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Seasonal prediction of the North Atlantic Oscillation and European winters

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The last few winters continue to suggest that the winter North Atlantic Oscillation and hence winter average weather over large areas of Europe is predictable at seasonal lead times with a good level of prediction skill.

High predictability of tropical rainfall is shown to lead to predictable changes in seasonal vorticity anomalies and hence to stationary Rossby waves that propagate polewards and eastwards out into the extratropics, including into the European sector. Initial atmospheric conditions are also shown to be important for seasonal prediction of the NAO: initial anomalies in upper stratospheric winds at the start of winter propagate downwards into the troposphere where they lead to anomalies in the winter mean surface conditions and affect the North Atlantic Oscillation. Together, these mechanisms can explain the majority of forecast variance in the winter NAO.

We also discuss an unresolved 'signal-to-noise' paradox which means that current seasonal forecasts for Europe are better at predicting the real world than they are at predicting their own forecast members. This unusual situation means that forecasts contain approximately the correct amount of total variance but are underconfident. This implies that skill estimates are very sensitive to ensemble size and that probabilistic verification measures, or verification using RMS error measures, will give misleading underestimates of forecast skill. In contrast, correlation skill measures are not subject to this limitation. There are also implications for real time forecasts, such as are available via the Copernicus Climate Change service for this region, which require a simple but important recalibration of forecast ensembles.