

**Intergovernmental Oceanographic Commission**  
*Reports of Governing and Major Subsidiary Bodies*



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

**Twenty-eighth Session**

Barcelo Montelimar, Nicaragua  
2–5 April 2019

**UNESCO**

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<sup>1</sup> The Executive Summary is available in French, Spanish and Russian.

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## Executive summary

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The Twenty-eighth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVIII) was held in Barceló Montelimar, Nicaragua, from 2 to 5 April 2019, chaired by the ICG/PTWS Chair (a.i.), Dr Wilfried Strauch (Nicaragua). The meeting was attended by 63 participants from 21 countries, and 4 Observer organizations.

The **ICG established** a Working Group 2 Task Team on the minimum competency levels for National Tsunami Warning Centre (NTWC) operations staff, and a Working Group 2 Task Team on the integrated PTWS sensor networks for tsunami detection and characterisation.

The **ICG decided** to hold an Exercise Pacific Wave 2020 (PacWave20) which 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).

The **ICG decided** 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.

The **ICG recommended** 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.

The **ICG requested** Chair of Working Group 3 to 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 **ICG agreed** 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 of other Technical Working Group.

The **ICG decided** to commence the full operation of the South China Sea Tsunami Advisory Center (SCSTAC) on 5 November 2019.

The **ICG decided** 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; it **also decided** to support the proposal to begin sending CATAC trial tsunami messages as of August 2019 using the official IOC ICG/PTWS list of National Tsunami Warning Centres (NTWCs) and Tsunami Warning Focal Points (TWFP).

The **ICG advocated** 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.

The **ICG recommended** 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.

The **ICG expressed its gratitude** to the Government of Nicaragua for kindly hosting the 28<sup>th</sup> session of the ICG/PTWS and **accepted** the offer of the Government of Japan to host the 29<sup>th</sup> session in 2021.

The **ICG elected** Mr Wilfried Strauch (Nicaragua) as Chair, and Mr Ofa Fa'Anunu (Tonga) and Mr Yuji Nishimae (Japan) as Vice-Chairs for the ICG/PTWS for the period May 2019–2021.

## Résumé exécutif

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La vingt-huitième session du Groupe intergouvernemental de coordination du Système d'alerte aux tsunamis et de mitigation dans le Pacifique (GIC/PTWS-XXVIII) s'est tenue à Barceló Montelimar, Nicaragua, du 2 au 5 avril 2019, sous la présidence du Président (par intérim) du GIC/PTWS, M. Wilfried Strauch (Nicaragua). Elle a rassemblé 63 participants de 21 pays, ainsi que 4 organisations observatrices.

Le **GIC a constitué** une Équipe spéciale du Groupe de travail 2 sur les niveaux de compétence minimum pour le personnel opérationnel du Centre national d'alerte aux tsunamis (NTWC) et une Équipe spéciale du Groupe de travail 2 sur les réseaux intégrés de capteurs du PTWS pour la détection et la caractérisation des tsunamis.

Par ailleurs, le **GIC/PTWS a décidé** d'effectuer un exercice d'alerte au tsunami (PacWave 2020), qui se déroulera de septembre à novembre 2020, pour marquer la Journée internationale pour la réduction des risques de catastrophe (13 octobre) et la [Journée mondiale de sensibilisation aux tsunamis](#) (5 novembre).

Le **GIC a décidé** d'accepter le document *Local-Source Tsunami Response Best Practice* figurant à l'[annexe IV](#) comme une première version destinée à orienter les États membres.

Le **GIC a recommandé** aux États membres pourvus de données GNSS d'étudier les moyens de partager celles-ci en temps réel. En échange de la mise en commun des données et/ou des résultats analysés, les États membres bénéficieront de meilleures prévisions des effets des tsunamis sur leurs littoraux exposés et d'un plus fort potentiel de sauver des vies, en particulier au niveau local.

Le **GIC a prié** le Président du Groupe de travail 3 d'élaborer un projet de stratégie à moyen-terme du PTWS pour 2022-2029 pour examen par le Comité directeur du PTWS en 2020 et approbation par la prochaine session du GIC/PTWS en 2021.

Le **GIC est convenu** que le Président du Groupe de travail 3 poursuivrait ses travaux en vue de la future structure du PTWS, avec l'appui du Président et des Vice-Présidents du GIC/PTWS et des Présidents d'autres groupes de travail techniques.

Le **GIC a décidé** de lancer le plein fonctionnement du Centre consultatif pour les tsunamis pour la mer de Chine méridionale (SCSTAC) le 5 novembre 2019.

Le **GIC a décidé** d'appuyer les efforts et les progrès accomplis par le Nicaragua dans la création du Centre consultatif sur les tsunamis en Amérique centrale (CATAC), en tant que prestataire de services relatifs aux tsunamis, dans le cadre du GIC/PTWS ; **il a également décidé** d'appuyer la proposition visant à commencer d'envoyer des messages d'essai du CATAC sur les tsunamis à compter d'août 2019 en utilisant la liste officielle du GIC/PTWS de la COI des centres nationaux d'alerte aux tsunamis (NTWC) et des points focaux pour l'alerte aux tsunamis (TWFP).

Le **GIC a préconisé** que la [Décennie des Nations Unies pour les sciences océaniques au service du développement durable \(2021-2030\)](#) favorise les conditions d'une initiative visant à améliorer les stratégies de détection et d'analyse pour permettre une caractérisation rapide des sources de tsunami, qu'il juge indispensable pour transformer la capacité des États membres de prévoir les risques de tsunamis locaux et/ou non sismiques et d'alerter à leur sujet.

Le **GIC a recommandé** aux États membres de contribuer, dans la mesure du possible, à la Décennie en mettant en commun les données existantes et nouvelles aptes à renforcer les capacités de détection, et de promouvoir cet effort, sur le plan conceptuel, au sein de leurs instances de formulation des politiques en témoignage des progrès accomplis dans la réalisation de l'initiative susmentionnée.

Le **GIC a exprimé sa gratitude** au Gouvernement du Nicaragua pour avoir bien voulu accueillir la 28<sup>e</sup> session du GIC/PTWS et a accepté l'offre du Gouvernement du Japon d'accueillir la 29<sup>e</sup> session en 2021.

Le **GIC a élu** M. Wilfried Strauch (Nicaragua) Président et M. Ofa Fa'Anunu (Tonga) et M. Yuji Nishimae (Japon) Vice-Présidents du GIC/PTWS pour la période allant de mai 2019 à 2021.



## Resumen dispositivo

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La 28ª reunión del Grupo Intergubernamental de Coordinación del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico (ICG/PTWS-XXVIII) se celebró en Barceló Montelimar (Nicaragua) del 2 al 5 de abril de 2019, bajo la presidencia del Presidente interino del ICG/PTWS, el Dr. Wilfried Strauch (Nicaragua). A la reunión asistieron 63 participantes de 21 países, así como cuatro organizaciones observadoras.

El **ICG constituyó** un equipo de tareas del Grupo de Trabajo 2 sobre los niveles mínimos de competencia del personal operativo de los centros nacionales de alerta contra los tsunamis y un equipo de tareas del Grupo de Trabajo 2 sobre las redes integradas de sensores del PTWS para la detección y caracterización de tsunamis.

El **ICG decidió** realizar el ejercicio Pacific Wave 2020 (PacWave20) entre septiembre y noviembre de 2020 para apoyar el Día Internacional para la Reducción del Riesgo de Desastres (13 de octubre) y el [Día Mundial de Concienciación sobre los Sunamis](#) (5 de noviembre).

El **ICG decidió** aceptar el documento sobre “Mejores prácticas locales de respuesta a los tsunamis” que figura en el [anexo IV](#) como primera versión para orientar a los Estados Miembros.

El **ICG recomendó** a los Estados Miembros que disponen de datos del Sistema Mundial de Navegación por Satélite (GNSS) que estudien la manera de compartir estos datos en tiempo real. A cambio de compartir datos y/o resultados analizados, los Estados Miembros obtendrán mejores predicciones sobre el impacto de los tsunamis en sus zonas costeras vulnerables, lo que aumentará las posibilidades de salvar vidas, en particular en las zonas cercanas.

El **ICG pidió** al Presidente del Grupo de Trabajo 3 que elaborara un proyecto de Estrategia a Plazo Medio del PTWS para 2022-2029 para su examen por el Comité de Dirección del PTWS en 2020 y su aprobación en la próxima reunión del ICG/PTWS, en 2021.

El **ICG acordó** que el Presidente del Grupo de Trabajo 3 prosiguiera su labor en relación con la estructura futura del PTWS, con el apoyo del Presidente y los vicepresidentes del ICG/PTWS y los presidentes de otros grupos de trabajo técnicos.

El **ICG decidió** que el Centro de Asesoramiento sobre los Tsunamis en el Mar de China Meridional (SCSTAC) comenzara a funcionar plenamente el 5 de noviembre de 2019.

El **ICG decidió** apoyar los esfuerzos y progresos realizados por Nicaragua para la creación del Centro de Asesoramiento sobre los Tsunamis de América Central (CATAC), en calidad de proveedor de servicios sobre tsunamis dentro del marco del ICG/PTWS; **decidió también** apoyar la propuesta de comenzar el envío de mensajes experimentales del CATAC sobre tsunamis a partir de agosto de 2019, utilizando la lista oficial de centros nacionales de alerta contra los tsunamis y puntos focales de alerta contra los tsunamis del ICG/PTWS de la COI.

El **ICG propugnó** que el [Decenio de las Naciones Unidas de las Ciencias Oceánicas para el Desarrollo Sostenible](#) (2021-2030) fomente las condiciones para una iniciativa encaminada a mejorar las estrategias de detección y análisis a fin de permitir la rápida caracterización de las fuentes de tsunamis, que el ICG considera fundamental para transformar la capacidad de los Estados Miembros de predecir y alertar contra las amenazas de tsunamis de origen local y/o no sísmico.

El **ICG recomendó** que los Estados Miembros contribuyeran al Decenio, en la medida de lo posible, compartiendo los datos existentes o nuevos que fomenten las capacidades de detección y promuevan conceptualmente esta labor en sus propios foros de formulación de políticas, como demostración de los progresos realizados en la ejecución de la iniciativa antes mencionada.

El **ICG expresó su agradecimiento** al Gobierno de Nicaragua por haber acogido amablemente la 28ª reunión del ICG/PTWS y **aceptó** el ofrecimiento del Gobierno del Japón de acoger su 29ª reunión, en 2021.

El **ICG eligió** Presidente al Sr. Wilfried Strauch (Nicaragua), y al Sr. Ofa Fa'Anunu (Tonga) y al Sr. Yuji Nishimae (Japón) vicepresidentes del ICG/PTWS para el periodo comprendido entre mayo de 2019 y 2021.

## Рабочее резюме

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28-я сессия Межправительственной координационной группы по Системе предупреждения о цунами и смягчения их последствий в Тихом океане (МКГ/СПЦТО-XXVIII) состоялась 2-5 апреля 2019 г. в отеле Барсело Монтелимар в Монтелимаре (Никарагуа) под председательством д-ра Уилфрида Строка (Никарагуа), и.о. председателя МКГ/СПЦТО. В сессии приняли участие 63 представителя из 21 страны и четырех организаций-наблюдателей.

**МКГ учредила** целевую группу рабочей группы 2 по минимальным уровням компетенции оперативных сотрудников национальных центров предупреждения о цунами (НЦПЦ) и целевую группу рабочей группы 2 по комплексным сетям датчиков СПЦТО для обнаружения цунами и определения его характеристик.

**МКГ постановила** провести учения «Тихоокеанская волна-2020» в период с сентября по ноябрь 2020 г. в поддержку Международного дня сокращения риска стихийных бедствий (13 октября) и [Всемирного дня распространения информации о цунами](#) (5 ноября).

**МКГ постановила** одобрить содержащийся в [приложении IV](#) документ «Сборник примеров передового опыта реагирования на вызванные местными источниками цунами» в качестве первого варианта руководства для государств-членов.

**МКГ рекомендовала** государствам-членам, располагающим данными ГСЧН, изучить возможности обмена этими данными в режиме реального времени. В обмен на предоставление данных и/или проанализированных результатов государства-члены смогут воспользоваться усовершенствованными прогнозами воздействия цунами на их уязвимые прибрежные зоны, что позволит им повысить эффективность спасения людей, особенно в ближней зоне.

**МКГ просила** председателя рабочей группы 3 разработать проект среднесрочной стратегии СПЦТО на 2022-2029 гг. для его обсуждения руководящим комитетом СПЦТО в 2020 г. и утверждения на следующей сессии МКГ/СПЦТО в 2021 г.

**МКГ согласовала решение** о том, что председатель рабочей группы 3 продолжит свою работу по будущей структуре СПЦТО при поддержке председателя и заместителей председателя МКГ/СПЦТО и председателей других технических рабочих групп.

**МКГ постановила** перевести Консультативный центр по цунами в Южно-Китайском море (КЦЦЮКМ) в режим полномасштабного функционирования с 5 ноября 2019 г.

**МКГ постановила** поддержать усилия Никарагуа и достигнутый прогресс в ходе создания в рамках МКГ/СПЦТО Консультативного центра по цунами для Центральной Америки (КЦЦЦА) в качестве провайдера услуг по цунами (ПУЦ); она **постановила также** поддержать предложение о том, чтобы КЦЦЦА начал с августа 2019 г. рассылку пробных сообщений о цунами по официальному списку МКГ/СПЦТО МОК национальных центров предупреждения о цунами (НЦПЦ) и координаторов по предупреждению о цунами (КПЦ).

**МКГ выступила** за то, чтобы [Десятилетие ООН, посвященное науке об океане в интересах устойчивого развития \(2021-2030 гг.\)](#), способствовало созданию условий для реализации инициативы, направленной на повышение эффективности стратегий зондирования и анализа в целях быстрого определения характеристик источников цунами, что, по ее мнению, имеет важнейшее значение для совершенствования потенциала государств-членов в области прогнозирования угрозы цунами из местных и/или несейсмических источников и предупреждения о них.

**МКГ рекомендовала** государствам-членам, по возможности, вносить вклад в проведение Десятилетия путем обмена имеющимися и новыми данными, которые способствуют укреплению потенциала в области обнаружения цунами, и оказывать концептуальное содействие этим усилиям в рамках их собственной деятельности по разработке политики, демонстрируя прогресс, достигнутый в реализации вышеупомянутой инициативы.

**МКГ выразила признательность** правительству Никарагуа за любезный прием 28-й сессии МКГ/СПЦТО в этой стране и **приняла** предложение правительства Японии провести у себя 29-ю сессию в 2021 г.

**МКГ избрала** г-на Уилфрида Строка (Никарагуа) на пост председателя, а г-на Офа Фаануну (Тонга) и г-на Юдзи Нисимае (Япония) на должности заместителей председателя МКГ/СПЦТО на период с мая 2019 г. по 2021 г.

## 1. WELCOME AND OPENING OF SESSION

- 1 The Twenty-eighth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVIII) was held in Barceló Montelimar, Nicaragua, from 2 to 5 April 2019, chaired by the ICG/PTWS Chair, Dr Wilfried Strauch (Nicaragua). The meeting was attended by 63 participants from 21 countries, and 4 Observer organizations.
- 2 Dr Vladimir Gutierrez, Co-Director of the Instituto Nicaraguense de Estudios Territoriales (Nicaraguan Governmental Geosciences Institution, [INETER](#)), welcomed the participants. He highlighted the relevance of international cooperation in the context of tsunamis, natural hazards and socio-natural risks, which are highly sensitive issues in Nicaragua and Central America. He indicated that the government of Nicaragua mandated institutions, such as Instituto Nicaraguense de Estudios Territoriales ([INETER](#)) and National System for the Prevention and Mitigation of Disasters ([SINAPRED](#)), to strengthen themselves in the preparation against disasters, with the primary objective of safeguarding the life of the population. He thanked all participants for the enthusiastic response to the invitation to come to Nicaragua to hold the 28<sup>th</sup> session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).
- 3 Lic. Xochilt Cortéz Stubbert, Co-Director of SINAPRED, recalled that due to its geographical position, Nicaragua is considered a multi-threatening country, historically affected by earthquakes, volcanic eruptions, hurricanes, floods, forest fires and tsunamis. She noted the experience of Nicaragua with the tsunami of September 1, 1992, an event that destroyed large parts of the Pacific area with waves that reached 4 and even 10 meters high, causing the death of more than 100 people. She noted that the common goal work of this session and PTWS is the reduction of loss of human lives in the face of events such as tsunami. At this session important contributions will be made to strengthen warning and mitigation systems for tsunamis in the Pacific Ocean, to alert our communities and authorities to avoid losses of valuable lives.
- 4 Lic. Cortéz Stubbert indicated that, with the support of UNESCO, Nicaragua is also working on the strengthening of early warning systems for tsunami in the Southern Caribbean Coast, in an effort that involves communities and also in the process of building an operational protocol that will be used at the Central American level. All this effort fits perfectly into the actions that the government of Nicaragua has been executing, but also in the disaster risk reduction initiatives that take place in the Central American region.
- 5 Ms Esther Kuisch Laroche, Director and Multi-Country Representative of the UNESCO [Office in San José](#), Costa Rica, noted that the 1992 event, triggered by an earthquake of magnitude 7.6 generated extensive destruction in coastal areas such as El Tránsito (Nicaragua) when more than 40,000 people lost their homes or their means of subsistence. From the occurrence of the emblematic event of 1992 to the present, a long road has been traveled in the region in terms of tsunami preparedness, however more need to be done. The UNESCO San José Office has been working with the Intergovernmental Oceanographic Commission of UNESCO ([IOC](#)) for the past years in order to strengthen the Tsunami Early Warning Systems in Central America at regional, national and local level. UNESCO and IOC have been working with colleagues from scientific institutes and disaster risk management agencies. 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 tsunami inundation maps and identification of evacuation routes. Approximately 3,000 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 the Coordination Centre for the Prevention of Natural Disasters in Central America ([CEPREDENAC](#)) for approval through its official bodies.

