18 Mar. 2025: IWM8
@ IITM, Pune, Maharashtra, India

AsiaPEX
Asian Precipitation Experiment

Asian Precipitation Experiment and Coordinated Field Campaign, Asian Monsoon Years-II

Toru Terao (Kagawa Univ.)

Global Partnership for Asian Hydroclimatological Research

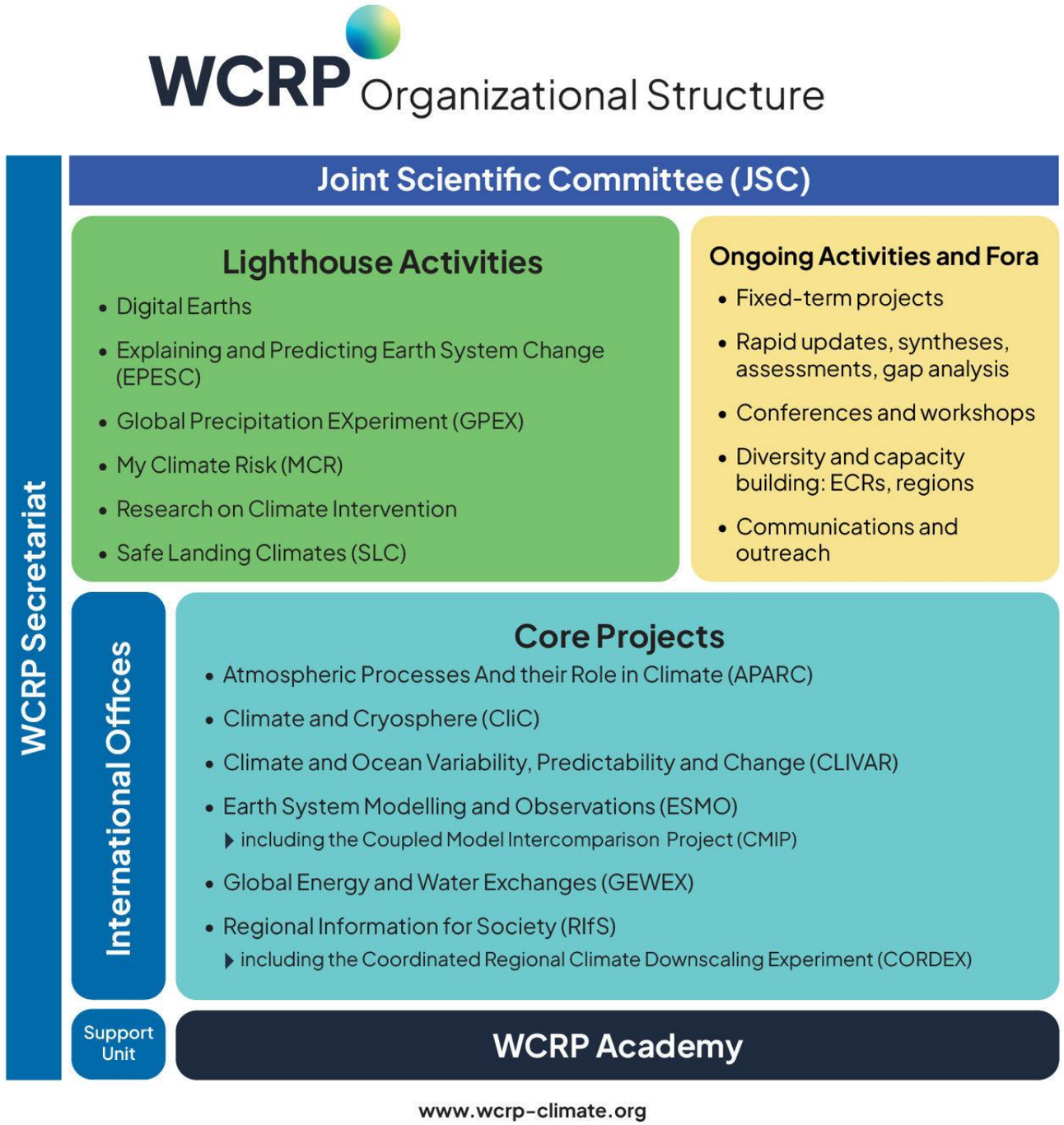
International collaboration framewoks and research projects in near future

World Climate Research Programme
Global Energy and Water Exchanges

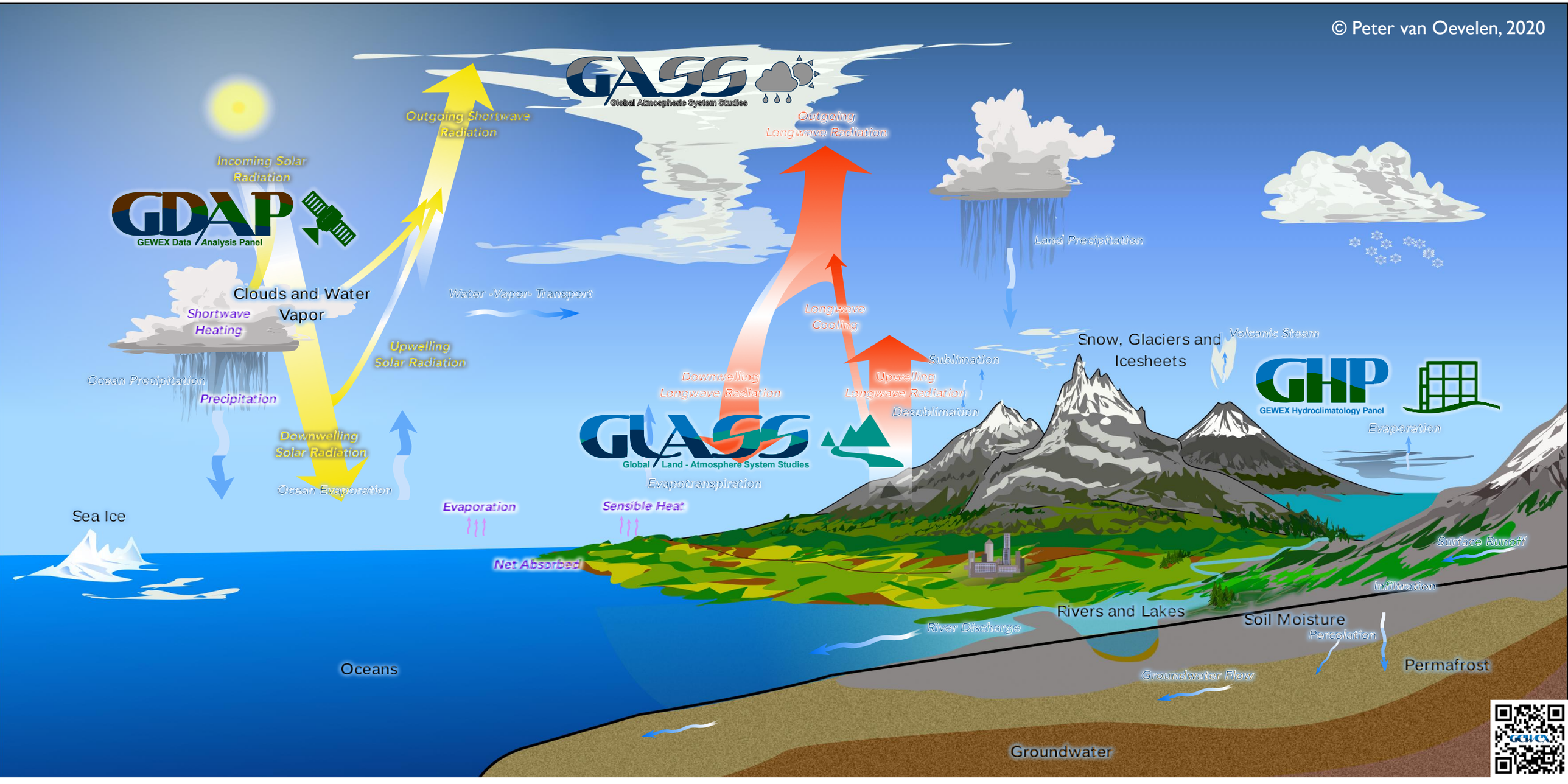
Global Energy and Water Exchanges
Asian Precipitation Experiment

WCRP, GEWEX, GHP, AsiaPEX

- GEWEX is one of Core Projects of WCRP
- GHP is one of Panels of GEWEX
- AsiaPEX is one of RHP (Regional Hydroclimatological Project) under GHP



GHP under GEWEX



The GEWEX Panels:

- GEWEX Data Analysis Panel — *Global Datasets Analysis and Assessments*
- Global Atmospheric System Studies — *Atmospheric Processes - Dynamics*
- Global Land–Atmosphere System Studies — *Land-Atmosphere Interactions and Processes*
- GEWEX Hydroclimatology Panel — *Regional Focused Processes and Hydroclimate Projects*

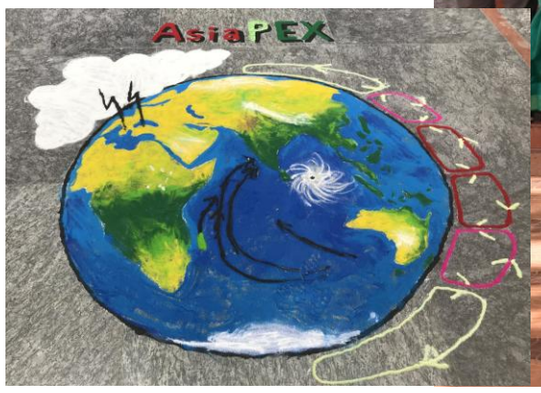
WCRP World Climate Research Programme

AsiaPEX Kick-off Conference

- Date: 28-30 August 2019
- Venue: Hokkaido University, Sapporo, Japan
- Participants: 72 from 10 countries
  - Philippins, Vietnam, Indonesia, Bangladesh, Mongolia, Nepal, USA, India, China, Japan
- 7 Sessions, 61 Presentations including 16 posters

Workshop AsiaPEX/South Asia

- 1-2 Mar 2020, CURAJ, India



AOGS2021 Top Conveners Award

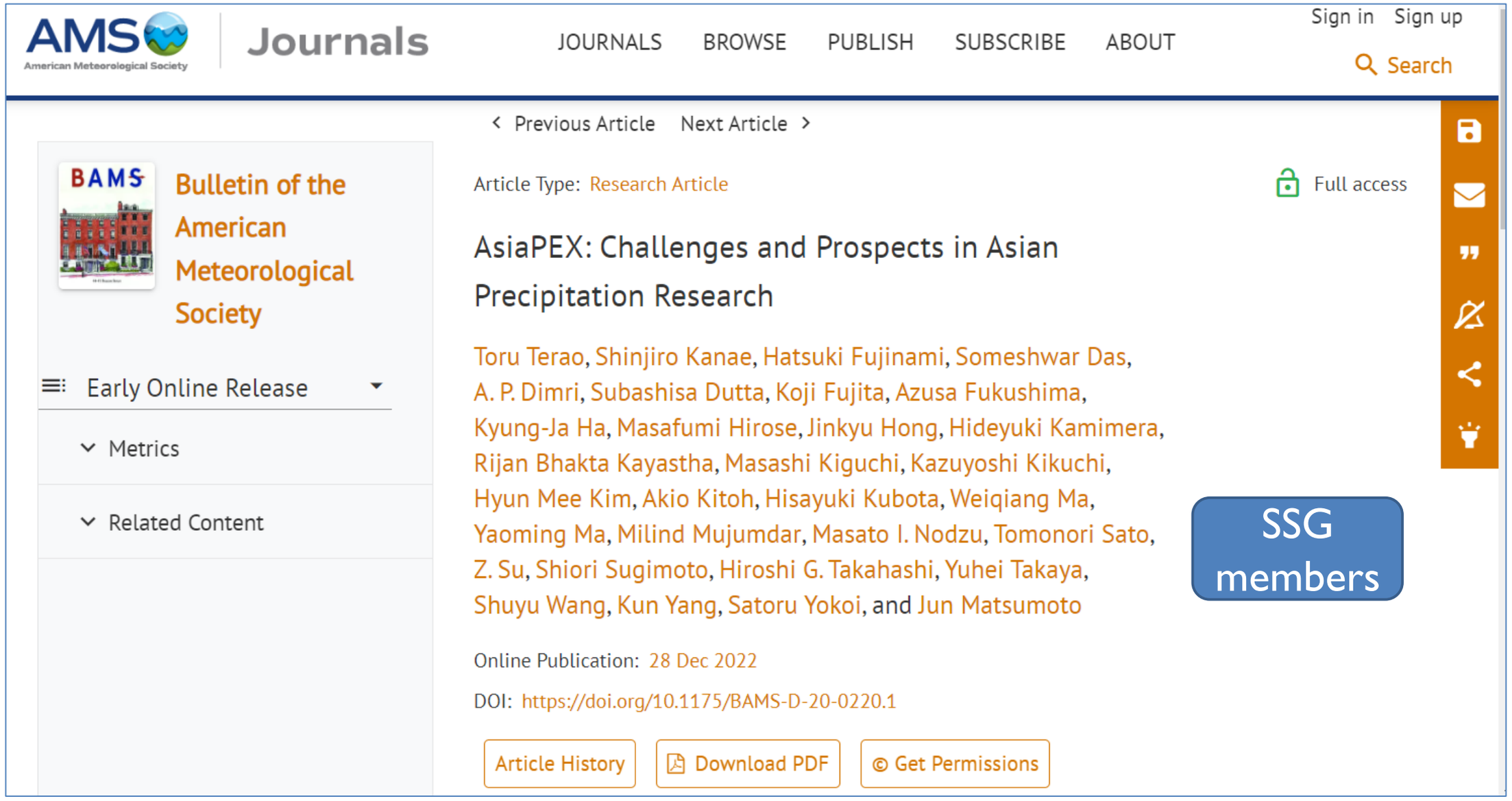
- AS28 (AsiaPEX session) was selected as one of five most popular session. (28 papers!)

Congratulations to the AOGS2021 Top Conveners!

Session	Main Convener	Co-Convener(s)
AS28 Asian Precipitation Experiment: Process and Predictability of Asian Hydroclimate System	Toru TERAO, *Kagawa University*	S DAS, *Central University of Rajasthan* Kyung-Ja HA, *Pusan National University* Shinjiro KANAE, *Tokyo Institute of Technology*

BAMS review paper was published!

