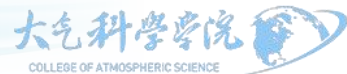




南京信息工程大学  
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# Climate Change and Climate Extremes

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## Dr. Botao Zhou

Professor/Deputy Dean, School of Atmospheric Sciences

Nanjing University of Information Science and Technology (NUIST)

### Education

- 1996-2003: Nanjing Institute of Meteorology, China. *B.S. & M.S (Meteorology)*
- 2003-2006: Institute of Atmospheric Physics, CAS, China. *Ph.D. (Meteorology)*

### Professional Experience

- 2006-2018: National Climate Center, CMA, China. *Assistant Professor-Professor*
- 2018- : School of Atmospheric Sciences, NUIST, China. *Professor*

# Personal Introduction



## Academic Service

- *Lead Author (LA)* of the IPCC WGI AR6
- *Advisor* of the United Nations Secretary-General's High-level Panel on Global Sustainability (GSP)
- *Deputy Secretary-General* of the National Technological Committee on Climate and Climate Change Standardization, China
- *Deputy Chairman* of the Climate Change and Low Carbon Development Committee, Chinese Meteorological Society (CMS), China

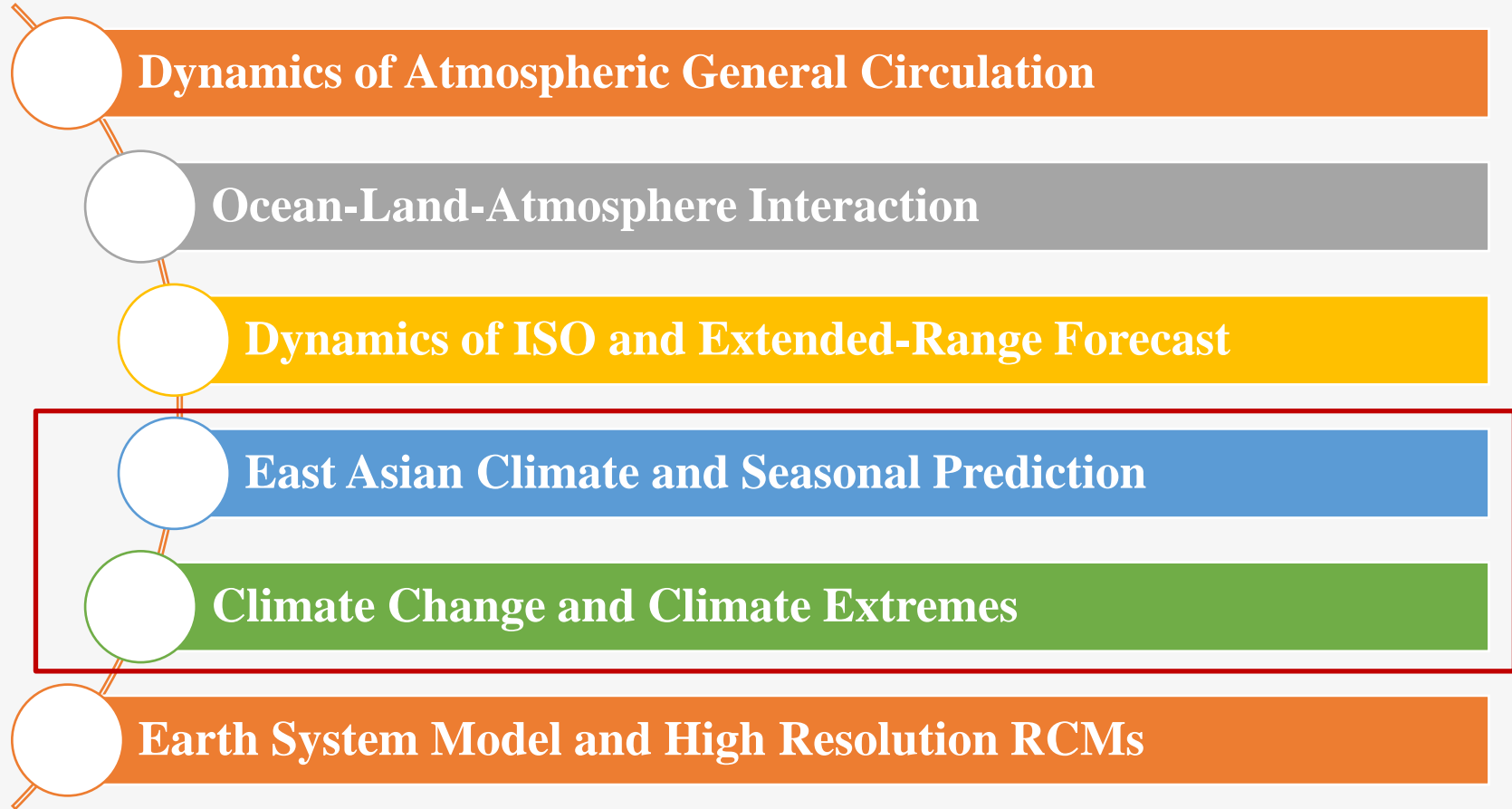
## Honor and Awards

- National Top-Notch Young Professionals of China
- Tu Changwang Meteorological Science and Technology Prize for the Youth, CMS, China
- Zou Jinqing Meteorological Science and Technology Prize, CMS, China
- National Outstanding Youth of Meteorological Science and Technology, CMS, China

# Research Interests



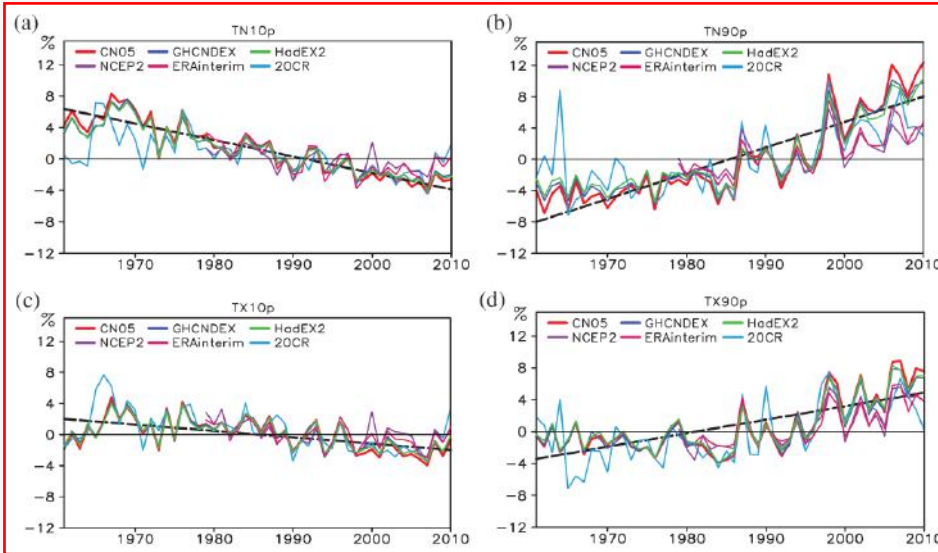
## Climate Research Areas



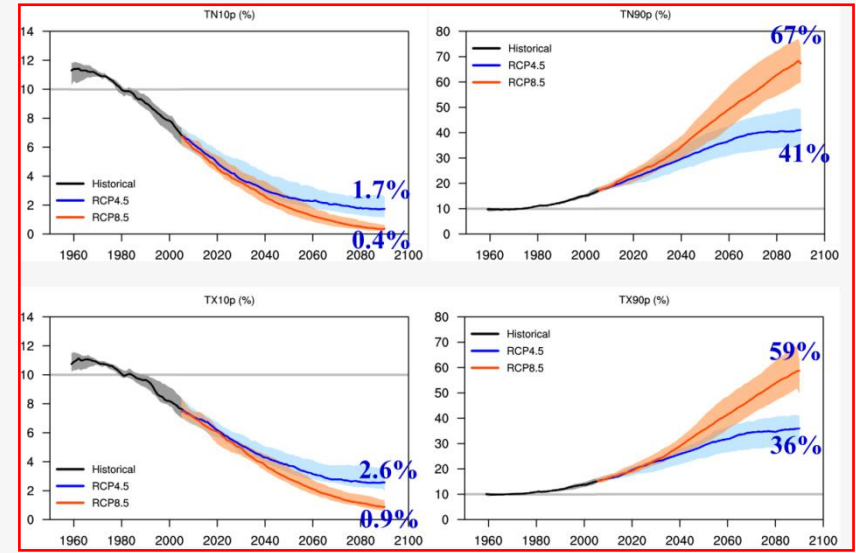
# 1) Changes and Risks of Climate Extremes in China



