

“FOREWARNED AND FOREARMED – ADVANCES IN SCIENCE TO ENHANCE RESILIENCE”

Saving Lives with Advances in Impact based Multi-Hazards Early Warning

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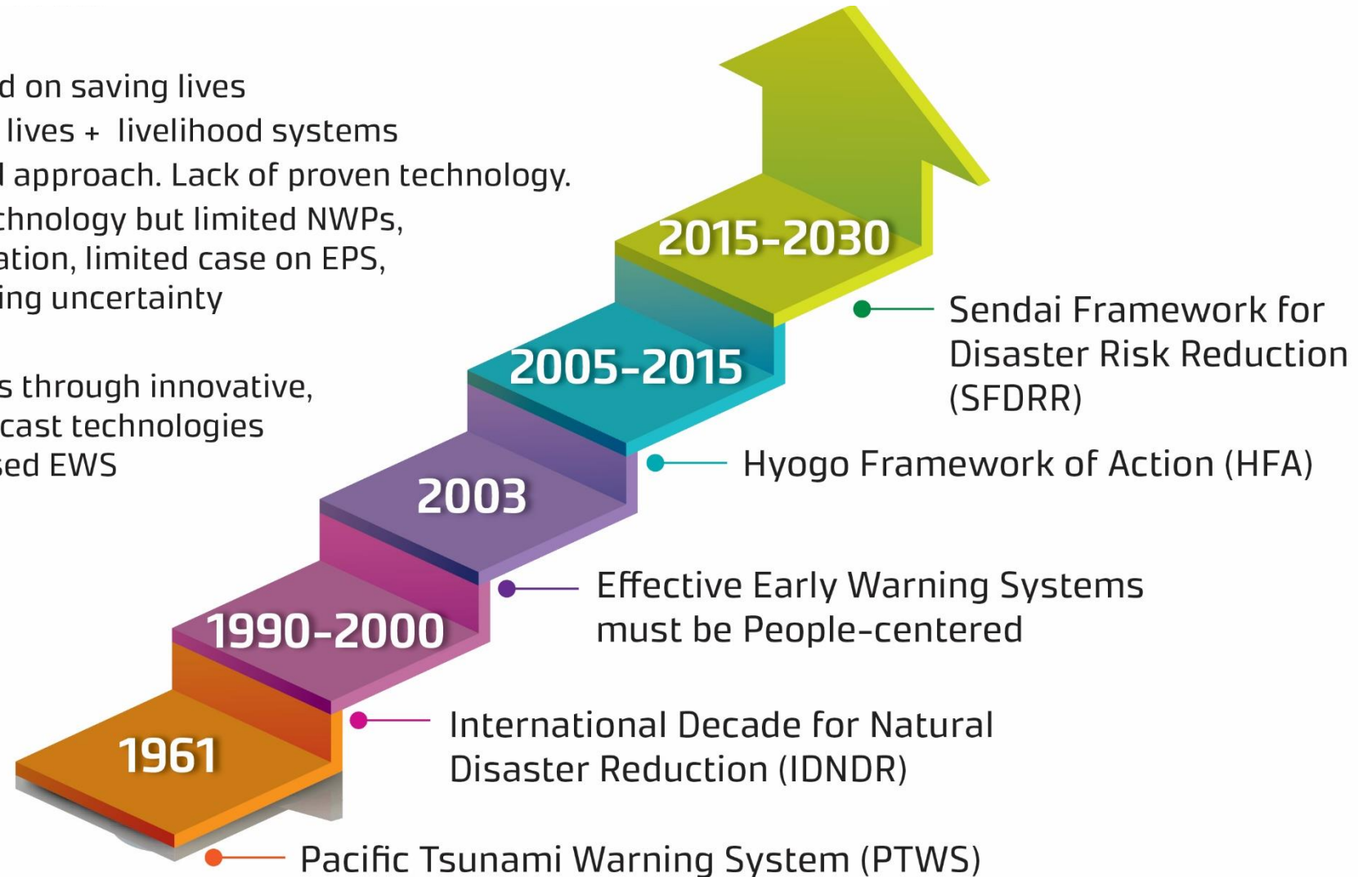


Exceptional thinking together
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Evaluation of Early Warning Systems (EWS)

- Till 1980's:** EWS focused on saving lives
- 1990's:** Focus on saving lives + livelihood systems
- 2000's:** People centered approach. Lack of proven technology.
- 2010's on:** Emerging technology but limited NWP's, data assimilation, limited case on EPS, communicating uncertainty

Currently: Opportunities through innovative, emerging forecast technologies for impact based EWS