- Based on discussion of SSG of AsiaPEX.



⇨ Science Planの完成、正式なRHPに認定される (2023)

AsiaPEX Asian Precipitation Experiment

Sessions and Workshops

Sessions and Workshops

Program at a glance

July 08 (Mon) Workshop on AsiaPEX Activities over SE & NE Asia: Part I

12:30-13:20 @ TBD [where ?]

July 09 (Tue) GEWEX/OSC AsiaPEX Session+Workshop

Observational and Modeling Initiatives for the Asian Monsoon Field Campaign (AsiaPEX and AMY-II)

13:30-15:00 @ Eminence Hall-B (Session 1)

15:30-17:00 @ Plaza Hall & Cherry (Poster Session)

17:00-18:30 @ Eminence Hall-B (Session 2)

18:30-19:00 @ Eminence Hall-B[?] (Workshop)

<<AsiaPEX/GPEX Beer Party>> : Beer Garden / [where?]

July 11 (Thu) A Reception Fostering Collaboration in AsiaPEX Activities

19:00-20:30 @ Room 6C, TKP Sapporo White Building Conference Center **MAP-B**

July 12 (Fri) Workshop on AsiaPEX Activities over SE & NE Asia: Part II

14:30-15:20 @ TBD [where?]

↓

July 13 (Sat) Workshop on Modeling Severe Local Storms over NE Indian Subcontinent

14:30-17:00 @ TBD [where?]

10:00-12:00 on 13 Jul. @ TBD [where?]



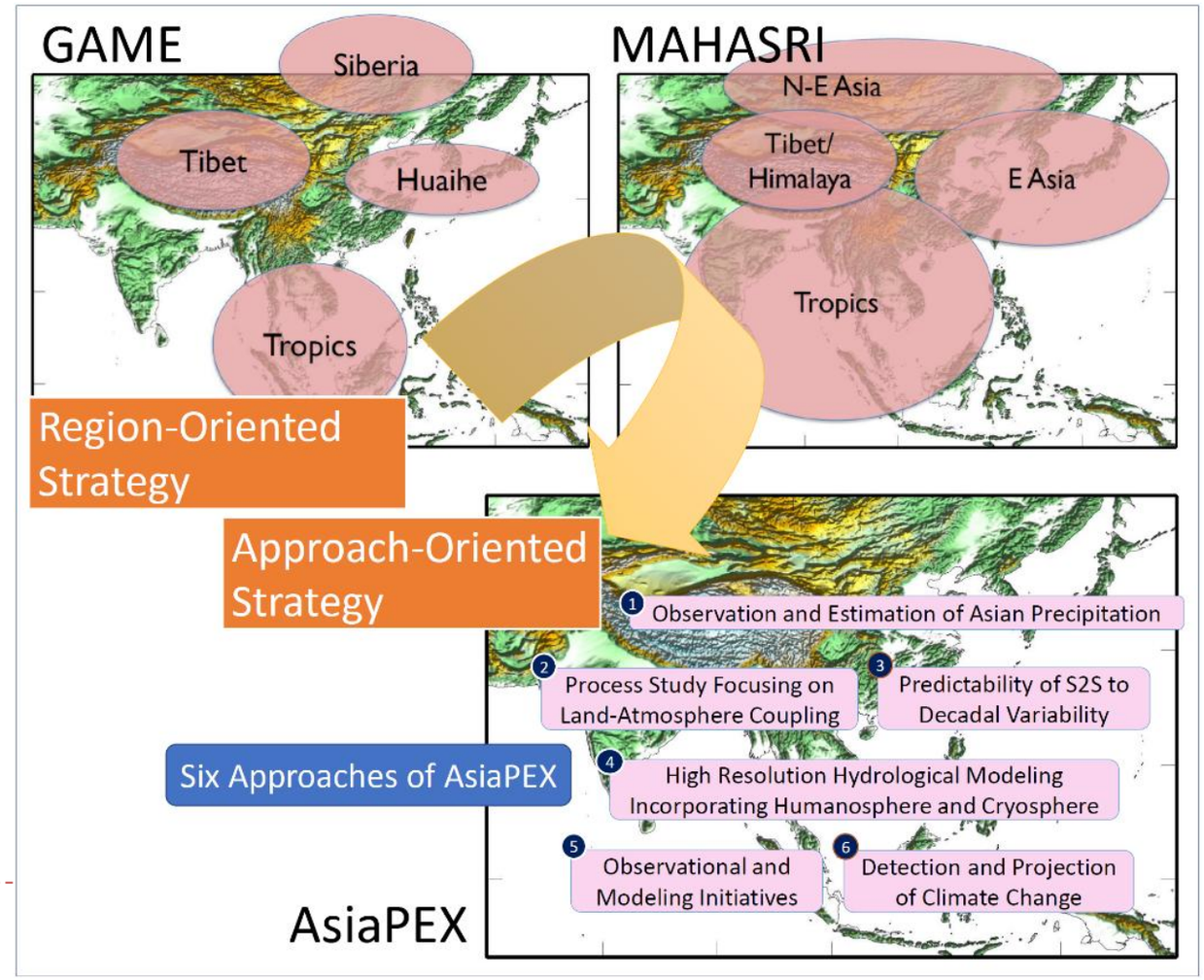

AsiaPEX as an umbrella

- Coordination of individual research activities
  - Project design / funding source / interaction with GEWEX

History of Asian Hydroclimatological Projects under GEWEX

Objectives of the AsiaPEX

- General Objective
  - Understanding of Asian Land Precipitation over Diverse Hydroclimatological Conditions: For Better Prediction, Disaster Reduction and Sustainable Development



GAME/MAHASRI

- RHP of Asian Monsoon hydroclimate research
  - GAME (1996-2005): GEWEX Asia Monsoon Experiments
    - Atmoshere-land surface interactions
    - Four regional components => Cross cutting (2002-2004)
      - GAME-Siberia, GAME/HUBEX, GAME-Tibet, GAME-Tropics
  - MAHASRI (2006-2016): Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative
    - Hydro-meteorological prediction system, up to a season
    - Based on collaboration of several regional projects
      - Maritime Continent, Thailand, Mongolia, Vietnam, South Asia …
    - Major Funding Source: JEPP -> SATREPS

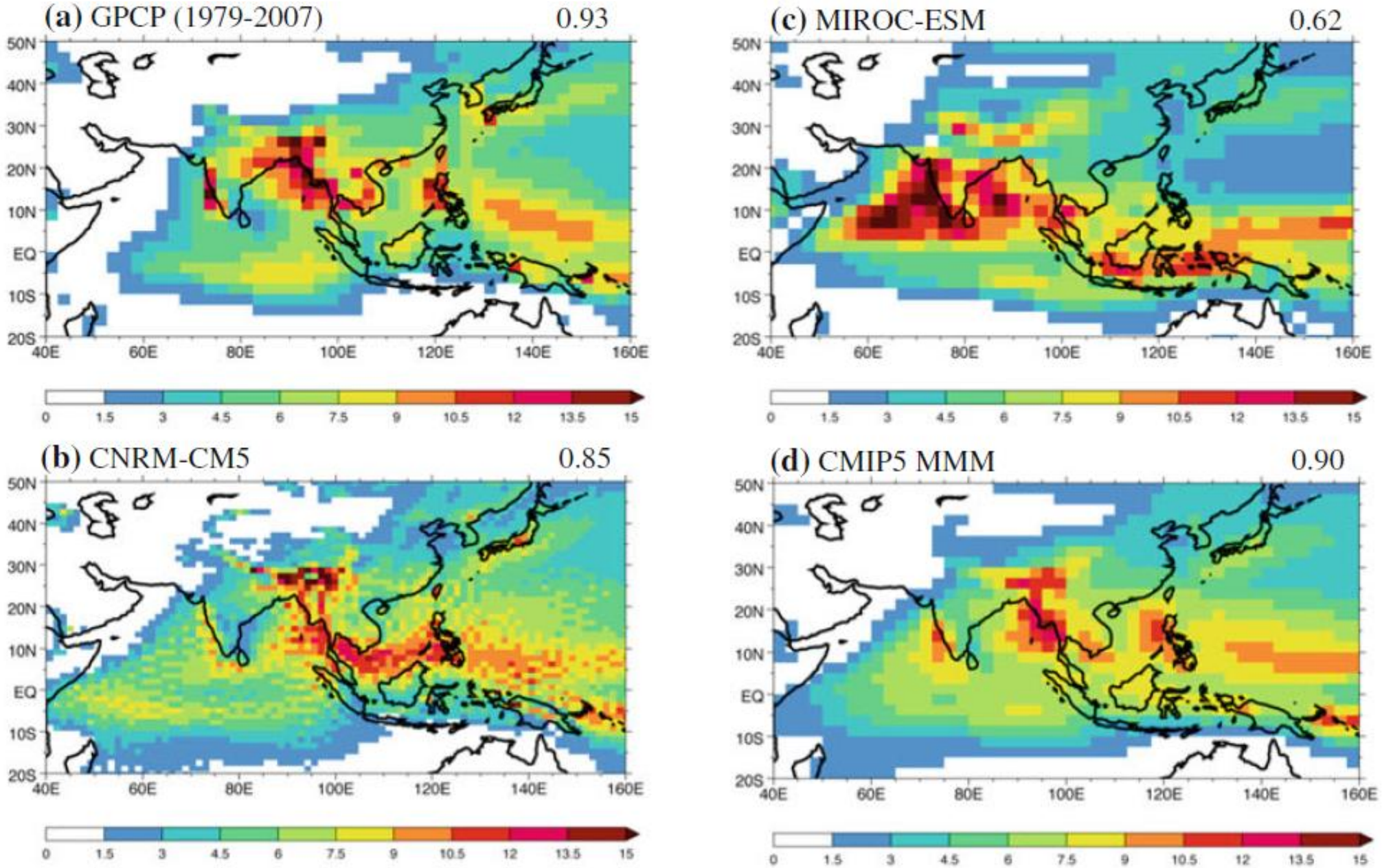
Outcomes / Impacts of MAHASRI

1. Since the GAME period, Asian operational agencies and research communities strongly stimulate research activities in monsoon Asia.
   - Local agencies and research inst. development in Asian countries
   - Education / capacity building / PhD / Co-authored papers
2. A real-time monitoring and flood prediction system have been developed in the Chao Phraya River Basin in Thailand.
3. Dynamics of autumn/winter extreme rainfalls in Indochina have been extensively investigated.
4. Collaboration with AMY community.
   - In-situ observation datasets (DIAS) in the Univ. Tokyo
   - AMY Re-analysis by MRI (Meteorological Research Institute)

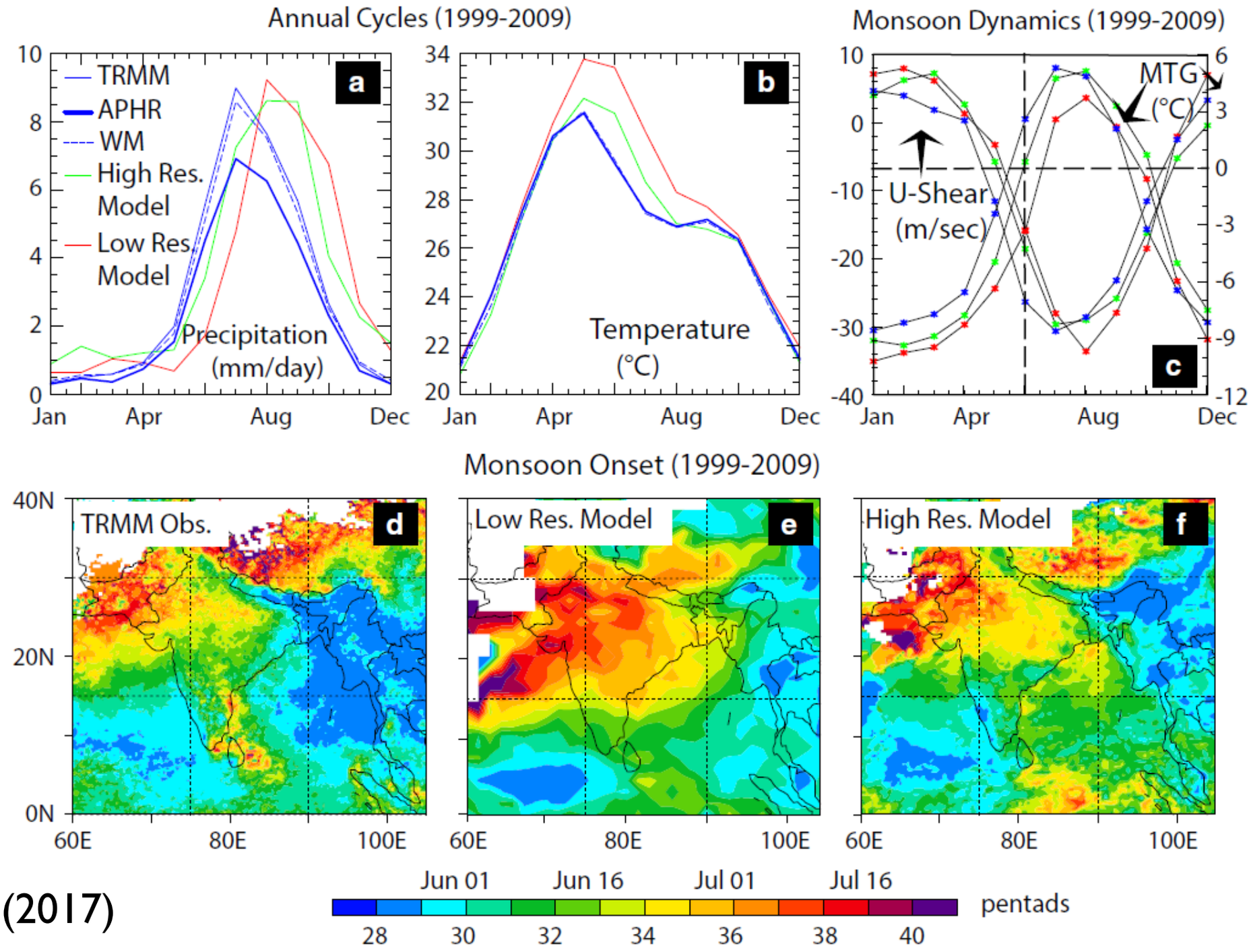
AsiaPEX and Climate Models

Annual Precipitation in Climate Models

- Sperber et al. (2013)



