

ANNEX II

ADOPTED RECOMMENDATIONS

Recommendation ICG/PTWS-XXVIII.1

ICG/PTWS Governance

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Recalling IOC Resolution IV–6 that established the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) and IOC Resolution XXXIX-8 that renamed ITSU to be the Pacific Tsunami Warning and Mitigation System (PTWS) and to provide continuity through the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Reaffirming that the Pacific Tsunami Warning and Mitigation System (PTWS) is a coordinated network of national systems and capacities, and is part of a global network of early-warning systems for all ocean-related hazards,

Noting:

- Recommendation ICG/PTWS-XXVI.3: The ICG decided to constitute, under the Steering Committee, a Task Team to look into performance monitoring measures for Tsunami Service Providers (TSPs), National Tsunami Warning Centres (NTWCs), and national warning systems starting from the PTWS Medium-term Strategy 2014–2021 ([IOC/2013/TS/108](#)) established goals,
- [Sendai Framework for Disaster Risk Reduction 2015–2030](#) was adopted by UN Member States on 18 March 2015 at the World Conference for Disaster Risk Reduction (WCDRR),
- IOC Executive Council Decision EC-XLIX/4.2 on IOC Contribution to the Sendai Framework for Disaster Risk Reduction 2015–2030,

Having reviewed the progress made in the implementation of the PTWS since the 27th Session of the ICG/PTWS,

Having considered the reports of:

- Working Group 1 on Understanding Tsunami Risk
- Working Group 2 on Tsunami Detection, Warning and Dissemination
- Working Group 3 on Disaster Risk Management and Preparedness
- Task Team on PacWave Exercises, on PacWave18
- WG2 Task Team on Seismic Data Sharing in the South West Pacific
- Task Team on Tsunami Evacuation Maps, Plans and Procedures (TEMPP) and Tsunami Ready
- Task Team on Future Goals and Performance Monitoring
- Regional Working Group on Tsunami Warning and Mitigation System in the Central American Pacific Coast
- Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region

- Pacific Island Countries and Territories Regional Working Group on Tsunami Warning and Mitigation System
- Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region
- Task Team of the Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region on Establishment of a South China Sea Tsunami Advisory Center
- Task Team of the Regional Working Group on Tsunami Warning and Mitigation System in the Central American Pacific Coast on Establishment of a Central America Tsunami Advisory Center
- 8th Meeting of the PTWS Steering Committee, Honolulu, Hawaii, USA, 7-8 June 2018
- 12th Meeting of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG-XII), Paris, France, 21-22 February 2019
- North West Pacific Tsunami Advisory Center (NWPTAC)
- Pacific Tsunami Warning Center (PTWC)
- International Tsunami Information Center (ITIC)
- Chair's Report
- Secretariat Report
- Reports of the ICG/IOTWMS, ICG/CARIBE-EWS,
- Report on the Joint Task Force to Investigate the use of Submarine Telecommunication Cable for Ocean and Climate Monitoring and Disaster Warning (ITU, WMO, and IOC)

Having further considered the reports on:

- Future Working Group and Task Team Structure
- UN Decade of Ocean Science for Sustainable Development (2021–2030)
- World Data Services for Geophysics including tsunamis
- Secretariat of Pacific Community Report

Recognizing the emerging capabilities of Member States to develop probabilistic tsunami hazard assessments,

Requests Working Group 1 to provide guidance on how to transfer and translate maps generated by probabilistic tsunami hazard assessments into a language that can be easily interpreted by the at-risk general population.

Noting the instruction to Working Group 2 by ICG/PTWS-XXVII to urgently establish the minimum competency level for National Tsunami Warning Centre (NTWC) operations,

Further noting the report of Working Group 2 on process to define a framework for the minimum competency levels for NTWC operations, and the available draft document,

Noting the instruction to Working Group 2 by ICG/PTWS-XXVII to review the sensing network of the PTWS and develop an optimal (defined by functional, resourcing and capability requirements) multi-instrument design that integrates emerging techniques and sensor technologies,

Further noting the oral and written reports of Working Group 2 on process to define a framework for assessing the sensitivity of the PTWS sensing networks,

Acknowledging that the PTWS is effective in saving lives and reducing the impacts to communities in both near-field and distant-tsunami events through the three pillars of risk assessment and reduction, detection, warning and dissemination, and awareness and response;

Requests Member States to share any new forms of sea level data for tsunami warning purposes in accordance with the IOC Oceanographic Data Sharing Policy;

Decides to:

1. Continue WG1 Understanding Tsunami Risk with Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Co-Chairs are Dr Diego Arcas (USA, second term) and Ms Sarah-Jayne McCurrach (New Zealand, second term);
2. Continue WG2 Tsunami Detection, Warning and Dissemination with minor changes to the Terms of Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Chair is Ms Lara Bland (New Zealand) and Vice-Chair Dr Chip McCreery (USA, second term).
3. Continue WG2 Task Team on Seismic Data Sharing in the Southwest Pacific with Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. The Task Team will be co-chaired by Mr Rennie Vaiomounga (Tonga) and Ms Adrienne Moseley (Australia).
4. Establish a Working Group 2 Task Team on the minimum competency levels for National Tsunami Warning Centre (NTWC) operations staff with Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Co-Chairs are Ms Lara Bland (New Zealand) and Mr Ofa Fa'anunu (Tonga).
5. Establish a Working Group 2 Task Team on the integrated PTWS sensor networks for tsunami detection and characterisation with Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Co-chairs are Dr Bill Fry (New Zealand) and Dr Tim Melbourne (United States).
6. Continue WG3 Disaster Risk Management and Preparedness with revised Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Chair is Mr David Coetzee (New Zealand), and Vice Chair is Dr Laura Kong (USA);
7. Continue Sub-Regional Working Groups and Task Teams with same Terms of Reference except where noted:
 - *Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast.* Chair Dr Silvia Chacon (Costa Rica) and Vice-Chair Ms Griselda Marroquin (El Salvador). The Terms of Reference for this group remains unchanged;
 - *Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region* with revised Terms of Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Chair is Ms Mary Rengifo (Colombia) and Vice-Chair is Lt Cdr.Carlos Zuniga (Chile).
 - *Pacific Island Countries and Territories Working Group on Tsunami Warning and Mitigation System* with revised Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Chair is Mr Jerome Aucan (France - New Caledonia) and Vice Chair is Mrs Esline Garaebiti (Vanuatu).

- Pacific Island Countries and Territories Working Group Task Team on Capacity Development with revised Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Co-Chairs are Mr Jerome Aucan (France-New Caledonia) and Mr Ofa Fa'anunu (Tonga).
 - *Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region*. Chair Mr Chan Sai-Tick (China) and Vice-Chair to be elected; The Terms of Reference for this group remains unchanged;
 - Task Team of the Regional Working Group on Tsunami Warning and Mitigation in the South China Sea Region on Establishment of a South China Sea Tsunami Advisory Center with revised Terms of Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1. Elected Chair is Dr Yuan Ye (China) with Vice-Chair to be elected;
 - Task Team on Future Goals and Performance Monitoring. Elected Chair is Ms Sarah-Jayne McCurrach (New Zealand), and Vice-Chair is Ms Mary Rengifo (Colombia). The Terms of Reference for this Task Team remains unchanged;
8. Dissolve Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP), and Tsunami Ready upon publication of the TEMPP guidelines noting that the Tsunami Ready component of the Task Team is now included in the Terms of Reference of WG 3.
9. Continue the *PTWS Steering Committee* with same Terms-of-Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1;
10. Dissolve Task Team on PacWave18 Exercises upon publication of the report;
11. Establish a *Task Team on PacWave20 Exercise* with Terms of Reference as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1, Elected Co-chairs are Mr Emilio Talavera (Nicaragua), and Dr Laura Kong (ITIC, USA);

Acknowledges the contribution of the Government of France through the Pacific Fund for its continued support of the Oceania Regional Seismic Network (ORSNET) as well as other development partners e.g. the World Bank for their support of the tsunami warning and mitigation activities in the Pacific Island Countries and Territories (PICTs);

Recommends the IOC and WMO to take into consideration the tsunami warning and mitigation needs of the Small Island Developing States and Territories when negotiating the reform of the Joint IOC/WMO Commission on Marine Meteorology and the establishment of the WMO Country Support Initiative;

Decides that a standing agenda item be established for the workshop or meeting about recent science and developments for the tsunami warning system prior to the ICG/PTWS Sessions to leverage donor support to promote better opportunities to enable participation of those Members States such as Pacific Island Countries and Territories (PICTs);

Expresses its gratitude to the Government of Nicaragua and Instituto Nicaragüense de Estudios Territoriales ([INETER](#)) for kindly hosting the 28th session of the ICG/PTWS in Montelimar, Nicaragua;

Accepts with appreciation the kind offer of Japan to host the 29th Session of the ICG/PTWS in 2021 in time and a location to be determined.

