

# WMO ETR Programme – Importance to WMO Priorities

## --Congratulations to the WMO SYMET- XIII



WORLD  
METEOROLOGICAL  
ORGANIZATION

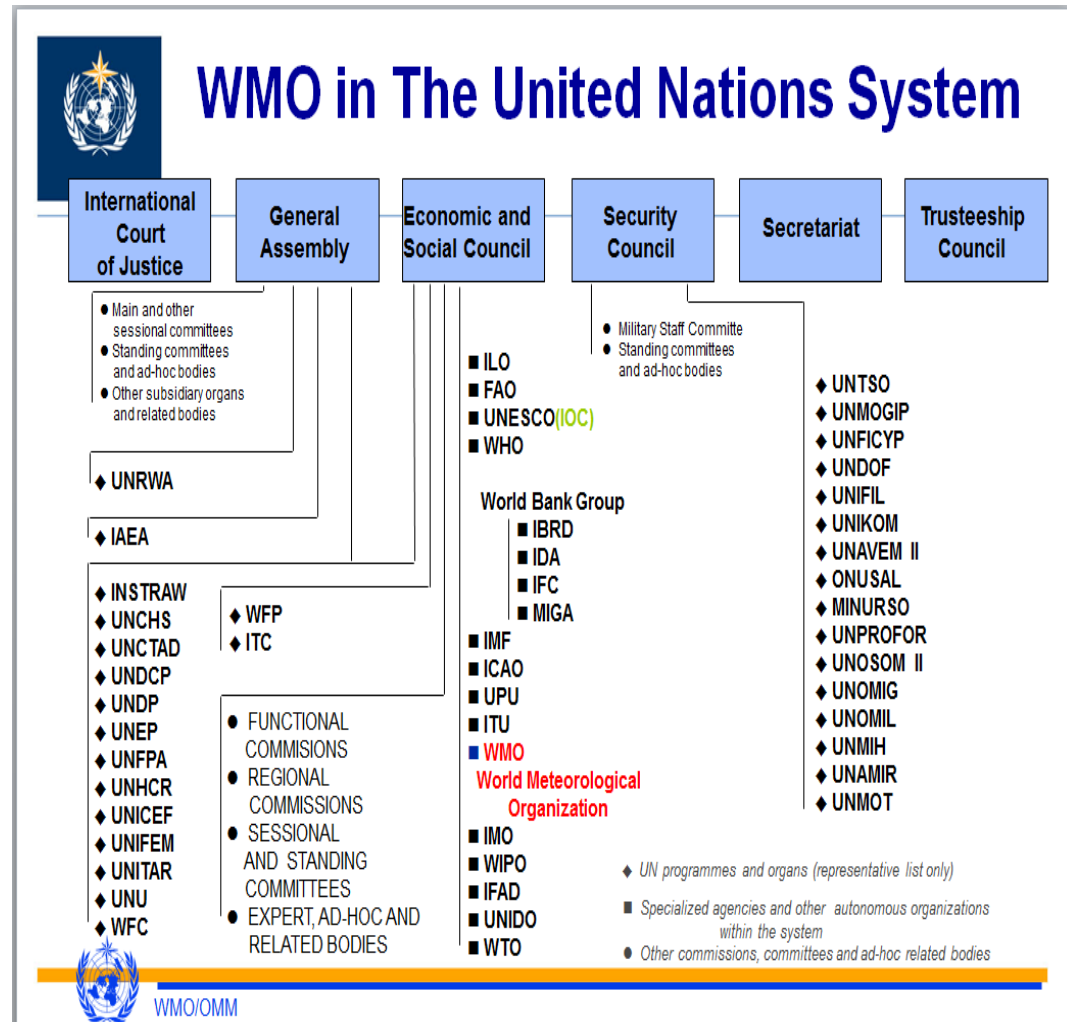
Dr. Wenjian ZHANG  
Assistant Secretary-General  
World Meteorological Organization  
[wzhang@wmo.int](mailto:wzhang@wmo.int)

# I: WMO & it's ETR Programme

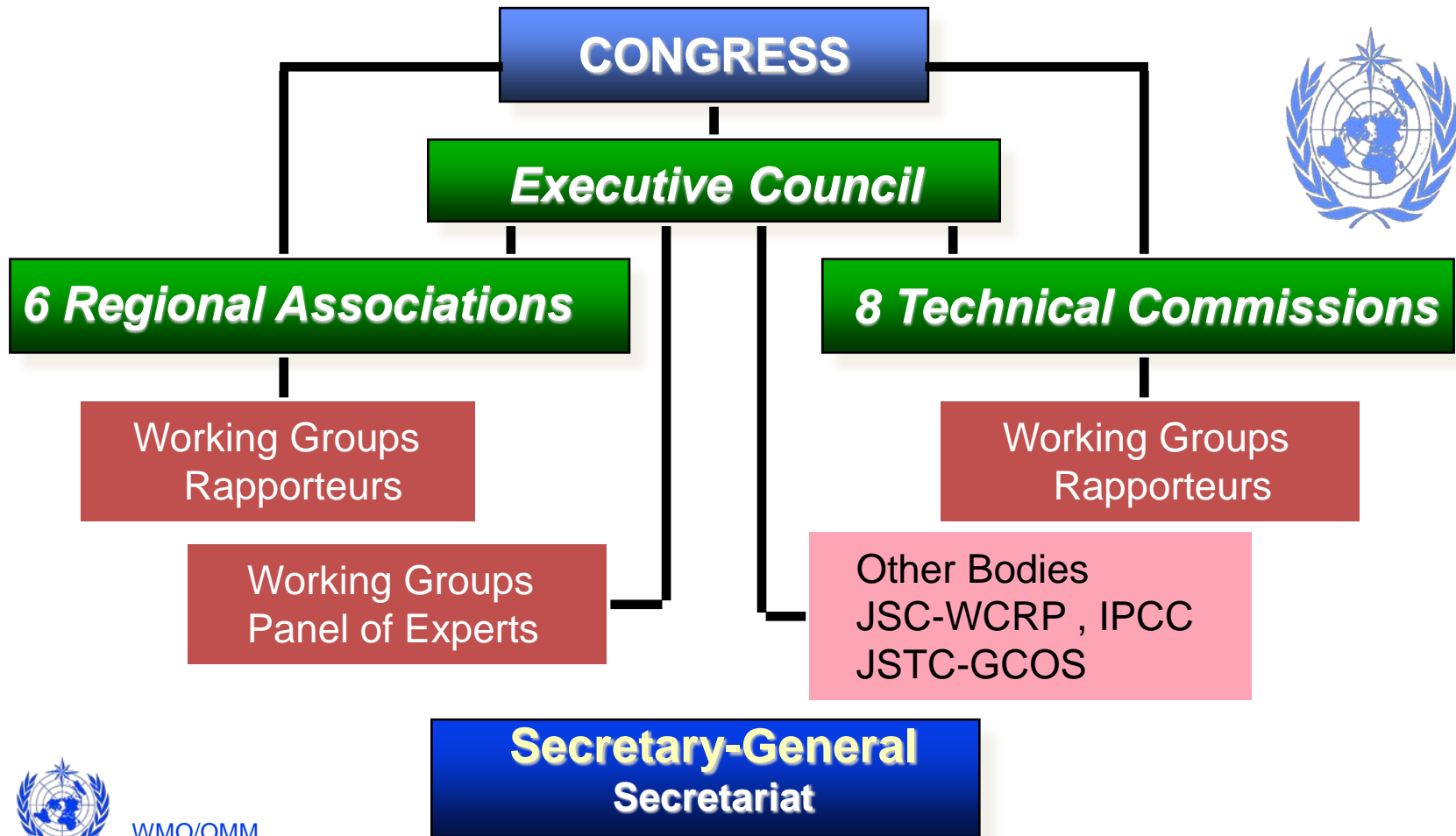
- Successful story of weather services
- New challenges for climate, water and environmental services

# WMO is the UN system's authoritative voice on weather, climate, water & related environmental issues

- The World Meteorological Organization (WMO) is a specialized agency of the United Nations, with 191 Members.
- It is the UN system's authoritative voice on the state and behavior of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of [water resources](#).<sup>[4]</sup>



# Organizational Structure of WMO ( *191 Members* )

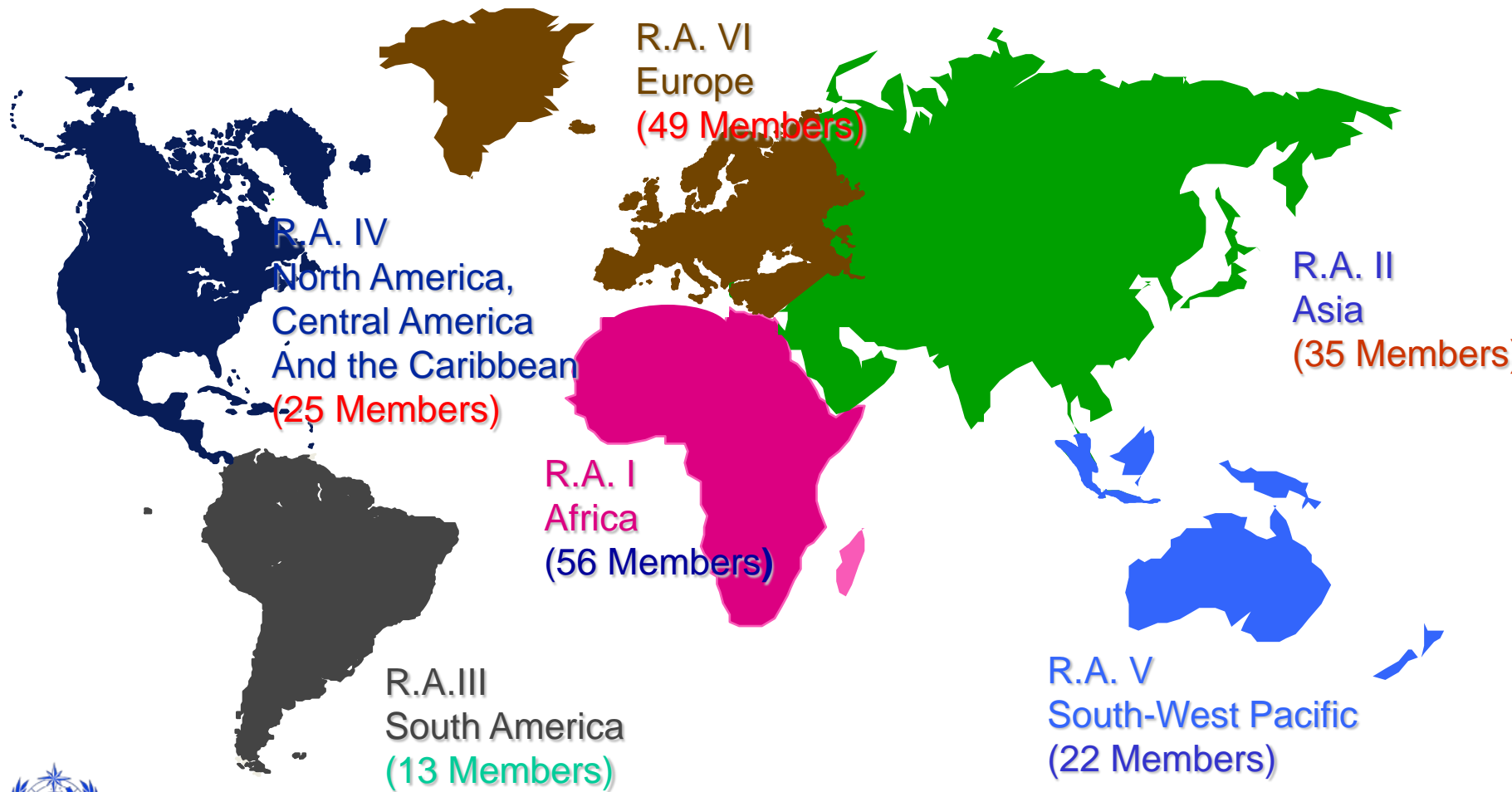


WMO/OMM



WMO OMM

# WMO Regional Associations



# WMO Technical Commissions

## *Basic Commissions*

- Commission for Basic Systems (**CBS**)
- Commission for Instruments and Methods of Observations (**CIMO**)
- Commission for Hydrology (**CHy**)
- Commission for Atmospheric Sciences (**CAS**)

## *Applications Commissions*

- Commission for Aeronautical Meteorology (**CAeM**)
- Commission for Agricultural Meteorology (**CAgM**)
- Joint WMO/IOC technical Commission for Oceanography and Marine Meteorology (**JCOMM**)
- Commission for Climatology (**CCI**)

# WMO Programmes

**World Weather Watch Programme**

**WMO Space Programme**

**Natural Disaster Prevention and Mitigation Programme**

**World  
Climate  
Programme**

**Atmospheric  
Research  
and  
Environment  
Programme**

**Applications  
of  
Meteorology  
Programme**

**Hydrology  
and  
Water  
Resources  
Programme**

**Education and Training Programme**  
**Technical Cooperation Programme**  
**Regional Programme**



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# ETR Programme *Overall objectives-1*

- To ensure the availability of adequately trained staff to meet Members' responsibilities for providing meteorological, hydrological and related information and services;
- To promote capacity building by assisting NMHSs in the attainment of an appropriate level of self-sufficiency in meeting their training needs and in developing their human resources;
- To promote and strengthen the exchange of training knowledge, resources and expertise between Members and WMO Regional Training Centres (RTCs) making particular use of relevant new and emerging technologies and techniques;





# ETR Programme *Overall objectives-2*

- To promote high-quality continuing education in meteorology, climatology, hydrology and related disciplines so as to keep Members' relevant staff up-to-date with the latest scientific advances and technological innovations, and to provide the competence and skills needed in additional fields, such as communication with users;
- To assist in the education of the public, government and other interested parties about the socio-economic benefits of meteorological, hydrological, oceanographic and related services.



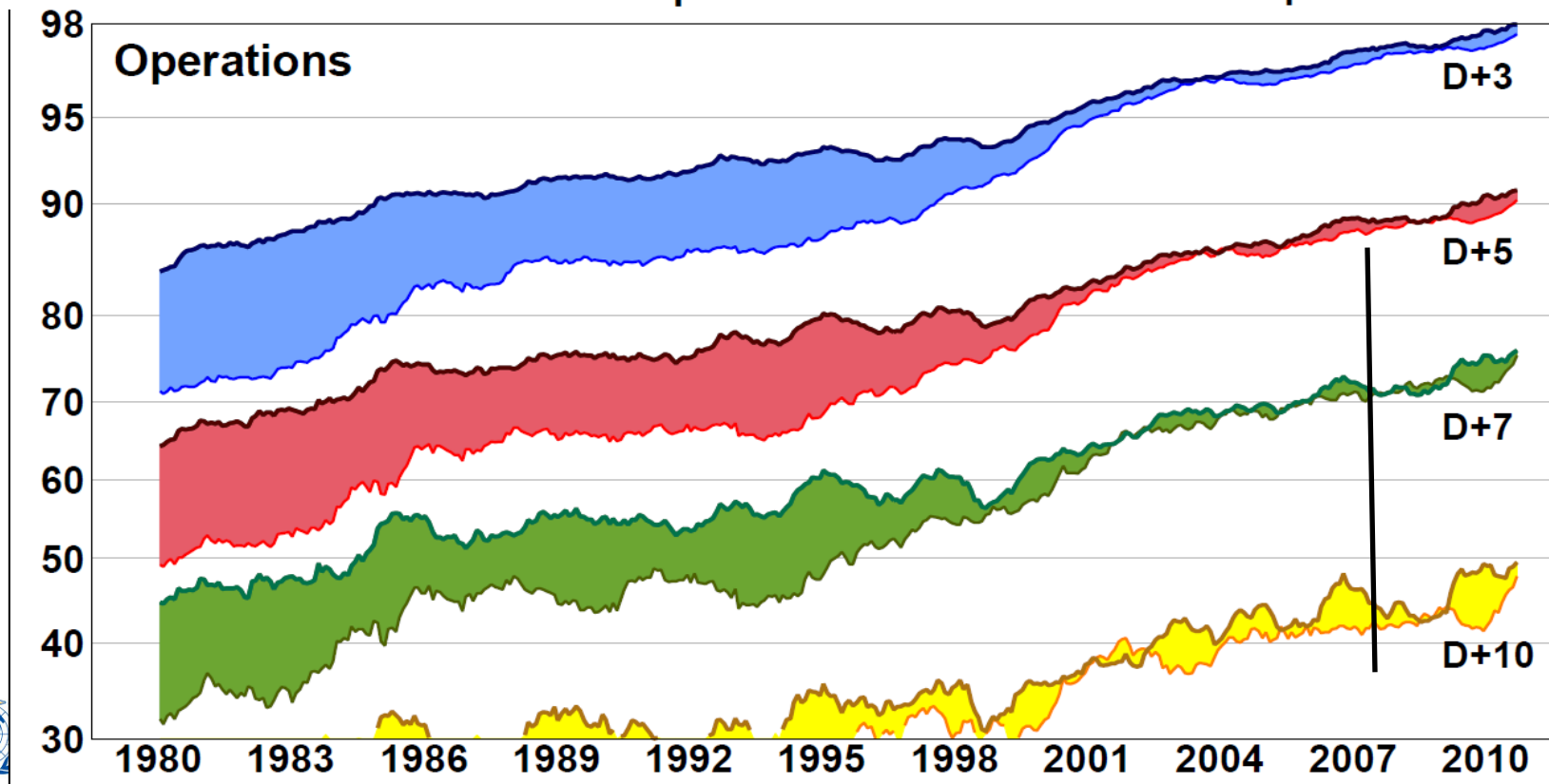
# Weather Forecasts & Services

- Over 50+ years, World Weather Watch not only lead to increased quality of weather services, but also lay critical foundation to the great success and achievements of all WMO Members and Programmes.

