Assessing reasons for skilful predictions of winter windstorms over the Atlantic/European region

Lisa Degenhardt[1,2], Gregor C. Leckebusch[1,2], Adam Scaife[3]
LXD943@student.bham.ac.uk
[1]Universtity of Birmingham, [2]NERC CENTA DTP, [3]UK MetOffice Hadley Center

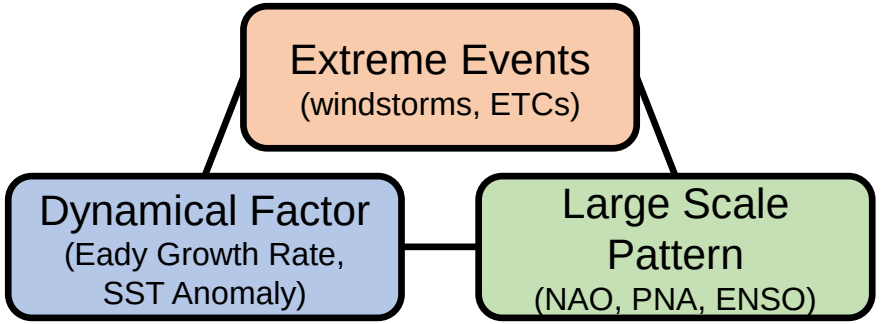
D3281 | EGU2020-10991

Introduction

Severe windstorms are one of the most damaging extreme events especially for the European region. Therefore, it is essential to provide a useful, skilful prediction of an upcoming storm season (December-January-February; DJF). But the skill of a prediction is usually known after the season. Knowledge about the skill in advance – during initialisation – would be of great value for the seasonal windstorm forecast community. Here we want to explore what factors are common within skilful seasonal windstorm forecasts to better assess model skill prior to the season.

Method

The study will analyse influencing factors for a skillful seasonal windstorm prediction. Therefore, this “triangle-scheme” is utilised to define skill in the three key areas but also the skill of the relationship between each factor.



- Tracking of Extreme Events

The windstorms are tracked with an exceedance of the local (98% percentile) wind speed (Leckebusch et al., 2008). And the track density is calculated as described in Kruschke et al. (2014) with a defined radii to count storms passing at each grid cell.

- Large Scale Pattern

The different large scale patterns like North Atlantic Oscillation (NAO) or Arctic Oscillation (AO) which are mostly influencing Europe will be calculated using an EOF analysis.

- Dynamical Factor

As a dynamical factor which could influence the seasonal prediction of the upcoming windstorm season, the Eady Growth Rate was selected for initial investigation.

This display will focus on validation of the Extreme Event Tracking. Therefore, different track density settings (radii) and data sets will be tested and compared. As skill score measure the Kendall-τ_b-correlation coefficient is used (as in Befort et al., 2018).

D3281 | EGU2020-10991

Data

ERA5 and ERAint:
The difference in the skill score pattern between the two different reference data sets from the ECMWF reanalysis.

GloSea5:
This is the seasonal forecast model of the UK Met Office. This is available in different model version – GA3 (from 2013) and GC2 (since 2015)

