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Edinburgh, 16th February 2017

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

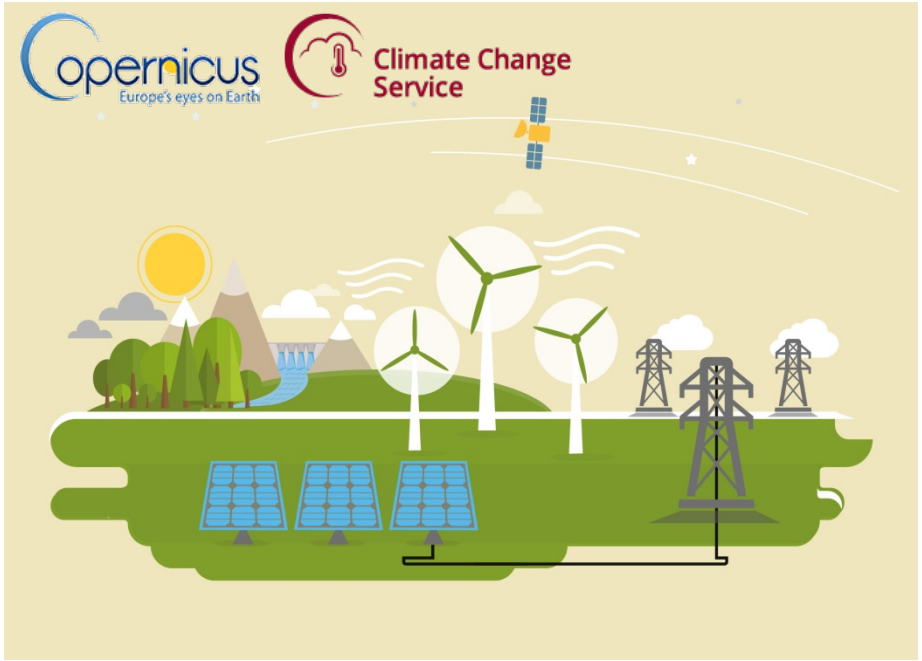
SEASONAL PREDICTIONS OF WIND POWER GENERATION ARE NOW POSSIBLE

Llorenç Lledó, Albert Soret, Francisco J. Doblas-Reyes

Resource Assessment 2017
WindEurope technology workshop




COPERNICUS Program



Providing a wealth of free climate data

CLIM4ENERGY
Tailoring climate services
for the energy industry

Seasonal forecast service
for wind power

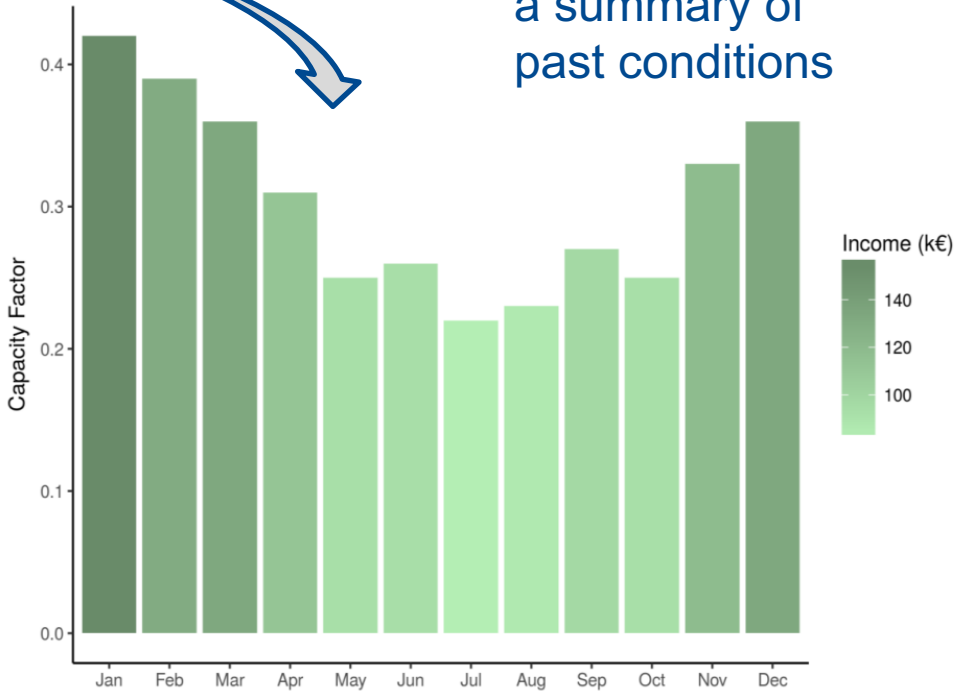
clim4energy.climate.copernicus.eu

1. Monthly Budgets & Anomalies

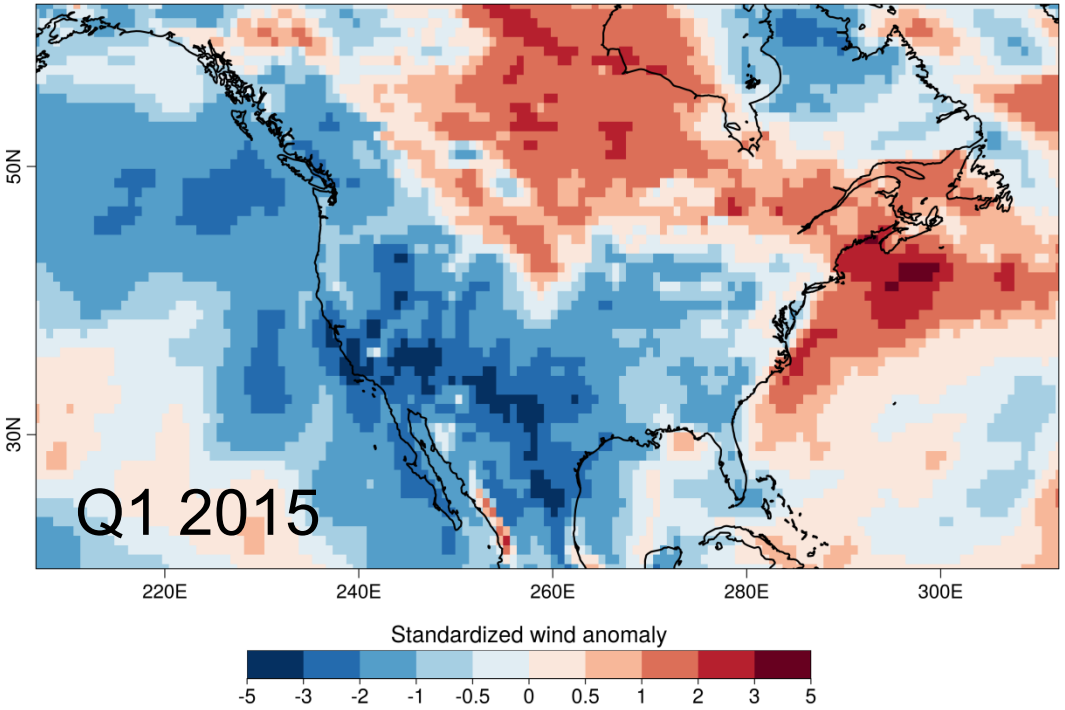
Monthly budgets

Uncertainty estimates
(Inter-Annual Variability)

Climatology:
a summary of
past conditions



