The PNA Teleconnection in Different Climate States

Yongyun Hu

Dept. of Atmospheric and Oceanic Sciences

School of Physics, Peking University

Collaborators: Yuchen Wang, Cheng Li,Yan Xia

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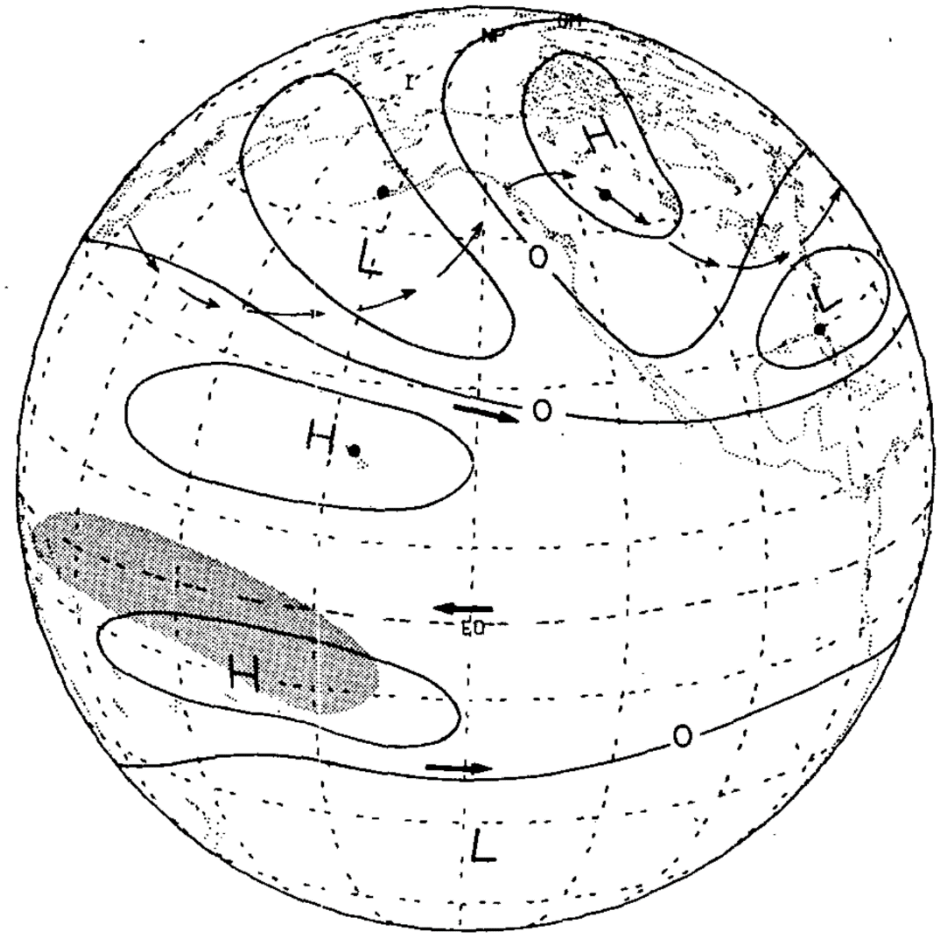
The Pacific-North America Teleconnection (PNA)



Horel and Wallace (1981)

1. About PNA: 3 papers in 1981

1. **Wallace, J. M., and Gutzler, D. S., 1981: Teleconnections in the Geopotential height field during the Northern Hemisphere Winter, Mon. Wea. Rev., 109, 784-812.**

2. **Horel, J. D., and Wallace, J. M., 1981: Planetary-Scale Atmospheric Phenomena Associated with the Southern Oscillation. *Mon. Wea. Rev.*, 109, 813-829.**

3. **Hoskins, B. J., and Karoly, D. J., 1981: The Steady Linear Response of a Spherical Atmosphere to Thermal and Orographic Forcing. *J. Atmos. Sci.*, 38, 1179–1196.**

Question

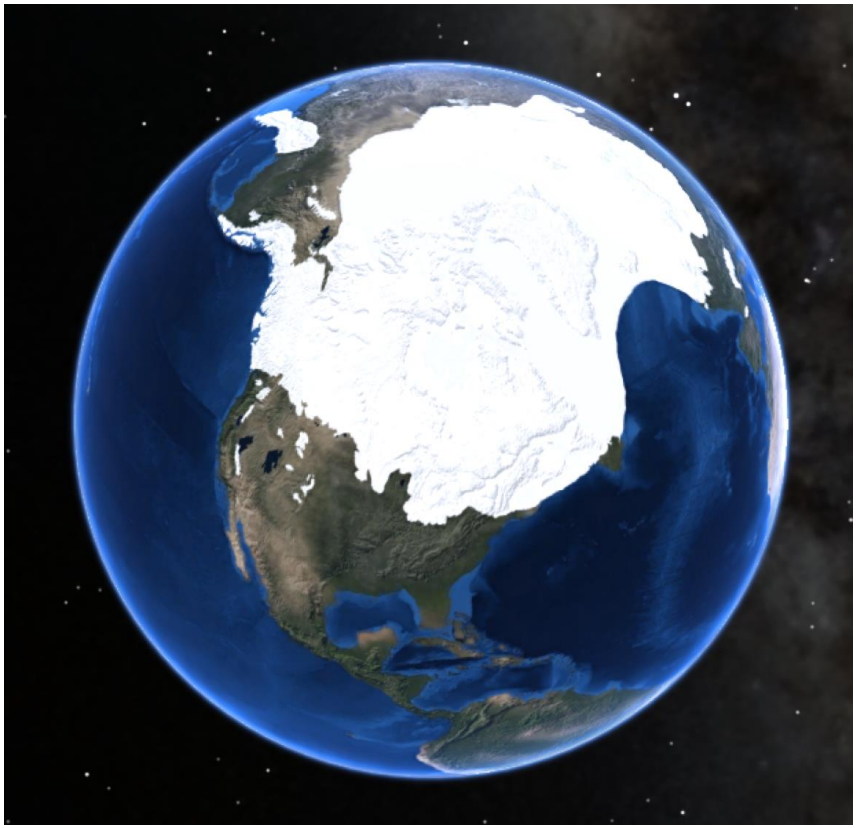
- **What cause the PNA differences for the different climate states?**
  1. **LGM (cold)**
  2. **Present**
  3. **RCP8.5 (warm)**

