Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

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

Twenty-fifth Session

Vladivostok, Russian Federation
9–11 September 2013

UNESCO

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Executive summary

The Twenty-fifth Session of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS-XXV) was held in Vladivostok, Russian Federation, from 9 to 11 September 2013, chaired by the ICG/PTWS Chair, Dr Ken Gledhill (New Zealand). The meeting was very well attended, with over 60 participants from 16 countries, one organization (World Meteorological Organisation) and 1 Observer from a business company (Science Applications International Corporation, SAIC).

The **ICG requested** the Pacific Tsunami Warning Center (PTWC) to replace the current PTWC tsunami products for PTWS as from 1 October 2014 with the endorsed Enhanced Tsunami Products. The PTWC Enhanced Tsunami Products for the PTWS will no longer advise levels of alert to Member States, but instead provide more detailed forecast levels of tsunami threat for use by the National Tsunami Warning Centres (NTWCs).

The **ICG accepted** China's proposal to build a South China Sea Tsunami Advisory Centre (SCSTAC) to service the approved sub-regional South China Sea Tsunami Warning and Mitigation System within the framework of the ICG/PTWS. China's National Marine Environmental Forecasting Centre (NMFEC) will be responsible for building the centre.

The **ICG decided** to continue Working Group 1 on Tsunami Risk Assessment and Reduction with Dr Vasily Titov (USA) as Chair.

The **ICG agreed** to continue Working Group 2 on Tsunami Detection, Warning and Dissemination with Mr Rick Bailey (Australia) as Chair.

The **ICG decided** to rename and redefine the Terms of Reference of the Working Group 3 to “Disaster Management and Preparedness” and elected Mr David Coetzee (New Zealand) as Chair.

The **ICG decided** to continue the Regional Working Group on Tsunami Warning and Mitigation on the Central American Pacific Coast with Ms Angelica Muñoz (Nicaragua) as Chair.

The **ICG decided** to continue the Regional Working Group on Tsunami Warning and Mitigation in the Southeast Pacific Region with Lt. Carlos Zuñiga (Chile) as Chair.

The **ICG decided** to continue Regional Working Group on Tsunami Warning and Mitigation in the South China Sea Region with Mr Hing-Yim Mok (China) as Chair.

The **ICG decided** to continue the Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Region and elected Ms Filomena Nelson (Samoa) as Chair.

The **ICG agreed** that a PacWave 15 exercise be conducted in 2015, and established a Task Team to coordinate the exercise chaired by Dr Laura Kong, ITIC Director.

The **ICG thanked** USA and **agreed** to hold the ICG/PTWS-XXVI session in Honolulu, USA, in April 2015.

The **ICG elected** Dr Ken Gledhill (New Zealand) as Chair and Captain Patricio Carrasco (Chile), Dr Tatiana Ivelskaya (Russian Federation) and Mr Takeshi Koizumi (Japan) as Vice-Chairs for the ICG/PTWS for the period September 2013–April 2015.

Résumé exécutif

La 25e session du Groupe intergouvernemental de coordination du Système d'alerte aux tsunamis et de mitigation dans le Pacifique (ICG/PTWS-XXV) s'est tenue à Vladivostok, Fédération de Russie, du 9 au 11 septembre 2013 sous la présidence de M. Ken Gledhill (Nouvelle-Zélande), Président du GIC/PTWS. La réunion a rassemblé une nombreuse assistance, plus de 60 participants venus de 16 pays, une organisation (l'Organisation météorologique mondiale) et un observateur d'une entreprise privée (la Science Applications International Corporation, SAIC).

Le **GIC a demandé** au Centre d'alerte aux tsunamis dans le Pacifique (PTWC) de remplacer les actuels produits relatifs aux tsunamis du PTWC destinés au PTWS par les produits améliorés relatifs aux tsunamis à compter du 1er octobre 2014. Ces produits améliorés du PTWC destinés au PTWS n'indiqueront plus les niveaux d'alerte aux États membres mais fourniront à la place, pour utilisation par les centres nationaux d'alerte aux tsunamis (NTWC), des prévisions plus détaillées des niveaux de menace des tsunamis.

Le **GIC a accepté** la proposition faite par la Chine de construire un centre consultatif pour les tsunamis pour la mer de Chine méridionale (SCSTAC), afin de desservir le système sous-régional approuvé d'alerte et de mitigation aux tsunamis de la mer de Chine méridionale dans le cadre du GIC/PTWS. Le Centre international de prévision de l'environnement marin de la Chine (NMFEC) sera chargé de sa construction.

Le **GIC a décidé** de proroger le Groupe de travail 1 sur l'évaluation et la réduction du risque de tsunamis avec, à la présidence, M. Vasily Titov (États-Unis d'Amérique).

Le **GIC est convenu** de proroger le Groupe de travail 2 sur la détection des tsunamis, l'alerte et la diffusion, avec M. Rick Bailey (Australie) comme Président.

Le **GIC a décidé** de renommer le Groupe de travail 3 et d'en redéfinir le mandat « Gestion et préparation en cas de catastrophe » et a élu M. David Coetzee (Nouvelle-Zélande) à sa présidence.

Le **GIC a décidé** de proroger le Groupe de travail régional sur l'alerte aux tsunamis et la mitigation sur la côte Pacifique de l'Amérique centrale, avec Mme Angelica Muñoz (Nicaragua) comme Présidente.

Le **GIC a décidé** de proroger le Groupe de travail régional sur l'alerte aux tsunamis et la mitigation dans la région du Sud-Est du Pacifique placé sous la présidence de M. Carlos Zuñiga (Chili).

Le **GIC a décidé** de proroger le Groupe de travail régional sur l'alerte aux tsunamis et la mitigation dans la région de la mer de Chine méridionale, avec M. Hing-Yim Mok (Chine) comme Président.

Le **GIC a décidé** de proroger le Groupe de travail sur l'alerte aux tsunamis et la mitigation dans le Sud-Ouest du Pacifique et a élu Mme Filomena Nelson (Samoa) à sa présidence.

Le **GIC est convenu** que l'exercice PacWave 15 se déroulerait en 2015 et a mis en place une équipe de travail pour le coordonner sous la présidence de Mme Laura Kong, Directrice du CIIT.

Le **GIC a remercié** les États-Unis d'Amérique et **est convenu** de tenir sa 26e session (ICG/PTWS-XXVI) à Honolulu, États-Unis d'Amérique, en avril 2015.

Le **GIC a élu** M. Ken Gledhill (Nouvelle-Zélande) Président et M. Patricio Carrasco (Chili), Mme Tatiana Ivelskaya (Fédération de Russie) et M. Takeshi Koizumi (Japon), Vice-Présidents du GIC/PTWS pour la période allant de septembre 2013 à avril 2015.

Рабочее резюме

Двадцать пятая сессия Межправительственной координационной группы по системе предупреждения о цунами и смягчения их последствий в Тихом океане (МКГ/СПЦТО-XXV) состоялась во Владивостоке, Российская Федерация, с 9 по 11 сентября 2013 г. под председательством д-ра Кена Гледхилла (Новая Зеландия), председателя МКГ/СПЦТО. В ней приняли участие свыше 60 участников из 16 государств, а также представители от одной организации (Всемирная метеорологическая организация) и наблюдатель от одной компании (Международная корпорация по практическому применению научных знаний, САИК).

МКГ постановила, что Центр предупреждения о цунами в Тихом океане (СПЦТО) заменит нынешние продукты СПЦТО с 1 октября 2014 г. одобренными усовершенствованными продуктами СПЦТО. Усовершенствованные продукты СПЦТО для СПЦТО больше не будут сообщать государствам-членам уровень опасности, а будут предоставлять более подробный прогнозируемый уровень угрозы цунами для использования национальными центрами по предупреждению о цунами (НЦПЦ).

МКГ приняла предложение Китая о создании Консультативного центра по системе предупреждения о цунами в Южно-Китайском море (КЦЦЮКМ) для обслуживания одобренной субрегиональной системы предупреждения о цунами и смягчения их последствий в Южно-Китайском море в рамках МКГ/СПЦТО. За создание данного центра будет отвечать Китайский национальный центр морского прогнозирования в области окружающей среды (НЦМПК).

МКГ постановила продолжить деятельность Рабочей группы 1 по оценке и уменьшению риска цунами под председательством д-ра Василя Титова (США).

МКГ постановила продолжить деятельность Рабочей группы 2 по обнаружению, оповещению и распространению информации о цунами под председательством г-на Рика Бейли (Австралия).

МКГ постановила переименовать и пересмотреть круг ведения Рабочей группы 3 по обеспечению готовности к стихийным бедствиям и ликвидации их последствий и избрала г-на Дэвида Коэтзи (Новая Зеландия) ее председателем.

МКГ постановила продолжить деятельность Региональной рабочей группы по предупреждению о цунами и смягчению их последствий для Тихоокеанского побережья Центральной Америки под председательством г-жи Анжелики Муньос (Никарагуа).

МКГ постановила продолжить деятельность Региональной рабочей группы по предупреждению о цунами и смягчению их последствий для юго-восточной части Тихого океана под председательством лейтенанта Карлоса Суньига (Чили).

МКГ постановила продолжить деятельность Региональной рабочей группы по предупреждению о цунами и смягчению их последствий для региона Южно-Китайского моря под председательством г-на Хина Имя Мока (Китай).

МКГ постановила продолжить деятельность Рабочей группы по предупреждению о цунами и смягчению их последствий для юго-западной части Тихого океана и избрала г-жу Филомену Нельсон (Самоа) ее председателем.

МКГ пришла к договоренности о том, что учение в Тихом океане «Волна 15» состоится в 2015 г., и учредила целевую группу для координации учений под председательством д-ра Лауры Конг, директора ИТИК.

МКГ поблагодарила США и пришла к договоренности провести 26-ю сессию МКГ/СПЦТО в Гонолулу, США, в апреле 2015 г.

МКГ избрала д-ра Кена Гледхилла (Новая Зеландия) в качестве председателя и капитана Патрисио Карраско (Чили), д-ра Татьяну Ивецкую (Российская Федерация) и г-на Коизуми Такеши (Япония) в качестве заместителей председателя МКГ/СПЦТО на период с сентября 2013 г. по апрель 2015 г.

1. WELCOME AND OPENING OF SESSION

1 The master of ceremony made a call of order and invited authorities to address the Plenary as follows:

- Mr Boris Kubay, Director, State Institution Primorsky State Department of Hydrometeorology and Monitoring of Environment.

- The Chairman of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS), Mr Ken Gledhill, who opened the Twenty-fifth Session of the ICG/PTWS. He referred in particular to the opportunity to approve the PTWS enhanced products.

2. ORGANIZATION OF THE SESSION

2.1 ADOPTION OF THE AGENDA

2 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-fourth Session of the ICG/PTWS held in Beijing, China, from 24 to 27 May 2011 (ICG/PTWS-XXIV/3), as well as the relevant parts of the IOC Rules of Procedures (IOC/INF-1166).

3 He referred to document Draft Provisional Agenda.

4 The agenda was approved without amendment.

2.2 DESIGNATION OF THE RAPPORTEUR(S)

5 The Chairperson requested delegates to propose candidates for Rapporteur of the session. Australia volunteered to be Rapporteur and nominated Mr Dan Jaksa, which was accepted by the Plenary.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

6 The Chairperson noted that interpretation is available in English and Russian, kindly provided by the Government of the Russian Federation.

7 He further noted that as customary, the documentation for the session is available on line in English:
(http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewEventRecord&eventID=1264)

8 The Chairperson informed that to guide the delegates an Annotated Provisional Agenda was provided, as document (ICG/PTWS-XXV/2 Prov.)

9 . He informed the Plenary that in order to facilitate the proceedings of the meeting a revised timetable was prepared by the Secretariat in coordination with the Officers, the local organizing committee and the PTWS Steering Committee (ICG/PTWS-XXV/1 Prov Timetable – Rev. 2).

10 He noted that a **deadline for nominations of candidates for Officers** had been set to Monday 9 September at 18:00 hours and a **deadline for submission of Draft**

Recommendations through the Secretariat had been set to Wednesday 11 September at 10:00 hours.

11 The Chairperson also indicated that a field trip was organized by the local host, the State Institution Primorsky State Department of Hidrometeorology and Monitoring of Environment.

12 At this point, he offered the floor to the local host to provide logistic details about the welcome dinner and about the logistics for Working Groups (WGs) and Plenary.

13 He then proposed to the Plenary to constitute two statutory sessional groups that were defined as follows:

- Elections Commission: Chair Mr David Coetzee (New Zealand) including members from Australia, China, New Zealand and United States.

- Recommendations Committee: Chair Mr Rick Bailey (Australia) with members from China, Japan and United States.

14 In order to smooth the work of the session and facilitate the generation of recommendations and agreements, the Plenary set up intra-sessional working groups to address some of the major issues addressed at the meeting, as follows:

- PTWS Implementation Plan: Chair Mr Francois Schindelé (France) with members from Australia, Japan, United States.

- Regional Working Group on Tsunami Warning and Mitigation in the South China Sea Region: Chair Dr Rosaidi (Malaysia) with members from China, Indonesia, Japan, Malaysia, Vietnam and International Tsunami Information Centre (ITIC).

- Working Group 3 on Tsunami Awareness and Response: Chair Mr David Coetzee (New Zealand).

15 The Chairperson asked Mr Tony Elliott, member of the Secretariat, to inform the session about the forth-coming Election of Officers, and reminded the ICG of the deadline for nominations by Member States, according to Rules and Procedures of the Intergovernmental Oceanographic Commission (IOC). He reminded the relevant Circular Letters and indicated the procedures for submitting candidates, in writing by 6 p.m. on Monday 9 September 2013, with two Member States seconding, signed by the Head of Delegation and two seconding delegates.

16 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 if the national reports can be given without PowerPoint presentations (PPTs), and the PPTs will be provided to the Secretariat for posting to the website. The Chair indicated the changes in the timetable to adapt to the time required to discuss in deep the policy issues.

17 The Chairperson opened the floor for comments from delegates on the timetable. The timetable was approved with the amendments suggested by the Chairperson.

3. REPORT ON INTERSESSIONAL ACTIVITIES

3.1 REPORT BY THE CHAIRPERSON

18 The Chair presented his report for the inter-sessional period 2011–2013 (June 2011 to August 2013). He summarised the main points and highlighted progress from the last session.

19 The guiding structure put in place in 2009 with the PTWS Steering Committee has been very effective to guide progress. The Steering Committee met in May 2012 and was useful for moving forward with the enhanced products. The PTWS SC was also useful as a tool to help organizing the revised versions of key guiding documents like the Medium-Term Strategy and Implementation Plan.

20 The structure put in place to coordinate the work on tsunami warning and preparedness through the Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS) and inter-ICG Task Teams has been important to make sure there is coherence among all basins in the world about the products and services provided to the public.

21 One relevant development is the development and testing of the PTWC enhanced products. The Twenty-fifth Session of the ICG/PTWS will produce a qualitative gap in making these products available through its approval by Member States.

22 Training has been also very important, in particular on Standard Operating Procedures (SOP) and on enhanced products. There have been two PACWAVE exercises, in 2011 and 2013; the latter was to test the enhanced products.

23 He indicated as challenges the implementation and uptake of Member States for the enhanced products, securing funding to continue training and a more committed participation in technical groups and task teams. He requested Member States to consider how they can support these groups.

24 He thanked the support provided by the Secretariat and, in particular, by the warning centres and ITIC, Dr Chip McCreery, Dr Laura Kong, Mr Takeshi Koizumi and Mr David Coetzee.

25 The United States of America joined the Chair in highlighting the significant needs in terms of training and the importance of ITIC works. It indicated its endorsement of moving forward with the enhanced products, which is a shift in emphasis with information provided to allow Member States to make their own decisions on warning status. It indicated that with the generalised reduction of travel resources there is a need to increased cooperation among Member States to continue training activities. The same need of active cooperation is required on the observing systems networks.

26 Australia thanked the Chair and its leadership in putting the priority on the enhanced products, with a collegial approach and supported the work of Warning Centres and ITIC. He recalled the experience of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) that has just come through this process, and indicated the need to look forward on how to implement these products

27 The ICG **noted** the report of the Chairman.

3.2 REPORT BY THE SECRETARIAT

28 The Technical Secretary for ICG/PTWS, Mr Bernardo Aliaga, presented the report of the Secretariat focusing on the current substantive reduction of resources in the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the actions led or coordinated by the Secretariat in the inter-sessional period 2011–2013, including looking for extrabudgetary projects and coordinating post-event assessment.

29 Mr Aliaga reported on current and future budgetary constraints of UNESCO which is at the same time undergoing reform and restructuring. The total budget cut, of order 22% for the present biennium and 28% for the next biennium has implied a reduction in the total number of staff in the order of 300 frozen posts out of 1800, which would be probably abolished to cope with the financial reduced envelope. Accordingly the capabilities to service the programme is and will be therefore much reduced. The Tsunami programme is still funded by extrabudgetary support, mainly due to the priority put on it by Member States, which provide direct contributions to the IOC, in cash, in kind and through secondments.

30 He further indicated that in the above environment the Secretariat has been active in securing funding for projects to support intergovernmental coordination and training. The European Union has provided funding for four South American and Central America projects with tsunami components. The Japan International Cooperation Agency (JICA) has also provided funding for a regional training and so on held in New Zealand. Bilateral support as well as an interagency cooperation have also help to cope with the budgetary restrictions. There are fewer people doing more work but the good news is that the level of funding is still there.

31 Australia said that it appreciates and acknowledges the challenges facing UNESCO. It further indicated that there is a need to be proactive in finding funding from bilateral and multi-lateral agencies, with the ICGs defining the priorities.

32 Colombia mentioned the work carried out through the Permanent Commission for the South Pacific (CPPS) to increase the regular funding at regional level for tsunami activities.

33 The ICG **noted** the report of the Secretariat.

3.3 REPORT BY WARNING AND ADVISORY SERVICES

3.3.1 Pacific Tsunami Warning Center (PTWC)

34 Dr Chip McCreery presented the report made by the Pacific Tsunami Warning Center (PTWC).

35 He introduced the status of PTWC monitored observing stations, including the sea level and seismic networks that are applied towards monitoring tsunamis. He recognised the contributions from Australia, Chile, Ecuador, Japan, the Russian Federation, Vanuatu and other countries towards improving these networks.

36 Operationally PTWC responded in the inter-sessional period to over 2,000 global earthquakes and issued Observatory Messages for 771 global earthquakes of M>5.8, Tsunami Bulletins were issued for 108 earthquakes of which five were Tsunami Warnings: Kermadec Islands on 6 July 2011, El Salvador on 27 August 2012, Philippine Islands on 31 August 2012, Costa Rica and Santa Cruz Islands on 5 September 2012. The one in Santa Cruz Islands of M 8.0 produced a locally destructive tsunami with 10 casualties.

37 PTWC developed the enhanced products for PTWS and began issuing new products as from 15 April 2012. It participated in trainings in Central America, South America and South West Pacific.

38 Communications routinely monthly communication tests began in May 2012 with any issues reported by Tsunami Warning Focal Points (TWFPs). Regular updates on contact details for TWFPs are provided by the Intergovernmental Oceanographic Commission (IOC). The Aeronautical Fixed Telecommunication Network (AFTN) dissemination is undergoing upgrades and a Social network's presence is now established on Twitter, Facebook and YouTube.

39 PTWC indicated that as reported at the last ICG major events resulted in fax charges of more than USD 20,000 and recommends that fax is used only for initial products unless fax is essential for TWFPs to receive all products. It suggested also limiting fax numbers to two per TWFP, eliminating unnecessary fax numbers and requested Secretariat assistance towards that.

40 The Chair reminded delegates that two related agenda items (4.3. and 4.4) are specifically devoted to discuss aspects related to the Wave Exercises and to the proposed enhancement of PTWS tsunami products.

41 China indicated appreciation to PTWC and recalled it will be hosting training for South China Sea countries on Standard Operating Procedures (SOP) and Enhanced PTWC products for PTWS later in 2013.

42 Malaysia pointed out to the absence of sea -evel stations in the South China Sea and Sulawesi Sea. The delegate further stressed that Malaysia tried to install one tsunameter in the Sulawesi Sea but political conditions were not favourable. Malaysia expects that the PTWS would be a good platform to improve sea-level monitoring and data sharing in this area.

43 The Secretariat inquired about the use of NEPTUNE (North East Pacific Time-series Underwater Networked Experiment) by PTWC and other centres. Canada indicated that data is available in real-time. WCATWC (West Coast and Alaska Tsunami Warning Center) and PTWC are aware and that data from this network is available to them.

44 Australia indicated that dissemination of data may require considering the increase use of smartphones and social networks. Australia indicated that a recommendation may indicate the need of using these new technologies.

45 France (Centre d'Alerte aux Tsunami, CENALT) addressed the issue of faxing by prioritising the fax to countries closer to epicentre and using other communication means for countries that are far from the epicentre.

46 Dr Chip McCreery asked for a recommendation on the faxing issue. New Zealand and ITIC suggested that the Secretariat should ask Member States if they do have the possibilities to reduce use of faxes, also being conscious that many Member States are not present at this session and they may be more dependent on faxes.

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

3.3.2 Northwest Pacific Tsunami Advisory Center (NWPTAC)

48 Ms Yohko Igarashi, Chief of the International Tsunami Information Section, Earthquake and Tsunami Observations Division, Seismology and Volcanology Department,

Japan Meteorological Agency (JMA), presented the report of the Northwest Pacific Tsunami Advisory Center (NWPTAC).

