

The European Wind from observational and simulated databases

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This is a reduced version of the presentation intended for EGU 20202 and prepared for Display at Sharing Geoscience Online

Information to be provided before the chat:

Presenter: Elena García Bustamante.

This presentation includes work developed in the frame of the New European Wind Atlas project. We have evaluated the sensitivity of WRF simulations to different parameterization selection and compared it to observations.

We find that:

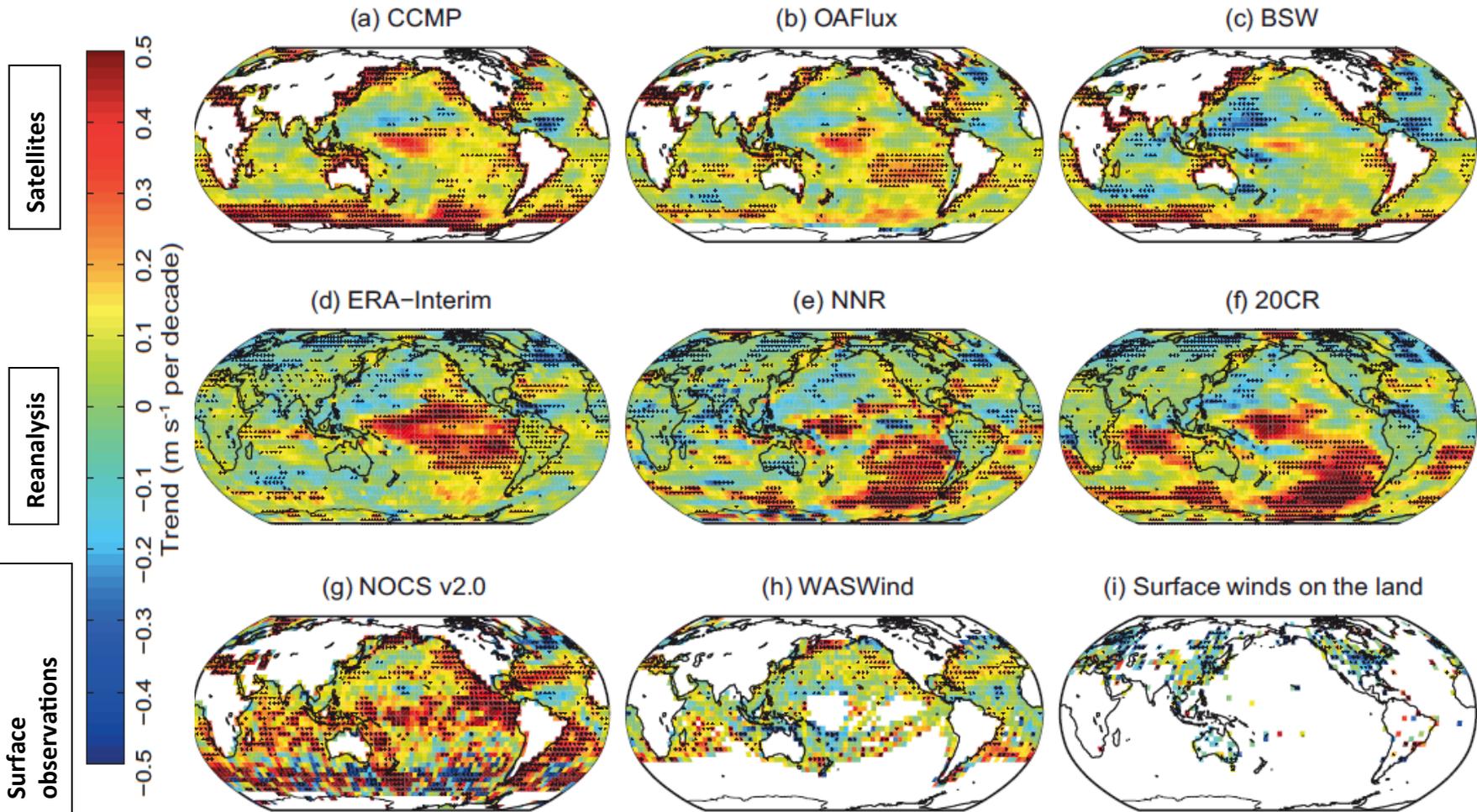
- Model sensitivity tends to be smaller than model error
- Regionalization strategies are useful for evaluating model sensitivity.

Motivation: uncertainties in observational datasets

SREX, AR5:

Confidence in surface wind trends is low both over land and oceans. Uncertainty affects both observational data and model simulations. E.g.:

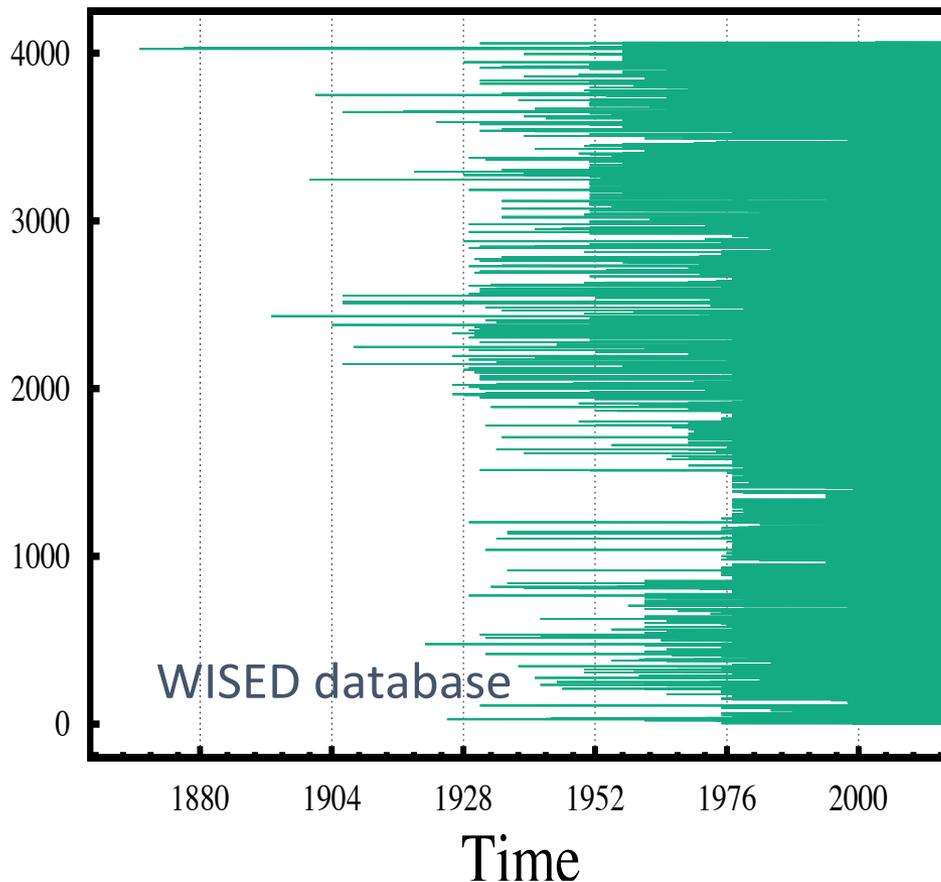
Trends in surface wind speed 1988-2010



Observational data

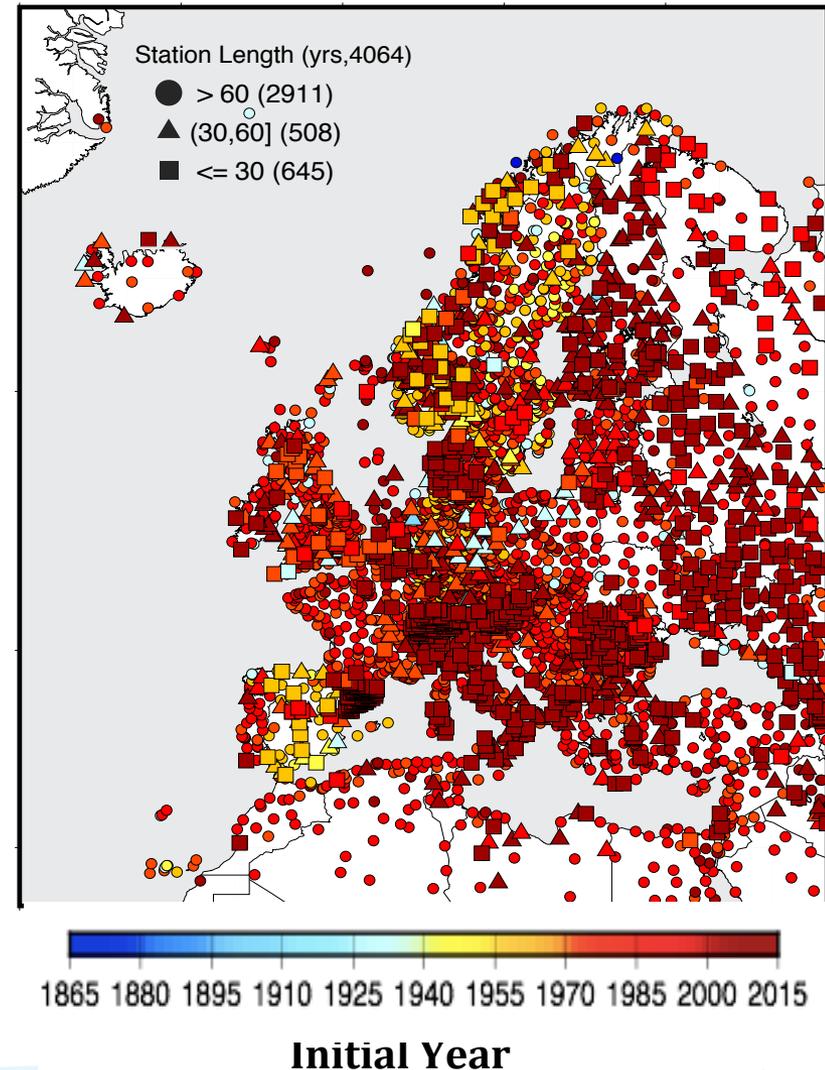
We address this issue by compiling datasets:

- Wind mast data from the NEWA
- A dataset of surface wind observations over Europe (~ 4000 sites)



Time coverage of WiSED stations

Number of time series per station



Initial Year

Uncertainties in observational datasets

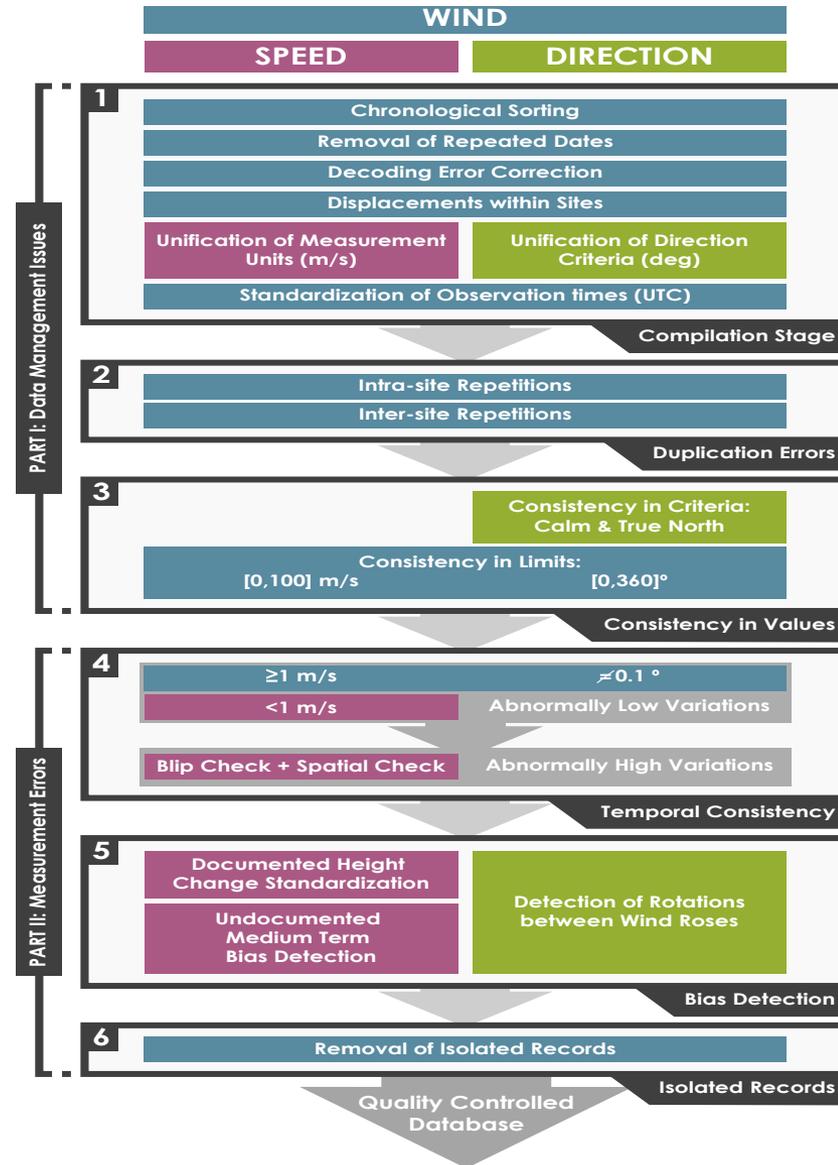


We address this issue by compiling datasets:

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We apply a Quality Control procedure to the WISED data to account for measurement and management errors.

The procedure is described in Lucio-Eceiza et al. (2018a,b; J. Atmosph. Oce. Tech.)