2. Data

CCSM4 simulations

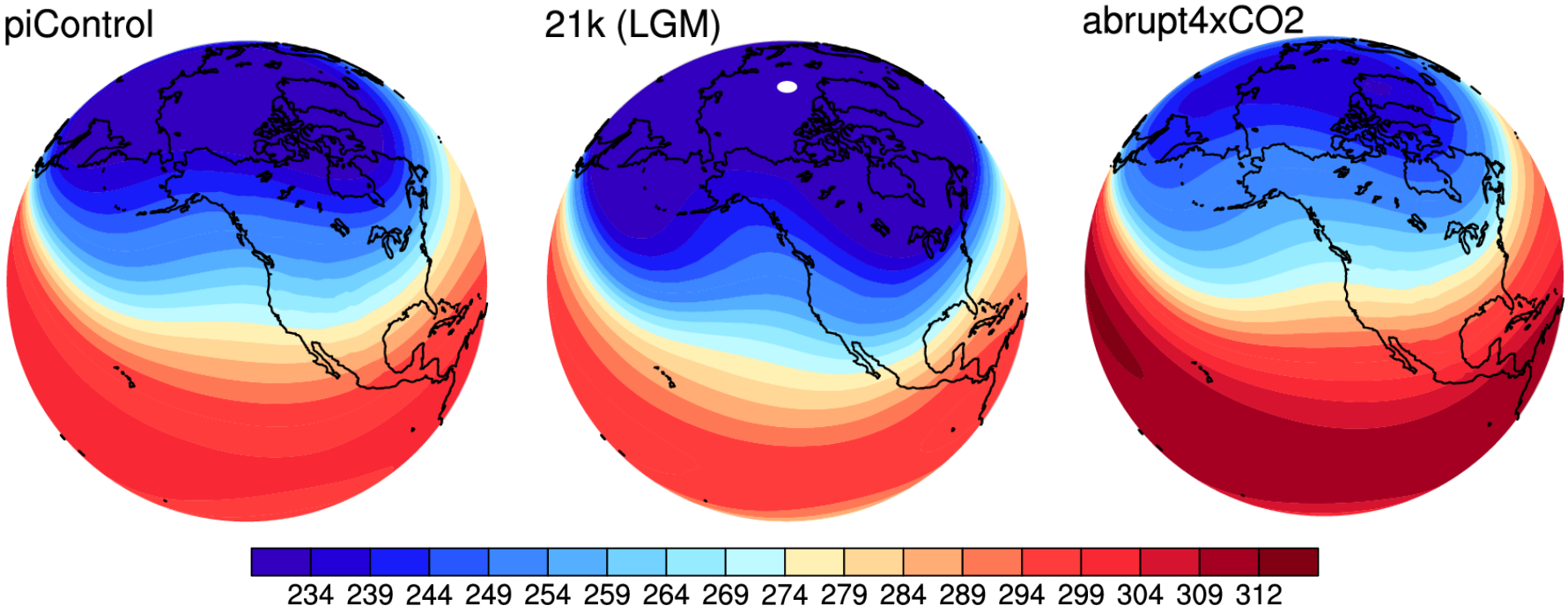
1. **Pre-industry (modest)**
2. **4xCO_2 (warm)**
3. **PMIP3: LGM (21 ka) (cold)**

The Last Glacier Maximum (LGM)