49 She indicated that since March 2005, NWPTAC has been providing tsunami information. From May 2011 to August 2013, JMA generated information for 42 earthquakes from which the one on 31 August 2012 in the Philippine Islands, and the one on 6 February 2013 in Santa Cruz Islands generated tsunamis.

50 Communication tests are conducted twice a year since July 2012 and for real events also communications are checked. Thanks to these tests and checks, the situation is becoming better; from 70% the rate of success has increased to 80% for faxes. More detail could be obtained and better communication can be realised with more countries' responses.

51 NWPTAC decided, in accordance with the evaluation of the Exercise Pacific Wave 13 (PacWave13, IOC/2013/TS/106VOL.1.), not to change the current format and contents by now because countries need more time to use fully the enhanced products. NWPTAC will continue the current products and services. In the meantime, it will investigate Member States' request and expectations and will submit a proposal at the Twenty-sixth Session of the ICG/PTWS.

52 Through the communication tests and reporting, JMA found that some countries, not included in the current recipients, are receiving (and probably using) the bulletins. NWPTAC is sending a questionnaire and, if any more countries would like to receive bulletins, they will work with the Secretariat for the procedures.

53 Russian Federation indicated that NWPTAC is very important for them. Though the information was not received for some events at the beginning of the communications with NWPTAC. All channels for NWPTAC are now working fine. The information from NWPTAC is very important and is appreciated.

54 China expressed greatest appreciation to NWPTAC's outstanding service and requested NWPTAC to verify its national report to check the fax numbers.

55 Indonesia indicated its preference for email communications because fax does not work very well in their case. PTWC and JMA will then receive updated email addresses from Indonesia via IOC to replace fax numbers.

56 The ICG **noted** the report of NPWPTAC.

3.4 NATIONAL PROGRESS REPORT

57 The Chair reminded the session that reports have been requested in a standard format, and have been received in advance of the session. They were made available through the meeting website. He asked delegates to make short statements focused on topics of their National Reports that may have implications for the policy discussion.

58 Canada reported on the Vancouver earthquake. In 28 October 2012, a magnitude 7.7 earthquake on the Pacific coast of Canada produced a tsunami with measured run-up of 5 metres or more along 200 kilometres of coastline. Maximum documented height of tsunami debris was 13 metres above the state of the tide. The region is uninhabited and there were no casualties and no damage. There are 17 continuously operating water level stations capable of recording tsunamis on Canada's Pacific coast. These stations are operated by the Canadian Hydrographic Service (CHS) of Fisheries and Oceans Canada, and Water Survey of Canada (WSC) of Environment Canada. The Geological Survey of Canada of Natural Resources Canada (NRCan) contributes data streams from 25 requested seismographs to

the PTWC. NEPTUNE Canada has tsunami recording bottom pressure recorders and ocean bottom seismographs at nodes on its 850 km fibre optic cable loop off the Pacific coast of Canada. Data from these instruments are available in real time to warning centres and researchers. Emergency Management BC of the province of British Columbia continues to be the agency for distributing tsunami warnings on Canada's Pacific coast and takes the lead in tsunami public education. In 2012 NRCan, produced Canada's first national tsunami hazard assessment in the form of national-scale probabilistic tsunami hazard maps.

59 Chile reported that the Hydrographic and Oceanographic Service of the Chilean Navy (a.k.a. SHOA), is the focal point and Chile representative on PTWS since 1966. Currently its Director Captain Patricio J. Carrasco is the Vice-chair of ICG/PTWS for the period 2011-2013. After the big earthquake and tsunami 2010 event, Chile has focused its effort to improve its national sea-level stations having currently a total number of 40 tide gages and 2 DARTs buoys fully operational. Even Antarctica has coverage within this very dense improved network. The whole sea-level network works on high frequency data transmission and systems redundancy (communications and data acquisition).

60 Capacity building has been also a special issue within SHOA's priorities therefore it has worked on agreement with universities and intergovernmental organizations to increase the knowledge in several tsunami matters such as: modelling, SOPs, PTWC new products, and people resilience. People who have been instructed are from, inter alia: Emergency Management, Educational Ministry, others NTWCs from the region, and coastal communities.

61 China indicated that in the past two years, it took the development of national tsunami warning system as a priority, especially in the development of earthquake and tsunami monitoring capability, real-time tsunami warning technologies and emergency responses. China now has developed a new tsunami warning platform and put it into operation at the end of 2012, with the capability of real-time acquisition of global and regional earthquake and sea-level data, fast tsunami modelling and hazard assessment in case of a tsunami, and tsunami message disseminating.

62 China have alternate approaches to get earthquake information, including automatic and manual earthquake locating system, and PTWC, USGS earthquake info via GTS and FAX. For local earthquake, the auto locating time is around 1–3 minutes, and 5–8 minutes for regional earthquake. China deployed two tsunami buoys in the SCS (South China Sea) region; however buoy maintenance is a big challenge due to continuous vandalism.

63 Overall, in the past two years the TWC of the State Oceanic Administration (SOA) issued 265 tsunami bulletins and two tsunami warnings to emergency management department of the government. No tsunami disaster occurred during this period. Regarding tsunami mitigation activities, "Tsunami hazard, vulnerability and risk assessment" programme on the coastlines of China, particularly on some seriously vulnerable areas was proposed by SOA since 2012, and will be on-going in the next few years. The National Marine Environmental Forecasting Center (NMEFC) and the Hong Kong Observatory joined tsunami exercises of Pacific Wave 11 (IOC/2011/TS/97VOL.1, VOL.2) and 13 (IOC/2013/TS/106 Vol.1, Vol.2). In PacWave 11, local governments conducted emergency evacuations in some regions including a village and middle school near the Dayawan nuclear station.

64 China also was actively involved in the international cooperation and coordination regarding tsunami training for example through the WESTPAC-ICG/PTWS Training Workshop on Tsunami Models and Risk Assessment held from 24 to 27 September 2012, Beijing, China. To further promote the introduction of the PTWC Enhanced Products in the SCS region, China will host a SOP training course in 2013 for the SCS countries and adjacent regions.

65 For the sub-regional Tsunami Warning and Mitigation System in the SCS region, China held the first South China Sea working group meeting in 2011 and joined the second one in 2012 hosted by Malaysia. A SOA delegation visited Pacific Marine Environmental Lab., PTWC and ITIC for enhancing the cooperation regarding tsunami warning capabilities in the SCS region in 2012. A pilot project for the development of real-time regional tsunami forecasting capabilities in the South China Sea was signed, and the first working group meeting was held in Beijing in 2013 with five-year implementation working plan discussed and revised.

66 Colombia presented the progress of the National Tsunami Early Warning Detection System (Sistema Nacional de Detección y Alerta de Tsunami, SNDAT), as well as its Protocol for inter-agency action and recent advances developed at the national level with the new Law 1523 about risk management of disaster.

67 Colombia has a network of two tidal stations in Caribbean and three in the Pacific; however it is contemplated the end of the year to strengthen this network by acquiring 11 tidal and meteorological stations, 9 stations for the Caribbean and two for the Pacific Colombian with data transmission for sea level every minute.

68 Similarly, Colombia has a seismic network with national coverage, which allows reporting information of seismic events to the National System for Disaster Risk Management. Currently, the network has 28 stations with broadband seismometers and satellite transmission, which highlights the seismological station in the Pacific islands of Malpelo Island. On the Caribbean coast, there has been a significant expansion in seismological instruments, with the installation of six broadband stations and five more in progress, including a station at the Providencia Island.

69 Currently, it is managing the signing of the national Decree that transfer responsibility from the Corporación OSSO (Observatorio Sismológico del Suroccidente) as Tsunami Warning Focal Point (TWFP) to the MDN–DIMAR (Ministerio de Defensa Nacional–Dirección General Marítima), which allow legally designated specific functions to each of the technical components that act in case of a tsunami event. Although the Decree has not been signed, technical entities have continued to work to achieve the proper fitting and operate in an emergency event.

70 Ecuador reported it has been improving its observational system. Seven sea-level stations and one tsunami buoy have been installed. Ecuador has been improving tsunami modelling for local sources, and developing tsunami inundation maps for communities. Ecuador thanked the support received from CPPS (Comisión Permanente del Pacífico Sur) and UNESCO, in particular for educational purposes.

71 France reported progress on tsunami modelling. Two different methods of focal mechanism and moment tensor (CMT) computation were recently implemented in CPPT. The SYS_AL process computes automatically the Mm magnitude, the slowness, the scalar moment and the seismic moment tensor (via a joint inversion of mantle waves and P waves first-motions). The Wphase inversion method is very robust for estimating the CMT of big earthquakes, including tsunami-earthquakes and mega-sources. The events of magnitude greater than 6.0 are processed automatically 30–45 minutes after the origin time of the earthquake. The two different source solutions are injected into the numerical modelling made by two methods: MERIT and COASTER. MERIT computes rapidly the tsunami height in deep sea; then the maximum tsunami height near the coasts is estimated in 5 minutes via the Green law that has been modified with a coefficient depending on the slope of the shore. COASTER is a full computation of the tsunami amplitude near the shore that uses nested grids of increasing resolution, until a 5 m x 5 m high resolution near the shore. The worst scenario is retained.

72 Indonesia reported having extended its observational system. It also reported that it is developing public awareness activities, extending communication/dissemination computer-based system and identifying the needs for training. Within the IOTWS framework, Indonesia reported that is conducting regional SOP training.

73 In the national report, Japan Meteorological Agency (JMA) reported in particular the following topics: JMA improved the tsunami warning system in Japan for near-field tsunamis based on the lessons learned from the Great Tohoku Disaster in 2011, and started the new operation in March 2013. Along with this improvement, JMA strengthened its seismic and tsunami observation network as well. JMA also puts high priority in providing educational materials such as DVDs both nationally and internationally. Now JMA is preparing to distribute a new brochure in English on what JMA learned and how JMA improved its national tsunami warning system. Adding to the materials, JMA has been joining some international cooperation programs like SATREPS and IISEE trainings with Japan Science and Technology Agency (JST), Japan International Cooperation Agency (JICA) and other organizations. JMA's one more international contribution is the sea level data sharing by allocating DCP channels of MTSAT (JMA satellite) for foreign sea level stations.

74 Republic of Korea reported that implementation of Tsunami Warning System (TWS) is in process. Korea has 177 seismic stations, and during the inter-sessional period it has installed 40 seismic stations.

75 Malaysia reporter that 17 water-level monitoring stations have been installed in 17 selected tsunami risk areas of Peninsular Malaysia as well as in Sabah and Sarawak (East Malaysia). Currently, there is only one Malaysian operating tsunami buoy located at Layang-Layang Island in the South China Sea. Malaysia plans to share internationally five tide gauge stations, there is Langkawi, Teluk Bahang, Labuan, Kudat and Lahad Datu by the end of 2013. The Malaysian government has also plans to install another 20 seismic stations (weak and strong motion sensors) throughout the country in 2014 to enhance the ability for detecting near-field and far-field tsunamigenic earthquakes and in order to reduce the earthquake information response time and the information accuracy. In order to enhance the delivery of tsunami early warning to the public, another 30 tsunami sirens will be installed throughout the coastal areas that are at risk in 2014 (this is an addition to the 23 tsunami sirens that have already installed at present). Before 2011, the average Malaysian TWC response time was 12 minutes and has been improved to 10 minutes. At present, MMD tsunami forecasting database (pre-computed modelling) has consists of more than 38,000 tsunami scenarios covering South China Sea, Indian Ocean, Sulu and Celebes Seas, which have also included the tsunami sources from Makran subduction, Japan and New Guinea Trenches.

76 New Zealand continued to demonstrate its dedication towards the PTWS in the inter-sessional period through the provision of the Chairs of the ICG, Working Group 3, the Data sharing Task Team under the South West Pacific Working Group and co-chairing the Exercise Pacific Wave 11 and 13 task teams. New Zealand also participated in the new Enhanced Products Task Team under Working Group 2, hosted a week long training and consultation workshop on the new enhanced products for 15 Pacific Islands countries and contributed financially towards the latter training as well as other PTWS activities.

77 New Zealand actively participated in the Exercise Pacific Wave 11 and 13, and provided evaluation support to some Pacific Island countries' participation in these exercises. The New Zealand tsunami risk management programme is described in detail in its report. A highlight of this programme in the inter-sessional period was a comprehensive review of the national tsunami risk assessment based on refined modelling and greater uncertainty with regards to subduction zone earthquake magnitudes, as a result of learnings from recent events.

78 Russian Federation stated that tsunami monitoring, prediction and warning for the Pacific coasts of Russia now are provided by Tsunami Warning Centres of Roshydromet (Federal Service for Hydrometeorology and. Environmental Monitoring) in Yuzhno-Sakhalinsk, Petropavlovsk-Kamchatsky and Vladivostok working in close cooperation with regional structures of the Ministry for Emergency Situations of the Russian Federation (EMERCOM), seismic centres of the Geophysical Service of the Russian Academy of Sciences (GS RAS), and local hydrometeorological stations of Roshydromet.

79 Russian Federation also added that the Russian subsystem as a whole and the Russian TWCs function according to regulations and instructions at the federal and local levels. The divisions involved in the TWS provide 24 hours operation, including continuous monitoring of seismicity and sea-level variations, situation analysis, declaring and cancelling tsunami watches and warnings, preparation and relaying of appropriate signals and messages in accordance with the established procedure.

80 The U.S. National Report, posted on meeting website, provides a basic overview of activities in the inter-sessional period including the highlights of the new enhanced products development and training on those new Pacific Tsunami Warning Center forecasting products conducted by PTWC and ITIC. (The reports from PTWC and ITIC contain further details). Significant advances were made in tsunami forecasting with the completion of operational testing, evaluation, and fielding of the SIFT (Short-term Inundation Forecasting for Tsunamis) model used by both NOAA Tsunami Warning Centres. Tsunami.gov website was also launched as part of an effort to improve easy access to all U.S. tsunami products. The number of U.S. coastal communities designated as TsunamiReady rose to 154, and the U.S. National Tsunami Hazard Mitigation Program (NTHMP) continued to expand and now includes the Pacific territories of Guam, Northern Marianas Islands and American Samoa. The U.S. federal agencies also collaborated with State partners in the development of the U.S. Post-Tsunami Survey Protocols.

81 In addition to these inter-sessional activities, the U.S. continues to support the desire of PTWS to deploy state-of-the-art tsunami forecast information in the form of the PTWC enhanced products. As these products represent a shift from “alert based” to “information based” support, the U.S. must meet internal criteria before formally implementing PTWC enhanced products, including operational testing and evaluation of the RIFT model, and the development of new domestic alerting products for the Pacific basin. The U.S. also continues to operate a robust network of sea-level and seismic observing sites and will enhance efforts to pursue collaborative means of maintaining these Pacific tsunami sensor networks. By establishing cost and/or responsibility sharing measures, the U.S. will have the opportunity to invest in new transformational technologies aimed at advancing tsunami sensing capability in the Pacific. The U.S. National Oceanic and Atmospheric Administration (NOAA) also noted the upcoming name change of the West Coast Alaska Tsunami Warning Center to the US National Tsunami Warning Center. There are no changes to Pacific tsunami forecasting responsibilities associated with this name change.

82 The Institute of Geophysics (IGP) of Vietnam is in the process of upgrading the earthquake monitoring network. By 2015, the National Seismic Network of Vietnam will consist of more than 30 stations, all equipped with broadband seismometers and GPS. The tsunami SOP has been revised at the Earthquake Information and Tsunami Warning Centre (EITWC) of the IGP. From 2014, the tsunami warnings will be categorized into 4 levels: 0, 1, 2 and 3, which correspond to “No evacuation”, “Stand-by for possible evacuation”, “Be on alert for unusual waves” and “Immediate evacuation is strongly recommended” emergency actions, respectively. The pre-calculated tsunami scenario database has been upgraded considerably during the last two years. More comprehensive study on the seismotectonic of the South China Sea has been carried out to improve the source models, and the COMCOT (Cornell Multi-grid Coupled Tsunami) model has been used for simulation. Since 2011, two

drills on earthquake and tsunami response has been organized throughout the country, help to raise awareness of people on the earthquake and tsunami threat. EITWC continuously maintain the close relationship with ITIC, PTWC and JMA on technical issues regarding tsunami warning and effectively contributes to the establishment of the Tsunami Warning System (TWS) in the South China Sea.

3.5 REPORT FROM THE INTERNATIONAL TSUNAMI INFORMATION CENTRE (ITIC)

83 Dr Laura Kong, Director ITIC, provided an update on the activities of ITIC in the intersessional period. She reported on ITIC's staffing status and highlighted the tools and awareness materials that have been developed by ITIC, including tsunami awareness and education materials, highlighting the *Tsunami Glossary, 2013* (IOC/2008/TS/85REV), the *Niuatoputapu Tsunami – Tongan survivor accounts* (2009 report), the Global Tsunami Sources map, and Global significant Earthquakes and Volcanic eruptions posters.

84 She reported that 450 scientists around the world are subscribed to the *Tsunami Bulletin Board* and receive *the Tsunami Quarterly Newsletter*. She indicated that in cooperation with UNESCO/IOC it has also coordinated Post-Tsunami Field Surveys and maintains a Library with historic documents, event data and reports. She further reported that Tsunami Decision Support Tools (TTT, Tide Tool), and tsunami awareness materials, have been delivered, with funding provided mainly by USA.

85 Dr Kong further reported that in cooperation with UNESCO/IOC and PTWC several training activities have taken place and will continue through 2013, involving regional partners and country experts, in particular in the area of Standard Operating Procedures (SOPs) and PTWC Enhanced Products for PTWS.

86 With respect to budgetary issues, she stressed that there is no sustainable funding to support training activities. Considering the high value Member States put into ITIC products and services, in particular on trainings, Dr Kong recommended that Member States routinely include training budget within annual national budgets, if tsunami training is a priority.

87 Through an ITIC Customer Satisfaction survey run on 30 August 2013, which was responded by 30 Member States, it become evident that the users of ITIC products value the periodic communications from ITIC including the *Tsunami Bulletin Board* and the products/services of ITIC, in particular the Exercise coordination (96%), Tsunami Awareness and Education Materials (92%), and Tsunami Warning Decision Support Tools (92%). A high percentage of responders (88%) indicated that they are interested in receiving future IOC/ITIC trainings through Distance Learning platforms. No single platform received a majority response. Highest rated platforms were: Video Teleconferences (live) 29%; Web-Based online training (not live) 25%; Video or computer-based, offline (not live) 25%. Several responders recommended conducting more practical training on Tsunami Warning Centre (TWC) operations activities and providing more opportunities to train on tsunami modelling.

88 Australia indicated they have experience in using video materials for trainings, which have been found very useful. Australia suggested developing case studies about trainings using Distance Learning platforms.

89 USA mentioned online tools like the ones used by the COMET® Program where a large number of online modules are available.

90 Mr Aliaga indicated that IOC and ITIC have been consistently working together to support the requests of Member States on activities, training, awareness materials, post-tsunami, events and communication. This cooperation has proven successful in getting

additional extra budgetary resources and regional and national partners to support training in particular. He thanked the US for its generous in-kind and funding support.

3.6 WORKING GROUP REPORTS

91 The Chair asked the Chairpersons of the Working Groups to present their reports to the Plenary.

Working Group 1 on Tsunami Risk Assessment and Reduction

92 Dr Francois Schindelé (France) reported on the status of Working Group 1 (WG1) and its Task Teams on Tsunami Modelling Hazard Assessment chaired by Dr Titov (USA) and on Tsunami Risk Assessment chaired by Dr Nguyen Hong Phuong (Vietnam). He indicated that the WG1 has not met in the inter-sessional period and that both Task Teams met on 12 and 13 December 2012 in Santiago, Chile. These TTs recommended:

- To encourage use of hazard assessment products based on numerical model products for real-time and long-term hazard assessment (as oppose to empirical formulas),
- To share Best Practices for real-time and long-term forecast products,
- That hazard assessment should feed the development of evacuation maps, which should be linked with warning procedures.

93 The Task Teams noted that there are now several models in use for tsunami modelling, and recommended compiling the information about where and how these models are being used for tsunami preparedness.

94 Mr Schindelé suggested that the future is investigating more about mega-earthquakes and tsunamis. The main questions are if at each important subduction, a similar mega-earthquake may happen, and where a new or the next mega-earthquake and tsunami can be generated. According to him research institutes are looking at these issues now but there are no results or products available yet.

95 Based on the elements above, he suggested the necessity of extending WG1 and its TTs for the next term.

96 The Russian Federation seconded the continuation of WG1 for the next term because historical records and modelling shows that only 9 mega-events in the last 2000 years are responsible for the 50% of the fatalities. The Russian Federation nominated Mr Gusiakov from Russian Federation to join WG1.

97 USA indicated that the Task Teams meetings were very productive and thanked the IOC for organizing their meeting. USA also seconded the extension of the Task Teams.

98 Australia inquired about the role of the Inter-ICG Task Team on mega-event on the needs indicated by Mr François Schindelé. Mr Schindelé responded that the first meeting of the Inter-ICG Task Team on Hazard Assessment Related to Highest Potential Tsunami Source Areas will take place in Fethiye, Turkey, on 23 September 2013.

99 Australia also indicated that the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) is revising its Manual on *Tsunami risk assessment and mitigation for the Indian Ocean: knowing your tsunami risk and what to do about it* (IOC/2009/MG/52) with the intention of making it global. Australia suggested that the ICG/PTWS may take benefit of this initiative and join through WG1 the works towards updating the report.

