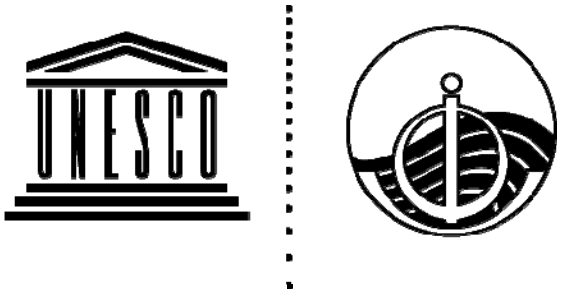
Intergovernmental Oceanographic Commission
Technical Series
103



EXERCISE NEAMWAVE 12

A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region

27–28 November 2012

Volume I Exercise Manual

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Prepared by the NEAMWAVE12 Exercise Team and the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas

UNESCO 2012

IOC Technical Series, 103, Volume 1
Paris, November 2012
English only

For bibliographic purposes, this document should be cited as follows:

Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012, Volume I: Exercise Manual. IOC Technical Series No 103 Vol.1. UNESCO/IOC 2012
(English only)

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Published in 2012
by United Nations Educational, Scientific and Cultural Organization
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also available online at
http://neamtic.iocunesco.org/

Printed in France

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1. INTRODUCTION

In every ocean, regional and national tsunami warning systems must maintain a high level of readiness so as to be able to efficiently and effectively act to provide for the public's safety during fast-onset and rapidly-evolving natural disasters involving marine inundation of coastal areas. Because of the relative infrequency of tsunamis, but knowing that tsunamis can have widespread impact across oceans and seas, the UNESCO/IOC and its Member States have been advocating through their Intergovernmental Coordination Groups (ICGs) for the regular conduct of tsunami exercises. To maintain a high state of operational readiness, National Tsunami Warning Centres (NTWCs) and Civil Protection agencies (CPA) must regularly practice their emergency response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during a real event.

2. SCOPE AND OBJECTIVES OF NEAMWave 12

By the end of 2011, The North-eastern Atlantic, the Mediterranean and Connected Seas (NEAM) region was the only region in the world where a Tsunami Warning System was not yet in operation. Two initial communication test exercises in 2010 were followed by the 1st Enlarged Communication Test Exercise (ECTE1) in 2011 with the involvement of all the Tsunami Warning Focal Points (TWFP) in the 31 countries of the NEAM region. On 22 May 2012, a second communication test, CTE2, was successfully conducted by CENALT with the additional aim of a preparatory exercise for NEAMWave 12. As of September 2012, several NTWCs have been established, and some have also declared their availability to operate as Tsunami Watch Provider in interim status (as Candidate Tsunami Watch Providers-CTWPs), subject to an accreditation procedure developed and approved by the ICG/NEAMTWS in its 9th Session in September 2012. NEAMWave 12, as the first Tsunami Exercise in NEAM, will attempt to assess the national and local warning dissemination and response mechanisms put in place by Member State CPAs upon the reception of a Tsunami warning from their TWFPs. In addition, NEAMWave 12 will also address the questions related to the evaluation of alert messages by CTWPs and the issuance of the tsunami messages to TWFPs, as in the previous communication test exercises.

The objectives proposed for NEAMWave 12 are to:

1. Validate and evaluate the Candidate Tsunami Watch Providers (CTWP) dissemination process of issuing Tsunami Messages in the NEAM region;

2. Validate and evaluate the procedures for countries to receive and confirm the Tsunami Messages issued by the CTWP through their National Tsunami Warning Centres (NTWC), or the country Tsunami Warning Focal Points (TWFP) or the country Tsunami National Contacts (TNC).

3. Validate and evaluate the dissemination of the warning messages to the relevant agencies that are responsible for emergency response.

4. Validate and evaluate the organizational decision making process on public warnings and evacuations.

5. Identify the modes that would be employed to notify and instruct the public.

Within the above framework, each country is invited to develop its own specific objectives for the exercise.

3. DESCRIPTION OF NEAMWave 12

3.1 GENERAL CONCEPTS

NEAMWave 12 will involve the simulation of the assessment of a tsunami, based on an earthquake-driven scenario followed by the alert message dissemination by CTWPs (Phase A) and continued with the simulation of the TWFP/NTWCs' and CPAs' actions (Phase B), as soon as the message produced in Phase A has been received. There will be multiple scenarios in NEAMWave 12, where each CTWP would be responsible for a single scenario at each scenario play and each non-CTWP Member State will be asked to choose a/the scenario(s) to participate in the exercise.

To avoid overlapping, scenarios will be played in half days at different regions of interest in a consecutive two-day period.

Phase A is planned as a drill exercise with a time-frame element focusing on the functional requirements of NTWCs which have declared their operational status as CTWPs. These CTWPs will be responsible for scenario tsunami assessment and message dissemination to Tsunami Watch Recipients (TWFP/NTWC). Each CTWP would be responsible for a single scenario.

Phase B is open to Member States by invitation and may include different types of exercise, such as an orientation exercise, a drill, a table-top exercise or a functional exercise, within the discretion of each Member State. We do not foresee that at this stage any Member State will conduct a full-scale exercise. The types of exercises in relation to NEAMWave 12 are described in more detail in Annex IX.

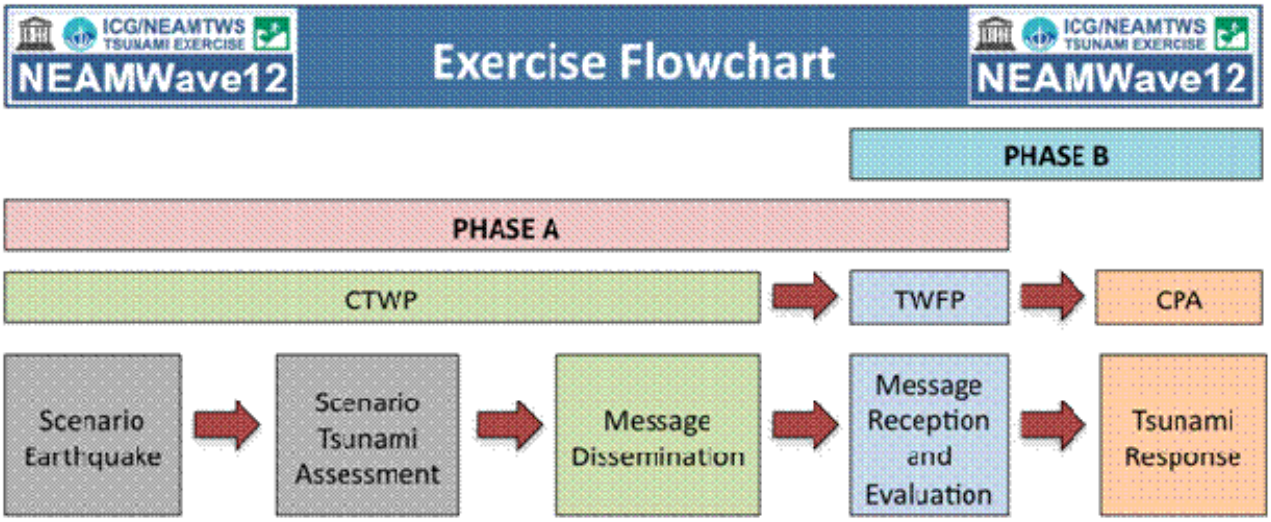


Figure 1 : NEAMWave 12 Exercise Flowchart.

3.2 DEFINITIONS OF NEAMWAVE 12 SCENARIOS

A **tsunami scenario** used for testing the alert message dissemination and response measures is a set of data corresponding to a hypothetical tsunami event. A brief historical and tectonic description of the scenario will be also provided. Draft Scenario Guidelines for NEAMWave 12 have been distributed as an attachment to IOC Circular Letter 2437 announcing the NEAMTWS Tsunami Exercise – "NEAMWave 12" (http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9327&lang=en).
As, for the time being, only earthquake-induced events are considered, a tsunami scenario is composed of:

- Earthquake data
- **Arrival times** at points of interest
- Estimated **wave heights** at points of interest (calculated but not to be included in the scenario as a numerical value)
- Information **messages** and material corresponding to the stages in time of a tsunami event.

Earthquake data comprise a **moment magnitude** value, and a **hypocenter** (i.e. location coordinates in latitude, longitude and depth). Additionally a **time stamp** is required, which has to be agreed by the members of the TT-CTTE preparing NEAMWave 12.

Arrival times are given as follows: arrival of the first wave exceeding an absolute deviation of the current sea level by more than 10 cm in hours, minutes and seconds after the rupture time (time stamp of the earthquake). Estimated wave heights are calculated as water level exceeding mean current sea level.

Tsunami alert messages and products are to be given in the usual (and officially announced) format of CTWP bulletins. In the course of the scenario event, they will/may also include parametric data from simulated tide gauge records. Additional preparatory material should be provided prior to the test.

3.3 SCENARIO CRITERIA

A useful scenario that will be utilized by a CTWP in NEAMWave 12 for testing information message dissemination should consider the following criteria:

The scenario should be based on a **computer-simulated** event in order to fulfil a minimum of realism with respect to the consistency of wave heights and travel times.

The scenario should be based on a **credible worst-case**. As agreed by the NEAMWave 12 Task Team, a worst-case scenario should be chosen in order to simulate an event of greatest extent and impact.

The **scenario description** should be given to participants prior to the NEAMWave 12 exercise by explaining the following key features:

- The basic earthquake assumed to cause the event (location and magnitude).
- A set of two plots, describing the basic characteristics of the wave dispersion:
  - An isochrone chart with arrival time iso-lines.
  - A wave energy plot with maximum wave heights for the entire domain.
- Example test information bulletin texts.
- A brief timeline explaining the standard operational procedures applied by the CTWP in case of a potential tsunami event.

The scenario should contain a list of (preliminary) **forecast points**, announced prior to the exercise, where arrival times and wave heights are given. Forecast points should be chosen such that they correspond to a well-defined geographical location at the coast. Thus, wave heights given correspond to a water level above ground at the shore. Consequently, the arrival times correspond to the arrival of the wave at the shore. While it is acknowledged that some CTWPs do not utilize modelling techniques allowing them to do computations of wave heights at the shore, reasonable measures should be taken to translate those values derived for deeper-water locations into on-shore values (e.g. Green’s Law heuristics, etc.).

It is important to note that since no real-world data set is used, the scenario data will comprise a certain level of ambiguity. This is not considered to be a problem, as long as the scenario is broadly consistent with common observations. In order to achieve this consistency, modelling would be applied to derive the scenario data.

3.4 FORECAST POINTS

As part of their SOP for responding to potentially tsunamigenic events, the CTWPs in the NEAM region calculate expected tsunami arrival times (ETA) to various pre-determined forecast points. Forecast points are chosen by individual Member States and agreed with designated CTWPs. They may correspond to important coastal cities or populations, and/or to the locations of sea-level gauges. In addition, some NTWCs may be able also to forecast tsunami wave heights at the forecast points in order to decide on the level of tsunami threat. In the NEAM region, the level of threat for a given country or region is defined in terms of its distance to the earthquake source and not by the estimated tsunami arrival time, as happens in the Pacific region.

ETAs for a country's forecast points that meet the criteria will be listed in the tsunami alert messages issued by the CTWPs.

For the selection of TFPs, the following criteria have been used:

- Locations of ports, shipyards, marinas, oil refineries, coastal airports, tourist destinations, densely populated beaches and existing tide-gauge stations.
- At least one point for each administrative division has been selected. If the administrative division has a coast on more than one sea, additional forecast points could be selected.
- Priority is given to the existing mareograph stations. No limits are applied to the number of mareograph stations per administrative division.

3.5 COMPOSITION OF TSUNAMI MESSAGES

Specific details of the tsunami messages to be used by the CTWPs are provided in the NEAMTWS Interim Operational Users Guide for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas, Version 2.0. Moreover, "Reducing and managing the risk of tsunamis - IOC Manuals and Guides, 57" provides the architecture of the "TSUNAMI EARLY WARNING THROUGH NEAMTWS" (Section 4.) A short summary on the content and the composition of the tsunami messages is provided in Annex X. However, exercise participants are strongly encouraged to read the documentation above.

3.6 RELATIONSHIP BETWEEN A NEAMWAVE 12 SCENARIO AND A TRUE EVENT

It should be stressed that in the case of a true event the Civil Protection Agencies or Emergency Management Organizations will have to react based exclusively on the Tsunami Messages that are broadcast by the CTWP. The more complete tsunami scenario that is provided in the NEAMWave 12 Exercise is not available in real-time. It is up to the National Exercise Team to decide on the way to respond to the information that is provided as to simulate the best way possible what would succeed in the case of a true event.

It is recommended the reading of the NEAMTWS Interim Operational User's Guide in order to get acquainted with the Operation Procedures of a Tsunami Watch Provider and on the details of Tsunami Messages. Suggested sections are: 4.3 on Operational Procedures; 4.4 on Operational Limitations; 4.5 on Types of NEAM-TWP Messages; 4.6 on NEAM-TWP Alert Status Definitions; and 4.7 on NEAM-TWP Text Messages Format and Content. Examples of messages are given in section 4.10.

The participating Member States can change the proposed scenario according to their own needs and objectives. They are encouraged to develop the exercise further and tailor it to its own requirements.

3.7 DESCRIPTION OF ROLES

3.7.1 NEAMWave 12 Exercise Team

An Exercise Team was established by the TT-CTTE (Task Team on Communication Test and Tsunami Exercises) for NEAMWave 12 with the following members: current and previous co-Chairs of TT-CTTE, Chairperson of NEAMTWS, current and previous co-Chairs of WG4 (Public Awareness, Preparedness and Mitigation), co-Chairs of WG1 on Hazard Assessment and Modelling and members of the IOC Secretariat. The Exercise Team is responsible for the planning, preparation, conduct and evaluation of NEAMWave 12 and is coordinated by the current co-Chairs of TT-CTTE.

3.7.2 National Exercise Teams

Each participant Member State is encouraged to appoint its own in-country Exercise Planning Team and Exercise Planning Coordinator to develop the exercise further and to tailor it to its own requirements. The Exercise Planning Team should have representatives from all national TWFPs and from each major participating agency, but should be kept to a manageable size. Planning Team members are generally not exercise players. Instead, due to their high-level involvement, members are ideal for roles such as National Exercise Director (NED) and/or evaluator positions during an exercise within their own agency. Moreover, if exercises are taken down to the provincial or community level, each should have its own Planning Team.

3.7.3 National Contact for the Exercise

For NEAMWave 12, the National Contact for Exercise (NCE) is the Tsunami National Contact (TNC) by default, unless communicated otherwise to the IOC. NCE will ensure that the commitment of participating Member States is fully coordinated. Planning of the conduct of the exercise will be communicated to the NCE. The NCE will be expected to confirm the accuracy of existing tsunami-warning arrangements within the Member State, including the identification of the operational point(s) of contact for the dissemination of tsunami warnings from the NTWC. The NCE will also be responsible for coordinating input for the exercise evaluation, details for which are given in this manual.

3.7.4 National Exercise Planning Coordinator

The TNC, in consultation with other participating national organizations, is encouraged to appoint a National Exercise Planning Coordinator (NEPC), who could also act as the National Exercise Director during the conduct of the exercise.

3.7.5 National Exercise Director

The National Exercise Planning Coordinator is expected to act as the National Exercise Director (NED), who will be the person primarily responsible for the successful conduct of the exercise.

3.7.6 CTWP Exercise Coordinator

The CTWP Exercise Coordinator (CTWP-EC) will be the responsible person for the CTWP to ensure the successful participation of the CTWP to the exercise during the planning and conduct phases.

3.7.7 TWFP Exercise Coordinator

The TWFP Exercise Coordinator (TWFP-EC) will be the responsible person for the TWFP to ensure successful participation of the TWFP to the exercise both during the planning and conduct phases.

3.7.8 Exercise Players

Exercise Players (EP) are participants who have to perform for real by receiving and responding to incoming messages or injects supplied by simulators. Examples are the operators at the CTWP and staff members in the crisis room of the CPA. Exercise Players have to be clearly defined prior to the exercise by the respective Exercise Coordinators.

3.7.9 Observers

Participant institutions are encouraged to appoint/invite observers for the exercise. An observer is an internal or external agency person invited to view the exercise but does not participate. Observers report lessons identified and outcomes to the NCE or NEPC and will undertake internal evaluator responsibilities.

3.7.10 External Agencies

Member States are free to invite External Agencies to participate in Phase B of NEAMWave 12. In such cases, External Agencies are invited to also appoint their Exercise Coordinator, Exercise Players and Observers, which should be reported to the NCE or NEPC.

3.7.11 Overlapping of Roles

In some cases, where required, some participating individuals may assume more than one responsibility. For example, CTWP-EC may also be the NEPC/NED, or at a higher-level NCE may also act as NPEC. This hierarchical organization of the national exercise structure is under the discretion of the Member States. The guidance provided in this manual is restricted by to ensure the successful planning and conduct of the exercise.

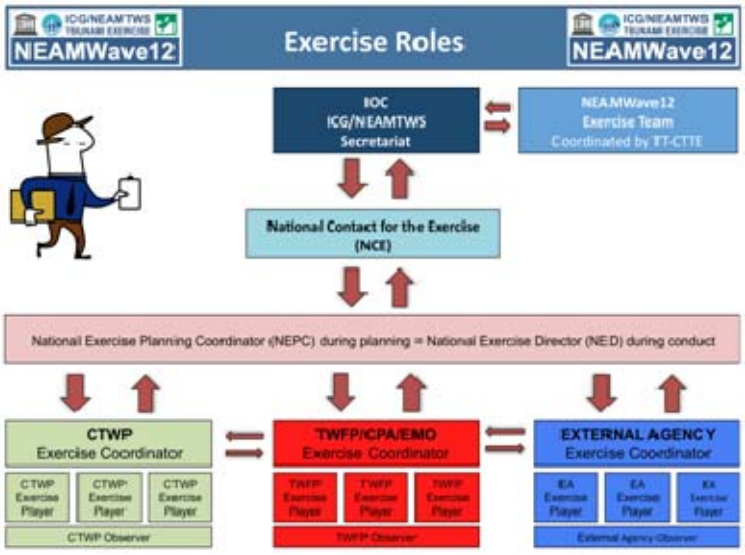


Figure 2: NEAMWave 12 Exercise Roles

3.8 NEAMWAVE 12 SCENARIOS

There are four scenarios in NEAMWave 12, provided by CENALT (CENtre d'ALerte aux Tsunamis, France), IPMA (Instituto Português do Mar e da Atmosfera, Portugal), KOERI (Kandilli Observatory and Earthquake Research Institute, Turkey) and NOA (National Observatory of Athens, Greece), where each respective CTWP will be acting as Message Provider during the exercise for their respective scenarios. NEAMWave 12 Scenarios are presented through Annexes IV-VII.

Please note that during the exercise, CTWP scenario messages will include only TFPs of the Member States, which have subscribed to the CTWP scenario and submitted its TFPs to IOC via official channels. Therefore, interested Member States are strongly encouraged to provide their TFPs to IOC and subscribe to CTWP scenario(s) of interest as soon as possible, no later than 15 October. It should be noted that the scenario messages presented through Annexes IV-VII will be updated according to the subscriptions and the final version of this manual will be available at least one month prior to the exercise at http://neamtic.ioc-unesco.org/neamwave12.

4. PARTICIPATION

CTWPs with a proven capability of disseminating messages using e-mail, fax and GTS were invited to participate in Phase A of NEAMWave 12, involving a scenario in that part of the NEAM region of their interest. Moreover, CTWPs participating in Phase A should test their GTS at least once within one month prior to the exercise.

CTWPs interested in acting as alert message providers were asked to inform the IOC Secretariat by 15 July 2012.

TWFPs, in cooperation with national Civil Protection agencies, are invited to inform IOC Secretariat (neamtws-secretariat@unesco.org) through their Tsunami National Contacts (TNCs) no later than 15 October 2012 on their participation, including the phases in which they would like to participate, also indicating, if applicable, the level of their participation in Phase B. However, TWFPs are invited and encouraged to participate in Phase B at least at the level of a table-top exercise. Moreover, Member States are free to subscribe more than one scenario during the exercise, nevertheless an overlapping of scenarios should be avoided. The participating Member States can change the proposed scenario according to their own needs and objectives. They are encouraged to develop the exercise further and tailor it to its own requirements.

5. NEAMWAVE 12 PREPARATIONS

5.1 PREPARATORY EXERCISE

The Second Communication Test Exercise (NEAMTWS-CTE2) was conducted on 22 May 2012, as announced by the IOC Circular Letter No. 2431. NEAMTWS-CTE2 addressed the questions related to the evaluation and issuance of the alert message by the Tsunami Watch Provider, as in the previous CTEs, but also attempted to assess the national and/or local response and warning dissemination mechanisms once CPAs or other designated authorities receive a warning. It involved all possible TWFPs using conventional message dissemination channels that have been previously subject to test between CTWPs and NTWCs. Message dissemination using GTS was only available between TWFPs that have this system available to them at the operational level. Member States were especially encouraged to actively participate in NEAMTWS-CTE2, which served the purpose of a build-up exercise for NEAMWave 12.

5.2 PREPARATORY MEETINGS

NEAMWave 12 Draft Manual was introduced first at the 9th PPRD-South "prevention and preparedness" workshop for staff-level officials "Tsunami emergency preparedness in Mediterranean coastal zones" realized in partnership with the ICG/NEAMTWS during 29 May – 4 June 2012 in Stromboli, Italy, with limited participation from NEAMTWS Member States.

The near-final version of the manual was presented to the ICG/NEAMTWS members at the NEAMWave 12 workshop conducted on September 10th in the fringes of ICG/NEAMTWS-IX in Southampton (UK). The manual was updated based on the feedback received during this workshop and at the 9th session of ICG/NEAMTWS conducted during 11-13 September at the same venue.

6. NEAMWAVE 12 TIMETABLE

NEAMWave 12 will be conducted on 27–28 November 2012 in the following schedule:

	Morning*	**Afternoon***
27 November	IPMA Scenario	NOA Scenario
28 November	CENALT Scenario	KOERI Scenario

* around 8-11 UTC
** around 12-15 UTC

7. CONDUCT OF NEAMWAVE 12

7.1 BRIEFINGS

7.1.1 Exercise Briefing

An initial exercise briefing should be provided to exercise participants, Exercise Control staff, and evaluators before the exercise begins. It is used to orientate all people involved in the exercise. The key points to raise at the initial briefing regardless of the group receiving it are:

Topic	Description
Timings	Timings and duration of participation required.
Exercise boundaries	What can and cannot occur in terms of role playing and operational response? The physical boundaries of the exercise.
Locations	Locations of key venues or activities, where relevant.
Expected outcomes	What is expected as a result of the exercise?
Safety briefings	What are the emergency procedures for the exercise?
Exercise logistics briefings	What are the logistical and administration arrangements for the exercise? What will happen in case of a real warning or emergency?

A final briefing should be conducted just before the exercise begins.

7.1.2 Exercise Players Briefings

Dedicated and detailed briefings should be provided to the Exercise Players by the institutional exercise coordinator to expand on the initial briefing and to state the range and limitations of their activities. Exercise Players briefings should include:

- Roles and responsibilities.
- Exercise documents.
- Methods to be used.
- Departures from scripts.
- Responding to participant actions.
- Keeping notes for later debrief.

7.1.3 Observer Briefings

Before the exercise begins, the National Exercise Director and/or institutional Exercise Coordinator should provide a briefing to their respective players and observers to verify roles, responsibilities and assignments, and to provide any significant updates, such as changes to the scenario. A summary of the Master Schedule of Events List (MSEL) is provided so that evaluators know which events are the most important.

This briefing is the time for observers to ask questions and to ensure complete understanding of their roles and responsibilities.

For operations-based exercises in Phase B, the briefing often includes a tour of the exercise site so that evaluators are familiar with the venue and know where they should position themselves to observe exercise play. Because many events may occur at once, evaluators may not be able to record all of the action. Knowing which events are most important can ensure that these are most closely evaluated.

7.2 START OF NEAMWAVE 12

The start of the exercise will be controlled by the CTWP in accordance with the schedule presented in Section 6.

7.3 EXERCISE CONTROL

Each in-country/agency Exercise Director uses the Master Schedule of Events List (MSEL) to control the exercise. He/she ensures that any problems are rectified to keep the exercise flowing. The Exercise Director can modify the flow of the exercise to make sure objectives are met. The National Exercise Director may be assisted by appointed Exercise Control staff with a range of responsibilities in order to keep the exercise running. In such a case, they need to stay in contact with the National Exercise Director throughout the exercise.

7.4 REAL EVENTS DURING THE EXERCISE

In the case of a real event occurring during the exercise, CTWPs and TWFPs/CPAs will give the full priority to the event and a decision will be made by CTWPs whether to continue or cease their participation in the exercise. Smaller earthquakes (M < 4) should, in principle, not be a reason to terminate the exercise. Nevertheless, individual Member States may suspend or terminate the exercise for their own reasons.

7.5 MASTER SCHEDULE OF EVENTS LIST (MSEL)

The Master Schedule of Events List is a detailed sequence of events used by the National Exercise Director/Agency Exercise Coordinators and by the Exercise Control Staff where applicable, to ensure that the exercise runs smoothly. It is also known as a running sheet, programme, script or main event list. MSELs for each scenario to be considered by NEAMWave 12 can be found in the Scenarios provided through Annexes V-VIII.

An example of such MSEL follows.

Date	Time (UTC)	Event	Notes
dd/mm/yyyy	T0 - 30 min	Exercise briefing	At the discretion of each MS
dd/mm/yyyy	T0 - 5 min	Tsunami Exercise Message is distributed by XXXXX	This message is planned but not yet typified in the Interim Op.
dd/mm/yyyy	T0	**The tsunamigenic earthquake occurs**	
dd/mm/yyyy	T0 + 5 min	Depending on the earthquake magnitude and epicentral distance to your country, the earthquake may be felt, and even moderate to large destruction may occur. This situation can be taken into consideration in the exercise development.	
dd/mm/yyyy	T0 + 10 min	Tsunami Watch Message #1	This first message is based only on earthquake information. At this time there is no confirmation that a tsunami has occurred. However, given the magnitude and location of the scenario, and also historical knowledge, it is very likely that a tsunami may have occurred.
dd/mm/yyyy	T0 + 20 min	Tsunami Watch Message #2	This message contains the confirmation of the occurrence of a tsunami by tide-gauge observations.
dd/mm/yyyy	T0 + 40 min	Tsunami Watch Message #3	This message contains additional information on the tsunami observation by tide-gauges
dd/mm/yyyy	T0 + 90 min	End of Tsunami Alert Message	This message marks the end of the exercise messages, but it cannot be considered as an "All-clear" message.
dd/mm/yyyy	T0 + 120 min	Exercise briefing	At the discretion of each MS

7.6 END OF NEAMWAVE 12

The last message provided by the CTWP for NEAMWave 12 is an "End of Tsunami Alert Message". This type of message is issued by a CTWP when observations, modelling and historical records show that the disturbances due to the tsunami wave subsided. This must not be confused to an "All Clear" message that can only by given by local authorities that have a more detailed description of the situation (please refer to the NEAMTWS Interim Op. Users Guide for details). Since the NEAMWave 12 must have a limited time-span, the sequence of messages needs to be ended, even before all coastal areas are relieved from the tsunami waves predicted by the scenario. Please keep in mind that in a true event, this message would likely be sent many hours after.

Finishing the exercise is a controlled activity. The in-country/agency National Exercise Director stops the exercise at a pre-planned time (e.g., this could be the END OF TSUNAMI message).

7.7 EVALUATION OF NEAMWAVE 12

7.7.1 General Concepts

The goal of the exercise evaluation is to validate strengths and identify opportunities for improvement within the participating organisations. This is to be accomplished by collating supporting data; analysing the data to compare effectiveness against requirements; and determining what changes need to be made by participating organisations, as well as the NEAMTWS as a coordinating group to support effective tsunami warning and decision making.

The evaluation of this exercise should focus on the adequacy of plans, policies, procedures, assessment capabilities, communication, resources and inter-agency/inter-jurisdictional relationships that support effective tsunami warning and decision-making at all levels of government. Participants that choose to include additional objectives, for example by exercising public warning and/or response plans, can expand the evaluation form accordingly. The evaluation of such additional objectives is recommended; however, it will be for the use of the particular participating agency only and is not required for the NEAMWave 12 Summary Report.

The evaluation tool aims to inform and facilitate individual participant country evaluations as well as the NEAMWave 12 Summary Report.

It is recommended that objective exercise observers be appointed at all exercise points to support the collection of NEAMWave 12-related data. Observers are to be guided by the exercise objectives and the information required in the Exercise Evaluation Forms. In completing evaluation forms, participating organisations must have the ability to note areas for improvement and the actions that they plan to take without concern that the information carries political or operational risks. Thus, the official Exercise Evaluation Form is designated as “For Official Use Only” and will be restricted for use by the Exercise Task Team for the sole purpose of compilation of the NEAMWave 12 Summary Report. Some participant countries may, however, decide at their own discretion to share their individual evaluation outcomes with the public.

7.7.2 Key Performance Indicators

Key Performance Indicators, also known as KPIs, are tools used to help an agency define and measure progress towards exercise objectives. A KPI may further define an objective, and is helpful when formulating the evaluation tool or measures. NEAMTWS Communication Test Exercises Performance Indicators (http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9331&lang=en, approved at ICG/NEAMTWS-IX in Southampton, UK during 11–13 September 2012) provides Key Performance Indicators for Phase A of NEAMWave 12. Objectives provided in “EVALUATION GUIDANCE FOR CIVIL PROTECTION AGENCIES AND EMERGENCY MANAGEMENT ORGANIZATIONS” as a part of Annex III are available as KPIs for NEAMWave 12.

