

Overview of Monsoon Asia Integrated Regional Study (MAIRS)



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Monsoon Asia Integrated Regional Study



Earth System
Science Partnership



The vision of MAIRS is “To significantly advance understanding of the interactions between the **human-natural components** of the overall environment in the monsoon Asian region, and implications for the global earth system, in order to support strategies for sustainable development.”



MAIRS in the Region



- + Promote new researches in global change sciences
- + Initiate new research projects nationally and internationally
- + Provide broad platform to show the visibility of Asian climate change research
- + Coordinate integrated studies among different institutes and stakeholders
- + Capacity building on observations, analysis and modeling.

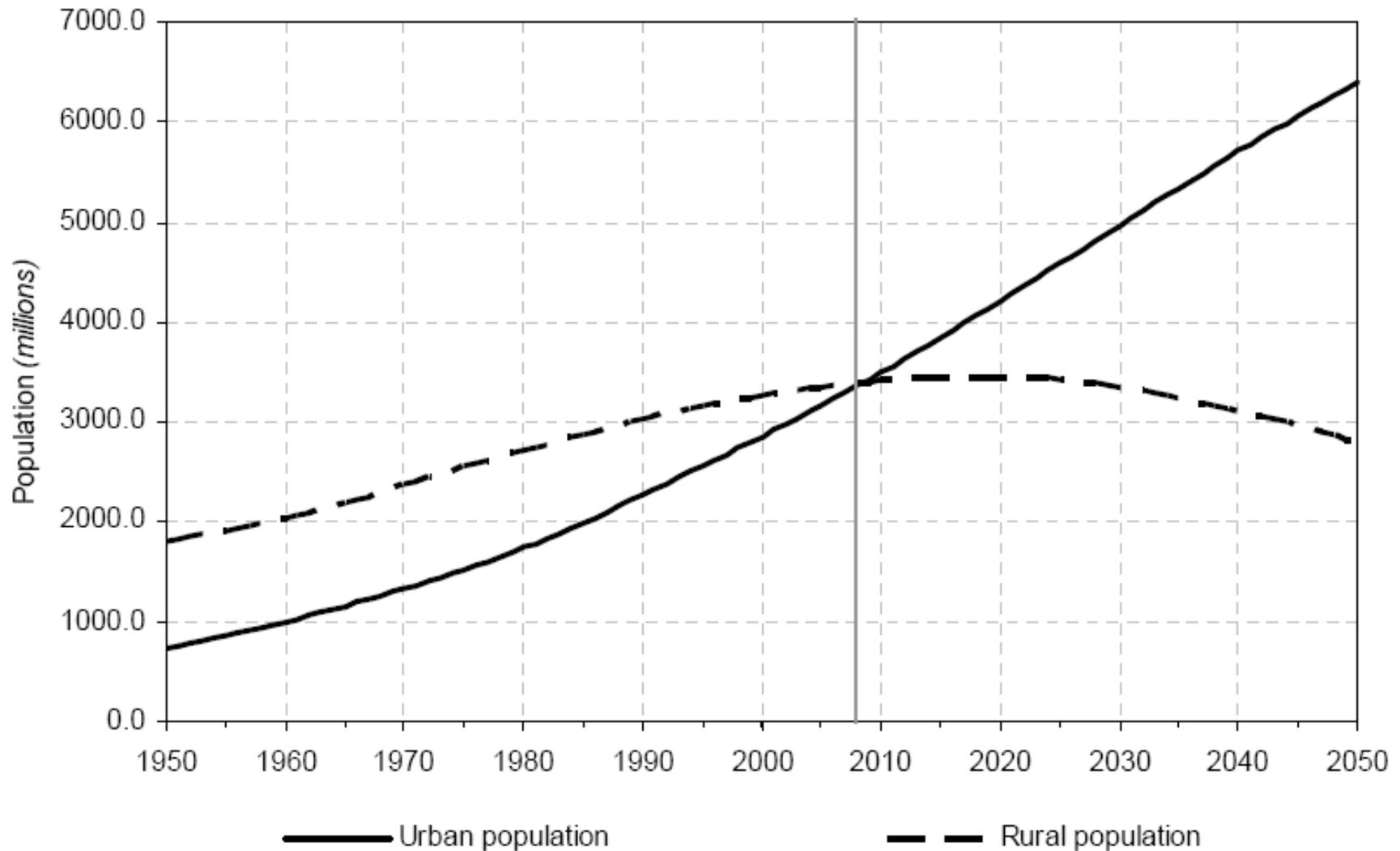
MAIRS working groups

1. Megacity Study (coastal & urban)
2. Dryland Study (semiarid & arid)
3. Mountain Study
4. Regional Modeling and cross cutting