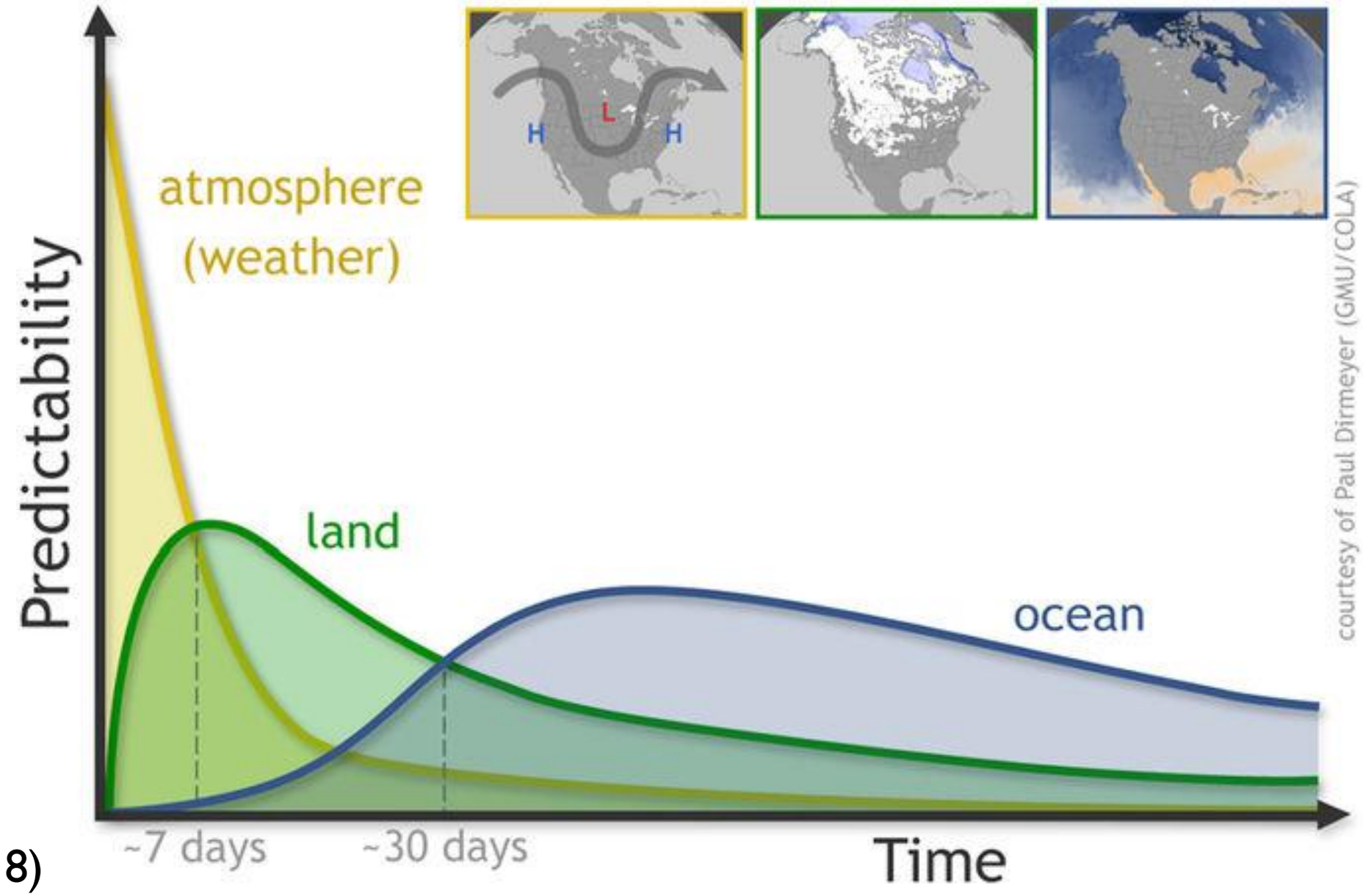
Seasonal march in climate models



Ashfaq et al. (2017)

S2S Predictability and Land Surface

- Role of Land Surface for Predictability at different Time Scales



Mariotti et al (2018)

Approaches and Strategy

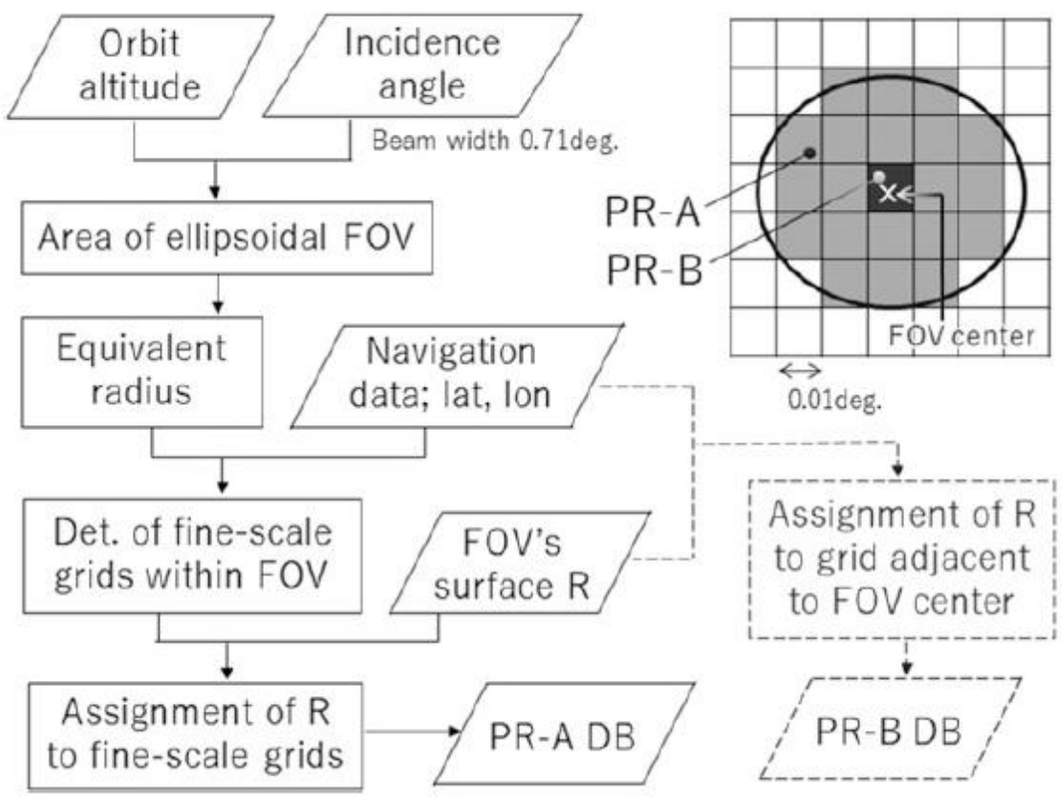
Approach-Oriented Research Strategy

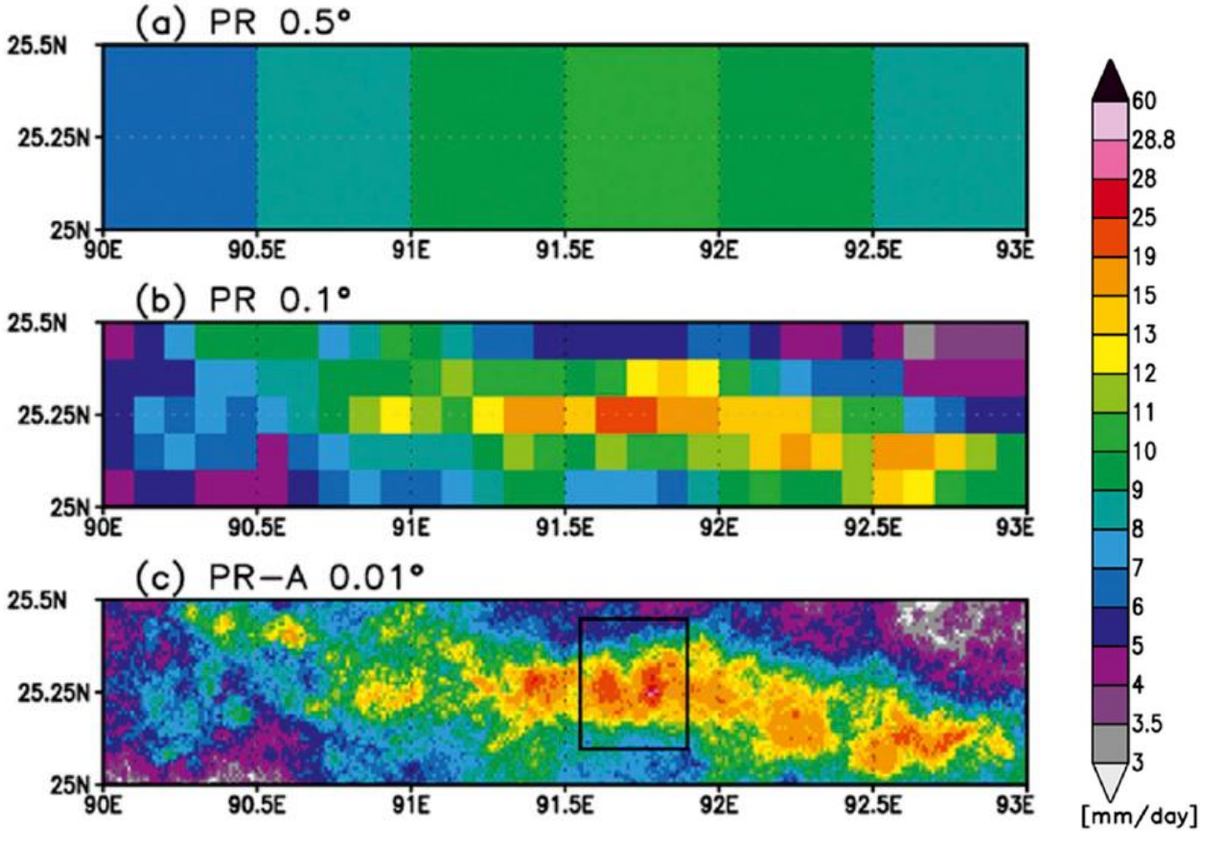
- Discussion on Science Plan of AsiaPEX
  - Project initiation and kick off Conference in Sapporo
  - Significance of six approaches are confirmed in the Conference

1. Observation and Estimation of Asian Precipitation
2. Process Study of LULCC Atmosphere Coupling
3. Predictability of S2S to Decadal Variability
4. High Resol. Hydrol. Modeling / Human to Glacier
5. Synergy Effect / Collab. Obs. & Model. Initiative
6. Seeking Effective and Useful Clim. Projection.

Hirose and Okada (2018)

- Ultra-high-resolution resolving TRMM PR climatology
  - Shown interesting applications resolving fine structure of topographic effect of rainfall pattern.
  - UHL TRMM PR climatology is now open from their web site.

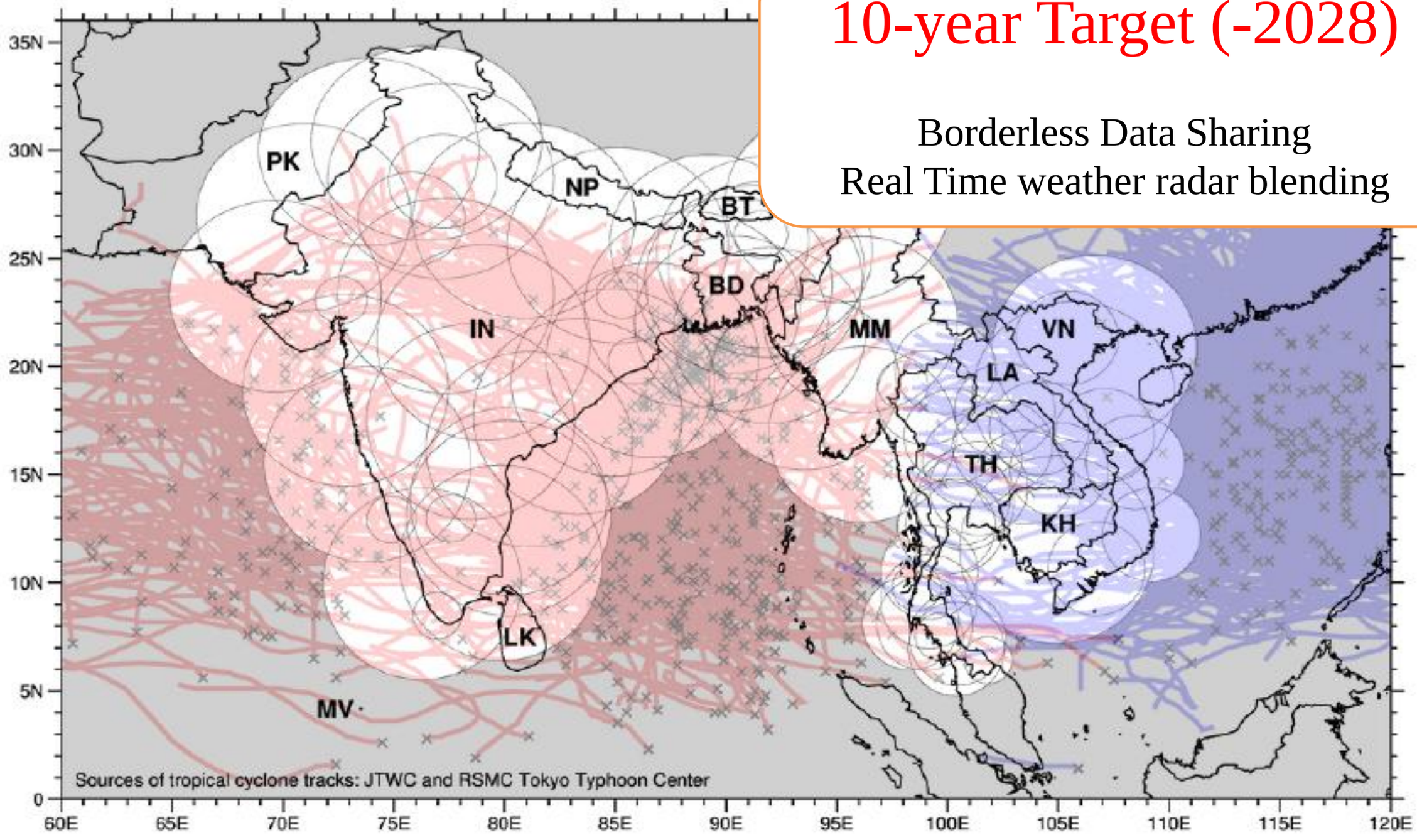




BRAIN: Borderless Radar Information Networking over South and Southeast Asia

10-year Target (-2028)

