The world has witnessed again that tsunamis are a silent danger that can claim many lives and cause important damage on infrastructure. This was the case of the 25 October 2010 Sumatra Tsunami that affected the Mentawai Islands off the western coast of Sumatra, Indonesia causing more than 400 deaths and more than 14,900 homeless. By evoking this event, it is worth recalling the importance of conducting tsunami risk assessments that support decision making regarding land use planning and construction codes in coastal zones, as well as the elaboration of community response plans. This event also recalls us the need to enhance public awareness through formal and informal education in all vulnerable coastal communities.

In this issue of the Tsunami Newsletter, it is to note that important activities promoting a regional and inter-institutional approach are being carried out to strengthen tsunami early warning and preparedness. IOC/UNESCO highly encourages this approach and is willing to facilitate technical support when needed by national and regional counterparts.

In 2010, IOC organized training and workshops for over 1000 staff from more than 40 countries to improve regional and national tsunami warning systems, reaching more than 50,000 people with tsunami awareness and preparedness materials. We couldn’t have been able to deliver this without the support of Member States, institutional partners, UNESCO field offices, donors and very committed experts and practitioners working under the leadership of UNESCO and its IOC.

The 25 October 2010 Sumatra Tsunami

The 25 October 2010 magnitude 7.7 Mentawai, Indonesia earthquake and tsunami caused damage and 457 deaths and more than 14,900 homeless in the Mentawai Islands off the western coast of Sumatra, Indonesia. The highest measured tsunami amplitude locally was 0.35 m in Padang, Sumatra, Indonesia, and the highest measured amplitude overall was 0.4 m in Rodrigues Islands, Mauritius. The highest tsunami waves were reported to be 3-6 m high by eyewitnesses and the inundation distance was reported to reach 600 meters. Further away from the epicenter, the tsunami wave dissipated rapidly to increases of only 10 to 40 cm in amplitude as recorded at tide gauges on Cocos Island, Enggano Island, Tannahbala Island, Padang, Hanimaadhoo, Rodrigues, and Port Louis, for example.

Five minutes after the earthquake, the Indonesian Meteorological, Climatological and Geophysical Agency (Badan Meteorologi Klimatologi dan Geofisika) issued a national warning for a local tsunami, and the Pacific Tsunami Warning Center and Japan Meteorological Agencies issued local tsunami watches seven and nineteen minutes after the earthquake, respectively, to Indian Ocean countries. However, as the centre of the earthquake and tsunami was located about 40 km of the South Pagai Island in Mentawai, the warning from Indonesian authorities could not reach the fishing villages on Pagai or Sigora before the tsunami hit the shore. Eyewitnesses reported the first wave arrives on the coast of South Pagai Island in less than 10 minutes after they felt the earthquake.

The PTWC cancelled the local watch 2 hours and 15 minutes after the earthquake. The center cautioned however that rapid changes and variations in currents in the region could continue for several hours following the seismic event and that boats and coastal structures should monitor the advice of local authorities.

This event demonstrated once again the critical importance of local planning and preparedness for tsunami arrivals that occur closer to the epicenter. “We must intensify our efforts to make sure communities on shorelines close to tsunami source zones know what to do when a strong earthquake is felt,” said UNESCO Director-General Irina Bokova. “Immediate self-evacuation is the key to survival for near-field tsunamis. People must know to head for high ground as quickly as possible.”

UNESCO/IOC, UNESCO Jakarta Office and the Indonesia Ministry for Research and Technology are coordinating post-tsunami surveys. The coordination effort namely, the International Tsunami Survey Team-Mentawai (ITST – Mentawai), is centered in Jakarta. The coordination for this effort is handled by ITST-Mentawai Coordination Team (ICT). ICT members include representatives, experts, and scientists from UNESCO Jakarta, UNESCO/IOC, Indonesia Government Agencies/Institutes and universities, Jakarta Tsunami Information Center (JTIC) and the International Tsunami Information Centre (ITIC).

Six teams of national and international experts (Japan, Germany, and USA) went on mission under the ITST-Mentawai in November and December, 2010. A consolidated report of these teams will be prepared by UNESCO for the Government of Indonesia by the end of February 2011.
PTWS

NEW Zealand Tsunami Exercise “Exercise Tangaroa”

Exercise Tangaroa, held on Wednesday 20 October 2010, was a national, multi-agency exercise focusing on the national response to a distant source tsunami event. The exercise was led by the Ministry of Civil Defense & Emergency Management (MCDEM), with participation from the 16 CDEM Groups, central government departments, emergency services, lifeline utilities, and other agencies across the country. In all, over 100 agencies and companies took part, making it one of the largest civil defense emergency management exercises ever held in New Zealand.