## Observation



## Projection

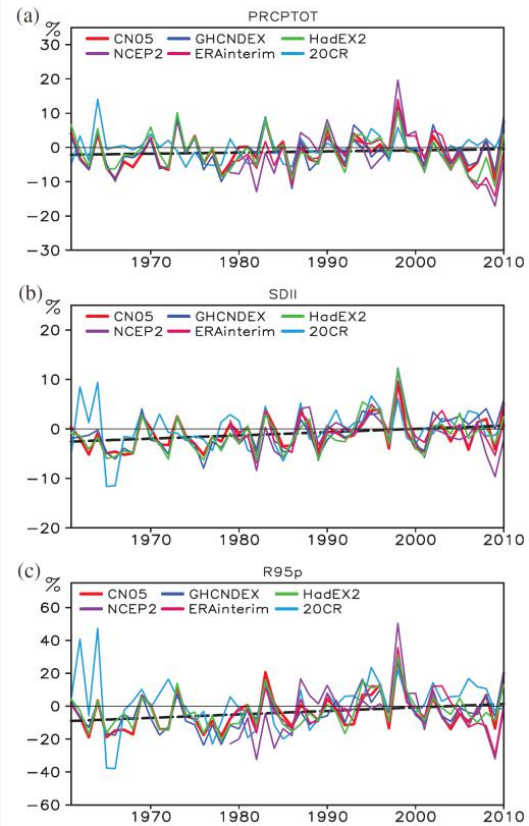


Observed and Projected Changes of Temperature Extremes (ETCCDI Indices) in China

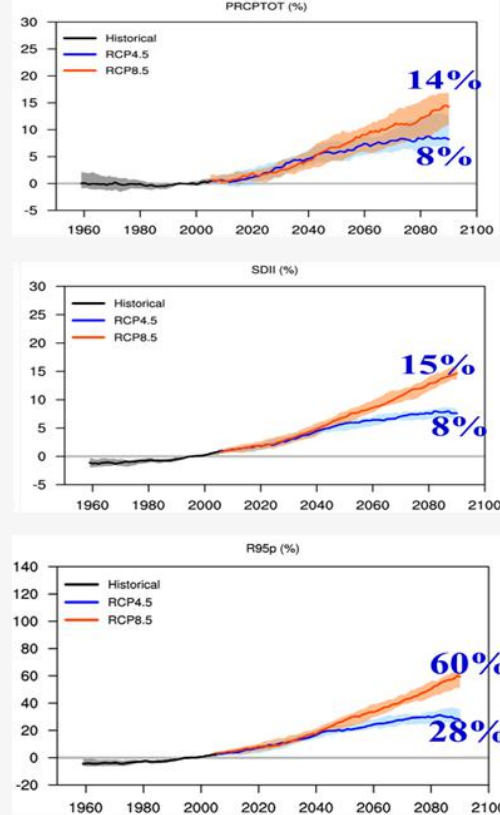


# 1) Changes and Risks of Climate Extremes in China

## Observation

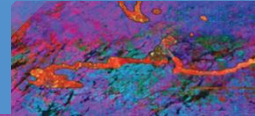