100 The Chair Ken Gledhill reminded the group that Global Earthquake Model (GEM) Foundation, a public-private partnership initiated in 2006 by the Global Science Forum of the Organisation for Economic Co-operation and Development (OECD), is a global collaborative effort with the aim to provide organizations and people with tools and resources for transparent assessment of earthquake risk anywhere in the world. He noted that GEM published in June 2013 the *The GEM Faulted Earth Subduction Characterisation Project*, which develops a globally consistent characterisation of the world's subduction plate boundary faults.

101 Malaysia indicated that the Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea requested WG1 to undertake seismotectonic study for the South China Sea. Malaysia supported the continuation of WG1 and its TTs.

102 Vietnam also seconded the idea of continuing WG1 and TTs. Vietnam requested enhanced cooperation among countries on this area, because there is a clear need for improving.

103 USA nominated Dr Vasily Titov for Chairman of WG1.

104 **The ICG decided** to extend the Working Group 1 on Tsunami Risk Assessment and Reduction (WG1) and its two Task Teams. The Group accepted the nomination of Dr Vasily Titov (USA) as Chairman of WG1 for the next term.

Working Group 2 on Tsunami Detection, Warning and Dissemination

105 Dr Charles McCreery reported that no meeting of the Working Group 2 (WG2) occurred in the intersessional period but significant work was carried out by its five Task Teams, the Task Team on Warning Dissemination, Task Team on PacWave11, Task Team on Enhancing Products, Task Team on Seismic Data Sharing in the South West Pacific, and Task Team on Sea Level Monitoring. Dr McCreery summarised the activities and recommendations of each of the Task Team. He reminded that reports of the following Task Teams were made available in the ICG/PTWS-XXV meeting website: Task Team on Warning Dissemination, Task Team on PacWave11 (and 13), Task Team on Enhancing Products, and Task Team on Seismic Data Sharing in the South West Pacific.

106 He indicated that all Task Teams recommended extending its term for the next intersessional period, with the exception of the Task Team on Sea Level Monitoring which functions can be assumed by WG2.

107 USA supported the work of WG2 and its Task Teams and indicated that Dr McCreery will not be able to continue chairing WG2 due to current priorities for development of PTWC including the Enhanced PTWC products for PTWS.

108 Australia indicated that there are a number of important ongoing activities and tasks for WG2 and its Task Teams, including for Tsunami Watch Operations, therefore WG2 should continue.

109 **The ICG decided** to continue Working Group 2 on Tsunami Detection, Warning and Dissemination, and elected Mr Rick Bailey (Australia) as Chair of WG2.

Working Group 3 on Tsunami Awareness and Response

110 Chair of Working Group 3 (WG3), Mr David Coetzee (New Zealand) referred to the report of the group available in the meeting website and highlighted some activities. The group designed a survey to assess current capacity, and to identify gaps and needs in

relation to Awareness and Response within the PTWS. The survey was made available in English, French and Spanish and sent to all Member States by the Secretariat in May 2011. The response by Member States to the survey was disappointingly low in spite of a further call to Member States at ICG/PTWS-XXIV to complete the survey, with only 11 countries responding. Subsequently a representative finding could not be made although it did provide some indication of development needs.

111 The WG3 supported the conduct and evaluation of Exercise Pacific Wave 11 (PacWave11) and Exercise Pacific Wave 13 (PacWave13) with both co-Chairpersons of the PacWave11–13 Task Team working on an evaluation instrument to address the matters critical to awareness and response. These included, among other aspects, validation of the readiness of Member States to respond to a local/regional source tsunami in respect of operational readiness of the National Tsunami Warning Centre (NTWC), or similar in-country function, and/or the National Disaster Management Office (NDMO).

112 Mr Coetzee also indicated that New Zealand sent staff to Samoa, Niue, Cook Islands and Tonga to conduct exercise evaluation and has been working with the NDMOs of these countries to assist with further enhancement of local tsunami arrangements.

113 Noting the absence of a generic and consistent guideline available for ICGs about the development and management of regional tsunami exercises, the TOWS Task Team on Disaster Management and Preparedness initiated the development of IOC Manual and Guides, 58, *How to plan, conduct and evaluate UNESCO/IOC tsunami wave exercises*. This guideline was developed by WG3 of ICG/PTWS (specifically New Zealand MCDEM and ITIC) in 2011, and socialized throughout basins which conducted wave exercises, including the Pacific and Indian Oceans and the Caribbean Sea.

114 Chair Coetzee also mentioned the participation of WG3 members at the ITIC Training Programme (ITP) and to 9 regional trainings, as well as assistance to ICG/IOTWS in development of training modules on tsunami policy support and exercises. ITIC and the IOC provided a summary on its training activities to the ICG/PTWS Steering Committee.

115 He also reported that IOC coordinated with UNESCO Offices in Santiago, Chile, and San José, Costa Rica, DIPECHO-funded projects addressing community-based tsunami preparedness and national reinforcement of Standard Operating Procedures for South American and Central American countries, respectively.

116 Much of the focus in 2013 has been on supporting training for new products and assistance with development of SOPs. WG3 was central to the organizing of the Pacific Islands, Central America and South America training sessions in 2013 and contributed to the meeting of the South West Pacific Working Group in July 2012.

117 At the Sixth meeting of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) held in Paris, France, on 20 and 21 February 2013 (IOC/TOWS-WG-VI/3), the Task Team on Disaster Management and Preparedness suggested updating its Terms of Reference (ToR) to reinforce the role of continued facilitation of exchange of experiences and information on preparedness and education among the ICGs. Mr Coetzee indicated that the WG3 notes this change and recommends to the ICG/PTWS-XXV that its own Terms of Reference (as determined in the PTWS Medium Term Strategy 2009–2013) be adjusted to align with the Terms of Reference of the related TOWS Task Team, as well as that its title be changed from “Awareness and Response” to “Disaster Management and Preparedness” so that the ICG/PTWS reflects the TOWS direction. WG3 notes that “Response” is a broad concept that spans wider than the original intent for WG3. This change may also solicit better involvement of countries’ Disaster Management agencies in the PTWS.

118 On tsunami Standard Operating Procedures (SOPs), it was noted that extensive work had been undertaken by the IOTWS with further input by WG3 to develop a guideline in relation to SOPs, taking into account and using already existing material from Member States. The ITIC also makes available a range of real examples in this regard. A focus of the WG will be to re-connect with the IOTWS to finalise a SOP Manual for submission to the other ICGs so that it can be formally adopted by UNESCO/IOC. The current draft started under the IOC/UNESCAP Project "Strengthening Tsunami Warning and Emergency Responses": Training Workshops on the Development of Standard Operating Procedures for the Indian Ocean and Southeast Asian Countries (2008–2010).

119 WG3 recommended to have a Chair to concentrate on South and Central America, and one for the rest of the Ocean, using regional trainings to have back to back WG3 meetings, appoint representatives to TOWS Task Team (one of which is ITIC Director). Request funding contributions for training, PacWave 15, and TOWS TT2 involvement.

120 The Chair, Mr Ken Gledhill, reminded the Group that David Coetzee has completed 2 terms of chairmanship (4 years) of the WG3, and consequently a new Chair should be elected, while he knows that Mr Coetzee is available to continue the work.

121 The Russian Federation indicated that WG3 has been very useful and Mr Coetzee has been very supportive in helping developing tools like IOC Manuals and Guides, 58 rev (IOC/2012/MG/58 REV.) They indicated that in respect of tsunami exercises, the PacWave manuals should be available at least two months before the exercise. Ms Tatiana Ivelskaya was nominated by the Russian Federation as member to the WG3.

122 Ecuador supported the work reported by WG3 and indicated it would like to continue participating on it.

123 Australia, France and USA supported the extension of WG3 and the continuation of Mr Coetzee. USA volunteered to have Ms Julie Leonard as Co-Chair.

124 The Group met intrasessionally and suggested to change its name and ToRs.

125 **The ICG agreed** to change the name and Terms of Reference of the Working Group 3 to "Disaster Management and Preparedness", and **elected** Mr David Coetzee as Chair of the re-defined WG3.

<u>Regional Working Group on Tsunami Warning and Mitigation on the Central America Pacific Coast</u>

126 Mr Bernardo Aliaga, Technical Secretary of ICG/PTWS, presented the report for Central America (CA).

127 He reported that CA is becoming more active with two inter-sessional meetings in November 2011 and December 2012, and a regional one-week training on SOPs and Enhanced PTWC tsunami products for PTWS. Mr Aliaga indicated that the WG recommended continuation and same Chairmanship, with the recently elected Ms Angelica Munoz (Nicaragua) as Chair and Mr Francisco Gavidia (El Salvador) as Vice-Chair.

<u>Regional Working Group on Tsunami Warning and Mitigation in the Southeast Pacific Region</u>

128 Captain Miguel Vasquez, Chair of the WG for the South East Pacific (SEP), indicated that 4 Member States have increased their sea-level monitoring network. Ecuador has installed one deep pressure sensor. Peru and Chile have steadily increased their coastal sea-level stations (Chile: from 20 to 40 stations with 2 DART buoys).

129 He further reported that during the inter-sessional period the region has been able to host several trainings with cooperation from UNESCO, ITIC, PTWC, JICA, IHO (International Hydrographic Organization) and others. These trainings have focused on increasing capabilities in SOPs, inundation maps, Decision Support Systems, tsunami modelling, emergency management, and coastal communities' preparedness. The Group has also been active for PacWave exercises.

130 Captain Vasquez mentioned that several countries are also developing databases of forecasted tsunami scenarios, on top of enhancing the quality of tsunami inundation maps. Communications have been also increased with video chat available through a common web-based platform among the four National Tsunami Warning Centres (NTWCs). The four countries are also working towards improved awareness. The SEP WG recommended that the PTWC enhanced products for PTWS keep text formats for public dissemination and graphics only for NTWCs.

131 USA inquired if more DART stations will be installed in South America. Captain Vasquez indicated that DART buoys are also required for the South of Chile and so they are planning to add more.

132 The SEP WG recommended its continuity. Captain Vasquez indicated that the Chairmanship is rotational among the four countries and the current Chairmanship is from Chile.

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

133 The Chairman of the Working Group for the South China Sea (SCS), Dr Mohd. Rosaidi bin Che Abas, has met twice in the inter-sessional period.

134 The First meeting was held in Sanya, China, from 12 to 14 December 2011 (ICG/PTWS-WG-SCS-I/3), where China introduced a proposal from the National Marine Environmental Forecasting Center of the State Oceanic Administration (NMFEC/SOA) for a Tsunami Warning System for the SCS, and where the Group discussed about cooperation with the Association of South-East Asian Nations (ASEAN), which was invited to join the ICG/PTWS under an Observer status.

135 The Second meeting was hosted in Petaling Jaya, Malaysia, from 16 to 18 October 2012 (ICG/PTWS-WG-SCS-II/3), and further discussed the proposal submitted by China and decided the establishment of Task Teams to increase the regional capabilities and compile the knowledge on tsunami available for SCS. The Group approved a recommendation for ICG/PTWS-XXV for the establishment of a Tsunami Warning System for the South China Sea region and hosting of a regional advisory centre by China.

136 China congratulated the Chair of the Group, Dr Mohd. Rosaidi bin Che Abas, and confirmed the willingness of China to establish the centre in the future.

137 ITIC inquired about the interest of Cambodia in joining the Group. The Chair informed that so far Cambodia has not responded to the invitations.

138 The SCS WG met intrasessionally, to revise its ToRs and elect a new Chairman.

Regional Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Region

139 Mr David Coetzee presented the report on behalf of Ms Filomena Nelson.

140 The Third meeting of the South West Pacific (SWP) WG was held in Apia, Samoa, on 14 July 2012 (ICG/PTWS-WG SW), which revised status and availability of tools and programmes by ITIC and ORSNET (Oceania Regional Seismic NETwork). A number of recommendations of the SWP were agreed at this meeting, including on testing recognition programmes, like TsunamiReady, expanding vulnerability studies similar to the work done by New Zealand in Tokelau, and SOP development including the use of threshold tables.

141 The SWP will be meeting back to back with the Annual WMO Region V meeting in May 2014 in Vanuatu. Trainings have taken place in several countries and regional training and workshops have also been implemented in 2012 and 2013. Regional training and consultation workshops on *Strengthening Standard Operating Procedures for Tsunami Warning and the use of the ICG/PTWS PTWC New Enhanced Tsunami Products* were held in Wellington, New Zealand, from 12 to 16 August 2013, and recommended its introduction in 2014 with extensive training for countries to be able to meet the requirements for using the new products. Cooperative multi-lateral work funding should be available for these needs as it has been the case in 2011−2013.

142 Australia inquired about the expected use of threshold tables. Mr Coetzee explained that with GNS Science support, New Zealand Ministry of Civil Defence & Emergency Management (NZDM) agency developed tables to assist the decision-making process in countries.

143 Mr Coetzee indicated that the current Chair of the SWP WG, Ms Filomena Nelson (Samoa), is available to continue and the Group agreed about her continuation.

144 The **ICG approved** Recommendation ICG/PTWS-XXV.1

3.7 STATUS OF PROGRESS IN OTHER INTERGOVERNMENTAL COORDINATION GROUPS

145 Dr François Schindelé (France), Chairman of the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS), reported on the status and achievements of NEAMTWS. He indicated that the group has had 9 sessions since its establishment and that its current structure includes a Steering Committee, four Working Groups and one Task Team on Communication Tests and Tsunami Exercises. The NEAMTWS achieved in 2012 the establishment of three National Tsunami Warning Centres that are also Candidate Tsunami Watch Providers (CTWPs), in France, Greece and Turkey. These CTWPs performed in 2012 two communications tests with Tsunami Warning Focal Points (TWFPs) and since August 2012, regular communication tests are performed monthly by CTWPs. Also in 2012, Exercise NEAMWAVE 12 took place on 27 and 28 November 2012 (IOC/2012/TS/103 VOL.1).

146 Mr Schindelé indicated that the Ninth session of the ICG/NEAMTWS (ICG/NEAMTWS-IX) approved a CTWP Accreditation process including accreditation procedures and criteria with 12 functions and 12 requirements.

147 USA confirmed its support to the scenario Lisbon for Exercise Caribe Wave/Lantex 13 (IOC/2012/TS/101 VOL.1.), which could be organized in cooperation with NEAMTWS.

148 ITIC asked about the continuation of the Tsunami Information Centre for the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTIC). Dr Schindelé explained that NEAMTIC will not continue as a project because funding is ending this year, but he thanked the support of UNESCO and Member States. He added that some activities may continue, particularly on tsunami public awareness.

149 Mr Rick Bailey (Australia), Chairman of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), provided a Status Report about IOTWS. He reminded the group that the IOTWS is structured into three pillars, namely Risk Assessment & Reduction; Detection, Warning & Dissemination; and Awareness & Response. He reported that the Secretariat of IOTWS is hosted and funded by the Australian Bureau of Meteorology (BOM) and is located at BMO offices in Perth, Australia.

150 Mr Bailey briefly described the Regional Tsunami Service Providers (RTSPs) scheme in place in IOTWS which has India, Indonesia and Australia as fully operational RTSPs since October 2011, in the framework of an interoperable system, with harmonised product formats. He recalled that and Interim Advisory Service (IAS) was previously provided by PTWC and JMA and formerly ceased from 31 March 2013.

151 He indicated that the RTSPs products are Threat/No Threat model-based forecast information for defined/agreed coastal zones for each country. The Threat threshold is 0.5 m amplitude at 1.0 m depth and threat information includes estimated initial arrival time of waves above threat threshold, estimated arrival time, and amplitude of highest wave at "beach", and estimated time wave amplitude expected to fall below threat threshold. The products of the RTSPs are issued for earthquakes greater than magnitude 6.5, at any depth, at less than 200 km from coast in Indian Ocean. Also for any earthquake of magnitude greater than 8.0 in the Pacific Ocean.

152 The IOTWS organizes annual SOP training workshops for NTWCs on products run by the RTSPs. The training includes Disaster Management Organizations (DMOs) and is expanding to also include media.

153 A set of Key Performance Indicators (KPI) were adopted by the ICG/IOTWS for RTSPs, with performance published for Member States, reviewed by the ICG and tabled at TOWS-WG Task Team on Tsunami Watch Operations for harmonisation purposes.

154 Mr Bailey further detailed communication tests, awareness and response activities including by the Indian Ocean Tsunami Information Center (IOTIC) which is expected to provide a missing vital regional role in developing and sharing education materials, outreach, post event survey coordination, SOP training, among other functions. He indicated that the ToRs and budget for Jakarta Tsunami Information Centre (JTIC) are under development for review and approval by the IOTWS Steering Group.

155 Mr Aliaga, Technical Secretary for the ICG/CARIBE-EWS, presented the report for the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS). He recalled the structure composed by 32 Member States and 16 territories, with a Board of Officers and 4 Working Groups. The CARIBE-EWS decided in 2009 to accept the offer of the Government of Barbados to establish and host a Caribbean Tsunami Information Center (CTIC). Towards this end, a Memorandum of Understading (MoU) was signed in 2013 between Barbados and UNESCO/IOC for the establishment of the CTIC. Funding from Italy channelled through UNDP and from UNESCO was made available to support CTIC's establishment, including for SOP training, development of public awareness materials and the hiring of a CTIC Director, which is in the process of recruitment.

156 Mr Aliaga mentioned that the CARIBE-EWS performed the second Caribbean Wide tsunami exercise, CARIBE WAVE 13 (IOC/2012/TS/101 VOL.1), on 20 march 2013. Ninety-four percent (94%) of the Member States and territories of the CARIBE-EWS participated, with 481 organizations that registered for the exercise and 50,000 participants including through tsunami drills. The exercise revealed a smooth dissemination of messages from PTWC to TWFPs.

157 ITIC confirmed that it is working with the Indian Ocean Tsunami Information Center (IOTIC) and the Caribbean Tsunami Information Center (CTIC) to make sure there is consistency among the systems and key messages for public awareness and response.

158 Under this agenda item, the Chairman informed to the Plenary that two meetings of the Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG) were held during the intersessional period. He indicated that the most recent one was the Sixth meeting of TOWS-WG held in Paris, France, on 20 and 21 February 2013 (IOC/TOWS-WG-VI/3). He asked Mr Rick Bailey to summarise the main aspects of the Sixth session of TOWS-WG.

3.8 REPORTS FROM UN AND NON UN ORGANIZATIONS

159 The Chair asked representatives of United Nations (UN) and other organizations to report to the meeting.

160 Mr Tsunoda, Co-Chair of CBS OPAG-ISS (Commission for Basic Systems – Open Programme Area Groups on Information Systems Services) of World Meteorological Organization (WMO) presented the latest status of WIS (WMO Information System). He reviewed the characteristics of the GTS. He pointed that the GTS is for time-critical and operation critical-data exchange, and the GTS must be managed to operate data exchange sustainably with sample images of the GTS routeing. He explained WMO regional associations and four of six WMO regions are involved in PTWS activities. He introduced a Discovery Access and Retrieval (DAR) service of WIS and the necessity of the WMO metadata for its search service. He reported current status the six GISCs (Global Information System Centres) which will be related with PTWS, four of six GISCs are now in operation and other two GISCs will start its operation soon.

161 Answering to Ecuador, Mr Tsunoda indicated that the connection between NMC Quito and NTWC should be arranged by national and/or other organizations. The US introduced satellite dissemination service (GEO-NETCAST) and EMWIN that can be alternative communication services for Ecuador.

162 Dr Vasily Titov, Chair of the Joint Tsunami Commission (TC) of the International Union of Geodesy and Geophysics (IUGG), took the floor. Before 2004, there was only one IUGG/TC and one ICG, and the two were meeting and working closely together. After 2004, with the higher level of activities that came into the tsunami operational activities and tsunami science activities, there was also a disconnection between the tsunami scientific and operational communities. The scientific community and the operational community could get together again if organization of ICGs and the scientific community are put back to back.

163 The Tsunami Commission is jointly sponsored by the International Association of Seismology and Physics of the Earth's Interior (IASPEI), the International Association for the Physical Sciences of the Oceans (IAPSO) and the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI). It was established at the Twelfth General Assembly (GA) of IUGG held in Helsinki, Finland, in 1960 to promote the exchange of scientific and technical information about tsunamis among nations concerned with the tsunami hazard. Since then, the Commission has held 24 Tsunami Symposia, both as part of IUGG General Assemblies and independently in alternate years.

164 The next meeting will be the Twenty-sixth International Tsunami Symposium (ITS) that will be held from 25 to 28 September 2013 Fethiye-Gocek (Turkey) and Rhodes (Greece).

165 At this symposium, along with the new scientific advances, the Tsunami Commission plans to discuss 20oord collaboration with the operational tsunami warning community of IOC Tsunami Warning Systems.

166 Before 2004 Sumatra tsunami, much smaller tsunami scientific and operational community had been meeting regularly to exchange information, recommendations and requirements at joint workshops. Since 2004, the proliferation of tsunami activities created a challenge of too many meetings that are not necessarily coordinated between the communities. New forecast products that are being developed by the regional IOC/ICGs have substantial scientific component that needs to adhere to scientific standards. The Tsunami Commission plans to develop these standards in coordination with the IOC/PTWS.

167 The Tsunami Commission encouraged to organize joint workshops and meetings to re-integrate more closely the scientific body of the IUGG with the operational group of IOC. The Tsunami Commission will co-sponsor the symposium in conjunction with the next ICG/PTWS in Hawaii in 2015.

168 France suggested that for the next session (Anniversary) IUGG/TC could organize a back to back session focusing on links between science and operations.

