WEATHER CLIMATE WATER

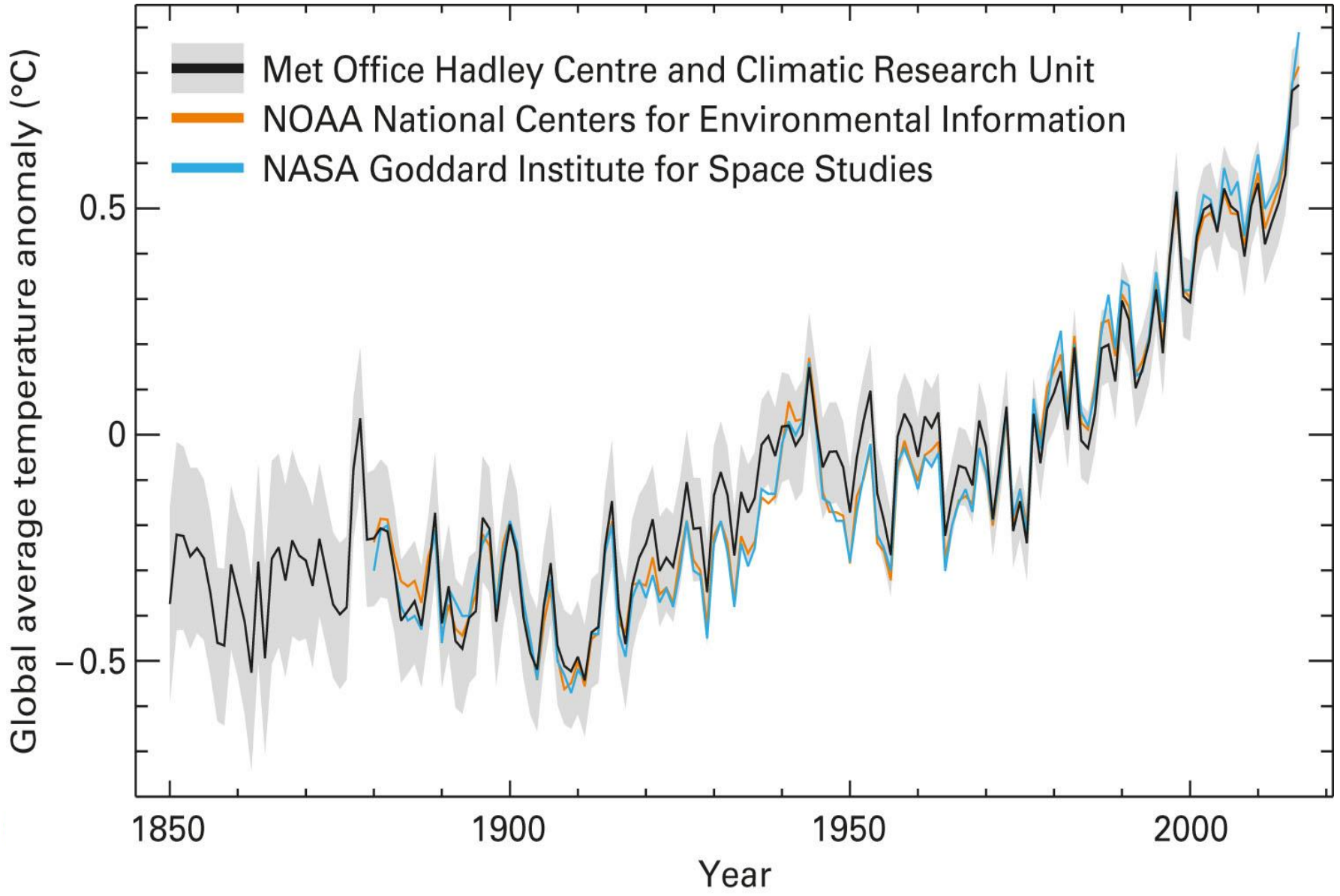
Impact-Based Forecast: WMO's Strategic Priority for Enhancing Socioeconomic Benefits and Visibility of NMHSs

