Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG)

Third Meeting
Lisbon, Portugal
5–6 May 2010

UNESCO

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG)

Third Meeting

Lisbon, Portugal
5-6 May 2010

UNESCO 2010

IOC/TOWS-WG-III/3
Paris, 2 June 2010
Original: English*

* This document contains an executive summary in English, French, Spanish and Russian

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Third Meeting of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG-III) was held in Lisbon, Portugal, on 5-6 May 2010, hosted by the Portuguese Instituto de Meteorologia, under the chairmanship of Mr. Sang-Kyung Byun (IOC Vice-chairman). The meeting reviewed progress with respect to actions and decisions taken by the Governing Bodies, mainly through Resolution XXV-13.

The group agreed that the performance and capacity of delivery of GTS for tsunami purposes needs to be addressed by WMO.

The group agreed on the need of having the Compendium of Terms and Definitions in Coastal Disaster Risk Reduction as a self contained document that will include basic as well as specialized concepts to serve as a reference document. This decision implies including in it definitions for risk and vulnerability. It further agreed to recommend completing the document by December 2010 as a reachable target. Towards that end a clear timeline should be put forward and agreed by the Executive Council. The Group also recommended establishing a strong editorial team to guide the process and provide direct advice to the consultant.

The group suggested that some other IOC and non-IOC communities be added to the reviewing process such as IP-HAB, ICAM, ISDR and ICG Working Groups.

The group agreed to forward to the IOC 43rd Executive Council the Draft Compendium of Terms and Definitions in Coastal Disaster Risk Reduction (as in Annex II) recommending to launch a 10 months process that shall include:

- Request ICGs to review and comment on the draft
- Request WMO, ISDR and IOC bodies to provide comments on the draft
- Open consultations conducted with specifics communities or users groups
- The establishment of an editorial team, to be determined by TOWS-WG in consultation with the Secretariat, to prepare a final version for printing and translating.

The group agreed that IOC should raise the data requirement at the policy level to demonstrate the need for real time data directly to governments, rather than at IOC governing bodies only.

The group agreed to focus on real-time data, emphasizing that for tsunami warning timeliness is more important than precision or data quality. This could make it easier for some institutions to agree to share their data.

The group agreed in respect of Tsunami related Data Exchange aspects to ask ICGs to provide sensitivity studies about data available/not available for tsunami warning systems within 3 months and establish a TOWS-WG Task Team to synthesize the results of the studies provided by the ICGs.

The group also agreed to solicit from IODE a report on implementation of the IOC Oceanographic Data Policy indicating which data type is less or not fully exchanged, in particular on sea level. It further agreed to solicit from CTBTO to provide similar analysis for seismic data.

The group recommended to raise to the highest levels the need for free data exchange for tsunami warning purposes, through bilateral meetings or when and if possible by IOC Executive Secretary, based on the above requested documentation yet to be developed.

The group recommended that IOC heighten its advocacy for real time data exchange in order to confirm as soon as possible that a tsunami is generated or not so that member states can save lives. The tsunami centres should receive and process these data in real time to measure the tsunami wave's amplitude. No automatic quality control is required from the data provider or at the tide station. The absolute value is not required to detect a tsunami, but relative fast variations of signal.

The group agreed that the Task Team on Sea Level should look at the ICGs Implementation Plans to guide them on how to design the systems. It should also look into maintenance issues. The Task Team should characterize how and with which criteria the core networks are designed in each TWS.

The group also agreed that all data from the core network of sea level stations should be available to all members, in compliance of the IOC Data Exchange Policy.

The group agreed to recommend a joint meeting of Inter-ICG Task Teams in the second half of 2010, preferably in September, with India and USA as potential hosts, pending definition of dates and funding arrangements, in coordination with the Secretariat. The Secretariat was requested to circulate information on WMO/CBS evaluation process.

The group agreed to reaffirm the value of a multi-hazard approach to maintaining a vital tsunami warning system at local, national and regional levels.

RESUME EXECUTIF

La troisième réunion du Groupe de travail sur les systèmes d'alerte aux tsunamis et aux autres aléas liés au niveau de la mer, et de mitigation (TOWS-WG-III) s'est tenue à Lisbonne (Portugal) les 5 et 6 mai 2010 ; elle a été accueillie par l'Institut portugais de météorologie, sous la présidence de M. Sang-Kyung Byun (Vice-Président de la COI). Les participants ont passé en revue les progrès accomplis quant aux mesures et décisions prises par les organes directeurs, essentiellement par la résolution XXV-13.

Le Groupe de travail a estimé d'un commun accord qu'il fallait que la performance et la capacité de transmission du SMT en ce qui concerne les tsunamis soient examinées par l'OMM.

Le Groupe de travail a reconnu la nécessité que le Compendium of Definitions and Terminology on Hazards, Disasters, Vulnerability and Risks in a Coastal Context (Recueil de définitions et de terminologie sur les aléas, les catastrophes, la vulnérabilité et les risques dans les milieux côtiers) soit un document complet en soi, incluant des notions de base et des notions spécialisées, et capable de servir de document de référence. Cette décision implique d'y intégrer une définition des risques et de la vulnérabilité. En outre, le Groupe de travail a décidé de recommander que le document soit achevé en décembre 2010, jugeant cette date réaliste. À cette fin, il faudrait qu'un échéancier clair soit proposé et accepté par le Conseil exécutif. Le Groupe de travail a également recommandé de mettre sur pied une solide équipe éditoriale chargée de diriger le processus et de fournir directement des avis au consultant.

Le Groupe de travail a proposé que d'autres entités faisant ou non partie de la COI, telles que l'IPHAB, l'ICAM, la SIPC et les groupes de travail du GIC, soient associées au processus d'examen.

Le Groupe de travail est convenu de transmettre au Conseil exécutif de la COI, à sa 43e session, le Projet de recueil de définitions et de terminologie sur les aléas, les catastrophes, la vulnérabilité et les risques dans les milieux côtiers (tel qu'il figure à l'Annexe II), recommandant de lancer un processus de dix mois incluant les actions suivantes :

- demander aux GIC d'examiner le projet et de formuler des observations à ce sujet ;
- demander aux organes de l'OMM, de la SIPC et de la COI de formuler des observations sur le projet ;
- mener des consultations ouvertes avec des communautés ou groupes d'utilisateurs spécifiques ;
- mettre en place une équipe éditoriale, dont la composition serait fixée par le TOWS-WG en consultation avec le Secrétariat, en vue d'élaborer une version finale pour impression et traduction.

Le Groupe de travail a reconnu que la COI devrait élever le critère des données au niveau stratégique afin de démontrer la nécessité de fournir des données en temps réel directement aux gouvernements, plutôt qu'au niveau des organes directeurs de la COI seulement.

Le Groupe de travail a décidé d'un commun accord de mettre l'accent sur les données en temps réel, soulignant qu'en matière d'alerte aux tsunamis, la rapidité était plus importante que la précision ou la qualité des données. Cela pourrait aider certaines institutions à accepter de partager les données dont elles disposent.

Le Groupe de travail a décidé, en ce qui concerne les questions d'échange de données relatives aux tsunamis, de demander aux GIC de fournir des analyses de sensibilité quant aux

données disponibles/non disponibles pour les systèmes d'alerte aux tsunamis dans un délai de trois mois et de mettre en place une équipe spéciale du TOWS-WG chargée d'élaborer une synthèse des conclusions des analyses fournies par les GIC.

Le Groupe de travail a également décidé de demander à l'IODE un rapport sur la mise en œuvre de la Politique de la COI en matière d'échange de données océanographiques indiquant quel type de données est moins ou pas pleinement échangé, en particulier en ce qui concerne le niveau de la mer. Il a en outre décidé de demander à l'OTICE de fournir une analyse similaire pour les données sismiques.

Le Groupe de travail a recommandé de faire savoir au plus haut niveau qu'il est nécessaire, pour l'alerte aux tsunamis, d'échanger gratuitement les données par le biais de réunions bilatérales ou, dans la mesure du possible, de la Secrétaire exécutive de la COI, sur la base des documents demandés ci-dessus, qui doivent encore être élaborés.

Le Groupe de travail a recommandé que la COI renforce ses activités de promotion des échanges de données en temps réel destinés à confirmer dès que possible qu'un tsunami est en formation ou non, afin de permettre aux États membres de sauver des vies. Il faudrait que les centres sur les tsunamis reçoivent et traitent ces données en temps réel pour mesurer l'amplitude de la vague de tsunami. Aucun contrôle automatique de la qualité n'est requis du fournisseur des données ou à la station marégraphique. Ce qui est nécessaire, pour détecter un tsunami, ce n'est pas la valeur absolue, mais les variations relatives rapides du signal.

Le Groupe de travail a reconnu qu'il faudrait que l'équipe spéciale inter-GIC sur le niveau de la mer à des fins relatives aux tsunamis examine les plans de mise en œuvre des GIC afin d'orienter ces derniers sur la façon de concevoir les systèmes. Il faudrait également qu'elle se penche sur les questions de maintenance, et qu'elle détermine la façon dont les réseaux de base sont conçus dans chaque TWS et selon quels critères.

Le Groupe de travail a également reconnu qu'il faudrait que toutes les données issues du réseau de base de stations d'observation du niveau de la mer soient mises à la disposition de tous les membres, conformément à la Politique de la COI en matière d'échange de données océanographiques.

Le Groupe de travail a décidé de recommander la tenue d'une réunion conjointe des équipes spéciales inter-GIC au cours du second semestre 2010, de préférence en septembre, éventuellement en Inde ou aux États-Unis, en attendant que la date et les modalités de financement de la réunion soient arrêtées, en coordination avec le Secrétariat. Ce dernier a été prié de diffuser des informations concernant le processus d'évaluation de l'OMM/CSB.

Le Groupe de travail a décidé de réaffirmer l'intérêt d'une approche multi-aléas pour le maintien d'un système d'alerte aux tsunamis vital aux niveaux local, national et régional.

RESUMEN DISPOSITIVO

La tercera reunión del Grupo de trabajo sobre sistemas de alerta contra tsunamis y otros peligros relacionados con el nivel del mar y atenuación de sus efectos (TOWS-WG III) se celebró en Lisboa (Portugal), los días 5 y 6 de mayo de 2010, en la sede del Instituto de Meteorología de Portugal, bajo la presidencia del Sr. Sang-Kyung Byun (Vicepresidente de la COI). En la reunión se examinaron los progresos realizados con respecto a las iniciativas y decisiones tomadas por los órganos rectores, particularmente en virtud de la Resolución XXV-13.

El Grupo acordó que es necesario que la Organización Meteorológica Mundial (OMM) aborde la cuestión del funcionamiento y la capacidad de ejecución del Sistema Mundial de Telecomunicación (SMT) en relación con los tsunamis.

El Grupo convino en la necesidad de disponer de un compendio de terminología y definiciones en materia de reducción de los riesgos de desastre en las zonas costeras en forma de documento independiente, que incluya conceptos básicos y especializados y sirva de documento de referencia. Esta decisión supone que en ese documento figuren las definiciones de riesgo y vulnerabilidad. El Grupo estuvo de acuerdo también en recomendar que ese documento se finalizara a más tardar en diciembre de 2010, lo que constituye un objetivo accesible. A fin de cumplirlo, habría que establecer un calendario claro y someterlo a la aprobación del Consejo Ejecutivo. El Grupo recomendó asimismo la creación de un sólido equipo editorial para orientar el proceso y facilitar asesoramiento directo al consultor.

El Grupo sugirió que otros órganos, que formen parte o no de la COI, se incorporaran al proceso de examen, tales como el IPHAB, el ICAM, la EIRD y los Equipos de trabajo de los ICG (Grupos Intergubernamentales de Coordinación).

El Grupo acordó remitir a la 43ª reunión del Consejo Ejecutivo de la COI el proyecto de compendio de terminología y definiciones en materia de reducción de los riesgos de desastres en las zonas costeras (tal como figura en el Anexo II), con la recomendación de que se inicie un proceso de 10 meses que debe comprender las siguientes medidas:

- Pedir a los ICG que examinen el proyecto y formulen comentarios al respecto.
- Pedir que la OMM, la EIRD y los órganos de la COI formulen comentarios al respecto.
- Organizar consultas abiertas que se realizarían con comunidades o grupos de usuarios específicos.
- Crear un equipo editorial, que será definido por el TOWS-WG en consulta con la Secretaría, a fin de preparar la versión final para su impresión y traducción.

El Grupo acordó que la COI debe promover el intercambio de datos al nivel de la formulación de políticas a fin de demostrar directamente a los gobiernos la necesidad de disponer de datos en tiempo real, en vez de hacerlo únicamente ante los órganos rectores de la COI.

El Grupo acordó centrarse en los datos en tiempo real, haciendo hincapié en que a efectos de las alertas contra los tsunamis la celeridad es más importante que la precisión o la calidad de los datos. Esta decisión podría propiciar que determinadas instituciones accedieran a compartir sus datos.

El Grupo acordó, por lo que respecta a determinados aspectos del intercambio de datos relativos a los tsunamis, pedir a los ICG que en un plazo de tres meses aportaran estudios acerca del grado de precisión de los datos disponibles y los no disponibles para los sistemas de alerta contra tsunamis, y que crearan un Equipo Especial del TOWS-WG para resumir los resultados de los estudios facilitados por los ICG.

El Grupo acordó también solicitar al IODE un informe sobre la ejecución de la política de la COI relativa a los datos oceanográficos, en el que se indicara qué tipos de datos se intercambian menos o no se intercambian completamente, en particular en lo relativo al nivel del mar. El Grupo acordó también pedir a la Organización del Tratado de Prohibición Completa de los Ensayos Nucleares (OTPCEN) que facilitara un análisis similar para los datos sísmicos.

El Grupo recomendó que se planteara en los niveles más altos posibles la necesidad del libre intercambio de datos a los efectos de las alertas contra tsunamis, mediante reuniones bilaterales o, cuando y si fuere factible, con la intervención de la Secretaria Ejecutiva de la COI, sobre la base de la documentación pedida *supra* y que está pendiente de elaboración.

El Grupo recomendó que la COI intensificara su promoción del intercambio de datos en tiempo real a fin de que se pudiera confirmar cuanto antes si se genera o no un tsunami, de modo que los Estados Miembros lograran salvar vidas. Los centros sobre tsunamis deberían recibir y procesar esos datos en tiempo real para medir la amplitud de la ola del tsunami. No se exige ningún control de calidad automático por parte del proveedor de datos o en la estación mareográfica. No se necesita el valor absoluto para detectar un tsunami, sino variaciones relativamente rápidas de la señal.

El Grupo convino en que el Equipo de trabajo sobre el nivel del mar debería examinar los planes de implementación de los ICG para orientar a éstos con respecto a la manera de concebir los sistemas. También debería ocuparse de las cuestiones de mantenimiento. El Equipo de trabajo debería determinar cómo y según qué criterios deben diseñarse las redes básicas dentro de cada sistema de alerta contra tsunamis.

El Grupo acordó además que todos los datos procedentes de la red básica de estaciones de medición del nivel del mar debían estar a disposición de todos los miembros, de conformidad con la Política de Intercambio de Datos Oceanográficos de la COI.

El Grupo recomendó que se celebrara una reunión conjunta de los equipos de trabajo de los ICG en el segundo semestre de 2010, preferiblemente en septiembre, posiblemente con los Estados Unidos de América o la India como anfitriones, una vez que se definieran las fechas y las modalidades de financiación, en coordinación con la Secretaría. Se pidió a la Secretaría que distribuyera información sobre el proceso de evaluación de la Comisión de Sistemas Básicos (CSB) de la OMM.

El Grupo acordó reafirmar la importancia de un enfoque de peligros múltiples para mantener un sistema de alerta contra los tsunamis vital en los planos local, nacional y regional.

РАБОЧЕЕ РЕЗЮМЕ

Третье совещание Рабочей группы по системам предупреждения и смягчения последствий цунами и других опасных явлений, связанных с изменением уровня моря (РГ-СПЦО-III), состоялось в Лиссабоне, Португалия, 5-6 мая 2010 г. в Португальском институте метеорологии под председательством г-на Пён Сан Гёна (заместителя Председателя МОК). На совещании был рассмотрен ход осуществления мероприятий и решений руководящих органов, главным образом в рамках резолюции XXV-13.

Группа пришла к мнению о том, что вопрос об эффективности и возможностях передачи через ГСТ сообщений о цунами необходимо рассмотреть в рамках ВМО.

Группа согласилась с необходимостью разработки «Перечня терминов и определений по уменьшению рисков, связанных с опасными явлениями в прибрежной зоне» в качестве самостоятельного документа, в который будут включены базовые и специализированные понятия и который будет служить справочным пособием. В соответствии с этим решением предусматривается включить в этот перечень определения риска и уязвимости. В качестве достижимой цели Группа также решила рекомендовать завершить подготовку этого документа к декабрю 2010 г. Для этого нужно определить точный срок, который будет одобрен Исполнительным советом. Группа также рекомендовала сформировать компетентный редакционный коллектив для руководства этим процессом и предоставления непосредственных рекомендаций соответствующему консультанту.

Группа высказала соображение о том, что к процессу пересмотра следует привлечь другие структуры, входящие или не входящие в МОК, такие как МГВЦВ, ИКАМ, МСУОБ и рабочие группы МКГ.

Группа решила представить вниманию 43-й сессии Исполнительного совета МОК проект «Перечня терминов и определений по уменьшению рисков, связанных с опасными явлениями в прибрежной зоне» (содержащийся в Приложении II) с рекомендацией приступить к осуществлению процесса, который рассчитан на десять месяцев и в рамках которого предстоит:

- просить МКГ рассмотреть и представить замечания по указанному проекту;
- просить за органы ВМО, МСУОБ и МОК представить замечания по проекту;
- провести открытые консультации с конкретными сообществами специалистов или группами пользователей;
- учредить редакционную группу в составе, который будет определен РГ-СПЦО-III в консультации с Секретариатом, в целях подготовки окончательного варианта для печатания и перевода.

Группа согласилась с тем, что МОК надлежит на политическом уровне привлечь внимание к потребности в данных, с тем чтобы показать не только руководящим органам МОК, но и непосредственно правительствам необходимость в данных, предоставляемых в режиме реального времени.

Группа приняла решение сосредоточить усилия на данных, предоставляемых в режиме реального времени, и подчеркнула, что своевременность предупреждения о цунами более важна, нежели точность или качество данных. При таком подходе некоторым учреждениям было бы легче согласиться предоставлять свои данные.