2015 US wind drought



"US clean energy suffers from lack of wind"

Financial Times, September 2015.

"El Niño Buffers U.S. Wind Power Dreams"

Wall Street Daily, September 2015.

"El Niño blowing down wind projections in US"

Fierce Energy, July 2015.

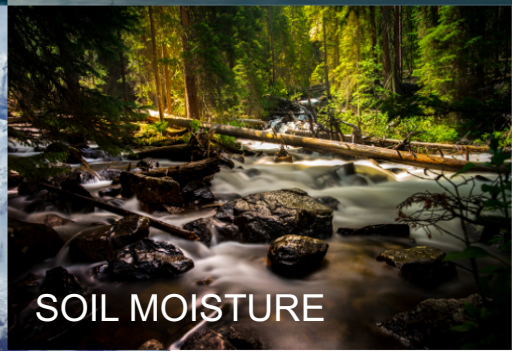
"We never anticipated a drop-off in the wind resource as we have witnessed over the past six months"

David Crane, RNG, September 2015.

Can we anticipate anomalies?

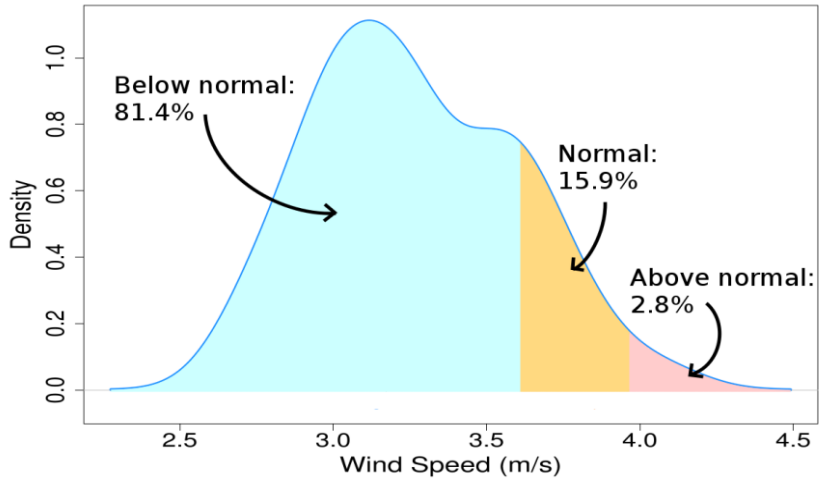
Coupled Ocean-Atmosphere global models

- ECMWF System4
- MeteoFrance System5
- UKMO GloSea5
- NCEP CFSv2



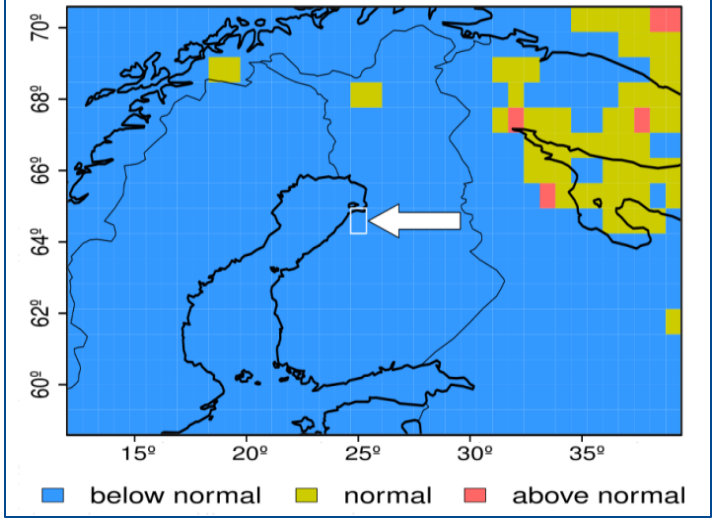
Example 1

AVG WIND SPEED FORECAST
Location: Finland (64.5N 25.0E)
Period: DJF 2009/2010
Issued: 1st November 2009
Source: ECMWF System4

