JICA's Approach for Cooperation on Earthquake and Tsunami Early Warning

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NO.20

Disaster Risk Reduction through Pre-disaster Investment and Build Back Better

Building nations' resilient foundation for saving lives and developing economy

Disaster risk reduction (DRR) is directly linked to "Human Security" and "Sustainable Development."

DRR is the basis for development as it saves people's lives and livelihoods.
JICA supports programs on strengthening the capacity of partner countries to augment pre-disaster investment in DRR for the future.
By 2030, JICA strives to substantially reduce the number of deaths, affected people, and economic losses caused by natural hazards.

Japan International Cooperation Agency (JICA) works toward the achievement of the Sustainable Development Goals (SDGs).

Cover Photo—A view of the suburbs of Bangkok, Thailand, which suffered unprecedented flooding in October 2011.
Photo : REUTERS/AFLO

JICA's cooperation approaches for Earthquake and Tsunami Warning in Development Countries

1. Developing Expert Human Resources through group training "Tsunami Disaster Mitigation Course" (1 year, IISEE-GRIPS master course)

Most of developing countries have limitation / difficulty of higher education environment on seismology and/or tsunami engineering in the domestic. **(Since 1960, a total of more than 1,250 for 87 countries)**

2. Enhancing capacity of development Earthquake Information and Tsunami Early Warning

2-1. Improving Promptness and Accuracy by applying Japan Meteorological Agency method

To apply advanced technology (such as JAM magnitude method) is needed to secure evacuation time for Local Tsunami. **(South America (Chile, Ecuador), ASEAN (Indonesia, Philippines))**

2-2. Enhancing Regional Cooperation Mechanism of UNESCO-IOC framework

Essential and fundamental resources for small scale country with small number of government staff for EQ and Tsunami monitoring. **(SIDS such as South Pacific (Vanuatu, Tonga, Fiji) and Central America - Caribbean (Nicaragua-CATAC))**

3. Enhancing Community Awareness for EQ – Tsunami -Volcano Risk though technical cooperation project and JICA Volunteer

JICA's cooperation approaches for Earthquake and Tsunami Warning in Development Countries

4. Enhancing collaboration with communication sectors to strengthen capacity of information dissemination and communication (Installation of Distal Broadcasting System with Early Warning Broad Casting System, Mobile Communication Company) (Peru, Chile, Maldives)

In some country, improvement of communication infrastructure at National Level is critical issue for EQ and Tsunami Monitoring and Information Dissemination.

Enhancing technical capacity of communication organization to Minimize Transition Time (automation) and Multi Language (National, Local) for community early warning.

5. Enhancing Science and Technology for Joint Research Project "SAPREPS - Science and Technology Research Partnership for Sustainable Development"

Scientific Research for understanding the mechanism of earthquake occurrence and historical record and Applied Research for advancement of technology with top-science knowledge are needed. **(19 projects in Chile, Peru, Colombia, Mexico,El Salvador, Indonesia, Philippine, Pacific, Turkey, etc.)**

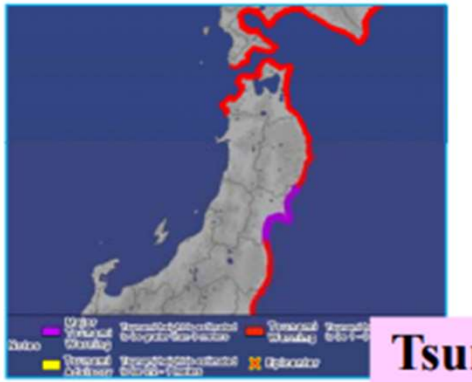
"SATREPS" aims to develop new technology and its social applications for tackling global issues, and also aims at capacity development of younger, funded by JICA and JST (Japan Science and Technology Agency).

