United Nations
Educational, Scientific and
Cultural Organization

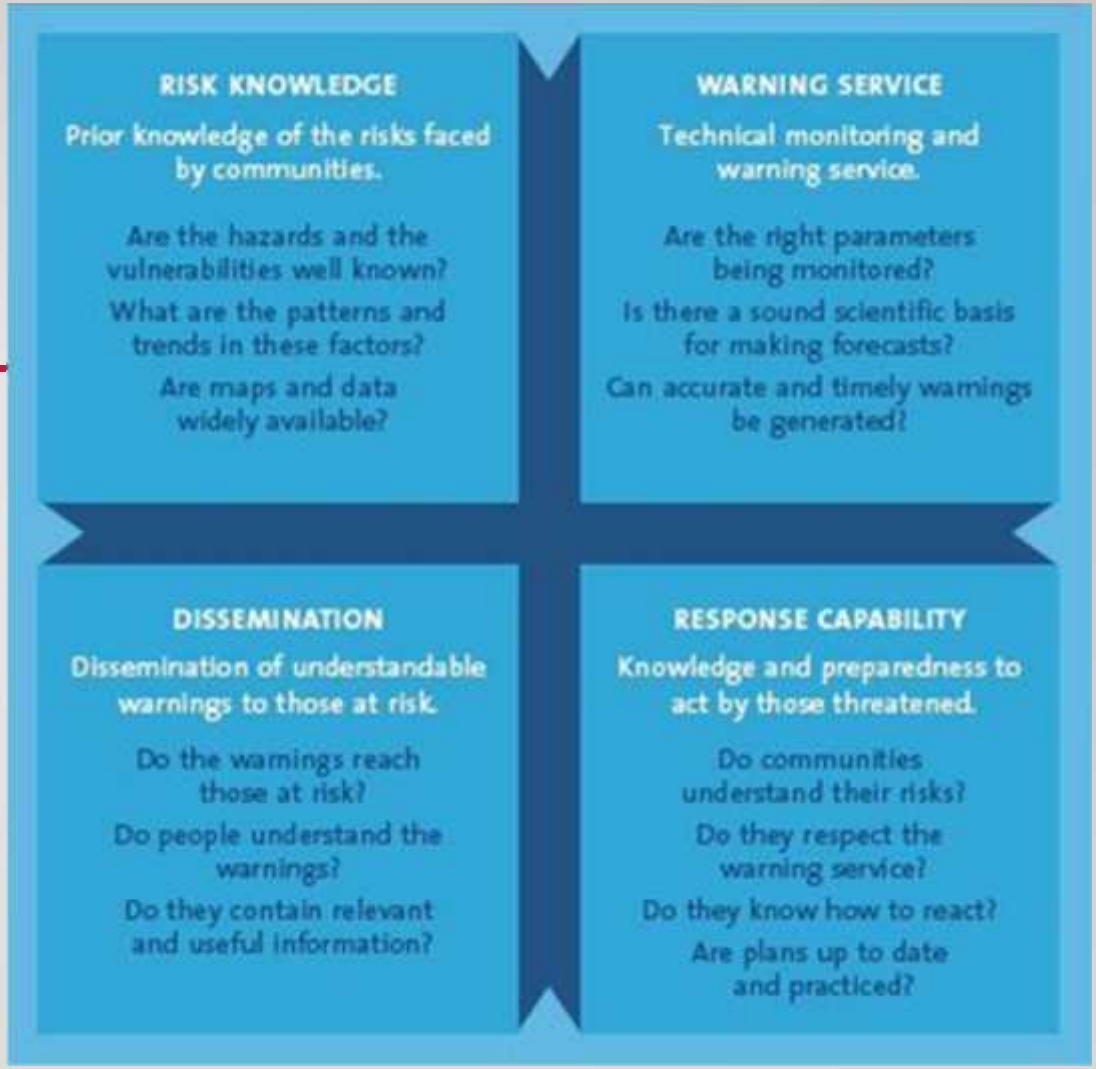
Earthquake Early Warning Systems: From Science to Real Implementation