NEWA: production run and probabilistic ensemble

General details of the NEWA runs:

WRF 3.8.1 (modified version)

- 3 km resolution, 61 levels
- 8-day runs, 24 hours spin-up, spectral nudging in D1
- MYNN PBL scheme (v3.8.1 with modifications)
+ MO surface layer
- Forcing: ERA5 and OSTIA SST
- CORINE land use patched with USGS
- NOAH land surface model
- $\text{radt} = 12$
- IO Quilting
- Icing
- 480 cores

Spatial coverage:

Entire EU + 100 km offshore

States of project partners

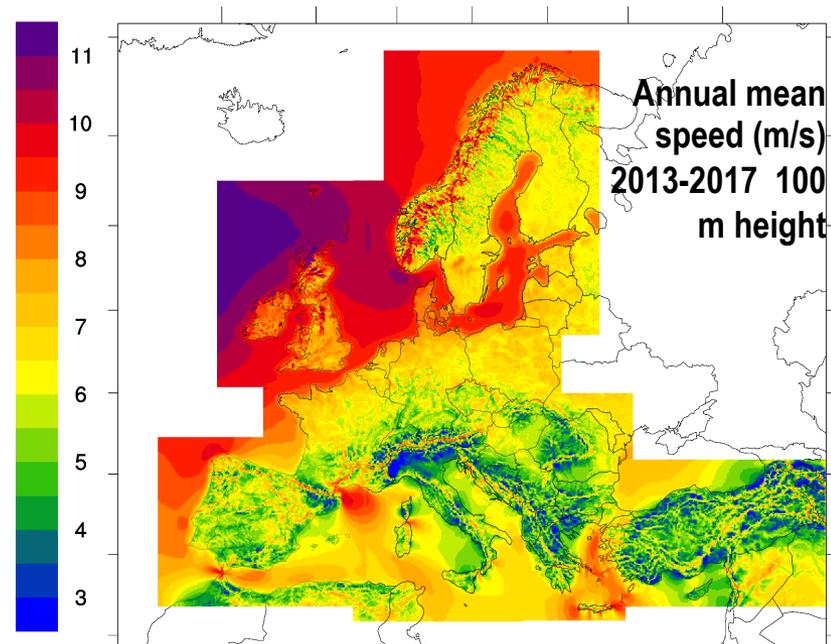
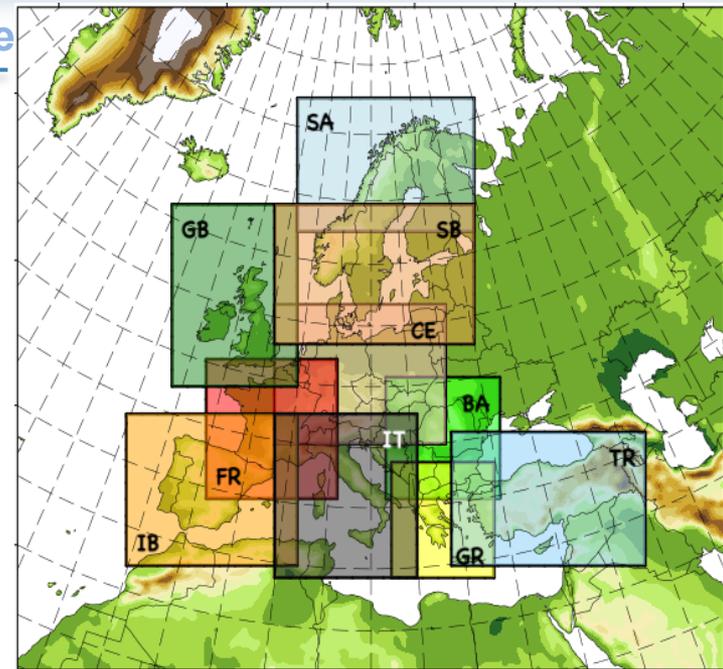
entire North and Baltic Sea

Calculated with the model WRF

3 km grid width

30 years (1988-2017)

Additionally: ensemble runs(1 year)

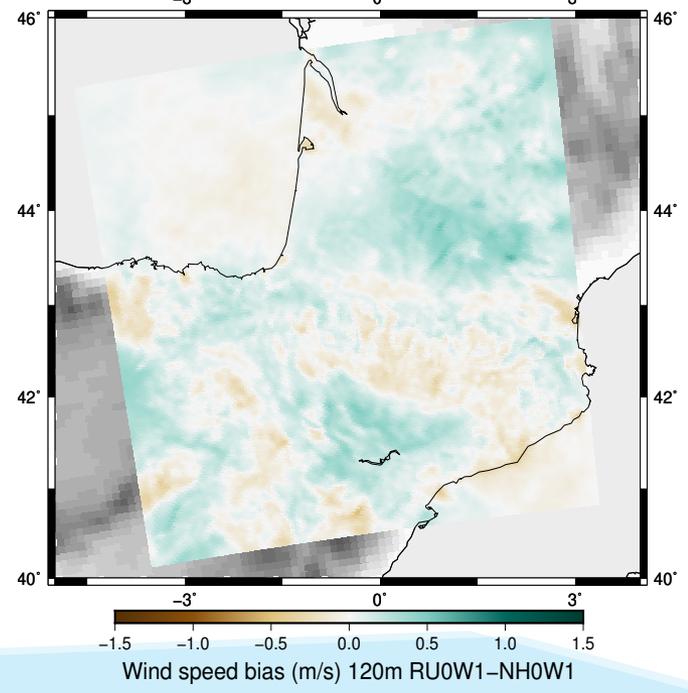
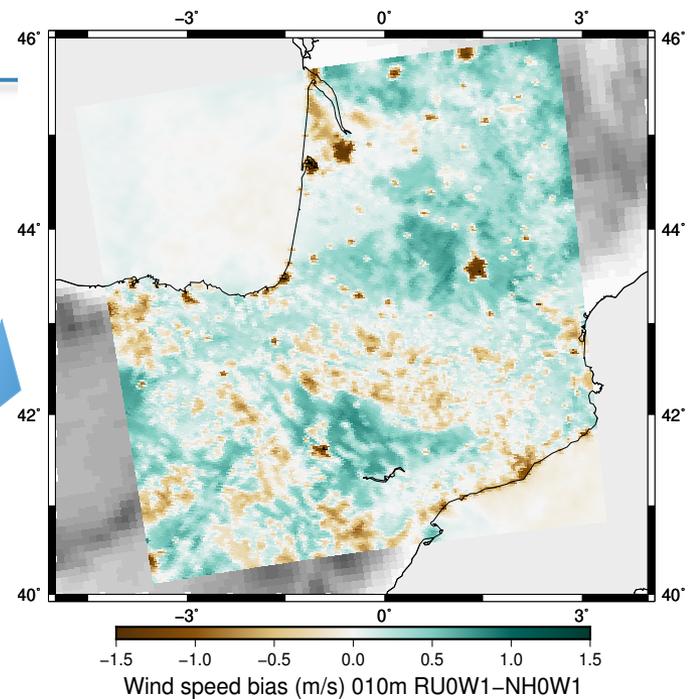
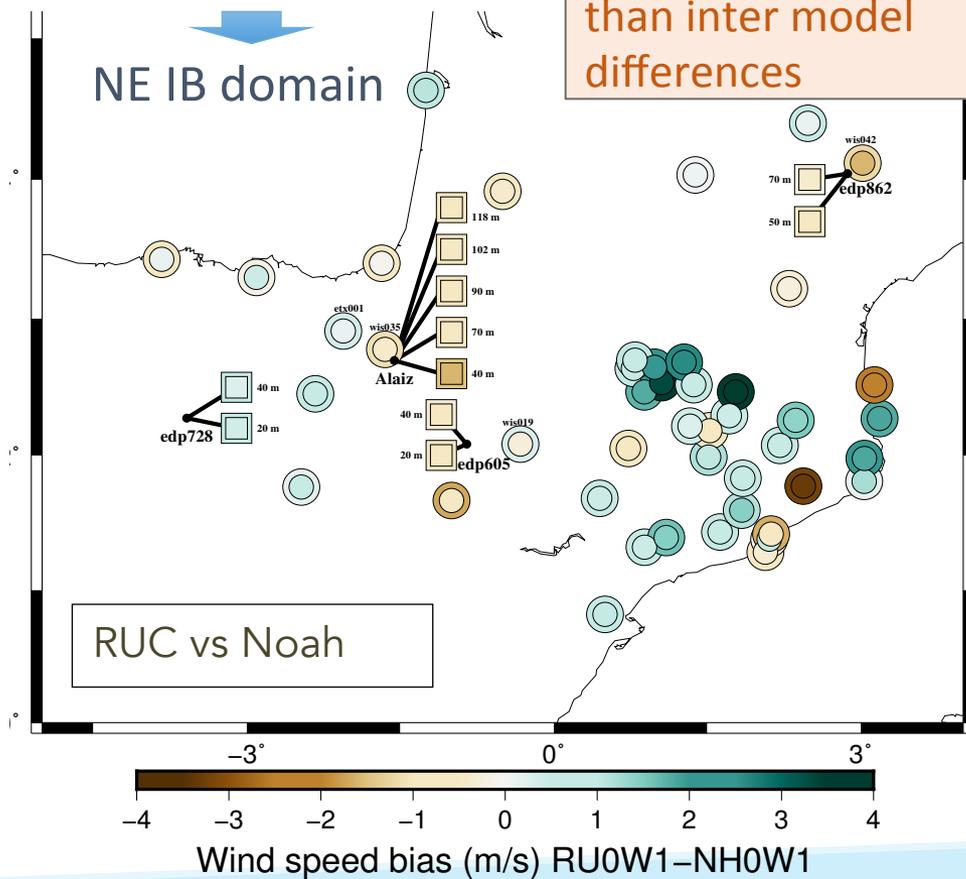


