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Extra-tropical climate variability and climate change

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Outline

- Personal information
- Research interests and highlights
- Collaborative intention

Personal Information



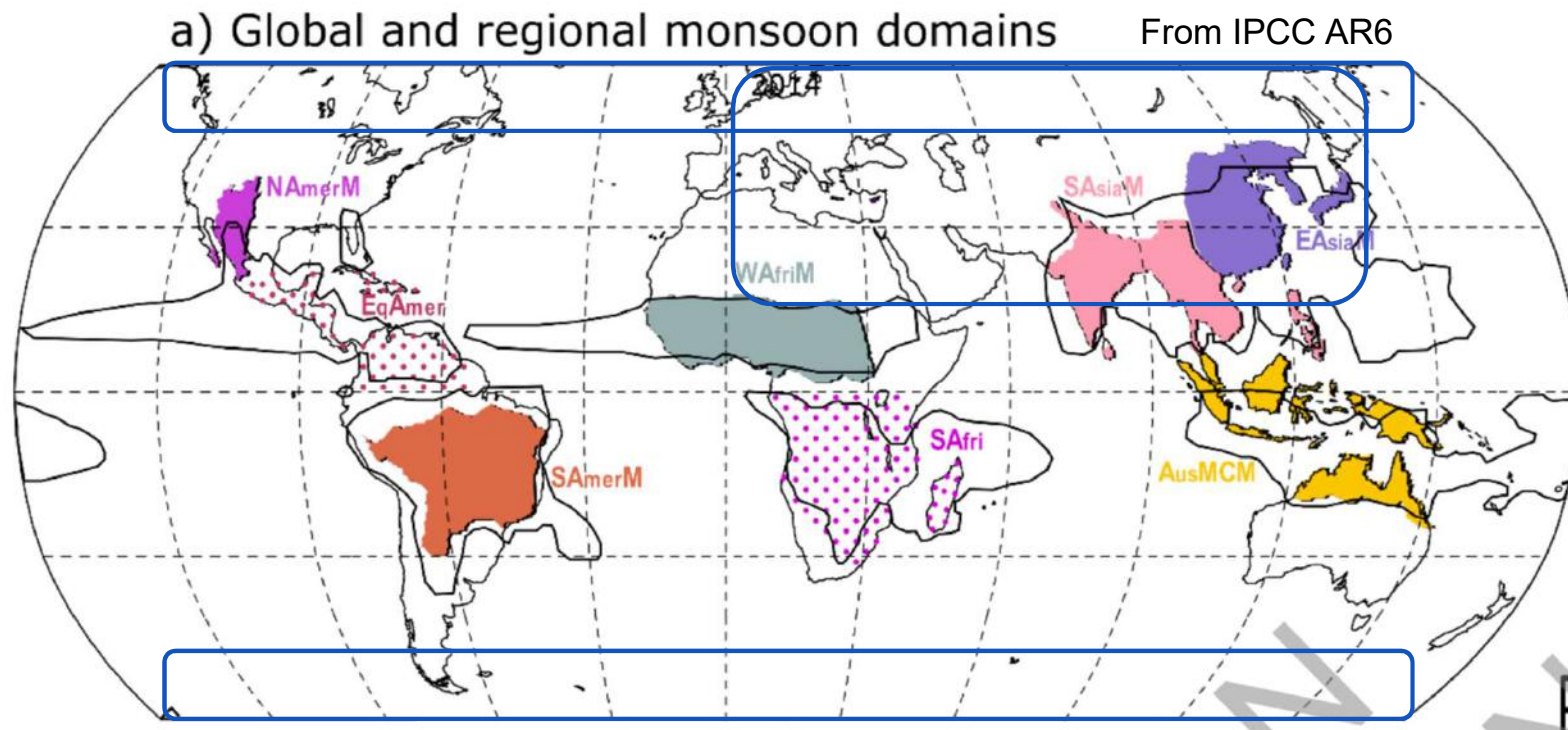
Lin Wang

- Professor of meteorology at IAP, CAS
- Research interests:
 - Extra-tropical climate variability and climate change
 - Asian monsoon
 - Climate dynamics
 - Climate extremes
 - Stratosphere-troposphere interaction
- International community service:
 - Associate Editor, Journal of Climate
 - Member, WCRP Lighthouse Activity Science Plan Development Team
 - Member, CLIVAR/GEWEX Asian-Australian Monsoon Working Group
- For more information:
 - <https://sforest81.github.io/en/>
 - wanglin@mail.iap.ac.cn

Research Interest:

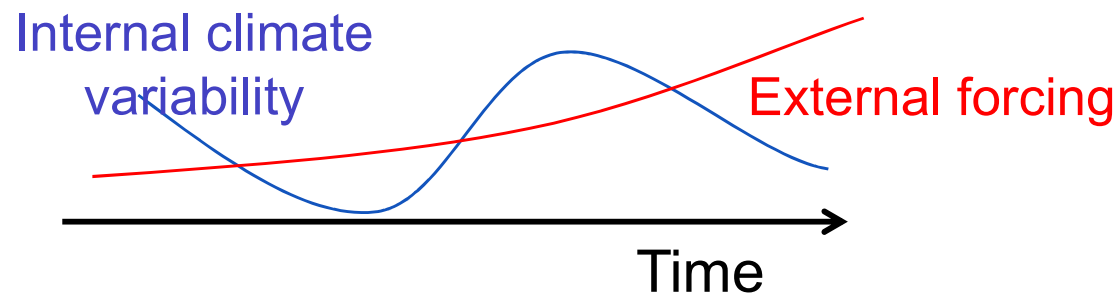
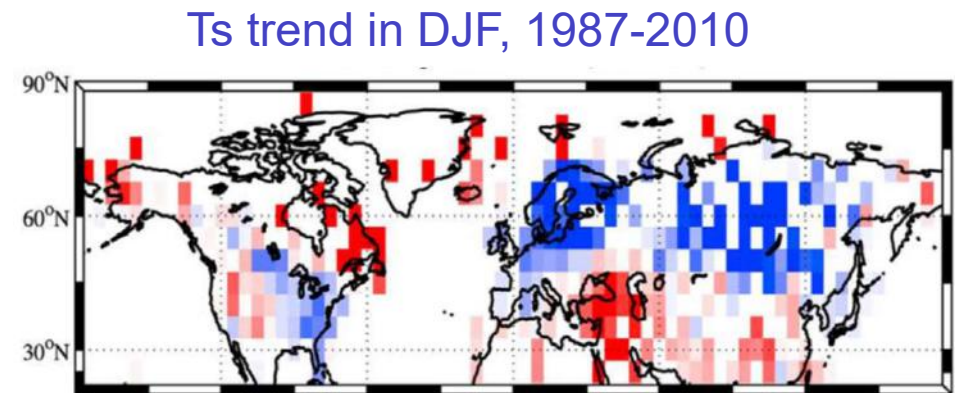
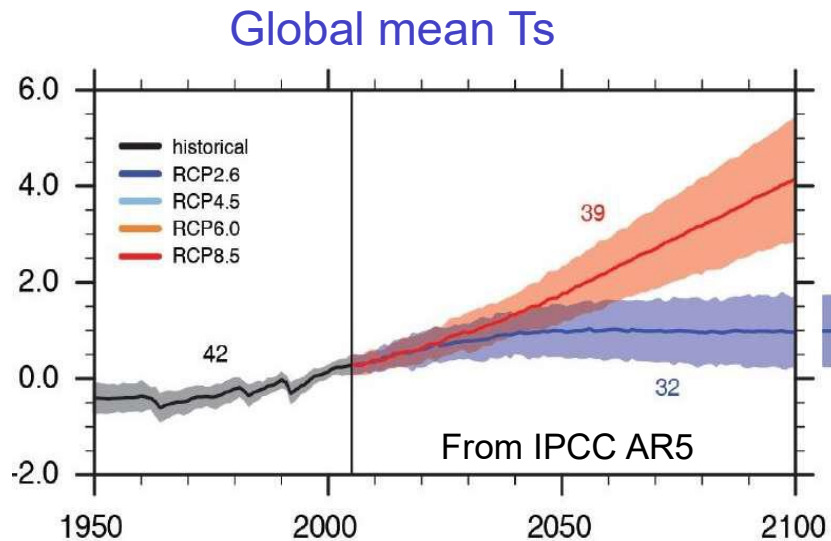
Climate & extremes over mid-latitudes & polar region

- Role of **internal variability** in climate and the underlying mechanism
 - Wintertime cooling over Eurasia
 - Summertime hot extremes over Eurasia
- Influences of **polar processes** on Southern Hemispheric climate