- 6 Ms Kuisch Laroche noted that 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, UNESCO 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, teaching materials were developed in El Salvador, Honduras, Guatemala and Nicaragua, and 160 teachers, 250 students and 200 parents were trained with and in the use of these materials. She reported that as part of our current project “Strengthening early warning and response capacities for tsunami and other coastal hazards in Central America” (2018-2019), which is also financed by the European Commission, UNESCO continues working along the same line; this time including also Costa Rica and Panama.
- 7 Through video message, Dr Vladimir Ryabinin, Executive Secretary of IOC, noted that the ICG/PTWS, formerly known as *International* Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU), has been operating since 1965 and 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 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.
- 8 Dr Vladimir Ryabinin encouraged PTWS to 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. He reiterated that IOC is committed to continue to facilitate, coordinate and provide governance for the PTWS and the other regional systems. Going forward he highlighted that the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) being coordinated by the IOC could provide a great platform for reinvigorating multi-lateral cooperation in tsunami and multi-hazard early warning systems.
- 9 Brigadier General Rogelio Flores, Director of the Civil Defence of Nicaragua, thanked Dr Vladimir Gutierrez for offering the opportunity to address this meeting. He indicated that the Army of Nicaragua, as per its mandate, has the role of addressing any calamity or threat for the country. While it works on response, the Civil Defence assists but also works on preparedness. He recalled the 1972 earthquake in Managua and the establishment of the Civil Defence in 1982, in the middle of the armed conflict. He indicated that the law #337 created a National System of Civil Protection. He detailed the functions of the National Civil Defence system, and noted that starting in 2007 with clear policies and response strategies, fatalities for these kind of events has dropped to zero.
- 10 Mr Miguel De Castilla, Permanent Secretary of the Nicaraguan National Commission for UNESCO noted that UNESCO through its efforts held in the Southern Caribbean coasts, specifically in Corn Islands and Bluefield, has had great success. On behalf of the Nicaraguan National Commission for UNESCO he wished the meeting reach its goals and in particular noted the candidature for the election of Chairperson of Mr Wilfried Strauch (Nicaragua).
- 11 Chair (a.i) of the ICG/PTWS, Dr Wilfried Strauch, recalled the significant cooperation and work with national organisations, neighbouring countries, all PTWS Member States and

international organisations. He shared his personal experience in Masachapa on 1<sup>st</sup> September 1992, where he could witness the impact of the tsunami and appraise the height of the inundation generated by the tsunami waves. He noted that this event has marked the beginning of his work on tsunami matters. Several decades have past and Nicaragua is much better prepared for these events now. He declared open the 28<sup>th</sup> Session of the ICG/PTWS and thanked the authorities for sharing their views with the group and hosting the session.

- 12 Opening speeches of Dr Vladimir Gutierrez, Lic. Cortéz Stubber, Ms Kuisch Laroche and Dr Vladimir Ryabinin are available in [Annex III](#)

## 2. ORGANIZATION OF THE SESSION

### 2.1 ADOPTION OF THE AGENDA

- 13 The Chairperson informed the Plenary that the agenda was prepared by the Secretariat and the Officers in consultation with the PTWS Steering Committee taking into account the Recommendations and instructions given at the [Twenty-seventh Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System \(ICG/PTWS-XXVII\)](#), 28–31 March 2017, Tahiti, French Polynesia.

- 14 The PROVISIONAL AGENDA **was approved** as presented, and is included as [Annex I](#).

### 2.2 DESIGNATION OF THE RAPPORTEUR(S)

- 15 The Chairperson informed Delegates that as per usual procedures a Rapporteur for the meeting needs to be appointed. He indicated that at the meeting of the PTWS Steering Committee held on Monday, 1<sup>st</sup> April 2018, the Chair was informed that USA and Guatemala may propose a candidate for Rapporteur. USA proposed Ms Jennifer Lewis (USA) and Guatemala proposed Mr Joshua Lemus (Guatemala) as rapporteurs. The Plenary accepted these nominations.

### 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

- 16 The Chairperson noted that interpretation is available for this session as agreed by the PTWS Steering Committee.

- 17 He further noted that, as customary, all the documentation is available on the website of the meeting, mainly in English.

- 18 The Chairperson informed the plenary that to guide the delegates an Annotated Agenda was provided, as documented in [ICG/PTWS-XXVIII/2 Prov.](#)

- 19 He informed the Plenary that in order to facilitate the proceedings of the meeting a Timetable was prepared by the Secretariat in coordination with the Officers, the local organizing committee and the PTWS Steering Committee. To advance policy items discussion in the timetable the item agenda 3.6 National Reports has been shifted to Thursday AM.

- 20 He noted that a deadline for nominations of candidates for Officers had been set to Wednesday, 3 April at 17:00 hrs and a deadline for submission of Draft Recommendations through the Secretariat had been set to Thursday, 4 April at 18:00 hrs.

- 21 Mr Strauch indicated that the Session on Tuesday, 2 April will end at 5:30 PM, and a reception will follow at 7 PM. A field trip was organised on Thursday, 4 April afternoon, to visit



the Hotel warning system & Masachapa community warning system, which are part of the Nicaraguan Tsunami Warning System.

22 He then offered the floor to the local Organising Committee (Ms Rosario Aviles) to provide logistic details about the field trip, welcome reception and about the logistics for working groups and plenary. A representative of the hotel introduced hotel security measures.

23 He then proposed to the Plenary to constitute two statutory sessional groups that, following nominations of Member States, were composed as follows:

- Elections Commission: Chair Mr David Coetzee (New Zealand) with members from Guatemala and Japan;
- Recommendations Committee: Chair Mr Hing-Yim Mok (China) with members from Australia, China and USA.

24 In order to smooth the work of the session and facilitate the generation of recommendations and agreements, the plenary set up five intra-sessional Working Groups to address some of the major issues addressed at the meeting, as follows:

- Working Group 2 - Local-Source Tsunami Response Best Practice & Draft National Tsunami Warning Centre Competency Framework: Chair Ken Gledhill (New Zealand) with members from Australia, Costa Rica, Tonga and USA;
- Working Group 2 - Tsunami Service Provider Users Guides: Chair Charles McCreery (USA) with members from China, Guatemala, Japan, Nicaragua and USA;
- Working Group 2 - PTWS and the UN Decade of Ocean Science for Sustainable Development (2021–2030): Chair Mike Angove (USA) with members from Korea;
- Working Group 3 - Tsunami Ready: Chair Mr David Coetzee (New Zealand) with members from Canada, Chile, El Salvador, Fiji, Honduras, Panama, Nicaragua, and Russia;
- PacWave 21: Chair Dr Laura Kong (ITIC, USA) with members from Chile, China, Japan, Mexico, Nicaragua and Tonga.

25 Mr Strauch indicated that due to limited time available the sessional Working Groups should meet outside the times of the plenary session and coordinate the booking of designated rooms with the Secretariat.

26 At this point, the Chairperson asked Mr Bernardo Aliaga, member of the IOC Secretariat, to inform the meeting about the forthcoming Election of Officers, and reminded the ICG of the deadline for nominations by Member States, according to IOC Rules of Procedure. He reported that, according to the rules, one Chair and two Vice-Chairs should be elected with candidatures accepted until EOB of the first day of the session, which was set for Wednesday, 3 April at 17:00.

27 The Chairperson requested that the time used to reporting is reduced as much as possible to concentrate on the exchange of views and decisions on policy matters. He asked Member States to deliver as much as possible national reports without PowerPoint presentations (PPTs), and the PPTs should be provided to the Secretariat for posting to the website.

28 The Chairperson opened the floor for comments from Delegates on the timetable. The timetable was approved as is.



### 3. REPORT ON INTERSESSIONAL ACTIVITIES

#### 3.1. CHAIRPERSON'S REPORT

29 Mr Wilfried Strauch presented his [report](#) for the intersessional period 2017–2019 (September 2017 to March 2019).

30 He recalled the Area of Responsibility (AoR) of the ICG/PTWS and its governance structure. He indicated that the PTWS has a Steering Committee, three technical Working Groups, four regional working groups and six Task Teams.

31 He recalled the key role of its two Tsunami Service Providers (TSPs), the Pacific Tsunami Warning Center ([PTWC](#)) and the North West Pacific Tsunami Advisory Center ([NWPTAC](#)), giving details about the PTWC Enhanced PTWS Products.

32 Mr Strauch recalled that, in accordance with the decisions of the Twenty-seventh Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, there is a more balanced effort of the ICG/PTWS across: a) risk and hazard assessment; b) warning systems; and c) awareness and preparedness, including a more proactive role in the field of Disaster Management through the initiatives of TEMPP (Tsunami Evacuation Mapping and Planning) and Tsunami Ready pilots.

33 He reported that the PTWS organised an [Exercise Pacific Wave 2018](#) (PacWave18) from September to November 2018, in support to the International Disaster Risk Reduction Day (13 October) and the [World Tsunami Awareness Day](#) (WTAD, 5 November). Regular monthly communication tests were organised by PTWC, and twice a year by NWPTAC.

34 Dr Strauch noted that the ICG/PTWS Steering Committee and Working Groups/Task Teams met on 4–8 June 2018, in Honolulu, USA, with detailed orientations decided for the Working groups and Task Teams to comply with the decisions and recommendations of ICG/PTWS-XXVII.

35 Dr Strauch indicated that at its 26<sup>th</sup> session, the ICG/PTWS agreed establishing a Task Team to develop a framework for future goals and performance monitoring measures for TSPs, NTWCs and national warning systems. The Framework had to be aligned with the [PTWS Medium Term Strategy \(2014-2021\)](#) and the [Sendai Framework for Disaster Risk Reduction \(SFDRR\) 2015–2030](#). The framework was completed in 2018 and distributed to Member States, TSPs and NTWCs in February 2019. Main goals that summarize the overall objectives for the performance monitoring are:

- Goal 1: Understanding and managing tsunami hazard risk
- Goal 2: Tsunami detection, warning & dissemination
- Goal 3: Enhancing tsunami preparedness for effective community response
- Goal 4: International coordination and cooperation

36 Dr Strauch reported as well as on the International Tsunami Information Center ([ITIC](#)) - IOC training activities in 2018-2019, including the successful [ITIC Training Programm \(ITP\) - Hawaii in Chile](#) (hosted by SHOA in Valparaiso) that provided training on End-to-End Tsunami Early Warning Systems to 35 persons from 12 countries (from the Pacific, Caribbean and Europe).

37 Dr Strauch recalled that the ICG/PTWS also decided to establish a Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) and Tsunami Ready to develop a new programme aimed at facilitating tsunami resilience through community preparedness, specifically through the preparation of tsunami evacuation maps and associated response plans for tsunami-vulnerable coastal communities. A Pilot training course was localised in Honduras (Central America) in 2016-2017 that led to first applications of knowledge in Nicaragua, that was done in 2018/2019 by personnel trained in the course. He was glad to report that the situation has greatly improved in terms of staff capabilities in this field thanks to these efforts.

38 He recalled that the ICG also endorsed the Northwest Pacific Tsunami Advisory Center's ([NWPTAC](#)) plan to begin issuing in experimental mode its new NWPTAC Enhanced products in 2017. As the experience was positive, NWPTAC did the full change over to Enhanced Products, including a change on Area of Service (AoS) from February 28, 2019. *A Users' Guide for the Northwest Pacific Tsunami Advisory Center (NWPTAC): Enhanced Products for the Pacific Tsunami Warning System* ([IOC Technical Series No 142](#)) has been published by IOC.

39 Dr Strauch reported that the [7<sup>th</sup> session of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region](#) (WG-SCS) was held in Hanoi, Vietnam, on 6-8 March 2018, and the [8<sup>th</sup> session of WG-SCS](#) was held in Jakarta, Indonesia, on 4-6 March 2019. The PTWS WG-SCS organised a [Regional Training Workshop on Tsunami SOPs and ICG/PTWS SCS Tsunami Advisory Products](#) in Beijing, China, on 8-11 May 2018. The WG-SCS also decided to commence the trial operation of the South China Sea Tsunami Advisory Center ([SCSTAC](#)), which began on 26 January 2018, with full operation planned in late 2019.

40 He noted that the [4<sup>th</sup> session of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the Pacific coast of Central America](#) (WG-CA) took place in Managua, Nicaragua, on 11 February 2019. He noted a new DIPECHO project funded by the European Union to develop Tsunami Ready pilots in Central America (EUR 400,000) through the UNESCO San José Office and reported on progress of Central American Tsunami Advisory Center (CATAC), with the support of JICA/Japan. Progress includes new Seismic and Sea level Stations in Nicaragua and Central America, upgraded Datacentre with Seismic/Tsunami processing capacity, 24/7 personnel extended to 15 watch standers, capacitation of personnel locally, and in Japan. He noted that the PTWS WG-CA recommended to ICG/PTWS to start experimental operation of CATAC in August 2019.

41 He indicated challenges for the tsunami warning and mitigation system posed by the deadly earthquake and tsunami in Celebes Sea, Palu area, on September 28<sup>th</sup>, 2018, slightly outside the PTWC EQ source zone and under the responsibility of Indonesia NTWC. And also by the deadly local tsunami generated by a landslide linked to a volcanic eruption of the Anak Krakatoa volcano, in the Sunda Strait, Indonesia, on December 22<sup>nd</sup>, 2018.

42 The **ICG noted** the report of the Chairperson.

### 3.2. SECRETARIAT REPORT

43 The Technical Secretary for ICG/PTWS, Mr Bernardo Aliaga, presented the report of the Secretariat focusing on actions led or coordinated by the Secretariat during the intersessional period 2018–2019, including extrabudgetary funded projects.

44 Mr Aliaga reported that the regular budget of IOC for its tsunami programme is organised around three lines that correlate with the three pillars of the [PTWS Medium Term Strategy \(2014-2021\)](#).

- 45 On Pillar 1 – Contribute to develop Member States capacities for coastal hazard assessment, with a total available for PTWS of USD ~19,000 for 2018–2019, the Secretariat supported a [Scientific meeting of experts to understand tsunami sources, hazards, risk and uncertainties associated with the Tonga-Kermadec Subduction Zone](#), 29 October – 2 November 2018, Wellington, New Zealand, and will support an equivalent meeting on “Tsunami Hazard in the Colombia/Ecuador border”, in October 2019.
- 46 On Pillar 2 – Promote integrated and sustained monitoring and warning systems, with a total available for PTWS of USD 19,000 for 2018–2019, the Secretariat provided support to ICG and WGs meetings. It included this 28<sup>th</sup> session, a PTWS Steering Committee meeting in 2018, two meetings of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region, two meetings of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the Southwest Pacific and one Regional Working Groups on Tsunami Warning and Mitigation System in the Central American Pacific Coast, and one Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region. The Secretariat is also responsible of keeping an updated database of NTWC/TWFP/TNC including contact details, follow up of PTWC and NWPTAC Communication Tests and promotion of seismic and sea level data sharing.
- 47 On Pillar 3 – Educate communities at risk with respect to ocean-related hazards, with a total available for PTWS of USD 13,000 for 2018–2019, the Secretariat provided support to the ITIC Training Programme —[Hawaii \(ITP-HAWAII in CHILE\) on Tsunami Early Warning Systems and the PTWC Enhanced Products](#), 1-10 August 2018, Valparaíso, Chile and earmarked UNESCO/IOC co-financing for a successful proposal to the DIPECHO project’s call for Central America, with the UNESCO San Jose Office, which was funded by the European Commission's Humanitarian Aid Office (ECHO) with EUR 400,000 (“Strengthening early warning and response capacities for tsunami and other coastal hazards in Central America”). It also presented a proposal to Indian High Commissioner for South Pacific Islands based in Fiji, in partnership with ITIC, but it was not funded.
- 48 He noted that funding contributions from China and New Zealand also contributed to the above indicated activities. Similarly, several PTWS training and workshops were consistently supported by USA through the [National Oceanic and Atmospheric Administration \(NOAA\)](#) and the [Office of Foreign Disaster Assistance the United States Agency for International Development \(USAID/OFDA\)](#).
- 49 The **ICG noted** the report of the Secretariat.

### 3.3. TOWS-WG REPORT

- 50 Under this agenda item, Mr David Coetzee (Chair of the Inter-ICG Task Team on Disaster Management and Preparedness, New Zealand) informed the Plenary that two meetings of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) have been held in the intersessional period: the [Eleventh meeting of TOWS-WG](#) held in Paris, France, on 16 and 17 February 2018 (IOC/TOWS-WG-XI), and the [Twelfth meeting of TOWS-WG](#) held in Paris, France, on 21 and 22 February 2019 (IOC/TOWS-WG-XII). He summarised the main aspects of IOC/TOWS-WG-XII.
- 51 Mr Coetzee noted that the IOC/TOWS-WG-XII approved updates to the Tsunami Glossary, approved changes to the Area of Service Map and approved the proposal on TSP Messages for the Maritime Community. It also requested the ICGs to consider the proposal on TSP Messages for the Maritime Community for implementation in their respective basins.

52 Mr Coetzee highlighted that with respect to the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) IOC/TOWS-WG-XII agreed to produce a compelling high level concept note to the Implementation and Science Plans for the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) and convey it to global and regional Decade planning meetings.

53 He also noted that TOWS-WG-XII recommended the Assembly to instruct ICGs to advocate WTAD 2019 among Member States and highlight target [d] of the Sendai Framework that stress protection of critical infrastructure and disruption of basic services, with an emphasis of ports, harbours and vertical evacuation; to consider the PTWS Key Performance Indicator Framework; and to provide input to a consolidated report for the 13<sup>th</sup> session of the IOC/TOWS-WG.

54 IOC/TOWS-WG-XII also decided to continue the Tsunami Ready pilot activities with UNESCO/IOC recognition, including conducting surveys on Member States status, interest and feedback on the implementation of Tsunami Ready.

