Nonlinear Ural Blocking Response to Barents-Kara Sea Warming

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with much input from collaborators
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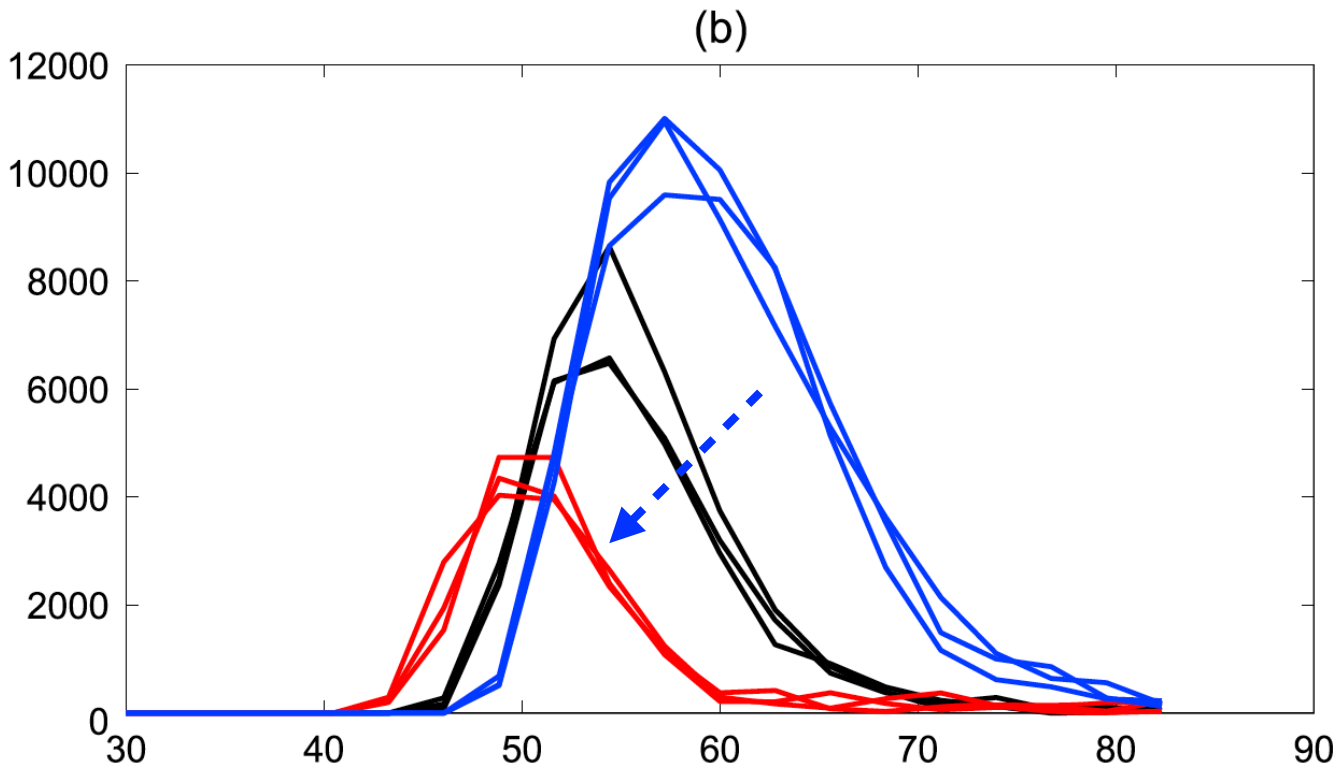
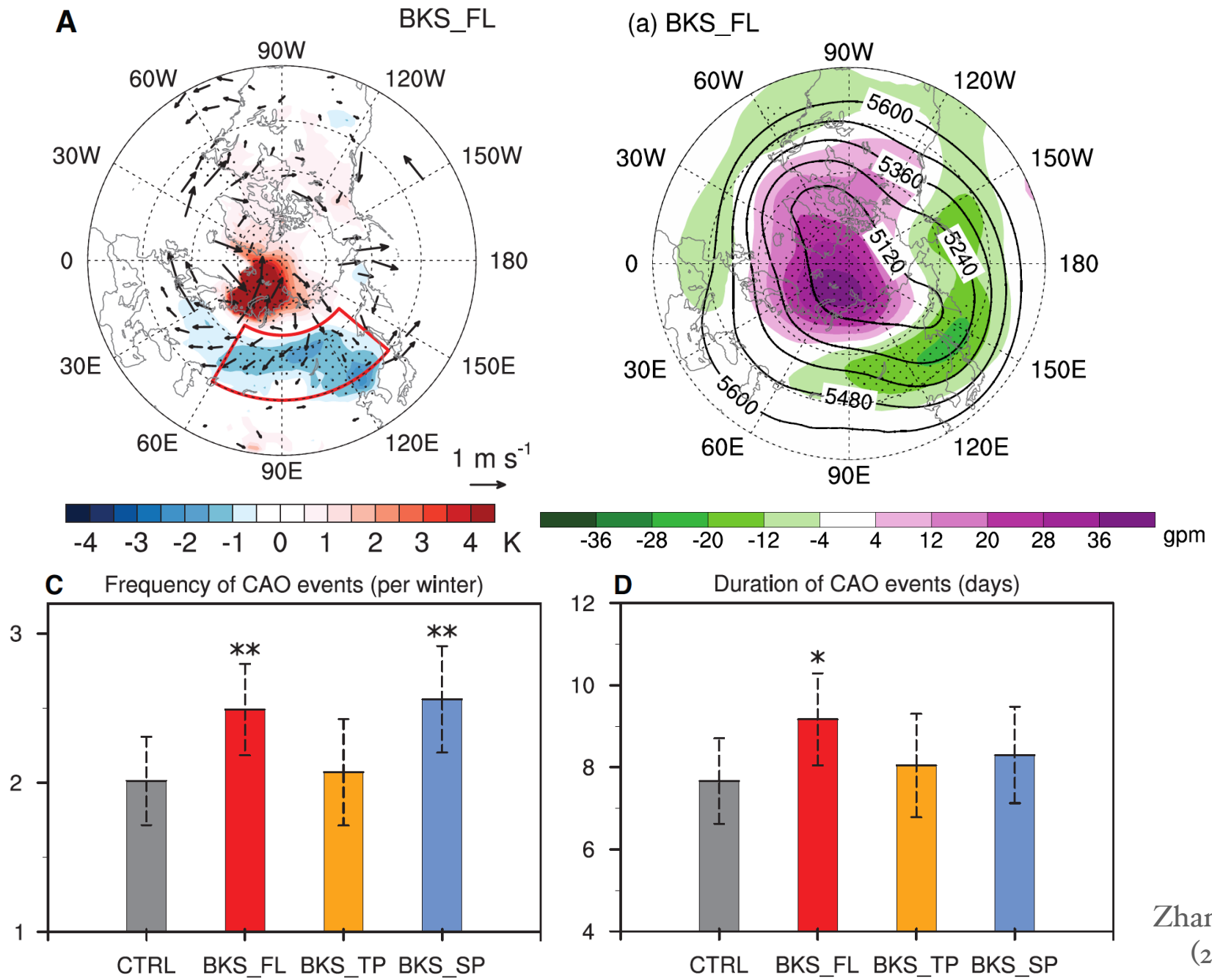
Decrease in blocking frequency with Arctic warming

reduced blocking area with reduced equator-to-pole temperature gradient



Hassanzadeh et al. (2014)

