

**Decadal variability of the spatial structure of the NAO - a 2D NAO index for sea-ice feedback**

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Various studies have documented an eastward shift in the northern node of the NAO between two subsequent twenty-year winter periods starting in the late fifties and ending in the late nineties, or 1958-1977 and 1978-1997, relating the shift to global change. However, when considering the longer time period of almost 14 decades starting in 1871 a much richer pattern of spatial variability of the NAO emerges. In fact, the shift in position of the southern node in the late nineteenth century is considerably greater than that of the northern node and in some instances both nodes shift positions in the opposite way leading to a jump in the position of the pattern. This paper examines the decadal variability of the variability in terms of surface pressure and relates it to other climatic variables such as sea-ice extent that are known to exert a feedback on the NAO. We shall present a comprehensive overview of uncertainty of the NAO in terms of the pattern of its standard deviation. We examine concurrent changes in variability in other near surface fields such as temperature, surface wind and sea-ice extent as well as the upper level jet. This leads to the definition of an alternative index that accounts for the location of the two nodes of the NAO as well as the value of loading in terms of pattern projection. Two time periods in the 14-decade record emerge as being particularly different, the last decades of the nineteenth century and the couple of decades following the mid 1920s. We plan to supplement our analysis of the reanalysis record by looking at historical climate simulations along with climate projections, firstly to determine if the two anomalous periods emerge in climate simulations, and secondly to determine if the two historical periods remain significantly different in climate projections for the next century