STI for Climate Extremes

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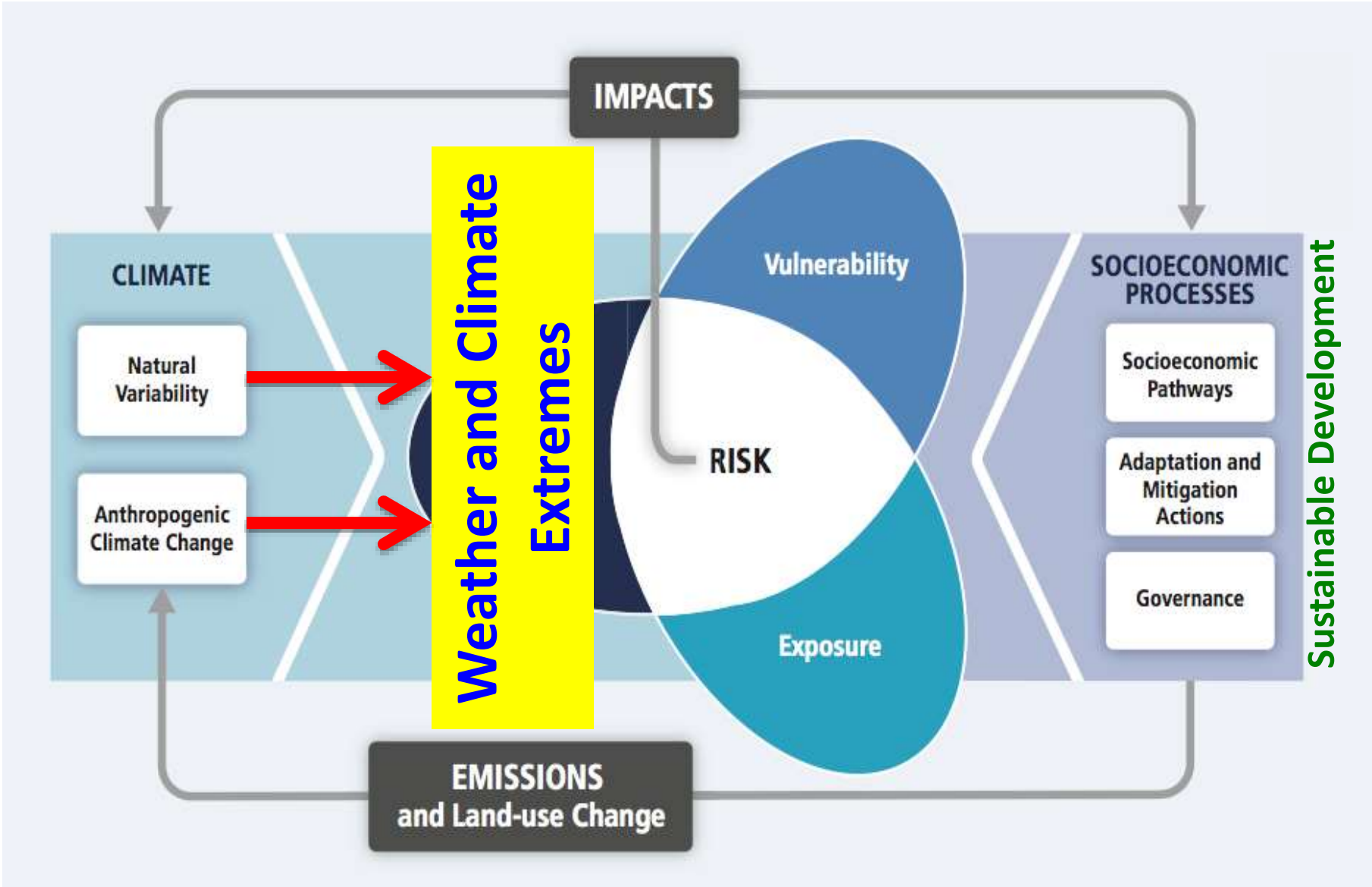
Sendai Framework for Disaster Risk Reduction (2015 – 2030)

7 Global Targets

4 Priorities for Action

- Understanding disaster risk
- Strengthening disaster risk governance
- Investing in DDR for resilience
- Enhancing disaster preparedness for effective response



