A Brief Introduction to a Planned International Programme for Asian-Australian-African (3A) Monsoons

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OUTLINE

1. Background
2. Scientific challenges
3. Objectives and goals
4. Concluding remarks

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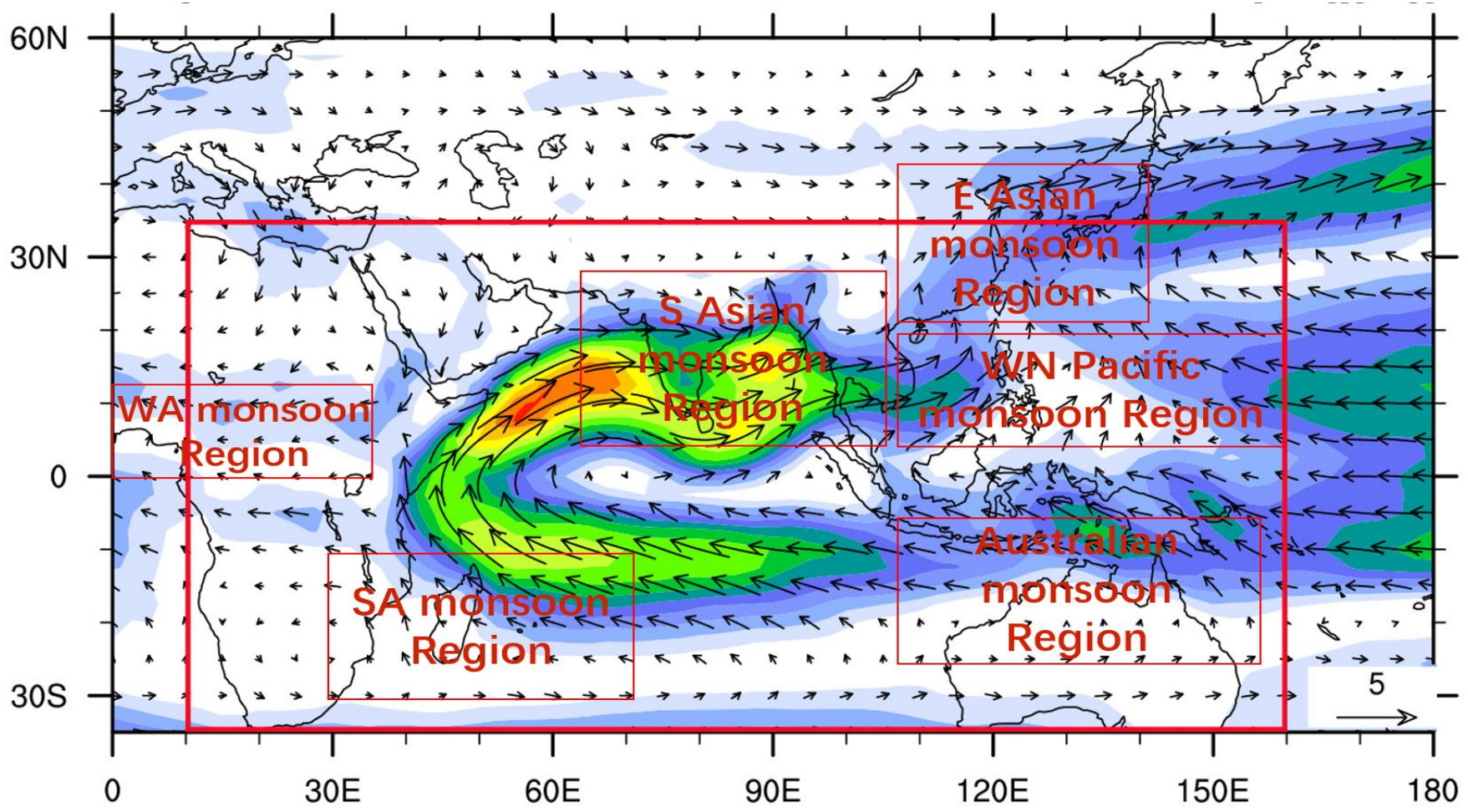
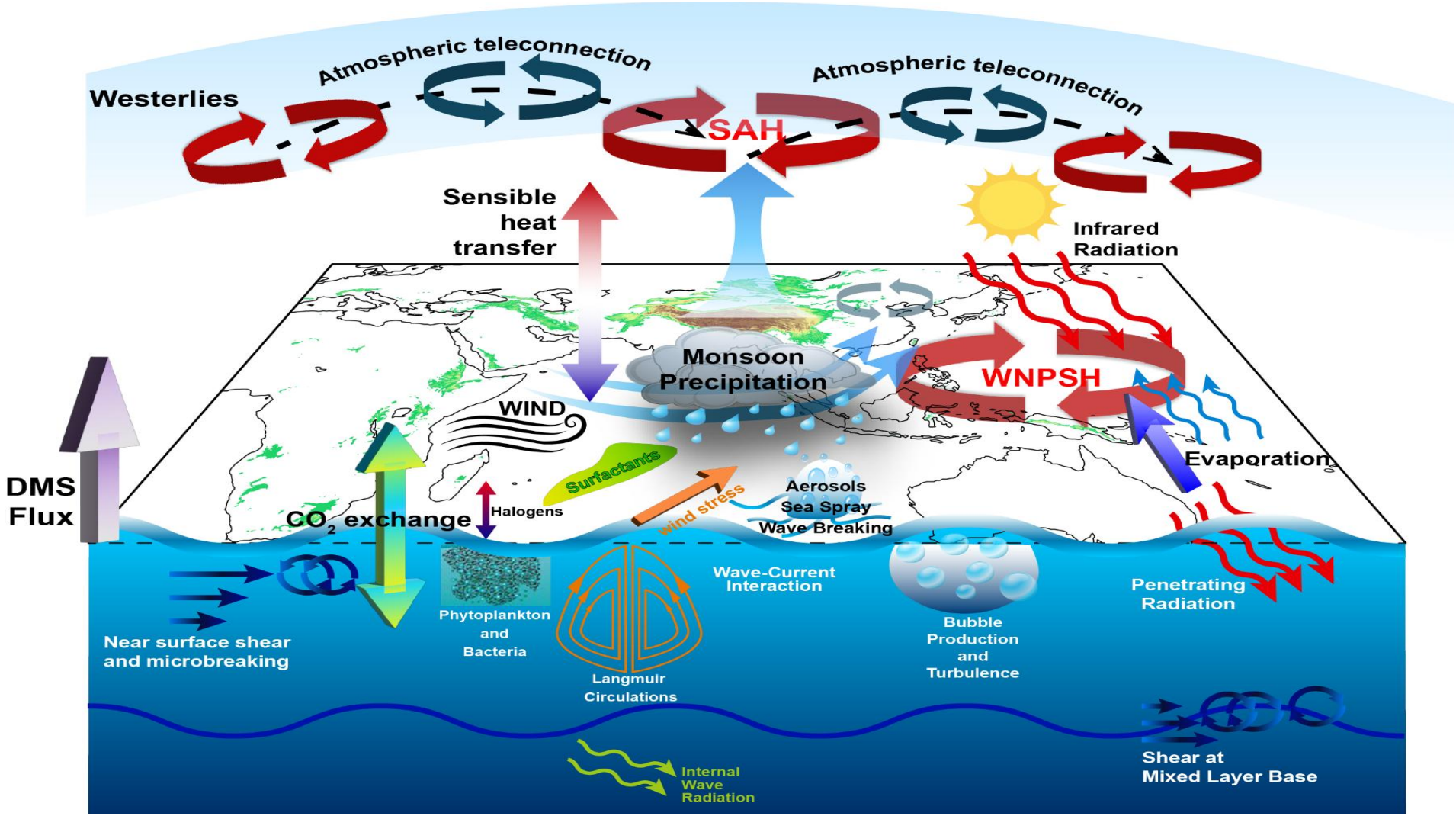
Geographic distribution of Asian-Australian-African (3A) monsoons and their sub-branches