Model – Data comparison

Differences of wind speed between RUC (inner color) and Noah (outer color) WRF simulations and observations for wind tower (squares) and WISED (circles) sites.

Differences of wind speed at the surface and at 120 m for the RUC and Noah simulations.

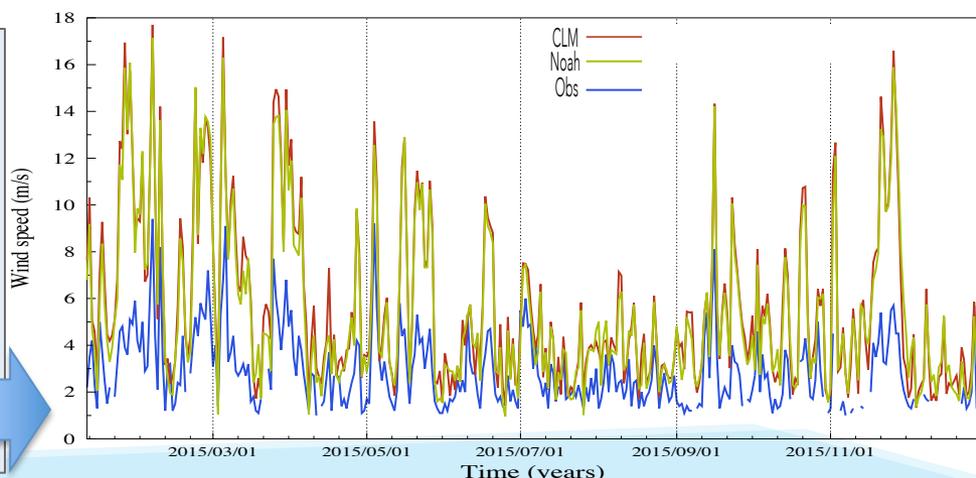
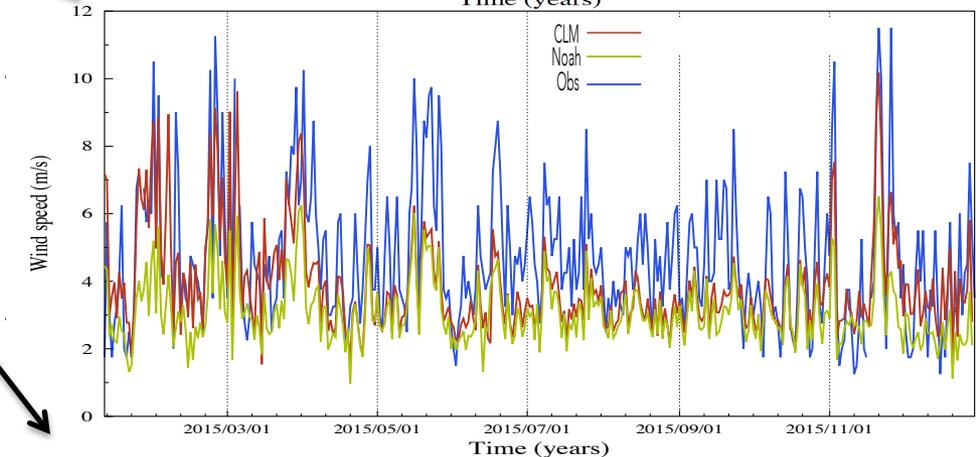
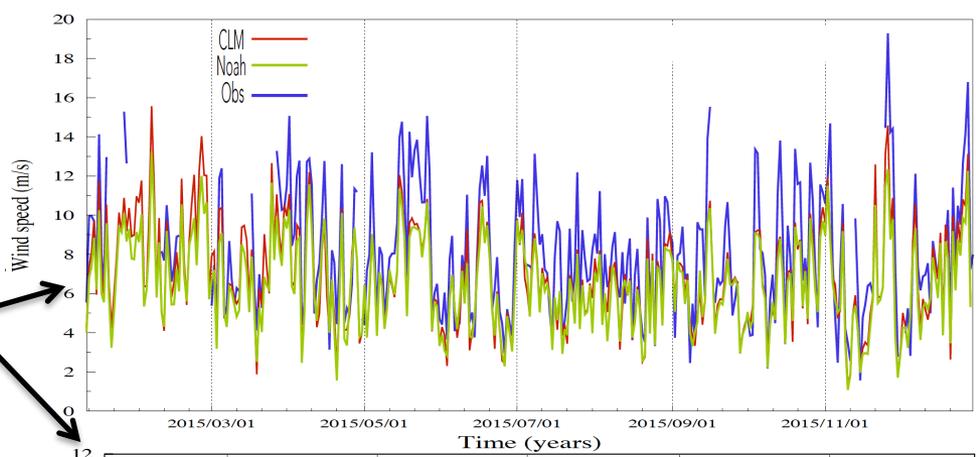
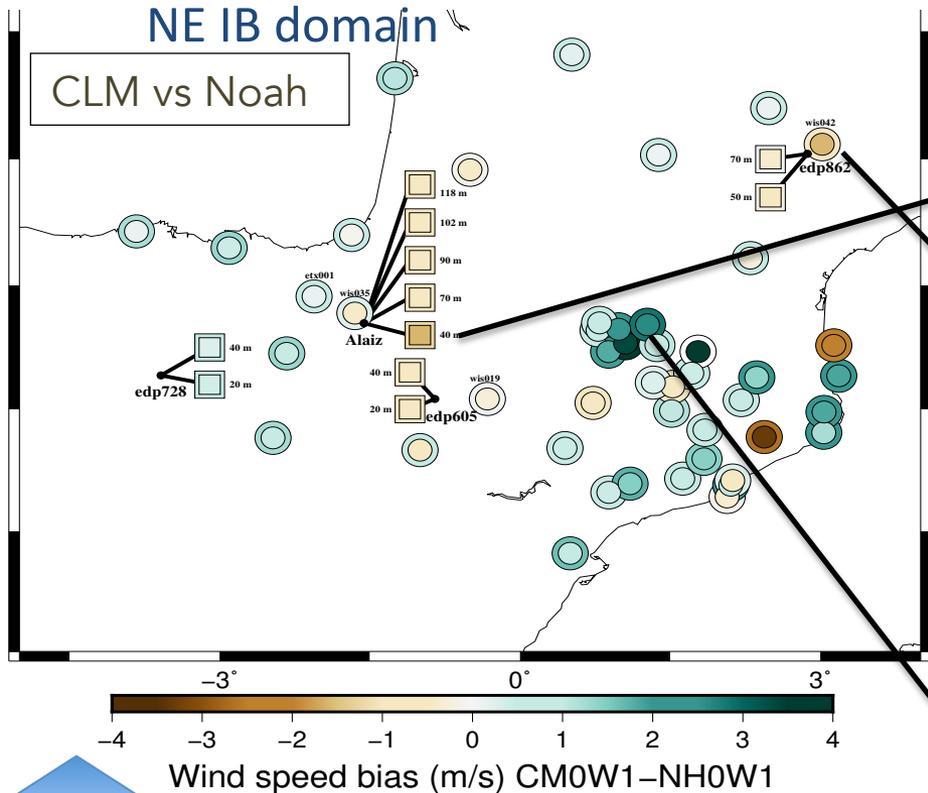
Deviations of the model simulations wrt. are larger than inter model differences