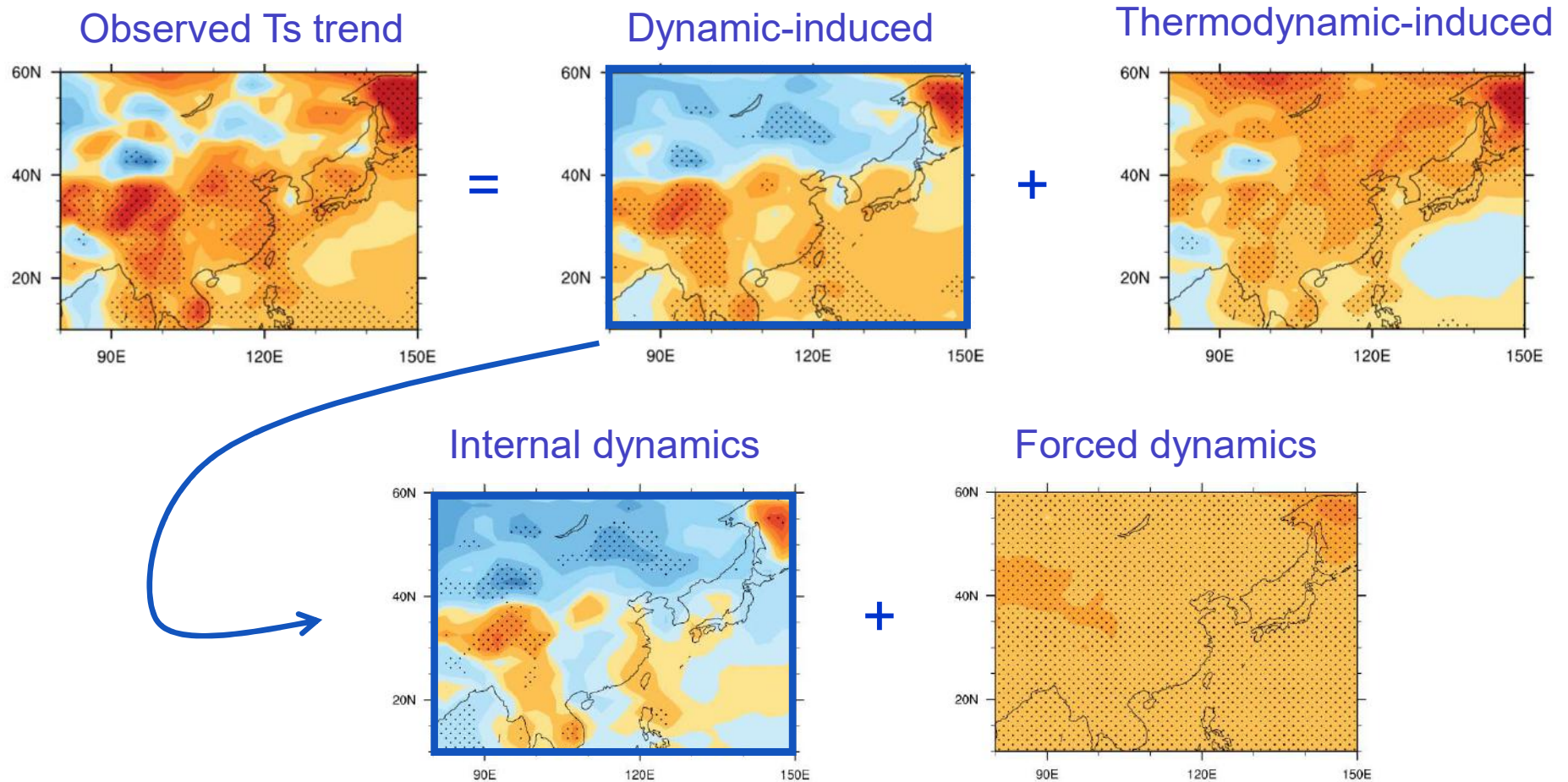
Highlight #1: Role of internal climate variability in the Eurasian wintertime cooling

- Global warming, Eurasian cooling
- Reason: Internal climate variability is as important as the external forcing for the near-term climate change



Highlight #1: Role of internal climate variability in the Eurasian wintertime cooling

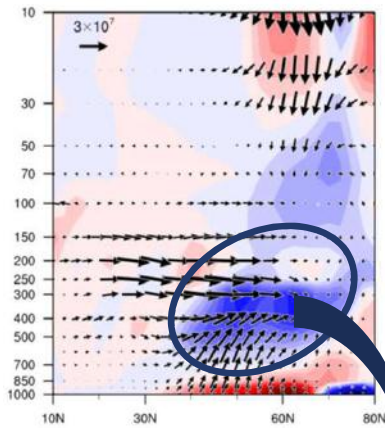
- The cooling is induced by internal dynamical processes, which explains 70% of the observed trend