55 Australia inquired about the recommendations of the Inter-ICG Task Teams and Chile asked if IOC/TOWS-WG-XII produced any recommendation about landslide generated tsunamis. Mr Coetzee responded that the recommendations of the Inter-ICG Task Teams will be reported under the TSPs and Working Groups reporting items (3.4 and 3.7). Dr McCreery (USA) indicated that the IOC/TOWS-WG-XII did not produced a recommendation about landslide generated tsunamis.

56 The **ICG noted** the report on TOWS-WG.

### 3.4. TSUNAMI SERVICES PROVIDERS REPORT

#### 3.4.1. Pacific Tsunami Warning Centre (PTWC)

57 The [PTWC](#) Director, Dr Charles McCreery (USA), presented a [report](#) on the TSP activities of PTWC during the two-year intersessional period. He noted that the seismic and sea level sensing networks for the Pacific have remained largely the same but there is a continued need for additional instrumentation and data sharing by Member States to fill gaps. He showed figures displaying, respectively, the elapsed time to collect the minimum P-wave arrival time data to locate an earthquake in all Pacific subduction zones as well as the elapsed time to observe the initial tsunami wave at 1, 2 and 3 sea level stations for those same earthquake sources. For the time period since the last ICG/PTWS meeting, PTWC issued Tsunami Information Statements for 88 large earthquakes and Threat Messages for 12 large earthquakes with potential or confirmed tsunamis. On average, PTWC products easily meet the Key Performance Indicator targets contained in the TSP Global Services Definition document, although for individual events a few targets were missed. Some special challenges were noted. In particular, for a few events with initial threats based on the earthquake magnitude, the later CMT-based model indicated no threat. In those cases, a final threat message was not issued until sea level gauge readings confirmed the no-threat forecast or enough time had passed. The September 28, 2018, earthquake near Palu, Indonesia was located just outside the PTWS earthquake area and because PTWC did not expect a threat to its service area, by rule it did not issue a product. However, it raised the question of whether a no-threat Information Statement should be permitted and if so how to avoid conflicting with a local warning closer to the epicenter. McCreery informed that PTWC had two outages since 2017, one that was three days long, requiring backup by the U.S. National Tsunami Warning Center (USNTWC) in Palmer, Alaska. USNTWC backup services are not identical to PTWC services and the U.S. is working to remedy this situation.

- 58        Aside from routine monthly communication tests, PTWC conducted two unscheduled communication tests requiring responses from Member State TWFPs and NTWCs, and their alternates, within an hour of message receipt. For the January 15, 2019 test only 62 of 208 designated contacts responded representing just 30 of the 57 countries or territories covered. PTWC followed up with an email to all contacts announcing that a second test would occur and urging a better response to verify a high level of PTWS readiness. However, in the second test conducted on March 28, 2019, only 58 of 208 contacts responded, again representing just 30 of the 57 countries or territories covered. To improve, PTWC recommends conducting these unscheduled, response-required tests more often with responses made via an online survey. Costa Rica also asked if possible to add Spanish as another language at the very beginning of the test message. That way, the people manning these offices who may only be fluent in Spanish can more easily and quickly recognize the test messages.
- 59        McCreery explained that PTWC is still in the process of transitioning from its longtime website at <https://ptwc.weather.gov> to a combined PTWC-USNTWC website at <https://tsunami.gov>. The combined site is already operational but is not yet configured to easily distinguish information applying to U.S. domestic responsibilities versus its international responsibilities covered by PTWC. Before the older site is retired, the new site will be improved and notification will be made to Member States well in advance so they can prepare for the change. In addition, after the retirement any attempts to access the old URL will be forwarded to the new URL.
- 60        PTWC and the U.S. Tsunami Program have been pursuing a few additional enhancements to their tsunami early warning capabilities. PTWC has been testing a new algorithm written by Luis Rivera of the Institut de Physique du Globe de Strasbourg that computes the W-phase CMT from seismograms at regional distances. The new technique will provide the earthquake mechanism to drive PTWC's RIFT tsunami forecast model with 10-20 minutes after the earthquake, about 10 minutes sooner than the current method. The two U.S. tsunami warning centers are also testing the use of real-time GNSS data to more quickly and accurately characterize ruptures from nearby earthquakes for local tsunami forecast and warning. While the most immediate target is the Cascadia subduction zone off of the U.S. West Coast, the technique can be expanded globally as more real-time GNSS data becomes available. The two warning centers are also working to expand the depth of their mutual backup capabilities to protect their respective service areas in case of outages.
- 61        Lastly, and at the request of the PTWS Member States and its Steering Committee, PTWC is making some changes to its text products to make them easier to use and more informative. Estimated times of arrival (ETAs) provided in PTWC Threat Messages will now be organized by country or territory so that each place can find its coastal point ETAs together in one place. For tsunami wave observations given in PTWC messages, a letter code will now be included to indicate whether the measure was for the maximum peak, the maximum trough, or half the maximum peak-to-trough.
- 62        Honduras commented on issues of misinterpretation generated by Media accessing PTWC text messages and inquired if intra-harbour forecast is available with PTWC products. Dr McCreery responded that text based tsunami information products are transmitted through the Global Telecommunication System (GTS), and then available to many parties. On intra-harbour tsunami forecast Dr McCreery indicated that is technically difficult to produce that kind of forecast in real time.
- 63        Australia suggested that to explore technical aspects of non-earthquake generated tsunami it would be useful to work together with the ICG/IOTWMS. It also suggested that when measuring performance, magnitude thresholds are measured also with absolute numbers.



64 USA suggested that countries supporting DART buoys contact NOAA/PMEL (Diego Arcas) to make sure complete metadata for those systems is also available to PMEL/PTWC.

65 New Zealand noted that PTWC is designed and fit for regional events. It inquired if with new technologies, including GNSS techniques, there is a possibility to elaborate more for local products. Dr McCreery responded that more local products are possible with new technologies, at country level, not for international products.

66 The **ICG noted** the report of PTWC.

### 3.4.2. Northwest Pacific Tsunami Advisory Center (NWPTAC)

67 Mr Ryosuke Sakakibara (Japan), Scientific Officer, Earthquake and Tsunami Observation Division, Seismology and Volcanology Department, [Japan Meteorological Agency](#) (JMA), presented the [report](#) of the [Northwest Pacific Tsunami Advisory Center](#) (NWPTAC).

68 Mr Sakakibara explained that NWPTAC issued advisories for 16 major earthquakes in the North-western Pacific region during the period of February 2018–January 2019. Almost all advisories were sent within 30 minutes after the occurrence of the respective events.

69 Mr Sakakibara reported that NWPTAC conducts communications tests basically twice a year and thanks to the coordination of the Secretariat and the Member States, the situation in terms of reliability of communications seems to be improving.

70 The **ICG noted** the report of NWPTAC.

### 3.5. REPORT FROM THE INTERNATIONAL TSUNAMI INFORMATION CENTER (ITIC)

71 The Chair invited the Director of UNESCO/IOC's [International Tsunami Information Center](#) (ITIC), Dr Laura Kong, to present her [report](#).

72 The ITIC Director summarized the activities of the ITIC during the intersessional period since the previous session. The ITIC is the IOC Tsunami Information Center (TIC) for the ICG/PTWS, working with the Caribbean Tsunami information Center (CTIC) for countries sharing the Caribbean and Pacific, and the Indian Ocean Tsunami Information Centre (IOTIC) for countries sharing the Indian Ocean and Pacific. ITIC mandate and functions (IOC-X.23 Annex, 1997) cover monitoring and recommending technical improvements to TSP services, training and capacity building for Member States to establish and strengthen their national systems, awareness and preparedness, event data archiving in cooperation with the WDS-Geophysics, and coordination of International Tsunami Survey Team (ITST) post-tsunami surveys.

73 ITIC, in collaboration with the IOC, conducted four trainings in 2017 (Fiji, Peru, Caribbean Regional, Indian Ocean Regional) and three trainings in 2018 (Kiribati, South China Sea Regional, [ITP-Hawaii in Chile](#) for all oceans). In August 2018, ITIC conducted, for the first time ever, its 2-week Training Program (ITP)-Hawaii on end-to-end tsunami early warning systems in Chile, hosted by SHOA, using Chile and a working example. The success, in terms of participation (35 participants, 12 countries) and best practice sharing, has encouraged ITIC to explore opportunities in other countries with long-established end-to-end systems for its 2-week 'ITP-Hawaii' training. For 2019, the next ITP-Hawaii will return to Hawaii 3-13 September 2019; an IOC Circular Letter announcement is planned for May. In 2019, training is also requested and/or planned, in collaboration with the IOC, for Tuvalu, Tonga, Papua New Guinea and Caribbean.

74 ITIC continues to support and distribute [Tsunami Warning Decision Support Tools](#) (TBB, CISON, TideTool, TTT, ComMIT, TsuCAT). The ITIC completed the PTWS Tsunami Evacuation, Maps, Plans, and Procedures ([TEMPP](#)) Pilot in Honduras and Central America 2015-2017; and ITIC, New Zealand, NOAA PMEL and CTWP completed IOC MG 82 Preparing for Community Tsunami Evacuations: from inundation to evacuation maps, response plans and exercises (Guide and Supplement), which will be published in June 2019. The Guide (English, Spanish, hard copy) is high-level, and the Supplement (English, electronic) contains a comprehensive set of training materials. To support the TOWS-WG Task Team on Disaster Management and Preparedness and as an action of the ICG/PTWS, the ITIC will compile and share through its website materials on Vertical Evacuation and Marine Preparedness (evacuation of ports and harbours). The NOAA's National Centers for Environmental Information ([NCEI](#)) and ITIC updated their global hazard posters (tsunami, earthquakes, volcanic eruptions), regional Historical Tsunami posters (American Samoa, Samoa, Tonga; Caribbean, Central America, Mexico and Adjacent Regions; Solomon Islands and New Hebrides, planned 2019), and collected ITST photos from 1946 (summary videos created for 13 events). ITIC customized the IOC Tsunami Warning comic book working with American Samoa in 2019. As a TIC, the ITIC continues to support country piloting of the UNESCO IOC Tsunami Ready programme chairing the PTWS Task Team on TEMPP and Tsunami Ready, hosting an informational website [www.tsunamiready-international.org](http://www.tsunamiready-international.org), and conducted, with IOC, a Tsunami Ready informational workshop on 1<sup>st</sup> April 2019 to inform interested countries, especially those supported under the IOC DIPECHO project.

75 Dr Kong recalled that on 28<sup>th</sup> September 2018, Indonesia was struck again by an unexpected deadly tsunami in Palu, this time generated by a strike-slip earthquake that triggered landslides, that also caused widespread liquefaction. Post-event, which killed over 4,000 persons, the IOTIC and ITIC, at the request of Indonesia, coordinated the International Tsunami Survey Team (ITST) post-tsunami surveys (10 teams, 87 international and national scientists); an ITST workshop is planned to share the results with Government of Indonesia stakeholders later in 2019. The ITIC facilitated the activities of the WMO/IOC/ITU Joint Task Force on SMART cables, especially in Indonesia, and the conduct of PacWave18 by co-chairing the Task Team and hosting the exercise website.

76 Dr Kong and Dr Diego Arcas (NOAA Center for Tsunami Research) informed on the new features of the Tsunami Coastal Assessment Tool ([TsuCAT](#), v4.0), which was first distributed at the ICG/PTWS-XXVII (2017). TsuCAT provides access to a database of 5,000 pre-computed scenarios, including deep-ocean maximum amplitudes, coastal hazard guidance, and tsunami travel times, as well as the PTWC forecast polygons and other products, and historical seismicity and tsunami event information. TsuCAT v4 (April 2019) adds a tool to provide Member States with the PTWC public text and enhanced products which can then be used to trigger tsunami exercises. The differences between the standalone TsuCAT for quick hazard assessment using coastal forecasts calculated using Green's Law, and the internet-accessed ComMIT for inundation modeling and evacuation mapping, were elaborated. On Wednesday, 3<sup>rd</sup> April 2019, prior to Plenary, Dr Kong conducted a mini-training demonstrating TsuCAT's different features and data layers.

77 The **ICG noted** the report of ITIC.

### 3.6. NATIONAL PROGRESS REPORTS

78 The Chair reminded that written reports have been requested through [Circular Letter 2756](#) providing a National Report Template with an online modality. They have been made available through the meeting website. Delegates made short statements focussed on key points of their National Reports. ICG/PTWS National Performance Monitoring Report were submitted by the following 26 Member States and Territories:

- 79            [Australia.](#)
- 80            [Canada.](#)
- 81            [Chile.](#)
- 82            [China.](#)
- 83            [Colombia.](#)
- 84            [Cook Islands.](#)
- 85            [Costa Rica.](#)
- 86            [Ecuador.](#)
- 87            [El Salvador.](#)
- 88            [France-French Polynesia.](#)
- 89            [France-New Caledonia.](#)
- 90            [Fiji.](#)
- 91            [Japan.](#)
- 92            [Korea \(Republic of\).](#)
- 93            [Honduras.](#)
- 94            [Mexico.](#)
- 95            [New Zealand.](#)
- 96            [Nicaragua.](#)
- 97            [Papua New Guinea.](#)
- 98            [Peru.](#)
- 99            [Philippines.](#)
- 100           [Russian Federation.](#)
- 101           [Singapore.](#)
- 102           [Tonga.](#)
- 103           [United States of America.](#)
- 104           [Vietnam.](#)



### 3.7. WORKING GROUP REPORTS

- 105 Dr Diego Arcas (USA), Co-Chair of the Working Group 1 on Understanding Tsunami Risk, presented a [report](#) and recalled that the Working Group 1 (WG1) was re-established in the previous session meeting (PTWS-XXVII) and renamed as “Understanding Tsunami Risk”. New Terms of Reference were drafted and during the first year of the intersessional period new membership was recruited amongst PTWS Member States.
- 106 During the second year of this reporting period, WG1 has been engaged in the organization of a Meeting of Experts in the Tonga-Kermadec trench In Wellington (New Zealand) with the objective of addressing the tsunami hazard situation in the region from a holistic point of view and with the intent of identifying credible worst-case scenarios for tsunami hazard assessment. In addition, WG1 members have supported the SMART Cable initiative by conducting array detection time studies based on proposed cable lines and, have organized one workshop at the request of SHOA (Chile) on inversion techniques for DART buoy at PMEL in Seattle.
- 107 WG1 has also supported WG3 with the development of some of the tsunami assessment tools made available via WG3 (TsuCAT and ComMIT) and assisted WG1 Task Team on PTWS Integrated Tsunami Sensor Networks by providing advice and analysis tools.
- 108 Australia and Nicaragua inquired and commented on the availability of metadata for DART © buoys and equivalent systems. Dr Arcas responded that metadata is available only for USA DART © buoys at the US National Data Buoy Center ([NDBC](#)), not for other systems where NDBC is not responsible. Australia commented that PTWS may use the same approach than IOTWMS where databases for observing systems is handled by the Secretariat.
- 109 Dr Ken Gledhill (New Zealand), Chair of the Working Group on Tsunami Detection, Warning and Dissemination, presented a [report](#) on the inter-sessional work of the group. He noted that Working Group 2 (WG2) has been working on several major tasks requested at the last ICG/PTWS-XXVII session. Although much progress has been made on these tasks, more work is required.
- 110 He noted that a draft document on [Local-Source Tsunami Response Best Practice](#) is available for the groups’ consideration. This document is framed as guiding principles, with individual Member States then able to shape their own SOPs to fit their own unique scenarios/circumstances.
- 111 He also noted that a draft document on [Minimum competency level for NTWC operations](#) is available for the groups’ consideration. The competency framework suggested is multi-tier systems with different levels of knowledge and skills required depending on the roles.
- 112 Dr Gledhill reported that on Optimal sensor networks is still a work in progress. Defining the task more clearly led to the following two goals being defined: a primary goal to detect and characterise the generation of a tsunami within 5 minutes; and a secondary goal to monitor and understand the evolution of tsunami waves/tsunami events.
- 113 He noted that the Working Group considered reports from the current TSPs (PTWC & NWPTAC), and discussed the need for a major review of TSP products. The consensus was that this was not required at present.
- 114 He also reported that meetings of the WG2 Task Team on Seismic Data Sharing in the Southwest Pacific were held in the intersessional period but the work of the team is not yet complete.