*maximum 2.5 million USD (5 years, approximately 60mil JYP/year), including Equipment Provision

Flow of issuance of information about tsunami and earthquake in Japan

JMA Magnitude

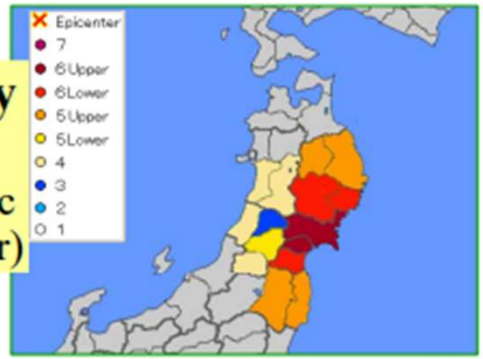
Earthquake

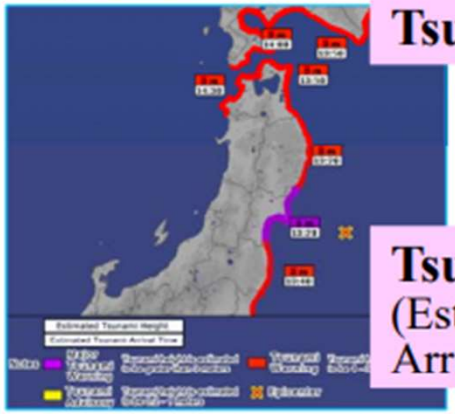


Tsunami Warning / Tsunami Advisory

1.5 min.

Seismic Intensity Information
(Regions with seismic intensity 3 or greater)

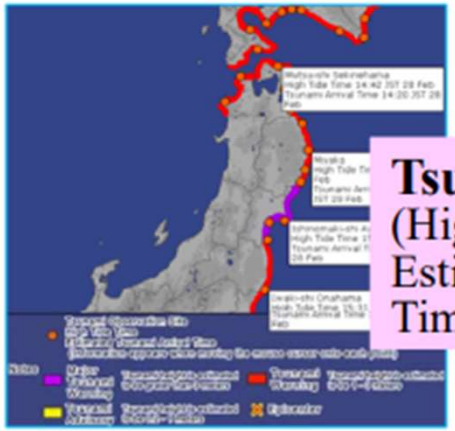




3min.

Tsunami Information
(Estimated Tsunami Arrival Time and Height)

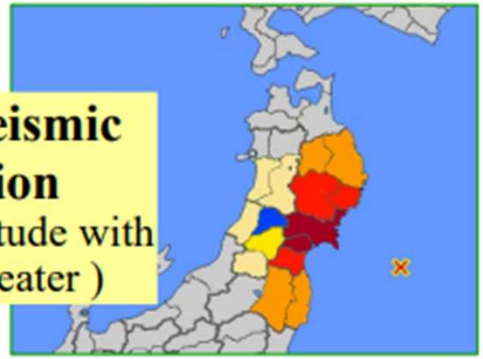
Earthquake Information
(Hypocenter and Magnitude)

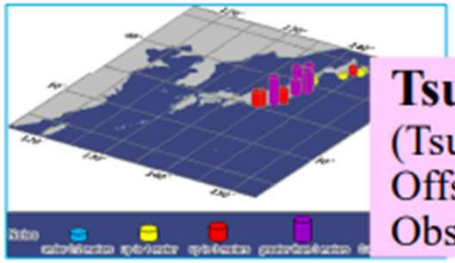


5min.

Tsunami Information
(High Tide Time and Estimated Tsunami Arrival Time at each place)

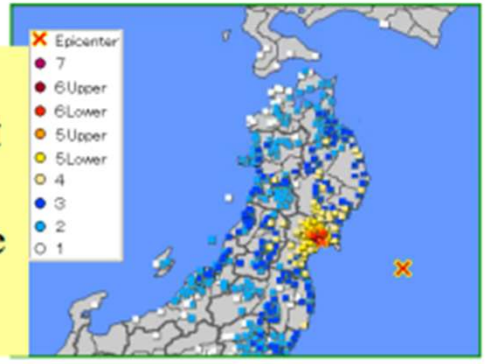
Earthquake and Seismic Intensity Information
(Hypocenter and Magnitude with seismic intensity 3 or greater)



