

**Intergovernmental Oceanographic Commission**  
*Reports of Governing and Major Subsidiary Bodies*



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

**Fourth Session**

Lisbon, Portugal

21–23 November 2007

**UNESCO**

**Intergovernmental Oceanographic Commission**  
*Reports of Governing and Major Subsidiary Bodies*

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

**Fourth Session**

Lisbon, Portugal

21–23 November 2007

**UNESCO 2008**

### **Abstract**

The 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 (ICG/NEAMTWS-IV) was held in Lisbon, Portugal, on 21 - 23 November 2007 under the Chairmanship of Prof Stefano Tinti. It was attended by 84 participants from 16 ICG/NEAMTWS Member States, one observer Member State, representatives from 7 organizations, and 36 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) the Working Groups to continue work on their respective tasks in the intersessional period, (ii) Member States to nominate national Tsunami Warning Focal Points (TWFP) and Tsunami National Contacts (TNC) and (iii) Member States to consider hosting a Tsunami Information Centre (TIC) for the NEAM region providing, in particular, an educational resource for the region. The ICG decided (iv) to harmonize methods and eventually software among regional centres and welcomed the initiative of Working Group 2 to provide all available real-time seismic data to Regional Tsunami Watch Centres (RTWC) on the basis of its SeisComp3 software within the next months for the interim NEAMTWS, and (v) to establish a Task Team on NEAMTWS Regional Structure of Tsunami Watch Centres to report back at the next ICG session.

The four intersessional Working Groups on (i) hazard and risk assessment and modelling; (ii) seismic and geophysical measurements; (iii) sea level measurements; and (iv) advisory, mitigation and public awareness each met in the intersessional period and during the Session and provided the ICG with a summary of the existing activities and the requested 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 expressed its support for the establishment of a framework for a global tsunami and other ocean-related hazards early warning system. The ICG decided to organize its Fifth Session in November 2008 and accepted the kind offer of Greece to host it.

(SC-2008/WS/20 rev.)

---

<sup>1</sup> An executive summary of this report (ICG/NEAMTWS-IV/3s) is also available in French, Russian and Spanish on <http://unesdoc.unesco.org>

## TABLE OF CONTENTS

	page
<b>1. OPENING</b> .....	<b>1</b>
<b>2. ORGANIZATION OF THE SESSION</b> .....	<b>1</b>
2.1 ADOPTION OF THE AGENDA .....	1
2.2 DESIGNATION OF THE RAPPORTEUR.....	2
2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION .....	2
2.4 ESTABLISHMENT OF INTRASESSIONAL COMMITTEES .....	2
<b>3. REPORT ON ICG/NEAMTWS INTERSESSIONAL ACTIVITIES</b> .....	<b>2</b>
3.1 OVERVIEW OF THE ACTIVITIES OF THE ICG/NEAMTWS .....	2
3.2 REPORTS ON THE ACTIVITIES OF THE WORKING GROUPS.....	2
3.3 REPORTS FROM OTHER INTERGOVERNMENTAL AND INTERNATIONAL ORGANIZATIONS.....	3
<b>4. IMPLEMENTATION PLAN</b> .....	<b>4</b>
<b>5. NATIONAL ASSESSMENT MISSIONS</b> .....	<b>4</b>
<b>6. REGIONAL TSUNAMI WATCH CENTRES</b> .....	<b>4</b>
<b>7. COMMUNICATION AND INFORMATION INFRASTRUCTURE</b> .....	<b>5</b>
<b>8. COOPERATION WITH OTHER ORGANIZATIONS</b> .....	<b>5</b>
<b>9. WORKING GROUP MEETINGS</b> .....	<b>5</b>
9.1 BREAK OUT SESSIONS .....	5
9.2 REPORTING IN PLENARY .....	5
<b>10. ELECTION OF THE OFFICERS OF THE ICG/NEAMTWS</b> .....	<b>6</b>
<b>11. PROGRAMME AND BUDGET FOR 2008 - 2009</b> .....	<b>6</b>
<b>12. DATES AND PLACE FOR ICG/NEAMTWS-V</b> .....	<b>6</b>
<b>13. ANY OTHER BUSINESS</b> .....	<b>6</b>
<b>14. ADOPTION OF DECISIONS AND RECOMMENDATIONS</b> .....	<b>7</b>
<b>15. CLOSING</b> .....	<b>7</b>

## **ANNEXES**

- I. AGENDA
- II. WORKING GROUP 1: HAZARD ASSESSMENT, RISK AND MODELLING REPORT
- III. WORKING GROUP 2: SEISMIC AND GEOPHYSICAL MEASUREMENTS REPORT
- IV. WORKING GROUP 3: SEA LEVEL DATA COLLETION AND EXCHANGE REPORT
- V. WORKING GROUP 4: ADVISORY, MITIGATION AND PUBLIC AWARENESS REPORT
- VI. TASK TEAM ON NEAMTWS WATCH CENTRES
- VII. DECISIONS AND RECOMMENDATIONS OF ICG/NEATMWS-IV, LISBON
- VIII. LIST OF PARTICPANTS
- IX. LIST OF ACRONYMS

## 1. OPENING

1 Prof. Carlos Matias Ramos, President of LNEC, welcomed the participants to Lisbon and the meeting venue and emphasized the importance of establishing a TWS for Portugal and the NEAM region. He also reported on LNEC activities and research in Coastal Engineering and inundation modelling and wished the delegates a fruitful discussion and successful meeting.

2 Prof. Mario Ruivo, of the Portuguese IOC committee, welcomed the delegates and thanked all national institutions involved in the organization of the 4<sup>th</sup> session of ICG/NEAMTWS in Lisbon. He then stressed the historical link of the maritime location, mentioning the Portuguese seafarers sailing from Lisbon as well the strong earthquake and subsequent tsunami in 1755 which destroyed great parts of Lisbon and caused numerous casualties. He reported briefly on the history of the coordination process established by the IOC as the leading UN agency for operational oceanography.

3 Prof. Stefano Tinti, Chairman of the ICG/NEAMTWS, reminded delegates of the progress achieved so far in the coordination process establishing a TEWS for the NEAMTWS region bridging Europe and North Africa which needs to be better reflected in the Implementation Plan. He also reminded the participants about the announcement during ICG/NEAMTWS-II in Nice and the subsequent common obligation, to have an initial tsunami warning system up and operating by end of 2007.

4 Prof. Cherif Sammari, Vice Chair of the IOC, stressed his support and continuous involvement in the coordination process and the importance for North African Member States of establishing a tsunami warning system (TWS) for the Mediterranean. He also expressed his hope of a stronger North-African representation in future ICG/NEAMTWS sessions.

5 Mr Peter Koltermann, head of the IOC Tsunami Unit, thanked the hosts for setting up the logistics as an essential prerequisite for a successful meeting. He recalled the devastating earthquake and tsunami on December 26, 2004, off the coast of Sumatra which triggered an enormous response and support by countries around the world. This event also instigated the decision of the IOC Assembly XXIII in June 2005 to establish TWS's around the globe. Reporting on the progress reached with the Indian Ocean TWS, he urged Member States to take ownership of the warning system and build upon experiences the IOC gained in establishing and operating TWS's in the Pacific and Indian Ocean. He concluded that the sustainability of the TWS's with little or no return of money in the short term is a difficult dilemma to solve.

## 2. ORGANIZATION OF THE SESSION

### 2.1 ADOPTION OF THE AGENDA

6 The Chairman of the ICG/NEAMTWS introduced the provisional Agenda prepared by the Secretariat (ICG/NEAMTWS-IV/1) and its annotation contained in the present document (ICG/NEAMTWS-IV/2). The Session adopted the proposed Provisional Agenda.

7 Portugal requested information on which Working Groups would meet and the anticipated number of participants for the room allocation and asked for the recommendations to be prepared as a printed document by Friday morning. This was agreed to by the Secretariat.

8 France suggested not to reconvene twice but only to report on the Working Group results to the plenary once at the end of the Thursday. This proposal was seconded by Spain and the UK.

## 2.2 DESIGNATION OF THE RAPPORTEUR

9 According to the IOC Rules of Procedure no. 25.4, Portugal suggested nominating Dr Luis Matias as Rapporteur. This was adopted by acclamation.

## 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

10 The Chairman of the ICG/NEAMTWS introduced the documentation for the meeting. The plenary reviewed and adopted the provisional Timetable (ICG/NEAMTWS-IV/1 Prov) including Working Group meetings in a breakout session followed by a reporting session to the plenary.

11 For agenda item 3.3 Report of Other Intergovernmental and International Organizations, the WMO and the European Commission requested the opportunity to provide reports related to the NEAMTWS process.

## 2.4 ESTABLISHMENT OF INTRASESSIONAL COMMITTEES

12 Prof. Tinti introduced the item and asked France to chair the ad-hoc Nominations Committee to review the nominations received for the Officers of the ICG. Spain and Finland assisted.

# 3. REPORT ON ICG/NEAMTWS INTERSESSIONAL ACTIVITIES

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

13 The Chairman of the ICG/NEAMTWS summarized the main activities and results following ICG/NEAMTWS-III in Bonn, Germany and provided scope and outlook for the future implementation of the NEAMTWS and clarified the scope and possible roles between National and Regional TWCs and their responsibility for near-field and far-field events. Prof. Tinti stressed the importance of the decision of tide-gauge operators in taking the step to operationalization by establishing a common web-based real-time sea-level data system by the end of 2007 as an essential part of the NEAMTWS. However, he admitted that the onset of the initial NEAMTWS might be postponed by a few months. In order to speed up the process he urged Member States to actively participate in the process and provide updates to the Implementation Plan and consider scheduling IOC led missions to assess national capacities for tsunami warning and mitigation.

## 3.2 REPORTS ON THE ACTIVITIES OF THE WORKING GROUPS

14 Dr François Schindele, Chairman of Working Group 1, reported on activities in the intersessional period and especially on the findings and recommendations of the intersessional Working Group 1 meeting in Lisbon. A summary report of that meeting is attached as annex II. He explicitly presented a draft version of the revised decision matrixes on threshold magnitudes for the Mediterranean and the Atlantic Ocean suggested by Working Group 1.

15 Greece expressed their interest in having a careful look at the revised decision matrix before adoption while Italy noted that further recommendations on numerical modelling were not mentioned.

16 Dr Alessandro Amato, Chair of Working Group 2, reported on the discussions and findings of the intersessional working group meeting in Rome. He summarized the recommendations and decisions which focus on the establishment of the operational TWS network and functional roles of possible regional tsunami warning centres. During the initial period 2008 – 2009, the NEAMTWS candidate institutions for RTWCs would join a network of warning centres with GFZ as the backbone data centre. It was also stressed that there is an urgent need to enable access and upgrade data transmission facilities to some of the existing seismic instrumentation which is

not yet accessible in real-time. The report of the intersessional Working Group 2 meeting is attached as Annex III.

17 The presentation was followed by a discussion with contributions from Portugal, Greece, Italy and Israel on the web-based VLIZ/IODE visualization tool for real-time sea-level data.

18 Ms Begoña Perez, Chairperson of Working Group 3, focused on the Working Group actions decided on during the last ICG/NEAMTWS session in Bonn, Germany and reported on the actual status of these items. She reported that only 15 out of 37 proposed sea-level stations are fulfilling the complete requirements of tsunami readiness (1 min data with 1 – 5 min transmission intervals) and only 7 of which are located on the priority sites defined previously. But due to the actual reports provided by several Member States, the NEAMTWS sea-level network will be significantly upgraded by the first quarter of 2008. A detailed report is attached as Annex IV.

19 France suggested considering locations for deep-ocean stations, too, while Israel recommended automatic quality control of sea level data.

20 Mr Russell Arthurton, Chair of Working Group 4, reported on intersessional activities as well as on the ICAM (Integrated Coastal Area Management) expert group meeting which met on November 19 and 20 in Lisbon to mainstream guidelines for awareness and mitigation of marine-related hazards. He focused on recommendations of the Working Group on the role of RTWC's and NTWC's as well as local emergency authorities and stressed the key role of communication pathways and Standard Operating Procedures at all levels of the warning chain. A Working Group report is attached as Annex V.

