Nonlinear Ural Blocking Response to Barents-Kara Sea 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
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

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\begin{figure}
\centering
\subfloat[ERA]{
\includegraphics[width=0.45\textwidth]{era.png}
}
\hspace{1cm}
\subfloat[WR18]{
\includegraphics[width=0.45\textwidth]{wr18.png}
}
\caption{Comparison of wind speed in ERA and WR18 models.}
\end{figure}

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)
Idealized dry dynamical core experiments

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

(a) T25

(b) T50

(c) T75

(d) T100
Nonlinear response in Ural blocking days
Nonlinear response in Ural blocking duration
Nonlinear response in Ural blocking duration
Nonlinear response in Ural blocking duration

→ more persistent
Nonlinear response in Ural blocking duration

—→ more persistent  —→ less persistent
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.
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.