В отношении обмена данными, касающимися цунами, **Группа решила** просить МКГ в трехмесячный срок провести исследования во вопросу о чувствительности датчиков применительно к данным, предоставляемым/не предоставляемым для систем предупреждения о цунами, и учредить Целевую группу РГ-СПЦО-III для обобщения результатов исследований, представленных МКГ.

Группа также постановила запросить у МООД доклад о выполнении Политики МОК в отношении океанографических данных с указанием вида данных, обмен которыми осуществляется в меньшей степени или не в полной мере, в частности в отношении уровня моря. Она далее решила обратиться к ОДВЗЯИ с просьбой предоставить аналогичный анализ применительно к сейсмическим данным.

Группа рекомендовала привлечь внимание на самом высоком уровне к необходимости свободного обмена данными в целях предупреждения о цунами на двусторонних совещаниях или, по возможности, с помощью Исполнительного секретаря МОК на основе вышеуказанной запрашиваемой документации, которую еще предстоит разработать.

Группа рекомендовала МОК усилить свою информационно-разъяснительную работу в отношении обмена данными в режиме реального времени для того, чтобы можно было как можно быстрее подтверждать, возникло цунами или нет, что позволит государствам-членам спасать жизнь людей. Центры по цунами должны получать и обрабатывать эти данные в режиме реального времени с целью определения амплитуды волн цунами. От поставщика данных и мареографических станций не требуется какого-либо автоматического контроля качества. Для выявления цунами нужны не абсолютные показатели, а данные об относительно быстрых колебаниях сигнала.

Группа согласилась с тем, что Целевая группа по уровню моря должна рассмотреть планы работы МКГ с целью предоставления им рекомендаций относительно формирования соответствующих систем. Ей надлежит рассмотреть также вопросы эксплуатационного обслуживания. Целевая группа должна определить, каким образом и на основе каких критериев разрабатываются сети в рамках каждой СПЦ.

Группа также согласилась с тем, что все данные, поступающие от основной сети станций измерения уровня моря, должны быть доступны для всех членов в соответствии с Политикой МОК в области обмена данными.

Группа постановила рекомендовать провести совместное совещание общих для МКГ целевых групп во второй половине 2010 г., предпочтительно в сентябре, исходя из того, что потенциальными принимающими сторонами могли бы быть Индия и США, с последующим определением сроков и механизмов финансирования в координации с Секретариатом. Секретариату было предложено распространить информацию о процессе оценки ВМО/КОС.

Группа решила вновь подтвердить ценность подхода, учитывающего множественные опасности, для обеспечения функционирования жизненно важных систем предупреждения о цунами на местном, национальном и региональном уровнях.

1. OPENING AND WELCOME

1.1 OPENING AND WELCOME

1. The Chair of TOWS-WG, Mr Sang-Kyung Byun opened the meeting of TOWS-III. He thanked the Government of Portugal and the Instituto de Meteorologia for hosting the meeting.

2. He recalled Res. XXV.13 that requested several specific products and results from TOWS-WG. In particular he highlighted the product "Definitions and Terminology on Hazards, Disasters, Vulnerability and Risks" as well as the work to be done on the IOC Data Exchange Policy.

1.2 ADOPTION OF THE AGENDA

3. Agenda was adopted as indicated in Annex I. During the meeting it was agreed to add a new item 5 to include a discussion on the multi-hazard approach and the IOC Tsunami Programme strategy.

1.3 WORKING ARRANGEMENTS

4. Mr Fernando Carrillo, Head of Seismology Department, Instituto de Meteorologia, Portugal, welcomed the participants on behalf of the hosting country, and provided logistic details. The list of participants is provided in Annex V.

2. REPORTS FROM RELEVANT BODIES

2.1 REPORT FROM THE IOC BODIES

5. Dr Francois Schindelé, Chairperson of the ICG/NEAMTWS reported on the status of ICG/NEAMTWS. He listed the four Working Groups and Task Teams, briefly introducing the work of the Task Team on Regional Tsunami Warning System Architecture and the newly established Task Team on Communication Test Exercises. He recalled that NEAMTWS does not have a regional warning centre in place but operational seismic and sea level networks. He indicated that Member States' monitoring or warning centres will initiate communicating tests as from June 2010. France has indicated that by mid 2012 it would be able to initiate tsunami national warning centre operations.

6. Dr Lorna Inniss, Chairperson of the ICG/CARIBE EWS reported that the 12th January Haiti earthquake and tsunami had a strong influence on the ICG/CARIBE EWS-V meeting in Managua, 15-17 March 2010. She indicated that the Caribbean is progressing towards the establishment of a tsunami warning centre with the USA having a phased approach to decide if it creates a Caribbean Tsunami Warning Center in Puerto Rico, USA. ICG/CARIBE EWS is also close to initiate operations of a Caribbean Tsunami Information Center (CTIC) funded by Italy and in cooperation with Italy and UNDP. The Implementation Plan is been accomplished and is currently under an updating process. Dr Inniss indicated that the ICG/CARIBE EWS decided at its last meeting to develop a CARIBE WAVE 2011 Exercise coordinated with the USA LANTEX exercise on 23rd March 2011. It also decided that communications tests will be run on a monthly basis. Noting that communications challenges were common across multiple ICGs, one TOWS WG member noted the potential value of enhanced and more frequent communications tests in all ICGs.

7. Mr Tony Elliott, Head ICG/IOTWS Secretariat reported on behalf of Dr Jan Sopaheluwakan, Chairperson of ICG/IOTWS, who was unable to attend due to logistic problems. He reported that the ICG/IOTWS-VII was held in Banda Aceh, Indonesia, 14–16 April 2010. Main activities in the year have consisted of several trainings and the IOWave09

Exercise. A restructuring of Working Groups reduced these to three groups encompassing the general structure other ICGs have adopted. A new development of ICG/IOTWS is that it is preparing to expand its role to cover other sea-level related hazards. He reported that public awareness campaigns are envisaged to create awareness about the need of protecting monitoring equipments and devices that help saving lives. Building on the Risk Assessment Guidelines (IOC Manual and Guides No. 52) the ICG/IOTWS has put in place several training activities to support its application.

8. TOWS-WG members exchanged views on the need or not for graphics and maps for warning services. There are different approaches in NEAMTWS with respect to the IOTWS and with respect to PTWS. At national and local level maps are indeed very important while communication among regional centres and national entities are more possibly based only on data and non graphical information.

9. Mr Peter Koltermann, Head of the Tsunami Unit (TSU) reported on behalf of the chair of the ICG/PTWS. He indicated that technical working groups lack membership. On the other hand, regional subgroups have been very active, with several trainings and workshops taking place in 2010. Dr Francois Schindelé (also Chairman of PTWS Working Group 2) provided additional comments on He indicated that technical working groups may need to have stronger links and joint work with regional working groups.

10. Mr Tom Gross, IOC GOOS staff reported on the status of the IOC/GOOS Programme, its contributions to Tsunami Warning Systems through the GLOSS programme and indicated that regional GOOS Regional Alliances (GRA) will be meeting alongside the EuroGOOS conference Oct. 3–7, 2011 in Sopot, Poland. TOWS-WG members commented that perhaps GOOS Regional Alliances could approach a larger community than the ICGs and could help discuss the tsunami issues within a broader coastal hazards framework. The GRAs should be contacted and encouraged to participate in ICG meetings and activities.

11. Mr Peter Koltermann, Head TSU, reported on the JCOMM/DBCP-ITP group that met in Paris in September 2009 and discussed the issue of vandalism on ocean observing systems with relevance to saving lives. He also informed the group that the UN General Assembly discussed these issues and approved two resolutions: UNGA A/64/L.18 that expressed concern at the intentional or unintentional damage to platforms used for ocean observation and marine scientific research, such as moored buoys and tsunameters, and urged States to take necessary action and to cooperate in relevant organizations, including the Food and Agriculture Organization of the United Nations, the Intergovernmental Oceanographic Commission and the World Meteorological Organization, to address such damage, and UNGA A/64/L.29 that calls upon States and regional fisheries management organizations or arrangements, working in cooperation with other relevant organizations, including the Food and Agriculture Organization of the United Nations, the Intergovernmental Oceanographic Commission, and the World Meteorological Organization, to adopt, as appropriate, measures to protect ocean data buoy systems moored in areas beyond national jurisdiction from actions that impair their operation

12. Mr Russell Arthurton, chair of the NEAMTWS Working Group on “Advisory, Mitigation and Public Awareness” reported that ICAM working with TSU has developed Manuals and Guides 50 ICAM Dossiers 5, “Hazard awareness and risk mitigation in Integrated Coastal Area Management”. Mr Arthurton drew attention to the multi-hazard scope of these guidelines.

13. The group requested information on the status of the planned JCOMM Guide to Storm Surge Forecasting. Mr. Edgard Cabrera Chief, Ocean Affairs Division, World Meteorological Organization (WMO) reported that the guide is presently in the final stages of peer review, which should be completed very soon and then printed.

2.2 REPORT OF NON IOC BODIES

14. Mr Spiro Spiliopoulos from the Preparatory Commission for the CTBTO reported that the CTBTO is currently contributing data from close to 40 stations, representing two of the four CTBT verification technologies (seismic and hydroacoustic), to regional tsunami warning centres in Japan and the United States (Alaska and Hawaii), and to national tsunami warning centres in Australia, Indonesia, Malaysia, the Philippines and Thailand. Sri Lanka has recently formalised the agreement to receive CTBTO data and it is expected that data will soon be forwarded to them. To consolidate the cooperation between UNESCO and CTBTO an agreement was signed in February 2010, focusing on training and capacity building cooperation. Two workshops will take place soon, in Canberra, Australia with countries from the South West Pacific and South-East Asia and the participation of the IOC Tsunami Unit. Another workshop will take place in Vienna, Austria, in the second half of 2010 that will include hardware and software training with funding for participants from Chile and Haiti.

15. Mr Edgard Cabrera, Chief, Ocean Affairs Division, World Meteorological Organization(WMO) provided a report covering aspects related to the WSIS project (former GTS) and training and workshops in the area of early warning, storm surges and multi-hazards implemented by WMO in several areas of the world, and a planned workshop for the Caribbean on Storm Surge. The outline of the Caribbean project and workshop will be discussed with the ICG/CARIBE EWS Chair and Technical Secretariat. ICG/NEAMTWS Chair requested clarifications on the status of GTS in WMO Region VI and the definition of headers for tsunami products as well as the use of GTS for sea level data in Mediterranean and North East Atlantic which has technical difficulties as only 10 stations could be accommodated with 6 minutes transmission while the need of slots is for over 100 stations. A similar note was made by Chair ICG/CARIBE EWS.

16. **The group agreed** that the performance and capacity of delivery of GTS for tsunami purposes needs to be addressed by WMO.

3. REVIEW OF PROGRESS

3.1 STATUS OF IMPLEMENTATION OF IOC RES.XXV.13

17. Mr Peter Koltermann, Head TSU, reported that in fulfilment of instructions given to the Secretariat through Res. XXV-13 the Executive Secretary has succeeded to get IOC to become a member of the ICSU/IASPEI Tsunami Commission which is the most relevant scientific body for tsunami research.

18. With respect to data availability from international seismic networks UNESCO has already signed an agreement with CTBTO and is pursuing a similar arrangement with IRIS.

19. The Secretariat has worked to get the Inter-ICG Task Teams constituted and running and has hired consultants to redesign the IOC Tsunami website and to develop the Draft definitions and terminology on hazards, disasters, vulnerability and risks that will be revised by the group under item 3.2.

20. Members of TOWS-WG were informed of the status of decline in IOC financial support to mapping programmes in IOC that in terms of funding has been decreasing consistently through the past two biennia.

3.2 REVIEW OF DRAFT WITH DEFINITIONS AND TERMINOLOGY ON HAZARDS, DISASTERS, VULNERABILITY AND RISKS

21. Mr Peter Koltermann, Head of TSU, introduced this item and commented on the partnership built with UNU which has the academic experience and expertise required to help guiding the process. He introduced the first draft Compendium of Terms and Definitions in Coastal Disaster Risk Reduction ("Compendium") produced with the support of a consultant. The first draft is available in Annex II.

22. The group discussed the options to further develop and finalize the document.

23. **The group agreed** on the need of having the Compendium of Terms and Definitions in Coastal Disaster Risk Reduction as a self contained document that will include basic as well as specialized concepts to serve as a reference document. This decision implies including in it definitions for risk and vulnerability.

24. **It further agreed** to recommend completing the document by December 2010 as a reachable target. Towards that end a clear timeline should be put forward and agreed by the Executive Council. The Group also recommended establishing a strong editorial team to guide the process and provide direct advice to the Consultant.

25. The group suggested that some other IOC and non-IOC communities be added to the reviewing process such as IP-HAB, ICAM, ISDR and ICG Working Groups.

26. **The group agreed** to forward to the IOC 43rd Executive Council the Draft Compendium of Terms and Definitions in Coastal Disaster Risk Reduction (as in Annex II) recommending to launch a 10 months process that shall include:

- Request ICGs to review and comment on the draft
- Request WMO, ISDR and IOC bodies to provide comments on the draft
- Open consultations conducted with specifics communities or users groups
- The establishment of an editorial team, to be determined by TOWS-WG in consultation with the Secretariat, to prepare a final version for printing and translating.

3.3 REVIEW OF THE IOC OCEANOGRAPHIC DATA EXCHANGE POLICY— IOC RES. XXII-6

27. Mr Peter Koltermann, Head TSU, introduced this item indicating that the discussions in some ICGs have revealed that sharing data is not a fully accomplished target, at least for tsunami warning related data, in terms of access, latency and quality. Bearing in mind the instruction contained in IOC Resolution XXV-13, the Secretariat requested the IODE Office to provide a background document for TOWS-III, which was made available to TOWS-WG members.

28. The group exchanged views on the role of the IOC Oceanographic Data Exchange Policy, and agreed that all ICGs have several examples whereby not all data necessary for tsunami warning is actually freely accessible or transmitted as fast as required for tsunami detection and forecast calculation.

29. **The group agreed** that IOC should raise the data requirement at the policy level to demonstrate the need for real time data directly to governments, rather than at IOC governing bodies only.

30. It was suggested that the TOWS WG should ask the ICGs to provide information on sensitivity analyses on the impact of data gaps on the impact on the detection and the forecast timeliness and it's accuracy that have been done, so that this can be used to compile a single document to demonstrate the problem.

31. **The group agreed** to focus on real-time data, emphasizing that for tsunami warning timeliness is more important than precision or data quality. This could make it easier for some institutions to agree to share their data.

32. **The group agreed** in respect of Tsunami related Data Exchange aspects to ask ICGs to provide sensitivity studies about data available/not available for tsunami warning systems within 3 months and establish a TOWS-WG Task Team to synthesize the results of the studies provided by the ICGs.

33. **The group also agreed** to solicit from IODE a report on implementation of the IOC Oceanographic Data Policy indicating which data type is less or not fully exchanged, in particular on sea level. It further agreed to solicit from CTBTO to provide similar analysis for seismic data.

34. **The group recommended** to raise to the highest levels the need for free data exchange for tsunami warning purposes, through bilateral meetings or when and if possible by IOC Executive Secretary, based on the above requested documentation yet to be developed.

35. **The group recommended** that IOC heighten its advocacy for real time data exchange in order to confirm as soon as possible that a tsunami is generated or not so that member states can save lives. The tsunami centres should receive and process these data in real time to measure the tsunami wave's amplitude. No automatic quality control is required from the data provider or at the tide station. The absolute value is not required to detect a tsunami, but relative fast variations of signal.

3.4 REPORT OF THE INTERNATIONAL TSUNAMETER PARTNERSHIP AND THE DBCP, IN COORDINATION WITH JCOMM, ON OCEAN OBSERVING PLATFORM VANDALISM

36. The Secretariat reported that the report is not yet available despite several reminders.

37. Mr Arthur Paterson (USA) recalled that the U.S. annual voluntary contribution allocated funding to hire support needed to produce the requested document on a timely basis. The report requested from JCOMM/DBCP will provide a persuasive rationale for regional fishery management organizations (RFMOs) and FAO's Committee on Fisheries to take appropriate action to minimize intentional or unintentional damage to ocean data buoy systems from actions that impair their operation. Mr. Paterson cited the recent action of the Western and Central Pacific Fisheries Commission to establish conservation and management measures on prohibition on fishing around data buoys.

38. The Secretariat committed to coordinate internally to make the document available in August/September 2010 at the latest.

4. REPORTS OF THE INTER-ICG TASK TEAMS

Sea Level Task Team Report

39. Dr Begoña Perez Gomez presented a report on behalf of the Task Team Chairperson, Mr Rick Bailey. She noted that the Task Team had only started exchanging information in April and has not been able to complete a report yet. The report will cover: data requirements; network design; station siting; data exchange formats; real time reporting requirements; formats; latency; QA; performance monitoring etc. Implementation plans, Working Groups reports, Manuals and Guides, national reports and guides will be used as references. The Task Team plans to finish the report by December 2010.

40. Mr Peter Koltermann enquired what were the biggest problems the Task Team foresaw? Ms Perez Gomez replied that access to some of the stations was limited, for technical or security reasons. Data latency is also a problem with many stations.

41. Dr Lorna Inniss asked what was the mode of communication between the Task Team and the ICGs? Mr Peter Koltermann commented that as ICG chairs nominated the Task Team members, they should have the confidence of their ICGs.

42. Mr Tony Elliott, Head IOTWS Secretariat, noted that all Task Teams had taken the opportunity to provide briefings at ICG/IOTWS-VII.

43. Dr Inniss enquired if all ICGs had a core network design. Dr Francois Schindelé commented that the concept of a core network could be misleading; the important aspect is to have as many sea level gauges as possible, with denser networks close to source zones.

44. Mr Peter Koltermann commented that tide gauges in the past have been installed pragmatically and opportunistically. But this is not a good design basis for a core network. GLOSS is looking into prioritizing station locations, based on practical issues.

45. Mr Srinivas Kumar, Chairperson of the Task Team on the Tsunami Watch Operations, commented that at least the core network data should be shared.

46. Mr Arthur Paterson commented that the core system design should include redundancy to take into account station failures and maintenance issues.

47. Dr Francois Schindelé commented that there should be a denser network near to tsunami sources, where double transmission link are recommended (included GTS) to provide redundancy. He suggested differentiating “alert” stations and “confirmation” stations.

48. Mr Tony Elliott noted that the IOTWS core networks were originally defined in 2005, but have evolved since due to the dynamic nature of the network design.