- 115 In view of the above, WG2 recommended that the ICG accepts the Working Group recommendation that there is no need for a major review of TSP products at this stage, but that we should continue conducting reviews after events and exercises to gather feedback on the products, and that the WG2 Task Team on Seismic Data Sharing in the Southwest Pacific continues during the next intersessional period to complete the necessary work to achieve effective data sharing in the region and the availability of the data for tsunami risk management purposes by Member States.
- 116 USA commented on the importance of access to GNSS data for early warning purposes. Mr Melbourne (USA) indicated that from ~20,000 GNSS stations that have been installed around the world, data from only 3,000 is publicly available. He indicated that from GNSS data his research group is able to produce a location in two seconds. He indicated that his group offers this service for tsunami warning purposes in exchange of sending data to them (*quid pro quo*).
- 117 Russian Federation inquired about the precision obtained with GNSS data. Mr Melbourne responded that GNSS data from 750 stations enables earthquake location with 95% of 3-5 and 7 seconds. Within 10 seconds for big earthquakes.
- 118 An intra-sessional Working Group discussed and presented recommendations about the following three main topics:
- 119 Local-Source Tsunami Response Best Practice: The discussion on “Local-Source Tsunami Response Best Practice” started with a brief presentation by Laura Kong (ITIC) on lessons learned from the Palu, Indonesia, tsunami of 2018 to introduce the topic. The discussion focussed on the document prepared by the Working Group on this topic and accepted feedback to be used to prepare a first version of the document for consideration to the ICG. It was agreed that a strong focus on self-evacuation was appropriate but also that the document should contain guidance for NTWCs on detection and impact evaluation to provide very rapid official warnings to support self-evacuation based on natural warning signs.
- 120 Minimum competency level for NTWC operations: The WG2 chair provided a brief introduction to the framework developed by a small task group formed at the 2018 WG3 meeting in Hawaii. While noting that the draft document containing the framework for the minimum competency level for NTWC operations was available, it was accepted that much more work was required. There is some urgency for the work to be completed, because it would be very beneficial to have a competency framework to underpin training for NTWC staff. To this end it was decided to recommend that a Task Team be formed under WG2 to complete this work.
- 121 Optimal sensor networks for tsunami: The WG2 Chair provided a brief introduction to the framework to integrate multiple sensing technologies that was developed by a small task group formed at the 2018 WG3 meeting in Hawaii. A progress report is available. However, following discussion it was agreed that much more work was required, and that it would be best to continue this work during the next intersessional period.
- 122 Mr David Coetzee (New Zealand), Chair of the PTWS, recalled that Working Group 3 was reconstituted under the name of “Disaster Risk Management and Preparedness”, and its Terms of Reference were adjusted accordingly. He presented a [report](#) of Working Group 3 (WG3) on the inter-sessional work. Mr Coetzee noted that WG3 was represented at (and reported to) the meetings of the TOWS Task Team on Disaster Management & Preparedness in [February 2018](#) and [February 2019](#).
- 123 Mr Coetzee reported that WG3 completed the task of finalising for publication a Standard Operating Procedures (SOP) Manual. The Manual has a national level focus;

countries will have to apply the content as appropriate at regional and local levels. WG3 would like to emphasize that where possible, a multi-hazard approach should be taken with regards to SOPs, however it is recognized that the tsunami hazard represents characteristics and challenges that will always require unique SOPs. The Manual has been finalized and published by the IOC.

124 Mr Coetzee reported that through the Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) Pilot Project, a new PTWS training programme was developed aimed at facilitating tsunami resilience through community preparedness for tsunami-vulnerable coastal communities. The Project was conducted in Honduras, inviting other Central American countries and Mexico to participate, between 2015 and 2017, led by the ITIC, with NOAA PMEL and CTWP, IOC and New Zealand, and supported by USAID/OFDA, NOAA, and IOC. The Project has developed a Quick Guide *Preparing for Community Tsunami Evacuations: From Inundation to Evacuation Maps, Response Plans, and Exercises* (hard copy, English and Spanish) and Supplements (electronic), which will be published as an IOC Manual and Guide by June 2019. It consists of 4 modules:

- Hazard Assessment - Inundation Modelling
- Evacuation Mapping
- Response Planning
- Exercising

125 He noted that at the WG3's inter-sessional meeting in June 2018, colleagues of the CARIBE-EWS joined a discussion on tsunami recognition programmes via Skype and in person. They reflected on progress with regards to the implementation of the Tsunami Ready community-based tsunami recognition programme in the Caribbean. A feedback questionnaire was developed to gauge interest by countries, based on Exercise Caribe Wave18. Tsunami Ready is found to be a powerful driver to motivate governments to invest in fixing gaps in tsunami hazard management.

126 To gauge planned interest in piloting Tsunami Ready, a question was included in the post-exercise evaluation [Exercise Pacific Wave 2018](#) (PacWave18). Results show that 44% of the participants (or up to 11 countries) currently do not have plans to implement a Community Performance-based Tsunami Recognition Pilot, such as Tsunami Ready. Seven responded that they will pilot Tsunami Ready in 2019. Funding and resourcing appears to be a major impediment. Where Tsunami Ready has been implemented successfully, it was supported by dedicated funding.

127 As a side activity during the TOWS Task Team on Disaster Management & Preparedness in February 2019, participants considered and consolidated an evaluation survey created by ICG/CARIBE-EWS with a view on presenting an agreed questionnaire to ICGs for endorsement, which is now available for consideration by the ICG/PTWS and its Task Team on TEMPP and Tsunami Ready. The TOWS-WG in February 2019 recommended to the IOC Assembly to encourage Member States to continue to strengthen tsunami awareness and preparedness in communities and among authorities through communication, evacuation planning, tsunami exercises, training, information, and piloting recognition programmes such as Tsunami Ready.

128 The Working Group's inter-sessional meeting in June 2018 also addressed the theme of Marine & Ports Guidance and noted that several countries have developed material in this regard, i.e. the USA, Japan, Indonesia, Israel and New Zealand (underway). The Director of ITIC presented on work conducted in Honolulu and Guam. The US "[Guidelines and Best Practices for Tsunami Hazard Analysis, Planning, and Preparedness for Maritime](#)

[Communities](#)” started in 2015, is expected to be finalized in 2019. Guidance from Japan is available for both large commercial (SOLAS) and recreational or fishing vessels. However, most are available only in Japanese and will need translation. WG3 agreed to centralize the available and new material in one place where countries can consult them, and requested the ITIC to host a web page. The ITIC has established a [webpage](#) for the topic where all existing and new material is centralized. Member States are requested to send materials to the ITIC for website sharing.

129 The Working Group’s inter-sessional meeting in June 2018 also addressed the theme of Structural Design and Vertical Evacuation Guidance. Through the American Society of Civil Engineers (ASCE) in 2016, the US created a new [Chapter 6 - Tsunami Loads and Effects for the ASCE 7-16](#) Standard for structures that serve as essential buildings, critical infrastructure, and taller buildings or high-capacity structures that can serve as tsunami evacuation shelters. Maps and criteria in the ASCE 7 design standard are based on engineering risk analysis and reliability targets, rather than deterministic scenarios. ASCE 7-16 was approved for reference in the International Building Code (IBC) in 2018. It was also reported that USA FEMA is updating the “[Guidelines for Design of Structures for Vertical Evacuation from Tsunamis](#)” Third Edition, to include the ASCE 7-16 and IBC 2018 design provisions.

130 Mr Coetzee reported that in 2018, Washington State of the USA published a Manual for Tsunami Vertical Evacuation Structures, based on their 2016 community-based experience in building a vertical evacuation area above the gymnasium of Ocosta Elementary School in Ocosta, Washington. Additional work is also in progress for Oahu, Hawaii, to improve its Tsunami Design Zone maps using the higher-resolution inundation mapping consistent with the new engineering guidelines. In New Zealand a two-phased approach is followed for guidance on evacuation structures of last resort. First a tool has been developed to follow a risk based approach to assess the need for vertical evacuation against other risk reduction options. Phase two will look at engineering design guidelines for purposely designated structures (retrofit and new build).

131 The ITIC has established a webpage for the topic where all existing and new material is centralized. Member States are requested to send materials to the ITIC for website sharing.

132 The Chair of Working Group 3 chaired an intra-sessional working group focused on Tsunami Ready. The meeting reviewed and agreed simplified text for the ten Tsunami Ready criteria/guidelines, and recommended that Tsunami Ready be included in the Terms of Reference of WG3 (see item 4.4).

133 Dr Silvia Chacon (Costa Rica), Chair of the Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast (WG-CA), provided an overview of activities of the WG-CA. She indicated that two projects funded by the European Commission's Humanitarian Aid Office (ECHO) have improved the tsunami preparedness in the region. The first one run from 2016 to 2017 and covered Guatemala, Honduras, El Salvador and Nicaragua. The second one started in 2018 and will finish in 2019 and is covering the before mentioned countries plus Costa Rica and Nicaragua. As part of this second project WG-CA proposed a regional protocol for tsunami warning communications, which is currently under review by Member States. Also in the framework of this project, WG-CA will hold a regional tsunami exercise on the Pacific coast, with a scenario of a rupture along 770 km, from Guatemala to Costa Rica. This exercise will test the preparedness of the Pacific communities of the project.

134 Dr Silvia Chacon reported that WG-CA held its [Fourth meeting of the Regional Working Group on Tsunami Warning and Mitigation on Central American Pacific Coast](#) on 11 February 2019 in Managua, Nicaragua, and recommended the Central America Tsunami Advisory Center (CATAC) to start issuing experimental products in August 2019. CATAC did issue experimental products for Caribe Wave 19 exercise in March 2019.

135 Captain Jean Carlo Amayo (Peru) presented a [report](#) on behalf of the Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region. He noted that in the field of hazard assessment some members of the Group have included the evaluation of the generation and areas affected by tsunamis caused by volcanic eruptions and submarine landslides, mainly in Chile. On the other hand, the elaboration of inundation maps and evacuation zones in the region continued, and coordination has been carried out with the local authorities to avoid inundation areas for urban development.

136 He reported that the increase of stations contribution to the regional network of tide gauges continues (74). Likewise, the exchange of seismic data between the countries of the region was improved and increased. The Standard Operating procedures (SOPs) were also updated, communication protocols were revised and workshops were carried out aimed at improving the backup systems, reducing the time of the operating procedures (<8 minutes) to disseminate the tsunami warning information in Peru.

137 He further reported that workshops and seminars were organized to improve alarm systems, tsunami response protocols, awareness, and vulnerability assessment, in which the countries of the region participated. Countries of the region also participated at PacWave 2017 and PacWave 2018 international exercises, and national exercises. Likewise, coordination meetings were held (face-to-face and virtual) among the Member States of the region, in order to update and formulate the Terms of Reference of the group.

138 Mr Ofa Fa'anunu (Tonga), Chair of the Pacific Island Countries and Territories Regional Working Group on Tsunami Warning and Mitigation System (WG-PICTs) presented a [report](#) summarizing key activities and recommendations from WG-PICTs.

139 He reported that the group met three times in the inter-sessional period, back to back to other regional meetings because it remains a challenge to fund it. Data exchange increased in the region and is being forwarded to PTWC. ORSNET has been supporting data sharing. Data sharing from ORSNET to individual countries is possible on one-to-one cases with signed agreement. He noted that the region has an issue with the maintenance of DART ® buoys.

140 Mr Hing-yim Mok (China), on behalf of the Chair of the Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea (WG-SCS), Mr Sai-tick Chan (China) reported that the group met twice in the intersessional period, ([ICG/PTWS-WG-SCS/VII](#) in Hanoi, Vietnam, 6-8 March 2018; [ICG/PTWS-SCS-WG/VIII](#) in Jakarta, Indonesia, 4-6 March 2019). He reported that the report on the Scientific meeting of experts for coordinated scenario analysis of future tsunami events and hazard mitigation schemes for the South China Sea region, 16-18 November 2015, Xiamen, China, was finalized and published in 2018 ([IOC Workshop Report No.275](#)). He indicated progress on the establishment of the network of seismic and sea level monitoring core stations in the South China Sea Region. He also reported that the South China Sea Tsunami Advisory Centre (SCSTAC) has been put into trial operation since 26 January 2018 with satisfactory performance and the WG-SCS decided to propose full operation of the SCSTAC in the second half of 2019.

141 The **ICG noted** the report of the Working Groups.

### 3.8. REPORT OF THE TASK TEAM ON FUTURE GOALS AND PERFORMANCE MONITORING

142 Chair Wilfried Strauch reminded delegates that the Task Team on Future Goals and Performance Monitoring was established to develop a framework for future goals and performance monitoring measures for PTWS Tsunami Service Providers (TSPs), National Tsunami Warning Centres (NTWCs), and national warning systems. He asked Ms Sarah Jayne McCurrach (New Zealand), Chair (a.i) of the Task Team, to report on the status of the tasks of the Task Team. This presentation was made remotely using Skype for Business.



143 Ms Sarah-Jayne McCurrach provided an update on the work completed by the Task Team over the two-year inter-sessional period. This included completion of a new [Framework for “Future Goals and Performance Monitoring for Tsunami Risk Reduction, Warning and Mitigation”](#), development of a new [reporting template](#), reporting survey and ‘how to guide’ for Member States to complete their individual IOC reporting requirements.

144 The new Framework has been developed to align with the goals and priorities of the [Medium-term strategy: Pacific Tsunami Warning and Mitigation System \(PTWS MTS\), 2014-2021](#) (IOC/2013/TS/108), and the global targets and priorities for action of the [Sendai Framework for Disaster Risk Reduction \(SFDRR\) 2015–2030](#). Specifically, the framework is aligned closely to Target G of the SFDRR, which aims to “Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030”. In addition, the Framework contributes to the EC decision EC-LI/3.3.

145 On 11 February 2019, via the [IOC Circular Letter No 2756](#) the new Framework with Key Performance Indicators and reporting structure was distributed to PTWS Member States, for completion of their 2017-2018 National Report (2017–2018). At the time of this session, 21 Member States had used the new Framework and reporting model. The results of which were synthesised by the ICG/PTWS Technical Secretary and presented by the Task Team Chair. It was noted that the results provided should not be taken as final as they are based on partial Member State completion. During the ICG/PTWS-XXVIII meeting, an additional 5 countries (26 in total) completed their reporting – these results from the online survey will be factored into the 2017-2018 review in the near future. The results of the survey were provided under [item 4.1](#).

146 Improvements in the Framework model and the online survey were discussed with Member States. This includes a review of the priorities for action and targets, refinement in language of questions to make them more intentioned and less theoretical, ease of use of the survey and Framework, and relevance of questions.

147 Ms McCurrach highlighted that a key task of this Task Team is to ensure that performance measures are updated, and results made actionable and intentional. It is anticipated that, where appropriate, PTWS Working Groups and existing Task Teams identify the gaps on progress and develop work items for addressing these gaps in the system. She noted the support provided by the ICG/PTWS Technical Secretary, in the development of the new Framework and reporting.

148 USA and Australia commented on the report and the Framework. USA suggested that the survey should have separate sections for Member States and for TSPs, or have a different survey for TSPs only. Both Australia and USA commented the Framework and the survey are useful tools to produce a PTWS Status Report, and indicated the work done is enough to consider sharing and working with other ICGs on adopting similar Key Performance Indicators (KPIs).

149 The ICG **noted** the report of the Task Team.

### 3.9. REPORT OF THE TASK TEAM ON EVACUATION PLANNING AND MAPPING (TEMPP) AND TSUNAMI READY

150 The Chair recalled that the PTWS at its 26<sup>th</sup> session established the Task Team on Evacuation Planning and Mapping ([TEMPP](#)) and Tsunami Ready, to develop a new programme aimed at facilitating tsunami resilience through community preparedness, specifically through the preparation of tsunami evacuation maps and associated response

plans for tsunami-vulnerable coastal communities. He invited Dr Laura Kong, ITIC's Director and Chair of the Task Team, to report on the results of the Task Team work.

151 Dr Laura Kong (ITIC, USA), Chair of the PTWS Task Team on Evacuation Planning and Mapping and Tsunami Ready, presented the report of the Task Team. She gave an [overview](#) on the progress of the Task Team during the intersessional period. She summarized the *Tsunami Evacuation Maps, Plans, and Procedures* (TEMPP) training pilot, led by the ITIC, that was conducted from 2015 to 2017 in Honduras, with participants from Central America and Mexico also attending. The training programme has been finalized with the publication of IOC Manuals and Guides 82 *Preparing for Community Tsunami Evacuations: From Inundation to Evacuation Maps, Response Plans, and Exercises* (under preparation, expected in June 2019; draft available [here](#)). The publication concludes this aspect of the work of the Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) and Tsunami Ready. IOC MG 82 (2019) and IOC MG 76 [Plans and Procedures for Tsunami Warning and Emergency Management](#) (2017), along with IOC MG 58 [How to Plan, Conduct, and Evaluate UNESCO/IOC Tsunami Wave Exercises](#) (2013), provide Member States with extensive guidance on how to develop reliable end-to-end tsunami warning and emergency response systems.

152 Dr Kong provided a summary of Tsunami Ready pilot activities in the PTWS. Coastal communities can be better prepared for tsunamis through planning, education and awareness, and the strengthening of their local emergency actions. Communities have fewer fatalities and property damage if they plan before a tsunami arrives. No community is tsunami proof, but Tsunami Ready can help minimize loss to communities. She recalled that the ICG/CARIBE-EWS-X approved 10 guidelines in 2015, and the TOWS-WG-X (2017) recommended the IOC Assembly to instruct ICGs to consider piloting guidelines with a view toward developing a harmonized consistent global guidelines. To date, three PTWS Member States – Honduras, Costa Rica, and Samoa – have piloted the ICG/CARIBE-EWS Tsunami Ready Guidelines, and eleven additional countries are planning pilots through 2020.

153 In February 2017, as a culmination of the TEMPP process supported by the Comisión Permanente de Contingencias de Honduras (COPECO), the community of Cedeño became the first community in the Pacific to be recognized as UNESCO IOC Tsunami Ready. In April 2017, the community of Ostional, Costa Rica, was recognized through the efforts by Sistema Nacional de Monitoreo de Tsunamis (SINAMOT) and Comisión Nacional de Prevención de Riesgos y Atención de Emergencias (CNE). To date working together, SINAMOT and CNE have prepared inundation and evacuation maps for 25 communities to support Tsunami Ready recognition on the Pacific and Caribbean coasts of Costa Rica. In June 2017, Samoa, led by its Disaster Management Office, recognized the village of Savaia on Upolu Island.

154 Through the UNESCO/IOC DIPECHO Project *Strengthening early warning and response capacities for tsunami and other coastal hazards in Central America*, Tsunami Ready recognition is planned for 10 additional communities in 6 countries (Costa Rica, Guatemala, El Salvador, Honduras, Nicaragua and Panama) on the Pacific and Caribbean coasts, USAID/OFDA is also supporting one community in El Salvador. Tsunami Ready pilots are also planned by Chile, Ecuador, Fiji, Panama, Philippines, Russia, Solomon Islands, Vanuatu, and Vietnam. On 1 April 2019, prior to the ICG/PTWS-XXVIII, the ITIC and IOC organized a Tsunami Ready Workshop for Central American and other countries sponsored under the DIPECHO Project. Through the PTWS Regional Working for the Pacific Island Countries and Territories Task Team on Capacity Development was established to further facilitate piloting in Tonga, Samoa and Vanuatu, with reporting to the Task Team on TEMPP and Tsunami Ready.