Chung Kyu Park

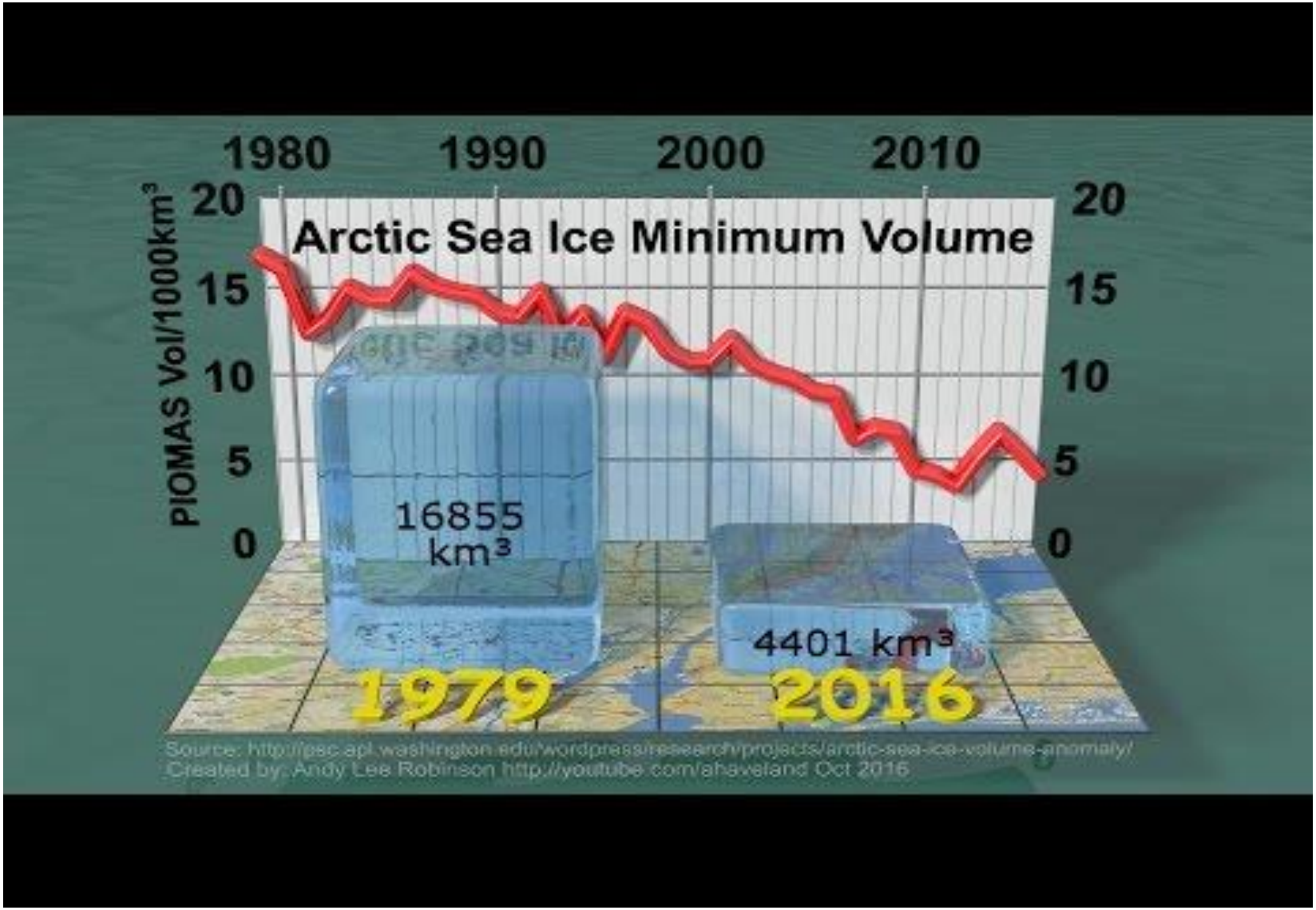
Director, Regional Office for Asia and the South-West Pacific
World Meteorological Organization

WORLD METEOROLOGICAL ORGANIZATION

Global temperature 1850-2016



Arctic sea ice volume 1979-2016: -74 %



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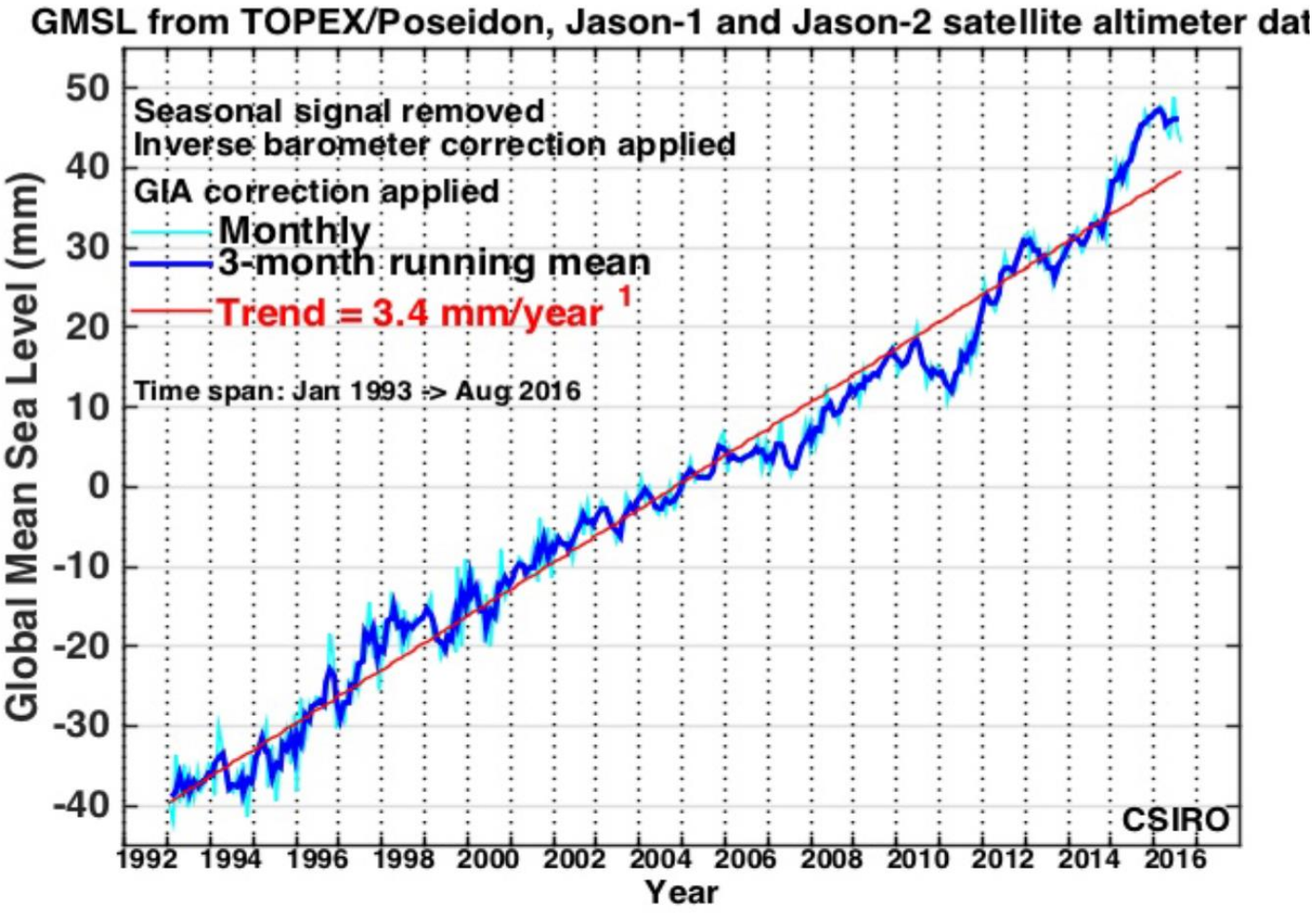
Sea level rise is accelerating