BKS Sea Ice Melting & Siberian Cooling



Zhang et al. (2018)

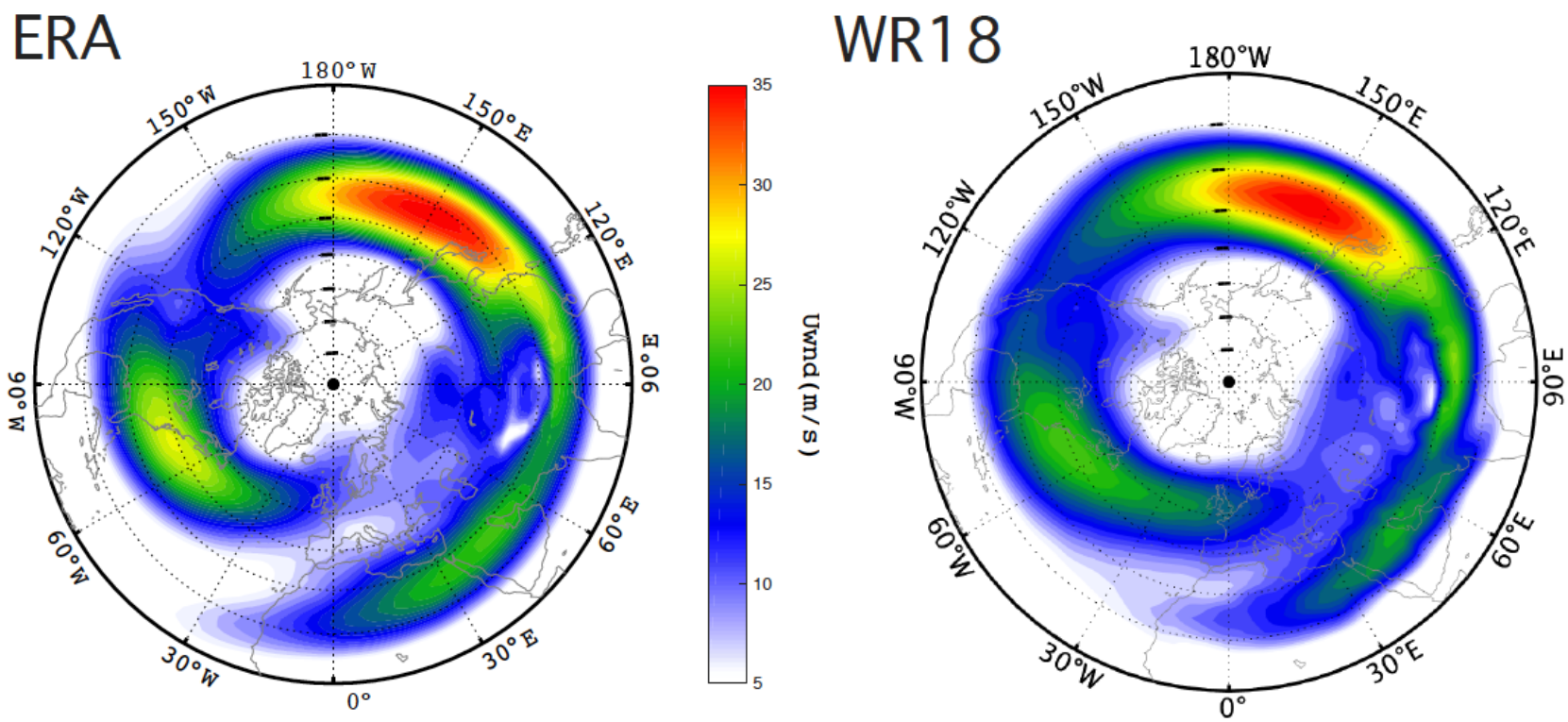
Questions

- How does Barents-Kara Sea sea ice melting and warming affect the Ural blocking activities?
- What is the underlying mechanism?

Towards a More Earth-Like Circulation in Idealized Models

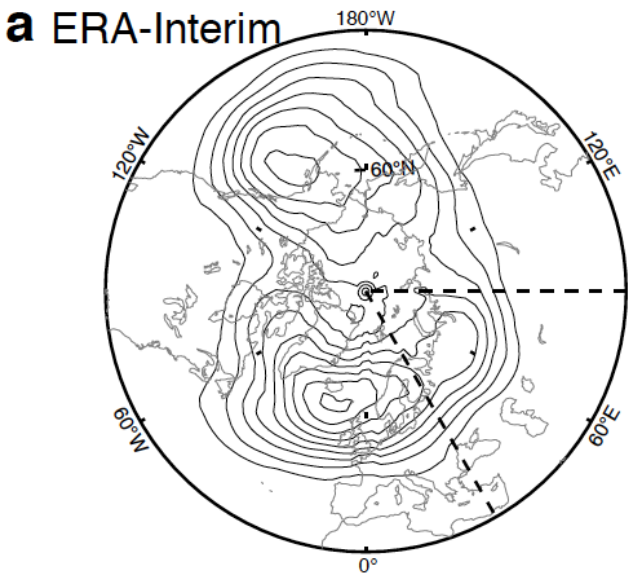
Zheng Wu[1] and Thomas Reichler[1]

[1]Department of Atmospheric Sciences, University of Utah, Salt Lake City, UT, USA



Chen, Wu, Luo, Dunn-Sigouin, in preparation

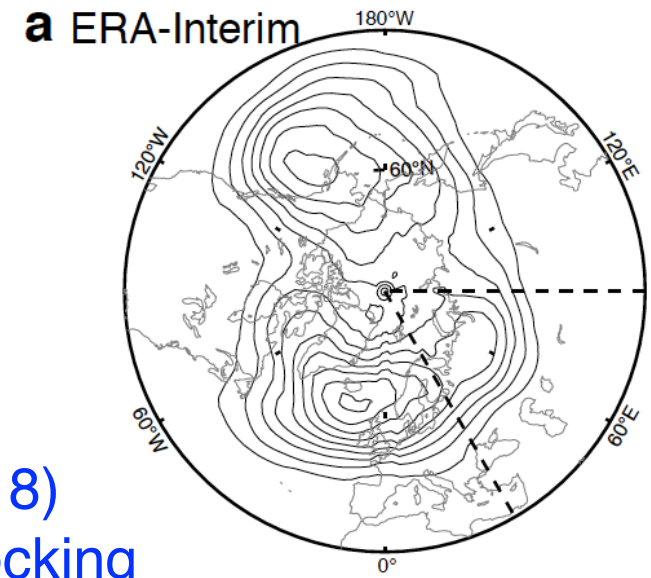
blocking index by Dunn-Sigouin et al. (2013) is used



