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North Atlantic Origin of Interdecadal variability of Siberian High

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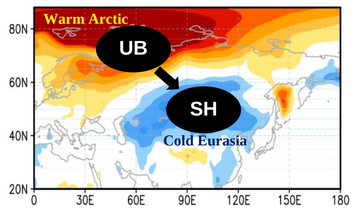
1. Introduction

- Interdecadal variability of SH (Siberian High) is partly explained by the Arctic Oscillation. However, we emphasize the role of WACE (Warm Arctic and Cold Eurasia), which is the second EOF mode of winter surface air temperature variability over Eurasia (Mori et al, 2014).
- SH-Ural blocking interaction is a crucial mechanism for East Asian winter climate (Takaya and Nakamura 2005). In this regard, the WACE pattern can be considered as a consequence of the interaction.

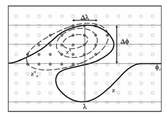


- In this study, we investigate new origin of SH through changes in the WACE pattern on the interdecadal time scale.

2. Data and Method

- NOAA-CIRES T 20 Century Reanalysis (20CR) version 2c during 1901-2013
- Blocking detection (Dunn-Sigouin et al., 2013)

It starts by identifying a contiguous area of blocking anomalies, as in the DG index, and then a reversal of the meridional gradient of geopotential height is evaluated about southward direction of the blocking anomaly maximum, as in the TM index.



- Blocking frequency

ratio of blocked days to the total number of wintertime days (unit: %)

3. Results

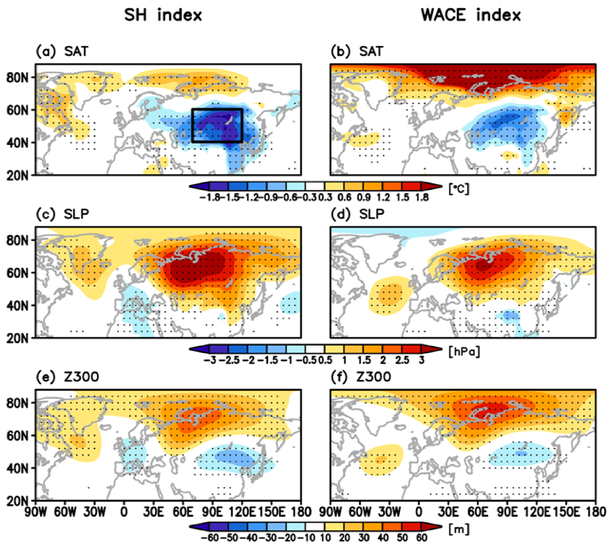


Figure 1. Linear regression maps of (a) surface air temperature (SAT), (b) sea level pressure (SLP), and (c) geopotential height at 300 hPa (Z300) onto the SH index. (b),(d) and (f) are same as (a),(c), and (e) except for regression onto the WACE index, respectively. Stippling indicates regions exceeding 95% confidence level on a t-test. Black box in (a) denotes domain for the SH index definition.

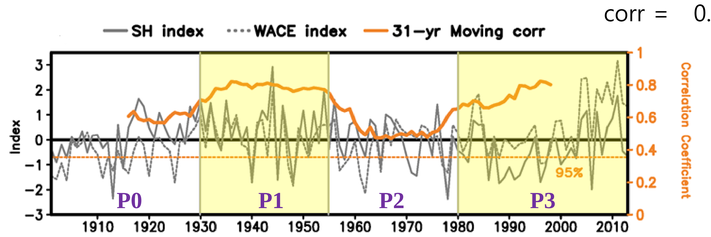
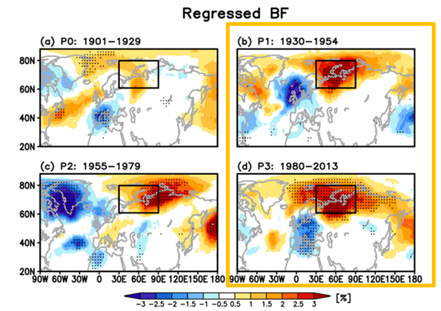
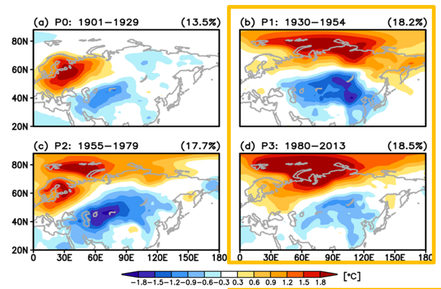