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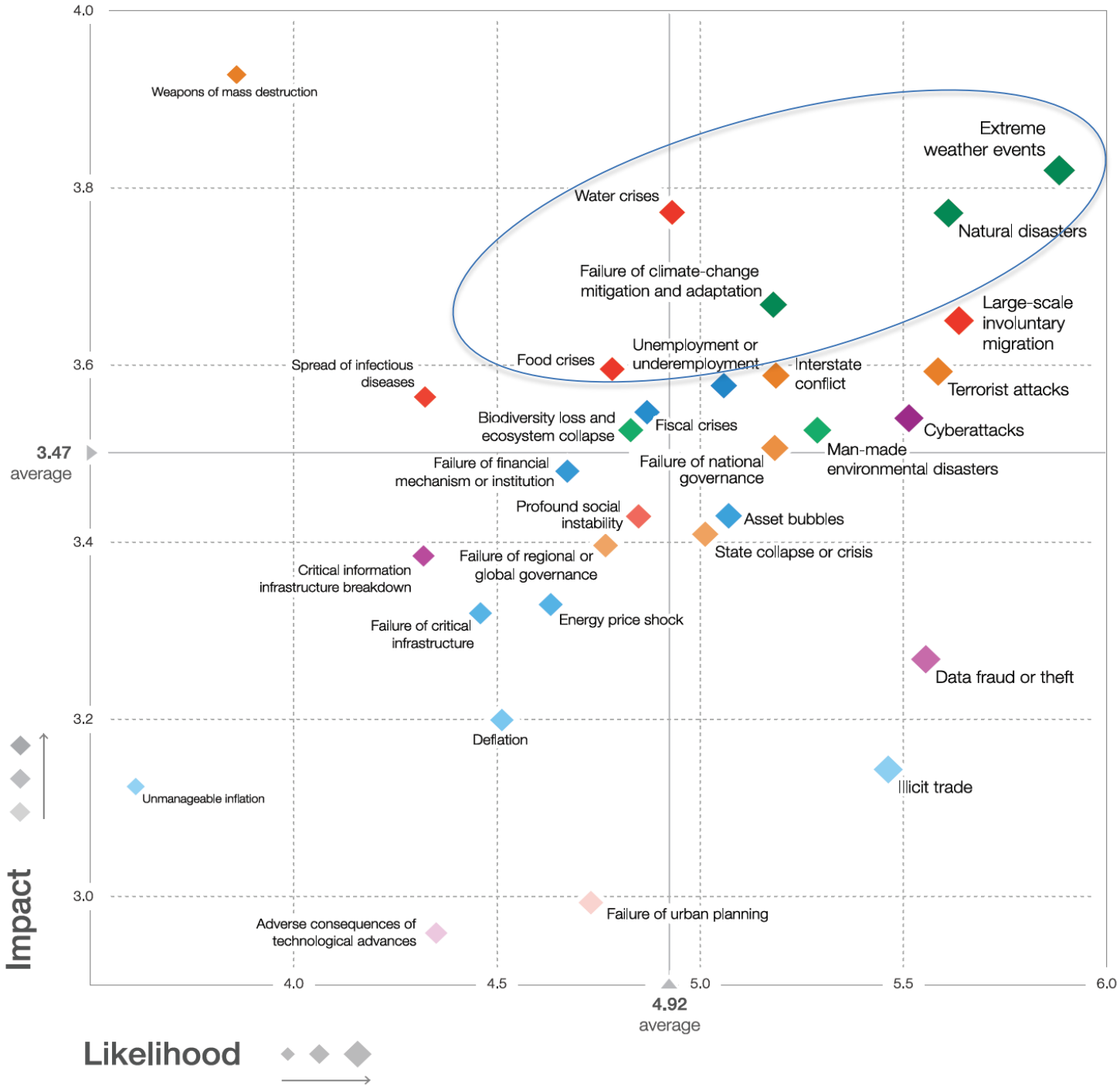
Global risks landscape 2017