7.7.3 Hot-Debrief

An immediate hot debrief should be provided for all players and staff to capture information and feedback while it is still fresh in their minds. Specifically for Phase B, for health and safety purposes in functional exercises, it should be ensured that all of the participants and staff are accounted for before releasing people from the exercise.

A suggested format for hot-debrief is to have a short break of about 10 minutes after the end of the exercise, followed by the initial feedback given by the National Exercise Director / Agency Exercise Coordinator. After this, Exercise Players would provide their round-table feedback followed by the Observers feedback.

7.7.4 Cold-Debrief

A cold-debrief is a more formal debrief held typically within three weeks following the exercise, before the exercise evaluation report is finalized. It could provide all the relevant people with a forum to exchange views and discuss the draft evaluation report.

The cold-debrief process should address the following questions:

- What happened during the exercise?
- What went well?
- What needs improvement?
- What plans, procedures or training programmes need amendment?
- What follow-up is required, including identifying any capability gaps for future capacity building?
- Was the exercise realistic?
- How could the exercise have been improved?

The debriefing process should remain focused on evaluating the exercise's effectiveness – on issues, successes and problems. It is important to note that personal criticism of individual participants at the meeting must be disallowed.

7.7.5 Evaluation Reports

For Phase A, CTWP and TWFP/NTWCs actively participating in NEAMWave 12, are required to submit a detailed evaluation report to the TT-CTTE within 45 days after the Exercise. Exercise evaluation forms for CTWPs are provided in Annex II.A to help structure the agenda and improve and focus the debrief session. A similar template is available for other Phase A participants in Annex II.B. Participants of Phase B (TWFP/NTWCs and CPAs) are required to provide their individual report to the TT-CTTE within 90 days after the Exercise. For the participants of Phase B, an evaluation guideline is provided in Annex III.

7.7.6 Final Evaluation Report

The NEAMWave 12 Exercise Team co-ordinated by the co-Chairs of TT-CTTE will be responsible for the compilation, evaluation and assessment of all the reports provided by the participants of Phase A and Phase B, and will submit a full report to the IOC Secretariat within 120 days after the Exercise. The report will include the following:

- Exercise description.
- Post-Exercise Evaluation Summary and Findings.
- Identification of Best Practices or Strengths.
- Identification of Areas for Improvement.
- Recommendations on Plans of Action for Improvement.

NEAMWave 12 Evaluation Report will be submitted to the ICG/NEAMTWS and IOC, and posted to the NEAMWave 12 website (http://neamtic.ioc-unesco.org/).

7.8 VALIDATION

The final stage of the exercise process is to determine whether or not the exercise has met its objectives. NEAMWave 12 validation compares the performance of the NEAMTWS, Member States, and/or agencies and participants during the exercise against performance expected. After validation, NEAMTWS Member States, or agencies may need to change or develop new plans, procedures, and training programmes. Exercise outcomes may be retested in future tsunami exercises, or new exercises written to meet newly identified needs.

8. MEDIA ARRANGEMENTS

Experience in conducting disaster response exercises with simulated events shows that there is always a potential for the public or media to interpret the exercise as a real. Taking this in consideration, procedures should be set up by all participating entities to address public or media concerns involving this exercise in case of misinterpretation by media or the public.

The UNESCO Bureau of Public Information will issue an international Media Advisory before the development of the NEAMWave 12 providing details of the exercise.

ICG/NEAMTWS Member States should consider issuing one or two exercise press releases to their respective country's media. Member States' press releases will give adequate alert to their country's population and give their local media time to conduct interviews and documentaries with participating exercise organisations in advance of the exercise.

A second Member State press release, one week before the exercise, in conjunction with the UNESCO release, would provide a more detailed description of exercise activities to take place within that country.

Annex VIII contains a sample press release in English that can be customized and translated to their national language(s) by the Member States.

9. LIST OF ACRONYMS

CEA	Commissariat à l'énergie atomique et aux énergies alternatives
CENALT	CENtre d'ALerte aux Tsunamis (France)
CPA	Civil Protection Agency
CTE	Communication Test Exercise
CTWP	Candidate Tsunami Watch Provider
CTWP-EC	Candidate Tsunami Watch Provider – Exercise Coordinator
DMO	Disaster Management Organization
ECTE1	1st Enlarged Communication Test Exercise
EMO	Emergency Management Organization
EOC	Emergency Operations Centre
EP	Exercise Player
ETA	Expected Tsunami Arrival Time
HLNTWC	Hellenic National Tsunami Warning Center
ICG	Intergovernmental Coordination Group
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPMA	Instituto Português do Mar e da Atmosfera, Portugal
KOERI	Kandilli Observatory and Earthquake Research Institute, Turkey
KPI	Key Performance Indicator
MSEL	**Mas**ter Schedule of Events List
NEAM	North-eastern Atlantic, the Mediterranean and Connected Seas
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas
NCE	National Contact for the Exercise
NED	National Exercise Director
NEPC	National Exercise Planning Coordinator
NGDC	National Geophysical Data Center
NOA	National Observatory of Athens, Greece
NTWC	National Tsunami Warning Centre
PPRD	Programme for the Prevention, Preparedness and Response to natural and Man-made Disasters
SOP	Standard Operating Procedures
TFP	Tsunami Forecast Point

TNC	Tsunami National Contact
TT-CTTE	Task Team on Communication Test and Tsunami Exercises
TWFP	Tsunami Warning Focal Point
TWP	Tsunami Watch Provider
TWR	Tsunami Watch Recipients
WG	Working Group

10. REFERENCES

Communication Test Exercise Manual ICG/NEAMTWS.
http://neamtic.ioc-unesco.org/index.php/docs/tech-docs

EXERCISE CARIBE WAVE 11 – Participant Handbook; Intergovernmental Oceanographic Commission Technical Series 93.
http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=6525&lang=en

EXERCISE INDIAN OCEAN WAVE 11 - Intergovernmental Oceanographic Commission Technical Series 99.
http://www.ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=7807

EXERCISE PACIFIC WAVE 11 – Exercise Manual; Intergovernmental Oceanographic Commission Technical Series 97.
http://unesdoc.unesco.org/images/0021/002114/211498e.pdf

HOW TO PLAN, CONDUCT AND EVALUATE TSUNAMI EXERCISES; Intergovernmental Oceanographic Commission, *Manuals and Guides 58.*
http://www.ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=8135

Interim Operational Users Guide for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS) Version 2.0; November 2011.
http://neamtic.ioc-unesco.org/images/pdf/neamtws.pdf

Intergovernmental Oceanographic Commission of UNESCO. 2011. *Reducing and managing the risk of tsunamis*. (IOC Manuals and Guides, 57) 74 pp. (English.) (IOC/2011/MG/57Rev.).
http://unesdoc.unesco.org/images/0021/002147/214734e.pdf

NEAMTIC North-Eastern Atlantic and Mediterranean Tsunami Information Centre
http://neamtic.ioc-unesco.org/

NEAMTWS
http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=70&Itemid=14&lang=en

ANNEX I

IOC CIRCULAR LETTER 2437

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCÉANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISIÓN OCEANOGRÁFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلوم المحيطات
政府间海洋学委员会
UNESCO

UNESCO - 1, rue Miollis - 75732 Paris Cedex 15
cable address: UNESCO Paris - telex: 204461 Paris - fax: (33) (0)1 45 68 58 12 - contact phone: (33) (0) 1 45 68 39 83/84
E-mail: w.watson-wright@unesco.org

IOC Circular Letter No. 2437
(Available in English and French)

IOC/WWW/SB/FS
Paris, 30 April 2012

To: ICG/NEAMTWS Tsunami Warning Focal Points (TWFP) and Tsunami National Contacts (TNC)
ICG/NEAMTWS Steering Committee

cc. Official National Coordinating Body for liaison with IOC Member States
Permanent Delegates/Observer Missions to UNESCO of IOC Member States

Subject: NEAMTWS Tsunami Exercise - "NEAMWave12"

At the 8th 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) (Santander, Spain, 22–24 November 2011), The ICG decided that, following the success of the communication test exercise of 10 August 2011 involving 31 National Tsunami Warning Focal Points from the region, a full-scale exercise named NEAMWave12 would be conducted in the fourth quarter of 2012 to test the readiness of the system and of the Member States. This letter provides details of the NEAMWave12 exercise in which all NEAMTWS Member States are encouraged to participate.

NEAMWave12 will simulate the countries bordering the North-eastern Atlantic, the Mediterranean and connected seas being placed in a Tsunami Warning situation and require the Tsunami warning focal point (TWFP), the National Tsunami Warning Centres (NTWC) and the Disaster Management Organizations (DMO) or Civil Protection Agencies (CPA) in each Member State to implement the procedures laid out in the NEAMTWS Interim Operational Users Guide (2012). The exercise will take place in November 2012 (date to be defined) and will run in real time. Exercise messages will be issued by the candidate Tsunami Watch Providers (TWPs). A NEAMWave12 Exercise Manual will be distributed in the near future with further details on the exercise scenario and the simulated messages.

Guiding principles for the planning and conduct of Exercise NEAMWave12 are listed in Annex 1 (NEAMWave12 Concept Paper) and Annex 2 (Draft Scenario Guidelines for NEAMWave12) for your information. Further details will be discussed and agreed upon at the workshop on Tsunami emergency preparedness in Mediterranean coastal zones, to be held in Stromboli, Italy, on 30 May – 2 June 2012 co-organized by PPRD South Project (Prevention, Preparedness and Response to Natural and Man-made Disasters), funded by the European Commission and coordinated by the Italian Civil Protection Department, and IOC.

In order to ensure that the commitment of participating Member States is fully coordinated, we seek your nomination of a **National Contact for Exercise NEAMWave12** with whom we will communicate about planning for the conduct of the exercise. The designated National Contact will be expected to confirm the accuracy of existing tsunami warning arrangements within your country, including the identification of operational points of contact for receipt and dissemination of tsunami warnings downstream from the NTWC. The designated National Contact will also be responsible for coordinating input to the exercise evaluation, details of which will be circulated as part of the NEAMWave12 Exercise Manual.

At its last session, the ICG acknowledged the steady progress made towards the provision of tsunami watch services for the region. France, Greece, Italy, Portugal and Turkey confirmed that they will be operating national tsunami warning centres in the short-term, of which some already in 2012. In 2012 some of the national tsunami warning centres will also offer interim operational tsunami watch provisions upon request to the other member states of the NEAM region. The NEAMWave12 exercise will provide the NEAMTWS Member States with an opportunity to evaluate their readiness for the forthcoming service. We would therefore urge all Member States to participate in NEAMWave12 to the extent possible.

We would be grateful if you could provide the details of your National Contact for Exercise NEAMWave12 **by 24 September 2012** to the ICG/NEAMTWS Secretariat by email (neamtws-secretariat@unesco.org) or FAX (+33 (0)1 45 68 58 12). We would also encourage you to disseminate copies of this letter to the appropriate organizations and authorities within your country.

Yours sincerely,

François Schindelé
Chair
ICG/NEAMTWS

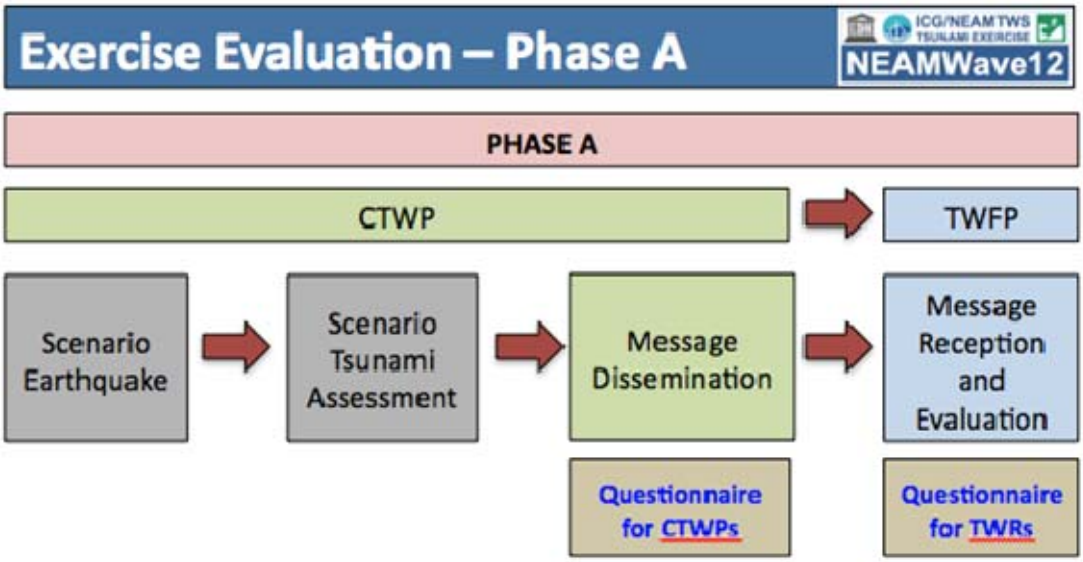
Wendy Watson-Wright
Executive Secretary, IOC
Assistant Director-General, UNESCO

Enclosures
Annex 1 NEAMWave12 Concept Paper
Annex 2 Draft Scenario Guidelines for NEAMWave12

ANNEX II

PHASE A – EVALUATION QUESTIONNAIRE FOR CTWPs AND TWRs

The forms presented here refer to the evaluation of Phase-A of the NEAMWave 12 Tsunami Exercise, as presented graphically below:



Objectives

1. Validate and evaluate the Candidate Tsunami Watch Providers (CTWP) dissemination process of issuing Tsunami Messages in the NEAM region;

2. Validate and evaluate the procedures for countries to receive and confirm the Tsunami Messages issued by the CTWP through their National Tsunami Warning Centres (NTWC), or the country Tsunami Warning Focal Points (NTWFP) or the country Tsunami National Contacts (NTC).

These forms provided in Annex II.A and Annex II.B are adapted from the NEAMTWS Communication Test Manual and more details on the evaluation procedure and concepts can be found there. Relevant information on GTS messages and headers and on procedures to evaluate the time-stamping of messages are repeated here as additional annexes, for easier reference.

ANNEX II.A

PHASE A – EVALUATION QUESTIONNAIRE FOR CTWP

Please note that all times should be provided in Universal Time in HH:MM:SS format. Please copy and paste confirmation sheets from the fax machine (if available), and a copy of the messages distributed by email, fax and GTS. Please verify that the time-stamp information is visible on the documents, if applicable. Preferably the e-mail message text appended to this report should be copied directly from the mail-box server in order to provide all the details on timing and routing.

COUNTRY:				
INSTITUTION:				
Provide T0 Time:				
Provide times of delivery for each message and communication technology:				
		E-MAIL	**FAX**	**GTS**
#1	***time stamp***			
#2 [(1)]	***time stamp***			
Provide a detailed story of all activities starting from T0 and TN (end of the exercise). Did you receive any error messages or observed any problems? If yes, describe them for all dissemination technologies and addresses concerned.				
Describe the operational service to deliver the e-mail messages.				
Describe the operational service to deliver the fax messages.				
Describe the operational service to deliver the GTS messages.				
Describe briefly the preparation made in your agency for the Communication Test Exercise				
Describe briefly the procedures taken during the exercise, before time zero, and after time zero.				
Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.				
Did you synchronize the fax machine before sending the messages? If yes, describe briefly the procedure used.				
Did you find the exercise useful in assessing the readiness of your agency to distribute tsunami related messages?				
Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?				
Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.				
[(1)] *Insert rows as adequate*				

ANNEX II.B

PHASE A – EVALUATION QUESTIONNAIRE FOR TWR

Please note that all times should be provided in Universal Time in HH:MM:SS format, where applicable. Please copy and paste into this questionnaire e-mail, fax and GTS messages received for each delivery.

COUNTRY:	
INSTITUTION:	

Provide the time stamps of the messages received through each communication technology:

E-MAIL	FAX	GTS

Provide times of message delivery for each communication technology[(1)]

Primary E-MAIL	Alternate E-MAIL	Primary FAX	Alternate FAX	GTS
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
Message Header:	*[type the header of the message here]*			
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*

Provide times for each communication technology when the message is read and understood by the operator[(1)]

Primary E-MAIL	Alternate E-MAIL	Primary FAX	Alternate FAX	GTS
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*

Was the provider e-mail address as expected?	

Was the e-mail message complete as expected? If not, report the differences.

Was the provider fax number as expected?	

Was the fax message complete as expected? If not, report the differences.

Was the GTS message complete as expected? If not, report the differences.

Did the operator who received the messages understood its content and knew how to respond to it?

Describe briefly the preparation made in your agency for the Communication Test Exercise.

Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.

Did you synchronize the fax machine before receiving the messages? If yes, describe briefly the procedure used.

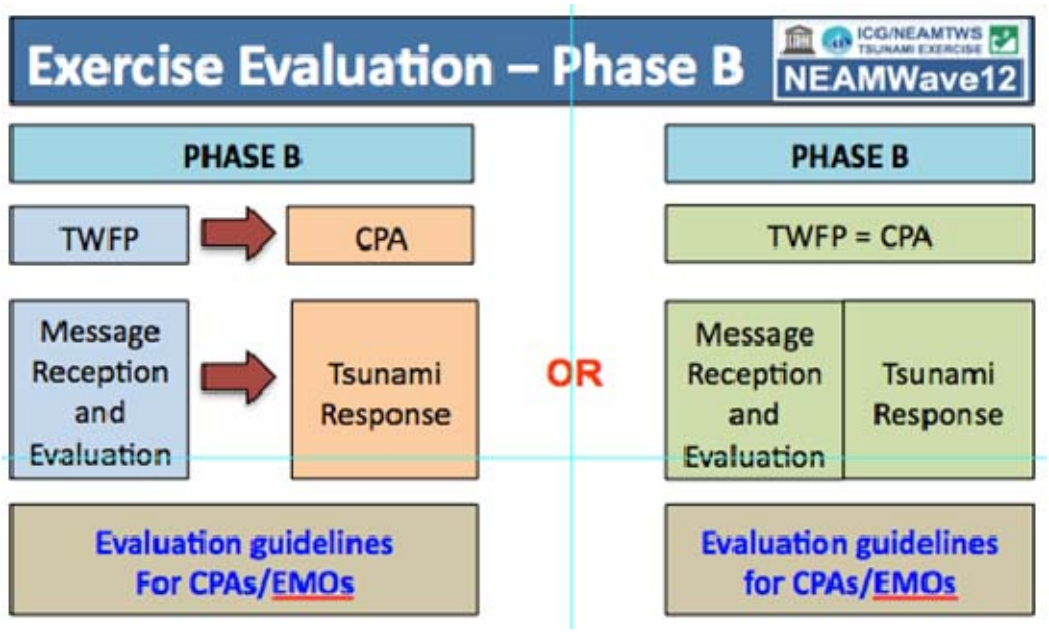
Did you find the exercise useful in confirmation communication contacts and delays?	

Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?
Do you have any suggestions for the next exercises?
Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.
[(1)] *Repeat the lines below corresponding to the times as necessary to accommodate all messages received*

ANNEX III

PHASE B – EVALUATION GUIDANCE FOR CIVIL PROTECTION AGENCIES AND EMERGENCY MANAGEMENT ORGANIZATIONS (CPA/EMO)

The guidance presented here refer to the evaluation of Phase-B of the NEAMWave 12 Tsunami Exercise, as presented graphically below. Two situations are considered, either the national agency responsible for receiving the Tsunami Messages from the Candidate Tsunami Watch Providers (CTWP) is the same as the national CPA/EMO (on the right) or they are different (on the left). If the agencies are different, then the communication channel between them should also be evaluated.



Objectives

1. Validate and evaluate the dissemination of the warning messages to the relevant agencies that are responsible for emergency response.

2. Validate and evaluate the organizational decision making process about public warnings and evacuations.

3. Identify the modes that would be employed to notify and instruct the public.

Scope

The level at which the NEAMWave 12 is developed at the national level is to the discretion of each Member State and it is expected to meet specific national requirements and objectives. Furthermore, the alerting of people at risk is a responsibility of each MS emergency management organization. Taking this into consideration, detailed templates for the evaluation forms will not be provided in this manual, but principal guidelines will be proposed that could be part of such an evaluation, taking into consideration the need for an end-to-end Tsunami Warning System.

Guidance for National Civil Protection agencies and Disaster Management offices as part of NEAMTWS

The management and interoperability of the core components of NEAMTWS (CTWPs, NTWCs/TWFPs, CPAs and their related emergency agencies) are governed by specific standard operating procedures (SOP) so that their operators know precisely what actions to take in an emergency, even if such an emergency is a very rare event. Much of the evaluation of the NEAMWave 12 Exercise is likely to relate to the effectiveness of messaging procedures and communication within the system. However, the evaluation may also provide an opportunity for assessing:

- The community's understanding of risk in respect of tsunami inundation,
- The appropriateness of the community's evacuation plans to cope with the threat or the reality of a major inundation with only a very short warning time.
- The community's awareness and preparedness for an inundation event.

The guidance manual for Civil Protection agencies within the NEAM region, prepared by the ICG/NEAMTWS (*Reducing and managing the risk of tsunamis*, IOC Manuals and Guides, No. 57, IOC/2011/MG/57. 2011), provides an overview of these topics, as well as the core warning architecture and functions of the system, and may serve as a useful reference in the evaluation process.

As an output of the Exercise, Civil Protection agencies may want to assess their understanding of the consequences of the tsunami hazard to their population and its supporting assets. For this topic, the guidance manual describes the procedures for assessing a community's vulnerability – its potential for loss and damage in the event of a credible tsunami scenario. The evaluation might consider the quality and relevance of pre-event hazard and vulnerability mapping and its application in evacuation planning – the demarcation of evacuation zones, priorities for evacuation, location of safe refuges, signage, etc. The exercise might highlight possible shortcomings in knowledge and preparedness in these areas. Community awareness and understanding of tsunami warnings and the level of preparedness to respond quickly and in an orderly manner to an emergency are further areas for possible evaluation that are described in the guidance manual.

Objective 1

- What are the communication channels used between the NTWC/TNFP/NTC and the national CPA/EMO? (If applicable)
- Were there any problems identified in these channels? How did they perform? What were the delays? (If applicable)
- What are the procedures to transmit the alert messages between the NTWC/TNFP/NTC and the national CPA/EMO? (If applicable)
- Are there any Standard Operational Procedures established for this communication? (If applicable)
- Was the original message changed, edited, translated or modified to facilitate its interpretation by national CPA/EMO?
- How was this procedure performed? Automatically or manually?
- Are there procedures in place to adequately provide time-stamps to alert messages and archiving?
- Where there any particular preparations done for NEAMWave 12 by the NTWC/TNFP/NTC and the national CPA/EMO?
- Was the exercise considered useful to validate and assess the dissemination of the warning messages to the relevant agencies that are responsible for emergency response?

Objective 2

- Were the messages received by the national CPA/EMO adequately validated and understood?
- Was the message received by the national CPA/EMO considered appropriate to make an adequate evaluation of the warning situation? Was the quality of information adequate? What improvements could be suggested?
- What are the procedures to receive and process the tsunami at the national CPA/EMO?
- Are there any Standard Operational Procedures established for this?
- What are the procedures that conduct to make the decision of alerting the public? Are there levels of alert defined?
- Was the decision making process considered timely and appropriate?
- Which are the national agencies at national, regional and local level that are involved in the process of alerting the public? Are there SOP established for this situation?
- What are the communication channels used between the national CPA/EMO and the other agencies involved? Are these channels adequate? How vulnerable are these channels estimated to be in case the earthquake also affects your country? (If applicable)
- Are there procedures in place to confirm that the alert messages are properly received and understood at all levels of the chain?
- Can a timeline be estimated from the message reception till the alert message is sent down the chain?
- Are there procedures in place to give alert to critical facilities, like harbours, nuclear power plants, etc.?
- Was any participant agency (or other) contacted by the media in relation to NEAMWave 12 exercise?
- Did any participant agency (or other) contact the media in relation to NEAMWave 12 exercise?
- Are there procedures in place to regulate the relationship with the media in case of a tsunami warning?

Objective 3

- What are the communication channels and means planned for citizen notification?
- Are there SOP established for this purpose?
- Was the quality of information issued by the national CPA/EMO dissemination point considered sufficient to support decision making at the local level?
- Did the messages addressed to the local level contain adequate information? (e.g. local hazard assessments, inundation areas identified, etc.)
- Are there procedures in place for verification that indeed the people at risk are notified?
- Are there evacuation plans established at the local level?
- Is it possible to estimate the elapsed time that would occur from the time the alert message is sent by the national CPA/EMO until the people at risk is notified?
- Did the exercise contribute to the improvement or the development of planning related to public warnings and other response activities required for an event of this nature?

ANNEX IV

NEAMWAVE 12 SCENARIO: CENALT (FRANCE)

The aim of the NEAMWave 12 exercise is to simulate the occurrence of a potential tsunami in the North-Eastern Atlantic and Mediterranean Sea, to build capacities and test the NEAM tsunami warning system.

CENALT is proposing a scenario in the Western Mediterranean Sea, which is a plausible worst case scenario along the Western Mediterranean faults. This note describes the scenario proposed and how it was selected.

The scenario proposed by CENALT for NEAMWave 12 was chosen thanks to the simulation software Calypso developed by CEA. This software models the initiation of the tsunami and its propagation along coasts and across the sea. The mathematic model, which will not be presented here, is based upon the Okada's formulas estimating the elastic deformation of the soil after an earthquake, and the equations of St Venant for computing the wave propagation, assuming wavelengths much longer than the water depth, as usual for tsunamis.

The scenario chosen had to be penalizing but probable, letting the countries test their operational answer to a tsunami, but without overestimating the threat across the basin. It had to impact most of the countries of the basin significantly. It must also fit the supposed geological situation knowledge along the North-Algerian margin.

Proposed scenario

It was decided to propose the following scenario, which is the most accurate regarding the supposed faults existing in the basin.

The scenario proposed for NEAMWave 12 is the one generated by the following earthquake:

- Longitude : 6.39846
- Latitude : 37.2906
- Mw: 7.5
- Depth : 9km
- Slip : 3.9m
- Strike : 80°
- Dip : 50°
- Rake : 90°
- Half-length : 40 km
- Width : 22km
- Shear module : 33.E9
- Mw: 7.5

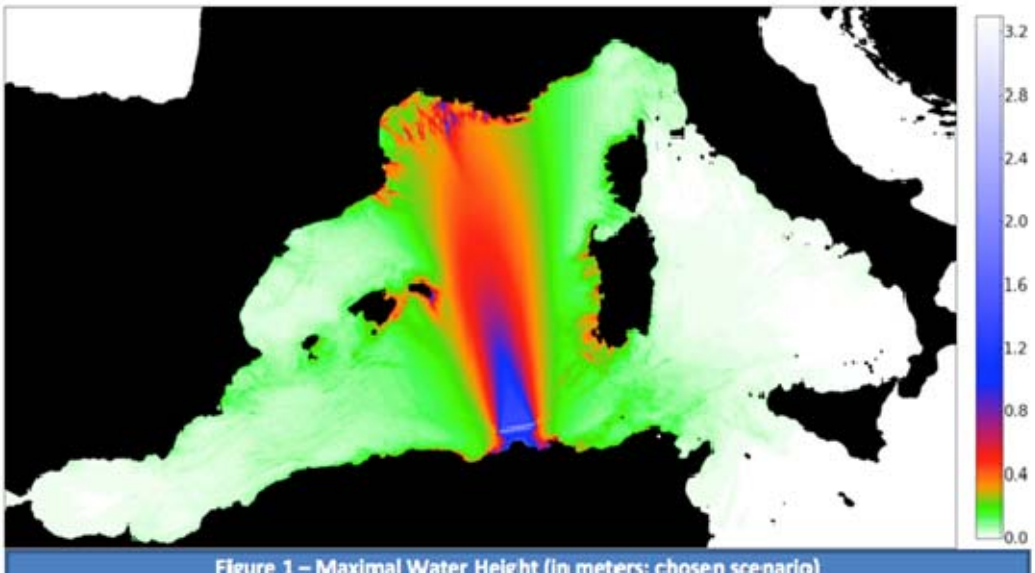


Figure 1 – Maximal Water Height (in meters; chosen scenario)

This scenario generates waves off the coasts up to:

- 0.55 meters at Italian coast (Sardinia);
- 0.95 meters at France;
- 1.25 meters Spain (Minorca);
- 0.35 meters Monaco;
- Less than 0.1 meters for United Kingdom (Gibraltar).

This virtual earthquake is compatible with the supposed geological characteristics described in bibliography around this zone, faults are identified where the tsunami simulation is initiated.

Comparison with other scenarios

Other scenarios were computed, with different earthquake origins, to determine the most impacting scenario.

The study was leaded on 5 sources all along the North-Algerian seismic margin: off the coasts of Boumerdès, Tigzirt, At Rahmun, Collo and Annaba. For each zone, 3 synthetic faults at least were created, with different lengths and widths between the zones and, inside each zone, with different strike angles. 17 faults were modeled and permitted to develop 17 tsunami scenarios.

The sea floor deformations were modeled for magnitude 7.5 earthquakes source parameters, except at Boumerdès where magnitude of 6.9 was used, same magnitude as the 2003 earthquake.

For each scenario, the water heights were obtained at each point of the basin. The results were also analyzed to determine the coastline length impacted by the tsunami.

The water heights obtained are computed offshore; indeed the simulation model does not include the coastal effects. At a basin-wide scale, these heights could not be correctly extrapolated on the coasts, and more accurate simulations would have to be conducted to know the heights more likely to occur at each coastal point.

