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Advances in Tsunami Warning to Enhance Community Responses

12–14 February 2018

Summary Statement



UNESCO

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The Symposium

Coming from 25 countries and six international organizations, 105 physical and social scientists, warning system operators, emergency and response managers, attended the UNESCO/IOC Symposium on Advances in Tsunami Warning to Enhance Community Responses from 12 to 14 February 2018 at UNESCO, Paris. The symposium was organized by the Intergovernmental Oceanographic Commission of UNESCO. Welcoming remarks were provided by Vladimir Ryabinin, Executive Secretary of IOC and Assistant Director-General of UNESCO.

The Background

The 26 December 2004 Tsunami in the Indian Ocean led to a decision by IOC Member States that Tsunami Warning Systems should be established in the Indian Ocean, Caribbean, and North-eastern Atlantic, Mediterranean and connected seas. Since 2005 much effort has gone into developing, establishing and/or upgrading these systems. The systems have gradually become operational and together with the already operational Pacific Tsunami Warning and Mitigation System they make up the Global Tsunami Warning System.

The Assembly of the Intergovernmental Oceanographic Commission of UNESCO decided at its 29th session (21–29 June 2017, Paris) to conduct a symposium on enhancing existing operational tsunami forecasting to further develop warning products and enhance timely, accurate, reliable and effective decision-making and community response.

Tsunamis are "short-fused" hazards that can impact coastal communities within minutes, or in the best-case scenario within hours. This requires extremely rapid threat assessment and warning of communities, which is both technically and practically challenging.

Recognising the needs of emergency responders and at-risk coastal communities for even more timely and accurate tsunami warnings than are currently available, the Symposium brought emergency responders and users of tsunami warnings together with scientists and warning authorities. Participants included experts from monitoring networks, seismology, tsunami forecast modelling and warning centres, maritime authorities, national and local emergency management authorities.

The aim of the Symposium was to:

- 1) Review the latest and potential new technologies and procedures for estimating tsunami threat and test their suitability and feasibility for providing more timely and accurate warnings.
- 2) Consider ways of estimating uncertainties associated with threat assessments and optimal ways of conveying these uncertainties to decision-makers.
- 3) Examine ways of utilising enhanced tsunami threat information in making decisions with regards to emergency responses.
- 4) Provide information on the latest technologies for disseminating tsunami warning information to responders and communities.
- 5) Formulate roadmaps for developing and implementing new technologies, procedures and their application to enable more effective community responses to tsunami threats.

The structure of the Symposium consisted of plenary sessions with invited presentations and panel discussions. Two poster sessions also addressed:

- Tsunami impacts and responses
- Tsunami hazard and risk assessment
- Tsunami forecasting tools and systems
- Sea level and seismic observing technologies
- Warning protocols
- Communication technologies
- Awareness and preparedness initiatives and resources
- Maritime community, ports and harbours preparedness
- Structural (building) design for tsunami
- World Tsunami Awareness Day

The Symposium programme and book of poster abstracts are available at:

<http://www.ioc-unesco.org/tsunami-symposium>.

Findings

The Symposium examined lessons learnt from past events and recent efforts in further developing tsunami warning and mitigation systems to enable enhanced community responses. The Symposium recognised the challenges that the tsunami community and tsunami warning systems face. The Symposium further identified future needs and suggested developments within the following areas: (i) Detection and Warning; (ii) Emergency Management; (iii) Community Awareness and Preparedness; (iv) National Initiatives; and (v) International Initiatives.

Challenges

- Tsunami threats can be difficult to characterise quickly and to monitor.
- Tsunamis are rare events but with potentially major consequences.
- Among nations, warning chain arrangements and responsibilities may differ.
- Educating the media about the meaning and urgency of tsunami warnings is an ongoing task.
- Meeting public and political expectations.
- Establishing and maintaining public trust.
- Mustering and retaining government commitment to appropriate resources for tsunami warning systems, including community awareness and preparedness.

Improvements Needed

- Provide decision makers with more accurate and timely tsunami forecasts with an appropriate measure of uncertainty.
- Tsunami warnings received 24/7 by at risk communities.
- Warnings for non-subduction earthquake zones and non-seismic sources of tsunami (e.g. meteorological tsunamis, coastal cliff failures and submarine landslides, landslides due to volcanic eruptions).

Detection and Warning

- Warnings should address the requirements of users (emergency managers/responders and the public) as determined through consultation and testing.
- Standard Operating Procedures should be routinely reviewed, updated and coordinated throughout the warning chain (national warning centre and emergency managers/responders), and underpinned by up-to-date competency training and assessment programmes for staff involved in the warning process.
- More detailed and specific community guidance should be provided about what to do in case of rare hazards.