49. Mr Peter Koltermann noted that historically GLOSS had introduced the concept of a core network for establishing sea level datums, but this is not so relevant now as we have GPS.

50. **The group agreed** that the Task Team on Sea Level should look at the ICGs Implementation Plans to guide them on how to design the systems. It should also look into maintenance issues. The Task Team should characterize how and with which criteria the core networks are designed in each TWS.

51. **The group also agreed** that all data from the core network of sea level stations should be available to all members, in compliance of the IOC Data Exchange Policy.

52. Dr Lorna Inniss asked about coordination of sea level gauges in Haiti as too many stations would be unmanageable. Mr. Koltermann reported that 3-4 sites have been discussed by GLOSS, which needs to be kept informed so that it can coordinate. Mr Edgar Cabrera noted that WMO will coordinate with IOC on sea level issues while helping to rebuild met services in Haiti.

Disaster Management and Preparedness Task Team Report:

53. Ms Irina Rafliana reported on the activities of the Task Team. The Task Team had communicated through email and had taken stock of what has been achieved by the ICGs. She

considered that face to face meetings were very important and perhaps in 2nd half of 2010 a meeting could be arranged.

54. Ms Rafliana listed some of the achievements in the IOTWS and PTWS, NEAMTWS and CARIBE-EWS. Many awareness materials have already been prepared. Guidelines on Tsunami Risk Assessment and Mitigation for the Indian Ocean have been published. Also, a number of earthquake events have occurred recently that we can learn from, for example in Samoa, Padang, Haiti and Chile.

55. She shared information on a GTZ report on the 30 September 2009 earthquake in Padang: Working Document No. 25, Case Study 30 Minutes in the City of Padang: Lessons for Tsunami Preparedness and Early Warning from the Earthquake on September 30, 2009.

56. Ms Rafliana indicated that gaps and deficiencies are difficult to define completely now and more time is needed for the Task Team to meet and discuss these issues. She noted that measurement of preparedness needs to be defined. She also indicated that how to engage media needs to be considered. She also indicated the need to engage media to be considered. Some earthquake and tsunami cases had reflected critical roles of media in warning dissemination. A standard protocol is therefore important, but, international media would not want SOPs imposed on them. Institutional capacity and resources need to be improved. There is a need to ensure understanding of RTWP products and towards that end the Task Team would require to liaise with other Task Teams.

57. Looking at the Terms of Reference for the Task Team in the context of the ICG Terms of Reference, Mr Russell Arthurton noted that mismatches in the respective ICG Working Groups' Terms of Reference created problems of comparability. Mr Arthurton submitted a diagram showing the different Working Groups and Task Teams under each ICG and TOWS-WG that is available under Annex III.

58. Mr Koltermann clarified that ICGs were primary subsidiary bodies, and that their Member States could decide their own programmes. Noting that this is a fact, Mr. Arthurton indicated that ICGs should recognize the problem. Ms. Rafliana thought that it was important to be inclusive and would not recommend changing the report until after a meeting with the Task Team members.

59. Peter Koltermann noted that there is no Global TWS but 4 regional TWS providing global cover. This was explicitly decided by member states through the IOC. Therefore the TOWS-WG was set up as a WG by the Assembly, reporting directly to the IOC Assembly, to avoid fragmentation.

60. Mr Tony Elliott enquired about the metrics for measurement of preparedness. Ms. Rafliana described some tools for assessment of preparedness including the UNESCO-ISDR-Indonesia Preparedness Assessment Framework, and the US concept of TsunamiReady that is used to assess tsunami preparedness of local communities.

61. Mr Bernardo Aliaga, Technical Secretary ICG/CARIBE-EWS, commented that CARIBE-EWS had looked into the concept and several countries have enquired about the possibility of using the same concept of TsunamiReady outside the US territories in the Caribbean. The US had started to explore the options and may be exploring in the near future its use in the framework of the intergovernmental coordination provided by UNESCO's Intergovernmental Oceanographic Commission.

62. Ms Rafliana noted that at least in the Indian Ocean there would be some resistance to certification processes, as the bottom-up approach are more preferred. She would rather leave it to local governments to decide on readiness. TOWS-WG may provide guiding recommendations.

63. Mr Arthur Paterson noted that in US the TsunamiReady programme, which was adapted from the StormReady programme, is implemented at the local level, designed to help cities, towns, counties, universities and other large sites in coastal areas reduce the potential for disastrous tsunami-related consequences.

64. Mr Peter Koltermann suggested that interested Caribbean member states could explore piloting the TsunamiReady approach. He further noted that with respect to the accepted ISO signage TsunamiReady could consider complying with ISO standards.

<u>Tsunami Watch Operations Task Team Report</u>:

65. Mr Srinivas Kumar, Chairperson of the Task Team on the Tsunami Watch Operations presented an activity report. He summarized the history of the Regional Tsunami Watch Providers (RTWPs) process in the IOTWS and then the global level. He had obtained input from the ICGs to capture information on the present status of warning centres. An informal meeting had been held in Banda Aceh on the sidelines of the ICG/IOTWS-VII.

66. The Task Team had looked at products, terminology, criteria for RTWP, performance indicators. Areas of Responsibility and current products for each region were also documented. Mr. Kumar described Service Levels in the Indian Ocean.

67. The Task Team had looked into and documented different terminology in each region. Future terminology will also need to be documented.

68. Capability requirements were also documented showing that most basins have similar requirements.

69. With respect to the mechanisms for judging performance of RTWPs, Mr Kumar indicated that this is a controversial issue. In IOTWS there is "soft" judgement by peers, but there is a need to look at this on a global level.

70. The Task Team needs more time to come up with specific recommendations. The report submitted to this meeting is a status report, but further inputs from ICGs are needed followed by a meeting, preferably with other Task Teams. Mr Kumar noted that the report would be completed by the end of 2010 for final submission in April 2011.

71. The Task Team at this stage of work is recommending that a perpetual body should be created with representatives from all the ICGs to oversee terminology and standards. Its terms of reference should include procedures for monitoring and evaluation.

72. Ms Irina Rafliana underlined the importance of interaction between Task Teams. She fully supported a joint meeting of the Task Teams to discuss these issues.

73. Mr Peter Koltermann, Head of TSU, noted that certification was a sensitive issue. There is a difference between national (NTWCs) and regional (RTWPs) warning centers. For RTWPs, IOC needs to try to ascertain that standards are met. There needs to be a discussion of performance indicators. He commented that the WMO model for hurricane centres could be considered but that would take time. The definition of Areas of Responsibility is a key issue because there is no national mandate for this.

74. Mr Peter Koltermann also commented on training and documentation. The PTWS Users' Guide was not available yet. It is still in draft and needs to be finalized and published. This would be useful for the other regions. Mr. Arthur Paterson confirmed that USA was working on completing the manual. He enquired how WMO reviewed performance of any particular centre in a system?

75. Mr Edgard Cabrera commented that reviews are carried out by CBS – Commission of Basic Systems and that evaluation is internal. He further indicated that WMO's documentation on this process is available and can be shared with the Task Team. He will provide the Secretariat with the relevant documentation.

76. **The group agreed** to recommend a joint meeting of Inter-ICG Task Teams in the second half of 2010, preferably in September, with India and USA as potential hosts, pending definition of dates and funding arrangements, in coordination with the Secretariat. The Secretariat was requested to circulate information on WMO/CBS evaluation process.

5. OTHER ISSUES

5.1 MULTI-HAZARD APPROACH

77. Mr Russell Arthurton commented that, while it was understandable that the focus of this meeting was on the tsunami hazard, it was important to take other marine hazards into account, as required in the TOWS Working Group Terms of Reference. In response, the group discussed and exchanged information on the activities that ICGs are implementing towards the multi-hazard approach.

78. Dr Lorna Inniss reported that the ICG/CARIBE-EWS is using the multi-hazard approach in practical terms and coordinating as much as possible throughout the national emergency management systems, including preparedness and awareness for several coastal hazards and putting it into CTIC's Terms of Reference.

79. Mr Tony Elliott noted that the ICG/IOTWS had included reference to multi-hazard approaches and frameworks within the Terms of Reference of the newly created Working Groups.

80. Mr Srinivas Kumar, Chairperson of the Task Team on the Tsunami Watch Operations referred to the Indian experience that puts the multi-hazard aspect as a matter of sustainability for the national tsunami warning system.

81. Russell Arthurton stressed the importance of multi-hazard approach including storm surge on practical and national levels

82. Mr Arthur Paterson noted that the existing and growing joint IOC-WMO partnership in JCOMM is an exemplary of the current multi-hazard approach.

83. **The group agreed** to reaffirm the value of a multi-hazard approach to maintaining a vital tsunami warning system at local, national and regional levels.

5.2 IOC TSUNAMI UNIT: TRANSITION FROM CONSOLIDATION TO OPERATION

84. On the request of the USA representative, Mr Arthur Paterson, Mr Peter Koltermann briefed the group on the strategy of the TSU transition from consolidation to operation. A summary of his presentation is provided in Annex IV.

85. He described the basic programmatic elements that guide over biennial and medium term the Tsunami elements of the IOC Programme.

86. He then recalled the legal UN framework including UN GA Resolutions UN61/132 and UN62/91 that provide the mandate to support and coordinate the Indian Ocean tsunami warning system.

87. He noted that IOC's tsunami activities are designed and structured as a coordination framework for supporting the Intergovernmental Coordination Groups responsible for each Tsunami Warning System rather than as a scientific programme. The ICGs have been set up as primary subsidiary bodies of the IOC, directly reporting to the IOC Assembly. This support is a binding commitment of the Secretariat that requires staff to coordinate, organize, run and report on ICG meetings, and coordinate the development and production of reference documents and standards for tsunami operational activities. The workplan of the Tsunami Unit is largely influenced by the decisions of the ICGs and the required documentation, in particular the Implementation Plan of each ICG.

88. More recently there are increased requests for assessment missions to support member states and provide technical assistance in the establishment and development of national tsunami warning centers and systems.

89. The ICGs are structured along ocean regions and the support provided is preferably located in the region. In addition to the ICG's basic secretariat, the Tsunami Information Centers (TICs) for each TWS add a different thrust with additional complexities given the interaction of these Centers with multiple countries/language groups/communities. They provide globally consistent and regionally relevant, i.e. culturally and language-adapted, tsunami outreach products.

90. In summary, the distinct characteristics of the IOC Tsunami activities include support to operational systems and strong regional activity.

91. Mr Koltermann provided detailed information on the regular and extra budgetary funding available to the Secretariat in recent biennia as follows: 0.360 MUS$ from regular budget and 2.1 MUS$ from extrabudgetary resources for the 35C/5. He also detailed the information on staff available to perform the activities and the origin of funding which presently consists of one P4 and one G4 staff funded by Regular Programme and 10 to 12 staff on extra budgetary funding. He commented that the ratio of RB/EB both in funds for activities and staff requested by member states will be difficult to maintain over the medium term. He also added that supporting single activities from EB requires staff support that is not included in these grants. This staff support has to be part of other substantial EB funds that require considerable efforts to acquire

92. The IOC has been effective in getting visibility and support from UNESCO for its tsunami activities. The Tsunami Programme is strongly linked to all member states in a TWS and gives LDCs and SIDS Member States a tangible and visible presence in the IOC.

93. Prof. Mario Ruivo, on behalf of the host country, Portugal, suggested that a note be prepared on the basic elements of the regional tsunami warning activities including its complexities, and be conveyed to Member State before the IOC 43rd Executive Council as soon as possible. With respect to the structures and funding of IOC's tsunami activities, he indicated that Portugal's official position is to revise the IOC Manual to standardize rules for existing bodies and use as much as possible the existing regional bodies.

94. Mr Arthur Paterson indicated that this meeting provided a very timely opportunity to provide before the Executive Council key information on IOC's tsunami programmatic and budgetary details. He suggested that the Secretariat provides a document to Member States, and to the Financial Committee, containing a brief over staffing and programmatic resources that emphasizes the operational character of the tsunami programme, noting that effective provision of essential services can not depend primarily on extrabudgetary funding.

95. The Secretariat provided the document contained in Annex IV to respond to the two requests above indicated.

6. DATE AND PLACE OF THE NEXT MEETING

96. April 2011 was suggested as timely for finalizing products for the next Assembly in particular those that requires Task Teams contributions. The venue will be coordinated by the Secretariat.

7. CLOSURE OF MEETING

97. Mr Koltermann expressed his thanks to all participants, appreciating the inputs and support of TOWS-WG members. He personally, reflecting on this retirement at the end of May 2010, expressed his gratitude for having the strong support of Member States over the last four years and an excellent, dedicated staff to assist in the consolidation of the IOC's efforts in establishing sustained operational warning systems for tsunami and other sea-level related coastal hazards.

98. Mr Fernando Carrilho, Head of Seismology Department, Instituto de Meteorologia, thanked the participants on behalf of the Government of Portugal.

99. Chairman Mr Sang-Kyung Byun said that it had been two days of very interesting presentations and discussions. He thanked all participants and expressed on their behalf their gratitude to the Portuguese government and the Instituto de Meteorologia for hosting the meeting. He declared the meeting closed at 13:45 on 6th May 2010.

ANNEX I

AGENDA

1 OPENING AND WELCOME

1.1 OPENING

1.2 ADOPTION OF AGENDA

1.3 WORKING ARRANGEMENTS

2. REPORTS FROM RELEVANT BODIES

2.1 REPORT FROM THE IOC BODIES

2.2 REPORT OF NON IOC BODIES

3. REVIEW OF PROGRESS

1.1 STATUS OF IMPLEMENTATION OF IOC RES.XXV.13

1.2 REVIEW OF DRAFT WITH DEFINITIONS AND TERMINOLOGY ON HAZARDS, DISASTERS, VULNERABILITY AND RISKS

1.3 REVIEW OF THE IOC OCEANOGRAPHIC DATA EXCHANGE POLICY - IOC RES. XXII-6

1.4 REPORT OF THE INTERNATIONAL TSUNAMETER PARTNERSHIP AND THE DBCP, IN COORDINATION WITH JCOMM, ON OCEAN OBSERVING PLATFORM VANDALISM

4. REPORTS OF THE INTER-ICG TASK TEAMS

5. OTHER ISSUES

5.1 MULTI-HAZARD APPROACH

5.2 TSUNAMI UNIT: TRANSITION FROM CONSOLIDATION TO OPERATION

6. DATE AND PLACE OF THE NEXT MEETING

7. CLOSURE OF MEETING

ANNEX II

DRAFT COMPENDIUM OF TERMS AND DEFINITIONS IN COASTAL DISASTER RISK REDUCTION

Table of Contents:

Introduction

In the course of inter-disciplinary and inter-sectoral work the demand for uniform definitions and language occurs as regularly as reprimands of most attempts that are made to standardize definitions and concepts.

The reason for this dilemma is twofold: on one hand, sometimes definitions and concepts really are imprecise, wrong or blurred. But on the other hand the majority of the professionals do have quite sharply defined concepts and definitions with which they work on a daily basis and which they grew into in the course of their education, specialization and experience. The problem is that experts from different fields may use contradicting definitions and concepts, while each one might be fully valid and academically sound. Terms simply have been defined differently in different fields and disciplins. Many glossaries were written with the intention to lay down reference/base line definitions. And that is most likely the reason why they are contested by all the experts who might work with different definitions than the one listed. Constant debate is the consequence. In that sense glossaries tend to be more the expression of a need rather than its remedy. In some way, this dilemma is a good sign because it means people are thinking “outside the box” and cooperate across disciplines and sectors. This is needed for effective disaster risk reduction, risk mitigation, hazard awareness, ecosystem management et cetera.

Discussion and exchange of methodologies, experiences, and concepts are a necessity but become difficult where the partners involved do not use the same technical language. If there cannot be total agreement on the definition of a specific term or concept it is very important to inform about existing – and sometimes contradicting – definitions. If all sides are at least aware of the various definitions that are being used, communication is unlikely to be misleading or misunderstood. Over time more and more definitions may converge because more definitions are known across the field of disaster risk reduction and, as John Twigg phrased it “ Thinking about disasters is always developing, so pinning down a term or concept is like trying to hit a moving target. And it’s good that thinking moves on, otherwise we would still be seeing disasters purely as acts of God.” [Twigg, 2007].

Hence, this compendium intends to list definitions for terms used in the context of the cause-and-effect-chain of coastal disasters as a basis for discussion and often will resort to listing more than one definition for a specific term. For the definition of the basic terms such as:

Coping Capacity, Catastrophe, Disaster, Exposure, Hazard, Human Security, Resilience, Risk, and Vulnerability

we would like to refer to *Components of Risk: A Comparatve Glossary* (Thywissen, 2006) which already list numerous definitions for each of those terms.

UNESCO/IOC – in response to the request of its member states who felt that internal and external communication of the IOC is hindered by the ambiguity of concepts and definitions – took on the task to assemble a compendium of coastal terms and definitions. This shall be embedded in a consultative process involving IOC members as well as external experts of the various fields and disciplines involved.