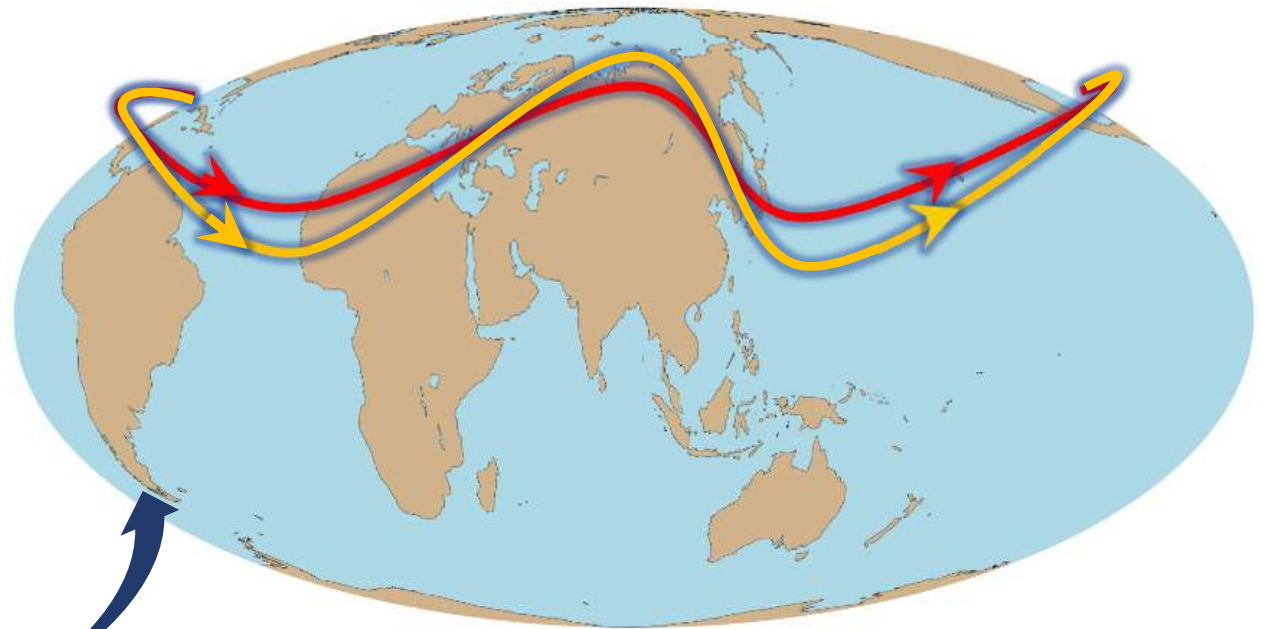
Highlight #1: Role of internal climate variability in the Eurasian wintertime cooling

- The stationary planetary waves and its interactions with the mean flow play a vital role in the internal dynamical process

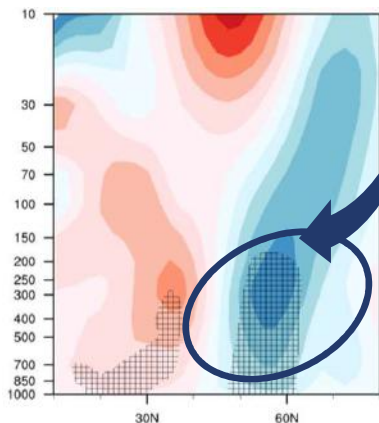
Changes in wave propagation



Increased wave amplitude



Weakened circumpolar flow



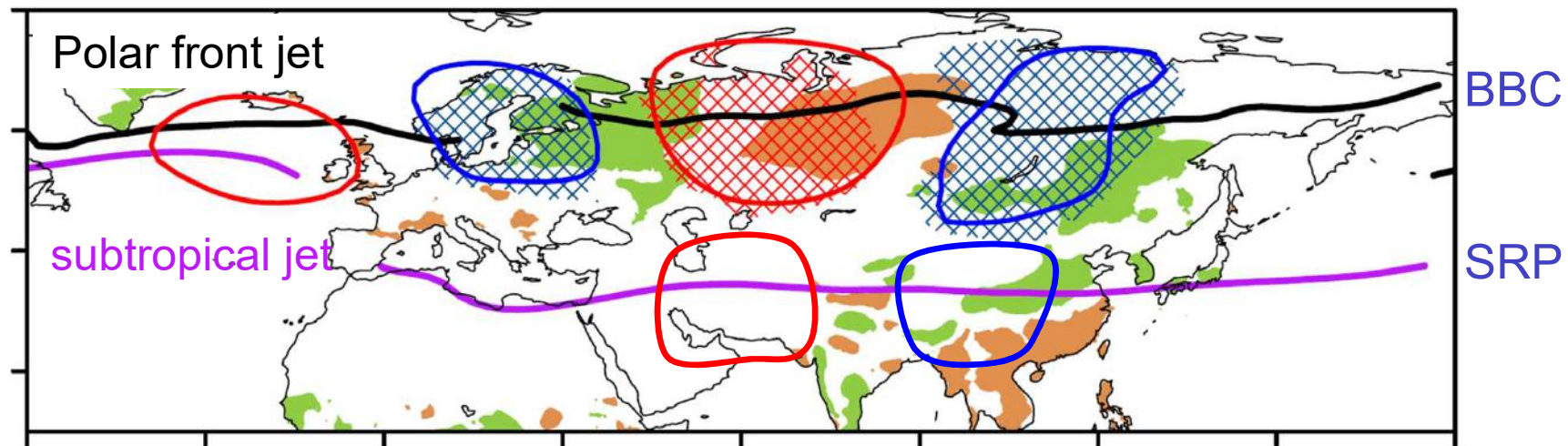
Wang* & Lu (2017) BC | Song, Wang*, et al. (2016) JC | Wang* et al. (2009) JC