Improvements Needed

- More rapid and accurate assessment of earthquake source characteristics for near-source events, to enable timely and appropriate community

responses, limit unnecessary disruption and enhance public trust.

- Explore use of observations from Global Navigation Satellite System to assist with rapid evaluation of earthquake magnitude, rupture fault size (width and length) position, and focal mechanism.
- Explore further development and use of deep ocean tsunami observing technologies (e.g. tsunameters and submarine cables) to optimise detection network for improved accuracy and verification of tsunami forecasts.
- Explore real-time application of remote sensing technologies (e.g. altimeters) and infrasound monitoring systems to assist tsunami characterisation and verification.
- Improve estimation of tsunami amplitudes and heights at the coast based on amplification laws and deep-sea amplitude forecasts.
- Explore real-time modelling (e.g. incorporating earthquake focal mechanism, and sea level observations) to provide more accurate tsunami forecasts.
- Explore Probabilistic Tsunami Forecasts to help provide estimates of uncertainties to assist decision makers.
- Utilise inundation modelling (requiring high-resolution bathymetry and topography datasets) for priority locations to better inform evacuation planning and required community responses.
- Investigate and develop detection networks and procedures to provide warnings and advice to the public on non-seismic sources of tsunamis.
- Explore multi-hazard uses of monitoring systems to facilitate network and system sustainability.

Emergency Management

- Promote continuing improvements to community warnings and advisories, so they are increasingly relevant, timely, accurate, clear and trusted.
- Attempt to simplify the end-to-end warning chain through integration and/or speeding up of processes.
- Given that local source tsunami events present the biggest challenge due to extremely short time constraints, enhancements to the warning chain should be considered from the end-point perspective to ensure optimal community responses.

- Broadcast identical warning messages simultaneously via multiple public alerting systems, (traditional and social media) insuring consistent information.
- Ensure public warning instructions and response procedures are simple and clear, and consider language and culture.

Improvements Needed

- Emergency managers/responders are to advise national warning centres of their timeline requirements for the first warning.
- National warning centres are to determine and advise emergency managers of the timelines for their best estimate forecast (including uncertainties).
- At the national level, define and consistently apply a limited number of threat levels such as those recommended by IOC, and provide specific, short, and clear instructions for the appropriate response for each threat level.
- Include officially determined, specific forecast points (within regions) in warnings, with details such as inundation forecasts.
- Address community expectations and misunderstandings with regards to the duration and cancellation of warnings.
- Simplify language used by regional IOC Tsunami Service Providers (TSPs) in tsunami threat information.

Community Awareness and Preparedness

- Develop/enhance a national culture of awareness, preparedness and community ownership of hazard management.
- Integrate tsunami awareness within multi-hazard awareness programmes to help sustain and ensure consistency.
- Embed awareness, education and preparedness in school programmes, starting at a young age.
- Conduct regular national and international exercises and drills to review, develop, and maintain awareness and preparedness.
- Acknowledge effective responses to a warning, including to a false alarm.

Improvements Needed

- Re-evaluate the quality and amount of information used in public awareness activities; explore different initiatives for more efficiently and effectively raising awareness to keep communities interested and prepared.
- Implement and monitor performance of national tsunami readiness programmes.

National Initiatives

- Work towards including tsunami risk management in multi-hazard legislative and policy frameworks.
- Establish a National Tsunami Warning Centre (NTWC) or a National Tsunami Warning Focal Point (TWFP) in at risk nations where neither exists.
- Ensure strong working relationships between NTWC or TWFP and emergency management authorities through well-defined national tsunami warning plans.
- Countries are encouraged to continue or initiate bilateral/collaborative efforts with each other.

International Initiatives

- Ensure NTWCs, TWFPs, emergency managers and the media know what to do in every country through regular training programmes, assessment and simulation tools.
- Consider how best to support Small Island Developing States, e.g. via acquisition and use of available decision support tools for monitoring of earthquake and tsunami, or training in utilisation of tsunami threat advice from IOC regional TSPs.
- Collaboratively improve and share tools, methodology, information and procedures in tsunami warning, emergency response, community awareness and preparedness.
- Ongoing review of international guidelines and manuals to ensure simplicity and clarity of instructions that involve the community.
- Encourage greater participation of emergency managers/responders in IOC ICGs and other fora to ensure warning systems meet user requirements.
- Encourage a repeat of this type of symposium.

Speakers and Panellists

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