



**TRAINING WORKSHOP ON THE
DEVELOPMENT OF STANDARD OPERATING
PROCEDURES
FOR
TSUNAMI EARLY WARNING SYSTEMS**

Organized by

PAKISTAN METEOROLOGICAL DEPARTMENT

in collaboration with

**UNESCO-INTERGOVERNMENTAL OCEANIC
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**NATIONAL SEISMIC MONITORING AND TSUNAMI
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Prepared by: Zahid Rafi, Najeeb Ahmed and Shafiq Ur Rehman

EXECUTIVE SUMMARY:

The project “Strengthening of Tsunami warning and Emergency Response” was initiated by the funding of Multi-donor fund on Tsunami Early Warning Arrangements in the Indian Ocean and Southeast Asia, consummated by UNESCO-Intergovernmental Oceanic Commission under which countries in a constant peril of earthquakes and Tsunami benefited including Pakistan and its neighboring countries. Under this arrangement a training workshop was held in Pakistan Meteorological Department, Karachi (09 -13 Feb 2009) with aim to develop of Standard Operating Procedure for Tsunami Early warning. The project is aimed to stimulate the National Tsunami Warning Centers and National Disaster management Organizations in the respective countries.

National Tsunami Warning Centers (NTWC) which are currently in a state of development will act as a Tsunami Warning Focal Point (TWFP) with the responsibility of receiving international tsunami advisories and issuing tsunami warnings within their own country/region. NTWC for the operation as well as for the issuance of warning, a well developed Standard Operating Procedures (SOP) is required. Participants included from Pakistan Meteorological Department, Pakistan Navy, Maritime Security Agency, Karachi Port Trust, Pakistan Red Crescent, National Disaster Management Authority, Bahria University (Karachi and Islamabad). Experts from UNESCO-IOC delivered lectures for preparation of SOPs and illustrated parameters developed by different countries. Beside these lectures table top group exercises were conducted under the supervision of experts. Guidelines for development of SOP were discussed. It was decided that next meeting will be held in the first week of May 2009 in Karachi.



Chief Guest and Participants of the training workshop

Workshop Overview

The workshop was lasted for five days. The workshop was meant for to provide the guidelines to different stakeholders in Pakistan who has responsibilities regarding the issuance of tsunami warning and the disaster management if tsunami generated in the Arabian Sea as well as in the Indian Ocean which may affect the coast line of Pakistan. The coordination and role of different agencies, local and provincial in case of emergencies, could be decided. Warning would be the responsibility of Pakistan Meteorological Department (PMD) and disaster management organizations must be equally participated in disaster mitigation response. UNESCO-IOC in 2006 felt that most of the Indian Ocean countries did not have well tested protocol and SOP for to cope with tsunami emergency. In this context UNESCO-IOC decided to hold a series of training workshops to provide guidelines, templates and the best practices to the countries across IOTWS.

In the first phase standard, generic set of SOP, COP, checklist and flow chart were provided to Pakistani stakeholders as a common starting point. This material is derived from the best experiences of existing systems in the pacific especially from USA and Japan. A team of well experienced lecturers comprised of Tony Elliot

Head ICG IOTWS Secretariat, Dr. Fauzi Chief, Seismic Engineering and Tsunami Division of NTWC, Meteorological, Climatology and Geophysical Agency Indonesia,

