

Ad Hoc Expert Meeting on

**Climate Change Adaptation for  
International Transport:  
Preparing for the Future**

16 to 17 April 2019

**Climate, climate change and their impact**

Presentation by

**Boram Lee**

Senior Scientific Officer  
World Climate Research Programme, WMO

WEATHER CLIMATE WATER  
TEMPS CLIMAT EAU

# Climate, climate change and their impact



**WMO OMM**  
World Meteorological Organization  
Organisation météorologique mondiale

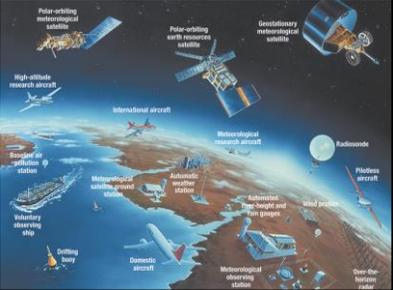
Dr Boram Lee (blee@wmo.int)  
World Climate Research Programme (WCRP)  
World Meteorological Organization

## WMO – Who we are



- UN Specialized Agency on **Weather, Climate & Water**
- 186 Member States and 6 Member Territories, HQs in Geneva
- 2<sup>nd</sup> oldest UN Agency, since 1873

- Coordinates work of > 200 000 national experts from meteorological & hydrological services, academia (& private sector)
- Founder and host agency of IPCC (1<sup>st</sup> World Climate Conference)
- Co-Founder of UNFCCC (2<sup>nd</sup> World Climate Conference)

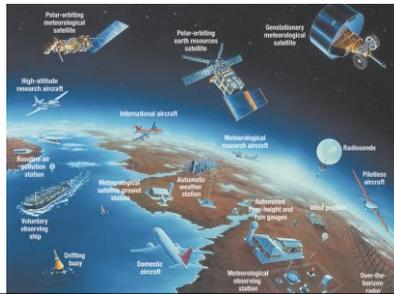



# WMO – Mission & Key Activities

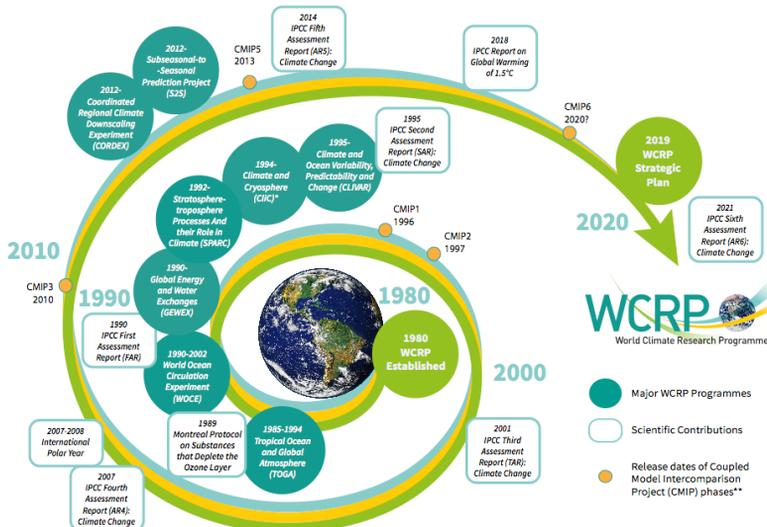


- **World Climate**
- **Weather**, disasters & safety
- **Water** resources

- Data & technology
- Strengthening the national service capabilities
- Earth system research
- Efficient governance



# World Climate Research Programme (WMO-ISC-IOC)



# WMO: Annual State of Climate

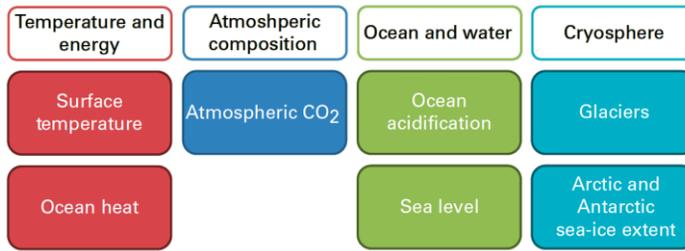


# WMO: Annual State of Climate



## WMO: Annual State of Climate

- Complements IPCC Assessment Reports and Special Reports: provides a **snapshot on key climate indicators and extreme events** with historical and geographical context