21 Israel requested to be informed on the status for standardization of emergency and evacuation codes. The Working Group chair indicated that standardization is not very well received by countries, particularly those that recently upgraded their emergency systems while the tsunami glossary, language and signal standardization are under revision within IOC.

### 3.3 REPORTS FROM OTHER INTERGOVERNMENTAL AND INTERNATIONAL ORGANIZATIONS

22 Mr Peter Billing, Head of the Information and Monitoring Department of the DG Environment —Civil Protection— of the European Commission, summarized the activities and decisions of the different units of the EC related to the NEAMTWS coordination process. He stressed the main areas of action, such as risk assessment, detection systems including real-time data sharing, alert dissemination within the European Civil Defence Mechanism and finally preparedness, education and awareness. The European Floods directive, so far, is the only European legal framework supporting the ICG/NEAMTWS coordination process. He indicated that the EC has several funding opportunities to support preparedness, education and awareness, capacity building and drills or exercises while financial support for TWS infrastructure and monitoring is not foreseen.

23 The United Kingdom asked if the European Commission really has a global interest in disaster warning systems. Peter Billing replied that this is correct and mirrored in the global coverage of GDACS. The Commission's activity in this field is triggered by the wish to immediately be informed on global disasters for decision making.

24 Portugal stressed the need to support the north-south capacity building process and asked the EC to assist in this.

25 Finland thanked the representative of the EC for the interesting presentation and expressed his hope that the ongoing coordination activities between the Commission and the



IOC on TWS will be strongly enhanced in the future and also reflected in the Implementation Plan.

- 26 Ms Alicia Soares, representative of the WMO, read an address of the Secretary General of the WMO to the ICG/NEAMTWS-IV. The WMO emphasized that there is a long lasting and intensive collaboration between the IOC and the WMO, for example through JCOMM but also in assisting the IOC in its task to coordinate tsunami warning systems globally by providing WMO's GTS as the backbone communication means for distributing tsunami alert messages and sea-level data. It was announced that plans to upgrade the GTS in the near future are in progress.

#### **4. IMPLEMENTATION PLAN**

- 27 In reporting on the actual status of the Implementation Plan, revised after the 24th Session of the IOC Assembly, the Chairman reminded the plenary that this is a living document and requested the Working Groups to carefully verify that the information provided so far is still up-to-date and to report back to the plenary on Thursday afternoon. The Meeting adopted the revised Implementation Plan as detailed by the Working Group reports.

#### **5. NATIONAL ASSESSMENT MISSIONS**

- 28 Mr Ulrich Wolf, IOC Tsunami Unit, reported on the two assessment missions on national tsunami warning capacity to Ireland and Algeria undertaken in the intersessional period. The report on the Irish mission is already available in the document database of the IOC tsunami website ([www.ioc-tsunami.org](http://www.ioc-tsunami.org)) while the report on the mission to Algeria will be finalized in early 2008. So far Tunisia and Lebanon already indicated interest in tsunami assessment missions as well.

#### **6. REGIONAL TSUNAMI WATCH CENTRES**

- 29 Prof. Tinti introduced the agenda item and reported on the results of the meeting of Working Group 2 with the seismological centres held in Rome at INGV on October 24 and 25, 2007. The main result of this meeting was the recommendation to harmonize algorithms and eventually software among Regional Tsunami Watch Centres (RTWC) by accessing all freely available real-time seismic data at Geoforschungszentrum Potsdam and installing SeisComp 3 for an initial testing phase at the key seismic centres in Europe. The chairman also asked Member States to provide an update on the national decisions to operate RTWC.

- 30 Portugal confirmed that the Instituto Meteorologica is already testing the SeisComp 3 software provided by GFZ.

- 31 The UK reiterated the statement given at the IOC assembly in June and stated that they are giving serious consideration to maintaining and operating a RTWC as a joint initiative among such key agencies as BGS, the UK Met office, POL, and DEFRA as the funding body. Unfortunately the final decision on the funding has not yet been taken. Ireland expressed interest in BGS becoming a RTWC to provide warnings for their territory too.

- 32 Turkey confirmed that their seismic centre, KOERI, is on a 24/7 operations mode already while the government confirmed KOERI will become one of the regional TWC in the Mediterranean. Turkey is also planning to upgrade their instrumentation significantly in the near future.

- 33 Greece also confirmed that with the actual 24/7 operation NOA would fulfil the basic requirements for regional TWCs while Greece is also planning to upgrade the national sea-level and seismic instrumentation networks. Thus they are prepared to act as an RTWC.

34 France announced plans to be prepared to operate a RTWC in cooperation with other partners/Member States following a multi-hazard approach. France proposed establishing a task team on this issue to report to the next ICG session.

35 Germany confirmed already being in the position to act as the offered “background centre” and the data and modelling database focal point as of today. Germany reiterated the offer to provide full real-time seismic data access and software tools to integrate seismic data for tsunami watch/alert for any interested RTWC.

36 The European Commission expressed its interest in supporting the process while the representative was not mandated to give a long-term funding commitment.

37 Based on the extensive discussion on this agenda item the Chairman proposed a drafting group (France, Germany, Italy, and UK) to summarize the discussion and to come up with a potential structure adopting the contributions of the Member State interventions (see terms of reference for the NEAMTWS task team in Annex VI.

## **7. COMMUNICATION AND INFORMATION INFRASTRUCTURE**

38 The Chairman considered that the communication and information infrastructure is already part of the Implementation Plan, the Working Group’s activity reports as well as part of the mandate given to the new Task Team, and thus did not require further discussion. This was adopted by the meeting.

## **8. COOPERATION WITH OTHER ORGANIZATIONS**

39 This agenda item was implicitly tackled under 3.3 and no further organizations asked for the floor.

## **9. WORKING GROUP MEETINGS**

### **9.1 BREAK OUT SESSIONS**

40 The plenary broke into the four Working Groups, with a view to elaborate proposals for concrete actions and recommendations.

### **9.2 REPORTING IN PLENARY**

41 The Chairpersons of the Working Groups, Mr François Schindele for Working Group 1, Mr Alessandro Amato and Ms Winfried Hanka for Working Group 2, Ms Begoña Perez for Working Group 3 and Mr Russell Arthurton for Working Group 4 summarized the discussion and findings of the breakout session. Detailed reports are attached as Annexes I - IV.

42 With respect the detailed offer from GFZ reported by Working Group 2, several Member States raised a number questions focusing on communication redundancy optimization of warning procedures. Spain recommended that oceanographic expertise for interpretation of sea-level measurements should be ensured in the RTWCs.

43 France expressed its concern that VLIZ/IODE Oostende is not an operational institution to ensure a long-term and reliable solution for the sea-level component of the NEAMTWS. The Secretariat explained the interim nature of the offer by VLIZ but also emphasized that in the near future no European tide gauge operator is planning to extend their service to a 24/7 operation. For this particular service in automatically collecting, ensuring distribution via GTS and visualizing of sea-level data no 24/7 operation is needed.

44 Israel recommends that Working Group 4 investigate mitigation issues in greater detail.

## **10. ELECTION OF THE OFFICERS OF THE ICG/NEAMTWS**

45 Following the report of the Nominations Committee on the status of the nominations, the meeting conducted the election of the Officers of the ICG/NEAMTWS for the term 2008 - 2009. As there was only one nomination for Chairman, Italy was confirmed by acclamation to act as Chairman of ICG/NEAMTWS for another two-year period.

46 Among the original four nominations for Vice-Chairpersons the nomination from Egypt was withdrawn during the session, which left three nominations for two Vice-Chair positions. The ballot among the 15 eligible Member States resulted in the following:

Greece: 15

Portugal: 8

United Kingdom: 6

Abstained: 1

with Greece and Portugal as Vice-Chairpersons for the next period.

47 The Working Group chairpersons were confirmed as is - with the information from Italy that the former director of the seismic centre within INGV, Mr Alessandro Amato, has been replaced by Mr Giulio Selvaggi who consequently is nominated by Italy to take over the responsibility to chair Working Group 2.

## **11. PROGRAMME AND BUDGET FOR 2008–2009**

48 The Head of the Tsunami Unit of the IOC Secretariat reported on the agenda item. So far no UNESCO/IOC regular budget and only some minor extra-budgetary funding were provided for the ICG/NEAMTWS. Triggered by an initiative of some IOC Member States led by Brazil, the UNESCO General Assembly decided to provide an additional 500,000 USD to the IOC. While approximately 200,000 USD of this budget are allocated for the IOC Tsunami Unit. As this is not sufficient to cover all expenses for all regional coordination bodies, Member States are invited to consider extra-budgetary support to IOC/TSU.

## **12. DATES AND PLACE FOR ICG/NEAMTWS-V**

49 The Chairman expressed his view that as important actions will be implemented in the near future there is a need to facilitate the next steps by an ICG session within the next 6 months. Portugal, France, Italy and the UK suggested having some more lead-time for the Working Groups to act and report on. Greece reiterated the offer to host the next meeting in Athens but expressed concern for the planned timing in late summer as there are conflicting meetings and conferences scheduled. Thus he offered late October as a possible timing. This offer was gratefully adopted by the plenary.

50 Portugal noted the importance of the intersessional period. Activities are to be encouraged and the meeting agendas should be circulated well in advance.

## **13. ANY OTHER BUSINESS**

51 The plenary had no other business to discuss.

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

52 Mr François Gerard, the Chairman of the TOWS, introduced a draft outline and Terms of Reference to establish a task team on NEAMTWS watch centres (Annex VI). Portugal, Finland, Greece and the UK thanked the drafting group for the proposal and suggested several changes which were incorporated in the document before adoption.

53 The plenary discussed in detail actions and recommendations based on the findings of the Working Group meetings which are attached as Annex VII.

54 Finland expressed serious concern on the modified timeline and, in view of the interest and involvement of the European Commission in the NEAMTWS coordination process, the onset of the initial NEAMTWS should not be shifted without a clear date and perspective.

#### **15. CLOSING**

55 The meeting was closed on Friday, 23 November 2007 at 15h00.

ANNEX I

**ADOPTED 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 INTRASESSIONAL COMMITTEES
- 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 REPORTS FROM OTHER INTERGOVERNMENTAL ORGANIZATIONS
- 4. IMPLEMENTATION PLAN**
- 5. NATIONAL ASSESSMENT MISSIONS**
- 6. REGIONAL TSUNAMI WATCH CENTRES**
- 7. COMMUNICATION AND INFORMATION INFRASTRUCTURE**
- 8. COOPERATION WITH OTHER ORGANIZATIONS**
- 9. WORKING GROUP MEETINGS**
  - 9.1 BREAK OUT SESSIONS
  - 9.2 REPORTING IN PLENARY
- 10. ELECTION OF THE OFFICERS OF THE ICG/NEAMTWS**
- 11. PROGRAMME AND BUDGET FOR 2008-2009**
- 12. DATES AND PLACE FOR ICG/NEAMTWS-V**
- 13. ANY OTHER BUSINESS**
- 14. ADOPTION OF DECISIONS AND RECOMMENDATIONS**
- 15. CLOSING**

ANNEX II

**WORKING GROUP 1: HAZARD ASSESSMENT, RISK AND MODELLING  
REPORT FOR ICG/NEAMTWS-IV**

Chairperson: Francois Schindele, CEA, France  
Mauricio Gonzalez, Univ. Of Cantabria, Spain

Participants: Teresa Ferreira, Azores Univ., Portugal  
Rachid Omiza, Portugal  
Vania Lima, FCUL, Portugal  
Fernando Carrilho, Met Inst., Portugal  
Maria Anna Baptista, FCUL, Portugal  
Stefano Tinti, Univ. of Bologna, Italy  
Alessandra Maramai, INGV, Italy  
Joern Behrens, AWI, Germany  
S. Rosen, A. Salomon, Israel  
A. Sursock, Lebanon  
A. Annunziato, EC-JRC  
M. Terrier, France  
G.A. Papadopoulos, Greece  
U. Kanoglu, Turkey  
L. M. Victor, Portugal