Source:  
ECMWF

### Anomaly correlation of 500hPa height forecasts

— Northern hemisphere      — Southern hemisphere



# II: New Challenges for WMO

- Disaster Risk Reduction (extreme events forecasting & services with extended range)
- Climate Services
- Support Paris Agreements
- Support UN SDGs 2030(Ocean, Water, Cities, Climate Adaption, etc)
- ....

Cost effectiveness • Influence and inform the global agenda • Alliances and partnerships • Relationships and cooperation • Interactive approach to science and services

### Guiding principles

### Vision

We envision a world in 2030 where all WMO Members, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, water, climate and other environmental events; and support their sustainable development through the best possible services, whether over land, at sea or in the air.

### Overarching Priorities

**Reducing losses of life and property** from hydrometeorological hazards.

Supporting climate action to build **resilience and adaptation to climate risk**.

**Enhancing socioeconomic value** from hydrometeorological and climate services.

### Long-Term Goals

**LTG 1 Better serve societal needs:** Delivering actionable, authoritative, accessible, user-oriented and fit-for-purpose services

**LTG 2 Enhance Earth system observations and predictions:** Strengthening the technical foundation for the future

**LTG 3 Advance targeted research:** Leveraging leadership in science

**LTG 4 Close the gap on services:** Enhancing and leveraging existing capabilities among all WMO Members to bring capability to all

**LTG 5 Work smarter:** Supporting effective policy- and decision-making and implementation in WMO

### Strategic Objectives

- 1.1 Integrating climate information
- 1.2 Enhancing climate and hydrometeorological disaster flagship products to support decision-makers
- 1.3 Enhancing weather warning systems worldwide
- 1.4 Supporting sustainable water management

- 2.1 Ensuring adherence to the highest standards of observations
- 2.2 Integrating observing networks and data management systems
- 2.3 Filling critical gaps in global observations
- 2.4 Fostering broadest application of free and open data exchange
- 2.5 Enhancing the value of cascading seamless prediction systems

- 3.1 Advancing scientific knowledge of the Earth system
- 3.2 Applying scientific and technological advances to improve prediction capabilities
- 3.3 Integrating greenhouse gas information system

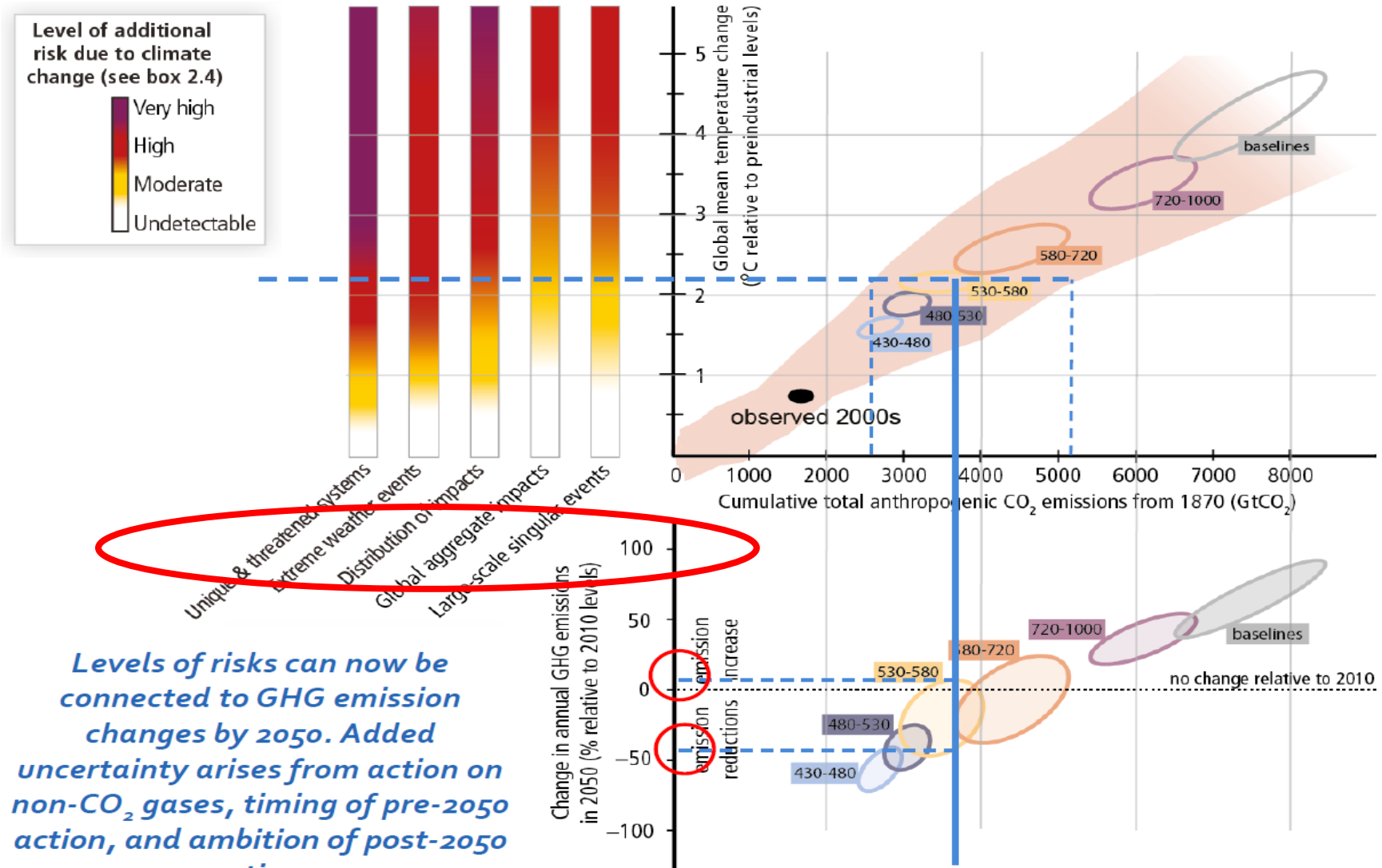
- 4.1 Understanding the needs of developing countries to provide better services
- 4.2 Strengthening core competencies and expertise
- 4.3 Establishing strategic partnerships for the global weather enterprise
- 4.4 Communicating effectively about the value of WMO's work

- 5.1 Optimizing WMO structures and processes
- 5.2 Mobilizing resources to implement WMO Programmes
- 5.3 Effectively supporting collaboration among Members
- 5.4 Ensuring equal and effective participation of women and men in governance and decision-making

**Reducing losses of life and  
property from  
hydrometeorological hazards.**



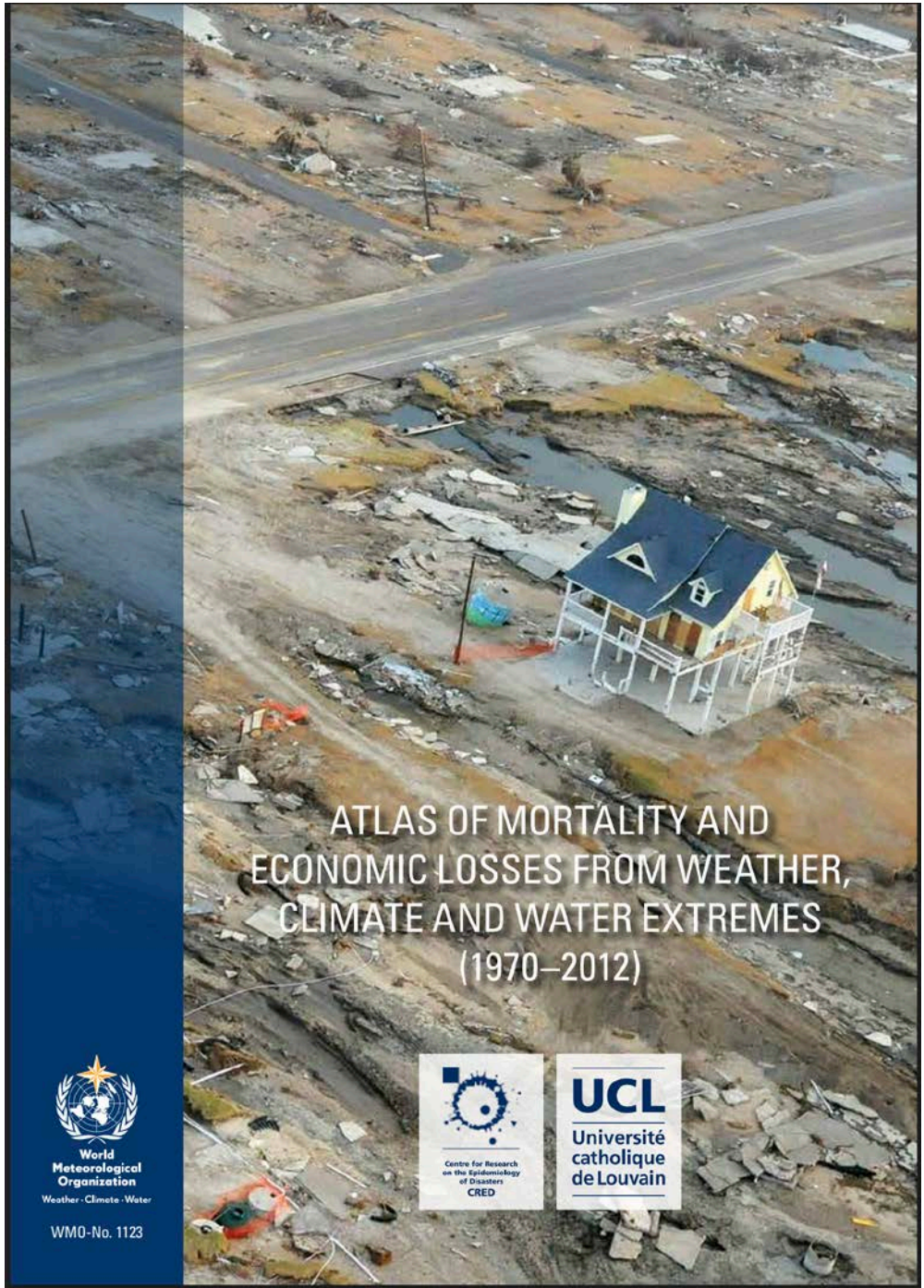
# The planet will be warmer, leading to more frequent extreme events in 2040



*Levels of risks can now be connected to GHG emission changes by 2050. Added uncertainty arises from action on non-CO<sub>2</sub> gases, timing of pre-2050 action, and ambition of post-2050*







ATLAS OF MORTALITY AND  
ECONOMIC LOSSES FROM WEATHER,  
CLIMATE AND WATER EXTREMES  
(1970–2012)



WMO OMM



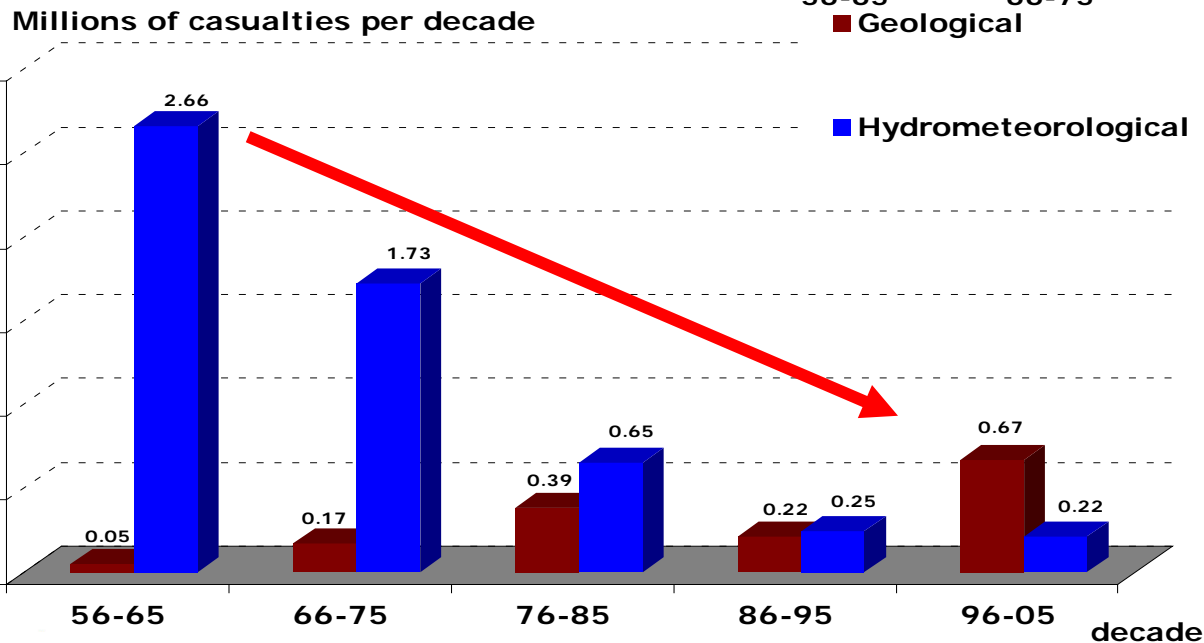
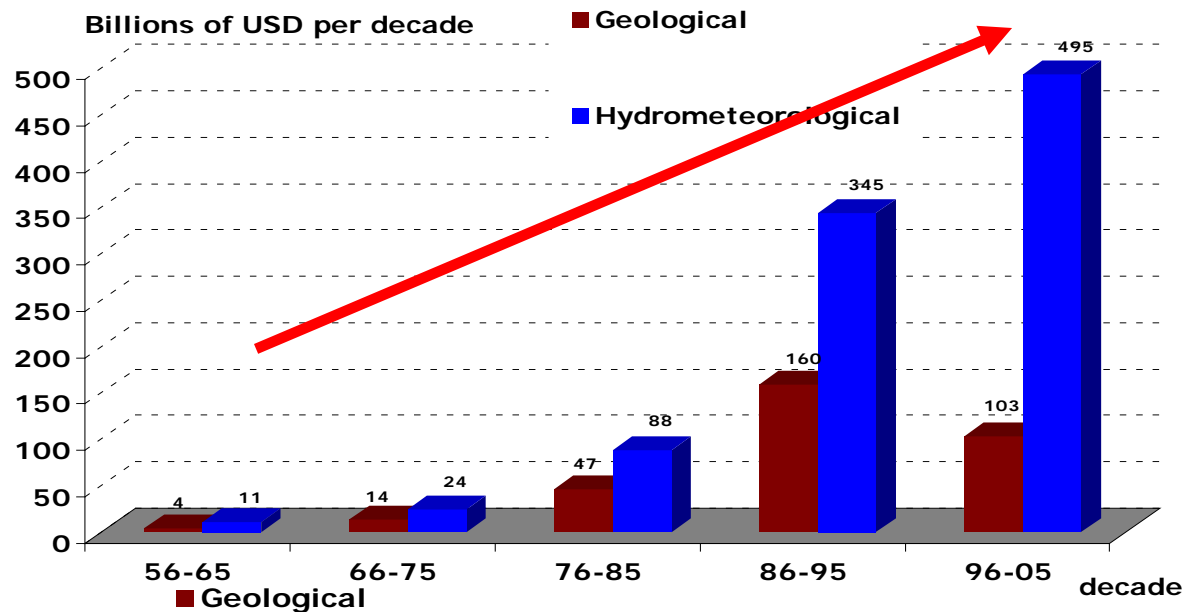
World  
Meteorological  
Organization  
Weather · Climate · Water

WMO-No. 1123



Université  
catholique  
de Louvain

While economic losses are on the way up!



Loss of life from hydro-meteorological disasters are decreasing!