Results and conclusions

One parameter that was studied is the percentage of coastlines impacted by the tsunami. This was computed all along the Western Mediterranean coastlines.

Figure 2 – The 17 faults studied

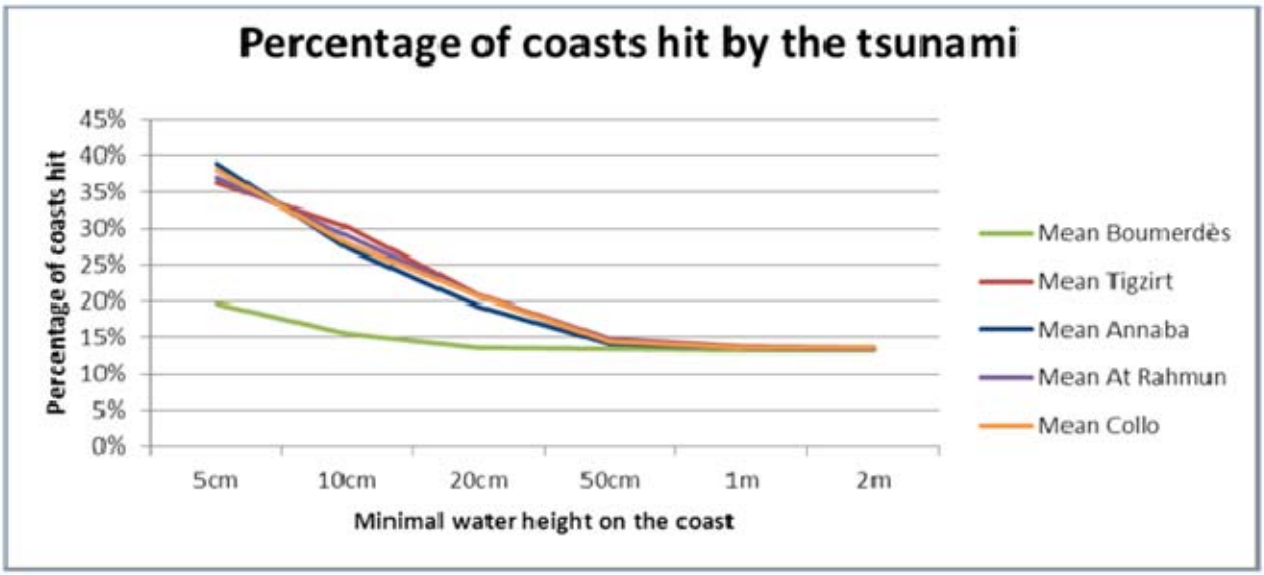


Figure 3 – Percentage of coasts hit by the tsunami

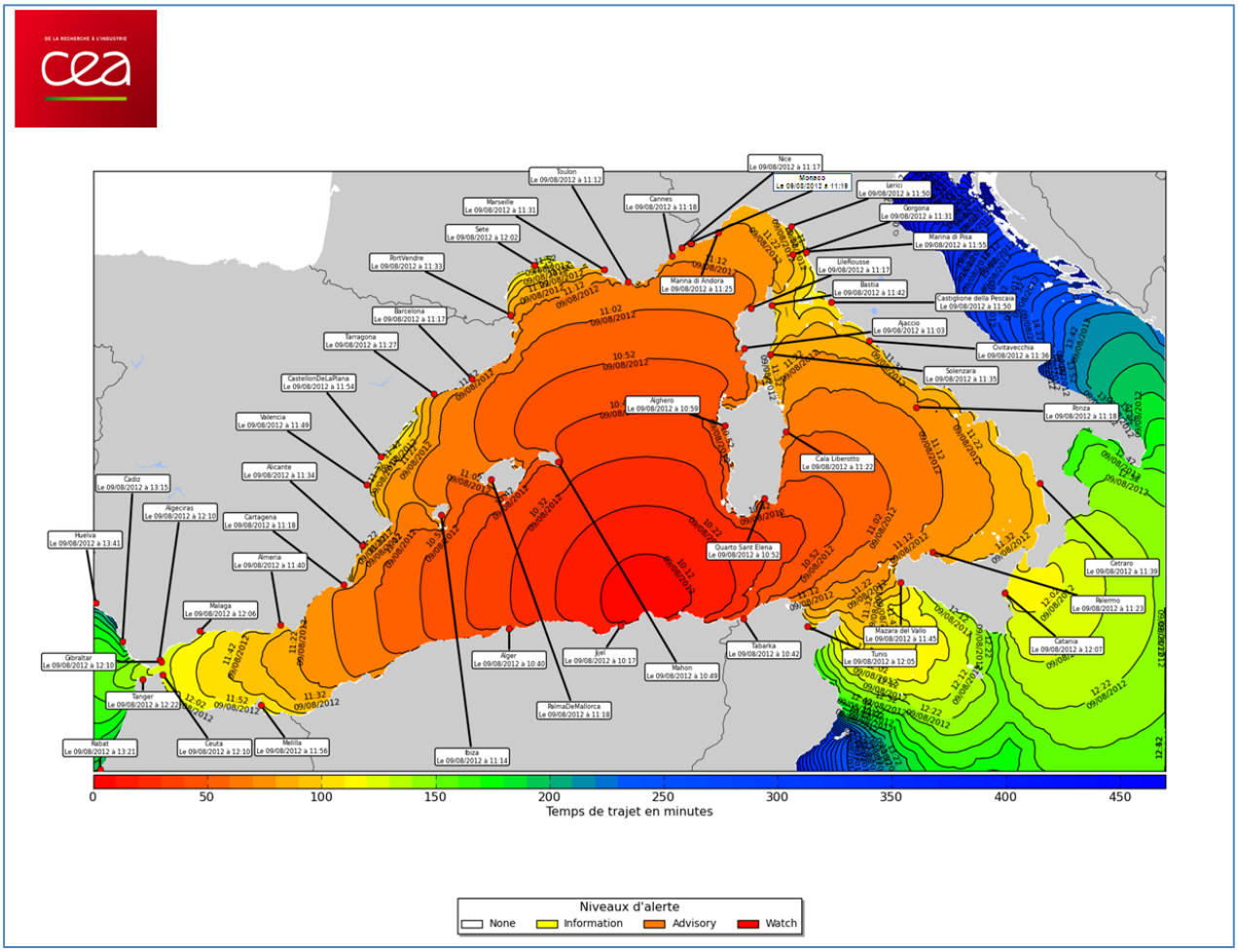


Figure 4 – Tsunami arrival time

Except for the Boumerdes case with smaller magnitude and tsunami height, no scenario could be considered more penalizing (Figure 3). Nevertheless, considering that the same coastlines length is impacted, the geographic repartition of these coasts moves from one scenario to another one. For example, the seismic scenario off Tigzirt impacts Balearic islands and north-eastern Spanish coasts, whereas the Annaba tsunami preferentially hits Sardinia and Nice.

On a second step, for each scenario, the maximum heights observed off the coasts of each country were compared. Two types of scenarios were noted :

- Some scenarios impacted mainly the coasts of only one or two countries and the others were not impacted
- Some scenarios impacted most of the countries

It was decided to propose a scenario of the second type, i.e. impacting most of the countries. The most interesting scenario was the one described previously (cf. Figure 1), which impacts Algeria around Collo and the nearby coasts, the Balearic Islands and the North-eastern coasts of Spain and the southern and western coasts of Sardinia, the western coasts of Tunisia, the French Gulf of Lion and French Riviera, Monaco and Gulf of Genova.

Master Schedule of Events List

TITLE	CONTENT	TIME
TSUNAMI EXERCISE MESSAGE NUMBER 001	Earthquake Parameters Estimated Arrival Time Level of Alert	T0 + 15’
TSUNAMI EXERCISE MESSAGE NUMBER 002	Earthquake Parameters Estimated Arrival Time Level of Alert Tsunami Measurements	T0 + 45’
TSUNAMI EXERCISE MESSAGE NUMBER 003	Earthquake Parameters Estimated Arrival Time Level of Alert Tsunami Measurements	T0 + 90’
TSUNAMI EXERCISE MESSAGE NUMBER 004	Earthquake Parameters Tsunami Measurements End of Tsunami Alert Message	T0 + 150’

CENALT Scenario Example Message

TSUNAMI EXERCISE MESSAGE NUMBER 001
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1145Z 24 OCT 2012

... TSUNAMI WATCH ...
THIS ALERT APPLIES TO ALGERIA ... FRANCE ... ITALY ... MONACO ... MOROCCO ... SPAIN ... TUNISIA ... UNITED KINGDOM

... TSUNAMI INFORMATION ...
THIS ALERT APPLIES TO ALBANIA ... BELGIUM ... BULGARIA ... CAPE VERDE ... CROATIA ... CYPRUS ... DENMARK ... EGYPT ... ESTONIA ... FINLAND ... GEORGIA ... GERMANY ... GREECE ... ICELAND ... IRELAND ... ISRAEL ... LEBANON ... LIBYA ... MALTA ... MAURITANIA ... NETHERLANDS ... NORWAY ... POLAND ... PORTUGAL ... ROMANIA ... RUSSIAN FEDERATION ... SLOVENIA ... SWEDEN ... SYRIA ... TURKEY ... UKRAINE

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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1143Z 24 OCT 2012
COORDINATES - 37.29 NORTH 6.40 EAST
DEPTH - 9 KM
LOCATION – WESTERN MEDITERRANEAN SEA
MAGNITUDE - 7.5

EVALUATION OF TSUNAMI WATCH
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED.
THIS WARNING IS BASED ONLY ON THE EARTHQUAKE EVALUATION.
AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI
THAT CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN 0.5M
AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS
POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR
THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE
THE SEVERITY OF THE THREAT.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY
SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE
TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE
THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO
THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR
MAJOR EFFECT IN THE REGION.THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN
THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND
THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES
AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.
LOCATION FORECAST POINT COORDINATES ARRIVAL TIME LEVEL (ADVISORY, WATCH)
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ALGERIA - JIJEL 36.82N 5.79E 1158Z 24 OCT WATCH
ALGERIA - ALGER 36.77N 3.08E 1221Z 24 OCT WATCH
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TUNISIA - TUNIS 36.81N 10.31E 1346Z 24 OCT WATCH
SPAIN - MAHON 39.89N 4.26E 1230Z 24 OCT WATCH
SPAIN - IBIZA 38.91N 1.43E 1255Z 24 OCT WATCH
SPAIN - BARCELONA 41.39N 2.17E 1258Z 24 OCT WATCH
SPAIN - PALMADEMALLORCA 39.57N 2.65E 1259Z 24 OCT WATCH
SPAIN - CARTAGENA 37.61N 0.94W 1259Z 24 OCT WATCH
SPAIN - TARRAGONA 41.12N 1.24E 1308Z 24 OCT WATCH
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SPAIN - ALMERIA 36.84N 2.47W 1321Z 24 OCT WATCH
SPAIN - VALENCIA 39.47N 0.38W 1330Z 24 OCT WATCH
SPAIN - CASTELLONDELAPLANA 39.98N 0.03W 1335Z 24 OCT WATCH
SPAIN - MELILLA 35.29N 2.94W 1337Z 24 OCT WATCH
SPAIN - MALAGA 36.72N 4.42W 1347Z 24 OCT WATCH
SPAIN - ALGECIRAS 36.18N 5.40W 1351Z 24 OCT WATCH
SPAIN - CEUTA 35.89N 5.32W 1351Z 24 OCT WATCH
SPAIN - CADIZ 36.53N 6.29W 1456Z 24 OCT WATCH
SPAIN - HUELVA 37.26N 6.95W 1522Z 24 OCT WATCH
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ITALY - PONZA 40.88N 12.95E 1258Z 24 OCT WATCH
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ITALY - CETRARO 39.49N 15.94E 1320Z 24 OCT WATCH
ITALY - MAZARA DEL VALLO 37.64N 12.58E 1326Z 24 OCT WATCH
ITALY - LERICI 44.06N 9.91E 1331Z 24 OCT WATCH
ITALY - CASTIGLIONE DELLA PESCAIA 42.74N 10.89E 1331Z 24 OCT WATCH
ITALY - MARINA DI PISA 43.62N 10.28E 1336Z 24 OCT WATCH
ITALY - CATANIA 37.44N 15.10E 1348Z 24 OCT WATCH
FRANCE - AJACCIO 41.93N 8.78E 1244Z 24 OCT WATCH
FRANCE - TOULON 43.11N 5.97E 1253Z 24 OCT WATCH
FRANCE - NICE 43.69N 7.27E 1258Z 24 OCT WATCH
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FRANCE - SOLENZARA 41.83N 9.40E 1316Z 24 OCT WATCH
FRANCE - BASTIA 42.70N 9.45E 1323Z 24 OCT WATCH
FRANCE - SETE 43.40N 3.69E 1343Z 24 OCT WATCH
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MOROCCO - TANGER 35.79N 5.80W 1403Z 24 OCT WATCH
MOROCCO - RABAT 34.04N 6.84W 1502Z 24 OCT WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

TSUNAMI EXERCISE MESSAGE NUMBER 002
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1150Z 24 OCT 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO ALGERIA ... FRANCE ... ITALY ... MONACO ... MOROCCO ... SPAIN ... TUNISIA ... UNITED KINGDOM

... TSUNAMI INFORMATION ONGOING ...
THIS ALERT APPLIES TO ALBANIA ... BELGIUM ... BULGARIA ... CAPE VERDE ... CROATIA ... CYPRUS ... DENMARK ... EGYPT ... ESTONIA ... FINLAND ... GEORGIA ... GERMANY ... GREECE ... ICELAND ... IRELAND ... ISRAEL ... LEBANON ... LIBYA ... MALTA ... MAURITANIA ... NETHERLANDS ... NORWAY ... POLAND ... PORTUGAL ... ROMANIA ... RUSSIAN FEDERATION ... SLOVENIA ... SWEDEN ... SYRIA ... TURKEY ... UKRAINE

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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1143Z 24 OCT 2012
COORDINATES - 37.29 NORTH 6.40 EAST
DEPTH - 9 KM
LOCATION - WESTERN MEDITERRANEAN SEA
MAGNITUDE - 7.5

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN
0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M.
THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY

SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR MAJOR EFFECT IN THE REGION.THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.
LOCATION FORECAST POINT COORDINATES ARRIVAL TIME LEVEL (ADVISORY, WATCH)
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MOROCCO - TANGER 35.79N 5.80W 1403Z 24 OCT WATCH

MOROCCO - RABAT 34.04N 6.84W 1502Z 24 OCT WATCH

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER
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CF06 39.14N 8.31E 0836Z 0.23M 20MN

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

TSUNAMI EXERCISE MESSAGE NUMBER 003
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1153Z 24 OCT 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO ALGERIA ... FRANCE ... ITALY ... MONACO ... MOROCCO ... SPAIN ... TUNISIA ... UNITED KINGDOM

... TSUNAMI INFORMATION ONGOING ...
THIS ALERT APPLIES TO ALBANIA ... BELGIUM ... BULGARIA ... CAPE VERDE ... CROATIA ... CYPRUS ... DENMARK ... EGYPT ... ESTONIA ... FINLAND ... GEORGIA ... GERMANY ... GREECE ... ICELAND ... IRELAND ... ISRAEL ... LEBANON ... LIBYA ... MALTA ... MAURITANIA ... NETHERLANDS ... NORWAY ... POLAND ... PORTUGAL ... ROMANIA ... RUSSIAN FEDERATION ... SLOVENIA ... SWEDEN ... SYRIA ... TURKEY ... UKRAINE

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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1143Z 24 OCT 2012
COORDINATES - 37.29 NORTH 6.40 EAST
DEPTH - 9 KM
LOCATION - WESTERN MEDITERRANEAN SEA
MAGNITUDE - 7.5

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN
0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M.
THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY
SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE
TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE
THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO
THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR
MAJOR EFFECT IN THE REGION.THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN
THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND
THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES
AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION FORECAST POINT COORDINATES ARRIVAL TIME LEVEL (ADVISORY, WATCH)
------------------------------ ----------- -----------
ALGERIA - JIJEL 36.82N 5.79E 1158Z 24 OCT WATCH
ALGERIA - ALGER 36.77N 3.08E 1221Z 24 OCT WATCH
TUNISIA - TABARKA 36.96N 8.75E 1223Z 24 OCT WATCH
TUNISIA - TUNIS 36.81N 10.31E 1346Z 24 OCT WATCH
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MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER
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ALCU 39.87N 3.12E 0944Z 0.50M 74MN
CA02 39.21N 9.11E 0917Z 0.26M 40MN
CF06 39.14N 8.31E 0836Z 0.23M 20MN
PALM 39.56N 2.64E 0958Z 0.01M 36MN

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

TSUNAMI EXERCISE MESSAGE NUMBER 004
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1155Z 24 OCT 2012

... END OF TSUNAMI WATCH ...
THIS ALERT APPLIES TO ALGERIA ... FRANCE ... ITALY ... MONACO ... MOROCCO ... SPAIN ... TUNISIA ... UNITED KINGDOM

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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1143Z 24 OCT 2012
COORDINATES - 37.29 NORTH 6.40 EAST
DEPTH - 9 KM
LOCATION - WESTERN MEDITERRANEAN SEA
MAGNITUDE - 7.5

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED.
WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO THE CONTINUING SEA LEVEL CHANGES AND RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

THIS WILL BE THE FINAL MESSAGE ISSUED FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

ANNEX V

NEAMWAVE 12 SCENARIO: NOA (GREECE)

The proposed scenario of the Hellenic National Tsunami Warning Center NOA - HLNTWC (Greece) is based on an earthquake event, similar to the well-known Amorgos earthquake which was followed by a tsunami that devastated the Aegean Sea on July 9, 1956. The earthquake, in a regional scale, is expressing backarc extensional tectonics in the general framework of the African subduction at the Hellenic trench (Okal et al., 2009).

The scenario earthquake of moment magnitude Mw = 7.6, occurs on the date of the NEAMWAVE 12 Exercise (for example November 28, 2012 at 12:00 GMT), in the southeast Aegean, with the epicentral coordinates of 36.72°N and 25.76°E, at a depth of 22.5 km. Considering that the focal depth was estimated at 45km (Okal et al., 2009), the scenario event is initiated at the centre of the fault. Considering the earthquake magnitude, the fault has a length of 81 km, a width of 41 km and is striking N39°E with a dip of 25° following Okal et al. (2009). The rake is -114° and this scenario event produces a slip of 2.46 m.

The generated tsunami has source estimated wave height of about 1.1 m. In the first 10 minutes, the tsunami wave arrives at the islands of Anafi, Astypalaia, Kos and the northeastern part of Crete, while the first half an hour arrives at Rhodes Island, Bodrum and the northern coast of Santorini, with a wave height near the coast between 0.2 and 0.4 m. In the first hour after the event, the wave arrives at the islands of Naxos, Syros and Milos, the east coast of Peloponnesus, the southwest coast of Turkey, the northeast coast of Lybia and the northwest coast of Egypt. In the next hour the wave arrives at the eastern most of the Mediterranean Sea, at Israel, Lebanon and Syria. The maximum wave heights estimated near the coasts are observed north of the island of Amorgos, at Naxos Island (0.5 m), 1 hour after the event, at the coast of Turkey in the area of Gulluk (0.7 m), 2 hours after the event and in the Gulf of Evoia at Chalkis (0.6 m) 3 hours after the event.

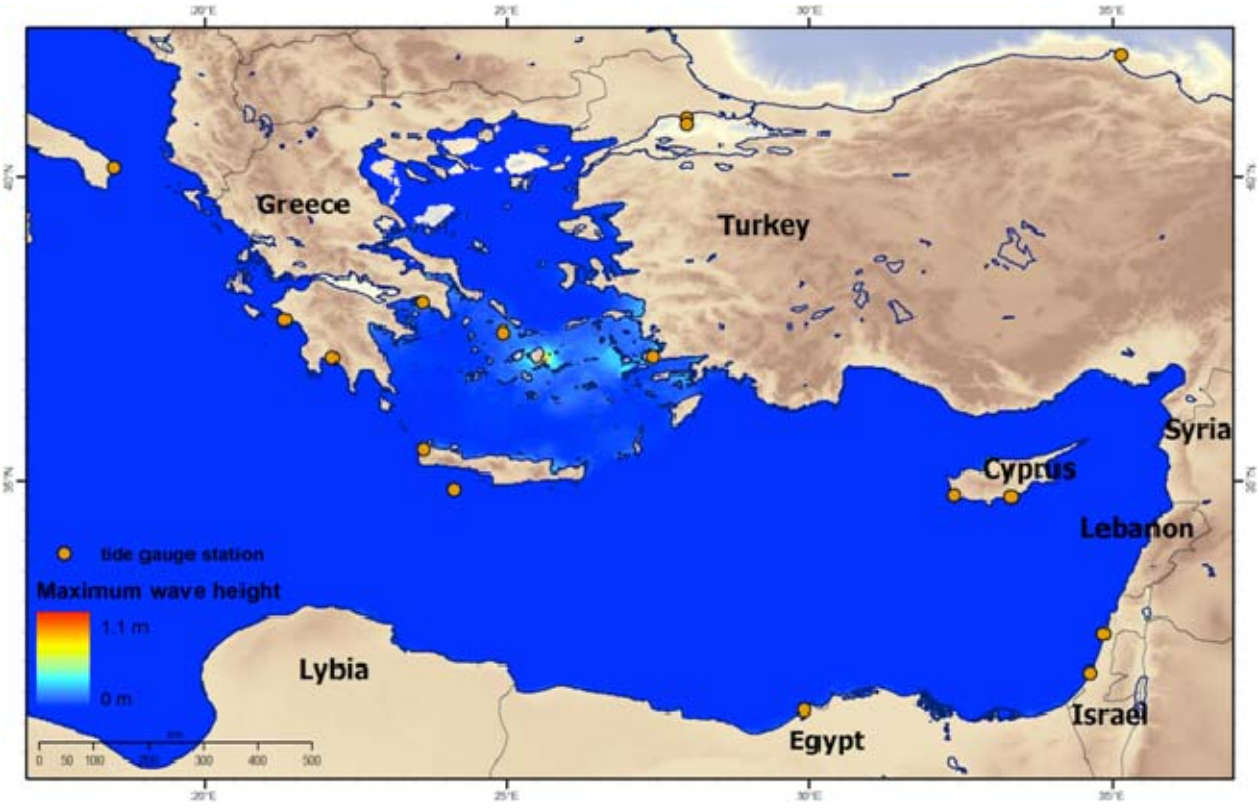

Figure 1: HLNTWC Scenario Wave-height Map. Orange filled circles indicate the locations of the tide gage stations linked to IOC and the CTWP centre.

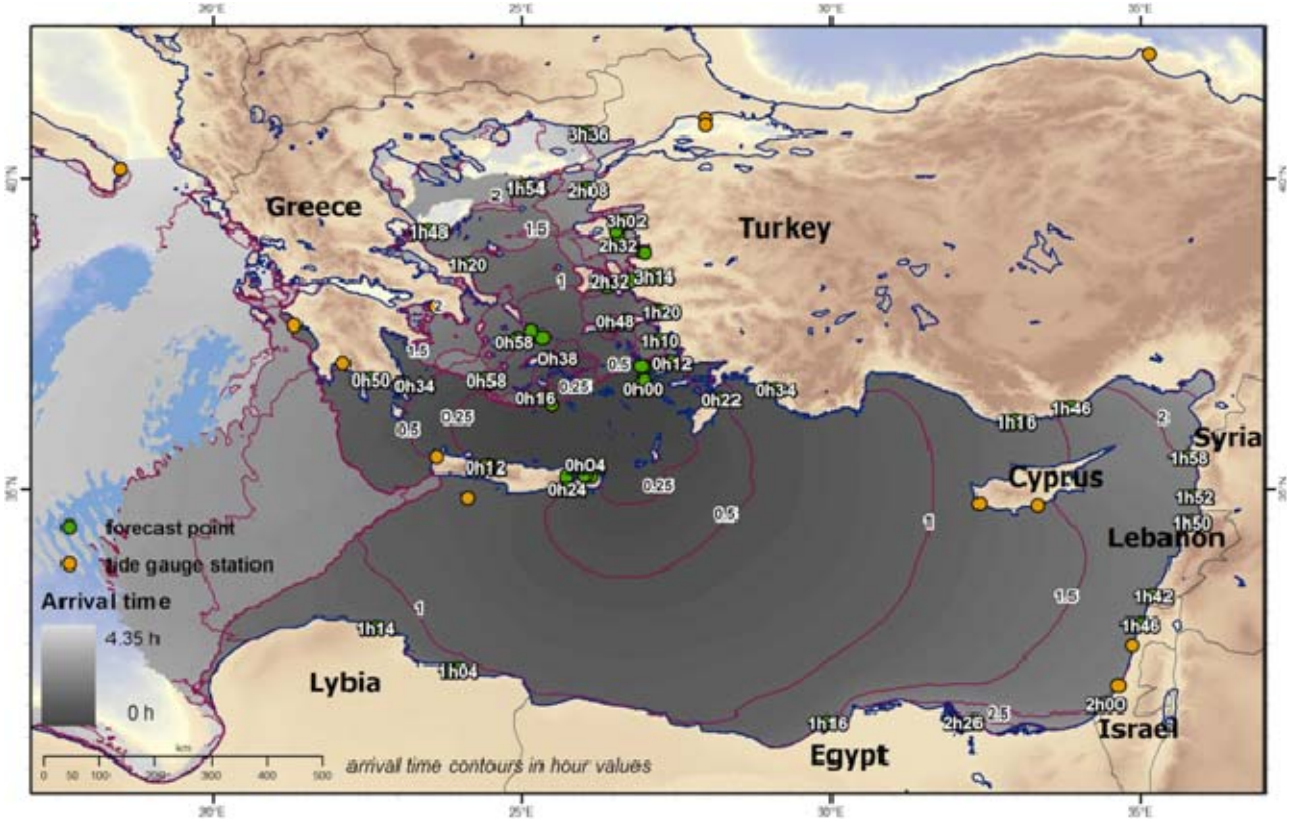

Figure 2: HLNTWC Scenario Travel-Time Map. Times are indicated at forecast points (green filled circles) and tide gage station locations (orange filled circles) that will be used in the scenario messages and they are expressed in values of hours-minutes.