CI = 1%

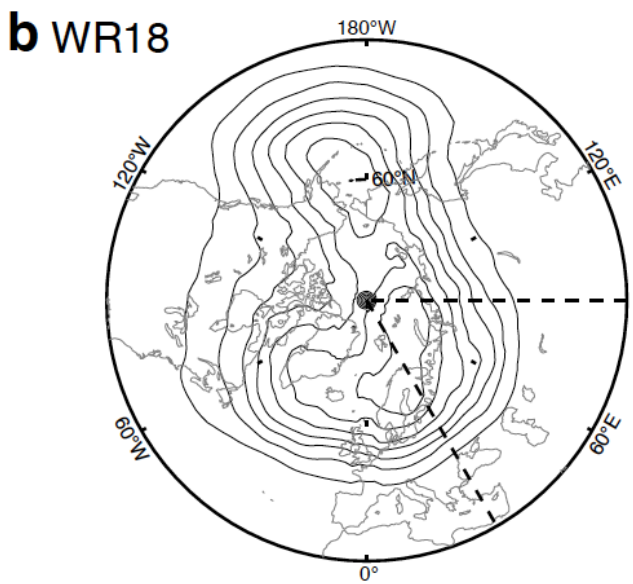
realistic simulation of blocking

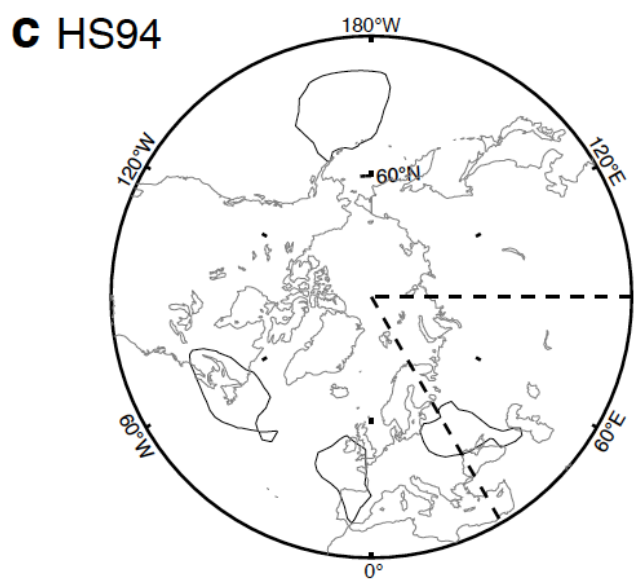
blocking index by Dunn-Sigouin et al. (2013) is used



Wu and Reichler (2018) realistic simulation of blocking

Held and Suarez (1994)