The working group met on November 22 at the Instituto de Meteorologica in Lisbon to discuss

- Possible updates for the NEAMTWS Implementation Plan
- Revision of the decision matrix for tsunami warnings in the region
- Recommendations to the ICG plenary derived from the 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, meaning 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 Working Group, the participants agreed upon the following recommendations:

1. The Working Group recommends considering two different levels of threat:

	Watch	Alert/Warning
<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	Watch impact + coastal inundation

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

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

**Mediterranean:**

<b>Depth</b>	<b>Location</b>	<b>(Mw)</b>	<b>Tsunami Potential</b>	<b>Bulletin Type</b>
< 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 Watch
		6.5 to 7.0	Potential for a destructive regional tsunami < 400 km	Regional Tsunami Alert/Warning Basin-wide Tsunami Watch
		≥ 7.0	Potential for a destructive basin-wide tsunami > 400 km	Basin-wide Tsunami Alert/Warning
	Inland (> 30 km)	5.5	No tsunami potential	Information Bulletin
≥ 100 km	All Locations	≥ 5.5	No tsunami potential	Information Bulletin

**NE Atlantic:**

<b>Depth</b>	<b>Location</b>	<b>(Mw)</b>	<b>Tsunami Potential</b>	<b>Bulletin Type</b>
< 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 Watch
		7.5 to 7.9	Potential for a destructive regional tsunami < 1000 km	Regional Tsunami Alert/Warning Ocean-wide Tsunami Watch
		≥ 7.9	Potential for a destructive ocean-wide tsunami > 1000 km	Ocean-wide Tsunami Alert/Warning
	Inland	5.5	No tsunami potential	Information Bulletin
≥ 100 km	All Locations	≥ 5.5	No tsunami potential	Information Bulletin

2. A task concerning update criteria must be added in the action items table
3. A task concerning guidance for cancellation policy must be added in the action items table
4. The terms of Watch and Warning could be modified :
  - nearshore related alert
  - inland related alert
5. Additionally recommends asking the IOC secretariat to provide a generic NEAMTWS web-space for important documentation separated from the documentation sites for the ICG sessions
6. Recommends having annual NEAMTWS sessions in the future while Working Groups should meet at least once in the intersessional period
7. Turkey and Germany are volunteering to provide material about benchmarking the numerical inundation models
8. Turkey is volunteering to provide standards for bathymetric topographic data sets

The group agrees the initial decision matrix which is solely based on seismic information will have to be replaced by a more detailed operations procedure when more RT data from other instrumentation networks (sea-level, GPS, satellite data,...) and numerical will be available.



## ANNEX III

### **WORKING GROUP 2: SEISMIC AND GEOPHYSICAL MEASUREMENTS REPORT FOR ICG/NEAMTWS-IV**

Prepared by A. Amato and W. Hanka

#### **Terms of reference:**

The working group is responsible for defining, based on existing organizations and functions, a transnational seismic network as part of early warning tsunami detection instruments in seismically active coastal areas and providing recommendations on the data processing and analysis.

#### **Priority Activities for 2007**

Priority Activities for 2007 were set according to the resolution of NEAMTWS III in Bonn. Here below a short description of the activities of the last months, reported and discussed in a technical workshop held in Rome on October 2007. Participants attended from France, Germany, Greece, Ireland, Israel, Italy, Lebanon, Malta, Portugal, Spain, Tunisia, Turkey, and the United Kingdom. Representatives from UNESCO/IOC also attended the meeting.

A list of participants is attached to this report (Rome-ListOfParticipants.pdf)

#### **1. Technical coordination meeting for regional centre procedures**

In October 2007, a coordination meeting was held in Rome. The meeting covered most issues of the seismological procedures that need to be adopted for a future regional centre. Attached to this file is a list of the presentations given at the Rome meeting. The topics covered are i) network status (see below); ii) presentations of existing experience (Pacific, JMA, etc.); iii) the on-going development of the GITEWS (see below) and the ; iv) technical issues on hypocentral locations and magnitude determinations. Participants from many countries of Europe, the Mediterranean and the Atlantic participated to the workshop. A list of recommendations was prepared during the workshop.

#### **2. Network inventory and check of real-time data availability.**

During the Rome meeting, many of the network operators presented the status of the operating networks operating. The general impression was that in most countries, including those not yet connected with the VEBSN or with other regional networks, the development was impressive. Besides the countries where the seismic data are already totally or partially open, modern broad band networks are already operating or are under development in Morocco, Algeria, Tunisia, Libya, Egypt, Lebanon, as well as in other countries of the Mediterranean and northeast Atlantic. It is really important that the UNESCO/ IOC push on the various countries to leave the data exchange increase. Moreover, in the week immediately preceding the NEAMTWS IV of Lisbon, a meeting will be held in Rabat, related to the EC-Project EERWEM (Earthquake monitoring and Earthquake Risk in Western Mediterranean), led by EMSC, ORFEUS and ROA. This project aims at improving the monitoring of the Western Mediterranean and wants to increase awareness on the issues associated to the establishment of a tsunami warning system in the area.

It was recognized that at the present stage Internet real-time connections among data centres, although not considered the best solution, are necessary and will be adopted for the interim system.

### **3. Identification of key backbone stations upgrade proposed.**

Again during the Rome meeting it the need for connecting existing or new broad band seismic stations from North Africa countries was emphasized the need for connecting existing or new broad band seismic stations from north Africa countries, also considering the high number and quality of seismic stations recently developed in many countries. INGV referred discussed an official visit to the Libyan Center for Remote Sensing and Space Science that manages the Libyan seismic network. We It is hoped that UNESCO could help in this.

### **4. Exploring possibilities and best practices for earthquake location and magnitude**

During the Rome workshop, the basic problems related to earthquake locations and magnitude determinations were discussed. Also, presentations concerning the existing and developing TWS helped in comparing the different views of the problems. Specific developments were carried out at the INGV MedNet data centre which is running automatic locations and magnitudes (using the Autoloc software) in the whole Mediterranean region, using public and non-public seismic stations. A similar task is under test at BGS for the Atlantic ocean and at GFZ on a global scale and for Indonesia and the Indian Ocean (see below). A simulation applied to the February 12, 2007, M6.1 earthquake offshore Portugal was published recently by Olivieri and Scognamiglio on Geophysical Research Letters. Other articles concerning the rapid magnitude estimate were published by Lomax, Michelini and Piatanesi in 2007 on GRL, and by Lomax and Michelini (submitted). GFZ has proven its expertise in establishing operational earthquake monitoring systems for tsunami warning purposes within the GITEWS project in Indonesia, where a prototype monitoring system on basis of GFZ's Seiscomp 3 software was installed in May 2007. This system is operated since then successfully in 24/7 mode in Jakarta jointly by BMG (Indonesian Agency for Meteorology and Geophysics) and GFZ. It was able to determine location, depth range and magnitude of the Bengkulu tsunamigenic earthquake of September 12 sufficiently precise within 4 minutes after origin leading to the first tsunami alert for Indonesia issued well below the intended 5 minute time limit. An essential development for this success was the introduction of the newly calibrated broadband magnitude mB, for which the applicability was extended from originally teleseismic distances only down to 5 degrees. Based on this experience, GFZ offered to act as a central background data centre for the NEAMTWS interim system which collects and processes all available real-time seismic data and provides data feeds and processing results to the regional TWC's on basis of its Seiscomp 3 software. INGV, BGS (not 24/7 yet), NOAA and KOERI are prepared to be part of a prototype network of regional centres for the period 2008-2009, limited to the seismic alert at the beginning.

### **5. Technical scheme for VSAT backbone and required budget.**

Presentations of the various networks operating in the different countries showed two views, which must be complimentary at this stage at least. The first one is the adoption of commercial hardware and software for VSAT transmission, namely the Nanometrics Libra system used in Spain, Italy, Albania, Lybia, Egypt and other countries. The other approach includes seismic stations connected with leased VSAT links, as proposed by GFZ and also tested by INGV. Although the second solution is in principle more convenient, particularly for its lower cost, at the present stage all the existing networks are needed and the private connections will still be still used to transfer data from the remote stations to the national data centres. Internet-based links will then be used to transfer data from one national centre to the others. In the meantime, the need for new installations in some selected high priority sites, where the new VSAT connections will be adopted it is recognized the need for new installations in some selected high priority sites, where the new VSAT connections will be adopted. Therefore GFZ is offering its new VSAT facility dedicated to the acquisition of reliable real-time data from GEOFON stations in the Mediterranean for the NEAMTWS backbone also for the collection of selected

other stations in Northern Africa. It may also be considered to extend this facility for general use in the NEAMTWS backbone may also be considered.  
More details on the topics discussed at the Rome meeting can be found in the presentations (see list and location below).

### Activities and time frame of WG2 for future Regional TWC's

<b>Inst.</b>	<b>Duties Extra Respons.</b>	<b>When</b>	<b>Region</b>
INGV (Italy)	Auto Locations-Mag Test	On-going	Mediterranean
	Revised Locs-Mag-info	On-going	Italy
	Automatic Moment tensors	On-going	Mediterranean
	Message delivery	3 months	Mediterranean
	Including sea-level data	when available	NEAM
KOERI (Turkey)	Auto Locations-Mag Test	On-going	Ae,BI,Mr,EM
	Revised Locations-Mag	On-going	"
	Automatic Moment tensors	6 months	"
	Message delivery	on-going	"
	Including sea-level data	when available	"
NOA (Greece)			
GFZ (Germany)	Auto Locations-Mag	On-going	Globally
	Revised Loc.-Mag	On demand	"
	Emails, web, etc.	On-going	"
	Including sea-level data	when available	NEAM
BGS (UK)	Auto Locations-Mag	On-going	NE Atlantic
	Revised Loc.-Mag	Not yet	"
	Emails, web, etc.	not yet	
IM (Portugal)	Auto Locations-Mag Test	On-going	NE-Iberia
	Revised Locations-Mag	On-going	"
	Message delivery/public.		

ANNEX IV

**WORKING GROUP 3:  
SEA LEVEL DATA COLLECTION AND EXCHANGE, INCLUDING OFFSHORE TSUNAMI  
DETECTION INSTRUMENTS  
REPORT FOR ICG/NEAMTWS-III**

November 20, 2007, Lisbon

14 Participants, 10 Member States:

Co-Chairpersons: Begoña Pérez, Spain, and A.K. Yelles Chaouche, Algeria (not present).

Attendees:

Laura Beranzoli, Istituto Nazionale di Geofisica e Vulcanologia, Italy  
Vibeke Huess, Danish Meteorological Institute, Denmark  
Anna v. Gyldenfeldt, BSH, Germany  
Jose Onofre, Instituto Hidrografico, Portugal  
Joana Reis, Instituto Hidrografico, Portugal  
Dov S. Rosen, Israel Oceanographic and Limnological Research, Israel  
Alice Soares, WMO  
Hans Dahlin, EuroGOOS  
Dave Smith, Porudman Oceanographic Laboratory, UK  
Begoña Pérez, Puertos del Estado, Spain  
Claudia Cardoso, Secretary of State for Civil Protection, Portugal  
Belén Martín Míguez, IOC-UNESCO  
Thorkild Aarup, IOC-UNESCO  
Ronan Créach, SHOM, France

**Terms of reference**

“The working group will be responsible for defining, based on existing organizations and functions, a transnational sea level and marine network that can be integrated in an early warning tsunami detection system, as well as for providing recommendations on the data processing and analysis, provide a list of possible sea level stations for the ITWS, report on status and needs of upgrade, and final requirements on priority of site”

**Intersessional activities and progress achieved since ICG NEAMTWS III**

The Action Plan decided in NEAMTWS III- Bonn focused on:

- Installation and upgrade of an initial backbone network of coastal sea level stations to be operational by the end of 2007
- Upgrade of additional sea level stations to the system based on the WG3 proposed list and national needs during the second stage of the implementation plan (end of 2011).
- Design and implementation of the network of deep ocean sea level monitoring stations to be also in operation by the end of 2011.
- Agreement on data format standards before the end of 2007, and test of GTS real time codes for sea level
- Proposal on Regional Data Centers for reception and quality control of sea level data

These general points translated into the list of tasks presented in the following table.