1, MAIRS Megacity Study

Urbanization and Industrialization: By 2008, more than half of human live in cities

Urban and rural populations of the world, 1950-2050



China Urbanization: Current and Future

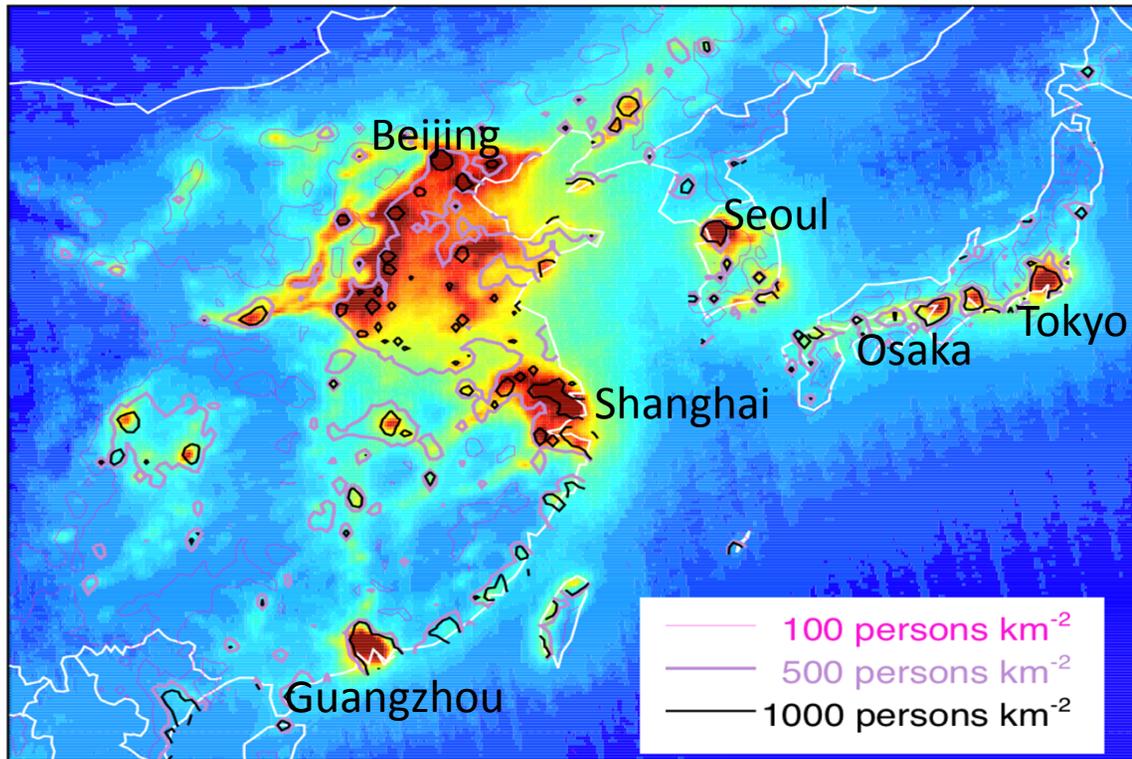
	2005	2010	2020	2030	2040	2050
Population	1307.56	1360.00	1440.00	1470.00	1470.00	1440.00
Urbanization rate	43%	49%	63%	70%	74%	79%
Urban Population	562.12	666.40	907.20	1029.00	1087.80	1137.60
Person per Household	2.96	2.88	2.80	2.75	2.70	2.65
Urban Household	189.91	221.94	288.00	336.76	364.78	380.38
Rural Population	745.44	693.60	532.80	441.00	382.20	302.40
Person per Household	4.08	3.80	3.50	3.40	3.20	3.00
Rural Household	182.71	189.68	181.03	159.97	151.59	144.00

As the prediction, the total population in China will not change very much from 2010 to 2040, but the urbanization rate will be increased from 50% to 74%, and to 79% in 2050. It means there will be 1.1 billion people living in the urban areas.