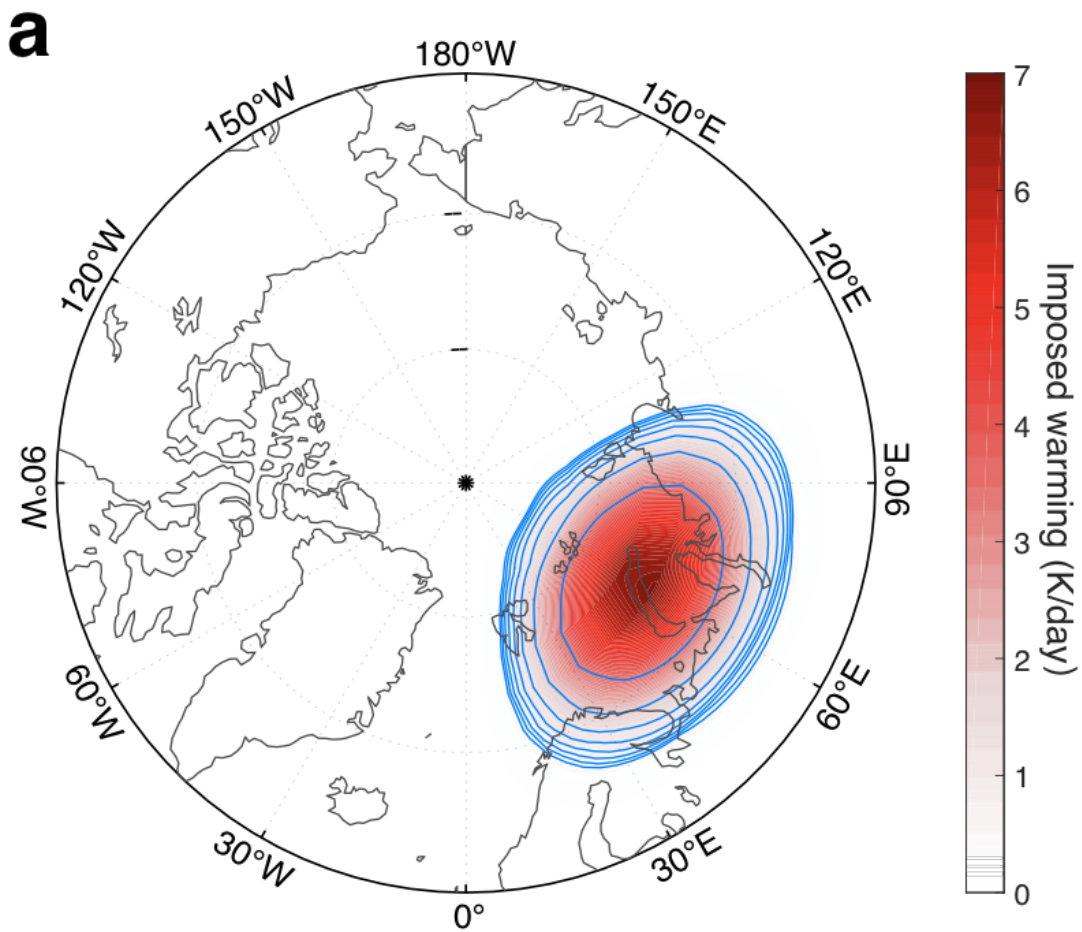




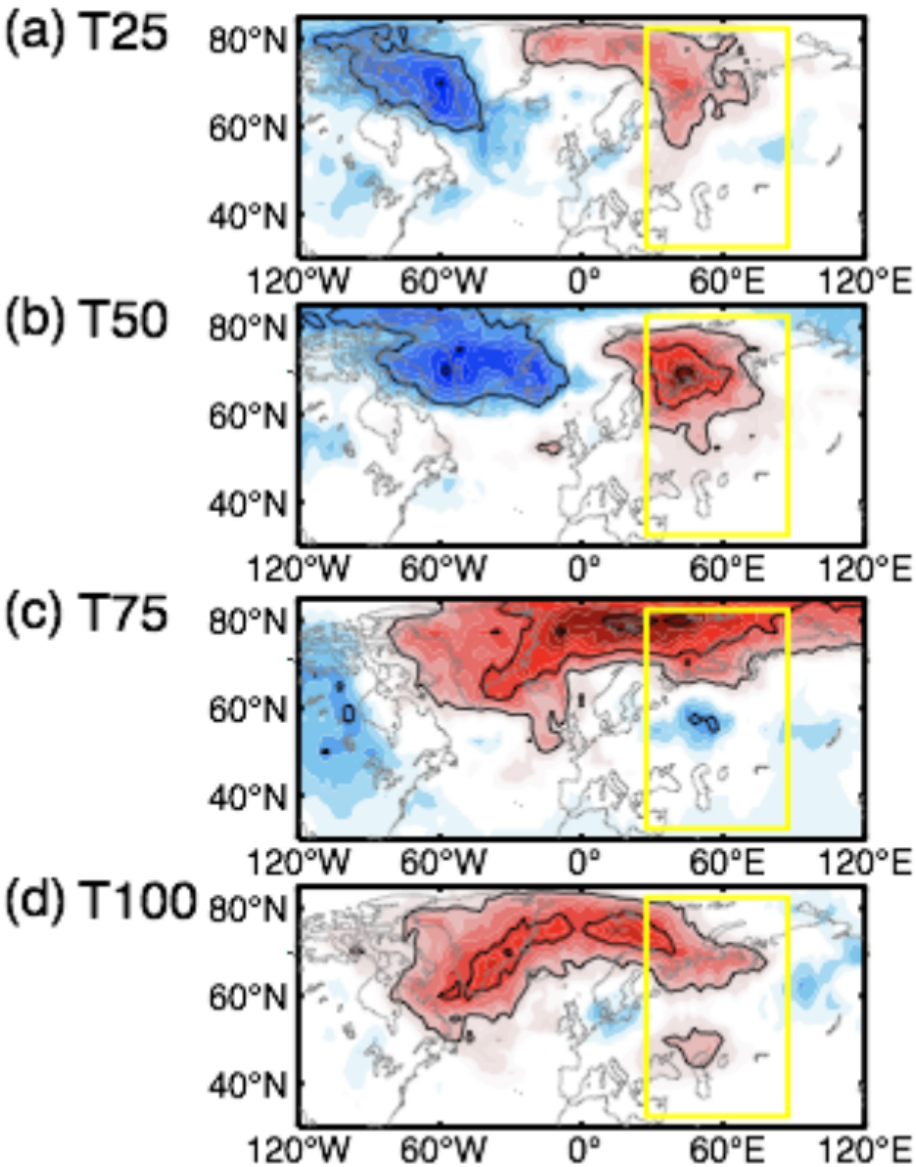
CI = 1%

Idealized dry dynamical core experiments

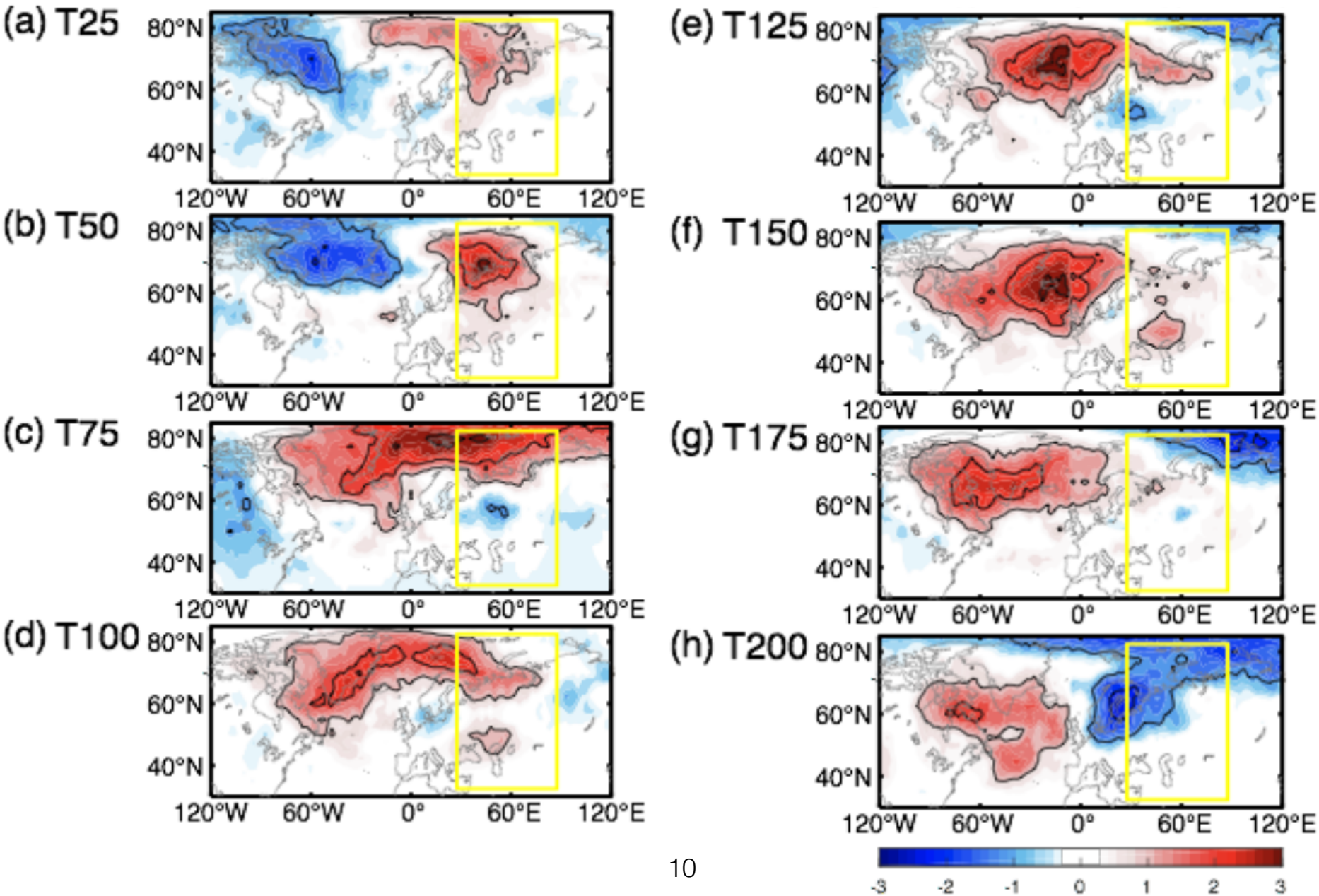
impose BKS warming of various magnitudes - T25, T50, T75, T100, T125, T150, T175, T200