World Economic Forum Davos



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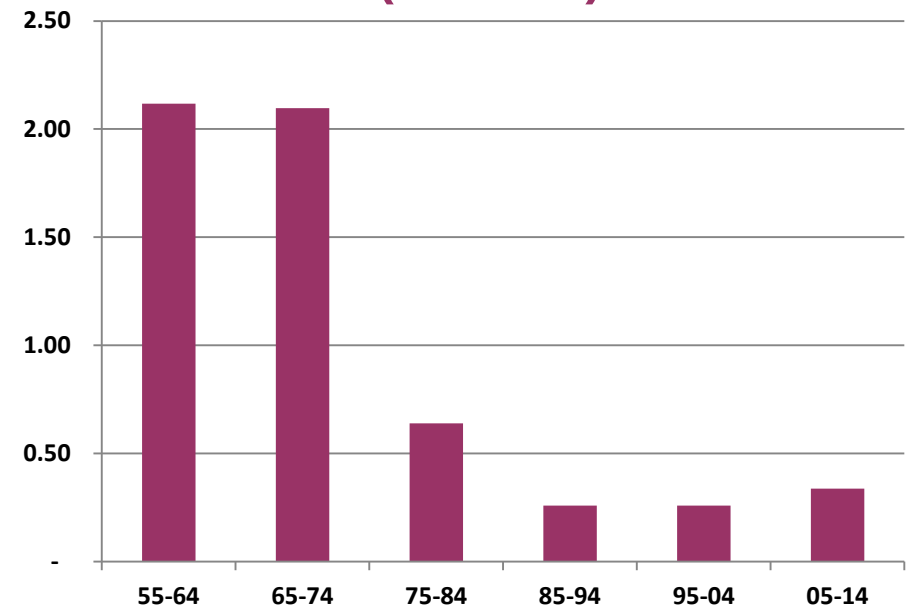
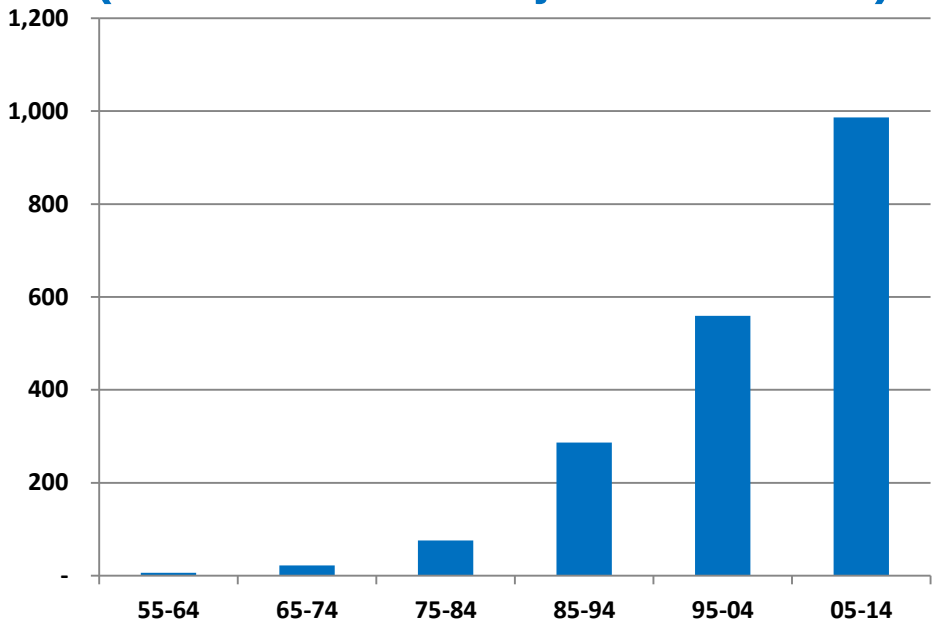
Impacts of hydrometeorological and climatological hazards (1955–2014)

Human losses by decade (millions)



Economic losses by decade (billions of US$ adjusted to 2013)



How to design IBF for the contribution to reduce Human & Economic losses???

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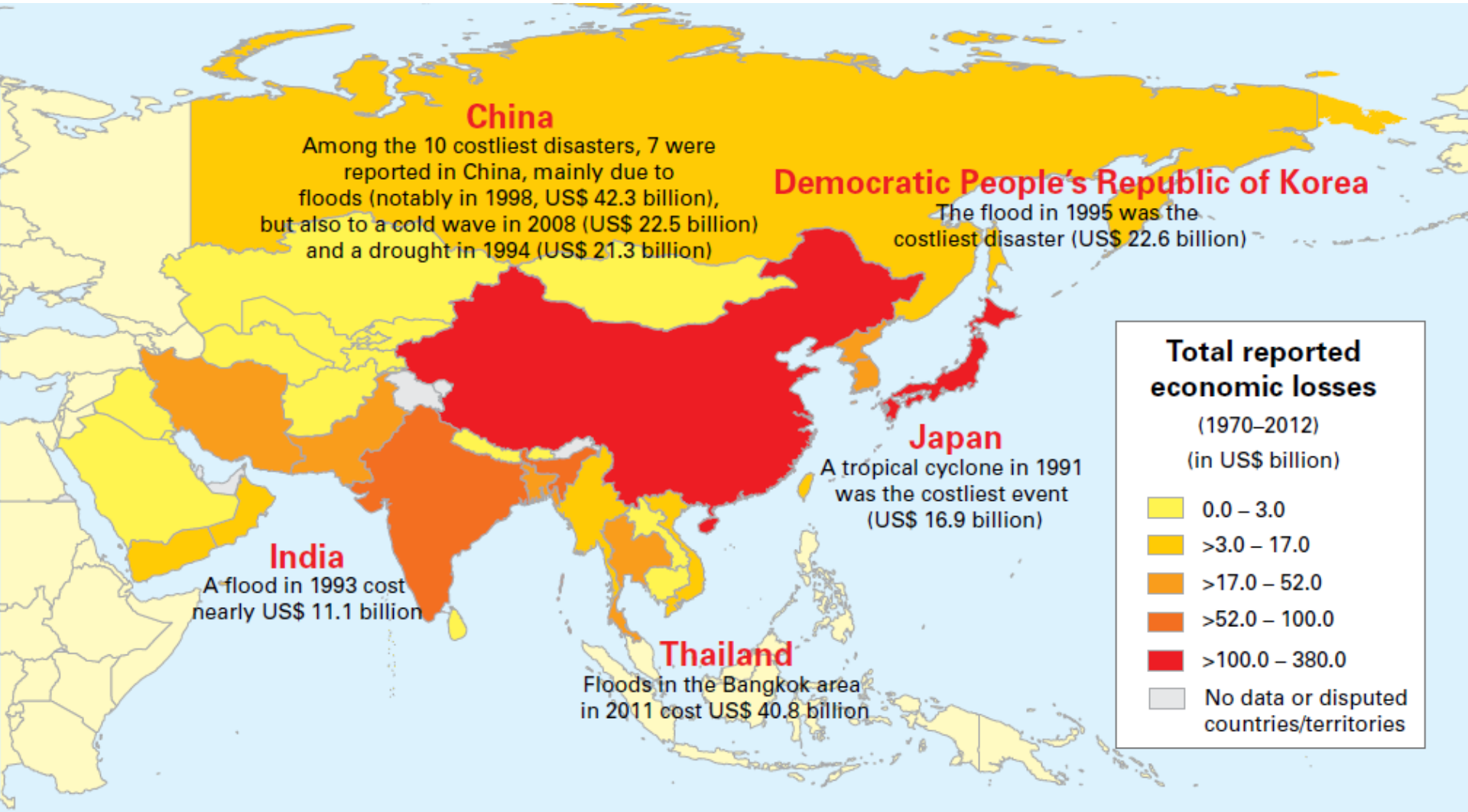
Map of reported disasters and their related economic losses (in US$ billion, 1970–2012)



Note:

Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Disasters ranked according to reported (a) deaths and (b) economic losses (1970–2012). TC indicates disasters caused by tropical cyclones.