Master Schedule of Events List

TTILE	CONTENT	TIME
TSUNAMI EXERCISE MESSAGE NUMBER 001	1. Earthquake Parameters validated by 24/7 staff 2. Wave Arrival Times 3. Level of Alert	T0 + 10’
TSUNAMI EXERCISE MESSAGE NUMBER 002	1. Earthquake Parameters 2. First validated Wave Arrival (Bodrum & Kastelli) 3. Level of Alert	T0 + 30’
TSUNAMI EXERCISE MESSAGE NUMBER 003	1. Earthquake Parameters 2. Validated arrivals at Turkey & Greece 3. Second validated Wave Arrival (Syros & Egypt) 4. Level of Alert	T0 + 90’
TSUNAMI EXERCISE MESSAGE NUMBER 004	1. Earthquake Parameters 2. Validated arrivals at Turkey, Greece & Egypt 3. End of Tsunami Alert Message	T0 + 120’

Figure 3: HLNTWC Scenario MSEL

Location Data for NOA (HLNTWC) Scenario

Country	Location	Lat	Lon	Arrival time	Time of Max Height	Actual Time	Height	Level
Greece	Emboreion	36.36	25.48	0h00	1h38	22 Nov 2012 12:00:00 PM	0.2	INFORMATION
Greece	Kefalos	36.74	26.97	0h00	1h06	22 Nov 2012 12:00:00 PM	0.4	ADVISORY
Greece	Kalimnos	36.95	26.98	0h00	1h02	22 Nov 2012 12:00:00 PM	0.4	ADVISORY
Greece	Chorion	36.97	26.93	0h00	1h00	22 Nov 2012 12:00:00 PM	0.4	ADVISORY
Greece	Therma	37.68	26.31	0h02	1h20	22 Nov 2012 12:02:00 PM	0.2	INFORMATION
Greece	Sitia	35.21	26.11	0h04	3h08	22 Nov 2012 12:04:00 PM	0.3	ADVISORY
Greece	Skopi	35.23	26.03	0h04	2h32	22 Nov 2012 12:04:00 PM	0.3	ADVISORY
Greece	Ayios Nikolaos	35.19	25.72	0h08	1h14	22 Nov 2012 12:08:00 PM	0.3	ADVISORY
Greece	Rethimnon	35.37	24.47	0h10	1h32	22 Nov 2012 12:10:00 PM	0.2	INFORMATION
Greece	Armenoi	35.36	24.41	0h12	2h08	22 Nov 2012 12:12:00 PM	0.2	INFORMATION
Greece	Oia	36.48	25.4	0h16	0h24	22 Nov 2012 12:16:00 PM	0.3	ADVISORY
Greece	Trianda	36.42	28.16	0h18	1h36	22 Nov 2012 12:18:00 PM	0.1	INFORMATION
Greece	Rodhos	36.45	28.23	0h22	1h42	22 Nov 2012 12:22:00 PM	0.1	INFORMATION
Greece	Ierapetra	35.01	25.74	0h24	3h28	22 Nov 2012 12:24:00 PM	0.1	INFORMATION
Greece	Monemvasia	36.69	23.03	0h34	2h22	22 Nov 2012 12:34:00 PM	0.1	INFORMATION
Greece	Mikonos	37.45	25.33	0h36	2h44	22 Nov 2012 12:36:00 PM	0.2	INFORMATION
Greece	Naxos	37.11	25.38	0h38	0h54	22 Nov 2012 12:38:00 PM	0.5	WATCH
Greece	Adamas	36.7	24.47	0h48	2h18	22 Nov 2012 12:48:00 PM	0.1	INFORMATION
Greece	Marathokambos	37.71	26.69	0h48	3h58	22 Nov 2012 12:48:00 PM	0.2	INFORMATION
Greece	Yithion	36.76	22.57	0h50	3h14	22 Nov 2012 12:50:00 PM	0.1	INFORMATION
Greece	Gythio	36.77	22.56	0h50	3h14	22 Nov 2012 12:50:00 PM	0.1	INFORMATION
Greece	Tinos	37.54	25.16	0h50	2h34	22 Nov 2012 12:50:00 PM	0.2	INFORMATION
Greece	Vari	37.39	24.94	0h56	2h34	22 Nov 2012 12:56:00 PM	0.2	INFORMATION
Greece	Ermoupolis	37.44	24.94	0h56	2h34	22 Nov 2012 12:56:00 PM	0.2	INFORMATION
Greece	Milos	36.76	24.43	0h58	2h18	22 Nov 2012 12:58:00 PM	0.1	INFORMATION
Greece	Posidhonia	37.39	24.88	0h58	2h34	22 Nov 2012 12:58:00 PM	0.2	INFORMATION
Greece	Kimi	38.63	24.12	1h20	2h02	22 Nov 2012 1:20:00 PM	0.1	INFORMATION
Greece	Skiathos	39.16	23.49	1h48	3h42	22 Nov 2012 1:48:00 PM	0.1	INFORMATION
Greece	Mirina	39.87	25.06	1h54	2h44	22 Nov 2012 1:54:00 PM	0.1	INFORMATION
Greece	Mitilini	39.1	26.56	2h32	4h06	22 Nov 2012 2:32:00 PM	0.1	INFORMATION
Greece	Loutra Termis	39.17	26.52	2h34	4h06	22 Nov 2012 2:34:00 PM	0.1	INFORMATION
Turkey	Ortakent	37.02	27.35	0h10	2h18	22 Nov 2012 12:10:00 PM	0.3	ADVISORY
Turkey	Bodrum	37.04	27.43	0h12	2h06	22 Nov 2012 12:12:00 PM	0.4	ADVISORY
Turkey	Fethiye	36.62	29.11	0h34	1h34	22 Nov 2012 12:34:00 PM	0.1	INFORMATION
Turkey	Alacati	38.27	26.38	1h02	2h00	22 Nov 2012 1:02:00 PM	0.1	INFORMATION
Turkey	Yenihisar	37.41	27.23	1h10	2h42	22 Nov 2012 1:10:00 PM	0.3	ADVISORY
Turkey	Bozyani	36.09	32.99	1h16	2h40	22 Nov 2012 1:16:00 PM	0.1	INFORMATION
Turkey	Kusadasi	37.86	27.26	1h20	1h42	22 Nov 2012 1:20:00 PM	0.4	ADVISORY
Turkey	Tasucu	36.31	33.88	1h46	3h06	22 Nov 2012 1:46:00 PM	0.1	INFORMATION
Turkey	Aliaga	38.81	26.98	2h06	3h44	22 Nov 2012 2:06:00 PM	0.2	INFORMATION
Turkey	Bozcaada	39.83	26.07	2h08	3h00	22 Nov 2012 2:08:00 PM	0.1	INFORMATION
Turkey	Urla	38.36	26.77	2h32	3h12	22 Nov 2012 2:32:00 PM	0.1	INFORMATION
Turkey	Kucukkoy	39.27	26.69	2h32	4h04	22 Nov 2012 2:32:00 PM	0.2	INFORMATION
Turkey	Ayvalik	39.33	26.7	3h02	4h02	22 Nov 2012 3:02:00 PM	0.3	ADVISORY
Turkey	Izmir	38.44	27.14	3h14	4h12	22 Nov 2012 3:14:00 PM	0.1	INFORMATION
Turkey	Enez	40.74	26.08	3h36	3h54	22 Nov 2012 3:36:00 PM	0.1	INFORMATION
Libya	Tubruq	32.08	23.97	1h04	3h12	22 Nov 2012 1:04:00 PM	0.1	INFORMATION
Libya	Darnah	32.77	22.64	1h14	4h08	22 Nov 2012 1:14:00 PM	0.1	INFORMATION
Egypt	Al Iskandariyah	31.24	29.95	1h16	4h06	22 Nov 2012 1:16:00 PM	0.1	INFORMATION
Egypt	Port Fouad	31.25	32.33	2h26	3h46	22 Nov 2012 2:26:00 PM	0.1	INFORMATION
Egypt	Bur Sa'id	31.25	32.3	2h26	4h14	22 Nov 2012 2:26:00 PM	0.1	INFORMATION
Israel	Haifa	32.82	35	1h46	2h56	22 Nov 2012 1:46:00 PM	0.1	INFORMATION
Syria	Tartus	34.88	35.88	1h52	3h20	22 Nov 2012 1:52:00 PM	0.1	INFORMATION
Syria	Al Lathqiyah	35.51	35.79	1h58	3h26	22 Nov 2012 1:58:00 PM	0.1	INFORMATION
Lebanon	Sour	33.28	35.21	1h42	3h04	22 Nov 2012 1:42:00 PM	0.1	INFORMATION
Lebanon	Tarabulus	34.46	35.84	1h50	3h54	22 Nov 2012 1:50:00 PM	0.1	INFORMATION
Gaza Strip	Ghazzah	31.53	34.44	2h00	3h28	22 Nov 2012 2:00:00 PM	0.1	INFORMATION

Figure 4: HLNTWC Scenario TFP Arrival Times

HLNTWC TSUNAMI MESSAGE TEMPLATES

Tsunami Exercise Initial Message

TSUNAMI EXERCISE MESSAGE NUMBER 001
NEAM NOA HL-NTWC CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1400Z 27 NOV 2012

... TSUNAMI WATCH ...
THIS ALERT APPLIES TO GREECE

... TSUNAMI ADVISORY ...
THIS ALERT APPLIES TO GREECE,TURKEY

... TSUNAMI INFORMATION ...
THIS INFORMATION APPLIES TO EGYPT,GAZA STRIP,GREECE,ISRAEL,LEBANON,LIBYA,TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1400 UTC TUE NOV 27 2012
COORDINATES - 36.70 NORTH 25.80 EAST
DEPTH - 22.5 KM
LOCATION - AMORGOS, AEGEAN SEA, GREECE
MAGNITUDE - 7.6

EVALUATION OF TSUNAMI WATCH
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS MESSAGE IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI THAT CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI ADVISORY
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WATCH IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI THAT CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR MAJOR EFFECT IN THE REGION.
THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH/ADVISORY AREA GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	FORECAST POINT	COORDINATES	ARRIVAL TIME	AMPL	ALERT LEVEL	DISTANCE
GREECE	NAXOS	37.1N 25.4E	27/11 12:38	0.51M/1.7F	WATCH	57.0
GREECE	KEFALOS	36.7N 27.0E	27/11 12:00	0.45M/1.5F	ADVISORY	107.1
GREECE	KALIMNOS	37.0N 27.0E	27/11 12:00	0.39M/1.3F	ADVISORY	112.0
GREECE	CHORION	37.0N 26.9E	27/11 12:00	0.45M/1.5F	ADVISORY	103.5
GREECE	SITIA	35.2N 26.1E	27/11 12:04	0.28M/0.9F	ADVISORY	169.2
GREECE	SKOPI	35.2N 26.0E	27/11 12:04	0.29M/1.0F	ADVISORY	167.9
GREECE	AYIOS NIKOLAOS	35.2N 25.7E	27/11 12:08	0.34M/1.1F	ADVISORY	167.2
GREECE	ARMENOI	35.4N 24.4E	27/11 12:12	0.23M/0.8F	ADVISORY	191.9
GREECE	OIA	36.5N 25.4E	27/11 12:16	0.34M/1.1F	ADVISORY	42.1
GREECE	MIKONOS	37.4N 25.3E	27/11 12:36	0.24M/0.8F	ADVISORY	89.7
GREECE	TINOS	37.5N 25.2E	27/11 12:50	0.21M/0.7F	ADVISORY	103.8
GREECE	VARI	37.4N 24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
GREECE	ERMOUPOLIS	37.4N 24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
TURKEY	ORTAKENT	37.0N 27.4E	27/11 12:10	0.32M/1.0F	ADVISORY	146.4
TURKEY	BODRUM	37.0N 27.4E	27/11 12:12	0.35M/1.1F	ADVISORY	146.4
TURKEY	YENIHISAR	37.4N 27.2E	27/11 13:10	0.31M/1.0F	ADVISORY	146.8
TURKEY	KUSADASI	37.9N 27.3E	27/11 13:20	0.41M/1.3F	ADVISORY	188.4
TURKEY	AYVALIK	39.3N 26.7E	27/11 15:02	0.26M/0.9F	ADVISORY	300.0
GREECE	EMBOREION	36.4N 25.5E	27/11 12:00	0.18M/0.6F	INFORMATION	42.8
GREECE	THERMA	37.7N 26.3E	27/11 12:02	0.20M/0.7F	INFORMATION	119.8
GREECE	RETHIMNON	35.4N 24.5E	27/11 12:10	0.17M/0.6F	INFORMATION	186.1
GREECE	TRIANDA	36.4N 28.2E	27/11 12:18	0.11M/0.4F	INFORMATION	217.2
GREECE	RODHOS	36.4N 28.2E	27/11 12:22	0.10M/0.3F	INFORMATION	217.2
GREECE	IERAPETRA	35.0N 25.7E	27/11 12:24	0.06M/0.2F	INFORMATION	189.5
GREECE	MONEMVASIA	36.7N 23.0E	27/11 12:34	0.11M/0.4F	INFORMATION	249.9
GREECE	ADAMAS	36.7N 24.5E	27/11 12:48	0.12M/0.4F	INFORMATION	116.0
GREECE	MARATHOKAMBOS	37.7N 26.7E	27/11 12:48	0.19M/0.6F	INFORMATION	137.0
GREECE	GYTHIO	36.8N 22.6E	27/11 12:50	0.13M/0.4F	INFORMATION	285.6
GREECE	MILOS	36.8N 24.4E	27/11 12:58	0.12M/0.4F	INFORMATION	125.4
GREECE	POSIDHONIA	37.4N 24.9E	27/11 12:58	0.16M/0.5F	INFORMATION	111.6
GREECE	KIMI	38.6N 24.1E	27/11 13:20	0.12M/0.4F	INFORMATION	259.2
GREECE	SKIATHOS	39.2N 23.5E	27/11 13:48	0.06M/0.2F	INFORMATION	343.8
GREECE	MITILINI	39.1N 26.6E	27/11 14:32	0.09M/0.3F	INFORMATION	276.3
GREECE	LOUTRA TERMIS	39.2N 26.5E	27/11 14:34	0.09M/0.3F	INFORMATION	285.0
TURKEY	FETHIYE	36.6N 29.1E	27/11 12:34	0.14M/0.5F	INFORMATION	294.9
TURKEY	ALACATI	38.3N 26.4E	27/11 13:02	0.12M/0.4F	INFORMATION	185.8
TURKEY	BOZYANI	36.1N 33.0E	27/11 13:16	0.06M/0.2F	INFORMATION	648.4
TURKEY	TASUCU	36.3N 33.9E	27/11 13:46	0.08M/0.3F	INFORMATION	726.0
TURKEY	ALIAGA	38.8N 27.0E	27/11 14:06	0.19M/0.6F	INFORMATION	256.5
TURKEY	URLA	38.4N 26.8E	27/11 14:32	0.12M/0.4F	INFORMATION	208.8

TURKEY	KUCUKKOY	39.3N	26.7E	27/11 14:32	0.16M/0.5F	INFORMATION	300.0
TURKEY	IZMIR	38.4N	27.1E	27/11 15:14	0.14M/0.5F	INFORMATION	221.3
TURKEY	ENEZ	40.7N	26.1E	27/11 15:36	0.06M/0.2F	INFORMATION	446.0
LIBYA	TUBRUQ	32.1N	24.0E	27/11 13:04	0.08M/0.3F	INFORMATION	538.1
LIBYA	DARNAH	32.8N	22.6E	27/11 13:14	0.14M/0.5F	INFORMATION	523.5
EGYPT	AL ISKANDARIYAH	31.2N	30.0E	27/11 13:16	0.12M/0.4F	INFORMATION	724.6
EGYPT	PORT FOUAD	31.2N	32.3E	27/11 14:26	0.07M/0.2F	INFORMATION	856.9
LEBANON	SOUR	33.3N	35.2E	27/11 13:42	0.06M/0.2F	INFORMATION	936.4
LEBANON	TARABULUS	34.5N	35.8E	27/11 13:50	0.07M/0.2F	INFORMATION	937.2
ISRAEL	HAIFA	32.8N	35.0E	27/11 13:46	0.08M/0.3F	INFORMATION	946.3
ISRAEL	ASHDOD	31.8N	34.6E	27/11 13:56	0.06M/0.2F	INFORMATION	975.6
ISRAEL	ASHQELON	31.7N	34.6E	27/11 13:58	0.06M/0.2F	INFORMATION	982.3
GAZA STRIP	GHAZZAH	31.5N	34.4E	27/11 14:00	0.07M/0.2F	INFORMATION	980.9

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 001

Tsunami Exercise Ongoing Message

TSUNAMI EXERCISE MESSAGE NUMBER 002
NEAM NOA HL-NTWC CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1400Z 27 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO GREECE

... TSUNAMI ADVISORY ONGOING ...
THIS ALERT APPLIES TO GREECE,TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1400 UTC TUE NOV 27 2012
COORDINATES - 36.70 NORTH 25.80 EAST
DEPTH - 22.5 KM
LOCATION - AMORGOS, AEGEAN SEA, GREECE
MAGNITUDE - 7.6

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE

FOR MANY HOURS AS MULTIPLE WAVES ARRIVE

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH/ADVISORY AREA GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	FORECAST POINT	COORDINATES		ARRIVAL TIME	AMPL	ALERT LEVEL	DISTANCE
GREECE	NAXOS	37.1N	25.4E	27/11 12:38	0.51M/1.7F	WATCH	57.0
GREECE	KEFALOS	36.7N	27.0E	27/11 12:00	0.45M/1.5F	ADVISORY	107.1
GREECE	KALIMNOS	37.0N	27.0E	27/11 12:00	0.39M/1.3F	ADVISORY	112.0
GREECE	CHORION	37.0N	26.9E	27/11 12:00	0.45M/1.5F	ADVISORY	103.5
GREECE	SITIA	35.2N	26.1E	27/11 12:04	0.28M/0.9F	ADVISORY	169.2
GREECE	SKOPI	35.2N	26.0E	27/11 12:04	0.29M/1.0F	ADVISORY	167.9
GREECE	AYIOS NIKOLAOS	35.2N	25.7E	27/11 12:08	0.34M/1.1F	ADVISORY	167.2
GREECE	ARMENOI	35.4N	24.4E	27/11 12:12	0.23M/0.8F	ADVISORY	191.9
GREECE	OIA	36.5N	25.4E	27/11 12:16	0.34M/1.1F	ADVISORY	42.1
GREECE	MIKONOS	37.4N	25.3E	27/11 12:36	0.24M/0.8F	ADVISORY	89.7
GREECE	TINOS	37.5N	25.2E	27/11 12:50	0.21M/0.7F	ADVISORY	103.8
GREECE	VARI	37.4N	24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
GREECE	ERMOUPOLIS	37.4N	24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
TURKEY	ORTAKENT	37.0N	27.4E	27/11 12:10	0.32M/1.0F	ADVISORY	146.4
TURKEY	BODRUM	37.0N	27.4E	27/11 12:12	0.35M/1.1F	ADVISORY	146.4
TURKEY	YENIHISAR	37.4N	27.2E	27/11 13:10	0.31M/1.0F	ADVISORY	146.8
TURKEY	KUSADASI	37.9N	27.3E	27/11 13:20	0.41M/1.3F	ADVISORY	188.4
TURKEY	AYVALIK	39.3N	26.7E	27/11 15:02	0.26M/0.9F	ADVISORY	300.0
GREECE	EMBOREION	36.4N	25.5E	27/11 12:00	0.18M/0.6F	INFORMATION	42.8
GREECE	THERMA	37.7N	26.3E	27/11 12:02	0.20M/0.7F	INFORMATION	119.8
GREECE	RETHIMNON	35.4N	24.5E	27/11 12:10	0.17M/0.6F	INFORMATION	186.1
GREECE	TRIANDA	36.4N	28.2E	27/11 12:18	0.11M/0.4F	INFORMATION	217.2
GREECE	RODHOS	36.4N	28.2E	27/11 12:22	0.10M/0.3F	INFORMATION	217.2
GREECE	IERAPETRA	35.0N	25.7E	27/11 12:24	0.06M/0.2F	INFORMATION	189.5
GREECE	MONEMVASIA	36.7N	23.0E	27/11 12:34	0.11M/0.4F	INFORMATION	249.9
GREECE	ADAMAS	36.7N	24.5E	27/11 12:48	0.12M/0.4F	INFORMATION	116.0
GREECE	MARATHOKAMBOS	37.7N	26.7E	27/11 12:48	0.19M/0.6F	INFORMATION	137.0
GREECE	GYTHIO	36.8N	22.6E	27/11 12:50	0.13M/0.4F	INFORMATION	285.6
GREECE	MILOS	36.8N	24.4E	27/11 12:58	0.12M/0.4F	INFORMATION	125.4
GREECE	POSIDHONIA	37.4N	24.9E	27/11 12:58	0.16M/0.5F	INFORMATION	111.6
GREECE	KIMI	38.6N	24.1E	27/11 13:20	0.12M/0.4F	INFORMATION	259.2
GREECE	SKIATHOS	39.2N	23.5E	27/11 13:48	0.06M/0.2F	INFORMATION	343.8

GREECE	MITILINI	39.1N	26.6E	27/11 14:32	0.09M/0.3F	INFORMATION	276.3
GREECE	LOUTRA TERMIS	39.2N	26.5E	27/11 14:34	0.09M/0.3F	INFORMATION	285.0
TURKEY	FETHIYE	36.6N	29.1E	27/11 12:34	0.14M/0.5F	INFORMATION	294.9
TURKEY	ALACATI	38.3N	26.4E	27/11 13:02	0.12M/0.4F	INFORMATION	185.8
TURKEY	BOZYANI	36.1N	33.0E	27/11 13:16	0.06M/0.2F	INFORMATION	648.4
TURKEY	TASUCU	36.3N	33.9E	27/11 13:46	0.08M/0.3F	INFORMATION	726.0
TURKEY	ALIAGA	38.8N	27.0E	27/11 14:06	0.19M/0.6F	INFORMATION	256.5
TURKEY	URLA	38.4N	26.8E	27/11 14:32	0.12M/0.4F	INFORMATION	208.8
TURKEY	KUCUKKOY	39.3N	26.7E	27/11 14:32	0.16M/0.5F	INFORMATION	300.0
TURKEY	IZMIR	38.4N	27.1E	27/11 15:14	0.14M/0.5F	INFORMATION	221.3
TURKEY	ENEZ	40.7N	26.1E	27/11 15:36	0.06M/0.2F	INFORMATION	446.0
LIBYA	TUBRUQ	32.1N	24.0E	27/11 13:04	0.08M/0.3F	INFORMATION	538.1
LIBYA	DARNAH	32.8N	22.6E	27/11 13:14	0.14M/0.5F	INFORMATION	523.5
EGYPT	AL ISKANDARIYAH	31.2N	30.0E	27/11 13:16	0.12M/0.4F	INFORMATION	724.6
EGYPT	PORT FOUAD	31.2N	32.3E	27/11 14:26	0.07M/0.2F	INFORMATION	856.9
LEBANON	SOUR	33.3N	35.2E	27/11 13:42	0.06M/0.2F	INFORMATION	936.4
LEBANON	TARABULUS	34.5N	35.8E	27/11 13:50	0.07M/0.2F	INFORMATION	937.2
ISRAEL	HAIFA	32.8N	35.0E	27/11 13:46	0.08M/0.3F	INFORMATION	946.3
ISRAEL	ASHDOD	31.8N	34.6E	27/11 13:56	0.06M/0.2F	INFORMATION	975.6
ISRAEL	ASHQELON	31.7N	34.6E	27/11 13:58	0.06M/0.2F	INFORMATION	982.3
GAZA STRIP	GHAZZAH	31.5N	34.4E	27/11 14:00	0.07M/0.2F	INFORMATION	980.9

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

COUNTRY	GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
TURKEY	BODRUM	37.03	27.42	00:13	0.38	0.0
GREECE	KASTELI	35.51	23.64	00:25	0.30	0.0

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTC TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL.
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 002

Tsunami Exercise Ongoing Message

TSUNAMI EXERCISE MESSAGE NUMBER 003
NEAM NOA HL-NTWC CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1400Z 27 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO GREECE

... TSUNAMI ADVISORY ONGOING ...
THIS ALERT APPLIES TO GREECE,TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1400 UTC TUE NOV 27 2012
COORDINATES - 36.70 NORTH 25.80 EAST
DEPTH - 22.5 KM
LOCATION - AMORGOS, AEGEAN SEA, GREECE
MAGNITUDE - 7.6

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH/ADVISORY AREA GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	FORECAST POINT	COORDINATES	ARRIVAL TIME	AMPL	ALERT LEVEL	DISTANCE
GREECE	NAXOS	37.1N 25.4E	27/11 12:38	0.51M/1.7F	WATCH	57.0
GREECE	KEFALOS	36.7N 27.0E	27/11 12:00	0.45M/1.5F	ADVISORY	107.1
GREECE	KALIMNOS	37.0N 27.0E	27/11 12:00	0.39M/1.3F	ADVISORY	112.0
GREECE	CHORION	37.0N 26.9E	27/11 12:00	0.45M/1.5F	ADVISORY	103.5
GREECE	SITIA	35.2N 26.1E	27/11 12:04	0.28M/0.9F	ADVISORY	169.2
GREECE	SKOPI	35.2N 26.0E	27/11 12:04	0.29M/1.0F	ADVISORY	167.9
GREECE	AYIOS NIKOLAOS	35.2N 25.7E	27/11 12:08	0.34M/1.1F	ADVISORY	167.2
GREECE	ARMENOI	35.4N 24.4E	27/11 12:12	0.23M/0.8F	ADVISORY	191.9
GREECE	OIA	36.5N 25.4E	27/11 12:16	0.34M/1.1F	ADVISORY	42.1
GREECE	MIKONOS	37.4N 25.3E	27/11 12:36	0.24M/0.8F	ADVISORY	89.7
GREECE	TINOS	37.5N 25.2E	27/11 12:50	0.21M/0.7F	ADVISORY	103.8

GREECE	VARI	37.4N	24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
GREECE	ERMOUPOLIS	37.4N	24.9E	27/11 12:56	0.22M/0.7F	ADVISORY	111.6
TURKEY	ORTAKENT	37.0N	27.4E	27/11 12:10	0.32M/1.0F	ADVISORY	146.4
TURKEY	BODRUM	37.0N	27.4E	27/11 12:12	0.35M/1.1F	ADVISORY	146.4
TURKEY	YENIHISAR	37.4N	27.2E	27/11 13:10	0.31M/1.0F	ADVISORY	146.8
TURKEY	KUSADASI	37.9N	27.3E	27/11 13:20	0.41M/1.3F	ADVISORY	188.4
TURKEY	AYVALIK	39.3N	26.7E	27/11 15:02	0.26M/0.9F	ADVISORY	300.0
GREECE	EMBOREION	36.4N	25.5E	27/11 12:00	0.18M/0.6F	INFORMATION	42.8
GREECE	THERMA	37.7N	26.3E	27/11 12:02	0.20M/0.7F	INFORMATION	119.8
GREECE	RETHIMNON	35.4N	24.5E	27/11 12:10	0.17M/0.6F	INFORMATION	186.1
GREECE	TRIANDA	36.4N	28.2E	27/11 12:18	0.11M/0.4F	INFORMATION	217.2
GREECE	RODHOS	36.4N	28.2E	27/11 12:22	0.10M/0.3F	INFORMATION	217.2
GREECE	IERAPETRA	35.0N	25.7E	27/11 12:24	0.06M/0.2F	INFORMATION	189.5
GREECE	MONEMVASIA	36.7N	23.0E	27/11 12:34	0.11M/0.4F	INFORMATION	249.9
GREECE	ADAMAS	36.7N	24.5E	27/11 12:48	0.12M/0.4F	INFORMATION	116.0
GREECE	MARATHOKAMBOS	37.7N	26.7E	27/11 12:48	0.19M/0.6F	INFORMATION	137.0
GREECE	GYTHIO	36.8N	22.6E	27/11 12:50	0.13M/0.4F	INFORMATION	285.6
GREECE	MILOS	36.8N	24.4E	27/11 12:58	0.12M/0.4F	INFORMATION	125.4
GREECE	POSIDHONIA	37.4N	24.9E	27/11 12:58	0.16M/0.5F	INFORMATION	111.6
GREECE	KIMI	38.6N	24.1E	27/11 13:20	0.12M/0.4F	INFORMATION	259.2
GREECE	SKIATHOS	39.2N	23.5E	27/11 13:48	0.06M/0.2F	INFORMATION	343.8
GREECE	MITILINI	39.1N	26.6E	27/11 14:32	0.09M/0.3F	INFORMATION	276.3
GREECE	LOUTRA TERMIS	39.2N	26.5E	27/11 14:34	0.09M/0.3F	INFORMATION	285.0
TURKEY	FETHIYE	36.6N	29.1E	27/11 12:34	0.14M/0.5F	INFORMATION	294.9
TURKEY	ALACATI	38.3N	26.4E	27/11 13:02	0.12M/0.4F	INFORMATION	185.8
TURKEY	BOZYANI	36.1N	33.0E	27/11 13:16	0.06M/0.2F	INFORMATION	648.4
TURKEY	TASUCU	36.3N	33.9E	27/11 13:46	0.08M/0.3F	INFORMATION	726.0
TURKEY	ALIAGA	38.8N	27.0E	27/11 14:06	0.19M/0.6F	INFORMATION	256.5
TURKEY	URLA	38.4N	26.8E	27/11 14:32	0.12M/0.4F	INFORMATION	208.8
TURKEY	KUCUKKOY	39.3N	26.7E	27/11 14:32	0.16M/0.5F	INFORMATION	300.0
TURKEY	IZMIR	38.4N	27.1E	27/11 15:14	0.14M/0.5F	INFORMATION	221.3
TURKEY	ENEZ	40.7N	26.1E	27/11 15:36	0.06M/0.2F	INFORMATION	446.0
LIBYA	TUBRUQ	32.1N	24.0E	27/11 13:04	0.08M/0.3F	INFORMATION	538.1
LIBYA	DARNAH	32.8N	22.6E	27/11 13:14	0.14M/0.5F	INFORMATION	523.5
EGYPT	AL ISKANDARIYAH	31.2N	30.0E	27/11 13:16	0.12M/0.4F	INFORMATION	724.6
EGYPT	PORT FOUAD	31.2N	32.3E	27/11 14:26	0.07M/0.2F	INFORMATION	856.9
LEBANON	SOUR	33.3N	35.2E	27/11 13:42	0.06M/0.2F	INFORMATION	936.4
LEBANON	TARABULUS	34.5N	35.8E	27/11 13:50	0.07M/0.2F	INFORMATION	937.2
ISRAEL	HAIFA	32.8N	35.0E	27/11 13:46	0.08M/0.3F	INFORMATION	946.3
ISRAEL	ASHDOD	31.8N	34.6E	27/11 13:56	0.06M/0.2F	INFORMATION	975.6
ISRAEL	ASHQELON	31.7N	34.6E	27/11 13:58	0.06M/0.2F	INFORMATION	982.3
GAZA STRIP	GHAZZAH	31.5N	34.4E	27/11 14:00	0.07M/0.2F	INFORMATION	980.9

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

COUNTRY	GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
TURKEY	BODRUM	37.03	27.42	00:13	0.38	0.0
GREECE	KASTELI	35.51	23.64	00:26	0.30	0.0
GREECE	SYROS	37.44	24.94	00:54	0.21	0.0
EGYPT	ALEXANDRIA	31.21	29.92	01:23	0.16	0.0

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)

TIME - TIME OF THE MEASUREMENT (Z IS UTC TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL.
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 003

Tsunami Exercise End Message

TSUNAMI EXERCISE MESSAGE NUMBER 004
NEAM NOA HL-NTWC CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1400Z 27 NOV 2012

... END OF TSUNAMI WATCH ...
THIS ALERT APPLIES TO GREECE

... END OF TSUNAMI ADVISORY ...
THIS ALERT APPLIES TO GREECE,TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1400 UTC TUE NOV 27 2012
COORDINATES - 36.70 NORTH 25.80 EAST
DEPTH - 22.5 KM
LOCATION - AMORGOS, AEGEAN SEA, GREECE
MAGNITUDE - 7.6

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED.

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED.

WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO THE CONTINUING SEA LEVEL CHANGES AND RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

THIS WILL BE THE FINAL MESSAGE ISSUED FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 004

IMPORTANT NOTE

All messages will be finalized a month before the date of exercise implementation.

References

Okal, E.A., Synolakis, C.E., Uslu, B., Kalligeris, N. and Voukouvalas, E., 2009. **The 1956 earthquake and tsunami in Amorgos, Greece.** Geophys. J. Int., 178, 1533–1554, doi: 10.1111/j.1365-246X.2009.04237.x .

ANNEX VI

NEAMWAVE 12 SCENARIO: IPMA (PORTUGAL)

Introduction

This note describes the tsunami scenario proposed by IPMA for the NEAMWave 12 exercise. This exercise has the objective of testing the dissemination alert by the NEAM tsunami warning system using numerical simulations of potential tsunami events in the NEAM region.