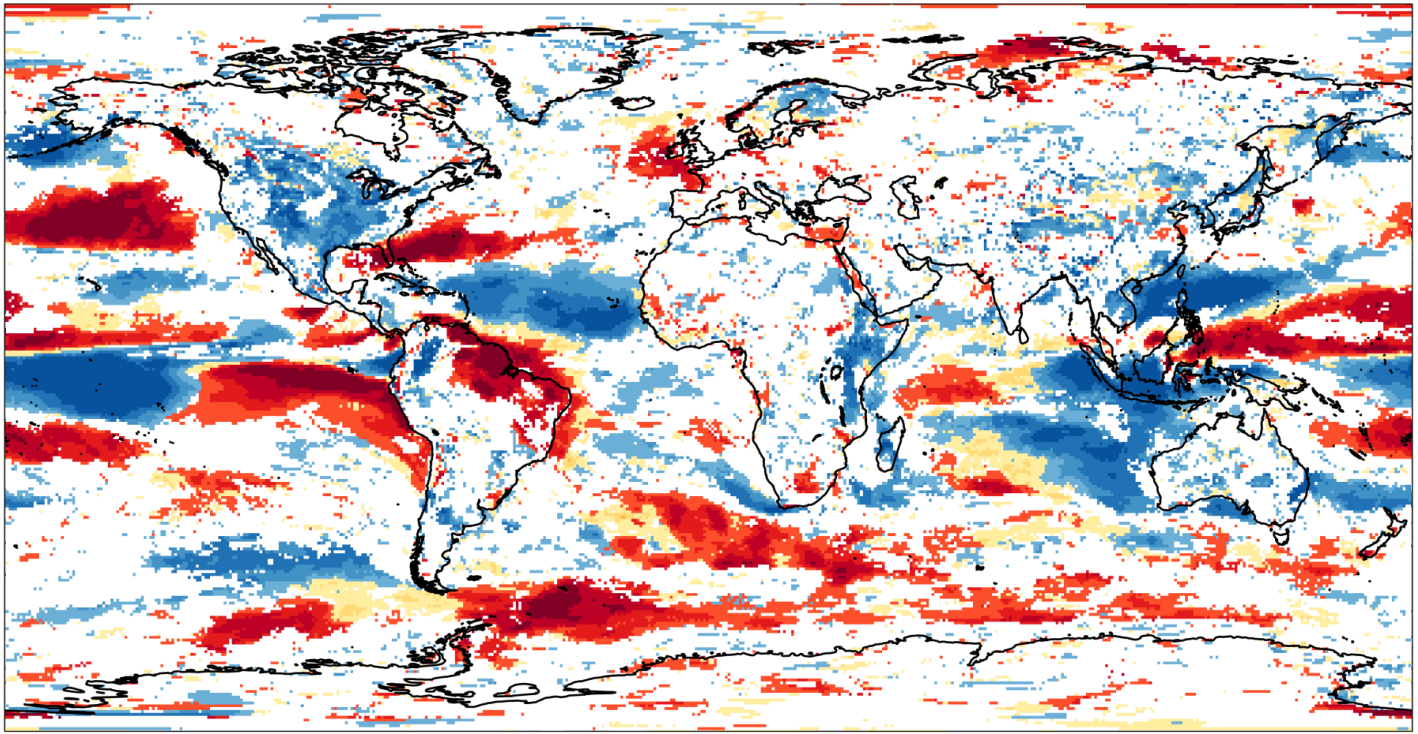


Skill: Corr=0.531 RPSS=0.234 CRPSS=0.141

OBSERVED TERCILE
Period: DJF 2009/2010
Source: ERA-Interim



Example 2



Wind speed forecast

DJF 2015/16

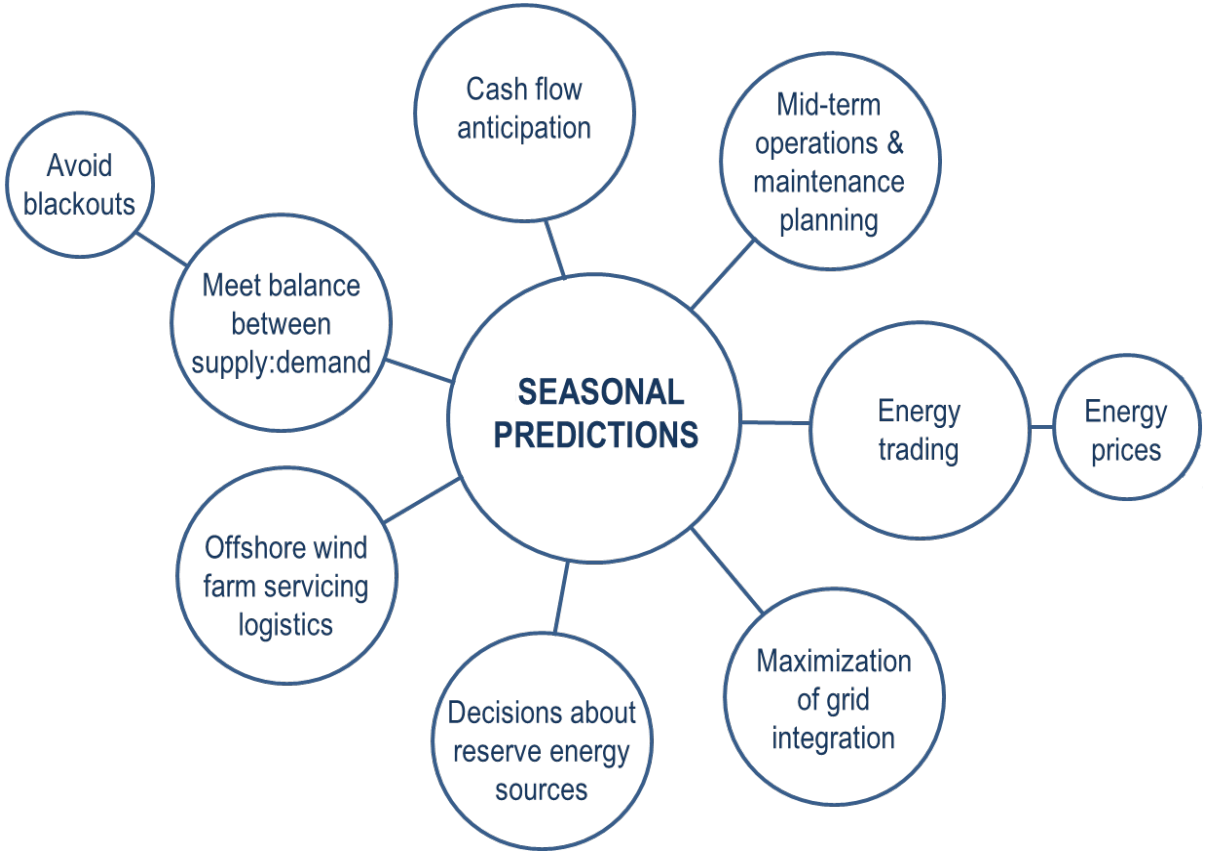
ECMWF System4

Most Likely Tercile

[probability>40%]