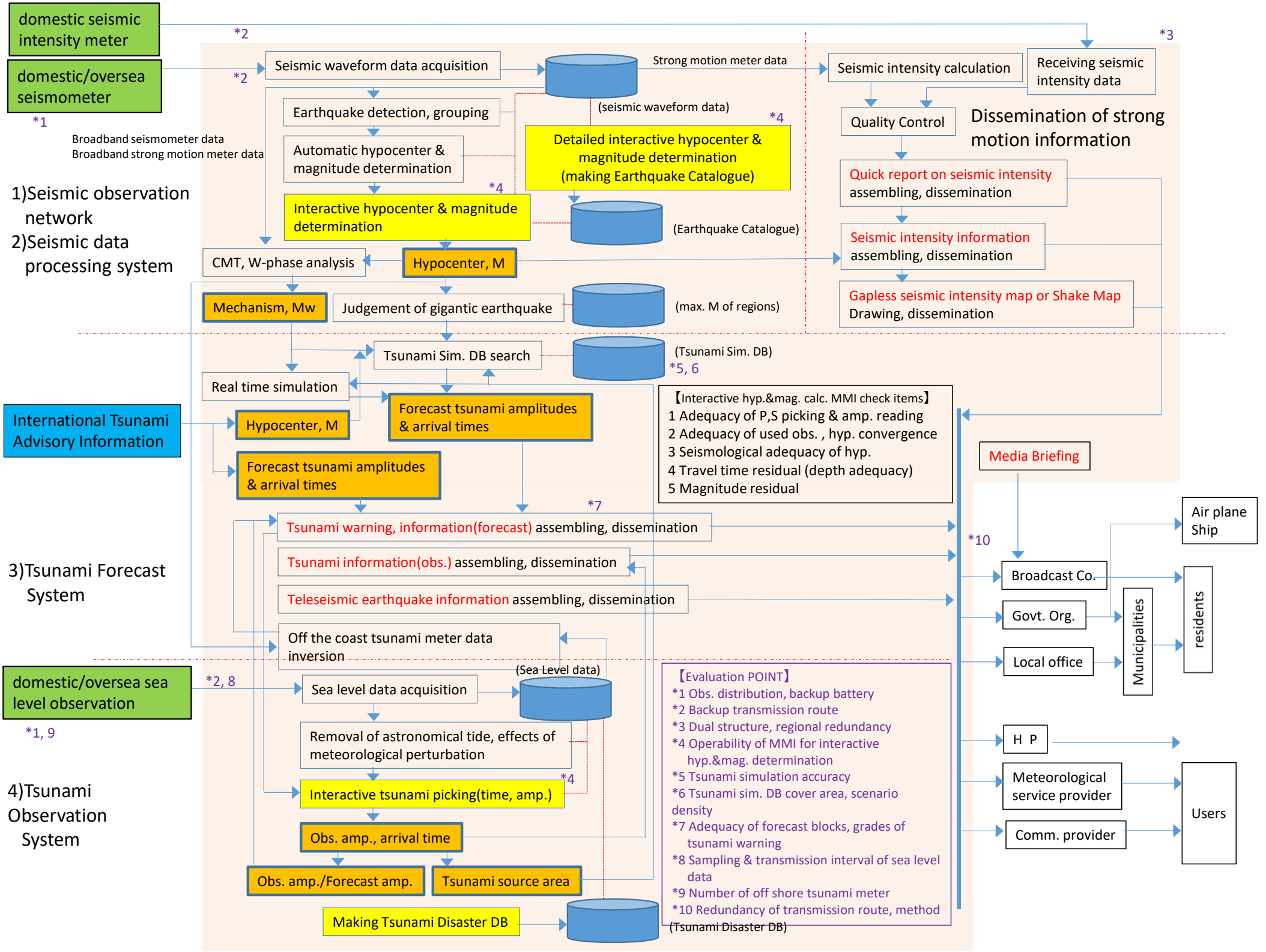


Tsunami Information
(Tsunami Observations at Offshore Gauges / Tsunami Observations)