Congratulates Chair Dr Wilfried Strauch (Nicaragua) and Vice Chairs Mr Ofa Fa'anunu (Tonga) and Mr Yuji Nishimae (Japan) for being elected as the new leadership for the PTWS.

Financial Implications: None

Appendix 1 to Recommendation ICG/PTWS-XXVIII.1

Terms of Reference

Working Group 1: Understanding Tsunami Risk

1. Develop and promote best practice tsunami risk reduction material, programmes, standards and tools for understanding tsunami risk, to support emergency management and early warning, including but not limited to:
 - hazard assessment and coastal inundation models and products
 - risk assessment methodology and risk forecasting
 - scenario assessments including maximum credible and most likely events to understand likely exposure, vulnerability and event frequency
 - forecast and threat models
 - evacuation and inundation modelling
 - use of new and improved data including Digital Elevation Modelling (DEM), GNSS and paleotsunami information
2. Work with International Union of Geodesy and Geophysics (IUGG) and other scientific bodies to ensure the translation of science information to support tsunami risk assessment and risk reduction. Develop recommendations for IUGG and other scientific bodies on science gaps in hazard assessment capability.
3. Better understand and develop best practice for assessing and reducing the risk of local source and non-seismic tsunami sources.
4. Develop projects in conjunction with subject matter experts and groups with specific interest to address gaps or areas for improvement in tsunami risk assessment and risk reduction.
5. Provide hazard specific support and advice to other ICG/PTWS working groups and working groups from other ocean basins, as well as other working groups to understand, coordinate and develop ways to address tsunami risk management.

The Group will be composed of members nominated by Member States, with two co-chairs, one from a science and one from a disaster risk management background, to be elected.

Terms of Reference

Working Group 2: Tsunami Detection, Warning and Dissemination

Liaise with other working group(s) and Task Team(s) within the ICG/PTWS and with working groups from the other ocean basins through the TOWS-WG to:

1. Develop, coordinate and enhance operational implementation of interoperable tsunami threat information products and services.
2. Undertake studies to determine warning requirements for seismic and sea level data.
3. Monitor and report on the performance of key observational, warning and communication system components.
4. Contribute to the conduct of regular exercises and communication tests of the PTWS.
5. Identify areas of priority for action following assessments, communications tests, exercises and real tsunami events.
6. Develop and maintain relevant documentation, such as the PTWS Users Guide.
7. Provide advice to the International Tsunami Information Centre (ITIC) on educational materials and for capacity building about the warning systems and services.
8. Help strengthen the capacity and capability of Member States.

The Working Group will be composed of members nominated by Member States, representatives for each ICG designated TSPs, ITIC, and invited observers, with a Chair and a Vice-Chair to be elected by the ICG.

Terms of Reference

WG2 Task Team on Seismic Data Sharing in the South West Pacific

1. Advocate seismic data sharing in the region.
2. Advise South West Pacific countries on data sharing protocols, techniques and technologies.
3. Work with South West Pacific Countries and donors to ensure a common data sharing policy.
4. Encourage South West Pacific Countries with existing or planned broadband seismograph stations to join the International Federation of Digital Seismograph Networks (FDSN), use the standards developed by the FDSN for data exchange and take advantage of the data archiving provided by the FDSN

Members are representatives of South Pacific Countries and territories (Australia, Fiji, France–French Polynesia, France-New Caledonia, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu), PTWC, NWPTAC, Japan, and United States. Co-chairs to be elected by the ICG.

Terms of Reference

**WG2 Task Team:
Minimum Competency Levels for National Tsunami Warning Centre (NTWC)
Operations Staff**

This expert Task Team will establish and document the minimum competency levels for NTWC operations staff and develop a framework for the competencies and training requirements of the roles of a NTWC.

1. Establish the minimum competency levels required for NTWC operations staff.
2. Establish a framework for the required competencies required by the roles of a NTWC.
3. Establish what training is required to ensure NTWC staff meeting minimum competency levels.
4. Investigate and document what schemes are currently in existence and what guidelines and principles can be adapted for this purpose.

The Task Team will be composed of Wilfried Strauch (Nicaragua), Ofa Fa'anunu (Tonga), Yuelong Miao (Australia), Chip McCreery (USA), Lara Bland (New Zealand), Laura Kong (USA), and Ken Gledhill (New Zealand). Co-chairs to be elected by the ICG.

Terms of Reference

**WG2 Task Team:
Integrated PTWS Sensor Networks for Tsunami Detection and Characterisation**

This expert Task Team will establish and document a methodology to test the sensitivity of the PTWS sensing networks, integrating new and emerging techniques and technologies by:

1. Developing a methodology for gap and sensitivity analysis that combines multiple sensing technologies for tsunami detection and characterisation.
2. Integrating emerging techniques and sensor technologies (e.g. better use of tide gauges; GNSS technology and processing; sensors on telecom cables) with the existing sensing network to meet tsunami warning service requirements.
3. Where possible, include cost-benefit analysis of the potential technologies being considered.

The Task Team will be composed of Tim Melbourne (United States), Bruce Howe (United States), Lara Bland (New Zealand), Bill Fry (New Zealand), Mike Angove (USA), Diego Arcas (USA), Stuart Weinstein (USA), Ken Gledhill (New Zealand) and Grigory Steblov (Russian Federation), Co-chairs to be elected by the ICG.

Terms of Reference

**Working Group 3:
Disaster Risk Management and Preparedness**

1. Facilitate in collaboration with TOWS Task Team on Disaster Management and Preparedness and organizations such as UNISDR, the exchange of experiences and information on risk reduction and preparedness actions, and matters related to disaster management;
2. Promote preparedness in coastal communities through education and awareness products and campaigns;
3. Facilitate SOP training across regions to strengthen emergency response capabilities of Member States and their Disaster Management Offices;
4. Facilitate the piloting of IOC-UNESCO Tsunami Ready, and report results from pilots to the ICG/PTWS and the TOWS-WG
5. Develop and promote best practice preparedness material, programs and assessment tools;
6. Develop and Promote tsunami risk reduction theory and practice;
7. Support the ITIC of the ICG.

The Group will be composed of members nominated by Member States, a representative of ITIC with a Chair and a Vice-Chair to be elected by the ICG.

Terms of Reference

Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast

1. To assist the Central American countries in the development, improvement and implementation of their National Tsunami Warning and Mitigation Systems, and the countries which are becoming new members of ICG/PTWS in their integration into the ICG/PTWS.
2. To request CEPREDENAC to support the development of CATAC in Nicaragua as interim Regional Tsunami Advisory Centre for all Central American countries.
3. To implement a regional communications and warning plan.
4. To facilitate Tsunami Hazard and Risk studies in the Central American Region.

The Group will be composed of members from Member States Nicaragua, El Salvador, Guatemala, Costa Rica, Honduras, Mexico and Panama, with a Chair and a Vice-Chair elected by the members of the Working Group and endorsed by the ICG.

Terms of Reference

Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region

1. To enhance regional capabilities in the South East Pacific Region for the Detection, Assessment, Warning and Dissemination of tsunami events, based on lessons learned and global trends, with the purpose of generating improvement opportunities for the National Tsunami Warning Centres (NTWCs) following the Sendai Framework priorities as a reference.
2. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks and communication systems in the region, and their interoperability in accordance with ICG/PTWS requirements, through the active participation of appropriate national delegates from Member States, in the Working Group 2: Tsunami Detection, Warning and Dissemination.
3. To improve the communication channels between the countries, according to the regional communications protocol established under Permanent Commission for the South Pacific (CPPS), through periodical tests using redundant systems.
4. To analyse the convenience of piloting Tsunami Ready program in the region.
5. To promote regional activities and join projects considering in-region capacity building and enhancing disaster preparedness for response as main efforts, according the priorities number 1 and 4 of the Sendai Framework.
6. To facilitate capacity building and the sharing of sea level information among others, including the free and open exchange of data.
7. To improve the educational programs with regional criteria based on social, cultural and economic reality, through the active participation of appropriate national delegates from Member States, in the Working Group 3: Disaster Risk Management and Preparedness.
8. To develop synergies with universities and academic centres to promote and to facilitate the regional tsunami research in order to cope with regional needs.

The Group will be composed of representatives nominated by the Member States of Chile, Colombia, Ecuador and Peru, with a Chair and a Vice-Chair from each country rotating every two years, following an alphabetical order. In this context, the Vice-Chair will assume regional presidency for the coming period.

Terms of Reference

**Pacific Island Countries and Territories Working Group
on Tsunami Warning and Mitigation**

1. To continually review and evaluate capabilities of and make recommendations for improvements to countries in the Pacific Islands and Territories (PICT) Region for providing end to-end tsunami warning and mitigation services.
2. To support the involvement and contribution of PICT countries in the activities of the ICG/PTWS.