- Allows analysis of climate change signals separated more clearly from natural modes of variability (e.g. El Niño-Southern Oscillation)



WMO OMM

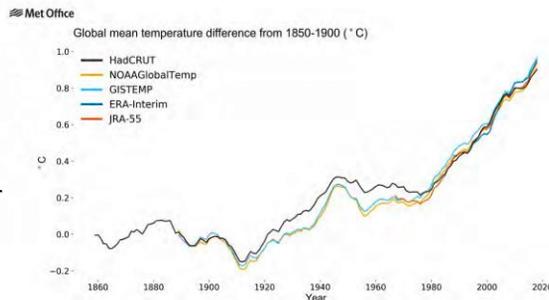
## Every bit of warming matters

- Average global temperature reached approximately 1 °C above pre-industrial levels
  - 2018 was the fourth warmest year on record
  - 2015–2018 were the four warmest years on record as the long-term warming trend continues

5 years (2014-2018)

**1.04 ± 0.09°C**

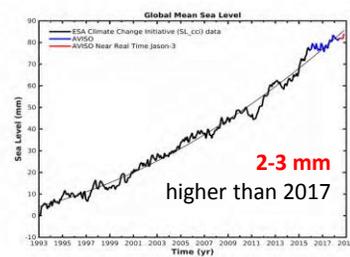
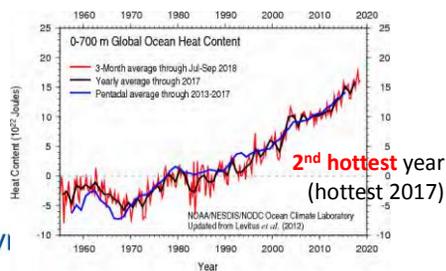
Warmest La Niña year



WMO OMM

## Every bit of warming matters

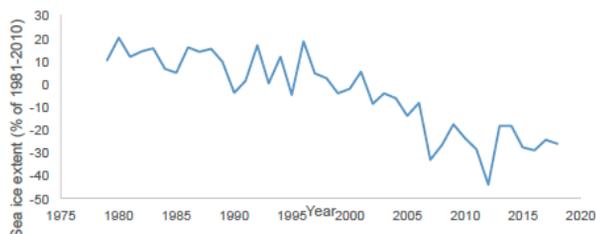
- Average global temperature reached approximately 1 °C above pre-industrial levels
  - 2018 was the fourth warmest year on record
  - 2015–2018 were the four warmest years on record as the long-term warming trend continues
  - Ocean heat content is at a record high and global mean sea level continues to rise



## Every bit of warming matters

- Average global temperature reached approximately 1 °C above pre-industrial levels
  - 2018 was the fourth warmest year on record
  - 2015–2018 were the four warmest years on record as the long-term warming trend continues
  - Ocean heat content is at a record high and global mean sea level continues to rise
  - Artic and Antarctic sea-ice extent is well below average