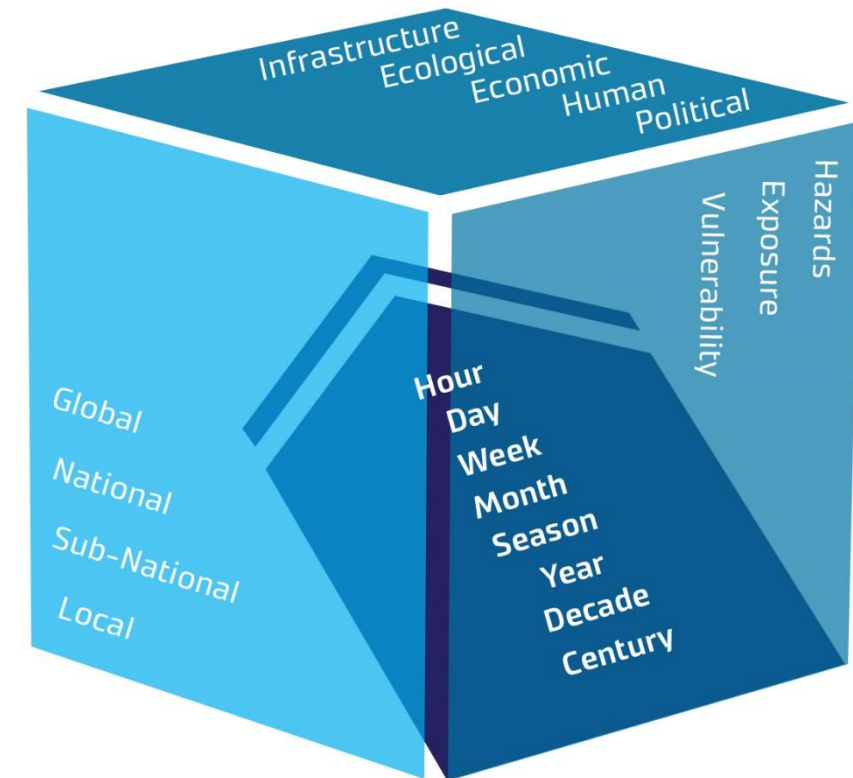
Sendai Framework for DRR 2015-2030

- Seven global targets-
 - A. Disaster mortality
 - B. The number of affected people
 - C. Direct disaster economic loss in relation to global gross domestic product (GDP).
 - D. Disaster damage to critical infrastructure and disruption of basic services, including health and educational facilities
 - E. The number of countries with national and local disaster risk reduction strategies by 2020.
 - F. International cooperation to developing countries to complement their national actions for implementation of this framework.
 - G. The availability of, and access to, multi-hazard early warning systems and disaster risk information and assessments to the people.**

Substantially reduce



Substantially increase

EWS is a key component for successful implementation of these framework.

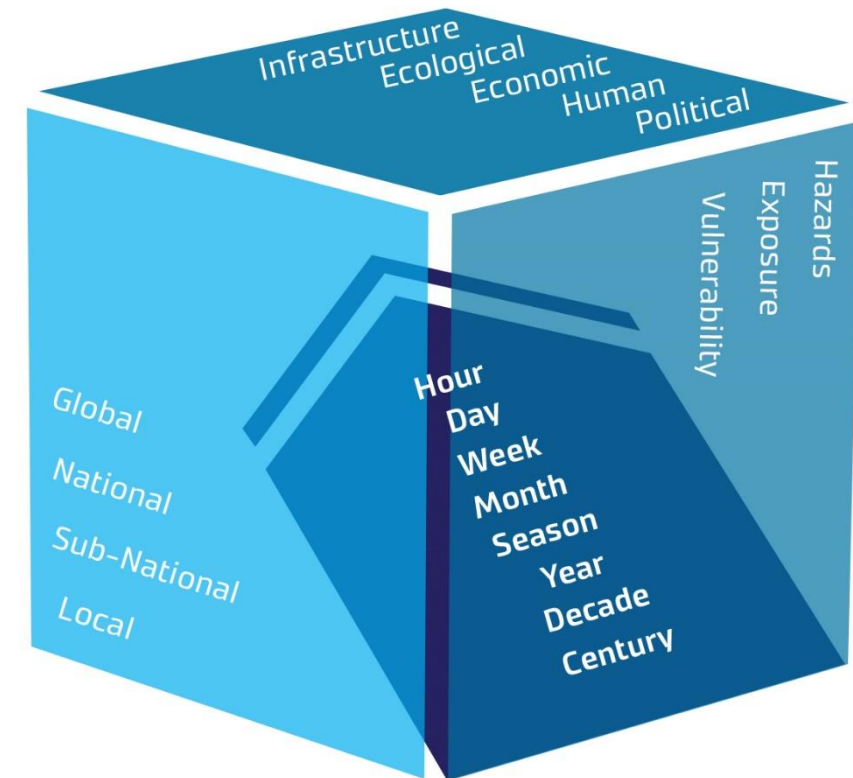
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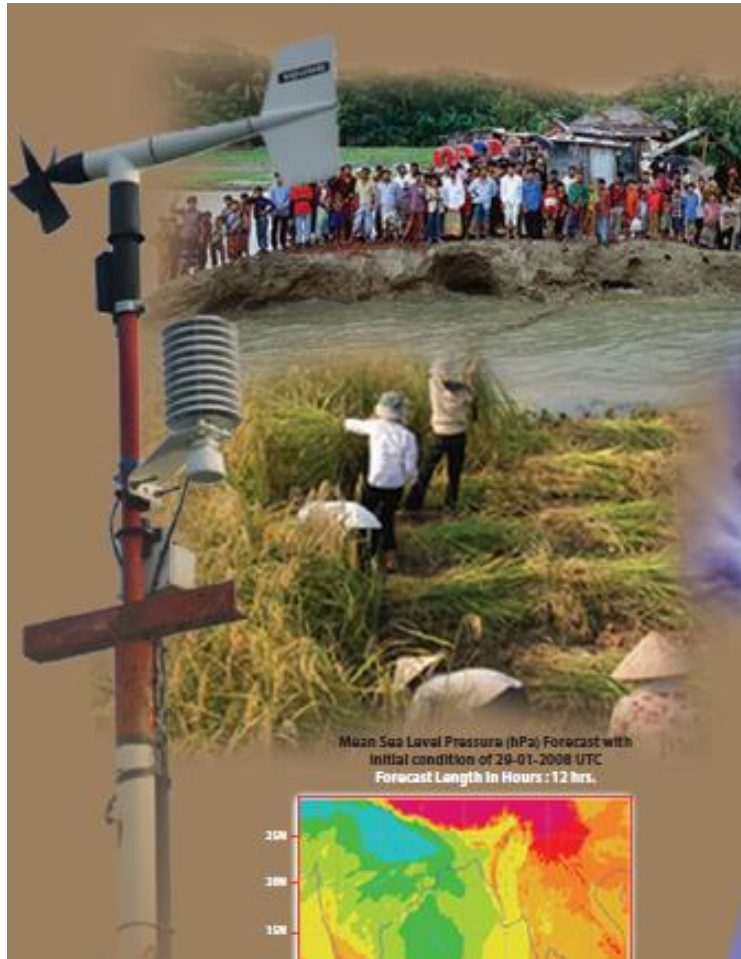


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Reasons for Warning Failure



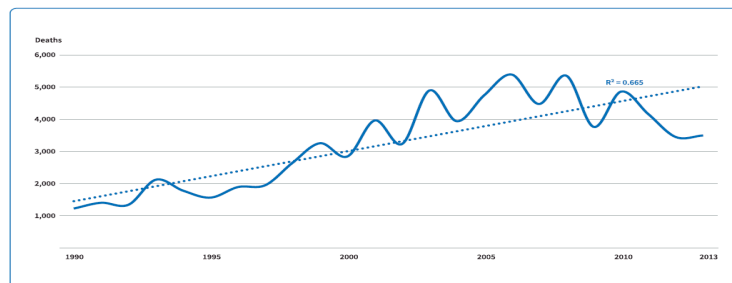
Despite advances
in forecasting,
***'Black swan
events'*** have
resulted in great
loss of lives as
well as property