Model – Data comparison

NE IB domain

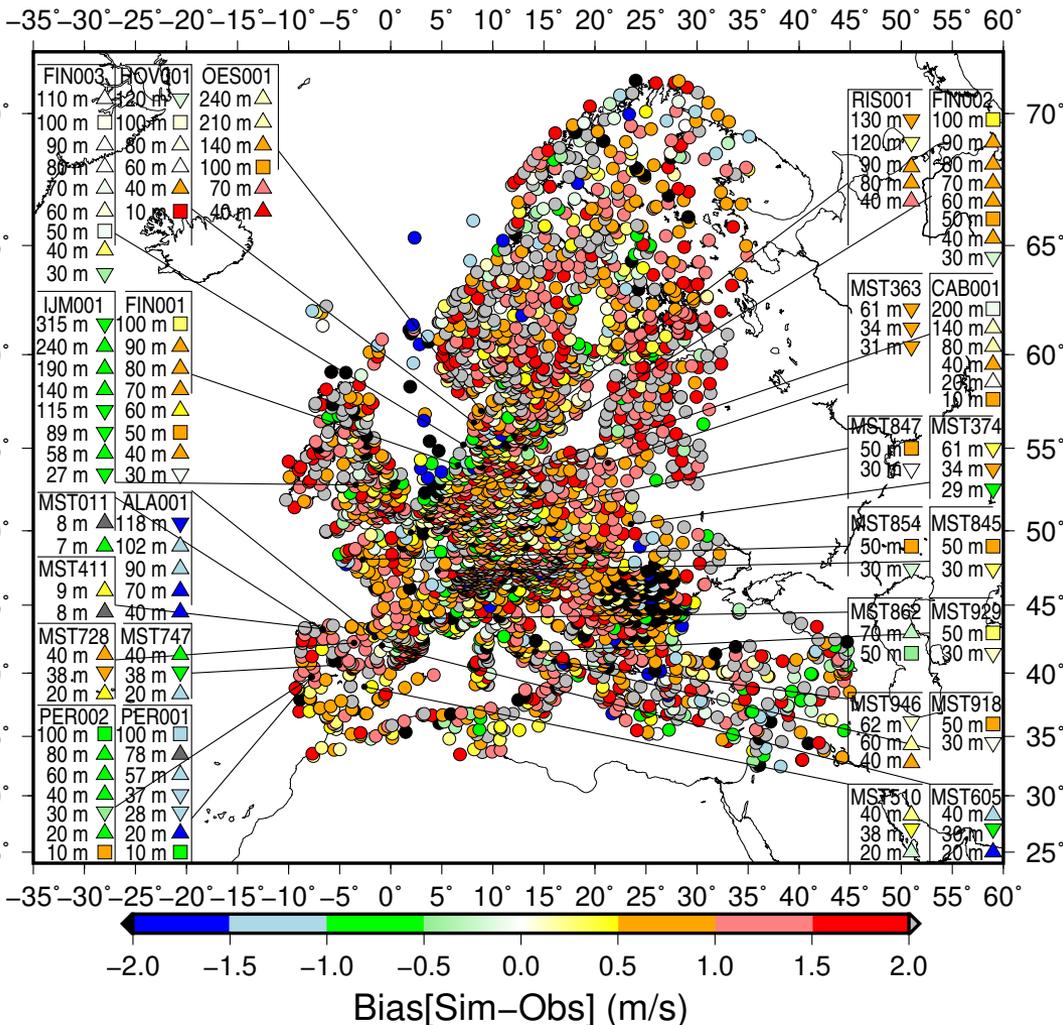
CLM vs Noah



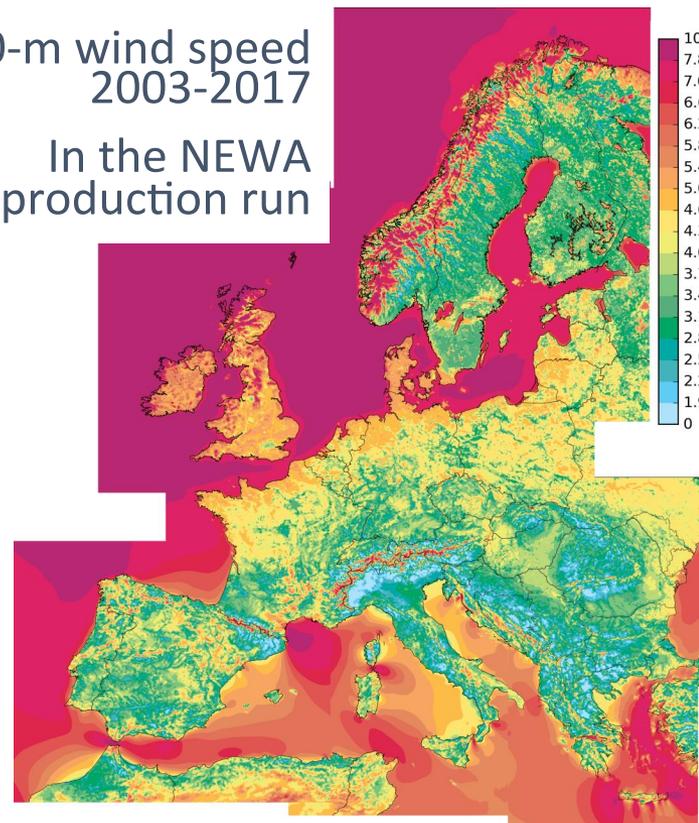
Example for differences of wind speed between CLM (inner color) and Noah (outer color) WRF simulations and observations for wind tower (squares). Time series show observations and model runs at several site examples. Differences may stem from very specific time intervals

