

Analysis of the difference between Arctic Oscillation and North Atlantic Oscillation using Self-Organizing Maps

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Arctic Oscillation (AO) is an oscillating phenomenon detected in sea-level pressure (SLP) fields between the North Pole and both North Pacific and North Atlantic. North Atlantic Oscillation (NAO) is a similar oscillating phenomenon detected in SLP fields between the North Pole and North Atlantic. Itoh (2008) said that the oscillations of AO and NAO cannot be divided by PC1-PC2 plain of Empirical Orthogonal Function (EOF) analysis of 3 point sea saw model.

In this study, therefore, the relationship and difference between AO and NAO are examined using Self-Organizing Maps (SOM). The SLP fields and the barotropic components of the atmosphere are analyzed using the Japanese 55-year Reanalysis (JRA-55) and National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) reanalyses. The analysis was conducted both for winter (December, January, and February: DJF) monthly data and their mean from 1960 to 2010. First, an EOF analysis was conducted for the SLP fields and their barotropic components. Second a SOM analysis was conducted for the first 20 EOFs. Third, the results of the SOM analysis were plotted on the PC1-PC2 -plain that is EOF score. By using this plain, the relationship and difference between AO and NAO were examined.

It was revealed that structure of AO depends on the period of the analysis. Therefore, the definition of AO is not suitable. A blank area of the score of EOF was seen on the PC1-PC2 plane only in the analysis of DJF mean (Figure 1). And it was found that the center of action of the SLP fields that is Atlantic Oscillation is negative, North Pole is positive, and North Pacific Ocean is positive. In this study, that center of action is named Pacific Atlantic Regime (PAR). But, the analysis of monthly mean and barotropic component was not found a blank area, which could be because the data of DJF mean have baroclinity due to heat flux during three months over North Pacific Ocean. It was also revealed that the SLP anomaly used DJF mean over North Pacific Ocean becomes large positive or negative only when NAO index is negative.

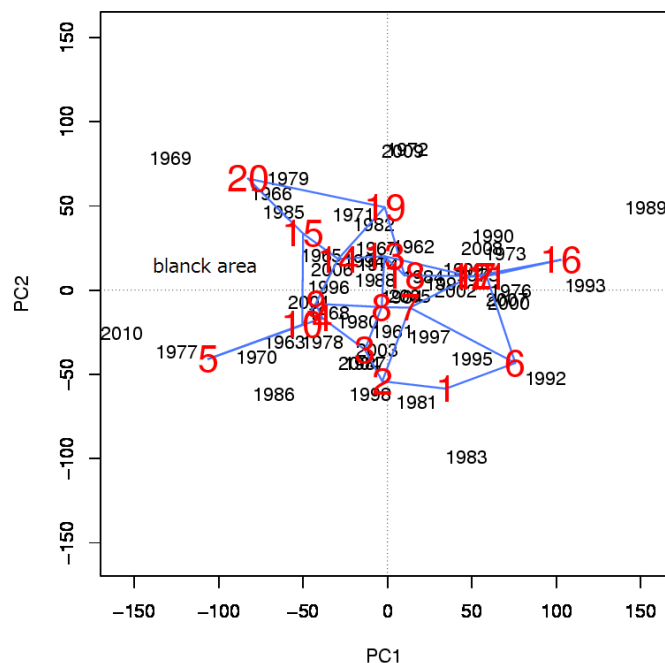


Figure 1. PC1-PC2 plain and node of SOM

References

- [1] Itoh, H., Reconsideration of the true versus apparent Arctic Oscillation. *Journal of Climate.*, **21**, 2047-2062 (2008)