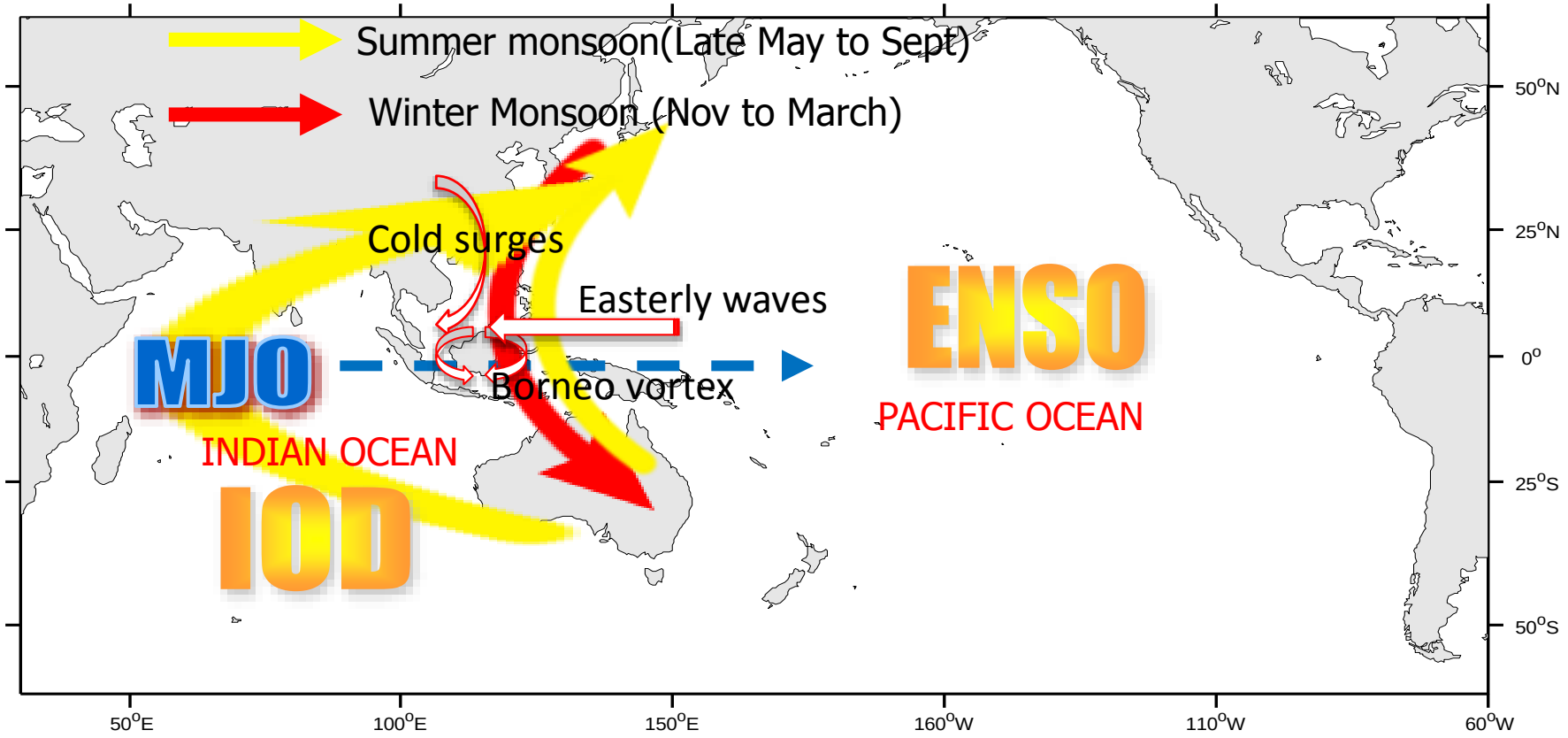
IPCC AR5 SYR 2014

Weather and Climate Extremes

Priority Actions!!!

- Incorporate robust scientific information in decision-making process
- Assess how climate variability and climate change influence weather and climate extremes
- Enhance the skills and capability of the Weather and Climate Forecasting System (for weather and short-term climate fluctuations)
- Conduct multi-model climate downscaling projections for long-term time scales based on latest global model outputs

Weather & Climate Extremes are modulated by multi-interaction of various climate and weather phenomena



GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L14S07, doi:10.1029/2008GL033429, 2008

Click Here for Full Article

On the roles of the northeast cold surge, the Borneo vortex, the Madden-Julian Oscillation, and the Indian Ocean Dipole during the extreme 2006/2007 flood in southern Peninsular Malaysia

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RMetS
Royal Meteorological Society

Characteristics of precipitation extremes in Malaysia associated with El Niño and La Niña events

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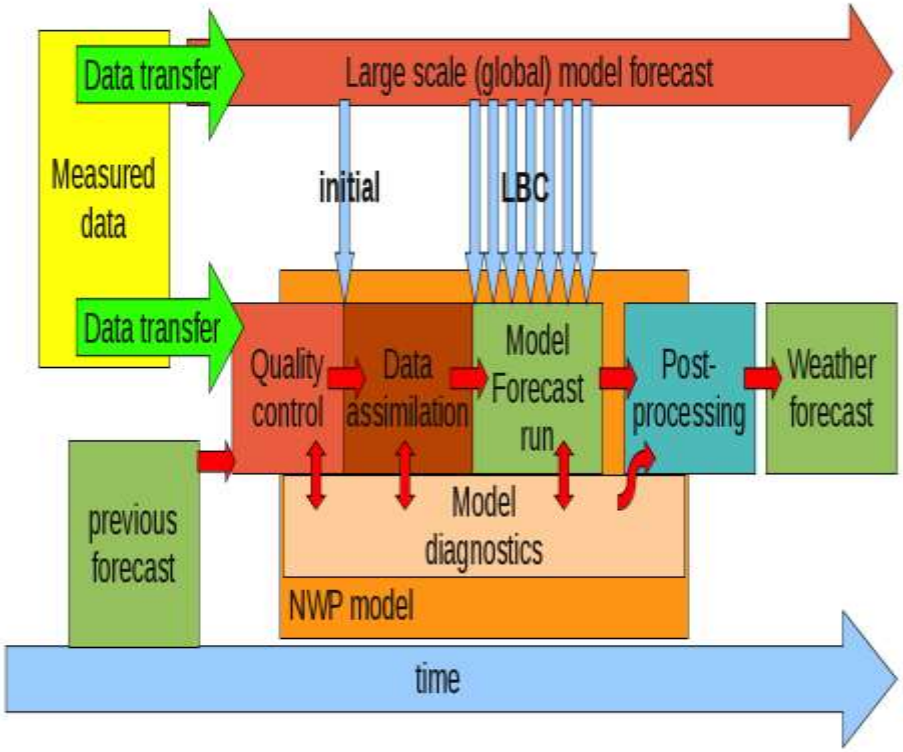
Climate Dynamics (2005) 25: 337–350
DOI 10.1007/s00382-005-0031-6