MAIRS Research Agenda

- ✦ Aerosol-climate interaction
- ✦ Urbanization, Land cover change and local/regional water cycle
- ✦ Mega-city risk assessment and disaster management (flood, drought, heat wave et. al)

The population dependence of pollutant concentrations

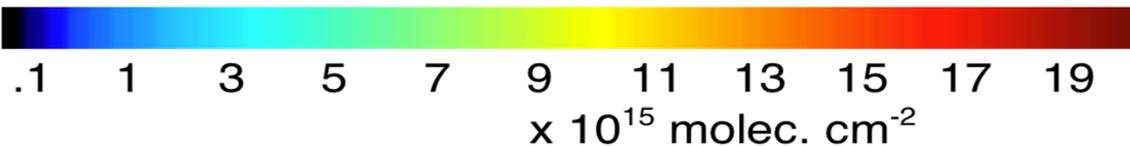


Primary pollutant concentrations are expected to increase as:

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

N: population

$$\beta = 0-1$$



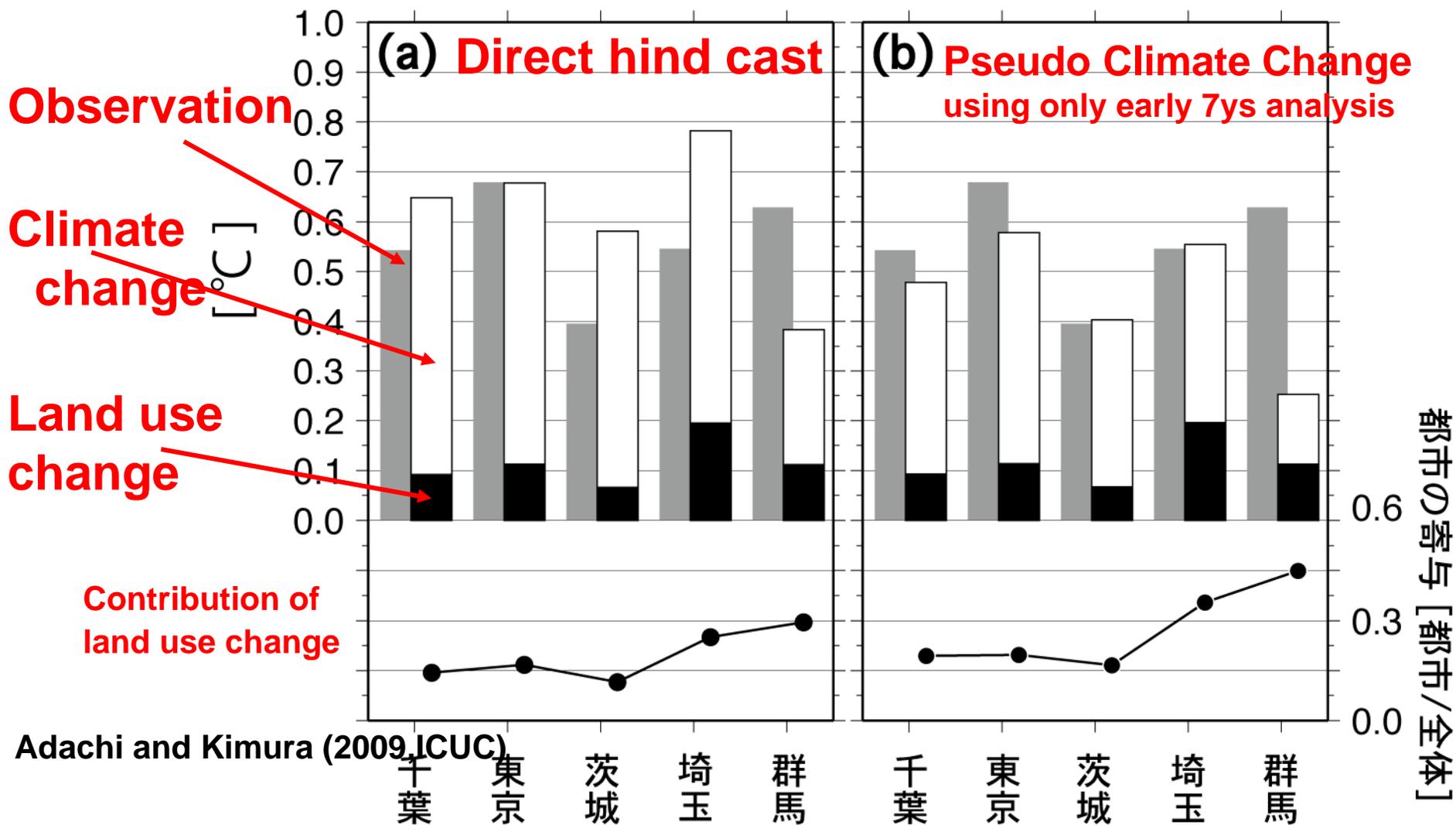
(Randal Martin)