2. Tailored applications

Applications

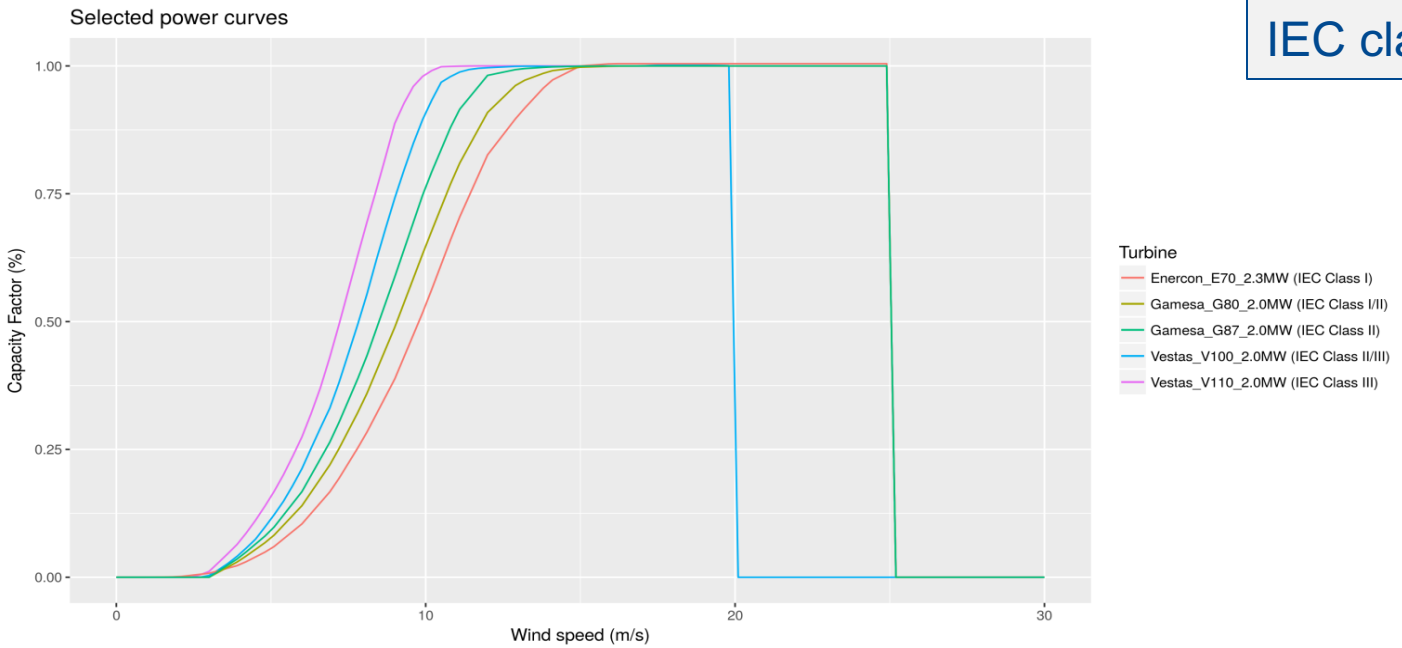


Capacity factor

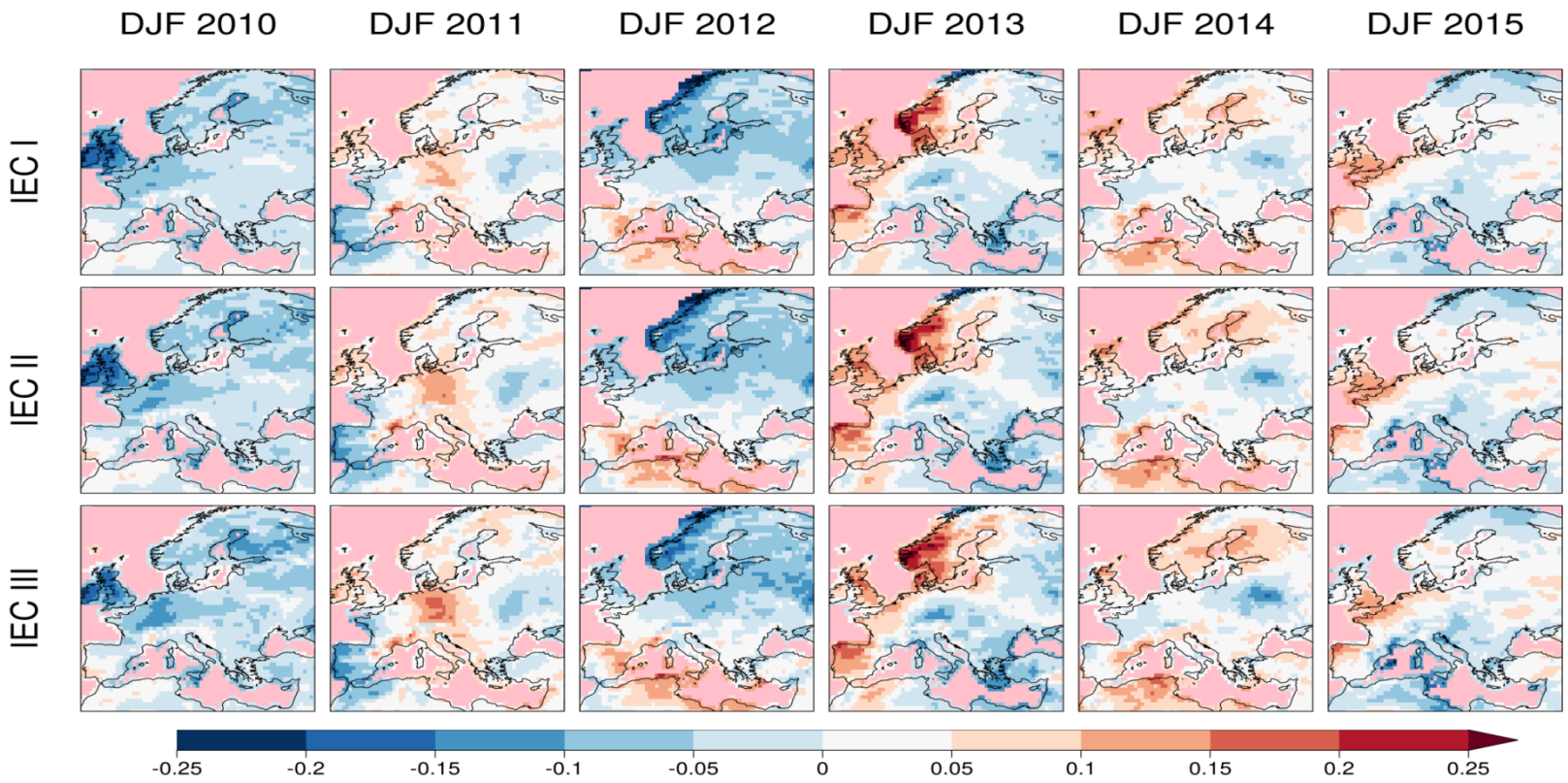
Independent of:

- number of installed turbines
- nameplate capacity of installed turbines

Using manufacturer power curves for three turbines representing IEC classes.