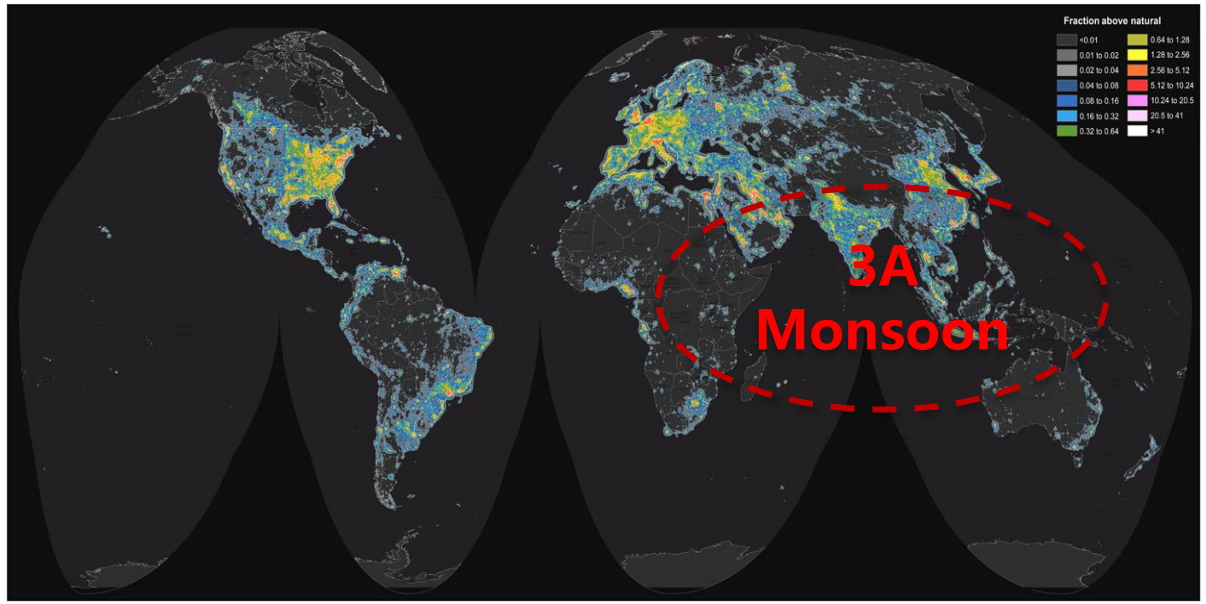


The region of 3A Monsoons is characterized by complex geographical features with typical air-land-sea interactions and global teleconnections.



