OECD Workshop on Anticipation and Preparation for Emerging Critical Risks
17-18 June 2024, ISO HQs, Geneva, Switzerland

Monitoring global risks: picking up weak signals, and improving international coordination and communication – the global tsunami warning and mitigation system

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Intergovernmental Oceanographic Commission

Mr. Bernardo Aliaga, Head of the Tsunami Resilience Section, Intergovernmental Oceanographic Commission, United Nations Education Scientific and Cultural Organisation

We have gone a long way…

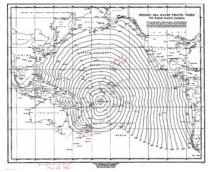
1948 the **Honolulu Magnetic Observatory**, under the US Coast and Geodetic Survey (USCGS)established

1952. The Japan Meteorological Agency started its national tsunami warning center

1965 - IOC Working Group on the International Aspects of the Tsunami Warning System in the Pacific, organized by the USCGS on behalf of the IOC, Honolulu, 27-30 April 1965

ITSU development

ITSU
IOC/IV-6, International Aspects of the Tsunami Warning System in the Pacific, Paris, November 1965



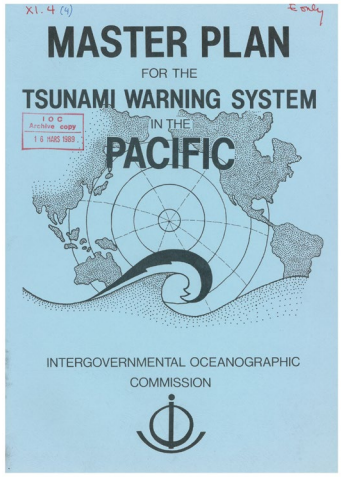
1965

The Honolulu Observatory renamed Pacific Tsunami Warning Center PTWC

1977

1989

First Master Plan



The tragedy brings world attention to the dangers of tsunamis in every nation and initiates the development of warning and mitigation systems in the Indian Ocean

Indian Ocean Tsunami

2004

2005

3 ICGs established

Indian Ocean (ICG/IOTWS), Caribbean and Adjacent Seas (ICG/CARIBE-EWS), Mediterranean and North Atlantic (ICG/NEAMTWS) (IOC/XXIII-11, 12, 13, **June 2005**)

ITSU renamed

September 2005, Vina del Mar, Chile

The 20th Session of the ICG/PTWS-XX decides to change its name to the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

nature

6 January 2005 Volume 433 Issue no 7021

A divided world

The lack of preparation for last month's tsunami illustrates shocking disparities in how science is applied in different regions of the world. The global response to the disaster offers a glimmer of hope that these disparities will be addressed.

As the full horror of the Asian tsunami sinks in, the reactions of scientists echo those of the population as a whole. These range from a sense of hopelessness in the face of nature's power to concern for the victims and a determination that their suffering should be addressed.

The Indian Ocean tsunami of 26 December 2004 occurred at about 01:00 GMT, when the Indian tectonic plate moved underneath the neighbouring Burma microplate, raising it by about 10 metres along a length of more than 1,000 km and sending a wave propagating through the full depth of the overlying ocean at high speed. With wavelengths much larger than the depth of the ocean, such waves propagate across the great distances of the open sea without much surface perturbation and with very little energy loss, until shallower coastal shelves slow the wave and increase its amplitude — resulting, in this case, in a calamity of biblical proportions.

Such disasters have always been with us, but this particular event (see News, pages 3–5) had some characteristics that cry out for a global response that is more emphatic and sustained than a brief outburst of charity.

The most distinctive of these characteristics is the uneasy feeling, prompted by the delayed action of the tsunami, that a great deal of the suffering could have been avoided. Much of the damage, after all, occurred in Sri Lanka and on India's eastern coast about two hours after an earthquake had triggered the tsunami in the ocean. Monitoring stations in Japan and the United States, for example, had been able to observe the event in real time and yet apparently could do nothing — despite the ubiquity of modern telecommunications — to warn victims of the impending risk.

