Geophysical Research Abstracts
Vol. 16, EGU2014-14492, 2014
EGU General Assembly 2014

A simulated lagged response of the NAO to the solar cycle over the period 1960-2009

Martin Andrews and Jeff Knight
Met Office Hadley Centre, Exeter, UK (martin.andrews@metoffice.gov.uk)

Recent satellite observations suggest that the solar cycle UV variability is enhanced compared to previous reconstructions of solar variability. If true, this would have a direct influence on heating of ozone in the tropical stratosphere and consequently on the meridional temperature gradient and zonal winds. Previous climate model simulations have shown how these perturbations could migrate downward and polewards through a wave-mean flow interaction mechanism to influence the winter North Atlantic Oscillation (NAO). The impact of the solar cycle on the observed winter NAO has also been investigated in previous studies, indicating an increased tendency for positive (negative) NAO signals to occur a few years after maxima (minima) of the solar cycle. Climate models, however, have had varying success in reproducing this delay. In this study, the impact of enhanced solar cycle UV forcing on the NAO is investigated using the HadGEM3 Atmosphere-Ocean coupled model. Ensembles of simulations are performed over the period 1960-2009 which include time-evolving greenhouse gases, anthropogenic aerosols, volcanic aerosols and ozone changes. Three ensembles are considered: constant solar irradiance, solar variability from the NRL solar reconstruction and enhanced UV variability based on results from the SIM satellite instrument (reconstructed for the period 1960-2009). Significant NAO responses several years after extrema of the solar cycle are found, and it is shown that these responses persist even when the solar cycle becomes neutral. This confirms earlier suggestions of a further component to the NAO mechanism beyond direct atmospheric heating and its dynamical responses, implying a role for other parts of the climate system with sufficient memory to allow multi-annual signals to accumulate. A leading candidate in fulfilling this role is the Atlantic Ocean. Consequently, an analysis of air-sea interactions through the phases of the solar cycle in the model will be presented.