Capacity factor anomalies

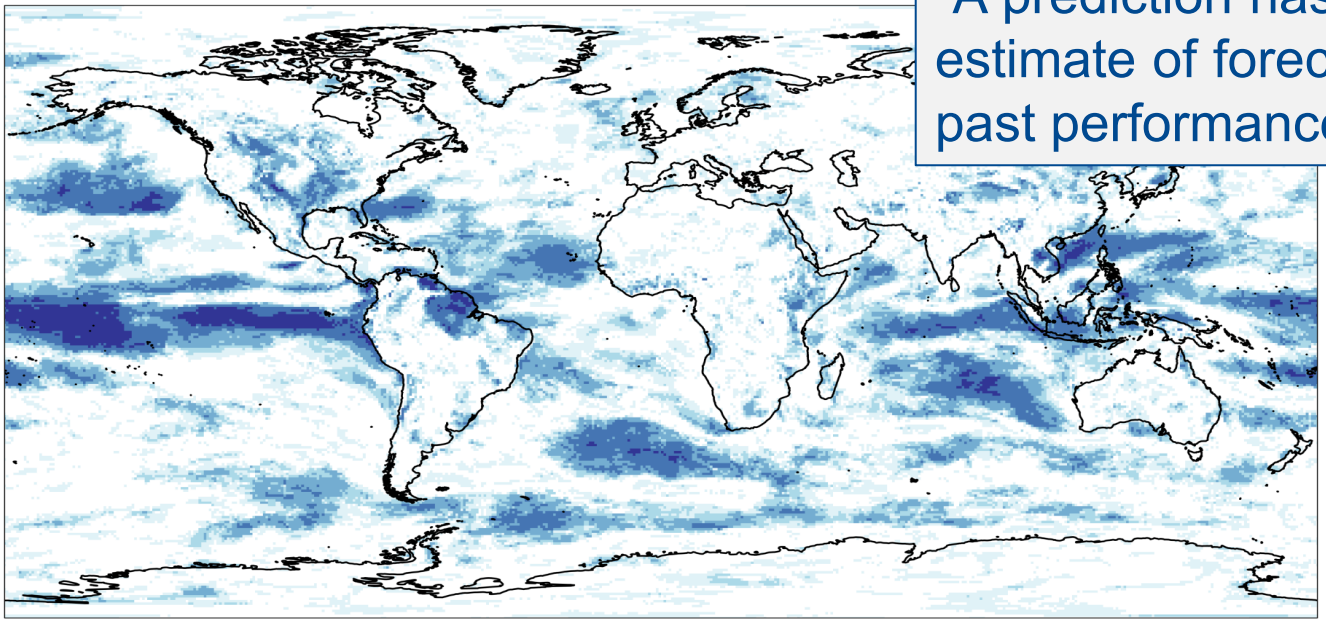


Observed anomalies (ERA-Interim)

3. How good are those forecasts?

Skill assessment

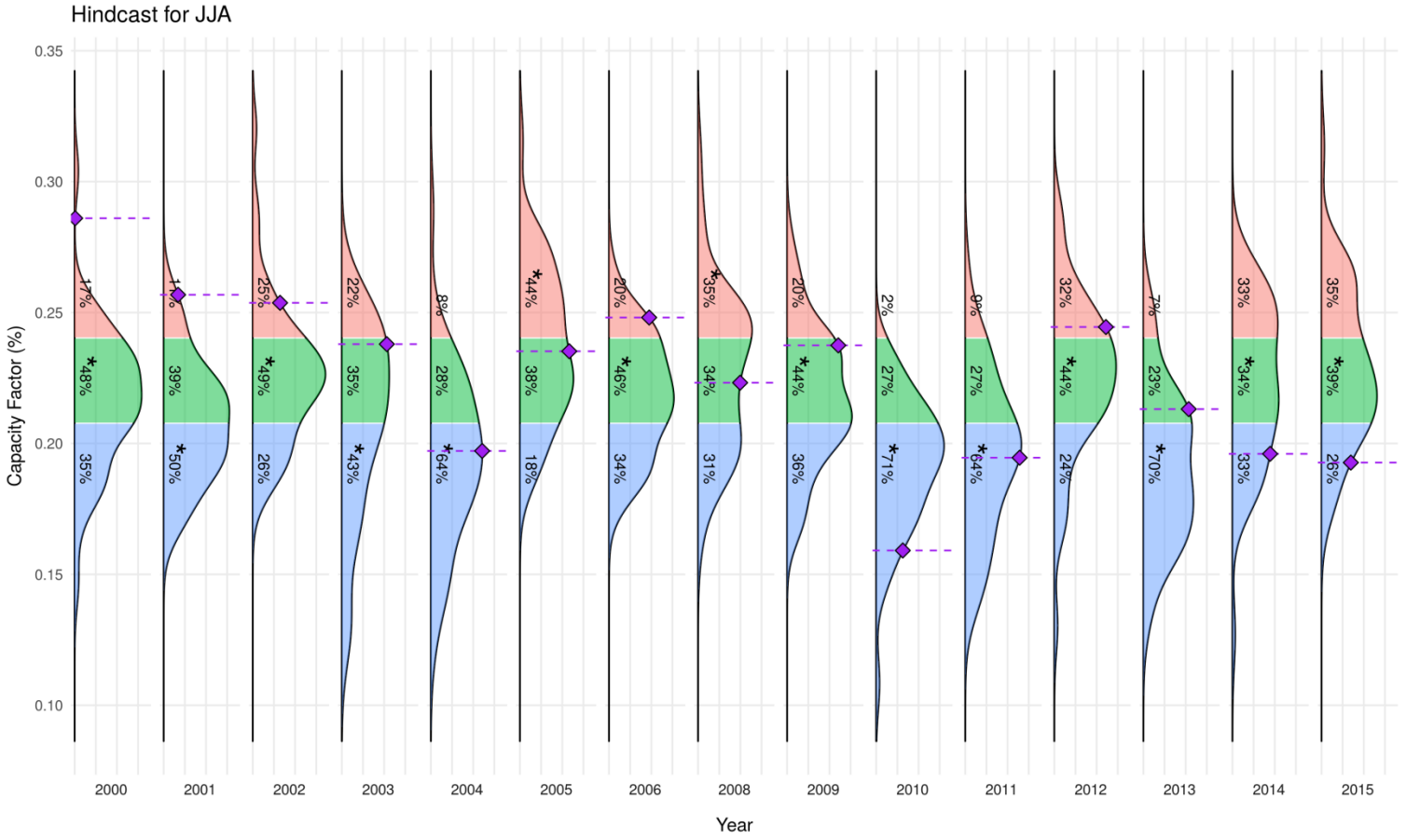
> "A prediction has no value without an estimate of forecasting skill based on past performance"