$$\frac{\partial \bar{u}}{\partial t} - f \bar{v}^* - \bar{X} = \frac{1}{\rho_0 a \cos \varphi} \nabla \cdot \bar{F}$$

Highlight #2: Role of internal climate variability in the Eurasian summertime hot extremes

- Two teleconnection embedded in the Eurasian jets:
 - Polar front jet: British-Baikal Corridor (BBC) pattern
 - Subtropical jet: Silk Road pattern (SRP)

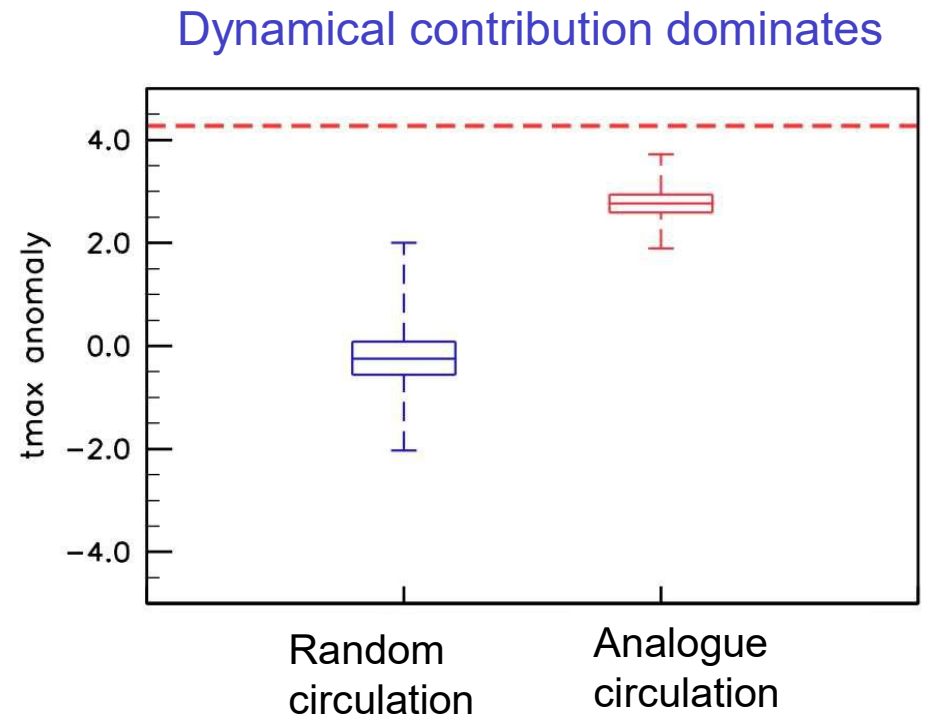
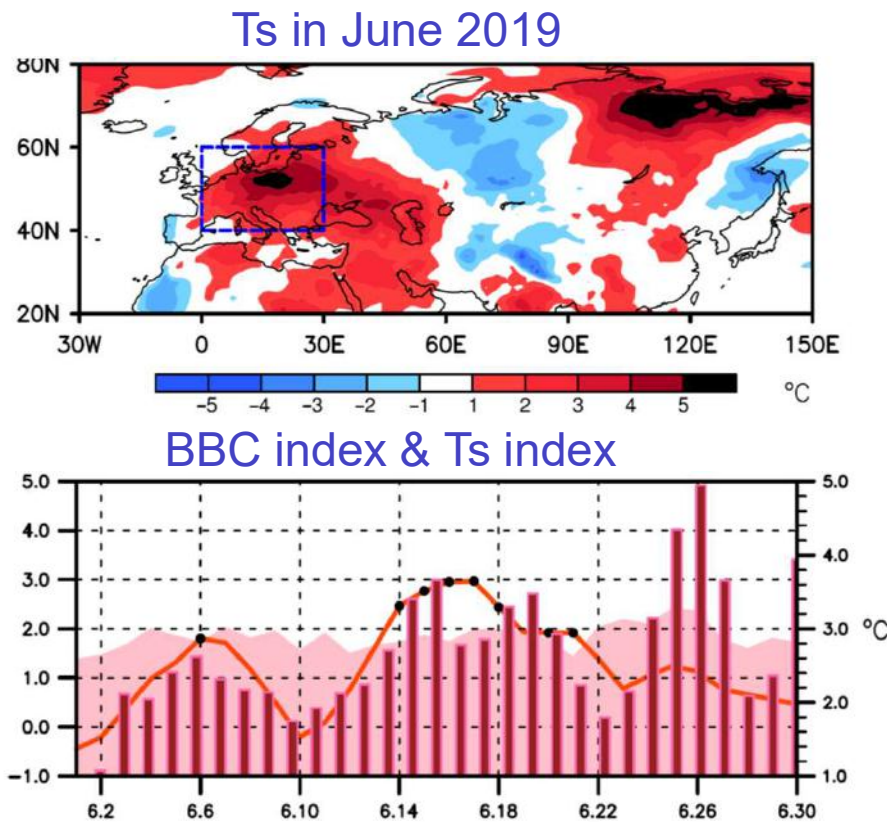
BBC, SRP, and their impacts on temperature & precipitation