(Parrish and Zhu, 2009)

Surface temperature difference
between two 7ys centered at 1987 and 1997

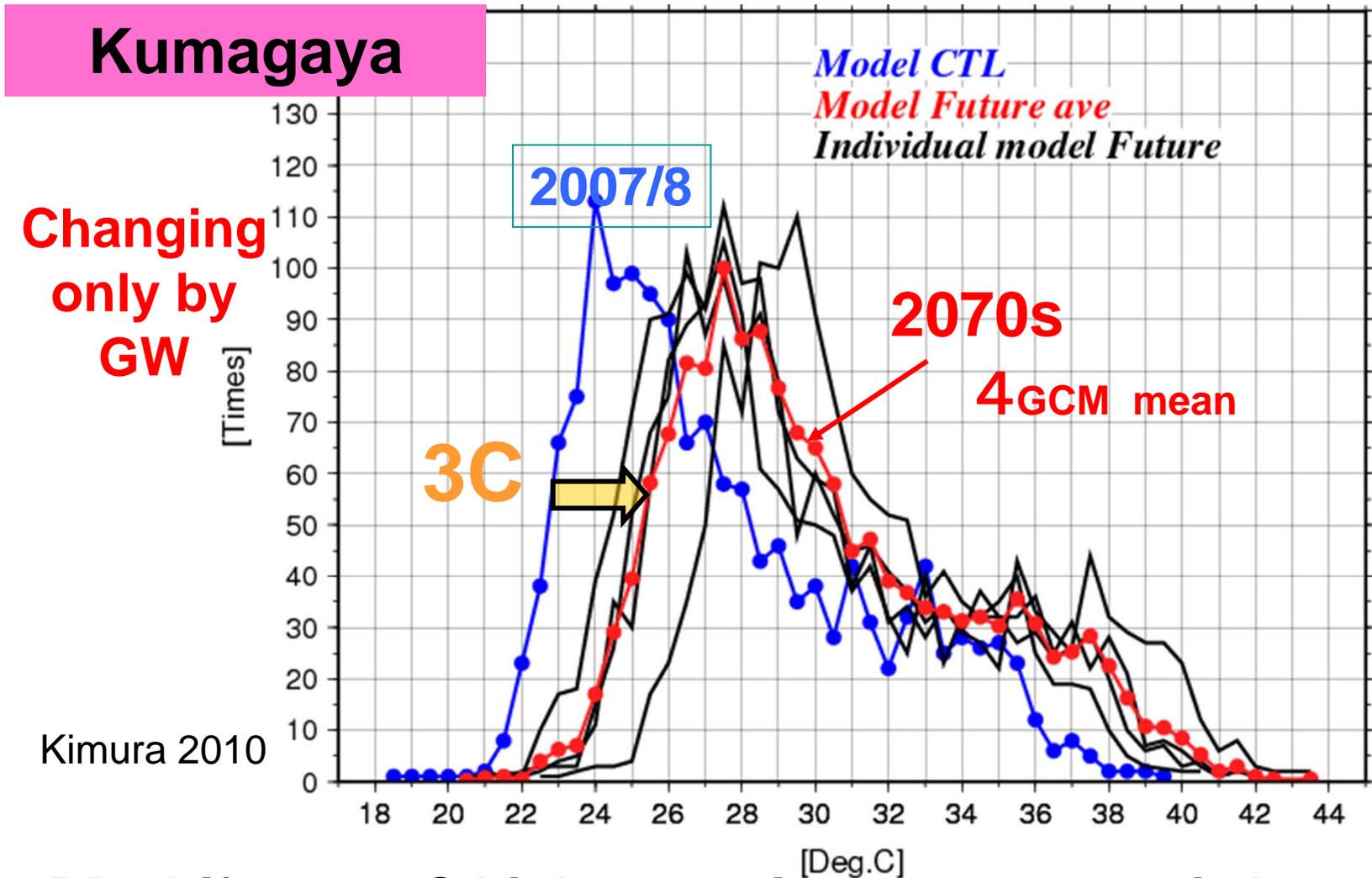
SCTL97-SCTL87

SP80L87-SCTL87



Contribution from GW is 3C (2070-2007)

