВАСМ. Пленарное заседание просило государства-члены (i) назначить национального координатора по предупреждению о цунами (КПЦ) и национальный контакт по цунами (НКЦ), а также (ii) открыто делиться и обмениваться всеми данными наблюдений в режиме реального времени, относящимися к цунами, в целях СПЦСВАСМ и в соответствии с политикой ЮНЕСКО/МОК в области обмена океанографическими данными. МКГ постановила: (iii) в отношении оповещений об опасности цунами, направляемых региональными центрами наблюдения за цунами (РЦНЦ), использовать термины «наблюдение» и «консультативный» только для двух классов оповещения об опасности в матрице принятия решений, тогда как термин «предупреждение» будет использоваться только национальными центрами предупреждения о цунами (НЦПЦ); (iv) продлить срок деятельности и мандат Целевой группы по конфигурации Региональной системы предупреждения о цунами (РСПЦ) до следующей сессии МКГ в целях подготовки плана операций РСПЦ для СПЦСВАСМ; и (v) что данные об уровне моря, поступающие из основной сети СПЦСВАСМ, будут находиться в свободном доступе для региональных и национальных центров оповещения о цунами. Пока что эти данные в качестве временной меры могут предоставляться механизму МОК по мониторингу уровня моря.

**Четыре рабочие группы** по (i) оценке, риску и моделированию опасностей; (ii) сейсмическим и геофизическим измерениям; (iii) сбору и обмену данными об уровне моря, включая средства и инструменты обнаружения цунами в открытом море; и (iv) консультированию, смягчению последствий и информированию общественности, **а также целевая группа провели свои совещания** в ходе секционных заседаний и представили МКГ резюме будущих мероприятий и запрошенную обновленную информацию об инфраструктуре, функциональных особенностях и конфигурации СПЦ. МКГ подтвердила полномочия четырех межсессионных рабочих групп и призвала их продолжить свою работу в контексте Плана осуществления.

МКГ постановила провести свою шестую сессию в ноябре 2009 г. и приняла любезное предложение Турции об организации сессии в этой стране.



## 1. OPENING

- 1 The participants were welcomed to Athens by Mrs Aikaterini Tzitzikosta, chairperson of the Hellenic National Committee of UNESCO. She recalled the long history of Greece and its importance for UNESCO with several World Heritage sites as well as the extensive Greek coastline and the numerous islands in the Aegean Sea prone to marine hazards.
- 2 Prof. K. Makropoulos from the Ministry of Environment also addressed his welcoming remarks to the assembly and wished the delegates a successful outcome in their deliberations and a nice stay in Athens.
- 3 Prof. Stefano Tinti, chair of ICG/NEAMTWS, welcomed the Member State delegates and opened the fifth session of ICG/NEAMTWS. He reminded the participants that given its geological situation and historical record, Greece is one of the countries within the NEAM region most prone to earthquakes and tsunamis. He thanked the authorities in Greece for hosting the meeting in Athens and he stressed the urgent need to make concrete endeavors to put an interim system in place as soon as possible. Prof. Tinti concluded by expressing his wish that this meeting make a positive contribution towards a sustainable solution for the NEAMTWS.
- 4 On behalf of the Executive Secretary of IOC the Head of the Tsunami Unit, Peter Koltermann, in his welcome note (ANNEX III) recalled the long history of earthquakes and tsunamis in Greece. He urged the plenary to consider that in recent decades due to economic pressure and the expansion of the tourist industry, more and more people are living near the coast and thus tsunamis similar to those in the past will cause many more casualties unless an effective end-to-end warning system is established.

## 2. ORGANIZATION OF THE SESSION

### 2.1 ADOPTION OF THE AGENDA

- 5 The Chairman of the ICG/NEAMTWS introduced the provisional and annotated agenda. The Session reviewed the documents and adopted both with slight modifications.

### 2.2 DESIGNATION OF THE RAPPORTEUR

- 6 France nominated Thomas Blake from Ireland as Rapporteur. This nomination was supported by Greece and Germany and approved by acclamation.

### 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

- 7 The session adopted the provisional Timetable while the Chairman of the ICG/NEAMTWS introduced the documentation for the meeting. He requested the report of this session to be ready in due time.

### 2.4 ESTABLISHMENT OF SESSIONAL WORKING GROUPS

- 8 Based on the existing Working Groups' structure including the ad-hoc Task Team on the RTWC architecture of ICG/NEAMTWS the plenary agreed to form sessional Working Groups and to meet in a breakout session followed by a plenary session.

### 3. REPORT ON ICG/NEAMTWS INTERSESSIONAL ACTIVITIES

#### 3.1 OVERVIEW OF THE ACTIVITIES OF THE ICG/NEAMTWS

9 The Chairman of the ICG/NEAMTWS, Prof. Tinti, provided a summary of the main activities and results following ICG/NEAMTWS-IV in Lisbon and outlined the scope and direction for future implementation based on the updated implementation plan, foreseen national contributions and the scheduling of missions to assess national capacities for tsunami warning and mitigation. He reiterated the roles and functions of the Working Groups and emphasized the key role of the ad-hoc Task Team for this session. Prof. Tinti outlined the key options for a regional NEAMTWS architecture under discussion and to be presented in detail under agenda item 4. He concluded by urging Member States to provide sufficient funding to upgrade the national instrumentation networks, establish a national TWC and consider stronger commitment to the regional structure of NEAMTWS.

10 Prof. Synolakis suggested that with no RTWC in place the ICG should also consider whether or not the Pacific Tsunami Warning Centre in Hawaii could provide temporary Tsunami Watch Services for the NEAMTWS region.

11 Turkey and Greece reiterated their offers to act as RTWC's for the eastern Mediterranean.

#### 3.2 REPORTS ON THE ACTIVITIES OF THE WORKING GROUPS

##### **Working Group 1: Hazard Assessment, Risk and Modelling**

12 François Schindelé, co-chair of Working Group 1 reported briefly on the activities of the Working Group and the eventual need to revisit the tsunami decision matrix because of the two recent and quite strong sub-sea earthquakes near Greece, which were generated by mainly horizontal motion of the crust near the fault and thus did not result in tsunamis. He also stressed that the Working Group is still in the process of completing a list of submarine volcanoes.

13 Israel asked for Working Group meetings to be planned so that all Member representatives are able to attend the sessions.

14 Israel, Turkey and the Head of the IOC Tsunami Unit suggested that the ICG and its Working Groups clarify the nomenclature of alerts and do not mix national and regional responsibilities.

##### **Working Group 2: Seismic and Geophysical Measurements**

15 Giulio Selvaggi, co-chair of Working Group 2, summarized the activities of his group and the progress on the SeisComP3 test among several candidate RTWC seismic centres. While the location could be determined quite well by all centres there is still room for improvement for the early magnitude estimations. He also stressed the need to concentrate on data sharing, especially with North African countries bordering the Mediterranean.

16 Stefano Tinti requested some background information on the huge differences in magnitude estimation. This triggered an intense discussion resulting in the plenary asking the Working Group to look into the issue in more detail.

##### **Working Group 3: Sea Level Data Collection and Exchange, including Offshore Tsunami Detection and Instruments**

17 Begoña Perez, chair of Working Group 3, recalled the terms of reference with which the group is tasked and reported on the progress of the action plan. She informed the session that real-time data of only 33 of the roughly 70 tide gauges of the minimum network are available

from the IOC GLOSS website ([www.ioc-sealevelmonitoring.org](http://www.ioc-sealevelmonitoring.org)). There remain major gaps in areas such as the North African coast and the eastern Mediterranean. Due to a better collaboration with scientific projects like EUROSITES there are promising plans to deploy deep ocean pressure sensors for tsunami detection within several projects.

18 Israel announced that, with funding from CIESM, some tide gauges in the eastern Mediterranean and Black Sea will be upgraded for real-time data transmission by the end of January 2009. The observations could then be made available to the IOC Sea Level Station Monitoring web-service.

19 Turkey reported on the status of their project to deploy 5 tsunameter buoy systems.

#### **Working Group 4: Advisory, Mitigation and Public Awareness**

20 The co-chair of Working Group 4, Russell Arthurton, reported on activities and the status of the action plan. He stressed the strong collaboration with IOC/ICAM, and the drafting of the IOC guidelines "Hazard Awareness and Risk Mitigation in ICAM" which is presently under peer review. Linking to the previous discussion he also recalled the different uses of warning nomenclature among regions and, based on this, he presented a draft use of wording for the NEAMTWS, to be approved by the sessional Working Group and the ICG. Mr Arthurton concluded by reporting on recently approved ISO signage on tsunami alert in specific coastal areas.

#### **3.3 REPORT ON THE TOWS-WG**

21 François Gérard, co-chair of the Working Group on Tsunamis and other Ocean Hazards Warning and Mitigation Systems (TOWS-WG), recalled the background relating to the establishment of this group and outlined the Terms of Reference as well as the global recommendations to harmonize the work of all regional Intergovernmental Coordination Groups on TWS's. He explicitly stressed the coordinating role of this body and the recommendation that the TOWS-WG believes IOC should adopt standards and endorse practices for the TWS as a whole and, to this end, will undertake a study of guidelines for regional and national tsunami watch standards. One of the key recommendations is to use the GLOSS network as a backbone for the real-time TWS sea level information while the benefits of visibility of the TWS subsidiary bodies and the role of the TOWS-WG should not interfere with or dilute accountability and ownership of TWS work programs and associated reports.

22 Israel requested clarification on whether the GLOSS network is truly mandated to real-time data acquisition and thus adequate to meet NEAMTWS goals.

23 Thorkild Aarup, Technical Secretary of GLOSS, replied that the GLOSS Group of Experts at its 9th session (24-25 February, 2005, Paris, France) decided to transform and sustain the GLOSS Core Network as an operational real time network of tide gauges (see also item 7.2).

#### **3.4 REPORTS FROM OTHER INTERGOVERNMENTAL ORGANIZATIONS AND GROUPS**

24 No other UN groups and bodies were present to report on their activities.

### **4. REGIONAL ARCHITECTURE OF NEAMTWS**

#### **4.1 REPORT OF THE AD-HOC TASK TEAM**

25 The co-chair of the ad-hoc Task Team on the NEAMTWS RTWC architecture, Trevor Guymer, recalled the Terms of Reference of this group and reported on the discussions

and findings of the two meetings held in Paris and Southampton. The detailed findings and recommendations are summarized in the attached report of the ad-hoc Task Team (ANNEX IV).

26 Russell Arthurton explicitly detailed the already mentioned international confusion in the use of tsunami warning nomenclature and suggested leaving the use of warning in a tsunami bulletin only for national authorities and presented watch and alert as the possible nomenclature for RTWC messages.

27 François Schindelé, co-chair of the ad-hoc Task Team outlined the draft roles and requirements for Regional Tsunami Watch Centres and National Tsunami Warning Centres as well as other recommendations prepared by the Task Team to be discussed and adopted by the ICG.