Figure2. Normalized Siberian High (SH) index (gray solid line) and WACE index (gray dotted line) during winter (1901-2013, DJF-mean) from 20CR data. Bold orange-colored line represents 31-yr moving correlation coefficient between the SH and WACE indices (right axis label) and thin orange dotted line denotes 95% confidence level on a t-test.



Strong correlation period



Strong correlation period

Figure3. Blocking frequency regressed onto the WACE index for (a) P0, (b) P1, (c) P2, and (d) P3 periods.

WACE-related UB increase

- **UB-induced cold advection**
- **Enhanced SH**
- **UB-SH strong coupling**
- **WACE pattern amplify**

Figure 4. The WACE EOF patterns during (a) P0, (b) P1, (c) P2, (d) P3 subperiods, respectively.

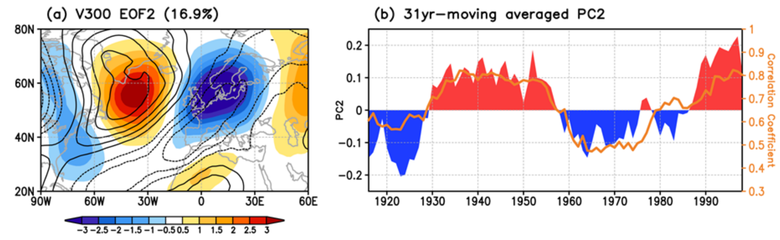
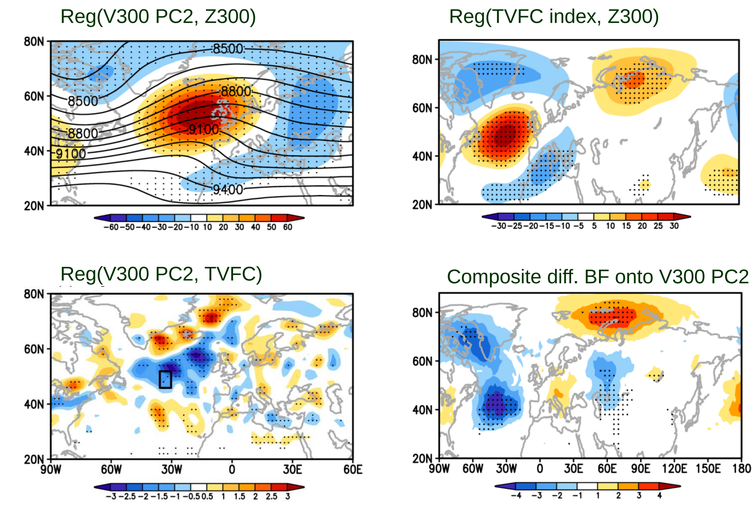
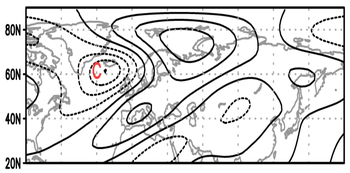


Figure 5. (a) The 2nd EOF mode (shading) of wintertime 300hPa meridional wind for Atlantic domain (90°W-60°E, 20°N-80°N), and climatological meridional wind (contour, interval is 2 m/s). (b) 31-yr moving averaged time series of PC2 (shading) and moving correlation coefficients between the SH and WACE indices.



Stationary Wave model result



Changes in atmospheric circulation (V300 PC2)

- **Interdecadal fluctuation of continental trough**
- **Resultant strengthening of baroclinicity**
- **Changes in transient vorticity flux con/div**
- **Leading to downstream wave development**
- **Existence of anticyclonic flow over Ural**
- **More frequent blocking occurrence**
- **Intensified SH**

4. Conclusion

- We suggest that changes in the mean atmospheric circulation structure in the North Atlantic play an important role in the interdecadal variability of SH through the modulation of Ural blocking frequency.

Acknowledgements
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