Probability Density of Hourly Temperature during August, 2070s



PD shifts to ~3C higher, maximum extreme will be 43°C.

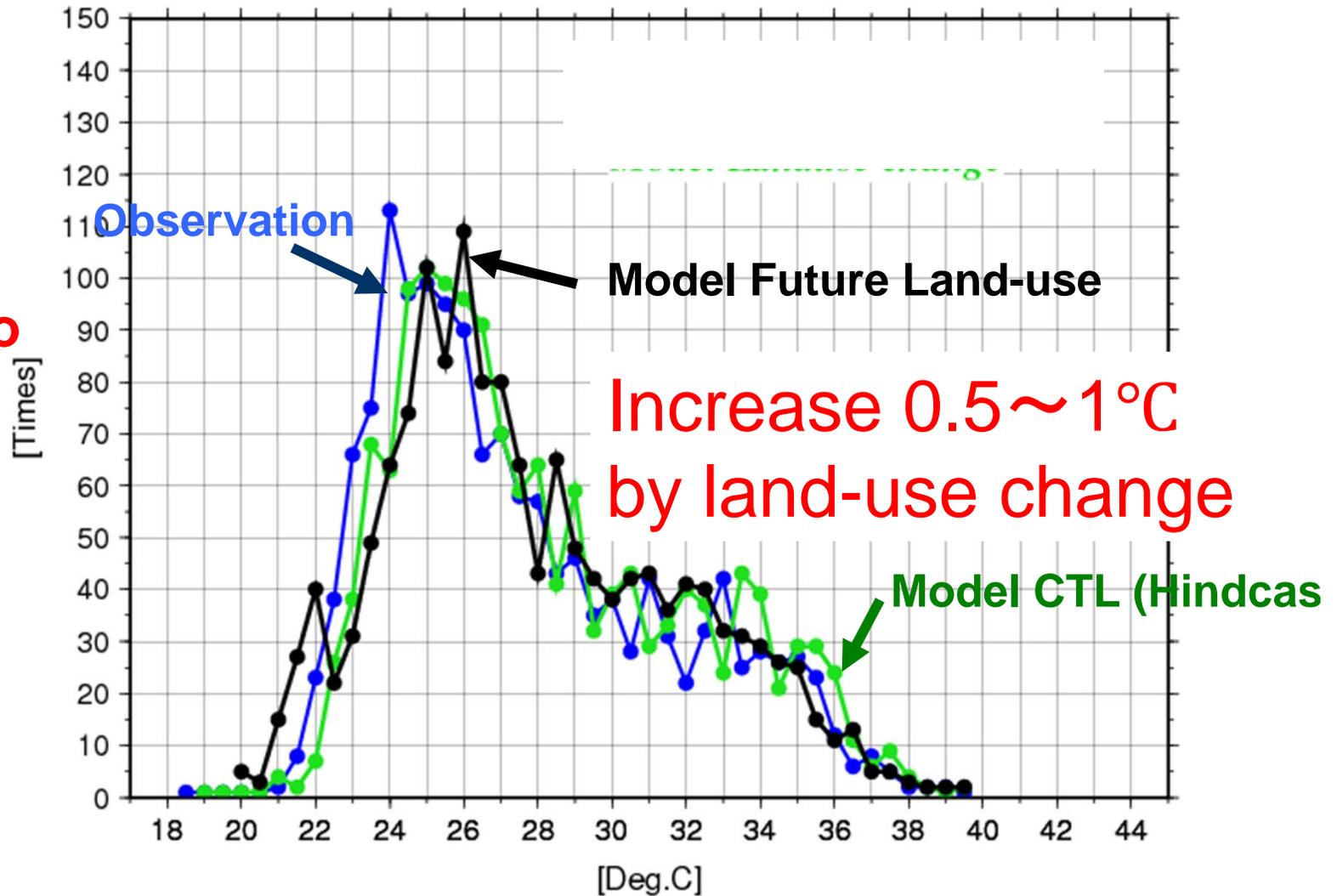
Contribution from Urbanization is 0.5-1C