Table 1. List of Tasks for the intersessional period (P, Planned; C, completed; O ongoing).

<b>Task/Milestone</b>	<b>Country/ Location</b>	<b>Responsible</b>	<b>Timeline</b>	<b>Status</b>
1. <i>Final selection of initial stations to be upgraded/installed within 2007</i>	Regional	Member States	NEAMTWS-III	C
2. Inclusion as an action item to be discussed in the IOC General Assembly the commitment of the Member States with the selected stations	Regional	Member States	NEAMTWS-III	P
3. Completion of survey on data transmission of existing sea level stations in NEAMTWS region	Regional	ESEAS	2007	O
4. <i>Report on initial sea level stations status and needs of upgrade</i>	Regional	Spain	NEAMTWS-III	C
5. <i>Final requirements on the priority of the sites</i>	Regional	WG1	NEAMTWS-III	C
6. Existing offshore instrumentation report	Regional	2007	Israel, France	O
7. Standard format description for sea level	Member States		May 2007 (by IOC-XXIV)	D
8. Test of the GTS new codes for real time transmission of sea level data	Regional	Spain	September 2007	D
9. Upgrade / install backbone network sea level sensors for the ITWS	Member States	Member States	December 2007	O
10. <i>Selection of deep ocean stations to be part of the final TWS (2011)</i>	Regional	Italy	2007	C
11. <i>Organization of a meeting of existing sea level organizations (GLOSS, MedGLOSS, ESEAS, EuroGOOS...) for proposals on the RTWC for sea level</i>		IOC	April 2007	C
12. Upgrade national sea level networks for the NEAMTWS	Member States	Member States	2011	P
13. Establish deep ocean sea level monitoring stations	Member States	Member States	2011	P
14. Upgrade national (enhanced) sea level networks tailored to specific national needs.	Member States	Member States	2011	P
15. Support WG1 to access historic sea level data in the region	Regional	Norway	2011	P
16. List of institutions with sea level data	Regional	Norway	2007	P

## Summary of discussion during the breakout sessions

The working group met on November 20<sup>th</sup> 2007 at the Instituto de Meteorologia in Lisbon to discuss several issues in advance to the plenary.

The NEAMTWS Implementation Plan was revisited, and more in particular the list of coastal sea level priority sites to be upgraded/installed by 2007 for the Initial Tsunami Warning system. Due to the short time available, an initial set was selected based on the identification of sea level stations that presented some sort of automatic data transmission (near real time). The next step was asking the institutions in charge of the selected stations about the actual status, plans of upgrading and availability of data, as well as their agreement with the selection.

This list initially consisted of 34 stations. By the time of the Lisbon meeting only a few of them were ready to take part of the system. However, during the breakout session, news concerning the next upgrading of new sites in countries such as Italy, Greece, Malta, Algeria, Portugal, Ireland and UK were also received and incorporated. The final map (Figure 1) includes 70 coastal sea level stations that could potentially participate in the system.

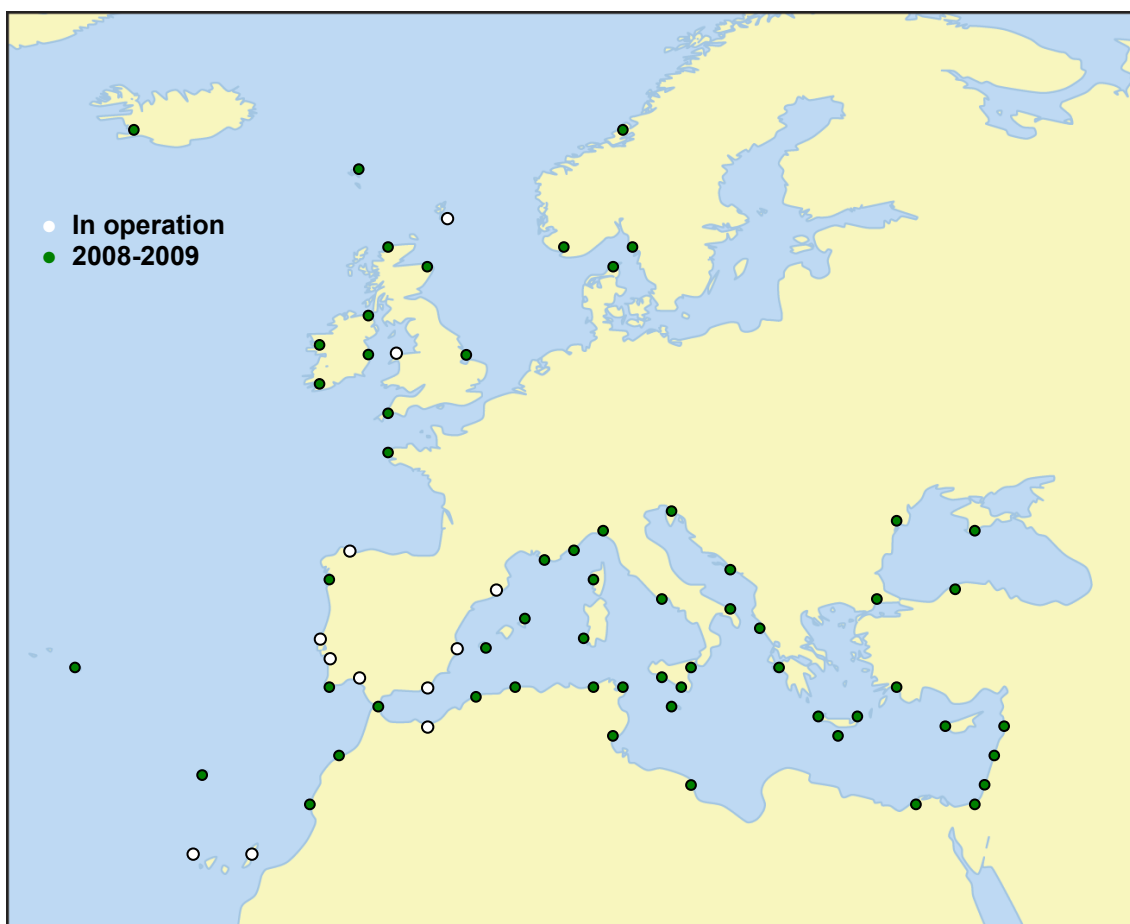


Figure 1. Selection of coastal sea level stations to be part of the system agreed upon during the ICG/NEAMTWS III meeting. White dots correspond to the ones which are already available to become part of the system (12 out of 70).

A detailed breakdown can be found in the updated Implementation Plan for NEAMTWS. North Africa was identified as one of the regions with lack of information and where a bigger effort must be done to densify the sea level network.

The need to integrate sea level data in the WMO's GTS was also highlighted. However, up to present there has been no progress concerning the standard format and use of GTS due to a problem of communication with WMO.

Concerning the network of deep ocean stations for the NEAMTWS, there are a number of priority sites: North of Algeria, South of Hellenic Arc, Azores, Gulf of Cádiz, Marmara Sea and South Eastern Mediterranean (Figure 2). Some discussion on the type of funding needed to support these sites was undertaken. The European Research Infrastructure EMSO can be a reference for the location of sea floor observatories equipped with tsunami detection sensors.

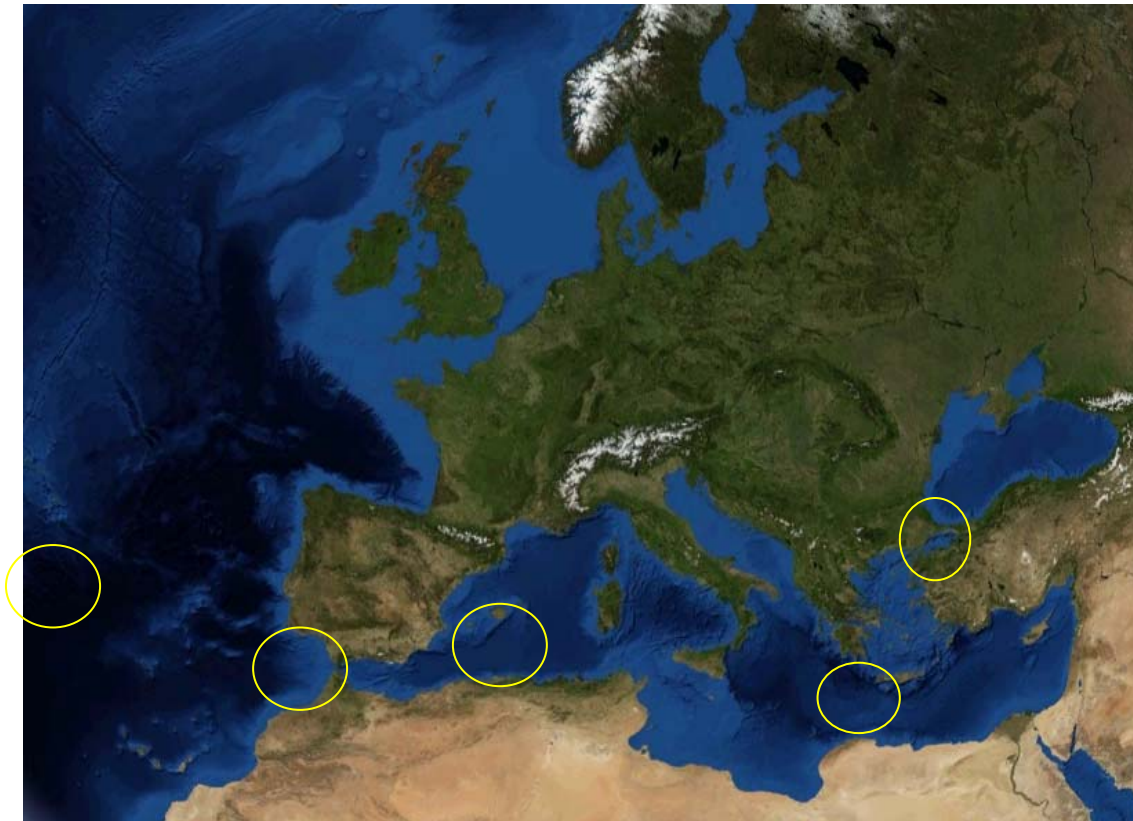


Figure 2. Priority sites for establishment of offshore sea level instrumentation for NEAMTWS, as proposed by WG3.

Finally, on October 2007, a consultation/coordination meeting between representatives of existing/planned operational real time sea level operator groups and projects in support of the NEAMTWS was held in Paris. During the Lisbon breakout session, the list of recommendations after Paris meeting was reviewed and approved. These recommendations were presented to the plenary and are listed below.

### **Recommendations to the Plenary**

1. Produce a map of the sea level station network to be included in final/minimum NEAMTWS.
2. Update the NEAMTWS implementation strategy to fully reflect the implementation goals in terms of sea level network and requirements of sea level stations.

3. Inform that the group re-examined the requirement specifications concerning RT tide gauges as stated in NEAMTWS Implementation Strategy and approved of these requirements for the Interim NEAMTWS system.
4. Ask the Regional Watch Centers to include the reception and visualization tool for sea level data from Tide gauges of the system, to guarantee 24/7 operation. Explore other options within the Sea level community (such as VLIZ-IOC/IOLD Project Office in Ostend) if no positive answer.
5. Organization of specific training on sea level data interpretation for staff on shift in the Regional Tsunami Watch Centre(s) and National Tsunami Warning Centre(s) (IOC)
6. Assist in facilitating contact with national authorities and tide gauge operators towards the establishment of the NEAMTWS sea level stations (IOC, CIESM, MedGOOS and MedGLOSS).
7. Maintain an updated survey on the status of sea level networks in the NEAMTWS region (EDIOS, BODC).
8. Member states should provide funding for upgrading/installation of sea level stations for real time data submission.
9. Consider how to best obtain access to GLOSS real time sea level data from the far field (i.e. Caribbean, Canada...)