Response in blocking days



Nonlinear response in Ural blocking days

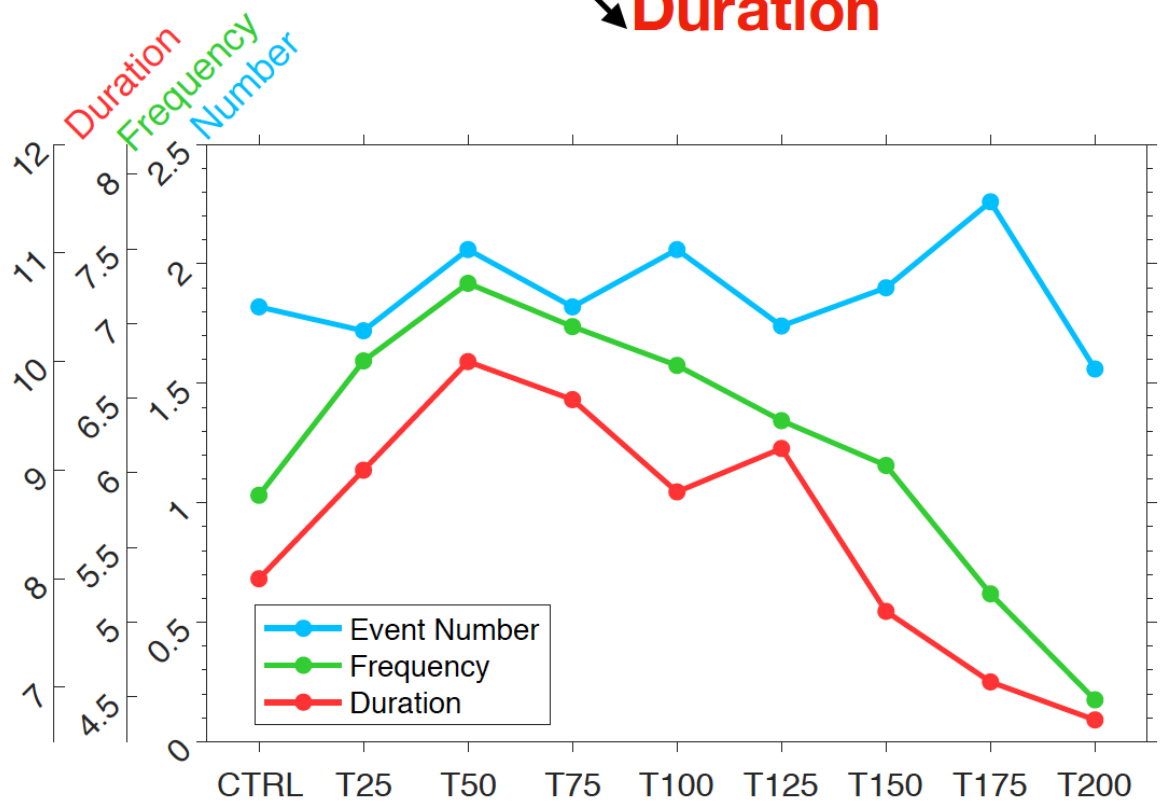


Nonlinear response in Ural blocking duration

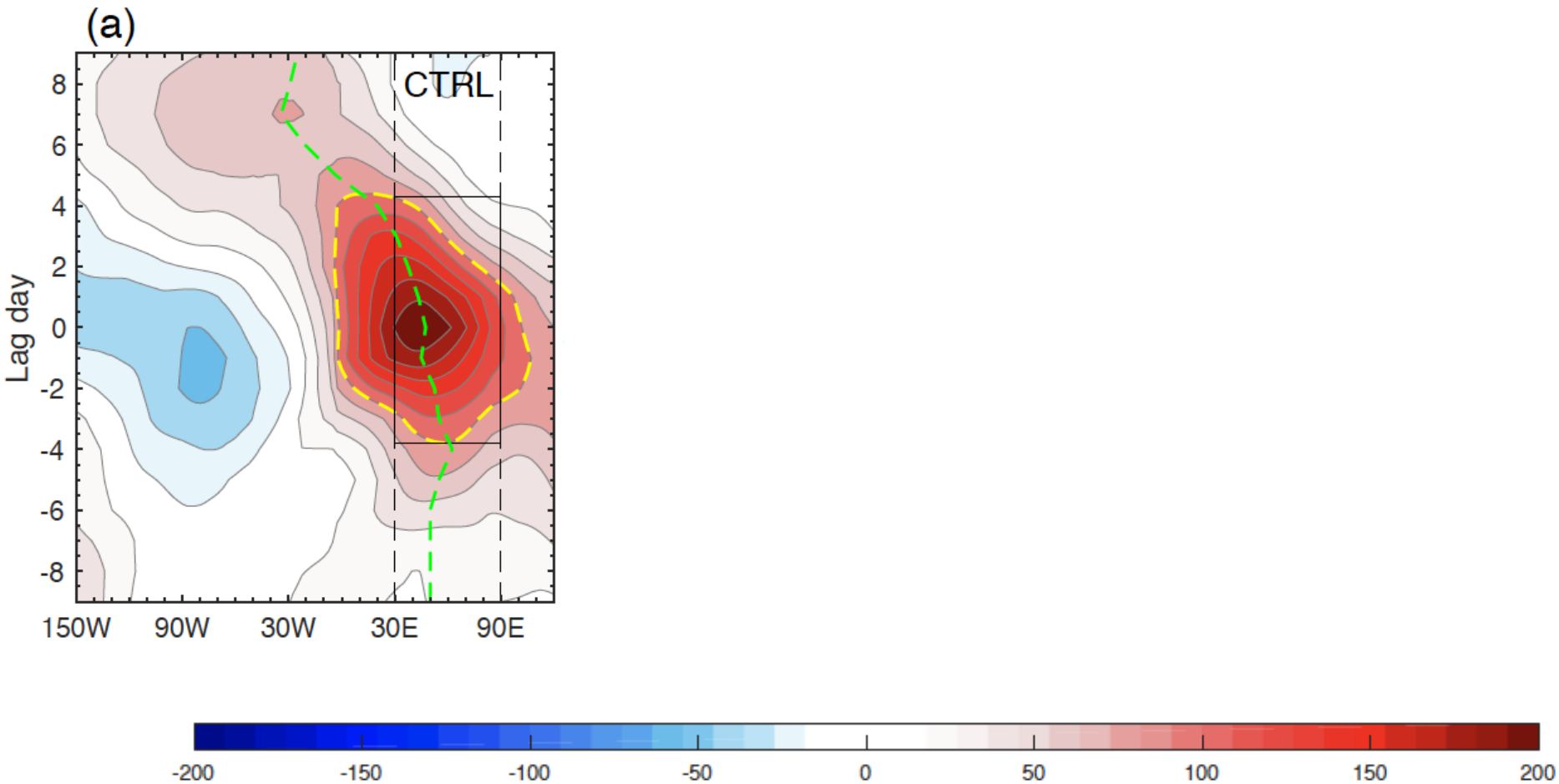