Alphabetical List of Terms and Definitions

Abiotic properties of the ecosystem	Geological, physical and chemical properties of the ecosystem (IOC, 2006), p.31.
Abiotic	Non-living thing. Usually refers to the physical and chemical components of an organism's environment. Also called inorganic. (Pidwirny, 1999).
Ablation	Surface removal of ice or snow from a glacier or snowfield by melting, sublimation, and/or calving. (Pidwirny, 1999).
Abyssal fan	Fan shaped accumulation of sediment from rivers that is deposited at the base of a submarine canyon within a ocean basin. (Pidwirny, 1999).
Abyssal plain	Another name for ocean floor. (Pidwirny, 1999).
Accommodation	The continued use of land at risk, without attmepting to prevent land from being damaged by the natural event. This option includes erecting emergency flood shelters, elevating buildings on piles, converting agriculture to fish farming or growing flood/salt tolerant crops (Bijlsma et al. 1996). (IOC, 2009)
Accretion, coastal	A long-term trend of shoreline advance and/or gain of beach sediment volume over several decades. In many cases, accretion is beneficial and creates a buffer against future coastal hazards. (Ministry for the Environment, 2008).
Adaptation	Adjustment in natural or human systems in response to actual or expected [climatic] stimuli or their effects, which moderates harm or exploits beneficial opportunities. (IPCC, 2001). (IOC, 2009)
Adaptation to climate change	Undertaking actions to minimise threats or to maximise opportunities resulting from climate change and its effects. (Ministry for the Environment, 2008).
Aerosols	A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 microns, which reside in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. (Ministry for the Environment, 2008).
Aerosols	A dispersion of solid and liquid particles suspended in gas. Atmospheric aerosols, unsurprisingly, refer to solid and liquid particles suspended in air. Aerosols are produced by dozens of different processes that occur on land and water surfaces, and in the atmosphere itself. Aerosols occur in both the troposphere and the stratosphere, but there are considerable differences in the size ranges, chemical nature and sources of the aerosols that occur in these two atmospheric layers. [http://www.newmediastudio.org/DataDiscovery/Aero_Ed_Center/Charact/A.what_are_aerosols.html]

Algae	A simple photosynthetic plant that usually lives in moist or aquatic environments. The bodies of algae can be unicellular or multicellular in design. (Pidwirny, 1999).
Algal blooms/harmful algal bloom (HAB)	This diverse array of phenomena includes blooms of toxic, microscopic algae that lead to illness and death in humans, fish, sea- birds, marine mammals, and other oceanic life. There are also non-toxic HABs that cause damage to ecosystems, fisheries resources, and recreational facilities, often due to the sheer biomass of the accumulated algae. The term “HAB” also applies to non-toxic macroalgae (seaweeds), which can cause major ecological impacts such as the displace- ment of indigenous species, habitat alteration and oxygen depletion in bottom waters. (Anderson, 2007) p.2.
Algal blooms/harmful algal bloom (HAB)	A phytoplankton (also called "microalgal" or "algal") bloom is the rapid growth of one or more species which leads to an increase in biomass of the species. … Often, in the case of exceptional/harmful blooms, it is a single species that comes to dominate the phytoplankton community (i.e. the blooms are "monospecific"). However, when toxic algae are involved in a harmful bloom, the mere presence of the toxic alga in concentrations sufficient to elicit effects is often enough to cause the scientific community and public at large to refer to a "bloom" of that particular species. In other words, one refers to "blooms" of toxic phytoplankton on the basis of the effects observed and not necessarily because of a large biomass. (Richardson, 1997).
Alluvial deposits	Detrital material which is transported by a river and deposited - usually temporarily - at points along the flood plain of a river. Commonly composed of sands and gravels. (FEMA, 2004)
Alluvial fan	Large fan shaped terrestrial deposit of alluvial sediment on which a braided stream flows over. Form as stream load is deposited because of a reduction in the velocity of stream flow. (Pidwirny, 1999).
Alluvial fan	The sedimentary deposit located at a topographic break, such as the base of a mountain front, escarpment, or valley side, that is composed of streamflow and/or debris flow sediments and has the shape of a fan, either fully or partially extended. These characteristics can be categorized by composition, morphology, and location. (FEMA, 2003)
Alongshore	Parallel to and near the shoreline. (FEMA, 2004)
Amplitude, wave	(1) The magnitude of the displacement of a wave from a mean value. An ocean wave has an amplitude equal to the vertical distance from still-water level to wave crest. For a sinusoidal wave, the amplitude is one-half the wave height. (2) The semi-range of a constituent tide. (FEMA, 2004)
Amplitude	Half of the peak-to-trough range (or height) of a wave.(Voigt, 1998).

Angle of repose	The maximum slope (measured from the horizontal) at which soils and loose materials on the banks of canals, rivers or embankments will stay stable. (FEMA, 2004)
Angle of repose	The maximum slope (measured from the horizon) at which soils and loose materials on the banks of canals, rivers or embankments stay stable.(Voigt, 1998).
Anoxic	Refers to an environment that contains little or no dissolved oxygen and hence little or no benthic marine life. These conditions arise in some basins or fjords where physical circulation of water is limited. (FEMA, 2004)
Archipelago	A sea that contains numerous islands; also the island group itself. (FEMA, 2004)
Archipelago	A group of islands that have an arc shaped distribution. These islands are usually of volcanic origin and are associated with subduction zones. (Pidwirny, 1999).
Astronomical tide	The tidal levels and character which would result from gravitational effects, e.g. of the Earth, Sun and Moon, without any atmospheric influences. (FEMA, 2004)
Atoll	A ring shaped reef composed largely of coral. These features are quite common in the tropical waters of the Pacific Ocean. (Pidwirny, 1999).
Backrush	The seaward return of the water following the uprush of the waves. For any given tide stage the point of farthest return seaward of the backrush is known as the Limit of backrush or limit backwash.(FEMA, 2004)
Backshore	Area behind the shore. This coastal feature is located between the beach berm and the backshore slope. (Pidwirny, 1999).
Backwash	1) The seaward return of the water following the uprush of the waves. Also called backrush or run down. (2) Water of waves thrown back by an obstruction such as a ship, BREAKWATER, CLIFF, etc.(Voigt, 1998).
Backwash	The return water flow of swash. This sheet of water flows back to ocean because of gravity. (Pidwirny, 1999).
Bar	A submerged or emerged embankment of sand, gravel, or other unconsolidated material built on the sea floor in shallow water by waves and currents. (FEMA, 2004)
Bar	An offshore ridge or mound of sand, gravel, or other unconsolidated material which is submerged (at least at high tide), especially at the mouth of a river or estuary, or lying parallel to, and a short distance from, the beach. (Voigt, 1998).
Bar	(1) Coarse grained deposit of sediment from a stream or ocean currents. (2) A unit of measurement for quantifying force. Equivalent to 1,000,000 dynes per square centimeter. (Pidwirny, 1999).

Barrier island	Long, narrow islands of sand and/or gravel that are usually aligned parallel to the shore of some coasts. (Pidwirny (1999)).
Bathymetry	The measurement of DEPTHS of water in oceans, seas and lakes; also the information derived from such measurements.(Voigt, 1998).
Beach	The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). The seaward limit of a beach--unless otherwise specified--is the mean low water line. A beach includes foreshore and backshore. (FEMA, 2004)
Beach	(1) A deposit of non-cohesive material (e.g. sand, gravel) situated on the interface between dry land and the sea (or other large expanse of water) and actively "worked" by present-day hydrodynamics processes (i.e. waves, tides and currents) and sometimes by winds. (2) The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation. The seaward limit of a beach – unless otherwise specified – is the mean low water line. A beach includes foreshore and backshore. (3) (SMP) The zone of unconsolidated material that is moved by waves, wind and tidal currents, extending landward to the coastline. (Voigt, 1998).
Beach	The terrestrial interface area in between land and a water body where there are accumulations of unconsolidated sediments like sand and gravel. These deposits are laid down by the action of breaking waves. (Pidwirny, 1999).
Beaufort wind scale	Descriptive system that determines wind speed by noting the effect of the wind on the environment. Originally developed for use at sea by Admiral Beaufort of the British Navy in 1806. (Pidwirny, 1999).
Benthos	The plant and animal organisms that live on the sea floor. Often divided into two categories: deep-sea benthos, below 200 meters and the littoral benthos, from 200 meters to the high-water spring tide level. (Pidwirny, 1999)
Berm	(1) On a beach: a nearly horizontal plateau on the beach face or backshore, formed by the deposition of beach material by wave action or by means of a mechanical plant as part of a beach renourishment scheme. Some natural beaches have no berm, others have several. (2) On a structure: a nearly horizontal area, often built to support or key-in an armor layer. (FEMA, 2004)
Berm	Low hill of sand that forms along coastal beaches. (Pidwirny, 1999)
Bleaching	Mag40
Blowout	A depression on the land surface caused by wind erosion. (FEMA, 2004)

Bog	A wet, spongy, poorly drained area which is usually rich in very specialized plants, contains a high percentage of organic remnants and residues and frequently is associated with a spring, seepage area, or other subsurface water source. A bog sometimes represents the final stage of the natural processes of eutrophication by which lakes and other bodies of water are very slowly transformed into land areas. (FEMA, 2004)
Bog	A habitat that consists of waterlogged spongy ground. Common vegetation are sedges and sphagnum moss. Bogs are common in Canada, Russia, and Scandinavia. (Pidwirny, 1999)
Boil	An upward flow of water in a sandy formation due to an unbalanced hydrostatic pressure resulting from a rise in a nearby stream, or from removing the overburden in making excavations. (FEMA, 2004)
Bore	A very rapid rise of the tide in which the advancing water presents an abrupt front of considerable height. In shallow estuaries where the range of tide is large, the high water is propagated inward faster than the low water because of the greater depth at high water. If the high water overtakes the low water, an abrupt front is presented, with the high- water crest finally falling forward as the tide continues to advance. (FEMA, 2004)
Bore, tsunami	A steep, turbulent, rapidly moving tsunami wave front, typically occurring in a river mouth or estuary. (IOC, 2008)
Brackish	Environment that is influenced by seawater with a salinity less than 35 parts per thousand (usually caused by the presence of an inflow of fresh water). (Pidwirny, 1999).
Breakwater	A structure protecting a shore area, harbor, anchorage, or basin from waves. (FEMA, 2004)
Breakwater	An offshore or onshore structure, such as a wall, water gate, or other in-water wave-dissipating object that is used to protect a harbour or beach from the force of waves. (IOC, 2008)
Brine	Seawater with a salinity greater than 35 parts per thousand. Usually occurs in isolated bodies of seawater that have high amounts of water loss due to evaporation. (Pidwirny, 1999).
Bruun Rule	A simple mathematical relationship that states: as sea-level rises, the shoreface profile moves up and back while maintaining its original shape. (Ministry for the Environment, 2008).
Bulkhead	Wall or other structure, often of wood, steel, stone, or concrete, designed to retain or prevent sliding or erosion of the land. Occasionally, bulkheads are use to protect against wave action. (NOAA Coastal Services Center, 20??)
Bulkhead	A structure or partition to retain or prevent sliding of the land. A secondary purpose is to protect the upland against damage from wave action. (FEMA, 2004)

Cable ocean-bottom instrument	An instrument at the ocean bottom connected to the land by a cable that provides power for the measurement and transmission of data from the sea floor to the coast. Cables can extend for tens of kilometers offshore and across oceans. They enable real-time, multi-sensor seafloor observatories to be deployed for long-term monitoring. Examples of sensors on cabled systems are seismometers to measure earthquakes, sensitive pressure gauges to measure tsunamis, geodetic sensors to measure seafloor deformation, and cameras. Japan operates several cable systems. (IOC, 2008)
Catchment Area	The area which drains naturally to a particular point on a river, thus contributing to its natural discharge. (FEMA, 2004)
Caustic	In refraction of waves, the name given to the curve to which adjacent orthogonals of waves refracted by a bottom whose contour lines are curved, are tangents. The occurrence of a caustic always marks a region of crossed orthogonals and high wave convergence. (FEMA, 2004)
Channel	(1) A natural or artificial waterway of perceptible extent which either periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. (2) The part of a body of water deep enough to be used for navigation through an area otherwise too shallow for navigation. (3) A large strait, as the English Channel. (4) The deepest part of a stream, bay, or strait through which the main volume or current of water flows. (FEMA, 2004)
Channel capacity	The maximum flow which a channel is capable of transmitting without its banks being overtopped. (FEMA, 2004)
Clapotis	The French equivalent for a type of standing wave. In American usage it is usually associated with the standing wave phenomenon caused by the reflection of a nonbreaking wave train from a structure with a face that is vertical or nearly vertical. Full clapotis is one with 100 percent reflection of the incident wave; partial clapotis is one with less than 100 percent reflection. (FEMA, 2004)
Clastic rocks	Rocks built up of fragments which have been produced by weathering and erosion of pre-existing rocks and minerals and, typically, transported mechanically to their point of deposition. (FEMA, 2004)

Climate change	Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests_ by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persisten anthropogenic change sint eh composition of the atmosphere or in land use. Note that the Framework Convention of Climate Change (UNFCCC), in its Article 1, defines climate change as: a change climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.' The UNFCCC this makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes. (IPCC, 2007) (IOC, 2009)) A statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). (Ministry for the Environment, 2008)
Coastal defense infrastructure	
Coastal ecosystems	
Coastal erosion	A long-term trend of shoreline retreat and/or loss of beach sediment volume over several decades. 'Cutback' is a more suitable term for a dynamically 'stable' shoreline to describe the temporary loss of beach volume or shoreline retreat during a storm (before the volume gets replenished over ensuing weeks and months). (Ministry for the Environment, 2008)
Coastal facies	
Coastal forcing	The natural processes which drive coastal hydro- and morphodynamics (e.g. winds, waves, tides, etc). (FEMA, 2004)
Coastal margin	Aquatic and land environments that are potentially affected by coastal hazards, including the long-term impacts of climate change, in which the coast and any dune or cliff system is a significant element or part, and includes the coastal marine area. (Ministry for the Environment, 2008).
Coastal Marine Area (CMA)	That area of the foreshore and seabed of which the seaward boundary is the outer limits of the territorial sea (12 nautical miles) and the landward boundary is the line of mean high water spring, except where that line crosses a river. There, the landward boundary is whichever is the lesser of: 1 kilometre upstream from the mouth of the river, or the point upstream that is calculated by multiplying the width of the river mouth by five. (Resource Management Act 1991). (Ministry for the Environment, 2008).
Coastal processes	Collective term covering the action of natural forces on the shoreline, and near shore seabed. (FEMA, 2004)

Coastal strip	A zone directly adjacent to the waterline, where only coast related activities take place. Usually this is a strip of some 100 m wide. In this strip the coastal defense activities take place. In this strip often there are restrictions to land use. (FEMA, 2004)
Coastal zone	The transition zone where the land meets water, the region that is directly influenced by marine and lacustrine hydrodynamic processes. Extends offshore to the continental shelf break and onshore to the first major change in topography above the reach of major storm waves. On barrier coasts, includes the bays and lagoons between the barrier and the mainland. (FEMA, 2004)
Coastal zone management	The integrated and general development of the coastal zone. Coastal Zone Management is not restricted to coastal defense works, but includes also a development in economical, ecological and social terms. Coastline Management is a part of Coastal Zone Management. (FEMA, 2004)
Coriolis effect	Force due to the Earth's rotation, capable of generating currents. It causes moving bodies to be deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. The "force" is proportional to the speed and latitude of the moving object. It is zero at the equator and maximum at the poles.(Voigt, 1998).
Coral	Simple marine animals that live symbiotically with algae. In the symbiotic relationship, the algae provides the coral with nutrients, while the coral provide the algae with a structure to live in. Coral animals secrete calcium carbonate to produce a hard external skeleton. (Pidwirny, 1999).
Coral bleaching	Situation where coral lose their colorful symbiotic algae. Thought to be caused by unusually warm water, changes in salinity of ocean seawater, or excessive exposure to ultraviolet radiation. (Pidwirny, 1999).
Cotidal	Indicating equality with the tides or a coincidence with the time of high or low tide. (IOC, 2008)
Creeping hazard	A hazard that impacts progressively over long-term. (Bogardi, 2004). (IOC, 2009).
cross-shore	Perpendicular to the shoreline. (FEMA, 2004)
Crustal spreading center	Mag40
Cyclone	An atmospheric closed circulation rotating counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. (NOAA, 2010).
Debris line	A line near the limit of storm wave uprush marking the landward limit of debris deposits. (FEMA, 2004)
Deep water waves	A wave in water the depth of which is greater than one-half the wave length. (FEMA, 2004)

Deep-ocean Assessment and Reporting of Tsunamis (DART) system,	consists of seafloor pressure sensors that can detect a tsunami as it passes and a communication system to relay information to tsunami warning centers in real time. Coastal_hazards.pdf
delta	Mag40
Design storm	A hypothetical extreme storm whose waves coastal protection structures will often be designed to withstand. The severity of the storm (i.e. return period) is chosen in view of the acceptable level of risk of damage or failure. A design storm consists of a design wave condition, a design water level and a duration. (FEMA, 2004)
diurnal	Having a period or cycle of approximately one tidal day. (FEMA, 2004)
Diurnal tide	A tide with one high water and one low water in a tidal day. (FEMA, 2004)
Doppler radar network	
Downscaling	Deriving estimates of local climate elements (eg, temperature, wind, rainfall), from the coarse resolution output of global climate models. Statistical downscaling uses present relationships between large-scale climate variables and local variables. Nested regional climate modeling uses the coarse resolution output from a global climate model to drive a high resolution regional climate model. (Ministry for the Environment, 2008).
drifting buoys	
Drop	The downward change or depression in sea level associated with a tsunami, a tide, or some long term climatic effect. (IOC, 2008)
Dune height (elevation)	(USGS, 2010a)
Early warning	The provision of timely and effective information, through identified institution, that allows individuals exposed to hazard to avoid or reduce their risk and prepare for an effective response. (UN/ISDR, 2004). (IOC, 2009)
early warning system	
Ebb tide	Time during the tidal period when the tide is falling. Compare with flood tide. (Pidwirny, 1999)
Ecosystem	A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to, ultimately the entire earth. (PCC, 2007). (IOC, 2009)
Ecosystem	The living organisms and the nonliving environment interacting in a given area, encompassing the relationships between biological, geochemical, and geophysical systems. (FEMA, 2004)

Ecosystem	A dynamic complex of plant, animal and microorganisms communities and their non-living environment interacting as a functional unit. (IOC, 2006)
Ecosystem	An ecosystem is a system where populations of species group together into communities and interact with each other and the abiotic environment. (Pidwirny, 1999)
Ecosystem approach	The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organization that encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems. (IOC, 2006)
Edge wave	A wave of water that moves parallel to the shore. This wave is usually a secondary wave of complex formation. (Pidwirny, 1999)
Ekman transport	Resultant flow at right angles to and to the right of the wind direction (in the northern hemisphere) referred to as upwelling and downwelling. (FEMA, 2004)
El Niño	Warm equatorial water which flows southward along the coast of Peru and Ecuador during February and March of certain years. It is caused by poleward motions of air and unusual water temperature patterns in the Pacific Ocean, which cause coastal downwelling, leading to the reversal in the normal north-flowing cold coastal currents. During many El Niño years, storms, rainfall, and other meteorological phenomena in the Western Hemisphere are measurably different than during non-El Niño years. (See La Niña). (FEMA, 2004)
El Niño	A significant increase in sea surface temperature over the eastern and central equatorial Pacific that occurs at irregular intervals, generally ranging between 2 and 7 years. Associated changes occur in atmospheric pressure patterns and wind systems across the Pacific. These can lead to changes in seasonal rainfall and temperature in parts of Australia and New Zealand. (Ministry for the Environment, 2008)
El Niño	Name given to the occasional development of warm ocean surface waters along the coast of Ecuador and Peru. When this warming occurs the tropical Pacific trade winds weaken and the usual upwelling of cold, nutrient rich deep ocean water off the coast of Ecuador and Peru is reduced. The El Niño normally occurs around Christmas and lasts usually for a few weeks to a few months. Sometimes an extremely warm event can develop that lasts for much longer time periods. (Pidwirny, 1999)