4. POLICY MATTERS

4.1. MEDIUM TERM STRATEGY AND IMPLEMENTATION PLAN

169 The Chair indicated that a revised draft Medium Term Strategy has been made available for consideration. The Chair asked Member States to submit specific comments to the Medium Term Strategy (MTS) considering that this document has been already checked by the Steering Committee.

170 The **ICG adopted** the ICG/PTWS Medium Term Strategy 2014–2021.

171 The Chair recalled Recommendation ICG/PTWS-XXIII.5 (PTWS Medium Term Strategy 2009-2013, Working Group structure and Implementation Plan 2009-2011) and Recommendation ICG/PTWS-XXIII.6 (Steering Committee of the ICG/PTWS) that adopted the Implementation Plan 2009–2011 in principle, but delegated to the Steering Committee the task of review and adjustment of the PTWS Implementation Plan where necessary, to ensure the Plan recognises and aligns with the Medium Term Strategy and Working Group structure. He reported that a revised Draft Implementation Plan is available for discussion but that some substantial editing is pending on the hazard and risk assessment section, as well as on the updated information on observing and monitoring systems that have been fast evolving in the recent period.

172 The ICG established an intrasessional group that met and suggested several editorial changes and more substantial comments on the sections covering tsunami hazard. The working group suggests to the ICG that the PTWS Steering Committee take the responsibility to review the document, and that in 2014 a new version should be developed for adoption during the Twenty-sixth Session of the ICG/PTWS.

173 The **ICG approved** Recommendation ICG/PTWS-XXV.1.

4.2. ICG/PTWS FUNDING STRATEGY

174 The Chair recalled Recommendation ICG/PTWS-XXIV.1 (PTWS Governance) that requested the Steering Committee to develop a strategy for funding PTWS activities. He reported that this task has not been accomplished and requested guidance from Member

States on the opportunity, format and mechanism to produce this guiding instrument. He recalled that in the process all Member States and agencies have managed to find funding and keep going for activities including training and observing and monitoring systems.

175 Australia indicated that to develop a strategy it is necessary to identify gaps and priority programmes or activities that need funding.

176 Dr Kong (ITIC) indicated that new products and SOPs can be easily identified like priorities but there is a difference in having this supported at national level or at regional level. She indicated that the example of the PICs training, which was financially supported by Australia, Japan, New Zealand, the U.S. and SOPAC, needs intensive coordination for getting these trainings alive.

177 The Secretariat asked if hazard assessment was also a priority.

178 The **ICG decided** to task the PTWS-SC to identify gaps and priority programmes or activities that need funding and, based on that, define funding priorities document instead of developing an ICG/PTWS Funding Strategy.

4.3. REPORTS OF THE EXERCISE PACIFIC WAVE 11 AND PACIFIC WAVE 13

179 The Chairman recalled Recommendation ICG/PTWS-XXIV.3 (PTWS Exercises) that decided to conduct Exercise Pacific Wave 11 (PacWave11, IOC/2011/TS/97Vol.1) held on 9 and 10 November 2011, and to continue with the PTWS WG2 Task Team on PacWave 11. He reported that the PTWS Steering Committee requested the PacWave11 Task Team to continue until the Twenty-fifth Session of the ICG/PTWS to plan and conduct a PacWave exercise in 2013 under its existing Terms of Reference, noting that the exercise will not be end-to-end and will focus on validation of the enhanced products. This decision translated in the holding of Exercise Pacific Wave 13 (PacWave13, IOC/2013/TS/106Vol.1) in the first half of May 2013.

180 Dr Kong, Co-Chair of the PacWave11 Task Team, indicated that Experimental Products were utilised for the first time in 2011 and then again in 2013. The evaluation of these products by Member States was slightly different for both exercises; it was more detailed in 2013. The process helped to refine the enhanced products, for example eliminating words in the original threat thresholds (i.e. marine heights or land inundation).

181 Some recommendations of Member States were the following: moving forward with selection of official date to implement enhanced products, further improving content based on feedback before implementation, using text message products as a minimum for release to media/public. IOC sponsor follow-up regional trainings on enhanced products.

182 The Task Team recommended the establishment of a Task Team PacWave15 chaired by the ITIC Director.

183 New Zealand seconded the continuation of Dr Laura Kong as Chair.

184 Colombia thanked Dr Kong and indicated that the exercises are very important and the Task Team should be continued.

185 PTWC reiterated that it will assist the organization of PacWave15.

186 France thanked Dr Laura Kong, ITIC and members of the Task Team for implementing the exercises. NEAMTWS is also implementing exercises, organized by the ICG. France suggested that the exercises should be organized every 2 years and indicated that training to

prepare for the exercises is required for all Member States but in particular for those that are not closely involved in the PTWS.

187 Australia indicated that earlier the PTWS decided to have exercises every 2 years.

188 The representative of the North West Pacific Tsunami Advisory Center (NWPTAC) informed that NWPTAC supported the exercises PacWave15 and reported that Japan is willing to continue as member of the Task Team.

189 Australia and Chile indicated they would like to join the Task Team.

190 The **ICG decided** to form a Task Team on PacWave15 with the same Chairmanship than the previous PacWave Task Teams.

4.4. ENHANCING PTWS TSUNAMI WARNING PRODUCTS

191 The Chairman introduced this agenda item by recalling that through Recommendation ICG/PTWS-XXIII.1 a Task Team on Enhancing Tsunami Warning Products was established, under the Chairmanship of Dr Chip McCreery. He then requested the Chair of the Task Team to present his report.

192 Dr McCreery, PTWC Director and Chair of the Task Team, recalled that the last major revision of the PTWS products took place in 2001 where the change from Ms to Mw was decided. He indicated that the current criteria are based primarily on historical data, and that PTWC initially puts areas into a Warning or Watch based on earthquake magnitude and estimated time left to tsunami impact or distance from earthquake epicentre. These procedures may lead to the entire Pacific put in Warning if a big tsunami is confirmed. He also indicated that the current PTWC products are primarily for regional and basin-wide tsunamis with no timely guidance for local tsunamis.

193 Dr McCreery provided a detailed sample of timeline for events, including the use and timing of the preliminary W-phase Centroid Moment Tensor (WCMT) analysis and RIFT supplemental products. He provided several examples of text products: PTWC deep-ocean tsunami amplitude forecast; PTWC coastal tsunami amplitude forecast; snapshot of kmz file in Google Earth, and the table of zone statistics.

194 The Task Team recommended to the ICG to move forward with the products' full implementation in 2014, set the target changeover date to be 1 October 2014, at a minimum, provide the Text Message as a public product, and disseminate the remaining non-public products only to country National Tsunami Warning Centres (NTWCs) via their Tsunami Warning Focal Points (TWFPs), and at a minimum, only by electronic mail.

195 France indicated that the PTWC Coastal Tsunami Amplitude Forecast does contain information on Tsunami Travel Time as well and it should be identified. Also asked that if the information be made available in case of ETA (Estimated Time of Arrival) it is calculated. Mr McCreery answered affirmatively to this question.

196 The Russian Federation thanked Dr McCreery for the huge amount of work done in a very brief period of time. It indicated that there is great progress from PacWave11 and the materials provided are very useful. It proposed that timeline for changeover is for autumn 2014. The Russian Federation indicated that more training would be required, but for the public the graphic products should not be made available.

197 Indonesia indicated that, with respect to graphical products, Indonesia does have its own segmentation. Indonesia enquired about the possibility of using the same polygons in

PTWC products. PTWC indicated that it exist the possibility, and so that should be feasible unless the polygons are too small.

198 Australia agreed to the example products as presented in Plenary while some changes are still being introduced and should be entrusted to PTWC to make the final touches based on the agreements among technical centres. Australia would also like to align, as much as possible, the PTWC polygons with the Australian ones.

199 USA thanked the Russian Federation for its comment on the technical issues. USA would be interested in the way of defining that there is an issue with the initial estimate and wanted a confirmation of the Group (PTWS) that countries do want the first bulleting even if the earthquake is in the range of those that may be poorly constrained in the first minutes.

200 ITIC indicated that at both PacWave Exercises it was asked the question about the first message for events that are poorly constrained, and the majority of answers did confirm the need for a first message. New Zealand indicated that this is needed because disaster managers need to have at least an indication to be able to take action immediately. JMA confirmed that their experience with the event of 2011 is that for big events rapid development evacuation in the first minutes is essential.

201 Russian Federation indicated that the graphical products may also need some enhancement considering the increased use of technological devices including GPS systems. The Russian Federation indicated that GPS is possible to be used now and is more precise than Google Earth.

202 Chair Ken Gledhill indicated that the products that will come with this change should be improved with the time.

203 Dr McCreery indicated that PTWC does need to meet U.S. domestic requirements for validating the forecasting model, and then the final date for changing over can be pending that process to happen.

204 Australia indicated that financial implications in term of training should be indicated in the PTWS Recommendation addressing the Enhanced Products.

205 ITIC indicated that in sum what is needed is to have four regional trainings in one year, which is challenging. Doing that for 46 countries would be much more difficult.

206 USA indicated that funding for training in ITIC's budget is increased in 30% to try to cover the additional costs.

207 New Zealand indicated that the introduction of the Enhanced Products should not be subject to funding for training.

208 Colombia indicated that is also looking to make sure that the polygons can be modified and if there is a date for the change. Dr McCreery stated that, polygons and forecast points can be changed at any time.

209 Chair Ken Gledhill thanked PTWC, Dr Chip McCreery, ITIC and Dr Laura Kong to have enormously contributed to make this achievement possible.

210 The **ICG approved** Recommendation ICG/PTWS-XXV.1

4.5. SUB-REGIONAL TSUNAMI EARLY WARNING AND MITIGATION SYSTEM OF THE SOUTH CHINA SEA

211 The Chairman recalled the Plenary Recommendation ICG/PTWS-XXIII.5 (PTWS Medium Term Strategy 2009–2013, Working Group structure and Implementation Plan 2009-2011) and in particular Recommendation ICG/PTWS-XXIV.4 (Sub-Regional Tsunami Warning and Mitigation System for the South China Sea Region) that decided to establish a Sub-Regional Tsunami Warning and Mitigation System for the South China Sea region within the framework of ICG/PTWS. He asked the Chairman of the South China Sea Regional Working Group on Tsunami Warning and Mitigation (WG-SCS), Mr Mohd Rosaidi bin Che Abas, to report to the Plenary.

212 Dr Rosaidi, Chair of the WG-SCS, recalled the First meeting held in Sanya, China, from 12 to 14 December 2011(ICG/PTWS-WG-SCS-I/3) and Second meeting held in Petaling Jaya, Malaysia, from 16 to 18 October 2012 (ICG/PTWS-WG-SCS-II/3), and its detailed results. He reported that at the Second meeting the WG decided to recommend the establishment of a South China Sea Tsunami Advisory Center (SCSTAC).

213 He indicated that a draft Recommendation for the ICG/PTWS is contained as Annex II in the report of the Second WG-SCS meeting, which in sum proposes to approve the establishment of the SCS-TWS and to establish a Task Team with ToRs in Annex III (Terms of Reference for Task Team on Establishment of the South China Sea Tsunami Advisory Centre) of the same report, and decides to accept China's offer to host the SCSTAC under the guidance of WG-SCS.

214 The floor then was open to comments from delegates starting with Member States of the concerned region. China thanked Dr Rosaidi for his leadership in getting the SCS system to this point. China is open to review and modify the proposal as Members States decide, and welcome any technical support provided by Member States and IOC Headquarters. Japan indicated that it will follow IOC's procedures to cease the interim service to the SCS by JMA NWPTAC after the establishment of the system.

215 The Group met intrasessionally and elected Mr Mok as Chair of WG-SCS and Dr Nguyen Hong Phuong as Vice-Chair. Also elected Ye Yuan (China) as Chair of TT on the SCSATC.

216 The **ICG approved** Recommendation ICG/PTWS-XXV.3.

5. PROGRAMME AND BUDGET FOR 2014−2015

217 This agenda item was only informational considering the status of funding from regular programme (RP).

218 The Secretariat indicated that Regular Programme (RP) funds for 2013 will likely be in the order of USD 20,000 and suggested concentrating these resources on SOP and enhanced PTWS training.

219 Australia suggested that the Steering I develops a list of priorities for funding including for RP and extrabudgetary funding, to be used as guidance for the work of the Secretariat.

6. NEXT SESSION

6.1. CONFIRMATION OF DATE AND PLACE

220 The Chair invited interventions from Member States on the subject; he recalled that at the ICG/PTWS-XXIV, the ICG noted the interest indicated by USA of hosting its Twenty-sixth Session in 2015. He offered the floor to the delegate of USA to indicate the status of the offer and options for date and venue.

221 USA indicated that it can confirm the hosting of the Twenty-sixth Session in Honolulu in April 2015, as the 50th Anniversary of the Pacific Tsunami Warning System in April 2015 coincides with Tsunami awareness month in Hawaii.

222 ITIC reminded the suggestion from Dr Titov (IUGG) and suggested that a scientific session is organized back to back also on commemoration of the 50th Anniversary of the ICG/PTWS.

6.2. TARGET DATE FOR ICG/PTWS-XXVII

223 The Chair invited expressions of interest to host the Twenty-seventh Session of the ICG/PTWS. There were no interventions under this agenda item.

224 The **ICG agreed** that the Secretariat and the PTWS Steering Committee will explore hosting options for the Twenty-seventh Session of the ICG/PTWS in 2017.

7. OFFICERS ELECTIONS

225 The Chair handed over the Chairing of this part of the meeting to the Chair of the Election Committee, Mr David Coetzee (New Zealand). The Chair of the Election Committee asked the Technical Secretary to remind rules and procedures to the session for the election of Officers. The Chair then presented the report of the Sessional Working Group.

226 The Elections Committee recommended that the experimental phase decided at the Twenty-fourth Session of the ICG/PTWS to increase the number of Vice-Chairs from two, as per the ICG's Terms of Reference, to three, be continued for a further intersessional period. It also requested that the Chair of the ICG/PTWS in his report to the Twenty-sixth Session of the ICG/PTWS comment on the success or otherwise of the experiment so that the ICG could decide whether to continue with three Vice-Chairs and accordingly recommend a change in its Terms of Reference to the IOC Governing Bodies.

227 Against the above recommendation, the Elections Committee reported that there was only one nominee for each position and therefore there is no need for voting to take place.

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

Chair: Dr Ken Gledhill (New Zealand)

Vice-Chairs (in alphabetical order by country):

- Mr Patricio Carrasco (Chile)
- Mr Takeshi Koizumi (Japan)
- Dr Tatiana Ivelskya (Russian Federation)

8. ANY OTHER BUSINESS

229 No other business was proposed.

9. ADOPTION OF DECISIONS AND RECOMMENDATIONS

230 The **ICG** debated in Plenary and **approved** three recommendations as included under ANNEX II.

10. CLOSE OF THE MEETING

231 Chile and Japan intervened at the closing of the session to express sincere thanks for the Russian Federation hosting. The Chair thanked the Russian Federation for all the facilities provided that contributed to a smooth running of the session. He highlighted the significant achievement of endorsing the PTWC Enhanced Products for PTWS. He urged Member States to support the accomplishment of this important change. The session was closed at 17:42 on 11 September 2013

ANNEX I

AGENDA

1. WELCOME AND OPENING

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. REPORT FROM CHAIRPERSON
- 3.2. REPORT FROM SECRETARIAT
- 3.3. REPORT FROM WARNING AND ADVISORY SERVICES
- 3.4. NATIONAL PROGRESS REPORTS
- 3.5. REPORT FROM ITIC
- 3.6. WORKING GROUP REPORTS
- 3.7. STATUS OF PROGRESS IN OTHER ICGs
- 3.8. REPORTS FROM UN AND NON UN ORGANIZATIONS

4. POLICY MATTERS

- 4.1. IMPLEMENTATION PLAN AND MEDIUM TERM STRATEGY
- 4.2. ICG/PTWS FUNDING STRATEGY
- 4.3. REPORTS OF PACIFIC WAVE EXERCISE 2011 AND 2013
- 4.4. ENHANCING PTWS TSUNAMI WARNING PRODUCTS
- 4.5. SUB-REGIONAL TSUNAMI EARLY WARNING AND MITIGATION SYSTEM OF THE SOUTH CHINA SEA

5. PROGRAMME AND BUDGET FOR 2014–2015

6. NEXT SESSION

- 6.1. CONFIRMATION OF DATE AND PLACE OF ICG/PTWS-XXVI
- 6.2. TARGET DATE FOR ICG/PTWS-XXVI

7. OFFICERS ELECTION

8. ANY OTHER BUSINESS

9. ADOPTION OF DECISIONS AND RECOMMENDATIONS

10. CLOSE OF THE SESSION

ANNEX II

ADOPTED RECOMMENDATIONS

Recommendation ICG/PTWS-XXV.1

ICG/PTWS Governance

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

Having met for its 25th Session from 9 to 11 September, 2013 in Vladivostok, the Russian Federation,

Expresses its deep condolences to the people of Solomon Islands for the loss of life caused by the earthquakes and tsunamis in February 2013;

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) will be a coordinated network of national systems and capacities, and will be part of a global network of early-warning systems for all ocean-related hazards,

Reaffirming further that each Member State has the sovereign responsibility to issue warnings within its respective territories,

Noting with appreciation the tsunami forecasting products provided for the Member States of the PTWS by the PTWC hosted by the USA and the NWPTAC hosted by Japan, and guidance materials by the ITIC,

Recalling the *Mauritius Declaration* adopted at the Intergovernmental Coordination Meeting held at Grand Baie, 14–16 April 2005 (IOC Workshop Report, 198, SC.2005/WS/40) to openly share and exchange tsunami-relevant real-time observational data in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy,

Having noted IOC Decision IOC-XXVII/Dec.5.2.2, which decided to continue the TOWS-WG and the Inter-ICG Task Teams on Disaster Management and Preparedness, Hazard Assessment Related to Highest Potential Tsunami Source Areas, and Tsunami Watch Operations for the next intersessional period, with the same membership and Terms of Reference,

Having reviewed the progress made in the implementation of the PTWS since the 24th Session of the ICG/PTWS,

Having considered the reports of:

- Working Group 1 on Tsunami Risk Assessment and Reduction,
- Working Group 2 on Tsunami Detection, Warning and Dissemination and its Task Teams,
- Working Group 3 on Tsunami Awareness and Response,

- WG2 Task Team on Warning Dissemination,
- WG2 Task Team on PACWAVE 11,
- WG2 Task Team on Enhancing Products,
- WG2 Task Team on Seismic Data Sharing in the South West Pacific,
- Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast,
- Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region,
- Regional Working Group on Tsunami Warning and Mitigation System in the South West Pacific Region,
- Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea,
- The intra-sessional Working Groups' reports for PTWS Implementation Plan, WG-SCS, WG3,
- Third Meeting of the PTWS Steering Committee held in Hawaii, USA, May 2012,
- Sixth Meeting of the TOWS-WG and Task Team on Tsunami Watch Operations (Paris, February 2013),
- North West Pacific Tsunami Advisory Center (NWPTAC),
- Pacific Tsunami Warning Center (PTWC),
- International Tsunami Information Center (ITIC),

Recognizing the difficulty in providing effective near-field tsunami warning,

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,

Encourages voluntary contributions to support Budget and Programme activities recommended by the ICG/PTWS either directly or through the IOC Special Account set up for the PTWS as well as in-kind and extrabudgetary contributions, in particular for training with regards to the new enhanced products;

Encourages Member States to nominate members for the WG1 Risk Assessment and Reduction, and WG3 on Awareness and Response;

Recognizing the limited capacity of many Member States of the PTWS in hazard assessment and risk reduction,

Requests Member States to regularly review the list of Tsunami National Contacts (TNCs) and Tsunami Warning Focal Points (TWFPs) on the IOC website and inform the Secretariat of all changes;

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

Decides to:

1. Continue existing Working Groups (WG) and associated Task Teams with same Terms of Reference as attached in Appendix to Recommendation ICG/PTWS-XXV.1:

   WG1. Tsunami Risk Assessment and Reduction; Chair Dr Vasily Titov (USA) and Vice-Chair Dr François Schindelé (France);

   - WG1 Task Team on Tsunami Modelling Hazard Assessment; Chair Dr Vasily Titov (USA);
   - WG1 Task Team on Tsunami Risk Assessment; Chair Dr NGUYEN Hong Phuong (Vietnam);

   WG2. Tsunami Detection, Warning and Dissemination; Chair Mr Rick Bailey (Australia) and Vice-Chair Mr Carlos Zuniga (Chile);

   - WG2 Task Team on Warning Dissemination (Filomena Nelson (Samoa))
   - WG2 Task Team on Enhancing Products (Chair Chip McCreery (USA)
   - WG2 Task Team on Seismic Data Sharing in the South West Pacific (Co-Chair Esline Garaebiti Bule (Vanuatu) and Siosina Lui (Samoa))

   Sub-Regional Working Groups:

   - Regional Working Group on Tsunami Warning and Mitigation System on the Central American Pacific Coast, Chair Angelica Munoz (Nicaragua) and vice-chair Francisco Gavidia (El Salvador).
   - Regional Working Group on Tsunami Warning and Mitigation System in the South East Pacific Region; Chair Carlos Zuniga (Chile).
   - Regional Working Group on Tsunami Warning and Mitigation System in the South West Pacific Region; Chair Ms Filomena Nelson (Samoa).
   - Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea; Chair Mr MOK Hing-yim (China) and Vice-Chair Dr NGUYEN Hong Phuong (Vietnam).