IPMA in its contribution to the NEAMWave 12 exercise as “Message Provider” proposes a tsunami scenario similar to the November, 1st, 1755 Lisbon event for the warning dissemination process. This scenario is numerically simulated from the occurrence of a submarine earthquake offshore SW Iberia using a validated numerical code. Tsunami generation is computed using the Okada’s formula, while shallow water equations are adopted to simulate the waves’ propagation.

Assuming that the 1755 event represents the worst-case tsunami scenario impacting the NE Atlantic region, IPMA proposes a 1755-like scenario that is one of the most credible earthquake scenarios in the region. Thus, the proposed scenario of Mw8.6 may be considered as one of the credible worst-case scenarios.

Scenario description

- Earthquake Parameters

The tsunami scenario proposed by IPMA for the NEAMWave 12 exercise is the one triggered by an earthquake that ruptures the Horseshoe fault located at about 165km offshore SW Iberia. This earthquake has a magnitude similar to the November, 1st, 1755 Lisbon event and is considered as one of the most credible maximum earthquake scenarios in the Gulf of Cadiz region.

The following map shows the active tectonic structures in the Gulf of Cadiz area and the earthquake source (Horseshoe) adopted by IPMA for the NEAMWave 12 exercise:

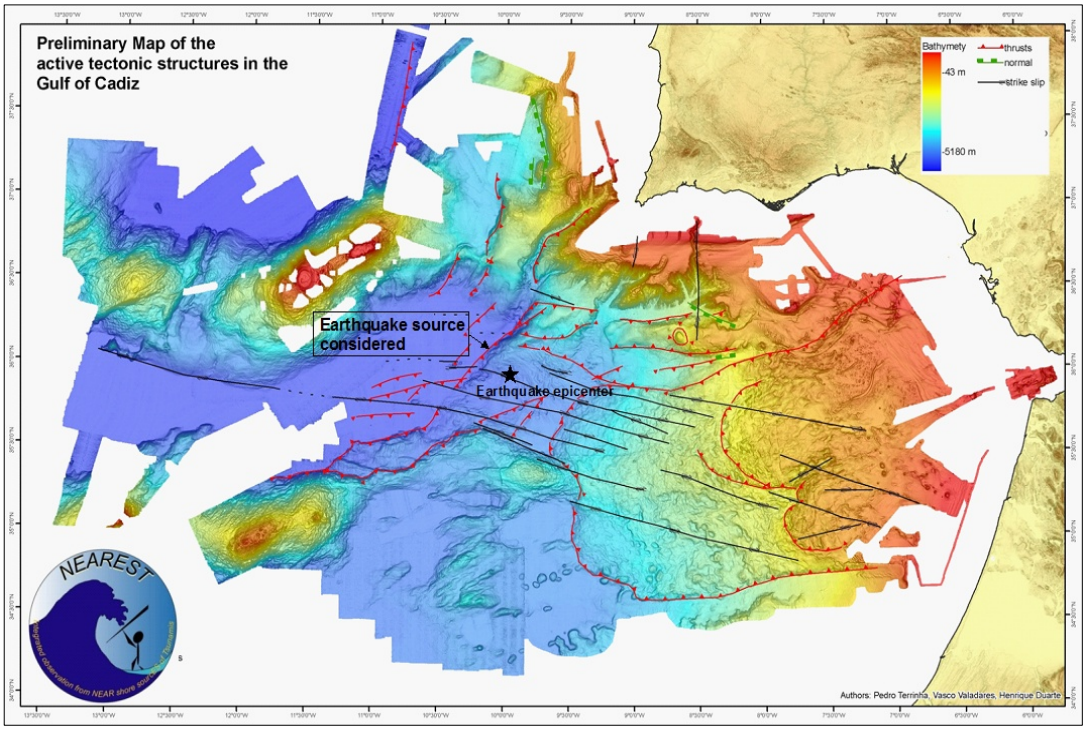

Figure 1: Tectonic structures in the Gulf of Cadiz area and the earthquake source (Horseshoe) adopted by IPMA for the NEAMWave 12 exercise.

The earthquake fault parameters for the proposed scenario are summarized in the following table:

Earthquake Fault Parameters	
Epicenter Location (Fault center)	Longitude : -9.890 Latitude : 35.574
Dimensions	Length : 170 km Width : 90 km
Slip	10 m
Strike	42.1º
Dip	35º
Rake	90º
Depth to the top of the fault	5 km
Shear modulus	6.5 e+10Pa
Moment magnitude	8.6

Table 1: Earthquake fault parameters for the proposed scenario.

Tsunami Simulations

- Initial sea surface perturbation

The initial sea surface perturbation is calculated for the proposed submarine earthquake scenario considering a simplified rectangular geometry of the fault and a uniform slip distribution. The earthquake rupture is supposed to be instantaneous and the generated seabed displacement is computed using the Okada's half-space elastic theory. The vertical sea bottom displacement is then transferred to the ocean surface with the assumption that both deformations of sea bottom and ocean surface are equal.

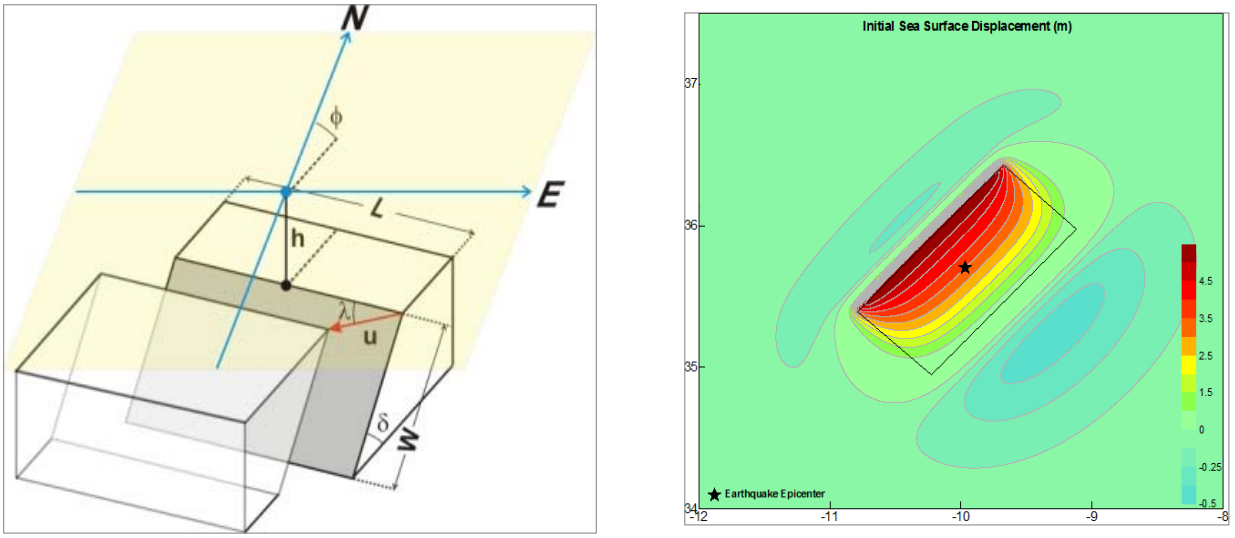

Figure 2: Geometry of the fault parameters and the sea surface displacement.

- Tsunami Travel Time

Tsunami travel time is calculated using the TTT software, TTT SDK version 3.2, and a point source that corresponds to the epicenter of the proposed submarine earthquake. This software employs the global bathymetry grids derived from NGDC's ETOPO1 at varying resolutions; here, a 5 arc-minute grid is used to simulate the TTT in the NE Atlantic region.

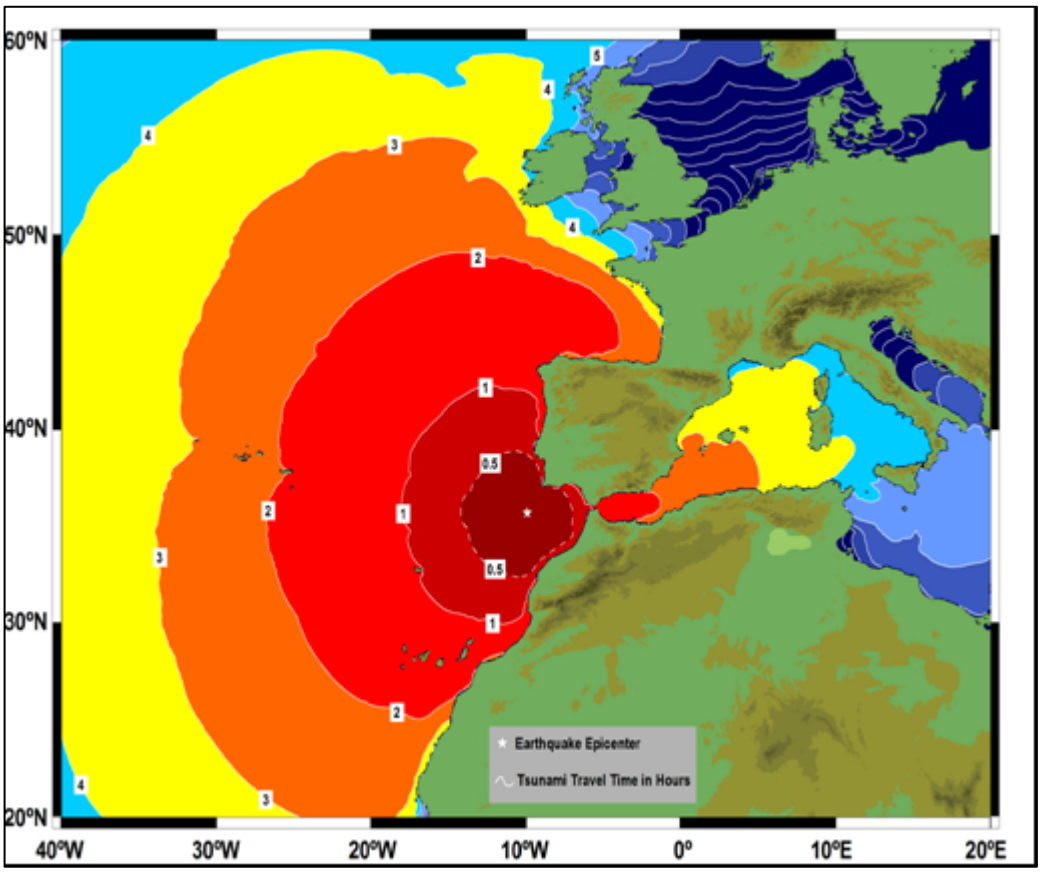

Figure 3: Tsunami Travel Times. The point source corresponds to the epicenter of the proposed submarine earthquake.

Simulated tsunami travel time to some coasts of NE Atlantic Region:

- 24 min to southwestern coasts of Portugal;
- 54 min to southwestern coasts of Spain;
- About 48 min to Atlantic coasts of Morocco;
- About 1h to the coast of Madeira, Portugal;
- About 1.5h to Alboran sea coasts (North of Morocco and South of Spain)
- About 2.25h to the coast of Azores, Portugal;
- About 2.6h to the Atlantic coast of France;
- About 3.5h to southern coast of Ireland;
- More than 4h to United Kingdom coasts;

- Maximum wave heights

The maximum wave height distribution, which corresponds to the extraction of the maximum sea level perturbation at each grid point from the output tsunami propagation snapshots, is computed for the proposed scenario. The Linear shallow water approximation is used to simulate the tsunami propagation in the NE Atlantic area and the GEBCO 30 arc-second bathymetric database is employed to generate the bathymetric/topographic simulation domain grid.

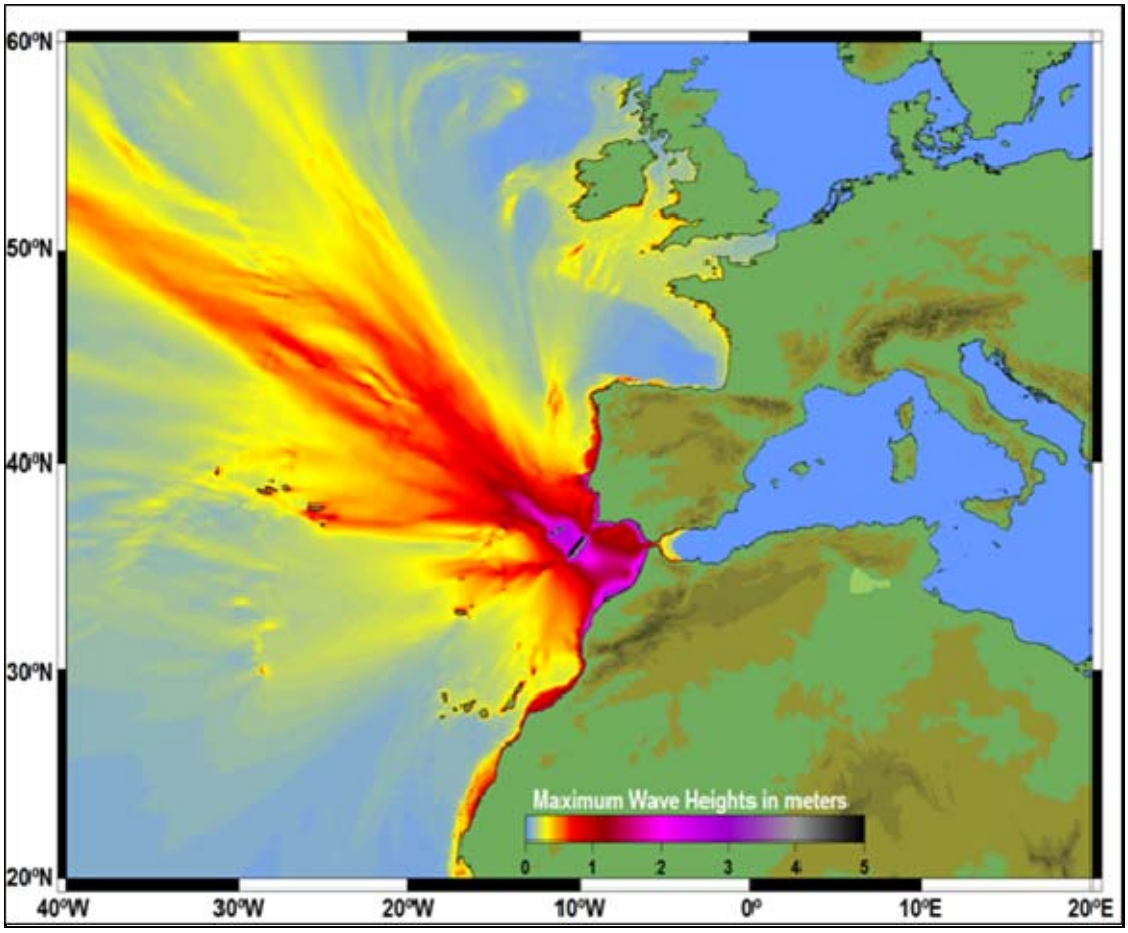

Figure 4: Maximum wave height distribution

The numerical simulation of a tsunami triggered by the proposed 1755-like event allows estimating the wave heights in all grid points of the computation domain. However, adequate estimates of the tsunami waveforms along the coast require high resolution bathymetric grids to better describe the tsunami shoaling effects near-shore. To overcome this difficulty, numerical simulation is applied to calculate waves heights at the "forecast points" located seaward from the coast. Then, tsunami wave heights at the coast are estimated through the Green's law.

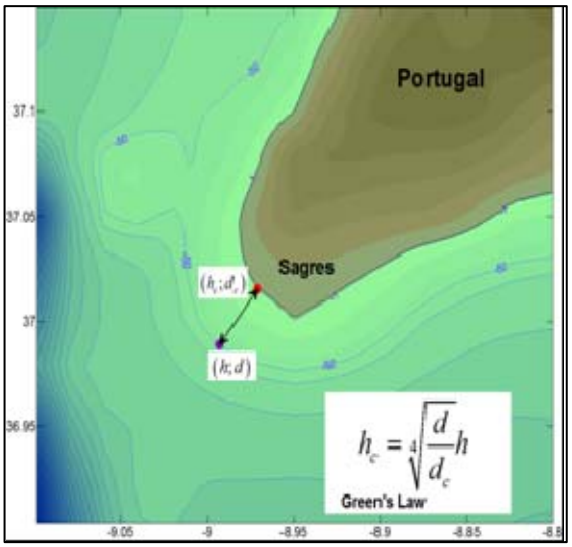

Figure 5: Application of Green's Law for the estimation of the tsunami wave amplitudes at the coast.

By the estimate of wave heights (h) at points located seaward at depths of 50m (d), through numerical modeling and the application of Green's law we compute the following maximum wave heights (h_c) at the NE Atlantic coasts corresponding to a depth of 1m (d_c):

Coast		Maximum wave heights at 50m depth, from numerical modeling	Wave heights at coast (1m depth) from Green's law
Sagres, Portugal		3.561m	9.469m
Madeira, Portugal		1.036m	2.754m
Azores, Portugal		1.763m	4.688m
Cadiz, Spain		2.119m	5.634m
Alboran coasts	South of Spain	0.423m	1.124m
	North of Morocco	0.542	1.441m
Canary Island		0.319m	0.848m
Casablanca, Morocco		3.070m	8.163m
La Rochelle, France		0.230m	0.611m
Saundersfoot , United Kingdom		0.476m	1.265m

Table 2**:** Maximum wave heights computed at the selected locations.

Using the wave heights at the coasts, computed through the Green's law, a preliminary estimate of the run-up can be established. The run-up, with respect to the coastal morphology and presence or not of man-made obstacles, could be considered of the range of the computed wave height at coast.

It is important to mention here that the computations conducted for wave heights estimates suffer from various limitations due to the assumptions and data used. Thus, these values should be used with some cautions for tsunami warning requirement. These values are provided for the exercise only, in case of a real event they cannot be computed with confidence and are not available.

- Master schedule events

Following, is a brief timeline of the procedures that will be adopted by IMPA CTWP in the exercise.

Please notice that the "end of tsunami" message will be issued 3 hours after the EQ origin time, at a time when many countries are still suffering the tsunami or have not been hit yet. In case of a real tsunami the "end of tsunami" message will be sent much later. The decision to send this message earlier was taken considering the maximum duration of the exercise.

Another important note has to do with the heights values reported as measured on the coastal sea-level instruments (tide-gauges), which may not be possible to record in case of real events due to the limitations on the dynamic range of the stations.

Time	Events
T0	Earthquake occurs
T0+3m	Initial earthquake parameters (hypocenter and MW) computed: mag 8.1; deph:28km
T0+4m	First evaluation of possible tsunami impact (DM); **Issue of first message (#1)**
T0+20m	Revision of earthquake parameters: mag 8.6; depth 35km
T0+21m	Second evaluation of possible tsunami impact; Increase in magnitude but same levels of alert (according to DM) ; **Issue of suppl. Message (#2)**
T0+33m	Confirmation of tsunami on the first tide-gauge, Lagos, portuguese mainland SW coast;
T0+38m	**Issue of suppl. message (#3)**
T0+41m	Tsunami wave arrival to Sines tide-gauge
T0+43m	Tsunami arrival to Cascais tide-gauge
T0+60m	**Issue of suppl. message (#4)**
T0+1h04m	Tsunami wave arrival to Casablanca tide-gauge
T0+1h07m	Tsunami wave arrival to Gibraltar tide-gauge
T0+1h11m	Tsunami wave arrival to Huelva tide-gauge
T0+1h49m	Tsunami wave arrival to Ferrol tide-gauge
T0+2h	**Issue of suppl. message (#5)**
T0+2h05m	Tsunami wave arrival to Ponta Delgada, Azores, tide-gauge
T0+3h*	**Issue of End Tsunami message (#6)**

* - This end of tsunami message is generated much earlier than what should occur in case of a real event.
DM -. NEAMTWS decision matriz.

Table 3: Master schedule of events

- Tsunami Messages

The tsunami messages to be issued are listed below (please notice that the first line of each message corresponds to the GTS header):

Message #1

WENT40 LPMG 161527
TSUNAMI EXERCISE MESSAGE NUMBER 001
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1527Z 16 NOV 2012

... TSUNAMI WATCH ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ... IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ... UNITED KINGDOM

... TSUNAMI INFORMATION ...
THIS INFORMATION APPLIES TO RUSSIAN FEDERATION ... POLAND ... LITHUANIA ... ESTONIA ... FINLAND ... ALGERIA ... ALBANIA ... BULGARIA ... CROATIA ... CYPRUS ... EGYPT ... GEORGIA ... GREECE ... ISRAEL ... ITALY

... LEBANON ... LIBYA ... MALTA ... MONACO ... ROMANIA ... SLOVENIA ... SWEDEN ... SYRIA ... TUNISIA ... TURKEY ... UKRAINE

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.1

EVALUATION OF TSUNAMI WATCH
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WARNING IS BASED ONLY ON THE EARTHQUAKE EVALUATION.
AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI THAT CAN STRIKE COASTLINES WITH WAVE HEIGHT GREATER THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR MAJOR EFFECT IN THE REGION. THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.
LOCATION, FORECAST POINT COORDINATES, ARRIVAL TIME, ALERT LEVEL (ADVISORY, WATCH)

PORTUGAL	- SAGRES	37.00N	8.94W	1548Z 16 NOV 2012 WATCH
PORTUGAL	- ARMACAO DE PERA	37.07N	8.37W	1559Z 16 NOV 2012 WATCH
PORTUGAL	- CASCAIS	38.68N	9.45W	1604Z 16 NOV 2012 WATCH
PORTUGAL	- MADEIRA	33.05N	16.32W	1618Z 16 NOV 2012 WATCH
PORTUGAL	- NAZARE	39.60N	9.09W	1622Z 16 NOV 2012 WATCH
PORTUGAL	- PONTA DELGADA	37.67N	25.65W	1725Z 16 NOV 2012 WATCH
PORTUGAL	- ANGRA	38.62N	27.00W	1736Z 16 NOV 2012 WATCH
PORTUGAL	- FLORES	39.43N	31.05W	1815Z 16 NOV 2012 WATCH
MOROCCO	- RABAT	34.04N	6.84W	1612Z 16 NOV 2012 WATCH
MOROCCO	- TANGER	35.79N	5.80W	1626Z 16 NOV 2012 WATCH

SPAIN - ALGECIRAS 36.13N 5.40W 1630Z 16 NOV 2012 WATCH
SPAIN - CADIZ 36.53N 6.29W 1632Z 16 NOV 2012 WATCH
SPAIN - HUELVA 37.16N 6.97W 1633Z 16 NOV 2012 WATCH
SPAIN - CEUTA 35.89N 5.32W 1641Z 16 NOV 2012 WATCH
SPAIN - LAS PALMAS 28.15N 15.33W 1648Z 16 NOV 2012 WATCH
SPAIN - SANTA CRUZ 28.47N 16.19W 1651Z 16 NOV 2012 WATCH
SPAIN - MALAGA 36.66N 4.40W 1655Z 16 NOV 2012 WATCH
SPAIN - VIGO 42.24N 8.81W 1709Z 16 NOV 2012 WATCH
SPAIN - CORUNHA 43.43N 8.40W 1716Z 16 NOV 2012 WATCH
SPAIN - ALMERIA 36.84N 2.47W 1721Z 16 NOV 2012 WATCH
UNITED KINGDOM- GIBRALTAR 36.13N 5.35W 1631Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE2 47.00N 14.00W 1705Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE1 47.00N 10.00W 1708Z 16 NOV 2012 WATCH
UNITED KINGDOM- ST MARY'S 49.92N 6.32W 1931Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE3 60.00N 12.00W 1934Z 16 NOV 2012 WATCH
UNITED KINGDOM- NEWLYN 50.10N 5.55W 2009Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE4 62.00N 4.00W 2038Z 16 NOV 2012 WATCH
UNITED KINGDOM- LERWICK 60.15N 1.13W 2212Z 16 NOV 2012 WATCH
UNITED KINGDOM- WHITBY 54.48N 0.62W 0302Z 17 NOV 2012 WATCH
FRANCE - BAYONNE 43.51N 1.60W 1802Z 16 NOV 2012 WATCH
FRANCE - BISCARROSSE 44.45N 1.34W 1812Z 16 NOV 2012 WATCH
FRANCE - LE CONQUET 48.35N 4.83W 1845Z 16 NOV 2012 WATCH
FRANCE - LORIENT 47.66N 3.39W 1849Z 16 NOV 2012 WATCH
FRANCE - OLERON 46.02N 1.41W 1907Z 16 NOV 2012 WATCH
FRANCE - SAINT-NAZAIRE 47.24N 2.26W 1937Z 16 NOV 2012 WATCH
FRANCE - CHERBOURG 49.67N 1.65W 2133Z 16 NOV 2012 WATCH
FRANCE - LE HAVRE 49.48N 0.08E 2322Z 16 NOV 2012 WATCH
FRANCE - CALAIS 51.00N 1.84E 0056Z 17 NOV 2012 WATCH
IRELAND - CASTLETOWNBERE 52.08N 10.52W 1844Z 16 NOV 2012 WATCH
IRELAND - MALIN HEAD 55.62N 7.55W 1952Z 16 NOV 2012 WATCH
IRELAND - GALWAY PORT 53.45N 9.08W 2026Z 16 NOV 2012 WATCH
IRELAND - DUNMORE 52.25N 7.65W 2114Z 16 NOV 2012 WATCH
IRELAND - BALLYCOTTON 52.37N 8.00W 2250Z 16 NOV 2012 WATCH
IRELAND - DUBLIN PORT 53.58N 6.33W 0332Z 17 NOV 2012 WATCH
DENMARK - SUDERø 61.38N 6.69W 2024Z 16 NOV 2012 WATCH
DENMARK - THORSHVAN 62.02N 6.73W 2108Z 16 NOV 2012 WATCH
DENMARK - KLAKSVIG 62.18N 6.61W 2114Z 16 NOV 2012 WATCH
DENMARK - NANORTALIK 60.12N 45.24W 2132Z 16 NOV 2012 WATCH
DENMARK - ANGMAGSALIK 65.58N 37.61W 2140Z 16 NOV 2012 WATCH
DENMARK - NUUK 64.17N 51.76W 2239Z 16 NOV 2012 WATCH
DENMARK - HIRTSHALS 57.61N 9.93E 0123Z 17 NOV 2012 WATCH
DENMARK - COPENHAGEN 55.75N 2.67E 0138Z 17 NOV 2012 WATCH
GERMANY - (LERWICK) 60.15N 1.12W 2212Z 16 NOV 2012 WATCH
GERMANY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
GERMANY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
GERMANY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
GERMANY - (ABERDEEN) 57.15N 2.07W 0009Z 17 NOV 2012 WATCH
GERMANY - (HARTLEPOOL) 54.70N 1.20W 0255Z 17 NOV 2012 WATCH
GERMANY - WESTERLAND 54.92N 8.27E 0516Z 17 NOV 2012 WATCH
GERMANY - HELGOLAND 54.18N 7.88E 0555Z 17 NOV 2012 WATCH
GERMANY - BORKUM 53.55N 6.75E 0632Z 17 NOV 2012 WATCH
GERMANY - ALTE WESER LT 53.87N 8.13E 0633Z 17 NOV 2012 WATCH
GERMANY - NORDERNEY 53.70N 7.15E 0639Z 17 NOV 2012 WATCH

GERMANY - CUXHAVEN 53.87N 8.72E 0733Z 17 NOV 2012 WATCH
GERMANY - BUSUM 54.12N 8.87E 0813Z 17 NOV 2012 WATCH
NORWAY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
NORWAY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
NORWAY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
NETHERLANDS - DOMBURG 51.57N 3.49E 0333Z 17 NOV 2012 WATCH
NETHERLANDS - ZANDVOORT 52.37N 4.52E 0512Z 17 NOV 2012 WATCH
SWEDEN - OFF-SHORE SITE1 58.50N 11.00E 0114Z 17 NOV 2012 WATCH
MAURITANIA - NOUAKCHOTT 18.08N 16.03W 1949Z 16 NOV 2012 WATCH
ICELAND - VIK 63.41N 19.01W 2024Z 16 NOV 2012 WATCH
CAPE VERDE - PALMEIRA 16.79N 22.99W 1853Z 16 NOV 2012 WATCH
BELGIUM - OOSTENDE 51.21N 2.88E 0317Z 17 NOV 2012 WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND
EVALUATION ALLOWS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END
OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 001

Message #2

WENT40 LPMG 161544
TSUNAMI EXERCISE MESSAGE NUMBER 002
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1544Z 16 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ...
IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ...
UNITED KINGDOM

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NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE
DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY
ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.6

ESTIMATED INITIAL TSUNAMI ARRIVAL TIMES AT FORECAST POINTS WITHIN
THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND
THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES
AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE
HOUR.
LOCATION, FORECAST POINT COORDINATES, ARRIVAL TIME, ALERT LEVEL (ADVISORY, WATCH)

PORTUGAL - SAGRES 37.00N 8.94W 1548Z 16 NOV 2012 WATCH
PORTUGAL - ARMACAO DE PERA 37.07N 8.37W 1559Z 16 NOV 2012 WATCH
PORTUGAL - CASCAIS 38.68N 9.45W 1604Z 16 NOV 2012 WATCH