#### 4.2 CONTRIBUTIONS BY MEMBER STATES TO NEAMTWS

28 Fernando Carrilho reported on the recent upgrades of the Portuguese seismic and sea-level networks on the mainland, Azores and Madeira and the successful installation and testing of the SeisComP3 software at Instituto Meteorologica (IM) in Lisbon. By the end of 2009 the IM will be able to fully act as an NTWC and intends to become an RTWC covering the NE Atlantic.

29 Luis Matias, co-chair of Working Group 4, concluded by reporting that Portugal implemented the tsunami travel time software developed by the Joint Research Centre in Ispra to create a national database of pre-calculated tsunami scenarios.

30 France appreciated the results presented by the Task Team chairs and thanked the group for their work. It also announced that the establishment of a NTWC at the Commissariat à l'Énergie Atomique (CEA) has been approved by the government and reiterated the offer to serve as an RTWC for the Western Mediterranean. Consequently the CEA would be the designated French TWFP for the NEAMTWS. France also announced plans to continuously explore funding possibilities, e.g. from the European Commission, for a consortium of possible RTWCs to the benefit of all NEAMTWS Member States.

31 Italy thanked the Greek government for hosting this session and stated their plans to seriously consider the recommendations from the recent Task Team meeting in Southampton. With regard to concretely offering INGV in collaboration with the Italian Civil Protection as an RTWC, Italy is still strongly committed and looking forward to receiving a confirmation from the government very soon.

32 Germany reported on a draft proposal brought forward as a partner in the EuroMED framework to fill the gaps identified by the NEAMTWS Implementation Plan. This initiative will involve all relevant Member States from the Mediterranean region, including North African countries willing to participate as a full partner and detailing the full proposal after confirmation from the Meeting of European Foreign Affairs Ministers in November 2008.

33 Turkey welcomed the German initiative and announced interest in participating.

34 Italy also welcomed the German proposal but raised concern about the need to carefully consider which proposal should be supported once all initiatives are known and be cautious not to harm national proposals in this context.

35 Greece requested more detailed information while Germany replied they would willingly share the two page proposal.

36 France supported the German proposal and suggested using all diplomatic channels to facilitate a positive statement of the EU Ministers meeting. Gerassimos Papadopoulos and Costas Synolakis detailed the structure and the set-up of the Greek earthquake information

system and actual collaboration of the National Observatory of Athens and the Greek Civil Protection. The national networks of seismic and tide gauges stations are in the process of being upgraded significantly while Greece plans to deploy two DART-like buoy systems off the east coast of Peloponnesus.

37 Morocco reported that it is in the process of establishing an NTWC and is prepared to share seismic and sea level data with RTWCs and interested Member States.

38 In the subsequent discussion France suggested, based on the Task Team findings, the establishment of a sessional Working Group to redefine the Terms of Reference of a future RTWC coordination group.

39 The chair suggested that the IOC Secretariat send out another letter as detailed in the recommendations of the Task Team. Only Italy, Portugal and Greece reported having received the last letter signed by the Executive Secretary of IOC. The secretariat was requested to check the distribution list and follow up as to why most of the Member States did not receive the letter.

40 The Head of the IOC Tsunami Unit raised concerns that the Task Team recommendations would not perfectly meet the TOWS-WG recommendations on harmonization and heading for a system of systems. The UK asked the secretariat to clarify.

41 Israel announced that regarding the TWFP request a new national body will be formed as a merger of existing agencies which will then act in this regard.

## **5. IMPLEMENTATION PLAN**

42 The Chairman provided a brief update on the status of the Implementation Plan, revised after the 41<sup>st</sup> Session of the IOC Executive Council. He stressed that there are still some inconsistencies with respect to the actual status of the instrumentation networks and the timeline of the initial system, which need to be adopted and updated.

43 Portugal reiterated the already mentioned updates to their national TWS and stressed that indeed the NEAMTWS timelines need to be revised.

44 The Chairman also stated that the work and results of the ad-hoc Task Team are not reflected in the Implementation Plan yet and requested the secretariat take care of this issue.

## **6. COOPERATION WITH OTHER ORGANIZATIONS**

45 No other organizations were present at this session which triggered a discussion on whether or not links to these groups need to be strengthened. The group finally agreed that the TOWS-WG is taking care of integrating with other bodies both inside and outside IOC and thus to a large extent could explain why other organizations did not attend.

## **7. SESSIONAL WORKING GROUP MEETINGS**

### **7.1 BREAK OUT SESSIONS**

46 The session broke into five working groups, with the view to elaborating proposals for concrete actions and recommendations for the RTWC structure and updating the Implementation Plan. Detailed reports are attached as ANNEX V.

## 7.2 REPORTING IN PLENARY

- 47 Following the breakout session the five Working Groups reported on their findings in plenary.
- 48 The co-chair of Working Group 1, François Schindelé, summarized the discussion of the breakout session and presented an update to the action list which included documentation on numerical models, guidelines for inundation maps, mainly through collaboration with EC funded projects like TRANSFER and SCHEMA, and a possible update of the decision matrix. The full report is attached as ANNEX V.
- 49 Winfried Hanka, co-chair of Working Group 2, reported on the discussion during the session and the associated updated action plan. The group agreed to look into issues such as data quality control, additional tests and the preparation of the pilot phase of SeisComp3 and evaluate the tsunami warning decision matrix and revise the backbone seismic network given the different funding opportunities and options, as well as possibilities to establish redundant and reliable communication means. A detailed summary is attached in ANNEX V.
- 50 The chairperson of Working Group 3, Begoña Perez, presented their results of their discussion during the breakout session which to a larger extent covered the IOC data sharing policy and Member State commitments to the IOC GLOSS website displaying real time sea level data. The group will also look into options to reduce the data transmission latency by satellite based communication tools. Members of the group will explore options to receive real time data from open ocean buoy systems in the NE Atlantic. A full report is available as ANNEX V.
- 51 Israel, Cyprus and France expressed concern of the possibility that raw sea level data can actually be downloaded from the IOC GLOSS website for the general public and thus are reluctant to provide data to the website. Israel requested background information on whether or not GLOSS is mandated to handle 1 min real-time data. In reply the IOC Secretariat referred participants to the Communiqué issued by the Group of Experts for the Global Sea Level Observing System concerning the contribution by GLOSS and its core network of sea level stations to tsunami and sea-level related warning systems (see report from 9th session of the GLOSS Group of Experts, 24 and 25 February 2005, Paris, France). The role of GLOSS in coordinating and upgrading its core network to address hazard monitoring has been endorsed by the IOC Assembly and Executive Council, through endorsements of reports from IOC subsidiary bodies including (i) the International Coordination Meetings for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean (3 - 8 March 2005, Paris, France); (ii) all Intergovernmental Coordination Groups for the regional tsunami warning systems and (iii) the IOC Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG).
- 52 The group discussed the issue extensively and the finally adopted a suggestion by France that Working Group 3 and the Task Team on the architecture need to elaborate on this issue and define the use of sea level data in more detail.
- 53 Russell Arthurton, chair of Working Group 4 presented the recommendations based on a discussion of the different perspectives of alert messages. Especially for RTWCs the group recommends avoiding the word “warning” and proposes using “advisory” and “watch” for the two classes of tsunami alert. The working group also discussed the possibility of a stakeholder’s workshop in 2009. The full report is attached as ANNEX V.
- 54 The group discussed the issue by clarifying the different roles and functions of RTWCs and NTWCs and their ramifications in the light of legal liability.
- 55 François Gérard, as chair of the working group on the NEAMTWS architecture presented the decision of the working group as detailed in ANNEX V.

56 The IOC Secretariat informed the plenary that as of yet ICG/NEAMTWS Working Group Chairs are not elected according to the IOC rules and procedures and requested Member States to respect the latter.

57 The plenary discussed the issue and, not sharing the former opinion, decided not to change the procedure followed so far and to confirm the Working Group chairs in plenary as suggested by the Working Groups.

## **8. PROGRAMME AND BUDGET FOR 2008-2009**

58 The Secretariat informed the meeting on the actual figures of the regular budget which so far compared to the IOC total budget is of the order of 1% and thus not at all sufficient for the whole IOC Tsunami Unit, the associated regional TWS structure and coordination process. Furthermore, as already announced during the IOC EC-41 in June 2008, contributions from Germany and UN-ISDR are offered to support a NEAMTWS Secretariat in Bonn while the final decision has not been taken yet.

## **9. DATES AND PLACE FOR ICG/NEAMTWS-VI**

59 This agenda item was introduced by the chairman. He requested Member States to express their views. France suggested extending the period to 18 months given the workload of the Task Team. Greece strongly requests the plenary to keep the actual meeting frequency of 11-12 months. Turkey and Lebanon supported the view. The group agreed by consensus to reconvene in November 2009 while Turkey kindly offered to host the next meeting in Istanbul.

60 The chairman requested Member States to consider hosting ICG/NEAMTWS-VII.

## **10. ANY OTHER BUSINESS**

61 Finland asked if the material Italy might be preparing due to the anniversary of the Messina earthquake and tsunami would be available in other languages too. The chair replied that two mainly scientific meetings are planned for 2008 but he will investigate with the Italian Civil Protection if this is foreseen.

62 Turkey reported that 2009 is the 500 anniversary of the Marmara Sea earthquake and tsunami as well as the scheduled inauguration of the NTWC. Dates will be announced.

63 Finland suggested to consider communication tests among NTWCs and RTWCs "back to back" with the inauguration of the different centres.

## **11. ADOPTION OF DECISIONS AND RECOMMENDATIONS**

64 The meeting discussed the draft decisions and recommendations from the Working Groups for adoption prepared by the Secretariat and the Rapporteur. The adopted version is attached as ANNEX II.

## **12. CLOSING**

65 The meeting closed on Wednesday, 5 November 2008 at 13:00.

ANNEX I

**AGENDA**

- 1. OPENING**
- 2. ORGANIZATION OF THE SESSION**
  - 2.1 ADOPTION OF THE AGENDA
  - 2.2 DESIGNATION OF THE RAPPORTEUR
  - 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION
  - 2.4 ESTABLISHMENT OF SESSIONAL WORKING GROUPS
- 3. REPORT ON ICG/NEAMTWS INTERSESSIONAL ACTIVITIES**
  - 3.1 OVERVIEW OF THE ACTIVITIES OF THE ICG/NEAMTWS
  - 3.2 REPORTS ON THE ACTIVITIES OF THE WORKING GROUPS
  - 3.3 REPORT ON TOWS
  - 3.4 REPORTS FROM OTHER INTERGOVERNMENTAL ORGANIZATIONS AND GROUPS
- 4. REGIONAL ARCHITECTURE OF NEAMTWS**
  - 4.1 REPORT OF THE AD-HOC TASK TEAM
  - 4.2 CONTRIBUTIONS BY MEMBER STATES TO NEAMTWS
- 5. IMPLEMENTATION PLAN**
- 6. COOPERATION WITH OTHER ORGANIZATIONS**
- 7. SESSIONAL WORKING GROUP MEETINGS**
  - 7.1 BREAK OUT SESSIONS
  - 7.2 REPORTING IN PLENARY
- 8. PROGRAMME AND BUDGET FOR 2008–2009**
- 9. DATES AND PLACE FOR ICG/NEAMTWS-VI**
- 10. ANY OTHER BUSINESS**
- 11. ADOPTION OF DECISIONS AND RECOMMENDATIONS**
- 12. CLOSING**



## ANNEX II

### RECOMMENDATIONS AND DECISIONS

The Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS),

**Having met** for its 5<sup>th</sup> Session in Athens, Greece, 3 - 5 November 2008,

**Having reviewed** the progress made in the implementation of the NEAMTWS,

**Welcomes** the declaration by several Member States of progress achieved in the establishment of NTWCs **and appreciates** the willingness and commitment of France, Greece, Italy, Portugal and Turkey in offering RTWC services to other Member States. This does not exclude other candidate centres from joining the RTWC network to improve the coverage for the NEAM coastlines, and provide relevant data and backup services.

