Valuing sub-seasonal to seasonal predictions for the wind energy sector

Albert Soret[1], **Sergio Lozano** [2], **Verónica Torralba**[1], **Llorenç Lledó**[1], **Andrea Manrique-Suñén**[1], **Nicola Cortesi**[1], **Nube González-Reviriego**[1], **Pierre-Antoine Bretonnière**[1], **Francisco J. Doblas-Reyes,**[1,3]

(1)   Barcelona Supercomputing Center (BSC), Barcelona, Spain

(2)   National Renewable Energy Centre (CENER)

(3) Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

NEWA Final Workshop, Tue, 2 April 2019
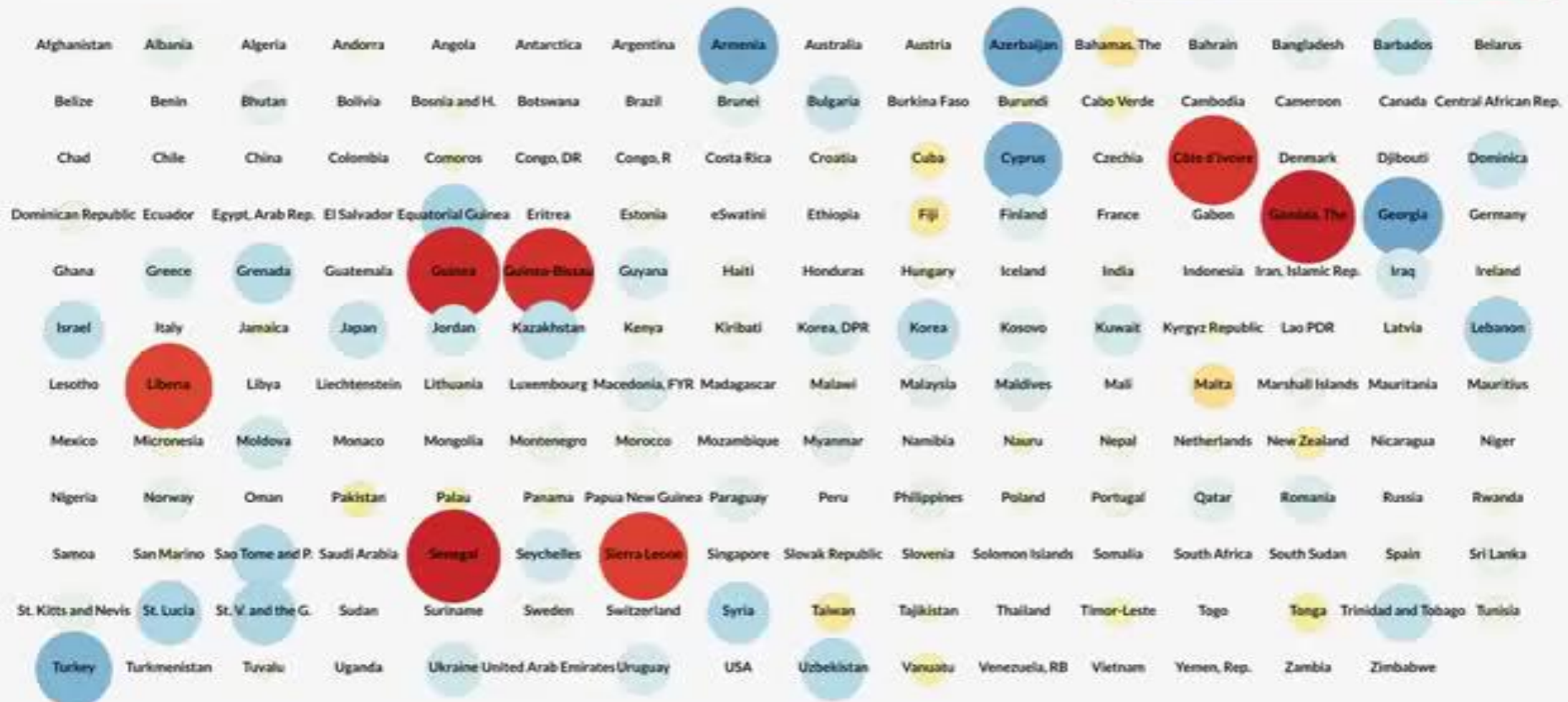Wind Europe, Bilbao

Weather forecast is a familiar concept …

… and climate change too, but what about climate variability?