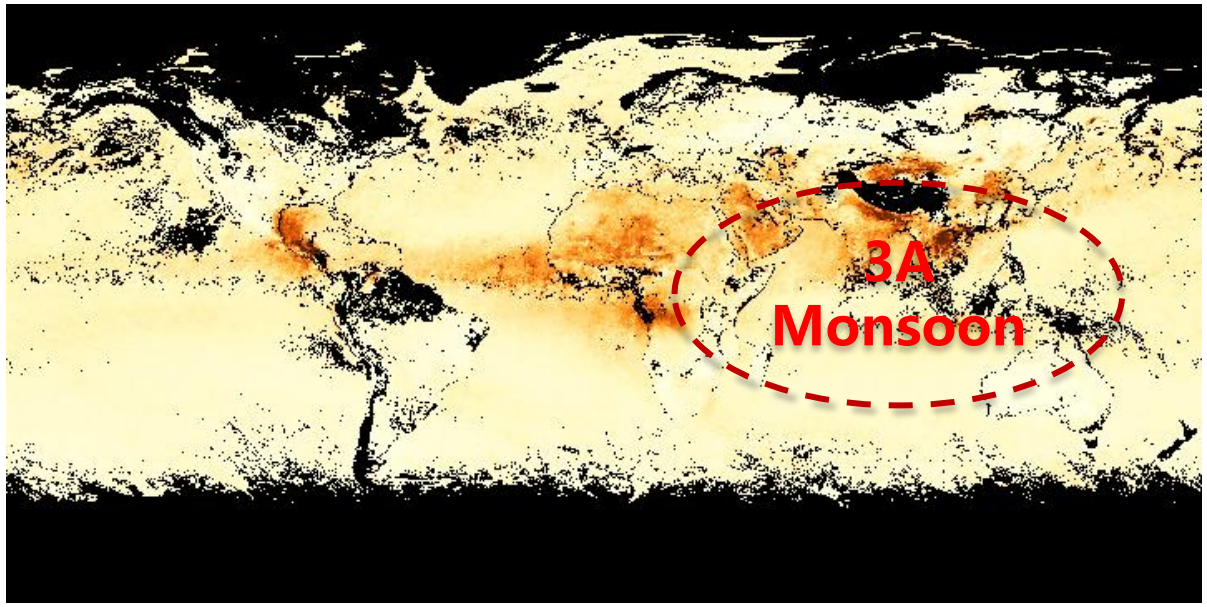
The region of 3A Monsoons is of high population density: a global hub of human and economic activities.

World map of artificial sky brightness



[Falchi F et al., Sci Adv, 2016]

Aerosol Optical Thickness
(March 2024 TERRA/MODIS)



https://neo.gsfc.nasa.gov/view.php?datasetId=MODAL2_M_AER_OD&date=2024-06-01

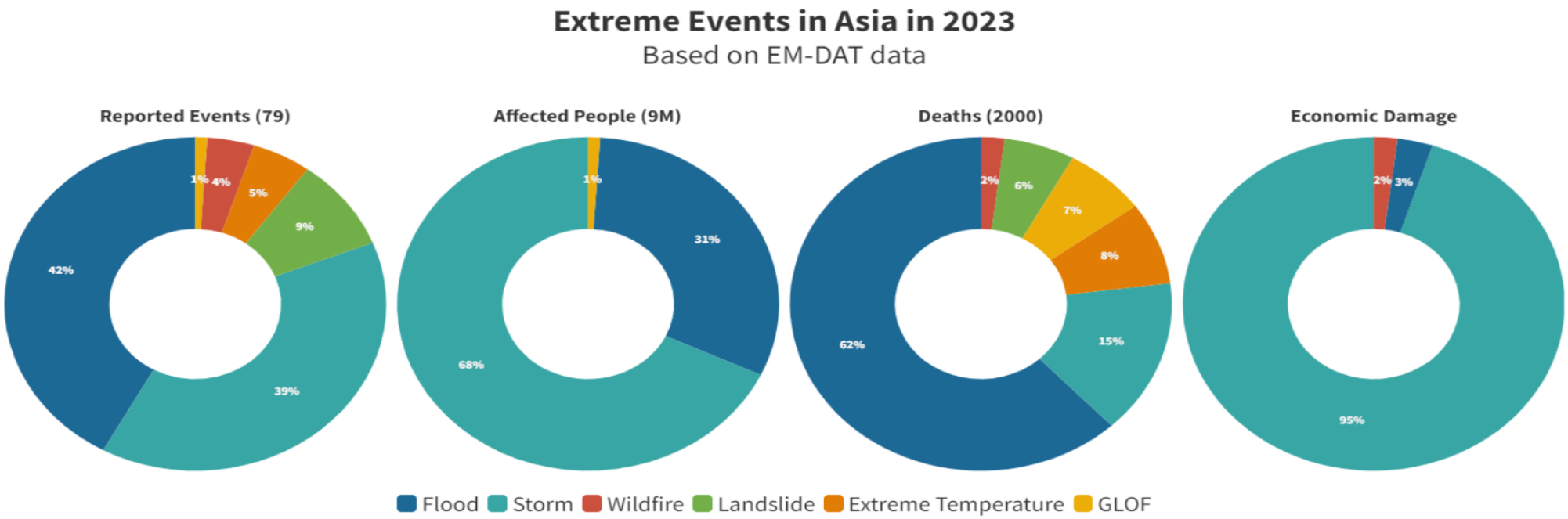
The region of 3A monsoons is a major disaster area severely affected by extreme weather and climate events.

