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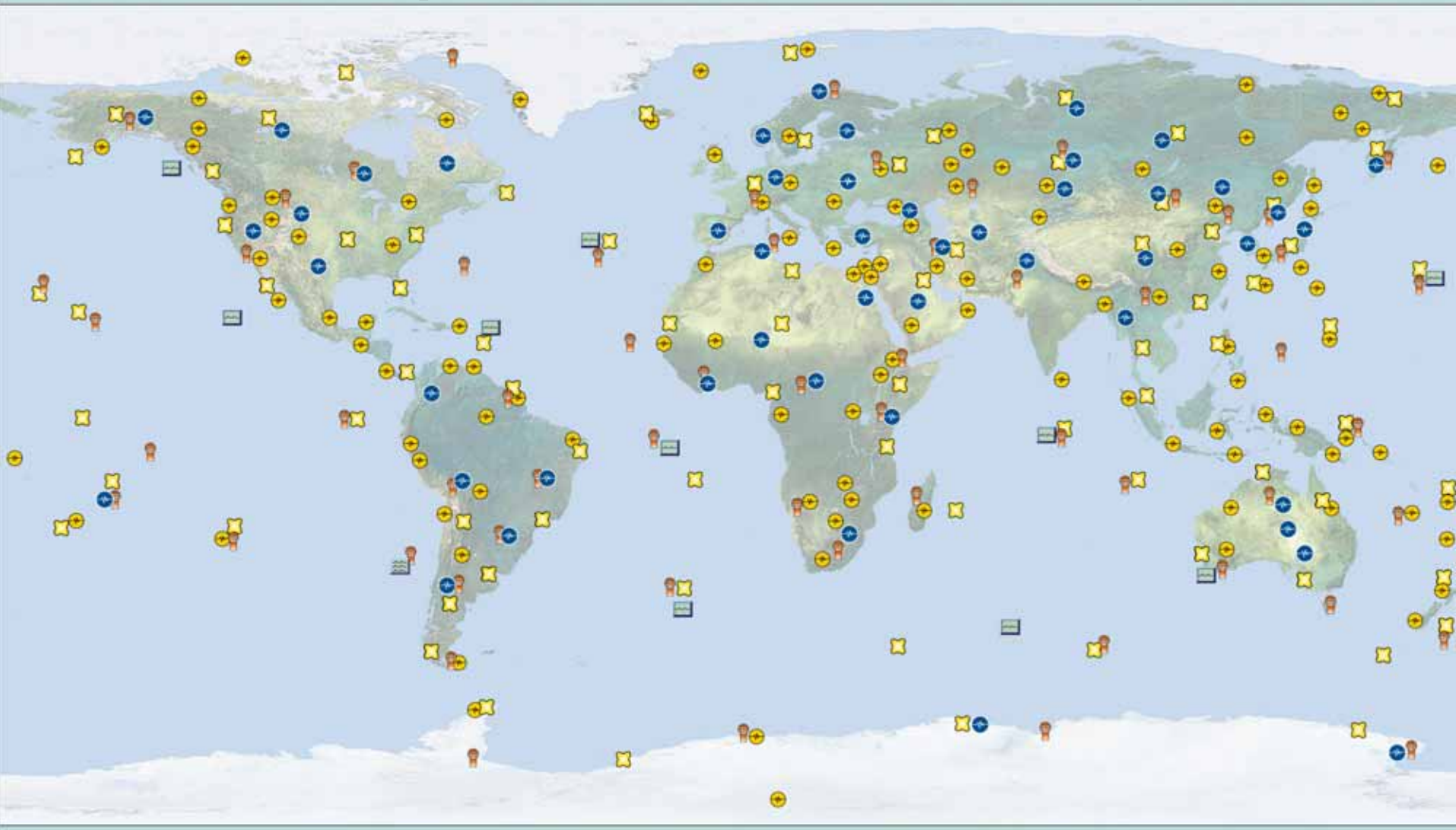
Status of the IMS network: implications for civil and scientific applications

Federico Guendel
Director, International Monitoring System Division

Preparatory Commission for the Comprehensive
Nuclear-Test-Ban Treaty Organization
Provisional Technical Secretariat
Vienna International Centre
P.O. Box 1200
A-1400 Vienna
AUSTRIA
Federico.Guendel@ctbto.org

The Complete IMS Verification System



Seismic Networks

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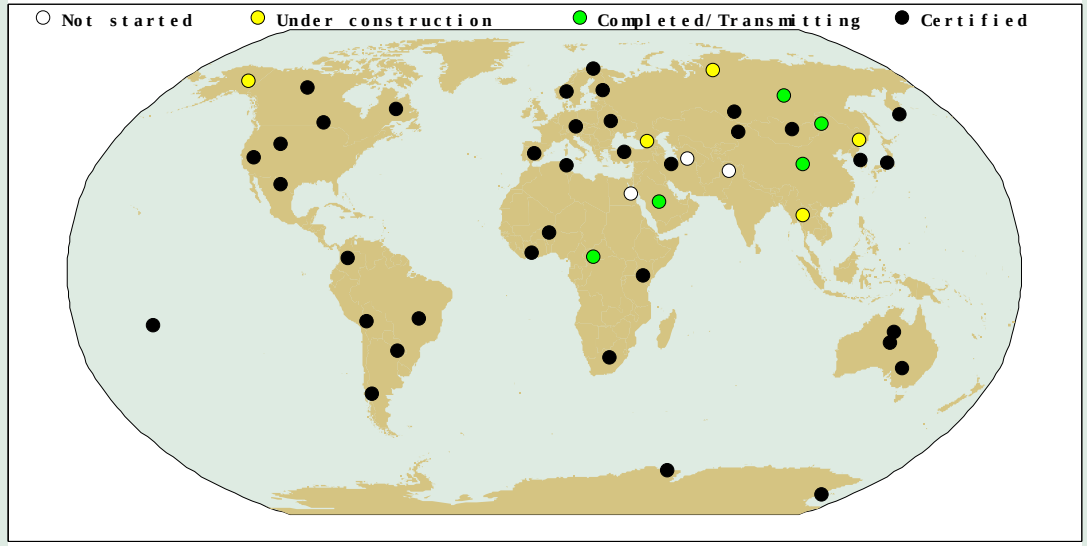
Primary Network