Link: https://youtu.be/PhbdyNnUliM

Context and motivation

▶ Energy sector routinely uses weather forecast, especially between day-ahead and one week. Beyond this time horizon, climatological data are used.

Thursday, Aug 30th 2018 1PM 25°C 4PM 26°C 5-Day Forecast

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Britain's turbines are producing 40% less energy as wind 'disappears' for six weeks across the UK causing record low electricity production

- Britain got 15 per cent of its power from wind last year — twice as much as coal
- Since the start of June, wind farms have been producing almost no electricity
- The 'wind drought' has seen July 2018 be 40% less productive than July 2017
- In the still weather, solar energy has increased by 10% to help cover the drop-off

By JOE PINKSTONE FOR MAILONLINE
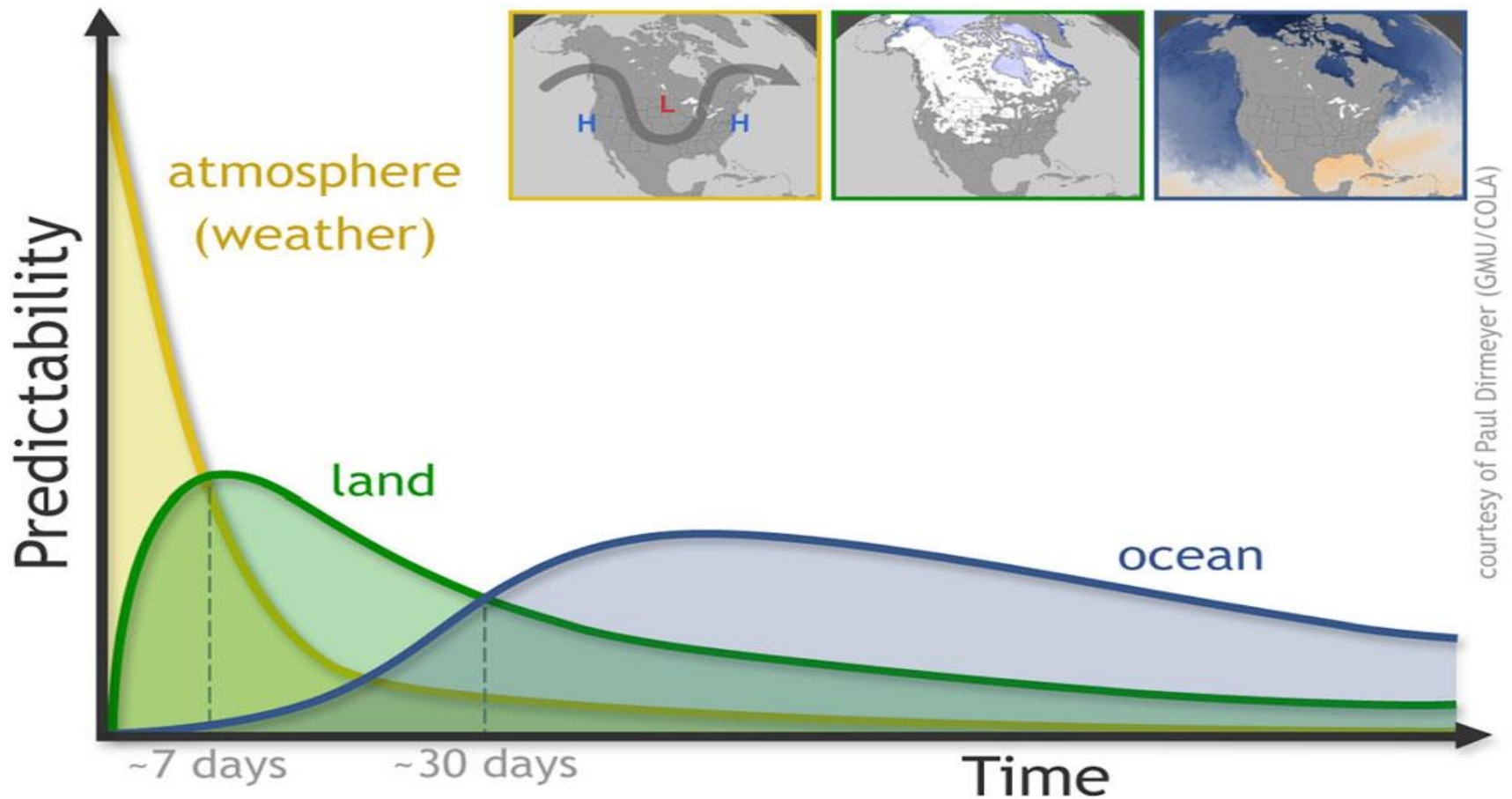PUBLISHED: 15:48 BST, 18 July 2018 | UPDATED: 17:29 BST, 18 July 2018