PORTUGAL - MADEIRA 33.05N 16.32W 1618Z 16 NOV 2012 WATCH
PORTUGAL - NAZARE 39.60N 9.09W 1622Z 16 NOV 2012 WATCH
PORTUGAL - PONTA DELGADA 37.67N 25.65W 1725Z 16 NOV 2012 WATCH
PORTUGAL - ANGRA 38.62N 27.00W 1736Z 16 NOV 2012 WATCH
PORTUGAL - FLORES 39.43N 31.05W 1815Z 16 NOV 2012 WATCH
MOROCCO - RABAT 34.04N 6.84W 1612Z 16 NOV 2012 WATCH
MOROCCO - TANGER 35.79N 5.80W 1626Z 16 NOV 2012 WATCH
SPAIN - ALGECIRAS 36.13N 5.40W 1630Z 16 NOV 2012 WATCH
SPAIN - CADIZ 36.53N 6.29W 1632Z 16 NOV 2012 WATCH
SPAIN - HUELVA 37.16N 6.97W 1633Z 16 NOV 2012 WATCH
SPAIN - CEUTA 35.89N 5.32W 1641Z 16 NOV 2012 WATCH
SPAIN - LAS PALMAS 28.15N 15.33W 1648Z 16 NOV 2012 WATCH
SPAIN - SANTA CRUZ 28.47N 16.19W 1651Z 16 NOV 2012 WATCH
SPAIN - MALAGA 36.66N 4.40W 1655Z 16 NOV 2012 WATCH
SPAIN - VIGO 42.24N 8.81W 1709Z 16 NOV 2012 WATCH
SPAIN - CORUNHA 43.43N 8.40W 1716Z 16 NOV 2012 WATCH
SPAIN - ALMERIA 36.84N 2.47W 1721Z 16 NOV 2012 WATCH
UNITED KINGDOM- GIBRALTAR 36.13N 5.35W 1631Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE2 47.00N 14.00W 1705Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE1 47.00N 10.00W 1708Z 16 NOV 2012 WATCH
UNITED KINGDOM- ST MARY'S 49.92N 6.32W 1931Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE3 60.00N 12.00W 1934Z 16 NOV 2012 WATCH
UNITED KINGDOM- NEWLYN 50.10N 5.55W 2009Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE4 62.00N 4.00W 2038Z 16 NOV 2012 WATCH
UNITED KINGDOM- LERWICK 60.15N 1.13W 2212Z 16 NOV 2012 WATCH
UNITED KINGDOM- WHITBY 54.48N 0.62W 0302Z 17 NOV 2012 WATCH
FRANCE - BAYONNE 43.51N 1.60W 1802Z 16 NOV 2012 WATCH
FRANCE - BISCARROSSE 44.45N 1.34W 1812Z 16 NOV 2012 WATCH
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FRANCE - LORIENT 47.66N 3.39W 1849Z 16 NOV 2012 WATCH
FRANCE - OLERON 46.02N 1.41W 1907Z 16 NOV 2012 WATCH
FRANCE - SAINT-NAZAIRE 47.24N 2.26W 1937Z 16 NOV 2012 WATCH
FRANCE - CHERBOURG 49.67N 1.65W 2133Z 16 NOV 2012 WATCH
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DENMARK - ANGMAGSALIK 65.58N 37.61W 2140Z 16 NOV 2012 WATCH
DENMARK - NUUK 64.17N 51.76W 2239Z 16 NOV 2012 WATCH
DENMARK - HIRTSHALS 57.61N 9.93E 0123Z 17 NOV 2012 WATCH
DENMARK - COPENHAGEN 55.75N 2.67E 0138Z 17 NOV 2012 WATCH
GERMANY - (LERWICK) 60.15N 1.12W 2212Z 16 NOV 2012 WATCH
GERMANY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
GERMANY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
GERMANY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH

GERMANY - (ABERDEEN) 57.15N 2.07W 0009Z 17 NOV 2012 WATCH
GERMANY - (HARTLEPOOL) 54.70N 1.20W 0255Z 17 NOV 2012 WATCH
GERMANY - WESTERLAND 54.92N 8.27E 0516Z 17 NOV 2012 WATCH
GERMANY - HELGOLAND 54.18N 7.88E 0555Z 17 NOV 2012 WATCH
GERMANY - BORKUM 53.55N 6.75E 0632Z 17 NOV 2012 WATCH
GERMANY - ALTE WESER LT 53.87N 8.13E 0633Z 17 NOV 2012 WATCH
GERMANY - NORDERNEY 53.70N 7.15E 0639Z 17 NOV 2012 WATCH
GERMANY - CUXHAVEN 53.87N 8.72E 0733Z 17 NOV 2012 WATCH
GERMANY - BUSUM 54.12N 8.87E 0813Z 17 NOV 2012 WATCH
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NORWAY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
NETHERLANDS - DOMBURG 51.57N 3.49E 0333Z 17 NOV 2012 WATCH
NETHERLANDS - ZANDVOORT 52.37N 4.52E 0512Z 17 NOV 2012 WATCH
SWEDEN - OFF-SHORE SITE1 58.50N 11.00E 0114Z 17 NOV 2012 WATCH
MAURITANIA - NOUAKCHOTT 18.08N 16.03W 1949Z 16 NOV 2012 WATCH
ICELAND - VIK 63.41N 19.01W 2024Z 16 NOV 2012 WATCH
CAPE VERDE - PALMEIRA 16.79N 22.99W 1853Z 16 NOV 2012 WATCH
BELGIUM - OOSTENDE 51.21N 2.88E 0317Z 17 NOV 2012 WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND
EVALUATION ALLOWS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END
OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 002

Message #3

WENT40 LPMG 161601
TSUNAMI EXERCISE MESSAGE NUMBER 003
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1601Z 16 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ...
IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ...
UNITED KINGDOM

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY
NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE
DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY
ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.6

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER
---------- --- --- --- ---- ---

PORTUGAL - LAGOS 37.10N 8.67W 1600Z 16 NOV 2012 5.00M 8.17MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTZ TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH WAVE HEIGHT GREATER THAN
0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. THIS
CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGSES NEAREST THE
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS
POSSIBILITY.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY
SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE
TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE
THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

ESTIMATED INITIAL TSUNAMI ARRIVAL TIMES AT FORECAST POINTS WITHIN
THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND
THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES
AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE
HOUR.
LOCATION, FORECAST POINT COORDINATES, ARRIVAL TIME, ALERT LEVEL (ADVISORY, WATCH)

PORTUGAL - SAGRES 37.00N 8.94W 1548Z 16 NOV 2012 WATCH
PORTUGAL - ARMACAO DE PERA 37.07N 8.37W 1559Z 16 NOV 2012 WATCH
PORTUGAL - CASCAIS 38.68N 9.45W 1604Z 16 NOV 2012 WATCH
PORTUGAL - MADEIRA 33.05N 16.32W 1618Z 16 NOV 2012 WATCH
PORTUGAL - NAZARE 39.60N 9.09W 1622Z 16 NOV 2012 WATCH
PORTUGAL - PONTA DELGADA 37.67N 25.65W 1725Z 16 NOV 2012 WATCH
PORTUGAL - ANGRA 38.62N 27.00W 1736Z 16 NOV 2012 WATCH
PORTUGAL - FLORES 39.43N 31.05W 1815Z 16 NOV 2012 WATCH
MOROCCO - RABAT 34.04N 6.84W 1612Z 16 NOV 2012 WATCH
MOROCCO - TANGER 35.79N 5.80W 1626Z 16 NOV 2012 WATCH
SPAIN - ALGECIRAS 36.13N 5.40W 1630Z 16 NOV 2012 WATCH
SPAIN - CADIZ 36.53N 6.29W 1632Z 16 NOV 2012 WATCH
SPAIN - HUELVA 37.16N 6.97W 1633Z 16 NOV 2012 WATCH
SPAIN - CEUTA 35.89N 5.32W 1641Z 16 NOV 2012 WATCH
SPAIN - LAS PALMAS 28.15N 15.33W 1648Z 16 NOV 2012 WATCH
SPAIN - SANTA CRUZ 28.47N 16.19W 1651Z 16 NOV 2012 WATCH
SPAIN - MALAGA 36.66N 4.40W 1655Z 16 NOV 2012 WATCH
SPAIN - VIGO 42.24N 8.81W 1709Z 16 NOV 2012 WATCH
SPAIN - CORUNHA 43.43N 8.40W 1716Z 16 NOV 2012 WATCH
SPAIN - ALMERIA 36.84N 2.47W 1721Z 16 NOV 2012 WATCH
UNITED KINGDOM- GIBRALTAR 36.13N 5.35W 1631Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE2 47.00N 14.00W 1705Z 16 NOV 2012 WATCH

UNITED KINGDOM- OFF-SHORE SITE1 47.00N 10.00W 1708Z 16 NOV 2012 WATCH
UNITED KINGDOM- ST MARY'S 49.92N 6.32W 1931Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE3 60.00N 12.00W 1934Z 16 NOV 2012 WATCH
UNITED KINGDOM- NEWLYN 50.10N 5.55W 2009Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE4 62.00N 4.00W 2038Z 16 NOV 2012 WATCH
UNITED KINGDOM- LERWICK 60.15N 1.13W 2212Z 16 NOV 2012 WATCH
UNITED KINGDOM- WHITBY 54.48N 0.62W 0302Z 17 NOV 2012 WATCH
FRANCE - BAYONNE 43.51N 1.60W 1802Z 16 NOV 2012 WATCH
FRANCE - BISCARROSSE 44.45N 1.34W 1812Z 16 NOV 2012 WATCH
FRANCE - LE CONQUET 48.35N 4.83W 1845Z 16 NOV 2012 WATCH
FRANCE - LORIENT 47.66N 3.39W 1849Z 16 NOV 2012 WATCH
FRANCE - OLERON 46.02N 1.41W 1907Z 16 NOV 2012 WATCH
FRANCE - SAINT-NAZAIRE 47.24N 2.26W 1937Z 16 NOV 2012 WATCH
FRANCE - CHERBOURG 49.67N 1.65W 2133Z 16 NOV 2012 WATCH
FRANCE - LE HAVRE 49.48N 0.08E 2322Z 16 NOV 2012 WATCH
FRANCE - CALAIS 51.00N 1.84E 0056Z 17 NOV 2012 WATCH
IRELAND - CASTLETOWNBERE 52.08N 10.52W 1844Z 16 NOV 2012 WATCH
IRELAND - MALIN HEAD 55.62N 7.55W 1952Z 16 NOV 2012 WATCH
IRELAND - GALWAY PORT 53.45N 9.08W 2026Z 16 NOV 2012 WATCH
IRELAND - DUNMORE 52.25N 7.65W 2114Z 16 NOV 2012 WATCH
IRELAND - BALLYCOTTON 52.37N 8.00W 2250Z 16 NOV 2012 WATCH
IRELAND - DUBLIN PORT 53.58N 6.33W 0332Z 17 NOV 2012 WATCH
DENMARK - SUDERø 61.38N 6.69W 2024Z 16 NOV 2012 WATCH
DENMARK - THORSHVAN 62.02N 6.73W 2108Z 16 NOV 2012 WATCH
DENMARK - KLAKSVIG 62.18N 6.61W 2114Z 16 NOV 2012 WATCH
DENMARK - NANORTALIK 60.12N 45.24W 2132Z 16 NOV 2012 WATCH
DENMARK - ANGMAGSALIK 65.58N 37.61W 2140Z 16 NOV 2012 WATCH
DENMARK - NUUK 64.17N 51.76W 2239Z 16 NOV 2012 WATCH
DENMARK - HIRTSHALS 57.61N 9.93E 0123Z 17 NOV 2012 WATCH
DENMARK - COPENHAGEN 55.75N 2.67E 0138Z 17 NOV 2012 WATCH
GERMANY - (LERWICK) 60.15N 1.12W 2212Z 16 NOV 2012 WATCH
GERMANY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
GERMANY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
GERMANY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
GERMANY - (ABERDEEN) 57.15N 2.07W 0009Z 17 NOV 2012 WATCH
GERMANY - (HARTLEPOOL) 54.70N 1.20W 0255Z 17 NOV 2012 WATCH
GERMANY - WESTERLAND 54.92N 8.27E 0516Z 17 NOV 2012 WATCH
GERMANY - HELGOLAND 54.18N 7.88E 0555Z 17 NOV 2012 WATCH
GERMANY - BORKUM 53.55N 6.75E 0632Z 17 NOV 2012 WATCH
GERMANY - ALTE WESER LT 53.87N 8.13E 0633Z 17 NOV 2012 WATCH
GERMANY - NORDERNEY 53.70N 7.15E 0639Z 17 NOV 2012 WATCH
GERMANY - CUXHAVEN 53.87N 8.72E 0733Z 17 NOV 2012 WATCH
GERMANY - BUSUM 54.12N 8.87E 0813Z 17 NOV 2012 WATCH
NORWAY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
NORWAY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
NORWAY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
NETHERLANDS - DOMBURG 51.57N 3.49E 0333Z 17 NOV 2012 WATCH
NETHERLANDS - ZANDVOORT 52.37N 4.52E 0512Z 17 NOV 2012 WATCH
SWEDEN - OFF-SHORE SITE1 58.50N 11.00E 0114Z 17 NOV 2012 WATCH
MAURITANIA - NOUAKCHOTT 18.08N 16.03W 1949Z 16 NOV 2012 WATCH
ICELAND - VIK 63.41N 19.01W 2024Z 16 NOV 2012 WATCH
CAPE VERDE - PALMEIRA 16.79N 22.99W 1853Z 16 NOV 2012 WATCH
BELGIUM - OOSTENDE 51.21N 2.88E 0317Z 17 NOV 2012 WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND
EVALUATION ALLOWS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END
OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 003

Message #4

WENT40 LPMG 161623
TSUNAMI EXERCISE MESSAGE NUMBER 004
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1623Z 16 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ...
IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ...
UNITED KINGDOM

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY
NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE
DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY
ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.6

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER
---------- --- --- --- ---- ---
PORTUGAL - LAGOS 37.10N 8.67W 1600Z 16 NOV 2012 5.00M 8.17MIN
PORTUGAL - SINES 37.95N 8.89W 1608Z 16 NOV 2012 2.00M 8.00MIN
PORTUGAL - CASCAIS 38.69N 9.42W 1610Z 16 NOV 2012 5.00M 8.33MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTZ TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH WAVE HEIGHT GREATER THAN
0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. THIS
CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGSES NEAREST THE
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS
POSSIBILITY.

A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

ESTIMATED INITIAL TSUNAMI ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION, FORECAST POINT COORDINATES, ARRIVAL TIME, ALERT LEVEL (ADVISORY, WATCH)

PORTUGAL - SAGRES 37.00N 8.94W 1548Z 16 NOV 2012 WATCH
PORTUGAL - ARMACAO DE PERA 37.07N 8.37W 1559Z 16 NOV 2012 WATCH
PORTUGAL - CASCAIS 38.68N 9.45W 1604Z 16 NOV 2012 WATCH
PORTUGAL - MADEIRA 33.05N 16.32W 1618Z 16 NOV 2012 WATCH
PORTUGAL - NAZARE 39.60N 9.09W 1622Z 16 NOV 2012 WATCH
PORTUGAL - PONTA DELGADA 37.67N 25.65W 1725Z 16 NOV 2012 WATCH
PORTUGAL - ANGRA 38.62N 27.00W 1736Z 16 NOV 2012 WATCH
PORTUGAL - FLORES 39.43N 31.05W 1815Z 16 NOV 2012 WATCH
MOROCCO - RABAT 34.04N 6.84W 1612Z 16 NOV 2012 WATCH
MOROCCO - TANGER 35.79N 5.80W 1626Z 16 NOV 2012 WATCH
SPAIN - ALGECIRAS 36.13N 5.40W 1630Z 16 NOV 2012 WATCH
SPAIN - CADIZ 36.53N 6.29W 1632Z 16 NOV 2012 WATCH
SPAIN - HUELVA 37.16N 6.97W 1633Z 16 NOV 2012 WATCH
SPAIN - CEUTA 35.89N 5.32W 1641Z 16 NOV 2012 WATCH
SPAIN - LAS PALMAS 28.15N 15.33W 1648Z 16 NOV 2012 WATCH
SPAIN - SANTA CRUZ 28.47N 16.19W 1651Z 16 NOV 2012 WATCH
SPAIN - MALAGA 36.66N 4.40W 1655Z 16 NOV 2012 WATCH
SPAIN - VIGO 42.24N 8.81W 1709Z 16 NOV 2012 WATCH
SPAIN - CORUNHA 43.43N 8.40W 1716Z 16 NOV 2012 WATCH
SPAIN - ALMERIA 36.84N 2.47W 1721Z 16 NOV 2012 WATCH
UNITED KINGDOM- GIBRALTAR 36.13N 5.35W 1631Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE2 47.00N 14.00W 1705Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE1 47.00N 10.00W 1708Z 16 NOV 2012 WATCH
UNITED KINGDOM- ST MARY'S 49.92N 6.32W 1931Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE3 60.00N 12.00W 1934Z 16 NOV 2012 WATCH
UNITED KINGDOM- NEWLYN 50.10N 5.55W 2009Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE4 62.00N 4.00W 2038Z 16 NOV 2012 WATCH
UNITED KINGDOM- LERWICK 60.15N 1.13W 2212Z 16 NOV 2012 WATCH
UNITED KINGDOM- WHITBY 54.48N 0.62W 0302Z 17 NOV 2012 WATCH
FRANCE - BAYONNE 43.51N 1.60W 1802Z 16 NOV 2012 WATCH
FRANCE - BISCARROSSE 44.45N 1.34W 1812Z 16 NOV 2012 WATCH
FRANCE - LE CONQUET 48.35N 4.83W 1845Z 16 NOV 2012 WATCH
FRANCE - LORIENT 47.66N 3.39W 1849Z 16 NOV 2012 WATCH
FRANCE - OLERON 46.02N 1.41W 1907Z 16 NOV 2012 WATCH
FRANCE - SAINT-NAZAIRE 47.24N 2.26W 1937Z 16 NOV 2012 WATCH
FRANCE - CHERBOURG 49.67N 1.65W 2133Z 16 NOV 2012 WATCH
FRANCE - LE HAVRE 49.48N 0.08E 2322Z 16 NOV 2012 WATCH
FRANCE - CALAIS 51.00N 1.84E 0056Z 17 NOV 2012 WATCH
IRELAND - CASTLETOWNBERE 52.08N 10.52W 1844Z 16 NOV 2012 WATCH
IRELAND - MALIN HEAD 55.62N 7.55W 1952Z 16 NOV 2012 WATCH

IRELAND - GALWAY PORT 53.45N 9.08W 2026Z 16 NOV 2012 WATCH
IRELAND - DUNMORE 52.25N 7.65W 2114Z 16 NOV 2012 WATCH
IRELAND - BALLYCOTTON 52.37N 8.00W 2250Z 16 NOV 2012 WATCH
IRELAND - DUBLIN PORT 53.58N 6.33W 0332Z 17 NOV 2012 WATCH
DENMARK - SUDERø 61.38N 6.69W 2024Z 16 NOV 2012 WATCH
DENMARK - THORSHVAN 62.02N 6.73W 2108Z 16 NOV 2012 WATCH
DENMARK - KLAKSVIG 62.18N 6.61W 2114Z 16 NOV 2012 WATCH
DENMARK - NANORTALIK 60.12N 45.24W 2132Z 16 NOV 2012 WATCH
DENMARK - ANGMAGSALIK 65.58N 37.61W 2140Z 16 NOV 2012 WATCH
DENMARK - NUUK 64.17N 51.76W 2239Z 16 NOV 2012 WATCH
DENMARK - HIRTSHALS 57.61N 9.93E 0123Z 17 NOV 2012 WATCH
DENMARK - COPENHAGEN 55.75N 2.67E 0138Z 17 NOV 2012 WATCH
GERMANY - (LERWICK) 60.15N 1.12W 2212Z 16 NOV 2012 WATCH
GERMANY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
GERMANY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
GERMANY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
GERMANY - (ABERDEEN) 57.15N 2.07W 0009Z 17 NOV 2012 WATCH
GERMANY - (HARTLEPOOL) 54.70N 1.20W 0255Z 17 NOV 2012 WATCH
GERMANY - WESTERLAND 54.92N 8.27E 0516Z 17 NOV 2012 WATCH
GERMANY - HELGOLAND 54.18N 7.88E 0555Z 17 NOV 2012 WATCH
GERMANY - BORKUM 53.55N 6.75E 0632Z 17 NOV 2012 WATCH
GERMANY - ALTE WESER LT 53.87N 8.13E 0633Z 17 NOV 2012 WATCH
GERMANY - NORDERNEY 53.70N 7.15E 0639Z 17 NOV 2012 WATCH
GERMANY - CUXHAVEN 53.87N 8.72E 0733Z 17 NOV 2012 WATCH
GERMANY - BUSUM 54.12N 8.87E 0813Z 17 NOV 2012 WATCH
NORWAY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
NORWAY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
NORWAY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
NETHERLANDS - DOMBURG 51.57N 3.49E 0333Z 17 NOV 2012 WATCH
NETHERLANDS - ZANDVOORT 52.37N 4.52E 0512Z 17 NOV 2012 WATCH
SWEDEN - OFF-SHORE SITE1 58.50N 11.00E 0114Z 17 NOV 2012 WATCH
MAURITANIA - NOUAKCHOTT 18.08N 16.03W 1949Z 16 NOV 2012 WATCH
ICELAND - VIK 63.41N 19.01W 2024Z 16 NOV 2012 WATCH
CAPE VERDE - PALMEIRA 16.79N 22.99W 1853Z 16 NOV 2012 WATCH
BELGIUM - OOSTENDE 51.21N 2.88E 0317Z 17 NOV 2012 WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND
EVALUATION ALLOWS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END
OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 004

Message #5

WENT40 LPMG 161723
TSUNAMI EXERCISE MESSAGE NUMBER 005
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1723Z 16 NOV 2012

... TSUNAMI WATCH ONGOING ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ...
IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ...
UNITED KINGDOM

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY
NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE
DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY
ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.6

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER
---------- --- --- --- ---- ---
PORTUGAL - LAGOS 37.10N 8.67W 1600Z 16 NOV 2012 5.00M 8.17MIN
PORTUGAL - SINES 37.95N 8.89W 1608Z 16 NOV 2012 2.00M 8.00MIN
PORTUGAL - CASCAIS 38.69N 9.42W 1610Z 16 NOV 2012 5.00M 8.33MIN
MOROCCO - CASABLANCA 33.62N 7.59W 1631Z 16 NOV 2012 4.00M 8.50MIN
UNITED KINGDOM - GIBRALTAR 36.13N 5.35W 1635Z 16 NOV 2012 1.50M 8.00MIN
SPAIN - HUELVA 37.13N 6.83W 1639Z 16 NOV 2012 3.50M 7.50MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTZ TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH WAVE HEIGHT GREATER THAN
0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. THIS
CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGSES NEAREST THE
REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED.
AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS
POSSIBILITY.
A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE
LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY
SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE
TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE
THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

ESTIMATED INITIAL TSUNAMI ARRIVAL TIMES AT FORECAST POINTS WITHIN
THE WATCH AREA ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND
THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES
AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE
HOUR.
LOCATION, FORECAST POINT COORDINATES, ARRIVAL TIME, ALERT LEVEL (ADVISORY, WATCH)

PORTUGAL - SAGRES 37.00N 8.94W 1548Z 16 NOV 2012 WATCH
PORTUGAL - ARMACAO DE PERA 37.07N 8.37W 1559Z 16 NOV 2012 WATCH

PORTUGAL - CASCAIS 38.68N 9.45W 1604Z 16 NOV 2012 WATCH
PORTUGAL - MADEIRA 33.05N 16.32W 1618Z 16 NOV 2012 WATCH
PORTUGAL - NAZARE 39.60N 9.09W 1622Z 16 NOV 2012 WATCH
PORTUGAL - PONTA DELGADA 37.67N 25.65W 1725Z 16 NOV 2012 WATCH
PORTUGAL - ANGRA 38.62N 27.00W 1736Z 16 NOV 2012 WATCH
PORTUGAL - FLORES 39.43N 31.05W 1815Z 16 NOV 2012 WATCH
MOROCCO - RABAT 34.04N 6.84W 1612Z 16 NOV 2012 WATCH
MOROCCO - TANGER 35.79N 5.80W 1626Z 16 NOV 2012 WATCH
SPAIN - ALGECIRAS 36.13N 5.40W 1630Z 16 NOV 2012 WATCH
SPAIN - CADIZ 36.53N 6.29W 1632Z 16 NOV 2012 WATCH
SPAIN - HUELVA 37.16N 6.97W 1633Z 16 NOV 2012 WATCH
SPAIN - CEUTA 35.89N 5.32W 1641Z 16 NOV 2012 WATCH
SPAIN - LAS PALMAS 28.15N 15.33W 1648Z 16 NOV 2012 WATCH
SPAIN - SANTA CRUZ 28.47N 16.19W 1651Z 16 NOV 2012 WATCH
SPAIN - MALAGA 36.66N 4.40W 1655Z 16 NOV 2012 WATCH
SPAIN - VIGO 42.24N 8.81W 1709Z 16 NOV 2012 WATCH
SPAIN - CORUNHA 43.43N 8.40W 1716Z 16 NOV 2012 WATCH
SPAIN - ALMERIA 36.84N 2.47W 1721Z 16 NOV 2012 WATCH
UNITED KINGDOM- GIBRALTAR 36.13N 5.35W 1631Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE2 47.00N 14.00W 1705Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE1 47.00N 10.00W 1708Z 16 NOV 2012 WATCH
UNITED KINGDOM- ST MARY'S 49.92N 6.32W 1931Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE3 60.00N 12.00W 1934Z 16 NOV 2012 WATCH
UNITED KINGDOM- NEWLYN 50.10N 5.55W 2009Z 16 NOV 2012 WATCH
UNITED KINGDOM- OFF-SHORE SITE4 62.00N 4.00W 2038Z 16 NOV 2012 WATCH
UNITED KINGDOM- LERWICK 60.15N 1.13W 2212Z 16 NOV 2012 WATCH
UNITED KINGDOM- WHITBY 54.48N 0.62W 0302Z 17 NOV 2012 WATCH
FRANCE - BAYONNE 43.51N 1.60W 1802Z 16 NOV 2012 WATCH
FRANCE - BISCARROSSE 44.45N 1.34W 1812Z 16 NOV 2012 WATCH
FRANCE - LE CONQUET 48.35N 4.83W 1845Z 16 NOV 2012 WATCH
FRANCE - LORIENT 47.66N 3.39W 1849Z 16 NOV 2012 WATCH
FRANCE - OLERON 46.02N 1.41W 1907Z 16 NOV 2012 WATCH
FRANCE - SAINT-NAZAIRE 47.24N 2.26W 1937Z 16 NOV 2012 WATCH
FRANCE - CHERBOURG 49.67N 1.65W 2133Z 16 NOV 2012 WATCH
FRANCE - LE HAVRE 49.48N 0.08E 2322Z 16 NOV 2012 WATCH
FRANCE - CALAIS 51.00N 1.84E 0056Z 17 NOV 2012 WATCH
IRELAND - CASTLETOWNBERE 52.08N 10.52W 1844Z 16 NOV 2012 WATCH
IRELAND - MALIN HEAD 55.62N 7.55W 1952Z 16 NOV 2012 WATCH
IRELAND - GALWAY PORT 53.45N 9.08W 2026Z 16 NOV 2012 WATCH
IRELAND - DUNMORE 52.25N 7.65W 2114Z 16 NOV 2012 WATCH
IRELAND - BALLYCOTTON 52.37N 8.00W 2250Z 16 NOV 2012 WATCH
IRELAND - DUBLIN PORT 53.58N 6.33W 0332Z 17 NOV 2012 WATCH
DENMARK - SUDERø 61.38N 6.69W 2024Z 16 NOV 2012 WATCH
DENMARK - THORSHVAN 62.02N 6.73W 2108Z 16 NOV 2012 WATCH
DENMARK - KLAKSVIG 62.18N 6.61W 2114Z 16 NOV 2012 WATCH
DENMARK - NANORTALIK 60.12N 45.24W 2132Z 16 NOV 2012 WATCH
DENMARK - ANGMAGSALIK 65.58N 37.61W 2140Z 16 NOV 2012 WATCH
DENMARK - NUUK 64.17N 51.76W 2239Z 16 NOV 2012 WATCH
DENMARK - HIRTSHALS 57.61N 9.93E 0123Z 17 NOV 2012 WATCH
DENMARK - COPENHAGEN 55.75N 2.67E 0138Z 17 NOV 2012 WATCH
GERMANY - (LERWICK) 60.15N 1.12W 2212Z 16 NOV 2012 WATCH
GERMANY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
GERMANY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH

GERMANY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
GERMANY - (ABERDEEN) 57.15N 2.07W 0009Z 17 NOV 2012 WATCH
GERMANY - (HARTLEPOOL) 54.70N 1.20W 0255Z 17 NOV 2012 WATCH
GERMANY - WESTERLAND 54.92N 8.27E 0516Z 17 NOV 2012 WATCH
GERMANY - HELGOLAND 54.18N 7.88E 0555Z 17 NOV 2012 WATCH
GERMANY - BORKUM 53.55N 6.75E 0632Z 17 NOV 2012 WATCH
GERMANY - ALTE WESER LT 53.87N 8.13E 0633Z 17 NOV 2012 WATCH
GERMANY - NORDERNEY 53.70N 7.15E 0639Z 17 NOV 2012 WATCH
GERMANY - CUXHAVEN 53.87N 8.72E 0733Z 17 NOV 2012 WATCH
GERMANY - BUSUM 54.12N 8.87E 0813Z 17 NOV 2012 WATCH
NORWAY - (BLOM0Y) 60.53N 4.88E 2244Z 16 NOV 2012 WATCH
NORWAY - (FLORø) 61.60N 5.03E 2259Z 16 NOV 2012 WATCH
NORWAY - (KARM0Y) 59.15N 5.25E 2320Z 16 NOV 2012 WATCH
NETHERLANDS - DOMBURG 51.57N 3.49E 0333Z 17 NOV 2012 WATCH
NETHERLANDS - ZANDVOORT 52.37N 4.52E 0512Z 17 NOV 2012 WATCH
SWEDEN - OFF-SHORE SITE1 58.50N 11.00E 0114Z 17 NOV 2012 WATCH
MAURITANIA - NOUAKCHOTT 18.08N 16.03W 1949Z 16 NOV 2012 WATCH
ICELAND - VIK 63.41N 19.01W 2024Z 16 NOV 2012 WATCH
CAPE VERDE - PALMEIRA 16.79N 22.99W 1853Z 16 NOV 2012 WATCH
BELGIUM - OOSTENDE 51.21N 2.88E 0317Z 17 NOV 2012 WATCH