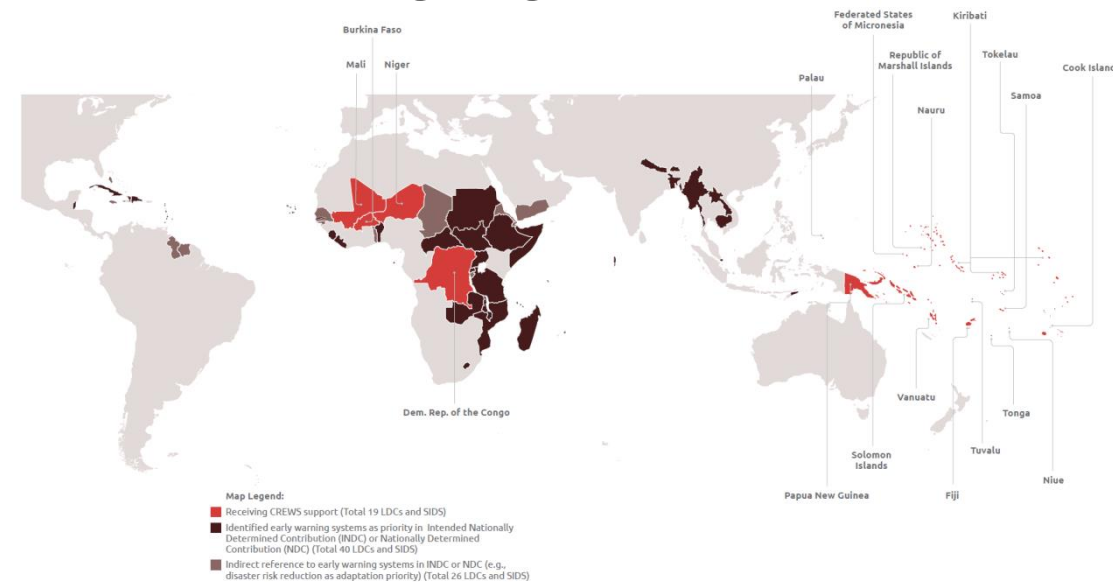
❑ WMO Strategic Plan 2020-2023 sets an ambitious Goal – to close the capacity gap on weather, climate, and water services between developed and developing countries

❑ Casualty risk increasing in LDCs and SIDS (going down in most other countries)

Extensive mortality 1990-2013



(Source: UNISDR with data from national loss databases.)



EWS Challenges...

- Unrelenting pressure on science to make a difference
- Linear and instrumental interpretations of relevance-
“science proposes, society disposes”
- Advances research >> operational vs decision making process
- Communicating probabilistic scientific information
- Interface between policy makers, practitioners and researchers is often tense-time lines>>pressures>>objectives
- Lessons identified never learned!



Differential impacts and Information need (example)

Hazard Class	Hazard	Problem/Rating			Impacts		
		Airport	Telco	Port	Airport	Telco	Port
Fog	Visibility	High	V Low	V Low	Collision	Signal alteration	Collision Oil pollution
Thunderstorm	Lightening	Medium	High	High	Navigation aid damage	Equipment damage	Equipment, Navigation aid and cargo damage
Tropical Cyclone	Extreme Wind	High	Medium	High	Damage to buildings Cancelation of flights	Outdoor and outer island network affected	Delays Abort inbound ferries Cargo damage
	Heavy Rainfall	High	High	High	Aquaplaning Reduced visibility Diversion of routes	Signal alteration Outer network affected	Delays Cargo, equipment and navigation damage
	Storm Surge	Low	Low	High	Outer island infrastructure damaged	Outdoor and outer island network affected	Warf and ship damage Delays to schedule Cargo damage
	Coastal Inundation	High	High	High	Outer island infrastructure damaged	Lose the port	Lose the port
	Strong Gale	High	Medium	High	Damage to buildings Cancelation of flights	Outdoor and outer island network affected	Delays Abort inbound ferries Cargo damage

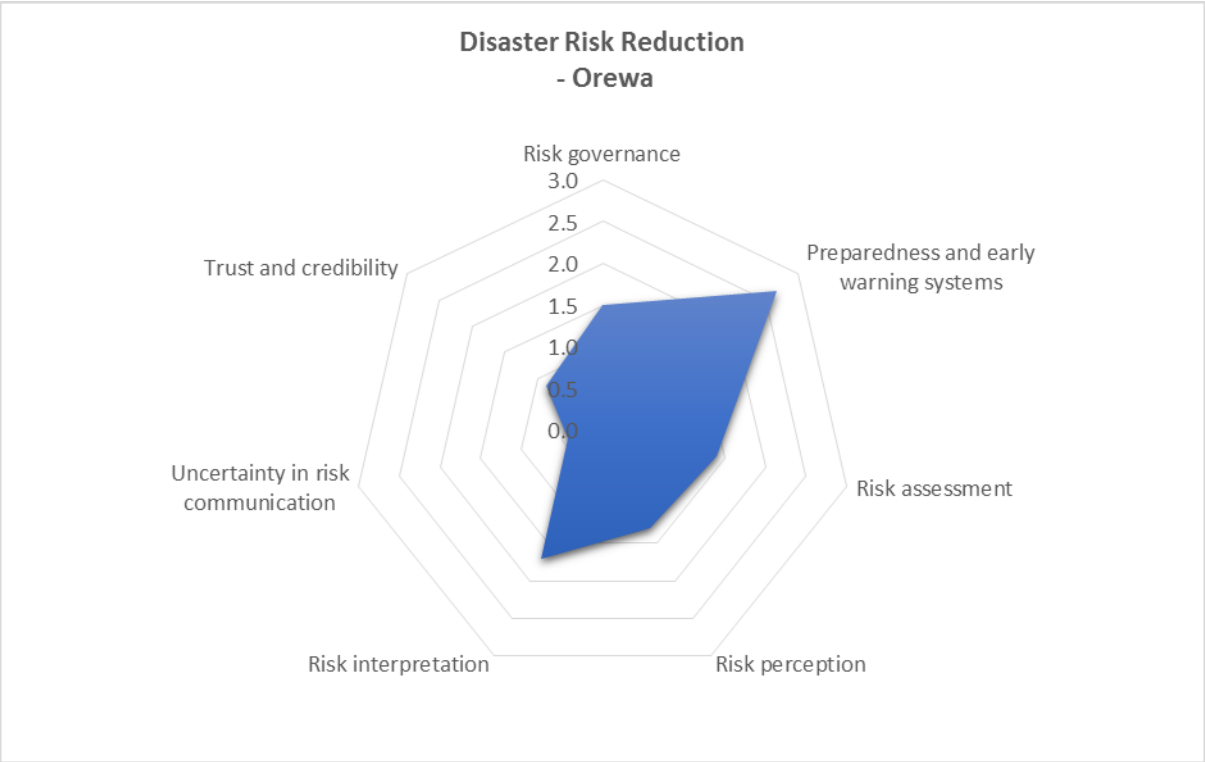
Country	Observations Network	Data Transmission	Hydrological Modeling Capacity	Integration of NWP products & <1 to 2 days forecasts	Extended Forecasts 3-10 days & more	Capacity to generate tailor made forecasts	Integration to community response system and feedback
Bangladesh	2	2	3	3	2	2	2
Bhutan	2	2	2	2	0	0	0
Cambodia	1	1	1	0	0	0	0
China	4	4	4	4	3	2	2
India	4	4	3	3	2	2	1
Kenya	3	3	2	2	0	1	1
Lao PDR	2	2	2	1	0	1	1
Maldives	3	2	1	1	0	1	1
Madagascar	2	1	1	0	0	0	1
Myanmar	1	1	2	1	0	0	1
Mozambique	2	2	2	2	0	0	0
Nepal	3	2	2	1	0	1	0
Pakistan	3	3	3	2	0	1	1
Philippines	4	4	3	2	2	2	2
Sri Lanka	3	3	2	1	0	1	1
Thailand	4	4	3	2	1	1	1
Vietnam	2	2	3	2	1	1	1
Yemen	2	2	2	1	0	0	0