## ANNEX V

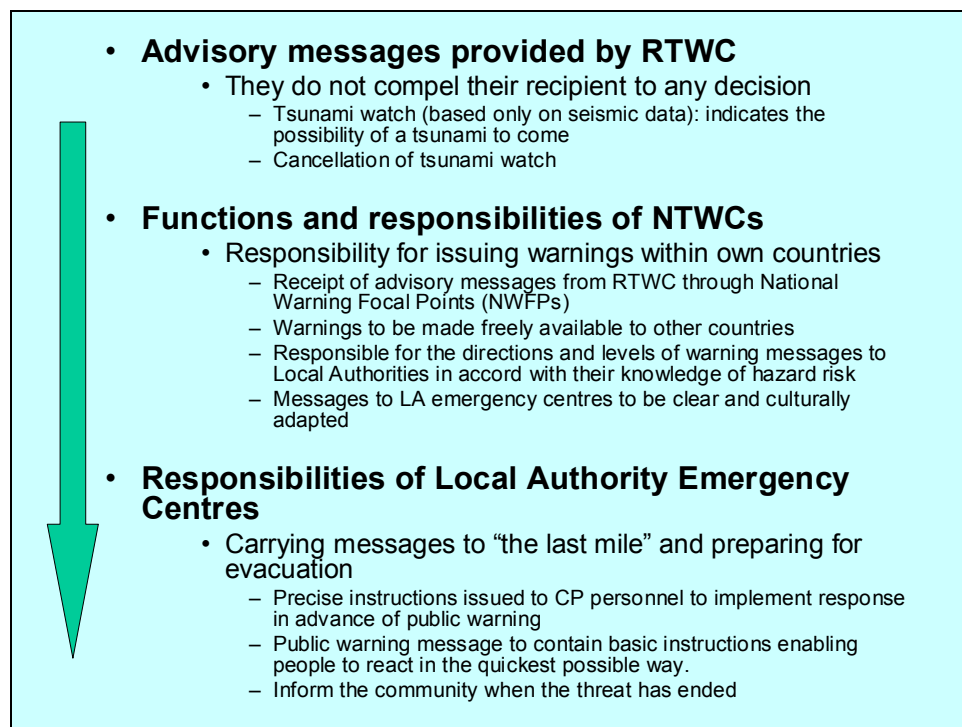
### WORKING GROUP 4: ADVISORY, MITIGATION AND PUBLIC AWARENESS REPORT FOR ICG/NEAMTS-IV

#### Terms of Reference and Intersessional Activities

The WG was tasked at NEAMTWS III in Bonn with the submission of recommendations for the Initial Tsunami Warning System (ITWS) in the fields of Warnings, Emergency Preparedness and Response, and Communications. In addition, the WG has hosted a project being carried out by an IOC Expert Group on the production of global Guidelines for “Mainstreaming awareness and mitigation of marine-related hazards and risks within Integrated Coastal Area Management (ICAM)”. Only a brief summary of progress on this action is provided in this report. Another task was the organization of a workshop on stakeholder participation in marine-related hazards mitigation processes. The recommendations and Guidelines are currently in draft.

#### Recommendations on Warnings

Whatever the nomenclature, there are likely to be limitations and uncertainties in the performance of the system during the Initial phase of the TWS (ITWS). There is particular concern over the handling by RTWCs of false alarms and their possible negative impacts on recipient countries. The uncertainties arise because of the lack of sea-level data in the ITWS, without which neither confirmation nor cancellation of a tsunami watch advisory can be effected.



Box 1: Advisory and warning functions and selected responsibilities of the operational elements of the NEAMS Initial TWS (ITWS)

### Advisory messages provided by Regional Tsunami Watch Centres (RTWCs)

RTWCs will issue to NTWCs, through National Warning Focal Points, advisory messages of potential tsunamigenic events. These are explicit statements expressed in common language about the possible occurrence of a tsunami (Figure 1). In the ITWS, these messages are based exclusively on seismic information received by the RTWC. Such messages must be concise. They do not compel their recipient to any decision.

- Tsunami watch (based on seismic data): indicates the possibility of a tsunami to come,
- Cancellation: cancels the *tsunami watch* message

A decision matrix, indicating the different levels of tsunami advisory messages to be issued on the basis of information received about the earthquake magnitude and location, is in preparation by Working Group 1 of the ICG NEAMTWS.

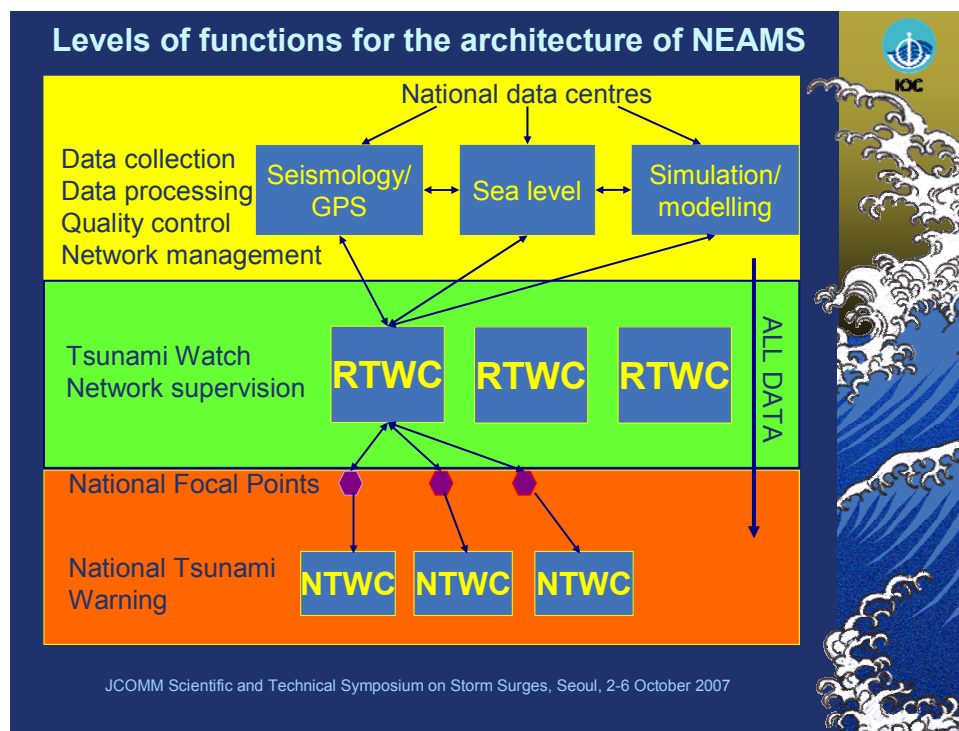


Figure 1: Levels of functions for the architecture of NEAMTWS

### Functions and responsibilities of Tsunami Warning Focal Points (NWFPs) and National Tsunami Warning Centres (NTWCs)

The following is a provisional list of recommendations covering the receipt of watch messages by countries from a RTWC and the dissemination by NTWCs of warnings to those at risk of a tsunami impact.

- Countries receive tsunami watch messages through a Tsunami Warning Focal Point (NWFP). The Warning Focal Point operating 24/7 is an essential element of the TWS.
- National Tsunami Warning Centres, through their Tsunami Warning Focal Points, operate 24/7 and will receive tsunami advisory messages issued by RTWCs.
- NTWCs are responsible for issuing tsunami warnings within their own countries. However, Member States may choose, through bilateral arrangements with RTWCs, to transfer to RTWCs a mandate of authorization to issue tsunami warnings within their countries.

- Rapid response facilities for issuing tsunami warnings should be a key feature of NTWCs in view of the short lead times.
- Tsunami warnings issued by NTWCs should be made freely available to other countries.
- Some NTWCs may derive tsunami warnings from their own country's primary seismic and sea-level observations and seismic and ocean models.
- NTWCs are responsible for the directions and levels of tsunami warning messages to local authorities in accord with their knowledge of hazard risk. Tsunami warning messages should be geographically-specific to ensure warnings are targeted only to those at risk.
- The level(s) of tsunami warnings issued by NTWCs may be determined by the decision support matrix as being developed in NEAMTWS Working Group 1.
- The distribution of tsunami warning messages by NTWCs to local authority emergency centres should be clear, easy to understand and culturally adapted, as appropriate.
- NTWCs should accommodate tsunami warnings within their existing emergency alert-level frameworks (notably for flood warnings and their respective institutional response triggers) as employed by Civil Protection agencies in most Member States, or create a new framework, if necessary.

### **Responsibilities of local authority emergency centres**

Carrying messages to the all-important “last mile” and preparing for evacuation (which may be horizontal, or vertical into secure refuges)

- Precise instructions should be issued to operational personnel (Civil Defence or security/safety staff of critical facilities) to implement the response to a tsunami warning. These orders must be launched before public warning since the operational personnel may need to manage the population in evacuation.
- A public warning message, broadcast to the whole population by mass-media, must contain basic instructions enabling people to react in the quickest possible way and to save their life.
- The alert definitions must be readily available to emergency response agencies and to the general public, and everyone must know and understand these definitions, ‘what is happening’, ‘what it means for them’ and ‘what they can do’.
- Mechanisms need to be established to inform the community when the threat has ended.
- It may be important within particular countries to consider whether provinces may issue warnings autonomously or whether such warnings should stem only from the NTWC.

### **Standards in advisory messages and warnings**

The ISDR Global Survey of Early Warning Systems: <http://www.unisdr.org/ppew/info-resources/ewc3/Global-Survey-of-Early-Warning-Systems.pdf> has recognised “Inadequately standardised nomenclature, protocols and standards nationally and internationally”. A source of confusion in warning dissemination is that different issuers of alerts within a single early warning system may use different protocols for issuing alerts, resulting in varying standards in language, messages and other aspects of warnings. People may not understand the warning, as warning terminology tends to be confusing. Alert stages, which are often expressed in colours or numbers (such as green, yellow, orange, red or I, II, III, IV) vary by country, leading to problems in translating alert stages across territorial and linguistic boundaries, creating confusion on the level of risk. There is a need for a single, consistent, easily understandable,

global nomenclature to be used as a standard by all issuing authorities across all hazards and risk situations.

### **Recommendations on Preparedness**

The recommendations focus on the particular actions that are relevant to preparing for and responding to far-field tsunami events within ITWS. They should be regarded as a supplement to the preparation and response actions that are already covered by countries' Civil Protection arrangements.

Key features of tsunami events in the NEAM region are:

- their unpredictability
- the short times (30 minutes to 2-3 hours in the Mediterranean, up to several hours in the Atlantic) for emergency response between tsunami detection and coastal impact
- the sea-level drawdown as a precursor to the main inundation event
- the potential inland extent (and run-up), severity and destructive power of the inundation
- the damaging potential of debris-charged seaward drainage after the inundation

### **Improving risk assessment**

While some countries are well aware of the risks that tsunamis pose for their coastal communities, it is recommended that all countries and local authorities review their risk levels. These may be based on:

- historical tsunami “frequency” and “magnitude” information and regional tsunami propagation modelling,
- local tsunami inundation modelling (coastal terrain, bathymetry, natural and engineered defences, etc.), and
- vulnerability assessments, taking into account population density, vulnerable groups (especially children and elderly), infrastructure, critical facilities institutional resilience, etc.

The assessment process allows potential risk “hot spots” to be identified, so that emergency managers can target efforts towards preparedness, with resources allocated accordingly. Further information on tsunami hazard risk assessment is being compiled in the forthcoming IOC Guidelines on “Mainstreaming the awareness and mitigation of marine-related hazards and risks within ICAM (Integrated Coastal Area Management)” (IOC, in preparation).

