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Seasonal forecast skill of windstorm frequency and intensity over Europe and their dynamical and physical reasons

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The seasonal forecast of extreme events is gaining more and more interest in science, for stakeholders and the general public. The most important extreme events with a seasonal variance for Europe, including the British Isles, are winter windstorms.

This study is investigating the prediction of seasonal accumulated storm frequency and intensity based on one state-of-the-art seasonal forecast model, the UK Met Office (GloSea5 GC2) and analyses the dynamical and physical reasons for skill.

Winter (DJF) windstorm events are individually identified and tracked using 10m wind speed once exceeding the local 98th percentile. The intensity of the season is calculated via an integrated measure based on the Storm Severity Index (Leckebusch et al., 2008). Thus, the total seasonal intensity is investigated as grid cell accumulated index over all storm events and as storm count normalised sum. The forecast skill is assessed via different skill measures (e.g. Kendall-Correlation or RPSS) and validated in a hindcast approach with ERA5 for 23 seasons (1993-2015).

This presentation will give an overview about three main topic areas: the prediction skill for storm frequency and intensity; a multi-linear regression analysis to identify dominant large-scale modes, and finally, an outlook on first results on chosen dynamical parameters influencing the skill.

This investigation shows significant positive correlations over the British Isles for all three different storm parameters (frequency and both intensity measures). The positive skill pattern of the storm intensity is shifted north-west-wards compared to the positive skill in the storm frequency results. The accumulated intensity shows slightly higher correlations as the storm frequency. The normalised intensity reveals the lowest skills but still significant values downstream of the British Isles. Hence, three different storm parameters show positive prediction over UK; pure frequency, pure intensity and a combined measure of intensity and frequency.

Additionally to the model skill investigation, a regression analysis based on the three dominant teleconnection patterns over Europe (NAO, SCA and EA) was performed in order to gain better understanding in the connection of storms and these modes. This regression predicts the three

storm parameters out of the given indices and explains up to 40-50% of variance. A statistical-model based approach of the storm parameters using three large-scale modes is showing improvements in skill compared to previous studies with NAO as only predictor. But the forecast model output shows still the best storm predictions.

Further studies will investigate the dynamical and physical reasons of the skill and their connections between the windstorm parameters, the dominant large-scale modes, and other atmospheric parameters.