It turns out, on closer examination, that not all of this is true. The size of the earthquake wasn't apparent at first glance: early estimates put it at magnitude 8, which is not exceptional for submarine quakes and is an order of magnitude smaller than the eventual value of 9 that made this the world's largest seismic event for 40 years. And, in the absence of an ocean-based monitoring system, remote seismologists did not know that the quake had triggered a tsunami. Many researchers who were alerted to the event in the United States on their Christmas night, for example, went to bed quite oblivious to the carnage that was unfolding as they slept.

Additionally, as the awful scale of the disaster slowly emerged from remote regions of western Indonesia, it has become clear that most of the death and destruction had occurred in a region that was too close to the epicentre of the event for warnings to have made much difference.

Neglect

Nonetheless, an effective warning system, allied to a public education campaign of the sort that has already taken place around the Pacific Ocean, could have reduced the scale of the disaster.

It is clear, with the benefit of hindsight, that the arcane international bodies that manage tsunami protection have been neglected and underfunded for many years. Most of them have focused on the Pacific Ocean, and occasional attempts to widen their brief to the Indian Ocean have been rebuffed.

A master plan prepared in 1999 by ITSU, one of the international organizations that plans for the monitoring of tsunamis, stated: "Tsunami hazards exist on both sides of the Atlantic Ocean, in the eastern Indian Ocean, and in the Mediterranean, Caribbean, and Black Seas. Efforts to establish warning centers in those areas should be encouraged."

An important reason for the previous confinement of monitoring systems to the Pacific has been the occurrence of two tsunamis in the Pacific quite recently, in 1960 and 1964. The last tsunami produced by an earthquake in the Indian Ocean is thought to have occurred back in 1833.

However, the most important differentiating factor has been the readiness of 'Pacific rim' nations such as Japan, Australia and the United States to support a cheap but potentially effective system for monitoring and for educating the public about an infrequent risk. India, Indonesia and the other nations on the Indian Ocean's rim are relatively poor countries with needs that seemed more pressing than that of planning against the remote — but nonetheless inevitable — prospect of a tsunami.

Pushing for change

A great amount could have been done at relatively little expense to plan for a tsunami, however. The most important component of such preparation is public education, so that local inhabitants are aware, for example, of the fact that a dramatic recession of the ocean is in itself a warning of an impending event. The next most important component is the construction of a simple network that will quickly convey warning information from the seismological stations to some central point (such as the Pacific Tsunami Warning Center in Hawaii) and back out again to local radio and television channels, perhaps using siren systems in regions that can afford them.

Some of this will doubtless now take place — and so it must. As earthquake-mitigation programmes in Japan and California have shown, we can avoid vast carnage in the face of major natural disruptions. Scientists have a role to play in this. Biomedical researchers have taken global initiatives to address preventable deaths from tropical diseases that might otherwise be ignored. In the same spirit, Earth scientists around the world must now press even harder for resources in rich countries to be brought to bear to confront the risks of natural disasters in poor countries.

The same communications technologies that could have helped to mitigate this disaster have, instead, brought it home relentlessly to our living rooms. The science behind the event has been busily and prominently displayed for all to see — alongside the consequences of inaction in the face of well-established risks.

Is it too much to expect that people in rich countries, when confronted with evidence on such a scale, will ask that their governments start to pay modest respect to the value of human life amongst the poor, and adjust their budgetary priorities accordingly? Scientists, at least, should argue for a strengthening of research priorities that reflect the needs not of well-protected interest groups in their own nations, but of humanity itself. ■