Information on seismic intensity at each site
(Hypocenter, Magnitude and Sites with seismic intensity 1 or greater)



Source: JMA HP


domestic seismic intensity meter
domestic/oversea seismometer
*1
Broadband seismometer data
Broadband strong motion meter data
1)Seismic observation network
2)Seismic data processing system
*2
*2
Seismic waveform data acquisition
Strong motion meter data
(seismic waveform data)
Earthquake detection, grouping
Automatic hypocenter & magnitude determination
*4
Detailed interactive hypocenter & magnitude determination (making Earthquake Catalogue)
*4
Interactive hypocenter & magnitude determination
(Earthquake Catalogue)
CMT, W-phase analysis
Hypocenter, M
Mechanism, Mw
Judgement of gigantic earthquake
(max. M of regions)
Tsunami Sim. DB search
(Tsunami Sim. DB)
*5, 6
Real time simulation
International Tsunami Advisory Information
Hypocenter, M
Forecast tsunami amplitudes & arrival times
Forecast tsunami amplitudes & arrival times
*3
Seismic intensity calculation
Receiving seismic intensity data
Quality Control
Dissemination of strong motion information
Quick report on seismic intensity assembling, dissemination
Seismic intensity information assembling, dissemination
Gapless seismic intensity map or Shake Map Drawing, dissemination
【Interactive hyp.&mag. calc. MMI check items】
1 Adequacy of P,S picking & amp. reading
2 Adequacy of used obs. , hyp. convergence
3 Seismological adequacy of hyp.
4 Travel time residual (depth adequacy)
5 Magnitude residual
Media Briefing
*7
Tsunami warning, information(forecast) assembling, dissemination
Tsunami information(obs.) assembling, dissemination
Teleseismic earthquake information assembling, dissemination
3)Tsunami Forecast System
Off the coast tsunami meter data inversion
(Sea Level data)
domestic/oversea sea level observation
*1, 9
*2, 8
Sea level data acquisition
Removal of astronomical tide, effects of meteorological perturbation
*4
Interactive tsunami picking(time, amp.)
Obs. amp., arrival time
4)Tsunami Observation System
Obs. amp./Forecast amp.
Tsunami source area
Making Tsunami Disaster DB
(Tsunami Disaster DB)
【Evaluation POINT】
*1 Obs. distribution, backup battery
*2 Backup transmission route
*3 Dual structure, regional redundancy
*4 Operability of MMI for interactive hyp.&mag. determination
*5 Tsunami simulation accuracy
*6 Tsunami sim. DB cover area, scenario density
*7 Adequacy of forecast blocks, grades of tsunami warning
*8 Sampling & transmission interval of sea level data
*9 Number of off shore tsunami meter
*10 Redundancy of transmission route, method
*10
Air plane
Ship
Broadcast Co.
Govt. Org.
Local office
Municipalities
residents
H P
Meteorological service provider
Comm. provider
Users

Current JICA's Cooperation including Volcano Generated Tsunami

●**Vanuatu: Tech. Coop.「The Project for Enhancement the Capacity of Issuing Earthquake, Tsunami and Storm Surge Information」(2019 - 2023)**

* including developing SOP for Earthquake, Tsunami and Storm Surge

●**Tonga: Mission for Build Back Better「Information Collection and Preliminary Survey for the Formation of Disaster Recovery Projects against Volcanic Eruptions and Tsunami Damage」(Apr. 2022-Aug. 2023)**

https://www.jica.go.jp/Resource/information/seminar/2022/glkrjk00000067rt-att/20220817_02_02.pdf

● **Tonga, Vanuatu and Fiji : Joint Research Prpject, "SATREPS"「The Project for Disaster Risk Reduction of Widespread Volcanic Hazards in Southwest Pacific Countries」(2024 - 2029)**

・Objective: The foundation to reduce the risk of widespread eruption disasters from oceanic and island volcanoes in Tonga, Vanuatu, and Fiji is established through the three countries' network.