28% below average  
in Sep 2018

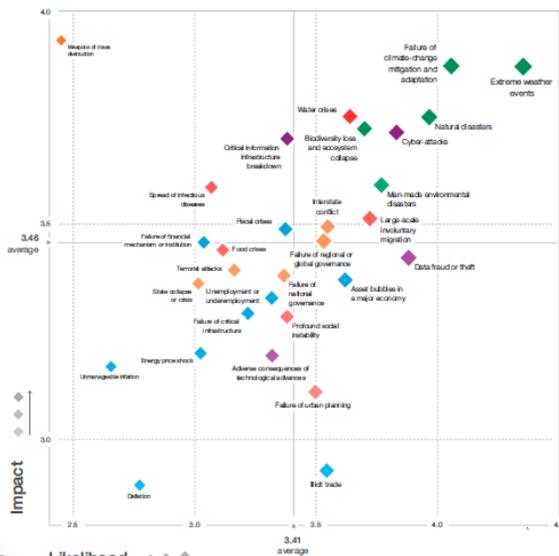


## Extremes and Risks: Our choice?

- Average global temperature reached approximately 1 °C above pre-industrial levels
  - 2018 was the fourth warmest year on record
  - 2015–2018 were the four warmest years on record as the long-term warming trend continues
  - Ocean heat content is at a record high and global mean sea level continues to rise
  - Arctic and Antarctic sea-ice extent is well below average
- **Extreme events** had an impact on lives and sustainable development on every continent
- We are **not** on track to meet climate change targets and rein in temperature increases



## Extremes and Risks: Our choice?



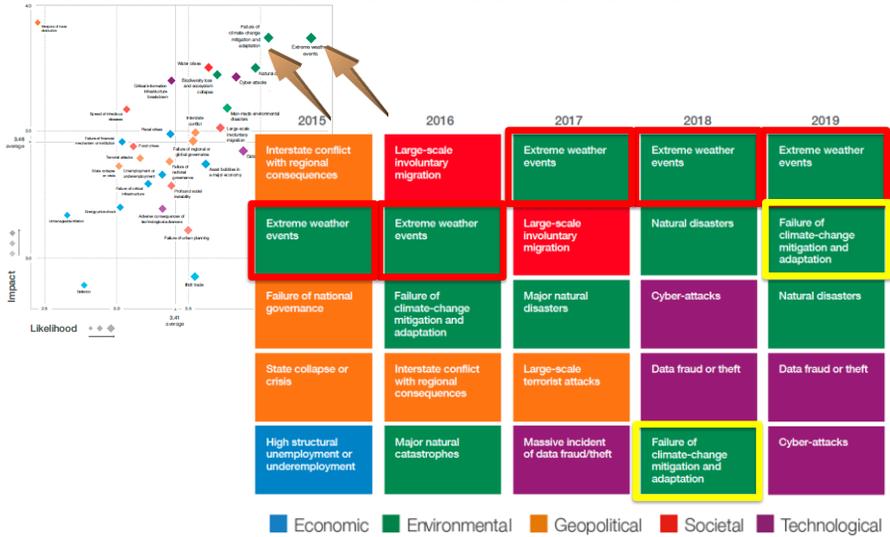
• Extreme weather events  
 • Natural disasters  
 • Failure of climate-change mitigation & adaptation

- ◆ Economic
- ◆ Societal
- ◆ Environmental
- ◆ Technological
- ◆ Geopolitical



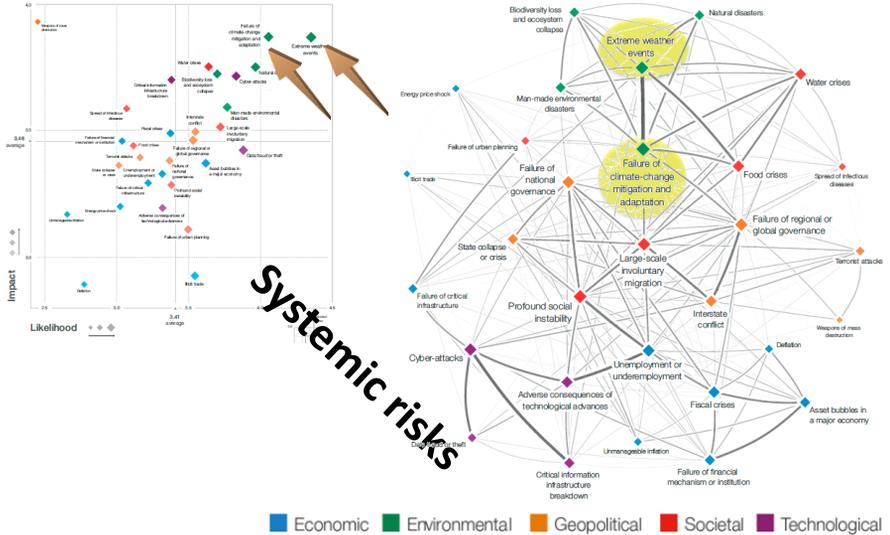
Source: World Economic Forum – Global Risk Landscape 2019