UNESCO/IOC Tsunami Coordination Unit 2005

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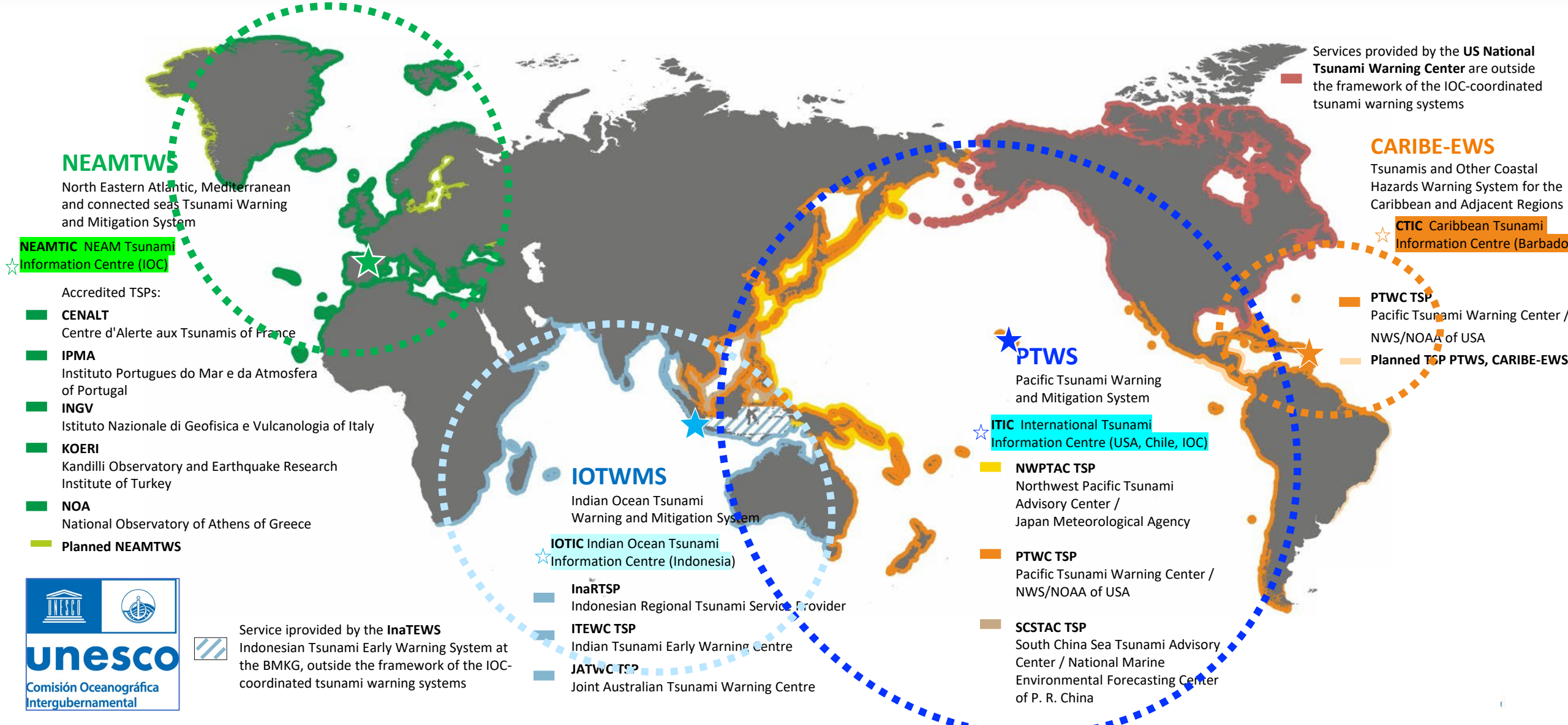
GLOBAL TSUNAMI WARNING AND MITIGATION SYSTEM

Intergovernmental Oceanographic Commission of UNESCO
2024 www.ioc-tsunami.org



NEAMTWS

North Eastern Atlantic, Mediterranean and connected seas Tsunami Warning and Mitigation System

NEAMTIC NEAM Tsunami Information Centre (IOC)

Accredited TSPs:

- **CENALT** Centre d'Alerte aux Tsunamis of France
- **IPMA** Instituto Portugues do Mar e da Atmosfera of Portugal
- **INGV** Istituto Nazionale di Geofisica e Vulcanologia of Italy
- **KOERI** Kandilli Observatory and Earthquake Research Institute of Turkey
- **NOA** National Observatory of Athens of Greece
- **Planned NEAMTWS**

IOTWMS

Indian Ocean Tsunami Warning and Mitigation System

IOTIC Indian Ocean Tsunami Information Centre (Indonesia)