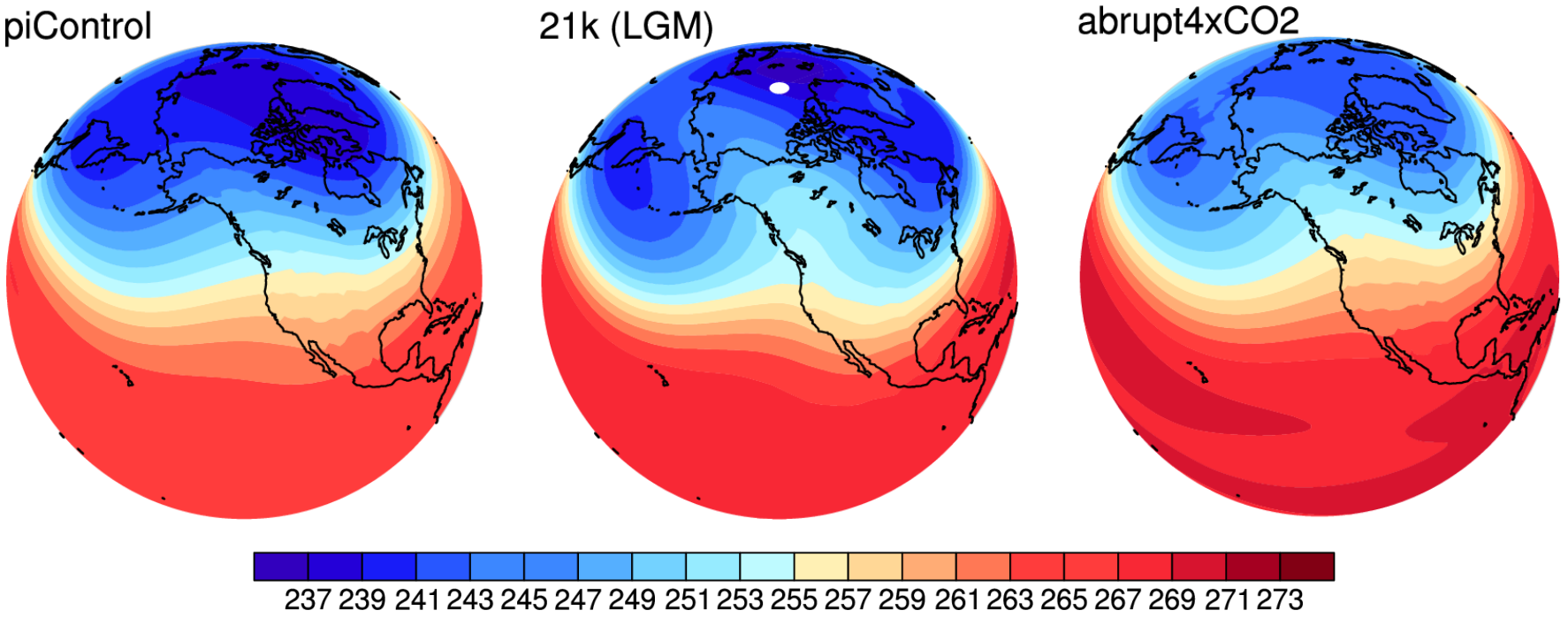


21000 years ago (21 ka)