Extreme floods in India

Southeast Asian heatwaves

Wildfire in Australia

East African droughts



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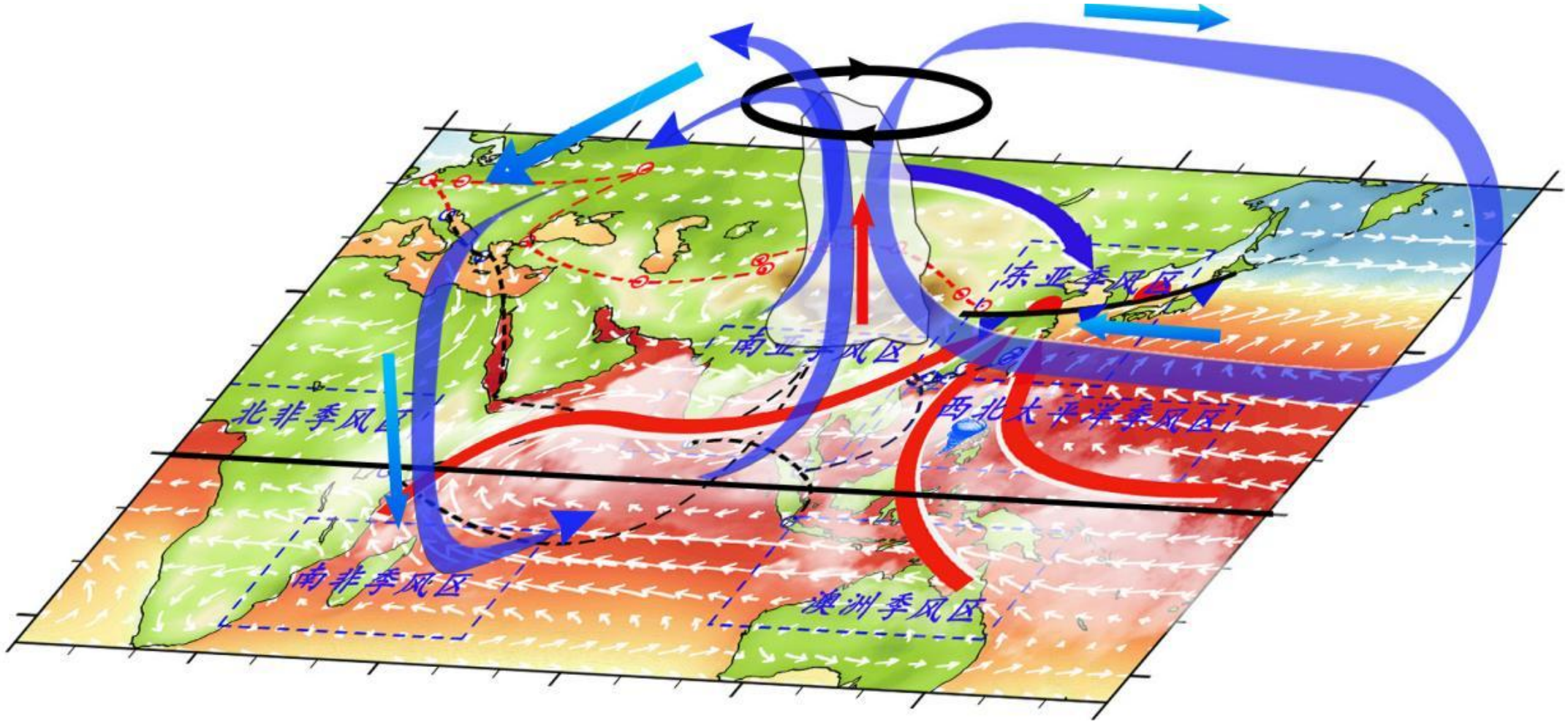
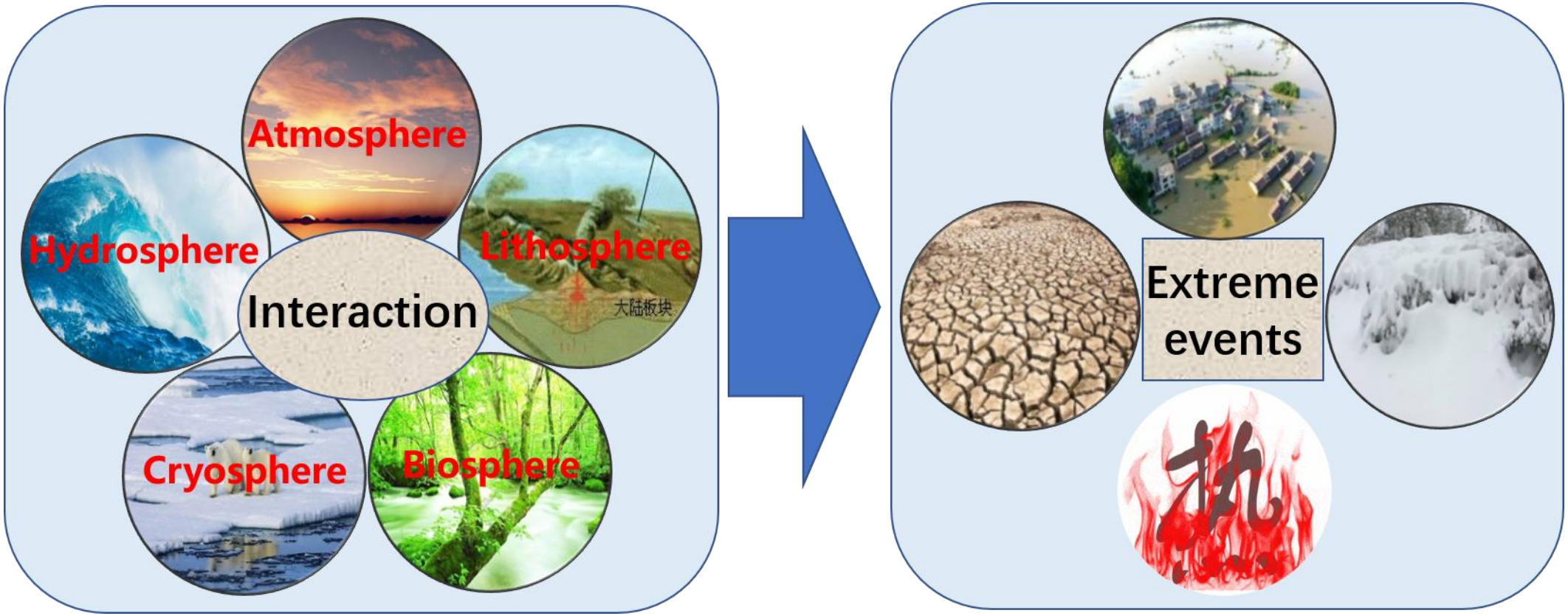
Challenge 1: 3A monsoons are connected as an unified system. An integral investigation is needed for an overall understanding of monsoon system.