## Projection

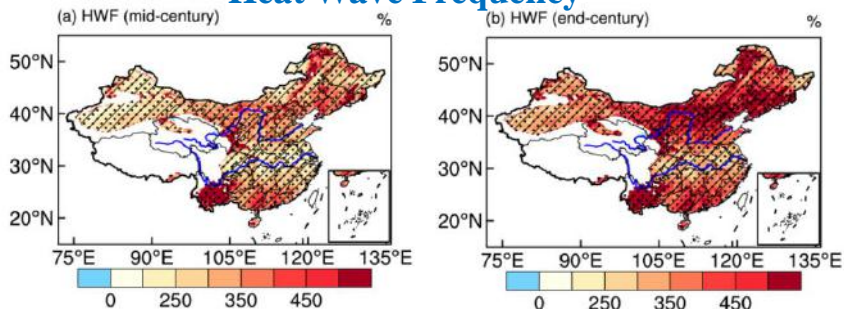


Observed and Projected Changes of Precipitation Extremes (ETCCDI Indices) in China

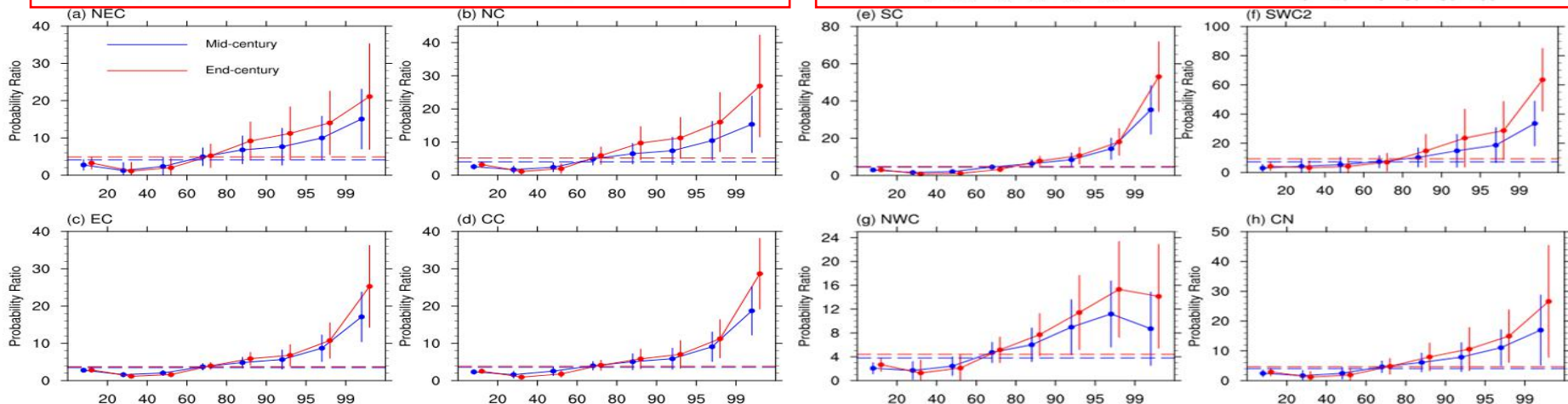
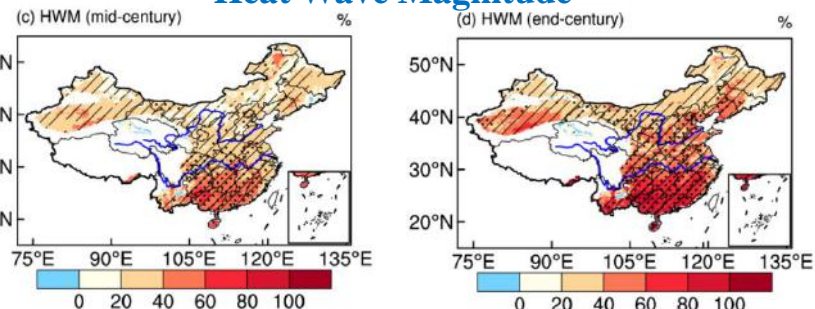
# 1) Changes and Risks of Climate Extremes in China