Xu, Wang*, et al. (2019) JC | Xu, Wang* et al. (2020) JC

Highlight #2: Role of internal climate variability in the Eurasian summertime hot extremes

- The BBC pattern explains the European heatwave in June 2019

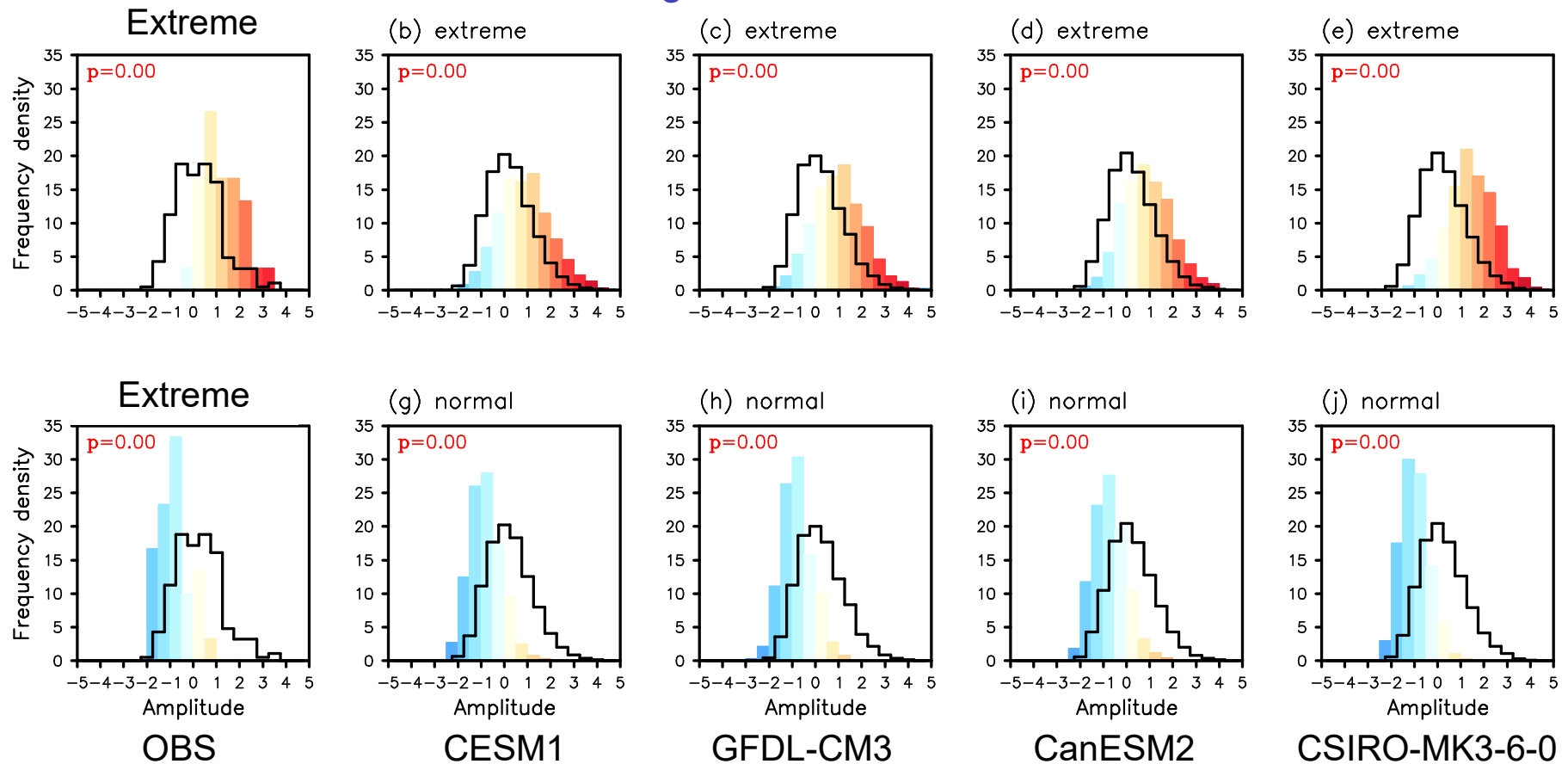


Xu, Wang*, et al. (2020) ASL | Xu, Wang* et al. (2021) AR

Highlight #2: Role of internal climate variability in the Eurasian summertime hot extremes