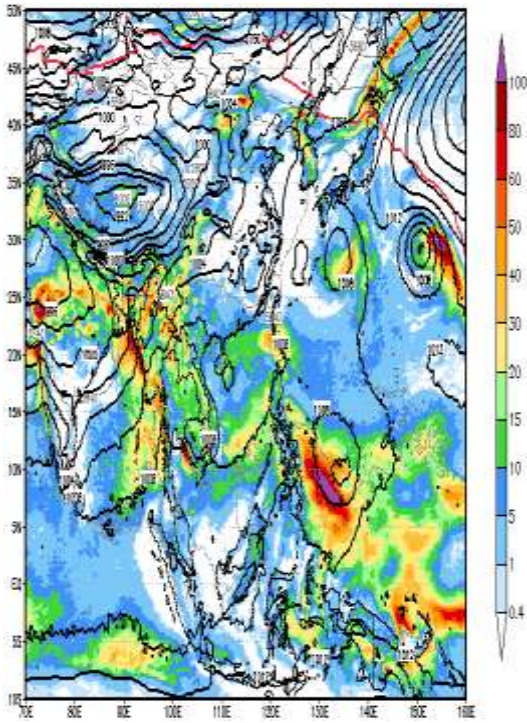
Liew Juneng · Fredolin T. Tangang

Evolution of ENSO-related rainfall anomalies in Southeast Asia region and its relationship with atmosphere–ocean variations in Indo-Pacific sector

How to translate these scientific information and incorporate them into policy making process?

Numerical Weather Prediction (NWP) System for early warning of < 7 days





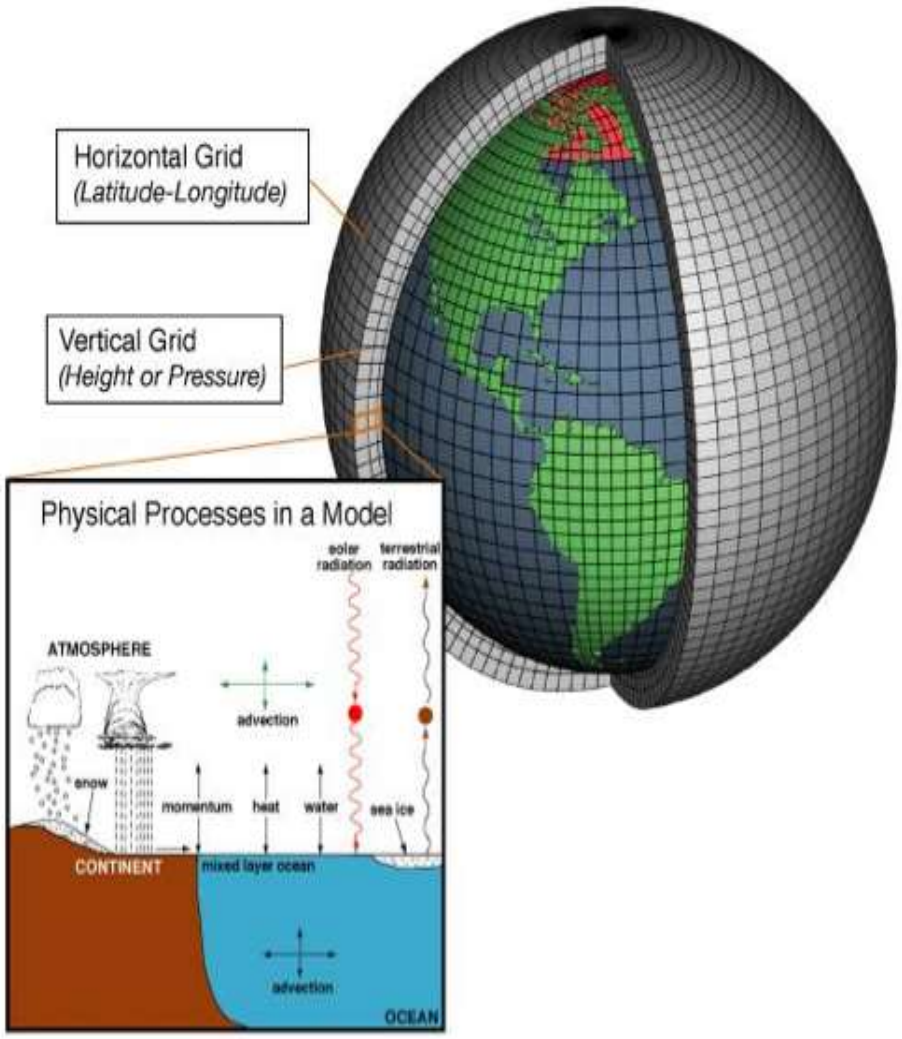
Invest in human resources and R&D in improving our NWP

Climate Models for Long-term Climate Projection

General Circulation Model (GCM)	Regional Climate Model (RCM)
Global Scale (100 – 300 km) resolution	Local & regional scales (few – 50 km) resolution