Skill assessment for DJF (1981-2013)

Displaying: Ranked Probability Skill Score [RPSS]

Example 3



SKILL SCORES

CRPSS = -0.01
RPSS = 0.08
EnsCorr = 0.44

Probability for each tercile
- Above normal
- Normal
- Below normal

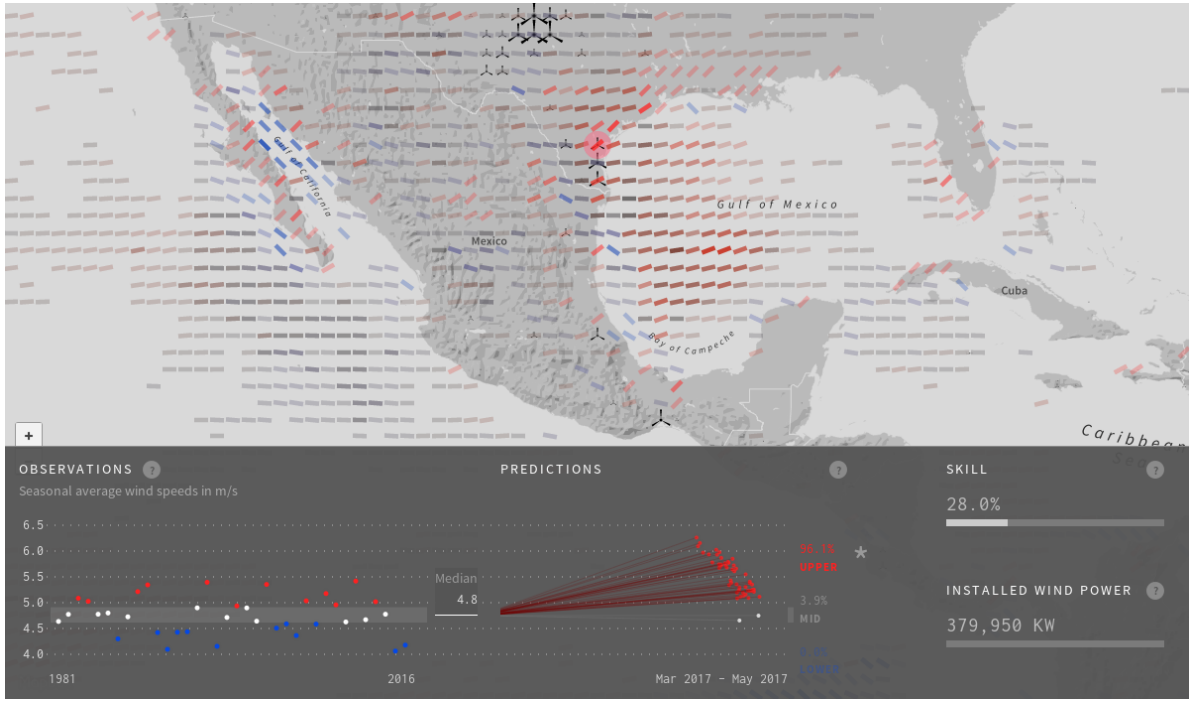
Observations

4. Visualization

Proof of Concept

PROJECT Ukko

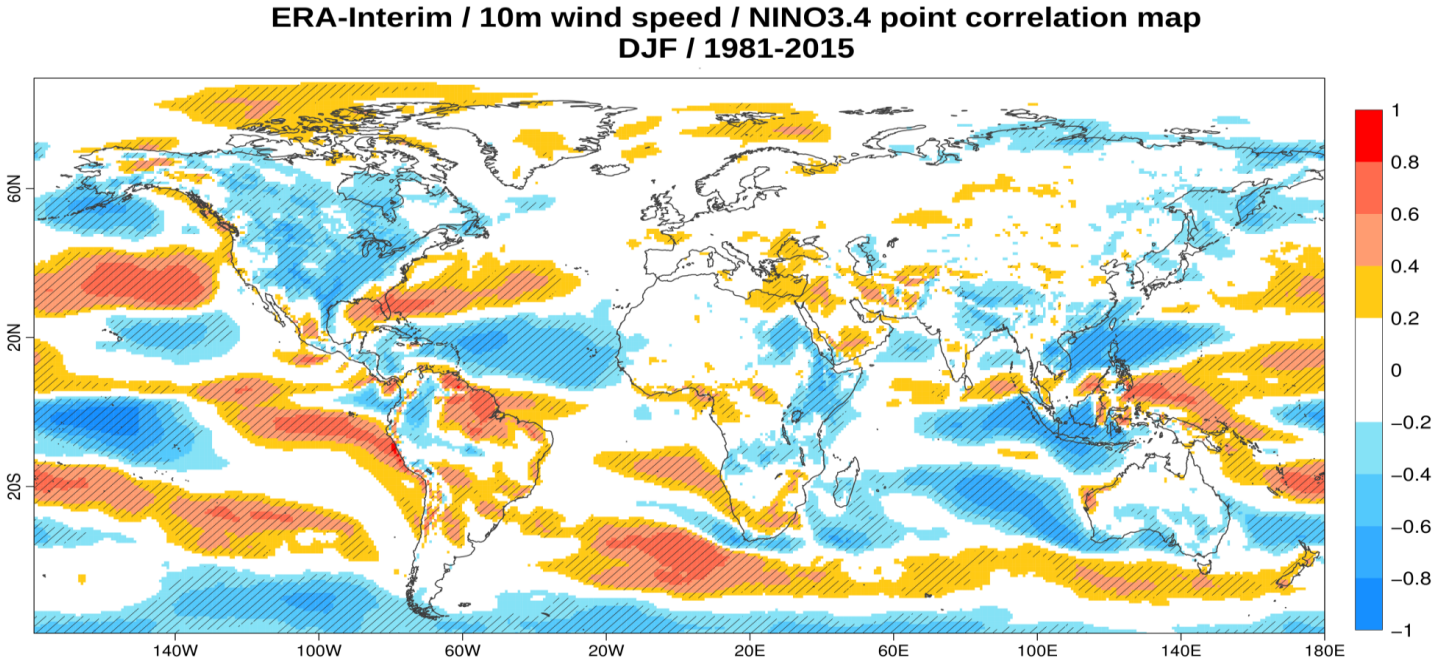
MAM 2017 forecasts now available as a Proof of Concept