Probability Density of Hourly Temperature during August

Kumagaya

Station=kumagaya 2006-2007/08
Frequency of surface temperature at lowest level

**Changing
only by
urban ratio**



Kimura 2010

Wuhan, 18 June 2011



Beijing, 23 June 2011



@水葆拉
weibo.com/watersama

Urban flood



中新网
ChinaNews.com

1. Temperature Increase 1°C, the frequency of heavy rain increase 50-100% (Shaw Liu et al., GRL, 2009)



2. Higher temperature lead to faster chemical reaction rates, higher emission and water vapor, and consequently higher concentration of O_3 (Millstein and Harley, 2009).

MAIRS Megacity Task Teams

1. Comprehensive **observing network** in typical megacities of Asia
2. Recognizing the **evidences** of climate changes caused by urbanization
3. **Modeling** of urbanization impacts on regional/global climate

Megacity Modeling Task Teams

- 1, Atmosphere aerosol modeling
- 2, regional urban climate modeling
- 3, GCM modeling

The 2nd MAIRS Workshop on Impact of Urbanization in Asia to local/regional/global Climate

- # Date: 21-22 Dec 2011
- # Location: Suzhou city,
China
- # Sponsors: MOST-China,
JST-Japan, MAIRS

2, MAIRS Dryland Study

Environmental changes in Dryland

Asia (Mongolia, China, India, Pakistan)

- # Global warming and extreme events (drought, snow storm, flood)
- # Intensive agricultural activity and overuse of ground water
- # Overgrazing and land degradation
- # Local industry such as oil/gas/coal mining, fuel-burning power plants, cashmere etc.