## Heat Wave Frequency



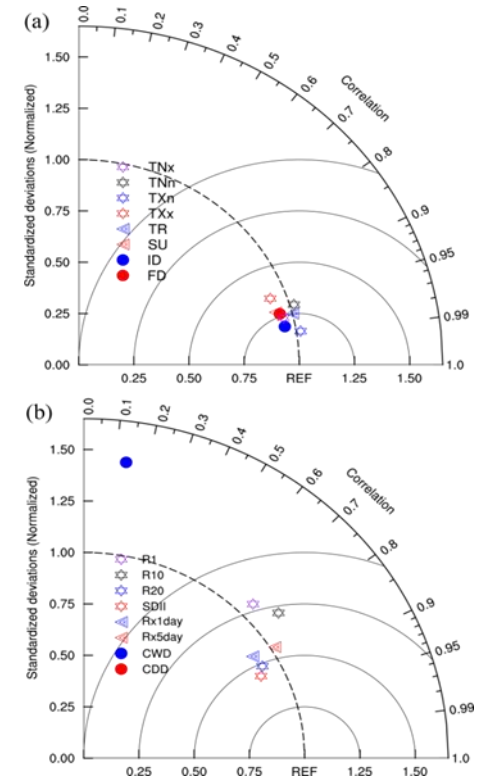
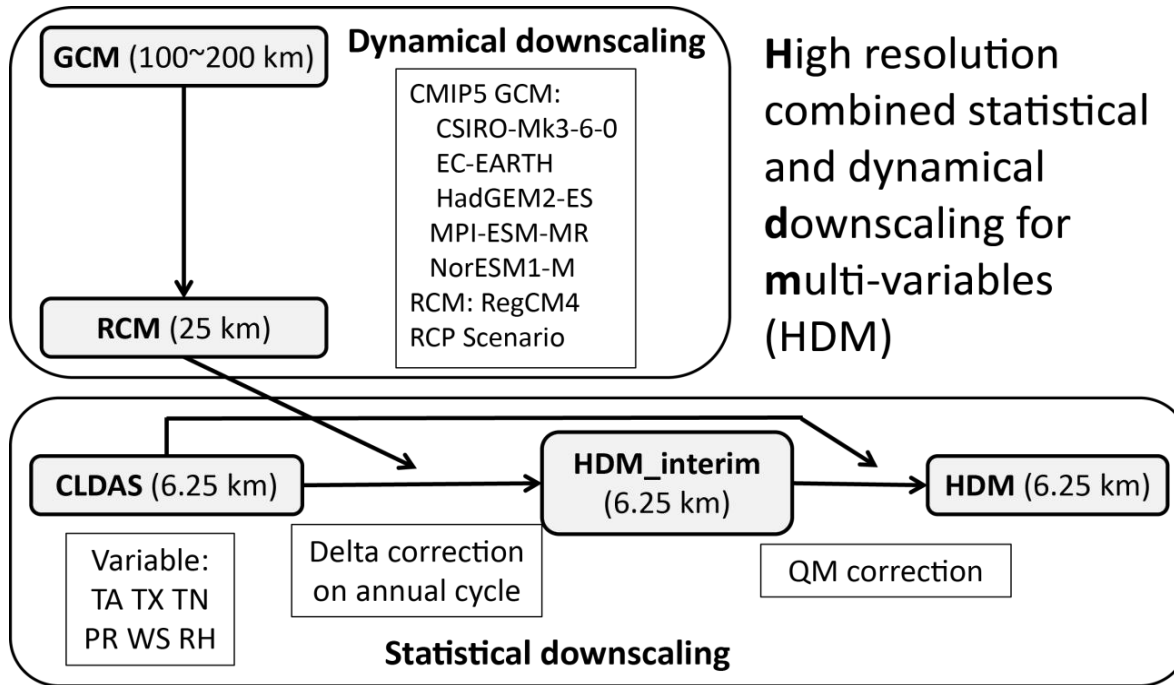
## Heat Wave Magnitude



PRs are higher for rarer HW events; Highest risks for extreme HWs in Southern China

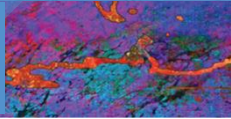
# 1) Changes and Risks of Climate Extremes in China