Annual-mean surface temperatures



Annual-mean geopotential height at 500 hPa

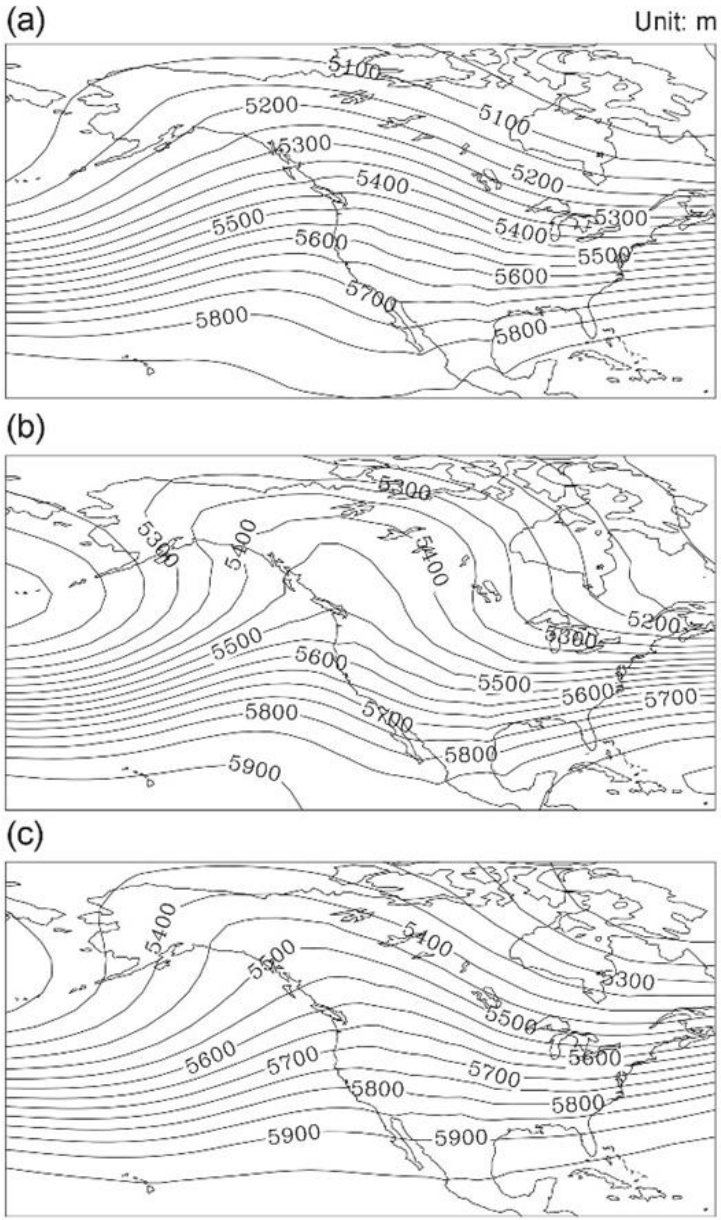


DJF Geopotential heights at 500 hPa

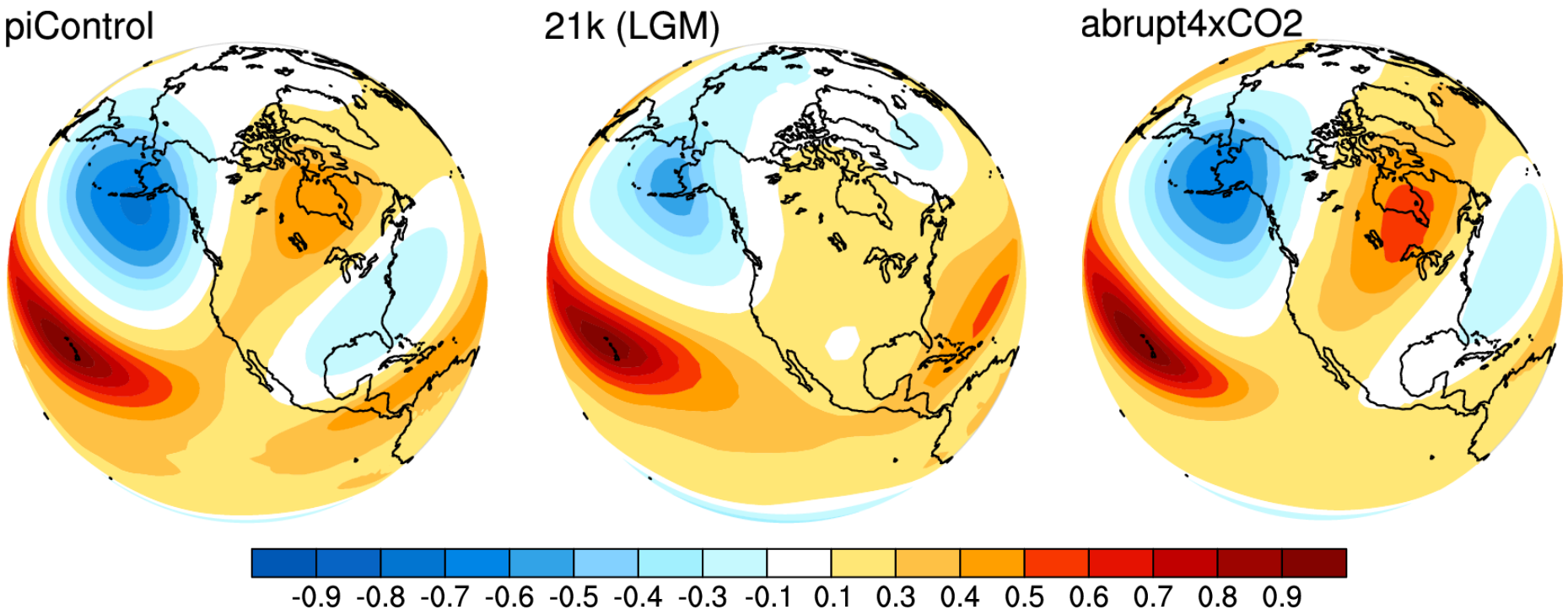
Present

LGM

4xCO2

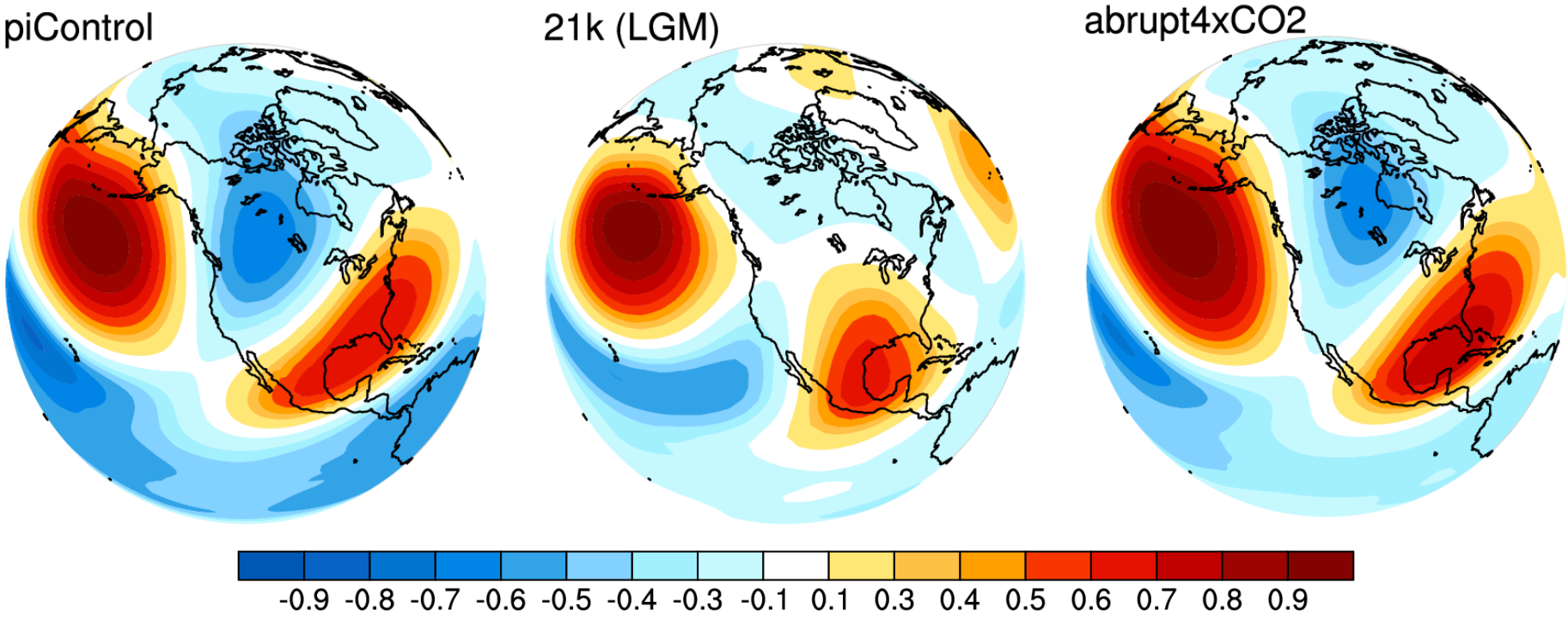


One-point correlation of DJF geopotential heights at 500 hPa, with the base-point at 20° N and 160° W

