How Predictable Are the Arctic and North Atlantic Oscillations? Exploring the Variability and Predictability of the Northern Hemisphere

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The North Atlantic Oscillation (NAO) and the Arctic Oscillation (AO) describe the dominant part of the variability in the Northern Hemisphere extratropical troposphere. Because of the strong connection of these patterns to surface climate, recent years have shown an increased interest and an increasing skill in forecasting them. However, it is unclear what the intrinsic limits of short-term predictability for the NAO and AO patterns are. This study compares the variability and predictability of both patterns, using a range of data and index computation methods for the daily NAO and AO indices, and a suite of diagnostics including probability distributions and moments, autocorrelation functions, Fourier spectra and dynamical systems theory tools (phase space reconstruction and the Lyapunov spectrum). We found that predictability is not significantly different between the AO and NAO or between reanalysis products. Differences exist, however, between the indices based on EOF analysis, which exhibit predictability time scales around 12–16 days, and the stationbased indices, exhibiting a longer predictability of 18–20 days. Both of these time scales indicate predictability beyond that currently obtained in ensemble forecast models. This additional longer-term predictability for these patterns may arise through local feedbacks and remote forcing mechanisms for particular atmospheric conditions.