**Reinforces** the urgency of having the NEAMTWS operational in an interim phase as soon as possible and in the full configuration no later than 2011.

#### **Requests Member States to**

- openly share and exchange for the purpose of the NEAMTWS all tsunami-relevant real-time observational data as appropriate and in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy,
- nominate both Tsunami Warning Focal Points and Tsunami National Contacts as soon as possible,
- consider extra-budgetary contributions to IOC in support of NEAMTWS,
- ensure seismic and sea-level expertise in the operational staff for potential RTWCs,

**Invites** Member States, acknowledging the pre-proposal by Germany to *Barcelona Process: Union for Mediterranean*, to consider preparing prioritized action items in accordance with the NEAMTWS Implementation Plan.

**Encourages** Member State institutions to submit proposals to appropriate calls within the 7<sup>th</sup> FP of the European Commission.

**Agrees** in principle on the revised Roles and Requirements for TWCs as detailed in the Task Team report.

#### **Decides:**

- To extend until the next ICG session the duration and mandate of the Task Team on the RTWS architecture to prepare a development plan and operations guide for the NEAMTWS network as detailed in ANNEX V.
- For tsunami alert messages from RTWCs to use watch and advisory solely for the two classes of alert in the decision matrix. Warning will be used by the NTWCs only.
- Sea level data from the NEAMTWS core network should be freely available for the regional and national tsunami warning centres, once these become established. In the meantime, these data can be provided to the IOC sea level monitoring facility as an interim solution for visualization and control of operational status, without data archiving facility for those stations not belonging to GLOSS.

**The ICG thanks** Greece for hosting its fifth session in Athens, and **gratefully acknowledges** the offer by Turkey to host the next ICG session in Istanbul in November 2009. Details will be decided in consultation with the ICG officers.

ANNEX III  
**STATEMENTS AND ADDRESSES**

Address to the Plenary by Peter Koltermann, Head, IOC Tsunami Unit,

Αξιότιμη Πρόεδρε ή Αγαπητή Κυρία Τζιτζικώστα-Παπαχριστοπούλου,  
Αγαπητέ Πρέσβη Κύριε Παρασκευόπουλε  
Αγαπητέ Κύριε Μακρόπουλε

Σας ευχαριστώ θερμά που μας δίνετε την ευκαιρία να συναντηθούμε στη χώρα «των Θεών» και ιδιαίτερα στην Αθήνα, στην πόλη «της Γνώσης και της Σοφίας». Όλοι γνωρίζουμε ότι η Ελλάδα έχει την υψηλότερη σεισμικότητα στην Ευρώπη. Η λέξη «σεισμός» παράγει τη λέξη «σεισμολογία» (seismology) που χρησιμοποιείται σε όλο τον κόσμο. Γνωρίζουμε επίσης ότι μερικοί σεισμοί έχουν προκαλέσει μεγάλα καταστροφικά τσουνάμι από την αρχαιότητα μέχρι τη σύγχρονη εποχή.

Το τσουνάμι από την έκρηξη της Θήρας το 1650 προ Χριστού. Τα μεγάλα τσουνάμι του 365 και του 1303 μετά Χριστόν μετά από μεγάλους σεισμούς στο Ελληνικό Σεισμικό Τόξο. Και πιο πρόσφατα, το μεγάλο τσουνάμι του 1956 στην Αμοργό ξανά έπεται από μεγάλο σεισμό.

Αυτή η συνάντηση έχει κρίσιμη σημασία όχι μόνο για την Ελλάδα αλλά και για ολόκληρη την Ευρώπη. Πρέπει να συζητήσουμε και να αποφασίσουμε πως θα αντιμετωπίσουμε τους ωκεάνιους κινδύνους και ιδιαίτερα τον κίνδυνο από τσουνάμι με μια παν-Ευρωπαϊκή προσπάθεια.

Αγαπητοί φίλοι,

Είναι μεγάλη ευχαρίστηση να βρίσκομαι και πάλι στην Αθήνα, μερικά χιλιόμετρα από εκεί που πήγα σχολείο πριν από 50 χρόνια. Ακόμη θυμάμαι τη διεύθυνση, Μετσόβου 4.

I would like to thank you warmly since you give us the opportunity to meet in the country “of the Gods” and particularly in Athens, “the city of knowledge and mentality”

Everybody knows that Greece has the highest seismicity in Europe. The word “seismos” produces the word “seismology” which is in use all over the world. Everybody knows also that some earthquakes have caused catastrophic tsunamis from the antiquity up to the modern epoch.

The tsunami after the Thera eruption on 1650 BC. The large tsunamis of 365 and 1303 AD after large earthquakes in the Hellenic Seismic Arc. And more recently, the large tsunami of Amorgos of 1956 after again large earthquake.

This meeting is of crucial importance not only for Greece but also for the entire Europe. We should discuss and make decision on how to mitigate the ocean-related hazards, particularly the tsunami hazard within a pan-European effort.

Dear friends,

It is a great pleasure to be back here in Athens, some few kilometres from where I went to school more than 50 years ago: I'll always remember the address Metsovou 4. Excharisto poli.

It is a great honour and pleasure for me to welcome you to the 5<sup>th</sup> Meeting of the Intergovernmental Co-ordination Group of the Northeast Atlantic, Mediterranean and Connected Seas Tsunami Warning and Mitigation System NEAMTWS here in Athens on behalf of the Assistant Director General of the UNESCO, and Executive Secretary of the Intergovernmental Oceanographic Commission IOC, Dr. Patricio Bernal.

As I said in Greek earlier, Greece did not only give the word “seismos” to the science behind earthquakes. It also has a long history of tsunamis connected to large earthquakes: Thera, now Santorini exploded ca 1650 BC. Costas Synolakis has searched for evidence of the tsunami this earthquake generated in Crete. And some see links to the abrupt extinction of the Minoan culture. Again in 365 and 1303 AD earthquakes and tsunamis originated in the Hellenic Seismic Arc. More recently the small island of Amorgos in 1956, after an earthquake in Santorini, was almost swept away. No casualties, as there were no people living there. This has changed; more people live close to the coasts, make their living from tourism, and are at increasing risks.

We all know that one challenge for TWSs is to detect, confirm and predict tsunamis. That is largely a science part, and leads to “event formulations” called warnings. Where, when, what, how much! This is not, at a first glance, what disaster managers need. They have to get an “impact oriented warning”, issuing instructive warning: where what to do, and when! So we have to get the disaster management, the emergency authorities, the civil defence much more involved. They need hazard identification, risk definitions, risk assessment. And they will have to prepare for these risks by mapping the relevant areas, introducing these into the land use planning in the coastal zone, reviewing building codes, and preparing emergency response. That’s their job, and they are good at it. Europe has a good record for this, and the transboundary response to large disaster such as forest fires or river or flash floods are met with great competency and effect.

An EWS for tsunami alone is not affordable, effective and is not the aim of our deliberations. The command chain for producing, issuing, disseminating warning information for, and responding to natural hazards is largely identical. It is the detection side, the sensor side that is different, and very specific. And tsunamis with their extremely short lead times of a few minutes to just over one hour in the European case pose the greatest challenge.

The EU since the Portuguese presidency has acquired for Tsunami warning Systems a high profile mandate, underpinned by a Conclusion of the EU Council of Home and Interior Ministers. This is an excellent opportunity for EU member states holding the respective EU Presidency to mark their Presidency with particular achievements. The EU also has in place a number of instruments to address particular European problems: integrating the North African coast and countries, updating or putting in place specific sensor systems, such as seismometers and sea level gauges, data and communication systems, agreeing on terminology, standards. In a nutshell: to make sure that all participants profit and are able to establish, maintain and use this Early Warning System with a strong multi-hazard approach. Europe, compared to other oceans where the IOC is mandated to establish and co-ordinate TWSs, has one great advantage: there is an intergovernmental, cross-border responsibility, which is working and well established.

When the 1960 Tsunami off the coast of Chile hit Japan and Hawaii some 16 hours later, it took 5 years, for the IOC to finally establish the PTWS in 1965. It was conceived and still is an ocean-wide system with central facilities, built for distant, far-field tsunami. It only now changes to address the near-field threat.

In response to the 2004 Indian Ocean Tsunami generated by the strong earthquake off Sumatra, it took only 3 years to start operating several national Tsunami Warning Centres TWCs. The IOTWS is not a central system but a system of national systems. Nations are responsible for protecting their population, and it is only nations that can issue warnings.

IOC member states in 2005 and the UN General Assembly in 2006 and 2007 mandated the IOC to organize cover from tsunami hazards for other ocean regions prone to the risk of tsunami, and extending that brief to other sea-level related hazards. Subsequently similar systems are being established for the Caribbean, and the European regions.

The IOTWS addresses several forms of tsunamis, develops towards other ocean-related hazards, and is today the most modern system in terms of structure, technology and governance. Its governance reflects the changes in the world that happened since the 1960s when the Pacific

system was built; all member states take full responsibility to protect their coasts, their people on the beach, their livelihoods and the investments in the coastal zone. Any tsunami will be a disaster, and its impact on the local, regional and possibly national economy and its development will be long-felt. All other new systems are sharing this experience, and contribute towards building efficient and reliable Early Warning Systems. Each system also finds its way of getting organized, sharing the burden and providing the cover with the means at its disposal.

All oceans are at risk, differing in frequency, magnitude, and impact. All countries around these ocean regions are now well aware of that, they are increasingly getting prepared to meet the challenges at the coast. These are manifold:

- Raising the awareness of the people,
- Preparing local and regional authorities and empowering them to act when a tsunami warning is issued in a well-rehearsed and appropriate manner,
- Reviewing and adapting national command structures, and finally
- Participating in this system of nationally owned systems where each neighbour crucially depends on the other to make the NEAMTWS work and perform.

There are still many challenges and today is not the end of getting ready but the beginning of an arduous long road:

- to sustain these national systems and the required national and international infrastructure over decades
- to develop clear mechanisms to responsibly share all relevant data, information and experiences with all in real-time.

The European system faces a few different challenges:

- it has to cover several closed or semi-enclosed basins and the North East Atlantic coasts, which implies short warning times,
- it is supported by the developed mainland Europe countries, and has as partners the lesser developed countries of the North African coast
- with the European Union and its Commission it has a strong cohesive element that could be of great impact to the successful implementation of the NEAMTWS.