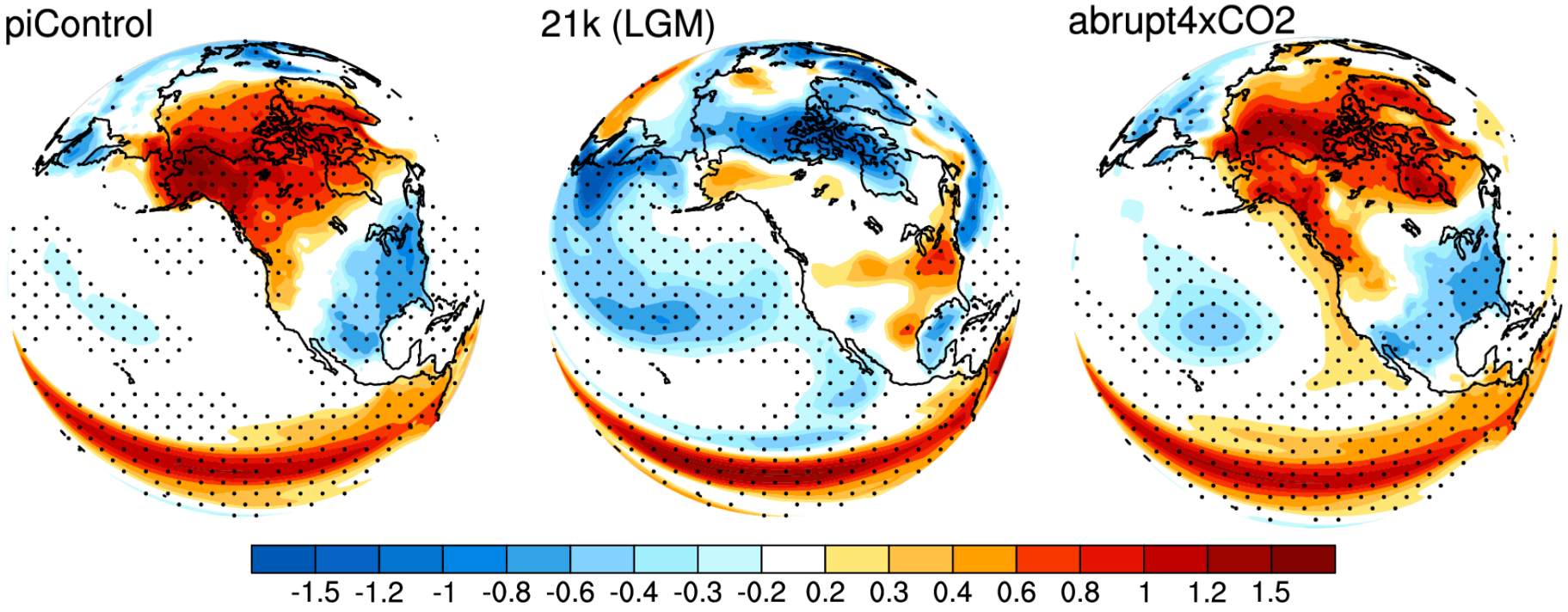


The PNA Teleconnection is lost in LGM.

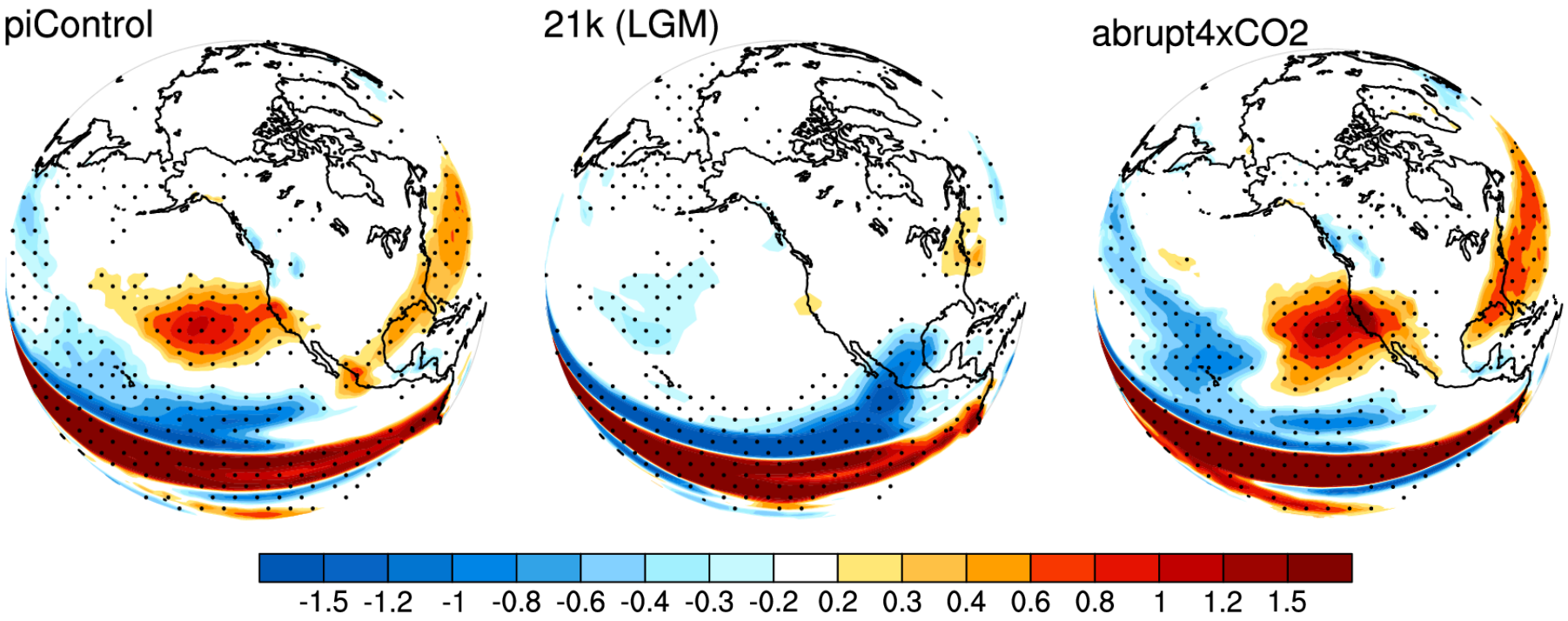
One-point correlation of DJF geopotential heights at 500 hPa, with the base-point at 45° N and 165° W