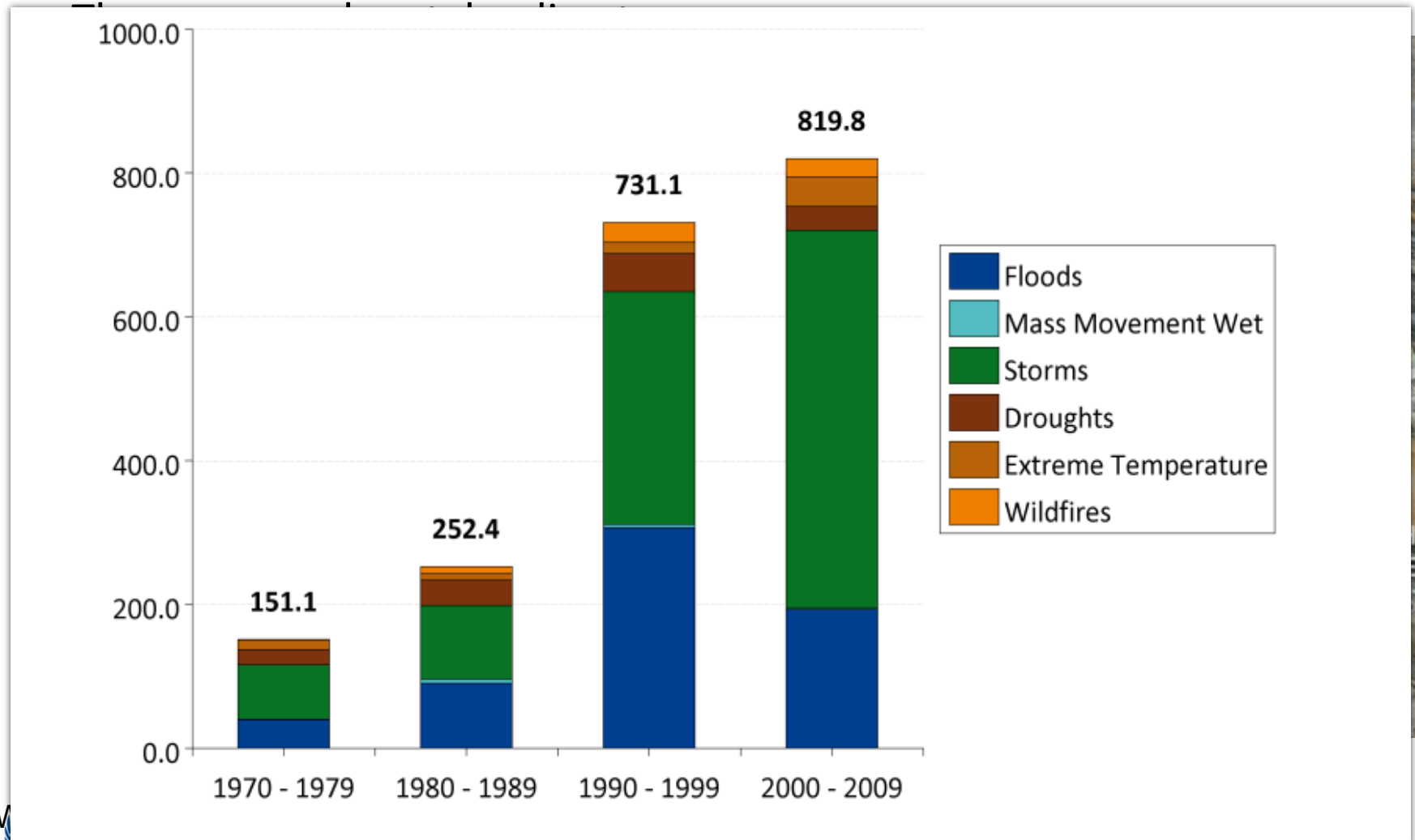
Source: EM-DAT: The OFDA/CRED International Disaster Database





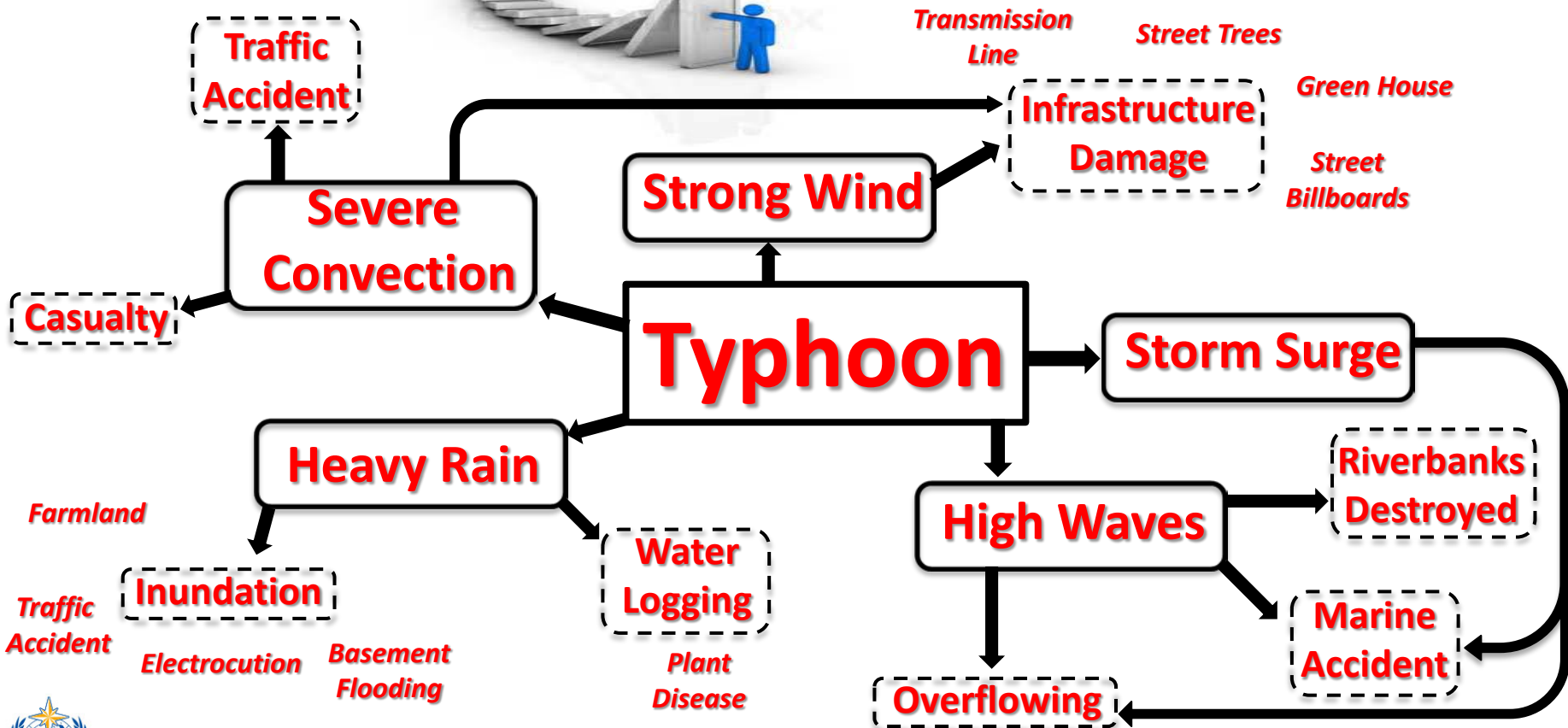
# WMO Strategic Priority 1- DRR!

The global total economic losses by decade and by hazard type in USD billions adjusted to 2011



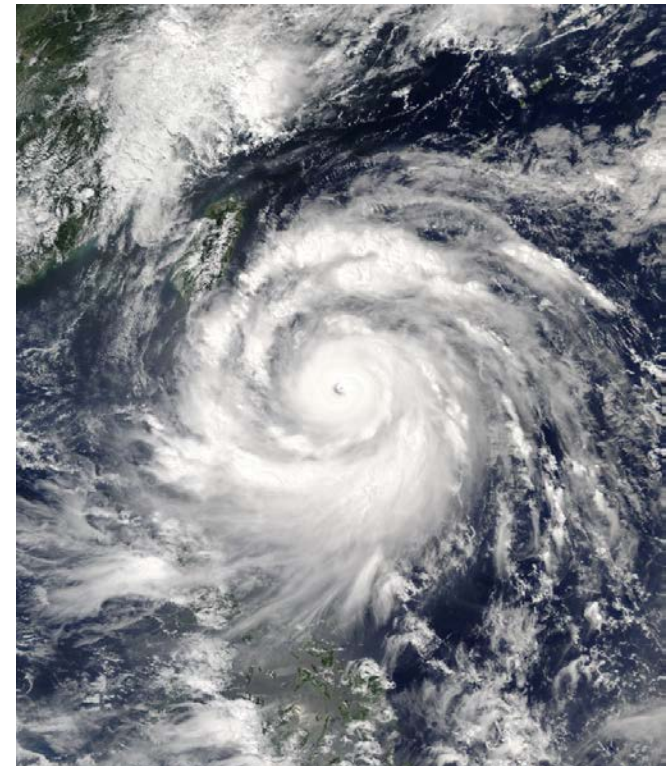
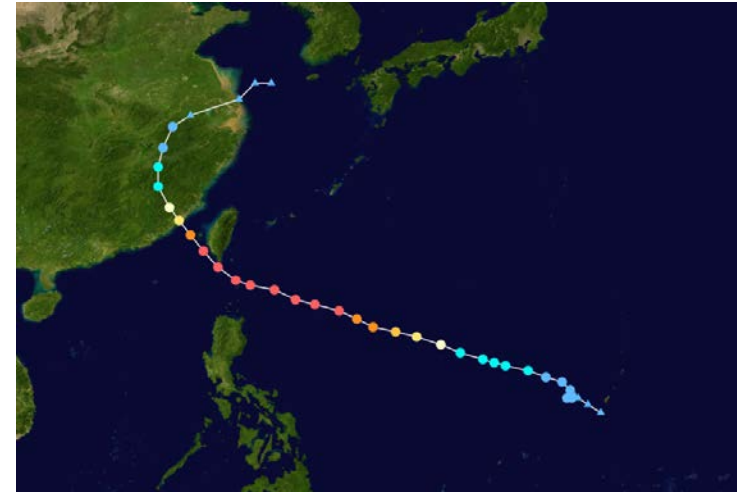
# Through a domino effect, a single extreme event can lead to a broad breakdown of a city's infrastructure:

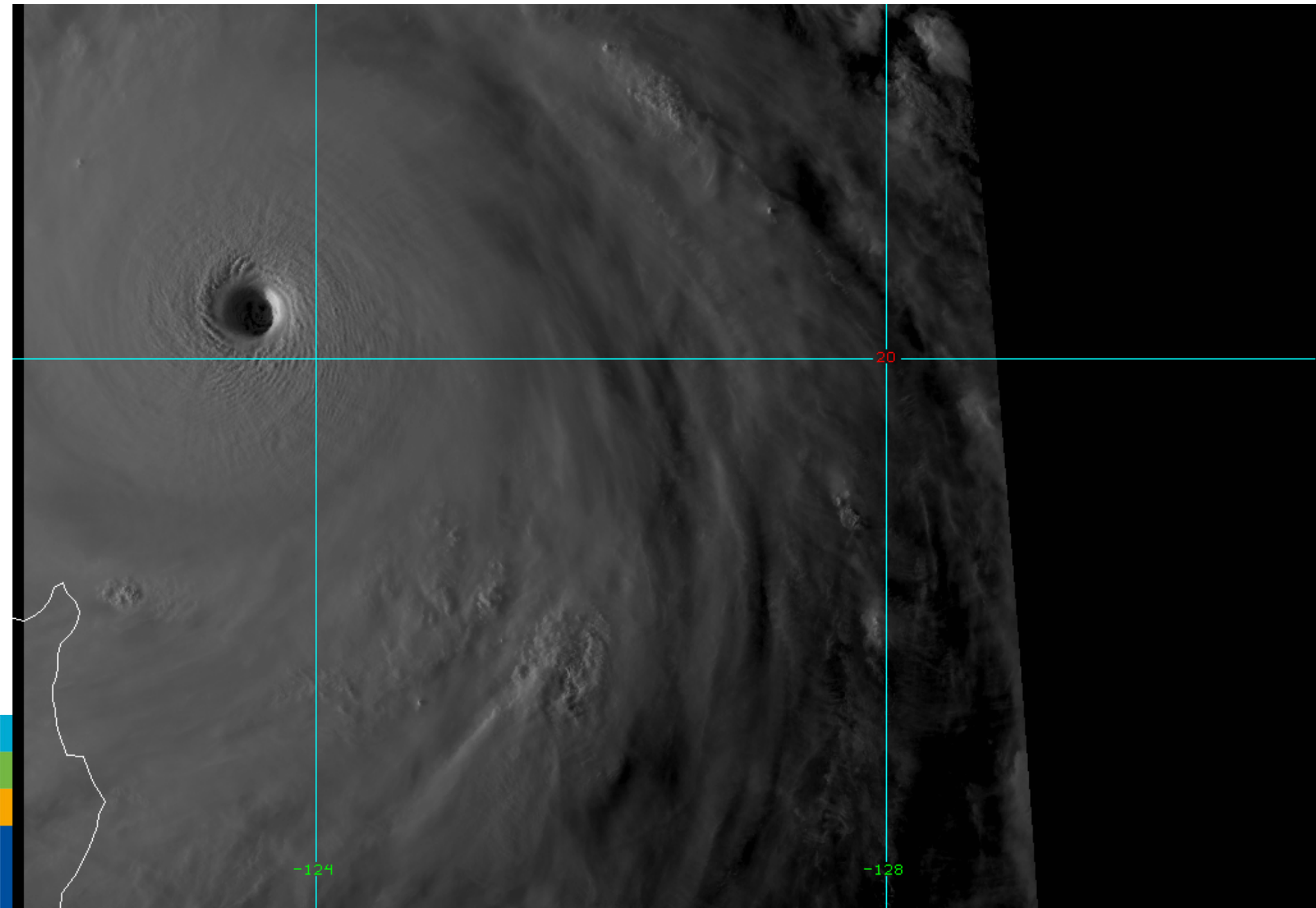
## Example of Hazard Domino Effect (Typhoon)



# Typhoon Meranti, one of the most intense Typhoone (landing China on Sept. 15, 2016)

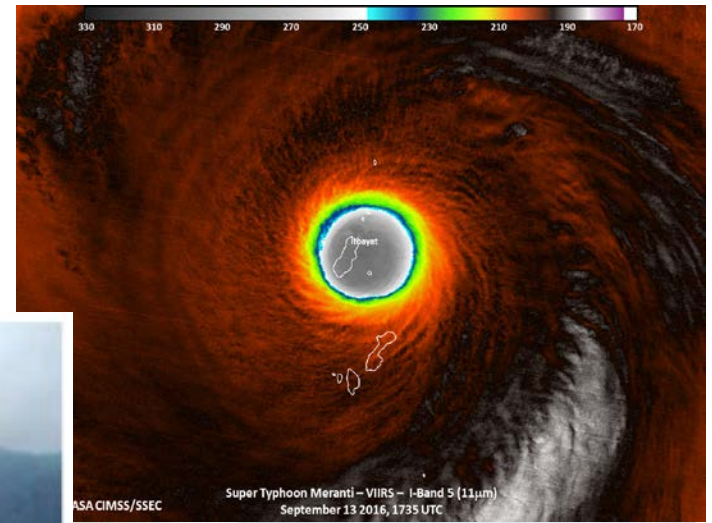
- Basic Data:
  - Highest Winds: 220km (10"), 305 KM (1")
  - Lowest Pressure: 890 hPa
- Impact:
  - [Philippines](#), Korea and East China ([Taiwan](#) & [Fujian](#)),
- Losses in Fujian alone
  - Died: 28
  - Missing: 15
  - Enjured: 50
  - Impacted: 304,320
  - Economic lost : 21 Billion (RMB)







# Typhoon Meranti, one of the most intense Typhoone (landing China on Sept. 15, 2016)



— ECONOMIC LOSS : 21 BILLION (RMB)