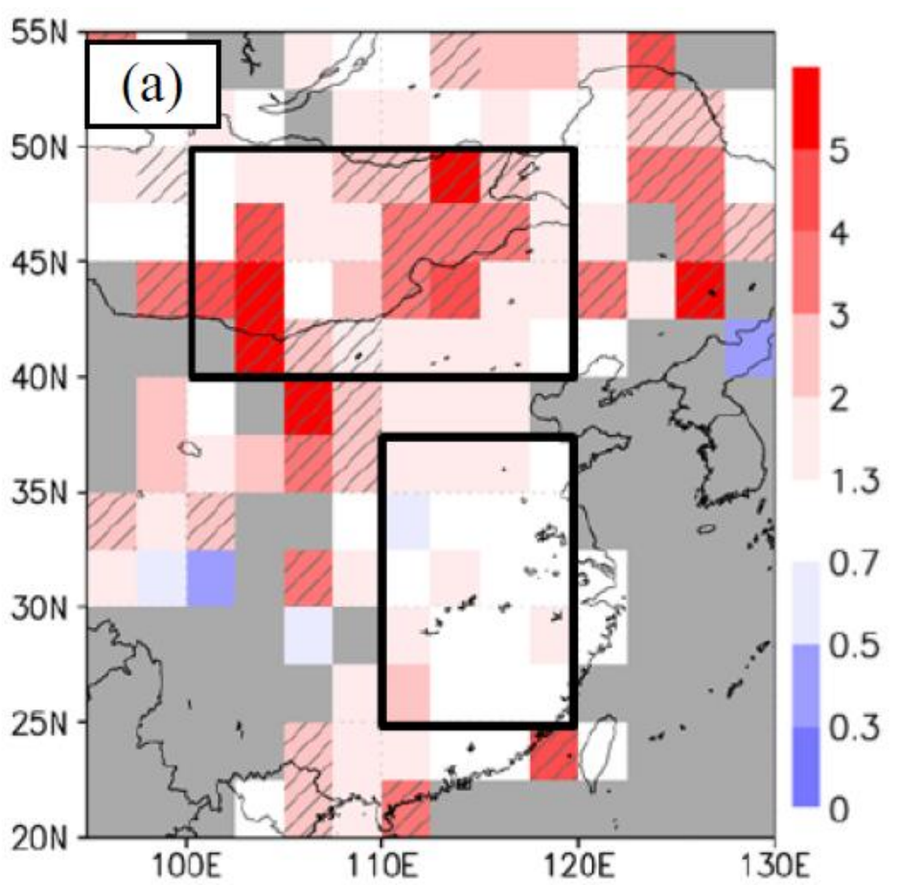
Borderless Data Sharing
Real Time weather radar blending

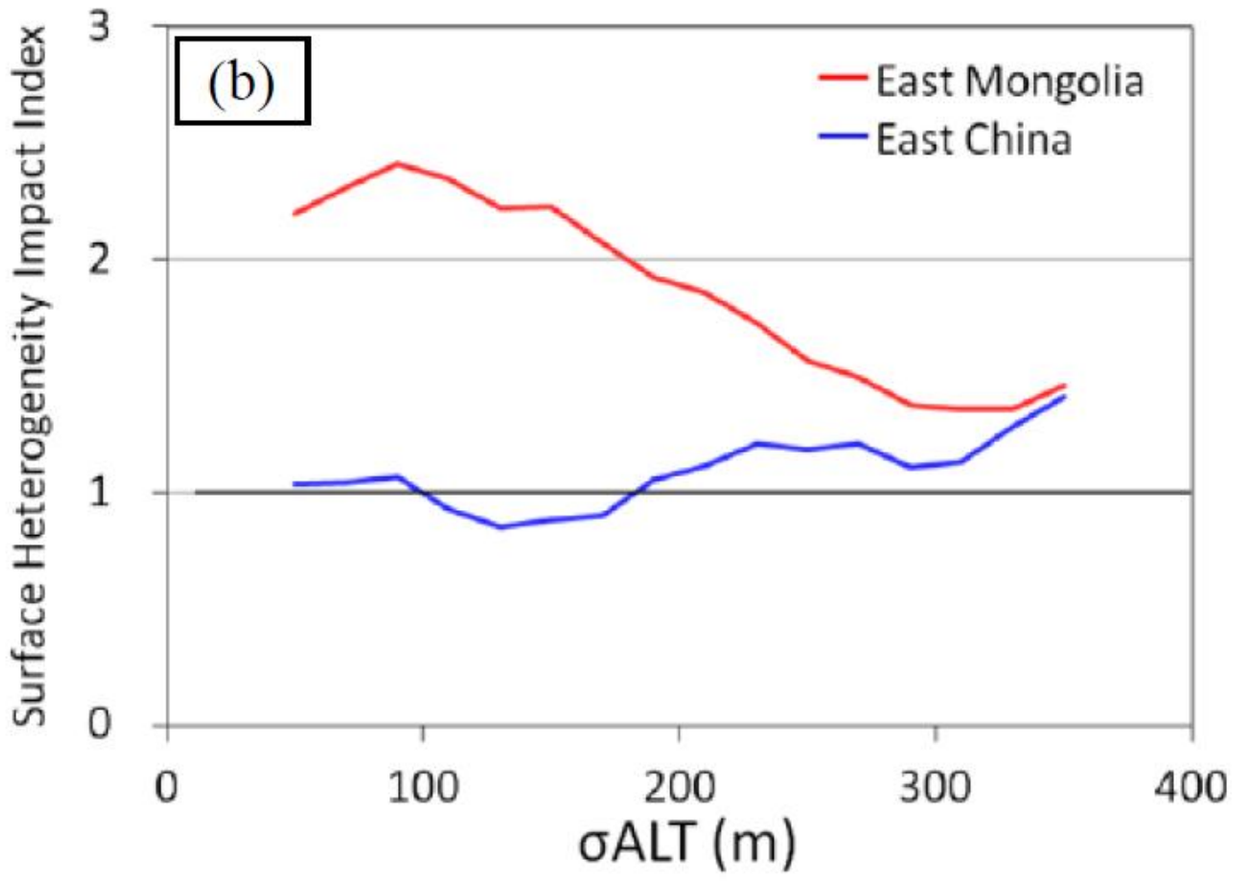


Hideyuki Kamimera, NIED, Japan

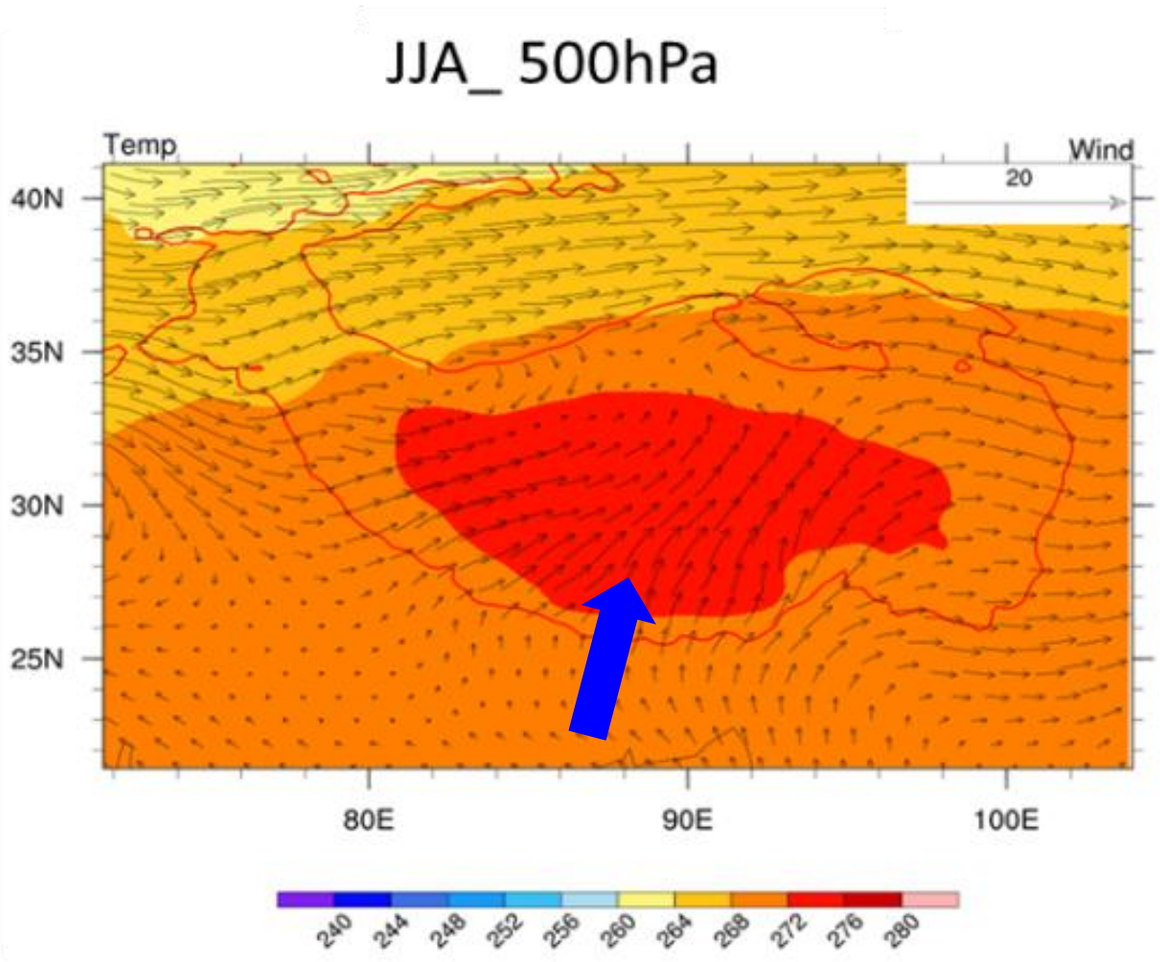
Teramura et al. (2019)

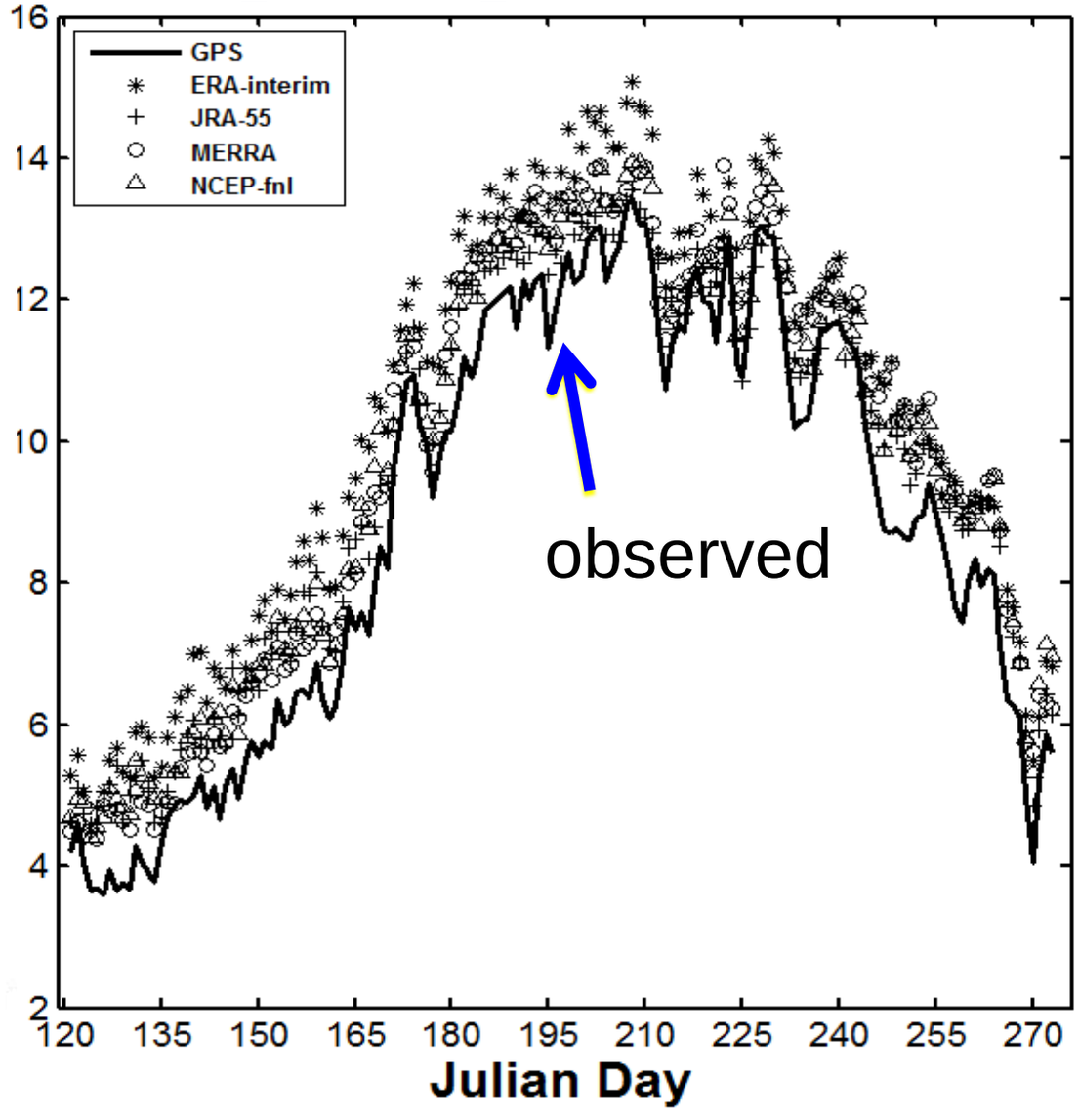
- Detection of the impact of land surface heterogeneity on the mesoscale convective systems
  - Surface temperature heterogeneity enhances MCS initiation.
  - Topography with scale >300m hinds the T-heterogeneity effect.