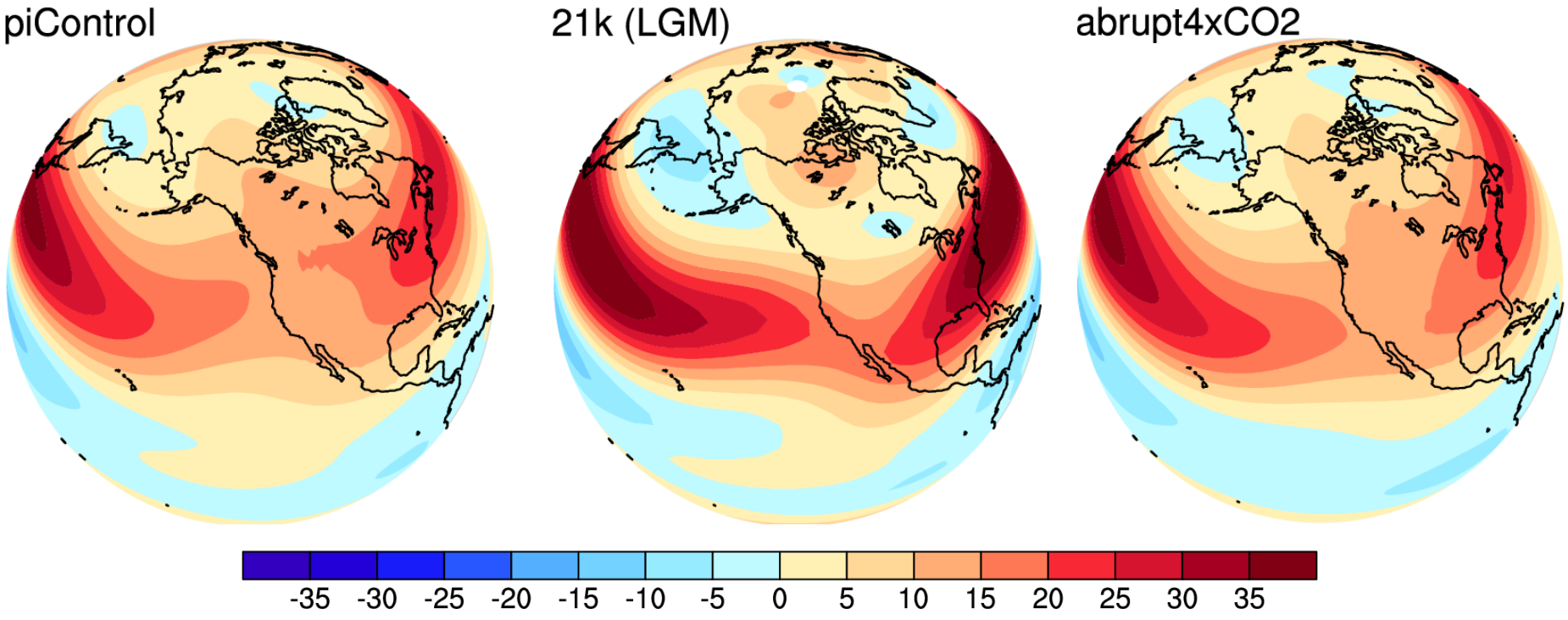
DJF SATs regressed on Nino3.4



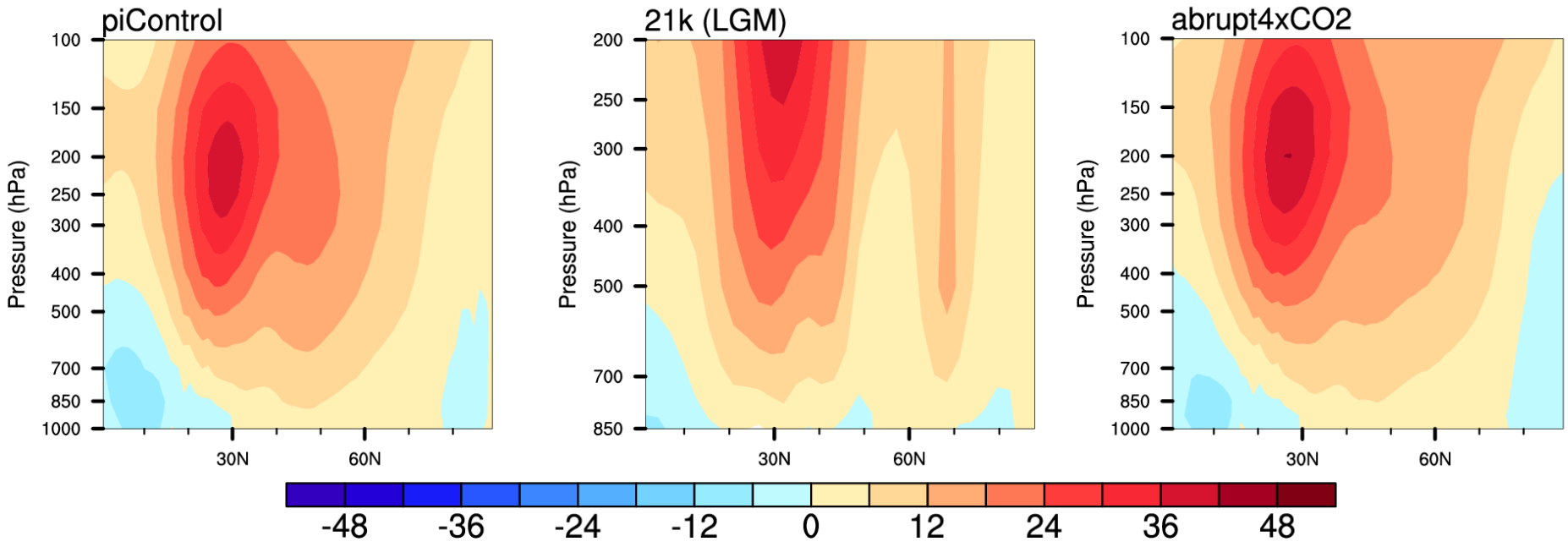
DJF precipitation regressed on Nino3.4



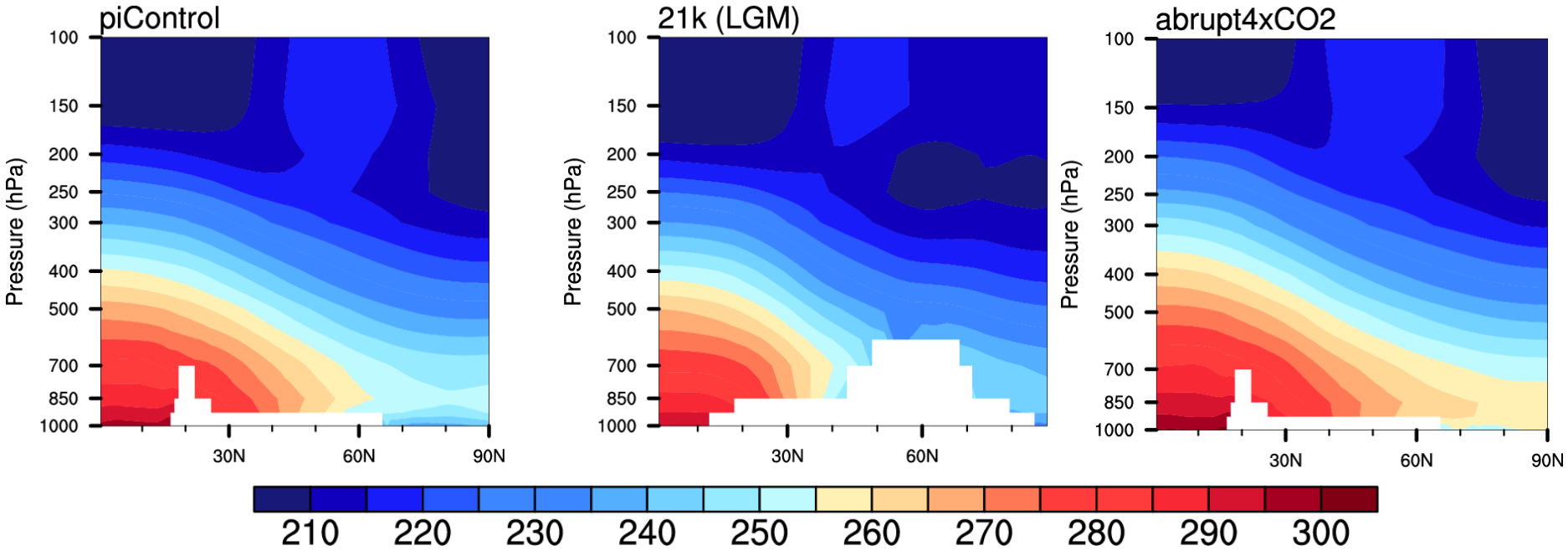
DJF zonal wind at 500 hPa



Vertical cross-section of DJF zonal-wind at 100° W



Vertical cross-section of DIF temperature at 100° W