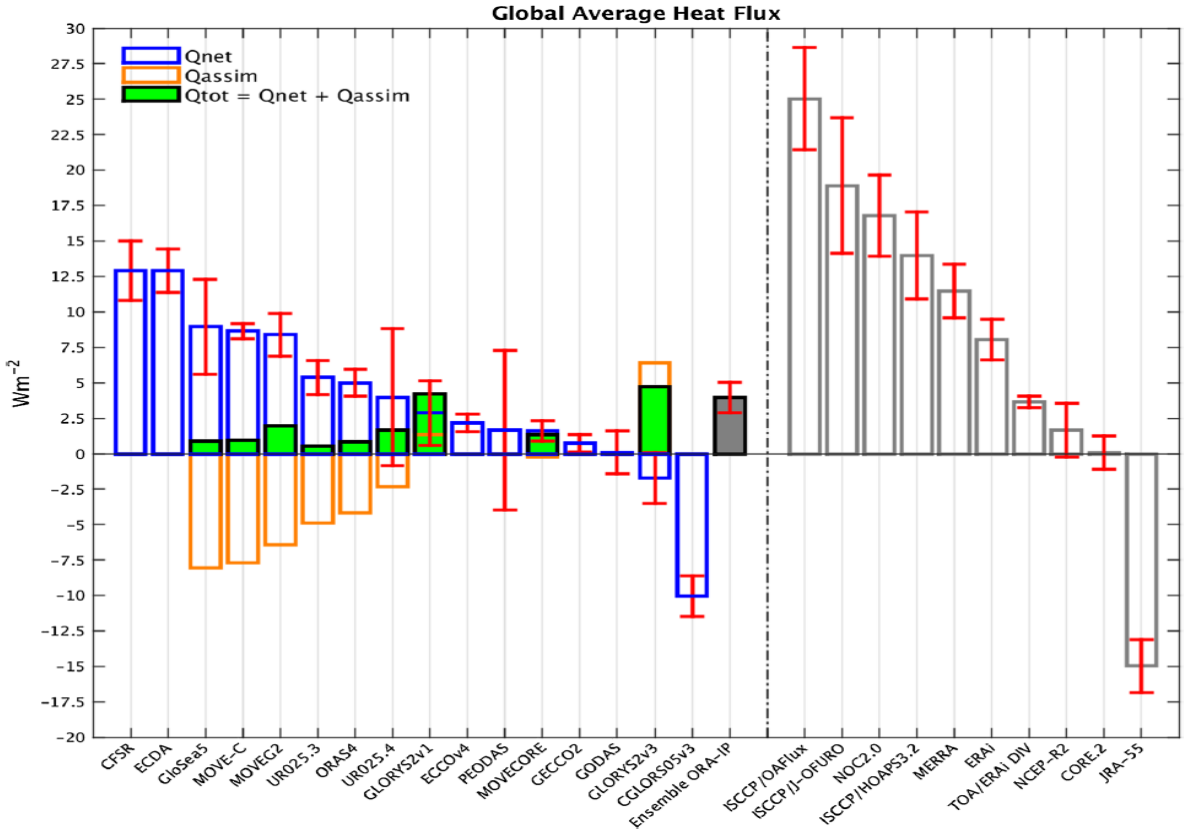


Challenge 2： It remains unknown that the roles played by the interactions among multi-spheres and multi-scale atmospheric variability in the occurrence of weather and climate extremes under the background of global warming in the region of 3A monsoons.



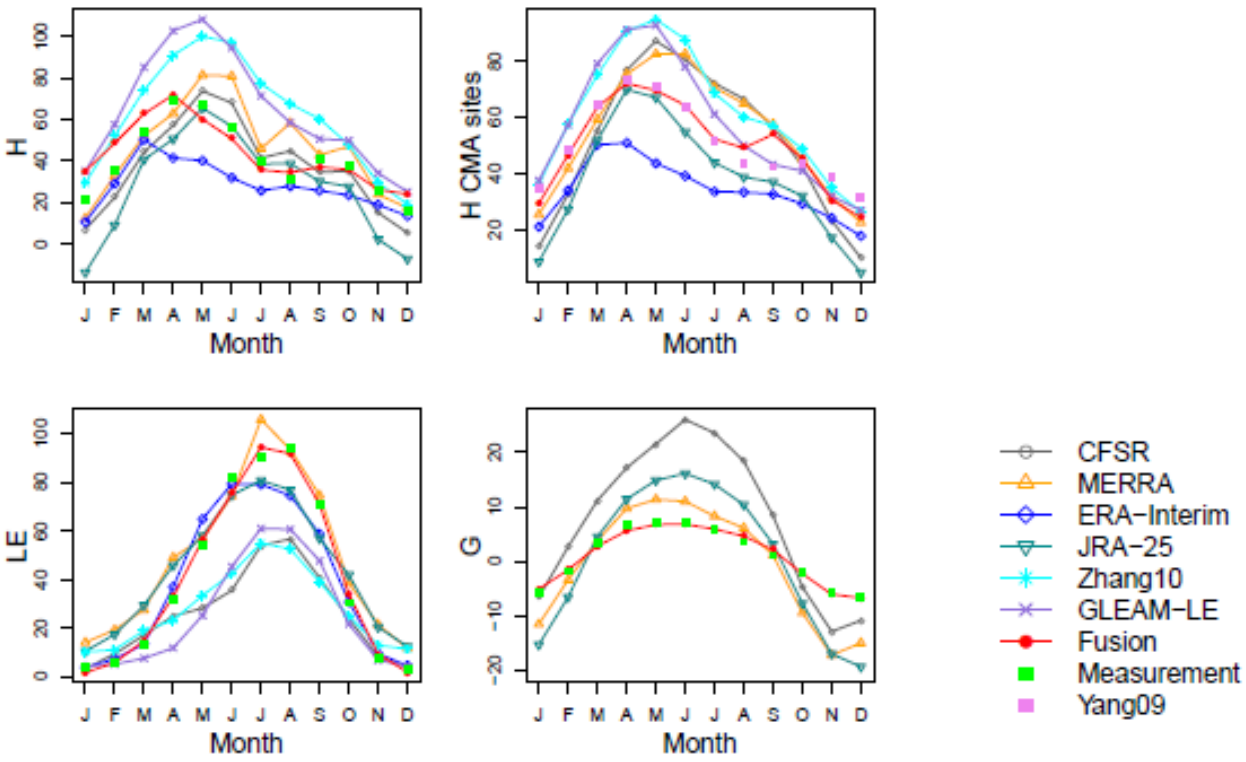
Challenge 3: Land-atmosphere-ocean interactions in the region of 3A monsoons are not well understood. Large uncertainty still exists.

