European Weather Sensitivity to Barents-Kara Sea Ice Variability

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Key Questions

- **Changes in the tropospheric circulation over the Euro-Atlantic sector are associated to sea ice variability in Barents-Kara (B-K): is there a causal link?**
- **What happens with sea ice reduction?**
- **Such changes can be explained via a propagation of signal into the stratosphere: does it work?**

A link between sea ice and tropospheric circulation patterns is analysed. An observational analysis based on 18 years is presented where years with low (LIYs) and high ice cover (HIYs) are compared. **The local circulation over B-K in low ice regimes is linked with anomalies in the Euro-Atlantic Sector (EAS) through a stratospheric intermediary. The circulation in the EAS is analysed in terms of blocking occurrence and low-level jet regimes.**

1. Data & Methods

The atmospheric data sets used in this study are from the Era-Interim reanalysis (ECMWF). A two-dimensional blocking index based on Tibaldi and Molteni (1990, Tellus) has been computed (2DTM90). The Jet-Latitude Index (JLI) has been calculated following the procedure in Woollings et al. (2010, QJRMS) for the Atlantic Sector. The 100 hPa eddy heat flux has been integrated as in Hinssen and Ambaum (2010, JAS).

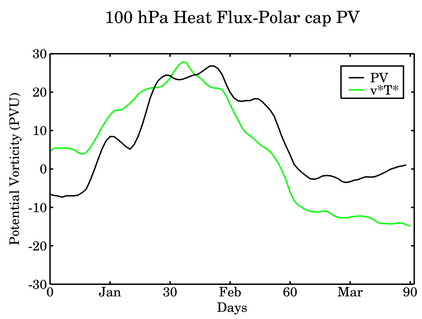

Figure 1: Anomaly of the integrated 100 hPa eddy heat flux (green line) and minus the isentropic PV at 530 K (black line) for the LIYs minus HIYs.

2. The Jet Latitude Index

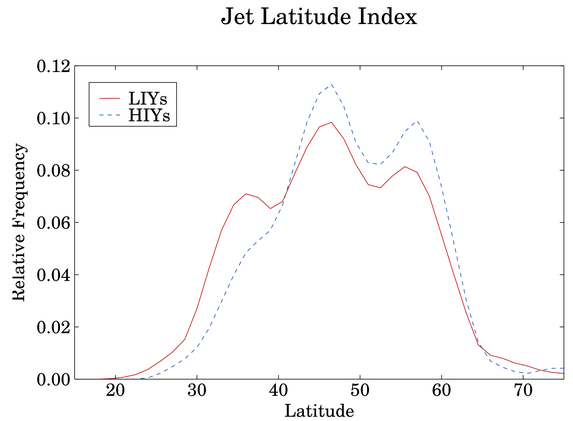

Figure 2: .Comparison of the PDFs of the JLI for LIYs (red line) and HIYs (blue-dashed line) in DJFM

The JLI is a measure of the low-level jet over the Atlantic Ocean. It shows that the southern peak is lost in the HIYs and that LIYs have more events of meridional jet (figure 2). Changes in the JLI regimes can explain temperature anomalies over Europe.

3. Main Results

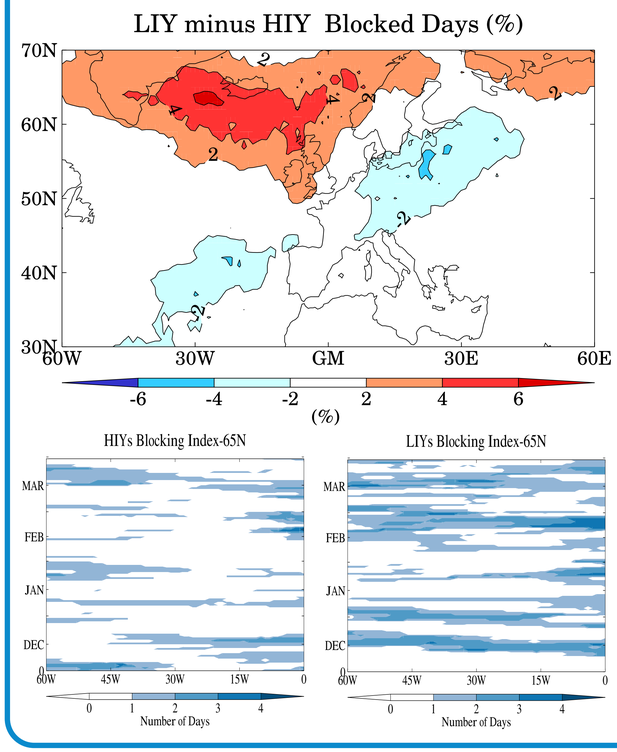

Figure 3: Difference of the percentage of blocked days for LIYs minus HIYs according to the 2DTM90 index (top). Hovmöller diagrams for the 2DTM90 index at 65°N (bottom).

The impact of sea ice anomalies on the stratospheric circulation has been recently assessed. The analysis of the eddy heat flux reveals a weakening of the polar vortex in late January and in February (figure 1). **Much of the high latitude blocking events detected by the previous index occurred in February and March in the LIYs case (figure 3).** Indications from the 2DTM90 index (figure 3) suggest an increase in high latitude blocking. The downward propagation of the stratospheric anomaly can favor the occurrence of high latitude blocking in the North Atlantic. The mechanism can have an impact on the European weather (figure 4).

4. Conclusion and Further Work

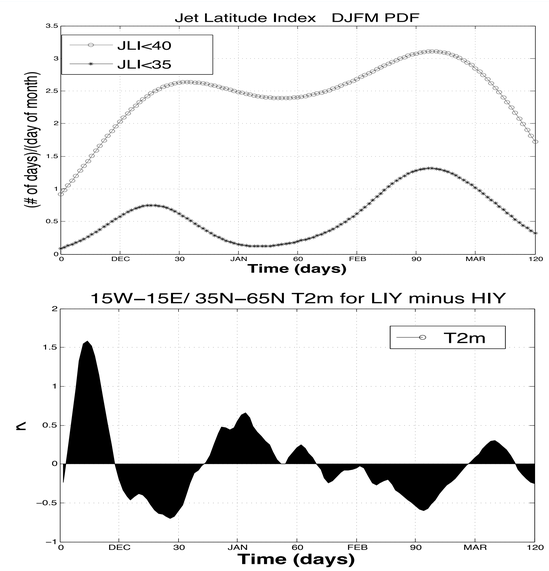

Figure 4: Distribution of low latitude jet events for the LIYs case (top). T2m anomaly over Western Europe.

- The reduction of sea ice in B-K is associated with a weakening of the polar vortex.
- Enhanced blocking activity may be favored by those stratospheric anomalies.
- The European weather could be sensitive to B-K sea-ice.
- *Is Sea-Ice the cause or just a collateral consequence?*
- *What is (if there is one) the dynamical mechanism propagating the signal downward?*

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