50 primary stations sending data to Vienna in real time, continuous mode

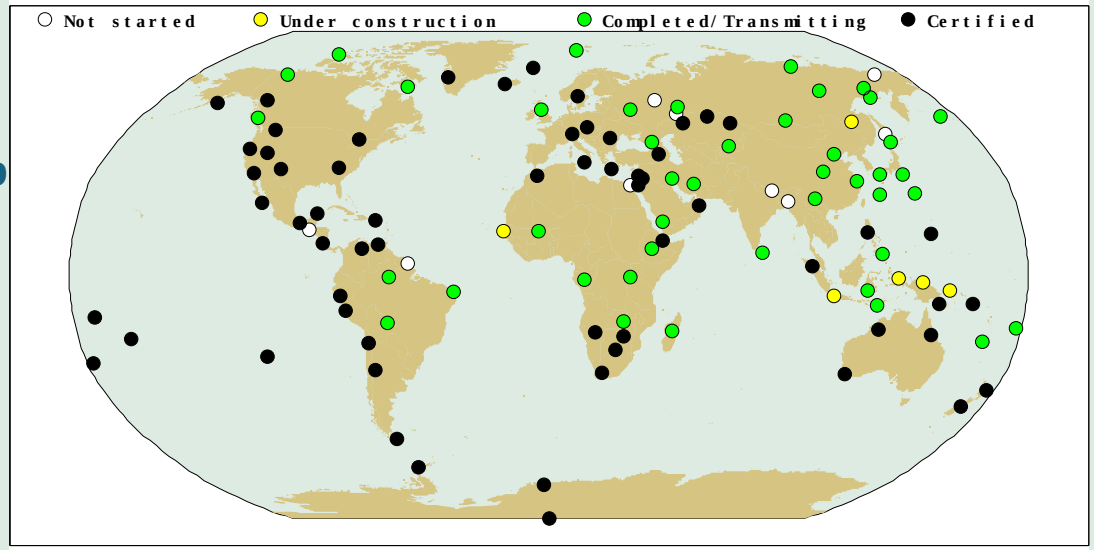
- 30 array stations
- 19 3-C stations
- 1 to be determined
- **41 installations completed**



Auxiliary Network

120 auxiliary stations ready to respond requests from IDC to help characterize the detected event

- 7 array stations
- 112 3-C stations
- 1 to be determined
- **98 installations completed as of 31 Dec. 2006**



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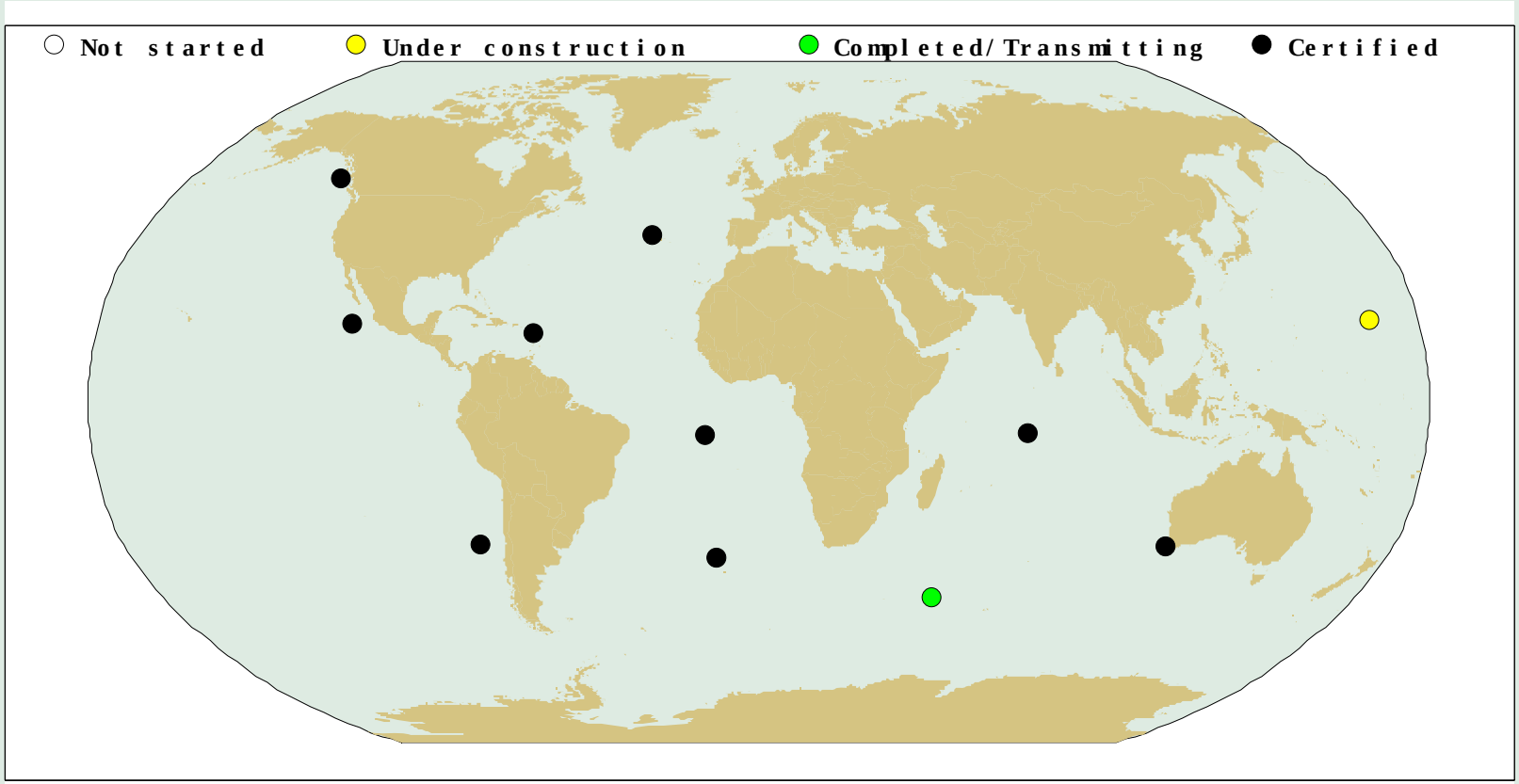
Hydroacoustic Network