Warning systems are not attractive, they are dormant. They cost money, keep people busy and over the years will annoy the Secretary of the Treasury: no or little return on investment! The public does not notice them. Only in that one moment when they are needed and perform, they are visible and essential. This dilemma is difficult to resolve. Early Warning Systems try to extend the time available to react. The earlier the threat is known, the better prepared the affected areas are, the greater are the chances to save lives.

Ladies and Gentlemen, for tsunami threats there is no time to be wasted. The time to warn ranges from 20 minutes to a very few hours. This threat is imminent, it is not predictable and it is everywhere. Europe can show it is aware of these hazards, and how it contributes in its very own way to establishing its own ETWS as a system fully connecting to the other TWSs.

Let me thank, also on your behalf, the organizers of this meeting, namely Gerassimos Papadopoulos, the vice-chair, and to the Government of Greece.

Thank you for your attention!

Εύχομαι καλή επιτυχία σ' αυτή τη συνάντηση,

Ευχαριστώ πολύ.

I wish every success to this meeting,

Thank you very much.

## ANNEX IV

### **REPORT OF THE MEETING OF THE NEAMTWS TASK TEAM ON THE RTWC ARCHITECTURE**

Southampton, UK, 30 September – 1 October, 2008

#### **Review of past activities**

Trevor Guymer, co-chair of the NEAMTWS Task Team on the RTWC architecture, welcomed participants on behalf of the National Oceanography Centre Southampton (NOCS), introduced the logistics for the meeting and provided a brief overview on the structure of NOCS.

Stefano Tinti, chair of the ICG/NEAMTWS, recalled the achievements and decisions since the establishment of the ICG at its inaugural session in Rome in November 2005 and outlined the role of this Task Team meeting in collaboration with the existing technical Working Groups of the ICG/NEAMTWS. He reminded the participants that based on the preliminary findings and decisions from its first meeting in Paris, the Task Team is mandated to provide recommendations on the RTWC structure for the region to the next ICG session in Athens.

Trevor Guymer briefly recalled the outcomes and recommendations from the first Task Team meeting and introduced the draft agenda and timetable which were both approved by the group.

#### **Requirements for RTWCs**

The group briefly discussed the Requirements for RTWCs drafted at the first Task Team meeting in Paris and adopted the paper with a few modifications as attached in ANNEX V.

The secretariat briefly reported on the first meeting of TOWS in April 2008, the main outcomes reported at the parent IOC body in June and the extended mandate given by the 41st IOC Executive Council. It was explicitly mentioned that TOWS expressed general concern that the creation of Working Groups under each ICG, all dealing with similar matters and often calling on the same capability for advice and input, is not fully efficient. Moreover, where Working Groups are working in similar areas, such as standards, the terms of reference are often sufficiently different as to lead to different outputs and outcomes, making the task of harmonisation and integration more difficult.

#### **Ideas for institutional co-operation towards initial RTWCs**

Based on the introductory presentation by Stefano Tinti, Trevor Guymer briefly outlined the basic idea for the initial NEAMTWS moving to a more institutional collaboration instead of relying on official governmental contributions only. Within this context the Task Team chair requested representatives of present institutions to focus on the progress made since the last meeting and possible contributions to the future system.

Kevin Horsburgh from the Proudman Observatory in Liverpool (POL) recalled the history of earthquakes and tsunamis in the NE Atlantic and the future threat to the UK, based on a study funded by DEFRA. As an example of a successfully operating warning system for coastal inundation, he described in detail the UK storm surge prediction model which is run through a collaboration of the UK Met Office and POL.

Lars Ottermoeller from the British Geological Survey (BGS) in Edinburgh completed the reporting of tsunami related activities in the UK by detailing the positive results of a project funded by Defra assessing the capacity for earthquake observation and tsunami warning for the UK.

Several participants requested more detail on the UK plans and role in the future RTWC architecture.

François Schindelé presented the French plans to establish a Tsunami Warning System for the NE Atlantic and Western Mediterranean, directly threatening the French coastlines; in particular the very recent enhancement of the CEA broad band network. He stressed that the seismic data must be shared between RTWC by a reliable communication system such as the MPLS and a core network must be maintained by each Member State. He stressed also that for the Mediterranean there is a need for a much denser sea-level network capable to properly detect local and regional tsunamis.

Based on the actual Implementation Plan and the known gaps and needs for NEAMTWS, Joern Lauterjung from Geoforschungszentrum Potsdam presented an initiative Germany submitted to the Union for the Mediterranean initiative within EuroMED generated through the Barcelona process. The according proposal will be discussed by the European Council of ministers in November.

Ulrich Raape from DLR, Germany, presented their Decision Support System (DSS) which has been developed within the GITEWS project for Indonesia. He suggested considering making use of this software tool in the NEAMTWS region as tsunami warning timelines are very similar to the Eastern Indian Ocean region for which this software has been developed.

Several participants requested detailed information on both presentations.

Gülay Altay and Mehmet Yilmazer reported on the actual seismic network upgrades in Turkey, including cabled OBS sensors and other ongoing activities within KOERI's plan to strengthen the data transmission and processing capacity on earthquake prediction. For several years KOERI has been responsible for earthquake observation in Turkey on a 24/7 basis and was nominated as NTWC, while the institution is ready to provide regional coverage for the Eastern Mediterranean in collaboration with Greece.

Fernando Carrilho from the Instituto de Meteorologia, Lisbon, presented the actual upgrades and status of the Portuguese seismic and sea-level networks improving their warning latency significantly. Portugal is working with the JRC to establish a modified tsunami scenario database and an operational Tsunami Analysis Tool for decision making. They plan to finish their upgrades by 2009 and by that time, if proper funding can be found in order to solve human resources availability, offered to act as an RTWC for at least the nearby NE Atlantic coastal areas.

Stefano Cacciaguerra, from the Italian Foreign Office and chair of the Italian Tsunami Inter-ministerial Coordination Group reported on the recent developments and coordination meetings to determine the intended Italian contribution to the RTWC architecture. He informed the session that due to the as of yet undetermined budget allocation the explicit commitment for INGV to act as a RTWC will probably be announced during the ICG/NEAMTWS-V session in Athens.

Tom De Groeve, from European Commission Joint Research Centre in Ispra, Italy, presented the portfolio of tsunami tools developed by JRC which include a global Tsunami scenario database which is operationally used in the context of the Global Disaster Alert and Coordination System (GDACS). He focused especially on the Tsunami Analysis Tool which is decision support system that allows the fusion of seismic parameters, sea level measurements and scenario calculations. Both products have been adopted by Portugal for the development of their National Tsunami Watch Centre and are also available to other governments through bilateral agreement with the European Commission.

Participants had several questions on the functionality and the presented performance measures and statistics on false alarms.

Chris Little from the British Met Office, outlined WMO's role in and function for warning dissemination on a global scale through their Global Telecommunication System (GTS). He reported on the progress in recent years when improving the GTS for the European Area and provided an outlook for the future WMO's communication system (WIS) which even includes internet connections. With respect to the NEAMTWS RTWC structure and duties, WMO suggests drafting an information flow diagram to clarify the regional architecture and responsibilities.

Participants welcomed the progress in upgrading of WMO's communication system.

### **Links with NEAMTWS working group activities**

The chair of WG 1, François Schindelé, reported from the last meeting of his group which was held in Cadiz on April 1, 2008. During that meeting the group mainly discussed the option to modify the decision matrix initiated by a 6.9 earthquake off the Greek coast which had a magnitude above the warning threshold while no tsunami was triggered.

The group discussed the issue intensively and agreed that even with grossly improved detection networks and improved simulations there is no guarantee of avoiding "false" tsunami bulletins and based on the experience from the Pacific, education on the nature of warnings will improve acceptance by the population.

Giulio Selvaggi, co-chair of WG 2 presented the actual status of the seismic network in the Mediterranean which has been upgraded since NEAMTWS-IV but the progress is still quite slow. Based on the wide range and variability of estimates of the 6.9 earthquake off the Greek coast in February 2008, he strongly suggested reviewing the used instrumentation networks by the different centres as well as the software for calculating magnitude. WG 2 will concentrate on this issue for the next session.

The second co-chair of WG 2, Winfried Hanka, provided a quick overview on the situation in the Indian Ocean and reported on the ongoing progress installing SeisComp3 for the different European/Mediterranean seismic centres. So far the software has been successfully installed at IM, CEA/EMSC, IGN and KOERI, while the installations for INGV and NOA are under way.

Begoña Perez, chair of WG 3, focused on the progress of the different action items of the working group and the actual status of the real-time sea-level network for NEAMTWS which progressively populates the IOC sea-level facility website hosted by IODE/VLIZ ([www.ioc-sealevelmonitoring.org](http://www.ioc-sealevelmonitoring.org)). So far Sweden, Denmark, the UK, Ireland, Germany, Spain and Italy are providing real-time data to the sea-level website.

Russell Artherton, chair of WG 4 provided an overview on the actual usage and nomenclature of tsunami warning messages by the different regional TWS around the globe. Derived from the regionally quite non-coherent usage there is still a need to harmonize globally but also for NEAMTWS to re-consider the use of the word "warning" for RTWC (red-alert) messages.

### **Implementation plans for RTWCs**

In order to properly tackle the next steps in drafting the report and recommendations to ICG/NEAMTWS-V in Athens, Trevor Guymer summarized the discussion and tackled issues so far and suggested splitting up into sessional discussion groups on a) technical questions and b) funding possibilities.

Italy expressed its concern regarding that proposal and suggested not splitting into sessional groups but rather discussing possible recommendations in plenary starting with the political/funding issue. Italy also stated that they are taking a cautious point of view to the proposed draft project presented by Germany and submitted to EuroMED. Thus they recommended carefully drafting the wording on this overall initiative to prevent jeopardizing any national initiative on the same issue.

Stefano Tinti recommended that WG1 draft a list of countries close to the seismic sources which are mainly threatened by tsunamis and should be advised by the ICG to establish NTWCs. This should be accompanied by a letter from the IOC secretariat requesting information on the national plans.

To facilitate the future collaboration among RTWCs, the group suggested that the co-chairs of the Task Team prepare an outline for a NEAMTWS RTWC operations guide considering elements from the IOTWS RTWP Implementation Plan, (IOC Technical Series 81).

### **Conclusions and recommendations**

Based on the prior results and findings the group discussed in detail possible conclusions and recommendations of the Task Team on the RTWC architecture and agreed upon the following items to be transmitted to NEAMTWS-V:

- Adopt the revised paper on *Regional Watch Centre - Roles and Requirements*, as attached.
- To facilitate the immediate start of the Interim Tsunami Watch System for the NEAMTWS an initial subset of potential RTWC's, identified by the ICG, and which are already on a 24/7 watch mode, namely Italy, Turkey, Greece and Portugal, are requested to consider offering their services to other Member States as soon as possible. This does not exclude other candidate centres from joining the RTWC network to better cover the NEAM coastlines and provide data and backup warning services.
- Establish a Coordination Group of RTWC representatives to ensure complementarity, harmonization and agreed protocols for NEAMTWS.
- WG 1 is to compile a list of countries close to the seismic sources zones whose coastlines are primarily threatened by tsunamis. These Member States are strongly advised by the ICG to establish National Tsunami Warning Centres (NTWC). Based on this list, all NEAMTWS Member States should receive a letter from the IOC secretariat requesting information on the national plans for a NTWC, warning mandates and official nominations of Tsunami Warning Focal Points and Tsunami National Contacts.
- Based on and subject to approval of the pre-proposal submitted by Germany to *Partenariat EuroMED* and the NEAMTWS Implementation Plan, Working Groups and Member States are invited to consider preparing prioritized action items. Member States are also invited to encourage national centres submitting proposals to appropriate calls within the 7<sup>th</sup> FP of the European Commission.



