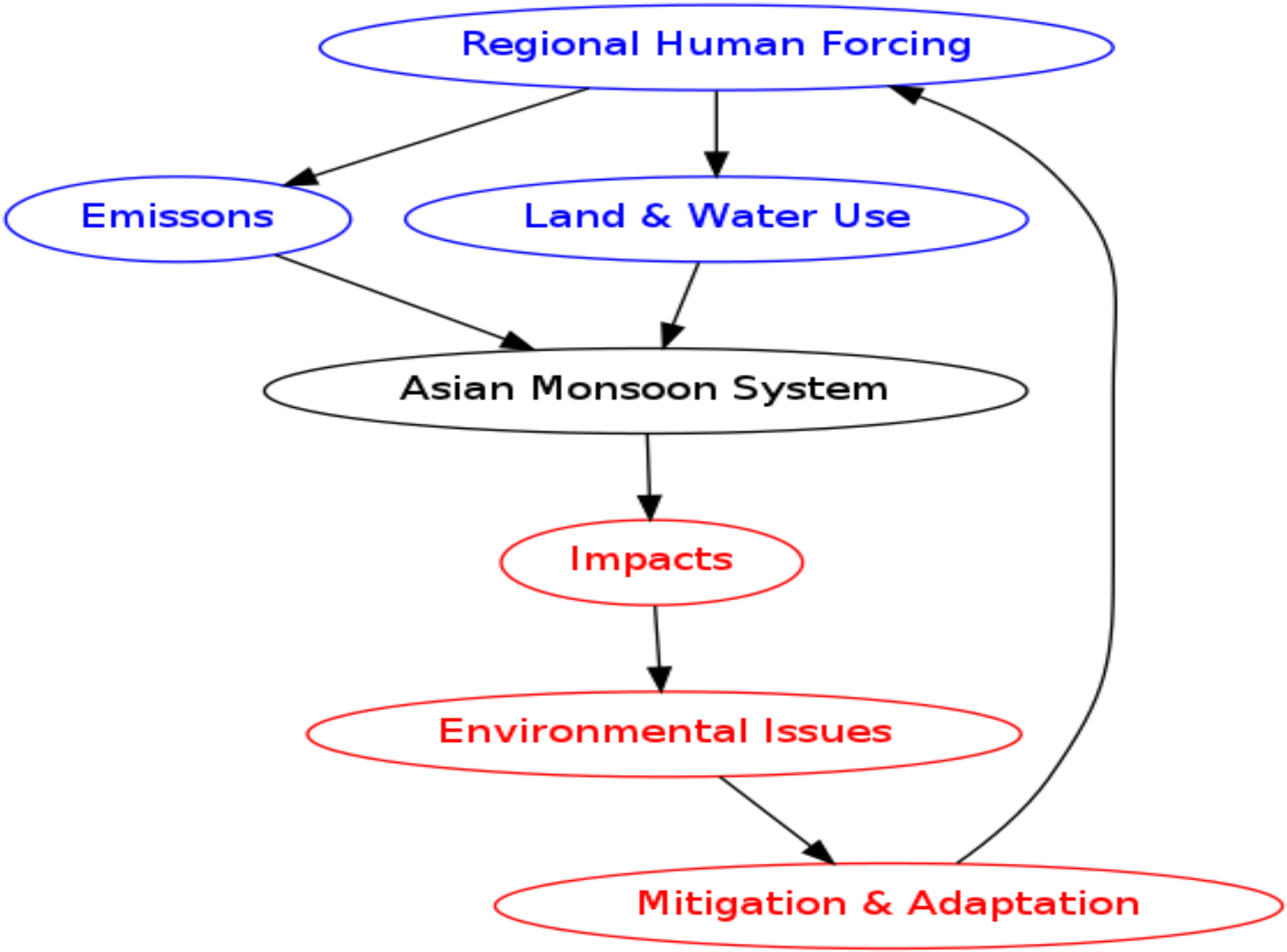
Monsoon Asia Integrated Regional Study (MAIRS)

Future Asia Symposium, Kyoto, 14 December 2012

Significance of Monsoon Asia

- World's highest mountains
- Heat source of Tibetan Plateau
- Seasonal monsoon affects water and food resources
- Range of natural hazards (TC to GLOF)
- Anthropogenic aerosols
- 3.6 billion people
- Rapid urbanisation
- Vulnerable coastal development


Regional Human Forcing
Emissons
Land & Water Use
Asian Monsoon System
Impacts
Environmental Issues
Mitigation & Adaptation