2. Continue the Steering Committee with same Terms of Reference as attached in Appendix to Recommendation ICG/PTWS-XXV.1

3. To reconstitute WG3 under the name of Disaster Management and Preparedness with new Terms-of-Reference as attached in the Appendix, Chair Mr David Coetzee (New Zealand), Vice-chair to be appointed by the Working Group.

4. To establish WG2 Task Team on PACWAVE 15 (Co-Chair Jo Guard (New Zealand) and Laura Kong (ITIC)) with Terms of Reference as attached in Appendix to Recommendation ICG/PTWS-XXV.1.

5. To establish a Task Team on Establishment of a South China Sea Tsunami Advisory Center of the Regional Working Group on Tsunami Warning and Mitigation in the South China Sea, with Terms of Reference as attached in Appendix to Recommendation ICG/PTWS-XXV.1.

6. Continue to disseminate a communication test message from the PTWC once a month on the same day and at the same time every month and two random unannounced tests annually to the PTWS Member State TWFPs;

7. Conduct training workshops on hazard and risk assessment organised by WG1 in coordination with IUGG to enhance collaboration between the operational and research communities as recommended by the TOWS-WG, subject to extra-budgetary funding support being identified;

Decides to implement the enhanced PTWC products for the PTWS in accordance with the timetable and conditions contained in Recommendation ICG/PTWS-XXV.2;

Endorses the proposal of the South China Sea Sub-Regional Working Group to the Establishment of a South China Sea Tsunami Advisory Centre in accordance with the timetable and conditions contained in Recommendation ICG/PTWS-XXV.3;

Endorses the PTWS Medium Term Strategy 2014-2021 presented by the Steering Committee noting the change of the third pillar to Disaster Management and Preparedness;

Requests the Executive Secretary to:

1. Publish the PTWS Medium Term Strategy 2014-2021.

2. Publish the PTWS Implementation Plan when finalised by the Steering Committee.

3. Inform the Member States about the website for TNC and TWFP contact details, provide them with passwords and advise them of the procedures for updating contact details.

4. Organize documentation on the IOC Tsunami website by discipline/topic to facilitate access and utility of reference material across Working Groups and ICGs.

5. In conjunction with PTWC:

    - Ascertain whether each Member State needs every text product issued by PTWC for a single event, or they only need the initial text product after which any additional PTWC products will be obtained via other methods such as GTS, AFTN, email, or EMWIN (for example);

    - Ascertain whether each Member State TWFP needs every fax number currently assigned to them on the PTWC distribution list and if there are more than two could they limit each TWFP to two fax numbers; and

    - Notify Member States at least 90 days in advance that PTWC will begin faxing only the first text product of a single event to Member States unless they specifically request to receive all text products for each event.

Encourages Member States to include representation of Disaster Management Organizations (DMOs) in their delegations to the ICG and intersessional Working Groups;

Instructs the PTWS Steering Committee to prepare a priority list of activities and resource requirements to be reported at ICG/PTWS-XXVI;

Instructs the PTWS Steering Committee to complete and have published the Implementation Plan, taking into consideration the outcomes from the Intrasessional Working Group for the Implementation Plan;

Expresses its gratitude to the Government of the Russian Federation for kindly hosting the 25th Session of the ICG/PTWS in Vladivostok;

Accepts with appreciation the kind offer of the USA to host the 26th Session of the ICG/PTWS in Hawaii in April 2015 subject to the approval of the Government.

Financial Implications: None

Appendix to Recommendation ICG/PTWS-XXV.1

WORKING GROUPS AND STEERING GROUP
TERMS OF REFERENCE

Terms of Reference Working Group 1: Tsunami Risk Assessment and Reduction

1. Review and report on existing arrangements with regard to tsunami hazard identification and characterization;

2. Advise on credible seismic scenarios that need to be captured for numerical tsunami modelling e.g., location, magnitude, rupture, orientation, dip, and probability of occurrence;

3. Review details on models that are currently used or in development and desirable standards of documentation (model inputs and outputs etc.);

4. Explore cooperation regarding coastal inundation models, including appropriate requirements for bathymetry;

5. Develop guidance on mandatory metadata including details of bathymetry, hydrography and topography;

6. Consider the issue of assessing hazard, vulnerability and risk, including the facilitation of access to models and mitigation measures;

7. Liaise with Working Groups from the other ocean basins, as well as other working groups within ICG/PTWS to coordinate and ensure efficient and effective information for tsunami warning and mitigation.

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

Terms of Reference of WG1 Task Team on Tsunami Modelling Hazard Assessment

1. Develop relevant methodology and recommend standards for tsunami modelling for hazard assessment;

2. Define and recommend tsunami risk and hazard assessment products, for planning and/or real-time hazard assessment.

Terms of Reference of WG1 Task Team on Tsunami Risk Assessment

1. Define relevant methodology and required data and products for tsunami risk assessment based on existing ones;

2. Establish links with the WG3 activities, in particular the required products.

Terms of Reference Working Group 2 on Tsunami Detection, Warning and Dissemination

1. Review and report on existing arrangements with regard to seismic, sea level and other kind of measurements, data collection and exchange;

2. Advise on how best to ensure that all events likely to cause tsunami can be reliably located and sized in a timely manner;

3. Review and make recommendations regarding upgrades and enhancements to the PTWS seismic and sea level stations and networks, communications, processing and analysis, particularly those that are important for the rapid characterization of earthquakes capable of generating local tsunamis, to further reduce the time required for source characterization to meet desired warning responses;

4. Liaise with the appropriate organizations and relevant experts to ensure effective data representation and code forms are used for the exchange of data (standards, metadata requirements);

5. Review and report on various means of transmitting data to warning centres, and conduct tests of latency (timeliness) of transmissions as required;

6. Coordinate the development and operational implementation of [the upstream part of] warning systems in the Pacific;

7. Liaise with Working Groups from the other ocean basins, as well as other working groups within ICG/PTWS to coordinate and ensure efficient and effective information for tsunami warning and mitigation;

8. Coordinate and ensure training on existing and new operational procedures and products;

9. Coordinate regular exercises to test the end-to-end performance of the PTWS;

10. Review and report on various means of transmitting warning products end-to-end to improve their efficiency and effectiveness.

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

Terms of Reference of WG2 Task Team on Warning Dissemination

1. Encourage Member States to develop arrangements for the transmission and receipts of tsunami warning alerts from international centres, and the dissemination of alerts and public safety actions within their countries;

2. Provide a forum to identify methods and systems currently available and planned for the future for alert dissemination within Member States, and internationally across the Pacific, and between oceanic basins;

3. Consult with National Tsunami Warning Focal Points to determine appropriate requirements for the dissemination of alerts from the Tsunami Warning Centres and exchange of information for the confirmation of reception.

Terms of Reference of WG2 Task Team on PacWave 15

1. Design and carry out a fifth Pacific-wide exercise with the following characteristics:

   - The exercise will take place preferably in the first quarter of 2015.
   - The exercise scenarios will be major tsunamis originating in various seismic zones of the Pacific to complement previous scenarios in other places.
   - The exercise date be finalized by the Task Team and the exercise announced to Member States at least 180 days in advance of the exercise date.
   - The exercise manual including 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 taking into account lessons learned and any need to collect additional information.
   - The exercise manual be distributed to Member States at least 60 days in advance of the exercise date.
   - Participating Member States be asked to complete and return the evaluation instrument no more than 30 days following the exercise.
   - The exercise be considered as a way to test new enhanced products from the Pacific Tsunami Warning Center

2. Advise countries as requested on the design and conduct of national tsunami exercises.

Terms of Reference of WG2 Task Team on Enhancing Products

1. Review the capabilities and plans of the international TWCs with respect to their operational products and product dissemination for the PTWS;

2. Gather feedback from Member States regarding international TWC current and planned product content, format, and dissemination;

3. Consider best practices based on social science as well as the experiences of the Member States;

4. Consider the global harmonization of tsunami warning products and terminology;

5. Develop recommendations to improve current products and /or develop new products.

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

1. To advocate seismic data sharing in the region;

2. To advise South West Pacific countries on data sharing protocols, techniques and technologies;

3. To work with SWP Countries and donors to ensure a common data sharing policy;

4. To ensure the recommendations of the ICG/PTWS-XXIII Sessional Working Group on Data Exchange in the South West Pacific are achieved.

Terms of Reference of Working Group 3 on Disaster Management and Preparedness

1. Facilitate in collaboration with TOWS Task Team 2 and organizations such as UNISDR, the exchange of experiences and information on preparedness actions, education/awareness raising campaigns and other matters related to disaster management and preparedness;

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. Promote preparedness programs and assessment tools that have been successful in one region in the others as appropriate;

5. Support ITIC of the ICG;

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

Terms of Reference Working Group for the Central American Pacific Coast

1. 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. Recommend CEPREDENAC to determine whether the National Tsunami Warning Centres of Nicaragua or El Salvador (or of both countries cooperating) could act as interim Regional Tsunami Warning Centre disseminating warnings to all Central American countries;

3. Invite CEPREDENAC to consider the implementation of a Technical Committee for the Development of Regional Tsunami Warning and Mitigation Systems;

4. Implement a regional communications and warning plan;

5. 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 and Panama, with a Chair and a Vice-Chair to be elected.

Terms of Reference Working Group for the South East Pacific Region

1. Identify current gaps on the warning and mitigation capabilities of countries in the South East Pacific Region based upon the lessons learned from the last tsunami events. Understand and prioritize the new requirements from countries in the Southeast Pacific Region for the tsunami warning and mitigation services, and group them under the three central pillars of the Medium Term Strategy 2009-2013;

2. Organize the working plan and structure of the South East Pacific Region taking into account the three central pillars of the Medium Term Strategy 2009–2013;

3. Promote and facilitate tsunami hazard and risk studies in the region, through the active participation of appropriate national delegates from Member States, in the Working Group 1: Tsunami Risk Assessment and Reduction;

4. 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;

5. Improve the education programmes with a regional criteria based on the regional social, cultural and economic reality, through the active participation of appropriate national delegates from Member States, in the Working Group 3: Tsunami Awareness and Response;

6. Facilitate capacity building and the sharing of tsunami information in the region, including the free and open exchange of data;

7. Promote and facilitate the creation of in-region trainers in order to meet the regional needs of training.

The Group will be composed of representatives nominated by the Member States of Colombia, Ecuador, Peru and Chile, with a Chair from each country rotating every two years.

Terms of Reference Working Group for the South West Pacific Region

1. Continually review and evaluate capabilities of and make recommendations for improvements to countries in the Southwest Pacific Region for providing end-to-end tsunami warning and mitigation services;

2. Support the involvement and contribution of SWP countries in the activities of the ICG/PTWS;

3. Promote and facilitate the tsunami hazard and risk studies in the SWP region;

4. 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. Facilitate training and capacity building in the end to end tsunami warning and mitigation system in the region;

6. Encourage the sharing of tsunami information in the region, including but not limited to the free and open exchange of data;

7. Facilitate tsunami awareness in school curricula, and development and dissemination of public educational materials;

8. Work in cooperation with PTWS Working Group 3, especially on activities which strengthen country capacity in tsunami emergency response.

The Group will be composed of representatives from Member States and territories of the Secretariat of the Pacific Community (SPC) as members and observers with Chair and Vice Chair to be elected by the members of the Working Group and endorsed by the ICG/PTWS.

Terms of Reference Working Group for the South China Sea

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

2. Ascertain requirements from countries in the South China Sea for the tsunami warning and mitigation services;

3. Promote and facilitate tsunami hazard and risk studies in the region;

4. Facilitate cooperation in the establishment and upgrading of seismic and sea-level stations and networks and communication systems in the region;

5. Facilitate improvement of the education programs on tsunami mitigation in the region;

6. 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[1], China, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam and invited experts with a Chair and Vice-Chair to be elected.

Terms of Reference of South China Sea Sub-Regional WG Task Team on Establishment of a SCS Tsunami Advisory Center

1. Develop capability guidelines and performance indicators for the SCSTAC;

2. Explore ways for facilitating the sharing and exchange of data and relevant information necessary for the establishment of the SCSTAC;

3. Consult with National Tsunami Warning Focal Points of the SCS region to determine appropriate requirements for Tsunami service/products;

4. Develop the SOP and the contents of tsunami advisory products for the SCSTAC;

5. Identify potential resource requirements for the establishment of the SCSTAC;

6. Keep contact with PTWC and NWPTAC (JMA) for technical guidance and assistance.

Membership:

Representatives of Member States of the ICG/PTWS WG-SCS (Brunei Darussalam, China, Cambodia[1], Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam) and invited experts; representatives of PTWC and NWPTAC (JMA); with chairperson and vice chairperson to be elected.

[1] Non-IOC Member State at the date of the report

Terms of Reference of the 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 three 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.

Recommendation ICG/PTWS-XXV.2

PTWC Enhanced Products for PTWS

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

Recalling the following Recommendations adopted by the ICG/PTWS:

1. Recommendation ICG/PTWS-XXIII.1 on Enhancing Tsunami Warning Products;

2. Recommendation ICG/PTWS-XXIV.1, Annex on Working Groups and Task Teams which established a Task Team on Enhancing Products and PacWave 11;

3. Recommendation ICG/PTWS-XXIV.3 on PTWS Exercises which endorsed the objective of using the exercise programme to test Enhanced Products.

Having considered:

1. The report of the Task Team on Enhanced Tsunami Products;

2. The Statement from Pacific Island Countries to Member States at the 25th Session of the UNESCO/IOC Intergovernmental Coordination Group of the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXV);

3. The report on the Exercise Pacific Wave 11 by the PacWave11 Task Team;

4. The report on the Exercise Pacific Wave 13 by the PacWave13 Task Team;

5. The report of the Task Team on Tsunami Watch Operations of the IOC Working Group on Tsunami and Other Hazards Related to Sea-Level Warning and Mitigation System (TOWS-WG)

Acknowledging it is the sovereign right of Member States to issue tsunami warnings for their communities,

Acknowledging with appreciation the efforts of the US/NOAA Pacific Tsunami Warning Centre (PTWC) Director and staff in developing and testing the Enhanced Tsunami Products,

Noting that the issuance of the PTWC Enhanced Tsunami Products for the PTWS on an experimental basis began on 15 April 2013,

Noting that the PTWC Enhanced Tsunami Products for the PTWS will no longer advise levels of alert to Member States, but instead provide more detailed forecast levels of tsunami threat,

Noting with appreciation the large number of training and consultation workshops undertaken under the leadership of the US/NOAA International Tsunami Information Centre (ITIC) Director,

Noting the importance of training for both implementation and ongoing operations for the PTWC Enhanced Products for the PTWS,

Endorses the PTWC Enhanced Tsunami Products as presented in the updated Report of the Task Team on Enhanced Products attached in ANNEX III of the Summary Report for ICG/PTWS-XXV;

Agrees that the text bulletins of the endorsed PTWC Enhanced Tsunami Products be made available to the public;

Agrees that the scientifically more complex graphical products only be disseminated via secure channels to Tsunami Warning Focal Points (TWFPs) for use by National Tsunami Warning Centres (NTWCs) in order to avoid potential misinterpretation by the public;

Requests the PTWC to replace the current products from 1st October 2014 with the endorsed Enhanced Tsunami Products for use by NTWCs of the PTWS subject to:

1. The satisfactory completion by the U.S. National Weather Service of the operational baseline process for the PTWC tsunami forecasting models;

2. The satisfactory completion of U.S. National Weather Service arrangements for U.S. national alerting products;

Agrees that the transition to PTWC Enhanced Tsunami Products for the PTWS may be delayed beyond 1st October 2014 through consultation with the Steering Committee, if internal U.S. issues arise that require extra time to rectify;

Requests the PTWC to advise the ICG/PTWS Working Group 2 on Tsunami Detection, Dissemination and Warning of changes to the agreed PTWC Enhanced Tsunami Products for the PTWS, which WG2 may refer major changes to the Steering Committee for consideration and approval and referral to the ICG/PTWS for decision if required;

Requests further the PTWC to work with the IOC Secretariat to advise Tsunami National Contacts (TNCs) and TWFPs of any changes to the Enhanced Tsunami Products with at least three months formal notification.

Financial implications: None

Recommendation ICG/PTWS-XXV.3

Sub-Regional Tsunami Warning and Mitigation System for the South China Sea Region (WG-SCS)

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, by which the Member States around the South China Sea and other regional seas, as appropriate, actively promote the development, establishment and sustained operation of national and sub-regional Tsunami Warning and Mitigation Systems within the framework of the ICG/PTWS,

Recalling further that the ICG/PTWS adopted Recommendation ICG/PTWS-XXIII.5, which established the Working Group for the South China Sea; 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,

Having considered the reports of:

- The First meeting of the ICG/PTWS-WG-SCS, held in San Ya, China, 12–14 December 2011,
- The Second meeting of the ICG/PTWS-WG-SCS, held in Petaling Jaya, Malaysia, 16–18 October 2012,

Having considered the *Proposal for a South China Sea Tsunami Warning and Mitigation System* submitted to the WG-SCS by China;

Noting with appreciation that PTWC and NWPTAC are providing tsunami advisory services on an interim basis to the South China Sea region,

Reaffirms its commitment to establish a sub-regional Tsunami Warning and Mitigation System for the South China Sea region within the framework of the ICG/PTWS;

Approves the *Proposal for a South China Sea Tsunami Warning and Mitigation System* as the basis for the establishment of the sub-regional Tsunami Warning and Mitigation System within the framework of the ICG/PTWS;

Decides further to establish a South China Sea Sub-Regional WG Task Team on Establishment of a SCS Tsunami Advisory Center, with Terms of Reference attached as Appendix I;

Noting the offer of China to host the SCSTAC at the National Marine Environmental Forecasting Centre in Beijing, China,

Accepts China's offer to host the SCSTAC and **recommends** the establishment of the SCSTAC under the guidance of the WG-SCS;

Encourages members of the Working Group of the South China Sea, as well as all coastal countries of this region to actively participate in and contribute to the establishment of the sub-regional Tsunami Warning and Mitigation System within the framework of the ICG/PTWS;

Invites countries outside the South China Sea region to provide appropriate support to establish the sub-regional Tsunami Warning and Mitigation System within the framework of ICG/PTWS;

Decides to organize an inter-sessional meeting of the WG-SCS in either late 2013 or in early 2014;

Expresses gratitude to the Government of China for hosting the First meeting of the WG-SCS in San Ya, China, from 12 to 14 December 2011 and the WESTPAC-ICG/PTWS Training Workshop on Tsunami Modelling and Risk Assessment, held in Beijing, China, from 24 to 27 September 2012; and

Expresses gratitude to the Government of Malaysia for hosting the Second meeting of the WG-SCS in Petaling Jaya, Malaysia, from 16 to 18 October 2012.

Financial implications: None

Appendix I to Recommendation ICG/PTWS-XXV.3

Terms of Reference

South China Sea Sub-Regional WG Task Team
on the Establishment of a South China Sea Tsunami Advisory Center

Task team: On the Establishment of the SCS Tsunami Advisory Center (SCSTAC).

Purpose: To assist the SCS Working Group in establishment of the SCSTAC until it has the ability to provide operational service.

Mandate: Under the guidance of the ICG/PTWS-WG-SCS, the task team shall strengthen coordination and cooperation among the SCS countries to establish the SCSTAC:

- Develop capability guidelines and performance indicators for the SCSTAC;
- Explore ways for facilitating the sharing and exchange of data and relevant information necessary for the establishment of a SCSTAC;
- Consult with National Tsunami Warning Focal Points of the SCS region to determine appropriate requirements for tsunami advisory services;
- Develop the SOP and the contents of tsunami advisory services for the SCSTAC;
- Identify potential resource requirements for the establishment of the SCSTAC;
- Keep contact with PTWC and NWPTAC (JMA) for technical guidance and assistance.

Membership: Representatives from the Member States of the ICG/PTWS-WG-SCS (Brunei Darussalam, China, Cambodia[2], Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) and invited experts; representatives of PTWC and NWPTAC (JMA); with Chairperson and vice Chairperson to be elected.

Modus operandi: The task team will work mainly by correspondence, and prepare reports for the SCS-WG meetings.

[2] Non-IOC Member State at the date of the report

ANNEX III

REPORT OF WORKING GROUP 2
TASK TEAM ON ENHANCING PRODUCTS

1. INTRODUCTION

This report of the Working Group 2 Task Team on Enhancing Products is to inform the ICG on the status of the development and implementation of enhanced international products being created by the U.S. Pacific Tsunami Warning Center (PTWC) and Japan's Northwest Pacific Tsunami Advisory Center (NWPTAC) for the UNESCO Intergovernmental Oceanographic Commission's (IOC's) Pacific Tsunami Warning and Mitigation System (PTWS).

Terms of Reference of this Task Team, as established at ICG/PTWS-XXIV, are:

1. Review the capabilities and plans of the international TWC's with respect to their operational products and product dissemination for the PTWS;

2. Gather feedback from Member States regarding international TWC current and planned product content, format, and dissemination;

3. Consider best practices based on social science as well as the experiences of the Member States;

4. Develop recommendations to improve current products and/or develop new products.

NWPTAC enhanced products will be developed by Japan after the PTWC enhanced products have been implemented. Therefore, this report deals exclusively with the PTWC enhanced products. It provides an overview of the proposed procedures for issuing the new PTWC products, as well as their content, format, staging, and dissemination methods, that has evolved based upon feedback received as a result of the Pacific Wave 2011 and 2013 Exercises (PacWave11 and PacWave13), consultations with Member States that have occurred in conjunction with numerous regional trainings on the products and through other meetings, discussions between members of the Task Team, and in consideration of the results of the PacWave13 on the interest and readiness of countries to change over to the new PTWC products.