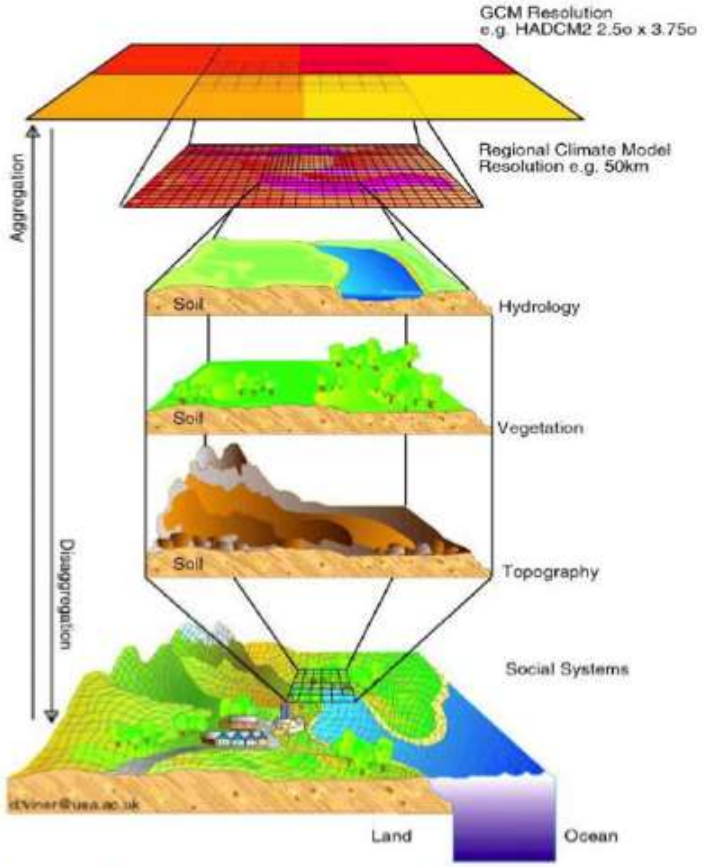
Refining the climate information at global scale with RCM is called "Regional Climate Downscaling"

CONCEPTUAL STRUCTURE OF A GCM

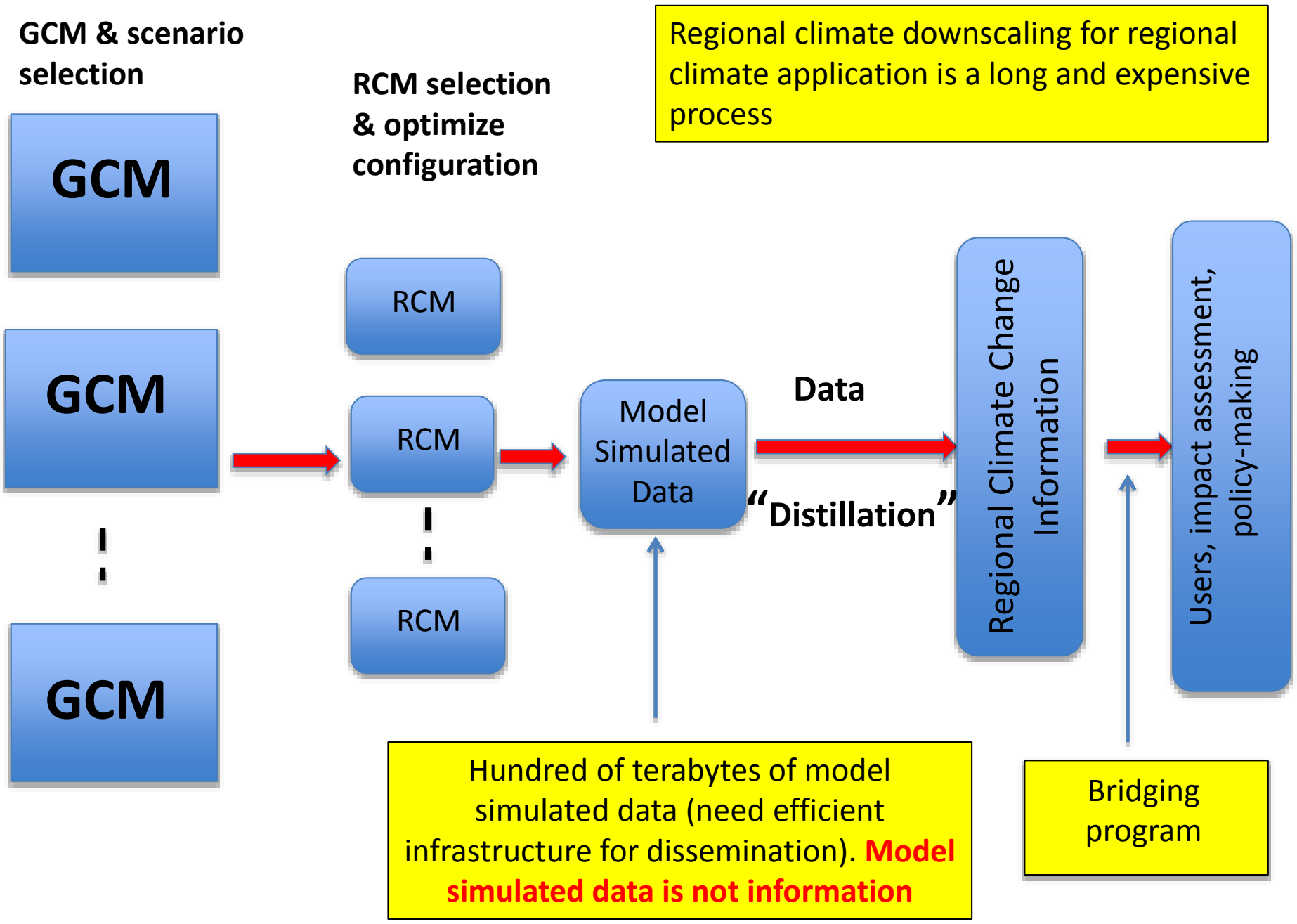


Source: National Oceanic and Atmospheric Administration (NOAA), 2012

THE CONCEPT OF SPATIAL DOWNSCALING



Many of the processes that control local climate, e.g., topography, vegetation, and hydrology, are not included in coarse-resolution GCMs. The development of statistical relationships between the local and large scales may include some of these processes implicitly.
Source: Viner, 2012