Event Number

Frequency of blocking days

Duration

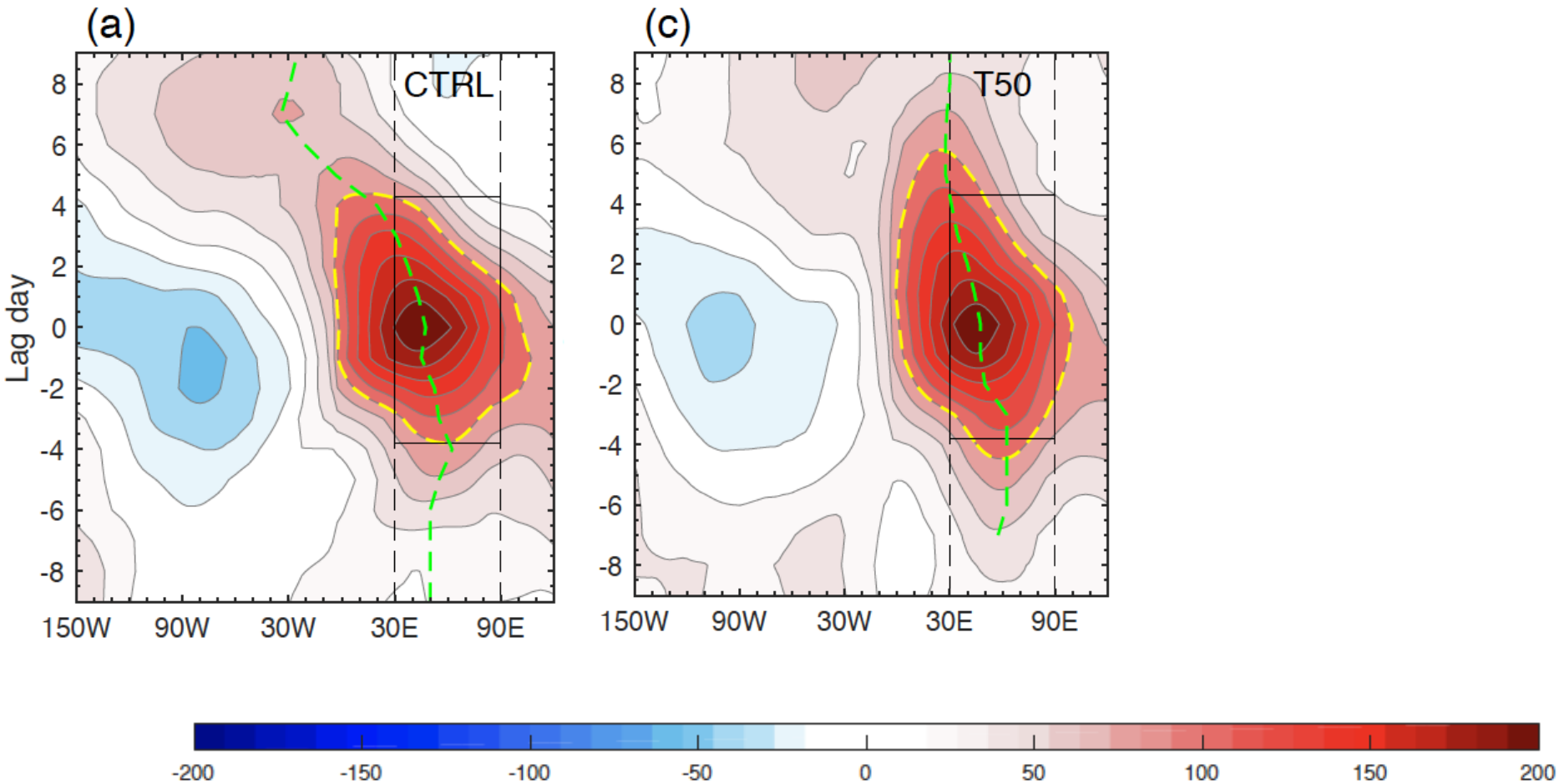


Nonlinear response in Ural blocking duration

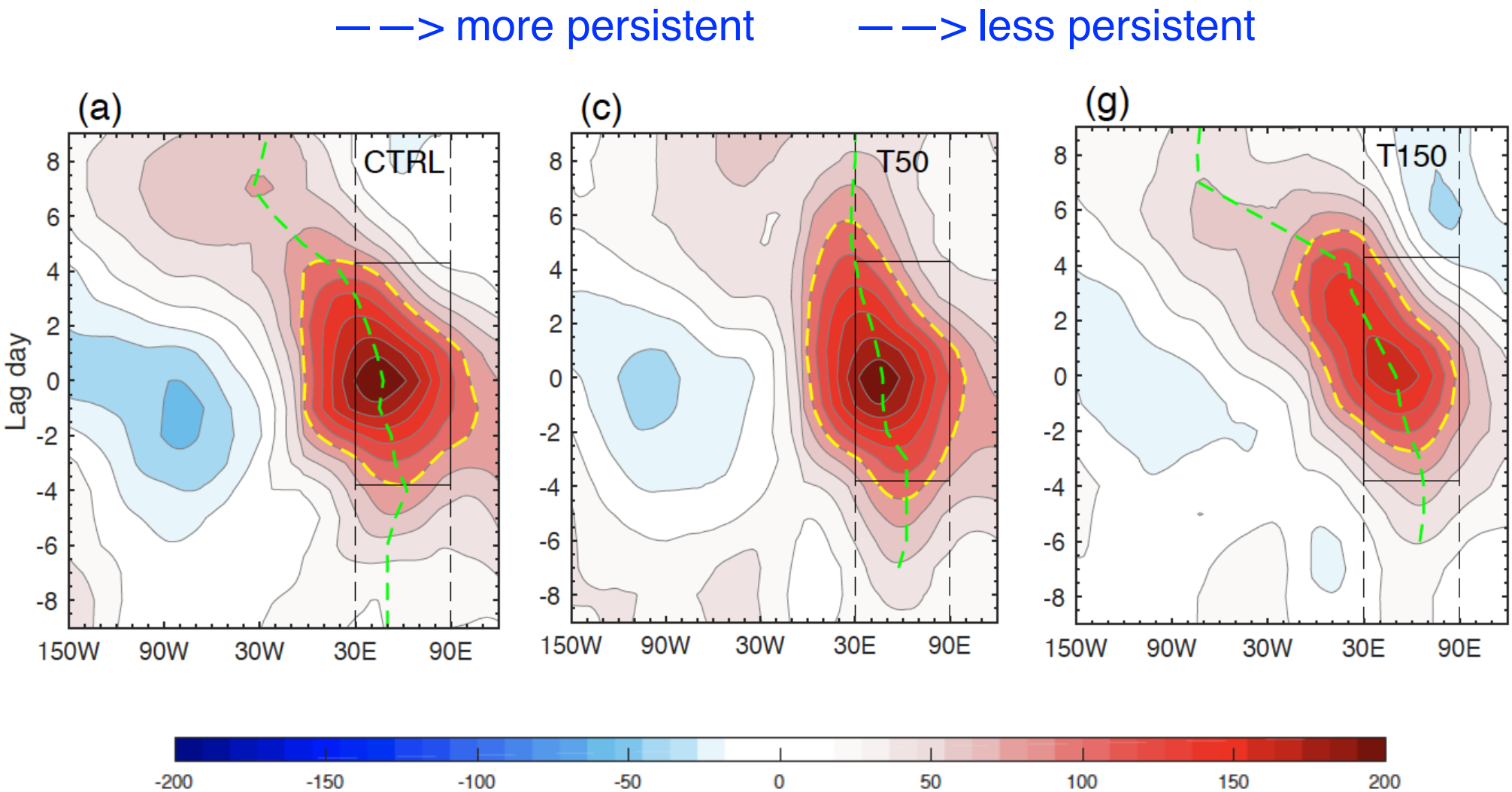