155 Dr Kong shared that the Tsunami Ready information is available on the ITIC website at [www.tsunamiready-international.org](http://www.tsunamiready-international.org). A PTWS Tsunami Ready Fact Sheet, Guidelines and

Application Form, Flow Chart and Steps, Stakeholders, Roles and Responsibilities, and FAQs are available, as well as summaries of Pacific and Caribbean pilots. To provide feedback on the applicability of the CARIBE-EWS Guidelines for the PTWS, and streamline and compare feedback across the ICGs, the TOWS-WG Inter-ICG Task Team on Disaster Management and Preparedness prepared common feedback questions that could be deployed to Tsunami Ready implementing stakeholders.

156           The **ICG noted** the report of the Task Team.

### 3.10. REPORT OF PACIFIC WAVE EXERCISE 2018

157           The Co-Chair of the Task Team on PacWave18 Exercise, Dr Laura Kong, Director ITIC, gave a summary on the outcomes of [Exercise Pacific Wave 2018](#) (PacWave18), which conducted between September and November 2018, with one live communications test from the PTWC, NWPTAC, and SCSTAC to Tsunami Warning Focal Points and National Tsunami Warning Centres on 5 November 2018, World Tsunami Awareness Day (WTAD). PacWave18 also validated the NWPTAC Enhanced Products and evaluated the SCSTAC products. Seven scenarios were available, including past actual events and their marigrams (2009 Tonga Trench, 2010 Peru-Chile Trench, 2011 Japan Trench, and 2013 south Solomon Trench). As for past PacWave exercises, TSPs message products and other supplemental information (historical tsunamis and seismicity, tsunami travel times), were made available on the PacWave18 website ([www.pacwave.info](http://www.pacwave.info)). Altogether 26 countries, including 3 sub-national entities, participated.

158           For scenarios, the hypothetical Tonga Trench M9.0 scenario was the most popular, followed by the Manila Trench M8.8 scenario. The Peru-Chile Trench M8.8 and Japan Trench M9.1 real events, and the hypothetical South Solomon Trench M9.0 scenarios were also used. About half of the respondents exercised a distant source, and the remaining a local source tsunami. Few respondents engaged in communication and cooperation with other countries in their sub-region, despite it being a PacWave18 objective.

159           Through PacWave18, the majority of Member States reported that the format and conduct of the PTWS TSPs products were clear and easy to understand. Within the majority of countries, the NTWC and NDMO know their roles, and have an activation and response process in place. TSP forecasts were used by the majority to help assess their tsunami threat, followed by national resources (pre-computed scenarios, forecasts, experts). About half of the respondents have tsunami-related curriculum at all levels of education, and many have some programmes in place. Only a small number of Member States have tsunami evacuations maps, signage, and assembly points, but many communities have some elements, and countries do plan to undertake more activities.

160           Despite delays in the [IOC Circular Letter 2709](#) going out and the Manual and products being published, all of them were produced well in advance compared to previous PacWave exercises. Regarding improvements for the next PacWave, as in past PacWave exercises, the nomination of PacWave National Contacts was slow to come in, and overall, incomplete compared to the number of post-exercise respondents. It was also noted that it continues to be a challenge to provide scenarios that all countries view as useful to them; late requests for additional scenarios do cause delays in the provision of exercise manuals and products. Finally, it was recognized that the TSPs need to coordinate their simulated 'observations' that are used for each common scenario so that there is only 1 set of 'observations.'

161           At the Task Team Meeting for PacWave18 on 5 June 2018, then endorsed by the PTWS Steering Committee 7-8 June 2018, a hashtag and logo for PacWave exercises and socialise with Member States were requested. New Zealand volunteered to take this action, establishing #PacWave18, and proposing 3 designs for consideration by the ICG/PTWS-XXVIII. In designing, other ICG Tsunami Wave logos and hashtags were reviewed, and a similar style adopted where possible to provide consistency across all ICGs. For PacWave18,



no summary on the popularity and use of #PacWave18 was done, but it could be requested for PacWave2020. A logo for PacWave20 should also be available.

162 The Task Team also provided recommendations for the next Exercise Pacific Wave regarding dates for the exercise, announcement, and availability of materials, and suggested it be linked to the Sendai Framework for Disaster Risk Reduction. These were taken into consideration by the Intra-session Working Group on PacWave Exercises.

163 The [draft Summary Report](#) will be reviewed by PacWave18 National Contacts, and then finalized for publication by the IOC in May 2019.

164 Costa Rica indicated that logo Example #3 was the clearest since it included all countries of the Pacific and showed multiple waves. The Group was agreed that the word 'Exercise' was not needed, only 'PacWave'.

165 PTWC indicated that with respect to the request/observation on "matching up" real event observations to ensure consistency in text and graphical products, there may be differences between calculated and actual measures by coastal gauges. Australia indicated the same problem showed up in the Indian Ocean where they have experienced the same issue. That is why at the last exercise (IOWave18) the three TSPs coordinated their messages to match among them.

166 New Zealand indicated that it was useful to compare the real events with the simulated scenarios and see how the operations have improved.

167 The **ICG noted** the report of the Task Team.

### 3.11. STATUS OF PROGRESS IN OTHER ICGs

168 Mr Yuelong Miao, Chair of the ICG/IOTWMS Working Group 2 on Tsunami Detection, Warning and Dissemination, provided an [overview](#) of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) recent activities, including the successful IOWave18 Indian Ocean tsunami exercise when 24 active Member States participated, 11 of them to community level with a total of 116,000 taking part in the evacuation drill.

169 The [ICG/IOTWMS-XII](#) meeting was held in Iran on 9–12 March 2019, when Prof. Dwikorita Karnawati (Indonesia), Director of the Agency for Meteorology, Climatology and Geophysics (BMKG), was elected as the new Chair. The ICG recognised Palu and Sunda Strait tsunami events as being very complex from an early warning perspective, and the current technical limitations of producing timely and accurate forecasts for tsunamis from near-source "atypical" sources (e.g. aerial landslides, submarine landslides, volcanoes). As a result, a new task team was formed to improve tsunami preparedness for a near-field tsunami.

170 Mr Yuelong indicated that opposite to the ICG/PTWS, the detailed quantitative TSPs exchange messages to NTWCs are not publicly available, either text or graphical. However, as per the agreed TSP Service Definition Document for IOTWMS, each TSP should provide to the public a qualitative message explaining whether there is tsunami threat or no threat to Indian Ocean. TSP India and TSP Indonesia have already issued such public bulletins, and TSP Australia will start to issue them from 2019. Japan commented that his understanding is that all 3 TSPs issue each an independent message. How would NTWCs choose from these three? Mr Yuelong indicated that the messages have the same format but tsunami wave prediction values may be different. For most cases the event is not complex thus the threat assessment will be quite similar. For complex events then this is up to the country to choose. The annual regional SOP workshop training becomes important.

171 On IOTWMS training opportunities, Tonga inquired if SOP workshop trainings are available for non-IOTWMS countries. Mr Yuelong indicated not likely because funding is only

for IOTWMS countries, such as being specified by the fund from UNESCAP. Also there may be less value to other countries because the training is tailored specifically for Indian Ocean countries with TSP IOTWMS products and protocol.

172 USA indicated that it would be interested in the experiences out of Sunda Strait and Palu tsunamis and the role of TSPs for areas out of its AoRs, like for these events.

173 Chile asked the ICG/IOTWMS to share with ICG/PTWS their results on detection and monitoring of landslide generated tsunamis.

174 Ms Silvia Chacon (Costa Rica), Chair of the ICG/CARIBE-EWS, provided an [overview](#) on the status of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS). She reported that the ICG held two sessions during the intersessional period: [ICG/CARIBE EWS-XII](#) in May 2017 and [ICG/CARIBE-EWS-XIII](#) in April 2018. At the ICG/CARIBE EWS-XIII new officers were elected. Currently CARIBE-EWS has nominated representatives from all 48 Member States and territories. The Caribbean basin experienced two tsunamis during the intersessional period. In 19 July 2017, a tsunami flooded several places between Santa Marta and Barranquilla, Colombia, very likely caused by a submarine landslide. And in 10 January 2018, a Mw 7.6 earthquake offshore Honduras caused a small tsunami registered in few tide gauges. This was the first time a tsunami threat was issued for the Caribbean. A questionable tsunami occurred in Venezuela 21 August 2018, after a Mw 7.3 earthquake.

175 Hurricanes Irma and Maria impacted severely the region in 2017, causing a setback in monitoring and detection. Communications were completely down in several islands during several weeks and radio amateurs were the only way to communicate with neighbouring islands, establishing the need of alternate communication protocols through neighbouring islands. The region is slowly recovering monitoring and detection capabilities with the strong support of USA and United Kingdom.

176 CARIBE-EWS established its [Implementation Plan 2018-2023](#) as a dynamic document and will be adapted to KPIs and Sendai targets as requested by TOWS-WG.

177 Ms Chacon presented the advances on the intersessional WGs and TTs, including studies of GNSS coverage in the region, the development of an interactive map on tsunami sources from Experts Meetings and exercises, research on existing tsunami evacuation maps and signage and procedures for volcanic crises, guidelines on planning and conducting an exercise. She noted that the Tsunami Ready pilot recognition program is currently working on 11 communities across the basin and are currently working on pre- and post- implementation evaluation instruments.

178 CARIBE-EWS held two tsunami exercises, [Caribe Wave 18](#) and [Caribe Wave 19](#), with more than 600,000 and 500,000 participants. Caribe Wave 18 considered three tectonic scenarios in Colombia, Puerto Rico and Barbados. Caribe Wave 19 considered one tectonic scenario in Panama and for first time a volcanic scenario at Kick'em Jenny.

179 USA indicated support to CARIBE-EWS through the USA Caribbean Tsunami Warning programme (CTWP) and indicated that about Tsunami Ready their experience is that for a Tsunami Ready Programme to work is necessary to have a person at the State level to keep the momentum. What is the situation for countries in the Caribbean? Ms Chacon indicated that country level the responsible person is usually also involved on response matters, particularly for hurricanes, which is very time consuming. She indicate that +200 communities would be interested in a Tsunami Ready recognition in the Caribbean which is an indication of need/interest, as a starting point.

180 New Zealand inquired if CARIBE-EWS has any initiative in the area of monitoring non-earthquake tsunami sources. Ms Chacon responded that in the region there are Volcano Observatories and they are involved in the current process on defining potential cooperation with TSP PTWC for messages for volcano-generated tsunamis, under an ICG/CARIBE-EWS Task Team.

181 Australia inquired about the Caribe Wave exercises registration mechanism and who is entitled to register, and how the ICG/CARIBE-EWS has managed to have such a success in participation. Ms Chacon responded that any person/institution could register. The key is to have the same date every year (mid-March), for several years now, for people to get the habit.

182 Chile inquired if cruise companies have participated in the exercises. Ms Chacon responded that they are been approached and some specific exercises have had cruise tourist involved.

183 The **ICG noted** the report of progress in other ICGs.

### 3.12. REPORTS FROM UN AND NON UN ORGANIZATIONS

184 Mr Bruce Howe (USA), Chair of the ITU/WMO/IOC SMART Cables for Observing the Ocean Joint Task Force (JTF), provided an [update](#) on the *JTF SMART (Science Monitoring And Reliable Telecommunications), Subsea Cable Initiative*. He noted that JTF includes experts from dozens of countries and nearly a hundred organizations representing science, observing system managers, industry, government agencies, and sponsors, working to bring the SMART cable concept to fruition. The JTF is sponsored by three United Nations organizations: [International Telecommunication Union](#), [World Meteorological Organization](#), and UNESCO's Intergovernmental Oceanographic Commission.

185 To address critical environmental threats, from climate and ocean warming to rising sea level, and tsunamis and earthquakes, the SMART cable initiative proposes to integrate environmental science sensors into the repeaters of future trans-oceanic submarine telecommunications cable systems. SMART cables will provide the unprecedented capability to directly monitor the deep ocean, a unique complement to existing satellite, float, and other in-situ systems. By riding on the existing power, communications, and development infrastructure that already serves 1 million kilometers of operational undersea cable and 20,000 repeaters, SMART cables offer the potential to achieve near global coverage at an incremental cost that is a fraction of that of alternative systems. Incorporating bottom pressure, temperature and acceleration sensors into future replacement cables can cost-effectively upgrade current "deaf, dumb and blind" cables into a global ocean sensor network within the 10-20-year refresh cycle. SMART cables would be a first order addition to the ocean-earth observing system, with unique contributions that will strengthen and complement satellite and in-situ systems.

186 Dedicated single purpose early warning systems such as Japanese S-Net are expensive. Plug and play science systems like NEPTUNE-Canada, US OOI-RCA, and DONET are also expensive and require ROV use. SMART systems lower the cost, contributing an incremental cost over and above the telecom infrastructure. One global (incremental) cost scenario in steady state: 10 year refresh cycle, \$200k/smart repeater, 200 repeaters/3 systems/16 Mm/\$40M per year, \$20k/repeater/y, 2000 active smart repeaters and 160 Mm of cable. For reference, a 10 Mm trans-Pacific telecom system costs \$250M now, so adding the SMART capability would be 10% with simple scaling. Development/pilot cost is estimated to be \$10-20M.

187 Development will occur stepwise. The InSea project of the National Institute of Geophysics and Volcanology (INGV) in Italy is now funded for a "wet demo" system, a

prototype attached to an existing science system. Office of Post and Telecommunications (OPT)-New Caledonia has proposed to the French government the Project SMART Cable Gondwana-3 between New Caledonia and Vanuatu, with 2 fully developed SMART repeaters. This would be a backup cable, thus permitting a longer timeline to installation (to allow development and testing), and additional funds can be requested by Vanuatu from the Asian Development Bank (ADB). Indonesia has adopted the SMART cable concept and is expecting significant funding to implement cable based tsunami warning.

188 Mr Howe noted that at the June 2018 ICG/PTWS Steering Committee meeting the Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region (WG-SEP) was given the action to produce a brief report for this 28<sup>th</sup> session describing the need and benefits of SMART cables for earthquake and tsunami early warning, in addition to climate and ocean observation purposes. Mr Howe reported briefly on this. While there are a number of existing cables along and around parts of Latin America, they are inadequate now because of rising demand and aging; the time is ripe to replace and add new cables, with SMART capability. To that end the Inter-American Development Bank (IADB) is considering an initiative to support SMART cables (telecom + early warning/science – “2 for the price of one”; including a Latin America – Asia and intercountry coastal cables). The aforementioned report needs to be broadened to provide IADB with material for a workshop on Digital Infrastructure and Financing workshop planned for 15 May 2019, leading to a formal report by October 2019, to be presented to a Ministerial meeting in November 2019 for approval. This may be an avenue to a new source of funding to support climate and disaster monitoring.

189 Mr Howe indicated that JTF requests the continuing assistance of ICG/PTWS as JTF continues to work to facilitate the implementation of SMART systems in the PTWS Area of Operations:

1. Define the liaison process with PTWS, specifying the PTWS group(s) that will work with the JTF. Continue with the WG-SEP expert team.
2. Refine the current draft WG-SEP SMART cable report immediately after this meeting for informational use in PTWS, and to form the basis for the next task.
3. Support JTF’s efforts in the next months to facilitate funding via the Inter-American Development Bank (IADB).
4. In the longer term, support JTF efforts with respect to specific proposed systems (e.g., New Caledonia-Vanuatu), regional, and basin efforts.

190 Mr Mike Angove (USA) presented an [overview](#) on the support provided by the NOAA National Centers for Environmental Information (NCEI, World Data Service for Geophysics (WDS). He noted it offer data management expertise to the scientific community which requires knowledge of data standards, knowledge of metadata standards, knowledge of data transfer standards, data delivery best practices, and data archive capabilities. Special emphasis is given to data supporting IUGG, IOC, and UNEP programs. WDC-GMG participates in the Intergovernmental Oceanographic Commission (IOC) committee on International Oceanographic Data and Information Exchange (IODE), the Intergovernmental Coordination Group for the Tsunami (ICG/PTWS and ICG/CARIBE-EWS), the General Bathymetric Chart of the Oceans (GEBCO), and IOC regional mapping projects. WDC-GMG operates the IHO Data Center for Digital Bathymetry, cooperates with the Integrated Ocean Drilling Program (IODP), operating data archives for DSDP and ODP data, and operates the IOC-endorsed Index to Marine and Lacustrine Geological Samples database.

191 USA inquired if NCEI can work with a country to update its information in the [Global Historical Tsunami Database](#). Mr Angove responded that the basic answer is yes, any new information available from Member States should be extremely useful if available at this global database, which is openly available.