All models over-estimated precipitable water

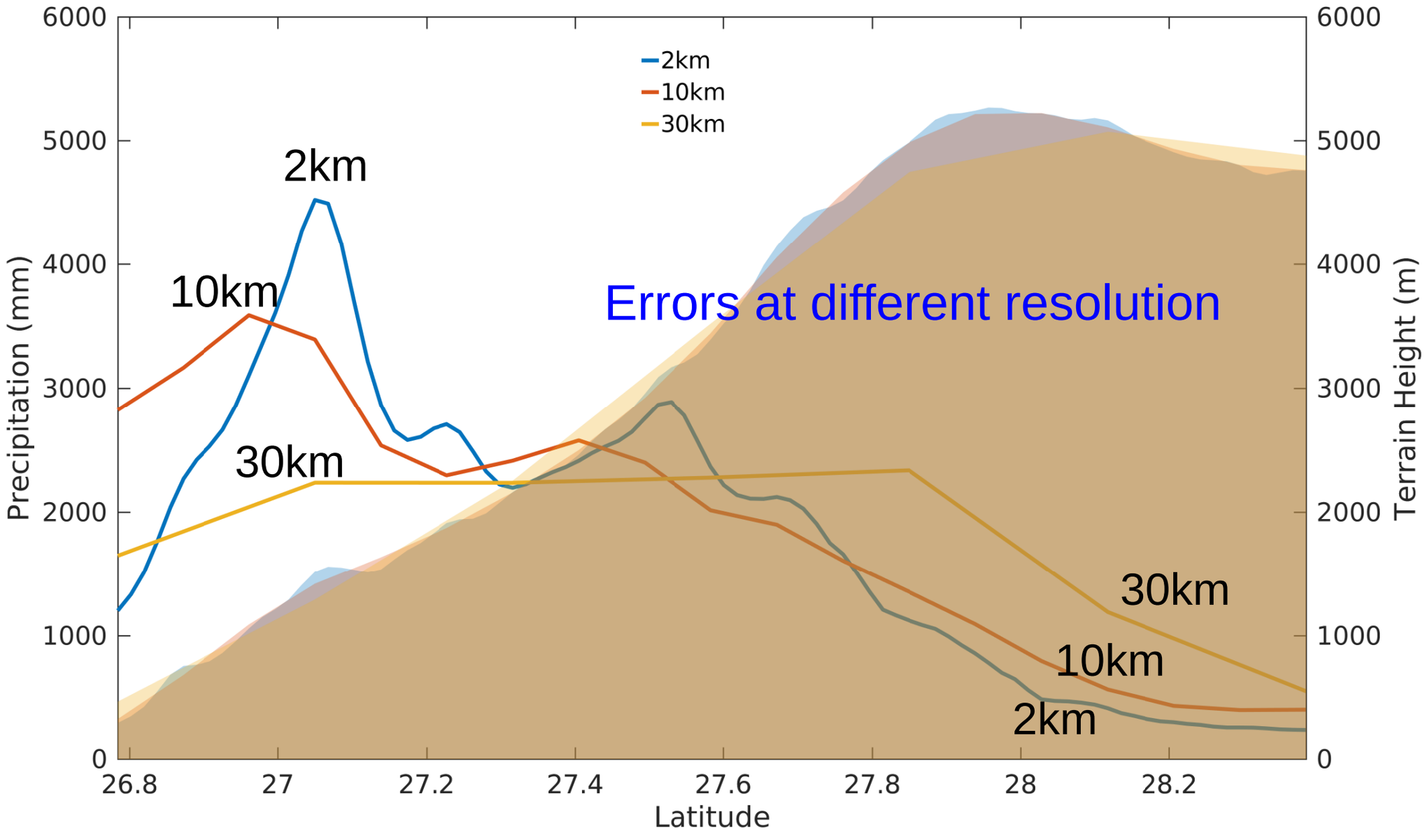




Seasonal cycle between observation and reanalyses, averaged at 9 GPS stations during 2007~2013

(Ling et al. 2015; Wang, Yang et al. 2017)

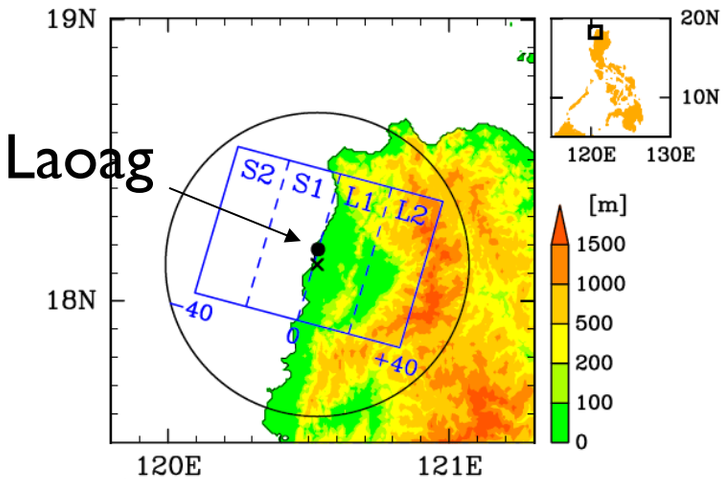
Positive biases in vapor flux results in much more precipitation in the Plateau and less in south slope

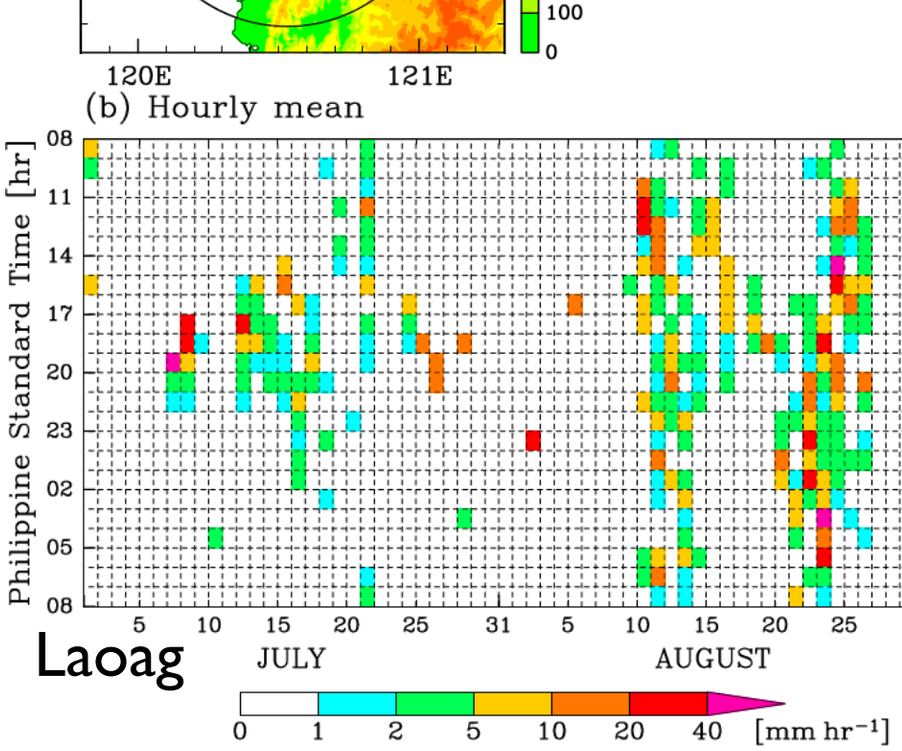


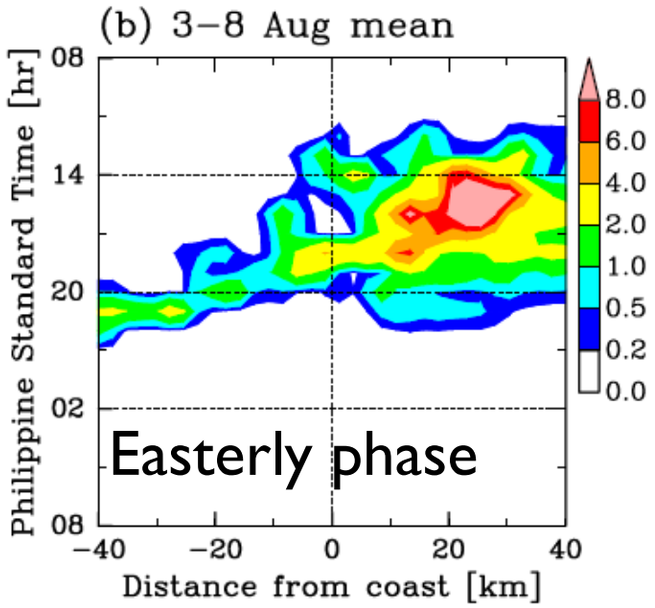
(Ling et al. 2015)

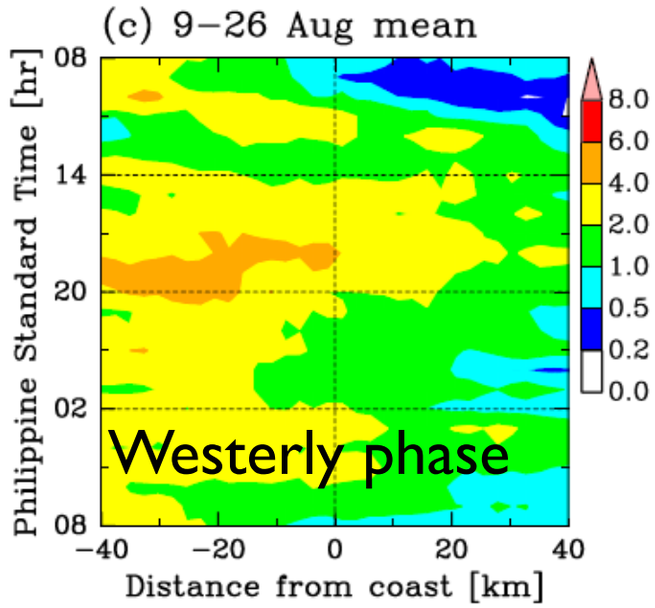
Multiscale Precipitation Variation

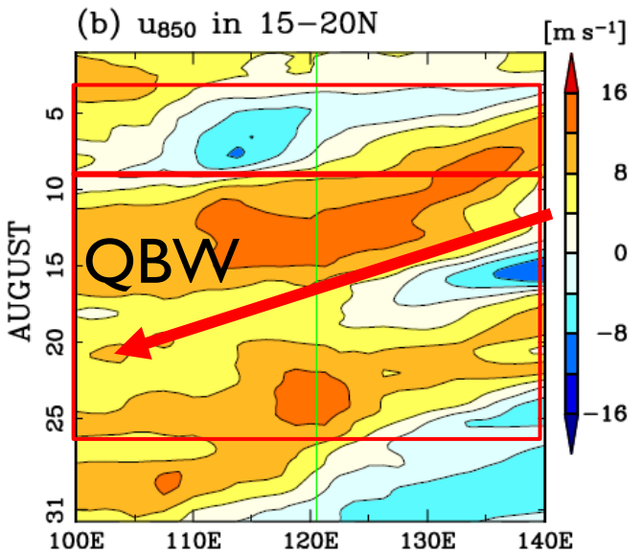
- Northern Coast of Luzon Island, the Philippines.
- QBW-Diurnal Multiscale Variabilities.