Upon review of the aforementioned, the Task Team recommends to the ICG to

1. Move forward with the product's full implementation in 2014,

2. Set the target changeover date to be 1 October 2014,

3. At a minimum, provide the Text Message as a public product, and

4. Disseminate the remaining non-public products

    a. Only to country National Tsunami Warning Centres (NTWCs) via their Tsunami Warning Focal Points (TWFPs), and

    b. At a minimum, only by electronic mail.

2. INTERSESSIONAL ACTIVITIES

The primary activities that have taken place during the intersessional period related to the PTWC enhanced product development and implementation readiness are the following:

2.1 EXERCISES

PacWave11. The PacWave11 exercise was conducted on November 9-10, 2011 (IOC/2001/TS/91Vol 1 Exercise Manual, Vol 2 Report). Thirty-five Member States participated at different levels ranging from table-top to full end-to-end. Current and enhanced PTWC products for ten earthquake-tsunami scenarios were used. Feedback on the exercise from participating Member States via an evaluation form was collected and compiled. The questionnaire included several questions related to the enhanced products. Opinions and suggestions given were considered by the Task Team at their May 2012 meeting in Honolulu and those accepted were implemented by PTWC wherever practicable. Some worthwhile suggestions were deferred for implementation until later in an effort to keep the initial products as simple as possible.

PacWave13. The PacWave13 table-top only exercise was conducted between May 1 and May 14, 2013 to validate the understanding and use of the new PTWC products, and to obtain feedback on country readiness for the changeover (IOC/2013/TS 106Vol 1 Exercise Manual, Vol 2 Report (final draft). Thirty-four Member States participated. Enhanced PTWC products for three earthquake-tsunami scenarios were used and a User's guide for the Pacific Tsunami Warning Center: enhanced products for the Pacific Tsunami Warning System (IOC/2013/TS/105 REV in English and Spanish) was produced and distributed. Feedback was again collected via an evaluation form with results compiled and considered for improving the products.

Detailed information on these exercises and their evaluations are contained in the individual PacWave11 and PacWave13 Exercise Reports. The Enhanced Products User's Guide contains detailed information about the products in the form used for the PacWave13 Exercise.

PacWave11 and PacWave13 will be discussed under ICG/PTWS-XXV Agenda Item 4.3

2.2 REGIONAL TRAININGS AND CONSULTATIONS

Central America and Mexico. Regional training on tsunami warning and emergency response standard operating procedures (TWC and TER SOPs) and the enhanced products was organized by ITIC and IOC and conducted in El Salvador for the Central American countries and Mexico of the PTWS from 11-15 February 2013. The training included a table-top exercise using the enhanced products. In discussions that followed the participating Member States offered their opinions and suggestions regarding the products.

South America. Regional training on TWC and TER SOPs and the enhanced products was organized by ITIC and IOC and conducted in Chile for the South American countries of the PTWS from 4-8 March 2013. The training included a table-top exercise using the enhanced products. In discussions that followed the participating Member States offered their opinions and suggestions regarding the products.

Pacific Island Countries. Regional training on TWC and TER SOPs and the enhanced products was organized by ITIC and IOC and conducted in New Zealand for the many of the Pacific Island countries of the PTWS from 12-16 August 2013. The training included a table-top exercise using the enhanced products. In discussions that followed the participating

Member States offered their opinions and suggestions regarding the products. At the end of the training, a consultation was conducted that resulted in a Statement from the 15 Pacific Island Countries that attended. The Statement requested implementation in the last Quarter of 2014 and requested additional training beforehand to fully ensure that countries will be ready.

ITIC ITP-Hawaii Trainings. The IOC and ITIC continued to organize and conduct their annual International Training Program (ITP), part of which has included training on the enhanced products. ITPs during the inter-sessional period took place from 22 August – 2 September 2011 and 20-31 August 2012 in Honolulu.

Further information about tsunami trainings can be found in the ITIC Director's Report, and will be discussed under ICG/PTWS-XXV Agenda Item 3.5

2.3 MEETING OF THE TASK TEAM ON ENHANCING PRODUCTS

A meeting of the Task Team was held in Honolulu, Hawaii, May 22-23, 2012, just prior to a PTWS Steering Committee Meeting. The Task Team meeting focused on how to continue moving forward, taking into account 1) past recommendations of the Task Team, 2) recommendations of the IOC Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS) Task Team 3 on Warning Operations, 3) lessons learned from the 2009 Samoa, 2010 Chile, and 2011 Japan tsunamis, 4) PacWave11 feedback, and 5) current scientific and technical capabilities and limitations. Certain changes to the products were agreed to while others were either kept under consideration, delayed for a later implementation, or determined not to be feasible. Some issues were left unresolved.

Further Notes on this meeting can be found Annex I of this Report.

2.4 MEETING OF THE PTWS STEERING COMMITTEE

A meeting of the PTWS Steering Committee (SC, ICG/PTWS-SC-III/3) in May 2012 in Honolulu, immediately following meetings of the PacWave11 Task Team and Enhancing Products Task Team considered their reports and endorsed their recommendations, including the publication of the Users' Guide and the start of issuance of the new PTWC products in an experimental mode in 2013. The SC also agreed that a comprehensive training program on the new products for PTWS Member States would be needed to ensure that the products are understood and that Member State SOPs are modified accordingly. The PTWS SC then met again in February 2013 in Paris to review progress, and agreed on the 15 April 2013 start of the new PTWC products in shadow mode with its existing products. During this experimental period, the PTWC would give its existing products its first priority, and as time permitted, the experimental products would be issued.

The outcomes of this meeting will be discussed under ICG/PTWS-XXV Agenda Item 3.1

2.5 MEETING OF THE TOWS TASK TEAM ON WARNING OPERATIONS

A meeting of TOWS Task Team 3 was held in Paris, France, 18-19 February 2013. The enhanced PTWC products were among many issues discussed aimed towards having a more seamless and comprehensive global tsunami warning and mitigation system. Issues raised with respect to the enhanced products reflected the comments and suggestions previously offered in the PacWave exercises and trainings.

The report of this meeting can be found in Annex III of the Report of the Sixth Meeting of the TOWS Working Group, 20-21 February 2013 (ICG/TOWS-WG-VI/3)

3. BACKGROUND–WHY CHANGE THE PRODUCTS?

There are many reasons why it is now time to make a significant change to the PTWC products for the PTWS. While the current procedures and products have successfully served to alert Member States about potentially destructive tsunamis crossing the Pacific, they are based primarily on science and technical capabilities from more than a decade ago, and they have shortcomings that can be better addressed with new procedures and products. In particular:

1. Current warning criteria were based upon limited historical data and are very conservative for safety, resulting in significant over-warning. Improved seismic analyses, more and better-quality sea level data, and numerical tsunami forecast models can significantly reduce the amount of over-warning by better determining where the threats exist.

2. The PTWC assignment of warning and watch alert levels for countries in the current products has caused confusion and/or conflict in some countries that issue their own independently-derived alert levels. The enhanced products will not assign alert levels but instead provide forecast tsunami amplitudes that can either be converted directly by Member States to alerts, or used to compare with Member State's own independent analyses of the threat. This change will be consistent with the United Nations policy that every country is sovereign and responsible for safety of its own population, and therefore, is responsible for the issuance of its own official national tsunami warning alerts.

3. Current criteria and procedures were designed to protect Member States from tele-tsunamis that can cause damage and threaten lives far from their source. At the time they were implemented, the analysis of a large earthquake might take an hour – far too long to provide an advance alert for a local tsunamis that may strike within minutes, are more frequent, and where damage and casualties are usually the highest. With the increased quantity and quality of real-time seismic data now available, PTWC can analyse most large earthquakes and issue a message within 10 minutes. The new products will improve the guidance for local tsunamis not only because of this reduced response time, but also because the threat will be based on a numerical forecast rather than on an earthquake magnitude threshold designed for tele-tsunamis.

4. Current products give no indication of the level or areal extent of the threat; they only assign warnings to entire countries. Member States cannot determine from the current products what parts of their coast will be affected and whether to expect minor coastal flooding or a large-scale inundation. The new products provide an indication of the level of threat and where it is predicted. This should help Member States to better anticipate impacts and respond accordingly. For example, in many cases the threat may primarily be confined to strong and unusual near shore ocean currents and minor flooding of beaches and harbours that doesn't require a full evacuation. On the other hand, if a major tsunami threat is forecast the strongest language and actions may be appropriate to ensure people in those areas are evacuated to safe places away from the coast when the tsunami arrives.

5. The current product is only a text message. While there is value in having concise text-based information for communicating about a sudden hazard, it is more efficient to convey some types of information using graphical products. The new product suite

includes maps showing forecast deep-ocean and coastal tsunami amplitudes as well as the expected tsunami travel times. They also show the coastal zone maximum tsunami amplitude forecast for each country, or sub-national region. A kmz file is included that can be used with GoogleEarth to zoom in to a region or coast and view individual forecast points and their values. Lastly the product suite includes a table of statistics about each forecast zone. The individual components of the new product suite are described in more detail below.

4. OUTCOMES FROM EXERCISE PACIFIC WAVE 2013 AND REGIONAL WORKSHOPS

Based on the latest feedback available, which is from the 34 countries participating to the PacWave13 in May 2013, and the consultation with 15 Pacific Island Countries in 12-16 August 2013, the following conclusions were made on the content, format, staging, use, and readiness of PTWS countries:

- An overwhelming majority ranked the Text Message as the most useful product, followed by the Forecast Polygon Map. Moderately useful products were the Coastal Forecast Map, Energy Forecast Map, and Forecast Polygon Table. The Coastal KMZ file was ranked the least useful product.

- The majority of respondents agreed that the format and content of PTWC Enhanced Products were satisfactory. Edits and additional information were suggested for the products.

- The majority of respondents recommended the text product at a minimum be made available to the public.

- The majority of respondents would like to see a forecast included in the initial product, knowing that earthquake magnitudes and tsunami forecasts are likely to change over the first hour.

- The majority of respondents indicated the National Tsunami Warning Centres understand the contents of the enhanced products, how to use the products, and their limitations.

- Half of respondents indicated the National Disaster Management Office also understand the content of the products.

- A strong majority of respondents anticipate being ready in 2014 through further training and harmonization with key stakeholder agencies. Currently, a majority are not yet ready. A strong majority requested training international experts to ensure their readiness, and where needed, assistance in evaluating and refining their national arrangements.

- The Pacific Island Countries requested implementation of the new products in the last quarter of 2014 in order to provide countries sufficient time to develop or adjust SOPs, to inform stakeholders about the changes, and to conduct training to respond to the changes. They also requested the ITIC to develop SOP guidance templates for tsunami warning and decision making to assist them and to make them available by 2014.

- The majority of respondents indicated their stakeholders understand that current PTWC international Watch/Warning products will be discontinued.

- The majority of respondents understand that the National Tsunami Warning Centre, not PTWC, will be responsible for issuing future national alerts (e.g. Watches/Warnings/ Cancellations).

- Efforts will be undertaken by almost all respondents to prepare their stakeholder agencies and media for the enhanced products official implementation in 2014.

5. PTWC ENHANCED PRODUCT SUITE

Current Products.

Current products issued by PTWC are text only. One type is an information bulletin that indicates a large earthquake has occurred but that there is no tsunami threat or that the threat, if any, is confined to a local area near the earthquake. The other is a warning bulletin. It indicates which countries have coasts with a warning-level threat either because of a confirmed tsunami or based on the tsunami potential from the earthquake parameters. Countries where the impact is not imminent may be assigned a "watch" status while the tsunami is still being evaluated. Warning bulletins also contain the estimated tsunami arrival times for countries in a warning or watch and select tsunami observations from coastal or deep-ocean sea level gauges.

Enhanced Products

The enhanced products will consist of a text message only, or a text message accompanied by a suite of graphical products, a kmz file, and a table of forecast statistics. A detailed explanation of each component is given in the March 2013 Enhanced Products User's Guide.

- Text Message – The text message contains the preliminary earthquake parameters and an evaluation of the tsunami threat. If there is a tsunami threat, the message will also contain a list of countries under each forecast tsunami amplitude range: less than 0.3m, 0.3-1m, 1-3m, and greater than 3m. It will also include the expected first tsunami wave arrival time for points within or near threatened areas. As tsunami observations become available, the message will include selected ones from coastal and deep-ocean gauges.

- Deep-Ocean Tsunami Amplitude Forecast Map – This map shows the earthquake epicentre and the forecast deep-ocean tsunami amplitudes. It is useful for indicating where the main beams of tsunami energy, guided by the bathymetry, are heading. Also shown on the map are the half-hourly tsunami travel-time contours.

- Coastal Tsunami Amplitude Forecast Map – This map shows the earthquake epicentre and the forecast coastal tsunami amplitudes. It is useful for estimating the level of tsunami impact along each coast. Also shown on the map are the half-hourly tsunami travel-time contours.

- Coastal Tsunami Amplitude Forecast Polygons Map – This map shows the earthquake epicentre and the maximum forecast tsunami amplitude within polygons that encompass the coasts of each Member State. It provides the quickest way for a Member State to discern whether any of its coasts are forecast to be threatened, and the level of that threat that is shown in four ranges: less than 0.3 m, 0.3-1 m, 1-3 m, and greater than 3 m.

- KMZ File – The kmz file can be used with the GoogleEarth computer program to display the colour-coded tsunami forecast points across the Pacific at any scale. When zoomed out to show a large part of the Pacific, adjacent points are

indistinguishable and they form a continuous band of colour along coasts. When zoomed in, the individual points become distinguishable, and their values can be displayed with a mouse-over. The file is useful to help judge the potential extent of affected area of a local tsunami, for example, or to judge differences in impact from one side of an island to the other. However, caution should be applied and users should not give too much significance to the exact value of individual points.

- Table of Statistics for the Coastal Forecast Points within Each Polygon – The forecast level of each polygon in the polygons map is the maximum value of all the forecast points within the polygon. This table can provide some indication of how representative that level is for the entire polygon. The maximum, mean, median, and standard deviation of the values for each polygon is given, along with the number of forecast points within each polygon. Also shown are the same statistics for the closest offshore forecast points but without the application of Green's Law that approximates the amplification at the coast.

6. ENHANCED PRODUCT DISSEMINATION METHOD AND THE PUBLIC-PRIVATE ISSUE

The current products issued by PTWC are text only and are disseminated by a variety of methodologies and circuits including the GTS, AFTN, email, faxing, EMWIN and the PTWC website to reach TWFPs of Member States. The new products that include maps and a kmz file are not suitable for dissemination by some of these methods. At a minimum, the new products will be disseminated to TWFPs by email. The new text products could also be disseminated by all the current methods. However, dissemination methods are related to the issue about what information should be made public and what information should only be for the use of the NTWCs. Decisions regarding dissemination methods will need to wait until after decisions about what products should be public and what should be kept private are made by the ICG.

7. TSUNAMI FORECASTING LIMITATIONS

The enhanced products depend upon the prediction made by PTWC's RIFT numerical forecast model. As with any forecast model, RIFT needs accurate input to produce accurate output and certain assumptions built into the model can also affect its accuracy.

The initial RIFT forecast is derived only from the preliminary earthquake epicentre, depth, and magnitude. From that it assumes an earthquake mechanism (shallow-thrust with parameters of the nearest subduction zone) as well as fault dimensions (empirical approximation based on magnitude). This generally works well for shallow earthquakes located right in a subduction zone – the place where most tsunamigenic earthquakes occur. But it can be wrong for large earthquakes located elsewhere. The next RIFT run is based on the WCMT earthquake focal mechanism parameters. The WCMT will correct forecast error associated with having assumed a wrong mechanism, but the fault dimensions are still unknown and must be presumed. For earthquakes with magnitudes in the mid-8's and above the fault dimensions can be very large and the rupture pattern very complex, so the WCMT and the assumed fault dimensions can still provide an incomplete characterization of the source. This is especially possible immediately after a gigantic earthquake when initial seismic estimates may underestimate the magnitude and dimensions of the rupture. Tsunami observations from deep-ocean gauges, however, do provide the most direct validation and constraint on the forecast. When they become available, then the forecast can be adjusted to best match those observations.

The other important limitation of RIFT is that it uses an approximation (Green's Law) to estimate amplification of the tsunami as is comes into shallow water. RIFT provides numerical tsunami prediction only in deep water where the tsunami wavelengths are much longer than the water depth and are also sufficiently sampled by the grid spacing used. This is a practical necessity to be able to quickly calculate a tsunami forecast. To use the fine grids necessary to numerically bring a tsunami to the shore along all the Pacific coasts would require more computer time than the tsunami takes to cross the Pacific. So an approximation is used. That approximation is based on having a uniform undersea planar slope from deep to shallow water. Since that is not the case for many coasts, especially bays and estuaries, the method can be inaccurate in those places. In addition, the application of Green's Law may not be appropriate for some islands, especially in the case of tele-tsunamis where the tsunami wavelength may be much larger than the size of the island.

In spite of those limitations, PTWC's experience with RIFT in the 2009 Samoa, 2010 Chile, 2011 Japan, and 2012 Sumatra tsunami events has shown the RIFT forecasts to be useful in providing general levels of impact. The U.S is currently conducting a more detailed baseline study of RIFT's performance that will be used to strengthen the forecast in the PTWS products.

A more detailed discussion of RIFT's strengths and limitations is provided in the March 2013 Enhanced Products User's Guide.

8. PTWC ENHANCED PRODUCTS – PROCEDURES

Based upon the sequence of events that occur following any large earthquake in the Pacific, a series of new enhanced products will be issued (highlighted in pink). The products will have different amounts of information and levels of accuracy depending on the type, quantity, and quality of data and analysis that have been available for producing the products. In general the accuracy and forecast area of the products will increase with time. A description of key events and the general time they will occur is provided in the table below.

TIME	DESCRIPTION OF THE EVENT
00h00m	A large earthquake occurs in the Pacific region.
00h02m	Vibrations from the earthquake reach seismic stations near the earthquake epicentre, triggering event alarms at PTWC. PTWC duty analysts respond to the operations centre and begin to analyse the event. [PTWC currently monitors over 400 seismic stations from around the world, with data collected at most of those stations reaching PTWC within a minute of when it is collected.]
00h08m	Using a combination of automatic and interactive analyses, duty analysts complete their preliminary determination of the earthquake epicentre, depth, and magnitude. These parameters are used to initiate a RIFT numerical tsunami forecast model run for a limited region near the epicentre. [*RIFT is one of three numerical forecast models in use at PTWC, each of which has its own strengths and weaknesses. RIFT is the model upon which the new products are primarily based. Forecasts from the other two models, SIFT and ATFM, are compared for consistency. For this initial RIFT run, the earthquake fault mechanism is based upon the mechanism of historical nearby earthquakes.*]

TIME	DESCRIPTION OF THE EVENT
00h10m	**Initial Product.** The type of product issued will depend on the estimate threat A. If there is no tsunami threat because the earthquake is too small or too deep inside the earth or inland, then the initial product will just be an Information Statement without the suite of graphical and other products. B. If there is a potential tsunami threat, then the initial product may either be 1. The entire suite of products with the initial forecast amplitudes or 2. A text product only containing the earthquake parameters and a statement to the effect that earthquakes of this size and location typically pose a tsunami threat but that it has not yet been quantified and the forecast will follow later. Option B.2 may be necessary to indicate a potential threat as quickly as possible but avoid issuing a misleading forecast if it is too poorly constrained with the initial seismic data.
00h15m	The seismic analyses continue as data from additional seismic stations arrive and are processed.
00h20m	**Supplemental Product with Updated Earthquake Parameters**. If the earthquake parameters change significantly from what was in the initial bulletin then RIFT is re-run. If there is a significant change in the forecast then appropriate supplemental products, similar to those described above, are issued.
00h25m	For earthquakes above about magnitude 7.0, the preliminary W-phase Centroid Moment Tensor (WCMT) analysis based upon broadband seismic data completes. The WCMT analysis not only gives a more accurate estimate of the earthquake location, depth and magnitude, but also an estimate of the earthquake's mechanism – the angle of the fault plane projected along the surface of the earth relative to north (strike), the angle of the fault plane relative to a horizontal plane (dip), and the direction of slip along the fault relative to horizontal (rake). These parameters help constrain the estimate of seafloor deformation that is the tsunami source, and they are used to drive a subsequent run of RIFT that covers the entire Pacific.
00h35m	**Supplemental Product with WCMT-based Forecast**. For events with a tsunami threat, a supplemental message is issued based upon the earthquake mechanism given by the WCMT analyses that includes the along with accompanying maps, table, and kmz file that cover the entire Pacific region and marginal seas of the PTWS. This second set of products will be based on this updated RIFT tsunami forecast that will be much better constrained by the seismic data and analyses. It will also cover most coasts within the Pacific.
00h30m to 02h00m	Sea level gauges are monitored for tsunami signals. Within the first 30 minutes to 2 hours, and depending upon where the earthquake occurs, the tsunami will arrive and be measured on the nearest one or two coastal gauges and one or two deep-ocean gauges.