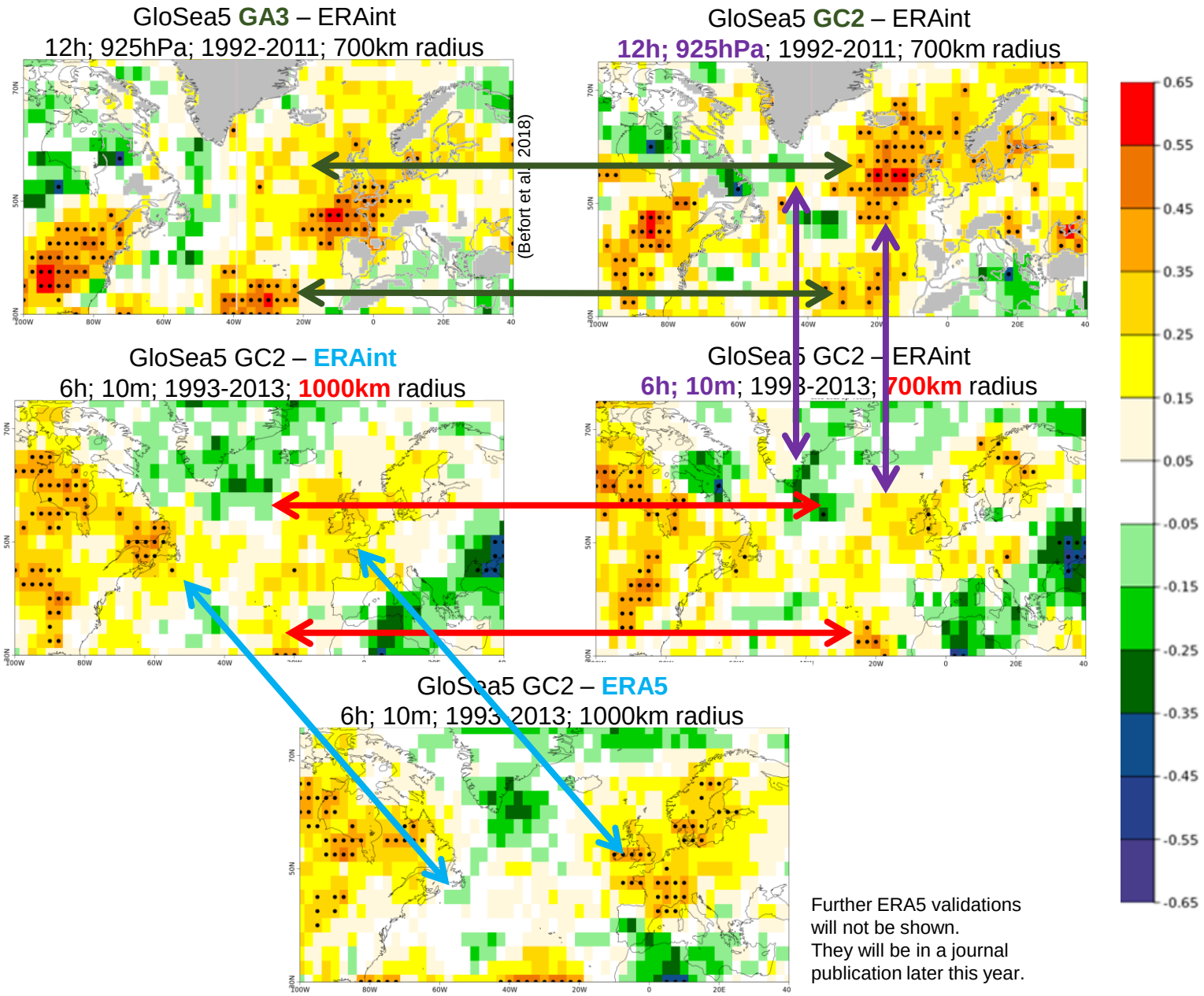
The figure show the **Kendall-τ_b-Correlation** for the different settings.

The GloSea5 model version shows differences, but the same overall patterns.

The tracking level (925hPa – 10m) show significant differences in the resulting skill score.

Some smaller differences are seen for changing the radius (700km to 1000km) for the track density

The reference data set and temporal resolution have some influence on the correlations



Further ERA5 validations will not be shown.
They will be in a journal publication later this year.