Gaps

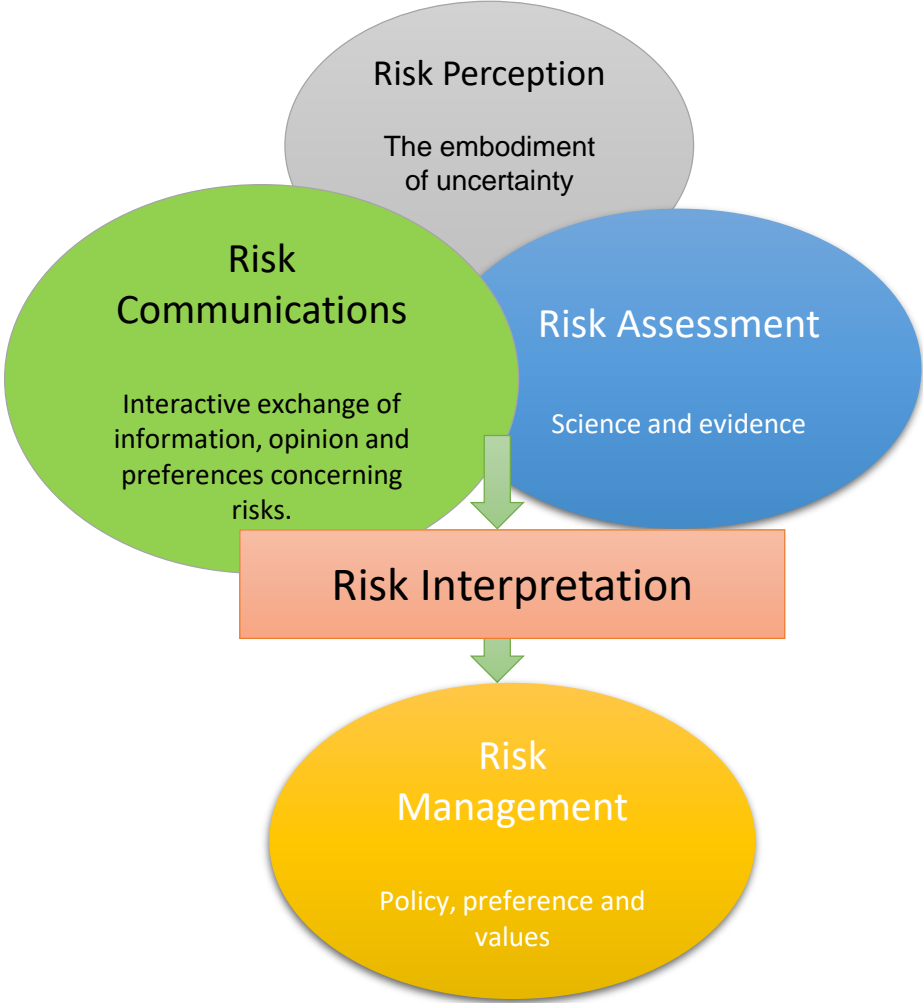
Note: Comparative rating: 5-excellent; 4-very good; 3-satisfactory; 2-needs improvement; 1-poor; 0-non-existent

Fakhruddin, 2013

Risk Management Framework



Source: Survey by Jessorda (2018), Master thesis supervised by B Fakhruddin



Multi-Hazard Impact Based Early Warning System

Community connection & response

- Linking communities with two way communication network
- Pre-impact assessment
- Local risk knowledge adopted
- Public awareness
- Risk perception
- Risk knowledge
- Risk interpretation
- Appropriate response in place
- Safe evacuation resourcing

Risk Communication

- Government notified
- Public notified
- Local community notified
- Tourists notified

Dissemination & notification methods

- Siren towers
- Text message
- Internet
- Mash Box
- Social Media
- Specialized networks
- Media
- TV
- Radio
- Others

Warnings & other infrastructure products

- Watches
- Advisories
- Statements

Impact based forecasting/warning

- Hazard assessment
- Vulnerability information
- Impact & risk assessments

Hazard assessment

- Observation
- Criteria
- Inundation
- Prediction models
- Uncertainty assessment

Institutional arrangement

- Regulatory framework
- Mandate
- Roles and responsibilities
- Interagency collaboration
- Concept of operation

Earth data observation

- Local hydro-met stations
- Local seismic networks
- Local tide gauge networks
- DART buoys
- AWS
- Doppler radars
- Upper air observation
- Satellite observation