11 SUSTAINABLE CITIES  
AND COMMUNITIES



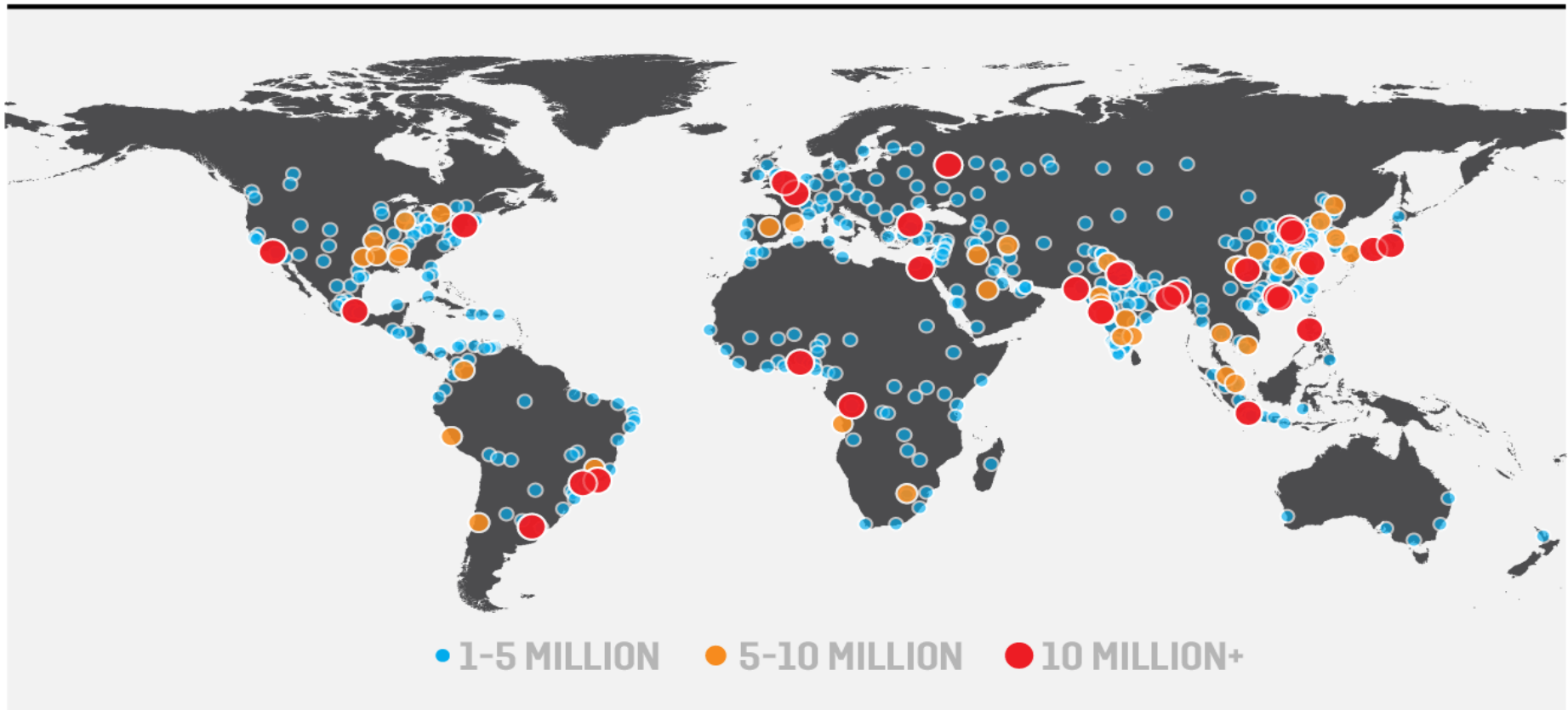
## SUSTAINABLE DEVELOPMENT GOAL 11

Make cities and human settlements inclusive,  
safe, resilient and sustainable



# Climate & climate change –extreme weather and climate events impact to costal Megacities !!!!

## **FP** Distribution of Cities 2014



FOREIGN POLICY / DATA VIA THE UNITED NATIONS



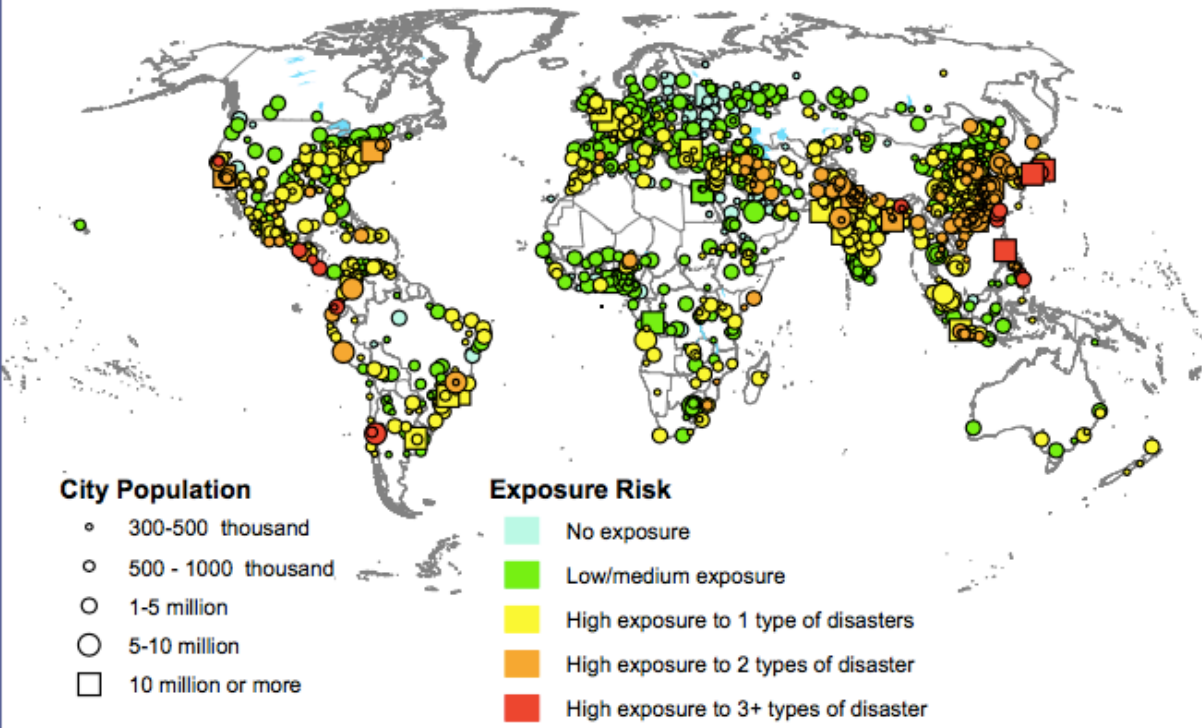
WMO OMM

© Dr W. ZHANG, WMO/OBS



# Most cities are vulnerable to at least one type of natural disaster

Cities' risk of exposure to natural disasters



Of the 1,692 cities with at least 300,000 inhabitants in 2014, 944 (56 per cent) were at high risk of exposure to at least one of six types of natural disaster (cyclones, floods, droughts, earthquakes, landslides and volcano eruptions), based on evidence on the occurrence of natural disasters over the late twentieth century.\* Taken together, cities facing high risk of exposure to a natural disaster were home to 1.4 billion people in 2014.

Around 15 per cent of cities—most located along coastlines—were at high risk of exposure to two or more types of natural disaster; 27 cities—including the megacities Tokyo, Osaka and Manila—faced high risk of exposure to three or more types of disaster.

\* Results summarised here are from a 2015 United Nations technical paper that analysed city population estimates from the 2014 revision of World Urbanization Prospects together with spatial hotspot data on the risks of exposure and vulnerability to natural disasters produced by research institutes at Columbia University and the World Bank. The natural disaster data used in this analysis included historical information on

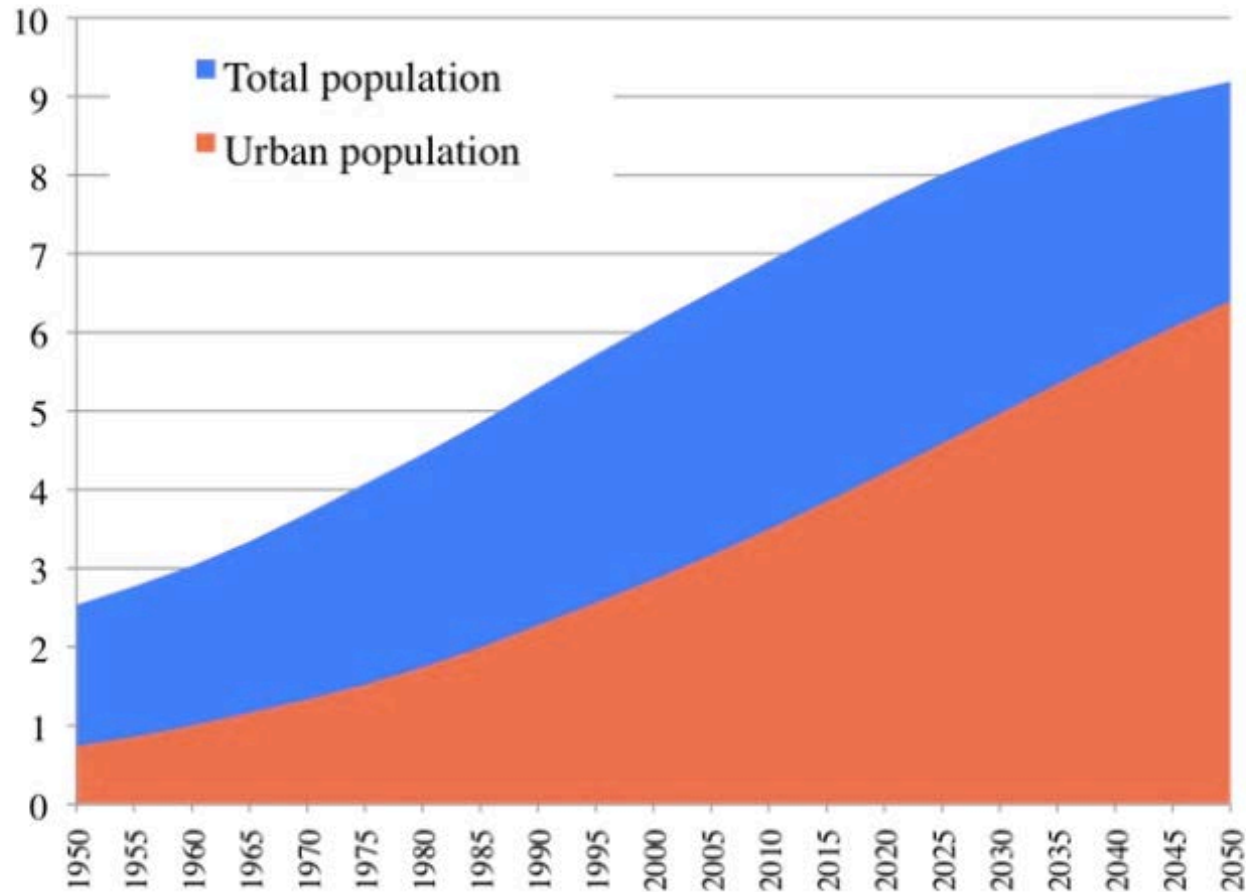






# Growing Urban Population

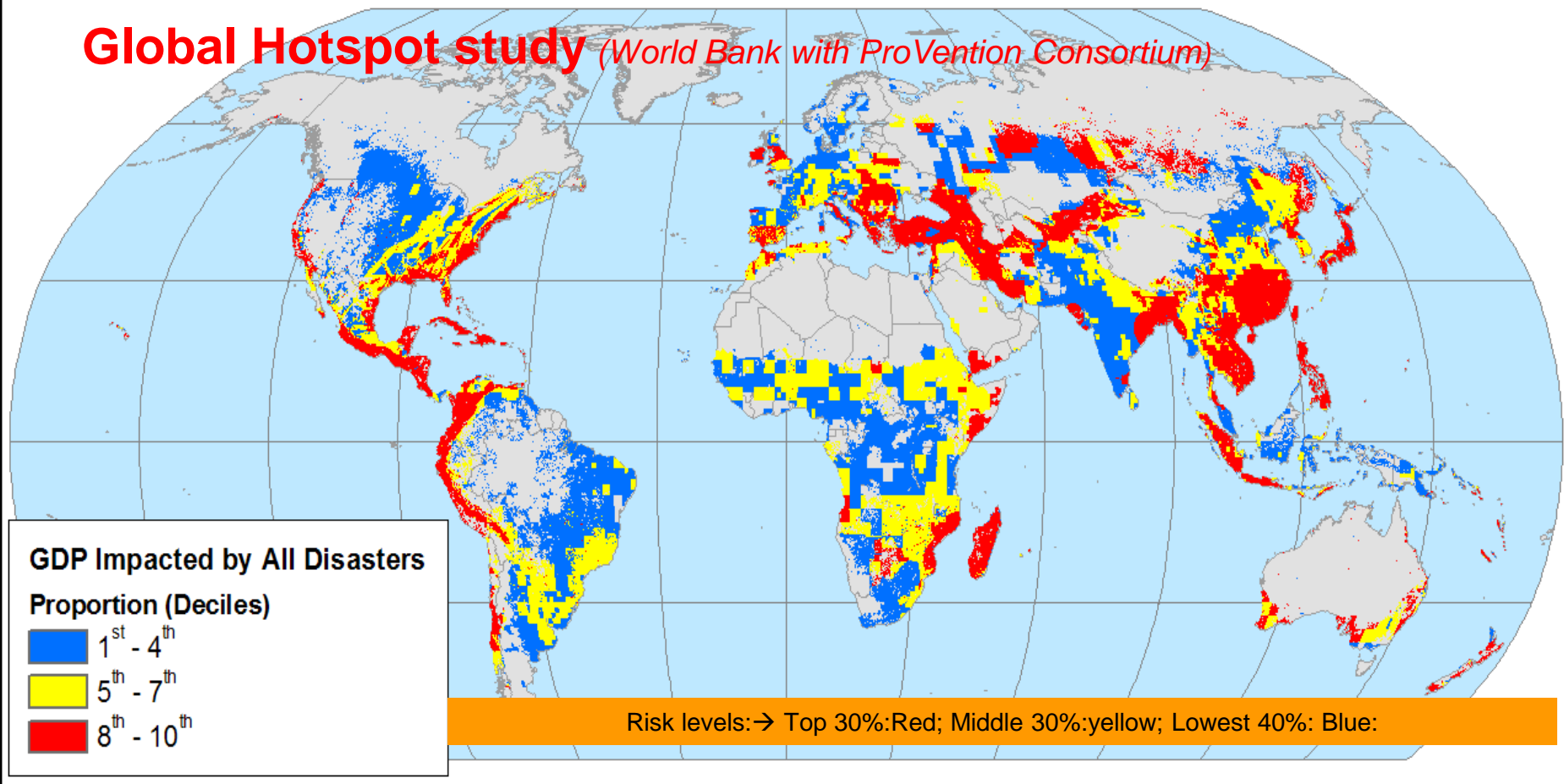
(Billion)



# Global Challenges We Share

*As society becomes more complex we become more sensitive to natural and human induced variability.*

## Global Hotspot study (World Bank with ProVention Consortium)



35 countries have more than 5% pop in areas at risk from three or more hazards  
96 countries have more than 10% pop in areas at risk from two or more hazards  
160 countries have more than 25% pop in areas at risk from one or more hazards





# How ETR can support the DRR ?

- To education and promote the National Legislation Process on DRR (China example)
- Weather Ready Nation (USA example)
- Using Advanced Technologies for DRR (Satellite examples, Big Data, Artificial Intelligence, Earth System Forecasting, etc )
- Building Global Multi-Hazard Alert System (GMAS) and Resilience (building back better)



# Promote the Met Services through legislation process

- **Example: Meteorology Law of the People's Republic of China**(adopted on October 31, 1999)
- **Article 1** This Law is enacted for the purpose of developing meteorological service, standardizing meteorological activities, ensuring the accurate and timely issue of meteorological forecast, preventing meteorological disasters, properly exploiting and effectively protecting climatic resources, and providing meteorological services for economic development, national defense, social development and people's well-being.

# Promote the Met Services through legislation process

- **Chapter V: Prevention of Meteorological Disasters**
- **Article 27** People's governments at or above the county level shall improve their monitoring and warning systems for meteorological disasters, make arrangements for relevant departments to work out plans for prevention of meteorological disasters, and take effective measures to increase the capability of preventing such disasters. Relevant organizations and individuals shall comply with the directions given and arrangements made by the people's governments, and shall make a success of prevention of meteorological disasters.



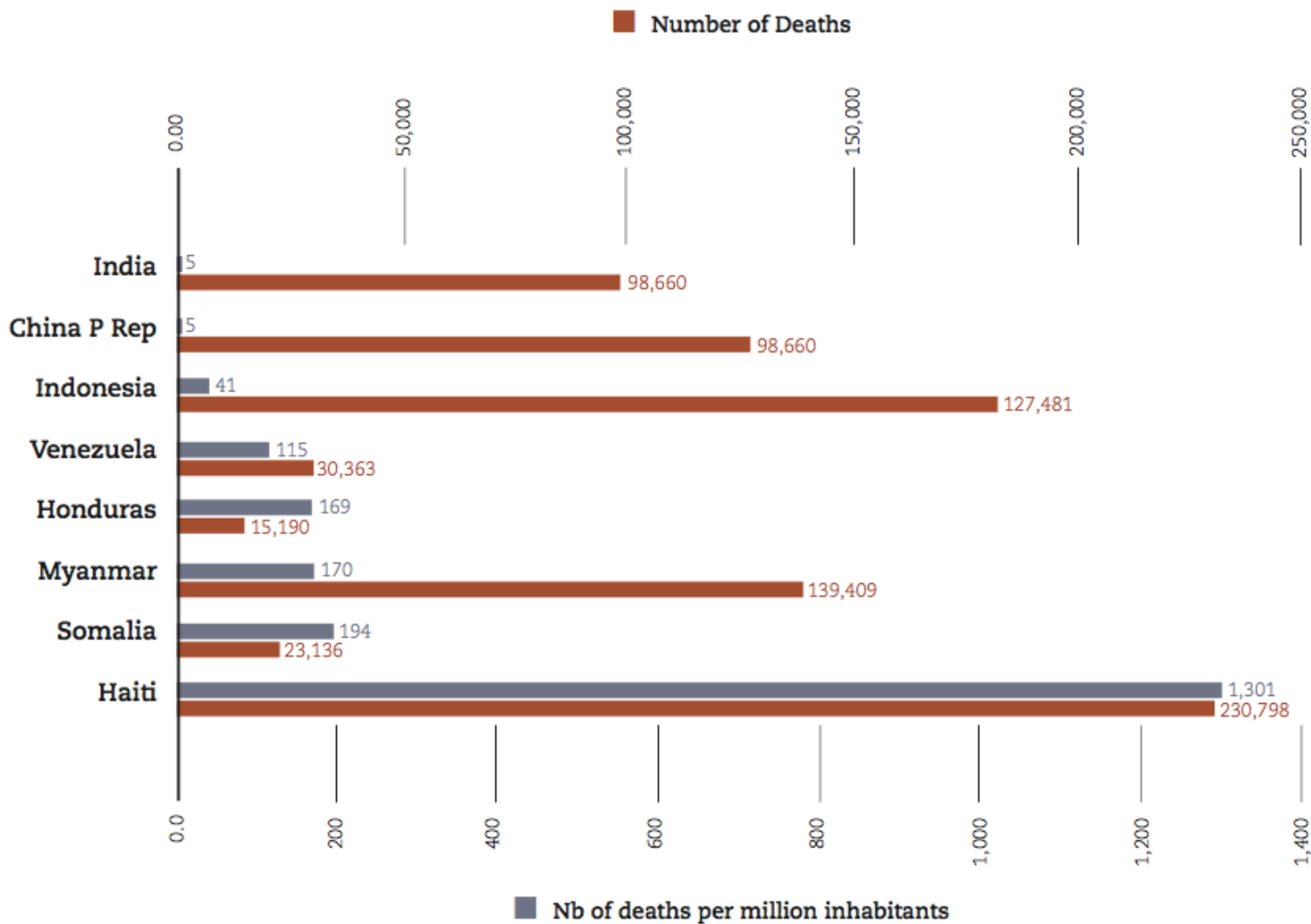
# Weather–Ready Nation is about readying your community for extreme weather, water, and climate events-NOAA example

- The devastating impacts of extreme events like record breaking snowfall, violent tornadoes, destructive hurricanes, widespread flooding, and devastating drought can be reduced by taking advanced action, which is why the Weather–Ready Nation initiative is so important.
- **What is NOAA doing to build a Weather-Ready Nation?**
  - NOAA’s National Weather Service is transforming its operations to help America respond. Offices now provide forecast information in a way that better supports emergency managers, first responders, government officials, businesses and the public make fast, smart decisions to save lives and property and enhance livelihoods.
- While we at NOAA are taking steps towards building a Weather–Ready Nation, ***we can not do it alone!***
- **What can you do to help us build a Weather–Ready Nation?**
  - Become a Weather–Ready Nation Ambassador! Building a Weather–Ready Nation requires action from other government agencies, America’s Weather Industry, emergency managers, researchers, the media, nonprofits, and businesses. Any organization committed to serving as an example and engaging their stakeholders to make this country ready, responsive, and resilient can be an Ambassador.