### ***Vulnerabilities, SOPs, EOCs and legal aspects***

SOPs (Standard Operating Procedures) should be updated to include tsunamis. SOPs should be developed by each agency, in particular, critical facilities within high risk zones. In coastal cities, these may include police departments, schools, health centres and hospitals, energy and telecommunication facilities and mass transport systems. Warnings should reach these critical facilities, places which congregate vulnerable groups in exposed areas (children in schools which may be located in exposed areas, for example) as well as shore locations where people congregate – beaches, tourist and commercial areas including markets, train and bus stations – to begin the anticipated responses as soon as possible.

National and local authorities are encouraged to review the coordination of their various agencies of the emergency services. Recent marine-related disasters in developed and developing countries alike have exposed significant weaknesses in coordination which have contributed to loss of life. Because local authorities are responsible for the coordination of many aspects of emergency management, a Command Post or an Emergency Operations Centre

(EOC) should be activated.

Legal and institutional aspects of the various elements contained within the ITWS and SOPs should be considered. The establishment of norms and regulations will ensure the delegation of institutional responsibilities. However, it is important to allocate appropriate resources for all tasks within the ITWS to be executed.

#### ***Education, public awareness and drills***

In the NEAM region, there is a particular need to address the vulnerability of seasonal coastal visitors who may be unfamiliar with local geography and language. Clear graphical signage is a solution that has been used elsewhere. The challenge for emergency managers in the NEAM region is to maintain awareness amongst the community. These events may be extremely infrequent (perhaps without a recurrence over several generations), though potentially devastating.

#### ***Mitigating and adapting to destructive inundation and drainage***

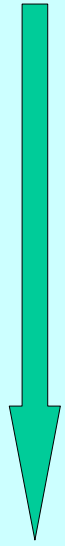
While structural mitigation can moderate tsunami inundation, for example, by engineered pathway barriers or breakwaters, this approach is costly and may be appropriate only for the protection of valuable coastal infrastructure. On the coasts of the NEAM region, adaptation through regulation and planning, particularly coastal land-use planning, is likely to have a greater potential role in the reduction of tsunami hazard risk. There may be trade-offs, however, with the disruption of livelihoods. Mitigation and adaptation options are covered more fully in the forthcoming IOC Guidelines on “Mainstreaming the awareness and mitigation of marine-related hazards and risks within ICAM (Integrated Coastal Area Management)” (IOC, 2008).

#### ***Workshops and a Tsunami Information Centre (TIC)***

It is recommended that countries conduct inter-institutional workshops among all the agencies in coastal cities, as well as awareness campaigns targeting the private sector and the civil society. This will help to ensure that all agencies, the private sector, and the civil society share the same view of the ITWS, its structure and *modus operandi*, in particular the flow of information and warnings. These workshops may help to define the roles that each institution must play within the ITWS. The establishment of a Tsunami Warning Centre within the NEAMS region would provide a key facility and resource to promote awareness and understanding of tsunamis and their associated risks for coastal communities.

#### **Communications between RTWC and NTWCs**

The communications system or systems that will be used in the ITWS in the NEAMS region is yet to be agreed. The Internet is considered a vital option but there is a need to find other secure systems. While the WMO Global Telecommunications System (GTS) is widely used globally for transmitting hazard warning data, it is currently used by very few sea level operators in Europe. The use of an FTP system through the International Ocean Data Exchange (IODE) facility at Ostend in Belgium, which can “push” data onto the GTS, has been considered. ASDL is another option under consideration.



- **Communication from detection sensors to RTWC(s)**
  - Transmission of seismic data
  - The standardisation of data format
    - International Data Collection System (IDCS) standard
  
- **Communication between RTWCs and NWFPs**
  - WMO Global Telecommunications System (GTS)
  - Other systems, e.g. ADSL, Internet
  
- **Communication between NWFPs, NTWCs and Local Authorities**
  - Telecommunications are key in effective response to emergencies in urban and rural settings
    - Using established emergency communications networks
    - Satellite systems provide additional layer of resilience
    - Dual band messaging prone to network overload, potential for 3GPP
  - Traditional communication efforts must not be neglected
    - TV and radio channels, sirens, bells, door-to-door messengers

Box 2: Communication functions and selected issues in the end-to-end NEAMS ITWS

WMO, through its GTS and GDPFS, has developed various protocols for exchange of high priority data, alerts and bulletins on the urgency and risk levels of meteorological hazards. This has enabled coordinated and systematic exchange of relevant information among countries. Protocols are critical, particularly when the lead time is short. To facilitate the rapid exchange of for example tsunami data and alerts on the GTS, protocols are being developed through the Intergovernmental Coordination Groups for Tsunami Warnings in collaboration with WMO.

#### Action Plan for Intersessional Activities post NEAMTWS IV

<i>Activity</i>	<i>Country/Location</i>	<i>Timeline</i>	<i>Responsibility</i>	<i>Required Budget</i>	<i>Status</i>
Further develop recommendations to Civil Protection authorities and agencies on tsunami warning nomenclature and standards	Regional	Continued output to 2009	IOC TWS Member States		O
Further develop recommendations to Civil Protection authorities and agencies on emergency preparedness for tsunami impacts	Regional	Continued output to 2009	IOC assisted by UNU EHS		O
Further develop recommendations to Civil Protection authorities and agencies on communications for tsunami impacts	Regional	Continued output to 2009	IOC TWS		O
Complete IOC	Global	End 2008	IOC Expert		O

<i>Activity</i>	<i>Country/Location</i>	<i>Timeline</i>	<i>Responsibility</i>	<i>Required Budget</i>	<i>Status</i>
Guidelines for mainstreaming awareness and mitigation of tsunami, storm surge and other sea-level related hazards and risks in ICAM			Group		
Workshop on stakeholder participation in marine-related hazards mitigation processes	Regional	End 2008	Portugal		P

Notes: Status: C – Completed, O – Ongoing, P – Planned

## ANNEX VI

### TASK TEAM ON NEAMTWS WATCH CENTRES

#### **Background:**

After two years of work, the ICG-NEAMTWS and its four working groups have accumulated knowledge and experience, and are in a situation to start some tsunami watch activities relying on some available systems (Ref: proposals from the NEAMTWS WG2 meeting on seismic watch (Rome, October 2007)). But this still does not define the pre operational warning system expected by ICG for the end of 2007.

It is the reason why the ICG considers as mandatory to go farther in the incremental process leading within three to four years to an operational warning system focused on tsunamis and to be extended to coastal inundations from maritime origin. The ICG considers also that the development of key elements of the system (monitoring systems, regional watch centres, etc) shall be cooperative, involving institutions from the Euro Mediterranean area.

In this context, the ICG noted the suggestions to establish a group tasked for defining the final architecture of the operational part of the NEAMTWS. This would help to clarify requirements for the RTWCs, the relationship between RTWCs and national tsunami warning centres, the interface with other relevant monitoring and watch systems in a multi hazards framework. It could also investigate the appropriate resources and mechanisms for sharing.

Therefore the ICG decides to establish a task-team with the following mandate and modus operandi.

#### **Mandate:**

The task team shall, taking account of the NEAMTWS draft implementation plan, of the four working groups list of actions and tasks, and of the previous decisions made by the ICG.

1. refine, architecture, tools and partnership for RTWC, as elements of the technical operational structure of the NEAMTWS ;
2. propose the use of other existing or developing monitoring and watch systems,
3. prepare a development plan for the RTWC network,
4. evaluate costs and identify possible in kind and financial contributions by members, institutions or donor agencies.

#### **Modus operandi:**

The Task Team will mainly work by correspondence, but hold a first meeting in the second part of January 2008 that will be hosted by France and a final one, in preparation to the next ICG meeting, September 2008.

#### **Membership:**

- Experts designated by member states having interest in participating in the system,
- The ICG officers and the chairpersons of the four ICG working groups,
- Representatives of organizations like European Commission, WMO, EMSC, etc.

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



## ANNEX VII

### DECISIONS AND RECOMMENDATIONS

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 4<sup>th</sup> Session in Lisbon, Portugal,

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

**Welcomes** that until the next ICG Session, Working Group 4 will focus its activities on Advisory messages to the direct operational concerns of Member States, from the receipt of watch messages from the RTWS to the delivery of warnings to the “last mile”,

**Urges Member States to**

- openly share and exchange tsunami-relevant real-time observational data in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy,
- provide information on their requirements (meaning and content) of watch messages issued by future RTWCs
- nominate both, Tsunami Warning Focal Points and Tsunami National Contacts
- consider extra-budgetary contributions to support the Tsunami Programme of IOC in the NEAM region
- consider hosting a Tsunami Information Centre (TIC) for the NEAM region providing, in particular, an educational resource for Member States, and drawing on the existing information resources within IOC-ITIC, taking account of local language and cultural requirements
- ensure sea-level expertise on their operational staff for potential RTWCs,

**Concludes:**

- that the decision matrices for tsunami alerts, one in the Mediterranean and one for the North East Atlantic as outlined in the report of Working Group 1 are adopted by the ICG
- to ask the IOC Secretariat to set up a generic NEAMTWS web-space for important documentation separated from the documentation sites for the ICG sessions
- that the four Working Groups should meet at least once in the intersessional period
- to investigate possibilities, through the ICG and Working Group 2 chairpersons, for improving access to existing seismic national instrumentation, to fill the identified gaps in the NEAMTWS backbone network
- to establish a Task Team on NEAMTWS Regional Tsunami Watch Centres with the terms of reference given in annex VI of the report. The Task Team will report back at the next ICG session
- to harmonize methods and eventually software among regional centres, the ICG gratefully acknowledges the offer of GFZ to act as a background data centre for the interim NEAMTWS which collects and processes all available RT seismic data and provides data feeds and processing results to RTWCs on the basis of its SeisComp3 software. As potential RTWCs of a prototype network of regional centres for the initial period 2008–2009, ICG recommends that IGN, INGV, NOA, KOERI, IM, BGS and CEA test the system

- to update the Implementation Plan in respect of the Second Phase (2011) of the TWS to clarify national warning needs of near-field events
- that the ICG chair will inform the Water and Civil Protection units of the European Commission DG Environment of the outcome of ICG/NEAMTWS-IV, in particular in respect of preparedness for tsunami impact in the context of the Floods Directive;

**The ICG thanks** Portugal for hosting its fourth session in Lisbon, and **gratefully acknowledges** the offer by Greece to host the next ICG session. Dates and venue will be decided by the ICG officers.

ANNEX VIII

LIST OF PARTICIPANTS

**MEMBER STATES OF ICG/NEAMTWS**

**Algeria**

Prof Karim YELLES  
CRAAG Route de l'Observatoire  
B.P. 63 Bouzareah  
Algiers  
Tel : +2132 290 4467  
Fax : +2132 90 4458  
Email: kyelles@yahoo.fr; a.yelles@craag.dz

**Belgium**

Mr Jacques LONCKE  
COMMANDING-OFFICER MRCC-SAR  
Flemisch Government (Belgium)  
Maritiemplein, 3  
Oostende b-8400  
Tel: 003259255460  
Fax: 003259703605  
Email: jacques.loncke@mow.vlaanderen.be

**Croatia**

Dr Ivica VILIBIC  
n/a  
Zrinsko Frankopanska 161  
Split 21000  
Croatia  
Tel: +385 21 408048  
Fax:  
Email: vilibic@izor.hr

**Finland**

Dr Tapani STIPA  
Docent  
c/o Finnish Institute of Marine Research  
Helsinki 00561  
Tel: +358 40 5058090  
Fax: +358 50 783 00453  
Email: tapani.stipa@fiMrfi

**France**

Dr François GERARD  
Head of Delegation  
1, quai Branly  
Paris Cedex 07 75340  
Tel: +33 1 4556 7022  
Fax: +33 1 4556 7005  
Email: francois.gerard@meteo.fr

Ms Émilie CROCHET  
Chargée de mission auprès du chef du bureau  
des risques majeurs  
Ministère de l'intérieur et de l'aménagement du  
territoire  
Direc. de la défense et de la sécurité civile  
87 – 95 quai du Docteur Dervaux  
92600 Asnieres-sur Seine  
Tel: +33 1 56 04 76 27  
Fax: +33 1 56 04 71 85  
Email: emilie.crochet@interieur.gouv.fr