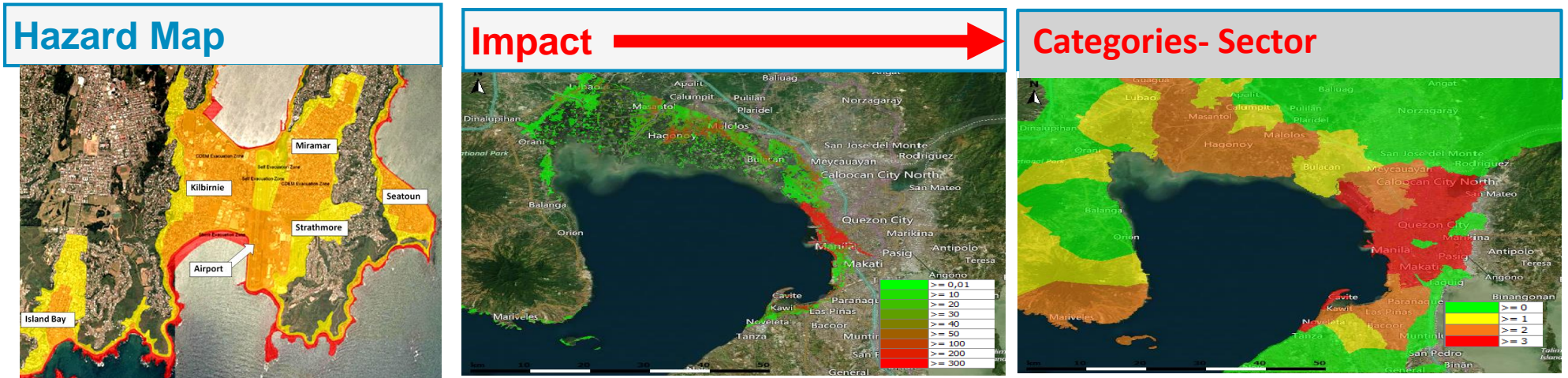
Data and information collection

- National information centre
- Satellite comms
- Broadband and telephone
- Global data
- Regional data

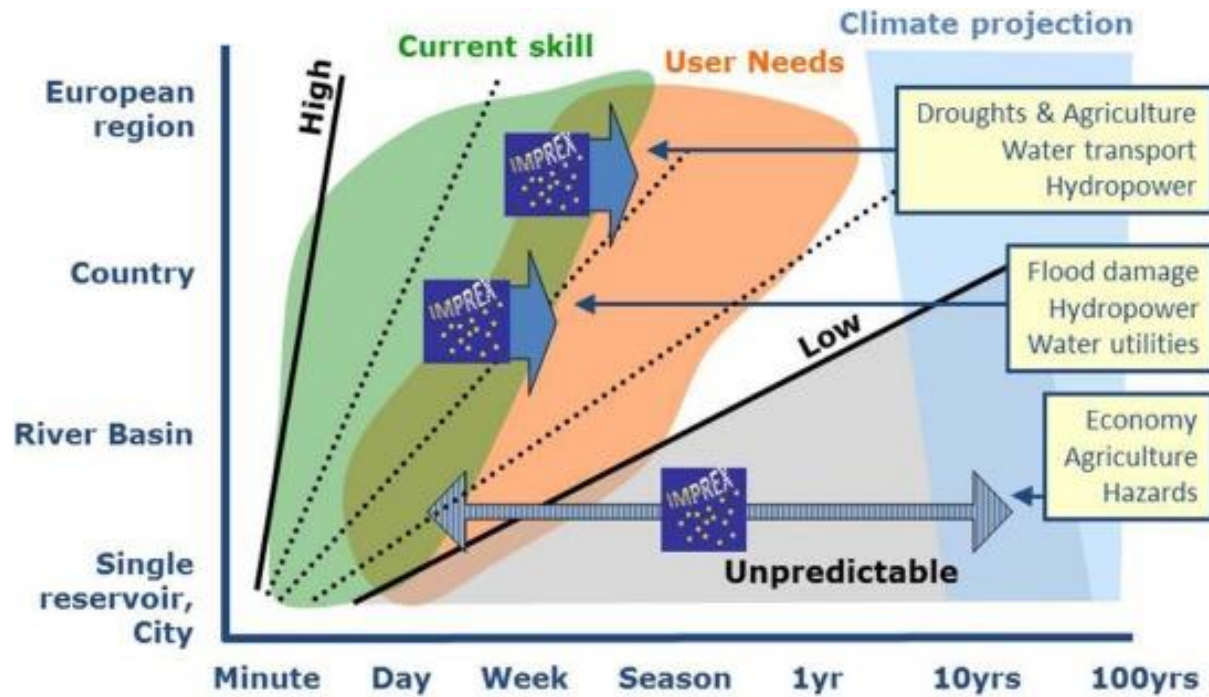
Hazard detection

- Hardware
- Operating system
- Data analysis software
- Data Integration software

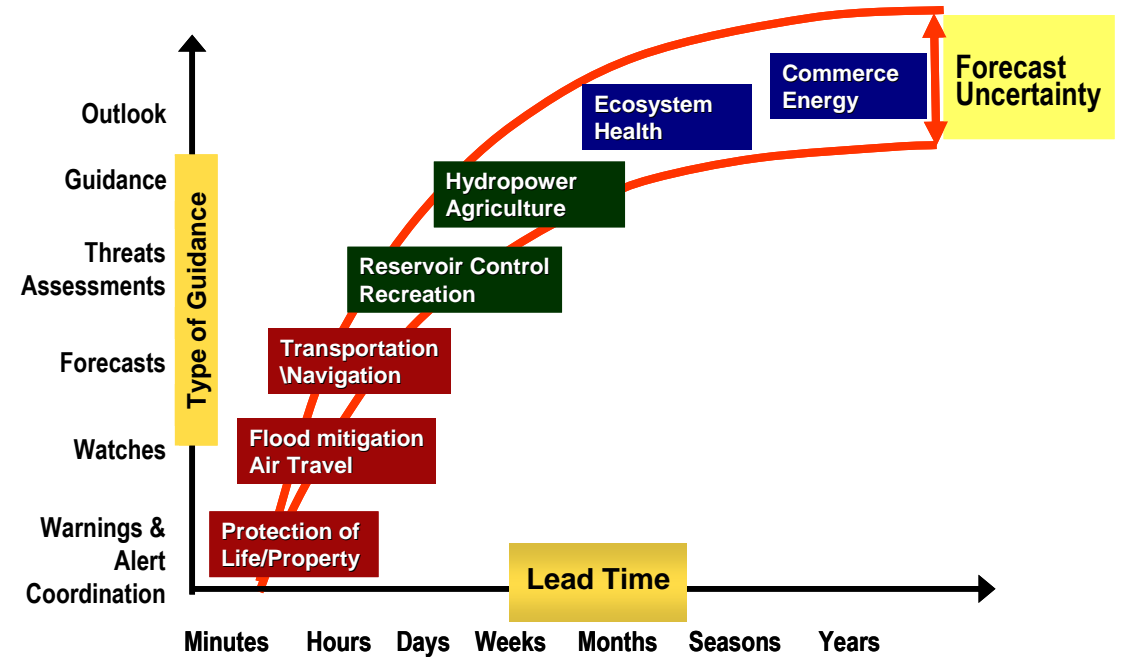
Impact Based EWS- Decision Support (example)