As of 31 Dec 2006: 10 (11) stations completed

26 December 2004 Seismic, Hydroacoustic and Tsunami Signal at Diego Garcia

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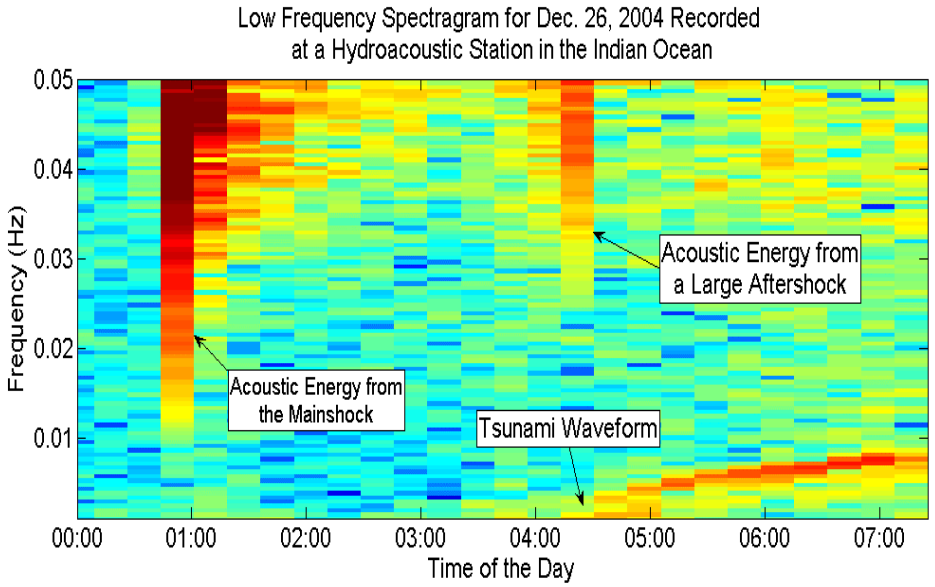
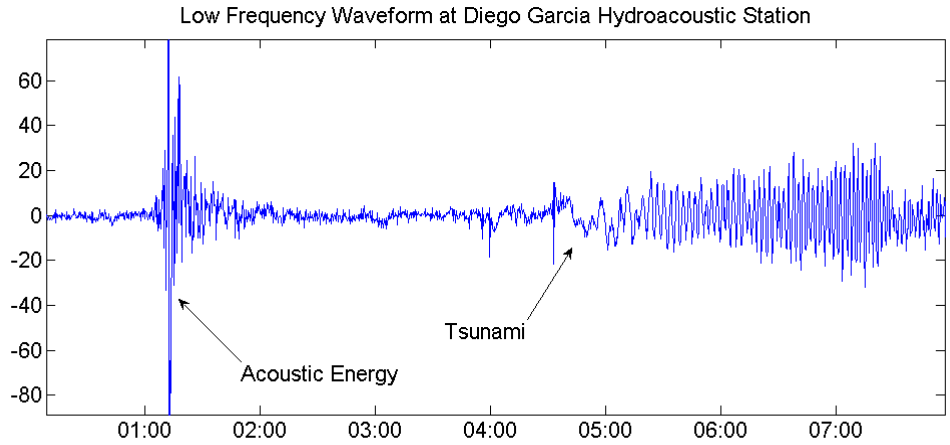
The hydroacoustic station at Diego Garcia recorded the Tsunami Waveform at frequencies of about 0.002 to 0.01 Hz, even though Diego Garcia was not significantly impacted by the tsunami. The water depth at this location is approximately 1500 m.





FK Azimuth variation with time Indicates Rupture Extent

(After C. McCreery, Pacific Tsunami Warning System)

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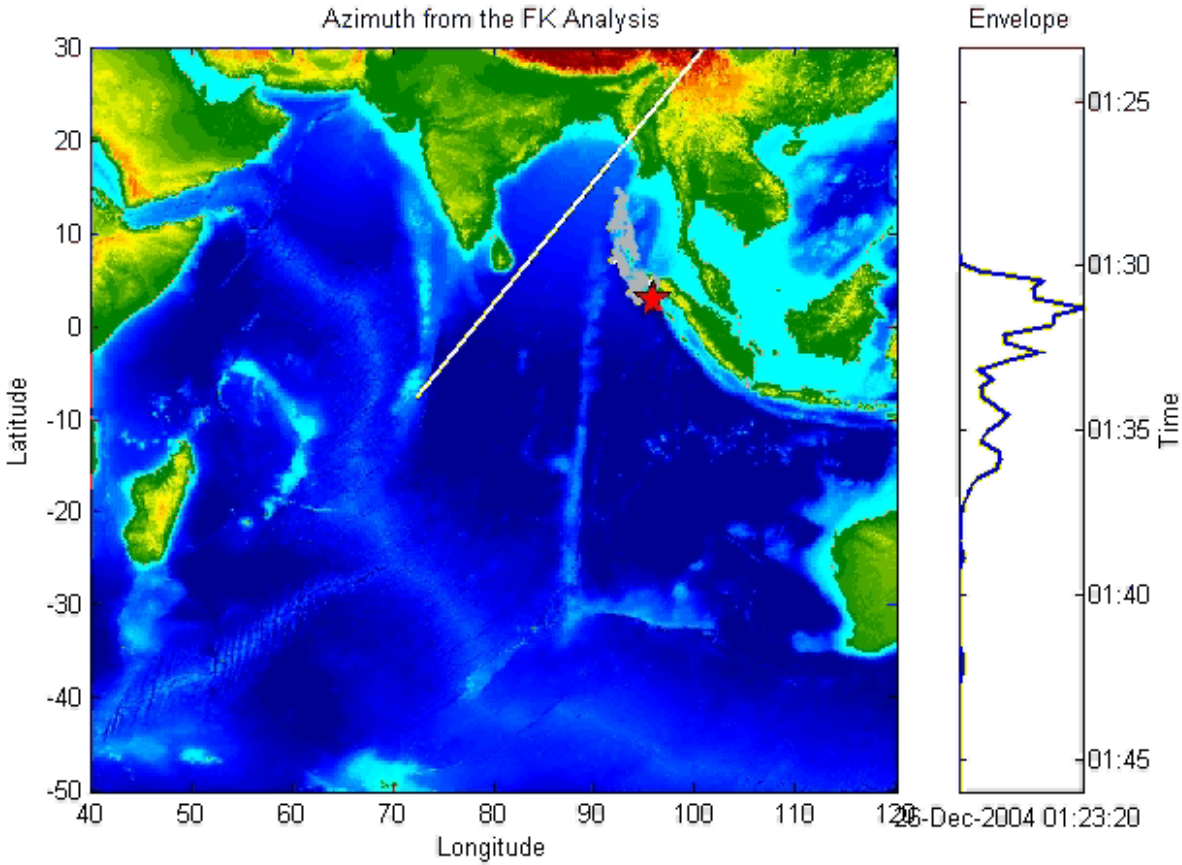
South to north rupture, observed from aftershock sequence relative to the main-shock.

Azimuth of the T-phase varies from south to north, consistent with the probable rupture.

At 01:40, the size of the fault rupture (> 1000 km) could be known using the T-Phase Azimuth.



The white line is the azimuth propagating out from Diego Garcia. The red star is the main-shock hypocenter, and the grey dots are aftershock locations. The plot on the right is the energy envelope over time from the FK analysis. The red line is the current time step.