3. To promote and facilitate the tsunami hazard and risk studies in the PICT region.
4. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks in the region, and the interoperability of these systems in accordance with ICG/PTWS requirements.
5. To facilitate training and capacity building in the end to end tsunami warning and mitigation system in the region.
6. To encourage the sharing of tsunami information, including but not limited to the free and open exchange of data.
7. To facilitate tsunami awareness in school curricula, and development and dissemination of public educational materials.
8. To work in cooperation with PTWS Working Group 1, 2 & 3, and relevant task teams especially on activities that strengthen country capacity in tsunami warning, risk mitigation & emergency response.

Members composed of representatives from Pacific Island Countries and Territories (PICTs), Council of Regional Organizations in the Pacific (CROP) Agencies and WMO. Chair and Vice Chair elected by the members of the Working Group and endorsed by the ICG.

Terms of Reference

Pacific Island Countries and Territories Working Group Task Team on Capacity Development

1. Continue the development of competency framework for National Tsunami Warning Centres personnel and pilot it in Australia, Vanuatu, Fiji, Samoa and Tonga and report progress and lessons learnt to ICG/PTWS WG 1, 2 and 3;
2. Continue to monitor and coordinate the Pilot Tsunami Ready Program and TEMPP in Samoa, Tonga, Fiji, Cook Islands, Solomon Islands and Vanuatu and review the Tsunami Ready Checklist for schools and communities in PICT;
3. Continue to develop the guideline for National Tsunami Warning Centres in responding to local tsunami and report to WG 1, 2 and 3; and
4. Develop an online survey of warning and mitigation capabilities in the Pacific Island Countries and Territories (Member countries and IOC).

The Task Team Members: Australia, New Caledonia (Co-Chair), Tonga (Co-Chair), Samoa, Vanuatu, New Zealand, Solomon Islands, Fiji, PNG, ITIC, SPREP, SPC, IOC, PTWC. Co-chairs to be elected by the ICG.

Terms of Reference

Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region

1. To evaluate capabilities of countries in the South China Sea Region for providing end-to-end tsunami warning and mitigation services.

2. To ascertain requirements from countries in the South China Sea Region for the tsunami warning and mitigation services.
3. To promote and facilitate tsunami hazard and risk studies in the region.
4. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks and communication systems in the region.
5. To facilitate improvement of the education programmes on tsunami mitigation in the region.
6. To facilitate capacity building and the sharing of tsunami information in the region, including the free and open exchange of data.

The Group will be composed of members nominated by Member States Brunei, Cambodia, China, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam and invited experts with a Chair and Vice-Chair to be elected by the members of the Working Group and endorsed by the ICG.

Terms of Reference

Regional Working Group on Tsunami Warning and Mitigation in the South China Sea Region Task Team on Establishment of a South China Sea Tsunami Advisory Center

1. Evaluate and report on performance indicators for the SCSTAC.
2. Explore ways for facilitating the sharing and exchange of data, tsunami warning technologies and relevant information necessary for further enhancing tsunami warning advisory capability of the SCSTAC.
3. Consult with National Tsunami Warning Focal Points of the WG-SCS Member States for their latest requirements on Tsunami service/products.
4. Review and continue to improve the SOP and the contents of tsunami advisory products following the full operation of the SCSTAC.
5. Keep contact with PTWC and NWPTAC (JMA) for coordination, consistency, guidance and assistance.

Membership: Representatives of Member States of the ICG/PTWS WG-SCS (Brunei Darussalam, China, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam) and invited experts; representatives of PTWC and NWPTAC (JMA); with Chair and Vice-Chair to be elected by the ICG.

Terms of Reference

Task Team on Future Goals and Performance Monitoring

1. Finalise the ICG PTWS Framework for Goals and Performance Monitoring of Tsunami Warning & Mitigation Systems, to be harmonised with other ICGs, for use in the next two inter-sessional periods.
2. Use the outcomes from the 28th Meeting of the ICG/PTWS to establish a performance baseline and a list of activities and resources required to help meet the identified goals.

3. Develop a PTWS Status Report for reporting the status and performance of the PTWS at the next meeting of the ICG.
4. Utilise the new National Report template for Member States to collect the required information and determine performance metrics for the PTWS Status Report.

Members consisting of the Working Group Chairs, ITIC, PTWC, USA, and invited experts and observers as appropriate, reporting to the Steering Committee. Chair and Vice-Chair to be elected by the ICG.

Terms of Reference

PTWS Steering Committee

1. The Steering Committee shall act in an advisory capacity to the Chair of the ICG/PTWS during the inter-sessional period.
2. The Steering Committee shall coordinate and integrate the work of ICG/PTWS in the inter-sessional periods, as implemented through the various technical and regional working groups and task teams, including but not limited to:
 - Maintain the PTWS Medium Term Strategic Plan
 - Monitor, maintain and update the PTWS Implementation Plan
 - Develop a Strategy for funding PTWS activities
 - Monitor the performance of the PTWS.
3. The Steering Group will be composed of the ICG/PTWS Officers (Chair and two Vice-Chairs), Chairs of the Technical and Regional Working Groups, Directors of PTWC, NWPTAC and ITIC or their representatives, other members' representatives by invitation of the Chair.

Terms of Reference

Task Team on PacWave20 Exercise

1. Design and carry out a ninth Exercise Pacific Wave 2020 with the following characteristics:
 - An exercise shall be conducted with the aim to test PTWS tsunami service provider arrangements, and Country preparedness arrangements and operational procedures to respond and recover from a destructive tsunami.
 - An exercise shall be conducted with the following objectives
 - a) Test communications from the PTWS Tsunami Service Providers to Tsunami Warning Focal Points and National Tsunami Warning Centres of Member States.
 - b) Test national communication and cooperation, and readiness within the country.
 - c) Test regional communication and cooperation between Member States.

- d) Support the development of tsunami procedures and products by the Central America Tsunami Advisory Center (CATAC).
2. Exercise Pacific Wave 2020 (PacWave20) will:
- Take place in the months of September through to November 2020 to support International Disaster Risk Reduction Day (13 October) and World Tsunami Awareness Day (5 November).
 - Be conducted as a series of regional exercises organized through the PTWS Regional Working Groups where applicable, with support from the PTWS TSPs and ITIC, involving all PTWS countries as part of the regular biennial Pacific Wave exercise conducted since 2006.
 - Be conducted to include one live communications test from the PTWS TSPs to Member States on 5 November 2020.
 - Be conducted to include exercise activities over and above a table top exercise. Possible exercise variations include:
 - a) Consider conducting in real time during the daytime working hours with full staffing, or simulating minimal staff during night time or weekend hours
 - b) Consider testing country capability to carry out their warning and response responsibilities for the situation where one or more PTWS TSPs is not able to provide guidance in a timely manner.
 - c) Consider conducting the exercise down to the community level, including where possible including an extensive public awareness campaign.
 - d) Consider the [Sendai Framework for Disaster Risk Reduction \(SFDRR\) 2015–2030](#) seven global targets and four priorities for action, World Tsunami Awareness Day and/or the UN Decade of Ocean Science for Sustainable Development in designing the exercise.
 - The exercise shall be announced by the IOC to Member States at least 240 days in advance of the exercise date.
 - The exercise manual will
 - a) Include information on each regional exercise
 - b) Inform Member States on the availability of exercise products for their region, including instructions to Member States regarding the distribution dates,
 - c) Include instructions to Member States regarding their participation and the evaluation instrument be prepared with content and structure similar to what was prepared for previous Pacific-wide exercises, but considering lessons learned and any need to collect additional information.
 - d) Be distributed by the IOC to Member States at least 180 days in advance of the exercise date.
 - Participating Member States will be asked to complete and return the evaluation instrument no more than 21 days following the exercise.
3. Prepare the Summary Report for the exercise, compiling a list of recommendations and the list of actions from the findings for consideration by the ICG/PTWS-XXIX.
4. Members invited from the ICG/PTWS Member States and Regional Working Groups, SPC, PTWC, NWPTAC, SCSTAC and CATAC. Task Team co-chairs to be elected by the ICG.

Recommendation ICG/PTWS-XXVIII.2

Tsunami Detection, Warning and Dissemination

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Noting the gaps in response to recent unscheduled communications testing from the PTWC,

Recommends there is a need to have more unscheduled communication testing with additional mechanisms for collecting data about how they are received. It was also **noted** that test notifications would come with a notification in Spanish so all watch standers would understand it is a critical test message.