Mitigating the Impact of Natural Risk in Africa

23-26 October 2017, Cairo, Egypt

Jair TORRES
UNESCO
Earth Sciences and Geo-Hazards Risk Reduction Section
Natural Sciences Sector

Sendai Framework for Disaster Risk Reduction 2015-2030



TARGET "G'

"Substantially increase the availability of and access to MHEWS and disaster risk information and assessments to the people by 2030"

INTERNATIONAL NETWORK FOR MULTI-HAZARD EARLY WARNING SYSTEMS - (IN-MHEWS)

UNISDR
The United Nations Office for Disaster Risk Reduction

WORLD METEOROLOGICAL ORGANIZATION

UNESCO
United Nations Educational, Scientific and Cultural Organization

UNESCO
United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission

ITU International Telecommunication Union

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

UNITED NATIONS
Office for Outer Space Affairs
UN-SPIDER

World Health Organization

UNDP

PARTNERSHIP

GFZ Helmholtz-Zentrum POTSDAM

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

1. Promote synergies and partnerships
2. Identify effective strategies and actions to promote and strengthen MHEWS
3. Facilitate the sharing of good practice and making available to governments and key stakeholders expertise and policy-relevant guidance
4. Provide a sound conceptual and scientific understanding of MHEWS
5. Assess the progress made by individual EWS for specific hazards or hazard clusters, the existing relations within and between them and the potential synergies facilitating their integration into an effective, people-centred MHEWS
6. Identify new areas of, and promote further, scientific research on and technological development of EWS for single hazards (hazard clusters) while advocating for their integration into MHEWS as well as the application of these latest scientific and technical advances.

INTERNATIONAL NETWORK FOR MULTI-HAZARD EARLY WARNING SYSTEMS (IN-MHEWS)

Sendai Framework for Disaster Risk Reduction
2015 - 2030

- Target "a"
- Target "b"
- Target "c"
- Target "d"
- Target "e"
- Target "f"
- Target "g"
  - MHEWS
    - EWS for Geo-Hazards
    - EWS for Hydro-meteorological
    - EWS for Fire & Environmental Hazards
    - EWS for Technological Hazards

United Nations
Educational Scientific and
Cultural Organization

EWS Geohazards

Volcanoes

IMEWS

An International Mobile Early-Warning System for Volcanic Eruptions

Earthquakes

IP-EEWS

International Platform for Earthquake Early Warning Systems

Landslides

ICL

International Consortium on Landslides

INTERNATIONAL CONSORTIUM ON LANDSLIDES

Tsunamis

IOC

International Oceanographic Commission

Earthquake Early Warning Systems???????

- Is **NOT** Earthquake Prediction

  (Information about timing, location, and size of future earthquakes)

Earthquake prediction is a hotly debated topic and active area of research

EARTHQUAKE EARLY WARNING SYSTEMS???????

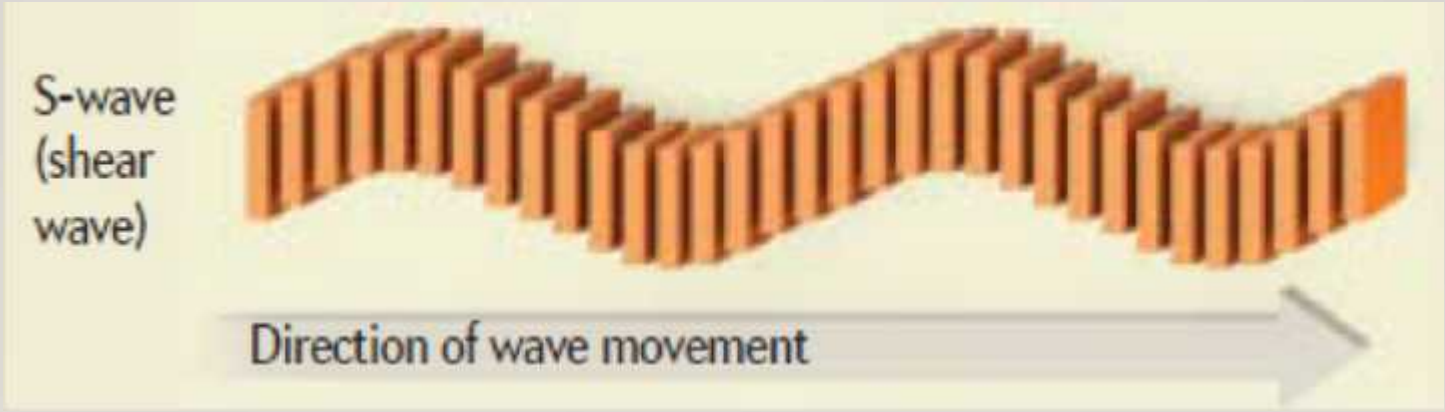
- While it may not be possible to predict when and where the next damaging earthquake might occur, it is possible to estimate the effects of strong ground shaking on surrounding areas while an earthquake is still rupturing.