Integrated Studies

- Integrated across
  - Disciplines
  - Sectors
  - Boundaries
  - Activities

- Collaboration and capacity building across region

History of MAIRS

- Commenced in 2006 under auspices of START
- Chair SSC: Congbin FU (2006-2010)
- IPO supported by CAS at IAP, Beijing
- Link to ESSP (Earth System Science Partnership)
- Review in 2010
- Commenced phase 2 in 2011

Organisation of MAIRS

- Chair of SSC
    - Michael Manton

- Vice Chair of SSC
    - Tetsuzo Yasunari

- Director of IPO
    - Ailikun

MAIRS Themes

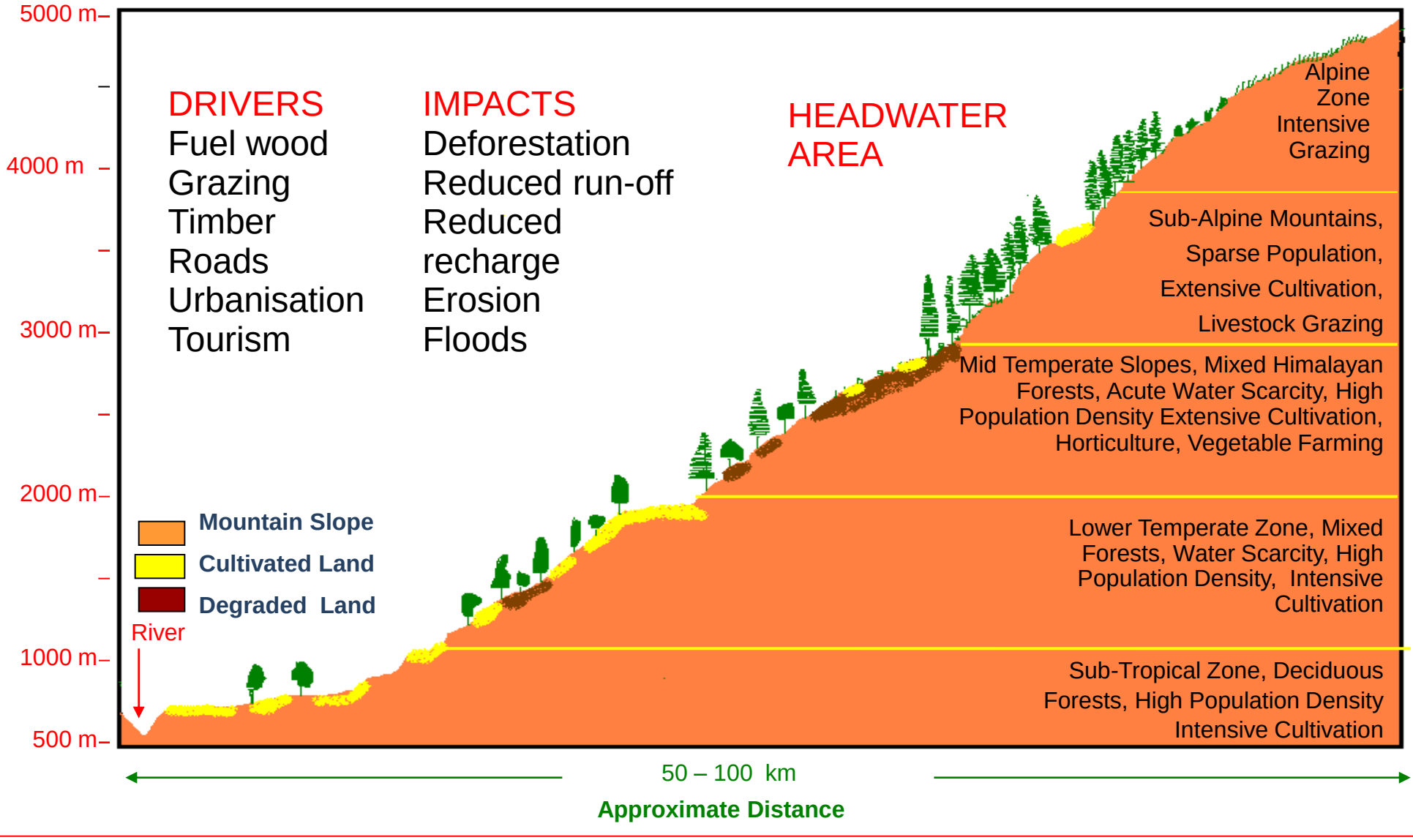
- Multiple stresses in high mountain zones
- Vulnerable systems in dryland zones
- Rapid transformation in coastal zones
- Rapid development of urban zones
- Modelling and observations

Key Questions for Themes

- What are the major drivers for change and variability?
- What are the vulnerabilities of communities and ecosystems?
- What are the options for responding to those vulnerabilities?