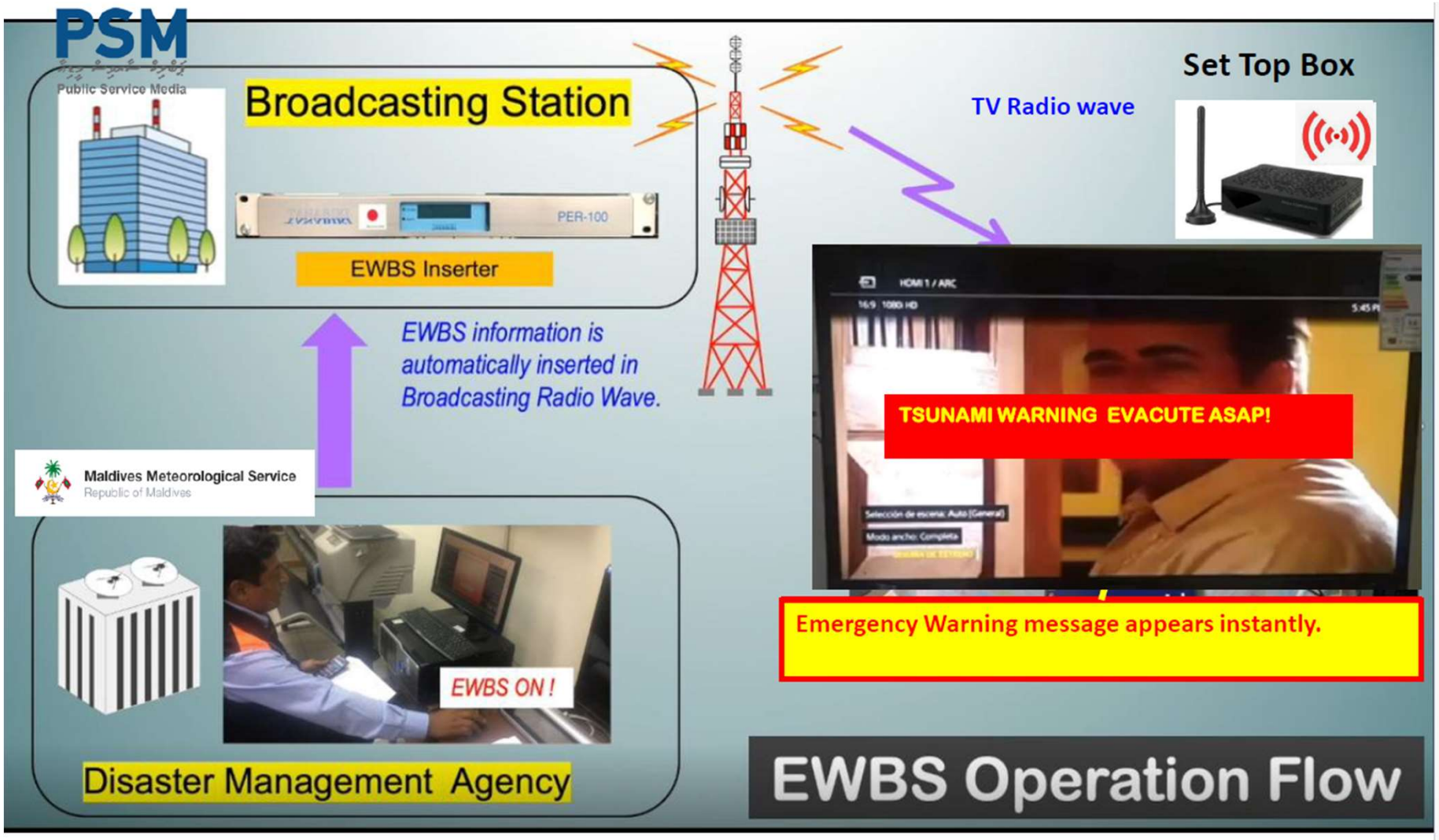
・ Vanuatu : To add Volcano - Tsunami SOP into EQ - Tsunami SOP