The scenario for the exercise was based on a magnitude 9.1 earthquake off the coast of Central Peru in South America. The exercise was played in real time, with the first notification of the earthquake (and the start of the exercise) at 4:59 am. The exercise finished at 7.05pm the same day.

Information about a simulated destructive tsunami crossing the Pacific was communicated through simulated tsunami, earthquake and sea-level information bulletins issued (notionally) by the Pacific Tsunami Warning Centre (PTWC), the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration’s National Data Buoy Centre (NOAA NDBC). These were sent to MCDEM as the national Tsunami Warning Focal Point (TWFP) and to other agencies that normally subscribe to PTWC bulletins.

The MCDEM analyzed the simulated PTWC information with the support of the Tsunami Experts Panel, a science group coordinated by GeoNet, and subsequently issued national advisory and warning messages. The participating national and regional agencies responded to this information by considering appropriate warning and response at their levels. This resulted in local warnings, evacuations and welfare support within affected areas.

Threat level estimates for 43 coastal zones along the New Zealand coastline were introduced during Exercise Tangaroa. These estimates were displayed on a map and are the result of significant modelling conducted by GNS Science (funded by MCDEM) over the last year. The maps were prepared by GeoNet and attached to MCDEM hourly updates. The threat level estimates are based on the expected maximum wave amplitude at shore at any point within each zone. This worked well as the first estimates could be distributed within the first two hours, allowing decision-makers at the regional and local level to assess the risk to their communities, and take appropriate steps. GeoNet applied further modelling to refine the estimates over the next hours and although they did not require significant adjustment, the maps were updated accordingly to provide the best possible indication of threat.

Overall, the exercise was a success. The national warning system messages were broadcast in a timely manner, local level Civil Defense responded quickly and appropriately, and useful information was gained. The evaluation process will continue until April next year, when the Exercise Report is expected to be completed.

Enhancing tsunami early warning and preparedness in the Southeast Pacific

The regional workshop “Mechanisms of inter-institutional and regional cooperation on tsunami early warning and preparedness” was held in Santiago de Chile from 12 to 14 October, 2011 within the framework of the DIPECHO project “Adaptive learning mechanism on tsunami preparedness at community level in Colombia, Ecuador, Peru and Chile” implemented by the UNESCO Regional Office for Education for Latin America and the Caribbean (OREALC) in coordination with the Intergovernmental Oceanographic Commission of UNESCO and national institutions. The workshop was attended by 50 representatives of 28 national institutions of the four countries as well as international organisations as the Permanent Commission for the South Pacific (CPPS), UNESCO, the European Commission Humanitarian Aid & Civil Protection (ECHO), the Chilean delegation of the European Union and the Chilean Association for United Nations (ACHNU).

The objective of this workshop was to exchange the lessons learned during the implementation of the project. The progress and challenges in the process of establishing inter-institutional and regional mechanisms for tsunami early warning and preparedness were discussed. As a result of this assessment, action plans were developed in order to fill gaps existing in all of the areas related to tsunami risk reduction, namely education, oceanography, seismology and risk management.

As a conclusion, it was noted that significant knowledge is available in the region to reduce vulnerability of coastal populations to tsunamis. The role of the school community in this process was highlighted. Likewise, it was stressed the need to complement the efforts already undertaken and start actions to expand the experiences to other vulnerable zones. The need of information and data exchange among institutions was particularly emphasized. In this respect, it was proposed to disseminate the materials elaborated within the framework of the project to other countries in the region.

This meeting was followed by the II Workshop for the Coordination and Follow-up of the Regional Tsunami Early Warning System for the Southeast Pacific (SRATTPS). The implementation of this multinational early warning system is coordinated by the Permanent Commission for the South Pacific (CPPS), whose Member States are Colombia, Ecuador, Peru and Chile. During the workshop the short and mid-term operational plan for the implementation of an early warning system for the four CPPS Member States was elaborated. Important inputs for the elaboration of this plan were the results of the regional DIPECHO project. The main components of the operational plan include the exchange of information and data among CPPS Member States, development of training programmes, and creation of a South American system for notification of tsunamigenic events and for exchange of oceanographic data.
**NEAMTWs**

The seventh session of the UNESCO/IoC Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the Northeastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWs-VII) met at UNESCO, Paris, France, on 23–25 November 2010. It was attended by about 70 participants from 16 member countries, 2 observer countries and other observer organizations.

The ICG extended the mandate of the Task Team on the Regional Tsunami Warning System Architecture and established a Task Team on Communication Test and Tsunami Exercises, which will conduct during 2011 Communication Test Exercises involving the Tsunami Warning Focal Points (TWFPs) and set up procedures for the first NEAM tsunami exercise to be conducted in 2012.