(a)	Disaster type	Year	Country	Number of deaths
1	Storm (TC[a])	1970	Bangladesh	300 000
2	Storm (TC[b])	1991	Bangladesh	138 866
3	Storm (*Nargis*)	2008	Myanmar	138 366
4	Flood	1974	Bangladesh	28 700
5	Storm (TC)	1985	Bangladesh	15 000
6	Storm (TC)	1977	India	14 204
7	Storm (TC)	1999	India	9 843
8	Storm (TC)	1971	India	9 658
9	Flood	1980	China	6 200
10	Storm (*Sidr*)	2007	Bangladesh	4 234

(b)	Disaster type	Year	Country	Economic losses (in US$ billion)
1	Flood	1998	China	42.25
2	Flood	2011	Thailand	40.82
3	Flood	1995	Democratic People's Republic of Korea	22.59
4	Extreme temperature	2008	China	22.49
5	Drought	1994	China	21.33
6	Flood	2010	China	18.95
7	Flood	1996	China	18.45
8	Storm (*Mireille*)	1991	Japan	16.86
9	Flood	1991	China	12.65
10	Flood	1999	China	11.16

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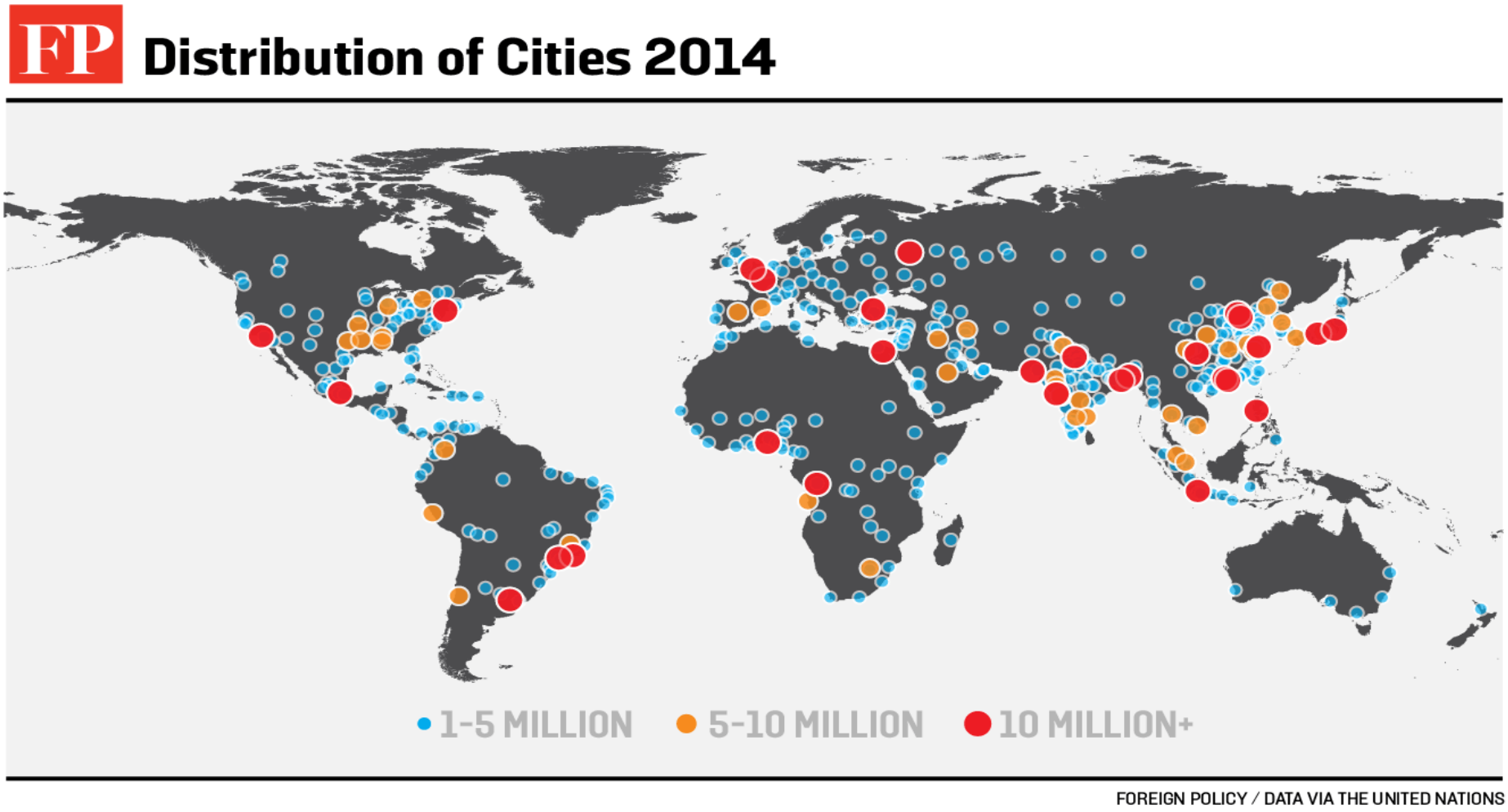
Disasters and their related economic losses (1970-2012)