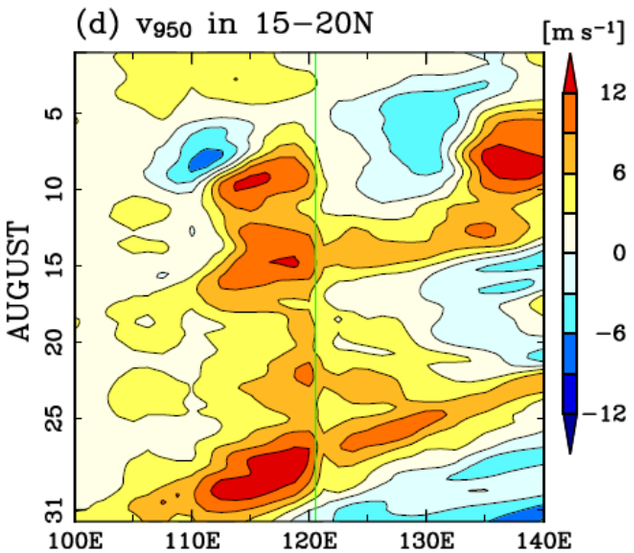








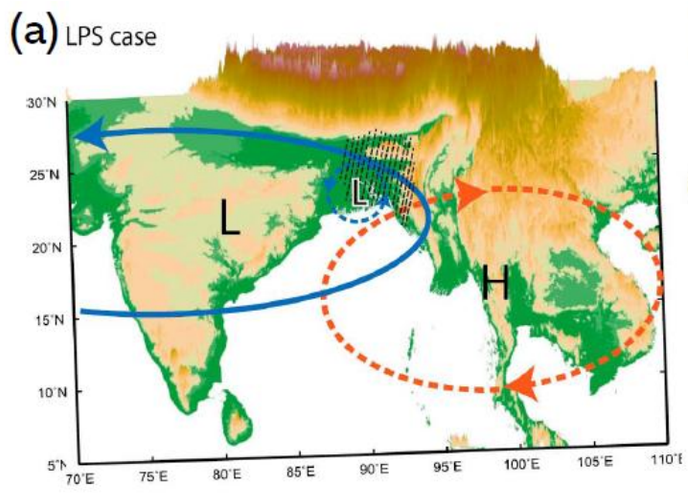


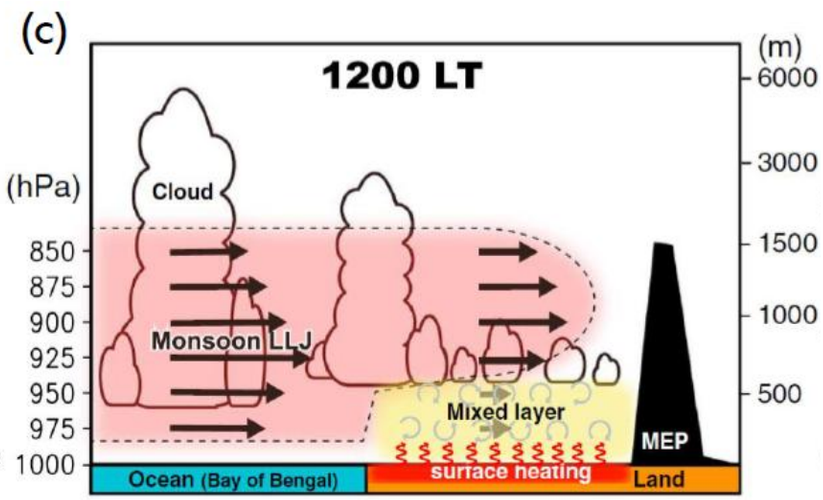


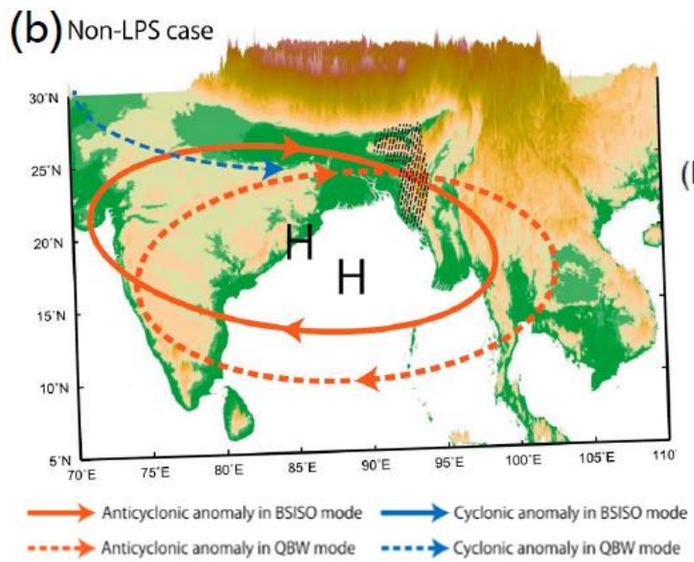
Yokoi et al. (2022)

Diurnal-QBW-MISO time scales

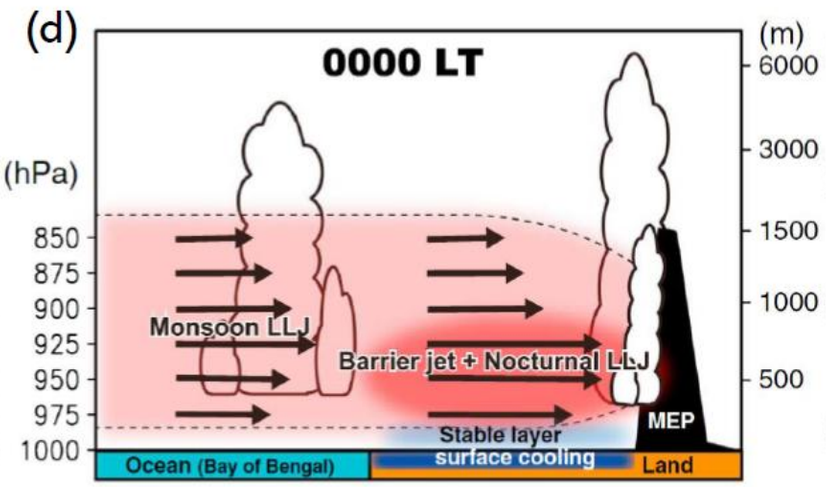
- Multiple scale interactions: Diurnal to S2S scales







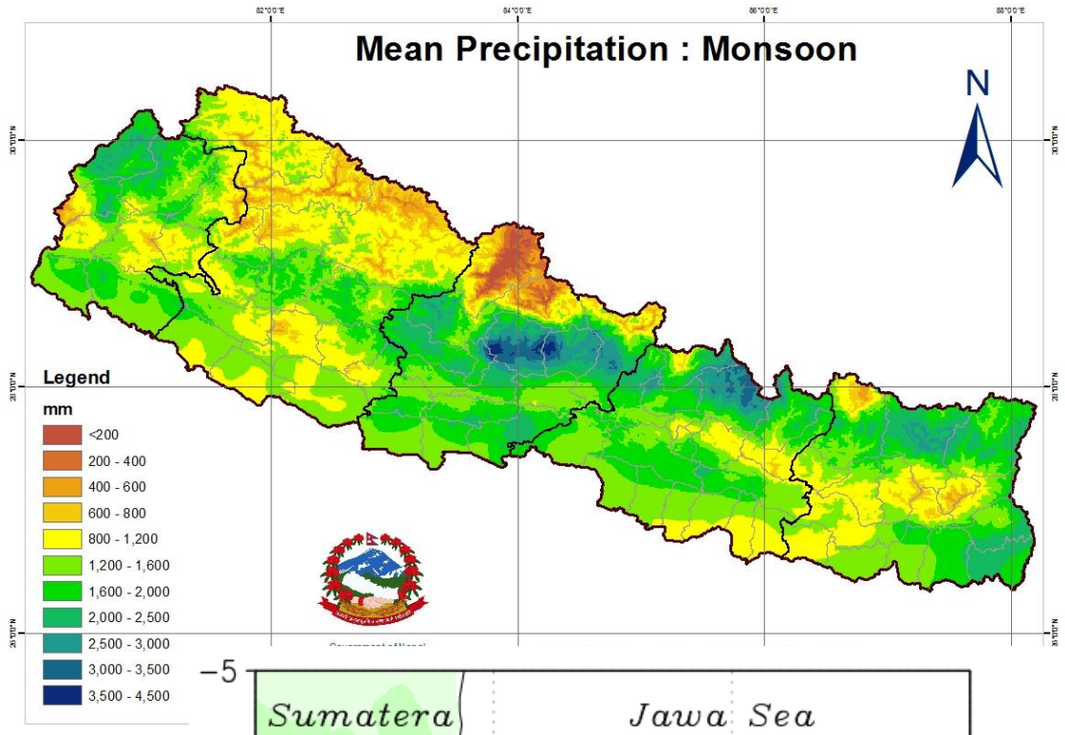
Hatsuzuka et al. (2014)



Fujinami et al. (2017)

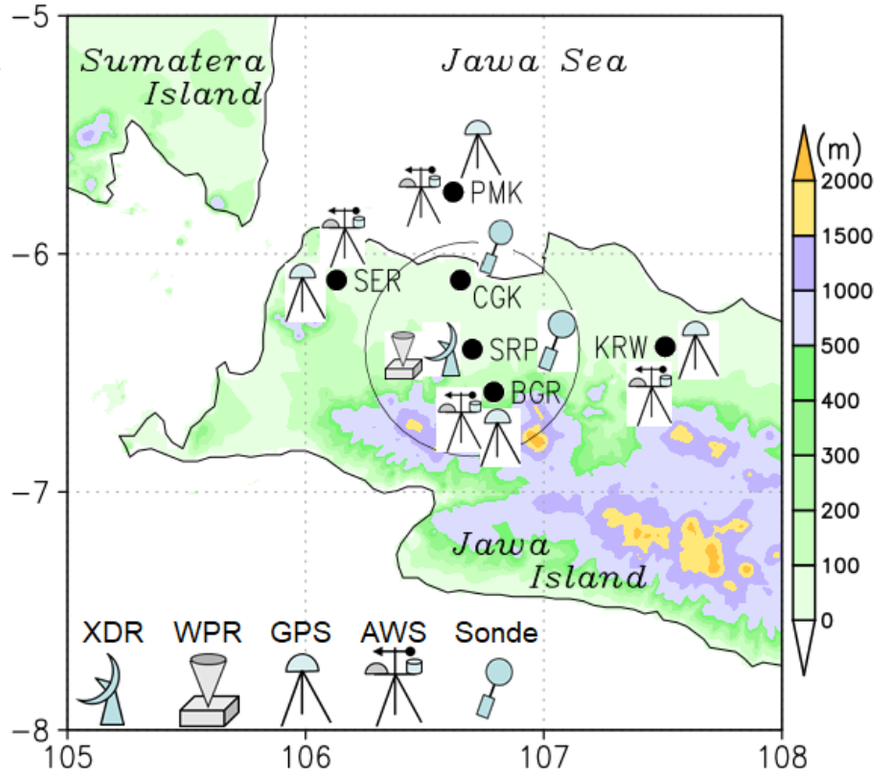
New Activities

- HiPRECS (Himalaya PRECipitation Study)
  - To investigate the mechanism of precipitation variability associated with the large-scale moist air flow over the complex terrain of the southern slope of Himalayan Range.



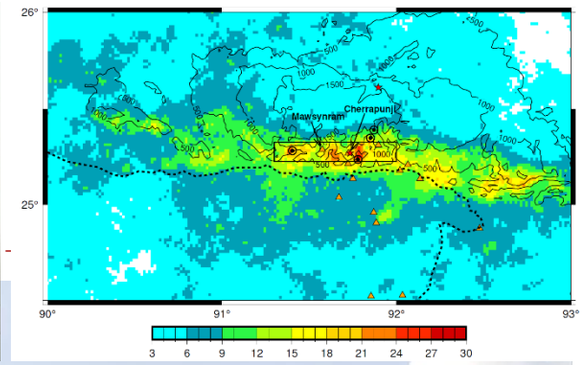
- JaHE (Jakarta Heavy precipitation Experiment)
  - To investigate the heavy rainfall along the northern coastal area of the Bali Island. They emphasised the Jakarta metropolitan area where severe floods attack every several years associated with the coastal rainfall.

Coastal Dehydrator



5 Synergy Effect / Observation Initiative

SOHMON Project



New Disdrometers in Bangladesh (already installed over the Meghalaya Plateau)