P

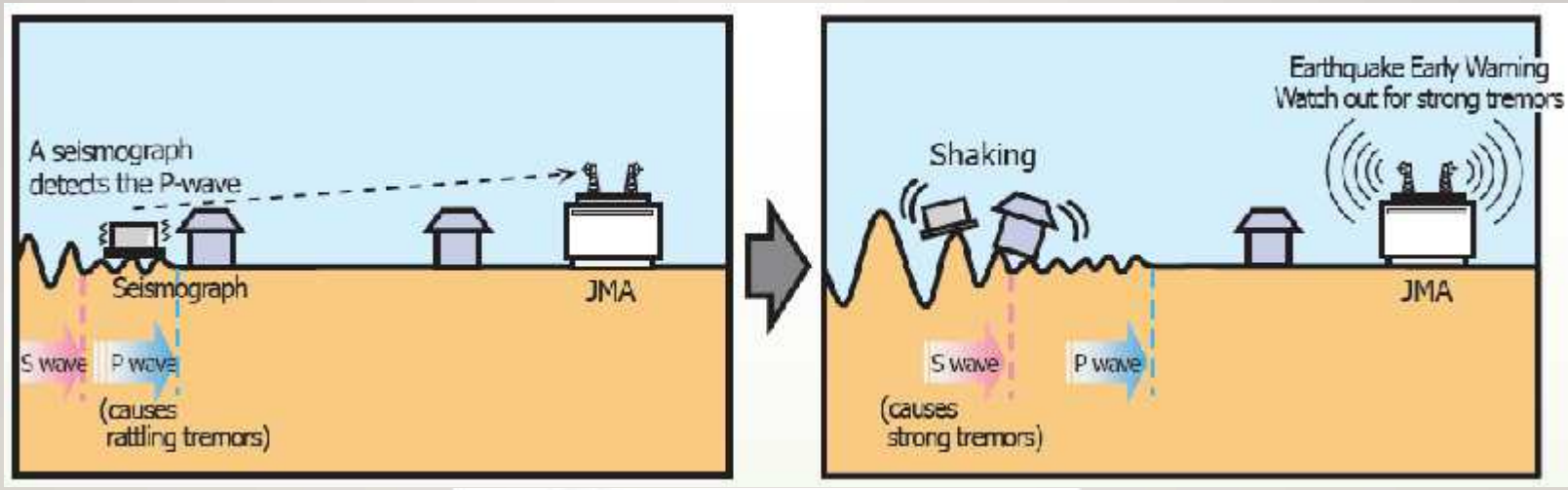
- P (or primary) waves travel at approximately 6.5 kilometers per second and are the first waves to arrive at seismic monitoring instruments in a given region. They have relatively low amplitudes and are less likely to cause damage to buildings, but they carry important information about the size and location of an earthquake.

S

- S (or secondary) waves travel more slowly at approximately 3.5 kilometers per second and arrive after the P-waves, but they cause stronger levels of shaking and can bring down buildings during an earthquake.