- In Asia, 2 681 disasters in 1970–2012, resulting in the loss of 915,389 lives and economic damages of US$ 789.8 billion : Attributed to floods (**45 percent**) and storms (**35 percent**)
- **Storms** had the highest impact on the **number of deaths (76 percent)**
- **Floods** caused the greatest **economic loss (60 percent)**
- Three tropical cyclones were the most significant events, striking Bangladesh and Myanmar and leading to over 500,000 deaths

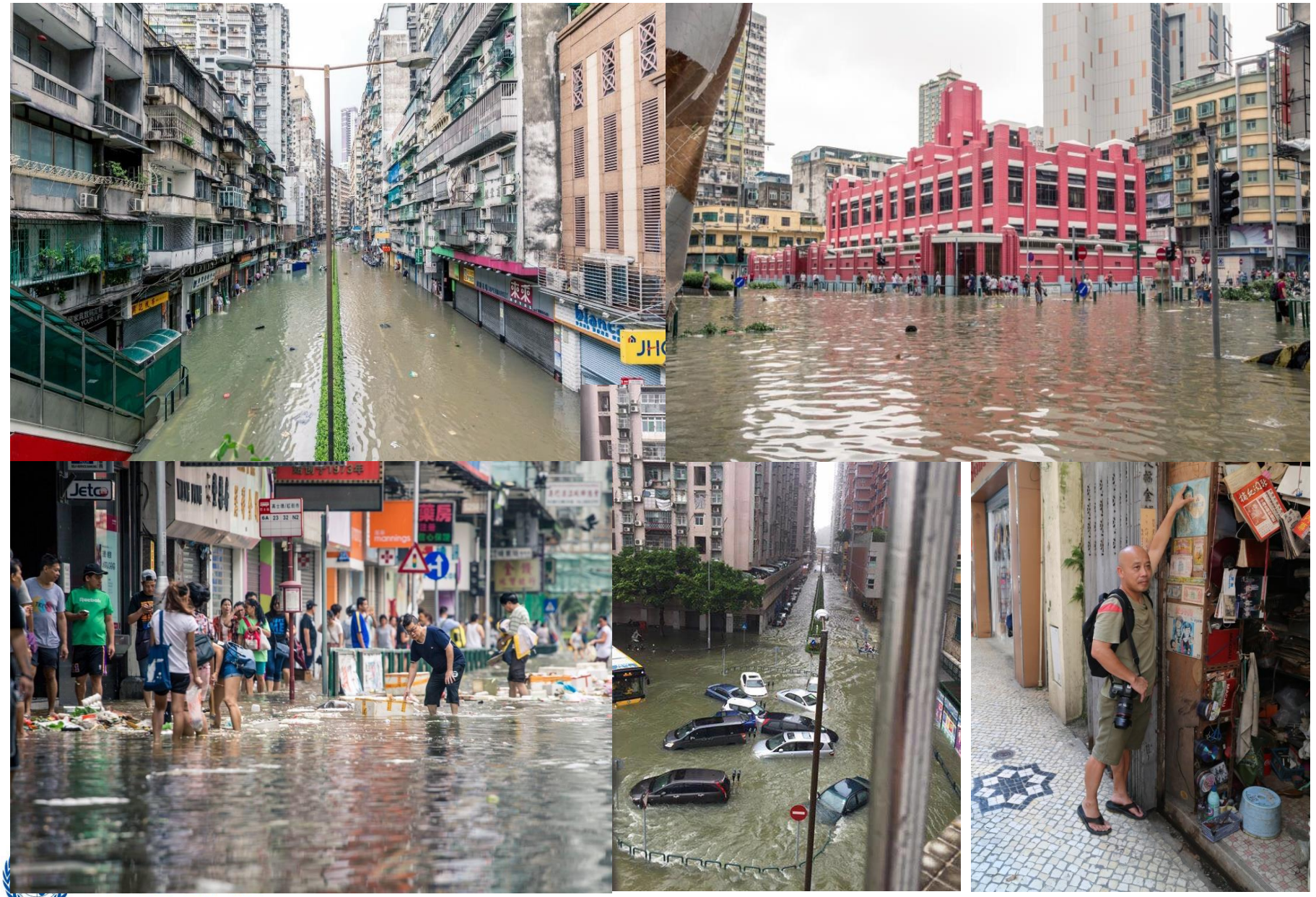
Climate & climate change –extreme weather and climate events impact to costal Megacities !!!!



Video showing sea water flowing into the underground car park (Video courtesy : Godfrey Ho)

Sea water flowing into Heng Fa Chuen (Video courtesy of Kitty Lam)

Flooding in Macao during the approach of Hato



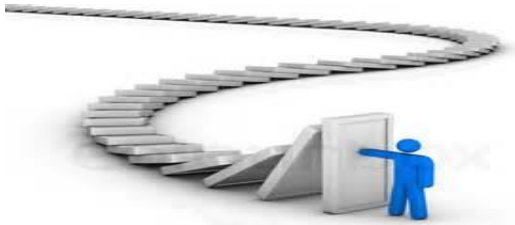
(Photo courtesy : Tomas Choi and Denise Lau)

Typhoon Committee Secretariat at Avenida de 5 de Outubro was damaged by storm surge

(Photo courtesy : TCS)

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)



Traffic Accident

Transmission Line

Street Trees

Green House

Infrastructure Damage

Street Billboards

Strong Wind

Severe Convection

Casualty

Typhoon

Storm Surge

Heavy Rain

Riverbanks Destroyed

High Waves

Farmland

Inundation

Water Logging

Traffic Accident

Electrocution

Basement Flooding

Plant Disease

Marine Accident

Overflowing

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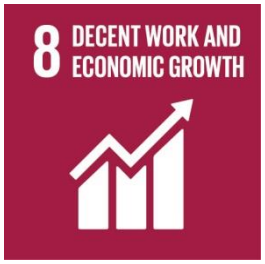
SUSTAINABLE DEVELOPMENT GOALS/WMO