In addition, the ICG established a Task Team on the Multi-hazard Approach to Coastal Inundation in NEAMTWs, emphasizing the need to link tsunami warning and preparedness with other types or related coastal inundation. Moreover, the ICG acknowledged the IOC Sea Level Station Monitoring Facility as hosted by the Flanders Marine Institute (Oostende, Belgium), and notes its importance for the interim provision of data to NEAMTWs’ NTWCs.

Moreover, the ICG encouraged Member States’ data centres to make sea-level data available in real time to NTWCs, e.g., through the Global Telecommunication System (GTS). Likewise, the ICG acknowledged the offer by the German Research Centre for Geosciences (GFZ) to provide to NEAMTWs members a prioritized automatic earthquake information service on demand and invites NEAMTWs members to make use of such service.

It is to note that the next ICG/NEAMTWs session will take place on 23–25 November 2011 in Santander, Spain.

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**IOTWS**

**Regional workshop on Standard Operating Procedures for tsunami warning and emergency response for East African and Western Indian Ocean countries**

A regional training workshop on tsunami warning and emergency response SOPs for East African and Western Indian Ocean countries was held at the Blue Pearl Hotel in Dar es Salaam, Tanzania, 15–19 November. The workshop was attended by 22 participants from 8 countries: Comoros, Kenya, Mauritius, Mozambique, Seychelles, South Africa, Tanzania and Yemen. The trainers were: Tony Elliott and Masahiro Yamamoto from UNESCO-IoC, Dr Laura Kong (ITIC) and Amir Mohyuddin (NDMA, Pakistan).

The participants comprised representatives from regional National Tsunami Warning Centres (NTWCs) and National Disaster Management Organisations (NDMOs), and the Tanzania Red Cross National Society. The training content focused on: earthquake and tsunami science for tsunami warning; tsunami hazards in the Indian Ocean; fundamental Tsunami Warning Centre SOPs for a timely warning; tsunami emergency response and preparedness; information flow SOPs – media and public information; the development of SOPs, including data analysis, processes, flow-charts and checklists, timelines; and tsunami warning decision support tools.

The key outcomes of the workshop were the provision of templates and guidelines to be used to create SOPs at the national level and a draft set of SOPs created at the workshop. Further important outcomes were the fostering of closer coordination between the NTWCs and NDMOs of the region.

A tabletop exercise tested the group’s understanding of SOPs for a distant tsunami scenario. The exercise demonstrated the groups’ understanding of the role of SOPs in tsunami warning and emergency response. At the same time, gaps and weaknesses were identified, which the participants will address at the national level.

This workshop was organized in response to a common need identified in country capacity assessment missions conducted in Indian Ocean member states following the December 2004 Indian Ocean tsunami. Funding for the workshop was from IOC Regular Programme funds and the Indian Ocean Consortium administered by UNISDR. The workshop has identified a demand for conducting a programme of country-specific workshops to develop critical capacity at the national level. A need for a regular biennial regional workshop was also identified.

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**ComMit/MOST training workshop in Comoros**

A training workshop on how to use the ComMit/MOST tsunami digital modelling software was held from 6 to 10 December 2010 in Moroni. It was most probably the first ComMit training workshop in a French-speaking area. The instructors were Narcisse Zahibo and Bernard Dutton from the University of the Antilles in French Guiana, mandated by UNESCO. Fifteen people, all of whom were Comorians from different activity sectors (the Civil Aviation and Meteorological Authority, the Volcano Observatory, the Hydrological Service, civil society players, non-governmental organizations (UNDP), etc.), took part in the workshop. The opening ceremony was honoured by the presence of the Minister of Transport, Mr Hassan Assoumane, whose address underlined the importance given by Comorian authorities to the mitigation of natural threats facing their islands. It should also be highlighted that the beginning of the workshop coincided with the inauguration of the first radar tide gauge funded by UNESCO which was installed in the Moroni port. All workshop participants attended the inauguration ceremony.

The workshop comprised three facets: theory, practice and lastly the presentation of participants’ work on case studies which they had to perform during the workshop. All tsunami features, from generation to coastal flooding, including concepts of risk management (mitigation, assessment and warning) were outlined at the start of the workshop. Historical data on tsunamis and more specifically the impact of the 2004 Indian Ocean tsunami on the coasts of the Union of the Comoros was examined. This was followed by a presentation of long ocean wave propagation equations and their digital modelling by the MOST method. The second day of the workshop addressed all the features of the ComMit interface, how to use the locally installed server containing the different sources of the Makran and Indian Ocean region, and how to construct different nested grids. Each participant then worked on a case study on which a formal presentation was made, during which we took note of their quick grasp of the ComMit/MOST modelling tool.
Field Workshop on Assessment and Awareness of Makran Tsunami Hazards

The Field Workshop on Assessment and Awareness of Makran Tsunami Hazards was held in Tehran, Chabahar and Jask, Iran, from 9-20 October 2010, hosted by the Iranian Institute for Oceanography (INIO). The seventeen participants and five trainers attended briefing sessions at INIO on 10 October before flying to the southern coast (Jask and Chabahar) to conduct the field work from 11-18 October.