Annual mean oceanic surface heat flux and standard deviation from different data sources



[Valdivieso M et al., *CDLI*, 2017]

Annual cycle of land-atmosphere interface heat flux over the Tibetan Plateau from different data sources

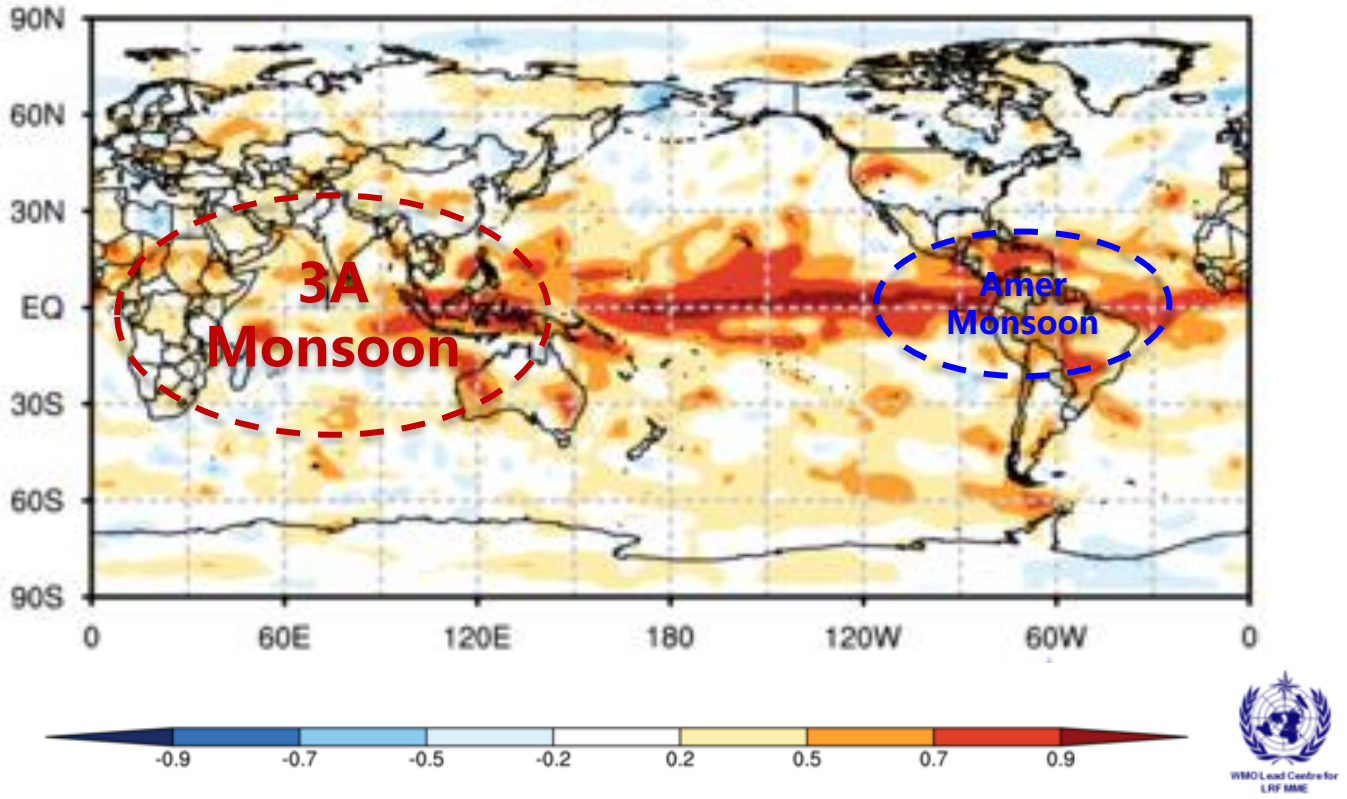


[Shi and Liang, *ACP*, 2014]

Challenge 4: The impacts of human activities in the region of 3A monsoons on the extreme weather and climate events are still unclear.

Challenges 5: Predictive skills are low for the climatic anomalies in the region of 3A Monsoons as well as the regional extreme weather and climate events.

ACC Skill for Summer Precipitation: Lower in the Asian-Australian-African Monsoon Region than in the American Monsoon Region.