Weather resilience

Climate change services

Water resource management

Solar, wind & hydro use



Climate resilience

Big data, innovations

Air quality, heat waves, flooding

DRR, Adaptation, carbon & climate monitoring

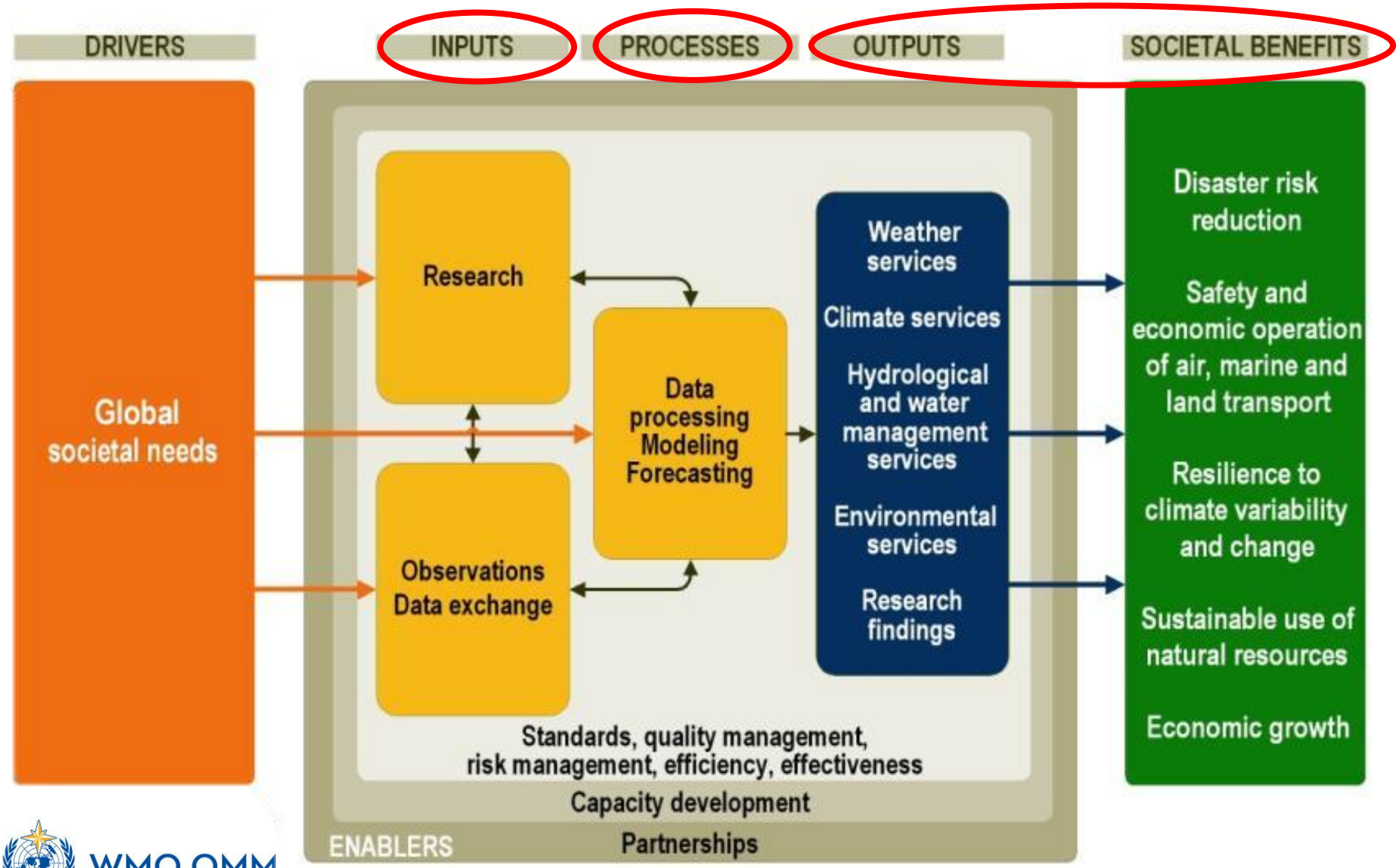
Sea level rise, climate<->oceans

Climate change <->ecosystems

Climate driven conflicts

Resources for climate adaptation & DRR

WMO STRATEGIC PLAN – Global Societal Needs Driven



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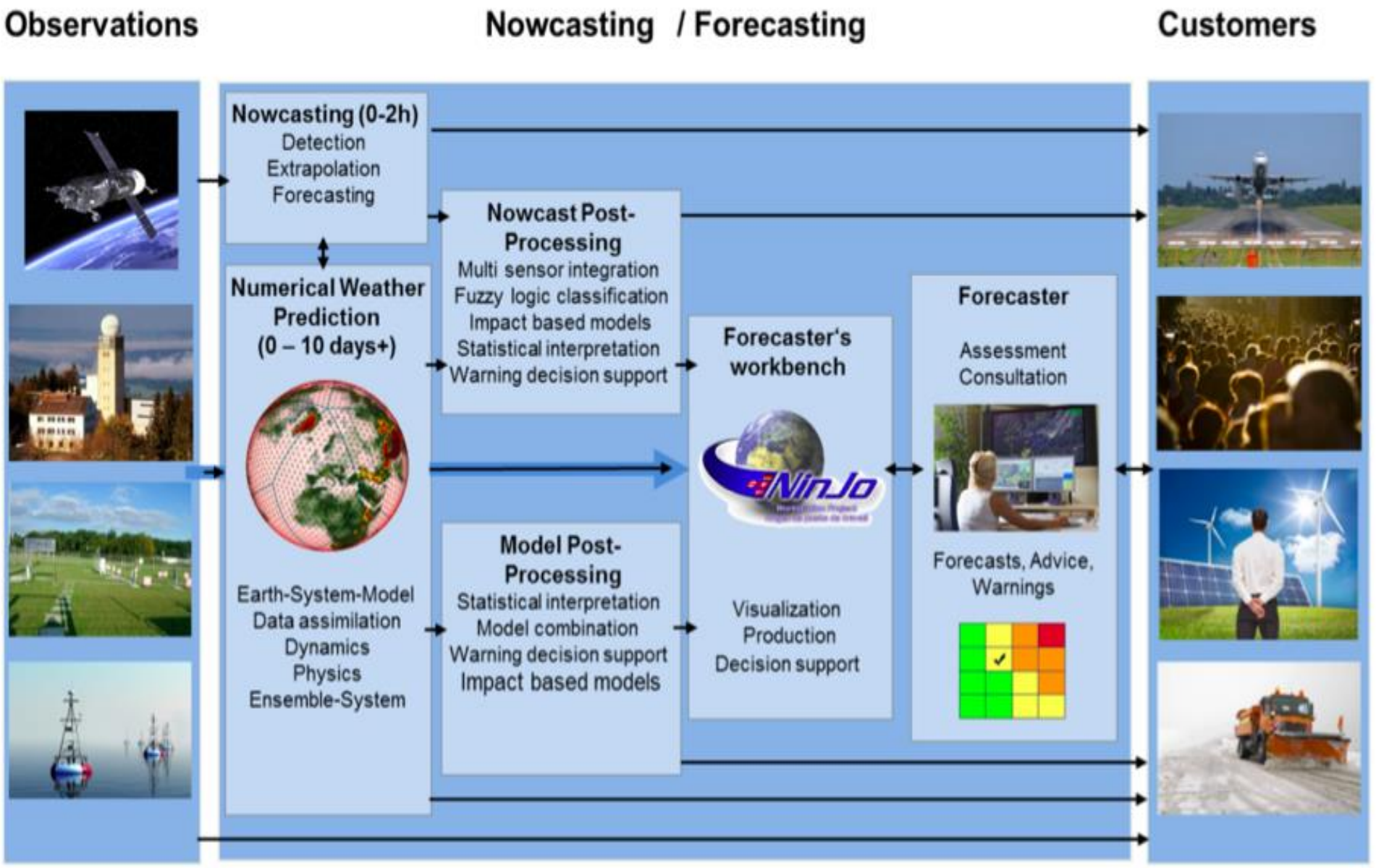
Towards impact-based forecasting



WMO Congress Resolution

Resolution 2 (Cg-17): Request the CBS to support the further development of service delivery by Members in the area of impact-based forecasting and risk-based warning

EC Decisions/Resolutions on IBF

- **Decision 5 (EC-68): U**rges Members to embark on the implementation of impact-based forecasting and warnings

- **Decision 58 (EC-68):** Requests **CBS**

- To assess the operational impacts and requirements for impact-based forecasting
- To prepare guidance materials on aspects of the system and compile lessons learnt in order to assist NMHSs in the implementation of impact-based forecast and warning services

CBS-16 Decision

- **Decision 30 (CBS-16):**

Decides

- More rapid realization of impact-based forecast and warning services through the development of a strategy for implementation of such services
- Implementation strategy should be WMO-wide and applicable to all activities and programmes, with inputs from relevant TCS and WMO programmes, as well as stakeholders and development partners

Requests OPAG-PWS **ET on Impact-Based Forecasting and Risk-Based Warning**:

- To initiate the development of an implementation strategy describing the actionable steps
- Review of the PWS Competency Framework to ensure that it adequately addresses those skills required for the delivery of this new service

EC Decision

- **Decision 3.2(2)/1 (EC-69):**

Decides:

- To further develop training materials on impact-based forecast and warning services in the curricula of WMO RTCs
- To develop a mechanism for the collection and processing of impact-related data and information for GDPFS centres