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND
EVALUATION ALLOWS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END
OF ALERT IS BROADCAST.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 005

Message #6

WENT40 LPMG 161823
TSUNAMI EXERCISE MESSAGE NUMBER 006
NEAM IPMA CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1823Z 16 NOV 2012

... END OF TSUNAMI WATCH ...
THIS ALERT APPLIES TO BELGIUM ... CAPE VERDE ... DENMARK ... FRANCE ... GERMANY ... ICELAND ...
IRELAND ... MAURITANIA ... MOROCCO ... NETHERLANDS ... NORWAY ... PORTUGAL ... SPAIN ... SWEDEN ...
UNITED KINGDOM

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY
NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE
DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY
ACTIONS TO BE TAKEN IN RESPONSE

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME - 1523Z 16 NOV 2012
COORDINATES - 35.57 NORTH 9.89 WEST
DEPTH - 35 KM
LOCATION - SW CABO S.VICENTE
MAGNITUDE - 8.6

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY
GAUGE LOCATION LAT LON TIME AMPL PER

---------- --- --- --- ---- ---
PORTUGAL - LAGOS 37.10N 8.67W 1600Z 16 NOV 2012 5.00M 8.17MIN
PORTUGAL - SINES 37.95N 8.89W 1608Z 16 NOV 2012 2.00M 8.00MIN
PORTUGAL - CASCAIS 38.69N 9.42W 1610Z 16 NOV 2012 5.00M 8.33MIN
MOROCCO - CASABLANCA 33.62N 7.59W 1631Z 16 NOV 2012 4.00M 8.50MIN
UNITED KINGDOM - GIBRALTAR 36.13N 5.35W 1635Z 16 NOV 2012 1.50M 8.00MIN
SPAIN - HUELVA 37.13N 6.83W 1639Z 16 NOV 2012 3.50M 7.50MIN
SPAIN - FERROL1 43.56N 8.33W 1717Z 16 NOV 2012 1.00M 10.00MIN
PORTUGAL - PONTA DELGADA 37.73N 25.68W 1734Z 16 NOV 2012 0.90M 10.00MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTZ TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED.
WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO THE CONTINUING SEA LEVEL CHANGES AND RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

THIS WILL BE THE FINAL MESSAGE ISSUED FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

END OF TSUNAMI EXERCISE MESSAGE NUMBER 006

ANNEX VII

NEAMWAVE 12 SCENARIO: KOERI/NTWC-TR (TURKEY)

KOERI has declared its interim operational status as a Candidate Tsunami Watch Provider (CTWP) starting 1 July 2012 with the aim of monitoring tsunamigenic earthquakes and tsunamis in the Eastern Mediterranean, Aegean and Black Seas. KOERI scenario is based on a worst-case interpretation of the 8 August 1303 Crete and Dodecanese Islands earthquake resulting in destructive inundation in the Eastern Mediterranean. According to many historical records (Ambraseys 1962; Ambraseys et al. 1994; Guidoboni & Comastri 1997), this earthquake was a very large tsunamigenic earthquake that occurred in the eastern segment of the Hellenic arc between Crete and Rhodes. It created a strong tsunami wave that affected Crete, Acre, Alexandria and Rhodes. Historical records indicated that the sea swept into Crete with such a force that it destroyed buildings and killed inhabitants; also, the Nile was flooded with great sound, throwing boats a bow-shot on land and smashing their anchors; then the water retreated leaving the boats on land (Antonopoulos 1980; El-Sayed et al. 2000; Papadopoulos et al. 2007). However, Evagelatou-Notara (1993) and Guidoboni & Comastri, (1997) did not support that Rhodes was damaged by this tsunami, and considered that three sediment layers found in Dalaman, SW Turkey, could be attributed to the 1303 tsunami (Papadopoulos et al. 2004) The earthquake of 8 August 1303 proves to be one of the largest and best-documented seismic events in the history of the Mediterranean area. The effects of this earthquake and associated tsunami waves were very destructive and in many ways comparable with other reported events of 29 May 1508 (Ambraseys et al. 1994) and 12 October 1856 (Sieberg 1932; Ambraseys et al. 1994). It has been suggested that the epicentre was probably near the island of Crete, and after this event, tsunami waves were reported to be seen as far as the coastlines of Crete, the Peleponnese, Rhodes, Antalya (SW Turkey), Cyprus, Acre and Alexandria – Nile delta (Egypt). In addition, this earthquake and associated damage distributions are listed in most descriptive and parametric catalogues for the Mediterranean basin. However, the orientations of active faults vary along the concave part of the Hellenic arc (e.g. Pliny and Strabo trenches) in accordance with subduction of remnants of old lithospheric slab (Taymaz et al. 1990, 1991). Hence, the Hellenic trench in the vicinity of Crete should be considered to be a seismogenic zone of considerable importance in the Mediterranean region (Guidoboni & Comastri 1997). (copied from Yolsal et al., Understanding tsunamis, potential source regions and tsunami-prone mechanisms in the Eastern Mediterranean, *Geological Society, London, Special Publications* 2007; v. 291; p. 201-230, and references herein).

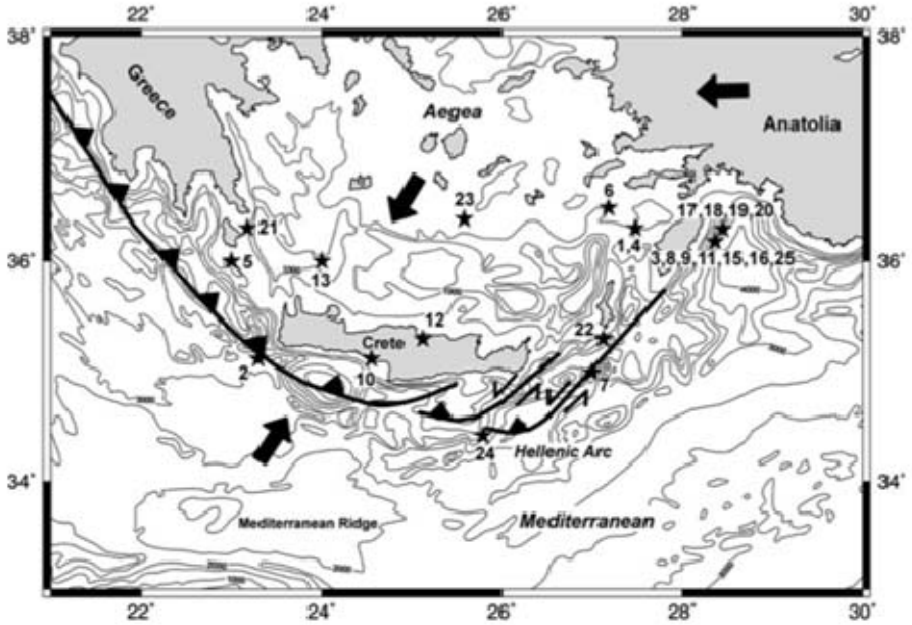

Figure 1: Reported locations of tsunamigenic earthquakes along the Hellenic arc and trench system (Papadopoulos2001; Papadopoulos et al. 2007). Large black arrows show relative motions of plates with respect to Eurasia (McClusky et al. 2000, 2003). Bathymetric contours are shown at

500 m interval, and are from GEBCO (1997). Star 7 refers to 1303 event. (copied from Yolsal et al., Understanding tsunamis, potential source regions and tsunami-prone mechanisms in the Eastern Mediterranean, *Geological Society, London, Special Publications* 2007; v. 291; p. 201-230, and references herein).

The following earthquake source parameters are considered for KOERI scenario:

Lat	Lon	Mw	Depth	Displacement	Strike	Dip	Rake
34.98°N	26.18°E	8.4	20 km	8 m	55°	30°	110°

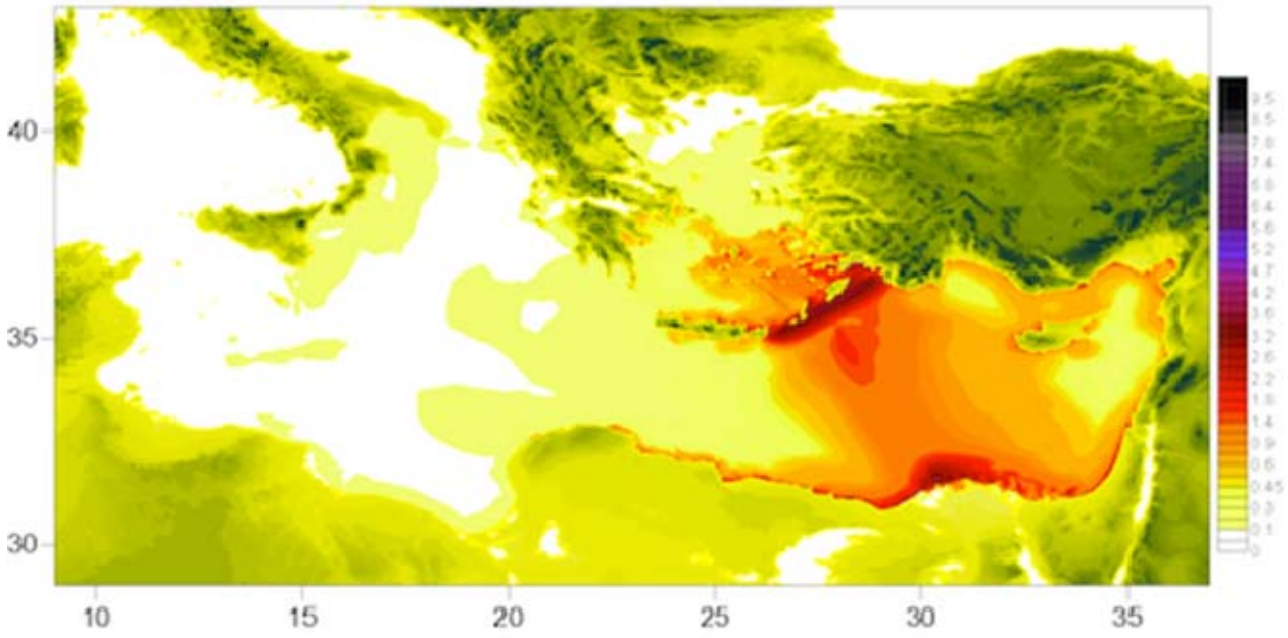

Figure 2: Maximum wave height distribution for KOERI Scenario

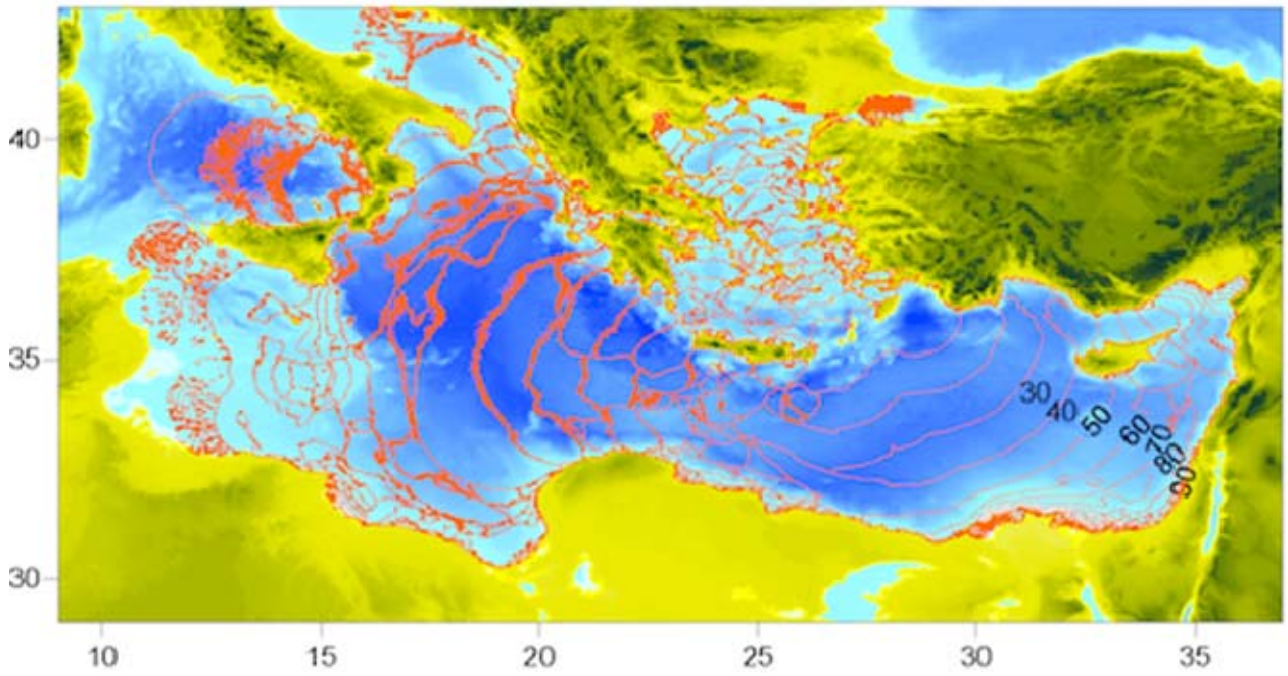

Figure 3: Travel time isochrones for KOERI Scenario

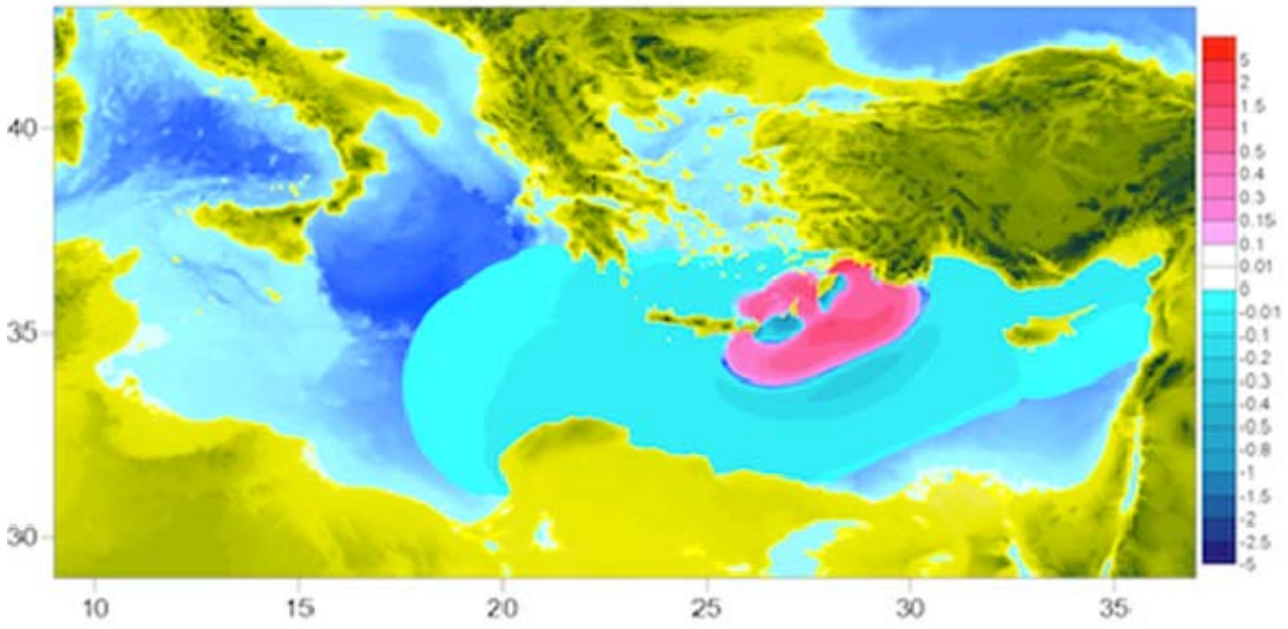

Figure 4: Sea state after 10 mins for KOERI scenario.

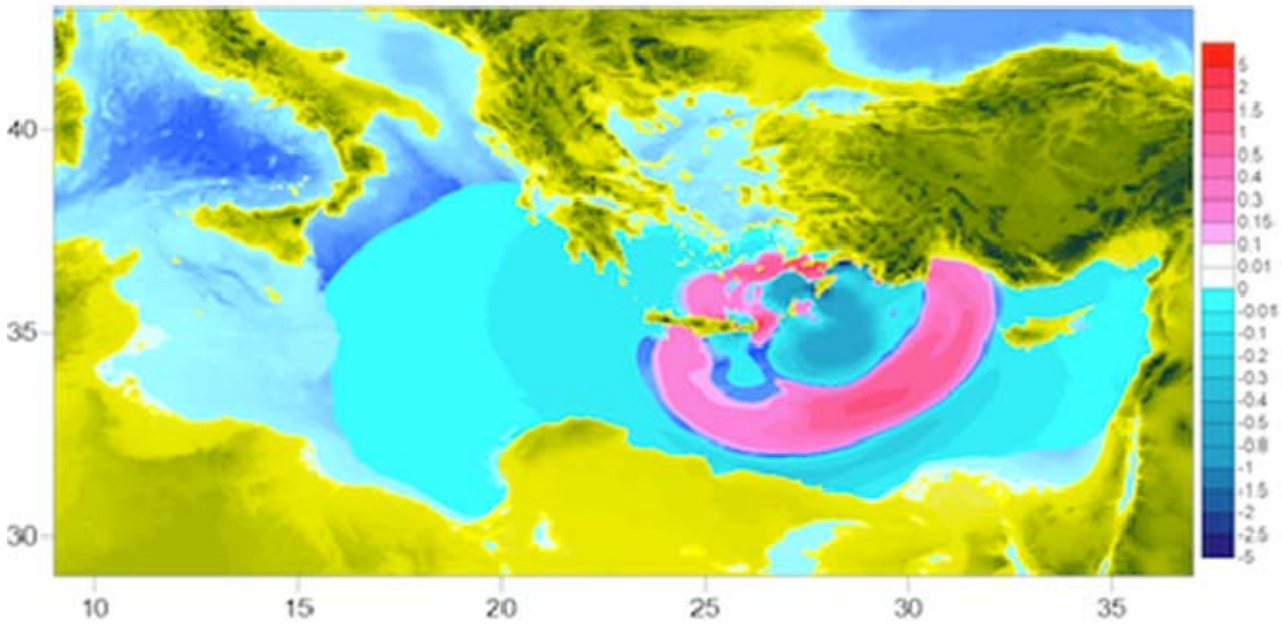

Figure 5: Sea states after 30 mins for KOERI scenario.

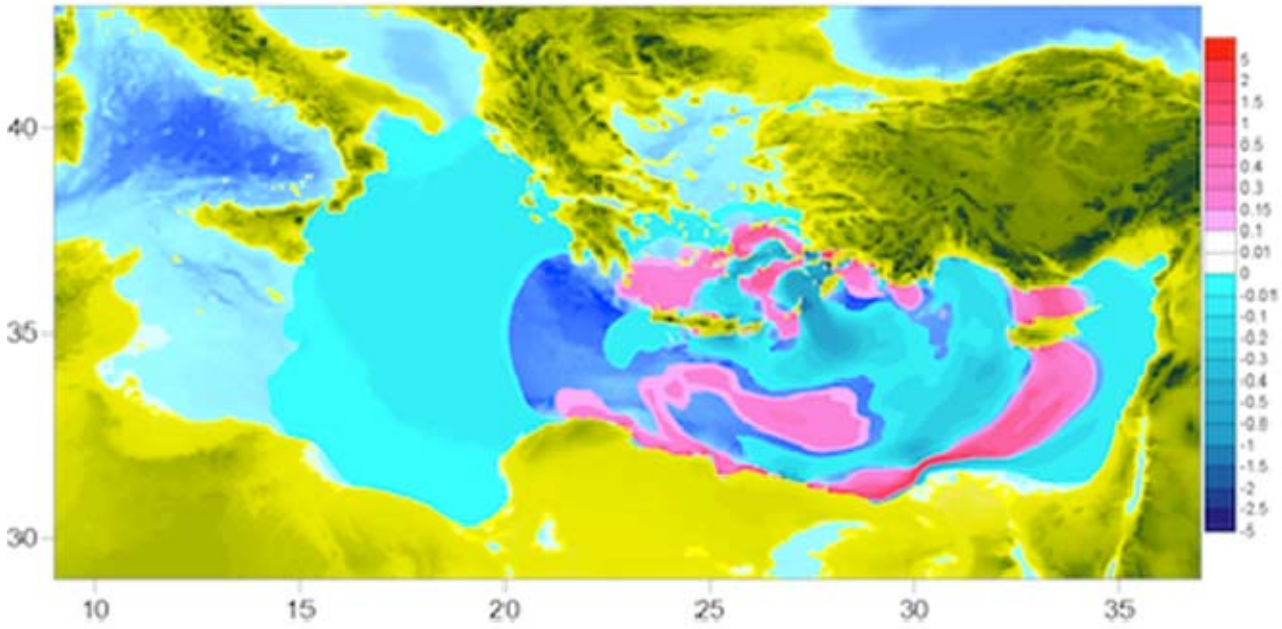

Figure 6: Sea state after 60 mins for KOERI scenario.

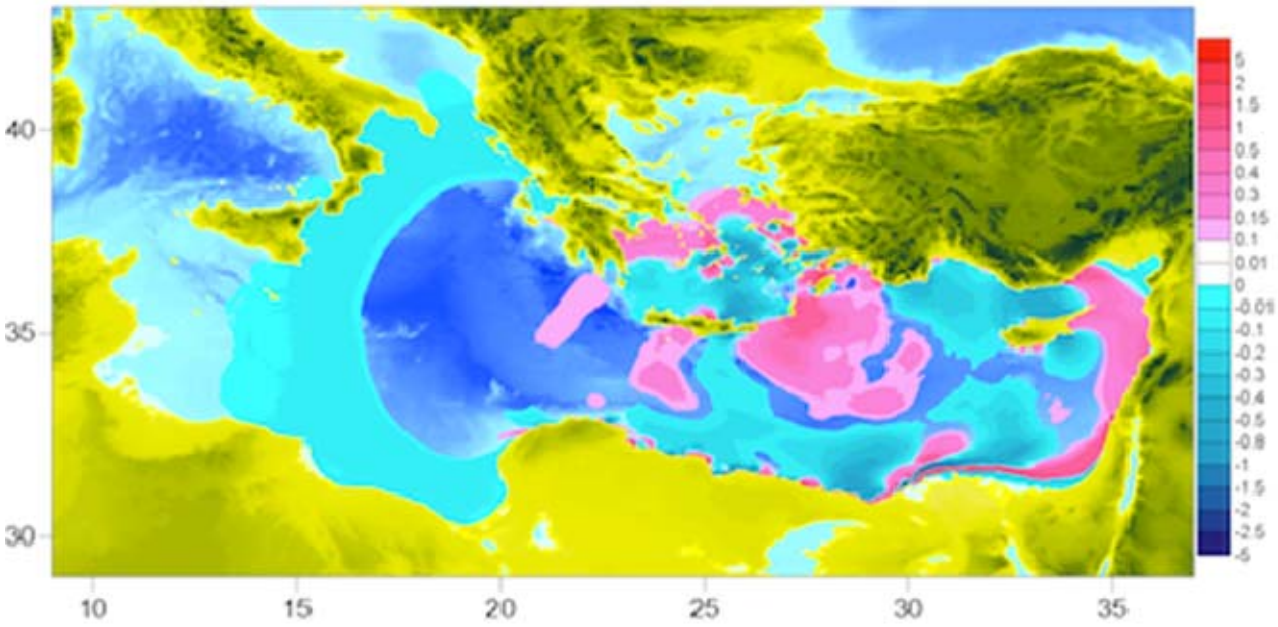

Figure 7: Sea states after 90 mins for KOERI scenario.

Figure 8: Tsunami Forecast Points considered for the KOERI Scenario. Turkey (red), Greece (blue) and Syria have already reported TFPs to IOC. Other green TFPs in the Eastern Mediterranean (Lebanon, Israel, Gaza, Egypt, Libya) have been selected for scenario simulation purposes. Please note that during the exercise, only TFPs from the Member States who subscribed to the KOERI scenario will be included in the Tsunami Messages. Therefore, interested Member States in the Eastern Mediterranean are especially encouraged to participate in the KOERI Scenario.

Figure 9: Sea-level Monitoring Network in Turkey (left) with real-time data transmission (right)

COUNTRY	TFP	Lon (E)	Lat (N)	Relative Arrival time of max wave (min)	Message Level
GREECE	RHODOS LINDOS	28.0863	36.081	3	WATCH
GREECE	RHODOS TOWN	28.2466	36.4373	7	WATCH
GREECE	IERAPETRA	25.743	35.009	42	WATCH
GREECE	KOS KEFALOS	26.977	36.742	64	WATCH
GREECE	NAXOS CHORA	25.3857	37.1024	81	WATCH
GREECE	SAMOS KARLOVASI	26.6913	37.800	84	WATCH
GREECE	IKARIA AGIOS KIRIKOS	26.3433	37.6923	89	WATCH
GREECE	TINOS	25.1809	37.5811	93	WATCH
GREECE	SIROS ERMOUPOU	24.948	37.437	98	WATCH
GREECE	AGIOS NIKOLAOS	25.774	35.187	126	WATCH
GREECE	SANTORINI ORMOS FIRON	25.3980	36.4129	135	WATCH
GREECE	GAVDOS KARAVE	24.0815	34.8249	142	WATCH
GREECE	AMOROGOS KATAPOLA	25.8431	36.8513	162	WATCH
GREECE	CHANIA	24.016	35.505	161	WATCH
GREECE	ANAFIOS	25.9857	36.3577	167	WATCH
GREECE	MILOS Abalevi	24.4581	36.7211	168	WATCH
GREECE	MONEMVASIA	23.0415	36.6791	174	WATCH
GREECE	TYRE	25.1882	33.2651	176	WATCH
GREECE	MIKONOS CHORA	25.324	37.447	178	WATCH
TURKEY	MUGLA DALAMAN	28.7931	36.6801	8	WATCH
TURKEY	MUGLA AKSAZ	28.3177	36.7980	15	WATCH
TURKEY	ANTALYA	30.6983	36.8280	39	WATCH
TURKEY	ALANYA	31.9736	36.5506	43	WATCH
TURKEY	MUGLA BÖYLAVI	27.9388	36.6891	55	WATCH
TURKEY	MUGLA FETHIYE	29.0843	36.6478	64	WATCH
TURKEY	ANTALYA FINIKE	30.1885	36.3077	70	WATCH
TURKEY	ANTALYA KAS	29.6164	36.1943	77	WATCH
TURKEY	IZMIR ALACATI	26.3825	38.2257	85	WATCH
TURKEY	MUGLA KOCAKLI	34.755	36.5634	94	WATCH
TURKEY	MUGLA BODRUM	27.2269	37.0394	97	WATCH
TURKEY	AYDIN KUSADASI	27.2661	37.8699	117	WATCH
TURKEY	KALIMNOS PANORMOS	26.922	36.9973	118	WATCH
TURKEY	AYDIN DIDIM	27.3172	37.336	119	WATCH
TURKEY	MUGLA BASUCU	28.8804	36.3077	146	WATCH
TURKEY	ADANA YUMURTALIK	35.7569	36.7541	151	WATCH
TURKEY	HATAY	36.176	36.7663	170	WATCH
EGYPT	ALEXANDRIA	29.9327	31.2269	73	WATCH
EGYPT	PORT SAID	32.3369	31.3137	177	WATCH
ISRAEL	HAIFA	34.9812	32.8361	84	WATCH
ISRAEL	TEL AVIV	34.7465	32.0427	165	WATCH
LEBANON	BEIRUT	35.4769	33.8827	85	WATCH
SYRIA	QUAMAT	35.9405	35.1917	94	WATCH
SYRIA	BANIYAS	35.9436	35.1917	94	WATCH
SYRIA	TARTUS	35.8882	34.8144	98	WATCH
SYRIA	LATAKIA	35.7581	35.5377	97	WATCH
SYRIA	JABLEH	35.9158	35.3752	101	WATCH
PALESTINIAN AUTHORITY	GAZA	34.4804	31.5493	106	WATCH
LIBYA	TOBRUQ	24.0842	32.0724	108	WATCH
GREECE	KITHERA KAPSALI	23.0611	36.1379	113	ADVISORY
GREECE	SKIATHOS	23.48	39.16	145	ADVISORY
GREECE	EVIA KIMI	24.1253	38.6124	157	ADVISORY
GREECE	CEPHALONIA ARGOSTOLI	20.471	38.1784	158	ADVISORY
GREECE	KERKIRA	21.6998	37.2559	166	ADVISORY
GREECE	CHORA SFAKION	24.1711	35.1921	167	ADVISORY
GREECE	KALAMOLO	21.3118	37.6209	175	ADVISORY
GREECE	CHIOS VOLISSOS	25.9317	38.4615	177	ADVISORY
GREECE	LESVOS MITILINI	26.569	39.101	179	ADVISORY
GREECE	VOLOS	22.946	39.362	179	ADVISORY
LIBYA	BENGHAZI	20.0484	32.1145	118	ADVISORY
TURKEY	CANAKKALE BOZCAADA	25.9618	39.8289	193	ADVISORY
TURKEY	IZMIR ALIAGA	26.9769	38.8501	169	ADVISORY
TURKEY	IZMIR MENTES	26.769	38.4048	171	ADVISORY

Figure 10: Estimated relative arrival times and alert levels at the Tsunami Forecast Points sorted by the countries in the interest region for the KOERI scenario targeting CPAs for Phase B Scenario Planning. Please note that, according to the NEAMTWS Decision Support Matrix, messages at WATCH level correspond to locations where the anticipated tsunami wave height is more then 0.5 m and anticipated run-up is more than 1m, respectively. For the ADVISORY level, the anticipated tsunami wave height is less then 0.5 m and anticipated run-up is less than 1m, respectively.