Nonlinear response in Ural blocking duration

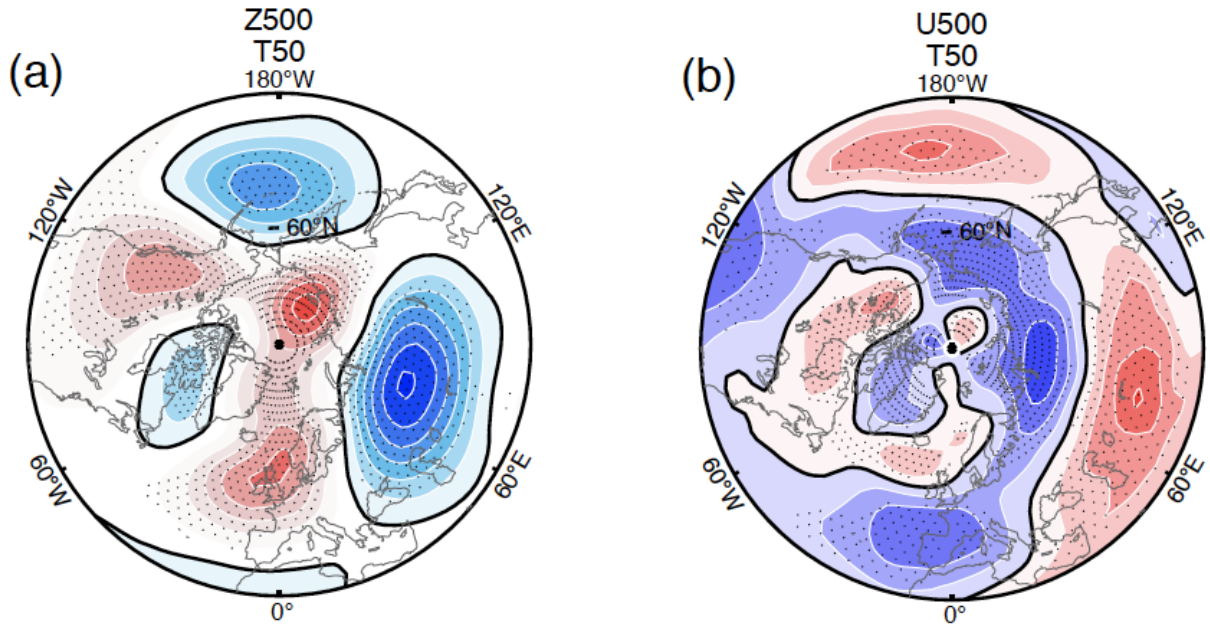
— —> more persistent



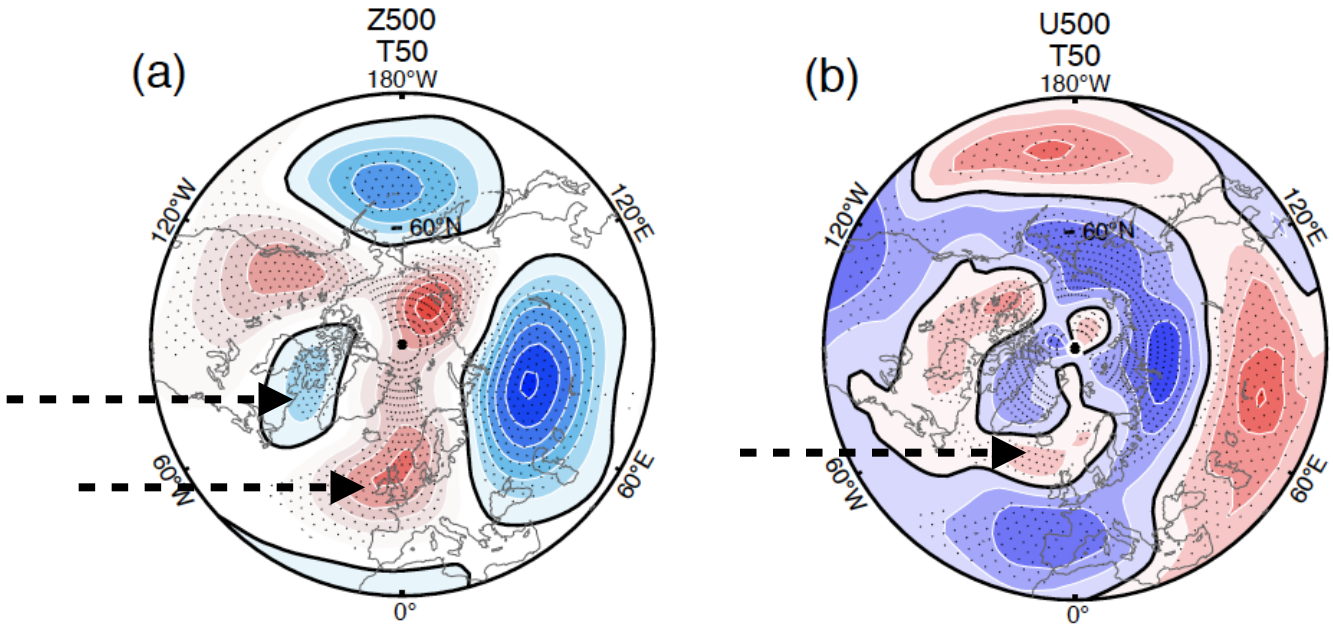
Nonlinear response in Ural blocking duration



