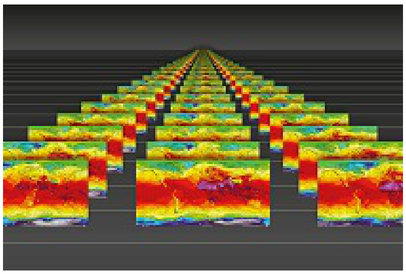

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Operational forecast products for studying large-scale flow variability in the Atlantic-European region

The large-scale extratropical circulation is dominated by Rossby wave activity along the upper-level mid-latitude wave guide and jet stream. This activity often occurs in preferred quasi-stationary, persistent, and recurrent states, so-called weather regimes (e.g. Vautard, 1990). In the Atlantic-European region, weather regimes account for most of the atmospheric variability on sub-seasonal time scales. However, their onset, persistence, and transition present a severe challenge in current numerical weather prediction systems (Ferranti et al., 2015, Grams et al. 2018). This is related to the fact that weather regime life cycles are affected by synoptic-scale processes such as latent heat release in ascending warm conveyor belts (WCBs) as well as by slower climate modes such as the MJO or the stratospheric circulation.
In this presentation we demonstrate how we make use of ECMWF's operational medium- and extended-range ensemble forecasts to study large-scale extratropical flow variability on sub-seasonal time-scales. First, we give a brief introduction in a year-round definition of 7 Atlantic-European weather regimes. We then illustrate how medium-range ensemble forecast products for WCB activity, diagnosed by computing Lagrangian air parcel trajectories in each ensemble member, help to understand modulations of the jet stream and regime onset. We further explore a novel set of ensemble forecast products for weather regimes that provides a simple and user-friendly overview of the regime evolution in the medium- and extended-range ensemble forecasts. These products are complemented by visualisations of meteorological variables for each regime, which provide a more distinct view on the current surface weather evolution compared to climatology than using classical visualisations of ensemble mean and spread. Finally, we explore how well large-scale flow variability is represented in operational numerical weather prediction models from the S2S database and how this variability affects socio-economic activities on sub-seasonal time scales, based on the example of European wind power.

Further reading:
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Track Classification: Workshop on Predictability, dynamics and applications research using the TIGGE and S2S ensembles