El Niño Southern Oscillation (ENSO)	Term coined in the early 1980s in recognition of the intimate linkage between El Niño events and the Southern Oscillation, which, prior to the late 1960s, had been viewed as two unrelated phenomena. The interactive global ocean–atmosphere cycle comprising El Niño and La Niña is often called the 'ENSO cycle'. (Ministry for the Environment, 2008)
Emergency management	The organization and management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation. (UN/ISDR, 2004). (IOC, 2009)
Emergent bars	In some areas, such as the west-central coast of Florida, sandbars can emerge where abundant sand is available for reworking by waves and currents (Fig. 7). The bars typically form in shallow water on the margins (platform shoals) of tidal inlets, or immediately downdrift of inlets where the rates of sediment transport are high. The emergent bars can migrate onshore and attach themselves to the beach, or they can continue to grow for years to form small islands. Where the bars migrate onshore, a narrow lagoon commonly separates them from the former ocean shore. In both situations, the sandbars would cause storm waves to break, and therefore they would provide additional protection to the adjacent shore that was fully exposed to ocean waves before the bar emerged. (USGS, 2010a)
emergent sandbars	(USGS, 2010a)
Encroachment	Any physical object placed in a floodplain that hinders the passage of water or otherwise affects the flood flows. (USGS, 2010)
Estuary	a place where fresh and salt water mix, such as a bay, salt marsh, or where a river enters an ocean. (USGS, 2010b)
Estuary	(1) The part of a river that is affected by tides. (2) The region near a river mouth in which the fresh water of the river mixes with the salt water of the sea and which received both fluvial and littoral sediment influx. (FEMA, 2004)
Estuary	(1) A semi-enclosed coastal body of water which has a free connection with the open sea. The seawater is usually measurably diluted with freshwater. (2) The part of the river that is affected by tides. (3) (SMP) The zone or area of water in which freshwater and saltwater mingle and water is usually brackish due to daily mixing and layering of fresh and salt water. (Voigt, 1998).
Eustatic sea level change	Change in the relative volume of the world's ocean basins and the total amount of ocean water. (FEMA, 2004)
Eutrophication	
Extreme weather event	An event that is rare at a particular place. 'Rare' would normally be defined as rare as or rarer than the 10th or 90th percentile. (Ministry for the Environment, 2008)

Eye	The roughly circular area of comparatively light winds that encompasses the center of a severe tropical cyclone. The eye is either completely or partially surrounded by the eyewall cloud. (NOAA National Hurricane Center, 2010)
Eyewall/wall cloud	An organized band or ring of cumulonimbus clouds that surround the eye, or light-wind center of a tropical cyclone. Eyewall and wall cloud are used synonymously. (NOAA National Hurricane Center, 2010)
Fetch	Distance over which wind acts on the water surface to generate waves. (NOAA Coastal Services Center, undated)
Fetch	The length of unobstructed open sea surface across which the wind can generate waves (generating area). (NOAA Coastal Services Center, undated)
Fetch	The distance of open water in one direction across a body of water over which wind can blow. (Pidwirny, 1999)
Flood	(1) Period when tide level is rising; often taken to mean the flood current which occurs during this period. (2) A flow above the carrying capacity of a channel. (NOAA Coastal Services Center, undated)
Flood	Inundation of a land surface that is not normally submerged by water from quick change in the level of a water body like a lake, stream, or ocean. (Pidwirny, 1999)
Flood tide	Time during the tidal period when the tide is rising. Compare with ebb tide. (Pidwirny, 1999)
Forereef	Mag40
Frontal dune	Ridge or mound of unconsolidated sandy soil, extending continuously alongshore landward of the sand beach and defined by relatively steep slopes abutting markedly flatter and lower regions on each side. (NOAA Coastal Services Center, undated)
Fujiwhara Effect	The tendency of two nearby tropical cyclones to rotate cyclonically about each other. (NOAA National Hurricane Center, 2010)
GLOSS	Global Sea-Level Observing System. A component of the Global Ocean Observing System(GOOS). TheUNESCOIOCestablished GLOSS in 1985 originally to improve the quality of sea level data as input to studies of long-term sea level change. It consists of a core network of approximately 300 stations distributed along continental coastlines and throughout each of the world'sislandgroups. TheGLOSSnetworkalso supports sea level monitoring for tsunami warning with minimum operational standards of 15-minute data transmissions of one-minute sampled data. (IOC, 2008)

GOOS	Global Ocean Observing System. GOOS is a permanent global system for observations, modelling, and analysis of marine and ocean variables to support operational ocean services worldwide. The GOOS Project aims to provide accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible; and the basis for forecasts of climate change. The GOOS Project Office, located at the IOC headquarters in Paris since 1992, provides assistance in the implementation of GOOS. (IOC, 2008)
GPM	
Groin	Narrow, roughly shore-normal structure built to reduce longshore currents, and/or to trap and retain littoral material. Most groins are of timber or rock and extend from a seawall, or the backshore, well onto the foreshore and rarely even further offshore. (FEMA, 2004)
Groin	(1) A shore-protection structure (built usually to trap Littoral drift or retard erosion of the shore). It is narrow in width (measured parallel to the shore) and its length may vary from tens to hundreds of meters (extending from a point landward of the shoreline out into the water). Groins may be classified as permeable (with openings through them) or impermeable (a solid or nearly solid structure). (2) (SMP) A barrier-type structure extending from the Backshore or stream bank into a water body for the purpose of the protection of a shoreline and adjacent upland by influencing the movement of water and/or deposition of materials. (Voigt, 1998)
Groin, adjustable	A groin whose permeability can be changed, usually with gates or removable sections. (FEMA, 2004)
Gulf	A relatively large portion of the ocean or sea extending far into land; the largest of various forms of inlets of the sea (e.g., Gulf of Mexico, Gulf of Aqaba). (FEMA, 2004)
Gut	A tidal stream connecting two larger waterways. (FEMA, 2004)
Halocline	a strong, vertical salinity gradient; the (sometimes indistinct) border between layers of water that contain different amounts of salt. [en.wiktionary.org/wiki/halocline]
Halocline	A zone in which salinity changes rapidly. (FEMA, 2004)
High-velocity wave action	Condition in which wave heights or wave runup depths are greater than or equal to 3.0 feet. (NOAA Coastal Services Center, undated)
Hinterland	Mag40

Hurricane	A cyclonic storm, usually of tropic origin, covering an extensive area, and containing winds in excess of 75 miles per hour.(Voigt, 1998)
Hurricane / Typhoon	A tropical cyclone in which the maximum sustained surface wind (using the U.S. 1-minute average) is 64 kt (74 mph or 119 km/hr) or more. The term hurricane is used for Northern Hemisphere tropical cyclones east of the International Dateline to the Greenwich Meridian. The term typhoon is used for Pacific tropical cyclones north of the Equator west of the International Dateline. (NOAA National Hurricane Center, 2010)
Hurricane	An intense cyclonic storm consisting of an organized mass of thunderstorms that develops over the warm oceans of the tropics. To be classified as a hurricane, winds speeds in the storm must be greater than 118 kilometers per hour. (Pidwirny, 1999)
Indicators	quantitative/qualitative statements or measured/observed parameters that can be used to describe existing situations and measure change or trends over time. Their three main functions are simplification, quantification and communication. (IOC, 2006) p.19 See also Jörns Definitions.....
Integrated Coastal and Ocean Management (ICOM)	A dynamic, multidisciplinary, iterative, and participatory process to promote sustainable management of coastal and ocean areas balancing environmental, economic, social, cultural and recreational objectives over the long-term. ICOM entails the integration of all relevant policy areas, sectors and levels of administration. It means integration of the terrestrial and marine components of the target territory, both, in time and space. (IOC, 2006) p.7

Integrated Coastal Area management (ICAM)	A dynamic, multidisciplinary, iterative and participatory process to promote sustainable management of coastal and ocean areas balancing environmental, economic, social, cultural and recreational objectives over the long-term. ICOM entails the integration of all relevant policy areas, sectors, and levels of administration. It means integration of the terrestrial and marine components of the target territory, both in time and space. (IOC, 2006) p. 117 ICAM is a multi-phased process that unites governments and the community, science and management, and sectoral and public interes in preparing and implementing an integrated plan for the development and the protection of coastal ecosystems and resources. Contributing to the sustainable development of coastal areas, its goals include the protection of public safety, land-use planning, the stewardship of resources, the promotion of economic development and conflict resolution between the various stakeholders. ICAM is functionally the same as ICZM (Integrated Coastal Zone Management). (IOC, 2009) p.12] [can be defined as continuous and dynamic process by which decisions are made for the sustainable use, development and protection of coastal and marine areas and resources. Firs and foremost, the process is designed to overcome the fragmentation inherent in both the sectorial management approach and the splits in jurisdiction among levels of government at the land-sea interface. This is done by ensuring that the decisions of all sectors and all levels of government are harmonised and consistent with the coastal policies of the country. A key part of ICAM is the design of the institutional process to accomplish this harmonistaion in a politically acceptable way.... ICAM is a multipurpose oriented concept that analyses implications of development, conflicting uses and interrelationshiups among physical process and human activiities. In addition it promotes linkages and harmonisation between sectorial coastal and ocean activities. (Kairu & Nyandwi, 2000) p. 50
Interdecadal Pacific Oscillation (IPO)	A long timescale oscillation in the Pacific Ocean–atmosphere system that shifts climate every one to three decades. The IPO has positive (warm) and negative (cool) phases. Positive phases tend to be associated with an increase in El Niño, and negative phases with an increase in La Niña events. (Ministry for the Environment, 2008)
Inundation	The state of flooding of coastal land resulting from the impact of a tsunami, storm surge or other coastal flood hazard. Quantitatively it is the horizontal distance attained by flooding, usually measured perpendicularly to the shoreline. (IOC, 2009)
Inundation line	The line marking the maximum horizontal inland penetration of a tsunami, storm surge or other coastal flood hazard from the shoreline. (IOC, 2009)
Inundation or inundation distance	The horizontal distance inland that a tsunami penetrates, generally measured perpendicularly to the shoreline. (IOC, 2008)

Island arc	A line of volcanic islands found of the ocean that have been created by the convergence of two tectonic plates and the subsequent subduction of one of the plates beneath the other. Subduction cause magma plumes to rise to the Earth's surface creating the volcanic islands. (Pidwirny, 1999)
Jetty	Wall built out into the water to restrain currents or protect a structure. (NOAA Coastal Services Center, undated)
Joint probability	The likelihood of two or more hazard events impacting the same coastal area simultaneously. (IOC, 2009)
Joint probability	The probability of two (or more) things occurring together. (FEMA, 2004)
Joint probability density	Function specifying the joint distribution of two (or more) variables. (FEMA, 2004)
Joint return period	Average period of time between occurrences of a given joint probability event. (FEMA, 2004)
La Niña	A significant decrease in sea surface temperature in the central and eastern equatorial Pacific that occurs at irregular intervals, generally ranging between 2 and 7 years. La Niña is the cool counterpart to the El Niño warm event, and its spatial and temporal evolution in the equatorial Pacific is, to a considerable extent, the mirror image of El Niño. Like El Niño, there are associated changes in atmospheric pressures and wind systems across the Pacific, and related changes can occur in temperature and rainfall in parts of Australia and New Zealand. (Ministry for the Environment, 2008)
La Niña	El Niño has come to refer to the more pronounced weather effects associated with anomalously warm sea surface temperatures interacting with the air above it in the eastern and central Pacific Ocean. Its counterpart--effects associated with colder-than-usual sea surface temperatures in the region--was labeled "La Niña" (or "little girl") as recently as 1985. The shift from El Niño conditions to La Niña and back again takes about four years. Understanding this irregular oscillation and its consequences for global climate has become possible only in recent decades as scientists began to unravel the intricate relationship between ocean and atmosphere. Although meteorologists have long been forecasting daily weather based on atmospheric measurements taken around the world, they had relatively little information about conditions in many parts of the world's oceans until the advent of arrays of fixed unmanned midocean buoys in the Pacific Ocean and orbiting satellites. (The National Academies, 2000)
La Niña	Condition opposite of an El Niño. In a La Niña, the tropical Pacific trade winds become very strong and an abnormal accumulation of cold water occurs in the central and eastern Pacific Ocean. (Pidwirny, 1999)

Land use and land use change	Land use refers to the total of arrangements, acitvities and inputs undertaken In a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land Is managed (e.g. grazing, timber, extraction, and conservation). Land-use change refers to a change in the use or management of land by humans, which may lead to a change in loand cover. (IPCC, 2007). (IOC, 2009)
Landfall	The intersection of the surface center of a tropical cyclone with a coastline. Because the strongest winds in a tropical cyclone are not located precisely at the center, it is possible for a cyclone's strongest winds to be experienced over land even if landfall does not occur. Similarly, it is possible for a tropical cyclone to make landfall and have its strongest winds remain over the water. Compare direct hit, indirect hit, and strike. (NOAA National Hurricane Center, 2010)
Landfall	The coastline location where a tropical storm or hurricane moves from ocean onto land. (Pidwirny, 1999)
Leading wave	First arriving wave of a tsunami. In some cases, the leading wave produces an initial depression or drop in sea level, and in other cases, an elevationorriseinsealevel. Whenadropinsea level occurs, sea level recession is observed. (IOC, 2008)
Lifelines	Key networks for communication and survival during emergency conditions, including connected links and operating facilities in electricity, telecommunications, roading, water supply and wastewater systems. They may also include key emergency services such as ambulance, fire and civil defence services, and facilitates such as hospitals and medical centres.(Ministry for the Environment, 2008)
Littoral	Of or pertaining to the shore, especially of the sea; coastal. (NOAA Coastal Services Center, undated)
Littoral zone	An indefinite zone extending seaward from the shoreline to just beyond the breaker zone.(Voigt, 1998)
Littoral zone	The zone along a coastline that is between the high and low-water spring tide marks.(Pidwirny, 1999)
Livelihood	
Macroalgae changes	
Management unit	The geographical area under consideration for the purposes of risk assessment and mitigation. This may be national in scale, or at the district or local levels. (IOC, 2009))
Maremoto	Spanish term for tsunami. (IOC, 2008)
Mareogram or marigram	1) Record made by a mareograph. 2) Any graphic representation of the rise and fall of the sea level, with time as abscissa and height as ordinate, usually used to measure tides, may also show tsunamis. (IOC, 2008)

Marigram	A graphic record of the rise and fall of the tide. The record is in the form of a curve in which time is represented by abscissas and the height of the tide by ordinates.(Voigt, 1998)
Mean high water spring (MHWS)	Mean high water spring is traditionally the level of the average spring tides just after full or new moon. In central–eastern regions, a 'pragmatical' MHWS or perigean-spring tide level (MHWPS) is a better hazard measure of upper-level high tides than the traditional MHWS, because the spring-neap effect is weak. (Ministry for the Environment, 2008)
Mean high water spring (MHWS)	The average height of the high water occurring at the time of spring tides.(Voigt, 1998)
Mean Level of the Sea (MLOS)	The actual level of the sea over a certain averaging period (days, weeks, years, decades) after removing the tides (not to be confused with mean sea level or MSL, which usually refers to a set vertical survey datum). (Ministry for the Environment, 2008)
Mean sea level	The average height of the sea surface, based upon hourly observation of tide height on the open coast or in adjacent waters which have free access to the sea. These observations are to have been made over a "considerable" period of time. In the United States, mean sea level is defined as the average height of the surface of the sea for all stages of the tide over a 19-year period. Selected values of mean sea level serve as the sea level datum for all elevation surveys in the United States. Along with mean high water, mean low water, and mean lower low water, mean sea level is a type of tidal datum. (IOC, 2008)
Mean Sea Level (MSL)	Mean sea level survey datum generally set down in the 1930s to 1950s for different regions. Because of the sea-level rise since then, MSL datum values around New Zealand are usually several centimetres below the current mean level of the sea. (Ministry for the Environment, 2008)
Mean sea level	The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings (see sea level datums).(Voigt, 1998)
Mean sea level	The average height of the ocean surface as determined from the mean of all tidal levels recorded at hourly intervals. (Pidwirny, 1999)
Mesotidal	Tidal range between 2 m and 4 m.(Voigt, 1998)
Meteorological tsunami	Tsunami-like phenomena generated by meteorological or atmospheric disturbances. These waves can be produced by atmospheric gravity waves, pressure jumps, frontal passages, squalls, gales, typhoons, hurricanes and other atmospheric sources. Meteotsunamis have the same temporal and spatial scales as tsunami waves and can similarly devastate coastal areas, especially in bays and inlets with strong amplification and well-defined resonant properties (e.g. Ciutadella Inlet, Baleric Islands; Nagasaki Bay, Japan; Longkou Harbour, China; Vela Luka, Stari Grad and Mali Ston Bays, Croatia). Sometimes referred to as rissaga. (IOC, 2008)

Microtidal region	A region of less than 0.5 m tidal amplitude (USGS, 2010a)
Micro-tidal	Tidal range less than 2 m. (Voigt, 1998)
Mitigation	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards. (UN/ISDR, 2004). See also Adaptation. (IOC, 2009)
Mitigation	Any action taken to reduce or permanently eliminate the long-term risk to life and property from natural hazards. (NOAA Coastal Services Center, undated)
Neap tide	Tide of decreased range occurring semimonthly as the result of the moon being in quadrature. The neap range of the tide is the average semidiurnal range occurring at the time of neap tides and is most conveniently computed from the harmonic constants. The neap range is typically 10 to 30 percent smaller than the mean range where the type of tide is either semidiurnal or mixed and is of no practical significance where the type of tide is diurnal. The average height of the high waters of the neap tide is called neap high water or high water neaps (MHWN), and the average height of the corresponding low water is called neap low water or low water neaps (MLWN). (Voigt, 1998)
Neap tide	Tide that occurs every 14 to 15 days and coincides with the first and last quarter of the moon. This tide has a small tidal range because the gravitational forces of the moon and Sun are perpendicular to each other. Contrasts with spring tide. (Pidwirny, 1999)
Non-structural measures	Policies, regulations and plans that promote good coastal hazard management practices to minimize coastal hazards risks. (IOC, 2009)
Oligo-elements	
Over-fishing	
Overwash zone	Overwash occurs when storm waters exceed the elevation of the adjacent land and the ocean water flows onshore. The overwash processes commonly transport large volumes of sand onshore where it is deposited as fan-shaped or terrace-shaped features Overwash areas, which are indicators of hazards to coastal development, are characterized typically by low elevations adjacent to the backbeach, absence of dunes, and either barren or sparse vegetation. Storm flooding in broad overwash areas is normally by sheetwash, whereas scouring and erosion are common in narrow overwash areas where the flow of waves and currents is restricted. In hurricanes and some winter storms (northeasters), the overwash waves and currents can open new inlets on barrier islands, destroy bridges and roads, or transport sand inland more than a kilometer from the shore, blocking streets and filling parking lots. (USGS, 2010a)