Model – Data comparison

Europe: Bias 1989-2018



10-m wind speed
2003-2017
In the NEWA
production run

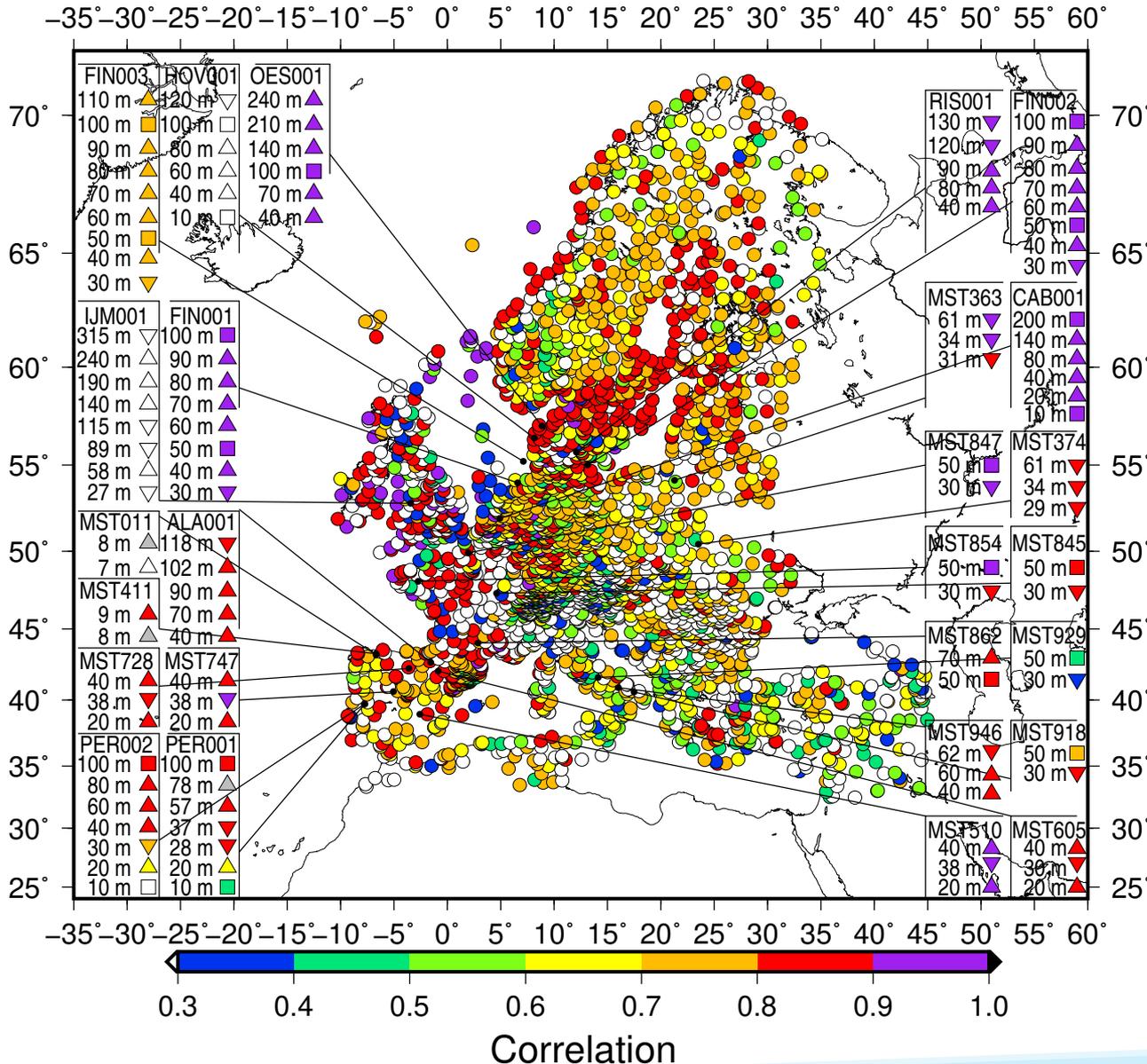


WRF tends to overestimate at the surface. Local large values due to data quality.

Differences between the NEWA production run and wind tower (left and right symbols in the figure) and WISED sites (circles).

Model – Data comparison

Europe: correlation 1989-2018

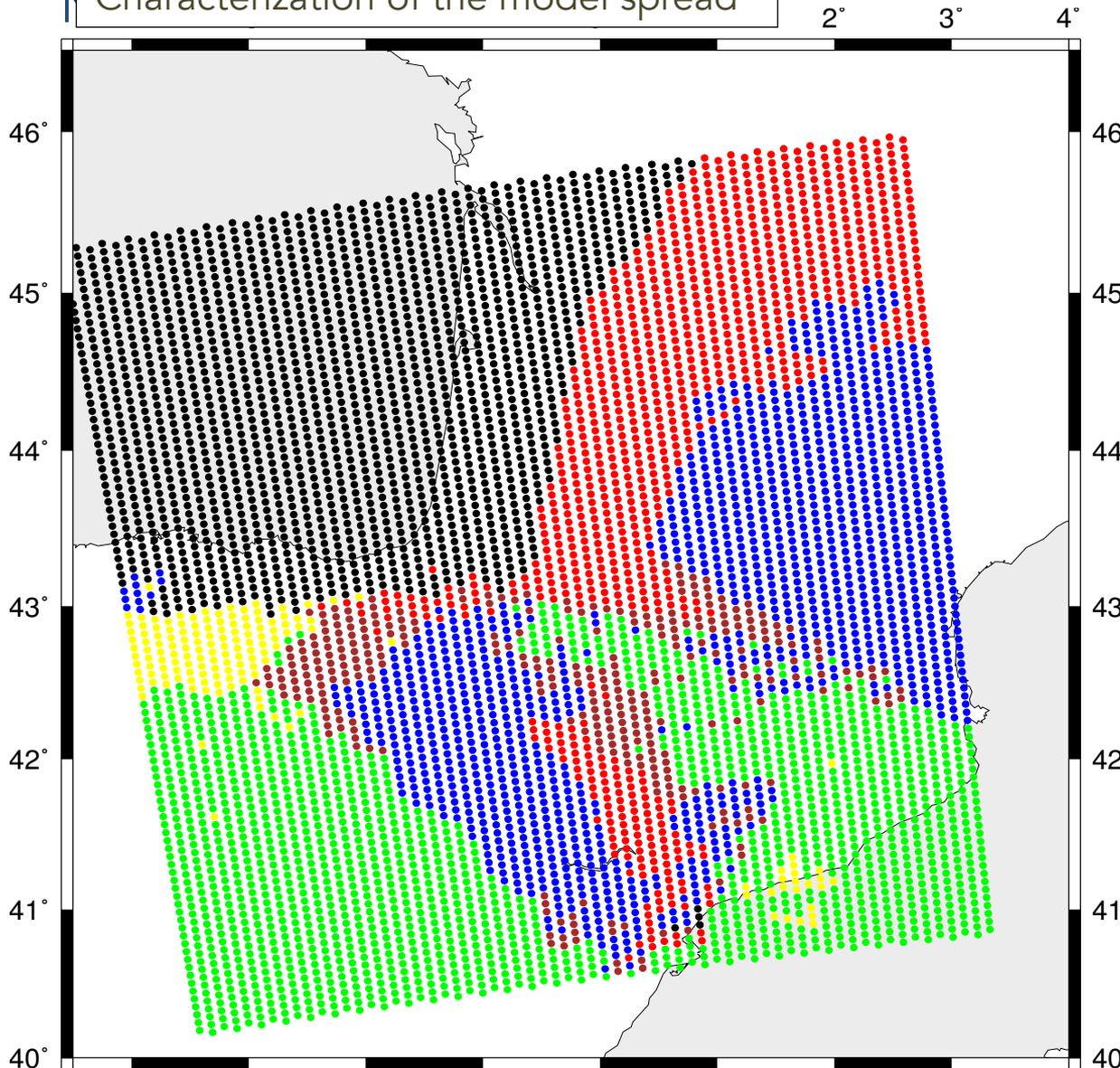


Correlations between NEWA production run and observations at wind towers and surface (WISED)

Correlations vary regionally (e.g. larger at the Baltic region). Local noise can be due to data quality (QC under development). Wind tower values show more homogeneous behavior.

