初冬バレンツ海における海氷面積の予測可能性

中野渡　拓也[1]、佐藤　和敏[2,3]、猪上　淳[3,4]
[1] *北海道大学　低温科学研究所*
[2] *総合研究大学院大学*
[3] *国立極地研究所*
[4] *海洋研究開発機構　地球環境変動領域*

Predictability of the Barents sea ice extent in early winter

Takuya Nakanowatari[1], Kazutoshi Sato[2,3], Jun Inoue[3,4]
[1]*Institute of Low Temperature Science, Hokkaido University*
[2]*The Graduate University for Advanced Studies*
[3]*National Institute of Polar Research*
[4]*Research Institute for Global Change, JAMSTEC*

The sea ice variability of the Barents Sea in early winter (December) and its resultant dynamical atmospheric response is considered to be the triggers of a dynamic atmospheric response with severe consequences for weather conditions over the Eurasia continent including Japan [Honda et al., 2009; Petoukhov and Semenov, 2010; Inoue et al., 2012]. In this study, canonical correlation analysis (CCA), a linear statistical method designed to find correlated patterns between predictor and predictand fields, is applied to the Barents sea ice concentration (SIC). The cross-validation technique is used to estimate the levels and sources of forecast skill for SIC for the 30-yr time period of 1980–2009. Sea surface temperature (SST), sub-surface temperature at 200m depth (Tsub), surface air temperature, surface wind in the Barents Sea and sea level pressure (SLP) and geopotential height at 500hPa (Z500) in the Northern hemisphere are used as predictor fields in an attempt to maximize the strength of the predictive relationships. The highest skill for a single-predictor model is from one-year leading Tsub and one-month leading meridional wind (Vsfc). Tsub explains 30% of SIC variability mainly in the eastern side on decadal timescale. CCA diagnostics suggest that change in the subpolar North Atlantic gyre generates a temperature anomaly and the resultant thermal anomaly is advected to the Barents Sea by Norwegian Atlantic Slope Current with 3 to 4 years. Vsfc explains 22% of SIC variability mainly in the western side on year-to-year timescale. CCA diagnostics indicate that the Vsfc is related to the teleconnection pattern from the North Atlantic. Thus, our study suggests that both atmospheric and oceanic remote effects lead to more accurate forecasting of the SIC than that using only local oceanic heat condition in the Barents Sea [Schlichtholz, 2011].

References

Honda, M., J. Inoue, and S. Yamane, Influence of low Arctic sea-ice minima on anomalously cold Eurasian winters, Geophys. Res. Lett., 36, L08707, doi:10.1029/2008GL037079, 2009.

Petoukhov, V., and V. A. Semenov, A link between reduced Barents-Kara sea ice and cold winter extremes over northern continents, J. Geophys. Res., 115, D21111, doi:10.1029/2009JD013568, 2010.

Inoue, J., M. Hori, and K. Takaya, The role of Barents sea ice in the wintertime cyclone track and emergence of a Warm-Arctic Cold Siberian anomaly, J. Climate, 25, 2561-2568, 2012.

Schlichtholz, P., Influence of oceanic heat variability on sea ice anomalies in the Nordic Seas, Geophys. Res. Lett., 38, L05705, doi:10.1029/2010GL045894, 2011.