The wave guide

$$K_s = \sqrt{\beta / U}$$

K_s: stationary wavenumber

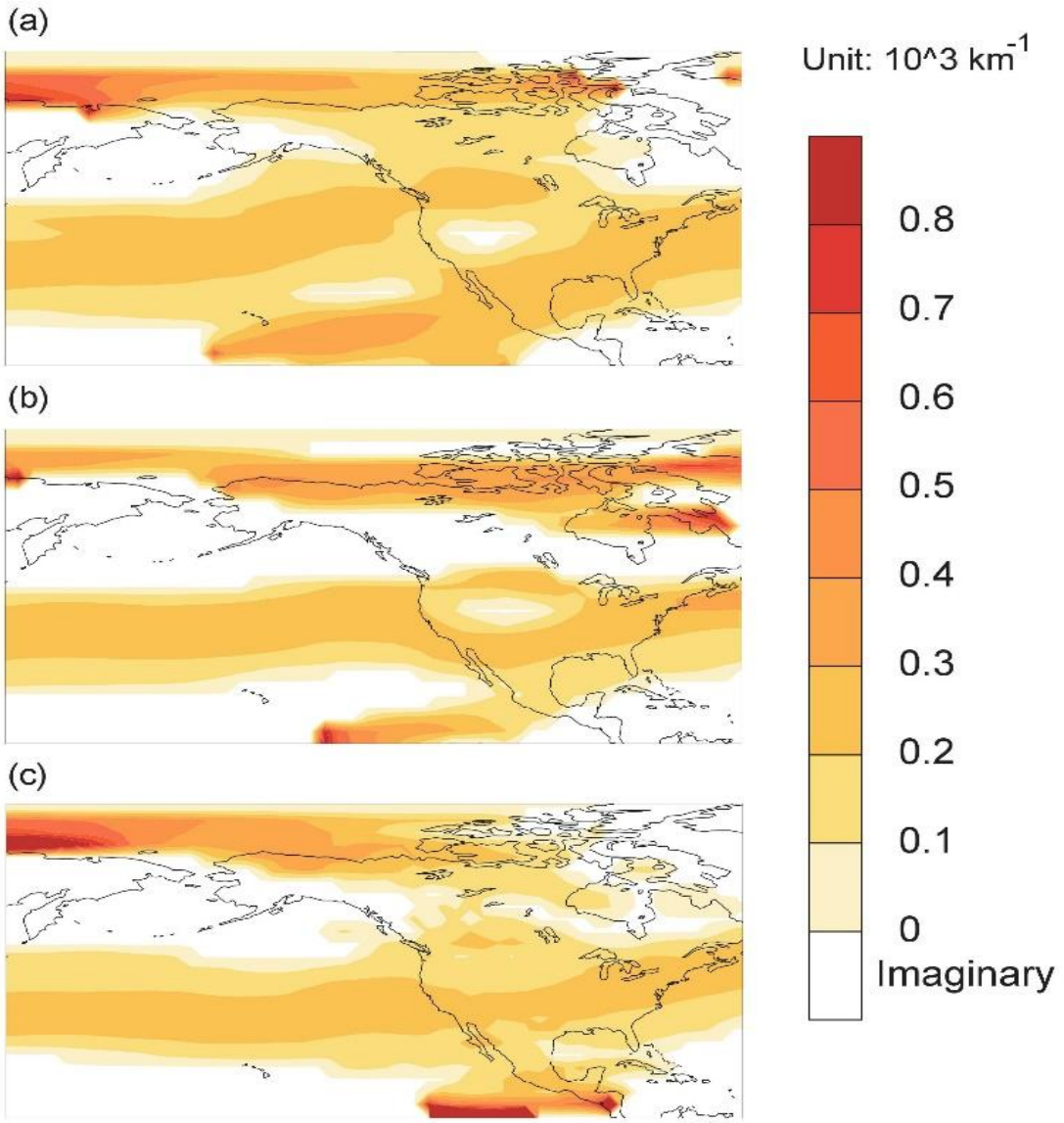
$$U: zonal - mean\ wind$$

K_s differences

Present

LGM

4xCO2



Conclusions

1. **The PNA is almost completely lost in LGM.**
2. **The PNA has not significant changes for 4xCO2 and RCP8.5, with