Model uncertainty: spread

Characterization of the model spread

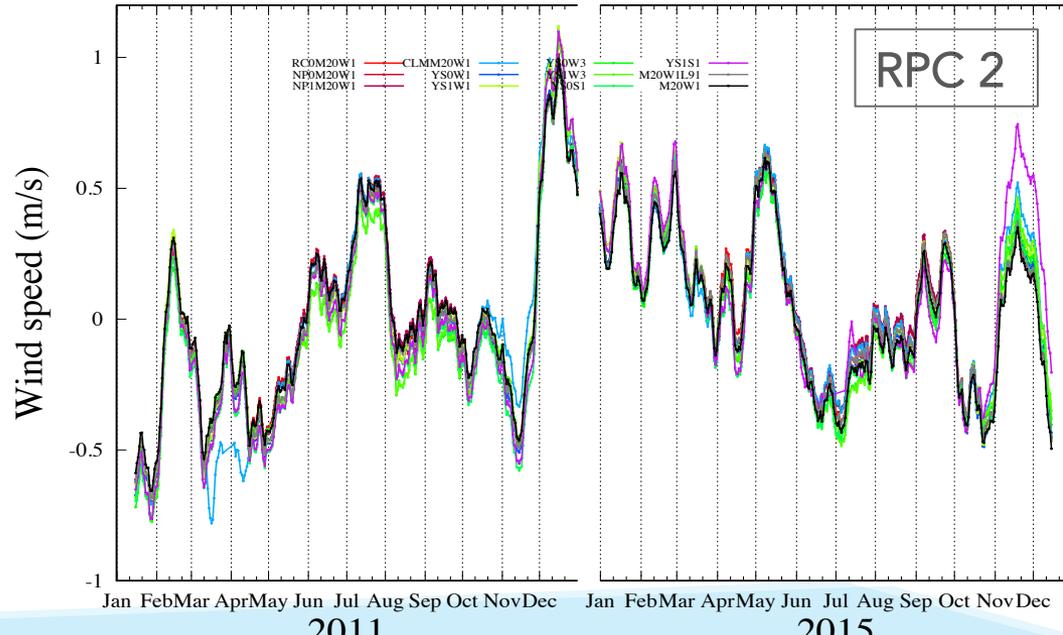
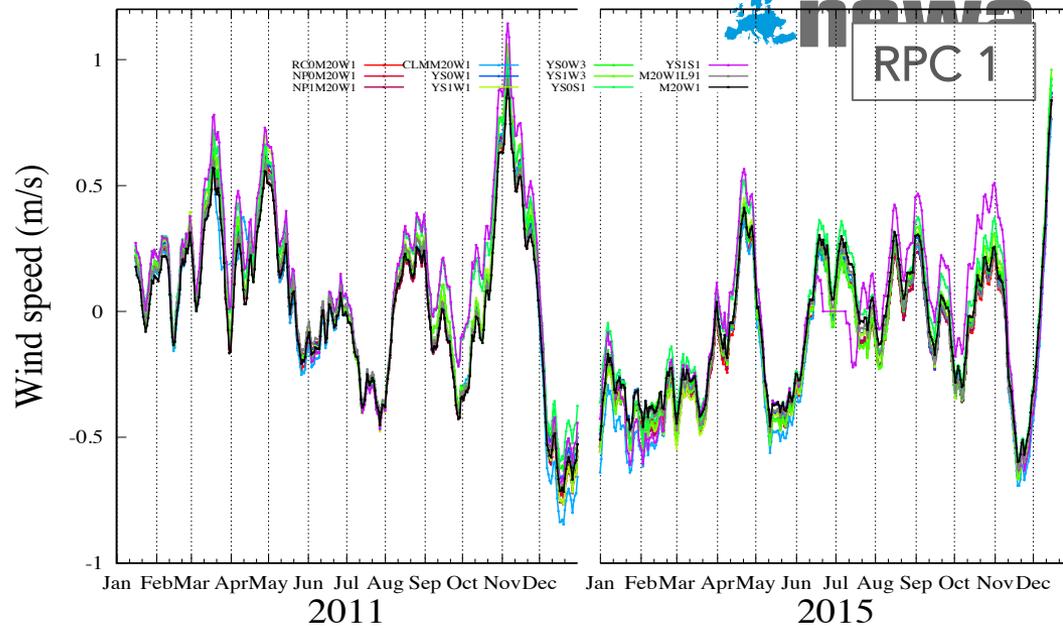
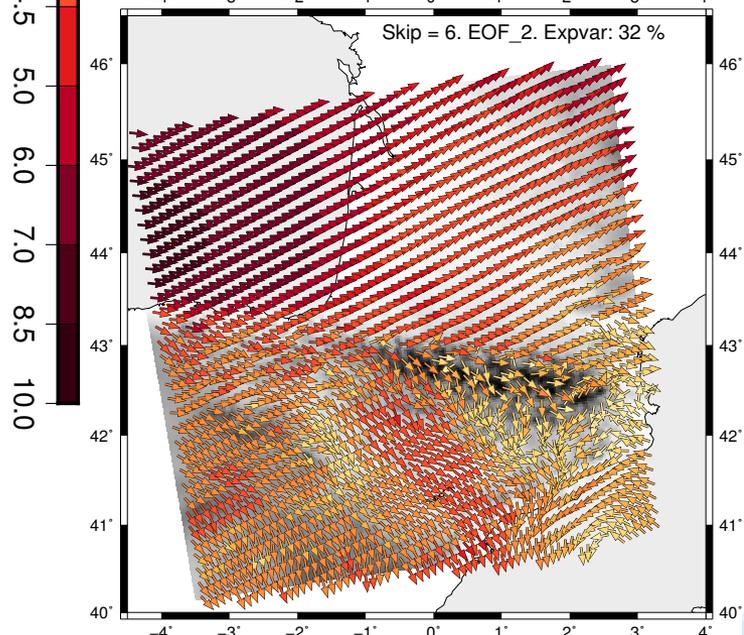
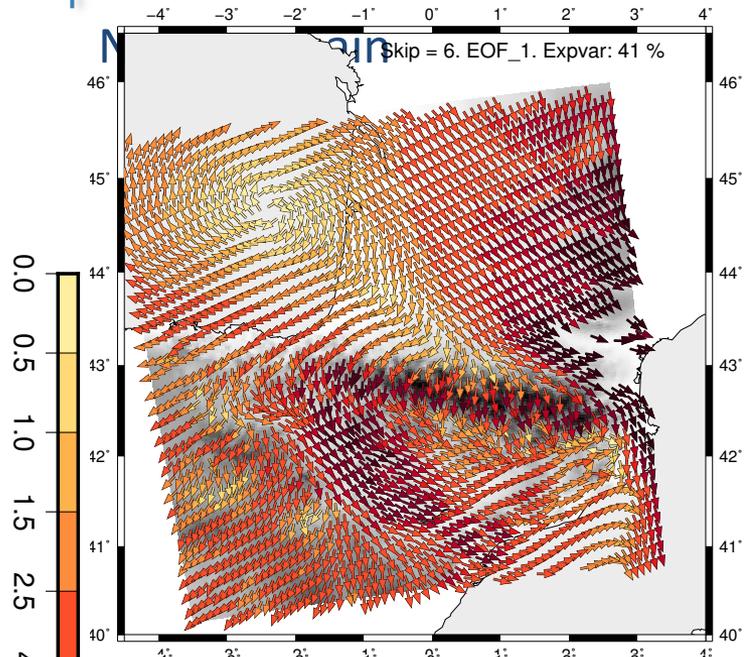


