



Seasonal hindcasts of the North Atlantic Oscillation with a troposphere- stratosphere model

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We have investigated the importance of the stratosphere-troposphere linkage on the predictability of the NAO and associated weather patterns on the seasonal time scale. Using the ARPEGE atmospheric general circulation model with a well-described stratosphere, an ensemble of model simulations was carried out for the winter months from 1979/80-1992/93. The runs were initiated with ERA-40 reanalysis data and included observed SSTs and sea ice extent. On the seasonal time scale, the NAO hindcast score for JFM was 0.59. The high correlation seems to largely originate from the successful prediction of high positive NAO in two particular years (JFM 1989 and 1990). Improvement brought by the inclusion of a stratosphere is rather on the medium time scale (1 month), where even higher scores are found (0.68 for December). This score likely results from the better initialisation of the forecasts that include the stratosphere. The model successfully simulated the negative NAO phase following sudden warmings and the positive NAO phase following vortex intensification. The stratospheric circulation changes were associated with anomalies in the tropospheric jet stream with southward (northward) displacement during vortex weakening (strengthening). We found evidence for anomalous blockings over Northern Europe before SSWs, on average. The signal was weak but showed consistently in geopotential and wind speed patterns. The NAO signatures proved characteristic of an average life-cycle, with considerable variability from event to event. The exact timing of the SSWs and SVs themselves were not predictable on the seasonal time scale.