Noting the recent improvements to the United States Website [Tsunami.gov](https://tsunami.gov) which supports both national and international interests covered by the United States tsunami warning centers,

Recommends that United States provide PTWS Member States with a prototype of the website and solicit feedback about its content and use;

Noting that the tsunami source region for the PTWS TSPs has been specifically defined through the TOWS-WG process and agreed to by the IOC Assembly,

Also noting that by existing PTWS procedures, for earthquakes that occur outside of that region the PTWS TSPs are only to issue products when there is an expectation that tsunami waves exceeding 0.3 meters amplitude are expected within that TSP's coastal service area,

Considering that there are cases when large earthquakes occur just outside the boundary, such as for the 2018 Palu, Indonesia, earthquake and tsunami, when it would be useful for a TSP to issue an Information Statement indicating no tsunami threat to its service area,

Further considering the importance of not causing confusion when the TSP and/or NTWC responsible for that earthquake may be issuing a threat message or tsunami warning for coasts closer to the earthquake,

Decides the following:

- The ICG/PTWS **agrees** to retain its guidance that TSPs only issue threat messages for earthquakes outside the designated PTWS source area when tsunami amplitudes within that TSP's coastal service area are expected to exceed 0.3 meters; and
- The ICG/PTWS **agrees** to add guidance to allow TSPs to issue Tsunami Information Statements for large earthquakes that occur close to but outside of the defined PTWS source boundary when it is judged by the TSP that the event may cause concern within its service area either because of the large earthquake magnitude, because a tsunami threat or warning message has been issued closer to the earthquake, or because a tsunami has been observed;
- TSPs will include special language within such Tsunami Information Statements to make it especially clear that it is forecasting no tsunami threat only for the coasts within its service area, and the boundary of the service area in that general region will be clearly stated.

Noting that there are two Tsunami Service Providers (TSPs) operating for the PTWS and another two TSPs approaching commencement of their services,

Considering that some of the documentation regarding PTWS TSP services is now out-of-date and all was developed without an overall plan,

Acknowledging that all the individual TSP user's guides have similar categories of information regarding their services but organized in different ways,

Decides the following:

- The Operational User's Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) ([IOC Technical Series No. 87](#)) that contained detailed information about PTWC, NWPTAC, and WC/ATWC services be revised to be a more general overview document of all TSP services;
- The existing and emerging TSPs create or revise their current individual TSP user guides (e.g., [IOC Technical Series No. 105](#) for PTWC, [IOC Technical Series No. 142](#) for NWPTAC, SCSTAC User's Guide after published within the IOC Technical Series) with a similar structure and content;
- The structure and content of the individual TSP user's guides discussed and generally agreed upon by TSP representatives at ICG/PTWS-XXVIII will be finalized and agreed to by the TSPs and Working Group 2 no later than June 30, 2019;
- The new or revised TSP User's Guides will be submitted to Working Group 2 for its review and approval no later than June 30, 2020;
- The overview document indicated above will be created by ITIC and the IOC Secretariat in consultation with the TSPs and finalized before ICG/PTWS-XXIX;
- The SCSTAC User's Guide in its existing format and content and accepted as an official publication within the IOC Technical Series upon endorsement of the IOC Assembly to be held in June 2019 will be used for full operation of the SCSTAC. The format and content of the endorsed and published SCSTAC User's Guide can then be modified in accordance with the aforementioned procedure;
- The IOC Secretariat will publish the guides and overview documents in accordance with their publication procedures.

Recognizing the current technical limitations of producing timely and accurate forecasts of local tsunami events,

Noting the instruction to Working Group 2 by ICG/PTWS-XXVII to develop guidelines and Standard Operating procedures (SOPs) to inform the "best practice" response to these local tsunami events;

Further noting the report of Working Group 2 on the development of a document of "best practice" response to these local tsunami events,

Decides the acceptance of the document "*Local-Source Tsunami Response Best Practice*" contained in [Annex IV](#) as a first version for the guidance of Member States, and

Instructs Working Group 2 to provide regular updates of the document, at least once every two years;

Recognizing the need to improve the speed and accuracy of source characterization in support of local source tsunamis, analysis of GNSS offset data holds promise for helping to directly depict seismic deformation and rapidly estimate the co-seismic sea floor deformations,

Noting that real-time sharing of GNSS data, in the form of satellite messages, receiver offsets and/or processed seismic solutions between Member States, TSPs, and NTWCs is necessary to support this capability,

Recommends Member States with GNSS data to investigate the means of sharing this data in real time. In exchange for sharing data and/or analyzed results, Member States will receive the benefit of improved tsunami impact forecasts for their vulnerable coastlines, with better potential for saving lives, particularly in the near-field.

Recognizing the potential of SMART Cables to significantly improve tsunami warnings,

Having endorsed the continuing efforts of the ITU/WMO/UNESCO-IOC Joint Task Force (JTF) toward SMART cables implementation, and

Reaffirming the same recognition and endorsement made by the PTWS Steering Committee in its meeting in June 2018,

Requests the SMART cable expert team and the Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region to complete and expand on the report describing the need and benefits of SMART cables for earthquake and tsunami early warning, in addition to climate and ocean observation purposes, and **further requests** the expert team to report on progress made to the PTWS XXIX.

Acknowledging the availability of deep-water sea level data is fundamental for tsunami forecasting and validation **and noting** the lack of available metadata for these systems, such as accurate location information for the Bottom Pressure Recorder (BPR), can undermine their use as effective tsunami detection and forecast tools,

Recommends the PTWS should agree on a mechanism for all Member States who own and operate a DART or DART-like system to ensure that both, data and metadata of these systems is pro-actively shared by the owner States every time there is a new deployment, re-deployment, or simply on a regular basis to confirm no changes to their national array. Details of the parameters that should be included in the metadata should also be coordinated;

Instructs Working Group 2 to bring a draft recommendation for cataloguing and updating this critical DART siting information to the PTWS Steering Committee, for subsequent discussion and endorsement at the next session (PTWS XXIX).

Financial implications: None

Recommendation ICG/PTWS-XXVIII.3

Disaster Risk Management and Preparedness

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Noting that a meeting of the Working Group 3 was held from 4-5 June 2018,

Noting that the SOP Guidelines project was completed in 2017 in the form of [IOC Manuals & Guides 76](#) *Plans and Procedures for Tsunami Warning and Emergency Management*,

Noting that the document *Preparing for community tsunami evacuations: From Inundation to Evacuation Maps, Response Plans, and Exercises* (in preparation as IOC Manuals and Guides 82) will be published by July 2019, and that this concludes the work of the Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) and Tsunami Ready,

Noting with appreciation the work of the Task Team on TEMPP and Tsunami Ready under the leadership of Dr Laura Kong, ITIC Director,

Noting that the Task Team on TEMPP and Tsunami Ready will dissolve given that the TEMPP project is now completed,

Agrees that the remaining focus of the Task Team (Tsunami Ready) will be included in the Terms of Reference of Working Group 3.

Noting that for 2019 “The Sendai Seven Campaign – 7 Targets, 7 Years” of the [Sendai Framework for Disaster Risk Reduction 2015–2030](#) focuses on **Target 4: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030**, and that in the 2020 it focuses on **Target 5: Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020**,

Noting that the International Tsunami Information Center (ITIC) has established dedicated web pages for:

- a) Maritime and Ports Guidance
- b) Structural design and vertical evacuation guidelines,

Requests Member States to send materials on the above subjects to the ITIC for sharing;

Encourages Member States to observe the World Tsunami Awareness Day (WTAD) in 2019 to address these themes with special emphasis on ports and harbors, and on vertical evacuation, and in 2020 on Tsunami Ready as a part of a national strategy.

Noting the participation of more than 35 experts from 12 countries and grand success of the first [ITIC Training on End-to-End Tsunami Early Warning Systems in Chile](#) hosted by the Hydrographic and Oceanographic Service of the Chilean Navy (SHOA), 1-10 August 2018, further noting that ITIC has held these trainings since 2001 for two weeks in Hawaii using Hawaii as a working example of an end-to-end tsunami warning and mitigation system,

Recommends to ITIC to seek opportunities to host these trainings in other countries with long-established end-to-end systems, which can share their best practices with Member States;

Noting the strong participation in the Tsunami Ready Workshop for Central American and other countries which was sponsored under the DIPECHO Project as a pre-ICG meeting organized by the IOC and ITIC, and

Recognizing its value for communicating information to build the capacities of countries,

Noting the difficulties the Pacific Island Countries and Territories (PICT) and other Members face in mobilising resources to participate in the ICG/PTWS regular sessions,

Recommends to organize a workshop or meeting about recent science developments for the tsunami warning and mitigation system prior to the ICG/PTWS-XXIX;

Encourages Member States to include in their national budgets costs for training or other support services.

Appreciating NOAA and ITIC for the further development of the Community Inundation Model (ComMIT) for hazard assessment within the Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) project to support the recognition of Tsunami Ready communities,

Appreciating NOAA and ITIC for the additional development of the Tsunami Coastal Assessment Tool (TsuCAT) for situational awareness and use as exercise tool to assist Member States in conducting tsunami exercises using the PTWC Enhanced Products,

Recommends that the ComMIT tool is further developed and enhanced in order to support and automate the computation of tsunami simulations from a large number of potential scenarios (e.g., from IOC Scientific meeting of experts), and these to be included in the TsuCAT database of pre-computed scenarios;

Requests that NOAA and ITIC further develop TsuCAT to facilitate exercises by including tools that enable the creation of exercise MSEL (Master List of Events) that include additional injects to be able to conduct realistic tsunami exercises, and to provide training on the use of TsuCAT's features.