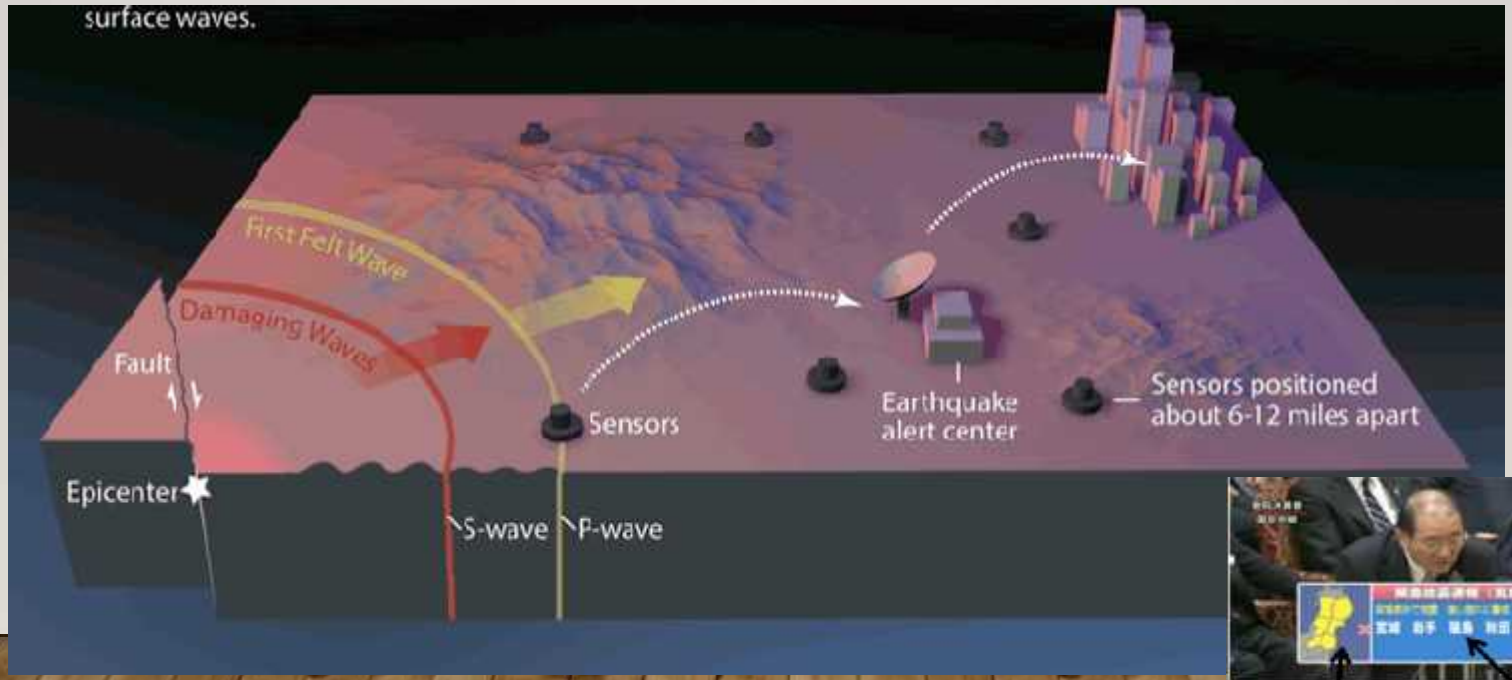


How Does it Works?



EARTHQUAKE EARLY WARNING SYSTEMS???????