Predictability

▶ How can we predict climate for the coming season if we cannot predict the weather next week? Slow components (sea surface temperature, soil moisture, etc.) force the atmosphere.
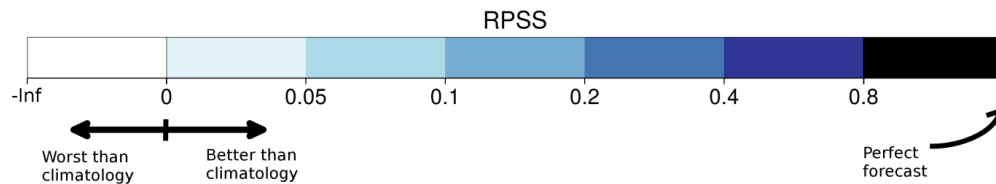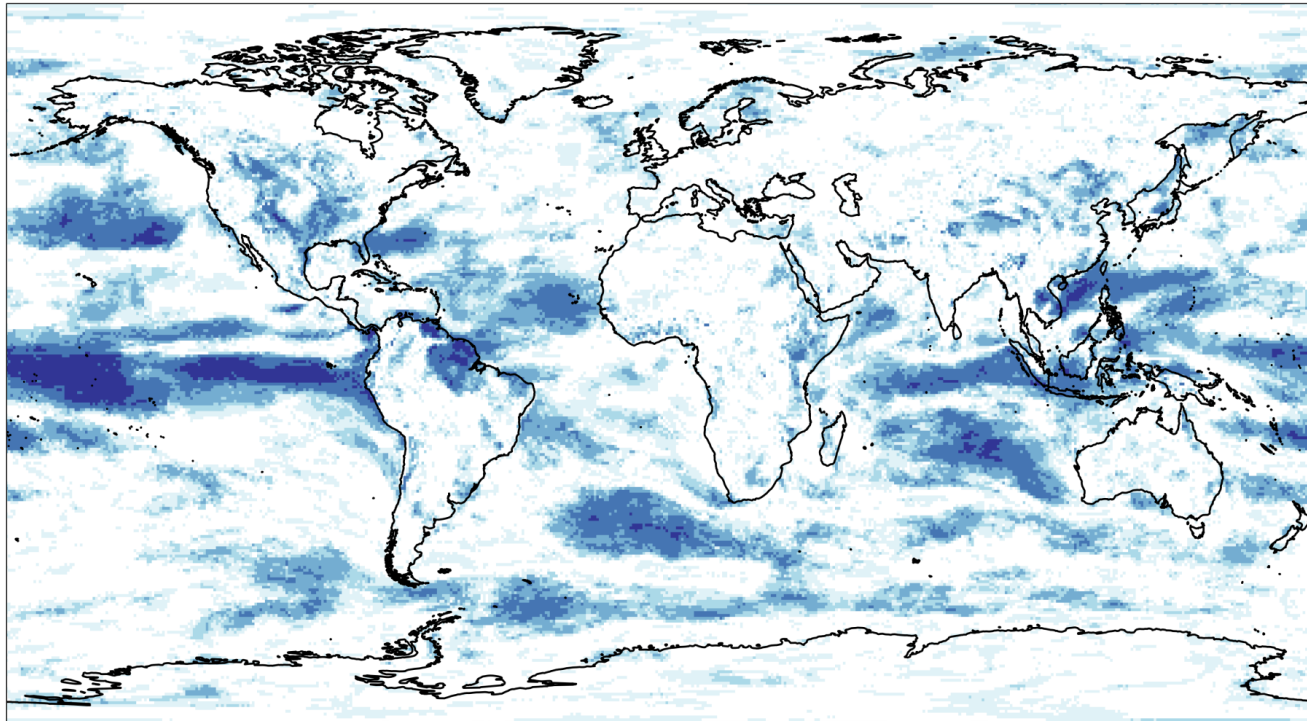
S2S Forecast range and skill