・ Fiji, Tonga: To utilize Vanuatu EQ & Volcano Tsunami SOP for update their SOP

●**Tonga: upcoming cooperation is under prepared**

Collaboration with Green Climate Fund
“Building Climate Resilient Safer Islands in the Maldives”

Component 3 Development of Disaster Warning and Information Dissemination
Activity 3.1 Installment of terrestrial digital broadcasting system
Activity 3.2 Establishment of Disaster Early Warning and Information Broadcasting System



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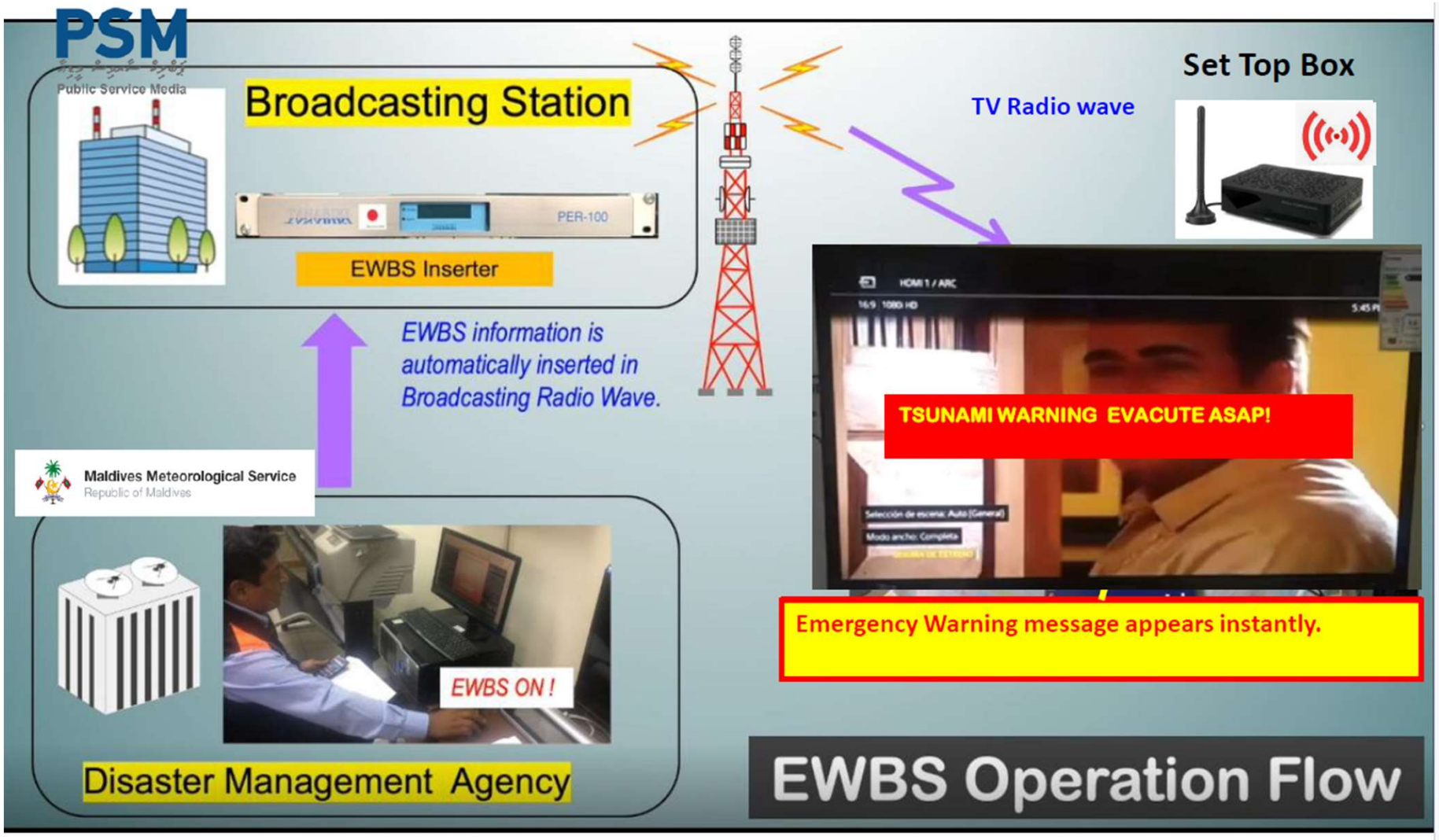