Adaptation of Communities in Himalayan Headwaters to Environmental Change

Prakash C Tiwari, Kumaon University, India



Prakash C Tiwari

Community Responses & Adaptation

- 27% villages have replenished water sources through water conserving forestry and horticultural practices
- 25% villages managed depleting water through rainwater harvesting schemes based on local indigenous knowledge
- 19% families cultivated less water requiring and drought resistant food as well as cash crops
- 21% households altered traditional cropping pattern & adjusted crop rotation
- 11% households cultivated abandoned land
- 27% families relocated their agriculture.
- 7% families abandoned agriculture & switched over to secondary & tertiary activities
- 5% households out-migrated the region
- 11% decreased consumption of low productive and expensive food items

Mountain Theme Workshops

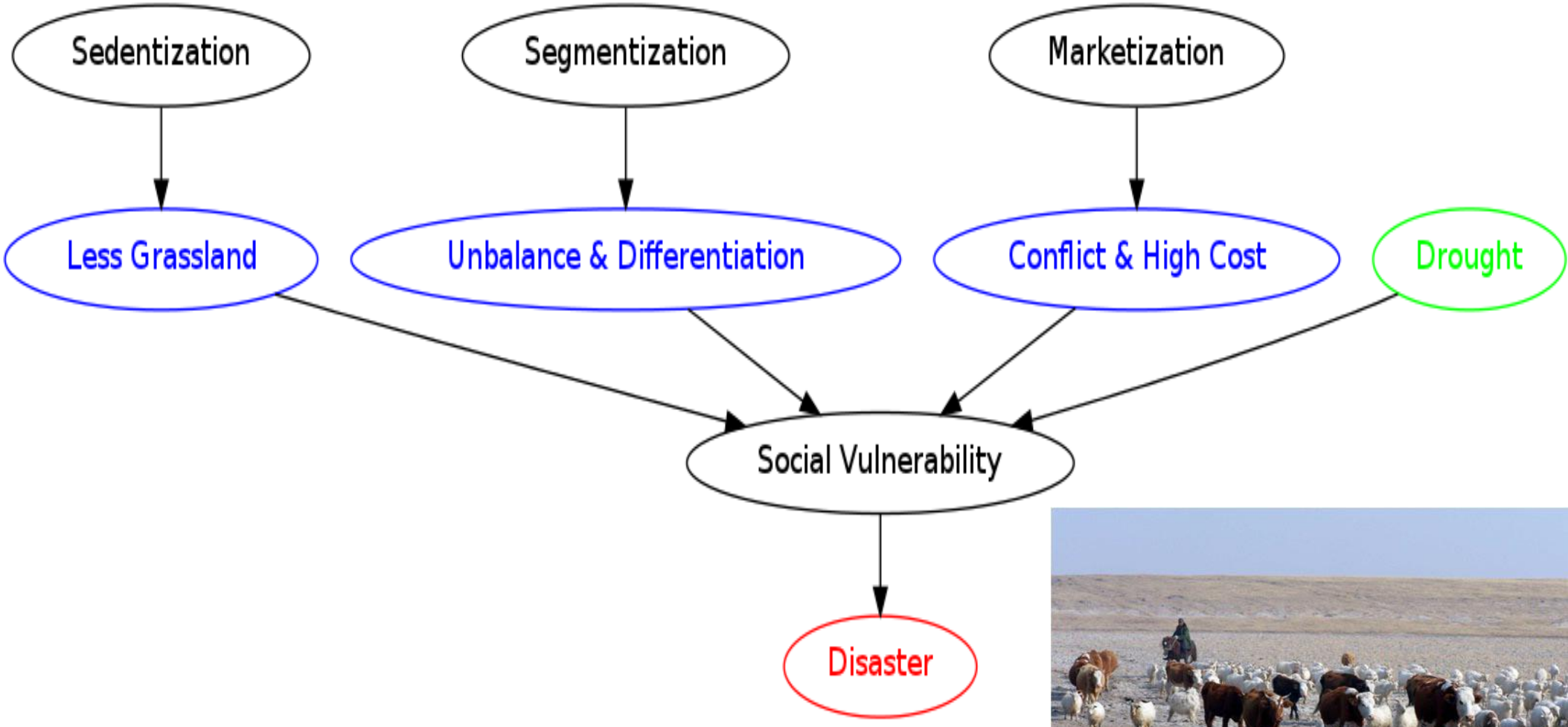
- **June 2012, Pokhara, Nepal**
  - Joint with International Centre for Integrated Mountain Development (ICIMOD)
  - Drafted strategic plan
  - Rio+20 call for development of mountain zones
- **March 2013, Guangzhou, China**
  - Case studies in downstream region of Himalayas in Bangladesh; including AusAID adaptation projects (ANU & Monash), CAS international project on climate change in Koshi Basin