- More active BBC, more frequent hot extremes over northern Eurasia

PDF of WAI during extreme and normal Ts months

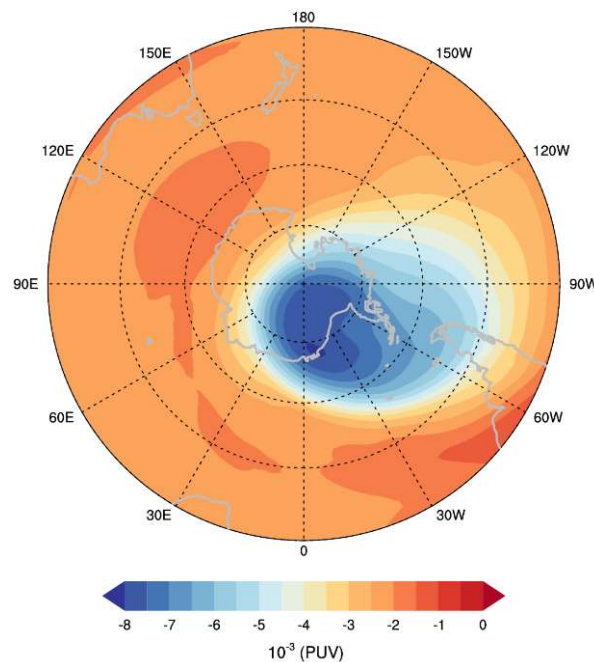


Xu, Wang*, et al. (2021) GRL

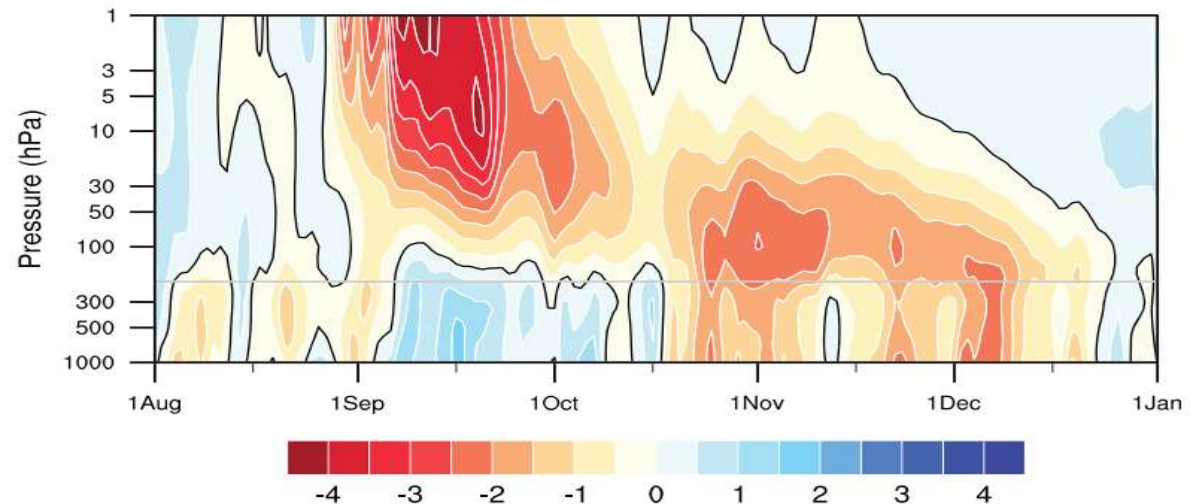
Highlight #3: Influences of the Antarctic stratospheric polar vortex on the S.H. climate