- **InaRTSP** Indonesian Regional Tsunami Service Provider
- **ITEWC TSP** Indian Tsunami Early Warning Centre
- **JATWC TSP** Joint Australian Tsunami Warning Centre

Service iprovided by the **InaTEWS** Indonesian Tsunami Early Warning System at the BMKG, outside the framework of the IOC-coordinated tsunami warning systems

PTWS

Pacific Tsunami Warning and Mitigation System

ITIC International Tsunami Information Centre (USA, Chile, IOC)

- **NWPTAC TSP** Northwest Pacific Tsunami Advisory Center / Japan Meteorological Agency
- **PTWC TSP** Pacific Tsunami Warning Center / NWS/NOAA of USA
- **SCSTAC TSP** South China Sea Tsunami Advisory Center / National Marine Environmental Forecasting Center of P. R. China

Services provided by the **US National Tsunami Warning Center** are outside the framework of the IOC-coordinated tsunami warning systems

CARIBE-EWS

Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions

CTIC Caribbean Tsunami Information Centre (Barbado

- **PTWC TSP** Pacific Tsunami Warning Center / NWS/NOAA of USA
- **Planned TSP PTWS, CARIBE-EWS**

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Comisión Oceanográfica Intergubernamental

United Nations Educational, Scientific and Cultural Organization
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The Director-General

Reference: DG/05/001

3 January 2005

Mr Secretary-General,

Permit me to begin by sharing with you my heartfelt regret at the devastating loss of life and destruction that occurred in the Indian Ocean region following the earthquake and tsunami of 26 December 2004. Let me assure you that UNESCO stands ready to cooperate with its sister agencies within the United Nations system to respond in all ways necessary.

As you are already aware, UNESCO and its Intergovernmental Oceanographic Commission (IOC) have extensive experience in the three component parts of the disaster reduction cycle - warning, mitigation and preparedness. In this regard, I would make particular reference to the Tsunami Warning System for the Pacific Region, established and coordinated by UNESCO since 1968. This early-warning system, which has been much-mentioned in the media in recent days, operates by ensuring that tsunami watches, warning and advisory bulletins are rapidly disseminated throughout the Pacific to the 26 States that constitute its membership. Furthermore, the System has a strong educational, awareness-raising and preparedness focus, both at the governmental and general public levels.

The UNESCO/IOC International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) has advocated for the establishment of similar early warning systems in other regions of the world, including the Indian Ocean. However, given that the risk of tsunamis is comparatively low in those regions, it has been difficult to mobilise the necessary support for such a project. The tragic events of the Indian Ocean compel us to recognise that tsunamis can occur at any time and almost anywhere, causing death and destruction both locally and across oceans thousands of miles away. We must therefore accept that the establishment of a global tsunami warning system is now a priority for the international community.

Mr Kofi A. Annan
Secretary-General
United Nations
New York
NY 10017
United States of America

The special ASEAN Leaders' Meeting on the Aftermath of the Earthquake and Tsunami, due to begin in Jakarta on 6 January 2005, takes on a special significance. It is my sincere hope that you will be able to convey to those gathered the urgency of establishing tsunami warning systems, both at the regional and global levels, and inform them of the role that the United Nations system can play in general, and UNESCO and its IOC in particular. With regard to the specific contribution of UNESCO and its IOC in the context of such an initiative, I enclose herewith some documentation for your perusal.

Allow me to reiterate UNESCO's readiness to contribute to the United Nations-wide response, drawing upon its long-established experience and expertise in this area.

Yours sincerely,

Koïchiro Matsuura

United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture
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The Director-General

Reference: DG/2.5/471

- 2 NOV 2005

Sir,

Following the kind offer of the Government of Italy, it is my pleasure to inform you that the first meeting of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) will take place on 21 and 22 November 2005 in Rome, Italy.