[WMO Long-Range Forecast Multi-Model Ensemble]

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Principle Goal

Mechanisms, Simulation and Prediction of Weather/Climate Extremes in the Region of 3A Monsoons Under Global Warming Background

Objectives

Enhancing Monitoring, Simulation, and Prediction of Extreme Weather and Climate Events in the Region of 3A Monsoons

Modulation of human activities on changes in extreme weather/climate Events

Impact of air-land-sea interactions on the variability of 3A Monsoons and its link to extreme weather/climate events

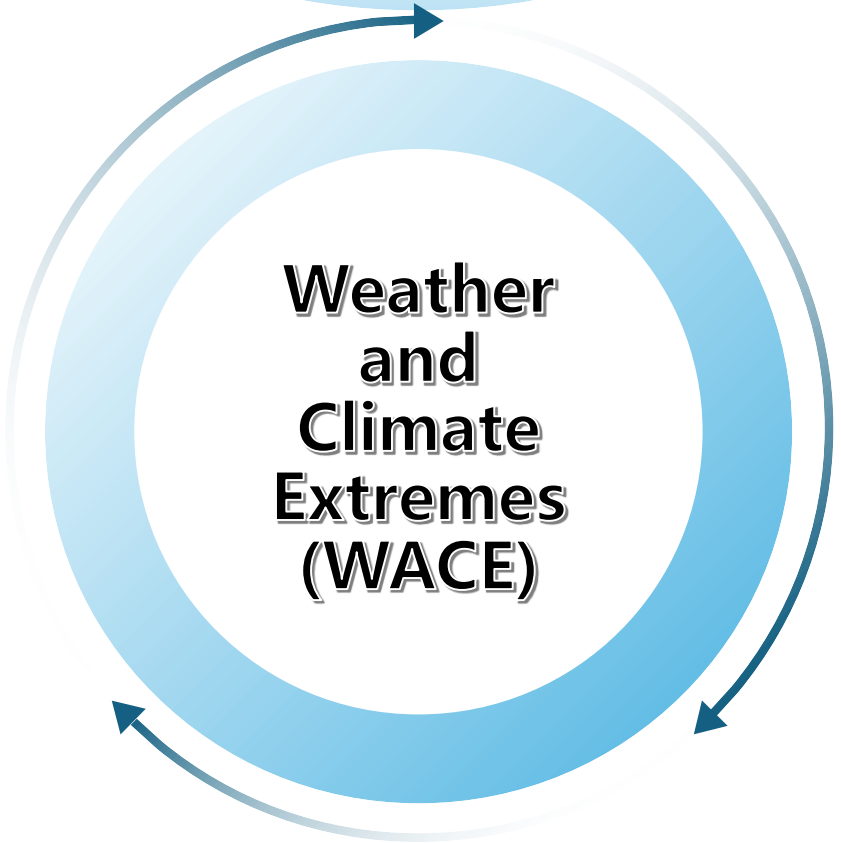
Impact of multi-scale variability of 3A Monsoons on extreme weather/climate events

Research Directions

1. Variability and interconnections of the 3A Monsoons

2. Regional and global impacts of the 3A Monsoons

3. 3A Monsoons and multi-sphere interactions



4. Relations between the 3A Monsoons and human activities

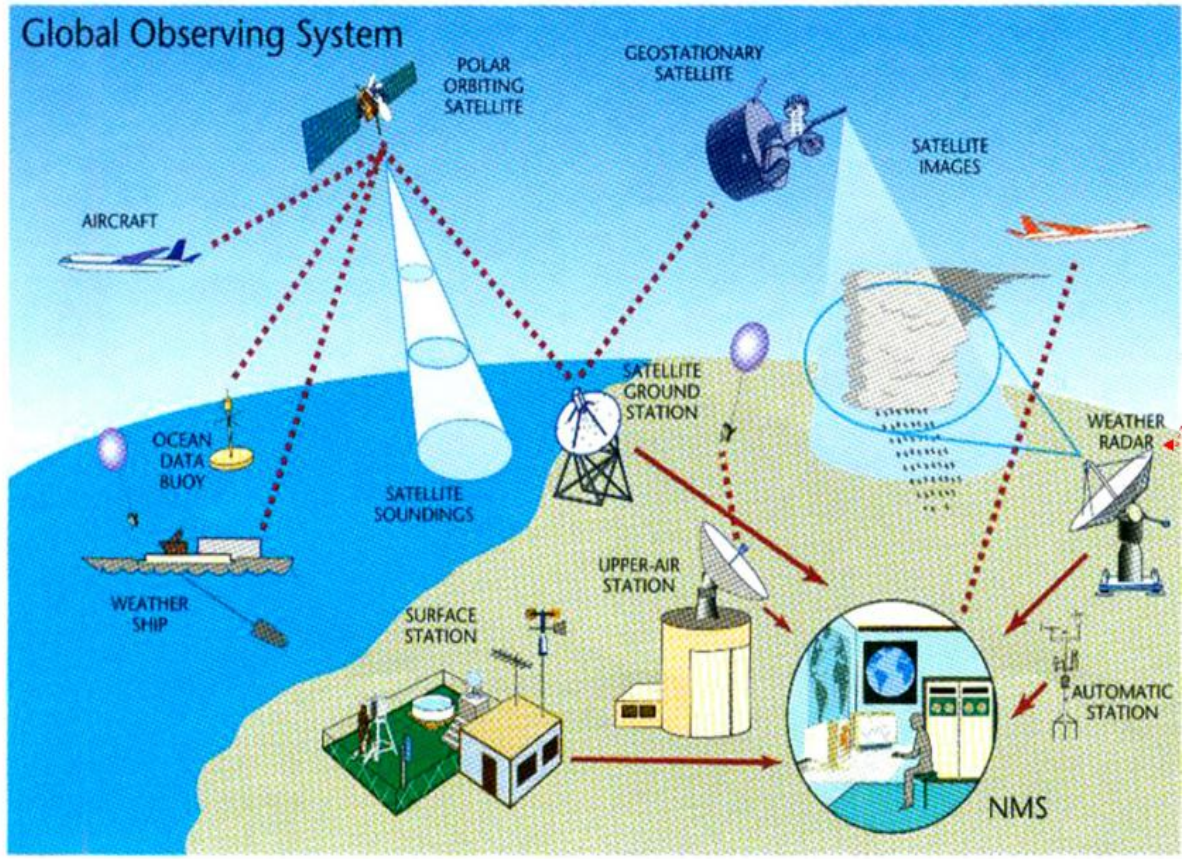
5. Interactions between the 3A Monsoons and typhoon