# Extremes and Risks: Our choice?



Source: World Economic Forum – Global Risk Landscape 2019

# Extremes and Risks: Our choice?

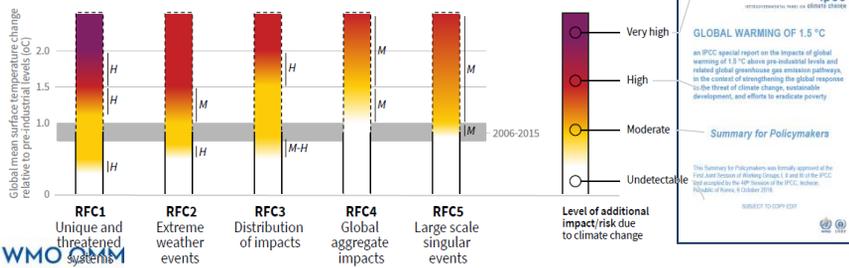


Source: World Economic Forum – Global Risk Landscape 2019

# Climate, Changes, Impact and Resilience

- Climate resilience: prioritized by international agencies and national governments.
- A long-term view is relevant to decision-making of now.
- Climate model projections can be relied upon to guide mitigation plans AND broad adaptation strategies

Impacts and risks associated with the Reasons for Concern (RFCs)



# Climate, Changes, Impact and Resilience

## (Aviation Example)

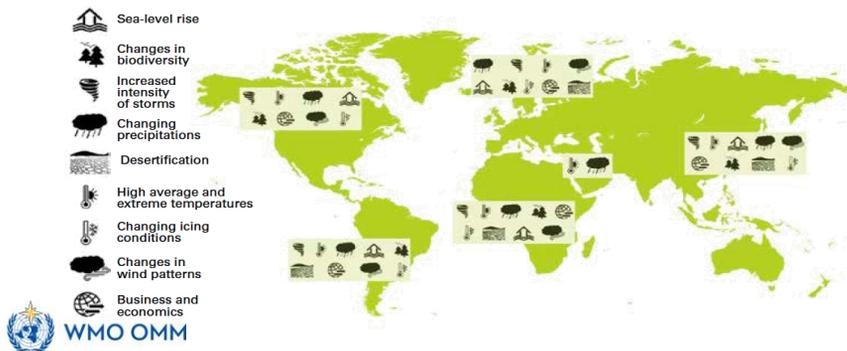
- How should aviation infrastructure be designed and built so that CO<sub>2</sub> emissions are limited; and more extreme weather events, water scarcity, sandstorms, or any impact attributable to a changing climate, can be withstood?



# Climate, Changes, Impact and Resilience

## (Aviation Example)

- Identified 8 categories for potential climate impacts
- A climate change risk assessment is required to determine the climate change vulnerabilities, before an adaptation strategy is developed.



# Climate, Changes, Impact and Resilience

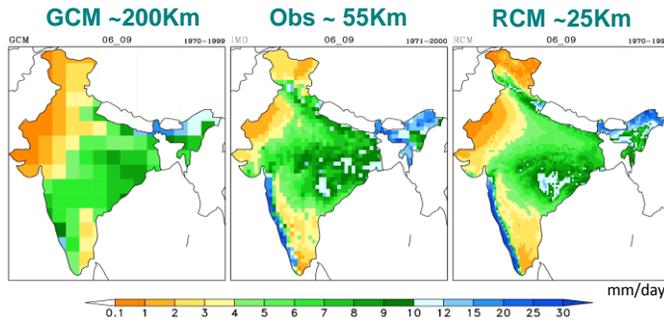
- Climate resilience: prioritized by international agencies and national governments.
- A long-term view is relevant to decision-making of now.
- Climate model projections can be relied upon to guide mitigation plans AND broad adaptation strategies
- Use of these models to guide adaptation actions? (**resolution/scale, precision and confidence?**)