As you are no doubt aware, at its 23rd Assembly from 21 to 30 June 2005, UNESCO's Intergovernmental Oceanographic Commission (IOC) decided through Resolution XXIII-14 to establish the ICG/NEAMTWS, in line with the guidance of the World Conference on Disaster Reduction held in Kobe, Hyogo, Japan from 18 to 22 January 2005, and the Hyogo Framework for Action 2005-2015 adopted by the World Conference.

Therefore, I am pleased to invite you to participate in the first meeting of the Intergovernmental Coordination Group. I would be grateful if you would submit in writing to the IOC Executive Secretary the name of the designated authority acting as National Tsunami Focal Point in your country with official responsibility to receive tsunami and other coastal hazard-related information bulletins and warning guidance. Kindly also provide the name of the institution or organization acting as National Tsunami Warning Centre for the issuance of warnings and related information, or with responsibility for the development of such capabilities.

When selecting your official contact point for the receipt of tsunami and other coastal hazard-related information bulletins and warning guidance, please bear in mind that two authorities may be designated, one of them acting as alternate focal point. Relevant fax numbers and email addresses must be provided in addition to the requisite telephone numbers. Nominated contacts should be available for contact twenty-four hours per day, seven days per week.

In order to facilitate the provision of the above-mentioned information, a form is enclosed with this letter. It should be sent duly completed, no later than 10 November 2005, directly to Mr Patricio Bernal, Assistant Director-General, UNESCO, Executive Secretary, IOC by email (p.bernal@unesco.org), with a copy to Mr Stefano Belfiore, (s.belfiore@unesco.org, Tel: +33 (0) 1 45 68 40 68, Fax: +33 (0) 1 45 68 58 10 (or 12)) IOC's Programme Specialist.

Accept, Sir, the assurances of my highest consideration.

Koïchiro Matsuura

Encl: Contact information form
Resolution IOC-XXIII-14

COMMUNICATIONS METHODS

For each Agency that should receive tsunami advisory information, kindly provide the following information:

Country:

National contact point:

Station Location (of National contact point)

Latitude: (minus=S):
Longitude: (minus=W):

Telephone numbers

24 Hr Phone:
1st alternate (phone):
2nd alternate: (phone):

FAX:

TELEX:

EMAIL:

Preferred methods to receive tsunami advisory information

Method(*) – Primary:

Method(*) – Alternate:

(*) SELECT ONE OF THE FOLLOWING METHODS FOR RECEIPT OF TSUNAMI ADVISORY INFORMATION : GTS – AFTN – TELEX – FAX – EMAIL - EMWIN

Last Update:

Photo 1. Damaged sea level station the day after the 27 February 2010 tsunami, Talcahuano, Chile
Photo by Rodrigo Núñez Gundlach

2010
Chile

Minamisoma, Fukushima prefecture, Japan. 2011 March 11, Mw 9.0, Honshu, Japan earthquake and tsunami. (Credit: AFP/AFP/Getty Images.)

2011 Tōhoku earthquake and tsunami

2011

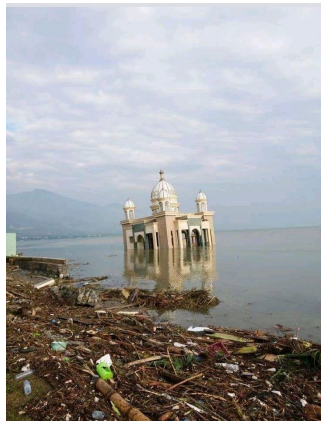
Inter-ICG Task Team on Hazard Assessment Related to Highest Potential Tsunami Source Areas

2016 ->Recent case studies demonstrated complexity and variability, as well as importance of other types of tsunami sources and that earthquake generated Tsunamis can happen in any subduction zones.