Overwash	(1) The part of the Uprush that runs over the crest of a berm or structure and does not flow directly back to the ocean or lake. (2) The effect of waves overtopping a coastal defence, often carrying sediment landwards which is then lost to the beach system.
Percolation	The process by which water flows through the interstices of a sediment. Specifically, in wave phenomena, the process by which wave action forces water through the interstices of the bottom sediment and which tends to reduce wave heights. (FEMA, 2004)
Phytoplankton bloom	
Polluter-pays principle	
Post-tropical Cyclone	A former tropical cyclone. This generic term describes a cyclone that no longer possesses sufficient tropical characteristics to be considered a tropical cyclone. Post-tropical cyclones can continue carrying heavy rains and high winds. Note that former tropical cyclones that have become fully extratropical...as well as remnant lows...are two classes of post-tropical cyclones. (NOAA National Hurricane Center, 2010)
Precautionary approach	
Preparedness	Activities and measures taken in advance to ensure effective respinse to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations. (UN/ISDR, 2004). (IOC, 2009)
Probability	The likelihood of a defined hazard event impacting a coastal area. (IOC, 2009)
Probability	The chance that a prescribed event will occur, represented by a number (p) in the range 0 - 1. It can be estimated empirically from the relative frequency (i.e. the number of times the particular event occurs, divided by the total count of all events in the class considered). (FEMA, 2004)
Protection	Involves the use of natural or artificial measures to protect landwards development and/or attempt to hold the shoreline in its existing position in an effort to reduce hazard impacts. (Bijlsma et al., 1996). (IOC, 2009)
Public awareness	The process of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster. (IOC, 2009)
Rapid-onset hazard	A hazard that impacts over a short time scale (minutes – hours), sometimes catastrophically. (see Bogardi, 2006). (IOC, 2009)

Recession	Drawdown of sea level prior to tsunami flooding. The shoreline moves seaward, sometimes by a kilometre or more, exposing the sea bottom, rocks, and fish. The recession of the sea is a natural warning sign that a tsunami is approaching. (IOC, 2008)
Red tides	Discoloration of surface waters, most frequently in coastal zones, caused by large concentrations of microorganisms. (Voigt, 1998).
Reef	A ridge of rock or other material lying just below the surface of the sea. (Voigt,1998).
Reef	A ridge of rocks found in the tidal zone along a coastline. One common type of reef is the coral reef. (Pidwirny, 1999)
Relative sea level	Sea level measured by a tide gauge with respect to the land upon which it is situated. Mean sea level is normally defined as the average relative sea level over a period, such as a month or a year, long enough to average out transients such as waves and tides. (IPCC, 2007). (IOC, 2009)
Relative sea level	Sea level measured by a tide gauge with respect to the land upon which it is situated. Mean Sea Level (MSL) is normally defined as the average relative sea level over a period, such as a month or a year, long enough to average out transient fluctuations such as waves. (Ministry for the Environment, 2008)
Retreat	Abandonment of coastal area and the landward shift of ecosystems. This choice can be motivated byt the nature of assets to be protected. (Bijlsma, 1996). (IOC, 2009)
Return period	The average time between occurrences of a defined event. (IPCC, 2007). (IOC, 2009)
Return period	The average time period between repetition of an extreme weather event, such as heavy rainfall or flooding, in a stationary climate (that is, a climate without global warming or other trends). In the case of rainfall, a return period is always related to a specific duration (eg, 50-year return period of 24-hour extreme rainfall).(Ministry for the Environment, 2008)
Rip current	A strong relatively narrow current of water that flows seaward against breaking waves. (Pidwirny, 1999)
Riprap	Broken stone, cut stone blocks, or rubble that is placed on slopes to protect them from erosion or scour caused by flood waters or wave action. (NOAA Coastal Services Center, undated)
Riprap	(1) Broken stones used for revetment, toe protection for BLUFFS, or structures exposed to wave action, foundations, etc. (2) Foundation of wall or stones placed together irregularly. (3) (SMP) A layer, facing or protective mound of stones placed to prevent EROSION, scour or sloughing of a structure or EMBANKMENT; also the stone so used.(Voigt, 1998).

Risk assessment	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potnetial threat or harm to people, property, livelihoods and the environment on which they depend. (UN/ISDR, 2004) (IOC, 2009)
Run-up	The difference between the elevation of maximymm tsunami penetration *inundation line) and the sea level at the time of the tsunami.
Run-up	1) Difference between the elevation of maximum tsunami penetration (inundation line) and the sea level at the time of the tsunami. In practical terms, run-up is only measured where there is a clear evidence of the inundation limit on the shore. 2) Elevation reached by seawater measured relative to some stated datum such as mean sea level, mean low water, sea level at the time of the tsunami attack, etc., and measured ideally at a point that is a local maximum of the horizontal inundation. Where the elevation is not measured at the maximum of horizontal inundation this is often referred to as the inundation-height. (IOC, 2008)
Run-up	the rush of water up a structure or BEACH on the breaking of a wave. The amount of run-up is the vertical height above stillwater level that the rush of water reaches.(Voigt, 1998).
Scenario	A plausible and often simplified description of how the future might develop, based on a coherent and internally consisten set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline. (IPCC, 2007) (IOC, 2009)
Scour	Removal of soil or fill material by the flow of floodwaters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence. See Erosion. (NOAA Coastal Services Center, undated)
Sea level change	Sea level can change, both globally and locally, due to (I) changes in the shape of the ocean basins, (ii) changes in the total mass of water and (iii) change sin water density. (IPCC, 2007) (IOC, 2009)
Sea level rise	Trend of annual mean sea level over timescales of at least three or more decades. Must be tied to one of the following two types: global – overall rise in absolute sea level in the world's oceans; or relative – net rise relative to the local landmass (that may be subsiding or being uplifted). Coastal-hazards-climate-change-guidance-manual.pdf]
Sea level rise	The long-term trend in mean sea level.(Voigt, 1998).
Seabed destruction	

Seawall	Solid barricade built at the water's edge to protect the shore and to prevent inland flooding. (NOAA Coastal Services Center, undated)
Sediment cell	In the context of a strategic approach to coastal management, a length of coastline in which interruptions to the movement of sand or shingle along the beaches or nearshore seabed do not significantly affect beaches in the adjacent lengths of coastline. (Simm et al., 1996). (IOC, 2009)
Seiche	A seiche may be initiated by a standing wave oscillating in a partially or fully enclosed body of water. Itmaybeinitiatedbylongperiodseismic waves (an earthquake), wind and water waves, or a tsunami. (IOC, 2008)
Seismic sea wave	Tsunamis are sometimes referred to as seismic sea waves because they are most often generated by earthquakes. (IOC, 2008)
Semi-diurnal tides	Tides occurring twice daily. There are two high and two lows per tidal day.(Voigt, 1998).
shoreline erosion	
Shoreline retreat	Progressive movement of the shoreline in a landward direction caused by the composite effect of all storms considered over decades and centuries (expressed as an annual average erosion rate). Shoreline retreat considers the horizontal component of erosion and is relevant to long-term land use decisions and the siting of buildings. (NOAA Coastal Services Center, undated)
Significant wave height	The average height of the one-third highest waves of a given wave group. Also called the “characteristic wave height”. (IOC 2008). (IOC, 2009)
Significant wave height	The average height of the highest one-third of waves during a short recording interval (typically 10–20 minutes). Generally, considered the height that a trained observer would report for a given sea state. Coastal-hazards-climate-change-guidance-manual.pdf]
SOI	Southern Oscillation Index. An index calculated from anomalies in the pressure difference between Tahiti and Darwin. Low negative values of this index correspond to El Niño conditions, and high positive SOI values coincide with La Niña episodes. (Ministry for the Environment, 2008)
Spit	(1) A long narrow accumulation of sand or shingle, lying generally in line with the COAST, with one end attached to the land the other projecting into the sea or across the mouth of an estuary. See also ness. (2) (SMP) An accretion shoreform which extends seaward from and parallel to the shoreline.(Voigt, 1998).

Spit	A long and narrow accumulation of sand and/or gravel that projects into a body of ocean water. These features form as the result of the deposition of sediments by longshore drift. [http://Pidwirny (1999)/physgeoglos/s.html]
Storm surge	An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic high tide from the observed storm tide. (NOAA National Hurricane Center, 2010)
storm surge	A rise or piling-up of water against shore, produced by strong winds blowing ONSHORE. A storm surge is most severe when it occurs in conjunction with a high tide.(Voigt, 1998).
Storm surge	The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place. (IPCC, 2007). (IOC, 2009)
Storm surge	The temporary excess above the level expected from the tidal variation alone at a given time and place. The temporary increase in the height of the sea is caused by extreme meteorological conditions such as low atmospheric pressure and/or strong winds. (Ministry for the Environment, 2008)
Storm surge	Rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface. (NOAA Coastal Services Center, undated)
Storm tide	The actual level of sea water resulting from the astronomic tide combined with the storm surge. (NOAA National Hurricane Center, 2010)
Storm tide	The total elevated sea height at the coast above a datum during a storm combining storm surge and the predicted tide height. Note that wave set-up and wave run-up need to be added to the storm tide level at any locality to get the final storm inundation level. (Ministry for the Environment, 2008)
Storm track	
Structural measures	Structural measures refer to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure. (UN/ISDR, 2004). (IOC, 2009)
Susceptibility	The predeposition to be affected by physical or socioeconomic change, including damage or loss. In these guidelines, “susceptibility” is taken to be broadly synonymous with “vulnerability”. (IOC, 2009)

Thermal expansion	In connection with sea level, this refers to the increase in volume (and decrease in density) which results from warming water. A warming of the ocean leads to an expansion of the ocean volume and hence an increase in sea level (IPCC, 2007). (IOC, 2009)
Tidal excursion	Mag40
Tidal wave	1) The wave motion of the tides. 2) Often incorrectly used to describe a tsunami, storm surge, or other unusually high and therefore destructive water levels along a shore that are unrelated to the tides. (IOC, 2008)
Tidal wave	(1) A wave, in the oceans and seas, produced by tides and tidal currents. (2) Non-technical term in popular usage for an unusually high and destructive water level along a shore. It usually refers to storm surge or tsunami.(Voigt, 1998).
Tide gauge	A device at a coastal location (and some deep-sea locations) that continuously measures the level of the sea with respect to the adjacent land. Time averaging of the sea level so recorded gives the observed secular changes of the relative sea level. (IPCC, 2007). (IOC, 2009)
Trophic interaction	
Tropical Cyclone	A warm-core non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined center. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere. In this they differ from extratropical cyclones, which derive their energy from horizontal temperature contrasts in the atmosphere (baroclinic effects). (NOAA National Hurricane Center, 2010)
Tropical depression	A tropical cyclone in which the maximum sustained surface wind speed (using the U.S. 1-minute average) is 33 kt (38 mph or 62 km/hr) or less. (NOAA National Hurricane Center, 2010)
Tropical disturbance	A discrete tropical weather system of apparently organized convection -- generally 100 to 300 nmi in diameter -- originating in the tropics or subtropics, having a nonfrontal migratory character, and maintaining its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field. (NOAA National Hurricane Center, 2010)

Tropical Rainfall Measuring Mission (TRMM)	Tropical Rainfall Measuring Mission (TRMM) is an example of a satellite designed strictly for research that has turned into a valuable component of many different weather and climate related activities. Launched by NASA and the Japanese space agency in 1997, TRMM's reliable sensors and high-quality measurements provide unique, near real-time data for many different agencies, including the Joint Typhoon Warning Center, the National Center for Environmental Prediction, and the National Hurricane Center. TRMM data have been used in determining hurricane centers and rainfall estimates for flood forecasts and warnings, as well as in routing aircraft across oceans to avoid storm cells. TRMM is expected to continue orbiting until about 2012-2013, or earlier if critical systems fail. NASA plans to launch the Global Precipitation Measurement mission (GPM) in 2013 to succeed TRMM. Coastal_hazards.pdf
Tropical storm	A tropical cyclone in which the maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 34 kt (39 mph or 63 km/hr) to 63 kt (73 mph or 118 km/hr). (NOAA National Hurricane Center, 2010)
tropical storm	
Tropical wave	A trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere. (NOAA National Hurricane Center, 2010)
Tsunami	A tsunami is a series of traveling ocean waves of extreme length, generated by rapid changes of the seafloor, mainly caused by earthquakes. Underwater volcanic eruptions and landslides can also generate tsunamis, although these sources are significantly less frequent. As the tsunami crosses the deep ocean, sometimes at speeds exceeding 800 km/h (480 mph), its length from crest to crest may be 100 km (60 miles), but its height in the deep ocean from trough to crest may only be a few tens of centimeters (a few inches or feet), even for a very destructive tsunami. It cannot be felt aboard ships in the open ocean. As the tsunami enters shallow water near coastlines in its path, the velocity of its waves decreases and its wave height increases. It is in these shallow waters that tsunamis become a threat to life and property for they can crest to heights of more than 10 m (30 feet), strike with devastating force, and flood low-lying coastal areas. For more information on tsunamis & their causes, download the International Tsunami Information Centre's (ITIC) publication, Tsunami, the Great Waves. [www.ioc-tsunami.org/content/view/19/1104/]

Tsunami	Tsunamis occur when ocean waters are rapidly displaced on a massive scale, typically because of an earthquake. During a tsunami event, elevated ocean water forms massive waves that flood coastal areas when they reach the shore. The death and destruction that result from tsu- nami events can be catastrophic, such as the aftermath of the tsunami that hit Southeast Asia in December 2004 after an earthquake erupted beneath the Indian Ocean. Hundreds of thou- sands of people died and many more were left homeless (Coastal_hazards.pdf)
Tsunami	Japanese term meaning wave (“nami”) in a harbour (“tsu”). A series of traveling waves of extremely long length and period, usually generated by disturbances associated with earthquakes occurring below or near the ocean floor. (Also called seismic sea wave and, incorrectly, tidal wave). Volcanic eruptions, submarine landslides, and coastal rockfalls can also generate tsunamis, as can a large meteorite impacting the ocean. These waves may reach enormous dimensions and travel across entire ocean basins with little loss of energy. They proceed as ordinary gravity waves with a typical period between 10 and 60 minutes. Tsunamis steepen and increase in height on approaching shallow water, inundating low-lying areas, and where local submarine topography causes the waves to steepen, they may break and cause great damage. Tsunamis have no connection with tides; the popular name, tidal wave, is entirely misleading. (IOC, 2008)
Tsunami	Large ocean wave created from an earthquake or volcanic eruption. Open ocean wave height may be as high as 1 meter. When entering shallow coastal waters, land configuration can amplify waves to heights of over 15 meters. [http://Pidwirny (1999)/physgeoglos/t.html]
Tsunami forerunner	[A series of oscillations of the water level preceding the arrival of the main waves. ioc3.unesco.org/itic/files/tsunami_glossary_small.pdf]
Tsunami resonance	The continued reflection and interference of tsunami waves from the edge of a harbour or narrow bay which can cause amplification of the wave heights, and extend the duration of wave activity from a tsunami. (IOC, 2008)
Tsunamigenic	Capable of generating a tsunami. For example: a tsunamigenic earthquake, a tsunamigenic landslide. (IOC, 2008)
Upwelling	The movement of nutrient-rich deep seawater to the ocean's surface. (Pidwirny, 1999)
Vigour of ecosystem	Is concerned with the productivity of the ecosystem and relates tot he energy flows within it and the interaction of the organizational components. Particular attention must be given to primary productivity, which is the basis of marine food chains, as well as to measures dealing with size (e.g. biomass) and species reproductive capacity. (IOC, 2006), p.31
Wave crest	1) The highest part of a wave. 2) That part of the wave above still water level. (IOC, 2008)

Wave run-up	The ultimate height reached by waves (storm or tsunami) after running up the beach and coastal barrier (see also wave set-up). (Ministry for the Environment, 2008)
Wave run-up	Rush of wave water up a slope or structure. (NOAA Coastal Services Center, undated)
Wave set-up	The super-elevation in water level across the surf zone caused by energy expended by breaking waves (see also wave run-up). (Ministry for the Environment, 2008)

Literature

Anderson, Donald M. (2007): The Ecology and Oceanography of Harmful Algal Blooms: Multidisciplinary Approaches to Research and Management. IOC Technical Series 74, UNESCO 2007. (English only). IOC/2007/TS/74.

Intergovernmental Oceanic Commission (IOC) (2006): A handbook for measuring the progress and outcomes of integrated coastal and ocean management. IOC Manuals and Guides, 46; ICAM Dossier, 2. Paris UNESCO, 2006 (English).

Intergovernmental Oceanographic Commission (IOC) (2008): Tsunami Glossary, 2008. Paris, UNESCO. IOC Technical Series, 85. (English.)
http://ioc3.unesco.org/itic/files/tsunami_glossary_small.pdf

Intergovernmental Oceanic Commission (IOC) (2009): Hazard Awareness and Risk Mitigation in Integrated Coastal Zone Management (ICAM). IOC Manual and Guides No. 50, ICAM Dossier No. 5, Paris, UNESCO (English).

FEMA (2003): Guidelines and Specifications for Flood Hazard Mapping Partners. Glossary. 26 pp. <www.fema.gov/fhm/dl_cgs.shtm>, April 30, 2010. frm_gsgl.pdf

FEMA (2004): Guidelines and Specifications for Flood Hazard Mapping Partners [November 2004].
<http://www.fema.gov/library/file?type=publishedFile&file=frm_cfd414.pdf&fileid=4de56330-91f7-11db-b057-000bdba87d5b>, April 30, 2010.

Kairu, K. and Nyandwi, N. (editors) (2000): Guidelines for the Study of Shoreline Change in the Western Indian Ocean Region ***IOC Manuals and Guides No.*** 40. **UNESCO 2000** (English).