An example of wind speed regionalization for the NE of the Iberian Peninsula is provided here using rotated EOF analysis as in Jiménez et al (2010; J. Appl. Meteorol. Climatol. 49, 210)

Regions show different variability in wind behaviour.

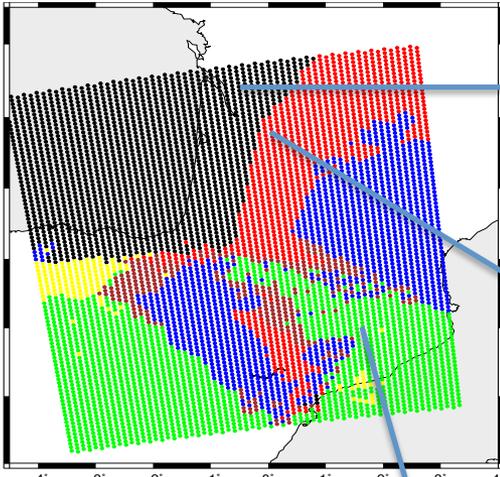
The next slide shows an example for the two first rotated EOF and their respective PCs. Model spread can be shown by projecting the simulations onto the EOFs

wind speed anomalies (m/s)



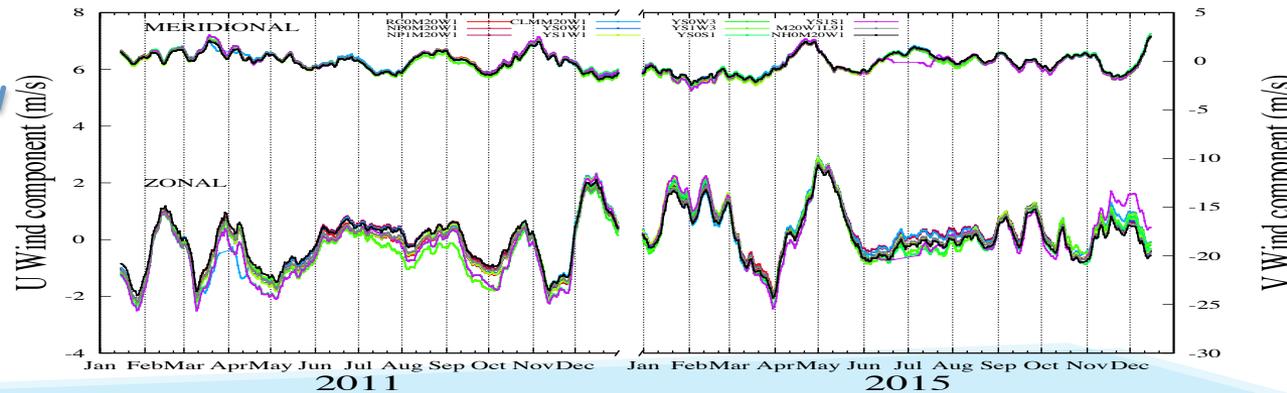
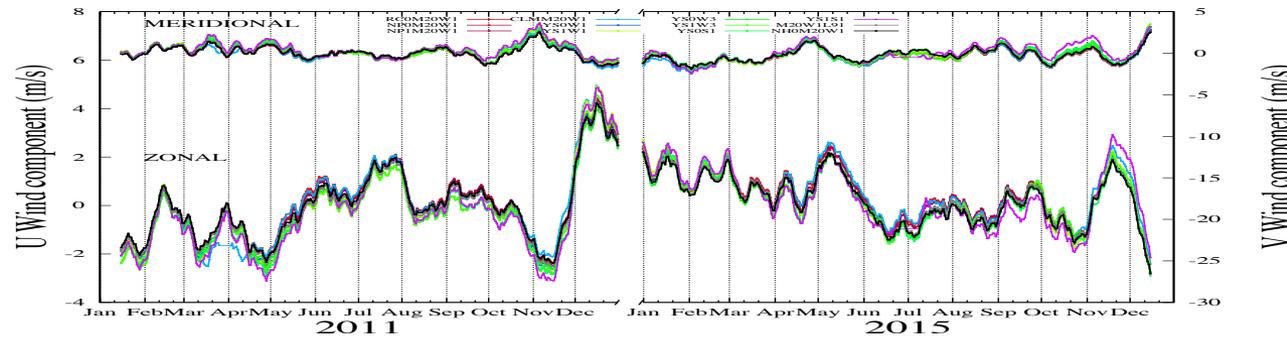
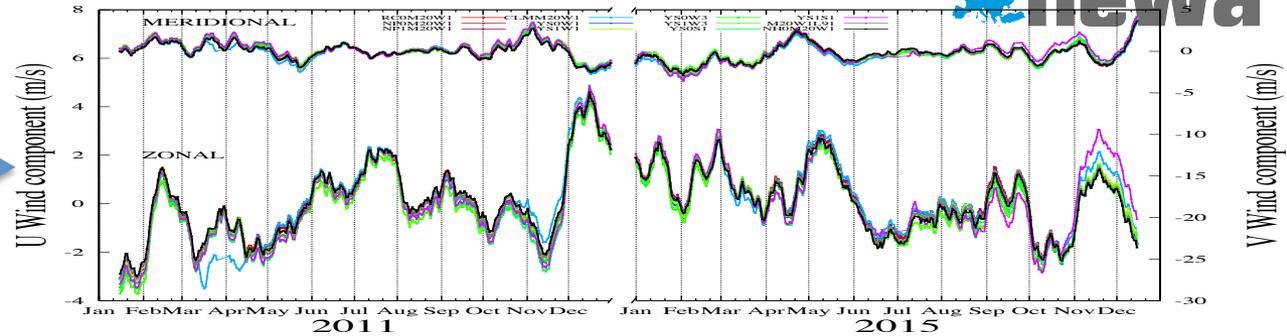
MODEL UNCERTAINTY: SPREAD

NE IB domain



Model spread, i.e. the range of variability in an ensemble of simulations, can be shown over the regions objectively defined.

The ensemble is produced in this example by selecting different Land Surface Model configurations.



- Having surface and mast level observations important.
- Model sensitivity lower than model error !? ☹.
- Errors at EU domain yet dependent on observational QC (perhaps).
- EOF, REOF and regionalization approaches can help quantifying spatiotemporal model sensitivity/spread.

Gracias