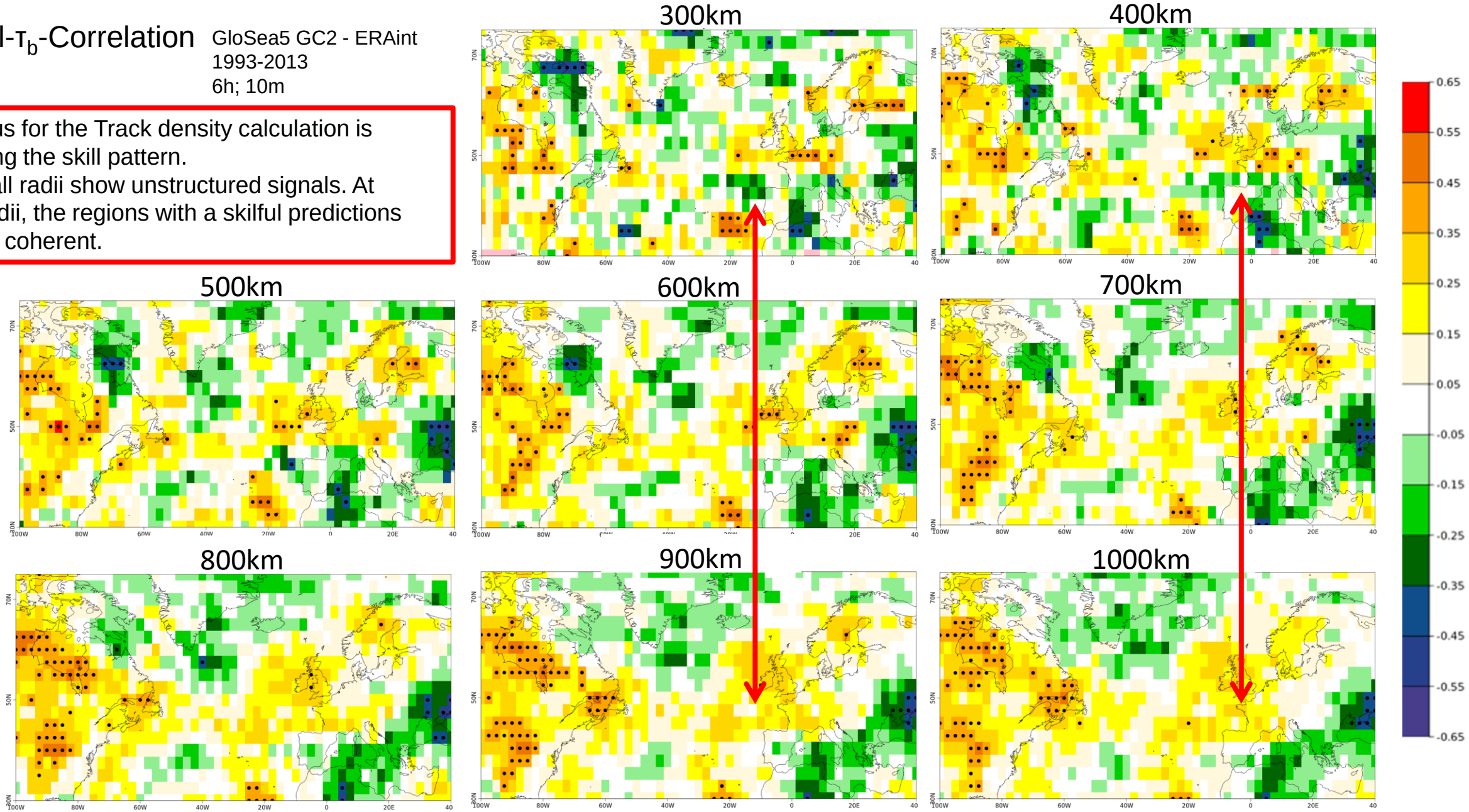
Validation of Data set & settings for skilful windstorm predictions

D3281 | EGU2020-10991

Kendall-τ_b-Correlation DJF

GloSea5 GC2 - ERAint
1993-2013
6h; 10m

The radius for the Track density calculation is influencing the skill pattern.
Very small radii show unstructured signals. At higher radii, the regions with a skilful predictions are more coherent.



Validation of Data set & settings for skilful windstorm predictions

D3281 | EGU2020-10991

Summary

The seasonal forecast skill of winter windstorm frequency (DJF) depending on different data sets (ERAint, ERA5, GloSea5 GA3 & GC2) and track density settings (different radii) were investigated.

- Only small differences in skill of frequency forecasts are verifiable between the **GloSea5 model version:** GA3 (from 2013) and GC2 (since 2015)
- The **tracking level** (10m or 925hPa) shows stronger influence on the predictability pattern than the change of the model version. This emphasises the importance of validating tracking methodology on seasonal prediction
- The choice of the **reference data set** (ERAint or ERA5) slightly influence the intensity of the skill score signal (Kendall correlation) which a stronger signal over the UK when comparing to ERA5
- Different **radii** to calculate the track density (from 300km to 1000km) have a stronger influence on the skill score than the change of the reanalysis, especially when a higher radii (bigger 700km) is used as the skill scores are more coherently distributed

For the main investigation to assess the seasonal forecast skill for the upcoming windstorm season the combination of **ERA5 with GloSea5 GC2 in 10m and 6 hourly** resolution will be used.

Outlook

Only the first steps, the main methodology and some first validation of the project are presented here.

We will further expand the validation presented here, with extra-tropical Cyclones of different intensity, other dynamical factors as well as other large scale patterns which influence other regions of the Northern Hemisphere. Also, other skill score measures will be tested to investigate the seasonal forecast of windstorms.

References

• BEFORT, D. J., WILD, S., KNIGHT, J. R., LOCKWOOD, J. F., THORNTON, H. E., HERMANSON, L., BETT, P. E., WEISHEIMER, A. & LECKEBUSCH, G. C. 2018. Seasonal forecast skill for extratropical cyclones and windstorms. *Quarterly Journal of the Royal Meteorological Society*.
• KRUSCHKE, T., RUST, H. W., KADOW, C., LECKEBUSCH, G. C. & ULBRICH, U. 2014. Evaluating decadal predictions of northern hemispheric cyclone frequencies. *Tellus A: Dynamic Meteorology and Oceanography,* 66**,** 22830.
• LECKEBUSCH, G. C., RENGGLI, D. & ULBRICH, U. 2008. Development and application of an objective storm severity measure for the Northeast Atlantic region. *Meteorologische Zeitschrift,* 17**,** 575-587.