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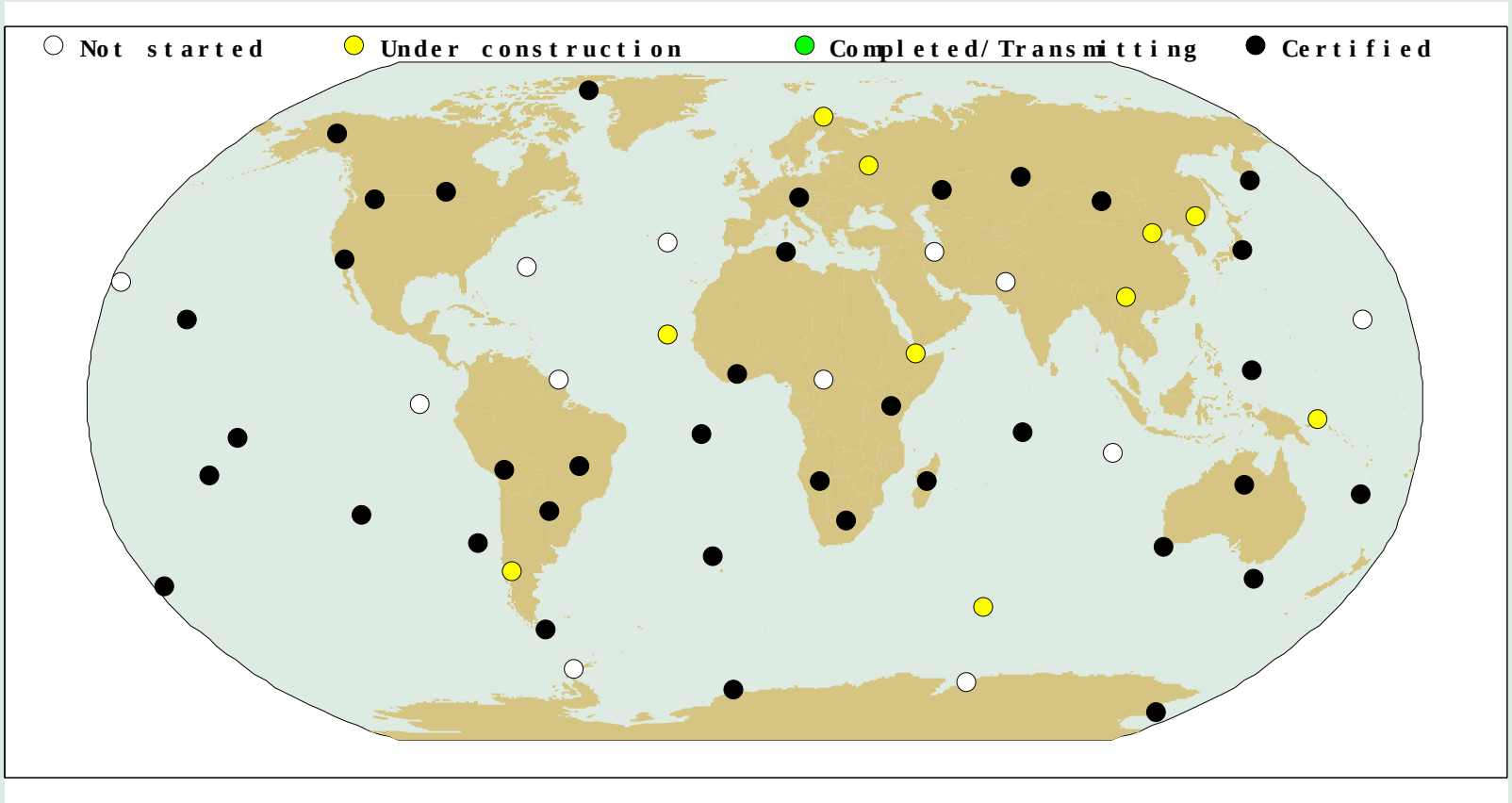
Infrasound Network



38 (60) stations completed

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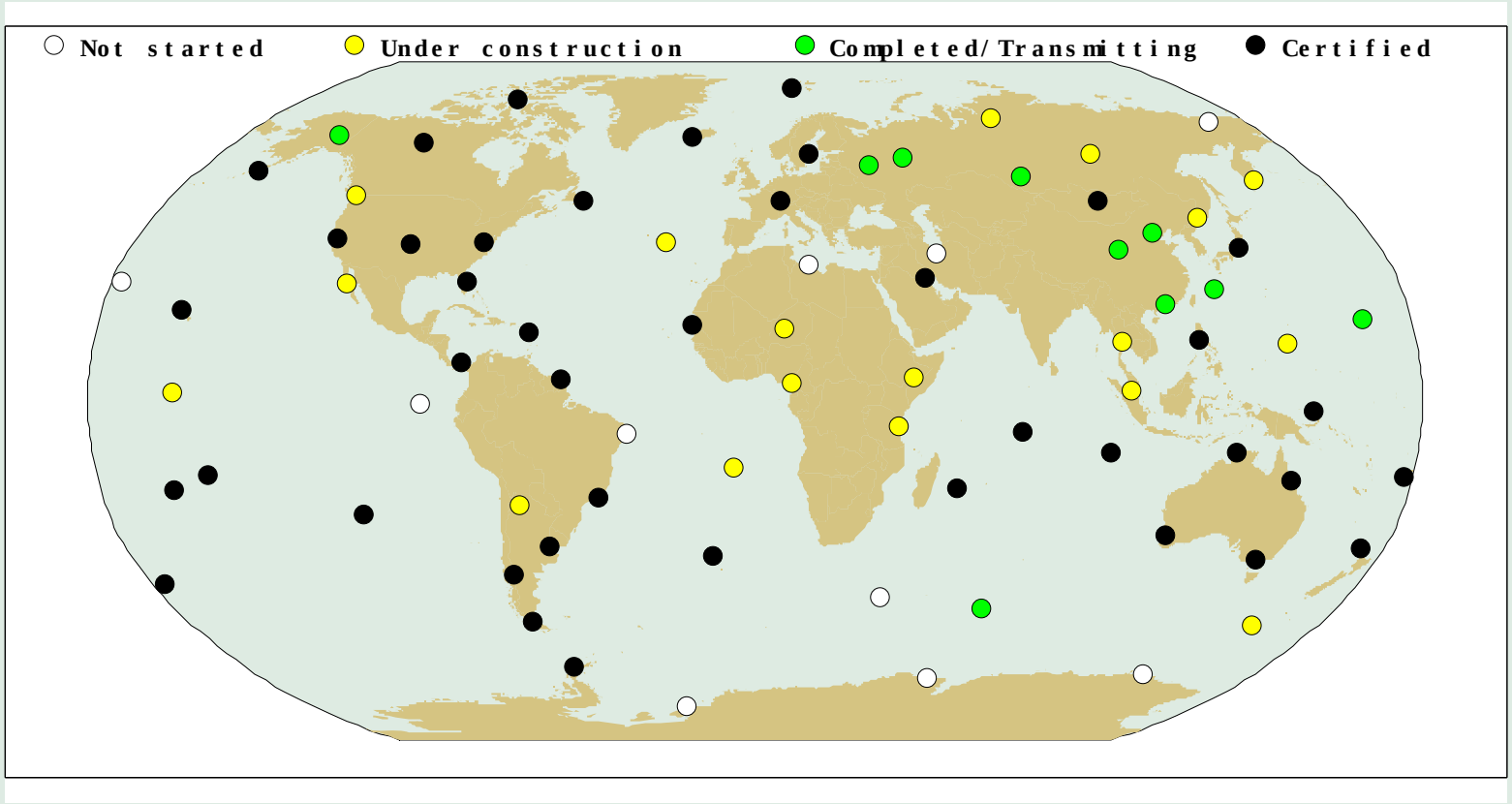
Radionuclide Network