- The descending signal of the 2019 sudden stratospheric warming (SSW) facilitates the subsequent Australian bush fire
- A survey of the historical Antarctic SSWs, their dynamics & influences

Polar vortex during the 2019 SSW



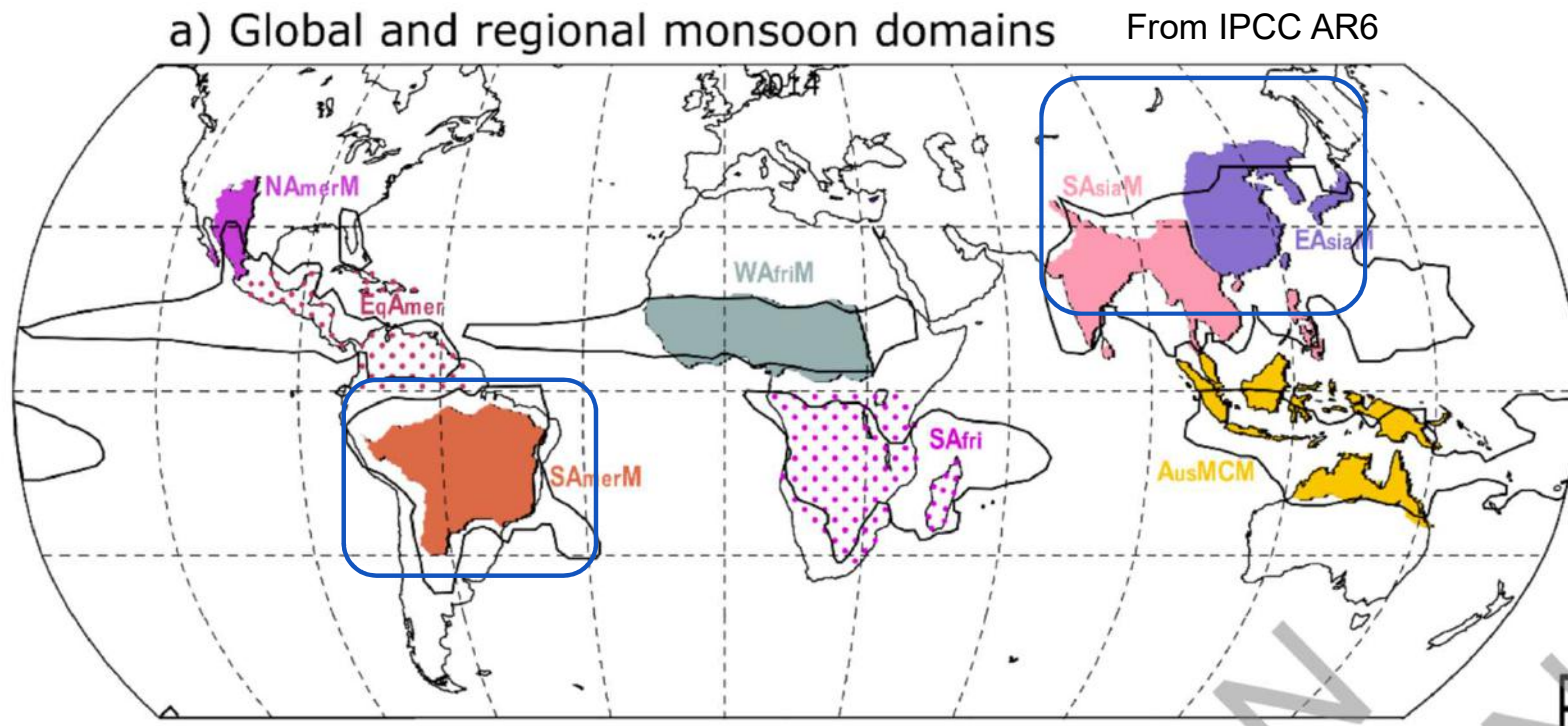
The descending SAM signal in the 2019 SSW



Shen, Wang*, et al. (2020) GRL | Shen, Wang*, et al. (2020) Sci Bull | Shen, Wang*, et al. (2021) JC

Collaborative Intensions

- South American climate change, climate variability, and extremes
 - Role of internal climate variability
 - Role of polar processes
 - Monsoon co-variability and prediction
- Interdisciplinary research with scholars outside climate community



Thanks!