Uncertainty in EWS

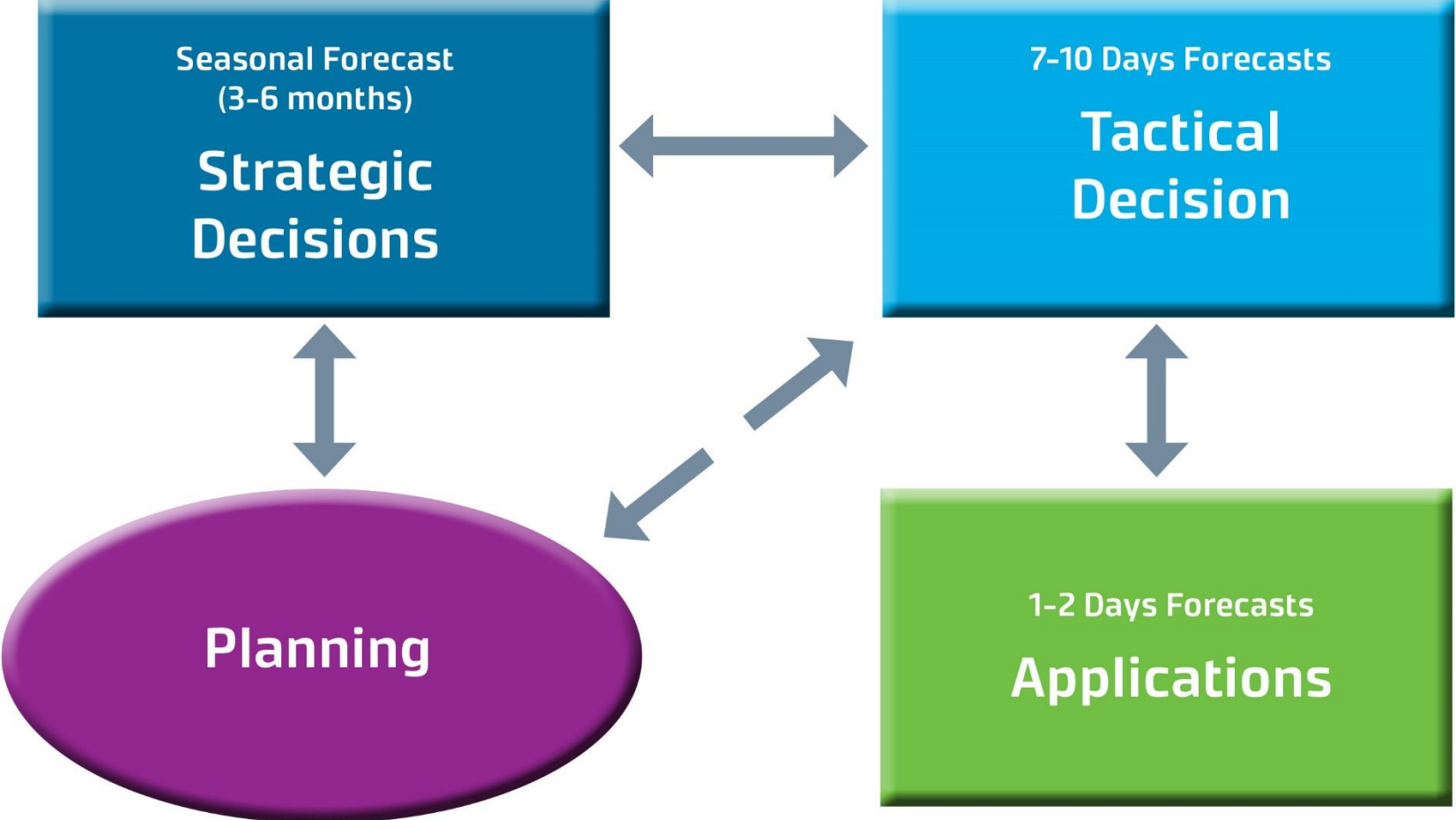


(Florian et al.,2016)



(Fakhruddin,2015)

Uncertainty Vs Opportunity





...a specialized climate risk and early warning initiative that saves lives and livelihoods in least developed countries and small island developing States.

CREWS Members



Australia



France (Chair)