51 (80) stations completed

International Monitoring:
321 Stations and
16 Radionuclide Laboratories

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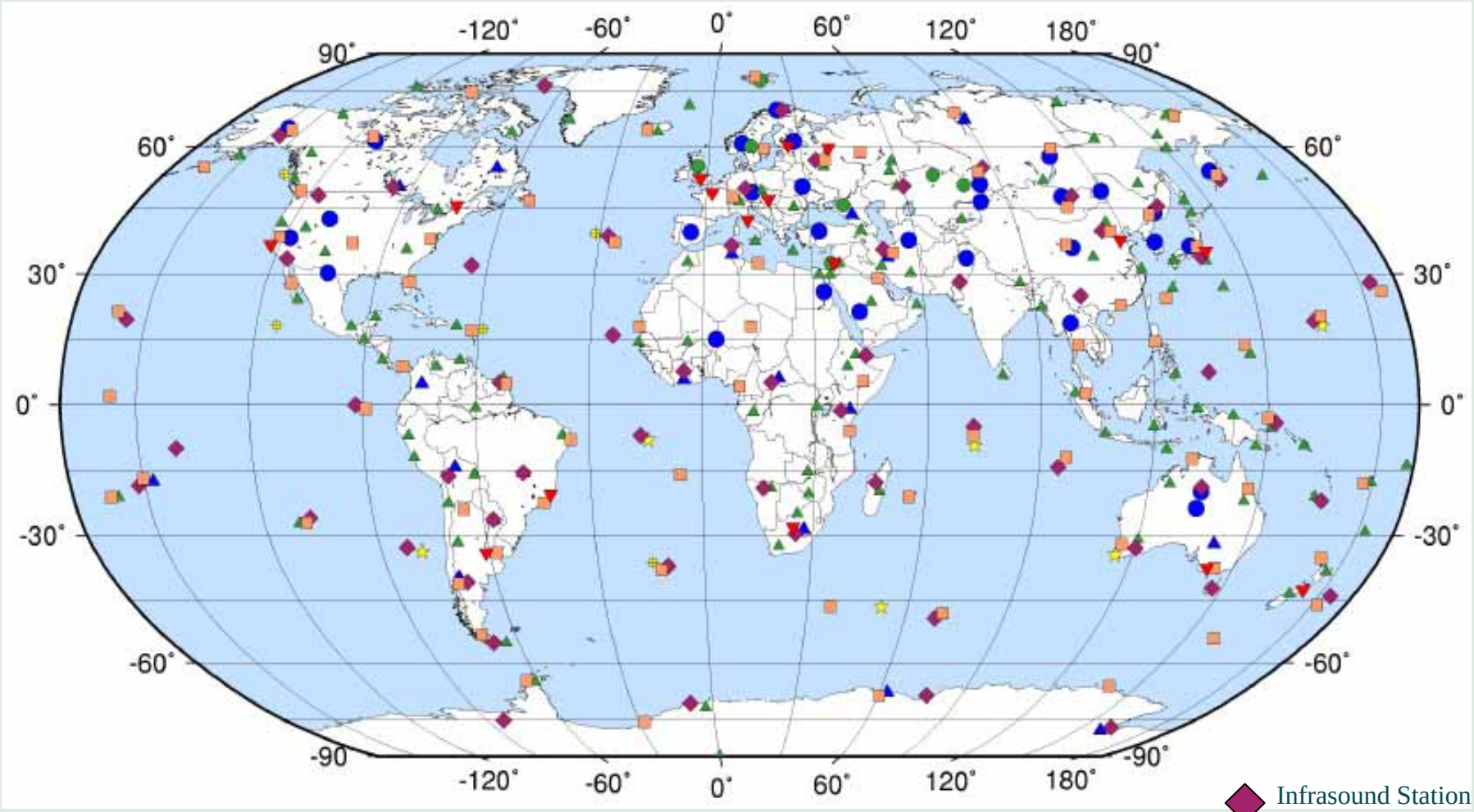

Seismic Primary Array
Seismic Primary 3-comp Station
Seismic Auxiliary Array
Seismic Auxiliary 3-comp Station
Hydroacoustic (hydrophone) Station
Hydroacoustic (T-phase) Station
Infrasound Station
Radionuclide Station
Radionuclide Lab

IMS Stations in IDC Operations: 31 December 2006 (193 Stations)

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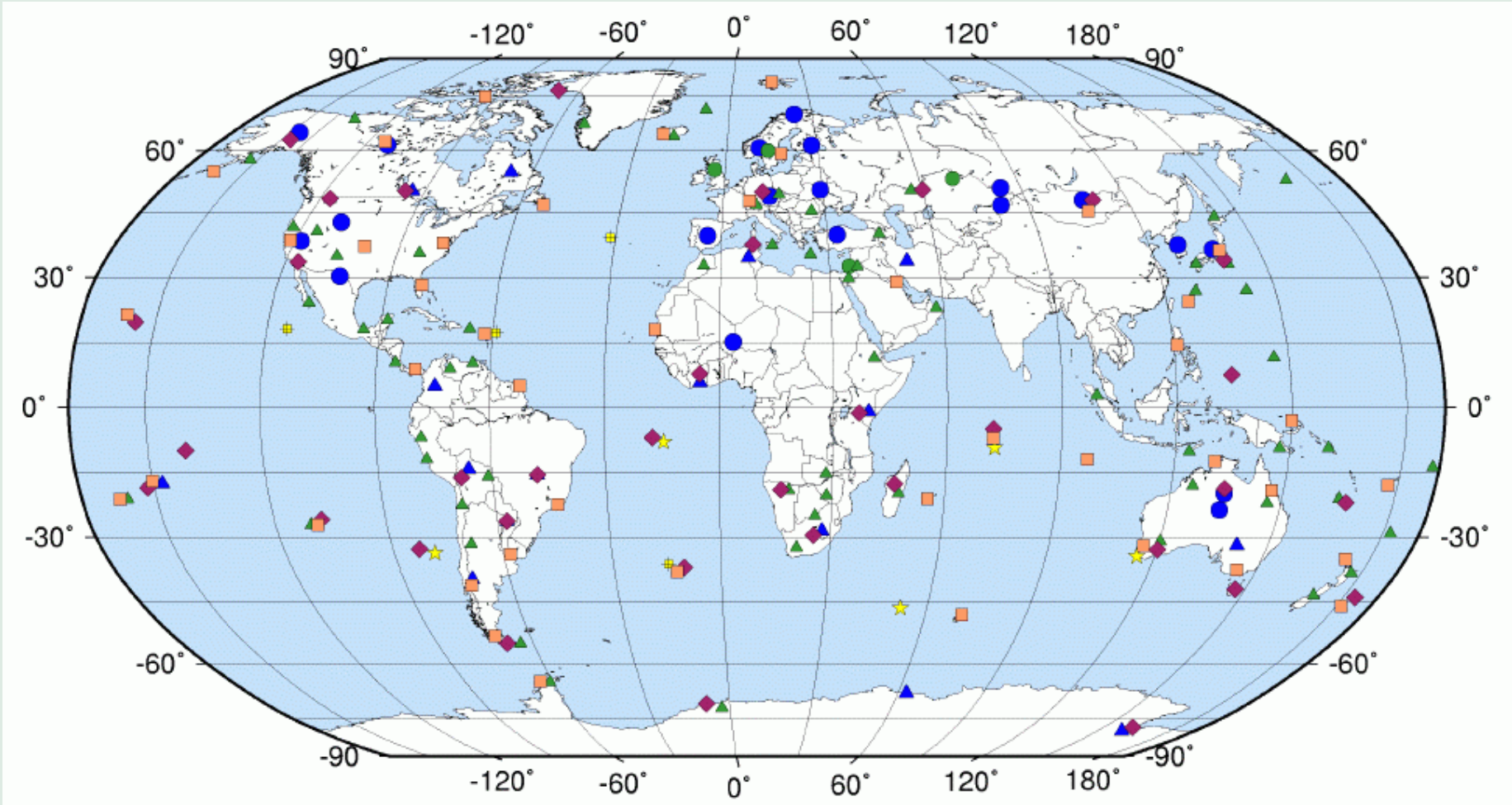

