



Interannual Variability and Long-Term Changes of Atmospheric Circulation over the Chukchi-Beaufort Seas

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Recent studies have documented many features of the Beaufort Sea High (BSH), including seasonal cycle, temporal variability based on a BSH strength index, and a trend towards a stronger summer BSH that began in the late 1990s. In this study, we will further examine the variability and long-term trends of atmospheric circulation over the Chukchi-Beaufort Seas and northern Alaska using ERA Interim Reanalysis for the period of 1979-2012.

To capture the moving feature of the BSH, the EOF analysis is applied to sea level pressure (SLP) field in the Chukchi-Beaufort Seas to investigate the principal patterns of the BSH variability for seasons of springtime (Apr.-May), summertime (Jun.-Aug.), autumn (Sep.-Oct.), and wintertime (Nov.-Mar.). In each season, the leading three EOF modes explain near 90% of the total variance, reflect a wintertime-like strengthened or weakened BSH centered over the western Arctic Ocean (EOF1), north-south dipole-like SLP anomalies (EOF2), and west-east dipole-like SLP anomalies (EOF3) respectively. The correlations are -0.83 between the PC time series of EOF1 (PC1) and the index of the Northern Annular Mode (NAM) in JJA, and -0.88 (0.57) between the PC 1 (PC2) of the EOF1 (EOF2) and the index of the North Pacific Oscillation (Pacific-North American) teleconnection pattern during Nov.-Mar., indicating that there are extensive controls of the BSH by the large-scale climate modes. Both PC2 associated with EOF2 in JJA and SO have exhibited a significant tendency toward high index polarity at the 10% level over the past few decades, are related to strongly reduced Arctic sea ice extent in summer and autumn.

In the study period, we also detected significant anticyclonic trends of surface wind fields associated with a strengthened BSH during summer (JJA) and autumn (SO), and significant cyclonic trends of surface wind fields associated with a weakened BSH during early-middle winter (November to January). Such changes in atmospheric circulation from summer to middle winter seasons over the Chukchi-Beaufort Seas and northern Alaska cannot be explained by the natural variability at the 5% significant level, and might be attributed to the externally anthropogenic forcings.