Germany



Luxembourg



Netherlands

CREWS Observers



Canada



Japan



Mexico



New Zealand



Norway



Switzerland



UNDP



USAID

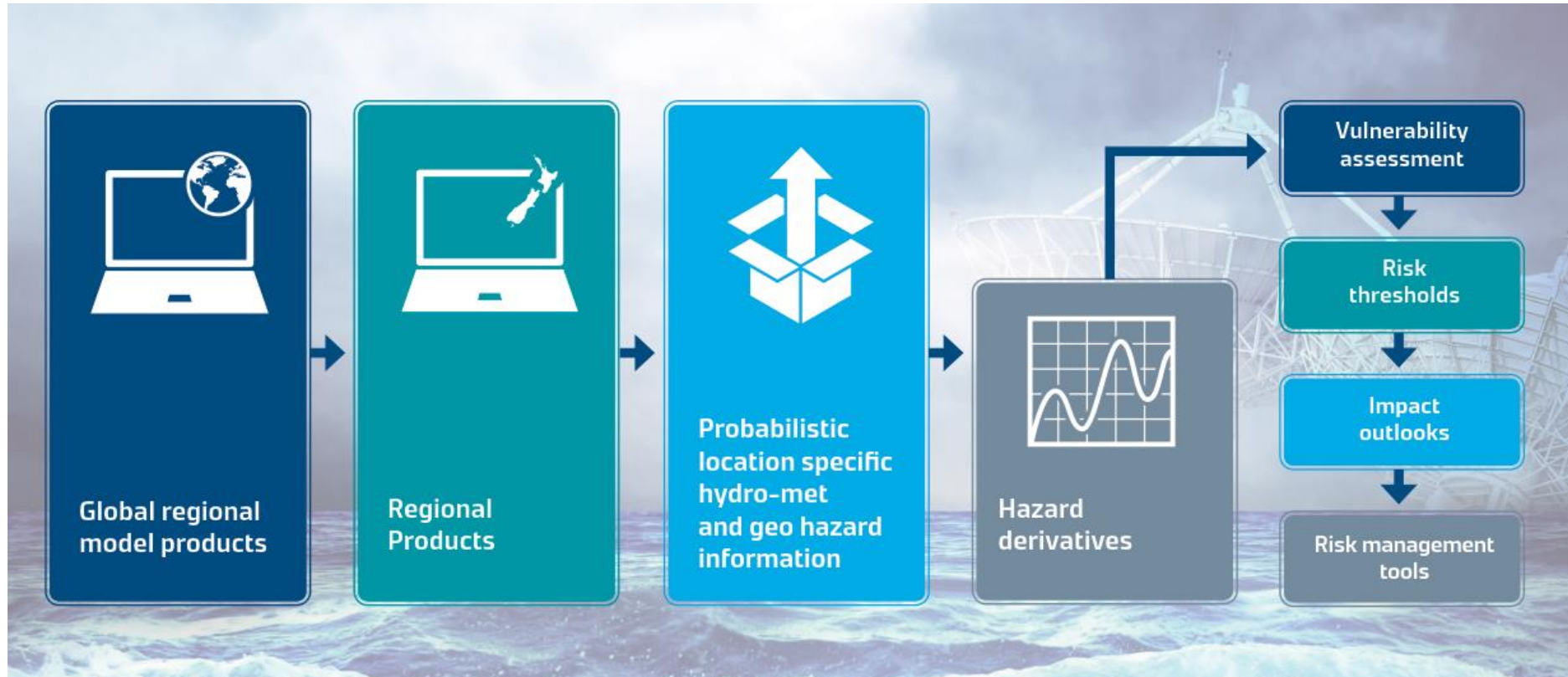


ACP

CREWS Implementing Partners

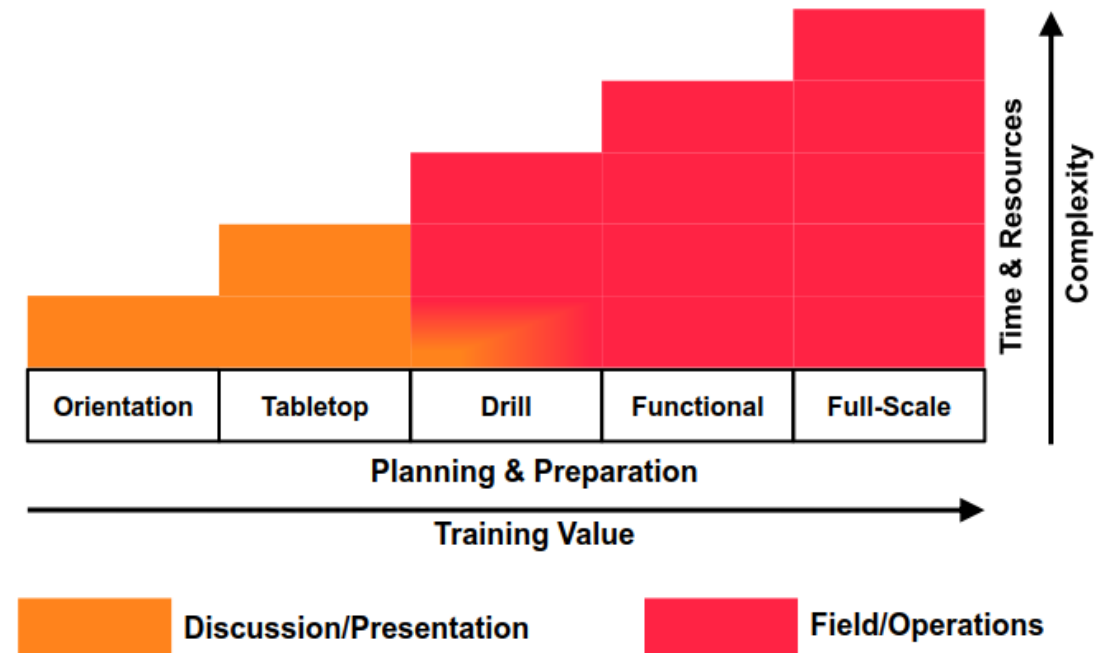


Connecting Science & Technology, Institutions and Society for an Integrated DRR



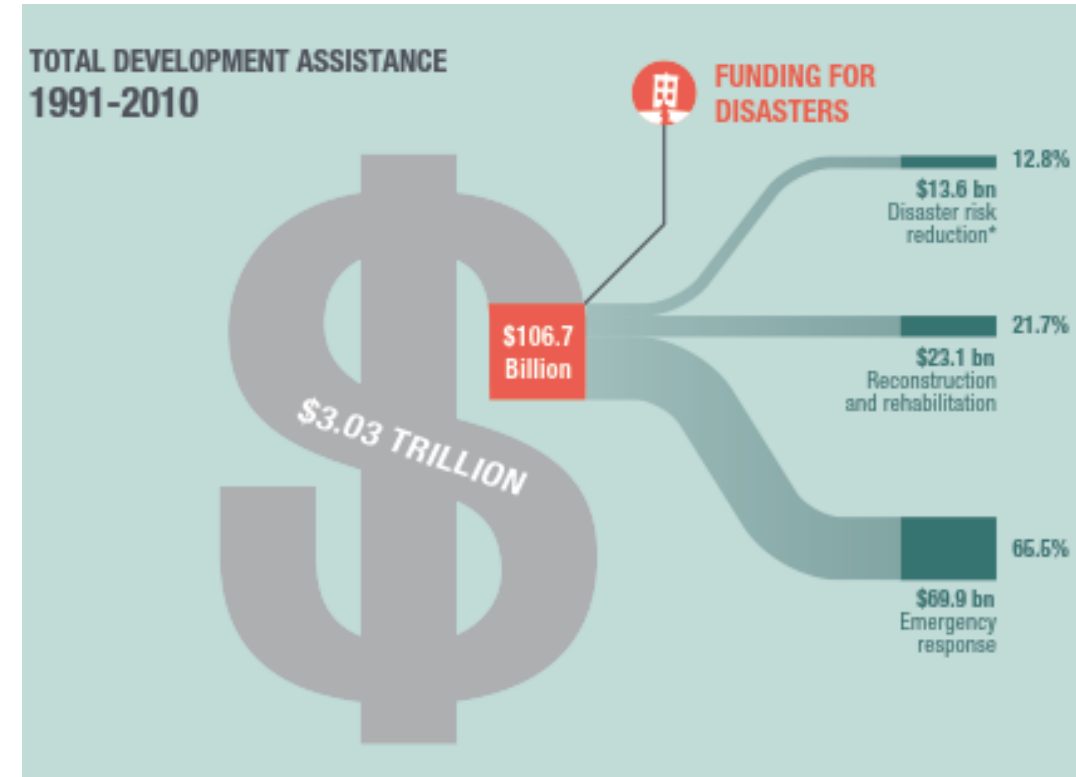
Essential to Operational Readiness

- Test>> Test>>TEST
- Design and conduct simulation exercises to test and enhance the framework, procedures and technology
- Goal of Simulation exercise
 - Improve overall readiness
 - Identify, evaluate, improve organizational weaknesses / gaps in Plans, Policies, SOPs
 - Communications, Interagency Coordination



Economic- Benefits

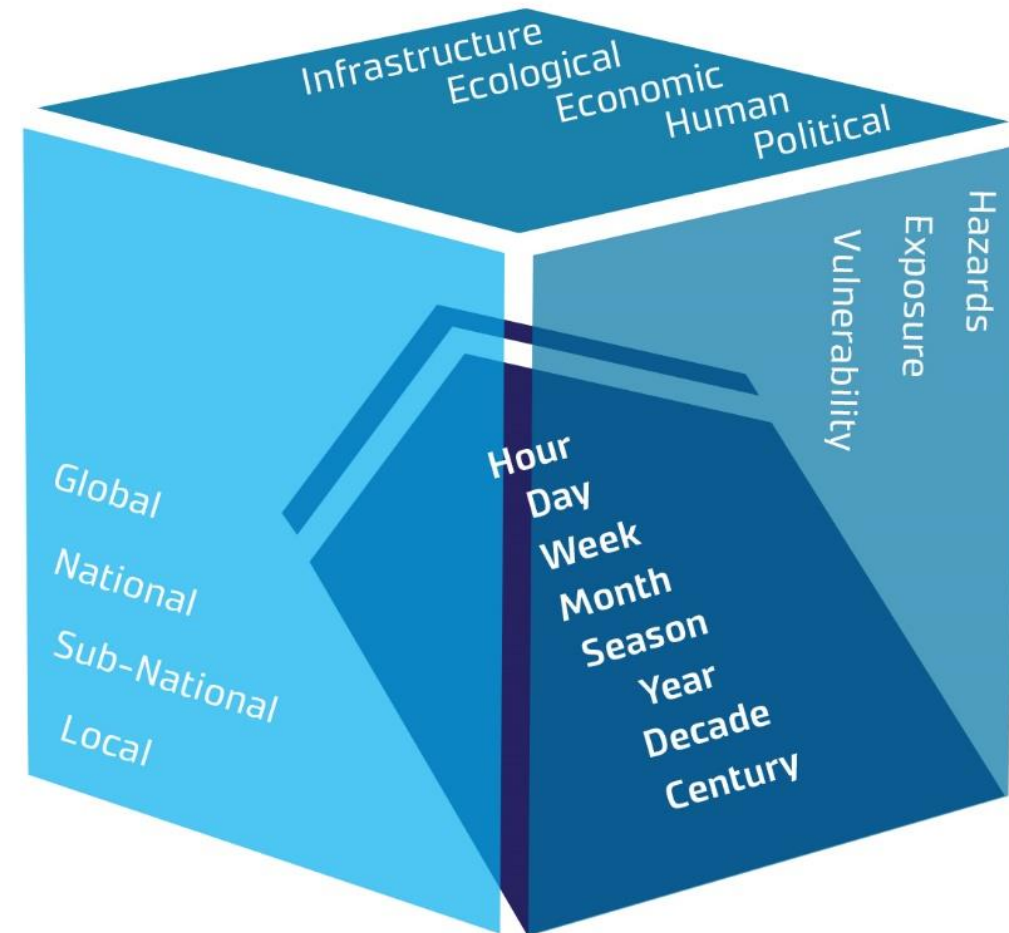
- Action to build disaster resilience is poorly incentivised (ODI, 2015)
- Economic benefit of the flood early warning system revealed a return of \$US559 for each dollar of investment (RIMES, 2013)
- Experiment showed that every USD 1 invested, a return of USD 40.85 in benefits over a ten-year period may be realized. Case study from Bangladesh (World Bank, 2012).
- USD 1 investment, a return of USD 70 in benefits in the Pacific cyclone early warning system. Case study from Samoa (Fakhruddin, 2015)



(Watson et al., 2015)

Take Home

- Skilful medium to long range/seasonal forecasts could be a valuable tool for decision making in the every sector (e.g. water, agriculture)
- We have enough tested technology to apply EPS for operational use in earth system science.
- Ensemble forecasts and warnings can only reach their full potential if they are understood and acted upon by the person receiving
- We can stretch our capabilities to utilize seasonal forecasting, flash flood forecasting for different sectors (e.g. dam operation, irrigation and electricity sectors, etc.)



Multi-Hazard, Impact-Based Early Warning Systems

Session 8 13:30-15:00 Thurs



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UNISDR Pacific



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Meteorological
Organization



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Oceania Regional
Seismic Network