## ANNEX V

### REPORT OF THE SESSIONAL MEETINGS

#### **Working Group 1 – Hazard Assessment, Risk and Modelling**

Athens – November 2008

12 Participants, 9 Member States:

Officers: François Schindelé, CEA, France  
Mauricio Gonzalez, Univ. Of Cantabria, Spain

Participants: Maria Ana Baptista, FCUL, Portugal  
Gerassimos Papadopoulos, NOA, Greece  
Vassilios Gougalis, Grèce  
Alessandra Maramai, Italy  
Stefano Tinti, Univ. of Bologna, Italy  
Alexander Rudloff, Germany  
Utku Kanoglu, Turkey  
Amos Salamon, Israël  
Alex Sursock, Lebanon  
Richard Guillande, France

The working group met to discuss

- I. Possible updates for the NEAMTWS Implementation Plan
- II. Decision matrix for tsunami warnings update : February 2008 events, Greece
- III. Recommendations to the ICG plenary based on new/actual developments.

As mentioned in the Implementation Plan the Interim TWS will be “designed to cope only with seismic tsunamigenic sources” and “the main target of the ITWS is that of handling large scale tsunamis, that is tsunamis that have a basin-wide propagation potential and can be destructive far from the source”.

Partly based on a suggestion from the NEAMTWS Seismic WG, the participants agreed upon the following recommendations:

- I: The recent seismic events in Greece on February 14, Magnitude 6.9 and 6.2 pointed out that the threshold of the decision matrix would certainly have to be revised for that specific region.

The Decision matrix endorsed in Lisbon during ICG/NEAMTWS IV states that in the Mediterranean Sea, for a magnitude 6.9 earthquake, a regional warning would have to be issued as a basin wide watch. If the Warning centre was in place, such a warning would have to be disseminate, with evacuations on Italian, Greek and Libyan coasts, and watch for coasts from Tunisia to Lebanon. This would create panic and can discredit the warning system for a long time.

No tsunami was detected on the tide gage records on the Tunisia coasts, neither on the Italian and Greek coasts. In addition, no tsunami was observed on the Greek coasts close to the epicenter.

One of the reasons is that, looking at the focal mechanism provided by Harvard, the Dip angle of this rupture zone was very small, 6 degrees. In consequence, the vertical deformation of the sea floor will be very small, around 10 cm. Is the slab slope angle so small along the subduction

zone near the Greek islands? Does any other large faults exist in that area that could be the origin of earthquakes of magnitude greater than 6.0 earthquakes with other focal mechanism (normal or reverse faults)?

The option could be to limit a specific zone all around the Greek islands with the same thresholds applied for the Atlantic, Pacific and Indian Ocean subduction zones.

The Group decided to maintain the decision matrix, without any modifications. Greece will provide a report on a study concerning that issue soon, in particular the magnitude estimation.

II: The Working Group confirms:

2.1 to still use two different levels of threat, as recommended by the ICG. In the decision matrix and related messages, *Warning* is changed into *Watch* and *Watch* into *Advisory*.

	Advisory	Watch
<b>Run-up</b>	< 1m	> 1m
<b>Amplitude</b>	0.2- 0.5 m	> 0.5 m
<b>Impact</b>	Currents, Bore, recession, damage in harbours, small inundation on beaches	Advisory impact + coastal inundation

2.2 To differentiate between the Atlantic and Mediterranean Basins for spatial range and decision matrix as follows:

	Mediterranean	NE Atlantic
<b>Local</b>	< 100km	<100km
<b>Regional</b>	100km – 400km	100km – 1000km
<b>Basin scale</b>	> 400km	> 1000km

**Mediterranean:**

Depth	Location	(Mw)	Tsunami Potential	Bulletin Type
< 100 km	Sub-sea or very near the sea (< 30 km)	5.5 to 6.0	Small potential for a local tsunami	Information Bulletin
		6.0 to 6.5	Potential for a destructive local tsunami < 100 km	Regional Tsunami Advisory
		6.5 to 7.0	Potential for a destructive regional tsunami < 400 km	Regional Tsunami Watch Basin-wide Tsunami Advisory
		≥ 7.0	Potential for a destructive basin-wide tsunami > 400 km	Basin-wide Tsunami Watch
	Inland (> 30 km)	5.5	No tsunami potential	Information Bulletin
≥ 100 km	All Locations	≥ 5.5	No tsunami potential	Information Bulletin

**Atlantic:**

Depth	Location	(Mw)	Tsunami Potential	Bulletin Type
< 100 km	Sub-sea or very near the sea (< 30 km)	5.5 to 7.0	Small potential for a local tsunami	Information Bulletin
		7.0 to 7.5	Potential for a regional tsunami < 1000 km	Regional Tsunami Advisory
		7.5 to 7.9	Potential for a destructive regional tsunami < 1000 km	Regional Tsunami Watch Ocean-wide Tsunami Advisory
		≥ 7.9	Potential for a destructive ocean-wide tsunami > 1000 km	Ocean-wide Tsunami Watch
	Inland	5.5	No tsunami potential	Information Bulletin
≥ 100 km	All Locations	≥ 5.5	No tsunami potential	Information Bulletin

- A task concerning update a must criteria must be added in the action items table
- A task concerning guidance for cancellation policy must be added in the action items table

III: The Working Group decided to finalize several tasks partially completed, to provide the related documentation in the IOC web site:

<b>Task/Action</b>	<b>Timeline</b>	<b>Responsibility</b>	<b>Required Budget*</b>	<b>Status</b>
Compilation of Data base	<b>May 2008</b>	Italy IOC secretariat	none	DONE
List of island, submarine & coastal volcanoes in activity, with their characteristics of activity (effusive, explosive, etc.)	NEAMTWS-IV <b>Jan 2010</b>	Italy, Greece Spain, Portugal, Iceland Portugal IOC secretariat		C Portugal will compile the data provided by Italy, Spain, Greece, Iceland and Portugal (MA Baptista), to be posted on the web page (IOC)
Model collection and assessment of documentation	<b>Nov 2009</b>	Turkey, Spain, Germany IOC secretariat		C The documentation prepared for ICG and TRANSFER will be finalized in April and May. A pdf file will be prepared early June to be posted on the IOC Web page. A paper can be prepared to be published.
List of standard output	<b>Nov 2009</b>	Turkey, Spain, Germany		

**Working Group 2 - Seismic and Geophysical Measurements**  
Athens – November 2008

**Prepared by: Giulio Selvaggi and Winfried Hanka**

**Intersessional activities and progress achieved since ICG/NEAMTWS-IV**

As recommended by the ICG/NEAMTWS-IV, GFZ Potsdam has started January 1<sup>st</sup>, 2008, to operate its global earthquake monitoring system as an experimental seismic background data centre for the interim NEAMTWS. The SeisComP3 (SC3) software, developed within the GITEWS (German Indian Ocean Tsunami Early Warning System) project was extended to test the export and import of individual processing results within a cluster of SC3 systems. On-site or remote SC3 installations and trainings courses were provided to IGN (Spain), IM (Portugal), CEA/EMSC (France) and KOERI (Turkey, not yet fully operational), similar installation at INGV (Italy) has been recently completed while for NOA (Greece) is still pending. BGS (UK) decided presently not to participate in the SC3 tests. The virtual real-time seismic network was substantially extended by many stations from Western European countries optimizing the station distribution for NEAMTWS purposes. To amend the public seismic network (VEBSN – Virtual European Broadband Seismic Network) some attached centres provided additional stations for NEAMTWS usage. In parallel to the data collection by Internet the GFZ VSAT hub for the secured data collection of the EuroMED GEOFON and NEAMTWS backbone network stations became operational and the first data links were established.

Although the test is at its beginning and need some time to provide good indications, the experimental system could already prove its performance since a number of relevant earthquakes has happened in NEAMTWS area in 2008. The results are very promising in terms of speed as the automatic alerts were issued between 2 1/2 and 4 minutes for Greece and 5 minutes for Iceland. They are also promising in terms of accuracy since epicenter coordinates, depth and magnitude estimates were sufficiently accurate from the very beginning, usually don't differ substantially from the final solutions and provide at least a good starting point for the operations of the interim NEAMTWS. However, although an automatic seismic system is a good first step, RTWCs are urgently needed for regular manual verification of the automatic seismic results and the estimation of the tsunami potential for a given event.

**Summary of discussion during the breakout sessions**

During the breakout session WG2 has discussed the following items:

- a) Data quality control;
- b) The SeiscomP3 (SC3) test;
- c) Terms of operation of the backbone network;
- d) Data policy;
- e) Communication;
- f) Technical meeting on data exchange.

a) It has been recognised that data quality check is of primary importance for the backbone network and it should relate both to real time control, in term of data latency, state of health of the stations, malfunctioning, and the site and instruments characteristics, in term S/N ratio, H/V characteristics, spectra on different time windows. WG2 agrees that network operators are primarily responsible of the quality check but it is under discussion also the possibility to collaborate with existing data centre (e.g Orfeus Data Centre) for a quality control of the data. It has also been recognised the importance to have an error reporting mechanism to reduce the time for restoring not working stations.

- b) WG2 decided to extend the Seiscomp3 test until April 2009, so to finalise the full installation already scheduled for INGV and NOA. It has been also decided to have a separate session at the forthcoming (May) “Erice International workshop on real time seismology” for a first evaluation of the test and a pilot phase will follow until the next ICG meeting where WG2 will report on both phases. Finally, it has been recalled that the interim NEAMTWS SC3 system is open to all NTWCs
- c) An effort will be dedicated to the general location problems that may arise from the actual geometry of the backbone network, although it is clear that it is necessary to implement the coverage of stations along the North-African coasts as many times underlined by WG2. Some participants will test the current decision matrix criteria and evaluate possible threshold effects.
- d) WG2 has also discussed in terms of data sharing between the participant, recognising as an objective an open data policy encouraging efforts to introduce reciprocity in data exchange within NEAMTWS participants.
- e) A preliminary statistics and experience feedback from SC3 test relates to communications failures observed during seven month of operation. The main outcome is the need of robust and possibly redundant communications.
- f) Two forthcoming meetings will be held in the first half of 2009. France will organise a technical meeting on data exchange in western Mediterranean and NE Atlantic, and Italy is organising a meeting on real time seismology in May.