## Dynamical and Statistical Downscaling of Climate Change Projection



Performance evaluation

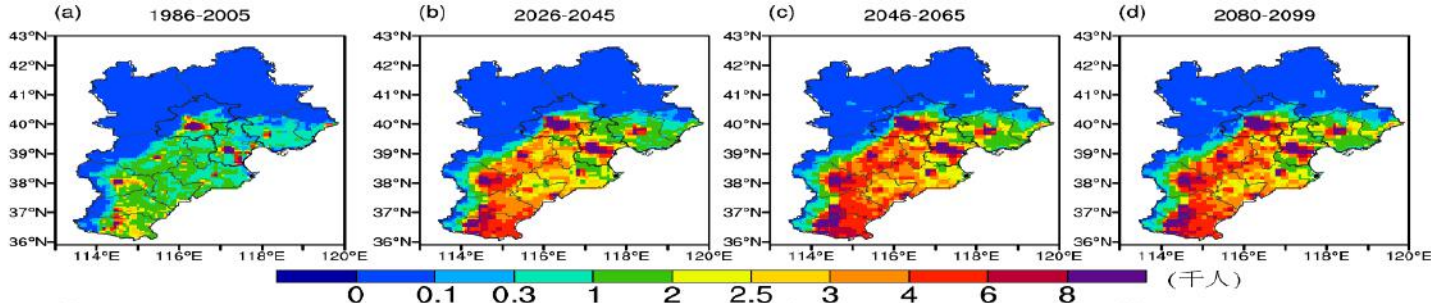




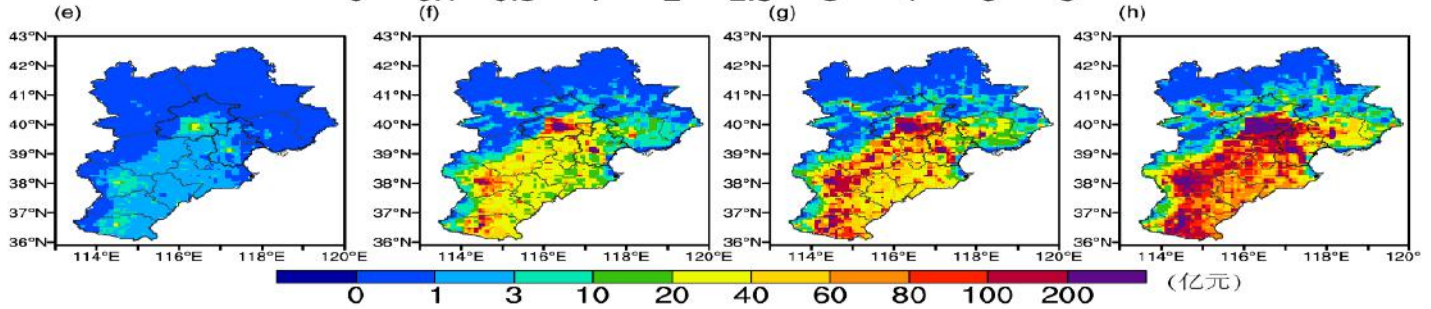
# 1) Changes and Risks of Climate Extremes in China

**Application example:** downscaling projection of changes in population and GDP exposure to extreme heat in the Beijing–Tianjin–Hebei Region of China

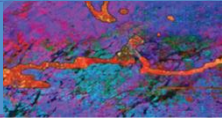
SSP2-4.5  
population



GDP



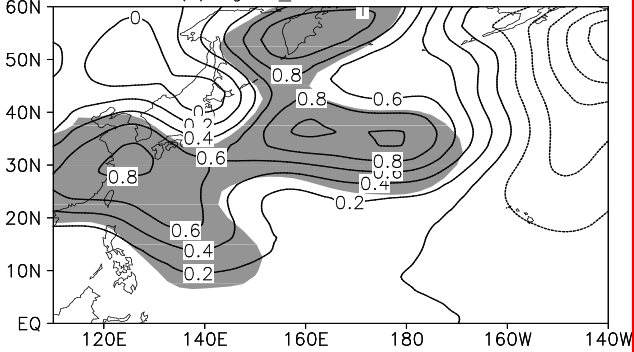
**Projected population exposure: greatest in the mid-century (2.3-fold)**  
**Projected GDP exposure: greatest in the end-century (58.9-fold)**