Mr René FEUNTEUN  
Ministère de l'Ecologie, du Développement et de  
l'Aménagement Durables  
direction de la prévention des pollutions et des  
risques (DPPR)  
20 avenue de Ségur  
75007 Paris  
Tel: +33 1 42 19 15 63  
Fax: +33 1 42 19 14 79  
Email:  
Rene.feunteun@developpement-durable.gouv.fr

Dr François SCHINDELE  
Scientific Advisor  
Département analyse, surveillance  
environnement  
B.P. 12  
91680 Bruyères-le-Châtel:  
Tel: +33 1 69 26 50 63  
Fax: +33 1 69 26 70 85  
E-mail: francois.schindele@cea.fr

**Germany**

Dr Anna von GYLDENFELDT  
Head of Delegation  
German IOC-Secretariat  
Federal Maritime & Hydrograph. Agency  
Bernhard-Nocht-Str. 78  
20359 Hamburg  
Tel: +49 40 3190 3111  
Fax: +49 40 3190 5032  
Email: anna.gyldenfeldt@bsh.de

Dr Jörn BEHRENS  
Alfred-Wegener-Institute for Polar and Marine  
Research Head of Tsunami Modeling Group  
Am Handelshafen 12  
27570 Bremerhaven  
Tel: +49 - 471 - 4831 1781  
Fax: +49 - 471 - 4831 1590  
Email: Joern.Behrens@awi.de

Dr Susanne FRETZDORFF  
Project Management Organisation Juelich  
Seestrasse 15  
18119 Rostock-Warnemuende  
Tel: +49 381-5197-288  
Fax: +49 381-51509  
Email: s.fretzdorff@fz-juelich.de

Dr Winfried HANKA  
Head of Seismology Project for TEWS  
Geoforschungszentrum Telegrafenberg  
14473 Potsdam  
Tel: +49 331 288 1213  
Fax: +49 331 288 1277  
Email: hanka@gfz-potsdam.de

Dr Jörn LAUTERJUNG  
Head Scientific Staff  
GeoForschungsZentrum  
14473 Potsdam  
Tel.: +49 331 288 1020  
Fax: +49 331 288 1002  
Email: lau@gfz-potsdam.de

#### **Greece**

Dr Gerassimos A. PAPADOPOULOS  
Research Director  
Institute of Geodynamics  
National Observatory of Athens  
11810 Athens  
Tel: +30 210 34 90165  
Fax: +30 210 34 90165  
Email: g.papad@gein.noa.gr

#### **Ireland**

Dr Brian McCONNELL  
Geological Survey of Ireland  
Beggars Bush  
Dublin 4  
Tel: +353 1 6782850  
Fax: +353 1 6782559  
Email: brian.mcconnell@gsi.ie

#### **Israel**

Dr Sergiu Dov ROSEN  
Israel Oceanographic & Limnological Research  
National Institute of Oceanography  
(IOLR)  
POB 8030  
Haifa 31080  
Tel: +972 4 856 5241  
Fax: +972 4 851 1911  
Email: rosen@ocean.org.il

Dr Amos SALAMON  
Geological Survey Institute of Israel  
30 Malkhei Israel St  
Jerusalem 95501  
Tel: 972 2 531 4272

Fax: 972 2 5380 688  
Email: salamon@gsi.gov.il

#### **Italy**

Gen.Dr Goffredo CORTESI  
Ministry Foreign Affairs  
Piazzale della Farnesina, 1  
00194 Roma  
Tel: +39 06 3691 6288  
Fax: +39 06 3691 3479  
Email: goffredo.cortesi@esteri.it

Prof Stefano TINTI  
ICG Chair  
University of Bologna  
Dipartimento di Fisica,  
Settore di Geofisica  
Viale Carlo Berti Pichat 8  
Tel: +39 051 2095025  
Fax: +39 051 2095058  
Email: Stefano.tinti@unibo.it

Dr Alessandra CAVALLETTI  
Italian Ministry of Environment & Territory  
Via Cristoforo Colombo, 44  
00154 Rome  
Tel: +39 335 8742208  
Email: acavalletti@gmail.com

#### **Lebanon**

Mr Alexandre SURSOCK  
CNRS - Conseil National de la Recherche  
Scientifique  
P.O.box 16-5432  
Achrafieh 1100-2040  
Beirut  
Tel: +961 4 981 885  
Fax: +961 4 981 886  
Email: asursock@cnrs.edu.lb

#### **Monaco**

Mr Michel BOISSON  
General Secretary Scientific Center of Monaco  
Monaco  
bd, de Suisse 16  
Monaco MC 98000  
MONACO  
Tel: + 377 98 98 85 96  
Fax: + 377 98 98 86 74  
Email: mboisson@gouv.mc

#### **Portugal**

Prof Mário RUIVO  
Head of Delegation  
Chairman  
Comité Português para a COI (CP-COI)  
Av. Infante Santo, 42-4º  
1350-179 Lisboa, Portugal

Tel: + 351 21 390 4330  
Fax: + 351 21 395 2212  
Email: cointersec.presid@fct.mctes.pt and  
cointersec.secretariado@fct.mctes.pt

Prof Maria Ana BAPTISTA  
Instituto Superior de Engenharia (ISEL)  
Dec. ISEL  
Rua Conselheiro Emídio Navarro, 1  
1950-062 Lisboa, Portugal  
Telephone: + 351 91 251 7556  
Fax: + 351 21 831 7001  
E-mail: mabaptista@dec.isel.ipl.pt

Eng. Fernando CARRILHO  
Departamento de Sismologia e Geofísica  
Instituto de Meteorologia, I.P. (IM)  
Rua C ao Aeroporto  
1749-077 Lisboa, Portugal  
Tel: + 351 21 844 7133  
Fax: + 351 21 849 1565  
Email: fernando.carrilho@meteo.pt

Prof Luís MATIAS  
Centro Geofísica Univ. Lisboa  
Campo Grande, ED C8  
Piso 6  
1749 016 Lisbon  
Tel: +351 962 650 272  
Fax: +351 217 500 977  
Email: lmatias@fc.ul.pt

Dr Gonçalo da MOTTA  
Direcção Geral dos Assuntos Técnicos e  
Económicos (DGATE)  
Ministério dos Negócios Estrangeiros  
Largo do Rilvas  
1350-179 Lisboa  
Tel: + 351 21 394 6621  
Fax: 21 394 66038/39  
Email: gmotta@sg.mne.gov.pt

### **Spain**

Dr Juan ACOSTA-YEPES  
Instituto Español de Oceanografía  
Av. Brasil 31  
28 020 Madrid  
Tel: +34 91 4175422  
Fax: +34 91 597 47 70  
E-mail: juan.acosta@md.ieo.es

Prof. Mauricio GONZALEZ  
Universidad de Cantabria  
Av de los Castros s/n  
39005 Santander, Spain  
Tel: +34 94 2201810  
Fax: +34 94 2201860  
Email: gonzalere@unican.es  
Dr Antonio PAZOS  
Head of the seismological Department. Real  
Observatorio de la Armada.

C) Cecilio Pujazon s/n  
1110-San Fernando (Cádiz).  
Email:pazos@roa.es

Ms Begoña PEREZ  
Head of Harbour Oceanography Division  
Spanish Harbours Authority  
Avda del Partenón, 10  
Campo de las Naciones  
28042 Madrid  
Tel: +34 91 5245500  
Fax: +34 91 5245504  
Email: bego@puertos.es

### **Tunisia**

Prof Cherif SAMMARI  
INSTM  
28 rue 2 mars 1934  
2025 Salammbô  
Tel: +216. 71. 730 420  
Fax: +216. 71. 732 622  
Email: cherif.sammari@instm.rnrt.tn;  
c.sammari@yahoo.fr

### **Turkey**

Prof Cemil GURBUZ  
Bogazici University, Kandilli Observatory and  
Earthquake Research Institute  
Cengelkoy  
Istanbul  
Tel: +90 216 3320242  
Fax: +90 216 332 2681  
Email: gurbuz@boun.edu.tr

### **United Kingdom**

Dr Trevor GUYMER  
Head, IACMST  
National Oceanography Centre  
Southampton SO14 3ZH  
Tel: +44 (0) 23 8059 6789  
Fax: +44 (0) 23 8059 6204  
Email: iacmst@noc.soton.ac.uk

Mr Russell Scott ARTHURTON  
Consultant  
5A Church Lane – Grimston, Melton Mowbray  
Leics LE14 3BY  
Tel: +44 (0) 1664 810024  
Email: r.arthurton@talktalk.net

Dr Lars OTTEMOLLER  
Seismologist  
British Geological Survey  
West Mains Road  
EH105GH  
Edinburgh  
Tel: +44-131-6500224  
Email: lot@bgs.ac.uk

## **OBSERVER MEMBER STATES**

### **Kenya**

Dr Mukirir WA GITHENDU  
Tel: +254 02 219420  
Email: mukiri@hotmail.com

Ms Margaret W. MAIMBA  
Tel: +254 02 241331  
Email: mwgacigua@yahoo.com

## **ORGANIZATIONS/INSTITUTIONS**

### **CSEM**

Dr Rémy BOSSU  
Secretary General  
CSEM (EMSC)  
C/o CEA, Bat. Sables  
BP 12 91680 Bruyeres le Châtel  
France  
Tel: +33 1 69 26 78 14  
Fax: +33 1 69 26 70 00  
Email: bossu@emsc-csem.org

### **Danish Meteorological Institute**

Dr Vibeke HUESS  
Danish Meteorological Institute  
Lyngbyvej 100  
Copenhagen DK-2100  
Denmark  
Tel: +45 39 15 72 05  
Email: vh@dmi.dk

### **EC-JRC**

Dr Ing. Alessandro ANNUNZIATO  
Scientific Officer  
Via Fermi 1  
21020 Ispra  
Tel: +39 0332 789519  
Fax: +39 0332 785154  
Email: alessandro.annunziato@jrc.it

### **EUROGOOS**

Dr Hans DAHLIN  
Director  
SMHI  
Norrköping 601 76  
Sweden  
Tel: +46 11 495 8030  
Email: eurogoos@eurogoos.eu

## **INGV**

Dr Selvaggi GUILIO  
Director  
Centro Nazionale Terremoti  
Via Di Vigna murata 605  
00143 Roma  
Italy  
Tel: 39 06 51860410  
Fax: 39 06 51860541  
Email: selvaggi@ingv.it

Dr Alessandro AMATO  
Italy National Earthquake Center  
Istituto Nazionale di Geofisica e Vulcanologia  
Via di Vigna Murata, 605  
00143 Roma  
Italy  
Tel: +39 06 51860414  
Fax: +39 06 51860507  
Email: amato@ingv.it

Dr Alessandra MARAMAI  
National Institute of Geophysics and  
Volcanology  
Via di Vigna Murata, 605  
Rome 143  
Tel: +39 06 5186 0210  
Email: maramai@ingv.it

### **MEDGLOSS**

Dr Sergiu Dov ROSEN  
Coordinator  
Israel Oceanographic & Limnological Research  
National Institute of Oceanography  
(IOLR)  
POB 8030  
Haifa 31080  
Israel  
Tel: +972 4 856 5241  
Fax: +972 4 851 1911  
Email: rosen@ocean.org.il

### **WMO**

Ms Alice SOARES  
Scientific Officer  
World Meteorological Organization (WMO)  
7 bis, Avenue de la Paix, CP 2300  
Genève CH 1211 Genève 2  
Suisse  
Tel: +41 22 730 8449  
Fax: +41 22 730 8128  
Email: asoares@wmo.int

**IOC/UNESCO Secretariat**

Mr Thorkild AARUP  
Programme Specialist  
IOC of UNESCO  
1, rue Miollis  
75732 Paris cedex 15  
France  
Tel: +33 (0)1 45 68 40 19  
Fax: +33 (0)1 45 68 58 12  
Email: t.aarup@unesco.org