2018

Palu, Indonesia

Landslide generated tsunami



December 18, 2018 **December 30, 2018**

Volcano generated tsunami

Sunda strait, Indonesia

2018

Tonga

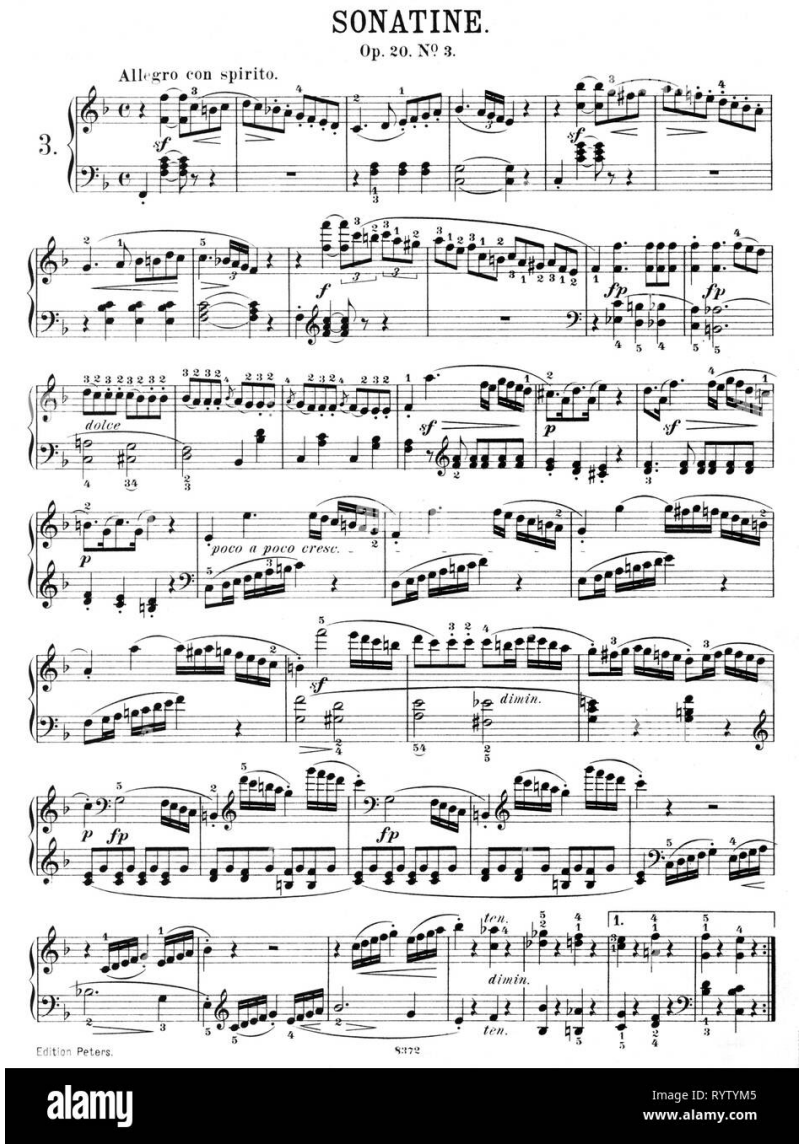
2022

The Group decided to establish a specific Ad Hoc Team on Meteo-tsunamis &Ad Hoc Team on Tsunamis Generated by Volcanoes