- Different from earthquake forecasting, earthquake early warning systems help identify which locations will be hit and issue warnings few seconds before the shake



Types of Application

1. **Personal safety**

– moving to a safe zone

2. **Situation awareness**

– initiating response before shaking

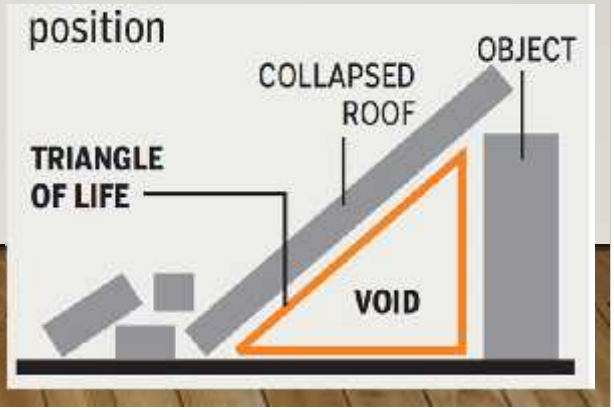
3. **Automated control**

– slowing/stopping/isolating sensitive systems

1. Personal Safety

Identifying a safe zone where you live and work

- Being mentally prepared for the shaking
- Protection from falling bookshelves, lighting etc
- Home or office: Under a sturdy table
- Outside: away from masonry and falling hazards
- Industrial plants, construction sites: away from machinery and chemicals



1. Personal Safety

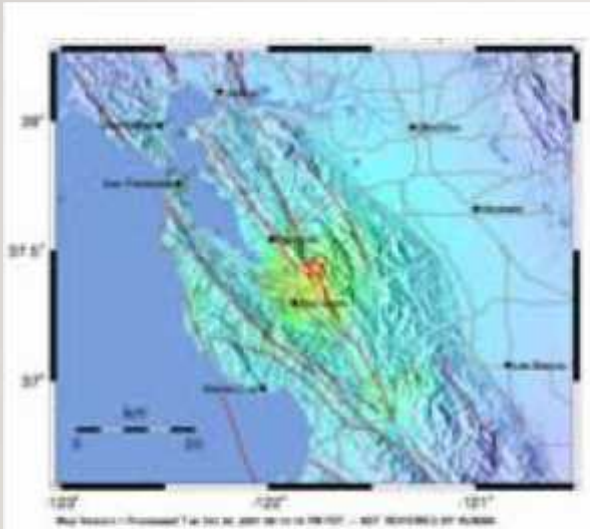
Sendai schools and universities

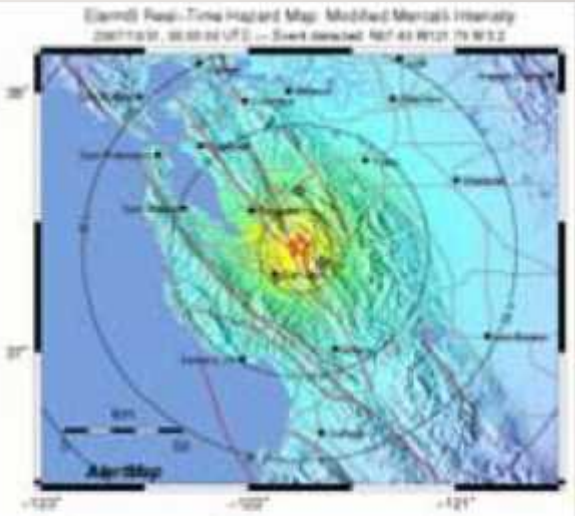
"I've confirmed that EEW worked well Nagamachi Elementary School in Sendai City: 'The earthquake warning was announced about 10 sec before shaking and all pupils sank under their desks. Gradually shaking became larger. One minute later a blackout occurred and after another two minutes severe shaking continued'.

The EEW at Shiroishi Junior High School, Shiroishi City was issued and staff and pupils were evacuated. Sendai-West High School's EEW using Miyagi-SWAN (School WAN) also worked. Teachers were in a meeting and sank under desks following the EEW. Athletics club students in the gymnasium were also evacuated. Tohoku University's EEW using the university LAN worked and issued the EEW which was broadcast across 5 campuses."