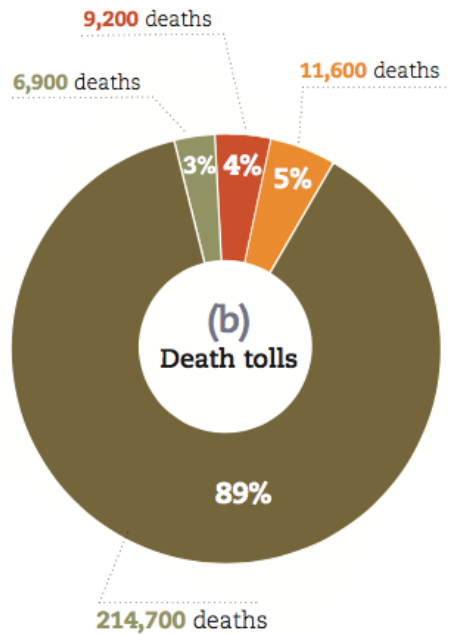
Figure 14

Number of deaths and relative mortality (deaths/million inhabitants) for 8 selected countries (1994-2013)

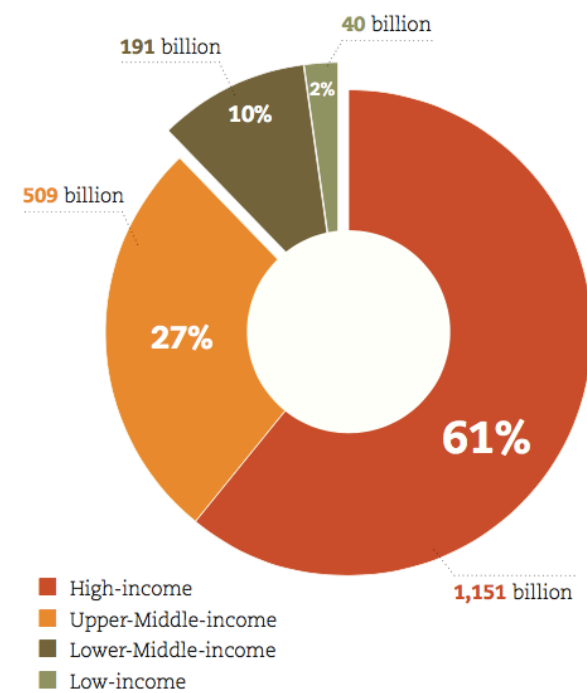




# Death toll & Economic loses over 20 years

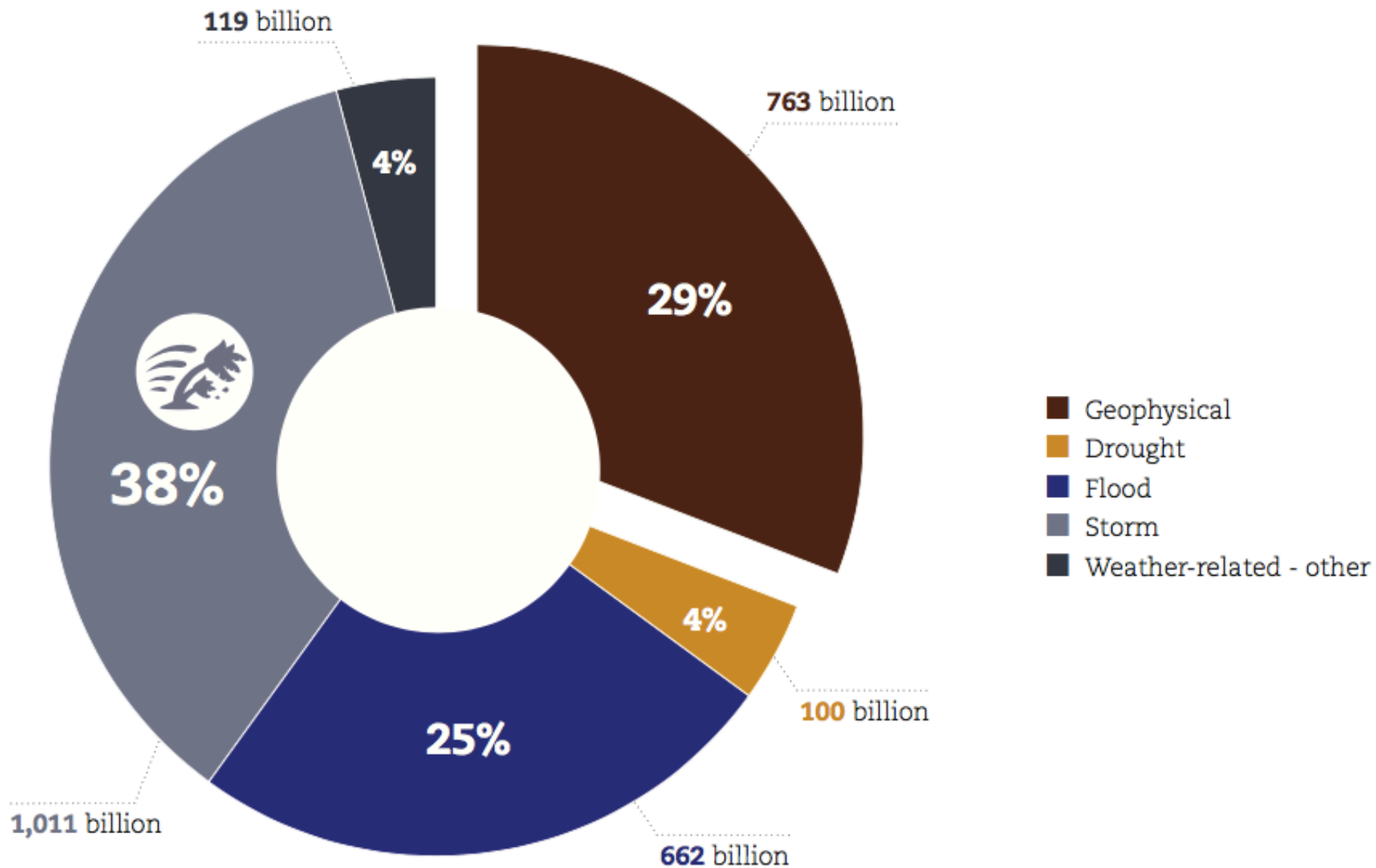


Income group analysis of economic damage (US\$) (1995-2015)



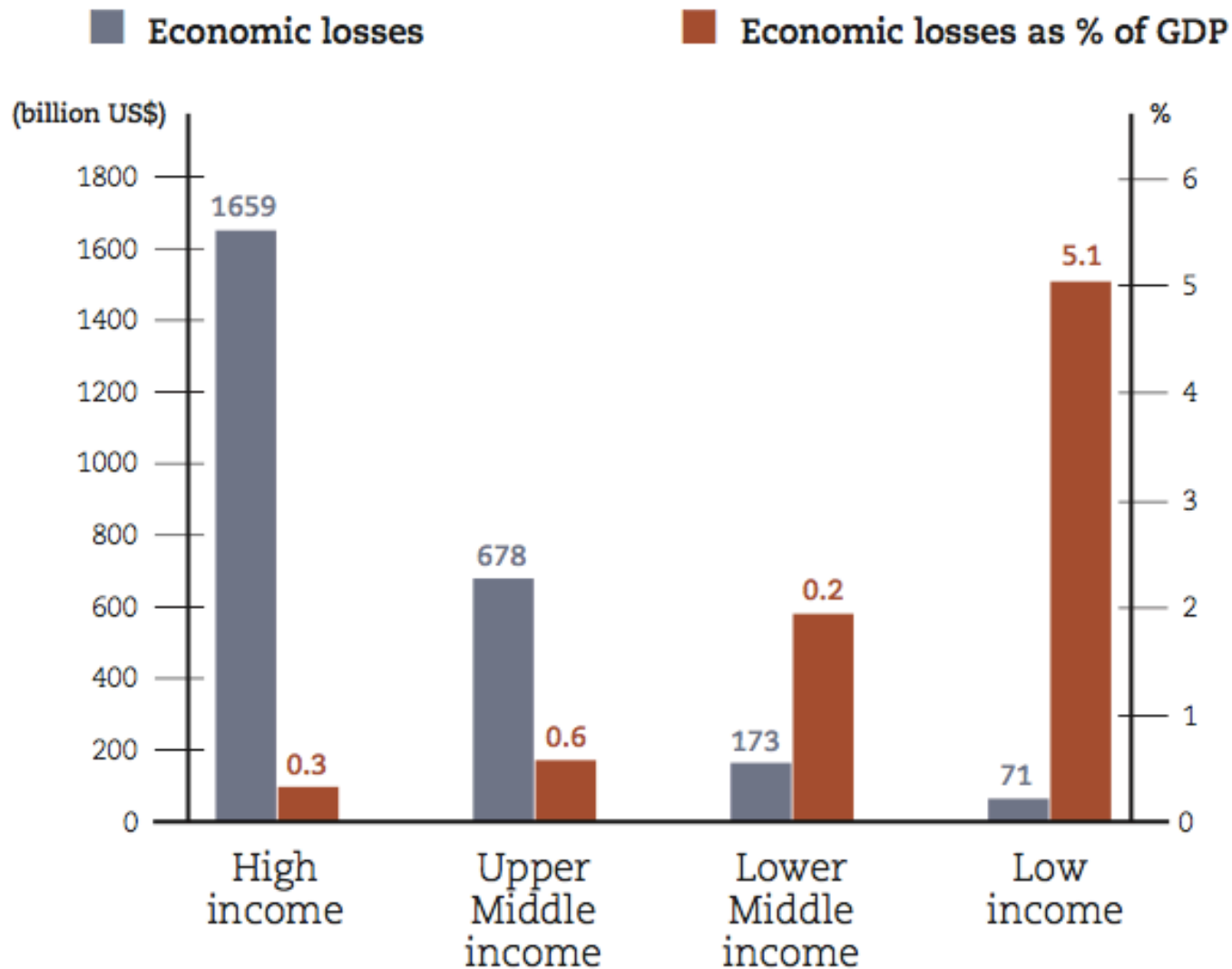
**Figure 13**

**Breakdown of recorded economic damage (US\$)  
by disaster type (1995-2015)**



**Figure 28**

## Economic losses in absolute values and compared to GDP



# Two basic approaches for reducing the impacts of natural disasters are mitigation and response

- Mitigation includes all those actions that are taken before, during, and after the occurrence of a natural event that minimize its impacts, and response includes those actions that are taken during and immediately after the event to reduce suffering and hasten recovery of the affected population and region.
- Mitigation includes avoiding hazards, for example, by building out of a flood plain or away from seismically active faults, or by providing warnings to enable evacuation in the periods immediately preceding hazards such as floods, hurricanes, and tornadoes. It also includes reducing vulnerability through flood-proofing of buildings or strengthening of structures to withstand the loads imposed by seismic shaking or

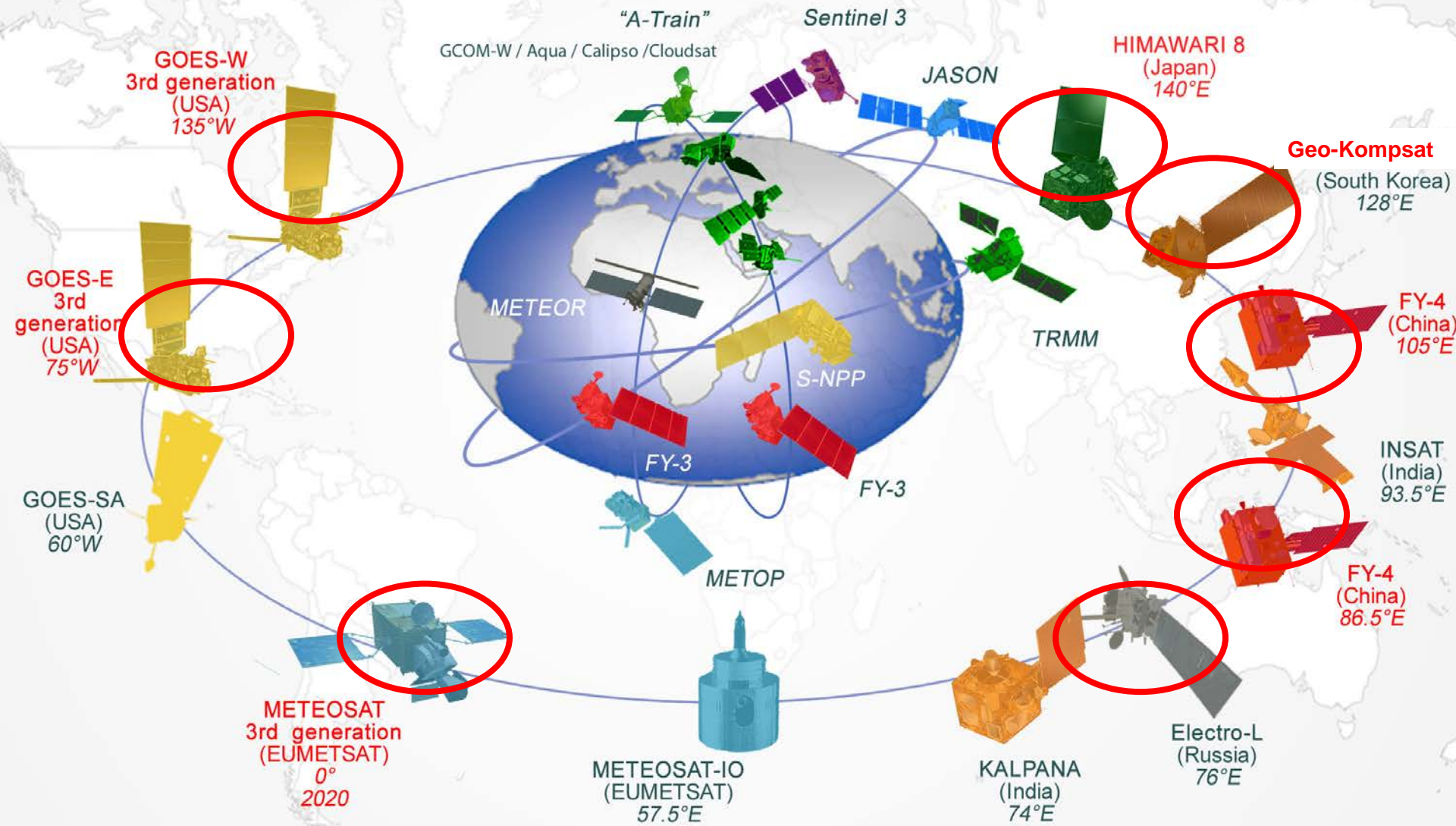


Two basic approaches for reducing the impacts of natural disasters are mitigation and response.

- Response includes both the short-term emergency actions taken by police, fire, and other agencies as well as the longer-term actions taken to meet needs for food, shelter, rebuilding, and restoration of the affected community. Both elements are important in dealing with natural hazards, but in past practice just one—response—has predominated.



# WMO Space Programme with New-Generation of Geostationary Constellation





# 3X MORE CHANNELS



Improves every product from current GOES Imager and will offer new products for severe weather forecasting, fire and smoke monitoring, volcanic ash advisories, and more.

# 4X BETTER RESOLUTION



The GOES-R series of satellites will offer images with greater clarity and 4x better resolution than earlier GOES satellites.