NOAA Coastal Services Center (undated): Risk and Vulnerability Assessment Tool (RVAT) – Glossary. <http://www.csc.noaa.gov/rvat/glossary.html>, April 30, 2010.

NOAA National Hurricane Center (last modified 2010): Glossary of National Hurricane Center Terms. <http://www.nhc.noaa.gov/aboutgloss.shtml>, April 30, 2010.

Ministry for the Environment (2008): Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand. 2nd edition. Revised by Ramsay, D, and Bell, R. (NIWA). Prepared for Ministry for the Environment. viii+127 p. [Coastal-hazards-climate-change-guidance-manual.pdf]

Pidwirny, Michael (1999): Physical Geography.net – Glossary of Terms. <http://www.physicalgeography.net/glossary.html>, April 30, 2010.

Richardson, K. (1997): Harmful or Exceptional Phytoplankton Blooms in the Marine Ecosystem. Advances in Marine Biology [Adv. Mar. Biol.]. Vol. 31, pp. 301-385. 1997.

The National Academies (2000): El Niño and La Niña: Tracing the Dance of Ocean and Atmosphere. Washington, National Academy of Sciences. 8pp.
elnino_PDF.pdf

Twigg, John (2007): Disaster reduction terminology: a common-sense approach. Humanitarian Exchange Magazine, Issue 38, 2-5.

U.S. Geological Survey (USGS) (last modified 2010a): Coastal Classification Mapping Project – Coastal Classifications. <http://coastal.er.usgs.gov/coastal-classification/class.html>, April 30, 2010.

U.S. Geological Survey (USGS) (last modified 2010b): Water Science Glossary of Terms. <http://ga.water.usgs.gov/edu/dictionary.html>, April 30, 2010.

Voigt, Brian (1998): Glossary of coastal terminology. NOAA Coastal Service Center Publication No. 98-105. Washington State Department of Ecology, Olympia, WA 98504-7600. http://www.csc.noaa.gov/text/glossary.html

ANNEX IV

TOWS-WG TASK TEAMS AND REGIONAL ICG TWS WORKING GROUPS AND TASK TEAMS, MAY 2010

TOWS-WG Task Teams		**PTWS** WGs and TTs	**IOTWS** WGs and TTs	**CARIB** WGs	**NEAMTWS** WGs/TTs
TT1 **Sea Level**		WG1 Risk assessment and reduction	WG1 Risk assessment and reduction	WG1 Monitoring and detection; warning guidance	WG1 Hazard assessment and modelling
TT2 **Disaster Management and Preparedness**		WG2 Detection, warning and dissemination	WG2 Detection, warning and dissemination	WG2 Hazard risk assessment and research	WG2 Seismic and geophysical measurements
TT3 **Tsunami Watch Operations**		WG3 Awareness and response	WG3 Awareness and response	WG3 Warning, dissemination and communication	WG3 Sea-level data collection and exchange
				WG4 Readiness and resilience	WG4 Public awareness, pre-paredness and mitigation
		TT on Pacific wave exercise	TT on Indian Ocean wave exercise		TT on Regional Tsunami Warning Syst. Architecture
		TT on Pacific Emergency Communications	TT on Regional Tsunami Watch Providers		TT on Communication Test Exercises

ANNEX V

IOC TSUNAMI UNIT: TRANSITION FROM CONSOLIDATION TO OPERATION

Background:

In 1965 the IOC in response to the Chile Earthquake of May 1960 and tsunami established the current Pacific Tsunami Warning System PTWS (formerly ITSU) at the Fourth Session of the IOC Assembly (3-12 November 1965) through Resolution IV-6. The tsunami programme until 2004 found little visibility and support. After the Indian Ocean tsunami on 26 December 2004 the IOC Executive Secretary immediately ensured that IOC's mandate for the Pacific was extended to all oceans. The experience of the IOC served as an important and essential asset to develop, agree and establish similar systems in all oceans.

Focussed on the Indian Ocean all resources made available were directed towards this goal. Since 2006 the required structures, cooperation mechanisms and standards have been developed that serve to support member states in establishing national tsunami warning systems that contribute to a system of nationally owned systems.

At the request to the IOC to report on the status of the implementation of UNESCO 33C/Res36:

"The IOC Assembly in June 2007 with Resolution XXIV-14 established the "Tsunamis and other Ocean Hazards warning and Mitigation Systems (TOWS-WG)". The IOC General Assembly XXIII in Paris, 21-30 June, 2006 had confirmed this global initiative by creating three additional regional Intergovernmental Coordination Groups (ICGs) as primary subsidiary bodies of IOC. Together with the Intergovernmental Coordination Group for the existing Tsunami Warning System in the Pacific PTWS, the new ICGs developed systems for the Indian Ocean (IOTWS) Northeast Atlantic, Mediterranean and Adjacent Seas (NEAMTWS), and the Caribbean (CARIBE EWS). Jointly, supported by other relevant UN bodies such as i.e. UNDP, UNEP, ISDR, WMO and the World Bank, they are building blocks to form a global system of early warning systems for tsunami and other ocean- related hazards. After having established in 2005 under the same governance structure four ocean Tsunami Warnings Systems by IOC Resolution XXIII-12, -13, -14, the IOC now has in place a mechanism to co-ordinate the global coverage to warn from and mitigate ocean-related hazards."

With this decision the IOC has taken on the global leadership in ocean-related disaster and mitigation issues. With its over 40 years experience with the end-to-end Pacific Tsunami Warning System PTWS, the IOC now has been able to transfer this performance into all other oceans, and thus co-ordinate the global cover.

The IOC Assembly in its Medium-Term Strategy (IOC-XXIV/2 Annex 5), established the High-level Objective 1 "Prevention and Reduction of the Impacts of Natural Hazards" with budgetary implications for the IOC Biennial Strategy 2008-2009 (XXIV-2). For the biennium 2010 – 2011 the **MLA 4 "**Strengthening the UNESCO Intergovernmental Oceanographic Commission (IOC) and broadening the scope of its activities for the benefit of all Member States: improving governance and fostering intergovernmental cooperation to manage and protect oceans and coastal zones" together with the SPO Strategic Programme Objective **(SPO) 5**: "Disaster Preparedness and Mitigation" are the guiding objectives of the entire Tsunami Programme, specifying as expected results "Risks from tsunami and other ocean and coastal-related hazards reduced, with special emphasis on particularly vulnerable regions in Africa, LDCs and SIDS"

Mandate:

The following resolutions provide the directives by which the IOC's tsunami programme is guided. It serves mainly to assist and coordinate operational early warning systems. Research and development components have been defined in cooperation with other relevant bodies that provide the appropriate expertise and resources.

IOC:	PTWS:	Resolution IV-6	
	IOTWS, NEAMTWS, CARIBE-EWS	Resolution XXIII-12, -13, -14	
	TOWS_WG:	Resolution XXIV-14	
UNESCO:		33C/Res36	
UN General Assembly:		UN61/132	IOTWS
		UN62/91	TWFP

European Union (EU) for NEAMTWS:

- Council Conclusions of December 2007 (15473/07) on the development and establishment of Early Warning Systems in the EU
- Council Conclusions of December 2007 (15479/07) on the establishment of an Early Warning System for tsunamis in the North East Atlantic and the Mediterranean region
- Council Conclusions on Reinforcing the Union's Disaster Response Capacity – towards an integrated approach to managing disasters of June 2008 (7562/08)

The UN General Assembly still needs to confirm the IOC's global mandate; so far it explicitly only addresses the Indian Ocean system (IOTWS) and the mechanism of nominating Tsunami National Contacts TNCs and Tsunami Warning Focal Points TWFPs.

Organization of the Tsunami Warning Systems

The PTWS was coordinated by an International Coordination Group, reporting to the IOC Assembly, until 2006. In 2006 its governance was brought in line with the now established **Intergovernmental Coordination Group**s ICGs.

Each ICG has its own Working Groups to develop and define technical aspects of the TWS. The initial Working Group structures reflected a wide range of interested partners and potential contributors. This led to diverging interests, directions and priorities.

The **Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG)** has been established under the IOC Assembly to "Advise on coordinated development and implementation activities on warning and mitigation systems for tsunamis and other hazards related to sea level of common priority to all ICG/TWSs". It thus ensures the coherence of all systems, and their approach to a multi-hazard concept to ultimately provide a global cover for ocean-related hazards. TOWS-WG ensures the cooperation with other IOC programmes, WMO and UN bodies.

Instigated by recommendations of TOWS-WG, the initial Working Group Structure of all ICGs has been reviewed and is being revised by the respective ICGs. It now focuses stronger on ICG-specific solutions and regional implementation issues, and contributes to global aspects under TOWS-WG.

All four ICGs as primary subsidiary bodies of IOC report directly to the IOC Assembly, they are supported by **ICG/Secretariat**s to be established "in the region".

The formal nomination of national **Tsunami Warning Focal Points (TWFP)** and **Tsunami National Contacts (TNC)** ensures unique entry points to member states and their responsible designated agency. UNGA Resolution UNGA62/91 confirms this approach.

All ICGs serve as the integrating vehicle for supporting the implementation of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disaster.

Support by the IOC Secretariat

The IOC Executive Secretary has been requested by several IOC Resolutions to provide secretarial support to the ICGs, preferably "in the region". Therefore Technical Secretaries serve the ICGs, regionally located when possible.

The Tsunami Unit serves as the central focal point for IOC's tsunami activities. At HQ and throughout the regionally based offices it maintains the links to all IOC programmes, and assembles unique and overall expertise in all tsunami matters. It maintains central web-based information resources for documents and material, especially in serving the ICGs. It is the unique and recognized group to provide succinct and impartial information on tsunami events to IOC Officers, member states, UNESCO and others.

More recently there is an increase in the request for assessment missions to support member states and provide technical assistance in the establishment and development of national tsunami warning centres and systems.

Budget and Finances

The IOC's budget for the Tsunami Programme has seen an impressive development, reflecting the need to urgently establish TWSs and move to operationality. For 2004 it still reflects the perception of member states in the Regular Budget RP. Since 2005 it has grown with the direct support for starting to establish four TWS systems. The RB has since been raised from 49kUS$ to 360kUS$ for the biennium 2010 – 2011 (35C/5).

Nevertheless the Tsunami Programme still depends on considerable extrabudgetary resources EB. To certain extend this forges strong links between the Programme and potential donors to highlight the need for TWSs, and establish them as an important part of Early Warning Systems. Single activities such as workshops, training courses funded by EB resources require staff support that is not included in these grants. This staff support has to be part of other substantial EB funds that require considerable efforts to acquire.

The level of required EB funding, mainly covers staff at HQ and the Secretariats running the ICGs and their Working Group structure, and their respective activities. One off funding is required for developing standards, and their adoption and subsequent publication.

IOC/TSU

Budget overview in kUS$

Biennia	Year	RP	EB
32 C/5	2004	49	nil
	2005	49	6 895
33 C/5	2006	27	2 290
	2007	27	2 592
34 C/5	2008	85	3 308
	2009	85	2 176
35 C/5	2010	180	2 125
	2011	180	

Summary of TSU budget development, both RB and EB

TSU Staff Development

Staff of the TSU serves largely as secretarial support to the ICGs, coordination with IOC Programmes and Member States, liaison with other UN and non-UN organizations and to provide unique expertise.

The table below summarizes the staff requirements and is broken down in to RB, EB and unfunded positions.

P-staff	EB	RB	Still unfunded	
9 total required	7	1	1	
G-staff				
7 total required	4	1	2	

Staff requirements largely are defined by the terms of reference for the **ICG Secretariats** and by HQ functions. In the built-up of the new TWSs the ICG support was wide ranging, and meeting support extensive. Cross-cutting technical expertise and advice was also needed for each ICG. This effort has been reduced by the revision of the Working Group structure, and subsequently the technical and secretarial support they require and by drawing on in-house support such as by the GLOSS Technical Secretary and growing interactions with ICAM and JCOMM.

The ICG Secretariats support the ICGs and their Working Groups; they serve as “antennas” in the region for the TSU and the IOC Secretariat at HQ and partially maintain specific regional functions to liaise with regional bodies,

At HQ staff serves in a coordinating role and for providing specific technical and scientific advice. Staffing policy develops towards a few professionals with fixed term contracts and permanent positions to secure full IOC Secretariat compatibility and professional and general staff on an ALD or limited term basis to create the opportunity for member states to second or provide staff in order to forge close links with the tsunami programme.

The TICs as a part of an end-to-end Tsunami Warning System, serve as an information resource from which the government agencies, donor countries, public and private stakeholders, NGOs and INGOs, and the general public can draw valuable advice, information and help in implementing tsunami safety measures to saving life and property. The centers have also enhanced capacities for action and planning by public authorities in the countries affected and improved public confidence and security .

Although under the supervision of the TSU, the **TICs** are developing towards their own administrative and organizational structure. This takes note of the regional requirements, and constraints, and accommodates potential donor requirements. Here the interaction with and supervision of the TSU will be mainly in an advisory function. The TICs are part of the TSU and its ICG Secretariats, so that the TSU can jointly develop this resource and report on plans and prospects of these important elements of the TWS downstream component.

Regular Budget and Extrabudgetary Resources

Since the Indian Ocean tsunami in 2004 the IOC Secretariat has been provided with extrabudgetary funds from a variety of donors for a variety of activities. They mirror the general concern and willingness to learn from the Indian Ocean tsunami event and implement measures to minimize such impact on coastal communities.

CONTRIBUTIONS TO IOC TSUNAMI PROGRAMME

2005

Donor	Special Account	Fund-in-Trust	Total
Israel	9 794		9 794
USA	46 000		46 000
Korea	1 000		1 000
France	24 705		24 705
Finland	1 722 546		1 722 546
Germany	332 926	429 412	762 338
Australia	194 670		194 670
ISDR		1 941 866	1 941 866
Italy		121 065	121 065
Ireland		600 960	600 960
Norway		1 470 742	1 470 742
TOTAL	2 331 642	4 564 045	6 895 687

2006

Donor	Special Account	Fund-in-Trust	Total
Vassar College	505		505
WMO	18 751		18 751
Israel	5 000		5 000
Canada	22 329	262 927	285 256
USA	20 000		20 000
Korea	1 000		1 000
Geohazards Intl	1 000		1 000
UNDP		60 000	60 000
ISDR		1 442 912	1 442 912
Norway		381 384	381 384
France	38 265		38 265
Czech Republic	36 379		36 379
TOTAL	143 229	2 147 223	2 290 452

2007

Donor	Special Account	Fund-in-Trust	Total
Vassar College	225		225
USA	260 000		260 000
Israel	10 000		10 000
New Zealand	10 097		10 097
UNEP		21 400	21 400
UNESCAP		100 000	100 000
Spain		37 739	37 739
Italy		1 251 644	1 251 644
Belgium	233 626		233 626
Germany	212 350		212 350
Australia	455 312		455 312
TOTAL	1 181 609	1 410 783	2 592 392

2008			
Donor	Special Account	Fund-in-Trust	Total
France	15 552		15 552
USA	40 000		40 000
Israel	10 000		10 000
Korea	980		980
Germany	50 518		50 518
Australia	568 132		568 132
UNESCAP		194 730	194 730
ISDR		188 162	188 162
Norway		1 568 318	1 568 318
Japan		481 872	481 872
Canada		189 356	189 356
TOTAL	685 182	2 622 438	3 307 620

2009 (provisional as at 01.10.2009)			
Donor	Special Account	Fund-in-Trust	Total
Australia	383 412		383 412
UNESCAP/SOP		150 000	150 000
Ireland		40 348	40 348
EU		561 674	561 674
UNESCAP/Makran		220 865	220 865
Oman TEWS		819 869	819 869
TOTAL	383 412	1 792 756	2 176 167
GRAND TOTAL			17 262 318

Below the EB provided by donors is listed for the period 2005–2009

CONTRIBUTIONS TO IOC TSUNAMI PROGRAMME by COUNTRY	
Japan	481 872,00
Israel	34 794,44
USA	366 000,00
Republic of Korea	2 980,00
France	78 522,37
Finland	1 722 546,00
Germany	1 025 206,29
Australia	1 601 525,98
Italy	1 372 709,00
Ireland	641 308,00
Norway	3 420 443,42
Canada	474 611,82
Czech Republic	36 378,52
New Zealand	10 096,50
Belgium	233 625,76
Spain	37 739,00
Oman TEWS	819 869,00
UNEP	21 400,00
UNDP	60 000,00
WMO	18 751,46
UN-ISDR	3 572 939,77
UNESCAP	444 730,00
UN-ESCAP Makran	220 865,00
EU	561 673,53
other*	1 730,00
TOTAL	17 262 317,86

*small non-governmental donors

Received contributions to the TSU for the period 2005 – 2009 listed per donor, summed for the entire period.

Interaction of TSU with Others

The **Secretariat support** requested by the ICGs and decided by IOC Resolutions is defined with three objectives:

- Adequate and timely preparation, organization and documentation of ICG meetings,
- "in the region" Secretariat for regional interaction and visibility, both with MS and UN organizations
- Particularly strong interaction with HQ, demonstrate "IOC as One"

Interaction with other **IOC Programmes and Sections**

All IOC programmes potentially contribute to delivering the tsunami programme. Primary objective, though, is that the TWS are operational systems and their success relies on using standardized procedures and process.

Interaction with other **UN Organizations**

(1) UNESCO
UNESCO provides a unique environment to address cultural, language and educational issues raised by the ICGs. IOC's tsunami programme has provided high visibility to UNESCO.

(2) WMO
WMO provides technical support and infrastructure to the TWSs. The main support is on the communications side via the Global Telecommunications System GTS and its imminent replacement WIS.

(3) CTBTO
The CTBTO under mutually beneficiary Resolutions of the governing bodies of IOC and CTBTO in February 2005 made the IMS data of CTBTO available to Tsunami Warning Centres established under the IOC mandate and being member states of the CTBTO.

In 2010 a MoU was signed between CTBTO and UNESCO to formalize these agreements and extended to joint training for TWS staff, including joint support for TWSs services.

(4) ISDR (International Strategy for Disaster Reduction)
ISDR and IOC have been collaborating very closely in the interpretation the Hyogo Framework of Action and the implementation of appropriate and relevant activities. From the programmatic side and with available staff support this has been very effective. The support of the Clinton Consortium with focus on establishing national tsunami warning systems in the Indian Ocean has led to close interaction between the three partners. ISDR has been particularly supportive in making its expertise and local or regional knowledge available to formulate and implement downstream activities using a common background.