Drought Impact on Rangeland Herders in Inner Mongolia

- Study by Xiaoyi Wang, CASS

- Pastoral village of 80 households
- 10,000 livestock
- Decade-long drought & rising temperature affected pasture & water availability
- Herders' incomes significantly reduced
- But there are social factors

Social Factors interacting with Drought Impacts



Xiaoyi Wang, CASS

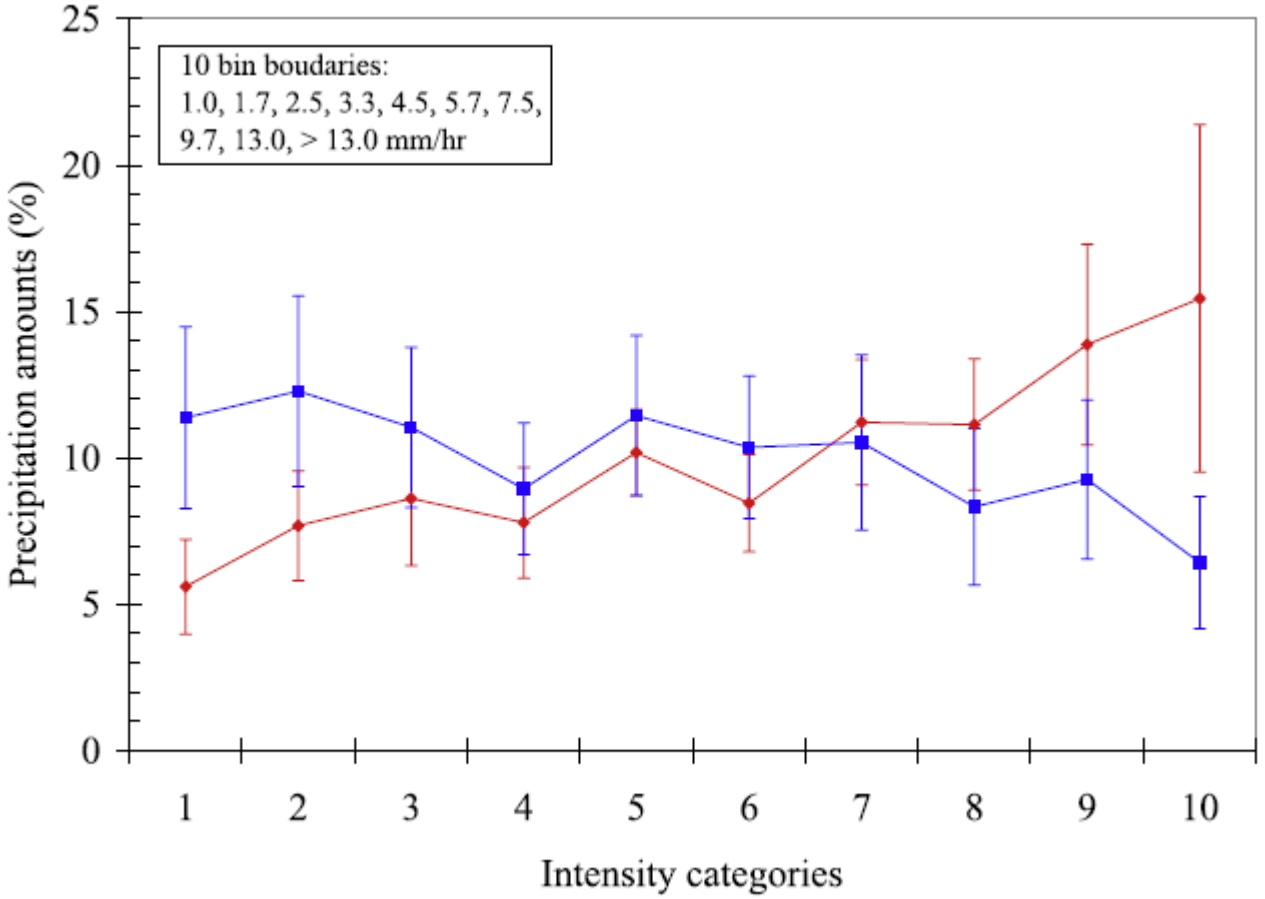
New Dryland Projects

- CDKN project on “Climate Compatible Development in Dryland Systems of Mongolia and Surrounding Asian Systems”, D. Ojima, K. Gavin and Chuluun, 2012-2014