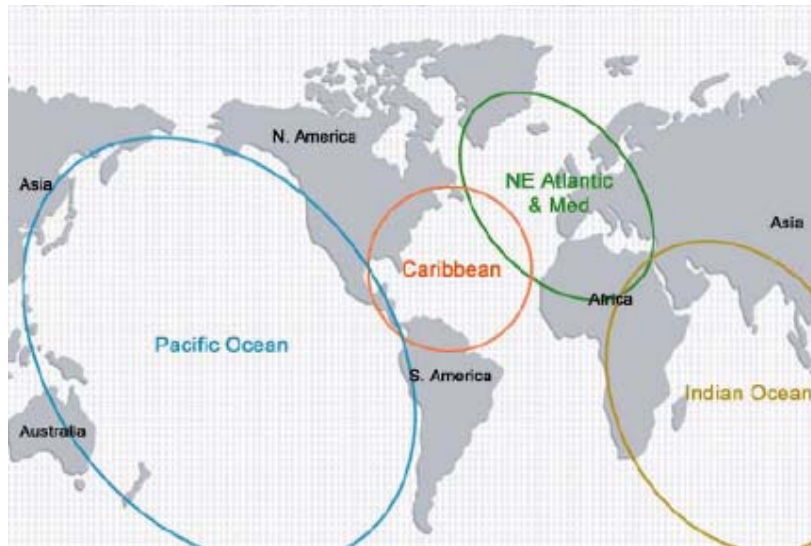


Figure – 1 Working Regions for Tsunami warning.

Masahiro Yamamoto Senior Tsunami Advisor UNESCO-IOC and Jane Cunneen UNESCO-IOC, conducted this training workshop at Karachi.

Workshop Activities

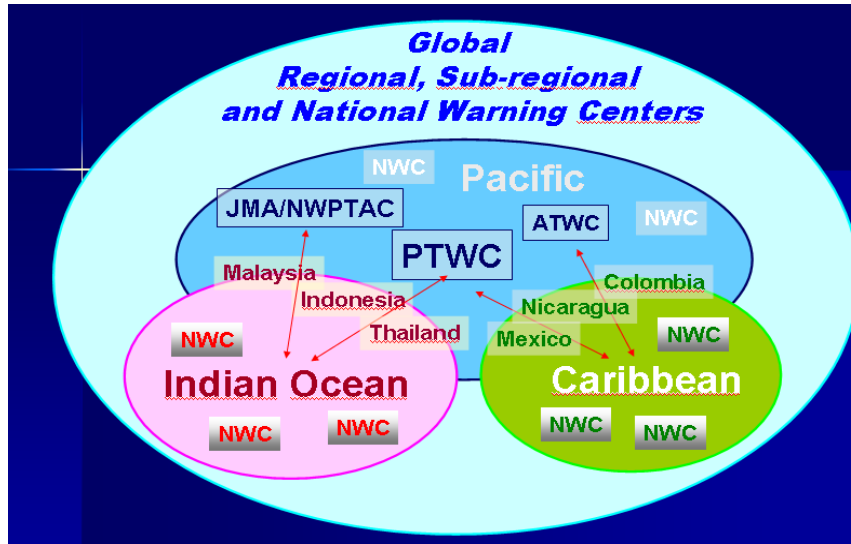
Day-1:

Workshop participants from different organizations elaborated their role in Early Warning, Disaster mitigation and management. Pakistan Meteorological Department was represented by Mr. Muhammad Riaz, Chief Meteorologist NSMC Karachi. He highlighted the role played by the PMD in Hazard and Risk assessment and briefed about the responsibilities of PMD as tsunami warning system in Pakistan. Tsunami hazard and Risk for Pakistan was dyed and expressed the need for the development of disaster mitigation plans. Other participants from NDMA, Red Crescent, UNDP and KPT also gave presentations indicating their role.

Dr. Fauzi and Yamamoto briefed the participants about the earthquake and tsunami science. Tsunami warning process was divided into three parts i.e. source of generation (earthquake faults), propagation of waves and inundation at impact. Dr. Fauzi described the criteria for tsunami source which is an Earthquake with magnitude > 7.5 with depth $< 50\text{Km}$, and focal mechanism. Travel time was estimation by using different techniques. Bathometry data and topography of coast line are equally important for tsunami watch.

Brief note was given about the structure and working of TWC of different regions. All the three regions i.e. Indian Ocean Pacific Ocean and Caribbean Sea were discussed with special emphases on IOTWS. The regions are shown in figure - 1 below whiles their coordination and working is shown in figure – 2.

IOC divided the world into four regions like Pacific, Caribbean, Indian Ocean and NE Atlantic & Meditarian Sea. Fig below mentioned the regional and sub regional tsunami warning centers. IOC with the help of UNESCO and other Funding organizations is trying to develop coordination and emergency response criteria.