(Source: Mariotti et al. 2018)

S2S skill

Skill assessment
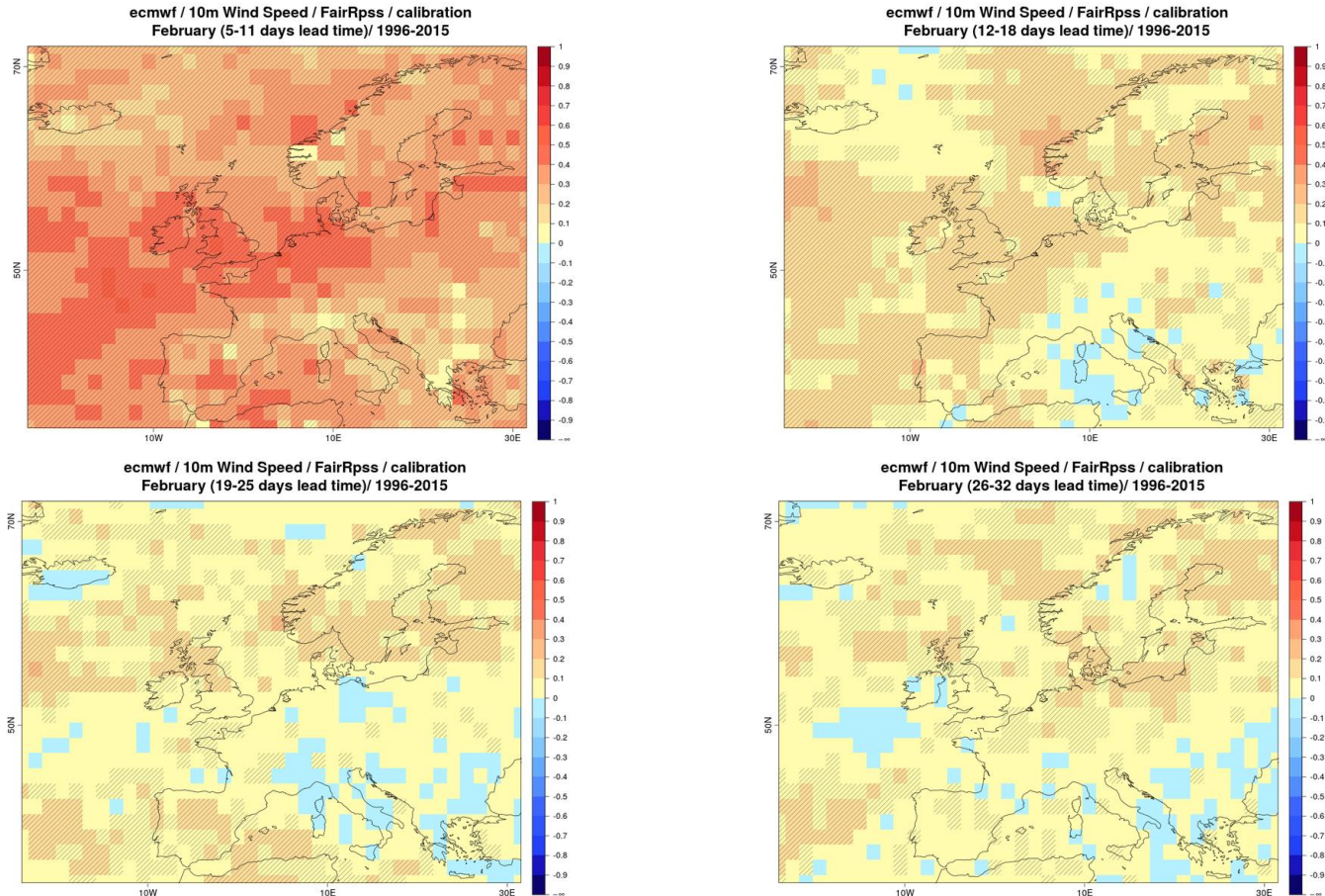for DJF (1981-2013)

System: ECMWF S5

Reanalysis: ERA-Interim

Displaying: Ranked
Probability Skill Score
[RPSS]

RPSS

-Inf 0 0.05 0.1 0.2 0.4 0.8 1

Worst than climatology   Better than climatology   Perfect forecast

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

NEW EUROPEAN WIND ATLAS
newa

S2S skill evolution with lead time

Fair RPSS of 10-m wind speed for the Monthly Prediction System of February (1996-2015).

