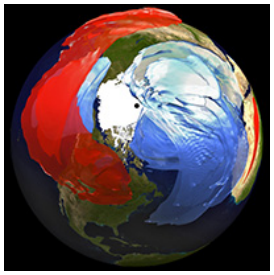

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The importance of stratospheric initial conditions for winter North Atlantic Oscillation predictability

Monday, 18 November 2019 16:00 (30 minutes)

This study investigates the influence of atmospheric initial conditions on winter seasonal forecasts of the North Atlantic Oscillation (NAO). Hindcast (or reforecast) experiments –which differ only in their initial conditions –are performed over the period 1960–2009, using prescribed sea surface temperature (SST) and sea-ice boundary conditions. The first experiment ("ERA-40/Int IC") is initialized using the ERA-40 and ERA-Interim reanalysis datasets, which assimilate upper-air, satellite and surface observations; the second experiment ("ERA-20C IC") is initialized using the ERA-20C reanalysis dataset, which assimilates only surface observations. The ensemble mean NAO skill is largest in ERA-40/Int IC (r = 0.54), which is initialized with the superior reanalysis data. Moreover, ERA-20C IC did not exhibit significantly more NAO hindcast skill (r = 0.38) than in a third experiment, which was initialized with incorrect (shuffled) initial conditions. The ERA-40/Interim and ERA-20C initial conditions differ substantially in the tropical stratosphere, where the quasi-biennial oscillation (QBO) of zonal winds is not present in ERA-20C. The QBO hindcasts are highly skilful in ERA-40/Int IC –albeit with a somewhat weaker equatorial zonal wind amplitude in the lower stratosphere –but are incorrect in ERA-20C IC, indicating that the QBO is responsible for the additional NAO hindcast skill; this is despite the model exhibiting a relatively weak teleconnection between the QBO and NAO. Whilst ERA-40/Int IC demonstrates a more skilful NAO hindcast, it appears to have a relatively weak predictable signal; this is the so-called "signal-to-noise paradox"identified in previous studies. Diagnostically amplifying the (weak) QBO–NAO teleconnection increases the ensemble-mean NAO signal with negligible impact on the NAO hindcast skill, after which the signal-to-noise problem seemingly disappears.

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