Figure–2: Arrangement of National, sub-regional regional warning centers into a global TWC

Day– 2:

The Makran Earthquake and Tsunami of 1945 (Mw 8.1 depth 15 Km) was a typical case study in the context of developing SOPs for Pakistan. As the source of the Tsunami is Subduction zone in the Arabian Sea hence producing expected impact time of upto 30 minutes (Table–1).

Table – 1

Tsunami Type	Typical Time of Impact
Local	0-1 hours
Regional	1-2 hours
Distant	>2 hours

The parameters for this region were elaborated by Jane Cunneen. The competency in historical data catalogue was discussed. It was accentuated that Pakistan must has Numerical models for wave travel time and height together with paleoseismology and Paleo-Tsunami project for determination of the past events.

Dr. Fauzi and Yamamoto highlighted the importance of real time seismic data and source characterization. Interactive seismic data processing procedure was discussed and gave emphasis to the importance of quick identification of an earthquake magnitude, location and depth by the operator at NSMC. Different decision support tools were introduced. For tsunami conformation data from tide gauge network will enable the operator to confirm earthquake having potential to generate tsunami and even expected wave heights and arrival time at coast. While working with tide gauge data state of sea for low or high tide must be kept in mind along side the delay in receiving the tide gauge data.

In the second session role of stockholders and media were talked about for tsunami warning. Essential coordination between warning center, Government emergency response centers (Police, fire etc who are first to respond), media and local communities, were convoluted. It was shown how communication gap on one side can trigger devastation so the warning must be clear and understandable by the stakeholders.

Day – 3:

Mr. Uli Wolf introduced the concept of using timeline for tsunami warning and disaster management. Timeline shows what actually took place during the event. These actions are taken under SOPs which must set forth the rules and actions to be followed under particular circumstances. Time line gives information about management and communication and any problem with SOPs can be resolved in the exercise or drill.

Case studies were given by Dr. Fauzi about previous events to judge the effectiveness of TWS and problems faced by experts in this regard. A special case was 2004 Indonesian tsunami. Satellite images and aerial photographs were shown to highlight the area.

Small groups of participants were made in order to develop SOPs which will define the role during routine operations and during tsunemogenic earthquakes. After the group exercise response of each group to events was evaluated and lapses were conversed. This will facilitate the NTWC by setting forward the rules for response. Each group prepared its own SOPs for given scenario and used timeline to perform actions. This highlighted the upstream processes on the TWC including coordination and time information management.

Lecture was given by Jane Cunneen about tsunami preparedness through education and awareness. The education must include tsunami science and hazard, previous events and emergency response system during actual event and safety rules. These enhance coordination and collaboration, sustainability and must be multi faceted to account for cultural variation, locality and diversity.

Day – 4

Mr. Yamamoto explained about the SOPs including the analysis processes which involved in making the SOPs besides this he also explained the flow charts and the check lists involved in making the SOPs. Then the participants were asked to break out in small groups and by using the templates to develop time line of processes and

actions on SOPs. Each group developed their messages, check lists and information dissemination procedures. In the evening session table top exercise was done by the participants. Four groups were arranged by the experts. Group 1 & 2 of PMD participants acted as TWC while group 3 and 4 responded as emergency response agencies. One of the developed formats is given in this report as an example.

Master Scenario for tabletop exercise.....Pakistan 2009

Large destructive earthquake felt along coastal areas of Pakistan



Table Top Exercise involving PMD Staff Members

Day – 5

Table top exercise of the previous day was discussed by the experts. The merits and demerits of the said exercise were briefed by both experts and participants. Communication gap between TWC and TER was highlighted and underscored the need to develop a clear warning message which could be understood by response agencies and general public. In the evening planning for mission 2 were discussed in which experts told that they will visit Pakistan in the first week of May in which they will examine the draft of different SOPs made by the participating organizations both on TWC and TER sides.

At the end ceremony was held for the presentation of certificates to participants. Besides this all the experts expressed their views about the said training workshop and they expressed that all the participants took the part in the workshop very actively. Training workshop concluded with expectations to develop comprehensive SOPs by different stakeholders who participated in the training workshop.



Mr. Tony Eliot delivering a lecture



Dr. Ulrich Wolf delivering a lecture