**Are Climate Change Information Fit For Purpose?**



# Climate information on different scales

## Monsoon precipitation JJAS

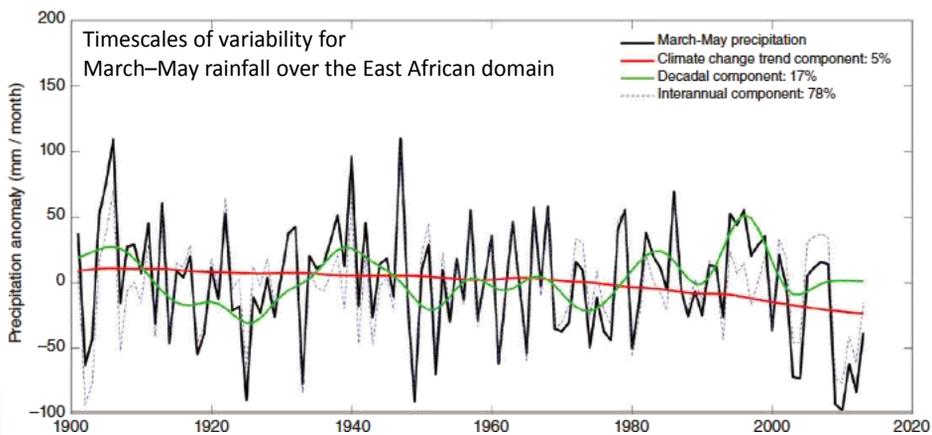


**More realistic monsoon precipitation in RCM simulations**  
(mean of 3 RCMs driven by 2 GCMs, 1970-1999)

Source: Pankaj Kumar, High Noon Project, MPI-M



# Climate information on different scales

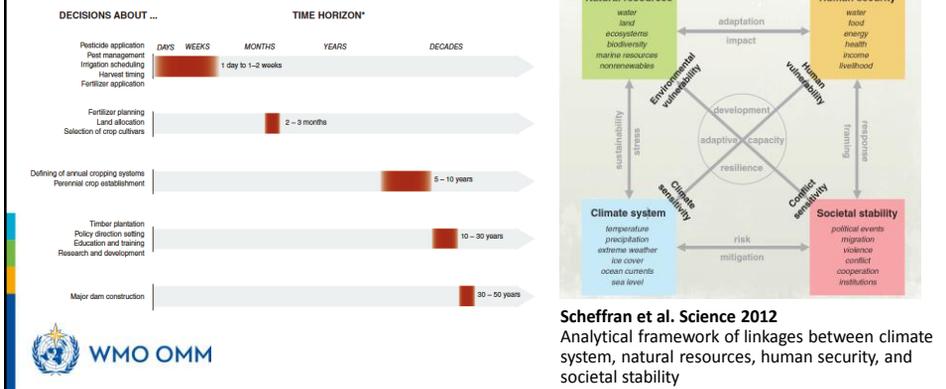


potential pitfalls of conflating decadal signals with longer-term trends...



# Climate, Changes, Impact and Resilience

- Climate projections available in a range of precision, and scales
- Foresights of societal / socio-economic changes should be available, matching scales with climate information and requirements for decision-making



## Climate Change Adaptation: A few questions

- What are key obstacles towards societal resilience across different sectors and SDGs, while facing climate change and emerging extremes?  
(Data? Knowledge? Perception? Governance? Compliance?)
- What long-term decisions could be recast onto shorter timeframes? Do we make systematic effort to identify and link them?
- What local to global governance arrangements best support equitable and sustainable CC adaptation?
- Do we secure and project sufficient resources to in-depth scientific analyses needed to develop reliable CC projections?

WEATHER CLIMATE WATER  
TEMPS CLIMAT EAU



WMO OMM

World Meteorological Organization  
Organisation météorologique mondiale

[blee@wmo.int](mailto:blee@wmo.int)

# Thank you