Seismic Primary Array
Seismic Primary 3-comp Station
Seismic Auxiliary Array
Seismic Auxiliary 3-comp Station
Hydroacoustic (hydrophone) Station
Hydroacoustic (T-phase) Station
Infrasound Station
Radionuclide Station

Status of IDC Forwarding of IMS Station Data to Tsunami Warning Centres

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Northwest Pacific Tsunami Warning Centre, JAPAN

Established May 2005 (received from IDC via VSAT)

Pacific Tsunami Warning Centre, HAWAII

Established October 2005 (received from IDC via VPN)

MALAYSIA (two centres)

Established December 2005 (received from IDC via VPN)

AUSTRALIA

Process initiated, awaiting establishment of VPN link.

The CTBTO International Data Centre IDC is currently forwarding data from 31 stations [27 Seismic, 2 Hydroacoustic, 2 Infrasound] to five Tsunami Warning Centres [Japan, Hawaii, Australia and two Centres in Malaysia].

Tsunami Warning Centres Data Supplying

Experimental mode via IDC

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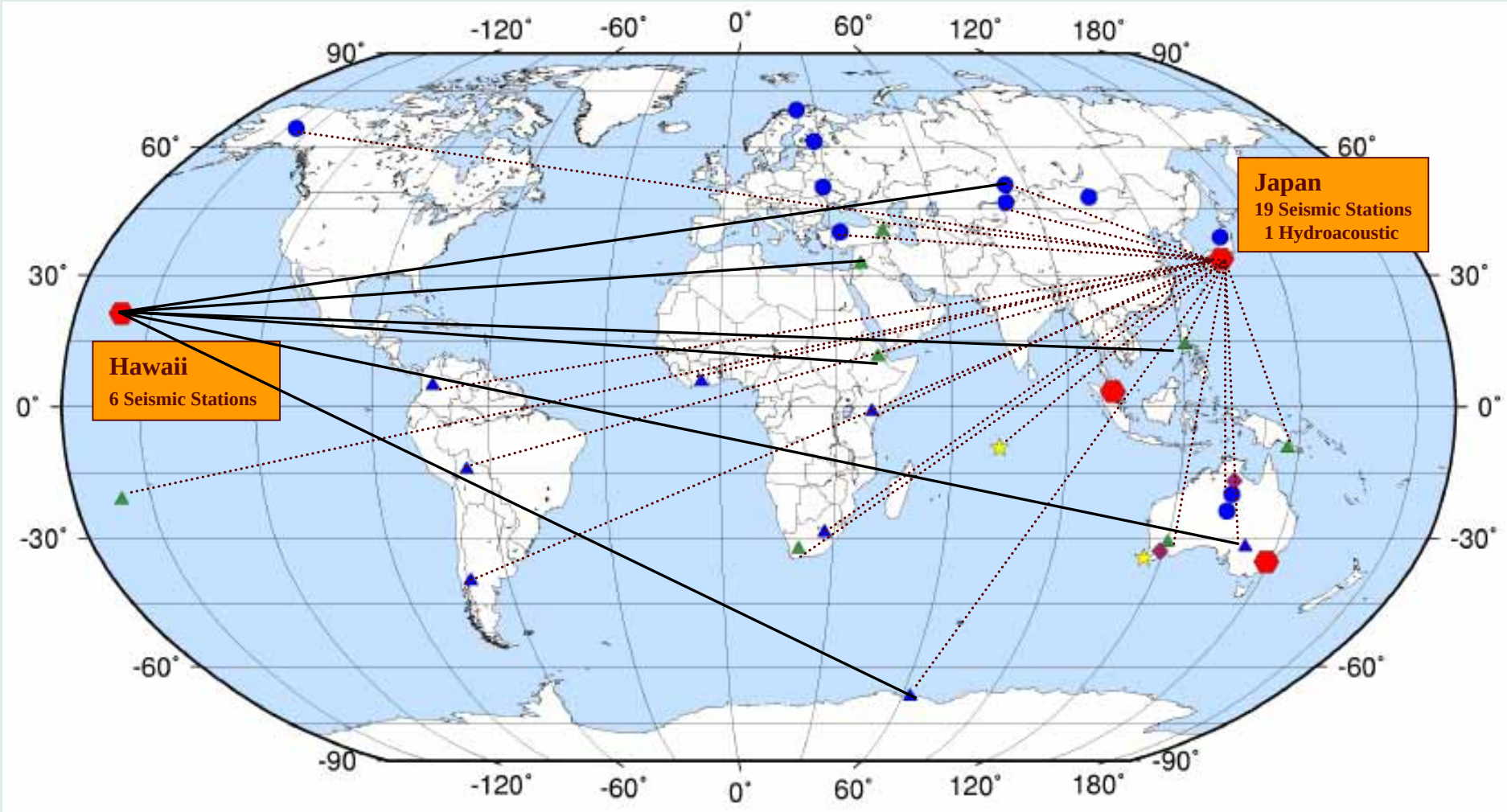