Ms Forest COLLINS  
ICG Logistics Coordinator  
IOC of UNESCO  
1, rue Miollis  
75732 Paris cedex 15  
France  
Tel: +33 (0)1 45 68 39 74  
Fax: +33 (0)1 45 68 58 12  
Email: f.collins@unesco.org  
Mrs Belén MARTIN MIGUEZ  
Programme Specialist  
IOC of UNESCO  
1, rue Miollis  
75732 Paris cedex 15  
France  
Tel: +33 (0)1 45 68 39 90  
Fax: +33 (0)1 45 68 58 12  
Email: b.martin-miguez@unesco.org

Mr Peter KOLTERMANN  
Head, Tsunami Unit  
IOC of UNESCO  
1, rue Miollis  
75732 Paris cedex 15  
France  
Tel: +33 (0)1 45 68 40 15  
Fax: +33 (0)1 45 68 58 12  
Email: p.koltermann@unesco.org

Mr Ulrich WOLF  
Programme Specialist  
IOC of UNESCO  
1, rue Miollis  
75732 Paris cedex 15  
France  
Tel: +33 (0)1 45 68 39 29  
Fax: +33 (0)1 45 68 58 12  
Email: u.wolf@unesco.org

**OBSERVERS, ADVISORS and INVITED GUESTS**

Mr José ÁLVAREZ-GÓMEZ  
Instituto Geográfico Nacional  
Email: Jaagomez@fementa.ex

Ms Anna ANTÓNIO  
Mr Tolga BERMEK

Mr Telmo CARVALHO  
EurOcean  
Avenida Dom Carlos I, 126, 2º andar  
1249-074 Lisboa  
Portugal  
Tel: (+351) 21 3924495  
Email: telmo.carvalho@fct.mctes.pt

Eng. Elsa COSTA  
Autoridade Nacional de Protecção Civil (ANPC)  
Av. do Forte de Carnaxide  
2794-112 Carnaxide, Portugal  
Telephone: + 351 21 427 7100  
Fax: + 351 21 424 7180  
E-mail: elsa.costa@prociv.pt

Ms Cláudia CARDOSO  
Advisor to Portugal  
Assessor of the Secretary of State for Civil Protection  
Autoridade Nacional de Protecção Civil (ANPC)  
Ministério da Administração Interna  
Praça do Comércio, Ala Oriental  
1149-015 Lisboa, Portugal  
Telephone: + 351 21 323 2262  
Fax: + 351 21 886 3795  
E-mail: claudia.cardoso@mai.gov.pt

Mr Mota CONGETO

Mr Ronan CREACH  
Service hydrographique et oceanographique de la marine  
\*SHOM\* - 13 rue du Chatellier – CS  
92803 - 29228 BREST CEDEX 2  
Tel: +33 2 98 22 15 89  
Fax: +33 2 98 22 08 99  
Email: creach@shom.fr

Dr André FORTUNATO  
Advisor to Portugal  
Head of Division for Estuaries and Coastal Zones  
Departamento de Hidráulica e Ambiente  
Laboratório Nacional de Engenharia Civil (LNEC)  
Av. do Brasil, 101  
1700-066 Lisboa, Portugal  
Tel: + 351 21 844 3425  
Fax: + 351 21 844 3016  
Email: afortunato@lnec.pt

Dr Utku KANOGLU  
Assistant Professor  
ODTU, Inonu Bulvari  
Ankara 06531  
Turkey  
Tel: +90 312 210 4789  
Fax: +90 312 210 4462  
Email: kanoglu@metu.edu.tr

Ms Vânia LIMA  
Portuguese Secretariat  
PhD Fellow  
Centro de Geofísica da Universidade de Lisboa  
Praça Camilo Castelo Branco, 17-6º Esq.º  
4700-209 Braga, Portugal  
Tel: + 351 96 452 55 22  
Email: vcvalima@gmail.com

Prof Teresa LOPES FERREIRA  
Special Advisor to Portugal  
Assistant Professor  
Centro de Vulcanologia e Avaliação de Riscos  
Geológicos  
Complexo Científico, 3º Piso, Ala Sul  
Universidade dos Açores  
Rua da Mão de Deus  
9500-801 Ponta Delgada, Portugal  
Tel: + 351 29 665 0147  
Fax: + 351 29 665 0142  
Email: Teresa.JL.Ferreira@azores.gov.pt

Dr Pierre LOYER  
Thales Alenia Space  
100 bd du Midi  
Cannes-la-Bocca 06150  
France  
Tel: +33 492 923 472  
Email: pierre.loyer@thalesaleniaspace.com

Dr Leonor MARTINS  
Invited Guest of Portugal  
Head of the Tides Sector  
Instituto Hidrográfico (IH)  
Rua das Trinas, 49  
1249-093 Lisboa, Portugal  
Telephone: + 351 21 0943 033  
Fax: + 351 21 0943 3299  
E-mail: leonor.martins@hidrografico.pt

Prof Luís MENDES VICTOR  
Advisor to Portugal  
Director  
Centro de Estudos de Riscos Urbanos  
Rua da Escola Politécnica, 58  
1250-102 Lisboa, Portugal  
Tel: 21 392 18 71/21 392 18 67  
Fax: 21 395 33 27  
Email: lmvector@fc.ul.pt

Francisca MENEZES-FERREIRA  
Portuguese Secretariat  
Liaison & Information Officer  
Research Fellow in Marine Science and  
Technology Management  
Comissão Oceanográfica Intersectorial (COI-  
MCTES)  
Av. Infante Santo, 42-4º  
1350-179 Lisboa, Portugal  
Tel: + 351 21 393 0104  
Fax: + 351 21 395 2212  
Email: f.menezesferreira@fct.mctes.pt

Commander José MESQUITA ONOFRE  
Advisor to Portugal  
Head of the Division of Oceanography  
Instituto Hidrográfico  
Rua das Trinas, 49  
1249-093 Lisboa, Portugal  
Tel: 21 0943 042  
Fax: 21 0943 299  
Email: mesquita.onofre@hidrografico.pt

Prof Miguel MIRANDA  
Director  
Centro de Geofísica da Universidade de Lisboa  
Fundação da Universidade de Lisboa  
Edifício C8, Campo Grande  
1749-016 Lisboa  
Tel: 21 750 08 09  
Fax: 21 750 0977  
Email jmiranda@fc.ul.pt

Prof José OLIVEIRA MENDES  
Associate Professor  
Faculdade de Economia, Universidade de  
Coimbra  
Grupo de Sociologia  
Av. Dias da Silva, 165  
3004-512 Coimbra, Portugal  
Tel: + 351 23 985 5570  
Fax: + 351 23 985 5589  
Email: jomendes@fe.uc.pt

Mr Rachid OMIRA  
Portuguese Secretariat  
Ph.D. Fellow  
Faculdade de Ciências da Universidade de  
Lisboa  
Rua Joaquim Bonifácio, 22-4º  
Picoas, 1100-101 Lisboa, Portugal  
Telephone: + 351 91 245 1108  
E-mail: omirarachid10@yahoo.fr

Rachid OMIRA  
Ph.D. Fellow  
Faculdade de Ciências da Universidade de  
Lisboa  
Rua Joaquim Bonifácio, 22-4º  
Picoas, 1100-101 Lisboa, Portugal  
Tel: + 351 91 245 1108  
Email: omirarachid10@yahoo.fr

Commander José Mesquita Onofre  
Head of the Division of Oceanography  
Instituto Hidrográfico  
Rua das Trinas, 49  
1249-093 Lisboa, Portugal  
Tel: 21 0943 042  
Fax: 21 0943 299  
Email: mesquita.onofre@hidrografico.pt

Eng. Patrícia PIRES  
Head of the Division for Risks and Early Warning  
Autoridade Nacional de Protecção Civil (ANPC)



Av. do Forte em Carnaxide  
2794-112 Carnaxide, Portugal  
Telephone: + 351 21 424 71 00  
Fax: + 351 21 424 71 80  
E-mail: patricia.pires@prociv.pt

Lieutenant Joana REIS  
Tides Specialist  
Instituto Hidrográfico (IH)  
Rua das Trinas, 49  
1249-093 Lisboa, Portugal  
Tel: + 351 21 0943 052  
Fax: + 351 21 0943 299  
E-mail: joana.reis@hidrografico.pt

Ms Rita SANTOS  
Portuguese Secretariat  
Science Officer  
Research Fellow in Marine Science and  
Technology Management  
Comissão Oceanográfica Intersectorial (COI-  
MCTES)  
Fundação para a Ciência e a Tecnologia  
Av. D. Carlos I, 126  
1249-074 Lisboa, Portugal  
Tel: + 351 21 392 4465  
Fax: + 351 21 392 4498  
Email: rita.santos@fct.mctes.pt

Ms Filipa SERAFIM  
Portuguese Secretariat  
Ph.D. Fellow  
Faculdade de Ciências da Universidade de  
Lisboa  
Av. de Angola, 12-8º Dto.  
2900-052 Setúbal, Portugal  
Tel: + 351 96 786 4600  
Email: filipasserafim@yahoo.com and  
filipa\_serafim@hotmail.com

Mr Adélio SILVA

Ms Rita SILVA  
Science Officer  
Research Fellow in Marine Science and  
Technology Management  
Comissão Oceanográfica Intersectorial (COI-  
MCTES)  
Fundação para a Ciência e a Tecnologia  
Av. D. Carlos I, 126  
1249-074 Lisboa, Portugal  
Tel: + 351 21 392 4465  
Fax: + 351 21 392 4498  
Email: rita.silva@fct.mctes.pt

Lieutenant Coronel António SOUSA DA CUNHA  
Chairman  
Serviço Regional de Protecção Civil e  
Bombeiros dos Açores (SRPCBA)  
Vale de Linhares – São Bento  
9700-854 Angra do Heroísmo, Portugal  
Tel: + 351 29 540 1411  
Fax: + 351 29 540 1451  
Email: antonio.hs.cunha@azores.gov.pt

Mr Filipe Távora

Ms Monique TERRIER

Ms Sandrine VON CAMPENHAUSEN  
Administrateur  
Office Parlementaire d'Évaluation des Choix  
Scientifiques et Technologies  
Sénat  
15 rue de Vaugirard  
Paris 75291  
France  
Tel: + 33 1 42 34 38 80  
Fax: + 33 1 42 34 38 55  
Email: s.voncampenhausen@senat.fr

Mr Raimundo VICENTE

Dr Ahmet Cevdet YALCINER  
Assoc. Prof  
Middle East Technical Univ Civil Engineering  
Department  
Ocean Engineering Research Center  
Ankara 06531  
Turkey  
Tel: +905324710006  
Fax: +903122107987  
Email: yalciner@metu.edu.tr

ANNEX IX

**LIST OF ACRONYMS**

<b>BGS</b>	British Geological Survey
<b>GDACS</b>	Global Disaster Alert and Coordination System
<b>GFZ</b>	GeoForschungsZentrum Potsdam
<b>GLOSS</b>	Global Sea Level Observing System
<b>ICG</b>	Intergovernmental Coordination Group
<b>IMO</b>	International Maritime Organization
<b>INGV</b>	Italian Institute of Geology and Vulcanology/Istituto Nazionale di Geofisica e Vulcanologia
<b>IOC</b>	Intergovernmental Oceanographic Commission
<b>IODE</b>	International Oceanographic Data and Information Exchange
<b>ISDR</b>	International Strategy for Disaster Reduction
<b>JCOMM</b>	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
<b>KOERI</b>	Kandilli Observatory and Earthquake Research Institute
<b>NEAMTWS</b>	Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas
<b>NMHS</b>	National Meteorological and Hydrological Services
<b>NOA</b>	National Observatory of Athens
<b>NTWC</b>	National Tsunami Watch Centres
<b>TOWS</b>	Tsunami and Other Ocean Hazards Warning and Mitigation Systems
<b>TWS</b>	Tsunami Warning System
<b>RTWC</b>	Regional Tsunami Watch Centres
<b>UNESCO</b>	United Nations Educational Scientific and Cultural Organisation
<b>VLIZ</b>	Flanders Marine Institute
<b>WMO</b>	World Meteorological Organization