– report from Masato Motosaka

2. Situation awareness





Today: ShakeMap
in 5-10 minutes

Soon?: AlertMap
seconds to tens of seconds before shaking

Current realtime earthquake information
- location
- magnitude
- ground shaking distribution

2. Situation awareness

Understanding why systems are failing

- Re-routing power or communications
- Preventing cascading failures
- Initiating emergency response

→ Information available before communications are lost

3. Automated control

Bringing systems into a safe mode

- Slowing and stopping trains
- Telling airplanes to "go-around"
- Isolating hazardous chemicals and machinery
- Putting sensitive equipment into a stable state
- Stopping elevators and opening doors at next floor
- Smart buildings: opening doors/windows, turning off gas
- Oleoducts/gazoducts

3. Automated control

PUBLIC APPLICATIONS

Bullet trains

At the time of the M9 Tohoku-oki earthquake…

- 24 trains were running in the Tohoku Shinkansen system
- 9 seismic sensors along the coast, and 44 sensors along the train track
- detected the initial tremor; automatic shutdown of power; activation of the emergency brakes
- all trains stopped without derailment they did not sustain any damage on bridges and tunnels, and could restore the operation very quickly

3. Automated control

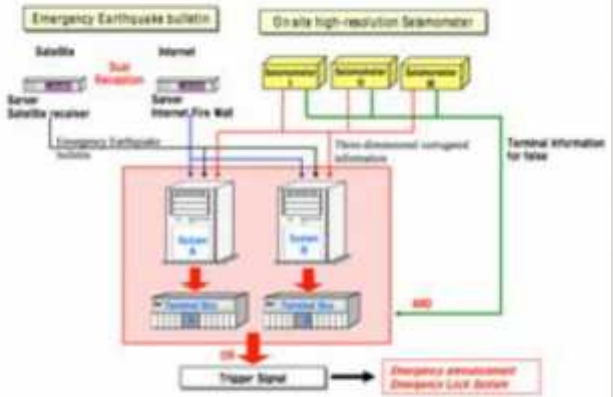
PRIVATE APPLICATIONS

OKI OKI Engineering Co.,Ltd.

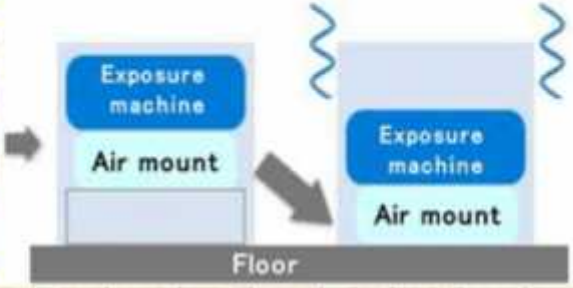
chip manufacturer — **Miyagi, Japan**

2003: Two damaging earthquakes
- $15 million in losses
- fire, equipment damage
- 17 and 13 days loss of productivity

Spent $600K on early warning and shear walls in basement
- Sensitive equipment set down on floor to reduce shaking and damage



Two similar earthquakes
- $200K in losses
- 4.5 and 3.5 days loss of productivity