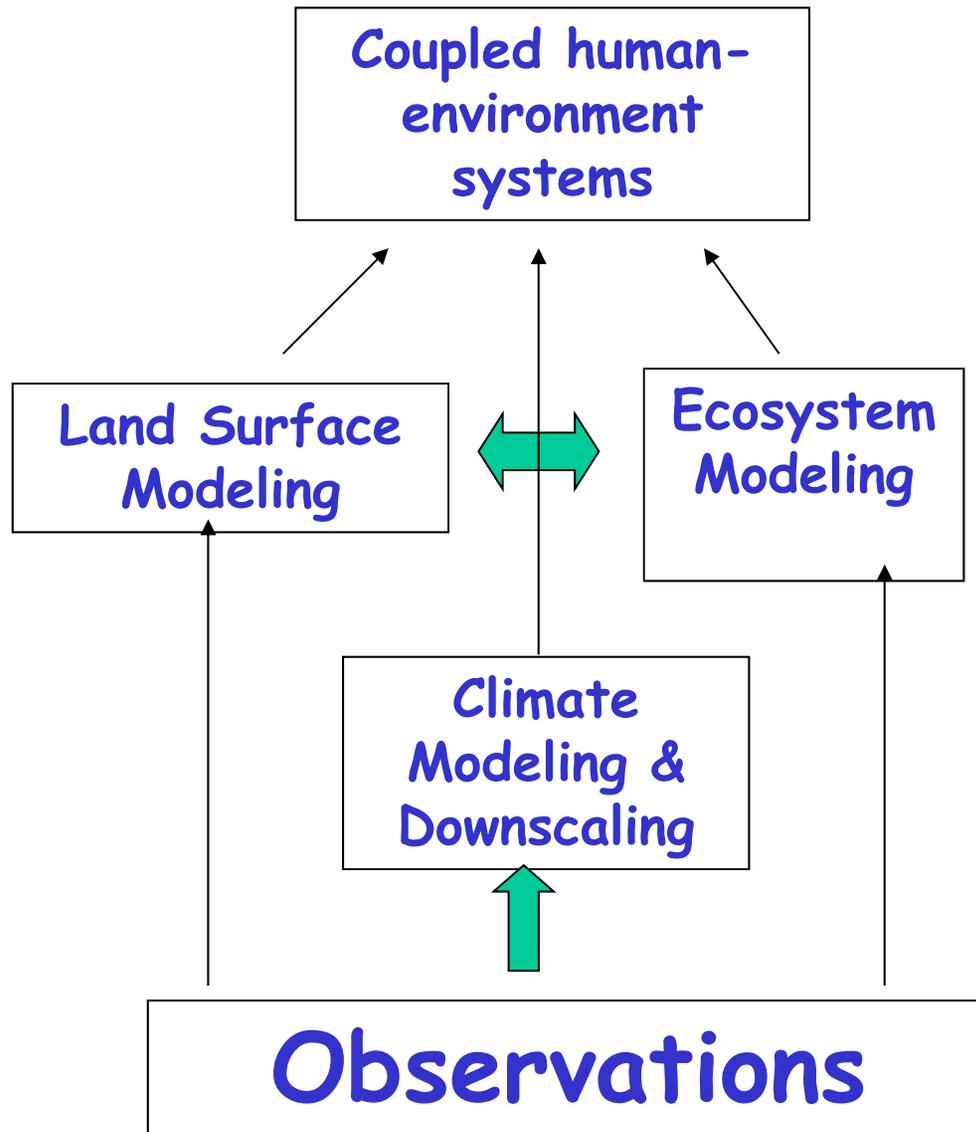
Main Research Agenda for MAIRS

- ✦ global warming impacts to water resource, water cycle and ecosystem services in dryland Asia
- ✦ Assessment of vulnerability of human-environmental system to climate changes in the region
- ✦ Feasible resilient adaptation strategies to off-set risks of climate impacts

Dryland Task Teams

1. Dryland climate change dynamics
2. Dryland coordinated observation network
3. Dryland land-surface modeling (ADMIP)
4. Coupled human-environment system (CHE)

Structure of Dryland Task Teams



Dryland Task Team on “Coupled Human-Environment Systems (CHE)”

To assess the vulnerability of dryland Coupled Human-Environment (CHE) systems in the MAIRS region and to develop and evaluate various coping strategies to global changes in the MAIRS dryland region.

Tasks of CHE 2011-2012

Develop a research framework for climate-compatible sustainable development strategies which bridges local to national institutions, and integrates across multiple scales of ecosystem services and livelihood strategies of the social-ecological systems

3, MAIRS Modeling

MAIRS Modeling Activities

- Regional modeling inter-comparison (RMIP)
- land surface (ecosystem) modeling inter-comparison (ADMIP)
- Regional urban climate modeling
- Atmosphere aerosol modeling

Dryland Task Team on “land surface modeling Inter-comparison” (ADMIP)

To evaluate and improve land surface models (LSMs, energy and water) & terrestrial ecosystem model (TEMs, carbon) through offline model inter-comparison using data obtained at Asian dryland, towards better reproduction and prediction of land surface state using improved models, and necessary capacity building.

Planned ADMIP Workshop

- + Date: 1-2 Dec 2011
- + Location: Sapporo city,
Japan
- + Sponsors: APN, MEXT-
Japan, MAIRS

Lessons from MAIRS

- ✓ More focused on physical processes
- ✓ Engaging more social scientists to MAIRS, looking for solutions of climate change adaptation
- ✓ Assessment of current and future water/land resources (availability) in regional level
- ✓ Data sharing internationally

谢谢!

Thank you!