Master Schedule of Events List

T[min]

T0: EQ Origin Time
T3: EQ Parameters (mag, lat, lon, depth, origin time)
T4: Tsunami Assessment based on the decision matrix
T10: Dissemination of the 1st Message
T18: Sea-level measurement at MUGLA AKSAZ Station confirms TSUNAMI
T25: 2nd message dissemination
T39: Sea-level measurement at ANTALYA Station re-confirms TSUNAMI
T55: Sea-level measurement at MERSIN BOZYAZI Station re-confirms TSUNAMI
T62: Dissemination of the 3rd message
T180: Dissemination of the 4th (last) message

TSUNAMI BULLETINS FOR KOERI SCENARIO

TSUNAMI MESSAGE NUMBER 001
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1210Z 28 NOV 2012

… THIS IS AN EXERCISE …

… TSUNAMI WATCH …

THIS ALERT APPLIES TO EGYPT … GREECE … ISRAEL … TURKEY

… TSUNAMI ADVISORY …

THIS ALERT APPLIES TO GREECE … TURKEY

… TSUNAMI INFORMATION …

THIS ALERT APPLIES TO ALBANIA ... ALGERIA ... BELGIUM ... BULGARIA ... CAPE VERDE ... CROATIA ... CYPRUS ... DENMARK ... ESTONIA ... FINLAND ... FRANCE ... GEORGIA ... GERMANY ... ICELAND ... IRELAND ... ITALY ... LEBANON ... LIBYA ... MALTA ... MAURITANIA ... MONACO ... MOROCCO ... NETHERLANDS ... NORWAY ... POLAND ... PORTUGAL ... ROMANIA ... RUSSIAN FEDERATION ... SLOVENIA ... SPAIN ... SWEDEN ... SYRIA ... TUNISIA ... UKRAINE ... UNITED KINGDOM

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME – 1200Z 28 NOV 2012
COORDINATES – 34.98 NORTH 26.18 EAST
DEPTH - 20 KM
LOCATION – EASTERN MEDITERRANEAN SEA
MAGNITUDE – 8.4

EVALUATION OF TSUNAMI WATCH
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS MESSAGE IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI THAT CAN STRIKE COASTLINES WITH A WAVE HEIGHT GREATER THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP GREATER THAN 1M. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI ADVISORY
IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WATCH IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A TSUNAMI THAT CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI INFORMATION
BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI MODELLING THERE IS NO THREAT THAT A TSUNAMI HAS BEEN GENERATED THAT CAN CAUSE DAMAGE OR MAJOR EFFECT IN THE REGION. THIS MESSAGE IS FOR INFORMATION ONLY.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WATCH AREA GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION-FORECAST POINT	COORDINATES	ARRIVAL TIME	LEVEL
GREECE-RHODOS LINDOS	36.08N 28.09E	1203Z 28 NOV	WATCH
GREECE-RHODOS TOWN	36.44N 28.24E	1207Z 28 NOV	WATCH
GREECE-IERAPETRA	35.01N 25.74E	1242Z 28 NOV	WATCH
GREECE-KOS KEFALOS	36.74N 26.98E	1304Z 28 NOV	WATCH
GREECE-NAXOS CHORA	37.10N 25.37E	1321Z 28 NOV	WATCH
GREECE-SAMOS KARLOVASI	37.69N 26.93E	1324Z 28 NOV	WATCH
GREECE-IKARIA AGIOS KIRIKOS	37.69N 26.34E	1329Z 28 NOV	WATCH
GREECE-TINOS	37.53N 25.17E	1333Z 28 NOV	WATCH
GREECE-SIROS ERMOUPOLI	37.44N 24.95E	1338Z 28 NOV	WATCH
GREECE-KALIMNOS PANORMOS	37.00N 26.92E	1358Z 28 NOV	WATCH
GREECE-AGIOS NIKOLAOS	35.21N 25.72E	1400Z 28 NOV	WATCH
GREECE-SANTORINI ORMOS FIRON	36.41N 25.40E	1415Z 28 NOV	WATCH
GREECE-GAVDOS KARAVE	32.02N 24.16E	1422Z 28 NOV	WATCH
GREECE-AMORGOS KATAPOLA	36.85N 25.84E	1432Z 28 NOV	WATCH

GREECE-CHANIA	35.53N	24.02E	1441Z 28 NOV	WATCH
GREECE-ANDROS	37.86N	24.95E	1442Z 28 NOV	WATCH
GREECE-MILOS ADAMAS	36.72N	24.46E	1449Z 28 NOV	WATCH
GREECE-MONEMVASIA	36.68N	23.04E	1454Z 28 NOV	WATCH
GREECE-TYRE	33.27N	35.20E	1454Z 28 NOV	WATCH
GREECE-MIKONOS CHORA	37.45N	25.32E	1459Z 28 NOV	WATCH
TURKEY-MUGLA DALAMAN	36.68N	28.79E	1208Z 28 NOV	WATCH
TURKEY-MUGLA AKSAZ	36.80N	28.32E	1218Z 28 NOV	WATCH
TURKEY-ANTALYA	36.83N	30.61E	1239Z 28 NOV	WATCH
TURKEY-ALANYA	36.55N	31.98E	1243Z 28 NOV	WATCH
TURKEY-MERSIN BOZYAZI	36.09N	32.94E	1255Z 28 NOV	WATCH
TURKEY-MUGLA FETHIYE	36.65N	29.08E	1304Z 28 NOV	WATCH
TURKEY-ANTALYA FINIKE	36.31N	30.17E	1310Z 28 NOV	WATCH
TURKEY-ANTALYA KAS	36.19N	29.62E	1317Z 28 NOV	WATCH
TURKEY-IZMIR ALACATI	38.23N	26.38E	1328Z 28 NOV	WATCH
TURKEY-MERSIN ERDEMLI	36.56N	34.26E	1334Z 28 NOV	WATCH
TURKEY-MUGLA BODRUM	37.04N	27.23E	1337Z 28 NOV	WATCH
TURKEY-AYDIN KUSADASI	37.87N	27.26E	1357Z 28 NOV	WATCH
TURKEY-AYDIN DIDIM	37.34N	27.32E	1359Z 28 NOV	WATCH
TURKEY-MERSIN TASUCU	36.31N	33.89E	1429Z 28 NOV	WATCH
TURKEY-ADANA YUMURTALIK	36.75N	35.76E	1431Z 28 NOV	WATCH
TURKEY-HATAY	36.79N	36.18E	1450Z 28 NOV	WATCH
EGYPT-ALEXANDRIA	31.23N	29.93E	1313Z 28 NOV	WATCH
EGYPT-PORT SAID	31.31N	32.36E	1407Z 28 NOV	WATCH
ISRAEL-NAHARIYA	33.01N	35.07E	1422Z 28 NOV	WATCH
ISRAEL-HAIFA	32.80N	34.94E	1428Z 28 NOV	WATCH
ISRAEL-HADERA	32.46N	34.87E	1503Z 28 NOV	WATCH
ISRAEL-TEL AVIV	32.08N	34.75E	1511Z 28 NOV	WATCH
ISRAEL-ASHDOD	31.81N	34.63E	1516Z 28 NOV	WATCH
ISRAEL-ASHKELON	31.69N	34.55E	1519Z 28 NOV	WATCH
GREECE-KITHERA KAPSALI	36.14N	23.00E	1353Z 28 NOV	ADVISORY
GREECE-SKIATHOS	39.16N	23.49E	1425Z 28 NOV	ADVISORY
GREECE-EVIA KIMI	38.61N	24.13E	1437Z 28 NOV	ADVISORY
GREECE-CEPHALONNIA ARGOSTOLI	38.18N	20.47E	1439Z 28 NOV	ADVISORY
GREECE-KIPARISSIA	37.26N	21.66E	1446Z 28 NOV	ADVISORY
GREECE-CHORA SFAKION	35.19N	24.17E	1447Z 28 NOV	ADVISORY
GREECE-KATAKOLO	37.63N	21.31E	1455Z 28 NOV	ADVISORY
GREECE-CHIOS VOLLISOS	38.46N	25.93E	1457Z 28 NOV	ADVISORY
GREECE-LESVOS MITILINI	39.10N	26.57E	1459Z 28 NOV	ADVISORY
GREECE-VOLOS	39.35N	22.95E	1459Z 28 NOV	ADVISORY
TURKEY-CANAKKALE BOZCAADA	39.83N	25.96E	1433Z 28 NOV	ADVISORY
TURKEY-IZMIR ALIAGA	38.85N	26.98E	1439Z 28 NOV	ADVISORY
TURKEY-IZMIR MENTES	38.40N	26.77E	1451Z 28 NOV	ADVISORY

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

… THIS IS AN EXERCISE …

END OF TSUNAMI EXERCISE MESSAGE 001

TSUNAMI MESSAGE NUMBER 002
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1225Z 28 NOV 2012

… THIS IS AN EXERCISE …

… TSUNAMI WATCH ONGOING …

THIS ALERT APPLIES TO EGYPT … GREECE … ISRAEL … TURKEY

… TSUNAMI ADVISORY ONGOING …

THIS ALERT APPLIES TO GREECE … TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME – 1200Z 28 NOV 2012
COORDINATES – 34.98 NORTH 26.18 EAST
DEPTH - 20 KM
LOCATION – EASTERN MEDITERRANEAN SEA
MAGNITUDE – 8.4

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
TURKEY MUGLA AKSAZ	36.80N	28.32E	1218Z	5.7M	3MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)
LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTC TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL.
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

… THIS IS AN EXERCISE …

END OF TSUNAMI EXERCISE MESSAGE 002

TSUNAMI MESSAGE NUMBER 003
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1302Z 28 NOV 2012

… THIS IS AN EXERCISE …

… TSUNAMI WATCH ONGOING …

THIS ALERT APPLIES TO EGYPT … GREECE … ISRAEL … TURKEY

… TSUNAMI ADVISORY ONGOING …

THIS ALERT APPLIES TO GREECE … TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME – 1200Z 28 NOV 2012
COORDINATES – 34.98 NORTH 26.18 EAST
DEPTH - 20 KM
LOCATION – EASTERN MEDITERRANEAN SEA
MAGNITUDE – 8.4

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
TURKEY MERSIN BOZYAZI	36.09N	32.94E	1255Z	1.5M	18MIN

LAT - LATITUDE (N-NORTH, S-SOUTH)

LON - LONGITUDE (E-EAST, W-WEST)
TIME - TIME OF THE MEASUREMENT (Z IS UTC TIME)
AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL.
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN METERS (M).
PER - PERIOD OF TIME IN MINUTES (MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
THIS TSUNAMI CAN STRIKE COASTLINES WITH A WAVE HEIGHT LESS THAN 0.5M AND/OR CAUSE A TSUNAMI RUN-UP LESS THAN 1M. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY ADDITIONAL TSUNAMI WAVE ACTIVITY IS OBSERVED. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

SUPPLEMENT MESSAGES WILL BE ISSUED AS SOON AS NEW DATA AND EVALUATION ALLOWS.
THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL AN END OF ALERT IS BROADCAST.

… THIS IS AN EXERCISE …

END OF TSUNAMI EXERCISE MESSAGE 003

TSUNAMI MESSAGE NUMBER 004
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1500Z 28 NOV 2012

… THIS IS AN EXERCISE …

… END OF TSUNAMI WATCH …

THIS ALERT APPLIES TO EGYPT … GREECE … ISRAEL … TURKEY

… END OF TSUNAMI ADVISORY …

THIS ALERT APPLIES TO GREECE … TURKEY

THIS MESSAGE IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS
ORIGIN TIME – 1200Z 28 NOV 2012
COORDINATES – 34.98 NORTH 26.18 EAST
DEPTH - 20 KM
LOCATION – EASTERN MEDITERRANEAN SEA
MAGNITUDE – 8.4

EVALUATION OF TSUNAMI WATCH
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED. WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO THE CONTINUING SEA LEVEL CHANGES AND RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

EVALUATION OF TSUNAMI ADVISORY
SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED.
OBSERVATIONS AND MODELS INDICATE THAT NO MORE TSUNAMI WAVES ARE EXPECTED. WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO THE CONTINUING SEA LEVEL CHANGES AND RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

THIS WILL BE THE FINAL MESSAGE ISSUED FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

… THIS IS AN EXERCISE …

END OF TSUNAMI EXERCISE MESSAGE 004

ANNEX VIII

SAMPLE PRESS RELEASE

USE AGENCY HEADER HERE	ICG/NEAMTWS TSUNAMI EXERCISE NEAMWave12

Contact: (insert name)
(insert phone number)
(insert email address)

FOR IMMEDIATE RELEASE
(insert date)

NEAMWave 12

TSUNAMI EXERCISE in the NORTH-EASTERN ATLANTIC, MEDITERRANEAN AND CONNECTED SEAS TO BE CONDUCTED XX XXXXX, 2012

(insert country name) will join other countries in the North-eastern Atlantic, Mediterranean and Connected Seas (the NEAM region) as a participant in a tsunami response exercise on the XX XXXX, 2012. The purpose of this exercise is to evaluate local tsunami response plans, increase tsunami preparedness, and improve coordination throughout the region.

Regional and national tsunami warning systems in every ocean must maintain a high level of readiness so as to be able to efficiently and effectively act to provide for the public's safety during fast-onset and rapidly-evolving natural disasters such as tsunamis. To maintain a high state of operational readiness, National Tsunami Warning Centres (NTWCs) and Civil Protection agencies must regularly practice their emergency response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during an actual event. This important exercise will test the current procedures of the Tsunami Warning System and help identify operational strengths and weaknesses in each country.

The exercise, titled NEAMWave 12, will simulate a widespread Tsunami Watch situation throughout the NEAM region which requires implementation of local tsunami response plans. It is the first international exercise as such, in this region. The exercise will (insert "include" or "not include") public notification. (Maybe specify here the level of the exercise, table-top, functional, ...)

The exercise will simulate a major earthquake and tsunami generated XXXXXX at XX:XX (UTC or local time) on XXXXX XX, 2012. Exercise participants will be provided with a Manual which describes the scenario and contains the tsunami messages that will be broadcast in real-time by the Candidate Tsunami Watch Provider XXXXXX.

[Insert paragraph tailored for specific Member State, such as if the centre is a CTWP or TWR. Could identify participating agencies and specific plans. Could describe current early warning program, past tsunami (and or earthquake) exercises (or Communication Testes if any), ongoing mitigation and public education programs, etc. Could describe tsunami threat, history of tsunami hazards, if any.]

If any real tsunami threat occurs during the time period of the exercise, the exercise will be terminated.

The exercise is sponsored by the UNESCO/IOC Intergovernmental Coordination Group for Tsunami and Other Coastal Hazards Warning System for the North-eastern Atlantic, Mediterranean and Connected Seas (ICG/NEAMTWS), (Include other international organizations, EU? MIC? Caribbean ICG?).

See http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=70&Itemid=14&lang=en for more information on the ICG/NEAMTWS and see http://neamtic.ioc-unesco.org/index.php/neamwave12 for more information on the NEAMWave 12 exercise. Insert additional state/ emergency response URLs and other national/international participating organizations.

ANNEX IX

CONCEPTS ON EXERCISE TYPES

Orientation Exercise

An orientation exercise may also be referred to as a ‘‘walk through’’, and can be conducted through a workshop. It puts people in a place where they would work during a tsunami response, or uses them as participants in a demonstration of an activity. This type of exercise is used to familiarise the players withthe activity. It lays the foundation for a more comprehensive exercise programme.

Orientation exercises are generally used when:

- No previous exercise related to tsunami has been conducted.
- No recent real tsunami events have occurred.
- There is a need to bring together organizations (government, NGOs, private sector) in developing emergency response planning, problem solving, SOPs, and resource integration.
- A new plan has been developed that requires testing.
- There are new procedures.
- There are new staff or a new leadership.
- There is a new facility.
- There is a new risk.
- Personnel training is required.
-

An example of an orientation exercise would be setting up a mock welfare centre to take in tsunami evacuees, and walking staff through how the centre is organized.

Another motivation for an orientation exercise may be because there is a need to provide stakeholders with an overview of authorities, strategies, plans, policies, procedures, protocols, and resources available for responding to a tsunami. Coordination between the NTWC, emergency operations centre(s), and response officials is essential for effective end-to-end warning.

Drill Exercise

In a drill exercise, staff physically handle specific equipment or perform a specific procedure or single operation. A drill usually focuses on a single organization, facility or agency such as a hotel, a school, or a village. The exercise usually has a time-frame element and is used to test procedures. Performance is evaluated in isolation. A drill is a subset of a full-scale exercise.

A drill exercise is used to:

- Assess equipment capabilities.
- Test response time.
- Train personnel.
- Assess interagency cooperation.
- Verify resource and staffing capabilities.

An example of a drill exercise would be activating an Emergency Operations Centre (EOC) or using alternative communications (such as radios) in a tsunami exercise. **In NEAMWave 12, Phase A will be conducted as a Drill Exercise**, meaning the ability of sending multiple consecutive tsunami messages by the CTWP will be subject to testing.

Tabletop Exercise

A tabletop exercise may also be referred to as a ‘‘discussion exercise’’, or ‘‘DISCEX’’. Participants are presented with a situation or problem that they are required to discuss and for which they formulate the appropriate response or solution. Normally, the exercise requires no simulation other than a scenario and/or prewritten exercise injects. An exercise controller or moderator introduces a simulated scenario to participants and, as the exercise advances (in time), exercise problems and activities (injects) are further introduced. This type of exercise is used to practice problem-solving and coordination of services with or without time pressures. There is no deployment or actual use of equipment or resources.

Tabletop exercises should be used to:

- Practice group problem solving.
- Promote familiarity with plans.
- Assess plan coverage for a specific case study.
- Assess plan coverage for a specific risk area.
- Examine staffing contingencies.
- Test group message interpretation.
- Assess interagency or interdepartmental coordination.
- Observe information sharing.
- Train personnel (usually staff with equal status or functions).

An example of a tabletop exercise may involve participants discussing their response to a tsunami threat to a particular area, where the only injects are tsunami messages from the CTWPs, as foreseen in NEAMWave 12.

Functional Exercise

A functional exercise may also be referred to an ‘‘operational’’ or a ‘‘tactical’’ exercise. It takes place in an operational environment and requires participants to actually perform the functions of their roles.

A normally complex response activity is simulated, which may require multiple activities to carry out the response. It lacks only the people "on the ground" to create a full-scale exercise.

Participants interact within a simulated environment through an exercise control group who provides prewritten injects and respond to questions and tasks developing out of the exercise.

Functional exercises normally involve multi-agency participation (real or simulated) and can focus on one or more geographical areas. Commonly, they involved the testing of standard operating procedures (SOP) and internal/external communications between organizations.

This type of exercise is used to practice multiple emergency functions e.g. direction and control, resource management and communications. It is particularly useful to:

- Evaluate a function.
- Evaluate or test physical facilities use.
- Reinforce or test established policies and procedures.
- Assess preparedness.
- Test seldom-used resources.
- Measure resource adequacy.
- Support policy formulation.

An example of a functional exercise would be multi-agency response to a potentially devastating tsunami, where evacuation of a coastal community is required. Messages and injects are provided by exercise control and are handled by the participants in the way described in appropriate plans and procedures. Outcomes are generated that would be expected in a real situation.

Functional exercises may also just focus on a specific aspect of warnings, such as the command and control activities of EOCs or the communications flow and procedures from international to national to provincial levels.

Full-scale exercise

A full-scale exercise may also be referred to as a ''practical'' or ''field'' exercise. It includes the movement or deployment of people and resources to provide a physical response ''on the ground'' to a simulated situation. It may be considered to be the climax of a progressive exercise programme. It can be ''ground'' focused only or may include the higher-level response structures. It can be simple (single agency) or complex (multi agency, multi-levels of government from national to local).

These exercises are typically used to test all aspects of a country's warning and emergency management systems and processes, and to the extent practical, using actual centres and communications methods. They are useful to:

- Assess and improve an operational activity.
- Assess and improve interagency cooperation.
- Assess negotiation procedures.
- Test resource and personnel allocation.
- Manage the public and media.
- Assess personnel and equipment locations.
- Test equipment capabilities.

Full-scale exercises are the largest, most costly, most time-consuming and most complex to plan, conduct and evaluate.

An example of a full-scale exercise would be a post-impact tsunami response with volunteers representing 'victims' and the emergency services using real rescue equipment at the scene. Coordinated, multi-agency response to the event is exercised. Actual field mobilization and deployment of response personnel are conducted.

ANNEX X

CONCEPTS ON THE COMPOSITION OF TSUNAMI MESSAGES

As part of their Standard Operating Procedures (SOP) for responding to potentially tsunamigenic events, the CTWPs calculate expected tsunami arrival times (ETA) to various, pre-determined Coastal Forecast Points. These forecast points are agreed upon points chosen by countries in consultation with CTWPs. They may correspond to important coastal cities or populations, and/or to the locations of sea level gauges. CTWPs (and/or NTWCs) may be able also to forecast tsunami wave heights at the forecast points in order to decide on the level of tsunamigenic threat.

The level of threat for a given country or region is defined in terms of its distance to the earthquake source and not by the estimated tsunami arrival time, as it happens in Pacific. When a country is in a “Watch” or “Advisory” status, the ETAs for its forecast points that meet the criteria will be listed in the tsunami bulletins issued by the CTWPs.

Decision matrix for the North-eastern Atlantic

Depth (km)	Epicentre location	Earthquake magnitude (M_W)	Tsunami potential	Type of tsunami message		
				Local	Regional	Ocean-wide
<100	Offshore or close to the coast (≤ 40 km inland)	5.5 – 6.5	Weak potential for a destructive local tsunami	Advisory	Information	Information
	Offshore or close to the coast (≤ 100 km inland)	6.5 – 7.0	Potential for a destructive local tsunami	Advisory	Information	Information
		7.0 – 7.5	Potential for a destructive local tsunami	Watch	Advisory	Information
		7.5 – 7.9	Potential for a destructive regional tsunami	Watch	Watch	Advisory
		≥ 7.9	Potential for a destructive ocean-wide tsunami	Watch	Watch	Watch
≥ 100	Offshore or inland (≤ 100 km)	≥ 5.5	No tsunami potential	Information	Information	Information

No message if the earthquake is localised inland beyond 100 km distance; no message if M_w < 6.5 and distance to the coast > 40 km; no message if M_w < 5.5.

Provisional decision matrix for the North-eastern Atlantic showing tsunami message categories related to detected earthquake depth, location and magnitude.

Decision matrix for the Mediterranean

Depth (km)	Epicentre location	Earthquake magnitude (M_W)	Tsunami potential	Type of tsunami message		
				Local	Regional	Basin-wide
< 100	Offshore or close to the coast (≤ 40 km inland)	5.5 – 6.0	Weak potential for a local destructive tsunami	Advisory	Information	Information
		6.0 – 6.5	Potential for a destructive local tsunami	Watch	Advisory	Information
	Offshore or close to the coast (≤ 100 km inland)	6.5 – 7.0	Potential for a destructive regional tsunami	Watch	Watch	Advisory
		≥ 7.0	Potential for a destructive basin-wide tsunami	Watch	Watch	Watch
≥ 100	Offshore or inland (≤ 100 km)	≥ 5.5	No tsunami potential	Information	Information	Information

No message if the earthquake is localised inland beyond 100 km distance; no message if M_w < 6.5 and distance to the coast > 40 km; no message if M_w < 5.5.

Provisional decision matrix for the Mediterranean showing tsunami message categories related to detected earthquake depth, location and magnitude.

Bulletins from a CTWP informing of a tsunami event (or its downgrading or cancellation) are of two types. Each shows the Areas Affected (AA) by country or country forecast zone and each is accompanied by an Authority Statement (AS) and an Evaluation Statement (ES).

- A Tsunami Watch message is issued by the CTWP whenever the seismic information or/and sea-level data indicates that any part of the NEAM coastline may be impacted by a tsunami with a wave height greater than 0.5 m, and/or when tsunami run-up is expected to be higher than one metre. A Tsunami Watch is the highest severity level of a tsunami alert message and it must be considered that the tsunami waves, if generated, pose a real threat to exposed coastal populations and may be damaging.

- A Tsunami Advisory message is issued by the CTWP whenever the seismic information or/and sea-level data indicates that any part of the NEAM coastline may be impacted by a tsunami with a wave height from 0.2 to 0.5 m, and/or when tsunami run-up is expected to be less than 1 metre.

Initial Tsunami Watch and Tsunami Advisory messages are based solely on seismic data received from detection networks by the CTWP(s). Supplementary, follow-up messages based on tide-gauge data as well as seismic data may confirm the generation of a tsunami. Or, depending on the sea-level data received by the CTWP, they may downgrade or cancel the Tsunami Watch or Tsunami Advisory message.

The estimated tsunami arrival times (ETA) received by the TWFP should be used with caution by the NTWC. All times given are in UTC (Coordinated Universal Time) and it is the task of the NTWC to convert these to local time as required. ETA will be provided only for Coastal Forecast Points,

with the forecast point localities ordered by ETA. If or when tsunami wave data become available – usually after the issue of the initial alert message – the CTWP will report wave measurements at key coastal and deep ocean sea-level gauges. Each measurement includes the name and coordinates of the gauge, the time of the measurement, the maximum observed height of the wave in metres (the height relative to normal sea level) and, if available, the period of the wave cycle in minutes.

Two other types of message may be issued by the CTWP

- a Tsunami Information message to advise on the occurrence of a major earthquake in the NEAM region but with an evaluation that there is no tsunami threat; and, usually at unannounced times

- a Tsunami Communication Test message to identify possible delays in disseminating tsunami messages by different methods of transmission, e.g., GTS, Internet, etc; to test the operation of the system by requiring a response; and to keep CTWP and NTWC operations personnel familiar with the procedures for handling tsunami message traffic.

A tsunami message may include Tsunami Information, Tsunami Advisory and Tsunami Watch together, depending on the distribution of the tsunami wave heights in the region of interest and/or distribution of the countries subscribed to the message services of CTWP.

ANNEX XI

NEAMWAVE 12 CHECK LIST

Timeline			Tick Boxes in Blue				
Date	Month referred to Exercise Day (approx.)	Action	TT-CTTS / Exercise Team	CTWP	MS (NTC/TWFP/ CPA)	IOC	
15 March 2012	-8	TT-CTTS Meeting. Pans. Exercise Team established					
19 April 2012	-7	IOC Circular Letter No 2427 inviting for the participation in the next CTS					
30 April 2012	-6 5	NEAMWave12 Concept Paper					
30 April 2012	-6 5	NEAMWave12 Scenario finalized					
30 April 2012	-6 5	IOC Circular Letter No. 2427 to all TWFP and NTC announcing NEAMWave12					
22 May 2012	-6	CTS2 with CENALT as Message Provider					Including as a presentation for NEAMWave12?
30 May to 2 June 2012	-5 5	PFRD South Bromlock Workshop					
9 July 2012	-4 5	Version 2 2 of the NEAMWave12 Exercise Manual is circulated					
11 July 2012	-4 5	IOC Circular Letter No. 2448 to all TWFP and NTC inviting to the IX ICG/NEAMTWS and associated meetings in Southampton					
15 July 2012	-4	Deadline for the MS to communicate to IOC their willingness to participate in the NEAMWave12			??	??	How many communications were received by IOC?
15 July 2012	-4	Deadline for the CTWP to communicate to IOC their willingness to participate as a Message and Scenario Provider for NEAMWave12		??		??	How many communications were received by IOC?
Mid August	-3	NEAMWave12 Exercise Manual and other documentation is made available at the IOC website.					Preparation is ongoing
10 September 2012	-2	Deadline for the presentation of the complete Exercise Scenarios by the CTWP					To be confirmed
10 September 2012	-2	NEAMWave12 Workshop, Southampton					
11 to 14 September 2012	-2	ICG/NEAMTWS IX, Southampton					
24 September 2012	-2	Deadline for the nomination of the National Contact for NEAMWave12 Exercise to IOC					
2nd half of November	0	NEAMWave12 Exercise					
1st January 2013	Next 2	NEAMWave12 Evaluation					

Blue: actions already completed
Blue Italic: actions completed but results are awaited
Black Italic: actions ongoing
Black: actions to be completed

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
20	A Focus for Ocean Research: The Intergovernmental Oceanographic Commission - History, Functions, Achievements. 1979	(out of stock)
21	Bruun Memorial Lectures, 1979: Marine Environment and Ocean Resources. 1986	E, F, S, R
22	Scientific Report of the Interealibration Exercise of the IOC-WMO-UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open Ocean Waters. 1982	(out of stock)
23	Operational Sea-Level Stations. 1983	E, F, S, R
24	Time-Series of Ocean Measurements. Vol.1. 1983	E, F, S, R
25	A Framework for the Implementation of the Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment. 1984	(out of stock)
26	The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984	E only
27	Ocean Observing System Development Programme. 1984	E, F, S, R
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