bsc.es/projects/earthscience/project-ukko/map.html

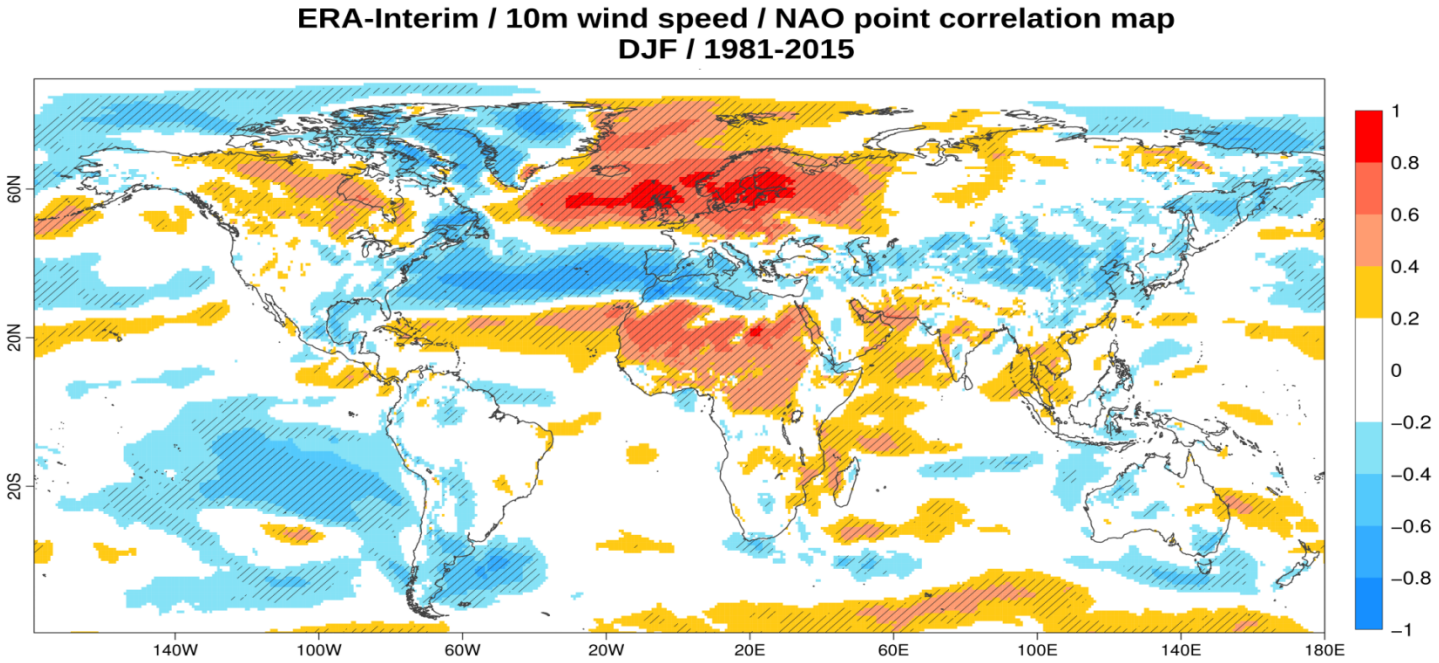
5. Teleconnections

Impact of ENSO on wind



Bias correction: none
Hatched area: siginficant at 95% confidence level from a two tailed Student's t-test

Impact of NAO on wind



Bias correction: none
Hatched area: siginficant at 95% confidence level from a two tailed Student's t-test

6. Conclusions

Conclusions

- Dynamical models can anticipate extreme events
- Tailored service helpful for several applications
- Assessing forecast quality is crucial before making decisions

Open questions

- Economic impact of those loses?
- Which decisions would you take in view of those forecasts?

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Thank you!

For further information please contact
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