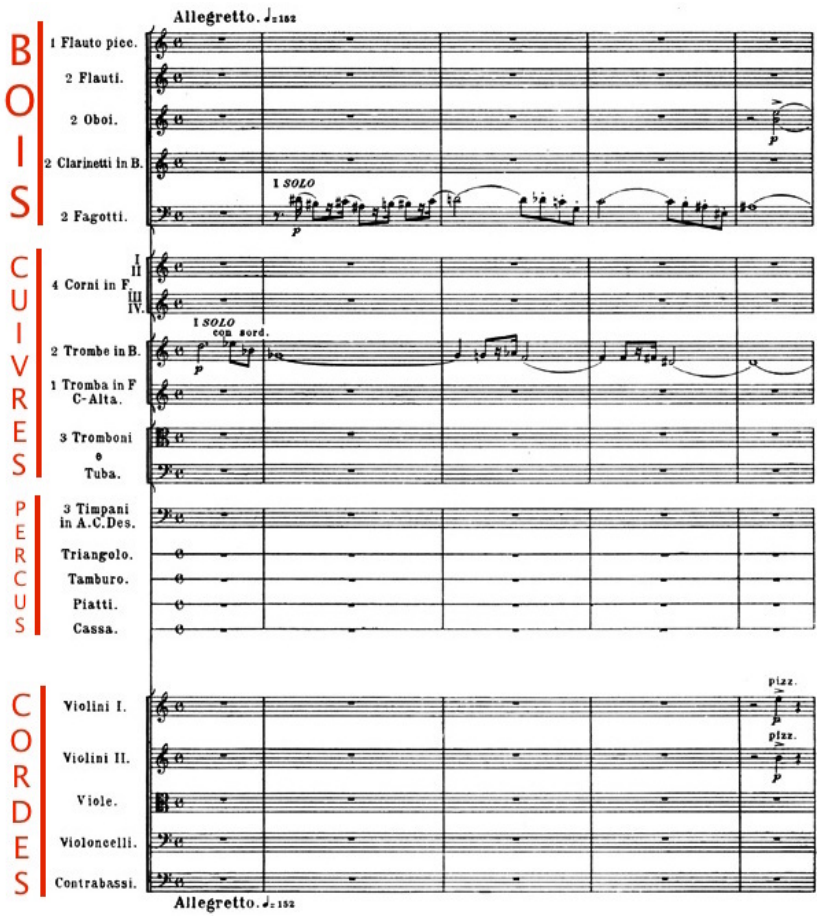
SOPs are like a partiture for an orchestra or a band

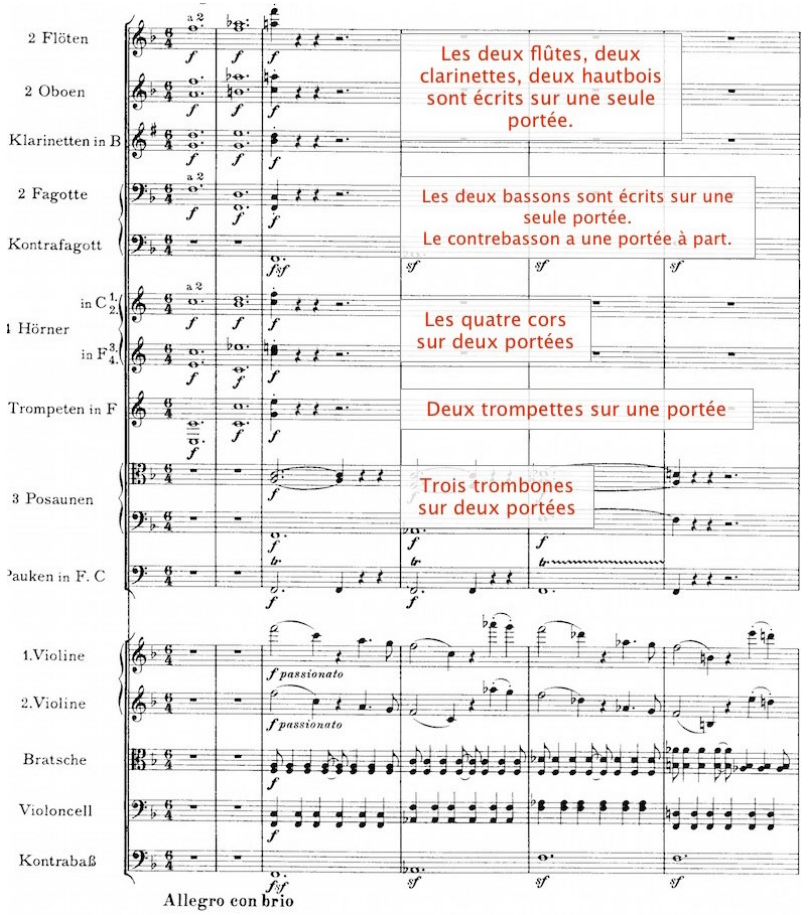
Who does what, when, and how

Simple partiture



Orchestra partiture





Tsunami Warning Centers – IOC Definitions

Tsunami Service Provider (TSP)