Seismic Primary Array

Seismic Auxiliary 3-comp Station

Infrasound Station

Seismic Primary 3-comp Station

Hydroacoustic (hydrophone) Station

Tsunami Warning Centre

Tsunami Warning Centres Data Supplying

Experimental mode via IDC

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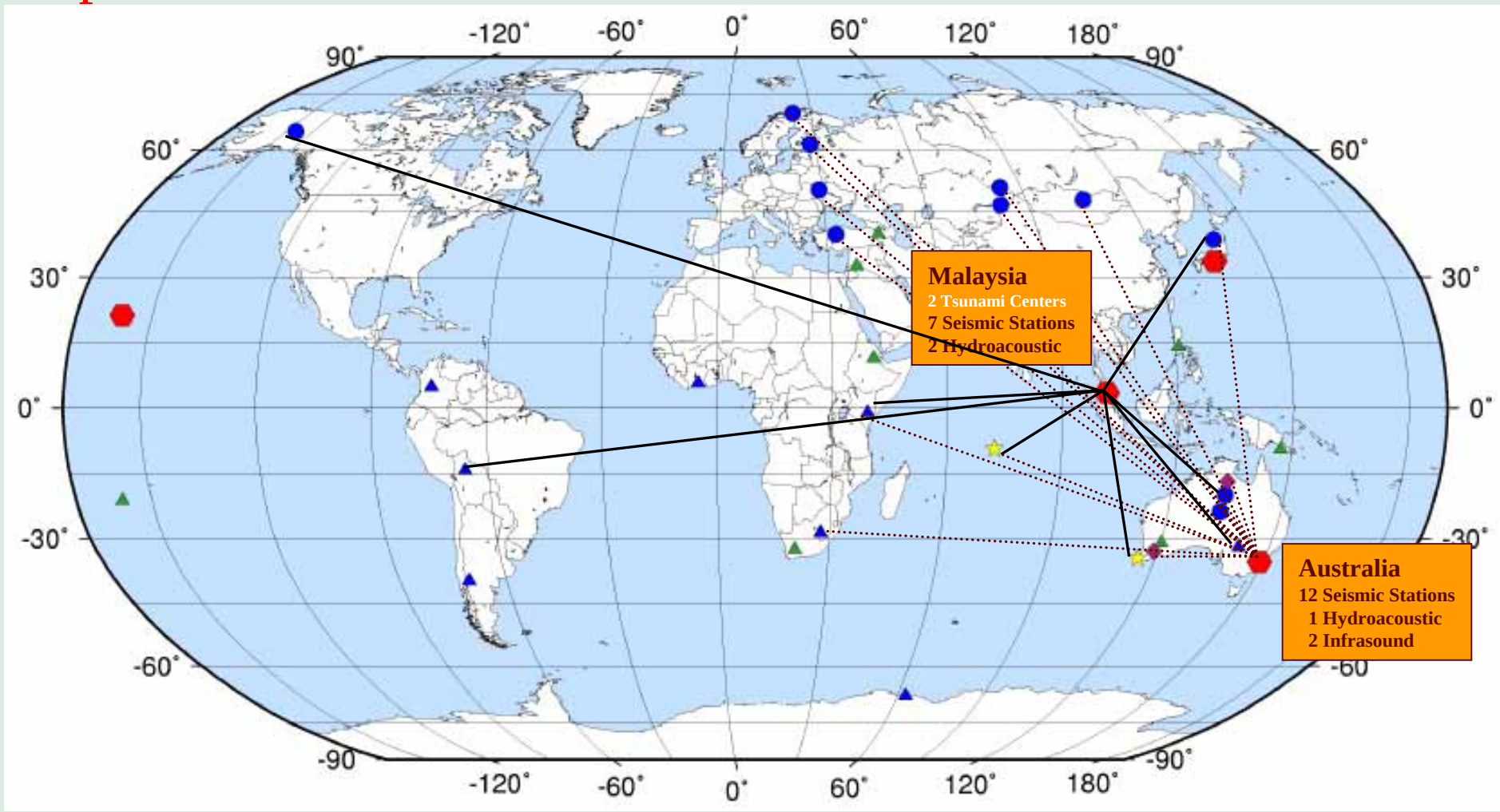

Seismic Primary Array

Seismic Auxiliary 3-comp Station

Infrasound Station

Seismic Primary 3-comp Station

Hydroacoustic (hydrophone) Station

Tsunami Warning Centre

Conclusions of JMA study

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1. JMA can receive data from CTBTO/IMS stations EARLIER than those from LISS/IRIS stations.

Delay in receipt of data
- CTBTO: 30 sec. at most
- LISS/IRIS: 100-180 sec. on average

-> Tsunami Warning is expected to be ISSUED EARLIER.

2. CTBTO/IMS stations obtain much more COMPLETE data than LISS/IRIS stations.

Data availability
- CTBTO: 99.67%
- LISS/IRIS: 82.14%

-> Tsunami Warning is expected to be MORE ACCURATE.

3. If JMA can use data from some auxiliary seismic stations site on an real-time on-line basis, tsunami warning will be issued much earlier and much more accurate!

Infrasound recording at IS26, Freyung, Germany

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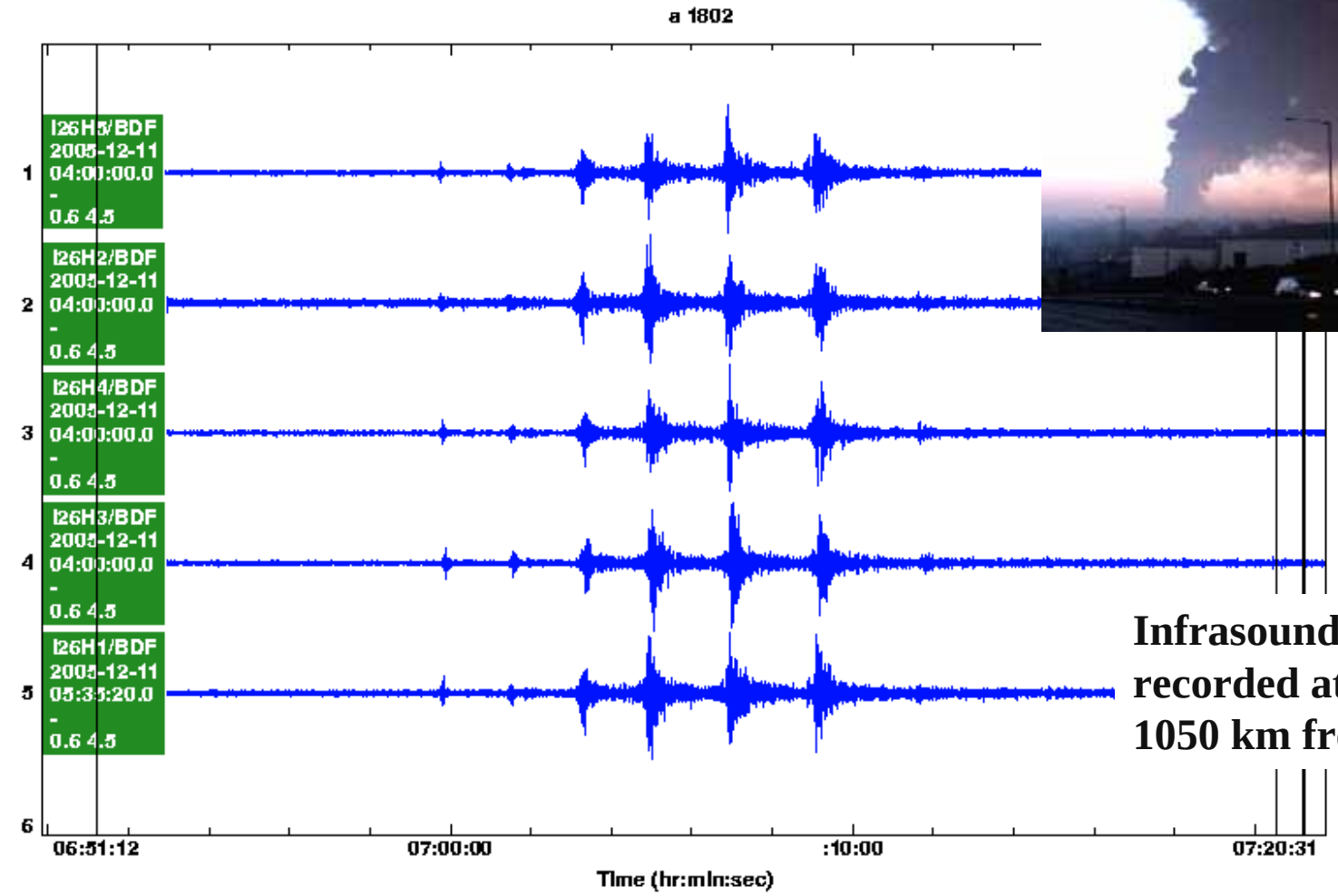
Explosions at UK oil depot, 11 Dec 2005