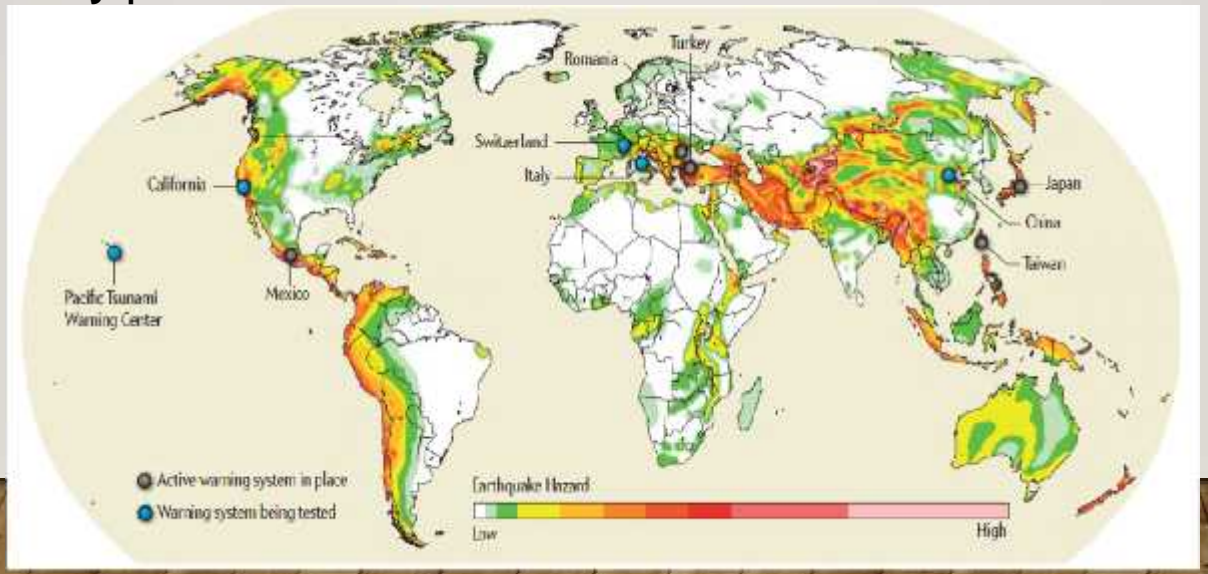
EARTHQUAKE EARLY WARNING SYSTEMS

UNESCO

International Platform on Earthquake Early Warning Systems (IP-EEWS)

10 Countries Already Committed

- China
- Germany
- Italy
- Japan
- Mexico
- Romania
- Spain
- Switzerland
- Turkey
- USA



EARTHQUAKE EARLY WARNING SYSTEMS

UNESCO International Conference on Earthquake Early Warning Systems: From Science to Policy

Hosted and co-sponsored by the People's Government of Sichuan Province

25-27 April 2018, Chengdu, China

	Day 1	Day 2	Day 3
09:30-11:00	Opening Ceremony	EEWS Practice: Implications for policy	Proven benefits of implementing EEWS and recommendations for reaching target "g"
11:00-11:30	Coffee Break	Coffee Break	Coffee Break
11:30-13:00	EEWS Science: State of the art of current knowledge	EEWS Policy: Country case studies	Wrap-Up
13:00-14:30	Lunch	Lunch	Lunch
14:30-16:00	EEWS Science: Implications for practice and policy	EEWS Policy: Challenges ahead	Way Forward
16:00-16:30	Coffee Break	Coffee Break	Coffee Break
16:30-18:00	EEWS Practice: Best practices	Roadmap from Science to Policy	Closing Ceremony

Preceded by

UNESCO Training Workshop for Young Scientists

23-24 April 2018

EARTHQUAKE EARLY WARNING SYSTEMS

Main Objectives:

1. To raise awareness on the importance of earthquake preparedness, and the role of EEWS on it.

2. To assess current capacities, gaps, challenges and opportunities for the advancement of EEWS worldwide, from science to policy, and to strengthen cooperation between active groups developing EEWS around the globe.

3. To present IP-EEWS globally, to expand the IP-EEWS database of national, regional and international experts involved in the development and/or operation of EEWS, to seek the engagement of additional countries in IP-EEWS and to raise additional funding.

4. To provide guidance, through IP-EEWS, on how local, national, regional and international investments in EEWS would best meet to address current challenges and provide path forward.

Expected Outputs:

1. A roadmap for advancing EEWS, from science to policy, worldwide.

2. A compendium of existing best practices, opportunities and challenges related to EEWS and contributing to reaching global target "g" of the Sendai Framework for Disaster Risk Reduction 2015-2030.

3. Engagement of new countries in IP-EEWS.

THANK YOU!

Looking forward
to receive your comments

Mr. Jair Torres
Disaster Risk Reduction and Resilience
Earth Sciences and Geo-hazards Risk Reduction
Natural Science Sector
7, Place de Fontenoy, 1.037, 75352 Paris 07 SP, France
Tel: +33 (0)1 45 68 41 22
j.torres@unesco.org