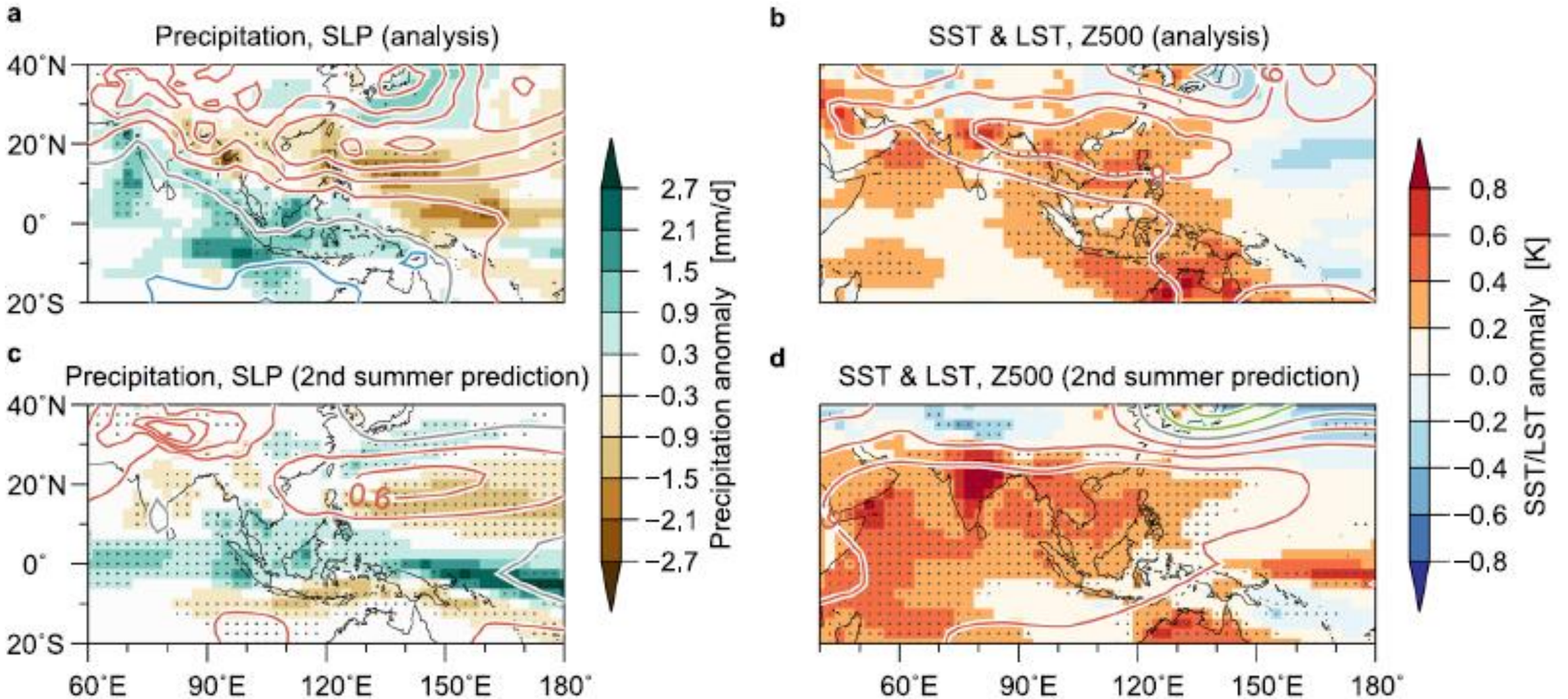
Sylhet

Dhaka

By courtesy of F. Murata

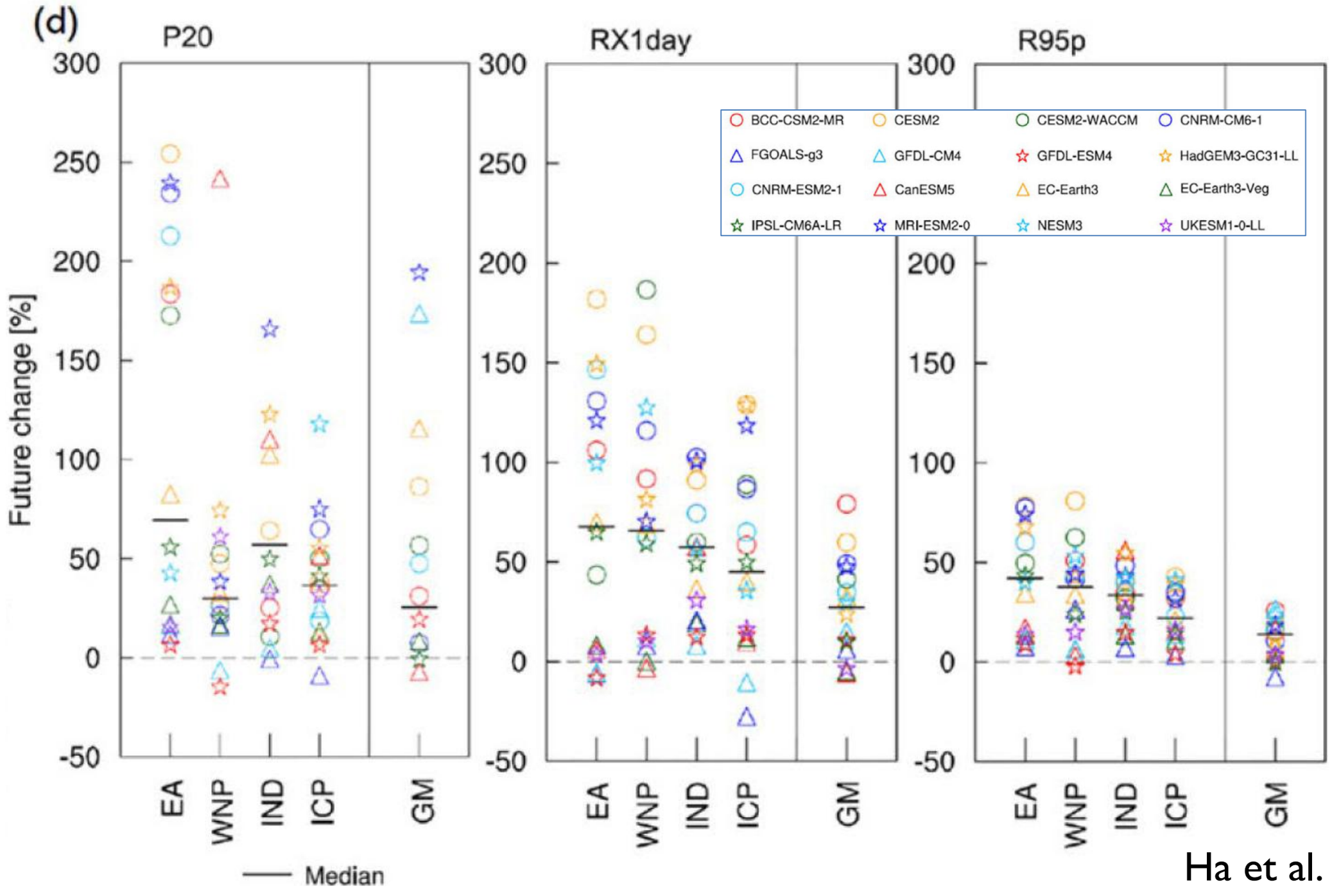
Predictability of Climate Models

- One year ahead
- Key: Representation of ENSO – IPOC mode



Takaya et al. (2021)

Future projection of Extremes



Ha et al. (2020)

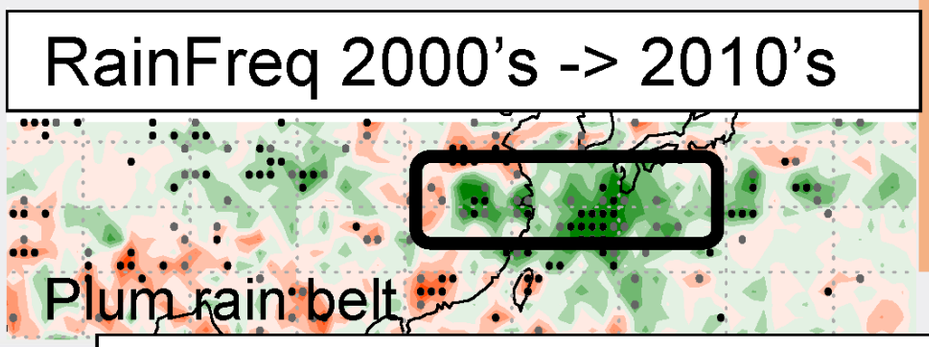
Decadal Enhancement of Meiyu-Baiu

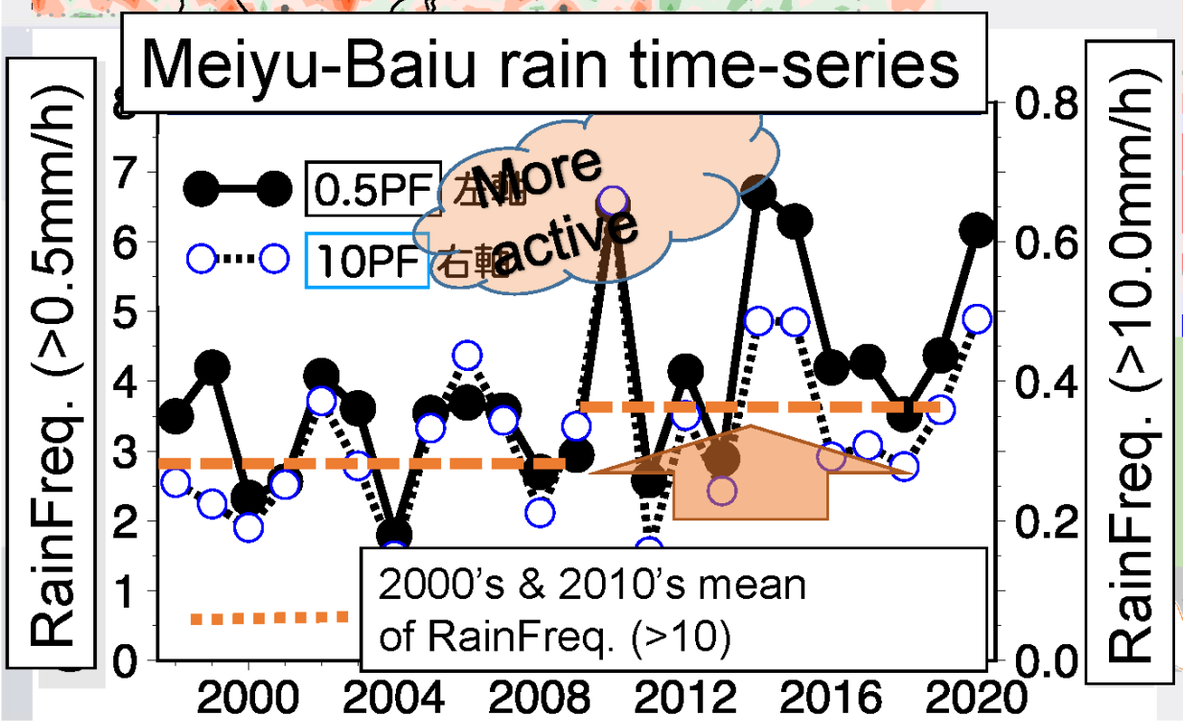
Recent decadal enhancement of Meiyu–Baiu heavy rainfall over East Asia

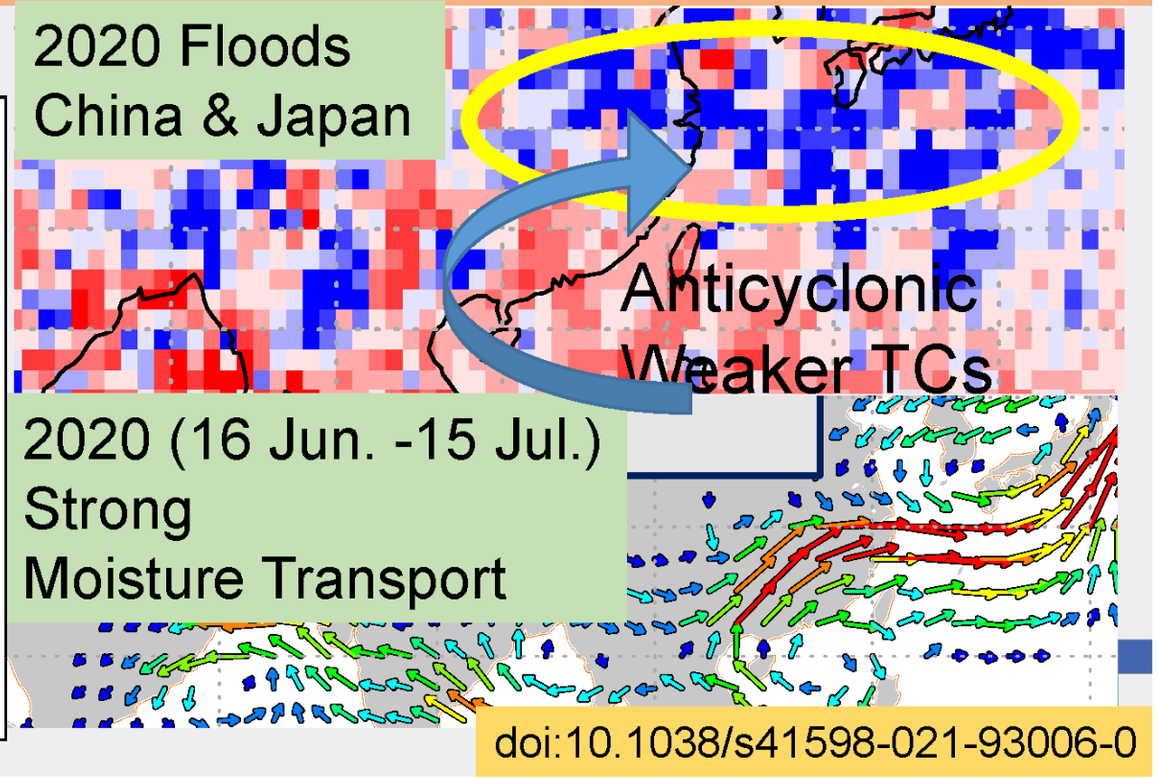
Takahashi & Fujinami 2021, Scientific Reports

○ **Using TRMM-GPM 23-year radar data**, we showed the recent decadal enhancement of Meiyu–Baiu heavy rainfall over East Asia

○ Related to the stronger anticyclonic anomaly & Rossby waves along the subtropical Jet.







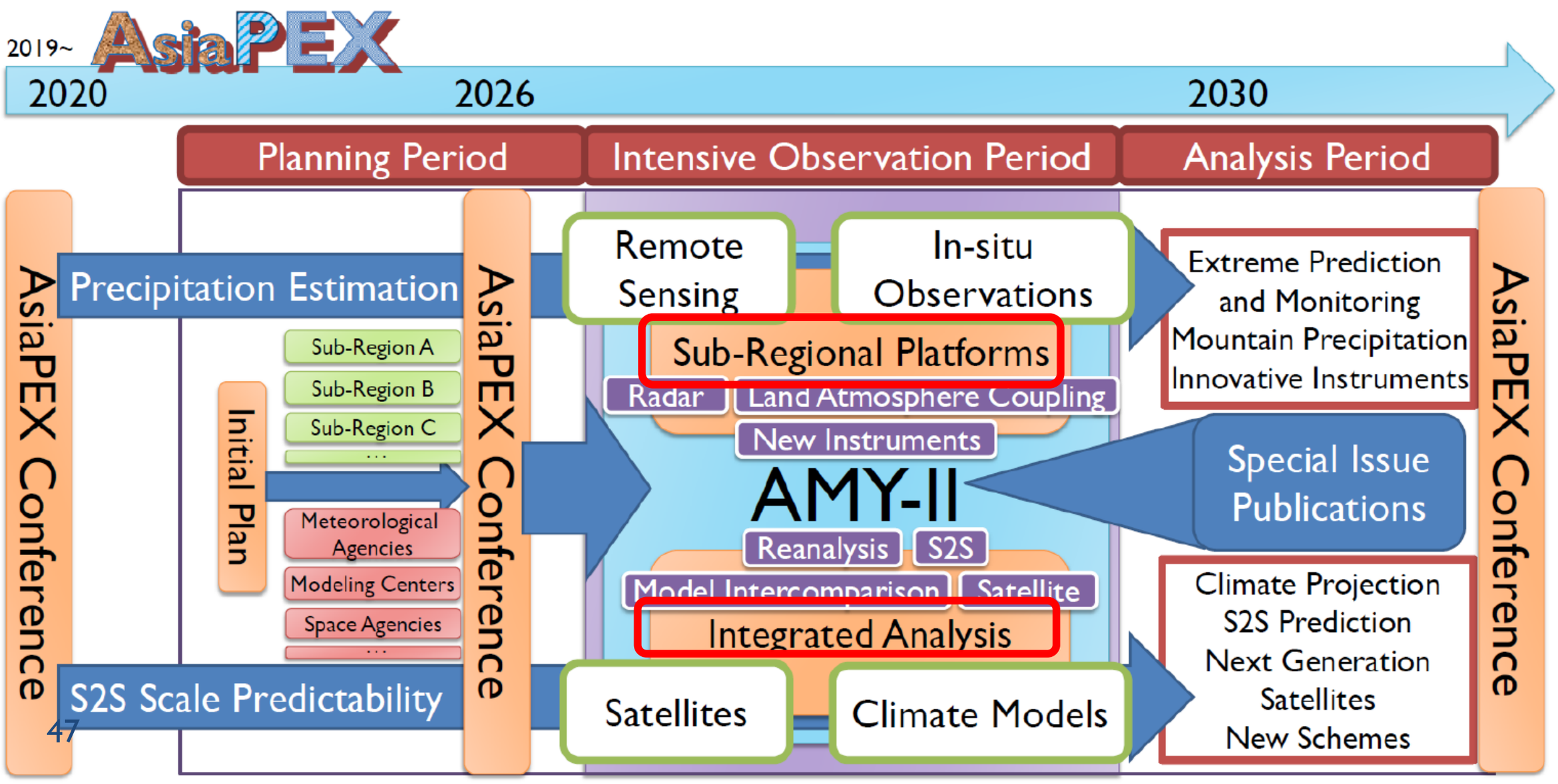
doi:10.1038/s41598-021-93006-0

Takahashi and Fujinami (2021)

Field Campaign: Asian Monsoon Year-II

Two Strategic Approaches:

1) the subregional process-oriented coordinated observation platforms at scales of tens to hundreds of kilometers with collaborative observations and
2) integrated analysis using global modeling, reanalysis, and remote sensing dataset that can be underpinned by subregional observation platforms.