Appreciating the development by Working Group 3 of a draft standardized post-event survey (*After Action Evaluation Survey*) for countries to complete and capture lessons identified from events that do not trigger the established IOC post-event assessment survey thresholds,

Requests Member States to review and provide feedback to Working Group 3 to document *After Action Evaluation Survey* for finalization at the ICG/PTWS-XXIX in 2021.

Noting that at least thirteen Member States have undertaken or are in the process of undertaking or plan to undertake Tsunami Ready,

Approves the revised text of the Tsunami Ready Guidelines for the PTWS ([ANNEX V](#)), as reviewed by the intra-session Working Group.

Noting that Working Group 3 reported on a review of the current PTWS Working Groups and Task Teams structure against the structures of other ICGs,

Also noting that the current [PTWS Medium-Term Strategy](#) ends in 2021, and that the next Medium-Term Strategy will further inform the PTWS Working Groups and Task Teams structure,

Agrees that the Chair of Working Group 3 would pursue his work with regards to the future PTWS structure, with the support of the Chair and Vice-Chairs of the ICG/PTWS and the Chairs other Technical Working Group, with the following focus:

1. Develop a draft PTWS Medium-Term Strategy for 2022-2029 to be discussed by the PTWS Steering Committee in 2020, and approved by the next ICG/PTWS session in 2021. The draft Medium-Term Strategy for 2022-2029 should take in account the Sendai Framework for Disaster Risk Reduction, Key Performance Indicators (KPI) process and the PTWS drivers of the UN Decade of Ocean Science for Sustainable Development.
2. Analyze and propose new PTWS structures that align with the draft Medium-Term Strategy for 2022-2029, and link with wider IOC and WMO (JCOMM or the equivalent

body, following the expected restructuring of WMO) efforts to engage in a multi-hazard early warning system framework.

Financial implications: None

Recommendation ICG/PTWS-XXVIII.4

Full Operation of South China Sea Tsunami Advisory Center

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Recalling that the Intergovernmental Oceanographic Commission (IOC) adopted Resolution EC-XLI.6, which encourages the Member States around the South China Sea and other regional seas, as appropriate, to actively promote the development, establishment and sustained operation of national and sub-regional Tsunami Warning and Mitigation Systems within the framework of ICGs,

Recalling further that the ICG/PTWS adopted Recommendation ICG/PTWS-XXIII.5, which established the Working Group for the South China Sea (WG-SCS), and Recommendation ICG/PTWS-XXIV.4 to establish a sub-regional Tsunami Warning and Mitigation System for the South China Sea region within the framework of the ICG/PTWS,

Recalling further that the ICG/PTWS adopted Recommendation ICG/PTWS-XXV.3, which approved the establishment of a WG-SCS Task Team on the Establishment of a South China Sea Tsunami Advisory Centre (SCSTAC), and accepted China's offer to host the SCSTAC and recommended to initiate the establishment of the SCSTAC under the guidance of the WGSCS,

Recalling further that the ICG/PTWS adopted Recommendation ICG/PTWS-XXVII.3, which decided to commence the trial operation of SCSTAC in late 2017, with specific date to be decided by the Steering Committee of the ICG/PTWS, and also **recalling** that the PTWS SC at its virtual meeting accepted the proposal to start the trial issuance of SCSTAC products in January 2018,

Recalling further that the trial operation of SCSTAC started on 26 January 2018, as decided by the Steering Committee of the ICG/PTWS on 11 September 2017, with satisfactory performance,

Having considered:

1. the report of the Fourth meeting of the ICG/PTWS WG-SCS, held in Jakarta, Indonesia, 11-12 February 2015,
2. the report of the Fifth meeting of the ICG/PTWS WG-SCS, held in Manila, the Philippines, 2-4 March 2016,
3. the report of the Second Task Team Meeting on the Establishment of the South China Sea Tsunami Advisory Centre (SCSTAC), held in Beijing on 24-26 October 2016,
4. the report of the Sixth meeting of the ICG/PTWS WG-SCS, held in Shanghai, China, 1-3 March 2017,

5. the report of the Seventh meeting of the ICG/PTWS WG-SCS, held in Hanoi, Vietnam, 6-8 March 2018, as well as the Third Task Team Meeting on the Establishment of the SCSTAC preceding WG-SCS-VII on 5 March 2018,
6. the report of the Eighth Meeting of the ICG/PTWS WG-SCS, held in Jakarta, Indonesia, 4-6 March 2019,

Having considered the coordination among the Pacific Tsunami Warning Center (PTWC), the North West Pacific Tsunami Advisory Center (NWPTAC) and SCSTAC on consistency of earthquake parameters in the South China Sea region after the full operation of SCSTAC as follows:

1. Noting that SCSTAC responds to an earthquake with magnitude equal to or greater than 6.0 within its Area of Service (AoS), and to major earthquakes that occur outside but pose a threat to AoS,
2. SCSTAC takes the priority on determining earthquake parameters at its AoS,
3. For Centroid Moment Tensor (CMT) solutions of major earthquakes within SCSTAC's AoS, the TSPs rely on their own operations,

Agrees to accept the document "[*User's Guide for the South China Sea Tsunami Advisory Center \(SCSTAC\) products for the South China Sea Tsunami Warning and Mitigation System*](#)" as an official publication within the IOC Technical Series upon endorsement of the IOC Assembly to be held in June 2019;

Decides to commence the full operation of SCSTAC on 5 November 2019, to be announced by the IOC Secretariat to WG-SCS Member States through Circular Letter at least 60 days in advance;

Expresses appreciation to NWPTAC for its reliable interim tsunami services which was started in 2006 and will be stopped following the full operation of SCSTAC;

Requests PTWC to continue to provide tsunami services to the SCS region in parallel with SCSTAC during its full operation.

Financial implications: None

Recommendation ICG/PTWS-XXVIII.5

Trial Operation of Central America Tsunami Advisory Center (CATAC)

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Considering the report of the fourth meeting of the Regional Working Group for Central America of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS), held in Managua, Nicaragua, on 11 February 2019,

Considering recent tsunamis on the Pacific (September 1992 and August 2012) and Caribbean Central America coasts (1991, 2009 and 2018), and the potential loss of life and economic impact caused by such possible future events,

Considering that in 2011, at its second meeting, the Regional Working Group for Central America of the ICG/PTWS recommended the strengthening of the human resources of the institutions responsible for tsunami early warning systems, the establishment of a tsunami early warning centre in Central America, and the implementation of education on tsunami hazards and their impact (floods) by the institutions responsible for emergency response systems,

Recalling that on 1 October 2014, the Pacific Tsunami Warning Center (PTWC) began providing the new Enhanced Tsunami Products, endorsed by the Pacific Tsunami Warning and Mitigation System (PTWS) and UNESCO/IOC,

Considering the Coordination Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC) as the institution specialized in integrated disaster risk management in Central America and that harmonizes the approach to these priorities with the strategies and agendas of other specialized bodies of the Central American Integration System (SICA),

Considering the efforts of Central American countries and regional organizations to establish new seismic stations, to maintain existing stations, and to make progress in the exchange of seismic data so as to advance tsunami and earthquake warning and research capabilities in Central America,

Urges further reduction of the gaps in seismic coverage through the exchange of seismic data and the establishment of new seismographic stations, particularly in the Caribbean area, to support the Pacific Tsunami Warning and Mitigation System (PTWS) in accordance with the requirements recommended by the ICG/PTWS and the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS);

Considering the experience of the Instituto Nicaraguense de Estudios Territoriales ([INETER](#)) in monitoring seismic activity and operating the tsunami warning system 24 hours a day, seven days a week, since 1992,

Considering and appreciating the technical cooperation provided by the Japan International Cooperation Agency (JICA) to Nicaragua for the creation of the Central America Tsunami Advisory Centre (CATAC) and the strengthening of the regional system, including technical training,

Decides to support the efforts and progress made by Nicaragua in the creation of the Central America Tsunami Advisory Centre (CATAC), as a tsunami service provider (TSP) within the framework of the ICG/PTWS;

Also decides to support the proposal to begin sending trial tsunami messages as of August 2019, based on the progress made in capacity-building for the establishment of the Central America Tsunami Advisory Centre (CATAC) using the official IOC ICG/PTWS list of National Tsunami Warning Centres (NTWCs) and Tsunami Warning Focal Points (TWFPs);

Recommends that countries ensure the development and strengthening of national institutional and personnel capacities in early warning systems;

Also expresses its appreciation for the funding that the European Union, through its Directorate-General for European Civil Protection and Humanitarian Aid Operations (ECHO), provided to UNESCO, through the Intergovernmental Oceanographic Commission (IOC), for the strengthening of the regional warning and prevention system, including technical training;

Further decides to submit to CEPREDENAC the report of the fourth meeting of the Regional Working Group for Central America of the ICG/PTWS for inclusion in the agenda of its second ordinary meeting;

Instructs the Technical Secretary of the PTWS to deliver this recommendation to the ICG/CARIBE-EWS and to forward this recommendation to CEPREDENAC for appropriate action.