TIME	DESCRIPTION OF THE EVENT
01h00m to 03h00m	**Supplemental Products with Observation-Constrained Forecasts**. As observations of tsunami waves become available, they will be used to compare with existing forecasts and to adjust those forecasts when necessary. Typically, the forecast will become stable after a few readings from deep-ocean gauges and not require further adjustment. Products will be issued at least once an hour with any updated forecasts.
Beyond 3h	The tsunami is monitored on coastal and deep-ocean sea-level gauges as it advances. Reports from Member States and the media may also be received.
Beyond 3h	**Supplemental and Final Products**. Products are issued at least once an hour with updated observations from coastal and deep-ocean gauges and other reliable sources. When it is clear there is no longer a significant tsunami threat or the tsunami has crossed the entire Pacific then a final product is issued.

Table III-1 Description of key events and general time

9. SAMPLE PTWC ENHANCED PRODUCTS

Based on feedback from inter-sessional activities, the PTWC modified its original proposed enhanced products to arrive at this final draft for implementation according to the ICG/PTWS-approved schedule. These products are provided as samples in this section.

Red text indicates recent changes not yet implemented in the product software.

Blue italicized text is for explanatory comments that are not part of the products.

SAMPLE TEXT PRODUCT

ZCZC
WEPA40 PHEB 150008
TSUPAC

EXPERIMENTAL TSUNAMI MESSAGE NUMBER 1
NOT FOR DISTRIBUTION
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
0008 UCT THU AUG 15 2013

...TSUNAMI THREAT MESSAGE...

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE *****

THIS MESSAGE IS ISSUED FOR INFORMATION ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH COUNTRY OF THAT SYSTEM.

NATIONAL AUTHORITIES WILL DETERMINE THE TSUNAMI THREAT AND APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY.

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE *****

PRELIMINARY EARTHQUAKE PARAMETERS

* MAGNITUDE 8.6
* ORIGIN TIME 0000 UTC AUG 15 2013
* COORDINATES 14.3 SOUTH 166.2 EAST
* DEPTH 20 KM / 12 MILES
* LOCATION VANUATU

Earthquake parameters in tabular form were moved to the top of the text product.

EVALUATION

* AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.6 OCCURRED IN THE VANUATU ISLANDS AT 0000 UTC ON THURSDAY AUGUST 15 2013.

* BASED ON THE PRELIMINARY EARTHQUAKE PARAMETERS... HAZARDOUS TSUNAMI WAVES ARE FORECAST FOR SOME COASTS.

TSUNAMI THREAT FORECAST...UPDATED

* TSUNAMI WAVES REACHING MORE THAN 3 METERS ABOVE THE TIDE LEVEL ARE POSSIBLE ALONG SOME COASTS OF

  VANUATU... SOLOMON ISLANDS... AND PAPUA NEW GUINEA.

* TSUNAMI WAVES REACHING 1 TO 3 METERS ABOVE THE TIDE LEVEL ARE POSSIBLE ALONG SOME COASTS OF

  AUSTRALIA... NEW CALEDONIA... MARSHALL ISLANDS... FIJI... SAMOA... KIRIBATI... AND WALLIS AND FUTUNA.

* TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE TIDE LEVEL ARE POSSIBLE FOR SOME COASTS OF

  NEW ZEALAND... AMERICAN SAMOA... TOKELAU... NAURU... HOWLAND AND BAKER... TONGA... TUVALU... AND NIUE.

* FOR OTHER AREAS COVERED BY THIS PRODUCT A FORECAST HAS NOT YET BEEN COMPUTED. THE FORECAST WILL BE EXPANDED AS NECESSARY IN SUBSEQUENT PRODUCTS.

RECOMMENDED ACTIONS

* GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

* PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD

FOLLOW INSTRUCTIONS FROM NATIONAL AND
LOCAL AUTHORITIES.

ESTIMATED TIMES OF ARRIVAL

* ESTIMATED TIMES OF ARRIVAL –ETA- OF THE INITIAL TSUNAMI WAVE FOR POINTS WITHIN THREATENED REGIONS ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	REGION	COORDINATES	ETA(UTC)
ESPERITU SANTO	VANUATU	15.1S 167.3E	0023 08/15
SANTA CRUZ ISLA	SOLOMON ISLANDS	10.9S 165.9E	0033 08/15
KIRAKIRA	SOLOMON ISLANDS	10.4S 161.9E	0057 08/15
ANATOM ISLAND	VANUATU	20.2S 169.9E	0115 08/15
AUKI	SOLOMON ISLANDS	8.8S 160.6E	0127 08/15
HONIARA	SOLOMON ISLANDS	9.3S 160.0E	0133 08/15
GHATERE	SOLOMON ISLANDS	7.8S 159.2E	0139 08/15
MUNDA	SOLOMON ISLANDS	8.4S 157.2E	0144 08/15
PANGGOE	SOLOMON ISLANDS	6.9S 157.2E	0157 08/15
FALAMAE	SOLOMON ISLANDS	7.4S 155.6E	0204 08/15
NOUMEA	NEW CALEDONIA	22.3S 166.5E	0208 08/15
NAURU	NAURU	0.5S 166.9E	0214 08/15
KIETA	PAPUA NEW GUINEA	6.1S 155.6E	0216 08/15
FUNAFUTI ISLAND	TUVALU	7.9S 178.5E	0216 08/15
WOODLARK ISLAND	PAPUA NEW GUINEA	9.0S 152.9E	0217 08/15
AMUN	PAPUA NEW GUINEA	6.0S 154.7E	0217 08/15
SUVA	FIJI	18.1S 178.4E	0230 08/15
RABAUL	PAPUA NEW GUINEA	4.2S 152.3E	0242 08/15
FUTUNA ISLAND	WALLIS AND FUTUN	14.3S 178.2W	0251 08/15
WALLIS ISLAND	WALLIS AND FUTUN	13.3S 176.3W	0307 08/15
KOSRAE ISLAND	KOSRAE	5.5N 163.0E	0307 08/15
LAE	PAPUA NEW GUINEA	6.8S 147.0E	0313 08/15
ULAMONA	PAPUA NEW GUINEA	5.0S 151.3E	0315 08/15
TARAWA ISLAND	KIRIBATI	1.5N 173.0E	0316 08/15
KAVIENG	PAPUA NEW GUINEA	2.5S 150.7E	0318 08/15
HOWLAND ISLAND	HOWLAND AND BAKE	0.6N 176.6W	0323 08/15
NORTH CAPE	NEW ZEALAND	34.4S 173.3E	0327 08/15
PORT MORESBY	PAPUA NEW GUINEA	9.3S 146.9E	0333 08/15
NUKUNONU ISLAND	TOKELAU	9.2S 171.8W	0333 08/15
KWAJALEIN	MARSHALL ISLANDS	8.7N 167.7E	0334 08/15
MAJURO	MARSHALL ISLANDS	7.1N 171.4E	0338 08/15
NUKUALOFA	TONGA	21.0S 175.2W	0338 08/15
MADANG	PAPUA NEW GUINEA	5.2S 145.8E	0339 08/15
KANTON ISLAND	KIRIBATI	2.8S 171.7W	0342 08/15
APIA	SAMOA	13.8S 171.8W	0350 08/15
BRISBANE	AUSTRALIA	27.2S 153.3E	0351 08/15
POHNPEI ISLAND	POHNPEI	7.0N 158.2E	0352 08/15
MANUS ISLAND	PAPUA NEW GUINEA	2.0S 147.5E	0356 08/15
PAGO PAGO	AMERICAN SAMOA	14.3S 170.7W	0358 08/15
ENIWETOK	MARSHALL ISLANDS	11.4N 162.3E	0411 08/15

NIUE ISLAND	NIUE	19.0S 170.0W	0417 08/15
CAIRNS	AUSTRALIA	16.7S 145.8E	0420 08/15
SYDNEY	AUSTRALIA	33.9S 151.4E	0420 08/15
WEWAK	PAPUA NEW GUINEA	3.5S 143.6E	0421 08/15
AUCKLAND WEST	NEW ZEALAND	37.1S 174.2E	0427 08/15
VANIMO	PAPUA NEW GUINEA	2.6S 141.3E	0442 08/15
GLADSTONE	AUSTRALIA	23.8S 151.4E	0501 08/15
CHUUK ISLAND	CHUUK	7.4N 151.8E	0506 08/15
AUCKLAND EAST	NEW ZEALAND	36.7S 175.0E	0509 08/15
NEW PLYMOUTH	NEW ZEALAND	39.1S 174.1E	0512 08/15
MACKAY	AUSTRALIA	21.1S 149.3E	0625 08/15

Estimated arrival times will only be given for points that fall in polygons with forecast amplitudes above 0.3 meters.

POTENTIAL IMPACTS

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

* PERSONS CAUGHT IN THE WATER OF A TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR BE SWEPT OUT TO SEA.

NEXT UPDATE AND ADDITIONAL INFORMATION

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES –ALL IN SMALL LETTERS-.

* THIS MESSAGE AS WELL AS ADDITIONAL INFORMATION ABOUT THIS EVENT MAY BE FOUND AT WWW.TSUNAMI.GOV.

$$

SAMPLE DEEP-OCEAN TSUNAMI AMPLITUDE FORECAST MAP

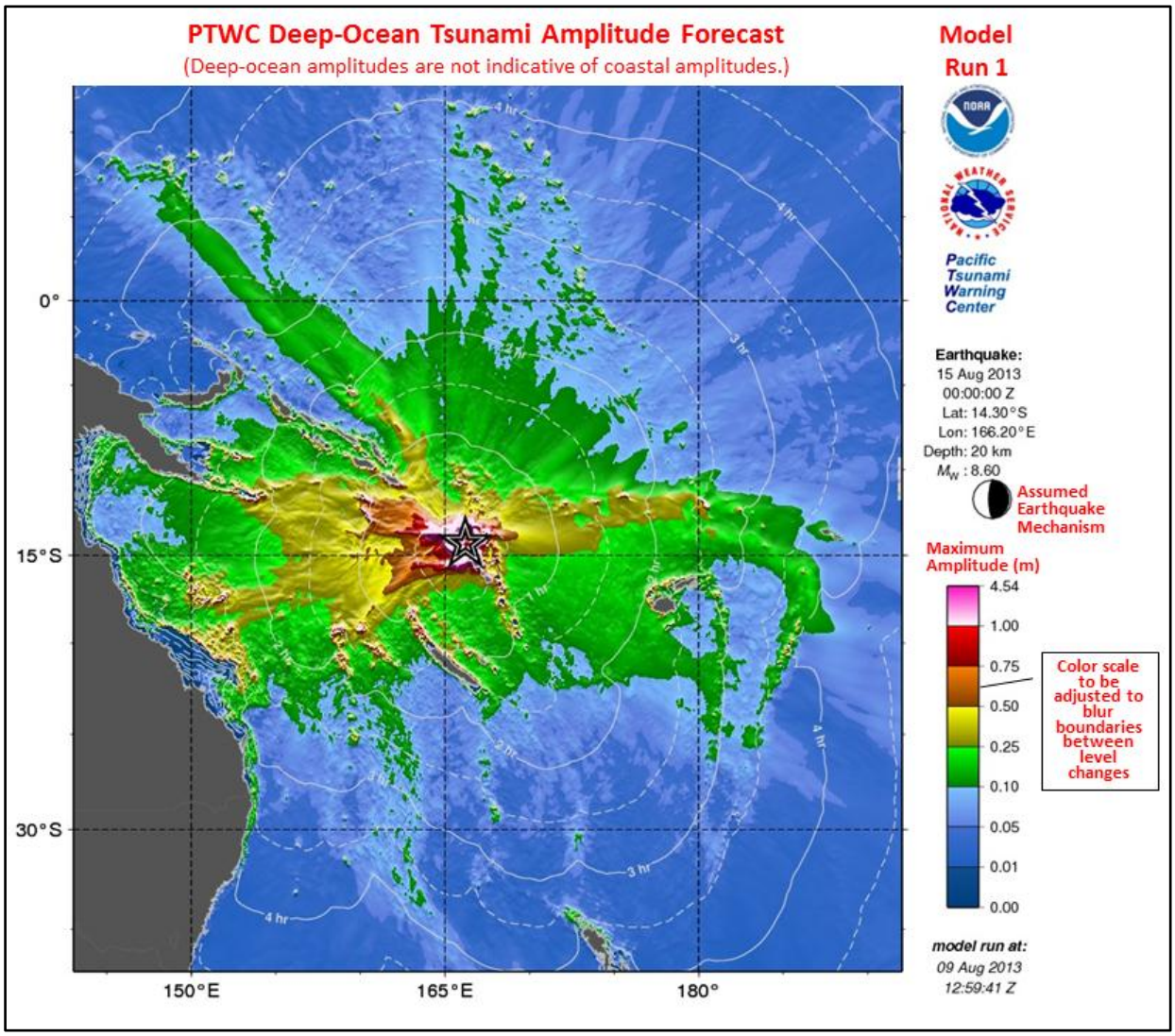

Figure III-1. Sample deep-ocean tsunami amplitude forecast map

SAMPLE COASTAL TSUNAMI AMPLITUDE FORECAST MAP

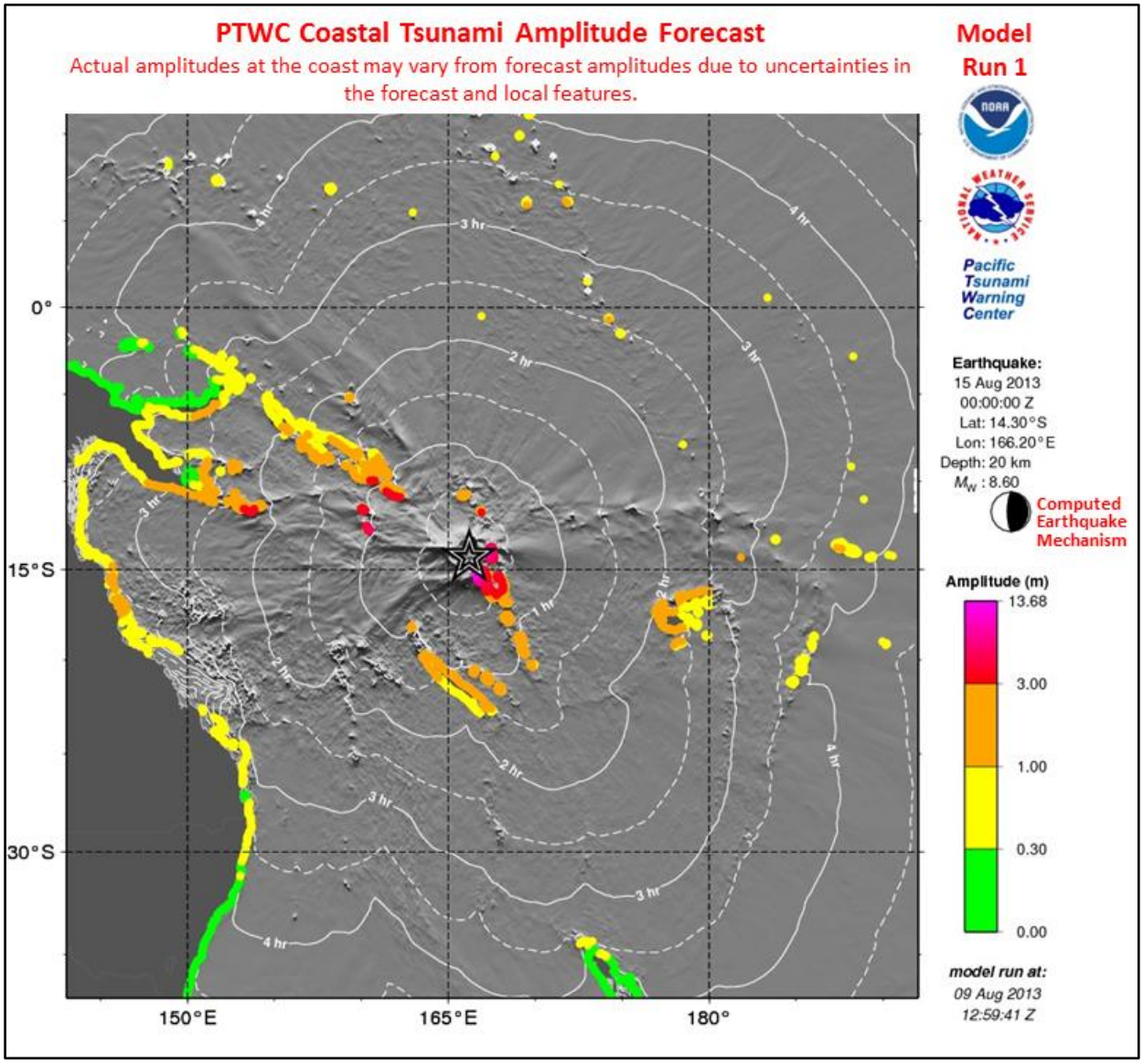

Figure III-2. Sample coastal tsunami amplitude forecast map

SAMPLE COASTAL TSUNAMI AMPLITUDE FORECAST POLYGONS MAP

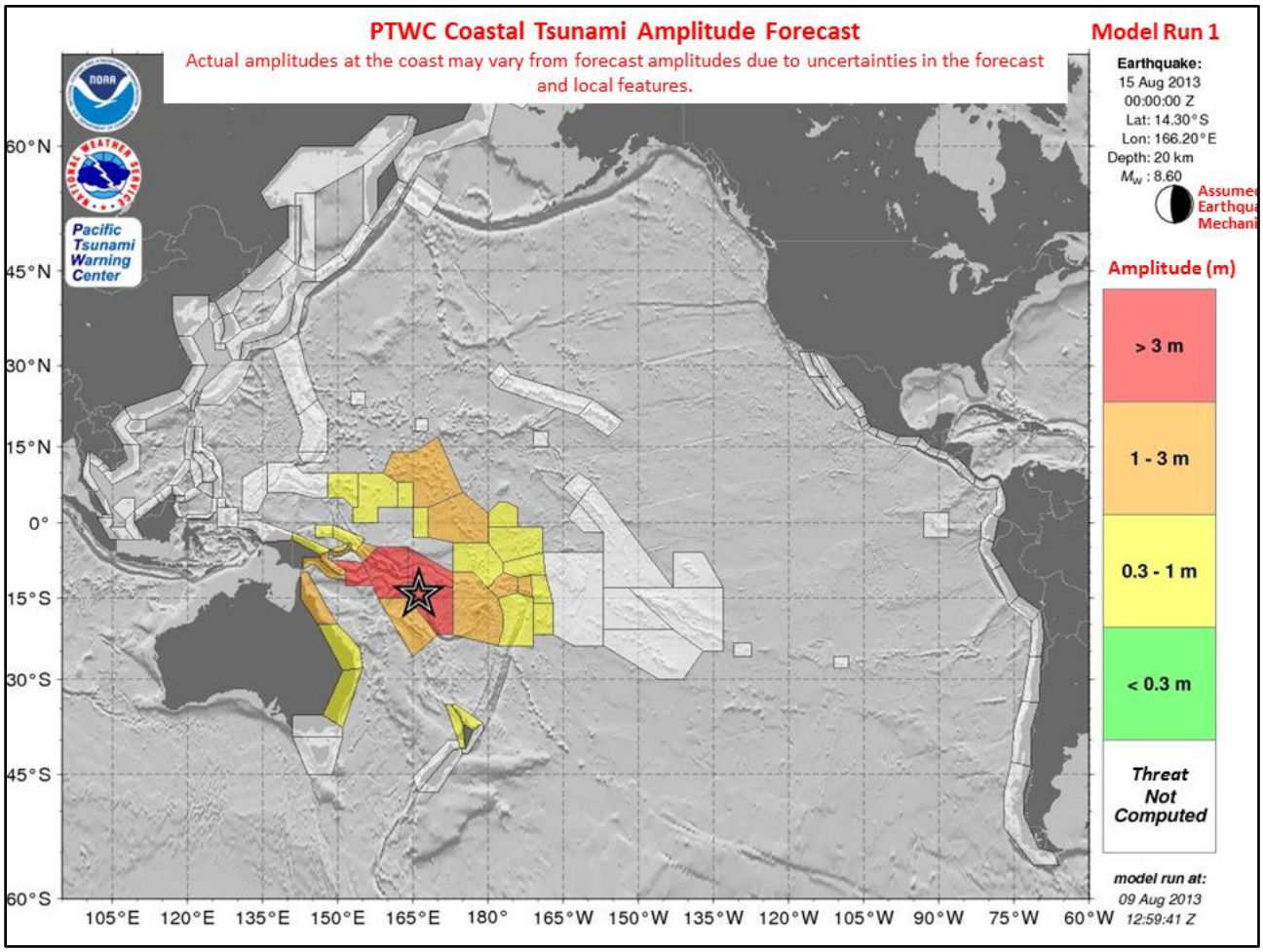

Figure III-3. Sample coastal tsunami amplitude forecast polygons map

PTWC Coastal Tsunami Amplitude Forecast Polygons

Polygons for the US coasts covered by the West Coast and Alaska Tsunami Warning Center will be included in the final product so that the entire USA is depicted.

SAMPLE TABLE OF STATISTICS FOR THE FORECAST POINTS WITHIN EACH POLYGON

EXPERIMENTAL – NOT FOR DISTRIBUTION

PTWC Tsunami Forecast Amplitude Statistics for each Forecast Polygon
Model Run 1 (made 09 Aug 2013 at 12:59:41 UTC)
Actual amplitudes may differ from forecast amplitudes due to uncertainties in the forecast and local features.