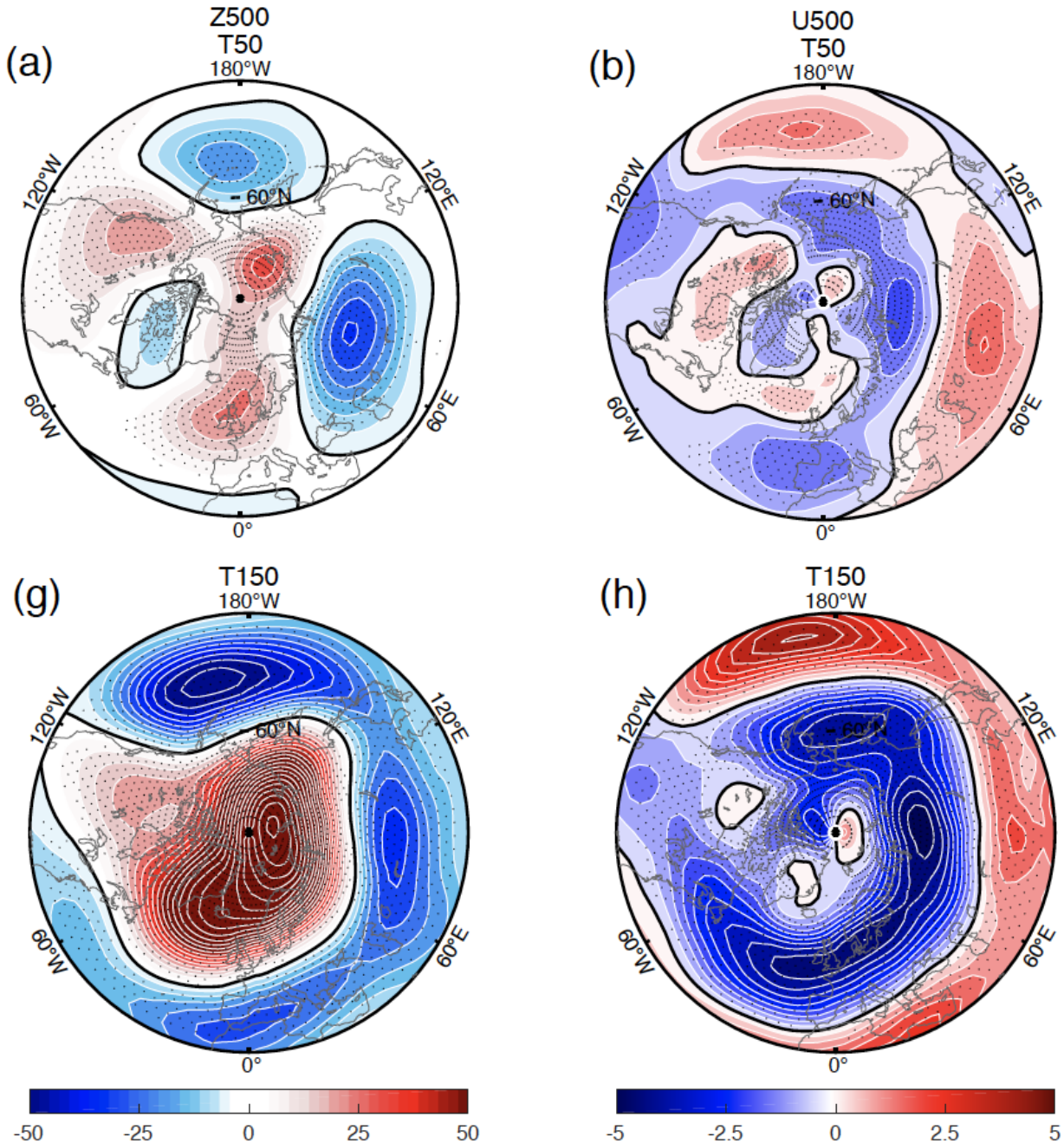
Nonlinearity in mean state response



Nonlinearity in mean state response



Nonlinearity in mean state response



Conclusions

- How does Barents-Kara Sea sea ice melting and warming affect the Ural blocking activities? Nonlinear response in Ural blocking is found - blocking duration first increases and then decreases with BKS warming. This is consistent with the mean state response in upstream zonal wind.

Chen, Wu, Luo, Dunn-Sigouin, in preparation

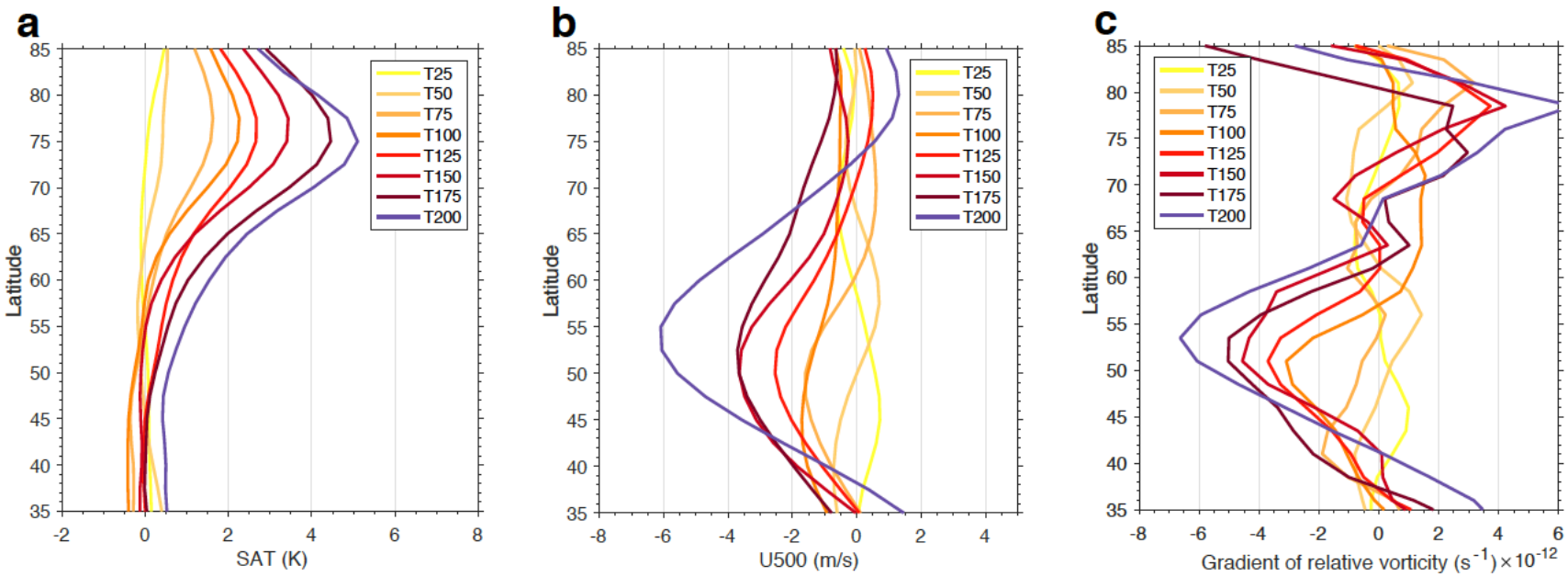


Figure 6. Latitude cross sections for mean-state responses of (a) surface air temperature (SAT), (b) U500 and (c) $\zeta_y 500$. Colored line denotes perturbation runs minus CTRL. SAT is averaged over Ural longitudes (30-90E) in (a), while U500 and $\zeta_y 500$ are averaged over 60W-30E where UB migrates through.