Workshop participants split into separate teams: one for interviewing potential witnesses to the 1945 Makran tsunami and surveying the inundated area, and the other conducting palaeotsunami studies looking for geologic evidence of the 1945 tsunami event and possible earlier events. Interviews were conducted with local inhabitants, several of whom recalled the 1945 event and provided information about the extent of inundation. The inundation sites were surveyed to provide input and feedback for tsunami inundation modeling of the 1945 tsunami event.

Geological investigation sites were chosen using satellite photos and maps during the evening discussion sessions. At the investigation sites, trenching, coring and geologic observations were used to identify evidence of tsunami or other high energy events. Five main investigation sites were chosen and about fifteen trenches and 5 cores were produced to understand the stratigraphy of the region. The trainers and participants returned to Tehran on 19 October and held summary discussions at the INIO office during the afternoon.

Direct results of the field workshop include: (1) improved awareness of the tsunami risk amongst coastal populations who were interviewed for their recollections of the 1945 tsunami event; (2) possible tsunami deposits from 1945 found in several trenches and cores, suggesting that the event was not as large in the western part of Iran, and that the western Makran may not have produced a large earthquake in the last 1000 years; (3) good examples of sedimentation from the Cyclone Gonu (2007), providing a good reference point for earlier high-energy events in the region (storms, cyclones or tsunamis).

CARIBE-EWS

The second UNESCO-IOC-CARIBE EWS-GLOSS Caribbean Training Course for Operators of Sea Level Stations took place January 14-28, 2011 in St. George, Grenada. The first course had been held June, 2008 in Mayaguez, Puerto Rico. Twenty participants from 9 Member States in the Caribbean and Central America (Grenada, Barbados, St. Vincent and the Grenadines, St. Lucia, Puerto Rico, Haiti, Belize, Guatemala and Nicaragua) attended the training in Grenada. The course provided the sea level station operators in the region lectures and hands on training on the science and operations of sea level stations for tsunami and other coastal hazards warning purposes. The five lecturers from the University of Hawaii Sea Level Center, NOAA NWS Caribbean Tsunami Warning Program, Puerto Rico Seismic Network and the Caribbean Regional Association for Coastal Ocean Observations covered the following topics: Basic Oceanography, Oceanography of the Caribbean, Sea Level Variations, Sea Level Sensors, Real Time Data Transmissions, Data Processing and Analysis, Leveling, Best Practices and Deep Ocean Observations (DART). The participants had a chance to become acquainted with the IOC Sea Level Data Facility and also install and run the Tide Tool program. One of the sessions was held at the Grenada sea level station where an overview of the station and the benchmarks was given. All the participants also gave presentations on the status and plans for sea level stations in their countries/organizations. An overview of the Caribbean Tsunami and Other Coastal Hazards Warning System and GLOSS was presented, as well as the upcoming first regional tsunami exercise, CARIBE WAVE (March 23, 2011) was discussed.

The course was possible thanks to the financial support of the Government of Monaco, the Puerto Rico Seismic Network and NOAA (USA). The local coordination was handled by the National Disaster Management Agency and the Grenada National Commission for UNESCO. IOCARIBE handled the administrative arrangements on behalf of UNESCO.

Upcoming events

- ICG/IOTWS National Tsunami Warning Centre Training Workshop, 8-9 February Hyderabad, India
- Intersessional Meeting of ICG/IOTWS Working Group 2 on Tsunami Detection, Warning and Dissemination, 10-11 February, 2011, Hyderabad, India
- Training workshop on the Emergency Managers Weather Information Network (EMWIN) for the Caribbean, 21-25 February, San Juan, Puerto Rico, United States
- ICG/PTWS Meeting of Working Group 2 Detection, Warning, and Dissemination, 28 February – 4 March, 2011 Wellington, New Zealand
- ICG/NEAMTW: Task Team on the Multi-hazard Approach to Coastal Inundation, 9 March, 2011 Paris, France
- ICG/NEAMTW: Task Team on the Regional Tsunami Warning System Architecture, 10 March, 2011 Paris, France
- ICG/NEAMTW: Task Team on Communication Test and Tsunami Exercises, 11 March, 2011 Paris, France
- Fourth Meeting of the Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS-WG), 21-22 March, 2011 Paris, France
- Exercise CARIBE WAVE 11/LANTEX, 23 March, 2011
- Sixth Meeting of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/ICARIBE EWS), 26-29 April, 2011 Santo Domingo, Dominican Republic

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