# 5X FASTER SCANS

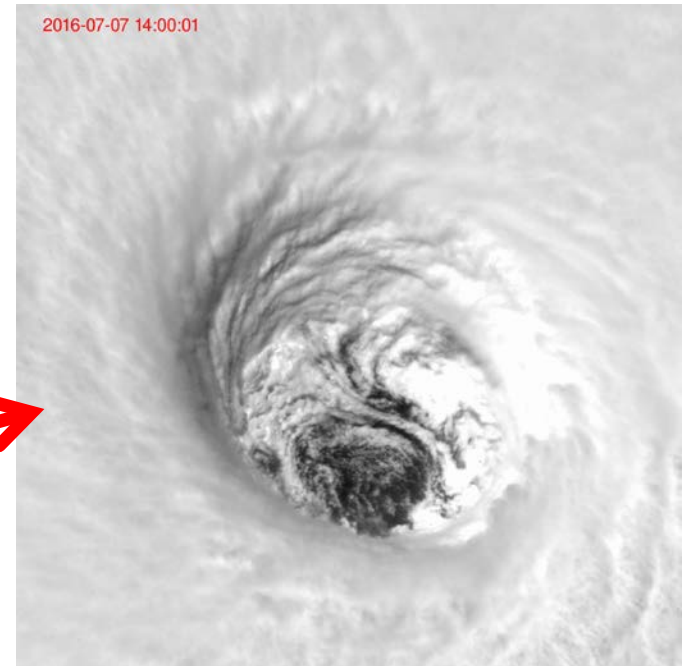
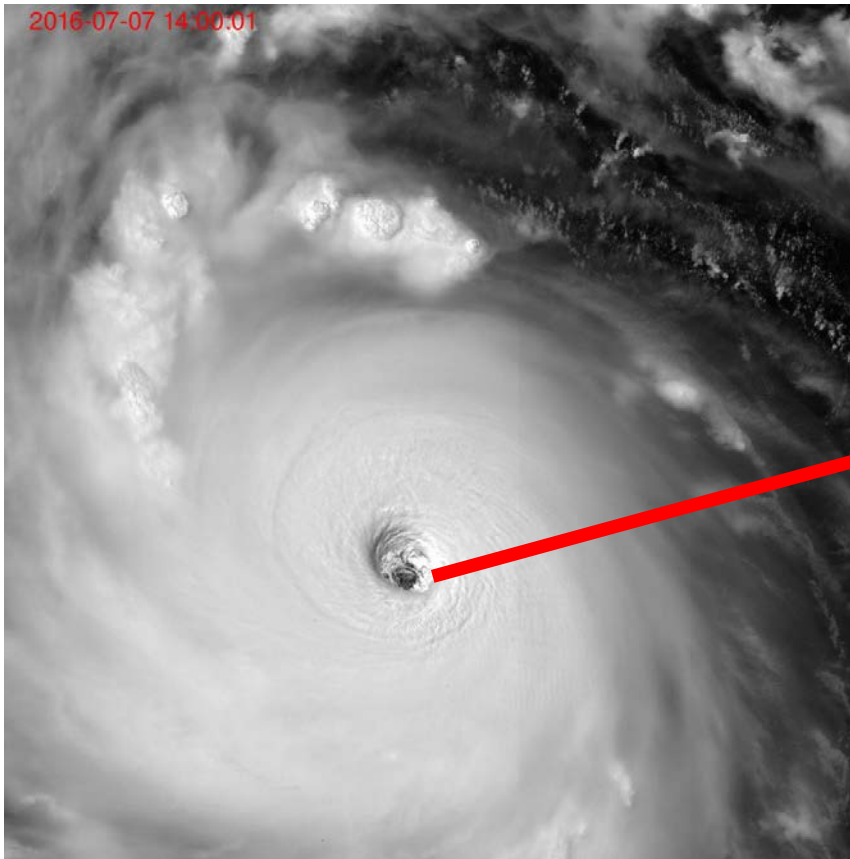


Faster scans every 30 seconds of severe weather events and can scan the entire full disk of the Earth 5x faster than before.



WMO OMM

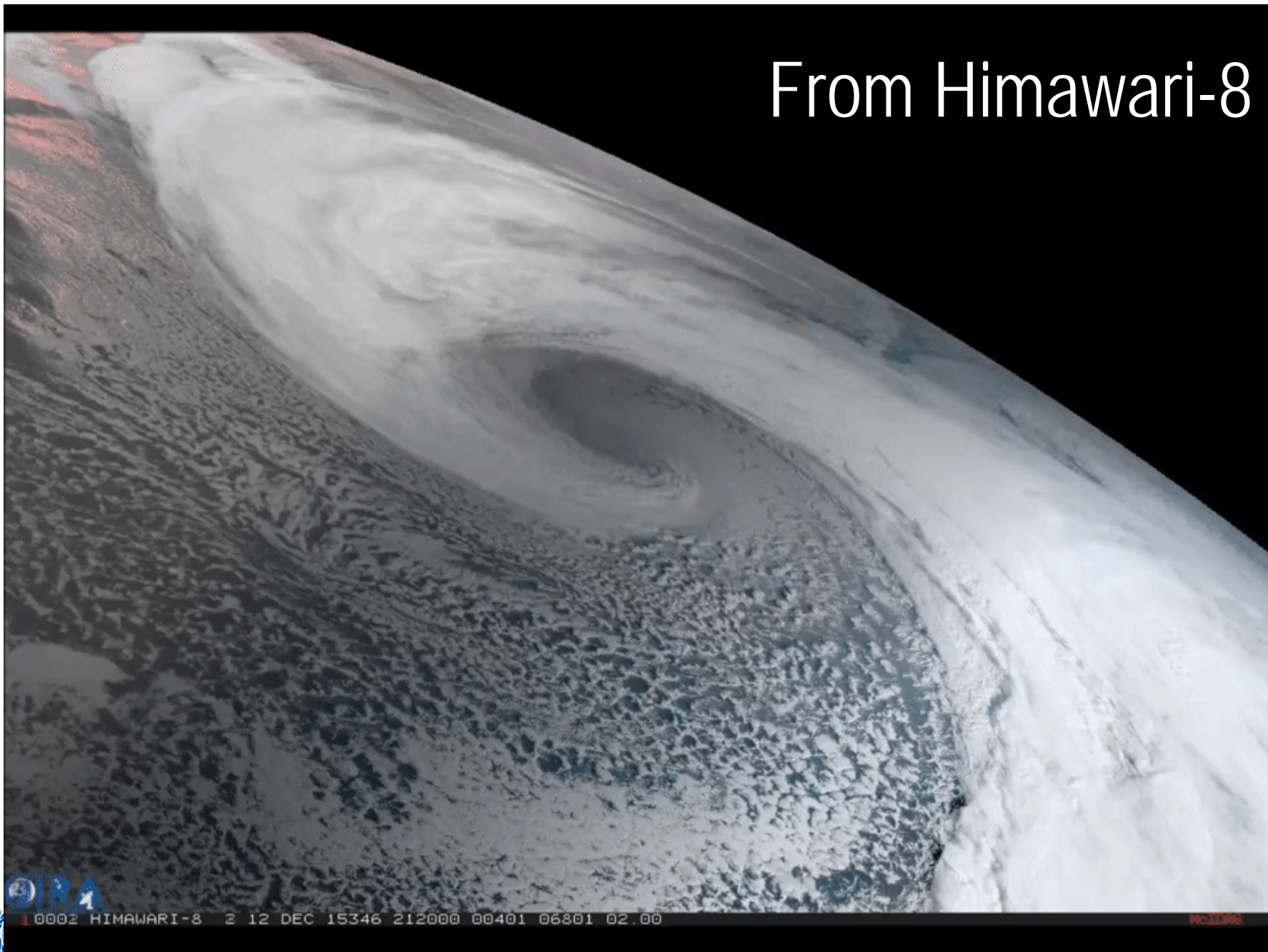
# Chinese RD GEO satellite applications (50 meters and less than 1 minute)



**Typhoon Nepartak  
(7 July, 2016)**



From Himawari-8



1 0002 HIMAWARI-8 2 12 DEC 15346 212000 00401 06801 02.00

NOAA


# Services are only the tip of the iceberg...




**... installation,  
operation and  
maintenance of  
infrastructure,  
observation,  
research...**



# Regionalization is a MUST for Promoting WMO Global visibility: WMO Multi-Hazard Alert System-GMAS: Building on the regional success



meteoalarm  
alerting europe for extreme weather



EUMETNET  
The Network of European Meteorological Services


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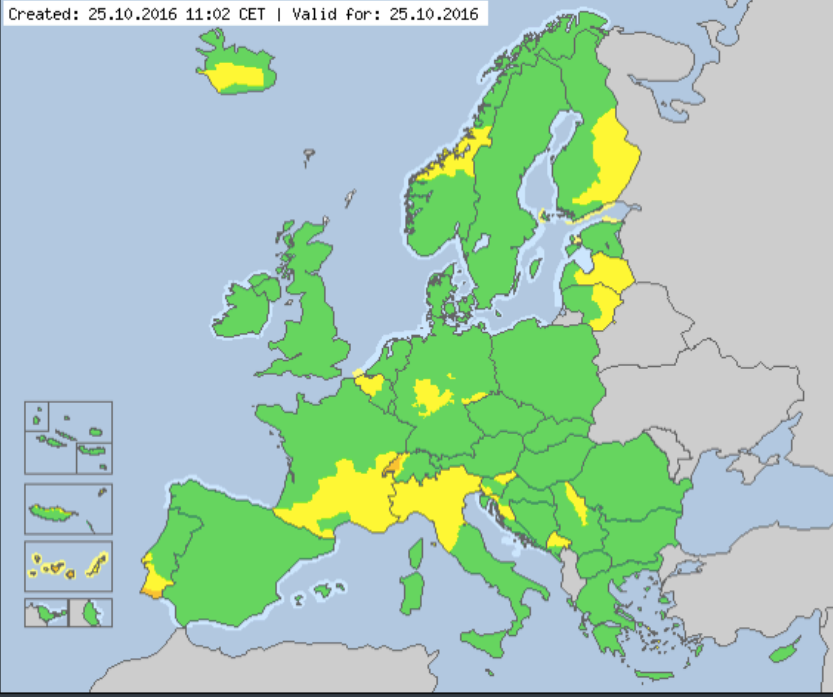
english

» Europe:

Created: 25.10.2016 11:02 CET | Valid for: 25.10.2016

## Weather warnings: Europe






**Awareness Reports** - You can find detailed information about the warnings in the awareness reports issued for each country. Select the relevant country.

AT			IT			
BA			LT			
BE			LU			
BG			LV			
CH			ME			
CY			MK			
CZ			MT			
DE			NL			
DK			NO			
EE			PL			
ES			PT			
FI			RO			
FR			RS			
GR			SE			
HR			SI			
HU			SK			
IE			UK			
IS						

Caption:

awareness types:

Display:



Change Language: | BG | BS | CZ | DA | DE | EE | EN | ES | ES | ES | FI | FR | GR | HR | HU | IS | IT | LT | LV | ME | MK | MT | NL | NO | PL | PT | RO | RS | SE | SI | SK | VA



# WMO Priority: Global Framework for Climate Services

How ETR Promotes GFCS ?

1979

1990

2009

World Climate Conference – 1

World Climate Conference – 2

World Climate Conference – 3

1989

WMO Global  
Atmosphere Watch

1988

WMO & UNEP  
IPCC

1980

World Climate Research Programme  
(WCRP)

1992

UNFCCC

WMO/UNEP  
IPCC

World Climate  
Programme (WCP)

1992

Global Climate Observing  
System – (GCOS)

UN-SDGs

PARIS Agreement

SENDAI framework

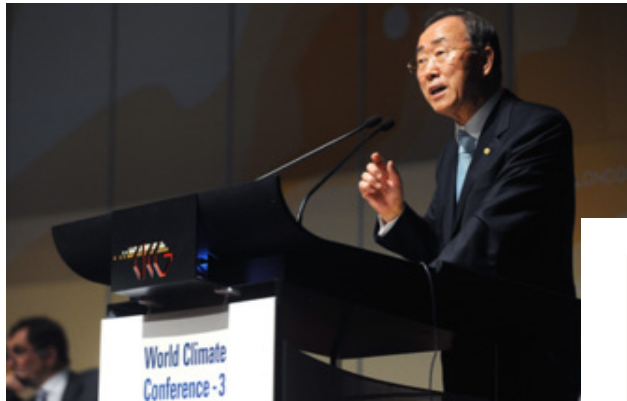
Global Framework for Climate  
Services – (GFCS), GCW

1963

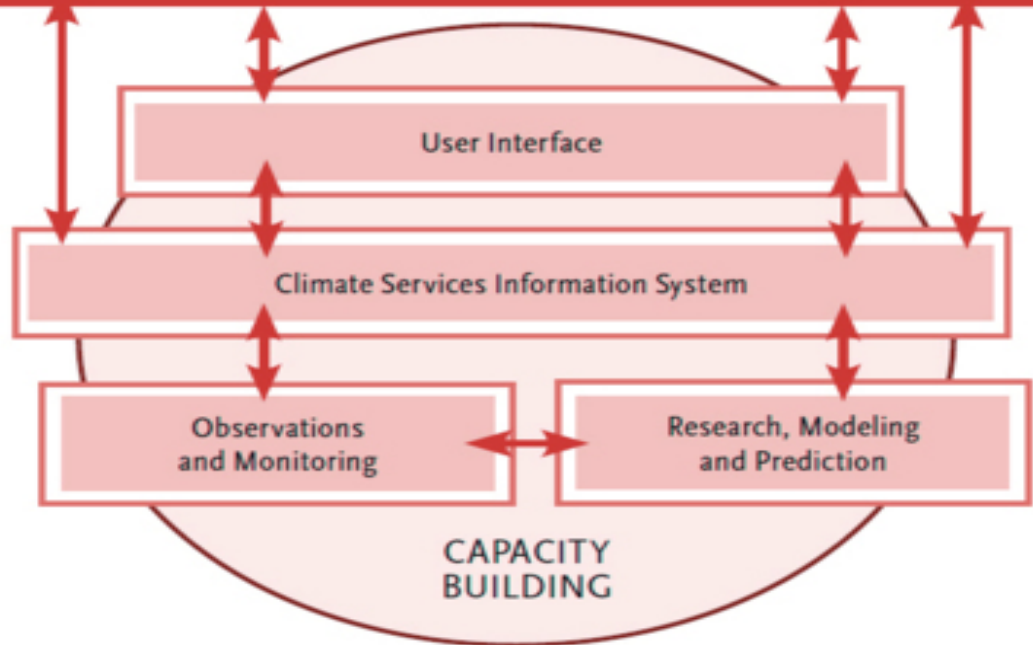
Backbone – World Weather Watch (GOS, GTS, DPFS, PWS) – WIGOS, WIS, Integrated Services

1. WMO established the global backbone observing and data exchange mechanism, greatly improved the global weather forecasting.
2. WMO jointly with partners established the global change mechanisms (GCOS, WCRP, IPCC & GFCS) made great contribution to the global climate





Users, Government, private sector, research, agriculture, water, health, construction, disaster reduction, environment, tourism, transport, etc





Warmest year on record by far, 0.76 °C above 1961–1990 average

2015

1°

Increase above pre-industrial era; halfway to 2 °C limit

EL NIÑO

One of the strongest on record, combined with climate change from human activities to drive global temperatures to new peak



EXTREME EVENTS

Heatwaves, droughts, floods, strong tropical cyclones

400 ppm

CO<sub>2</sub> concentrations breach symbolic benchmark in northern hemisphere spring

Excess energy from greenhouse gas emissions stored in oceans; record global ocean heat content down to 2 000 m.