- 192 Ms Litea Biukoto, Disaster Risk Team Leader, Disaster and Community Resilience Programme, Geoscience, Energy and Maritime Division-The Pacific Community, reported that the Pacific Community ([SPC](#)) is an intergovernmental organisation with 22 Pacific Island Countries and Territories. 4 metropolitan countries, that provides policy and technical advice and support across key development sectors across its Pacific membership, on Agriculture, Fisheries, Public Health, Maritime transportation, geosciences. This includes disaster risk management capacity from early warning and preparedness, disaster risk assessments - in particular, the use of risk information for evidence based decisions and support through the conduct of post disaster assessments, understand the hazard and calibrate the hazard& risk models, damage assessments that identify humanitarian and early recovery needs and post disaster needs assessments to inform recovery planning.
- 193 Efforts in strengthening early warning capacity need to consider multi-hazard risks in the Pacific. The same personnel and resources and processes used to determine and issue hydro meteorological warnings are often the same for tsunami warnings. The same can also be said of the capacities needed to respond to, recover from and mitigate the risks posed by natural hazards. Recent efforts to include risk considerations in early warning is being worked on with impact based forecasting to expand warning protocols and systems from issuing warning related to the hazard parameters to actionable messaging, i.e. stay and wait, stay and prepare or Move now to a safer location.
- 194 She noted that Mr Jiuta Korovulavula began his term as the UNESCO-IOC Tsunami Warning and Mitigation Officer co-located at the Pacific Community within the division responsible for Disaster Risk Management. Mr Korovulavula took over from Rajendra Prasad late 2018. Having this position at SPC has allowed joint up programming with projects to leverage the expertise and experience provided with resources that are available to countries. Technical advice provided through the planning and conduct of PacWave, revisions of Standard Operating Procedures and more recently the revision and conduct of regionally accredited courses Working in Emergency Operations Centre, and the Disaster Risk Assessments are just a few areas where we've seen tangible results. This has been through financial and technical resources from the European Union, World Bank, New Zealand and Australia. Effort is only possible through the true collaboration with the countries and the partners that SPC/IOC work with.
- 195 The need for Capacity development has been consistently reported across a number of meetings involving disaster management offices and national meteorological and hydrological services. Using the Pacific Competencies Model we can assess the capacities of personnel, determine gaps in capacity based on responsibilities of the agency then match the needs through training and/or additional resources. Limit the ad hoc training that is often offered to start conducting customized training to meet agency needs.
- 196 Demonstrable localized actions has been a key theme throughout recent discussions with Directors of National Disaster Management Offices. This has been consistent in the discussions had with partners and in particular Pacific Islands Emergency Management Alliance (New Zealand and Australia) that brings together emergency services i.e. fire and police and the national disaster management offices. A result of this has had them work through and agree to protocols that will allow them to function together during response operations. This requires joint training, exercises.
- 197 A frequent request from countries is the need for tsunami hazard maps, inundation models or the data required i.e. topography, bathymetry and exposure mapping. Ms Biukoto noted that Director ITIC Ms Kong presented on a number of resources available to countries, and assessment of what is needed to inform tsunami warning needs to be understood. Standard Operating Procedures and tsunami response plans to be improved with this direction.

198 Lastly, given the range of services needed to provide effective early warning system, partnerships are needed across various stakeholder groups including private sector, civil society and partner agencies to ensure that warning messages reach the last mile and elicit the right response from the public. SPC and the Secretariat of the Pacific Regional Environment Programme continue to work with partners like UNESCO/IOC and World Meteorological Organisation in Pacific Island Countries in order to strengthen the capacity of national warning centres and disaster management offices. This is in addition to national and bilateral initiatives already being rolled out. The [Pacific Resilience Partnership](#), which brings together disaster risk management and climate change practitioners, provides an avenue for us to work together. The partnership is guided by the Framework for Resilient Development in the Pacific ([FRDP](#)). Policies that guide development need to be informed by natural hazard risk assessments and in turn used to determine the best combinations of investments to prepare, prevent or mitigate and transfer disaster risk.

199 On next steps Ms Biukoto indicated that the KPIs give us some work to do with the regional Sendai Framework reporting and the efforts around Pacific Damage and Loss Information Systems, i.e. on disaster statistics, Disaster Risk Management competencies and targeted skillsets. She noted Tsunami Ready could be used as a multi-hazard model for communities and in that sense it offers coordinated capacity building opportunities.

200 The **ICG noted** the report of UN and non UN organizations.

#### **4. POLICY MATTERS**

##### **4.1. PTWS STATUS REPORT**

201 Chair Wilfried Strauch recalled that through [IOC Circular Letter No 2756](#) dated 11 February 2019, the [Framework for Future Goals and Performance Monitoring of Tsunami Risk Reduction, Hazard Warning, and Mitigation](#) was distributed to Member States with the request to prepare and issue the first online National Report (2017–2018) against Key Performance Indicators. Based on the national submissions, a presentation on the PTWS Status Report was prepared. He invited Ms Sarah Jayne McCurrach (New Zealand), Chair of the Task Team on Future Goals and Performance Monitoring, to present the work achieved and pending tasks.

202 Ms McCurrach presented an [overview of the preliminary result of the survey](#), based on selected questions from each of the Framework Goals (1 – 4) from the National Reports presented with the online survey and available under [item 3.6](#). Some areas for improvement and areas of strengths emerged very clearly from this analysis. It is expected that areas for improvement be addressed by PTWS Working Groups and existing Task Teams.

203 Before committing to next steps for working on lessons identified from the new Framework and the 2017-2018 reporting round, Ms McCurrach noted that TOWS-WG-XII recommended to the IOC Assembly to consider the PTWS Framework for Future Goals and Performance Monitoring of Tsunami Risk Reduction, Hazard Warning, and Mitigation, and request a team of representatives from the PTWS, IOTWMS, CARIBE-EWS, and NEAMTWS to review the current PTWS Framework, compare this with other, similar ICG initiatives and develop a consistent global performance monitoring framework, which includes data collection tools/questionnaire and reporting formats. It further requested a consolidated report for the TOWS-WG-XIII in 2020. Ms McCurrach suggested any amendments to the PTWS Framework be made after the new team under TOWS-WG begins their work. This will save double handling and inconsistency.

204 Ms McCurrach indicated that based on the National Reports submitted, a PTWS Status Report will be prepared for the 2017-2018 period, and will include a summary of potential, identified gaps and recommendations for action.

205 She noted that the inter-ICG team suggested by TOWS-WG-XII will comprise Ms Sarah Jayne McCurrach (PTWS), Mr Yuelong Miao and Ms Harkunti Rahayu (IOTWMS), Ms Elizabeth Vanacore and Ms Mary Rengifo (CARIBE-EWS), and Mr Öcal Necmioglu (NEAMTWS).

206 The **ICG agreed** to continue the Task Team on Future Goals and Performance Monitoring as attached in Appendix 1 to Recommendation ICG/PTWS-XXVIII.1 and **approved Recommendation ICG/PTWS-XXVIII.1.**

#### 4.2. FUTURE WORKING AND TASK TEAM STRUCTURE

207 Chair Mr Wilfried Strauch introduced this agenda item recalling that the ICG/PTWS Steering Committee meeting held from 7 to 8 June 2018 in Honolulu, requested the Chair of Working Group 3, in coordination with the chairs of Working Groups 1 and 2, and in consultation with the chairs of Task Teams, to review and recommend a future Working Group and Task Team structure to the 28<sup>th</sup> session of the ICG in 2019, noting ICG Functional Working Groups and Task Teams overlap in several respects, and therefore may not be the most effective of efficient structural composition. He invited Mr David Coetzee (New Zealand) to present a [Working Paper on ICG-PTWS Working Groups and Task Teams](#).

208 Mr Coetzee noted that the PTWS structure appears to be well aligned with other ICGs in terms of the themes addressed by technical working groups. One ICG consolidated technical themes to a larger extent than PTWS (specifically with regards to Tsunami Risk, Preparedness and Awareness) while others have broken a theme up into different working groups (specifically with regards to Monitoring, Detection, and Warning). A difference appears with other ICGs in terms of the approach towards regional working groups. Other ICGs appear to address regional working groups (or task teams) from the perspective of specific issues, rather than the all-inclusive/all-themes focus of regional working groups taken by the PTWS. He also noted that the PTWS structure appears somewhat aligned with other ICGs in terms of specific task teams (Capacity Assessment, Exercises, Evacuation Mapping, and Tsunami Ready).

209 Several Member States intervened about the opportunity to define a new PTWS Structure. Mr Coetzee summarised the discussion indicating that the current structure is not dysfunctional. He noted that the current [PTWS Medium Term Strategy \(2014-2021\)](#) stand until 2021, therefore he suggested that the work on the next PTWS Medium Term Strategy provides a better framework for a revised structure. He recommended consider a new structure in the context of a draft PTWS Medium term Strategy for 2022–2029, including elements aligned with the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#).

210 Australia suggested that it is a sensible approach and proposed that the Steering Committee is tasked with the development of the PTWS Medium Term Strategy 2022-2029. New Zealand and ITIC seconded and also added to ask one of the Vice-Chair to leader the process.

211 The **ICG agreed** to task Working Group 3 Chair with the development of a draft Medium term Strategy 2022-2029 and **approved Recommendation ICG/PTWS-XXVIII.1.**

#### 4.3. EVACUATION PLANNING AND MAPPING

212 Chair Mr Strauch recalled that the PTWS at its 26<sup>th</sup> session established the Task Team on Evacuation Planning and Mapping ([TEMPP](#)) and Tsunami Ready, to develop a new

programme aimed at facilitating tsunami resilience through community preparedness, specifically through the preparation of tsunami evacuation maps and associated response plans for tsunami-vulnerable coastal communities. He invited Dr Laura Kong, ITIC's Director and Chair of the Task Team, to report on the results of the Task Team work.

213 Dr Laura Kong (ITIC, USA), Chair of the PTWS Task Team on Evacuation Planning and Mapping and Tsunami Ready, presented the report of the Task Team. She noted that the Task Team on Evacuation Planning and Mapping ([TEMPP](#)) and Tsunami Ready has reached a milestone on the work on evacuation planning and mapping through the delivery of a draft IOC Manuals and Guides 82 *Preparing for Community Tsunami Evacuations: From Inundation to Evacuation Maps, Response Plans, and Exercises* (under preparation, expected in June 2019; draft available [here](#)). The publication consists of a Guide (hard copy, English and Spanish) and Supplement (electronic). Modules are Identifying Inundation Areas, Developing Tsunami Evacuation maps, Developing Tsunami Response Plans and Standard Operating Procedures (SOPs), and Tsunami Exercising. The Guide is a high-level document describing the steps, objectives, target participants, requirements, methodology, and expected results. The electronic Supplement contains comprehensive explanations, templates and how-to manuals, and the TEMPP Pilot training materials (e.g., agendas, Power Points, etc). The publication concludes this aspect of the work of the Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) and Tsunami Ready.

214 The **ICG approved** Recommendation ICG/PTWS-XXVIII.3.

#### 4.4. TSUNAMI READY RECOGNITION

215 Chair Wilfried Strauch recalled that Tsunami Ready is a framework for building resilient communities through awareness and preparedness strategies that will save lives from tsunamis. He noted that the PTWS Task Team on Tsunami Evacuation Maps, Plans, and Procedures (TEMPP) and Tsunami Ready was tasked to "Facilitate the piloting of the current CARIBE-EWS Tsunami Ready guidelines, as recommended by the TOWS-WG-X (Feb 2017) for reporting back to the next PTWS with a view to develop PTWS guidelines. Within this process the Task Team should take advantage of the TEMPP Process in piloting the Tsunami Ready community recognition program.

216 The ITIC Director Dr Laura Kong presented an overview of the international Tsunami Ready program and recalled the [Draft PTWS Tsunami Ready Guidelines](#).

217 Chair Strauch indicated that the cost of running Tsunami Ready pilots is important. The experience of Nicaragua with Corn Islands and Bluefield to prepare these villages for Tsunami Ready recognition including inundation and evacuation maps, public awareness, signs and drill is positive but intense in resources. USA PMEL indicated that indeed the cost involved in preparing a community for Tsunami Ready recognition could be high for a given standard but education/awareness and outreach could be done for smallest communities not going up to Tsunami Ready recognition.

218 ICG/PTWS Technical secretary inquired if USA does have an assessment of the TsunamiReady © programme on the different options, for example in Puerto Rico. USA responded that without Federal funding at the level of USD 0.5-1 million, the designation of communities will not be as important as is in Puerto Rico.

219 Costa Rica indicated they have one Tsunami Ready recognised community that was done with support of the National Emergency Commission (CNE). Several other communities in Costa Rica are in the pipeline for recognition with some of them looking for sponsoring from private sectors (bank, hotels, ports).



220 Mr David Coetzee (New Zealand, and Chair WG3) indicated that the key question is for how long the ICG continue the program as a pilot and when and how it becomes a full-fledged Programme.

221 The intra-sessional working group chaired by Working Group Chair Mr David Coetzee (New Zealand) presented a [report](#) on the results of the discussion.

222 The **ICG approved** Recommendation ICG/PTWS-XXVIII.3.

#### 4.5. NWPTAC ENHANCED PRODUCTS

223 Chair Wilfried Strauch introduced this agenda item by recalling that in the pursuit of improving PTWS tsunami warning products, Japan announced at the IOC Executive Council in July 2014, that the Northwest Pacific Tsunami Advisory Centre (NWPTAC) would also be preparing new products based on the requirements of the recipient countries. Following this announcement, during the 4<sup>th</sup> Meeting of the PTWS Steering Committee (SC) in July 2014, a proposed timeline for the NWPTAC to develop and introduce Enhanced NWPTAC Products, targeting 2018 for its complete transition.

224 Mr Ryosuke Sakakibara (Japan), Scientific Officer, Earthquake and Tsunami Observation Division, Seismology and Volcanology Department, [Japan Meteorological Agency](#) (JMA), presented the [report](#) of the [Northwest Pacific Tsunami Advisory Center](#) (NWPTAC) on this agenda item. Mr Sakakibara explained about full transition to NWPTAC Enhanced Products as from February 2019 and the extension of NWPTAC Area of Service to 170 degree east and coverage of whole Papua New Guinea and the Solomon Islands in the South.

225 NWPTAC Enhanced Products are including three kind of graphical products based on real-time simulation and got more effective and easier to understand.

226 An Intra-sessional Task Team on the TSP User's Guides met on the afternoon of April 3, 2019 and was attended by representatives from each TSP as well as the PTWS Acting Chair, the IOC Technical Secretary, and many of the ICG/PTWS-XXVIII attendees. The discussion was led by Charles McCreery, who opened with a description of the history of the TSP User's Guides. He explained that with the PTWS soon having up to four TSPs that the Steering Committee has recommended there be an overview document of TSP services and also that each TSP have their own User's Guide with a structure and content as common as possible.

227 McCreery proposed a structure for the User's Guides, loosely based on the current NWPTAC User's Guide structure. He described the general content of the sections: Overview; Area of Service; Procedures – Timeline and Criteria; Products – Types, Content, and Definitions; Dissemination; Forecast Methodology; and Annexes. Each of the current TSP User's Guides already contains most of the information in these sections but organized in slightly different ways. There were no requests from participants for additional information or sections, and the representatives of each TSP agreed that they could modify their respective Guides to conform with a common structure and content.

228 The intra-sessional working group recommended to the ICG that the common format, with an accompanying general description of content, be distributed to each TSP for review and comment and then a common format and content will be approved by WG2. TSPs will modify their User's Guides during the coming inter-sessional period and submit them for a final review by WG2 that will then recommend them for approval by the next ICG. As the SCSTAC User's Guides submitted to ICG/PTWS-XXVIII have been accepted as an official publication within the IOC Technical Series upon endorsement of the IOC Assembly (Re: para.4.6 below, Recommendation ICG/PTWS-XXVIII.4 and Recommendation ICG/PTWS-XXVII.3), the

SCSTAC User's Guides in its existing format and content will be submitted to the IOC Assembly to be held in June 2019 for endorsement and used for full operation of the SCSTAC. The format and content of the endorsed and published SCSTAC User's Guide can then be modified, if required, to the common format and content to be approved by WG2. ITIC and the Secretariat will write the TSP overview document also for submission through WG2 for approval by the next ICG.

229           The **ICG approved** Recommendation ICG/PTWS-XXVIII.2.

#### 4.6.    SOUTH CHINA SEA TSUNAMI ADVISORY CENTER

230           Chair Mr Strauch recalled that at its 25<sup>th</sup> session the ICG PTWS established a Task Team of the Regional Working Group on Tsunami Warning and Mitigation in the South China Sea on Establishment of a South China Sea Tsunami Advisory Center (SCSTAC). He further recalled that this Task Team has reported to the WG on the South China Sea region, which has oversight its development. He also recalled that Recommendation ICG/PTWS-XXVII.3 provided guidance on the Trial and Full Operation of South China Sea Tsunami Advisory Centre.

231           Mr Zhiguo Xu (China), Chief Seismologist, National Marine Environmental Forecasting Center (NMEFC)/Ministry of Natural Resources (MNR), presented a [report](#) on trial operation of the South China Sea Tsunami Advisory Center (SCSTAC). Firstly, Mr Xu recalled the background of establishment of SCSTAC under the guidance of the IOC. The 23<sup>th</sup> ICG/PTWS session decided to establish a Regional Working Group for Tsunami Warning and Mitigation System for the South China Sea region. The 24<sup>th</sup> ICG/PTWS session decided to establish a tsunami warning and mitigation system for the South China Sea region based on the framework plan for tsunami warning and mitigation system of the South China Sea region submitted by China. The 25<sup>th</sup> ICG/PTWS session accepted the offer from China to establish and host SCSTAC and agreed to establish a Task Team on the establishment of SCSTAC to guide the establishment of SCSTAC. Under the guidance of the UNESCO Intergovernmental Oceanographic Commission and with the strong support from the government of China, the capabilities of earthquake monitoring and tsunami warning in the South China Sea region had been enhanced substantially and establishment of SCSTAC was in good progress. With the endorsement of the 27<sup>th</sup> ICG/PTWS session and the decision of the Steering Committee of the ICG/PTWS on 11 September 2017, SCSTAC commenced trial operation on 26 January 2018 announced by the IOC Secretariat through Circular Letter No 2706.

232           Mr Xu provided a detailed introduction of the operating systems and the operation of SCSTAC, including the earthquake monitoring and tsunami detection system, tsunami warning and tsunami hazard assessment system, and the tsunami information dissemination system. The Decision Supporting System (DSS) tailored for SCSTAC integrated the earthquake and sea level monitoring, tsunami scenario database, tsunami simulation tools in real-time, tsunami product generating and issue system, which greatly shortened the time of response for tsunami warning.