Earthquake – Origin: 08/15/2013 00:00:00 UTC Coordinates: 14.3S 166.2E Depth: 020km Magnitude: 8.6

Coastal Forecast (meters)				Offshore Forecast (meters)				Total	
Maximum	Mean	Median	STD	Maximum	Mean	Median	STD	Points	Region Name
13.68	3.78	2.94	2.76	4.54	1.09	0.83	0.70	197	Vanuatu
7.21	1.50	1.16	1.04	2.94	0.56	0.40	0.48	354	Choisel_to_Philip_Solomon_Islands
4.20	1.76	1.70	0.84	1.77	0.60	0.49	0.33	129	Trobriand_Woodlark_and_Louisiade_Islands
3.31	2.24	2.17	0.35	1.65	0.94	0.89	0.31	19	Santa_Cruz_Islands
2.61	1.32	1.28	0.55	1.41	0.52	0.48	0.27	188	New_Caledonia
1.98	1.07	1.00	0.48	1.61	0.35	0.30	0.23	181	Fiji
1.77	0.57	0.49	0.35	0.83	0.16	0.13	0.13	151	Solomon_Sea_Side_of_Papua_New_Guinea
1.43	0.85	0.71	0.28	1.01	0.33	0.28	0.19	150	Coral_Sea_Side_of_Papua_New_Guinea
1.38	0.78	0.73	0.19	0.90	0.23	0.19	0.14	256	Northern_Queensland_Australia
1.29	0.91	0.81	0.20	0.57	0.37	0.29	0.14	5	Wallis_and_Futuna
1.26	0.80	0.78	0.26	0.89	0.24	0.22	0.13	82	Solomon_Sea_Side_of_New_Britain
1.17	0.69	0.62	0.26	0.54	0.27	0.24	0.14	30	Marshall_Islands
1.15	0.64	0.57	0.24	0.65	0.28	0.26	0.15	79	Bouganville_Papua_New_Guinea
1.03	0.75	0.68	0.16	0.58	0.17	0.16	0.09	40	Samoa
1.02	0.83	0.87	0.13	0.63	0.35	0.33	0.12	9	Gilbert_Islands
0.95	0.78	0.79	0.12	0.93	0.38	0.36	0.17	51	Tonga
0.95	0.42	0.38	0.17	0.40	0.13	0.11	0.07	134	New_Ireland
0.84	0.84	0.84	0.00	0.12	0.12	0.12	0.00	1	Nauru
0.79	0.79	0.79	0.00	0.10	0.10	0.10	0.00	1	Tuvalu
0.68	0.55	0.56	0.08	0.32	0.20	0.19	0.07	10	Pohnpei_State_Micronesia
0.66	0.54	0.52	0.07	0.15	0.10	0.09	0.03	18	American_Samoa
0.60	0.48	0.49	0.11	0.46	0.20	0.16	0.10	12	Chuuk_State_Micronesia
0.57	0.57	0.57	0.00	0.07	0.07	0.07	0.00	1	Kosrae_State_Micronesia
0.54	0.36	0.34	0.14	0.34	0.13	0.13	0.08	98	Southern_Queensland_Australia
0.52	0.44	0.45	0.06	0.27	0.11	0.08	0.08	5	Niue
0.52	0.52	0.52	0.00	0.17	0.17	0.17	0.00	1	Phoenix_Islands
0.51	0.51	0.51	0.00	0.06	0.06	0.06	0.00	1	Howland_and_Baker
0.44	0.21	0.16	0.10	0.23	0.11	0.09	0.05	139	New_South_Wales_Australia
0.40	0.18	0.17	0.06	0.35	0.10	0.08	0.06	33	West_Side_of_North_Island_New_Zealand
0.40	0.25	0.27	0.08	0.26	0.13	0.12	0.05	65	North_Side_of_North_Island_New_Zealand
0.39	0.14	0.11	0.07	0.21	0.05	0.04	0.04	84	Bismarck_Sea_Side_of_New_Britain
0.38	0.22	0.21	0.06	0.13	0.07	0.07	0.02	36	Manus_Island_Papua_New_Guinea
0.37	0.17	0.17	0.05	0.18	0.05	0.04	0.03	120	Bismarck_Sea_Side_of_Papua_New_Guinea
0.31	0.31	0.31	0.00	0.07	0.07	0.07	0.00	1	Tokelau

The values above will only be given to one decimal place to avoid implying too hig h a level of accuracy

10. TASK TEAM RECOMMENDATIONS

Upon review of the aforementioned, the Task Team recommends to the ICG to:

1. Move forward with the product's full implementation in 2014,

2. Set the target changeover date to be 1 October 2014,

3. At a minimum, provide the Text Message as a public product, and

4. Disseminate the remaining non-public products

    a. Only to country National Tsunami Warning Centres (NTWCs) via their Tsunami Warning Focal Points (TWFPs), and

    b. At a minimum, only by electronic mail.

Notes of the Meeting of the PTWS WG2 Task Team
on Enhancing Tsunami Products
Honolulu, Hawaii, USA
22−23 May 2012

Attendees

Task Team Members

Chip McCreery, Chair

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Secretariat

Tony Elliot, Rajendra Prasad

Introduction

The Task Team met on May 22-23, 2012. The meeting was led by the Chair who welcomed all attendees and noted the importance of their input at the meeting to keep the process of developing and implementing new operational products for the PTWS moving forward. He then gave an overview of the planned structure and goals for the meeting. He emphasized some key purposes of the proposed new PTWC products based on numerical forecast 18oordinac that include: 1) improved advice regarding local tsunami threats, 2) reduced over-warning, 3) information to help distinguish between a marine threat, land inundation threat, and major inundation threat, and 4) threat information at a finer geographic scale.

Discussion

The Task Team discussed and took into consideration the following information in their deliberations:

- Past Recommendations of this Task Team
- TOWS Working Group and its Watch Operations Task Team recommendations for harmonizing products
- Lessons learned from the recent 2009 Samoa, 2010 Chile, and 2011 Japan tsunamis
- Exercise Pacific Wave (PacWave11) feedback on the experimental products
- Scientific and technical capabilities and limitations of the:
    1. Seismic data and analysis
    2. Sea level data and analysis
    3. Numerical tsunami forecast models

Actions

Based on the PTWC New Products and Procedures as reviewed in PacWave11, the Task Team agreed that the following recommendations should be given to the PTWC for implementing in its new products:

Requested changes to PTWC's current New Products and Procedures:

- Inclusion of latitude and longitude lines on maps for reference
- Inclusion of additional geographic features on plots for reference
- Geographical division of PTWC & JMA responsibilities in sea between Japan and Asian continent
- Scaled Green's Law approximation for small islands
- Harmonization of colour palettes used for wave amplitudes in maps
- Levels of amplitude (0-0.3m, 0.3-1m, 1-3m, >3m) with upper bound included in ranges.
- Add earliest arrival times in table of forecast zones
- Creation of an Users' Manual for new products
- Limit forecast in first product to domain of a few hours tsunami travel time
- Upgrade forecast based on earthquake mechanism
- Upgrade forecast based on sea level observations used as constraints
- The new products will only be distributed by email to the TWFPs during the experimental phase

Suggested changes to stay under consideration for implementation in later versions of PTWC products:

- Zoomed in maps for all regions (some zoomed-in maps necessary now though, e.g., SCS)
- Addition of historical data in maps
- Estimated arrival times other than first wave
- Add seismic focal mechanism, finite fault
- Inclusion energy diagram as CISN and/or Google Earth layer files

Suggested changes that do not have to be implemented in version 1 of the PTWC new products:

- Forecast of inundation
- Special identification of tsunami prone areas (except through specific forecast points)
- Error bounds on forecasts (can give general guidance in Users Guide)
- Forecast number of waves
- Forecast time of maximum wave arrival
- Forecast time of last wave above threat threshold
- Use of local time in messages

After much discussion, the Task Team could not resolve the following issue, and deferred recommendation until a later time:

- Which new product types will be public and which will only be sent to the TWFPs

Recommendation

PTWC should continue with the development of its new products taking into consideration the information presented, discussions, issues raised, and advice of the Task Team during this meeting. PTWC should finalize procedures and software for an initial version of the products, including an Users Guide, and begin issuing the new products in an experimental mode in parallel with current products by February 1, 2013. Unresolved or new issues regarding the products during this development period can be addressed remotely by the Task Team and/or PTWS Steering Committee before the experimental period begins. In addition, the Task Team agreed that before full implementation there will need to be a comprehensive training program on the new products for PTWS Member States to ensure that the products are understood and that Member State SOPs are modified accordingly.

ANNEX IV

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ANNEX V

LIST OF DOCUMENTS

Working Documents

Agenda Item	Reference code	Document Title
--	ICG/PTWS-XXV/3 prov.	Provisional Summary Report of the Twenty-fifth Session of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System
2.1	ICG/PTWS-XXV/1 prov.	Provisional Agenda
2.3	ICG/PTWS-XXV/1 Add. Prov.	Provisional Timetable
2.3	ICG/PTWS-XXV/2	Annotated Provisional Agenda
3.1.	ICG/PTWS-SC-III/3	Meeting of the Steering Committee of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS), United States of America, 24-25 May 2012
3.1	ICG/PTWS-XXV/4	Report of the Chair to ICG/PTWS-XXV
3.2	192 EX/16	Implementation of 191 EX/Decision 15 on the Draft Medium-Term Strategy (37 C/4) and Draft Programme and Budget (37 C/5), and 5 X/EX/Decision 2 *(UNESCO Executive Board document)*
3.2	ICG/PTWS-XXV/5	External Project Assessment “Strengthening of the Regional Tsunami Warning System in Chile, Colombia, Ecuador and Peru”, 7th DIPECHO Action Plan 2011-2012
3.3	ICG/PTWS-XXV/6	North West Pacific Tsunami Advisory Center Report
3.3	ICG/PTWS-XXV/7	PTWC Warning and Advisory Services Report
3.3	ICG/PTWS-XXV/8	Warning and Advisory Services Report of the Pacific Tsunami Warning Center
3.3	ICG/PTWS-XXV/9	History of the Northwest Pacific Tsunami Advisory Center (NWPTAC)
3.4	ICG/PTWS-XXV/10	National Report submitted by France (French Polynesia)

3.4	ICG/PTWS-XXV/11	National Report submitted by the United States of America
3.4	ICG/PTWS-XXV/12	National Report submitted by Colombia
3.4	ICG/PTWS-XXV/12.1	National Report submitted by Colombia
3.4	ICG/PTWS-XXV/13	National Report submitted by Australia
3.4	ICG/PTWS-XXV/14	National Report submitted by Indonesia
3.4	ICG/PTWS-XXV/15	National Report submitted by the Russian Federation
3.4	ICG/PTWS-XXV/15.1	National Report submitted by the Russian Federation
3.4	ICG/PTWS-XXV/16	National Report submitted by Vietnam
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3.5	ICG/PTWS-XXV/25	International Tsunami Information Center (ITIC) Report
3.5	ICG/PTWS-XXV/25.1	ITIC Report: Tsunami Capacity Building (2005-2013)
3.5	ICG/PTWS-XXV/25.2	ITIC Report: Impact and Effectiveness of ITIC Training Courses (2009-2013)
3.5	ICG/PTWS-XXV/25.3	ITIC Report: Improving ITIC Customer Services
3.6	Circular CPPS/SG/118/2013	Informe Final Reunion Extraordinaria “Fortalecimiento de los mecanismos de 2oordinación regional sobre los sistemas de alerta temprana ante tsunamis”
3.6	ICG/PTWS-XXV/26	Fact Sheet of Working Group 2, Task Team on Sea Level

3.6	ICG/PTWS-XXV/27	Fact sheet of PTWS Working Group 2, Task Team on Enhancement of PTWS Products and Services
3.6	ICG/PTWS-XXV/28	Fact sheet of PTWS Working Group 2, Task Team on Pacific Wave 11 Exercise
3.6	ICG/PTWS-XXV/29	Fact sheet of PTWS Working Group 6, Regional Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Region
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3.6	ICG/PTWS-XXV/40	Report on Working Group 2 Task Team on Seismic Data Exchange
3.6	ICG/PTWS-XXV/41	Report of the WG2 Task Team on Enhancing Products
3.6	ICG/PTWS-XXV/42	Report of PTWS Working Group 2 on Tsunami Detection, Warning, and Dissemination

3.6	ICG/PTWS-XXV/43	Report of Working Group 3
3.6	ICG /PTWS-XXV/44	Report of Technical Working Group 3 on Tsunami Awareness and Response
3.6	ICG/PTWS-XXV/45	Report of Working Group of South-West Pacific
3.6	ICG/PTWS-XXV/46	Report of Working Group of South East Pacific
3.6	ICG/PTWS-XXV/47	Report of Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region (SCS-WG)
3.6	ICG/PTWS-XXV/48	Report of the 3rd Inter-Sessional Meeting of the Regional Working for TWS in the South West Pacific Region Apia, Samoa, 13 July 2012
3.6	ICG/PTWS-XXV/49	A statement from Pacific Island countries to Member States at the ICG/PTWS-XXV
3.6	IOC/PTWS-WG-CA-II/3	Informe Final Reunion Regional sobre Tsunamis en Centroamerica
3.6	IOC/PTWS-WG2/TT-PACWAVE11/3	PTWS Working Group 2 on Detection, Warning and Dissemination: Task Team on PacWave11, Honolulu, United States of America, 21 May 2012
3.6	IOC/PTWS-WG2/TT-WD-II/3	Intercessional Report of the 2nd Sessional Meeting of the Task Team on Warning Dissemination (formerly Pacific Emergency Communications); 26 August 2013
3.7	ICG/PTWS-XXV/50	Report of Tsunami and Other Sea-Level related Warning and Mitigation Systems (TOWS)
3.7	ICG/PTWS-XXV/51	Report of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS)
3.7	ICG/PTWS-XXV/52	Report of the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE-EWS)
3.7	ICG/PTWS-XXV/53	ICG/NEAMTWS Status and achievements
3.7	IOC/TOWS-WG-VI/3	Summary Report of the 6th Session of the Working Group on Tsunamis and Other Hazards Related to Sea-level Warning and Mitigation Systems (TOWS-WG), Paris, France, 20-21 February 2013

3.8	ICG/PTWS-XXV/54	WMO Information System
4.1	IOC Technical Series, 86	PTWS Implementation Plan, Version 3, 2013 (Draft)
4.1	IOC/2013/TS/108	Medium-term strategy: Pacific Tsunami Warning and Mitigation System (PTWS MTS), 2014-2021
4.3	IOC/2011/TS/97VOL.1; IOC/2011/TS/97VOL.2	Exercise Pacific Wave 11: a Pacific-wide tsunami warning and communication exercise, 9-10 November 2011 (Exercise Manual and Report)
4.3	IOC/CL-2460	PTWC Start of Issuance of Pacific Experimental Products, 1 February 2013; PTWS Pacific-wide Tsunami Exercise "PacWave13", April 2013 *(Circular letter)*
4.3	IOC/CL-2481	PTWC Start of Issuance of Pacific Experimental Products, 15 April 2013; User's Guide for the PTWC Enhanced Products for PTWS (IOC TS-105) ; PTWS Pacific-wide Tsunami Exercise "PacWave13", 1–14 May 2013 *(Circular letter)*
4.3	ICG/PTWS-XXV/55	Report of the Working Group 2, Task Team on PacWave11
4.3	ICG/PTWS-XXV/56	PTWS WG2 Task Team on PacWave 11: Exercise Pacific Wave 11 and Exercise Pacific Wave 13
4.3	IOC/2012/MG/58 REV.	How to plan, conduct and evaluate UNESCO/IOC tsunami wave exercises
4.3	IOC/2013/MG/37; SC.98/WS/24 Rev.	International Tsunami Survey Team (ITST) Post-Tsunami Survey Field Guide (Draft)
4.3	IOC/2013/TS/106 Vol.1rev; IOC/2013/TS/106 Vol.2	Exercise Pacific Wave 13: a Pacific-wide tsunami warning and enhanced products exercise, 1-14 May 2013 (Exercise Manual and Summary Report)
4.3	IOC/PTWS-WG2/TT-PACWAVE11/3	PTWS Working Group 2 on Detection, Warning and Dissemination: Task Team on PacWave11, Honolulu, United States of America, 21 May 2012
4.4	IOC/CL-2462	Sixth Meeting of the Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS-WG-VI), 20-21 February 2013, Paris, France *(Circular letter)*

4.4	ICG/PTWS-XXV/41	Report of the WG2 Task Team on Enhancing Products
4.4	ICG/PTWS-XXV/49	A statement from Pacific Island countries to Member States at the ICG/PTWS-XXV
4.4	ICG/PTWS-XXV/57	Report of the Task Team on Enhancing PTWS Tsunami Warning Products
4.4	IOC/2013/TS/105 REV	User's guide for the Pacific Tsunami Warning Center: enhanced products for the Pacific Tsunami Warning System
4.4	IOC/TOWS-WG-V/3	Fifth Session of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), Tokyo, Japan, 15 February 2012
4.4	IOC/TOWS-WG-VI/3	Sixth meeting of Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems; Paris, France; 20-21 February 2013
4.5	ICG/PTWS-WG-SCS-I/3	Final Report of the 1st Meeting of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation in the South China Sea
4.5	ICG/PTWS-WG-SCS-II/3	Final Report of the 2nd Meeting of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea
4.5	ICG/PTWS-XXV/58	Recommendation of the Sub-Regional Tsunami Early Warning and Mitigation System of the SCS
7	ICG/PTWS-XXV/59	Elections of the Officers of the ICG
9	ICG/PTWS-XXV/60	Draft Recommendation: Sub-Regional Tsunami Warning and Mitigation System for the South China Sea Region (WG-SCS) (Draft)
9	ICG/PTWS-XXV/61	Draft Recommendation: PTWC Enhanced Products for PTWS (Draft)

Background Documents

Document code	**Document title**
ICG/PTWS-XXIV/3	Twenty-fourth Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System; Beijing, China; 24-27 May 2011
ICG/PTWS-XXV/Inf.1	UNESCO-Russian Federation Host Agreement of ICG/PTWS-XXV

ANNEX VI

LIST OF ACRONYMS

AFTN	Aeronautical Fixed Telecommunication Network
ASEAN	Association of South-East Asian Nations
CA	Central America
CBS	Commission for Basic Systems
CENALT	CENtre d'Alerte aux Tsunami
CL	Circular Letters
COMCOT	Cornell Multi-grid Coupled Tsunami model
CPPS	Permanent Commission for the South Pacific
CPPT	French Polynesia Tsunami Warning Center
CTIC	the Caribbean Tsunami Information Center
DAR	Discovery Access and Retrieval
DART	Deep-ocean Assessment and Reporting of Tsunamis Project
EITWC	Earthquake Information and Tsunami Warning Centre
EMERCOM	Ministry for Emergency Situations of the Russian Federation
GNS	GeoNet Project (New Zealand)
GS RAS	Geophysical Service of the Russian Academy of Sciences
IAPSO	International Association for the Physical Sciences of the Oceans
IASPEI	International Association of Seismology and Physics of the Earth's Interior
IAVCEI	International Association of Volcanology and Chemistry of the Earth's Interior
ICG	Intergovernmental Coordination Group
ICG/PTWS	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System
IGP	Institute of Geophysics of Vietnam
IHO	International Hydrographic Organization
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOTIC	Indian Ocean Tsunami Information Center
IOTWS	Indian Ocean Tsunami Warning and Mitigation System
ISS	Information Systems Services
ITIC	International Tsunami Information Centre
ITS	International Tsunami Symposium
ITSU	Tsunami Warning System in the Pacific (renamed PTWS)
IUGG	International Union of Geodesy and Geophysics
JICA	Japan International Cooperation Agency

JMA	Japan Meteorological Agency
MDN–DIMAR	Ministerio de Defensa Nacional–Dirección General Marítima of Colombia
MMD	Malaysian Meteorological Department
MTS	Medium Term Strategy
NDMO	National Disaster Management Office
NEAMTIC	Tsunami Information Centre for the North-Eastern Atlantic, the Mediterranean and Connected Seas
NEAMTWS	Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NEPTUNE	North East Pacific Time-series Underwater Networked Experiment
NOAA	The National Oceanic and Atmospheric Administration
NTHMP	National Tsunami Hazard Mitigation Program
NWPTAC	Northwest Pacific Tsunami Advisory Center
NZDM	New Zealand Ministry of Civil Defence & Emergency Management
OPAG	Open Programme Area Groups
ORSNET	Oceania Regional Seismic NETwork
OSSO	Observatorio Sismológico del Suroccidente of Colombia
PPT	PowerPoint presentations
PTWS	the Pacific Tsunami Warning and Mitigation System
ROSHYDROMET	Federal Service for Hydrometeorology and Environmental Monitoring
RP	Regular Programme budget (UNESCO)
SATREP	Science and Technology Research Partnership for Sustainable Development projects
SC	Steering Committee
SCS	South China Sea
SCSTAC	SCS Tsunami Advisory Center
SEP	South East Pacific
SHOA	Hydrographic and Oceanographic Service of the Navy
SIFT	Short-term Inundation Forecasting for Tsunamis model
SNDAT	Sistema Nacional de Detección y Alerta de Tsunami
SOP	Standard Operating Procedures
TC	Joint Tsunami Commission
TOR	Terms of Reference
TOWS	Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems
TT	Task Team
TWFP	Tsunami Warning Focal Point
TWS	Tsunami Warning System

UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCATWC	West Coast and Alaska Tsunami Warning Center
WCMT	W-phase Centroid Moment Tensor
WG	Working Group
WIS	WMO Information System
WMO	World Meteorological Organization

In this Series *Languages*

Reports of Governing and Major Subsidiary Bodies, 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 *ad hoc* 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-Cornmission 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, Papetee, 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*

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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 (IOCARIBE), 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*