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## NAO index values estimated from Earth orientation parameters

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Earth orientation parameters are strongly influenced by atmospheric and oceanic signals. Thus, it should be possible to identify states of the climate system from these parameters; providing an independent measure of climate variability. A methodology is developed for estimating North Atlantic Oscillation (NAO) index values from polar motion excitation functions (χ1/2). The index is developed using data taken from a 20th century run of the ECHAM5/OM1 coupled atmosphere-ocean general circulation model (GCM). Atmospheric and oceanic polar motion excitation functions are calculated from the GCM data. The index is developed as follows: first, the impact of the NAO on the different subsystems - atmospheric pressure, wind, oceanic motion and oceanic mass redistribution is assessed. Partial polar motion excitation functions are calculated from the local contributions, at points where the excitation functions correlate well with the NAO index derived from atmospheric data. In the following, the spectral frequencies on which the NAO influence can be determined in the globally integrated excitation functions are extracted using Fourier and wavelet coherence analysis. Finally, an index is built with a linear regression model using the aforementioned relevant frequency bands of χ1 and χ2. It is assumed that the frequencies derived from the coupled model represent real climate variability. To validate this assumption, the method is tested using different data sets: a) the Ocean Model for Circulation and Tides (OMCT, Thomas 2001) driven with ECMWF ERA Interim Reanalysis data (1989-2008) and, b) polar motion excitation functions derived from observations (IERS C01 series) and a station-based NAO index (1865-2000, Hurrel 1995) . Different calibration periods are used to confirm the validity of the method. The comparison with the respective atmospheric NAO index yields correlations up to 0.65 (0.84 including the calibration period) for the ERA Interim /OMCT data set. Results for the observational data set reach 0.62 (0.73) for the 1984-2000 period.