- MOST international project “Disaster and risk management in Mongolian Plateau”, Heqing HUANG, 2012-2015

- APN CAPaBLE: Capacity Building to Study and Address Climate Change-induced Extremes in Northern Asia (MAIRS-NEESPI joint activity)

Impact of Warming on Precipitation



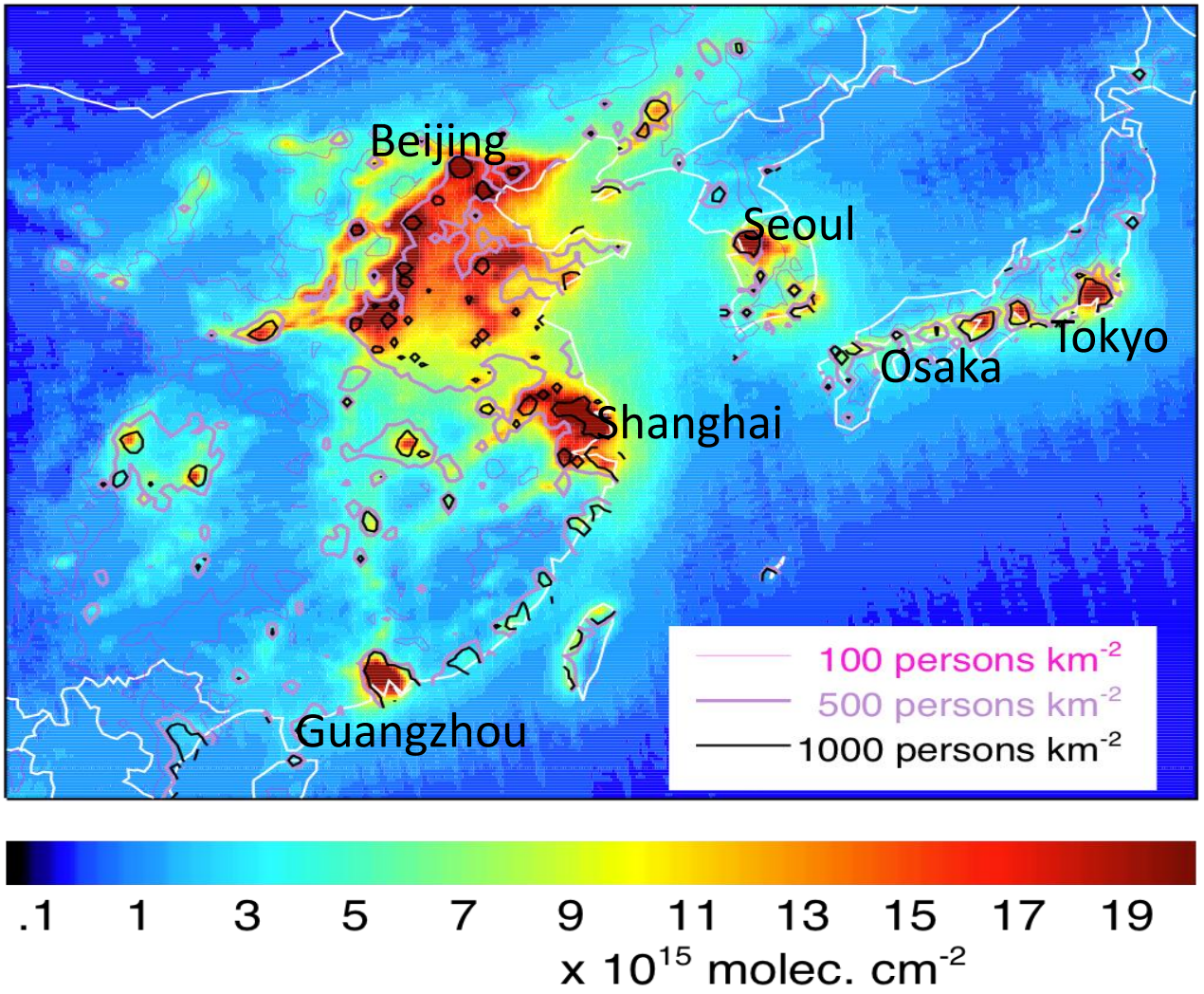
Comparison of precipitation intensity in Taiwan for the two coolest years (blue) and two warmest years (red) over the period 1961-2005