93%



WMO UMM

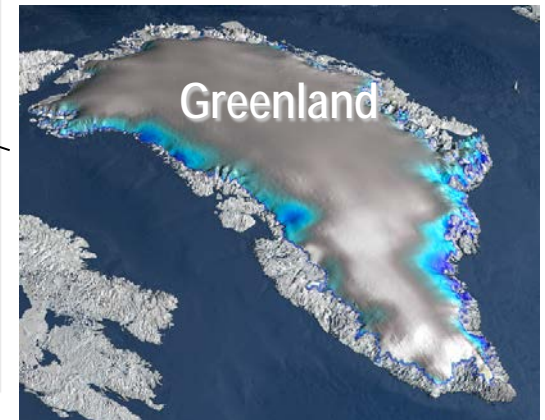
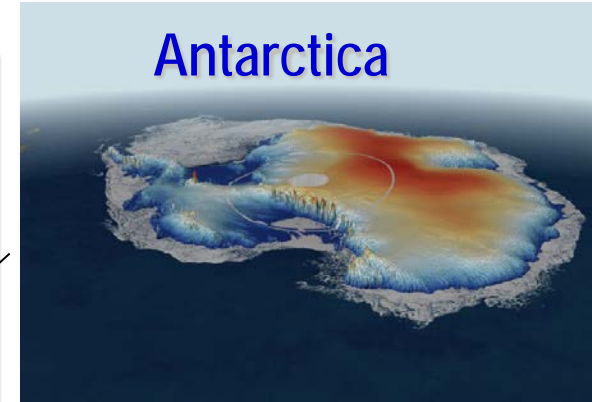
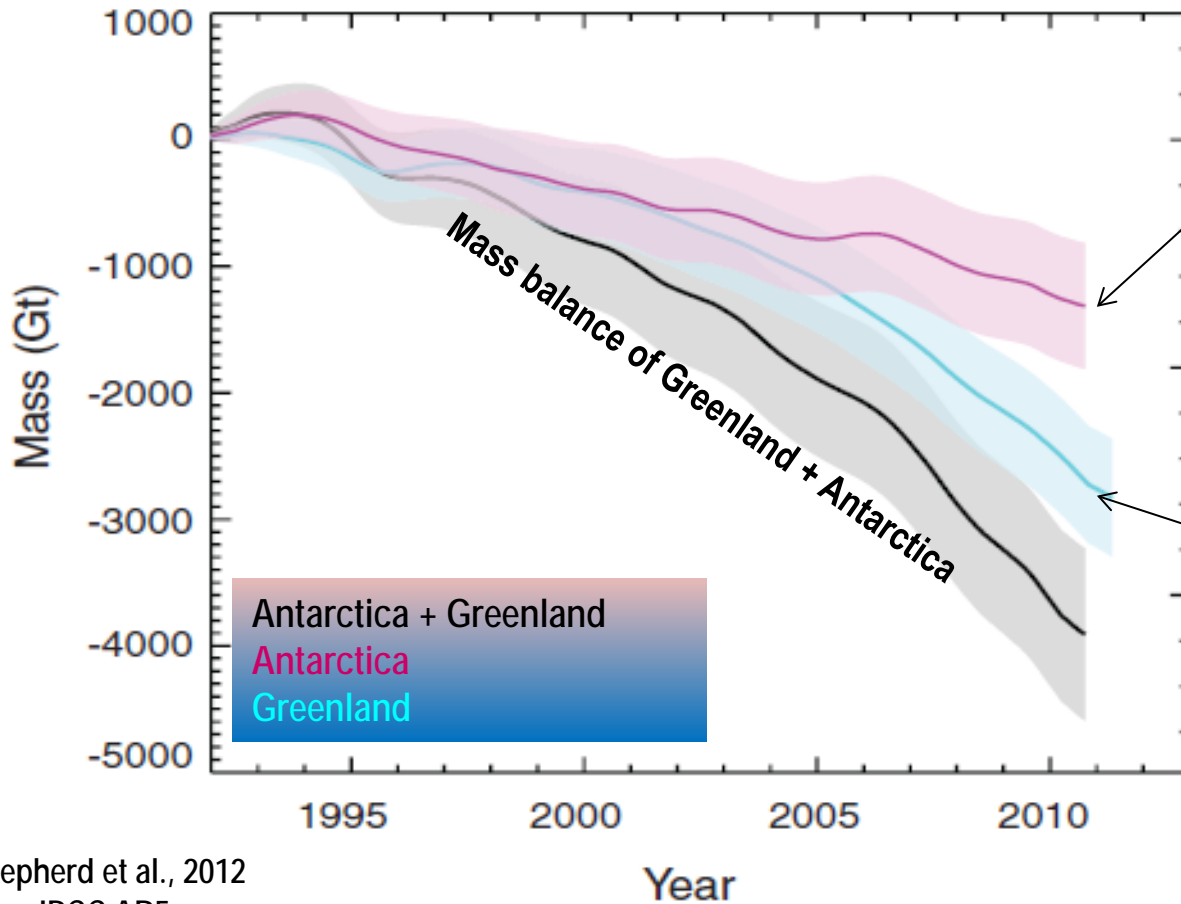
# WMO Statement on the Status of the Global Climate in 2015

WEATHER CLIMATE WATER



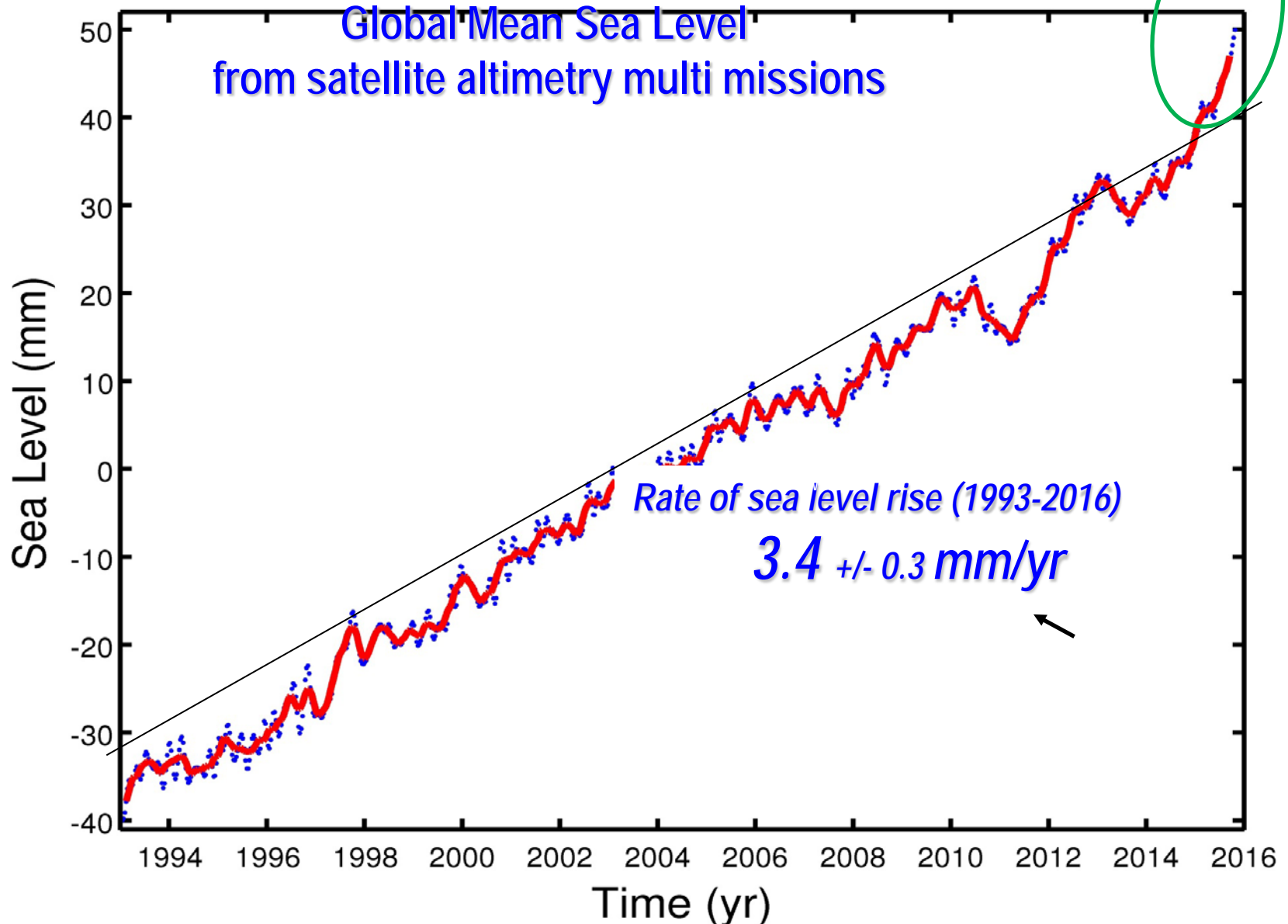
WORLD METEOROLOGICAL ORGANIZATION

*Ice mass loss from Greenland and Antarctica  
measured by space techniques  
since 1990 (in Gt) → mass loss acceleration since early 2000s*



# Global Mean Sea Level evolution (1993-2015) - planetary thermometer

Global Mean Sea Level from Altimetry (LEGOS/CLS)



# January-February 2016 global Temperature increase reference :1881-1910

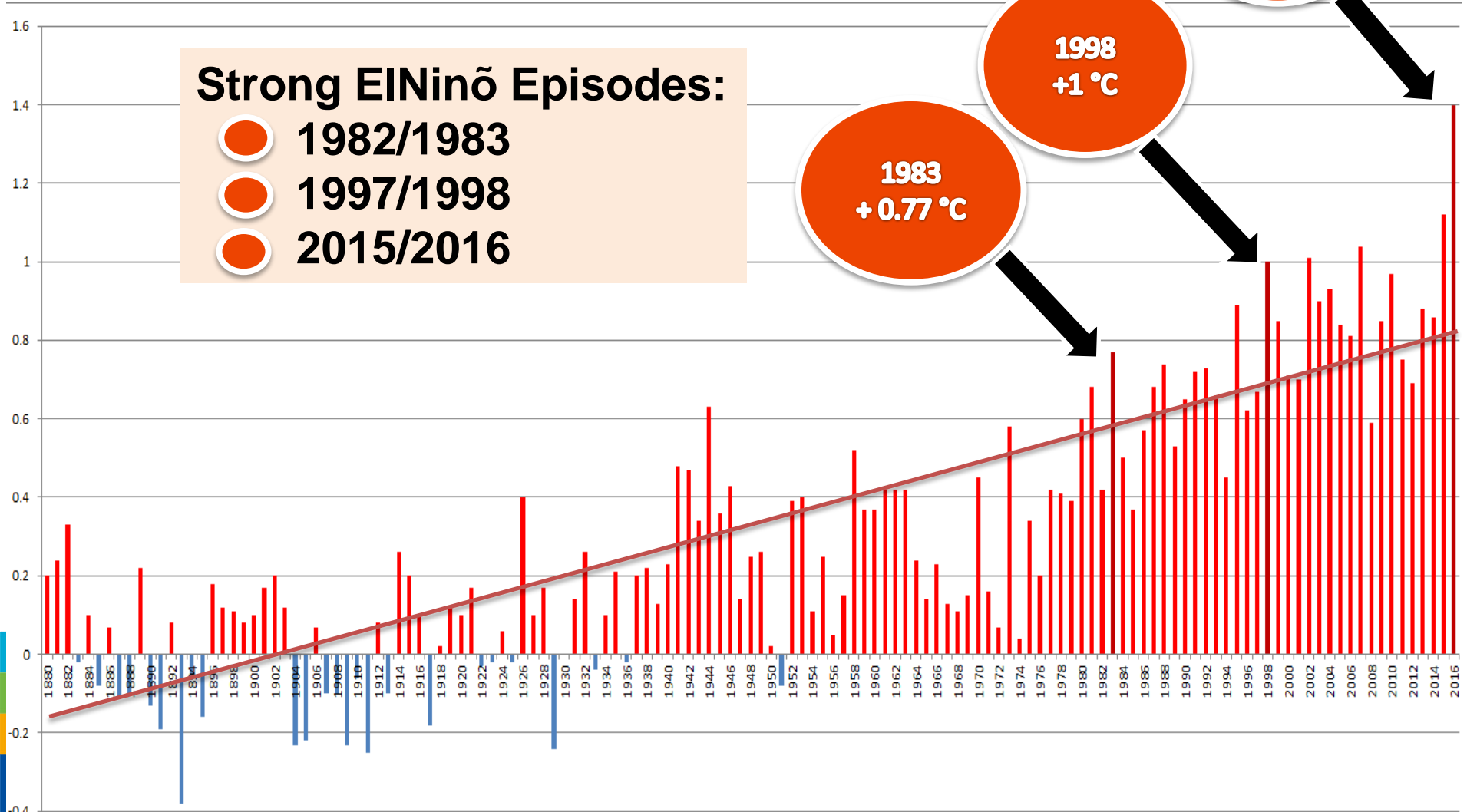
## Strong ElNiño Episodes:

- 1982/1983
- 1997/1998
- 2015/2016

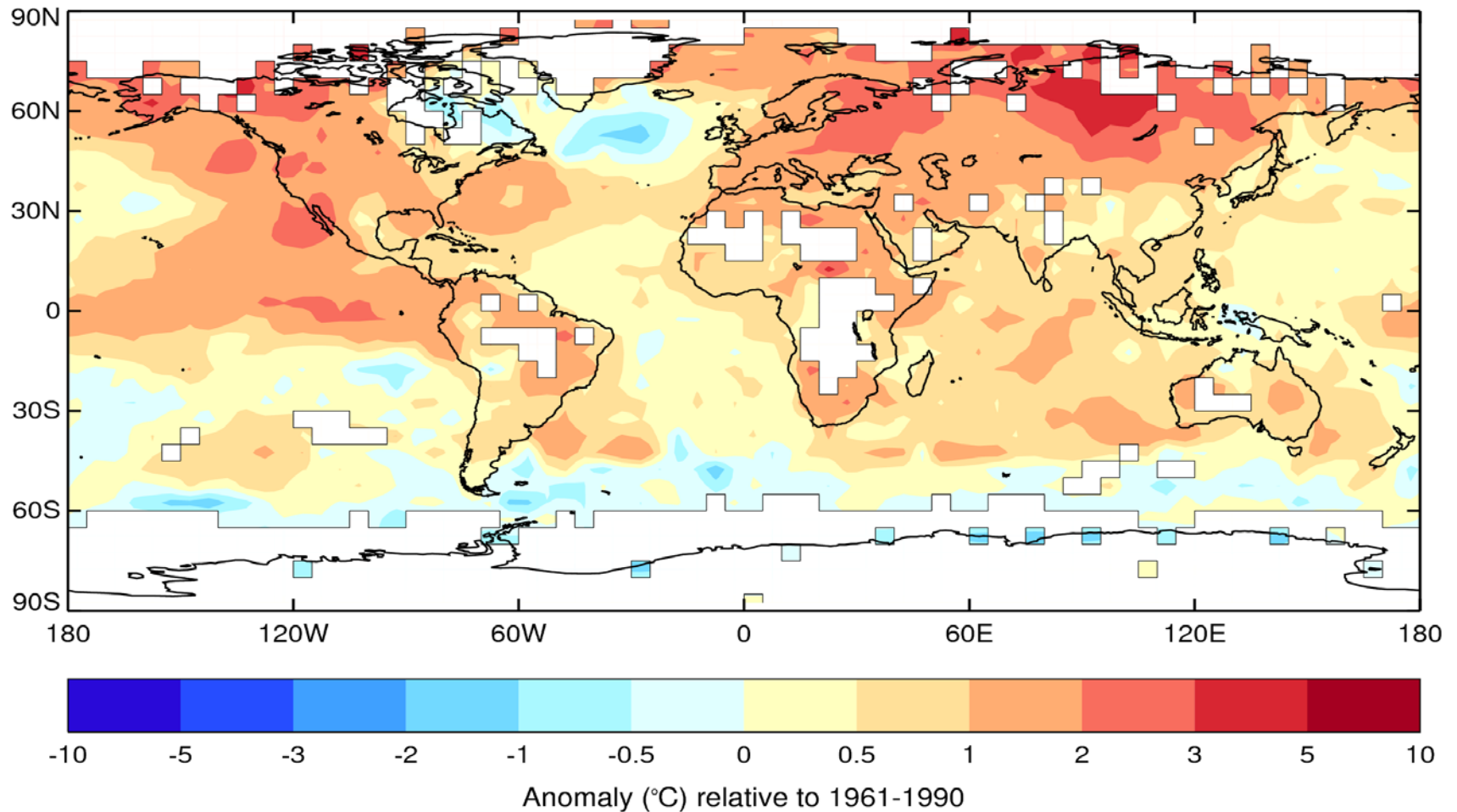
1983  
+ 0.77 °C

1998  
+1 °C

2016  
+1.4 °C



**Global surface temperature anomalies (2015) mainly based in-situ data.  
More Satellite data will be used for climate monitoring by 2040 with  
greater details and accuracy (integrated with in-situ data)**





# WMO contributions to the UN 2030 SDGs

Focusing on SDG 11: Cities



# WMO Strategic Priority 2- Climate Services need more & better climate observations

Agriculture



Water (Polar  
and High  
Mountain focus)

Energy



Health



Disaster Risk  
Reduction



# SUSTAINABLE DEVELOPMENT GOALS/WMO



**1 NO POVERTY**  
Weather resilience



**2 ZERO HUNGER**  
Climate change services



**6 CLEAN WATER AND SANITATION**  
Water resource management



**7 AFFORDABLE AND CLEAN ENERGY**  
Solar, wind & hydro use



**8 DECENT WORK AND ECONOMIC GROWTH**  
Climate resilience



**9 INDUSTRY, INNOVATION AND INFRASTRUCTURE**  
Big data, innovations



**11 SUSTAINABLE CITIES AND COMMUNITIES**  
Air quality, heat waves, flooding



**12 RESPONSIBLE CONSUMPTION AND PRODUCTION**



**13 CLIMATE ACTION**  
DRR, Adaptation, carbon & climate monitoring



**14 LIFE BELOW WATER**  
Sea level rise, climate->oceans



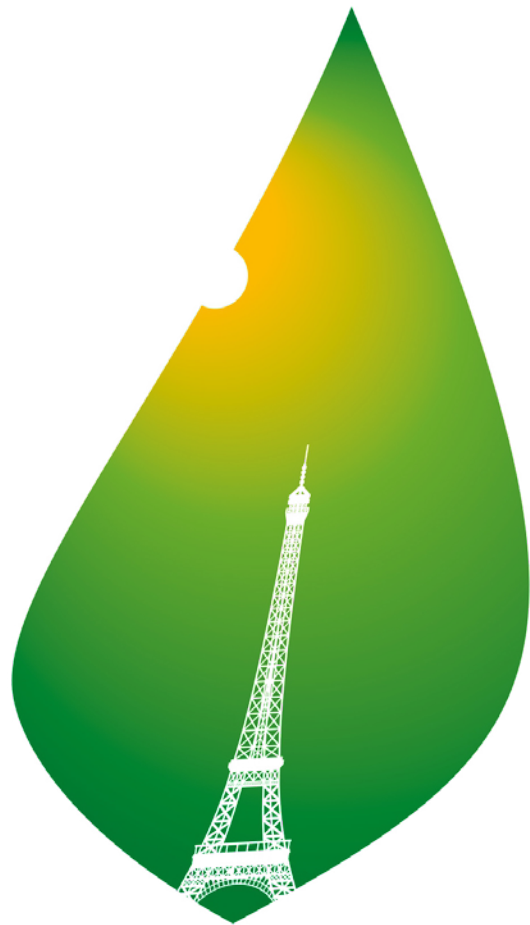
**15 LIFE ON LAND**  
Climate change <->ecosystems