- To incorporate methods to assess likelihood and risk using numerical weather ensembles into the WMO Guidelines on Multi-Hazard Impact-based Forecast and Warning Services

RA II-16 Key Outcomes

Agenda	Items	Key Outcomes
4.1	DRR	• Implementation of WMO DRR Roadmap and DRR related activities in RA II (SWFDP, CIFDP, FFGSs, TCP) • Development of Inter-Regional Meteo Alarm system • Pilot project for further enhancement of DRR capacity
4.4	Service Quality and Service Delivery	• Implementation and harmonization of the WMO Strategy for Service Delivery • Multi-hazard impact-based forecast and warning services
4.5	Polar and High Mountain Regions	• Asia High Mountains GCW observing network - Pilot project "Cryosphere monitoring to understand the trend of glacial hydrology of high Asia Mountains"
4.6	Data Processing, Modeling, and Forecasting	• Seamless Data-Processing and Forecasting System - involvement and contribution to demonstration or pilot projects • Forecast verification activities, high resolution NWP and production of Impact-based forecast and warning

Follow up to the RA II-16

Approved RA II Pilot Projects

Continued projects	Lead by
Pilot Project to Develop Support for NMHSs in Numerical Weather Prediction	Hong Kong, China Republic of Korea
Pilot Project to Develop Support for National Meteorological and Hydrological Services in the Collection and Application of Aircraft Meteorological Data Relay (AMDAR) data	China Hong Kong, China
Pilot Project to Sustain and Enhance the Capacity of NMHSs in the Provision of Official Weather Forecasts for the Medium Range	Hong Kong, China Republic of Korea

New projects	**Lead by**
Pilot Project on Impact-based Forecasting	**Republic of Korea**
Pilot Project to Enhance the Regional Capability in Meteorological Disaster Risk Reduction	**China**

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Recommendations

1) **Enhance data-processing and forecasting capabilities** to cope with the requirements of this new area of service delivery

2) **Build infrastructure and improve weather and climate modelling capabilities** to enhance forecast products

3) **Developments in understanding the impacts of hazards**

4) **Sustainable and long-term country assistance basis**, requiring expertise, resources, patience and persistence

Thank you

Gracias

Merci

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