



UNESCO/IOC – NOAA ITIC Training Program - International (ITP-Intl)
TSUNAMI WARNING AND EMERGENCY RESPONSE
9-12 January 2023, Rarotonga, Cook Islands

What Do Tsunami Warning Centers Provide to Tsunami Emergency Response Agencies?

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Tsunami Warning Centers – Two Types

Tsunami Service Providers (TSPs)

- **Capability to detect and assess tsunami threats over a large region, covering multiple member state.**
- **Has been accepted by the International Coordination Group (ICG) to disseminate threat assessment to other member states.**

Tsunami Service Providers (TSPs)

- ❑ PTWC (Pacific Tsunami Warning Center)
- ❑ NWPTAC (Northwest Pacific Tsunami Advisory Center, Japan Meteorological Agency (JMA))
- ❑ SCSTAC (South China Sea Tsunami Advisory Center)



Tsunami Warning Centers – Two Types

National Tsunami Warning Centers (NTWC)

- ❑ A center operated by a Member State that has the authority by law or otherwise to issue tsunami warnings for the coasts of that Member State.
- ❑ Ideally, an NTWC should have some technical capability to aid decisions making.

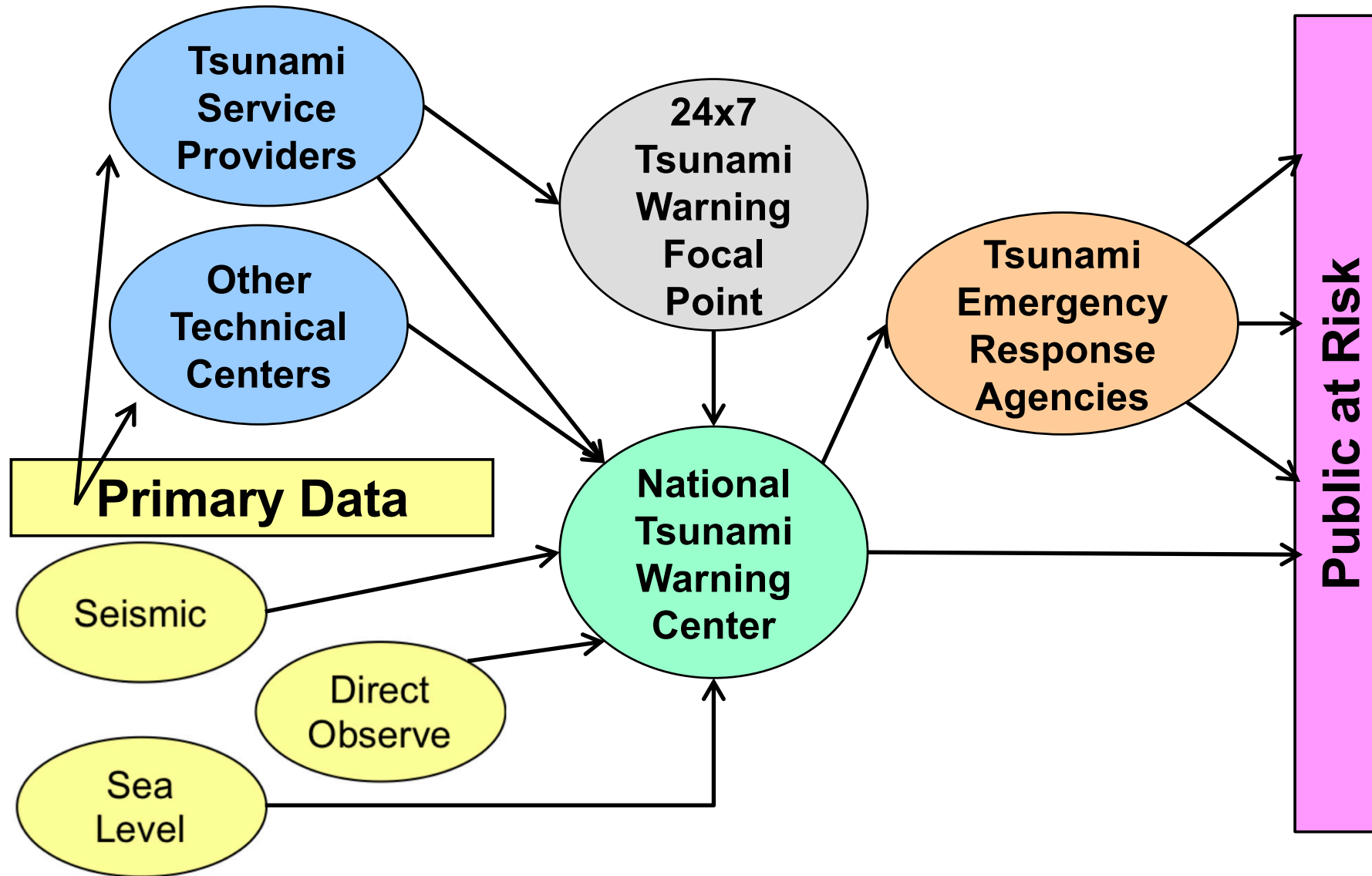


Tonga



Peru

Information Flow



Functions of TSPs and NTWCs

BASIC

- Monitor and Locate Earthquakes
- Monitor and Detect Tsunami Waves
- Assess the Tsunami Threat
- **Create and Disseminate Alerts**
- Monitor Tsunami Impacts