# 2) Projected Changes in Atmospheric Circulation System

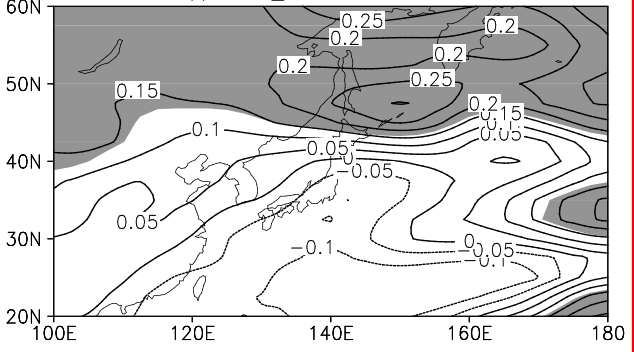
## WPSH

(d) Zg850\_SD,RCP8.5-his,MME



## EASJ

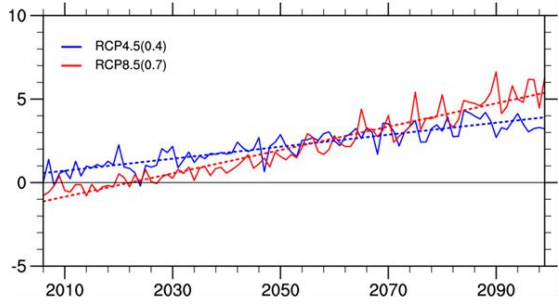
(f) Ua200\_SD,RCP8.5-his,MME



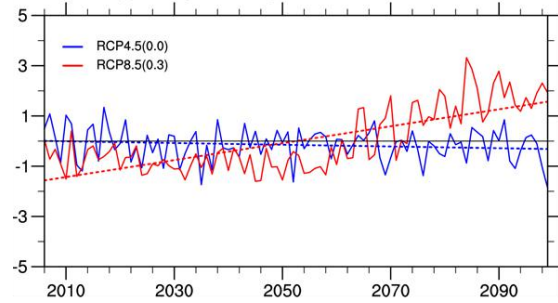
**Projected changes of the IAV of the EASM system in the end-century**

## Hadley Circulation

(a) Change of Hadley Circulation, DJF,  $10^5 m^2 s^{-1}$



(b) Change of Hadley Circulation, JJA,  $10^5 m^2 s^{-1}$

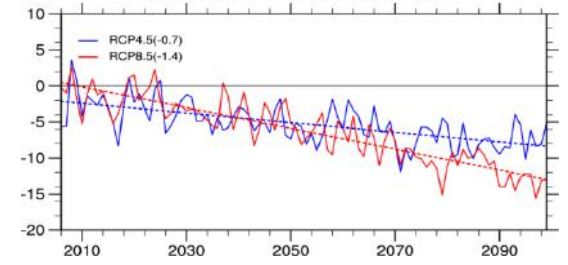


**Weakening of winter HC by the end-century**

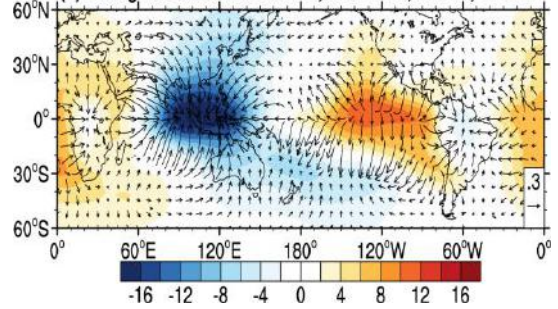
**Weakening in RCP8.5 while little change in RCP4.5 for summer HC**