Find similar result for GPCP data

Response is larger than expected from Clausius-Clapeyron

S. Liu et al. (2009)

Air Pollution in Mega-Cities



IGBP/IGAC Program

Primary pollutant concentrations are expected to increase as:

$$C \sim N^{\beta}$$

where N: population

$$\beta = 0\text{–}1$$

Parrish and Zhu, 2009, Science

Urban Projects

- APN ARCP project: Development of an integrated climate change impact assessment tool for urban policy makers, 2012-2015

-Chinese Academy of Science/Netherlands Organization for Scientific Research: climate change and water supply in Pearl River Delta, 2011-2014

- JST-MOST joint program: Impact of Asian Megacity Development on Local to Global Climate Change, 2010-2013

Modelling Studies

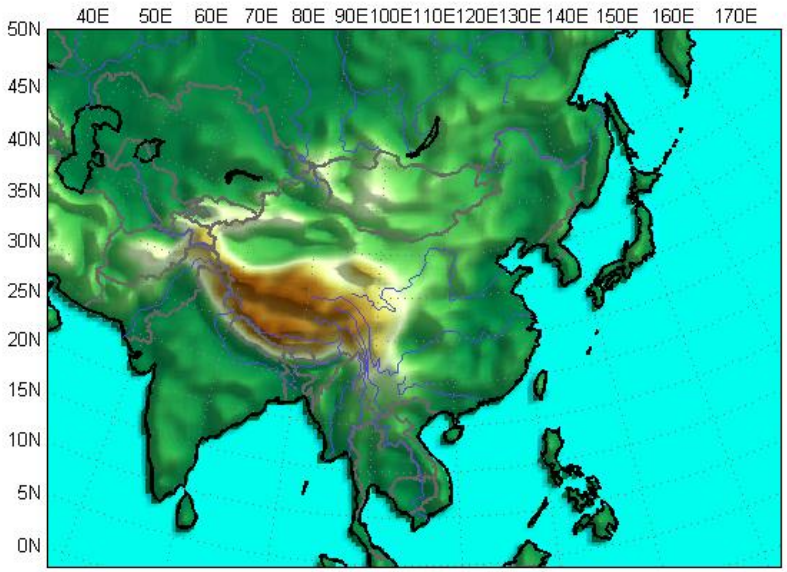
- Regional Modelling Inter-comparison Project (RMIP)

- Land surface (ecosystem) modelling inter-comparison (ADMIP)

- Regional urban climate modelling project (JST-MOST)

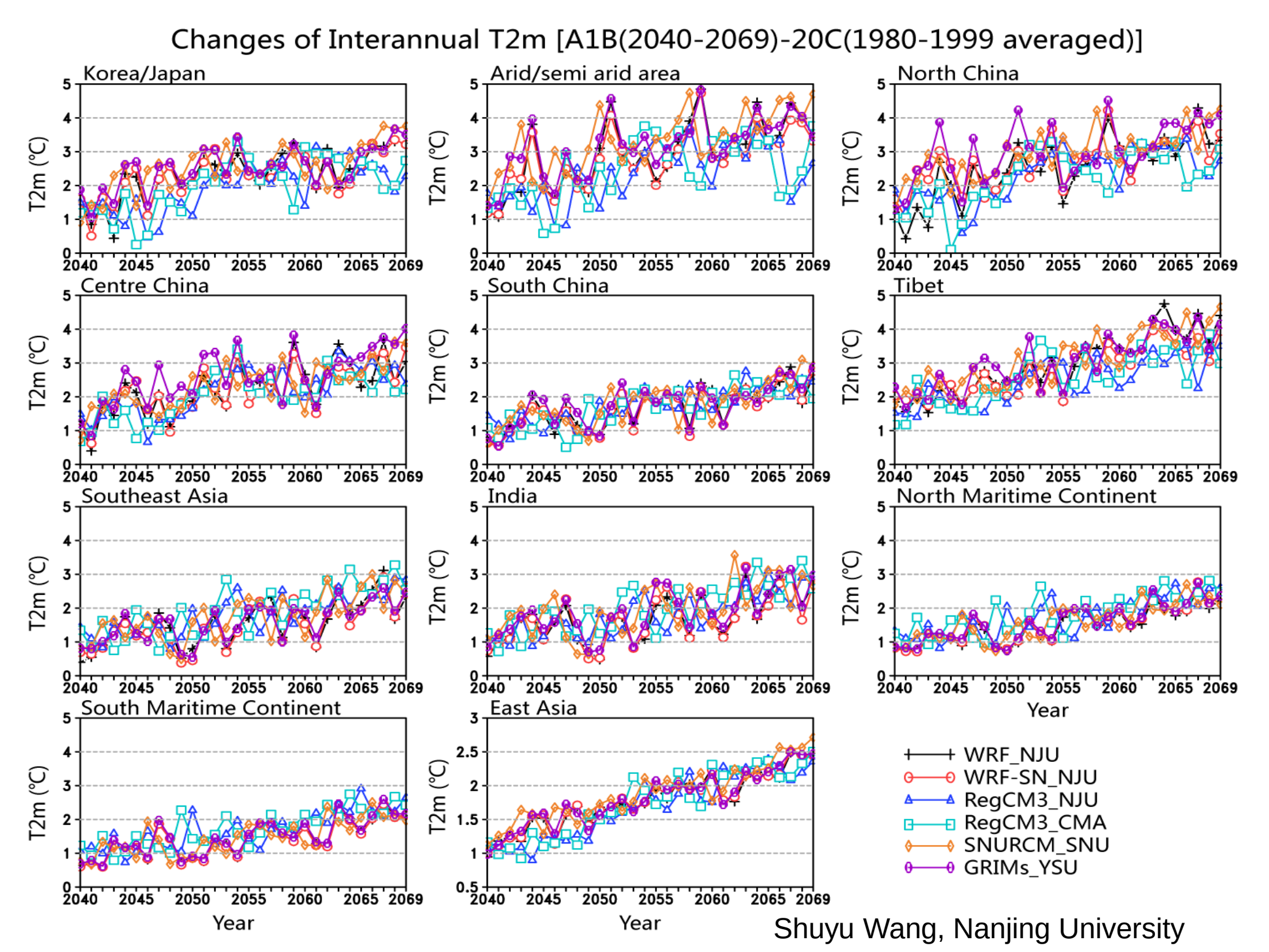
- Joint activity with WCRP CORDEX across monsoon Asia