OTHER CRISIS ACTIVITIES

- Consult with NDMO During Events
- Brief the Media – Your Partner

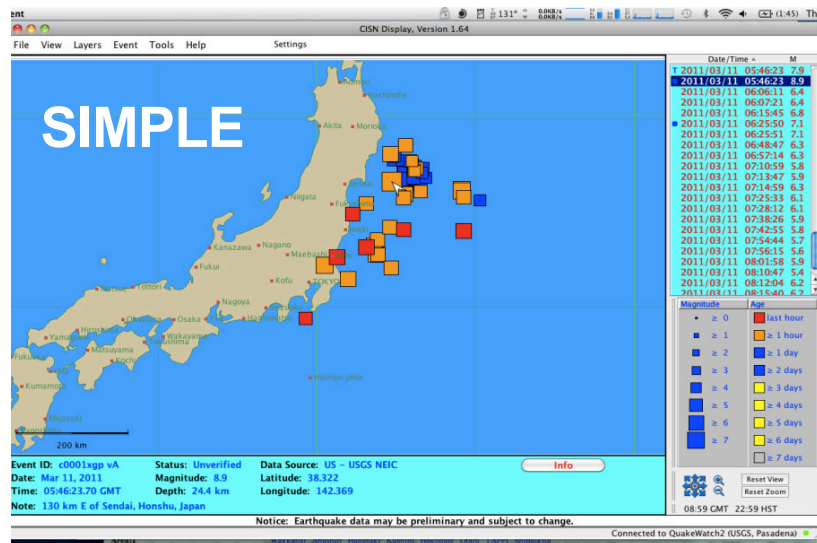
OTHER NON-CRISIS

- Outreach, Education

Basic Functions of an NTWC

□ Monitor for Earthquakes

- **SIMPLE** - Monitor other observatories real-time reporting of earthquakes (e.g., CISN).
- **COMPLEX** – Operate networks and perform real-time analysis of seismic waveform data.