233           Mr Xu presented the Key Performance Indicators (KPIs) and the corresponding target values for the trial operation and evaluated the trial operation performance for SCSTAC. During the period of trial operation, SCSTAC conducted many activities to enhance the capabilities of provision of tsunami advisory services in the South China Sea region. In the final part of his report, Mr Xu reported on SCSTAC's planned actions in 2019 as follows:

- Start full operation of SCSTAC in the second half of 2019;

- Continue to enhance the capacity of seismic and sea level monitoring in the South China Sea region (an IOC Training Workshop will be conducted on 21-25 October 2019 in Hangzhou, China);
- Continue with the International Staff Programme to host two experts from the Member States of the SCS-WG in 2019, with the travel and local expenses covered by SCSTAC;
- Continue to strengthen the understanding and use of the SCSTAC Tsunami Advisory Products by the SCS Member States (an IOC/ITIC training workshop on SCSTAC SOP and products is planned in 2020 in China);
- Continue to provide opportunities for education, outreach and training activities in the region; and
- Continue to collaborate with PTWC and NWPTAC with a view to further streamline the arrangement and enhance the efficiency of the operation of SCSTAC.

234 The **ICG agreed** 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, **decided to** commence the full operation of SCSTAC on 5 November 2019, and **approved** Recommendation ICG/PTWS-XXVIII.4.

#### 4.7. CENTRAL AMERICA TSUNAMI ADVISORY CENTER

235 Chair Mr Strauch recalled that at the 27<sup>th</sup> session ICG PTWS Nicaragua and the Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast (WG-CA) reported progress on the establishment of a Central America Tsunami Advisory Center (CATAC). He invited Mr Emilio Talavera (Nicaragua), director of Seismology, Instituto Nicaragüense de Estudios Territoriales ([INETER](#)), to report under this agenda item.

236 Mr Talavera provided a [report](#) describing CATAC’s objectives, Member States covered, actions to strengthen the seismic monitoring network, areas of surveillance and responsibility, and contributions of Japanese government as follows:

##### Contributions of JICA, JMA, University of Hokkaido

- Capacitation & Training
- Acquisition of SeisComp3 software, including commercial modules by GEMPA
- Acquisition of equipment: 8 bb & 8 Accelerometers, 8 sea gauges
- 2 long term advisors
- Several short term advisors
- Travels to meetings
- Workshops for Central American cooperation

##### Human Resource capacities:

- 30 persons for 1 year Seismology course at UNAN University/Managua

- 5 Masters studies in Japan
- 15 trainees to JMA/Japan on Tsunamis warning
- 15 watchstanders trained 20 days about SeisComP
- Visits of Japanese scientists from JMA & Univ. Hokkaido to capacitate watch standers at INETER/Managua in seismology and tsunami
- Training of INETER personnel on the job

237 Mr Talavera reported advances in seismic data processing including with the acquisition of new SeisComP and TOAST modules for tsunami simulation. Also, the strengthening of tsunami database, installation of 8 new broadband seismic stations and 8 sea level stations in Nicaragua.

238 He noted that operations and advisory products have been developed, that a Spanish/English [User's Guide for the Central American Tsunami Advisory Centre - CATAC](#) is available, and pilot products were developed in the framework of the Caribe Wave 19 exercise.

239 Finally, Mr Talavera reported that Nicaragua proposes to the ICG/PTWS the initiation of experimental tsunami message delivery, starting in August 2019, based on the progress made in capacity building for the establishment of the Central American Tsunami Advisory Centre (CATAC). He noted also that the ICG/PTWS WG-CA supports this proposal.

240 The **ICG decided** to commence the trial operation of CATAC in August 2019, and **approved** Recommendation ICG/PTWS-XXVIII.5.

#### 4.8. PACIFIC WAVE EXERCISE 2021

241 The Chair Ms Nelson recalled that the next Exercise Pacific Wave will be the ninth exercise of the ICG/PTWS.

242 An inter-sessional working group on PacWave 21 met during the session. The Group, chaired by Dr Laura Kong, Director, ITIC, included representatives from China, Japan, NWPTAC, Mexico, Tonga, Nicaragua, New Zealand, Republic of Korea, Fiji, Australia, SPC, NWPTAC, CATAC, SCSTAC, and PTWC.

243 Dr Kong reported that the group reviewed the Report of PacWave18 on the challenges from PacWave18 on how to meet country needs for exercise scenarios and mismatches of the simulated observations from the TSPs. Additionally, consideration and linkage to the Sendai Framework for Disaster Risk Reduction seven global targets and four priorities for action, World Tsunami Awareness Day and/or the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) were noted as important.

244 The group also discussed the dates for the next PTWS exercise, considering pre-exercise scheduling and post-exercise evaluation and reporting in the context of the next ICG/PTWS, aim, themes, and objectives, and format and conduct of the exercise. Australia shared the format and conduct, and lessons learned, of recent IOWave exercises, as well as how simulated observations are coordinated by the IOTWMS TSPs. The PTWC shared the format and conduct, and lessons learned, of recent Caribe Wave exercises. The group recognized high value of real-time exercises as it requires warning and response operations staff to make decisions, and communities to evacuate under real conditions 'with the clock ticking,' was noted.

245 In consideration of the above, the group agreed that the scenarios and format and conduct of a PacWave20 should be driven by the Regional Working Groups, where applicable, supported by the PTWS TSPs, ITIC and the Task Team. A proposed Task Team on PacWave20 Exercise will directly engage Member States outside of the Regional Working Groups to organize their exercise scenario, format, and conduct.

246 Australia suggested that TSPs should also be tested themselves for PacWave exercises.

247 The **ICG agreed** to organise an Exercise Pacific Wave 2020 (PacWave20).

#### 4.9. UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

248 The Chair Wilfried Strauch informed Member States that by Resolution [A/RES/72/73](#), the UN General Assembly proclaimed the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) in December 2017 and mandated the IOC to prepare an Implementation Plan in consultation with Member States, UN partners and other relevant stakeholders.

249 A Roadmap, detailing the governance arrangements of the preparation phase, as well as the preliminary objectives and expected outcomes of the Decade, was developed under the guidance of IOC Officers and circulated to IOC Member States through Circular Letter 2712. A [Revised roadmap for the UN Decade of Ocean Science for Sustainable Development](#) is now available.

250 Chair invited Mr Mike Angove (USA) to present a proposal on how PTWS and ICGs could contribute to the Decade, as contained in the document [Tsunami: Taking on the Oceans most dangerous waves](#).

251 New Zealand, Tonga and Australia strongly supported the idea of a substantive involvement of the PTWS in the [UN Decade of Ocean Science for Sustainable Development \(2021-2030\)](#) and to take advantage of this opportunity. Australia recalled the words of UN Ambassador for the Oceans on our limited knowledge of the vast ocean. Chair commented that there is also plenty of seismic stations that are not shared for tsunami warning purposes. New Zealand echoed that the same is valid for geodetic stations. A recommendation drafting group composed by USA, New Zealand and Tonga was established.

252 The **ICG approved** [Recommendation ICG/PTWS-XXVIII.6](#).

### 5. PROGRAMME AND BUDGET FOR 2020–2021

253 This agenda item was only informational. On behalf of the Secretariat, Mr Bernardo Aliaga, Technical Secretary of the ICG/PTWS, reported on the resources assigned from the UNESCO regular budget to the work of the Tsunami Unit of the IOC. He indicated that for the biennium 2020–2021 a slight increase in the regular budget may also impact positively in the resources available for the ICG/PTWS. Mr Aliaga thanked Member States support through extra-budgetary and in kind contributions.

### 6. NEXT SESSION

#### 6.1. CONFIRMATION OF DATE AND PLACE OF ICG/PTWS-XXIX

254 The Chair invited interventions from Member States on the subject.

255 Japan offered to host the 29<sup>th</sup> session of the ICG/PTWS beginning March or in November 2021.

256 The **ICG accepted** the offer of Japan to host the 29<sup>th</sup> session of the ICG/PTWS and instructed the Secretariat to coordinate the details with the Government of Japan.

## 6.2. TARGET DATE FOR ICG/PTWS-XXX

257 The **ICG decided** to schedule its 30<sup>th</sup> session in March/April 2023.

## 7. ELECTIONS OF OFFICERS

258 The Chair handed over this part of the Meeting to the Chair of the Elections Commission, Mr David Coetzee (New Zealand).

259 Mr Coetzee reported that the election of officers of the ICG/PTWS was announced with the Invitation in [IOC Circular Letter 2755](#), providing the required forms. Open for nominations were the positions of one Chair and two Vice-chairs. The deadline for nominations was set in CL 2755 and confirmed in the Annotated Agenda as Wednesday, 3 April 2019, at 17:00 Local Time Nicaragua.

260 Nominations were received by the Secretariat before the deadline for all open Officers positions. Each nomination was duly dated, timed and signed by the Secretariat.

261 The Elections Committee, composed of the USA, Guatemala, Japan, and New Zealand, chaired by Mr David Coetzee (New Zealand), met on Thursday, 4 April 2019. It duly scrutinized the nomination papers. One nomination was received for the position of chair and two nominations were received for the vice-chair positions. The nominations were considered complete, correct and in the required form and format.

262 The Elections Committee reported that there was only one nominee for each position and therefore there was no need for voting to take place.

263 The **ICG accepted** the proposal of the Elections Commission and **elected** the Officers by acclamation as follows:

- Chair: Dr Wilfried Strauch (Nicaragua)
- Vice-Chair: Mr Ofa Fa'Anunu (Tonga)
- Vice-Chair: Mr Yuji Nishimae (Japan)

## 8. ANY OTHER BUSINESS

264 No other business was discussed.

## 9. ADOPTION OF DECISIONS AND RECOMMENDATIONS

265 The **ICG** debated in Plenary and **approved** six recommendations as included under ANNEX II.

## 10. CLOSURE

266 The session was closed at 4:50 pm on 5 April 2019.



ANNEX I

**PROVISIONAL AGENDA**

- 1. WELCOME AND OPENING OF SESSION**
- 2. ORGANIZATION OF THE SESSION**
  - 2.1 ADOPTION OF AGENDA
  - 2.2 DESIGNATION OF THE RAPPORTEUR
  - 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION
- 3. REPORT ON INTERSESSIONAL ACTIVITIES**
  - 3.1. CHAIRPERSON REPORT
  - 3.2. SECRETARIAT REPORT
  - 3.3. TOWS-WG REPORT
  - 3.4. TSUNAMI SERVICES PROVIDERS REPORT
    - 3.4.1. PTWC
    - 3.4.2. NWPTAC
  - 3.5. ITIC'S REPORT
  - 3.6. NATIONAL PROGRESS REPORTS
  - 3.7. WORKING GROUP REPORTS
  - 3.8. REPORT OF THE TASK TEAM ON FUTURE GOALS AND PERFORMANCE MONITORING
  - 3.9. REPORT OF THE TASK TEAM ON EVACUATION PLANNING AND MAPPING (TEMPP) AND TSUNAMI READY
  - 3.10. REPORT OF PACIFIC WAVE EXERCISE 2018
  - 3.11. STATUS OF PROGRESS IN OTHER ICGS
  - 3.12. REPORTS FROM UN AND NON UN ORGANISATIONSS
- 4. POLICY MATTERS**
  - 4.1. PTWS STATUS REPORT
  - 4.2. FUTURE WORKING GROUP AND TASK TEAM STRUCTURE
  - 4.3. EVACUATION PLANNING AND MAPPING
  - 4.4. TSUNAMI READY RECOGNITION



- 4.5. NWPTAC ENHANCED PRODUCTS
- 4.6. SOUTH CHINA SEA TSUNAMI ADVISORY CENTER
- 4.7. CENTRAL AMERICA TSUNAMI ADVISORY CENTER
- 4.8. PACIFIC WAVE EXERCISE 2021
- 4.9. UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT
- 5. PROGRAMME AND BUDGET FOR 2020–2021**
- 6. NEXT SESSION**
  - 6.1 CONFIRMATION OF DATE AND PLACE OF ICG/PTWS-XXIX
  - 6.2 TARGET DATE FOR ICG/PTWS-XXX
- 7. ELECTIONS OF OFFICERS**
- 8. ANY OTHER BUSINESS**
- 9. ADOPTION OF DECISIONS AND RECOMMENDATIONS**
- 10. CLOSURE**

## 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
- 8<sup>th</sup> Meeting of the PTWS Steering Committee, Honolulu, Hawaii, USA, 7-8 June 2018
- 12<sup>th</sup> 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 29<sup>th</sup> 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.

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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 to 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).

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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.

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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.

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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.

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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.

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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 28<sup>th</sup> 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”

Release Version 1 – 06/04/19, ICG/PTWS XXVIII, Nicaragua

## 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 28<sup>th</sup> session reviewed and agreed the following ten Tsunami Ready Guidelines so they are better understandable against their intent:

<b>UNESCO IOC TSUNAMI READY GUIDELINES</b>	<b>DONE</b>
<b>MITIGATION (MIT)</b>	
MIT-1. Have designated & mapped tsunami hazard zones	X
MIT-2. Have a public display of tsunami information	X
<b>PREPAREDNESS (PREP)</b>	
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
<b>RESPONSE (RESP)</b>	
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

## ANNEX VI

### LIST OF PARTICIPANTS

#### Officers

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ANNEX VII

**LIST OF ACRONYMS**

<b>AoS</b>	Areas of Service
<b>CATAC</b>	Central America Tsunami Advisory Centre
<b>CEPREDENAC</b>	Coordination Centre for the Prevention of Natural Disasters in Central America
<b>ComMIT</b>	Community Inundation Model
<b>COPECO</b>	Comisión Permanente de Emergencias
<b>CTWP</b>	Caribbean Tsunami Warning programme
<b>DFO</b>	Department of Fisheries and Oceans
<b>DG ECHO</b>	Directorate-General for European Civil Protection and Humanitarian Aid Operations
<b>DIPECHO</b>	European Commission Humanitarian Aid Department's Disaster Preparedness Programme
<b>DMO</b>	Disaster Management Office
<b>ECHO</b>	European Commission's Humanitarian Aid Office
<b>ETAs</b>	Estimated Arrival Times
<b>FDSN</b>	Federation of Digital Seismograph Networks
<b>FEMA</b>	Federal Emergency Management Agency
<b>FRDP</b>	Framework for Resilient Development in the Pacific
<b>GTS</b>	Global Telecommunication System
<b>ICG/IOTWS</b>	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System
<b>ICG/NEAMTWS</b>	Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
<b>ICG/PTWS</b>	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System
<b>INETER</b>	Instituto Nicaragüense de Estudios Territoriales
<b>IOC</b>	Intergovernmental Oceanographic Commission

<b>IOTIC</b>	Indian Ocean Tsunami Information Center
<b>ITIC</b>	International Tsunami Information Center
<b>ITP</b>	International Training Programmes
<b>ITST</b>	International Tsunami Survey Team
<b>ITU</b>	International Telecommunication Union
<b>IUGG</b>	International Union of Geodesy and Geophysics
<b>JICA</b>	the Japan International Cooperation Agency
<b>JMA</b>	Japan Meteorological Agency
<b>JTF</b>	Joint Task Force
<b>MTS</b>	Medium-Term Strategy
<b>NCEI</b>	National Centers for Environmental Information
<b>NDBC</b>	National Data Buoy Centre
<b>NDMO</b>	National Disaster Management Organization
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NTWC</b>	National Tsunami Warning Centres
<b>NWPTAC</b>	Northwest Pacific Tsunami Advisory Center
<b>OFDA</b>	Office of Foreign Disaster Assistance
<b>ORSNET</b>	Oceania Regional Seismic NETwork
<b>PMEL</b>	NOAA Pacific Marine Environmental Laboratory
<b>PTWC</b>	Pacific Tsunami Warning Center
<b>SCS</b>	South China Sea
<b>SCSTAC</b>	South China Sea Tsunami Advisory Center
<b>SFDRR</b>	Sendai Framework for Disaster Risk Reduction
<b>SMART</b>	Science Monitoring And Reliable Telecommunication
<b>SHOA</b>	Servicio Hidrográfico y Oceanográfico de la Armada de Chile
<b>SINAPRED</b>	National System of Disaster Prevention
<b>SOP</b>	Standard Operating Procedures
<b>SPC</b>	Secretariat of the Pacific Community

<b>SPREP</b>	Secretariat of the Pacific Regional Environment Programme
<b>TNC</b>	Tsunami National Contact
<b>TEMPP</b>	Tsunami Evacuation Maps, Plans, and Procedures
<b>TOWS-WG</b>	Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems
<b>TSP</b>	Tsunami Service Provider
<b>TsuCAT</b>	Tsunami Coastal Assessment Tool
<b>TT</b>	Task Team
<b>TWFP</b>	Tsunami Warning Focal Point
<b>UNESCAP</b>	UN Economic and Social Commission for Asia and the Pacific
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>USAID</b>	United States Agency for International Development
<b>USNTWC</b>	U.S. National Tsunami Warning Center
<b>WCDRR</b>	World Conference on Disaster Risk reduction
<b>WDS</b>	World Data Service
<b>WG</b>	Working Group
<b>WG-CA</b>	Working Group for Central America
<b>WG-PICTs</b>	Pacific Island Countries and Territories Regional Working Group on Tsunami Warning and Mitigation System
<b>WG-SCS</b>	Working Group for the South China Sea region
<b>WMO</b>	World Meteorological Organization
<b>WTAD</b>	World Tsunami Awareness Day