RMIP Simulation Design



Integration Domain: (45-165E, 0-45N)
Resolution: 60KM (for whole area, downscaling to 30KM in some key areas)
Participating Countries: China, Japan, Korea, Australia, US
Regional Models: 6 models in RMIP II, and 9 models in RMIP III
Simulation Periods: 1978-2000 for control, 2038-2070 for projection, A 2-year spin-up time is applied to both control and projection runs

Shuyu Wang, Nanjing University


Changes of Interannual T2m [A1B(2040-2069)-20C(1980-1999 averaged)]
Korea/Japan
Arid/semi arid area
North China
Centre China
South China
Tibet
Southeast Asia
India
North Maritime Continent
South Maritime Continent
East Asia
T2m (℃)
Year
WRF_NJU
WRF-SN_NJU
RegCM3_NJU
RegCM3_CMA
SNURCM_SNU
GRIMs_YSU
Shuyu Wang, Nanjing University

RMIP Activities

- Regional projections for 2040-2070 with uncertainties

- Data sharing

- Development of integrated assessment tool for urban policy and planning (UrbanCLIM – Yinpeng Li)

- High-resolution precipitation events

- High-resolution urban simulations

- High-resolution mountain simulations in collaboration with ICIMOD

Asian Dryland Model Intercomparison Project (ADMIP)