Financial implications: None

Recommendation ICG/PTWS-XXVIII.6

UN Decade of Ocean Science for Sustainable Development (2021-2030)

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS),

Recognizing the unique opportunity to advance the global tsunami forecast and warning system capability provided through the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) given the close alignment between the Decade and ICG/PTWS strategic outcomes,

Advocates that the UN Decade of Ocean Science for Sustainable Development (2021-2030) foster the conditions for an initiative aimed at enhancing sensing and analysis strategies to enable the rapid characterization of tsunami sources, which it holds as fundamental in transforming the ability of Member States to forecast and warn against local and/or non-seismic source tsunami threats;

Noting that this initiative further advances the global tsunami forecast and warning system's ability to detect and measure tsunamis formed by atypical sources for example landslides, volcanic eruptions, and complex ruptures, for which there is currently little to no near-real time capability,

Further noting that a key underpinning of this effort relates to our ability to precisely map the sea floor, particularly near coastal zones. This not only contributes to tsunami forecast accuracy, but also the ability of emergency managers to plan for the threat and for communities to evacuate before the first waves arrive,

Recommends that Member States contribute where possible to the Decade by sharing existing and new data that advance detection capabilities and promote conceptually this effort within their own policy-making arenas as a demonstration of the progress made in realizing the above-mentioned initiative;

Further recommends this initiative be endorsed by the TOWS-WG, be advocated for at the upcoming Ocean Decade Planning Group meeting, WMO Congress, IOC General Assembly, and the UN General Assembly.

Financial implications: None

ANNEX III

OPENING SPEECHES

Opening Statement by Vladimir Gutiérrez, Ph.D., Co-Director of the Instituto Nicaraguense de Estudios Territoriales (Nicaraguan Governmental Geosciences Institution, [INETER](#))

Dear Heads of Delegation, delegates and observers from the countries of the Pacific Basin who are with us today (from Australia, Canada, USA, Chile, China, Colombia, Costa Rica, El Salvador, Fiji, French Polynesia, Guatemala, Honduras, Japan, México, New Zealand, Panamá, Peru, Korea, Russia, Tonga and Nicaragua).

It is both, a privilege and a pleasure, for me, to address you on behalf of the Nicaraguan Government of Reconciliation and National Unity (GRUN), on behalf of our president, Comandante Daniel Ortega Saavedra, and our vice-president, Compañera Rosario Murillo, I give you the most cordial welcome to Nicaragua, and welcome to this (28th) Twenty-eighth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).

For the Government of Nicaragua, the Tsunamis, the natural hazards and the socio-natural risks, are highly sensitive issues, and that is why our government mandate to institutions such as INETER and SINAPRED to strengthen ourselves in the preparation against Risks to Disasters, with the primary objective of Safeguarding the Life of the Population.

As you may know, Nicaragua was hit by an earthquake-tsunami in 1992.

This had its epicenter, some kilometers off the coast of Masachapa (a nearby beach: at 2 km from this Montelimar beach), with a magnitude of 7.7 degrees and waves of around 10 meters tall.

This Tsunami affected 26 villages along the 250 kilometers of the Nicaraguan Pacific coast, with more than 170 deaths, and 500 injured. We learned a lot from this Tsunami.

Apart of the affectations, this Tsunami represented a turning point in Nicaragua, regarding the preparation, that, since 2007 has been strengthening, against Tsunamis and other types of natural hazards, and, in addition, this Tsunami, represented a milestones at international level:

a)... Remember that it was the first tsunami of its kind, "earthquake-tsunami", captured by modern broadband seismometers which reflected that the highest energy was contained in the seismic waves of long periods.

b)... Due to the unusual characteristics of this earthquake-tsunami, the International Tsunami Survey Team (ITST) was formed.

In Nicaragua, we have been developing important advances in the Tsunamis area, with our own efforts, but also with the important support of different projects, that are carried out in cooperation with organizations, such as UNESCO, and the international cooperation of friends countries.

In this context, it is relevant to mention that Nicaragua, through INETER, is the headquarters of the Central America Tsunami Advisory Center (CATAC), a regional tsunami center that has been starting to operate since 2016, with the support and cooperation of Japan. At present time CATAC generates very valuable products for the entire Central American region.

This event has as its purposes:

(1) to review the monitoring goals, and (2) to review the performance goals of the Tsunami mitigation and warning systems, (3) to evaluate the results of the PacWave-2018 exercise, and (4) to decide on recommendations to improve Tsunami preparedness in the Pacific Ocean.

Joining together these purposes, among all the countries of the Pacific Basin, denotes the common interest we have, to establish links and mechanisms, which allow us to bring our efforts together, for the exchange between nations.

These objectives to be discussed at this event, are a sample of the progress and the challenges that our countries have to face, regarding to Tsunami Warning and Mitigation.

Finally, we would like to thank you, for the enthusiastic response, you have given to us, in confirming your participation, here in Nicaragua, to this 28th session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).

We are all congratulated for this new opportunity to share experiences, between professionals and research institutions associated with the Tsunami Warning and Mitigation topics.

I wish you all successes, in the development of this event, and I hope you enjoy the organization of it.

Thank you very much for your presence, and again, welcome to Nicaragua.

Vladimir Gutiérrez, Ph.D.

Opening Statement by Lic. Xochilt Cortez, Co-Director of the National System for the Prevention and Mitigation of Disasters ([SINAPRED](#))

Es un gusto acogerlos en nuestro país, en nombre de SINAPRED y del Gobierno de Nicaragua les damos la bienvenida y esperamos puedan conocer un poco de él (nuestra cultura gastronomía...)

Quiero iniciar estas palabras, recordando que, debido a su posición geográfica, Nicaragua es considerado un país multiamenazas, históricamente afectado por sismos, erupciones volcánicas, huracanes, inundaciones, incendios forestales y tsunamis.

Todos recordamos la experiencia de Nicaragua con el tsunami del 1 de septiembre de 1992, un evento que destruyó grandes partes de la zona del pacífico con olas que alcanzaron los 4 y hasta 10 metros de altura, posterior a un sismo fuerte en el océano, causando la muerte de más de 100 personas.

Y es precisamente eso, lo que nos tiene hoy reunidos en esta sesión, trabajar por un objetivo en común, la reducción de pérdidas de vidas humanas ante eventos como tsunami que afecta en su gran mayoría a las comunidades de las zonas costeras de nuestro país.

Resulta realmente importante que estemos reunidos hoy aquí celebrando la Vigésima Octava Reunión del Grupo Intergubernamental para el Sistema de Alerta y Mitigación de Tsunamis en el Pacífico, donde saldrán importantes aportes para fortalecer los sistemas de mitigación y alerta ante tsunamis en el Océano Pacífico, para mitigar, en primer lugar, para alertar a nuestras comunidades y autoridades ante tsunamis y evitar pérdidas de valiosas vidas.

Con el apoyo de la UNESCO también estamos trabajando en el fortalecimiento de los sistemas de alerta temprana ante tsunamis en la Costa del Caribe Sur, en un esfuerzo que involucra a todos desde el proceso de construcción de un protocolo operativo que será utilizado a nivel centroamericano.

Todo este esfuerzo encaja perfectamente en las acciones que como gobierno venimos ejecutando, pero también en los procesos que se desarrollan en la región centroamericana, donde hemos venido consensuando un enfoque común, que nos garantice, un mecanismo de respuesta ágil, para dar mayor seguridad a las poblaciones que viven en zonas costeras".

Esperamos que estos cuatro días de sesiones de trabajo sean muy bien aprovechados para reflexionar y compartir los criterios de cada uno de nosotros que nos encamine a mitigar y salvar vidas ante una situación que se nos pueda presentar. Muchas Gracias y quedan en su casa.

Opening Statement by Mrs Esther Kuisch-Laroche, Director and Multi-Country Representative of the United Nations Educational, Scientific and Cultural Organization (UNESCO)

En nombre de la Oficina de la UNESCO para Costa Rica, El Salvador, Honduras, Nicaragua y Panamá, quisiera unirme a las palabras de bienvenida de mi colega Vladimir, con especial atención al Instituto Nicaragüense de Estudios Territoriales ([INETER](#)), por el apoyo brindado para la realización de esta importante reunión.

En el caso particular de Centroamérica, en el año 1992, un terremoto de magnitud 7.6 impactó las costas de Nicaragua, provocó un oleaje de hasta 10 metros y una amplia destrucción en zonas costeras como El Tránsito (Nicaragua). Más de 40.000 personas perdieron su hogar o sus medios de subsistencia. En 2009, un tsunami afectó Honduras y Guatemala y en 2012 un tsunami de 5 metros afectó las costas pacíficas en El Salvador y Nicaragua.