In this Series	Languages
<b>Reports of Governing and Major Subsidiary Bodies</b> , which was initiated at the beginning of 1984, the reports of the following meetings have already been issued:	
1. Eleventh Session of the Working Committee on international Oceanographic Data Exchange	E, F, S, R
2. Seventeenth Session of the Executive Council	E, F, S, R, Ar
3. Fourth Session of the Working Committee for Training, Education and Mutual Assistance	E, F, S, R
4. Fifth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S, R
5. First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions	E, F, S
6. Third Session of the <i>ad hoc</i> Task team to Study the Implications, for the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime	E, F, S, R
7. First Session of the Programme Group on Ocean Processes and Climate	E, F, S, R
8. Eighteenth Session of the Executive Council	E, F, S, R, Ar
9. Thirteenth Session of the Assembly	E, F, S, R, Ar
10. Tenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific	
11. Nineteenth Session of the Executive Council, Paris, 1986	E, F, S, R, Ar
12. Sixth Session of the IOC Scientific Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S
13. Twelfth Session of the IOC Working Committee on International Oceanographic Data Exchange	E, F, S, R
14. Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Havana, 1986	E, F, S
15. First Session of the IOC Regional Committee for the Central Eastern Atlantic, Praia, 1987	E, F, S
16. Second Session of the IOC Programme Group on Ocean Processes and Climate	E, F, S
17. Twentieth Session of the Executive Council, Paris, 1987	E, F, S, R, Ar
18. Fourteenth Session of the Assembly, Paris, 1987	E, F, S, R, Ar
19. Fifth Session of the IOC Regional Committee for the Southern Ocean	E, F, S, R
20. Eleventh Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Beijing, 1987	E, F, S, R
21. Second Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Arusha, 1987	E, F
22. Fourth Session of the IOC Regional Committee for the Western Pacific, Bangkok, 1987	E only
23. Twenty-first Session of the Executive Council, Paris, 1988	E, F, S, R
24. Twenty-second Session of the Executive Council, Paris, 1989	E, F, S, R
25. Fifteenth Session of the Assembly, Paris, 1989	E, F, S, R
26. Third Session of the IOC Committee on Ocean Processes and Climate, Paris, 1989	E, F, S, R
27. Twelfth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Novosibirski, 1989	E, F, S, R
28. Third Session of the Sub-Commission for the Caribbean and Adjacent Regions, Caracas, 1989	E, S
29. First Session of the IOC Sub-Commission for the Western Pacific, Hangzhou, 1990	E only
30. Fifth Session of the IOC Regional Committee for the Western Pacific, Hangzhou, 1990	E only
31. Twenty-third Session of the Executive Council, Paris, 1990	E, F, S, R
32. Thirteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, New York, 1990	E only
33. Seventh Session of the IOC Committee for the Global Investigation of Pollution in the Marine Environment, Paris, 1991	E, F, S, R
34. Fifth Session of the IOC Committee for Training, Education and Mutual Assistance in Marine Sciences, Paris, 1991	E, F, S, R
35. Fourth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1991	E, F, S, R
36. Twenty-fourth Session of the Executive Council, Paris, 1991	E, F, S, R
37. Sixteenth Session of the Assembly, Paris, 1991	E, F, S, R, Ar
38. Thirteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Baja California, 1991	E, F, S, R
39. Second Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1992	E only
40. Twenty-fifth Session of the Executive Council, Paris, 1992	E, F, S, R
41. Fifth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1992	E, F, S, R
42. Second Session of the IOC Regional Committee for the Central Eastern Atlantic, Lagos, 1990	E, F
43. First Session of the Joint IOC-UNEP Intergovernmental Panel for the Global Investigation of Pollution in the Marine Environment, Paris, 1992	E, F, S, R
44. First Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1992	E, F, S
45. Fourteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 1992	E, F, S, R
46. Third Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Vascoas, 1992	E, F
47. Second Session of the IOC Sub-Commission for the Western Pacific, Bangkok, 1993	E only
48. Fourth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Veracruz, 1992	E, S
49. Third Session of the IOC Regional Committee for the Central Eastern Atlantic, Dakar, 1993	E, F
50. First Session of the IOC Committee for the Global Ocean Observing System, Paris, 1993	E, F, S, R
51. Twenty-sixth Session of the Executive Council, Paris, 1993	E, F, S, R
52. Seventeenth Session of the Assembly, Paris, 1993	E, F, S, R
53. Fourteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Tokyo, 1993	E, F, S, R
54. Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1993	E, F, S
55. Twenty-seventh Session of the Executive Council, Paris, 1994	E, F, S, R
56. First Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Melbourne, 1994	E, F, S, R
57. Eighth Session of the IOC-UNEP-IMO Committee for the Global Investigation of Pollution in the Marine Environment, San José, Costa Rica, 1994	E, F, S
58. Twenty-eighth Session of the Executive Council, Paris, 1995	E, F, S, R
59. Eighteenth Session of the Assembly, Paris, 1995	E, F, S, R
60. Second Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E, F, S, R

61.	Third Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1995	E only
62.	Fifteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Papete, 1995	E, F, S, R
63.	Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1995	E, F, S
64.	Fifteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange	E, F, S, R
65.	Second Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E only
66.	Third Session of the IOC Sub-Commission for the Western Pacific, Tokyo, 1996	E only
67.	Fifth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Christ Church, 1995	E, S
68.	Intergovernmental Meeting on the IOC Black Sea Regional Programme in Marine Sciences and Services	E, R
69.	Fourth Session of the IOC Regional Committee for the Central Eastern Atlantic, Las Palmas, 1995	E, F, S
70.	Twenty-ninth Session of the Executive Council, Paris, 1996	E, F, S, R
71.	Sixth Session for the IOC Regional Committee for the Southern Ocean and the First Southern Ocean Forum, Bremerhaven, 1996	E, F, S,
72.	IOC Black Sea Regional Committee, First Session, Varna, 1996	E, R
73.	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Fourth Session, Mombasa, 1997	E, F
74.	Nineteenth Session of the Assembly, Paris, 1997	E, F, S, R
75.	Third Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1997	E, F, S, R
76.	Thirtieth Session of the Executive Council, Paris, 1997	E, F, S, R
77.	Second Session of the IOC Regional Committee for the Central Indian Ocean, Goa, 1996	E only
78.	Sixteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Lima, 1997	E, F, S, R
79.	Thirty-first Session of the Executive Council, Paris, 1998	E, F, S, R
80.	Thirty-second Session of the Executive Council, Paris, 1999	E, F, S, R
81.	Second Session of the IOC Black Sea Regional Committee, Istanbul, 1999	E only
82.	Twentieth Session of the Assembly, Paris, 1999	E, F, S, R
83.	Fourth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1999	E, F, S, R
84.	Seventeenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Seoul, 1999	E, F, S, R
85.	Fourth Session of the IOC Sub-Commission for the Western Pacific, Seoul, 1999	E only
86.	Thirty-third Session of the Executive Council, Paris, 2000	E, F, S, R
87.	Thirty-fourth Session of the Executive Council, Paris, 2001	E, F, S, R
88.	Extraordinary Session of the Executive Council, Paris, 2001	E, F, S, R
89.	Sixth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, San José, 1999	E only
90.	Twenty-first Session of the Assembly, Paris, 2001	E, F, S, R
91.	Thirty-fifth Session of the Executive Council, Paris, 2002	E, F, S, R
92.	Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Lisbon, 2000	E, F, S, R
93.	Eighteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Cartagena, 2001	E, F, S, R
94.	Fifth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2001	E, F, S, R
95.	Seventh Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Mexico, 2002	E, S
96.	Fifth Session of the IOC Sub-Commission for the Western Pacific, Australia, 2002	E only
97.	Thirty-sixth Session of the Executive Council, Paris, 2003	E, F, S, R
98.	Twenty-second Session of the Assembly, Paris, 2003	E, F, S, R
99.	Fifth Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Kenya, 2002 (* Executive Summary available separately in E, F, S & R)	E*
100.	Sixth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, St. Petersburg (USA), 2002 (* Executive Summary available separately in E, F, S & R)	E*
101.	Seventeenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
102.	Sixth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
103.	Nineteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Wellington, New Zealand, 2003 (* Executive Summary available separately in E, F, S & R)	E*
104.	Third Session of the IOC Regional Committee for the Central Indian Ocean, Tehran, Islamic Republic of Iran, 21-23 February 2000	E only
105.	Thirty-seventh Session of the Executive Council, Paris, 2004	E, F, S, R
106.	Seventh Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2005 (* Executive Summary available separately in E, F, S & R); and Extraordinary Session, Paris, 20 June 2005	E*
107.	First Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Perth, Australia, 3-5 August 2005	E only
108.	Twentieth Session of the Intergovernmental Coordination Group for the Tsunami Warning System in the Pacific, Viña del Mar, Chile, 3-7 October 2005 (* Executive Summary available separately in E, F, S & R)	E*
109.	Twenty-Third Session of the Assembly, Paris, 21-30 June 2005	E, F, S, R
110.	First Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Rome, Italy, 21-22 November 2005	E only
111.	Eighth Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Recife, Brazil, 14-17 April 2004 (* Executive Summary available separately in E, F, S & R)	E*
112.	First Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions (ICG/CARIBE-EWS), Bridgetown, Barbados, 10-12 January 2006	E only
113.	Ninth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Cartagena de Indias, Colombia, 19-22 April 2006 (* Executive Summary available separately in E, F, S & R)	E S*

114.	Second Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Hyderabad, India, 14–16 December 2005	E only
115.	Second Session of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology, Halifax, Canada, 19–27 September 2005 (Abridged final report with resolutions and recommendations)	E, F, R, S
116.	Sixth Session of the IOC Regional Committee for the Western Indian Ocean (IOCWIO), Maputo, Mozambique, 2–4 November 2005 (* Executive Summary available separately in E, F, S & R)	E*
117.	Fourth Session of the IOC Regional Committee for the Central Indian Ocean, Colombo, Sri Lanka 8–10 December 2005 (* Executive Summary available separately in E, F, S & R)	E*
118.	Thirty-eighth Session of the Executive Council, Paris, 20 June 2005 (Electronic copy only)	E, F, R, S
119.	Thirty-ninth Session of the Executive Council, Paris, 21–28 June 2006	E, F, R, S
120.	Third Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Bali, Indonesia, 31 July–2 August 2006 (*Executive Summary available separately in E,F,S & R)	E*
121.	Second Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Nice, France, 22–24 May 2006	E only
122.	Seventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 16–18 March 2005 (* Executive Summary available separately in E, F, S & R)	E*
123.	Fourth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS-IV), Mombasa, Kenya, 30 February-2 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
124.	Nineteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Trieste, Italy, 12–16 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
125.	Third Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Bonn, Germany, 7–9 February 2007 (* Executive Summary available separately in E, F, S & R)	E*
126.	Second Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Cumaná, Venezuela, 15–19 January 2007 (* Executive Summary available separately in E, F, S & R)	E*
127.	Twenty-first Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Melbourne, Australia, 3–5 May 2006 (* Executive Summary available separately in E, F, S & R)	E*
128.	Twenty-fourth Session of the Assembly, Paris, 19–28 June 2007	E, F, S, R
129.	Fourth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Lisbon, Portugal, 21–23 November 2007 (* Executive Summary available separately in E, F, S & R)	E*
130.	Twenty-second Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Guayaquil, Ecuador, 17–21 September 2007 (* Executive Summary available in E, F, S & R included)	E*
131.	Forty-first Session of the Executive Council, Paris, 24 June–1 July 2008	E, F, R, S
132.	Third Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Panama City, Panama, 12–14 March 2008 (* Executive Summary available separately in E, F, S & R)	E*
133.	Eighth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 17–20 April 2007 (* Executive Summary available separately in E, F, S & R)	E*
134.	Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Apia, Samoa, 16–18 February 2009 (*Executive Summary available separately in E, F, S & R)	E*
135.	Twentieth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Beijing, China, 4–8 May 2009 (*Executive Summary available separately in E, F, S & R)	E*
136.	Tenth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOPCARIBE), Puerto La Cruz, Bolivarian Republic of Venezuela, 22–25 October 2008 (*Executive Summary available separately in E, F, S & R)	E, S*
137.	Seventh Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-VII), Sabah, Malaysia, 26–29 May 2008 (*Executive Summary available separately in E, F, S & R)	E*
138.	Ninth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, France, 10–12 June 2009 (* Executive Summary available separately in E, F, S & R);	E*
139.	Fifth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Athens, Greece, 3–5 November 2008 (* Executive Summary available separately in E, F, S & R)	E*
140.	Fourth Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Fort-de-France, Martinique, France, 2–4 June 2009 (* Executive Summary available separately in E, F, S & R)	E*
141.	Twenty-fifth Session of the Assembly, Paris, 16–25 June 2009	E, F, R, S
142.	Third Session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology, Marrakesh, Morocco, 4–11 November 2009	E, F, R, S
143.	Ninth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 22–24 April 2009 (* Executive Summary available separately in E, F, S & R)	E*
144.	Fifth Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Managua, Nicaragua, 15–17 March 2010 (* Executive Summary available in E, F, S & R)	E*
145.	Sixth Session of the IOC Regional Committee for the Central and Eastern Atlantic Ocean, Accra, Ghana, 28–30 March 2010 (* Executive Summary available in E, F, S & R)	E*
146.	Forty-second Session of the Executive Council; Paris, 15, 19 & 20 June 2009	E, F, R, S
147.	Forty-third Session of the Executive Council; Paris, 8–16 June 2010	E, F, R, S
148.	Sixth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Istanbul, Turkey, 11–13 November 2009 (* Executive Summary available separately in Ar, E, F, S & R)	E*
149.	Seventh Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Paris, France, 23–25 November 2010 (* Executive Summary available separately in Ar, E, F, S & R)	E*
150.	Sixth Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Santo Domingo, Dominican Republic, 26–29 April 2011 (* Executive Summary available in E, F, S & R)	E*



151.	Twenty-fourth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Beijing, China, 24–27 May 2011 (*Executive Summary in E, F, S & R included)	E*
152.	Twenty-first Session of the IOC Committee on International Oceanographic Data and Information Exchange, Liège, Belgium, 23–26 March 2011 (*Executive Summary available separately in E, F, S & R)	E*
153.	Eighth Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-VIII), Bali, Indonesia, 10–13 May 2010 (*Executive Summary available separately in E, F, S & R)	E*
154.	Tenth IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 12–14 April 2011 (*Executive Summary available separately in E, F, S & R)	E*
155.	Forty-fifth Session of the Executive Council, Paris, 26–28 June 2012 (*Decisions available in E, F, S & R)	E*
156.	Seventh Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Willemstad, Curacao, 2–4 April 2012 (*Executive Summary available in E, F, S & R)	E*
157.	Eleventh Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Miami, USA, 17–20 May 2011 (*Executive Summary available separately in E & S)	E, S*
158.	Eight Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS-VIII), Trinidad & Tobago, 29 April–1 May 2013 (*Executive Summary available in E, F, S & R)	E*
159.	Twenty-seventh Session of the Assembly, Paris, 26 June–5 July 2013 and Forty-sixth Session of the Executive Council, Paris, 25 June 2013	E, F, R, S
160.	Twenty-fifth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS), Vladivostok, Russian Federation, 9–11 September 2013 (*Executive Summary in E, F & R)	E*
161.	Ninth Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions, US Virgin Islands, 13–15 May 2014 (*Executive Summary available in E, F, S & R)	E*
162.	Forty-seventh Session of the Executive Council, Paris, 1–4 July 2014 (*Decisions available in E, F, S & R)	E*
163.	Ninth Session of the IOC Sub-Commission of the Western Pacific (WESTPAC-IX), Busan, Republic of Korea, 9–12 May 2012	E
164.	Eleventh Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, 12–14 November 2014, Nicosia, Cyprus (*Executive Summary available in E, F, S & R)	E*
165.	Twenty-sixth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVI), Hawaii, USA, 22–24 April 2015 (*Executive Summary available in E, F, S & R)	E*
166.	Tenth Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS), Philipsburg, Sint Maarten, Kingdom of the Netherlands, 19–21 May 2015 (*Executive Summary available in E, F, S & R)	E*
167.	Tenth Session of the IOC Sub-Commission of the Western Pacific (WESTPAC-X), Phuket, Thailand, 12–15 May 2015	E
168.	Twenty-eighth Session of the Assembly, Paris, 18–25 June 2015	
169.	Twelfth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS-XII), Dublin, Ireland, 16–18 November 2015 (*Executive Summary available in E, F, S & R)	E*
170.	Eleventh Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS-XI), Cartagena, Colombia, 5–7 April 2016 (*Executive Summary available in E, F, S & R)	E*
171.	Tenth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Muscat, Oman, 24–26 March 2015	E*
172.	Forty-ninth Session of the Executive Council, Paris, 7–10 June 2016 (*Decisions available in E, F, S & R)	E*
173.	Thirteenth Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions, Bucharest, Romania, 26–28 September 2016 (*Executive Summary available in E, F, S & R)	E*
174.	Twenty-seventh Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVII), Tahiti, France, 28–31 March 2017 (*Executive Summary available in E, F, S & R)	E*
175.	Twelfth Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS), Puntarenas, Costa Rica, 10–12 May 2017 (*Executive Summary available in E, F, S & R)	E*
176.	Eleventh Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Putrajaya, Malaysia, 18–20 April 2017 (*Executive Summary available in E, F, S & R)	E*
177.	Fourteenth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas (ICG/NEAMTWS), Lisbon, Portugal, 21–23 November 2017 (*Executive Summary available in E, F, S & R)	E*
178.	Twenty-ninth Session of the Assembly, Paris, 21–29 June 2017 and Fiftieth Session of the Executive Council, Paris, 20 June 2017 (*Executive Summary available in E, F, S & R)	E*
179.	Thirteenth Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS-XIII), Curaçao, 23–27 April 2018 (*Executive Summary available in E, F, S & R)	E*
180.	Twenty-fifth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Tokyo, 2019 (*Executive Summary available separately in E, F, S & R)	E*
181.	Fifteenth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Paris, France, 26–28 November 2018 (*Executive Summary available in E, F, S & R)	E*
182.	Twelfth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Kish, Islamic Republic of Iran, 9–12 March 2019 (*Executive Summary available in E, F, S, R)	E*
183.	Twenty-eighth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVIII), Montelimar, Nicaragua, 2–5 April 2019 (*Executive Summary available in E, F, S & R)	E*
184.	Fourteenth session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS-XIV/3), Punta Leona, Costa Rica, 8–11 April 2019 (*Executive Summary available in E, F, S & R)	E*