6. Monitoring, simulation and prediction of the 3A Monsoons

Field Experiments

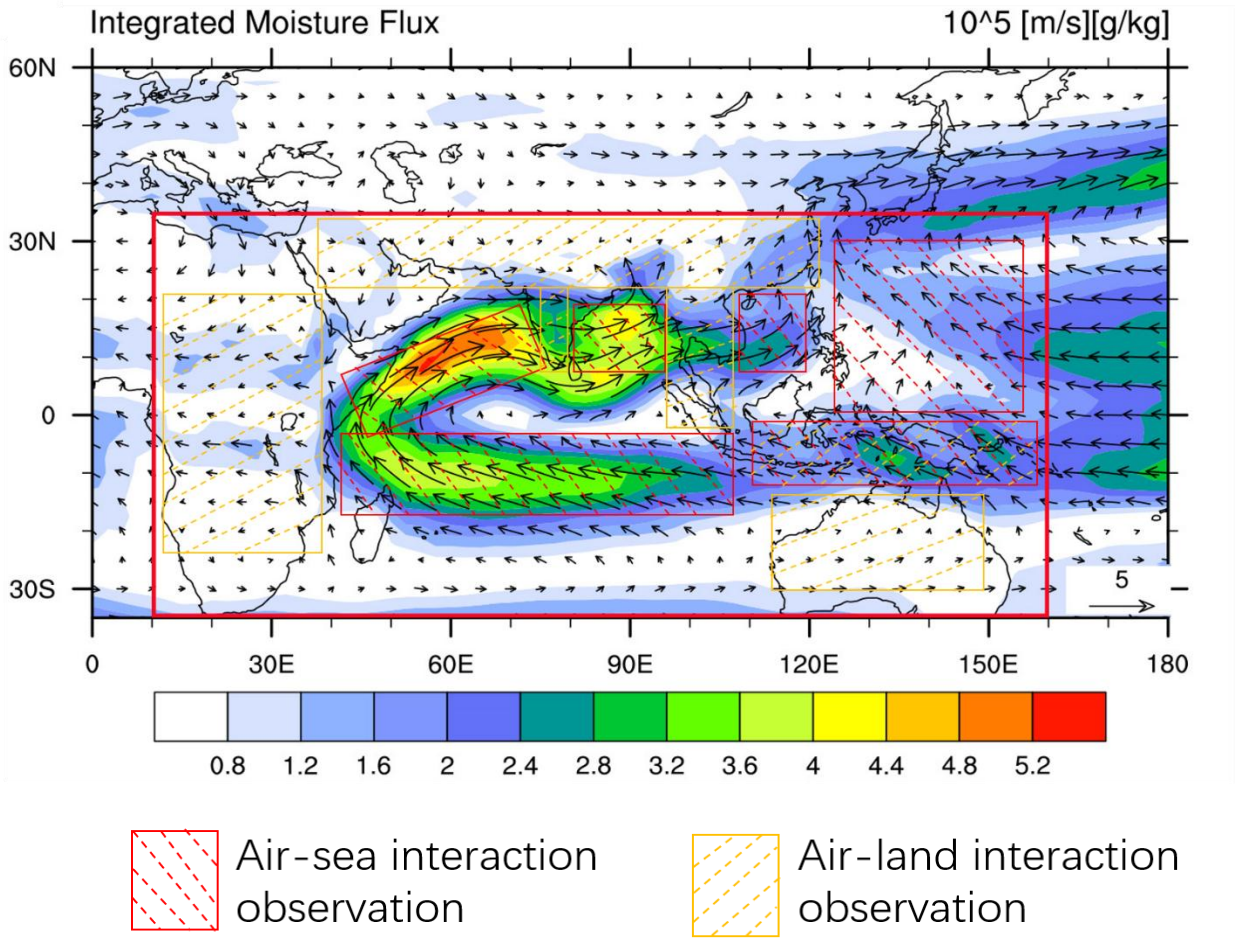
Field Observation Experiments for Atmosphere

- Monsoonal circulations
- Water vapor transports
- Convective activities
- Atmospheric components
- Urban meteorology
- Physical and chemical processes associated with heavy rainfall
- ……



Field Observation Experiments for Oceans and Air-Sea-Land Interactions

- Physical, chemical and biological surface processes over land and ocean
- Land-air and sea-air exchanges of energy and materials through their interfaces
- Oceanic currents
- Ocean thermal conditions
- Oceanic vortices
- ……



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This programme aims at

Establishing a Collaborative Research Platform for the Studies of 3A Monsoons

Build an international cooperative research platform involving experts from the region of 3A Monsoons and other regions. This platform will facilitate joint design of research projects, field observations, and scientific studies.

Utilizing and Sharing Observational Resources

Fully leverage operational observation facilities and scientific experimental infrastructures within the region of 3A Monsoons to enable data sharing and utilization.

Enhancing Understanding and Predictive Capabilities

Improve scientific understanding of multi-scale climate variability and extreme weather/climate events in the region of 3A Monsoons. Enhance monitoring and forecasting capabilities to support disaster risk reduction and climate change adaptation in the region.


Work Together to Unveil the Secrets of 3A Monsoons: A Global Collaboration for a Sustainable Future!
Thank You!