Lessons Learnt: Synergy of EW and DRR Infrastructure (Cyclone Shelter)

Bangladesh

By carrying out support to investment before disasters, the death toll from cyclones has fallen to 1/70th previous levels.

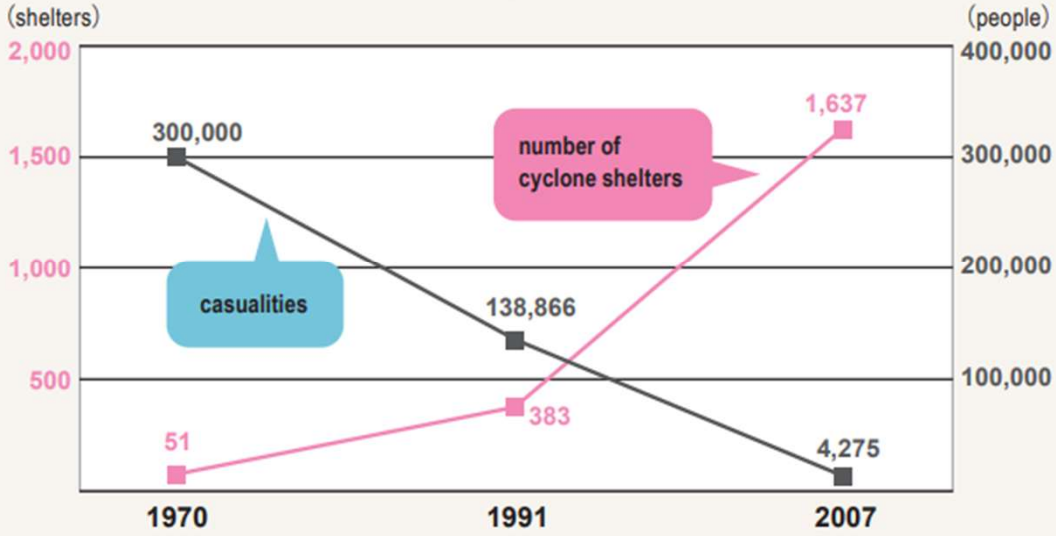
Only 20% of Bangladesh's land is located more than 9 meters above sea level. The country as well as lives, livestock, and properties are affected by large scale cyclones and floods almost every year. Japan has extended its support to Bangladesh starting with infrastructure rehabilitation support in the 1980s, and have carried out long term and comprehensive support including not only cyclone shelters but also support to strengthen meteorological observations and early warning systems.

Japan constructed approximately 120 raised-floor concrete style cyclone shelters, set up meteorological satellite imaging receiver equipment, communication circuitry, and 5 weather observation radars that cover the entire country. In parallel with construction Japan also trained the weather services staff, and have improved the system of cyclone tracking, prediction, and issuing alerts and evacuation warnings to the residents. As a result and together with development of Bangladesh as a nation, the damage and victims from cyclones in 2007 were greatly reduced.

Cyclone shelter

Predicting the path of a cyclone on a map

Transition of numbers of cyclone shelters and numbers affected by cyclones



Combination of **Hardware measures (Tsunami Evacuation Tower)** and **Software measures (Early Warning)** is quite effective to **Reduce Causalities**.

Thank you for your attention