Desde la ocurrencia del evento emblemático de 1992 hasta la actualidad, un largo camino se ha recorrido en la región en términos de preparación ante tsunamis.

El año pasado, el 10 de enero de 2018 un terremoto frente a Honduras generó un boletín de amenaza de tsunami por el Centro de Alerta de Tsunamis del Pacífico (PTWC) en su función de Proveedor de Servicios de Tsunami para la región del Caribe. Las organizaciones nacionales de emergencias en Honduras, Belice y Jamaica fueron alertadas, se activaron y mantuvieron un monitoreo permanente de la situación. Se observó que la población expuesta que había participado previamente en las actividades de preparación se comportó de manera diferente a las que no habían participado y sabía qué hacer, lo que demuestra la pertinencia de nuestras actividades de preparación para desastres.

En la actualidad, el Centro Nacional de Alerta del Instituto Nicaragüense de Estudios Territoriales ([INETER](#)) está trabajando para constituirse en un Centro de Asesoramiento de Tsunamis en América Central (CATAC).

El CATAC recibe información de una red de más de 400 estaciones sísmicas ubicadas en la región, emite en tiempo real información sobre terremotos y realiza la predicción de los parámetros de posibles tsunamis (tiempo de llegada de la primera ola y altura de las olas).

Este camino ha sido acompañado por la UNESCO.

The UNESCO San José Office has been working with UNESCO-IOC for the past years in order to strengthen the Tsunami Early Warning Systems in Central America at regional, national and local level.

We have been working with the colleagues who are present here today from scientific institutes and from national bodies in charge of disaster risk management on the improvement of the standard operating procedures in case of tsunami.

As a result of the project “Building resilient communities and integrated Early Warning Systems for tsunamis and other ocean-related hazards in Central America” which was generously financed by the European Commission in 2016 and 2017, 300 members of local communities improved their capacities to develop local tsunami response plans; and 50 professionals from El Salvador, Honduras, Guatemala and Nicaragua were trained in the elaboration of flood maps and identification of evacuation routes.

Approximately 3000 persons were mobilized in tsunamis drills in 2017. 150 professionals in charge of Tsunami warning systems were trained in the formulation of standard operating procedures (SOP), four national SOP were developed, and a draft regional communication protocol was shared with CEPREDENAC for approval through its official bodies.

Since a Tsunami Early Warning System can only function well, if the community at risk knows what a tsunami is, how to be prepared and how to stay safe, we also invested a lot of effort in working with the Ministries of Education and the educational communities in order to include tsunami preparedness in the class rooms.

Together with the Ministries, we developed teaching materials in El Salvador, Honduras, Guatemala and Nicaragua and trained 160 teachers in the use of these materials. We also trained 250 students and 200 parents.

As part of our current project “Strengthening early warning and response capacities for tsunami and other coastal hazards in Central America” which is also financed by the European Commission, we continuing working along the same line; this time including also Costa Rica and Panama.

Most recently, the national SOPs of Honduras, Nicaragua and Guatemala were reviewed and up-dated, and local SOPs of 5 communities have been developed and reviewed.

Four communities – Corn Island and Bluefields in Nicaragua, and Tela and Omoa in Honduras, participated with tsunami drills in the CaribeWave 2019 exercise. In total, this exercise mobilized 20,000 persons in Central America, from government, private sector, universities, schools, community organizations and the general population.

We were also able to train 70 teacher trainers on tsunami preparedness education in Nicaragua and Honduras and more will be trained in the other countries over the coming months. These persons will repeat the training with more teachers and thus, we hope to have trained over 1,000 teachers by the end of the project in October 2019.

A main expected result of the project is to achieve the recognition of 10 communities as “Tsunami Ready” by the end of October.

UNESCO is currently also working on a mobile phone application for communication between the relevant scientific institutions and the national disaster risk management bodies as well as CEPREDENAC, which will enhance the sharing of information in a speedy way.

Todo este trabajo ha sido posible gracias no solo a la excelente colaboración entre UNESCO San José y UNESCO-COI y el generoso aporte de la Comisión Europea, sino sobre todo por la colaboración y los esfuerzos realizados por las instituciones aquí presentes de los países Centroamericanas y el compromiso incansable de su personal. Quiero aprovechar esta oportunidad para expresarle nuestro agradecimiento.

Para finalizar, permítanme desearles una reunión fructífera y una vez más quisiera agradecer al Gobierno de Nicaragua por ser el anfitrión de esta importante reunión.

Muchas gracias

**Opening Statement by Dr Vladimir Ryabinin, Executive Secretary, IOC-UNESCO
Video Address**

On behalf of the IOC-UNESCO, allow me to welcome all of you to the 28th session of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS-XXVIII). I would like to convey my deep appreciation to the Government of Nicaragua and colleagues of the Instituto Nicaraguense de Estudios Territoriales ([INETER](#)) for hosting this important meeting in Montelimar, Nicaragua.

After the Boxing Day tsunami of 26 December 2004, much progress has been made in establishment of IOC-coordinated regional tsunami early warning systems in the Indian Ocean, Caribbean and Northeast Atlantic & Mediterranean. These three systems have joined the system that was already operational in the Pacific.

The Pacific Tsunami Warning and Mitigation System, formerly known as *International Coordination Group for the Tsunami Warning System in the Pacific* (ICG/ITSU), has been operating since 1965. The PTWS is a highly successful international scientific programme with the direct humanitarian aim of mitigating the effects of tsunami to save lives and property.

The PTWS encompass intergovernmental operation with supporting centres provided by its Member States, like the IOC International Tsunami Information Centre (ITIC) and the Pacific Tsunami Warning Center (PTWC) hosted by the United States, and the Northwest Pacific Tsunami Advisory Center (NWPTAC) hosted by Japan. This organisational setting is now reinforced through the South China Sea Tsunami Advisory Center (SCSTAC) hosted by China, which I had the opportunity of visiting in May 2018 on the occasion of its inauguration. I understand that at this session you will review its trial operation phase and will decide on its full operation, taking over from the interim system provided by PTWC and NWPTAC. I also understand that you will discuss the start of a trial operation phase for the Central America Tsunami Advisory Centre (CATAC) kindly hosted by Nicaragua.

These commitments and contributions of Member States are a testimony of the health of the Pacific Tsunami Warning and Mitigation System.

Ladies and Gentlemen.

The PTWS community made a significant contribution to establish and develop sister systems in the Indian Ocean, Caribbean and Northeast Atlantic & Mediterranean immediately after the 2004 Indian Ocean Tsunami. This community of managers and operational units, reinforced by an extended community of practice is now facing new challenges. The recent tsunamis in Palu and Sunda Strait of Indonesia once again remind us of the huge challenges facing the global tsunami warning community.

Tsunami warning systems have proven to be very effective in mitigating the impact of tsunamis from subduction zone seismic sources that account for a large percentage of tsunamis globally. However, the Tsunami Warning Systems are not built to respond to non-tectonic sources, like submarine landslides and landslides due to volcanic eruptions, as was also exemplified from these two recent events. In several cases these non-tectonic sources are at the same time very local and fast developing events. To complicate things further, tsunami warning for near-source regions requires rapid public response (within few minutes), more accurate and faster determination of the threat and, as you know, a substantial effort on public awareness and response.

In this context, I think it is pertinent the Pacific Tsunami Warning and Mitigation System continue to focus on system sustainability and technical enhancements with the best available science, to reinforce regional cooperation through the contributions and commitments of its Member States and to enhance community awareness and response.

The IOC Tsunami Programme, through the intergovernmental coordination of regional warning systems, capacity development activities and the support of national and regional projects, is a key stakeholder for tsunami risk reduction at the global level. And I wish to reiterate that IOC is committed to continue to facilitate, coordinate and provide governance for the Pacific Tsunami Warning and Mitigation System and the other regional systems.

Going forward the UN Decade of Ocean Science for Sustainable Development being coordinated by the IOC could provide a great platform for reinvigorating multi-lateral cooperation in tsunami and multi-hazard early warning systems. And I am pleased to learn that you will also discuss how to use and contribute to Decade.

In conclusion, let me wish you all a very successful meeting and once again thank the Government of Nicaragua for hosting this important meeting.

ANNEX IV

“LOCAL-SOURCE TSUNAMI RESPONSE BEST PRACTICE”

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INTRODUCTION

The purpose of this document is to outline the guiding principles that should be used by Member States of the Pacific Tsunami Warning and Mitigation System to manage local-source tsunami events. This is not intended to be a detailed, prescriptive procedure, but an outline of agreed best practice to assist Member States in developing their own response and readiness procedures and plans. Currently this document is largely designed for local tsunami generated by large earthquakes, but in future could be extended to include tsunamis from volcanic, landslide, and non-typical sources.