ANNEX VI

LIST OF PARTICIPANTS

TOWS-WG MEMBERS

CHAIRPERSON

Mr Sang-Kyung BYUN
Principal Researcher
Climate Change and Coastal Disaster Research Department
Korea Ocean Research and Development Institute (KORDI)
Ansan P.O. Box 29 425-600
Seoul
Korea Rep
Tel: 81-31-400-6127
Fax: 81-31-408-5829
Email: skbyun@kordi.re.kr

ICG/CARIBE-EWS

Dr Lorna INNISS
Deputy Director
Coastal Zone Management Unit
Bay Street
St. Michael
Barbados
Tel: +246 228-5950
Fax: +246 228-5956
Email: linniss@coastal.gov.bb

ICG/NEAMTWS

Mr François SCHINDELE
Chairman, ICG/NEAMTWS
CEA/DASE
Bruyère Le Châtel
91297 Arpajon cedex
France
Tel: (33 1) 69 26 50 63
Fax: (33 1) 69 26 70 85
Email: francois.schindele@cea.fr

ICAM Group of Experts on Coastal Hazards

Mr Russell ARTHURTON
Coastal Geoscience
5a Church Lane
Grimston
Melton Mowbray
Leics
LE14 3BY
United Kingdom
Tel: +44-1664-810024
Email: r.arthurton@talktalk.net

United States of America

Mr Arthur PATERSON
Deputy Director,
International Program Office
National Ocean Service
Rm 5641 SSMC 3
1315 East West Highway
Silver Spring, MD 20910
United States
Tel: +1 301 713 3078
Fax: 301-713-4263
Email: arthur.e.paterson@noaa.gov

WMO

Mr Edgard CABRERA
Chief, Ocean Affairs Division
World Meteorological Organization
7bis, avenue de la Paix
Case Postale 2300
1211 Geneva
Switzerland
Tel: +41 22 730 82 37
Fax: +41 22 730 81 28
E-mail: ecabrera@wmo.int

CTBTO

Spiro SPILIOPOULOS
Preparatory Commission for the CTBTO
Provisional Technical Secretariat
Vienna International Centre
PO Box 1200
A-1400 Vienna
Austria
Tel. +43 1 60306512
Spilio.spiliopoulos@ctbto.org

INVITED EXPERTS

Begoña PEREZ GOMEZ
Puertos del Estado
Avda. del Partenón 10
Campo de las Naciones
28042 Madrid
Spain
Email: bego@puertos.es

Mr Srinivasa Kumar TUMMALA
Head, ASG & In-charge, National Tsunami Warning Centre
Indian National Centre for Ocean Information Services
Ministry of Earth Sciences, Government of India
"Ocean Valley"
P.B. 21, IDA, Jeedimetla P.O.
Hyderabad 500 055
India
Tel: +91 40 23895006 +91 40 23886006
Fax: +91 40 23895001
Email: srinivas@incois.gov.in

Ms Irina RAFLIANA
Coordinator Community Preparedness Program (COMPRESS) -LIPI
Research Center for Oceanography; Indonesian Institute of Sciences
(LIPI – Lembaga Ilmu Pengetahuan Indonesia)
Jl. Raden Saleh No. 43 Jakarta Pusat 10330
Jakarta
Indonesia
Tel: +62 813 10332282
Fax: +62 21 3901214
Email: irina_rafliana@hotmail.com

Prof Mario RUIVO
Portuguese Committee for IOC
Av. Infante Santo - 42/4th Floor
1350 Lisbon
Portugal
Email: cointersec.presid@fct.mctes.pt

IOC SECRETARIAT

Mr. Bernardo ALIAGA
Technical Secretary ICG-CARIBE-EWS
IOC Tsunami Unit
Intergovernmental Oceanographic Commission (IOC)
1 Rue Miollis
75732 París, France
Tel: (33) 1 456 83 980
Fax: (33) 1 456 85 810
E-mail: b.aliaga@unesco.org

Mr Tony ELLIOTT
Head of ICG/IOTWS Secretariat,
IOC Perth Regional Programme Office
c/o Bureau of Meteorology
PO Box 1370, West Perth
1100 Hay Street
Perth WA 6872
Australia
Tel: +61 8 9226 0191
Fax: +61 8 9263 2211
E-mail: t.elliott@unesco.org

Thomas GROSS
Programme Specialist
Intergovernmental Oceanographic Commission of UNESCO
1 rue Miollis
75732 Paris cedex 15
France
Tel: +33 1 45 68 39 92
Fax: +33 1 45 68 58 12
Email: t.gross@unesco.org

Dr Peter KOLTERMANN
Head of Section, Tsunami Unit
Intergovernmental Oceanographic Commission of UNESCO
1 rue Miollis
75732 Paris cedex 15
France
Tel: +33 1 45 68 40 15
Fax: +33 1 45 68 58 10
E-mail: p.koltermann@unesco.org

OBSERVERS

Hugo ALMEIDA
Gabinete do Secretário de Estado da Protecção Civil
Praça do Comércio – Ala Oriental
1149-018 Lisboa
Lisboa
Portugal
Tel: + 351 21 323 2259
Fax: + 351 21 886 3795
Email: hugo.almeida@mai.gov.pt

Prof Maria Ana BAPTISTA
Professor
1700 Lisboa
Portugal
Tel: +351217500809
Email: mavbaptista@gmail.com

Fernando CARRILHO
Head of Seismology Department
Instituto de Meteorologia
Rua C - Aeroporto de Lisboa
1749-077 Lisbon
Portugal
Email: fernando.carrilho@meteo.pt

Luís MATIAS
Portugal
Email: lmatias@fc.ul.pt

Dr. Frederico NASCIMENTO
Chefe da Divisão do SPM/DGPE
Ministério dos Negócios Estrangeiros
Largo do Rilvas
1350-179 Lisboa
Lisboa
Portugal
Tel: + 351 21 394 6590
Fax: + 351 21 394 6073
Email: frederico.nascimento@mne.pt

Patrícia PIRES
Chefe do Núcleo de Riscos e Alerta
Autoridade Nacional de Protecção Civil, Headquarters
Av do Forte em Carnaxide
2794-12 Carnaxide
Portugal
Email: patricia.pires@prociv.pt

Prof Teresa De Jesus LOPES FERREIRA
Centro de Vulcanologia e Avaliação de Riscos Geológicos, Universidade dos Açores
Edifício do Complexo Científico, Ala Sul, 3º Andar
Rua Mãe de Deus
Ponta Delgada
Açores
Portugal
Tel: + 351 296 650 147
Fax: + 351 296 650 142
Email: teresa.jl.ferreira@azores.gov.pt

LCDR José ONOFRE
Head of Oceanography Division
1249-093 Lisbon
Portugal
Tel: +351 210943042
Fax: +351 210943299
Email: mesquita.onofre@hidrografico.pt

ANNEX VII

LIST OF ACRONYMS

CARIBE-EWS	Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
CTBTO	Comprehensive Test Ban Treaty Organisation
DBCP	Data Buoy Cooperation Panel
GLOSS	Global Sea-Level Observing System
GOOS	Global Ocean Observing System
GTS	Global Telecommunication System
ICAM	Integrated Coastal Area Management Programme
ICG	Intergovernmental Coordination Group
I-GOOS	Intergovernmental IOC-WMO-UNEP Committee for GOOS
IHO	International Hydrographic Office
IPHAB	Intergovernmental Panel on Harmful Algal Blooms (IPHAB)
IODE	IOC International Oceanographic Data and Information Exchange
IOTWS	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System
ISDR	Un International Strategy for Disaster Reduction
JCOMM	WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NTWC	National Tsunami Warning Center
NTWFP	National Tsunami Warning Focal Point
PTWS	Pacific Tsunami Warning and Mitigation System (formerly ITSU)
RTWC	Regional Tsunami Warning Centre
TSU	Tsunami Coordination Unit
TOWS-WG	Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems
TWFP	Tsunami Warning Focal Point
TWS	Tsunami Warning System
WG	Working Group
WMO	World Meteorological Organization

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans S. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' ***(Also printed in Spanish)***
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping ***(Also printed in French and Spanish)***
12. Joint 100-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica ***(Spanish only)***
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources ***(Also printed in French and Spanish)***
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans ***(Also printed in French)***
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities ***(Also printed in Spanish)***
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CCPS Working Group on the Investigations of 'El Niño' (***Also printed in Spanish)***
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. Cancelled
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic ***(Also printed in French)***
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico ***(Also printed in Spanish)***
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications

60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans ***(Also printed in French)***
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' ***(Spanish only)***
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico ***(Also printed in Spanish)***
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
78. Third Session of the IOC Group of Experts on the Global Sea-level Observing System
79. Third Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
80. Fourteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
81. Fifth Joint IOG-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of climate Change on Coral Reefs
83. Seventh Session of the JSC Ocean Observing System Development Panel
84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region
92. Fifth Session of the Joint IOC-JGOFS CO, Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System
97. Joint Meeting of GEMSI and GEEP Core Groups
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans
104. Fifth Session of the IOC Consultative Group on Ocean Mapping
105. Fifth Session of the IODE Group of Experts on Marine Information Management
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GLOSS
109. Second Session of the Strategy Subcommittee (SSC) of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System
110. Third Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
111. First Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate
112. Sixth Session of the Joint IOC-JGOFS C02 Advisory Panel Meeting
113. First Meeting of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS)
114. Eighth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño" ***(Spanish only)***
115. Second Session of the IOC Editorial Board of the International Bathymetric Chart of the Central Eastern Atlantic ***(Also printed in French)***
116. Tenth Session of the Officers Committee for the Joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO), USA, 1996
117. IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Fifth Session, USA, 1997
118. Joint Scientific Technical Committee for Global Ocean Observing System (J-GOOS), Fourth Session, USA, 1997
199 First Session of the Joint 100-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel, South Africa, 1997
120. Report of Ocean Climate Time-Series Workshop, Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, USA, 1997
121. IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS), Second Session, Thailand, 1997

122. First Session of the IOC-IUCN-NOAA *Ad hoc* Consultative Meeting on Large Marine Ecosystems (LME), France, 1997
123. Second Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), South Africa, 1997
124. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, Colombia, 1996 ***(also printed in Spanish)***
125. Seventh Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Ireland, 1997
126. IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), First Session, France, 1997
127. Second Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 1998
128. Sixth Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1997
129. Sixth Session of the Tropical Atmosphere - Ocean Array (TAO) Implementation Panel, United Kingdom, 1997
130. First Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 1998
131. Fourth Session of the Health of the Oceans (HOTO) Panel of the Global Ocean Observing System (GOOS), Singapore, 1997
132. Sixteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), United Kingdom, 1997
133. First Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1998
134. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IOC/EB-IBCWIO-IW3), South Africa, 1997
135. Third Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), France, 1998
136. Seventh Session of the Joint IOC-JGOFS C02 Advisory Panel Meeting, Germany, 1997
137. Implementation of Global Ocean Observations for GOOS/GCOS, First Session, Australia, 1998
138. Implementation of Global Ocean Observations for GOOS/GCOS, Second Session, France, 1998
139. Second Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Brazil, 1998
140. Third Session of IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), China, 1998
141. Ninth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Ecuador, 1998 ***(Spanish only)***
142. Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Croatia, 1998
143. Seventh Session of the Tropical Atmosphere-Ocean Array (TAO) Implementation Panel, Abidjan, Côte d'Ivoire, 1998
144. Sixth Session of the IODE Group of Experts on Marine Information Management (GEMIM), USA, 1999
145. Second Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), China, 1999
146. Third Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Ghana, 1999
147. Fourth Session of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC); Fourth Session of the WCRP CLIVAR Upper Ocean Panel (UOP); Special Joint Session of OOPC and UOP, USA, 1999
148. Second Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1999
149. Eighth Session of the Joint IOC-JGOFS CO2 Advisory Panel Meeting, Japan, 1999
150. Fourth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Japan, 1999
151. Seventh Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1999
152. Sixth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), France, 1999
153. Seventeenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), Canada, 1999
154. Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y el Golfo de Mexico (IBCCA), Septima Reunión, Mexico, 1998
IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA), Seventh Session, Mexico, 1998
155. Initial Global Ocean Observing System (GOOS) Commitments Meeting, IOC-WMO-UNEP-ICSU/Impl-III/3, France, 1999
156. First Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Venezuela, 1999 ***(also printed in Spanish and French)***
157. Fourth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), China, 1999
158. Eighth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Russian Federation, 1999
159. Third Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), Chile, 1999
160. Fourth Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS). Hawaii, 2000
161. Eighth Session of the IODE Group of Experts on Technical Aspects of Data Exchange, USA, 2000
162. Third Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 2000
163. Fifth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Poland, 2000
164. Third Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 2000
165. Second Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Cuba, 2000 ***(also printed in Spanish and French)***
166. First Session of the Coastal Ocean Observations Panel, Costa Rica, 2000
167. First GOOS Users' Forum, 2000
168. Seventh Session of the Group of Experts on the Global Sea Level Observing System, Honolulu, 2001
169. First Session of the Advisory Body of Experts on the Law of the Sea (ABE-LOS), France, 2001 ***(also printed in French)***
170. Fourth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, Chile, 2001
171. First Session of the IOC-SCOR Ocean CO_2 Advisory Panel, France, 2000
172. Fifth Session of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Norway, 2000 ***(electronic copy only)***
173. Third Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, USA, 2001 ***(also printed in Spanish and French)***
174. Second Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Italy, 2001
175. Second Session of the Black Sea GOOS Workshop, Georgia, 2001
176. Fifth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2000
177. Second Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Morocco, 2002 ***(also printed in French)***
178. Sixth Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Australia, 2001 ***(electronic copy only)***
179. *Cancelled*

180. Second Session of the IOC-SCOR Ocean CO_2 Advisory Panel, Honolulu, Hawaii, U.S.A, 2002 ***(electronic copy only)***

181. IOC Workshop on the Establishment of SEAGOOS in the Wider Southeast Asian Region, Seoul, Republic of Korea, 2001 (SEAGOOS preparatory workshop) ***(electronic copy only)***

182. First Session of the IODE Steering Group for the Resource Kit, USA, 19–21 March 2001

183. Fourth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), France, 2002

184. Seventh Session of the IODE Group of Experts on Marine Information Management (GEMIM), France, 2002 ***(electronic copy only)***

185. Sixth Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2001 ***(electronic copy only)***

186. First Session of the Global Ocean Observing System (GOOS) Capacity Building Panel, Switzerland, 2002 ***(electronic copy only)***

187. Fourth Session of the ad hoc Advisory Group for IOCARIBE-GOOS, 2002, Mexico ***(also printed in French and Spanish)***

188. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IBCWIO), Mauritius, 2000

189. Third session of the Editorial Board for the International Bathymetric Chart of the Western Pacific, Chine, 2000

190. Third Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Vietnam, 2002

191. Eighth Session of the IOC Consultative Group on Ocean Mapping, Russian Federation, 2001

192. Third Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Lisbon, 2003 ***(also printed in French)***

193. Extraordinary Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Chile, 1999 ***(Spanish only; electronic copy only)***

194. Fifth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, France, 2002

195. Sixth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, South Africa, 2003

196. Fourth Session of the Coastal Ocean Observations Panel, South Africa, 2002 ***(electronic copy only)***

197. First Session of the JCOMM/IODE Expert Team On Data Management Practices, Belgium, 2003 *(also JCOMM Meeting Report No. 25)*

198. Fifth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), Paris, 2003

199. Ninth Session of the IOC Consultative Group on Ocean Mapping, Monaco, 2003 ***(Recommendations in English, French, Russian and Spanish included)***

200. Eighth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), France, 2003 ***(electronic copy only)***

201. Fourth Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Greece, 2004 ***(also printed in French)***

202. Sixth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), Paris, 2004 ***(electronic copy only)***

203. Fifth Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Argentina, 2005 ***(also printed in French)***

204. Ninth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), France, 2005 ***(electronic copy only)***

205. Eighth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), China, 2003 ***(electronic copy only)***

206. Sixth Meeting of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Spain, 2006 ***(also printed in French)***

207. Third Session of the Regional Forum of the Global Ocean Observing System, South Africa, 2006 ***(electronic copy only)***

208. Seventh Session of the IOC-UNEP-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), Paris, 2005 ***(electronic copy only)***

209. Eighth Session of the IOC-UNEP-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), Paris, 2006 ***(electronic copy only)***

210. Seventh Meeting of the IOC Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Gabon, 2007 ***(bilingual English/French)***

211. First Meeting of the IOC Working Group on the Future of IOC, Paris, 2008 ***(Executive Summary in English, French, Russian and Spanish included)***

212. First meeting of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), Paris, 3–4 April 2008 ***(Executive Summary in English, French, Russian and Spanish included)***

213. First Session of the Panel for Integrated Coastal Observation (PICO-I), Paris, 10–11 April 2008 ***(electronic copy only)***

214. Tenth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), Paris, 6–8 June 2007 ***(electronic copy only)***

215. Eighth Meeting of the IOC Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Paris, 21–25 April 2008 ***(bilingual English/French)***

216. Fourth Session of the Global Ocean Observing System (GOOS) Regional Alliances Forum (GRF), Guayaquil, Ecuador, 25–27 November 2008 ***(electronic copy only)***

217. Second Session of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), Paris, 27 March 2009 ***(Executive Summary in English, French, Russian and Spanish included)***

218. Ninth Meeting of the IOC Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Paris, 30 March–3 April 2009 ***(bilingual English/French)***

219. First Session of the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) Scientific Steering Group (also IOCCP Reports, 3), Broomfield, Colorado, U.S.A., 1 October 2005 ***(electronic copy only)***

220. Second Session of the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) Scientific Steering Group (also IOCCP Reports, 6), Paris, France, 20 April 2007 ***(electronic copy only)***

221. Third Session of the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) Scientific Steering Group (also IOCCP Reports, 10), Villefranche-sur-mer, France, 3–4 October 2008 ***(electronic copy only)***

222. Fourth Session of the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) Scientific Steering Group (also IOCCP Reports, 15), Jena, Germany, 14 September 2009 ***(electronic copy only)***

223. First Meeting of the joint IOC-ICES Study Group on Nutrient Standards (SGONS) (also IOCCP Reports, 20), Paris, France, 23–24 March 2010 *(Executive Summary in E, F, R, S included)*

224. Third Session of the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG), Lisbon, Portugal, 5–6 May 2010 ***(Executive Summary in English, French, Russian and Spanish included)***