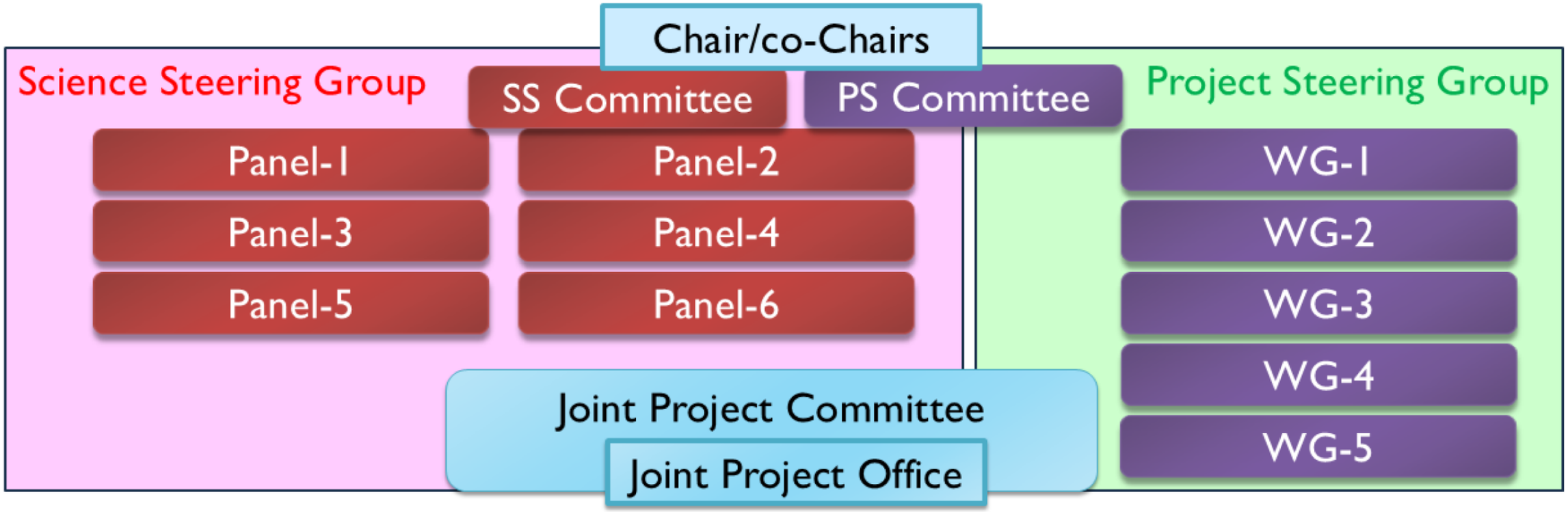


AsiaPEX Science Plan: Recent updates

Goals of AsiaPEX

- New proposal in recent update of Science Plan:
- Four Goals of AsiaPEX (this is not all of what will do)
  - 1) description and projection of precipitation extremes in the past, present and future
  - 2) improvement of S2S predictability
  - 3) prediction of freshwater availability and risks
  - 4) coordinated field campaign focusing on Asian monsoon system
- They are hotspots that will unite all the AsiaPEX people and attract people to join the upcoming AMY-II

Organization of AsiaPEX



Science Panels:

1) Observation and estimation of Asian precipitation
2) Process study focusing on land-atmosphere coupling
3) Predictability of S2S to decadal variability
4) High resolution hydrological modeling incorporating humanosphere and cryosphere
5) Observation and modeling initiatives
6) Detection and projection of climate change

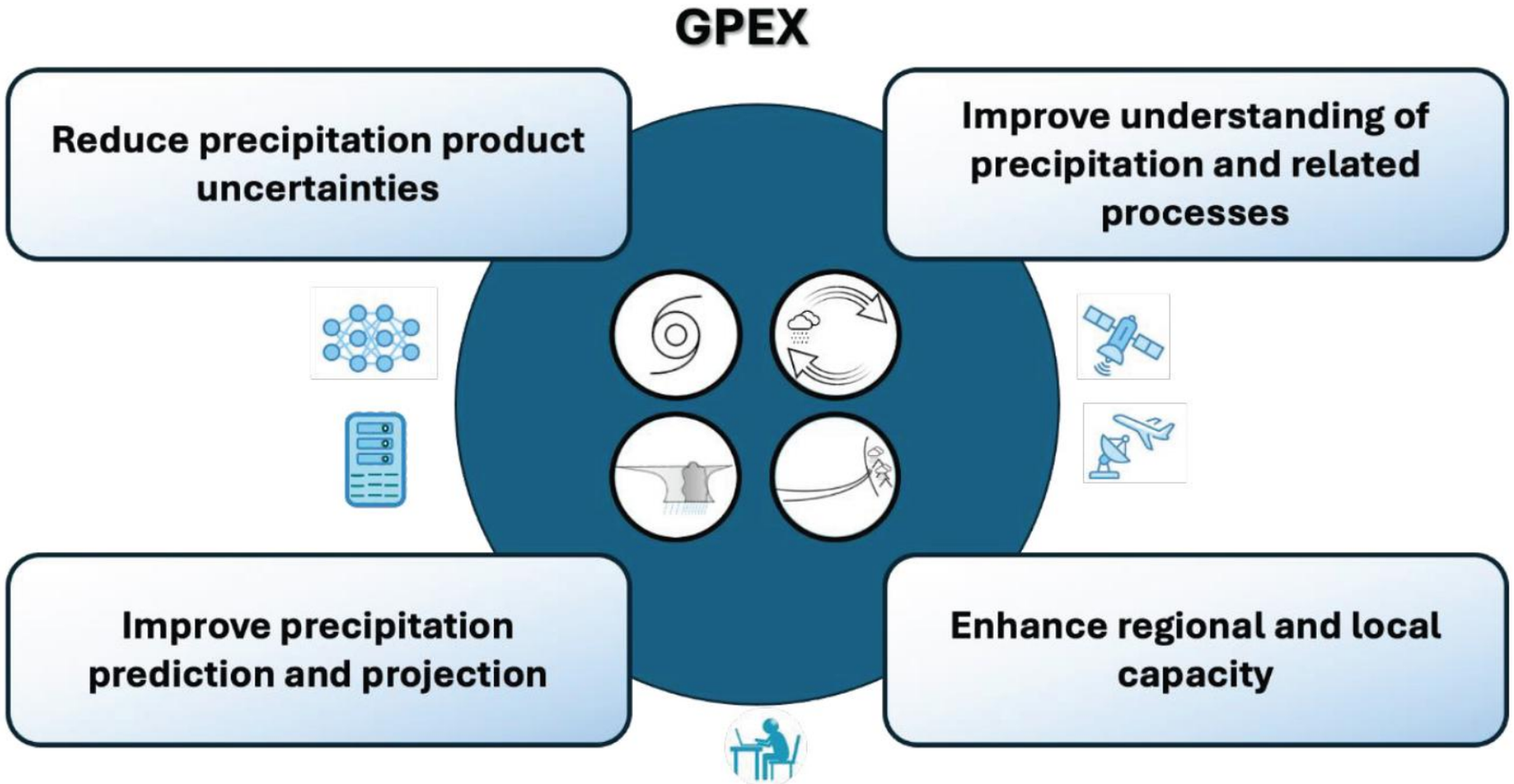
Project WGs:

1) Data sharing and open data
2) Funding for activities as an umbrella
3) Capacity development
4) International Exchange
5) Field Campaign

Asian Monsoon Years-II

GPEX & AsiaPEX

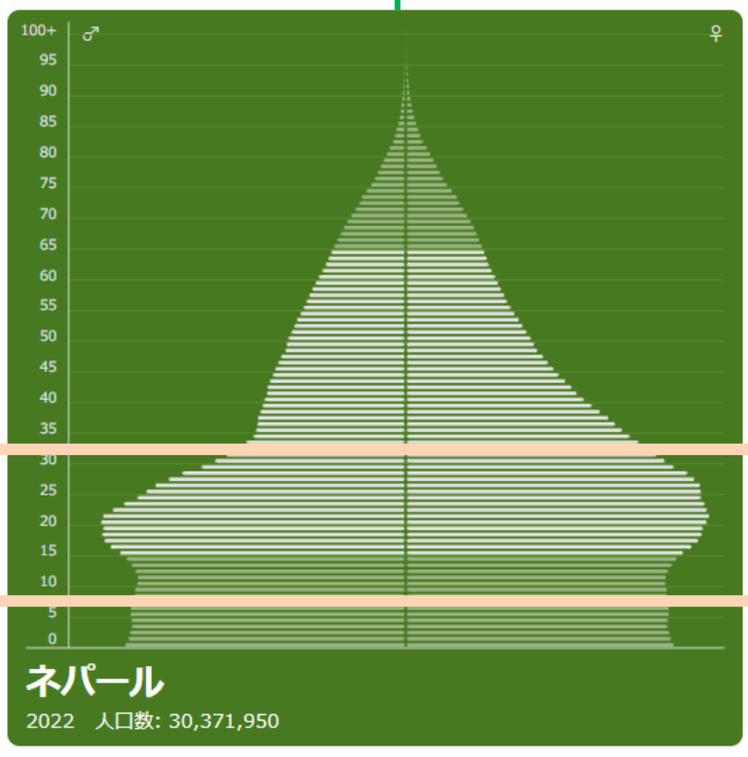
- GPEX focusing on precipitation. Focus of AsiaPEX is hydroclimatology of Asian monsoon.
- AsiaPEX intends to be an anchor project regarding "monsoon precipitation"



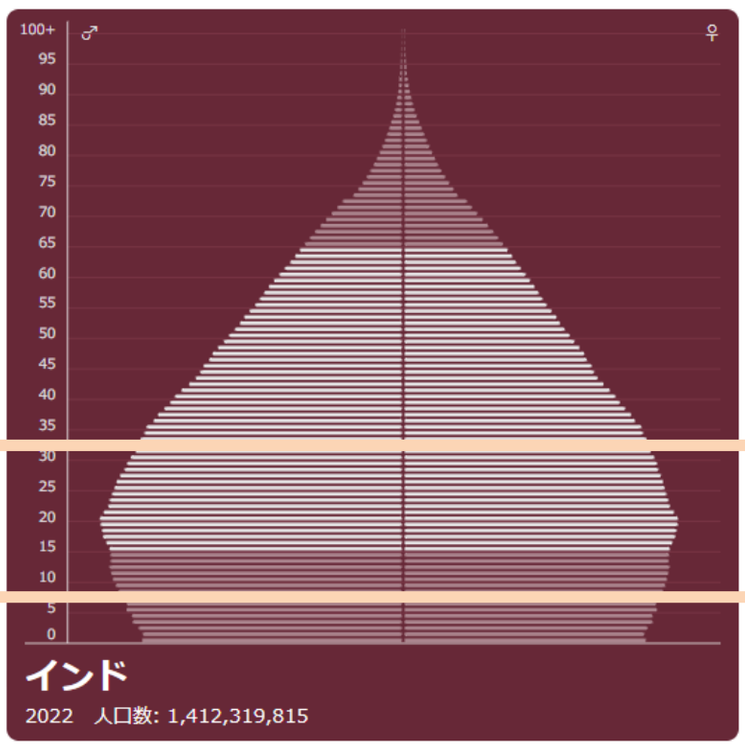
New Generation in South Asia

- We shall think about involving new generations in our projects.
- Capacity building for new generations
  - Computer literacy including model and big data manipulation
  - Capacity to design observation and fieldwork

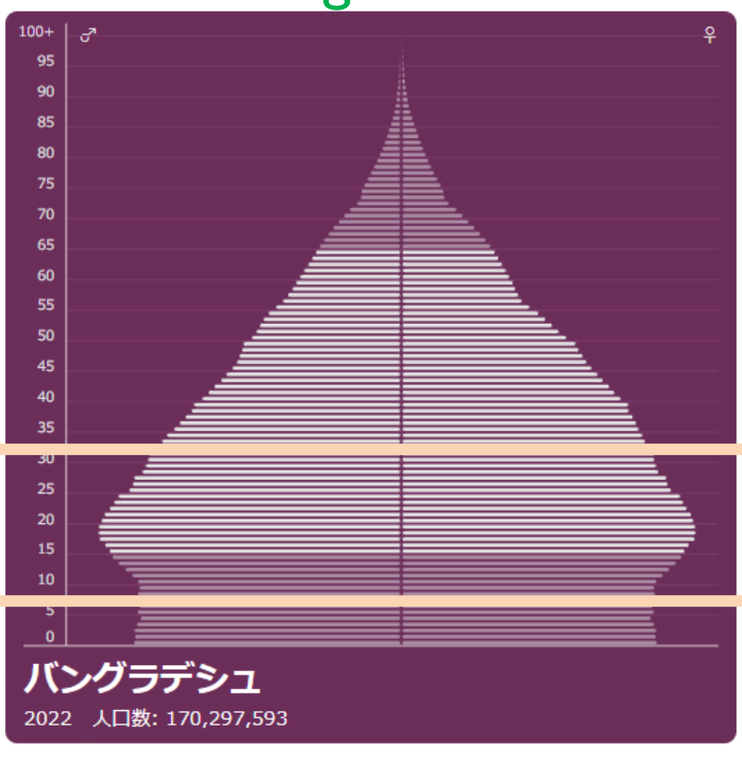
Nepal



India



Bangladesh



Current Tasks

- Organizing Science Panels 1-6
- Contributing to:
  - JpGU2025, BACO2025, AGU/JpGU2026
- Applying for funding agencies
- Discussion towards the AMY-II / coordinated with YoP
  - The AMY-II Plan will be finalized for the AsiaPEX Conference in 2026/2027.

Join AsiaPEX!

Please contact

terao.toru@kagawa-u.ac.jp