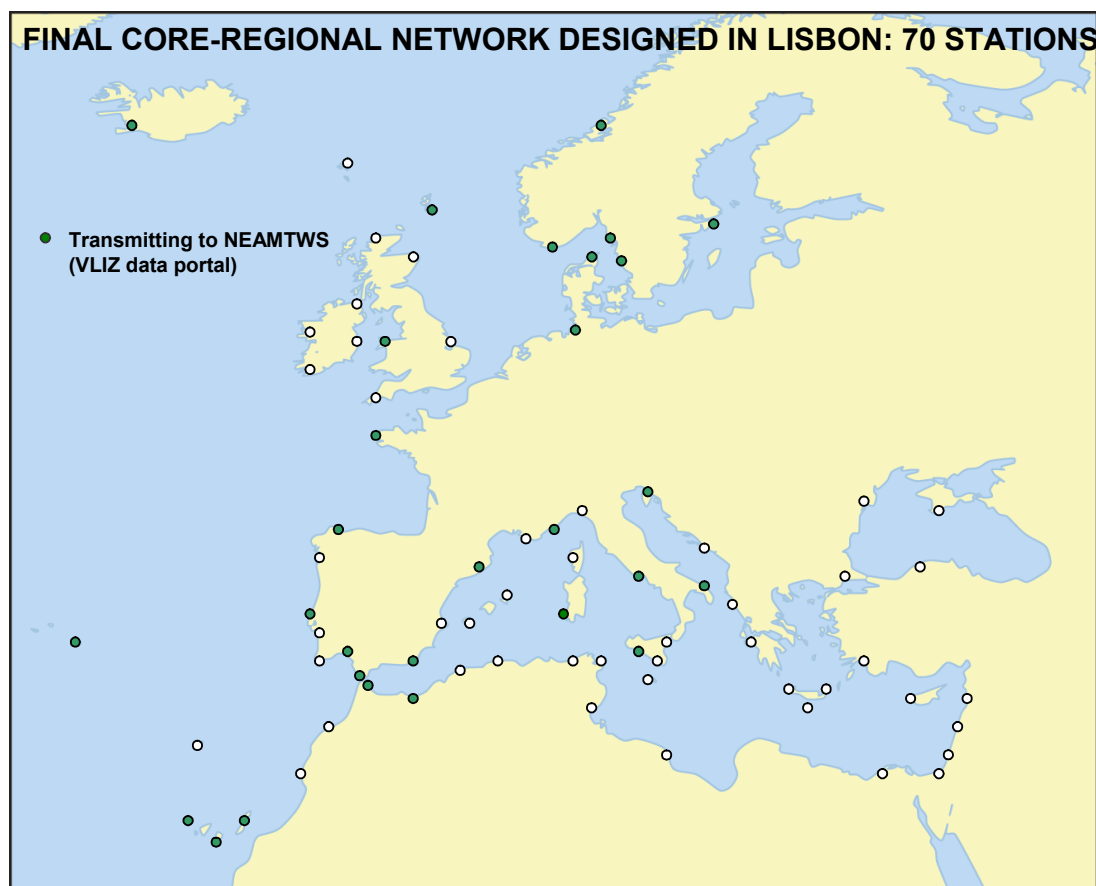
**Working Group 3 -Sea Level Data Collection and Exchange,  
including Offshore Tsunami Detection and Instruments**  
Athens – November 2008

Officers: B. Pérez (Spain), K. Yelles (Algeria) (not present)

Participants: T. Aarup, G. Zodiatis, A. Drago, D. Smith, A. von Gyldenfeldt, J. Reis, J. Onofre, C. Sammari, M. Yilmazer, D. Rosen, V. Lykousis, T. Kardaras, R. Creach

**Intersessional activities and progress achieved since ICG/NEAMTWS-IV**

Following the recommendation of Working Group 3 to the ICG/NEAMTWS-IV in Lisbon, most existing real time sea level stations in the NEAM region are now providing data to the IOC/GLOSS (Global Sea Level Observing System) Sea Level Station Monitoring Facility hosted at the Flanders Marine Institute (VLIZ in Oostende, ([www.ioc-sealevelmonitoring.org](http://www.ioc-sealevelmonitoring.org)) on a temporary basis. The web service monitors the operational status (colour-coded) of the real time GLOSS sea level stations with the additional option to display RT raw sea level data received from stations committed to the NEAMTWS, in the GLOSS Core Network as well as the Indian Ocean, Pacific and Caribbean Tsunami Warning Systems. The data are not quality controlled and are not processed by an algorithm for tsunami detection. At the time of this recommendation, no regional or subregional NEAMS tsunami warning centre had been established.



*Figure 1: Status (1st January 2009), of the stations that already transmit data to VLIZ data portal (some stations require upgrades to meet all NEAMTWS requirements)*

During 2008 the IOC secretariat contacted various national institutions that had committed sea level stations to the NEAMTWS, for status updates and data availability for possible inclusion in the above mentioned VLIZ website. As of this report, 33 of the minimum network of 70 stations

defined at ICG/NEAMTWS-IV in Lisbon are providing or starting to provide real time data from committed stations. (Figure 1) This network currently comprises Spain, the UK, Portugal, Iceland, Ireland, Denmark, Germany, Sweden and Italy. In order to fulfil tsunami monitoring requirements in Europe all existing stations will need to meet 1-min sampling/latency and remaining Member States will need to make available real time data from committed stations.

Despite ongoing Member State effort, the NEAMTWS network must continue to work towards more progress, particularly in the Mediterranean, which is a critical area in this region. The IOC secretariat and Working Group chair remain in contact with Member States and must continue to encourage responses to status requests. The last request sent by Working Group 3 resulted in replies from France and Spain. The lack of available real time sea level data from the North African coast is a major concern and the current solution is to ask for external funding by proposals, such as the one suggested by GFZ (Germany). Continued efforts should be made to seek out further resolution to this pressing issue. A combination of information and awareness rising in the region and commitment of resources towards the upgrade of targeted stations are needed.

Data transmission of sea level directly from the gauge via the meteorological geostationary satellite METEOSAT, the use of the Global Telecommunication System (GTS) and use of the CREX format have been postponed as the METEOSAT only allows 15-minute transmission slots (which would result in a latency of at least 15 minutes) which is too high for the NEAMTWS region. Nevertheless, it is a goal to make relevant NEAMTWS sea level data globally available for other systems. France has informed the group of several tests carried out with their tide gauges to explore options for optimisation. France notes that some completed tests include use of the CREX data format, and the results will be studied further to determine the usefulness and adequacy.

Some of the tabled actions for Working Group 3 have been delayed due to the changes in personnel responsible for particular actions. This is the case for the inventory survey of existing sea level stations in Europe and the survey of offshore instrumentation platforms and methods. Both of them are now carried out by the UK (POL) and Spain (OPPE), and will be in fact deliverables of the EU TRANSFER project.

Since NEAMTWS-IV, Working Group 3 has received some, but not sufficient, additional information regarding the availability of offshore sites with pressure sensors already in place. One example is the autonomous deep sea platform for tsunami detection that will be installed in October and November of 2008 within the EuroSITES project, at the Poseidon-Pylos site (SE Ionian Sea). This is one of the critical sites proposed and considered of interest for NEAMTWS. Another example is the OBS observatory close to the Alboran Island (Alboran Sea, North of Morocco) that will be established by the Spanish Navy (ROA) and will include a bottom pressure sensor.

Finally, in order to include the far field information from the Atlantic, a first contact has been established with the NOAA National Data Buoy Center (US) to arrange for direct access for NEAMTWS to ensure availability of data observations from the DART buoys in the Atlantic. It is noted that observations from the DART buoys are already made available through the GTS.

## **Summary of discussion during the breakout session**

### *Status of committed sea level stations*

The participants reported the status and modifications to the previous implementation plan. Portugal proposed a new and corrected list of stations: Lagos, Sines, Cascais, Peniche, Leixoes, Ponta Delgada (Azores) and Canical (Madeira). Greece reported that new stations will be added to NEAMTWS in the future, according to the national decisions and the



implementation of their National Tsunami Warning System. Still no detailed information is available. MedGLOSS stations in Ukraine, Bulgaria, Romania, Cyprus, Malta and Israel, will be upgraded in first half of 2009 to enable high frequency sampling. The upgrade does not include coverage of the running costs for the data transmissions and the mentioned countries will be responsible for covering these costs. Tunisia already operates two stations (Gulf of Gabés and Cape Bon), although they are not fulfilling the NEAMTWS requirements. UK has already upgraded all selected stations and proposed for the future the site at Stornoway. Spain also contributes all GLOSS stations from the Spanish Institute of Oceanography, and Palma (Balearic Islands) to the NEAMTWS. Germany suggested adding a station in Borkum or Helgoland.

Although not present during the WG3 breakout session, the national delegate of Morocco offered in plenary a coastal sea level station near Rabat, to become part of the NEAMTWS core network.

#### *IOC sea level monitoring facility and data policy discussion*

Several participants from the Mediterranean expressed hesitation in providing data on an interim basis to the IOC sea level monitoring facility as had been decided at the NEAMTWS IV session. They requested that the following conditions be met:

- A statement of the IOC Oceanographic Data Exchange Policy should be provided on the web site
- The data originating institution should be mentioned when displaying a particular station
- No possibility of archiving and downloading data
- Written agreement from IOC that data will not be archived

The discussion was not closed and will be followed up during the next months. Independently of this, all the participants reconfirmed that sea level data will be freely exchanged with the regional and national warning centres for tsunami monitoring.

#### *Mediterranean sea level gap. Northern Africa*

The lack of RT sea level data availability in the Mediterranean of some member states and providers like France, Greece and MedGLOSS has been due to the slower-than-expected upgrade process. However, even if the stations are upgraded right now, the data policy issue with respect to the interim solution of the IOC data portal could influence the access to the data, until the warning centres are established. It was also mentioned that funds for upgrading stations are not always available. However no evident problems of funding were mentioned.

Concerning the Northern African countries, Tunisia stated the lack of data is not due to a problem of limited funds as there are stations already in real time operation and there is also technical capacity. The problem is considered to be related with the lack of awareness of NEAMTWS at institutional and political levels.

#### *Sea level data transfer for Regional Tsunami Warning Centres and use of GTS*

In order to reduce the latency, sea level data for tsunami warning should be transmitted directly from the stations to the RTWCs, instead via the institution responsible for the tide gauge. To facilitate this, raw data without quality control is more reasonable, provided sea level expertise at the centres is ensured.

On the other hand, considering the lack of robustness of Internet connections, it has been proposed that the sea level stations closer to seismic sources also transmit data via VSAT or BGAN. For this the IOC secretariat was asked to explore volume discounts on satellite

communications for the NEAMTWS region, taking as an example the agreement already achieved in the Indian Ocean for the BGAN system.

GTS should be used for the exchange of data between regional warning centres and with other Tsunami Warning Centres outside the NEAMTWS region (i.e. the Caribbean centre). The Regional Warning Centres could upload the data to the GTS as soon as the centres receive the data.

#### *Offshore instrumentation*

Greece presented the status of their plan for the Pylos-Poseidon site, which is at this moment about to be deployed (bottom pressure sensor to be installed at a Seawatch buoy). Portugal is also looking for funds for the establishment of a bottom pressure sensor and a Seawatch buoy in the central coast of Portugal, and for collaboration in Spain for the Gulf of Cádiz. Cyprus informed about the existence of a buoy in the Levantine basin which actually has a seismometer while a bottom pressure sensor will be added to the station. Finally, Turkey is now installing 5 bottom pressure sensors connected by cable in the Marmara Sea.