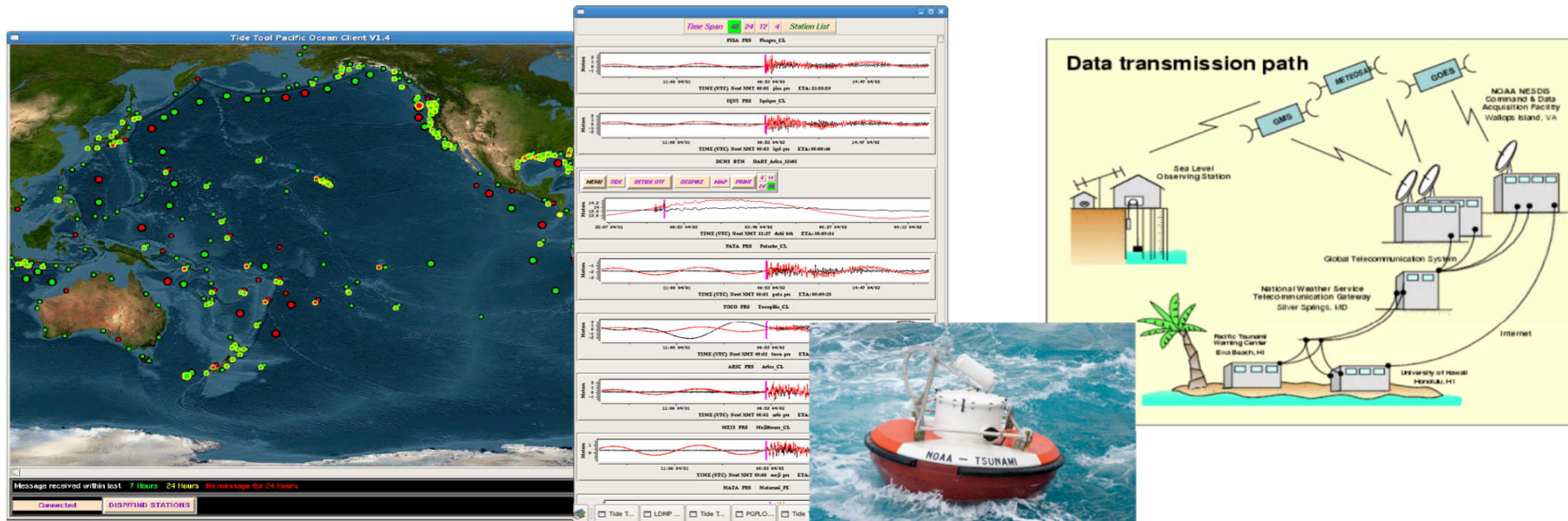
COMPLEX



Basic Functions of an NTWC

□ Monitor for Tsunami Waves

- **SIMPLE** – Run software to display data from existing global network of sea-level gauges (e.g., TideTool software or IOC website)
- **COMPLEX** – Operate network of coastal and deep-ocean sea level stations.



Basic Functions of an NTWC

□ Assess the Tsunami Threat

- **SIMPLE** – Base the tsunami threat on messages from PTWC, NWPTAC, and/or other TSPs.
- **COMPLEX** – Independently determine the tsunami threat based on historical data, forecast models, and sea-level readings.

□ Create and Disseminate Alerts

- **SIMPLE** – Issue warning / no warning to NDMO for all coasts based on maximum threat anywhere (NDMO alerts public)
- **COMPLEX** – Issue area-specific alerts of different levels to NDMO and public by numerous communication methods

Basic Functions of an NTWC

□ Monitor Tsunami Impacts

- Monitor network of real-time reporting sea level gauges along coasts.
- Monitor local television and radio for reports of tsunami impacts.
- Get reports from EMs, police, fire department, other spotters, especially for vulnerable coasts.
- Determine if/when alert levels should be raised, lowered, or cancelled.
- Wait sufficient time to ensure threat has passed before cancelling.

Other Crisis Functions of an NTWC

- **Consult with NDMO During Events**
 - **Consider other factors that may play into decision-making:**
 - Time of Day – Day, Night, Traffic
 - Season of Year – Temperature, Weather
 - Weekday, Weekend, Holiday, Special Events
 - **Advise from NTWC**
 - What Readings are Coming Next
 - Confidence in Forecast
 - Expected Level of Impacts
 - Places Expected to Have Biggest Impacts
 - When to Expect Cancellation

Other Crisis Functions of an NTWC

- **Brief the Media – Your Partner**
 - **Stay on Point – What is In Official Message**
 - Big Earthquake Occurred
 - Potential (Watch) or Confirmed (Warning) Tsunami Threat
 - Take Warnings Seriously
 - Follow Instructions from NDMO
 - **Don't Over-Speculate or Over-Discuss**
 - Public Won't Take Action if Mixed Messages
 - Media Will Want Your Opinions / Details
 - Give Official Message Only
 - Avoid jargons (use simple language).

Non-Crisis Functions of an NTWC

□ Outreach

■ Advise NDMO, Media, Public on Tsunamis and Potential Tsunami Threats

- Tsunami Characteristics
- Not If, But When
- Potential Sources – Local, Distant
- Potential Impacts – Lead Times,

■ Advise NDMO, Media, Public on Limitations of Forecast

- Many Unknowns: Exact Source, Coastal Effects
- Limited Data: A Few Readings
- You Act Conservatively
- There will be Over-Warnings

What should Tsunami Emergency Response Agencies Expect from an NTWC

- **Rapid Notification of a Potential Tsunami Threat**
- **Conservative Evaluation of a Tsunami Threat**
- **Reasonably Rapid Stand-Down if No Tsunami Threat or if Tsunami Threat has passed.**
- **NTWC Underlying Principles**
 - Will Provide Forecast as Accurately as Possible but still Conservatively
 - Saving Lives is the Highest Priority
 - Protecting Property only When Possible

Challenges in Detection and Threat assessment

- ❑ **Initial threat assessment is usually based on earthquake magnitude only, before the focal mechanism of the earthquake is known. (initial EQ mag for the 2011 Japan tsunami was only 7.9, well below the true magnitude of 9.0).**
- ❑ **Even if the EQ mag is correct, the location could be wrong, thus underestimating or overestimating tsunamis (M7.8 New Zealand EQ/tsunami).**
- ❑ **Difficult to assess/forecast tsunami threat from non-seismic sources such as submarine landslides (e.g., M7.0 PNG 1998) and volcanic explosions (Krakatoa, 1883 & 2018).**

Limitations to be Prepared For

- ❑ **Over-Warning due to Conservative Criteria**
- ❑ **General Forecast of Threat with Few Specifics**
- ❑ **Potential for Error in ETAs**
- ❑ **Uncertainty About How Long Impacts will Last**



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Thank You

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