Centre that monitors seismic and sea level activity and issues timely tsunami threat information within an ICG framework to National Tsunami Warning Centres/Tsunami Warning Focal Points and other TSPs operating within an ocean basin. The NTWCs/TWFPs may use these products to develop and issue tsunami warning for their countries. TSPs may also issue Public messages for an ocean basin and act as National Tsunami Warning Centres providing tsunami warnings for their own countries. Several ICG Tsunami Service Providers have been established

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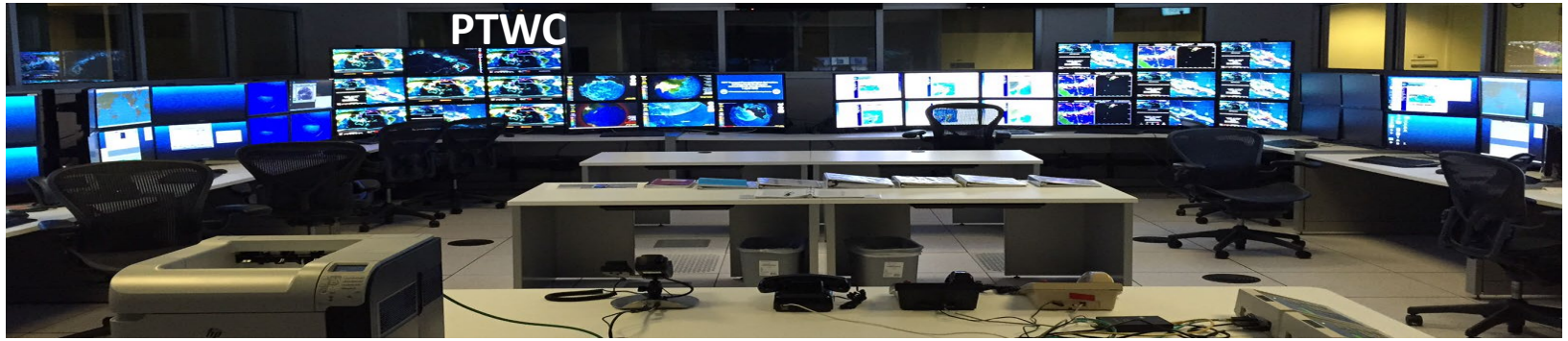

UN OCEAN DECADE TSUNAMI PROGRAMME:

100% AT-RISK COMMUNITIES TSUNAMI READY

	TSUNAMI READY INDICATORS
I	**ASSESSMENT (ASSESS)**
1	**ASSESS-1**. Tsunami hazard zones are mapped and designated.
2	**ASSESS-2**. The number of people at risk in the tsunami hazard zone is estimated.
3	**ASSESS-3**. Economic, infrastructural, political, and social resources are identified.
II	**PREPAREDNESS (PREP)**
4	**PREP-1**. Easily understood tsunami evacuation maps are approved.
5	**PREP-2**. Tsunami information including signage is publicly displayed.
6	**PREP-3**. Outreach and public awareness and education resources are available and distributed.
7	**PREP-4**. Outreach or educational activities are held at least 3 times a year.
8	**PREP-5**: A community tsunami exercise is conducted at least every two years.
III	**RESPONSE (RESP)**
9	**RESP-1**. A community tsunami emergency response plan is approved.
10	**RESP-2**. The capacity to manage emergency response operations during a tsunami is in place.
11	**RESP-3**. Redundant and reliable means to timely receive 24-hour official tsunami alerts are in place.
12	**RESP-4**. Redundant and reliable means to timely disseminate 24-hour official tsunami alerts to the public are in place.

- **STRATEGY:**
  Be Aware, Be Prepared
- **FRAMEWORK:**
  - Harmonized global guidelines UNESCO IOC Tsunami Ready
  - Performance-based Community Recognition
- **ACTION:**
  National programs empower Communities
- **GLOBAL MEASURE**

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Intergovernmental Oceanographic Commission

Standard Guidelines for the Tsunami Ready Recognition Program, UNESCO IOC TS 74

THANK YOU FOR ATTENTION!

QUESTIONS?
COMMENTS?