It was agreed to maintain the action of distributing the International Tsunameter Partnership technical requirements to WG3 participants to see its adequacy to our region.

Taking into account the already established contact with NOAA for access to DART buoys in the Atlantic, and that the potential Regional Tsunami Warning Centre in Portugal is interested in testing on use of this data.

#### **Actions/recommendations**

- Sea level data from the NEAMTWS core network will be freely available for the regional and national tsunami warning centres, once these become established. In the meantime, these data can be provided to the IOC sea level monitoring facility as an interim solution for visualization and control of operational status, without data archiving facility for those stations not belonging to GLOSS.
- Update the implementation plan with the modified sea level station list according to the input received from participants
- invite relevant tsunami focal points including seismic and sea level experts for the Task Team meeting in Tunisia
- Explore the planned GEO meeting in Cairo, and the intention of helping to advance the exchange of sea level data from North Africa
- RTWCs should identify the stations from the NEAMTWS core network that will contribute to their system
- IOC secretariat to explore if volume discount can be obtained for VSAT or BGAN for the NEAMTWS region
- Establishing official contact with ESONET/EMSO and highlight NEAMTWS needs
- Contact MOON and EuroGOOS for studying the possibility of upgrade with bottom pressure sensors existing operational buoy sites (Spain, Italy, Cyprus, Greece...etc)
- Distributing the ITP standards document within the WG3 to check their applicability to NEAMTWS
- Spain and Portugal to explore technical details for exchange of data with NOAA operated DART buoys in the Atlantic

#### **Working Group 4 - Advisory, Mitigation and Public Awareness** Athens – November 2008

Participants: Elana Dastalaki, Belen Martin Miguez, Juan Acosta Yepes, Alessandra Cavalletti, Baris Kalkavan, Luis Matias, Ulrich Raape, Eleni Athanasiou, Russell Artherton.

The WG received presentations by Ulrich Raape on aspects of the GITEWS project relevant to the WG task; also by Richard Guillande on aspects of the EU FP6 Schema project.

The WG discussed a proposal by Luis Matias, WG Co-Chair, on the Stakeholders Workshop which it is hoped to hold during 2009. Members of the WG were invited to comment on the proposal.

The main topic on the breakout agenda was the issue of alerting terminology to be used by RTWCs. The WG discussed alert messages from the different perspectives of the NTWCs and Civil Protection users on the one hand and the RTWCs on the other.

- The essential messages issued by RTWCs carried information on the location, timing and severity of the seismic event. These are confirmed or cancelled in accord with tide gauge or other observed data.
- The requirement for NTWCs was for the timing and magnitude of the tsunami at designated coastal locations.
- The extent to which RTWCs should process the basic source data for the benefit of NTWCs was discussed. It was accepted that it would be possible for RTWCs to provide information relating to specific coastal segments. The example of GITEWS was given.
- On the other hand, NTWCs might choose to make their own interpretation of the basic source information issued by RTWCs. This would be their prerogative. Countries of the NEAM region would vary in their capability in this respect.
- The different dimensions of urgency, severity and certainty should be criteria to be included in messages from RTWCs

The WG noted that the terms used by the RTWCs were specific to earthquake magnitudes; in contrast, the terms relevant to NTWCs and Civil Protection are wave magnitudes at specified coastal points or segments. The WG was agreed that there was scope for confusion if the same terms “Watch” and “Warning” are used for both purposes, as originally proposed by the ICG WG1.

The WG noted that the use of the term “warning” by the Regional Tsunami Watch Centres was not appropriate. Warnings implied a need for action. RTWCs had no mandate to issue such calls for action.

Recommendations of the Working Group:

- The WG recommends that the use by Regional Tsunami Watch Centres of the term “**warning**” should be avoided.
- The WG further recommends that the Regional Tsunami Watch Centres use two classes of tsunami alert – “**advisory**” for a lower level of alert; and “**watch**” for a higher level.

The WG agreed that National Tsunami Warning Centres be encouraged to anticipate modifications of tsunami impacts based on local parameters such as bathymetry, terrain, tides, coastal facing direction, protection, etc.

### **Report of the Sessional Meeting of the ICG/NEAMTWS Task Team on the Regional Tsunami Warning System Architecture**

Participants: F. Gérard, A. Strati, E. Fournatzopoulou, G. Altay, B. Öztürk, S. Cacciaguerra, T. Guymer, F. Carrilho, T. Stipa, M. Boisson, G. Papadopoulos, U. Wolf

As sessional chair of this Working Group François Gérard introduced the report prepared by the NEAMTWS Task Team and suggested to consider the following issues

- Recommendations made by the Task Team
- the continuation of the TT/WG for the next intersessional period including the modification of ToR
- possibly discuss sub-regional responsibility of RTWCs

The group agreed that there is a need to ensure a smooth transition period from the ad-hoc Task Team to the coordination group of RTWC representatives in the NEAMTWS area as recommended in the Task Team report. The perspective for that new group/Task Team should be to harmonise the findings of the different Working Groups and to look into an end-to-end system architecture.

The mandate should be as follows:

*Taking account of the NEAMTWS draft implementation plan, the four working groups list of actions and tasks, and of the previous decisions made by the ICG and the work carried out formerly, the Task Team shall*

1. *refine architecture, tools and cooperation for RTWC, as elements of the technical end to end operational structure of the NEAMTWS;*
2. *draft a development plan and prepare operations guide for the NEAMTWS network, with the involvement of all possible contributors and taking into account existing examples e.g. from IOTWS and PTWS, as appropriate*
3. *prepare a progress matrix as a tool to monitor the implementation of the NEAMTWS, and particularly the regional and national TWC*

#### **Modus operandi:**

*The Task Team will mainly work by correspondence, but hold a first meeting in the beginning of 2009 that will be hosted by Tunisia and a final one, in preparation to the next ICG meeting, September 2009. Other meetings will be held as needed.*

#### **Membership:**

- *The ICG officers and the chairpersons of the four ICG working groups,*
- *Representatives of potential RTWCs*
- *Experts designated by member states having interest in participating in the system,*
- *Representatives of relevant organizations working in the NEAMTWS region*

*The Task Team will have two co-chairs nominated by the Officers of the NEAMTWS ICG.*

The group agreed to leave any recommendation on regional responsibility for RTWCs to the Task Team and suggested small modifications to the NTWC/RTWC requirements for adoption by the ICG.

## Regional Tsunami Watch Centres (RTWC)

- roles and requirements -

### Watch

- Reception and interpretation of RT seismic and sea-level measurements
- Determination of seismic parameters
- Forecasting of tsunami arrival times and level of alert at each forecasting point specified by MS
- Exchange seismic parameters and information with other RTWCs and NTWCs
- Disseminate watch and cancellation messages based on the alert-level decision matrix to NTWCs and the TWFPs
- Monitoring of tsunami propagation and disseminate updated information in priority tsunami amplitude measurements
- Capability of acting as a backup centre to other RTWCs
- Function as a NTWC

### Above and beyond watch time

- Monthly tests of the watch system
- Procedures and documentation
- Regional tsunami exercises
- Conduct training courses with other RTWCs and IOC
- Participate actively and report to the ICG and WGs

### Requirements

- Seismic as well as tsunami/oceanographic expertise
- Direct access to a tsunami and large earthquakes data base
- Real-time transmission systems for reception of data
- Real-time alert reception and transmission systems like GTS, Internet...
- Backup/independent power supply
- Permanent staff on 24/7 watch
- Tsunami modelling capacity to produce and update canned scenarios

## National Tsunami Warning Centres (NTWC)

- recommended roles and performances -

### Warning/Watch

- Reception and interpretation of RT seismic & sea level measurements
- Reception of RTWC messages
- Dissemination of warning and cancellation messages to national authorities according to the national response plan
- Monitoring tsunami propagation and update information to national authorities
- Determination of seismic parameters
- Forecasting of tsunami arrival time, amplitude and run-up for the national coastline
- Provision of information to other national TWCs and RTWCs
- Acting as National Tsunami Warning Focal Point (TWFP)

### Above and beyond watch time

- National Tsunami Emergency Plan
- National Procedures (SOP), documentation
- National tsunami exercises
- Catalogue of inundation scenarios
- National tsunami data base

### Requirements

- Seismic as well as tsunami/oceanographic expertise
- Access to tsunami & large earthquakes data base
- Real-time transmission systems for reception of data
- Real-time alert reception system - e.g. GTS
- Backup/independent power supply
- Permanent staff on 24/7 watch
- Inundation modelling capacity

November 2008

ANNEX VI

LIST OF PARTICIPANTS

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## ANNEX VII

### LIST OF ACRONYMS

<b>BGS</b>	British Geological Survey
<b>CIESM</b>	the Mediterranean Science Commission
<b>EC</b>	Executive Counsel
<b>EU</b>	European Union
<b>EUROSITES</b>	European Ocean Observatory Network
<b>GLOSS</b>	Global Sea Level Observing System
<b>ICAM</b>	Integrated Coastal Area Management
<b>ICG</b>	Intergovernmental Coordination Group
<b>INGV</b>	Italian Institute of Geology and Vulcanology/Istituto Nazionale di Geofisica e Vulcanologia
<b>IOC</b>	Intergovernmental Oceanographic Commission
<b>ISDR</b>	International Strategy for Disaster Reduction
<b>NEAMTWS</b>	Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas
<b>NTWC</b>	National Tsunami Watch Centres
<b>RTWC</b>	Regional Tsunami Watch Centres
<b>TOWS</b>	Tsunami and Other Ocean Hazards Warning and Mitigation Systems
<b>TWS</b>	Tsunami Warning System
<b>UN</b>	United Nations
<b>UNESCO</b>	United Nations Educational Scientific and Cultural Organisation

