Regime View of Teleconnection: Euro-Atlantic Winter Regimes in ECMWF Seasonal Forecasts

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The concept of circulation regimes represents one method of organizing quasi-stationary atmospheric circulation patterns that have been identified on intra-seasonal time scales longer than a few days. The hypothesis that these patterns represent states in which there is a rough equilibrium between the planetary waves and the eddy fluxes due to synoptic-scale fluctuations is often used in theoretical studies. The purpose of this talk is to introduce a methodology for explicitly coupling the synoptic-scale ("storm track") variability to the planetary scale variability in estimating regime properties from ECMWF coupled seasonal forecasts for 25 years.

We focus on the Euro-Atlantic regimes during boreal winter, and use daily 200 hPa height obtained from 11-member ensembles of coupled forecasts initialized on 1 November for the years 1981-2005. Using the envelope function to define low-frequency storm track variations, we apply singular value decomposition (SVD) analysis to the covariability of the storm tracks and the low frequency flow, and use a partitioning algorithm on the resulting time series to obtain regimes. Three SVD modes represent more than 90% of the squared covariability, independent of the dimensionality retained in the original fields. (The dimensionality is reduced using principal component analysis.)

The four coupled patterns obtained can be termed as European Blocking, Greenland Ridge, Scandinavian Trough and Atlantic Wave. Using pdfs of a large number of samples from the ensembles (each sample containing one forecast per winter), we find the Scandinavian Trough to be most reproducible across samples, with the highest intra-sample pattern correlation and lowest differnce energy. The European blocking is the least reproducible.

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