GCM & scenario selection
RCM selection & optimize configuration
Regional climate downscaling for regional climate application is a long and expensive process
GCM
GCM
GCM
RCM
RCM
RCM
Model Simulated Data
Data
"Distillation"
Regional Climate Change Information
Users, impact assessment, policy-making
Hundred of terabytes of model simulated data (need efficient infrastructure for dissemination). Model simulated data is not information
Bridging program

SEACLID

CORDEX-Southeast Asia

The Southeast Asia Regional Climate Downscaling (SEACLID)/ CORDEX Southeast Asia

Fredolin Tangang[1,2]

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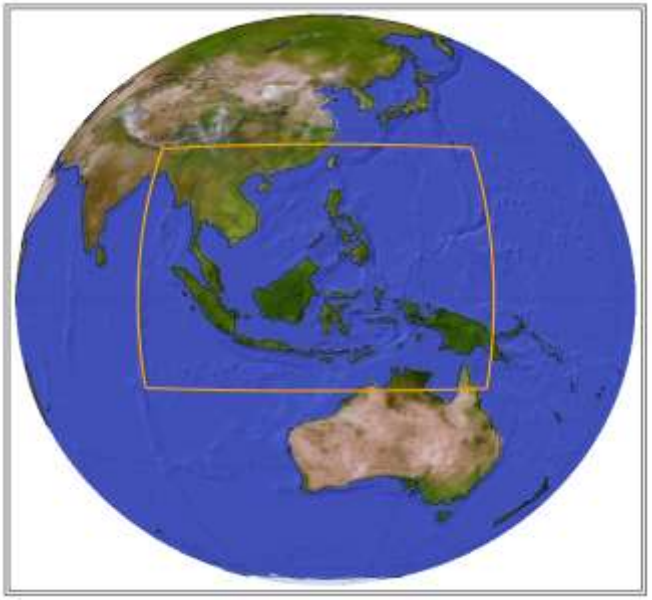
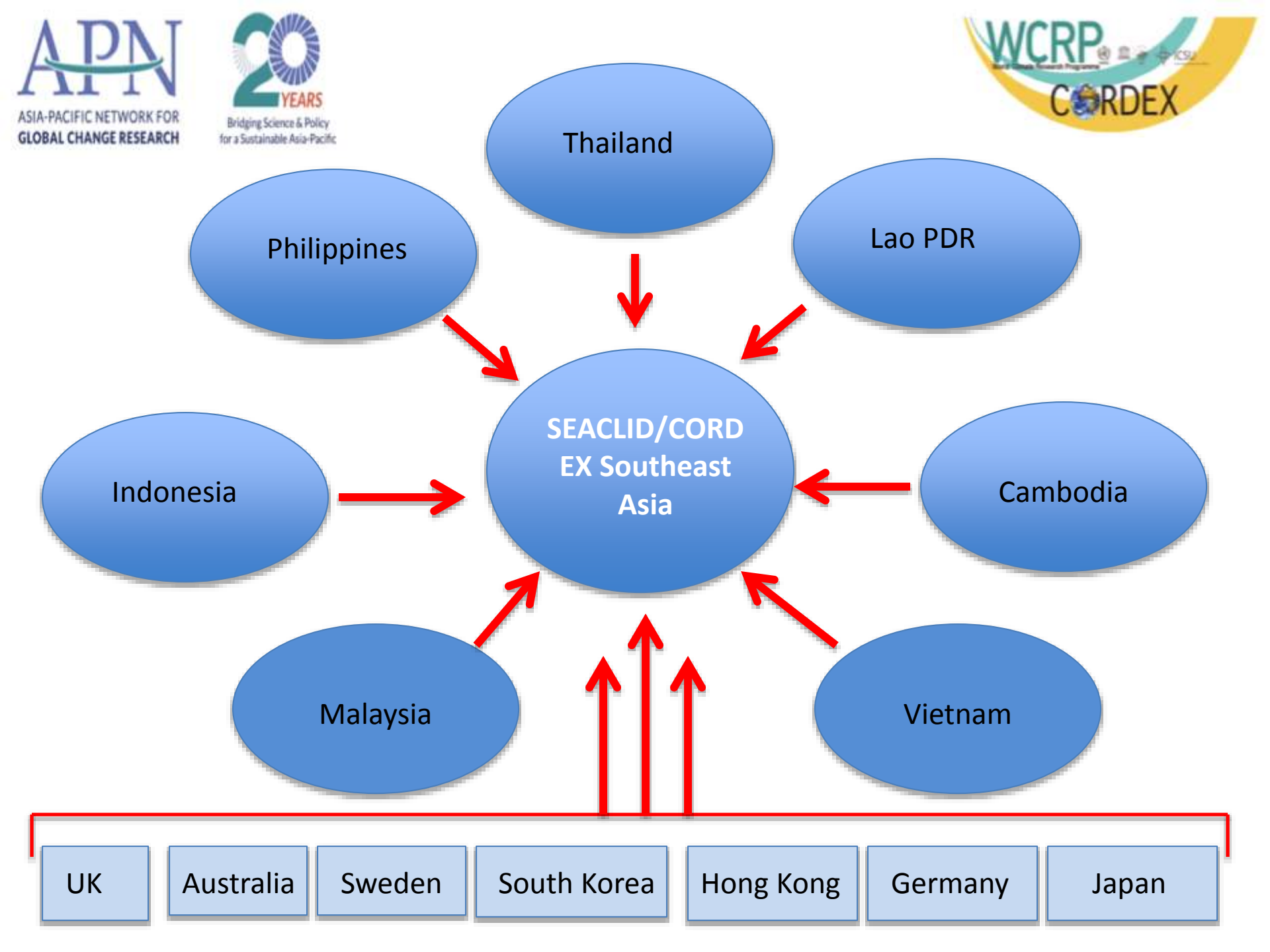
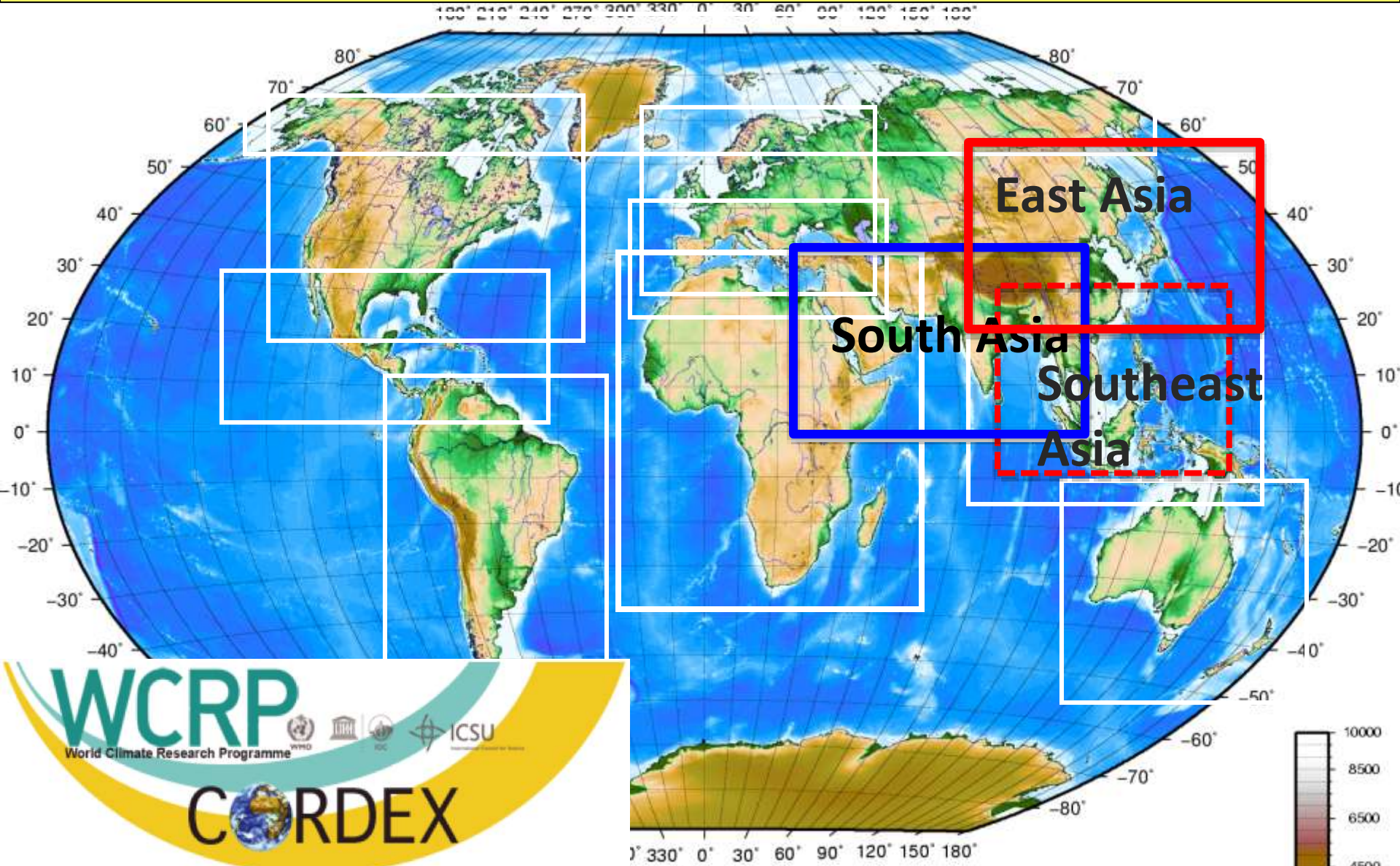