In this Series	Languages
<b>Reports of Governing and Major Subsidiary Bodies</b> , which was initiated at the beginning of 1984, the reports of the following meetings have already been issued:	
1. Eleventh Session of the Working Committee on international Oceanographic Data Exchange	E, F, S, R
2. Seventeenth Session of the Executive Council	E, F, S, R, Ar
3. Fourth Session of the Working Committee for Training, Education and Mutual Assistance	E, F, S, R
4. Fifth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S, R
5. First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions	E, F, S
6. Third Session of the <i>ad hoc</i> Task team to Study the Implications, for the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime	E, F, S, R
7. First Session of the Programme Group on Ocean Processes and Climate	E, F, S, R
8. Eighteenth Session of the Executive Council	E, F, S, R, Ar
9. Thirteenth Session of the Assembly	E, F, S, R, Ar
10. Tenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific	
11. Nineteenth Session of the Executive Council, Paris, 1986	E, F, S, R, Ar
12. Sixth Session of the IOC Scientific Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S
13. Twelfth Session of the IOC Working Committee on International Oceanographic Data Exchange	E, F, S, R
14. Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Havana, 1986	E, F, S
15. First Session of the IOC Regional Committee for the Central Eastern Atlantic, Praia, 1987	E, F, S
16. Second Session of the IOC Programme Group on Ocean Processes and Climate	E, F, S
17. Twentieth Session of the Executive Council, Paris, 1987	E, F, S, R, Ar
18. Fourteenth Session of the Assembly, Paris, 1987	E, F, S, R, Ar
19. Fifth Session of the IOC Regional Committee for the Southern Ocean	E, F, S, R
20. Eleventh Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Beijing, 1987	E, F, S, R
21. Second Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Arusha, 1987	E, F
22. Fourth Session of the IOC Regional Committee for the Western Pacific, Bangkok, 1987	E only
23. Twenty-first Session of the Executive Council, Paris, 1988	E, F, S, R
24. Twenty-second Session of the Executive Council, Paris, 1989	E, F, S, R
25. Fifteenth Session of the Assembly, Paris, 1989	E, F, S, R
26. Third Session of the IOC Committee on Ocean Processes and Climate, Paris, 1989	E, F, S, R
27. Twelfth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Novosibirski, 1989	E, F, S, R
28. Third Session of the Sub-Commission for the Caribbean and Adjacent Regions, Caracas, 1989	E, S
29. First Session of the IOC Sub-Commission for the Western Pacific, Hangzhou, 1990	E only
30. Fifth Session of the IOC Regional Committee for the Western Pacific, Hangzhou, 1990	E only
31. Twenty-third Session of the Executive Council, Paris, 1990	E, F, S, R
32. Thirteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, New York, 1990	E only
33. Seventh Session of the IOC Committee for the Global Investigation of Pollution in the Marine Environment, Paris, 1991	E, F, S, R
34. Fifth Session of the IOC Committee for Training, Education and Mutual Assistance in Marine Sciences, Paris, 1991	E, F, S, R
35. Fourth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1991	E, F, S, R
36. Twenty-fourth Session of the Executive Council, Paris, 1991	E, F, S, R
37. Sixteenth Session of the Assembly, Paris, 1991	E, F, S, R, Ar
38. Thirteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Baja California, 1991	E, F, S, R
39. Second Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1992	E only
40. Twenty-fifth Session of the Executive Council, Paris, 1992	E, F, S, R
41. Fifth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1992	E, F, S, R
42. Second Session of the IOC Regional Committee for the Central Eastern Atlantic, Lagos, 1990	E, F
43. First Session of the Joint IOC-UNEP Intergovernmental Panel for the Global Investigation of Pollution in the Marine Environment, Paris, 1992	E, F, S, R
44. First Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1992	E, F, S
45. Fourteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 1992	E, F, S, R
46. Third Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Vascoas, 1992	E, F
47. Second Session of the IOC Sub-Commission for the Western Pacific, Bangkok, 1993	E only
48. Fourth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Veracruz, 1992	E, S
49. Third Session of the IOC Regional Committee for the Central Eastern Atlantic, Dakar, 1993	E, F
50. First Session of the IOC Committee for the Global Ocean Observing System, Paris, 1993	E, F, S, R
51. Twenty-sixth Session of the Executive Council, Paris, 1993	E, F, S, R
52. Seventeenth Session of the Assembly, Paris, 1993	E, F, S, R
53. Fourteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Tokyo, 1993	E, F, S, R
54. Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1993	E, F, S
55. Twenty-seventh Session of the Executive Council, Paris, 1994	E, F, S, R
56. First Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Melbourne, 1994	E, F, S, R
57. Eighth Session of the IOC-UNEP-IMO Committee for the Global Investigation of Pollution in the Marine Environment, San José, Costa Rica, 1994	E, F, S
58. Twenty-eighth Session of the Executive Council, Paris, 1995	E, F, S, R
59. Eighteenth Session of the Assembly, Paris, 1995	E, F, S, R
60. Second Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E, F, S, R

61.	Third Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1995	E only
62.	Fifteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Papete, 1995	E, F, S, R
63.	Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1995	E, F, S
64.	Fifteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange	E, F, S, R
65.	Second Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E only
66.	Third Session of the IOC Sub-Commission for the Western Pacific, Tokyo, 1996	E only
67.	Fifth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Christ Church, 1995	E, S
68.	Intergovernmental Meeting on the IOC Black Sea Regional Programme in Marine Sciences and Services	E, R
69.	Fourth Session of the IOC Regional Committee for the Central Eastern Atlantic, Las Palmas, 1995	E, F, S
70.	Twenty-ninth Session of the Executive Council, Paris, 1996	E, F, S, R
71.	Sixth Session for the IOC Regional Committee for the Southern Ocean and the First Southern Ocean Forum, Bremerhaven, 1996	E, F, S,
72.	IOC Black Sea Regional Committee, First Session, Varna, 1996	E, R
73.	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Fourth Session, Mombasa, 1997	E, F
74.	Nineteenth Session of the Assembly, Paris, 1997	E, F, S, R
75.	Third Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1997	E, F, S, R
76.	Thirtieth Session of the Executive Council, Paris, 1997	E, F, S, R
77.	Second Session of the IOC Regional Committee for the Central Indian Ocean, Goa, 1996	E only
78.	Sixteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Lima, 1997	E, F, S, R
79.	Thirty-first Session of the Executive Council, Paris, 1998	E, F, S, R
80.	Thirty-second Session of the Executive Council, Paris, 1999	E, F, S, R
81.	Second Session of the IOC Black Sea Regional Committee, Istanbul, 1999	E only
82.	Twentieth Session of the Assembly, Paris, 1999	E, F, S, R
83.	Fourth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1999	E, F, S, R
84.	Seventeenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Seoul, 1999	E, F, S, R
85.	Fourth Session of the IOC Sub-Commission for the Western Pacific, Seoul, 1999	E only
86.	Thirty-third Session of the Executive Council, Paris, 2000	E, F, S, R
87.	Thirty-fourth Session of the Executive Council, Paris, 2001	E, F, S, R
88.	Extraordinary Session of the Executive Council, Paris, 2001	E, F, S, R
89.	Sixth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, San José, 1999	E only
90.	Twenty-first Session of the Assembly, Paris, 2001	E, F, S, R
91.	Thirty-fifth Session of the Executive Council, Paris, 2002	E, F, S, R
92.	Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Lisbon, 2000	E, F, S, R
93.	Eighteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Cartagena, 2001	E, F, S, R
94.	Fifth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2001	E, F, S, R
95.	Seventh Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Mexico, 2002	E, S
96.	Fifth Session of the IOC Sub-Commission for the Western Pacific, Australia, 2002	E only
97.	Thirty-sixth Session of the Executive Council, Paris, 2003	E, F, S, R
98.	Twenty-second Session of the Assembly, Paris, 2003	E, F, S, R
99.	Fifth Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Kenya, 2002 (* Executive Summary available separately in E, F, S & R)	E*
100.	Sixth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, St. Petersburg (USA), 2002 (* Executive Summary available separately in E, F, S & R)	E*
101.	Seventeenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
102.	Sixth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
103.	Nineteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Wellington, New Zealand, 2003 (* Executive Summary available separately in E, F, S & R)	E*
104.	Third Session of the IOC Regional Committee for the Central Indian Ocean, Tehran, Islamic Republic of Iran, 21-23 February 2000	E only
105.	Thirty-seventh Session of the Executive Council, Paris, 2004	E, F, S, R
106.	Seventh Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2005 (* Executive Summary available separately in E, F, S & R); and Extraordinary Session, Paris, 20 June 2005	E*
107.	First Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Perth, Australia, 3-5 August 2005	E only
108.	Twentieth Session of the Intergovernmental Coordination Group for the Tsunami Warning System in the Pacific, Viña del Mar, Chile, 3-7 October 2005 (* Executive Summary available separately in E, F, S & R)	E*
109.	Twenty-Third Session of the Assembly, Paris, 21-30 June 2005	E, F, S, R
110.	First Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Rome, Italy, 21-22 November 2005	E only
111.	Eighth Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Recife, Brazil, 14-17 April 2004 (* Executive Summary available separately in E, F, S & R)	E*
112.	First Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions (ICG/CARIBE-EWS), Bridgetown, Barbados, 10-12 January 2006	E only
113.	Ninth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Cartagena de Indias, Colombia, 19-22 April 2006 (* Executive Summary available separately in E, F, S & R)	E S*

114.	Second Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Hyderabad, India, 14–16 December 2005	E only
115.	Second Session of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology, Halifax, Canada, 19–27 September 2005 (Abridged final report with resolutions and recommendations)	E, F, R, S
116.	Sixth Session of the IOC Regional Committee for the Western Indian Ocean (IOCWIO), Maputo, Mozambique, 2–4 November 2005 (* Executive Summary available separately in E, F, S & R)	E*
117.	Fourth Session of the IOC Regional Committee for the Central Indian Ocean, Colombo, Sri Lanka 8–10 December 2005 (* Executive Summary available separately in E, F, S & R)	E*
118.	Thirty-eighth Session of the Executive Council, Paris, 20 June 2005 (Electronic copy only)	E, F, R, S
119.	Thirty-ninth Session of the Executive Council, Paris, 21–28 June 2006	E, F, R, S
120.	Third Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Bali, Indonesia, 31 July–2 August 2006 (*Executive Summary available separately in E,F,S & R)	E*
121.	Second Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Nice, France, 22–24 May 2006	E only
122.	Seventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 16–18 March 2005 (* Executive Summary available separately in E, F, S & R)	E*
123.	Fourth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS-IV), Mombasa, Kenya, 30 February-2 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
124.	Nineteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Trieste, Italy, 12–16 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
125.	Third Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Bonn, Germany, 7–9 February 2007 (* Executive Summary available separately in E, F, S & R)	E*
126.	Second Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Cumaná, Venezuela, 15–19 January 2007 (* Executive Summary available separately in E, F, S & R)	E*
127.	Twenty-first Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Melbourne, Australia, 3–5 May 2006 (* Executive Summary available separately in E, F, S & R)	E*
128.	Twenty-fourth Session of the Assembly, Paris, 19–28 June 2007	E, F, S, R
129.	Fourth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Lisbon, Portugal, 21–23 November 2007 (* Executive Summary available separately in E, F, S & R)	E*
130.	Twenty-second Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Guayaquil, Ecuador, 17–21 September 2007 (* Executive Summary available in E, F, S & R included)	E*
131.	Forty-first Session of the Executive Council, Paris, 24 June–1 July 2008	E, F, R, S
132.	Third Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Panama City, Panama, 12–14 March 2008 (* Executive Summary available separately in E, F, S & R)	E*
133.	Eighth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 17–20 April 2007 (* Executive Summary available separately in E, F, S & R)	E*
134.	Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Apia, Samoa, 16–18 February 2009 (*Executive Summary available separately in E, F, S & R)	E*
135.	Twentieth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Beijing, China, 4–8 May 2009 (*Executive Summary available separately in E, F, S & R)	E*
136.	Tenth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Puerto La Cruz, Bolivarian Republic of Venezuela, 22–25 October 2008 (*Executive Summary available separately in E, F, S & R)	E, S*
137.	Seventh Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-VII), Sabah, Malaysia, 26–29 May 2008 (*Executive Summary available separately in E, F, S & R)	E*
138.	Ninth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, France, 10–12 June 2009 (* Executive Summary available separately in E, F, S & R);	E*
139.	Fifth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Athens, Greece, 3–5 November 2008 (* Executive Summary available separately in E, F, S & R)	E*