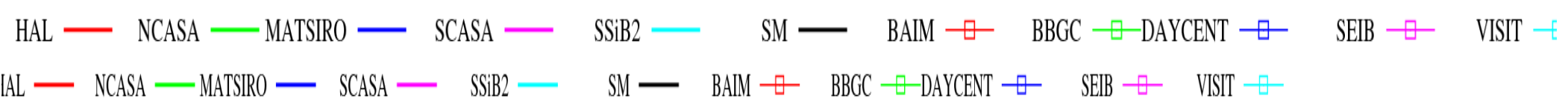
- Led by Jun Asanuma and Dennis Ojima

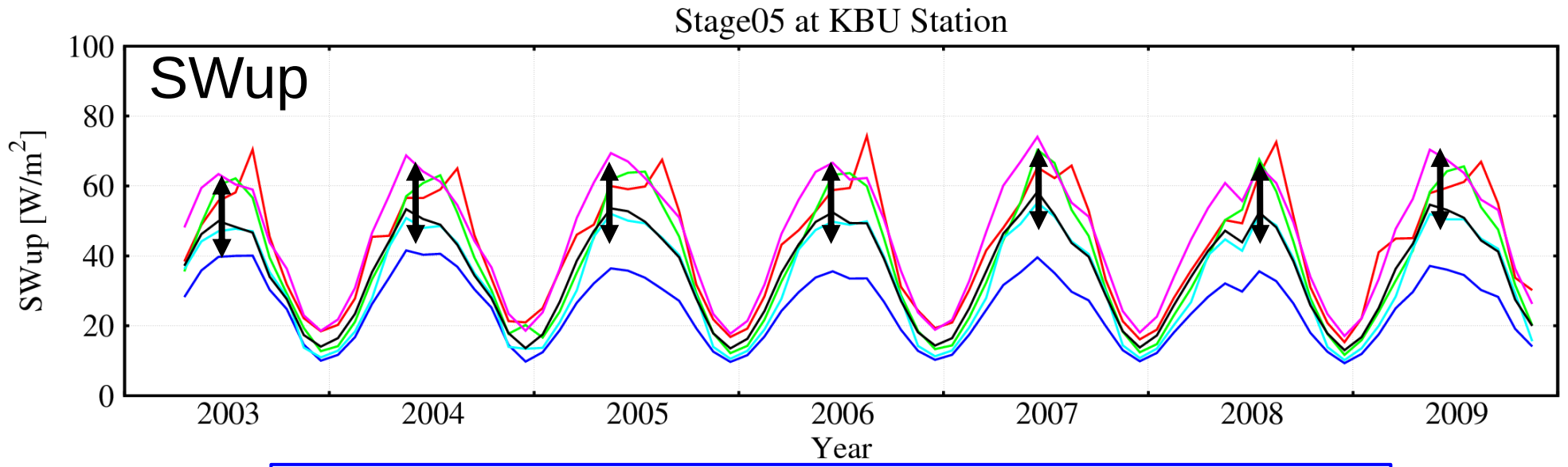
- Support from APN, MAIRS and MEXT-JSPS

- Few observations and relatively poor performance of LSM in Asian drylands

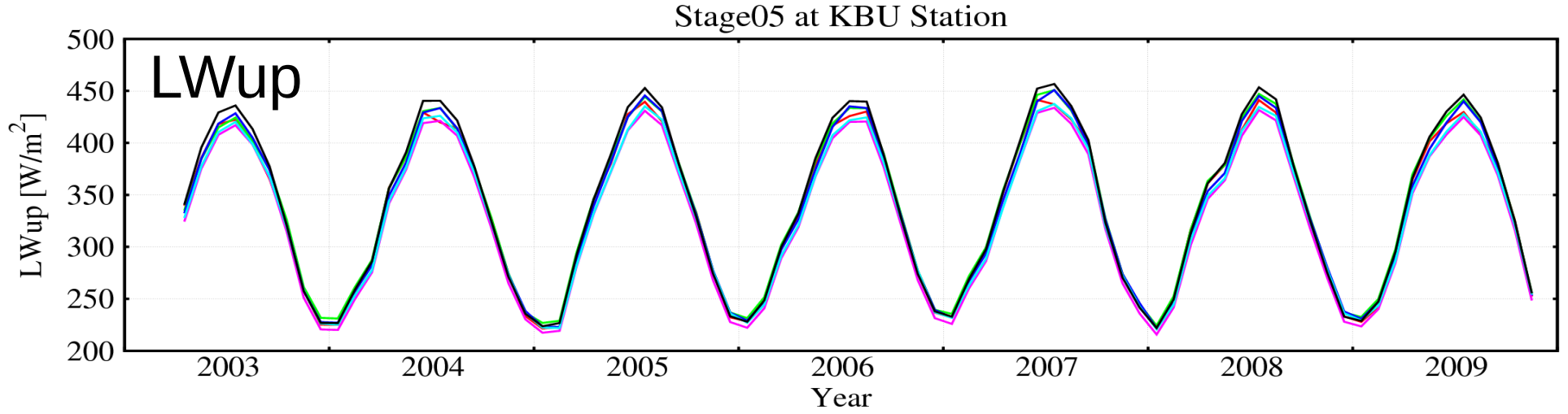
- Data from sites at Tongyu, China; Kherlen Bayan Ulaan, Mongolia (AsiaFlux)

- 7 LSMs and 7 TEMs from Japan, China, Korea, USA, Australia





SWup and LWup differences among model results is 10 - 30 W/m2.



Kazuaki Yorozu, Kyoto University

Conclusions

- MAIRS has focus on key global change issues for monsoon Asia

- Developed links between research groups across region

- Established links across disciplines

- Established links between regional and global research

- Aims to provide regional connection for Future Earth Program

MAIRS Open Science Conference 2014

Future Earth in Asia

April 7-10, 2014, Beijing, China

Objectives:

✓To report the latest research on integrated studies in Asia-Pacific region

✓To promote the research of both natural and social scientists

✓To promote the research by young scientists from the region

✓To promote multi-disciplinary studies and the new ICSU-ISSC Future Earth in Asia-Pacific region

✓To discuss the implementation of the Future Earth initiative