- **14 Countries, 20 Institutions involved in the project**

(http://www.ukm.edu.my/seaclid-cordex)

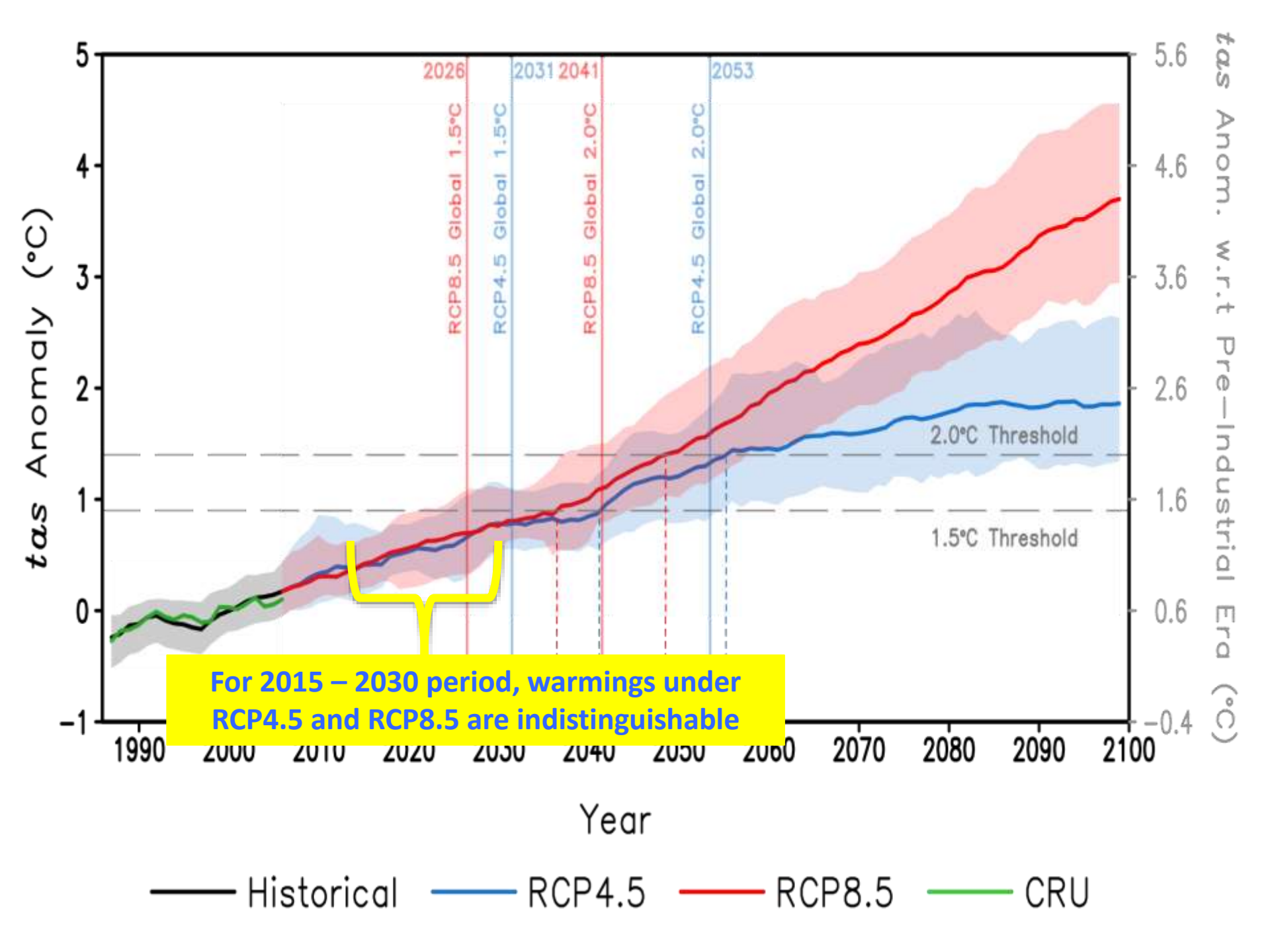

APN
ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH
20 YEARS
Bridging Science & Policy for a Sustainable Asia-Pacific
WCRP
CORDEX
Thailand
Philippines
Lao PDR
SEACLID/CORDEX Southeast Asia
Indonesia
Cambodia
Malaysia
Vietnam
UK
Australia
Sweden
South Korea
Hong Kong
Germany
Japan

CORDEX domains



GCMs, RCMs, RCPs and Country Assignments

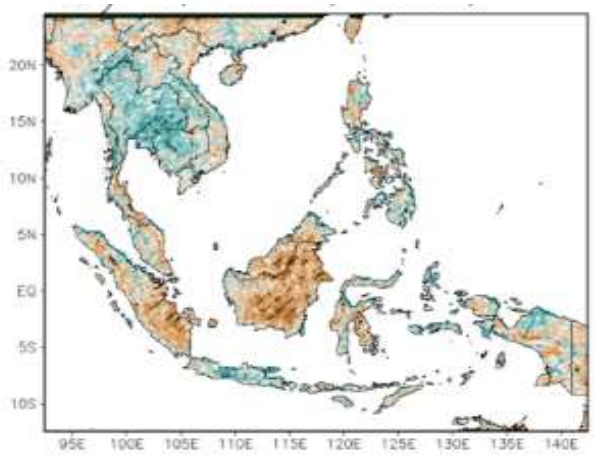
Country	GCM	Institution & Country developed the GCM	RCP	RCM
Vietnam	CNRM-CM5	Centre national de Recherches Meteorologiques, France	RCP8.5, 4.5	RegCM4
Philippines	HadGEM2	Hadley Centre, UK	RCP8.5, 4.5	RegCM4
Thailand	MPI-ESM-MR	Max Planck Institute for Meteorology, Germany	RCP8.5, 4.5	RegCM4
Thailand	EC-Earth	EC-Earth consortium	RCP8.5, 4.5	RegCM4
Indonesia	CSIRO MK3.6	CSIRO, Australia	RCP8.5, 4.5	RegCM4
Malaysia	CanESM2	Canadian Centre for Climate Modeling and Analysis, Canada	RCP8.5, 4.5	RegCM4
Malaysia	IPSL-CM5A-LR	Institute Pierre-Simon Laplace, France	RCP8.5, 4.5	RegCM4
Malaysia (*)	GFDL-ESM2M	GFDL, USA	RCP8.5, 4.5	RegCM4
South Korea	HadGEM2-AO	Hadley Centre, UKMO	RCP8.5, 4.5	WRF
Sweden	CNRM-CM5	Centre national de Recherches Meteorologiques, France	RCP8.5, 4.5	RCA3
Sweden	HadGEM2-ES	Hadley Centre, UKMO, UK	RCP8.5,4.5	RCA3
Australia	CNRM-CM5	Centre national de Recherches Meteorologiques, France	RCP8.5	CCAM
Australia	CCSM4	NCAR, USA	RCP8.5	CCAM
Australia	ACCESS1.3	CSIRO, Australia	RCP8.5	CCAM
Hong Kong SAR (*)	CCSM4 or CESM	NCAR, USA	RCP8.5, 4.5	WRF
United Kingdom	HadGEM2-ES	Hadley Centre, UKMO	RCP8.5, 4.5	PRECIS
Germany	MPI-ESM-LR	Max Planck Institute for Meteorology, Germany	RCP8.5, 4.5	ROM
Japan	MRI-AGCM3.2	Meteorological Research Institute, JMA, Japan	RCP8.5,4.5	NHRCM

