



Using the Convergent Cross Mapping method to test causality between Arctic Oscillation / North Atlantic Oscillation and Atlantic Multidecadal Oscillation

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There is a vast literature body on the climate indices and processes they represent. A large part of it deals with "teleconnections" or causal relations between them. However until recently time lagged correlations was the best tool of studying causation. However no correlation (even lagged) proves causation.

We use a recently developed method of studying casual relations between short time series, Convergent Cross Mapping (CCM), to search for causation between the atmospheric (AO and NAO) and oceanic (AMO) indices. The version we have chosen (available as an R language package rEDM) allows for comparing time series with time lags.

This work builds on previous one, showing with time-lagged correlations that AO/NAO precedes AMO by about 15 years and at the same time is preceded by AMO (but with an inverted sign) also by the same amount of time. This behaviour is identical to the relationship of a sine and cosine with the same period. This may suggest that the multidecadal oscillatory parts of the atmospheric and oceanic indices represent the same global-scale set of processes. In other words they may be symptoms of the same oscillation. The aim of present study is to test this hypothesis with a tool created specially for discovering causal relationships in dynamic systems.