**16 PEACE, JUSTICE AND STRONG INSTITUTIONS**  
Climate driven conflicts



**17 PARTNERSHIPS FOR THE GOALS**  
Resources for climate adaptation & DRR



COP21 • CMP11

PARIS 2015

UN CLIMATE CHANGE CONFERENCE



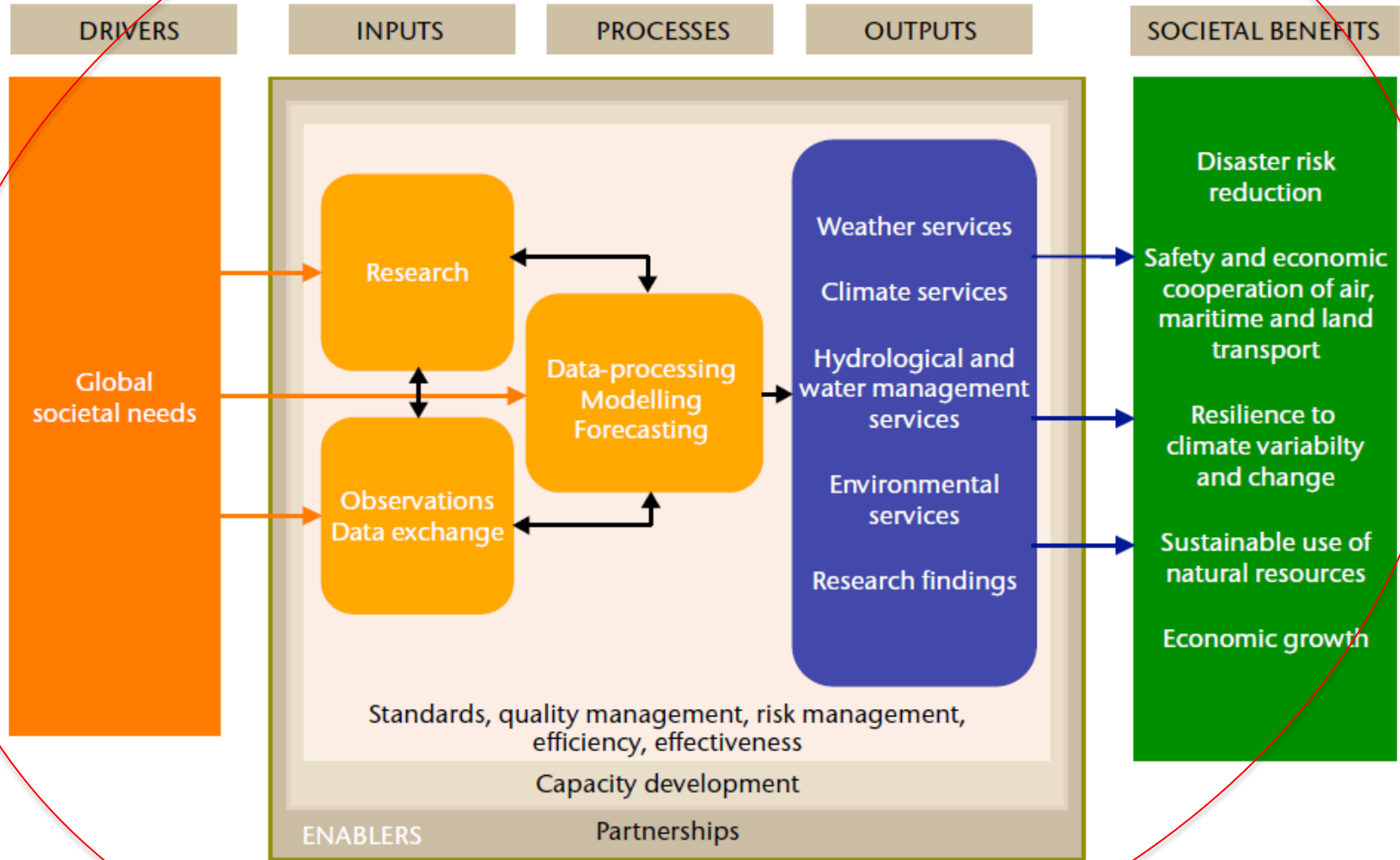
WMO OMM

Sendai Framework  
for Disaster Risk Reduction  
2015 - 2030



United Nations

# Processes involved in delivering effective weather, climate and hydrological services, and processes to achieve them linked with the WMO mandate

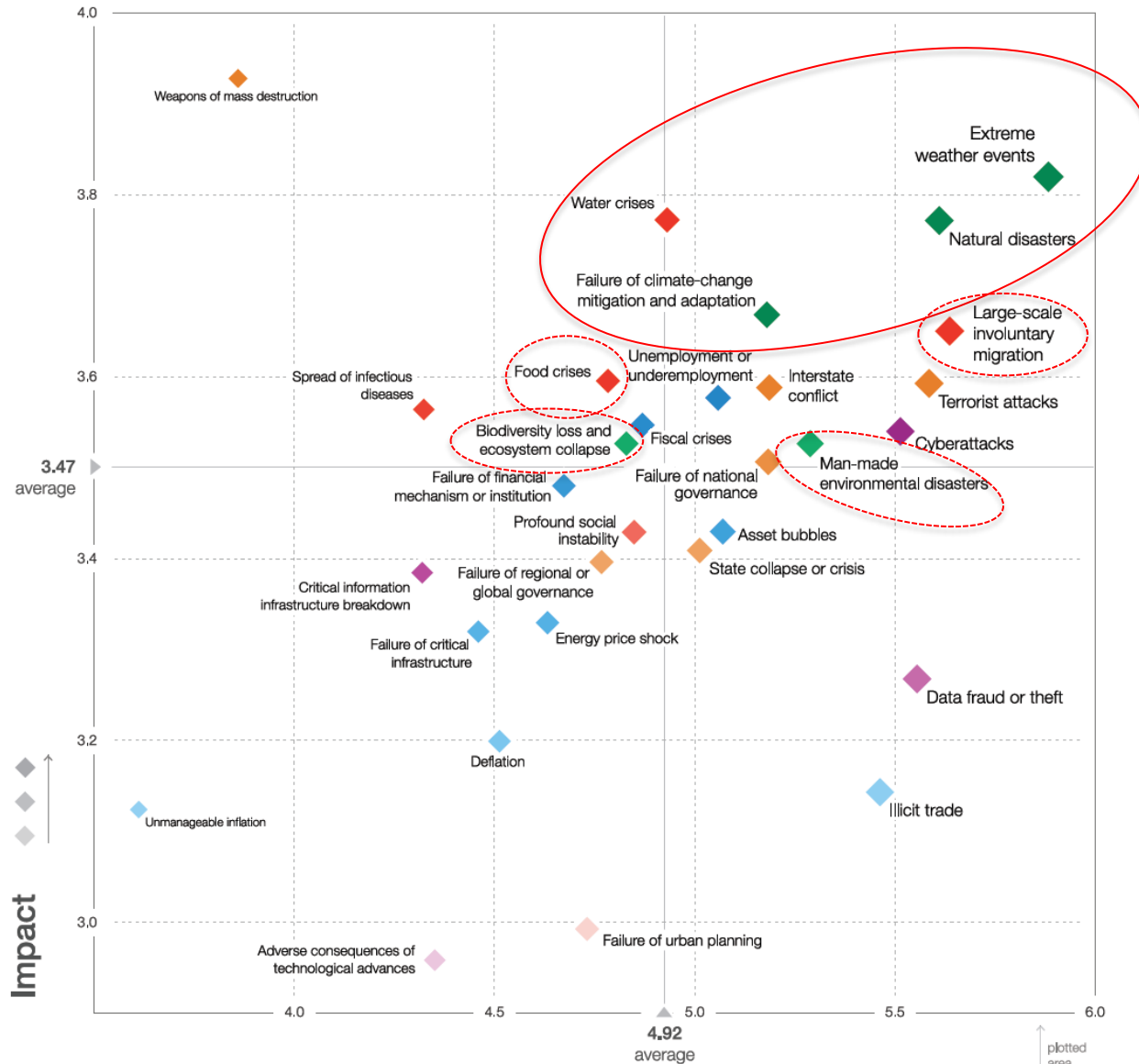


# Cg-17 statements on WMO Challenges

- **Socioeconomic impacts of meteorological and hydrological services and their communication to decision-makers and users**
  - The investments, both globally and for individual countries, have now reached such a level that NMHSs are required to demonstrate and justify the value of the continued public investment necessary to support the level of meteorological and hydrological services expected by their governments and national communities.
- (a) A clearer demonstration of the necessity of continued support for the observational and data processing infrastructure, and their capacity to provide essential public information, forecast and warning services to their national communities;
- (b) More rigorous and widely understood demonstration of the socioeconomic benefits of the services they provide to the governments, public and private sectors; and
- (c) A more systematic basis for prioritizing the use of available funding for infrastructure and service development and improvement.



# Socioeconomic context of weather, climate, hydrology





# Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services



**World  
Meteorological  
Organization**

Weather · Climate · Water

WMO-No. 1153



**WORLD BANK GROUP**



**USAID**  
FROM THE AMERICAN PEOPLE



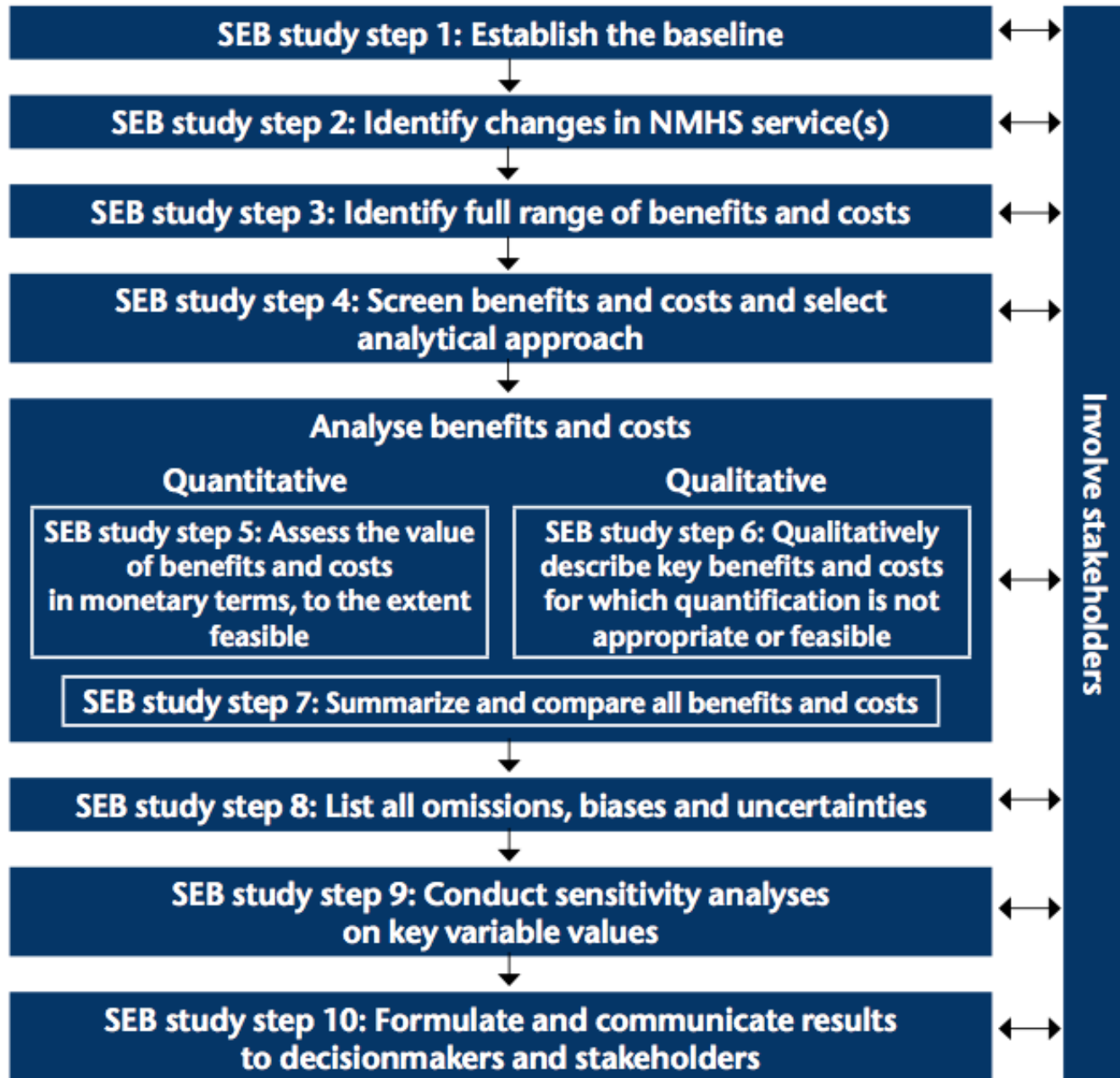
**GFDRR**

Global Facility for Disaster Reduction and Recovery



WMO OMM

# SEB STUDY STEPS



# Cg-17 identified high-priority ETR areas

- (a) Providing increased assistance to least developed countries **(LDCs)** and small island developing States (SIDS) in planning, management and implementing **human resources development (HRD) activities** in their NMHSs;
- (b) **Promoting international cooperation in order to more efficiently utilize the wealth of education and training resources** available worldwide in multiple languages and different formats; and supporting distance and e-learning activities in meteorology, climatology, hydrology and other relevant topics;
- (c) **Encouraging quality education by stimulating national/international accreditation** of training institutions and programmes, and professional certification of NMHS personnel;

# Cg-17 identified high-priority ETR areas

(d) **Supporting school and popular education in meteorology, climatology and hydrology, and contributing to the increase of public awareness on disaster risk reduction, prevention and mitigation as well as climate change science,** adaptation and mitigation options. Promoting careers in weather, water and climate, particularly for women;

(e) Preparing **programme or project oriented training programmes and packages, in collaboration with technical commissions and regional associations,** to assist the capacity development activities and improvements in the technical infrastructure of NMHSs;

(f) **Improving cooperation and exchange of the experts among the RTCs** and establishing a database of qualified lecturers on particular subjects for required training activities.

**WMO is a legal-binding organization, and best utilize this legal framework for further promotion of WMO ETR Programme for the WMO Community !**





# My view: WMO Training and Education Pyramid

PRs & Executive  
Managers

*Governmental Officers*

**Leaderships  
of PRs**

**Collaborations  
@regional PRAs**

**Competence @global**

**Advanced Science & Technology**

**Technical Programmes**

- National Strategy & Legislations-legal base
- Communicating Benefits-visibility
- National Partnership Mechanisms-Full benefit from authoritative information
- Resource Mobilization-Modern NMHS

- Identify Regional Priorities
- Effective Regional Collaborations (Members and regional partners)
- Strengthen Regional Facilities to support Members' implementation

Technical &  
Operational  
Staff

- WMO ETR Strategy & Implementation Plan
- Expanded Fellowships – Core areas
- Technical priority focus trainings
- Popular Education on WMO areas
- Assess and audit ETR Centers



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**Global Center Distributed Responsibility and Activities**

# WMO needs to strengthen the ETR Programme and Activities for meeting WMO Long-Term challenges !



Proverb:

If you want go fast, go alone  
If you want go far, go together



02/11/2017  
WMO OMM



# WMO Strategic Plan 2016-2019:

## Societal needs, strategic priorities, expected results

Societal needs	Strategic priorities	Expected results
Improved protection of life and property	<ul style="list-style-type: none"> <li>Disaster risk reduction</li> </ul>	<ul style="list-style-type: none"> <li>Improved service quality and service delivery</li> <li>Reduced disaster risk</li> </ul>
End poverty, ensure sustainable development, and combat climate change	<ul style="list-style-type: none"> <li>Global Framework for Climate Services</li> <li>WMO Integrated Global Observing System</li> <li>Aviation meteorological services</li> <li>Polar and high-mountain regions</li> </ul>	<ul style="list-style-type: none"> <li>Improved data-processing, modelling and forecasting</li> <li>Improved observations and data exchange</li> <li>Advance targeted research</li> </ul>
Sustainable use of natural resources and improved environmental quality	<ul style="list-style-type: none"> <li>Capacity development</li> <li>WMO governance</li> </ul>	<ul style="list-style-type: none"> <li>Strengthened capacity development</li> <li>Strengthened partnerships</li> <li>Improved efficiency and effectiveness</li> </ul>