## Walker Circulation

(c) Change of Walker Circulation,  $10^7 m^2 s^{-1}$

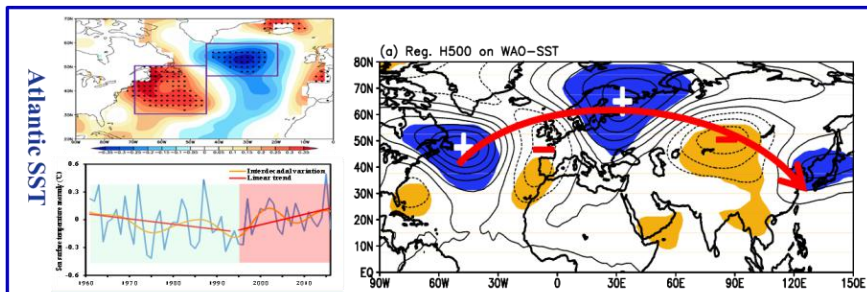
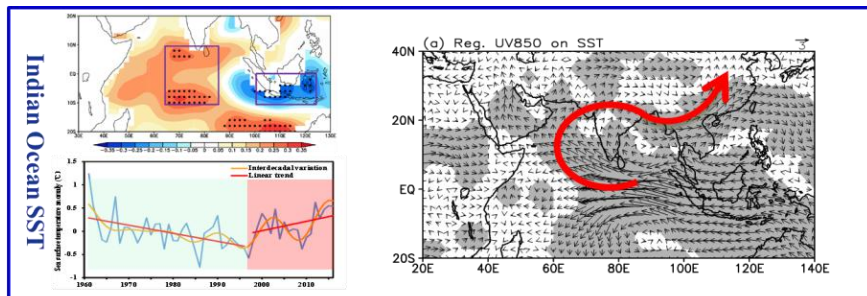


(d) Change of Walker Circulation, 2080-2099, RCP85,  $10^5 m^2 s^{-1}$

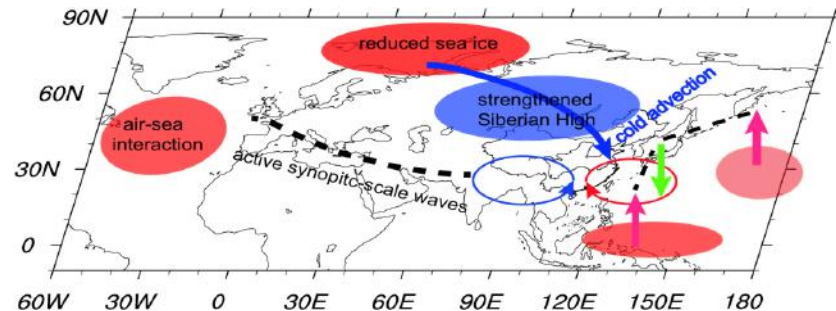
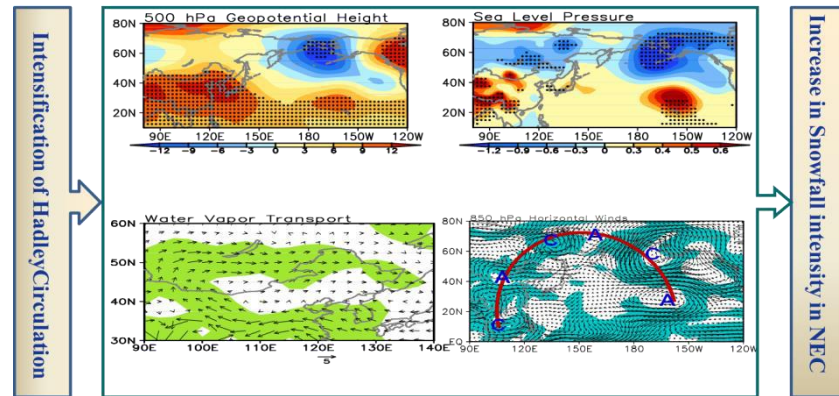


**Weakening of Walker circulation by the end-century**

# 3) East Asian Climate Variability



SST role in decadal transition in trend of autumn rainfall over central China in the late 1990s



Reduced sea ice in the Kara Sea and La Niña-like condition favor the occurrence of intense snowfall events in eastern China

## Research Projects in Progress

- National Natural Science Foundation of China (41991285)–"Impact of Climate Extremes on the Ecosystem in the Mid- and High-latitudes of Asia"
- National Key Research and Development Program of China (2018YFA0606301)– "Projected Changes of Climate and Climate Extremes in the Beijing–Tianjin–Hebei Region of China"



**THANKS**