stronger correlation at Alberta and weaker correlation at Gulf.**
3. **The different PNAs are caused by mid-latitude wave guides.**

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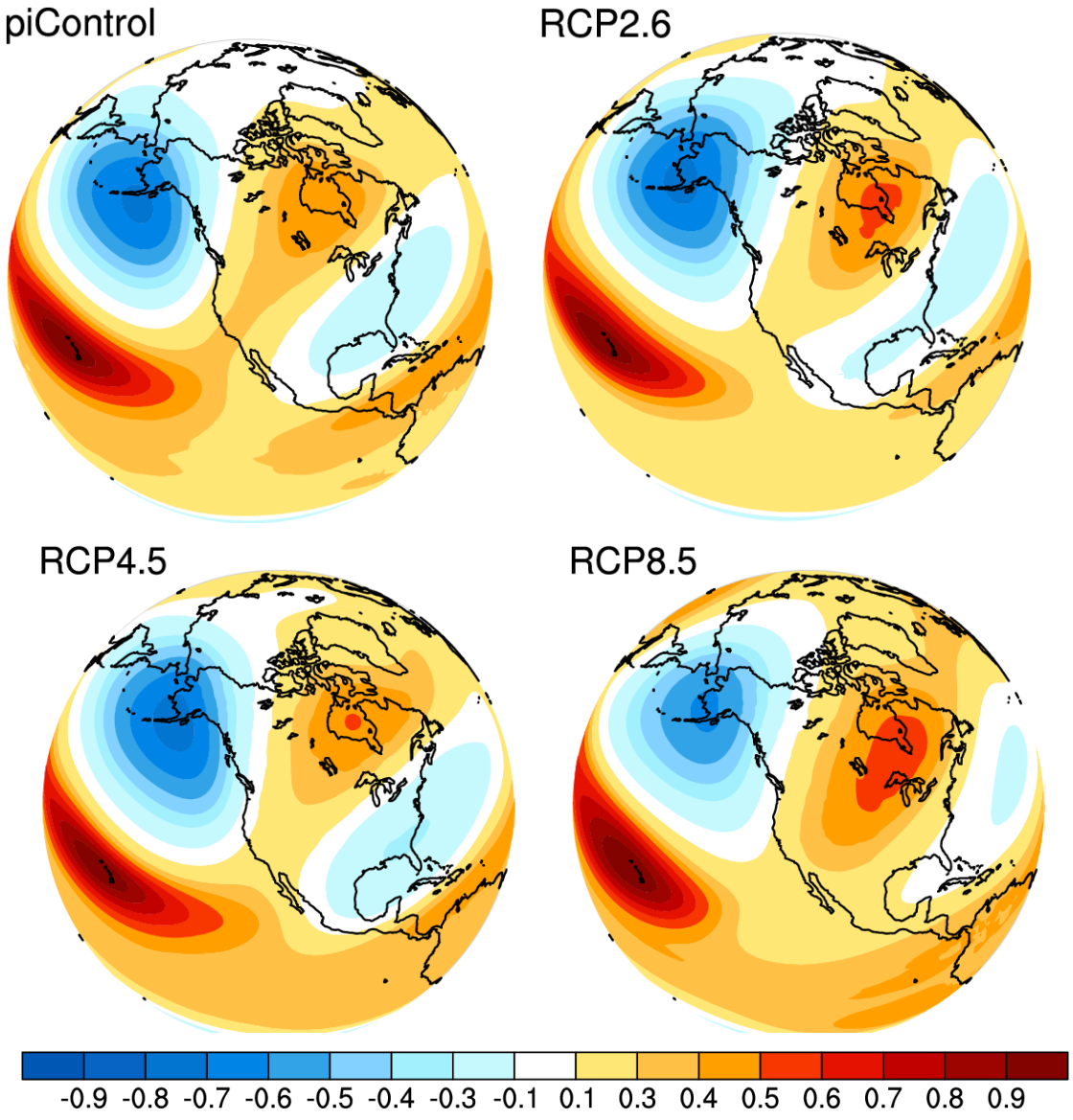
1. **Any paleo-records for PNA in LGM?**

PNAs for different RCPs



DJF SATs regressed on Nino3.4