



The Beaufort Anticyclone and its Relation to the Climate System

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Introduction

The Beaufort Anticyclone is the dominant surface pressure feature located over the Beaufort Sea. Its location has a large influence over the surface wind regime and also surface sea ice transport in the Arctic. It was first documented by Walsh, 1978 as a semiannual anticyclone with greatest influence during the transitional spring and autumn seasons. Other studies (Cullather and Lynch 2003) hypothesize the Beaufort Anticyclone is a result of mass flux between the Atlantic and Pacific Oceans. This study seeks to better define the Beaufort Anticyclone both spatially and temporally as well as discover any teleconnection influences.

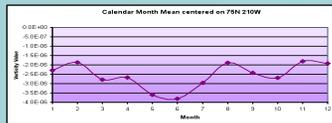
What was the data source?

The NCAR/NCEP SLP reanalysis is the dataset used for this study. Two 30-year climatologies were compared to verify the consistency of the pressure pattern from 1949-1978 and 1979-2008. 1979 is the beginning of the IABP buoy program. Incorporation of this data may show a different climatology pattern, which will decrease the number of usable years in the study.

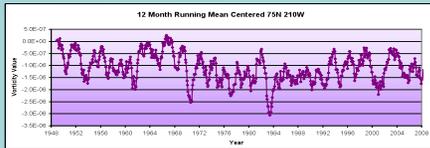


SON climatology comparison shows similar magnitude features for both time periods. This was evident in all seasons, thus verifying the usage of the entire period.

Do the data show changes over time?



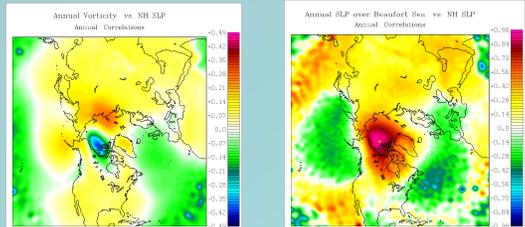
Calendar month mean shows the maximum anticyclone magnitude in May-June, not in the transitional seasons as previously documented.



12 month running mean shows more positive values in beginning of time period with more negative values in the middle and returning to slightly less negative at the end.

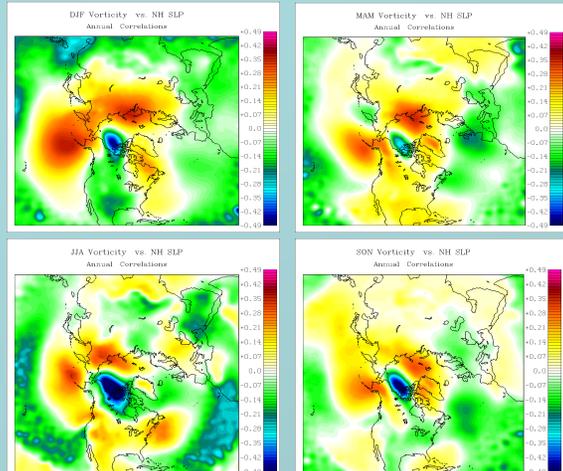
How was the Beaufort Anticyclone tracked?

SLP data was used to create a vorticity metric over Beaufort Sea. Vorticity values were calculated and averaged over a circular region centered at 75°N, 210°W with a radius of 555 km (5° latitude). Use of vorticity allows for tracking of pressure gradients, and creates cleaner correlation signal



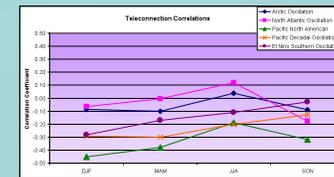
How is the Beaufort Anticyclone related to pressure variations in the Northern Hemisphere?

The seasonally averaged vorticity metric correlated with the NH SLP shows an opposite correlation signal over Northern Siberia and over the Aleutian Low track leading to the hypothesis that mass is transferred to and from these locations as the Beaufort Anticyclone builds and decays.



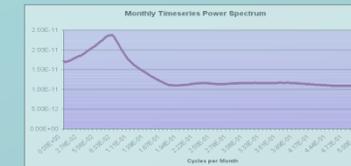
Is the Anticyclone part of large-scale atmospheric modes of variability?

Seasonally averaged teleconnection index values correlated with the Beaufort Anticyclone vorticity metric reveal weak correlations with the Atlantic patterns over all seasons and stronger correlations with the Pacific patterns. The El Niño/Southern Oscillation shows larger correlations over winter and weaker correlations during summer.



Are there any cyclic patterns associated with the Anticyclone?

Spectral Analysis of the monthly vorticity timeseries shows a peak at the 12 month cycle indicating an annual cycle. There were no other spectral patterns found.



Conclusions

- Calendar month mean shows the vorticity minima in May-June. This seasonality differs from earlier studies, which suggested two vorticity minima in transition seasons.
- Over time, the Beaufort Anticyclone appears to have increased in magnitude in the 1970s and 1980s, with a slight decrease into 2000s.
- Spectral Analysis indicates that the annual cycle as the only prominent cyclic pattern for the Beaufort Anticyclone.
- Compensating mass anomalies for Beaufort Anticyclone are found in Northern Siberia and the Aleutian storm track. This differs from the previous hypothesis a mass transfer between the Atlantic and Pacific Oceans.

References

Cullather, R. I. and A. H. Lynch, 2003: The annual cycle and interannual variability of atmospheric pressure in the vicinity of the North Pole. *International Journal of Climatology*, 23(10): 1161-1183.

Walsh, J.E., 1978: Temporal and Spatial Scales of the Arctic Circulation. *Mon. Wea. Rev.*, 106, 1532-1544.