Infrasound signals recorded at a distance of 1050 km from the source

Infrasound: Civil and Scientific Applications

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Tangurahua Volcano

Guagua Pichincha Volcano

IMS Infrasound stations detect volcanic explosions

Detection of volcanic explosions would assist in aviation safety

This data could be used by International Civil Aviation Organization

Atmospheric Transport Modeling - Examples

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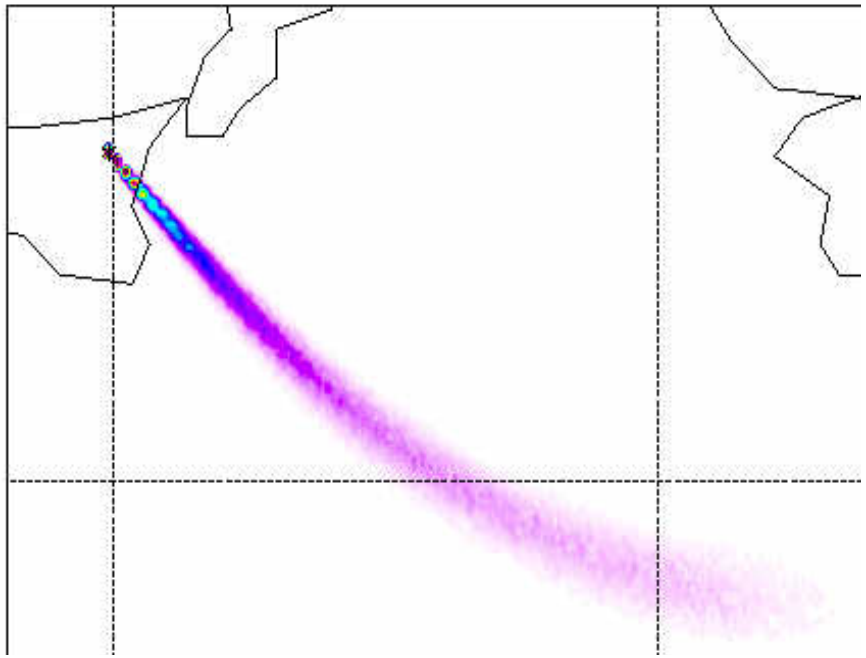
This NOAA-14 image shows an ash plume (indicated by the yellow arrow) from an eruption of the Mt. Etna volcano extending southeast over the Mediterranean Sea. This image was provided by Ferdinand Valli.

CREDIT: NOAA



Civil and Scientific Applications

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Seismology

- Civil application (e.g. hazard assessment)
- Scientific application (e.g. study of internal structure of the earth)

Hydroacoustics

- Civil application (e.g. disastrous chemical explosion near to earth's surface)
- Scientific application (e.g. study of processes in the atmosphere)

Infrasound

- Civil application (e.g. tsunami warning)
- Scientific application (e.g. study of ocean process)

Radionuclide

- Civil application (e.g. early mapping of dispersion of radioactive materials from accidental nuclear release)
- Scientific application (e.g. study of background levels at very remote areas)

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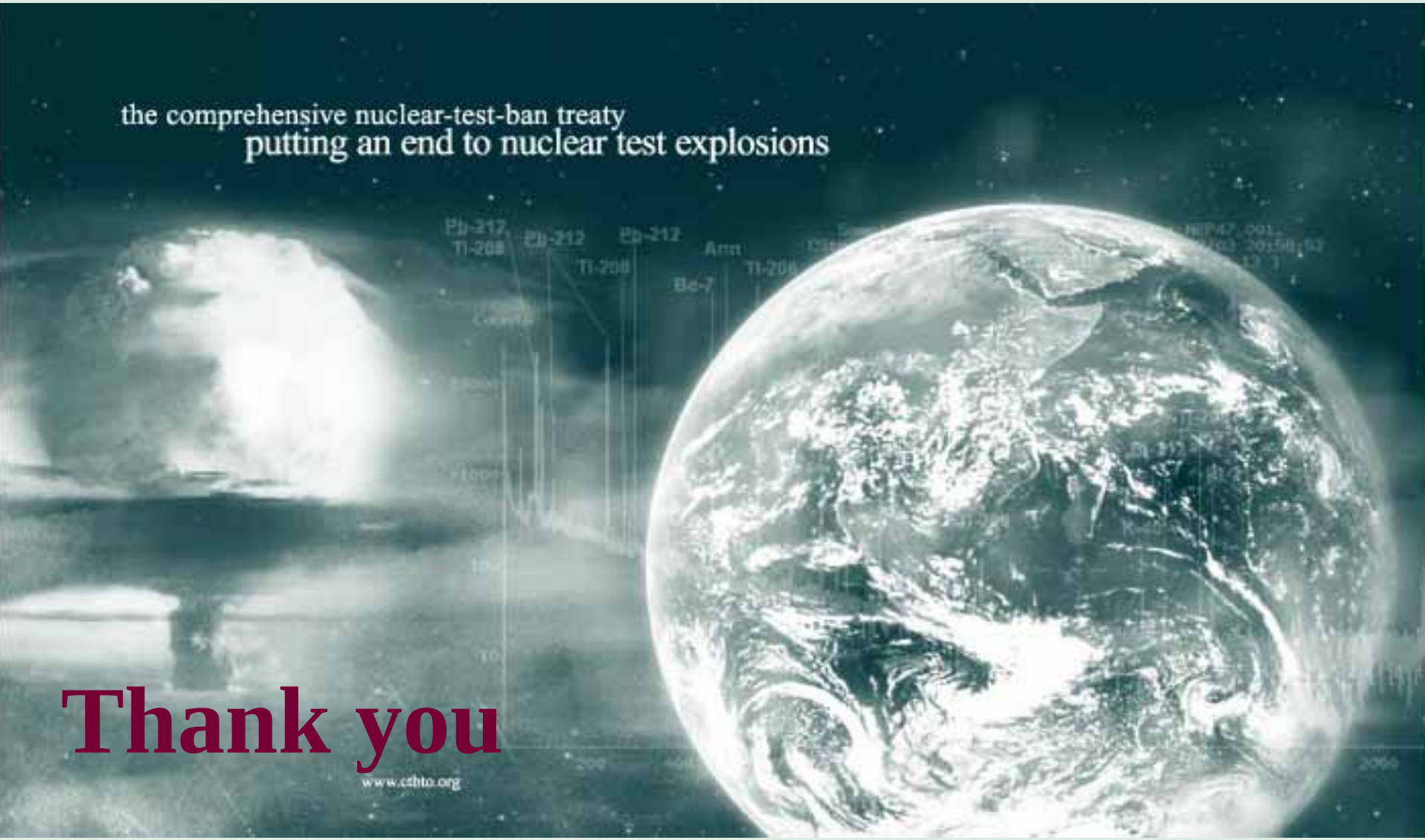

Thank you