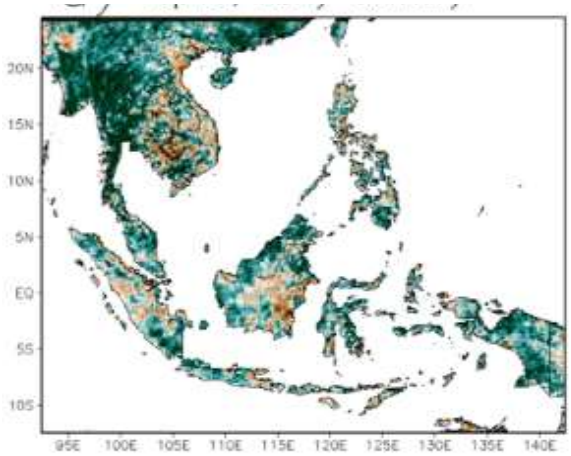

2026
2031
2041
2053
RCP8.5 Global 1.5°C
RCP4.5 Global 1.5°C
RCP8.5 Global 2.0°C
RCP4.5 Global 2.0°C
2.0°C Threshold
1.5°C Threshold
For 2015 – 2030 period, warmings under RCP4.5 and RCP8.5 are indistinguishable
tas Anomaly (°C)
tas Anom. w.r.t Pre-Industrial Era (°C)
Year
Historical
RCP4.5
RCP8.5
CRU

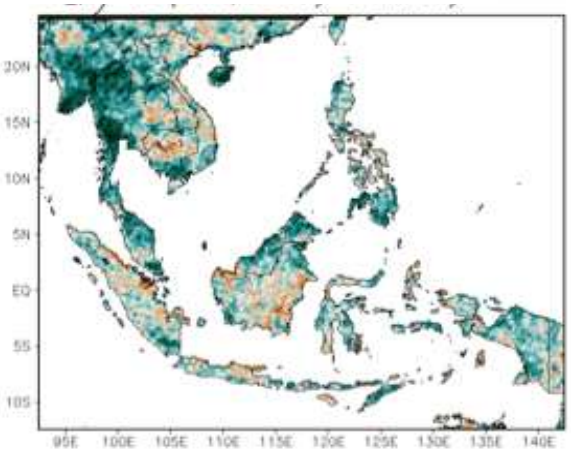
Projected changes on Extremes for near future (2016 – 2035) based on SEACLID/CORDEX – SEA multi-model simulations

Dryness index | **Frequency index** | **Intensity index**

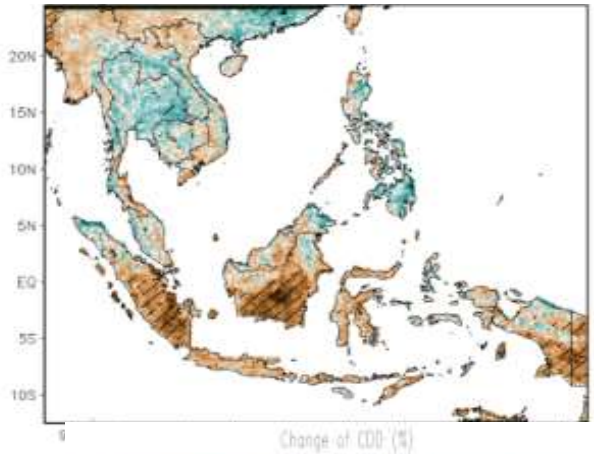
RCP 4.5

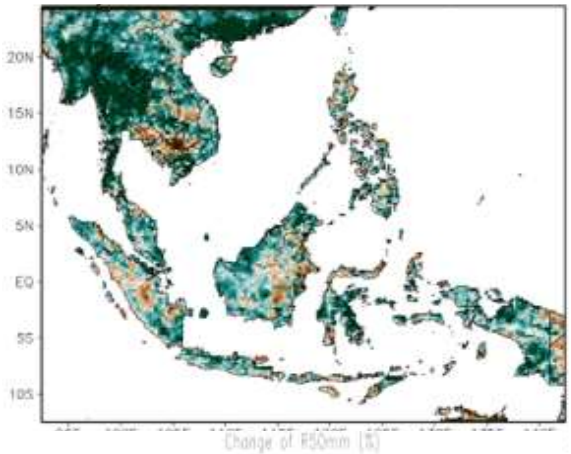


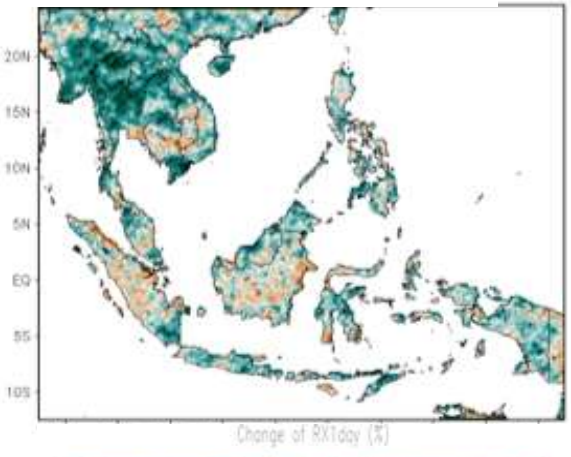




RCP 8.5







Summary

- Measures to reduce disaster risk related to extreme events must be built with robust scientific evidence
- We need to assess how risk of weather and climate extremes is influenced by climate variability and climate change
- We need to enhance our capability in forecasting extremes
- Projection of future extremes must be robust and based on updated and latest model products