Lagged effect of tropical ocean on sea ice variability in the Sea of Okhotsk

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The Sea of Okhotsk is a unique sea, where sea ice spreads to the lowest latitudes in the world. Sea ice extent in the Sea of Okhotsk varies remarkably from year to year controlled by various factors. One of the important factors is a remote effect. Previous studies showed that the sea ice extent in the Sea of Okhotsk increased in years of El Niño events, however, the lagged effect from the tropical ocean has not been considered. Tropical ocean has the significant-lagged impact on other regions such as the tropical Indian Ocean (TIO) capacitor effect (Xia et al., 2009). The TIO capacitor effect is a phenomenon in which the influence of the tropical Pacific Ocean appears in the TIO with a lag of 2-3 months. We therefore examined the lagged relationship between the tropical ocean and sea ice variability in the Sea of Okhotsk using statistical analysis. We found that sea ice extent in the Sea of Okhotsk was increased in the next winter after the La Niña events (Fig. 1a). We suggest the hypotheses that a process of relationship between La Niña and the variability of the sea ice extent in the Sea of Okhotsk in next winter are as follows: 1) In the La Niña winter, anomalous convection near the Philippine Sea persisted until half a year later in the summer. 2) Anomalous convection excites the Pacific-Japan teleconnection pattern, which are related to low pressure anomalies near Siberia (Fig. 1b) and low temperature anomalies in the soil. 3) The low temperature anomalies in the soil around Siberia persist until early winter, bringing cold air to the Sea of Okhotsk and increasing sea ice. Some of these process were also confirmed by numerical model experiments.
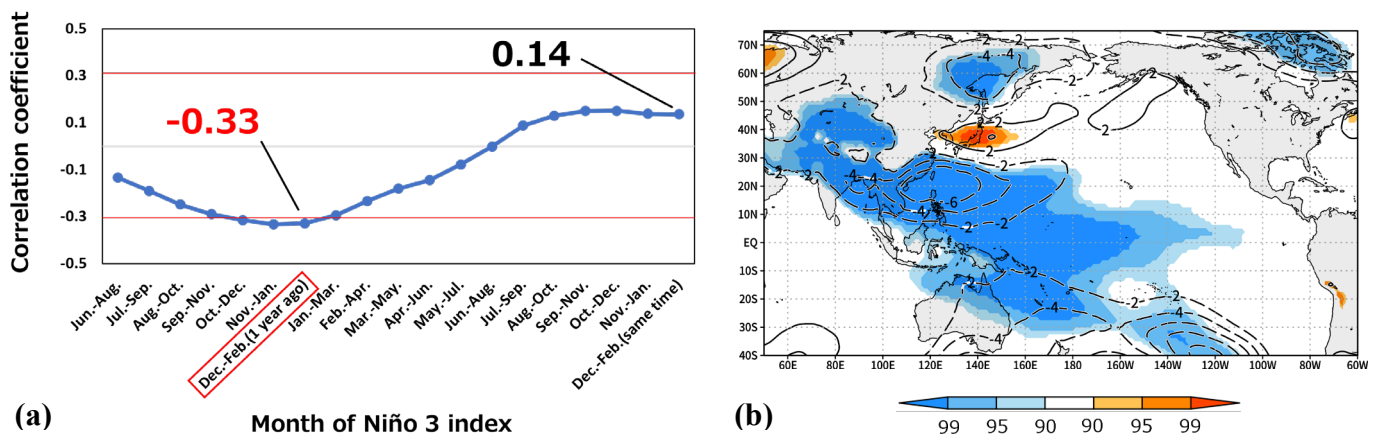

Figure 1. **(a)** Time series of lagged correlation coefficients between the Sea of Okhotsk sea ice extent and the Niño 3 indices. The red line indicates a confidence level of 95%. **(b)** Regression between the three months averaged OLR index in the Philippine Sea from June to August with the geopotential height of 850 hPa in the same time. Contours indicate regression coefficients (m). Color shading indicates confidence levels.

Reference

Xie, S.-P. et al. 2009：Indian Ocean Capacitor Effect on Indo–Western Pacific Climate during the Summer following El Niño. *Journal of Climate*, **22(3)**, 730-747.