It provides guidance on:

- 1.0 Local-Source Tsunami Priorities
- 2.0 Warning Types
- 3.0 Public Awareness and Education
- 4.0 Detection and Characterisation
- 5.0 Items for Subsequent Consideration

1.0 LOCAL-SOURCE TSUNAMI PRIORITIES

1.1 Self-evacuation is the key to surviving local tsunamis, particularly those with very short lead times. People must know and immediately recognise the natural warning signs and be able to self-evacuate successfully. Clear planning and instructions are required on when to evacuate, where to evacuate to, safe areas and when it is safe to return. Evacuation maps showing safe and effective routes and clear signage are essential. Effective public education and exercises will reinforce understanding of the risk and the actions required in an event. Past events provide powerful lessons that can be used to educate communities.

1.2 Official warnings are supplementary to natural warnings. The primary role of official warnings is to reinforce self-evacuation and assist all-clear decisions. People must know not to wait for official warning before evacuating.

1.3 Official warning systems must have fast and simple warning chains. The first official warning must be fast and conservative. It may be the only official warning to be received because of communications and power outages. Pre-calculated products may be the best way to produce impact estimates quickly to inform these warnings. Additional modelling and information can subsequently be used to enhance impact estimates, but they should not delay the issuance of the initial warning.

2.0 WARNING TYPES

There are fundamentally three types or categories of warnings – natural, official and unofficial. All three need to be a part of the warning process. The response plans for Member States must take all three into account. For example, official warnings must reinforce natural warning and self-evacuation.

2.1 Natural warning. Natural warnings such as strong or long shaking, unusual sea observations (receding sea level like a fast tides) or sounds (loud aircraft-like roaring) indicate

immediate self-evacuation is required. These can also include animal behaviour, such as animals running away from the ocean.

2.2 Official warnings. These are the warnings issued by the National Authority of Member States. Tsunami Service Providers (TSPs such as the Pacific Tsunami Warning Centre, PTWC) issue advisory messages to assist the NTWC to respond to events, but it is the designated NTWC which is responsible for issuing official warnings.

2.21 Official warnings should be designed to reinforce natural warnings and strengthen self-evacuation. It is very important that official warnings do not slow down natural self-evacuation.

2.22 Target releasing warning quickly (target within 10 minutes). Best practice is to issue warnings within 5 to 10 minutes for a local-source tsunami, based on the best information available at the time. However, it is always worthwhile issuing warnings as soon as possible because of the reinforcement of self-evacuation indicated above, and because a local source for nearby people is a regional source for others, allowing more time to evacuate for people further up or down the coast.

2.23 Error on the side of caution. . The first released warning message should be conservative for local-source tsunami. The warning status can be revised once more information becomes available.

Noting that official magnitude estimates often change considerably in the first 30 minutes, it is important to use conservative initial estimates of magnitude until a stable magnitude is reached. For example, in New Zealand 0.3 magnitude units are added to the official magnitude estimates when first assessing the tsunami threat. Another example is Japan (JMA), which uses a worst case scenario of magnitude if the network is suspected to be saturated.

It is often easier and safer to scale down following an over-estimation of impacts than to scale up after an underestimation.

2.24 Target regular warning updates. Use updates both to convey new information but also to reinforce the urgency of the situation and the need to evacuate. Consider developing (and educating the public about) a set schedule of warning updates (even if no change) to allow updated assessment information and build confidence of the communities in a response.

2.25 All clear. It is very important to have mechanisms and procedures for declaring all clear, particularly so for local-source tsunami. Because warnings need to be early and conservative in these events, the chance of false positives are high. Having procedures to quickly step back from the warning state are important but doing so too early has caused issues in the past.

2.26 Issue warnings over multiple channels if possible. Research shows that people are more likely to act upon information if it comes from multiple sources. Possible channels include radio, television, cell phone messages, social media and audible alerts (e.g. sirens). Supplementary information can be made available on slower or static media such as websites.

2.27 Be consistent. Where possible, use the same alert and warning mechanisms throughout the country or area. Many people may not be in their home area when an event occurs. If mechanisms are geographically consistent it is far more likely that they

will recognise a warning and know how to respond. Fast, effective community response is essential in time-critical events such as local tsunamis.

2.3 Unofficial warnings: Unofficial warnings come from the community, friends and family. They may be relaying official warning or natural warning sign observations. Social media is now a strong source of unofficial warnings.

3.0 PUBLIC AWARENESS AND EDUCATION

3.1 Have effective, comprehensive and continuing public education programmes. These programmes should be based on natural warnings. It is suggested that the New Zealand “Long or Strong, Get Gone” programme is a good model for an education programme. Education should include that ‘long’ shaking can be made up of what may feel like separate events – which are in fact the different energy phases of a single earthquake.

Any education programme should include what citizens can expect from official warnings (mechanism and timing) and how to recognise and respond to the natural warnings described in 2.1.

Education programmes need to include what tsunamis are and what to do when tsunamis strike, drawing on historical examples, preferably locally, but international examples are also useful. The action advice should include evacuation routes, maps and safe areas in the local area. It is important to target schools and Emergency Management Centres as mechanisms to educate communities. Planning should also make use of local knowledge and contacts (eg to devise evacuation routes, develop and use appropriate language and signage, and to design effective vertical evacuation – buildings, trees, etc.).

Exercises. Use regular public exercises to reinforce the desirable actions following a strong or long earthquake and official tsunami warnings. Reinforce desired actions with exercises through schools and Emergency Management agencies. Exercises can be at the local, regional or national level. Reinforce the importance of natural warning during exercises and stress that local-sources tsunami official warning are additional information to reinforce natural warning signs and self-evacuation. Allow local communities to practise the likely order of developing events for local-source tsunami to reinforce the “Long or Strong, Get Gone” message.

3.2 Undertake debriefings and post-event public response analysis. Events and exercises should be debriefed in detail. Much can be learned and improved both locally and internationally by understanding the responses to significant tsunami events. As a result, documents and Member State planning and procedures, including detailed SOPs, should also be reviewed after significant events and exercises to reflect any lessons.

4.0 DETECTION AND CHARACTERISATION

4.1 Use shaking. The strength and duration of shaking can be used to help estimate likely impacts, or to corroborate/challenge the earthquake solution. The SOPs of NTWS should consider shaking intensity when assessing the likely tsunami generated by a local earthquake. Shaking strength and extent can also be used as proxy for rupture size (and hence event size in the earthquake case).

4.2 Use magnitude threshold tables. The first estimates of magnitude, location and depth should be used to estimate likely threat and impacts from tsunami with pre-agreed threshold tables for specified locations. As described in 2.23, a conservative approach should be taken to early magnitude estimates if using such tables.

4.3 Refine with more information. Have concise SOPs to ensure warnings are updated quickly as more information becomes available. SOPs should cover how these updates are managed and distributed – e.g. a threshold of change, or what is done when there is no change.

4.4 Regular SOP training and exercising. Conduct regular training and testing of NTWC procedures, particularly for local-source tsunami warnings where time to act is very limited. These exercises should also include testing of communication methods, and debriefing to identify areas needing improvement.

5.0 ITEMS FOR SUBSEQUENT CONSIDERATION

1. The inclusion of false alarms in 3.0 - Public Awareness and Education to maintain confidence and proactive action
2. A separate piece of work to identify the minimum viable capability required of a NTWC and develop guideline procedures and techniques to deliver it.
3. Add references to support research findings mentioned
4. Expand scope or perform a separate piece of work to cover non-typical or non-earthquake-generated tsunamis (2018 Indonesian Palu and volcanic tsunamis, Nicaragua 1992 slow earthquakes)
5. Further refinement of the definition of natural warnings
6. The inclusion of recommendations on communication channels

ANNEX V

PTWS TSUNAMI READY GUIDELINES

The ICG/PTWS at its 28th session reviewed and agreed the following ten Tsunami Ready Guidelines so they are better understandable against their intent:

UNESCO IOC TSUNAMI READY GUIDELINES	DONE
MITIGATION (MIT)	
MIT-1. Have designated & mapped tsunami hazard zones	X
MIT-2. Have a public display of tsunami information	X
PREPAREDNESS (PREP)	
PREP-1. Have a tsunami evacuation map developed in collaboration with communities and local authorities	X
PREP-2. Develop and distribute outreach and public education materials	X
PREP-3. Hold at least three outreach or educational activities annually	X
PREP-4: Conduct an annual tsunami community exercise	X
RESPONSE (RESP)	
RESP-1. Address tsunami hazards in the community's emergency operations / response plan	X
RESP-2. Have the capacity to manage emergency response operations during a tsunami	X
RESP-3. Have redundant and reliable means to receive official tsunami warnings 24x7	X
RESP-4. Have redundant and reliable means to disseminate official tsunami warnings and information to the public 24x7	X