S2S skill evolution over the year

FairRPSS of ECMWF 10-m wind speed for 1996-2015 over Europe
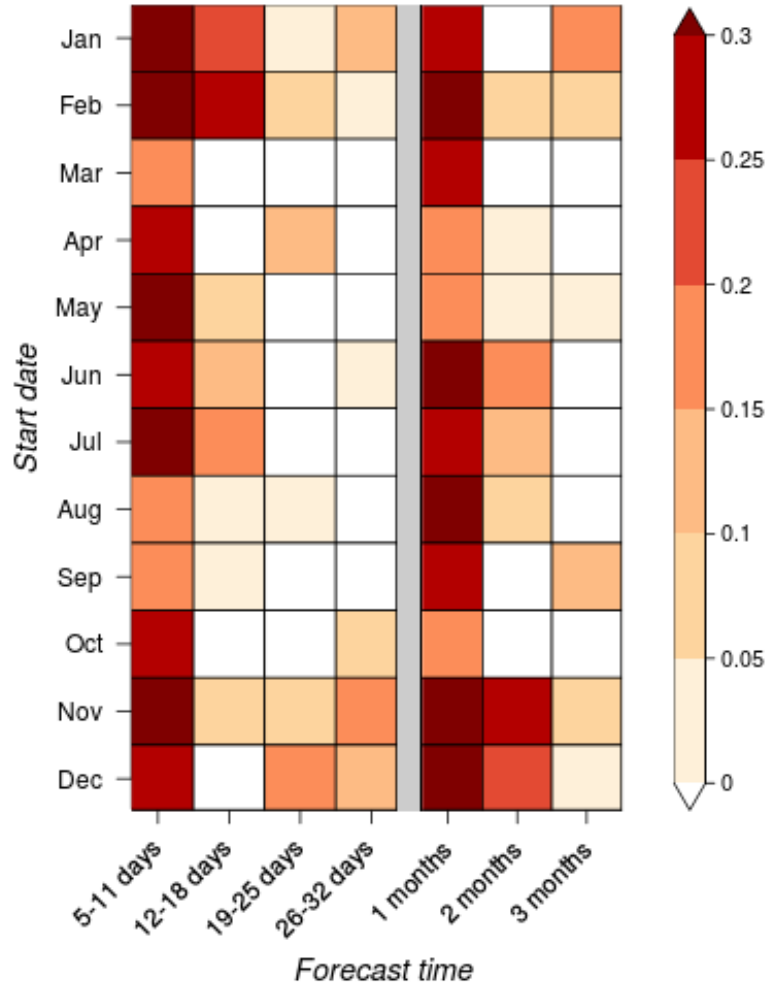
Reference dataset: Era-Interim

Forecast skill characterization in the Fino 1 area for different start dates (Y axis) and forecast window (X axis).

January 2017
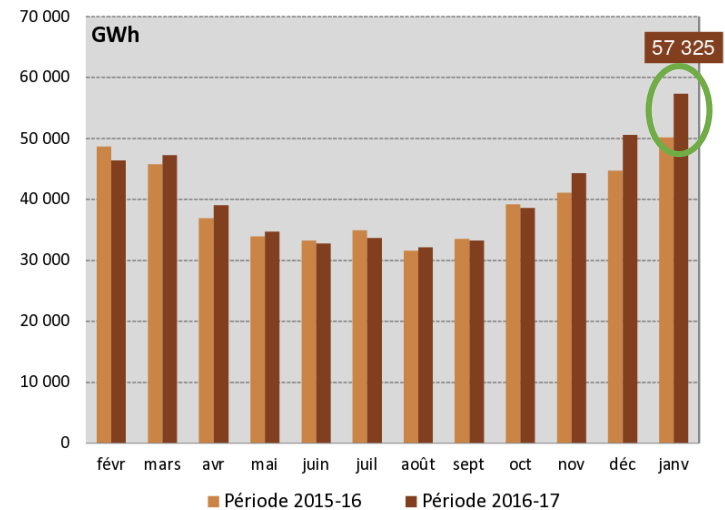# Cold spell over central Europe while low wind speeds

Analysis of the 2m temperature anomalies …

Observed weekly means and climatological values averaged over 5 W–12E, 47–54N during Dec 2016 to Feb 2017 (ERA-Interim 1979-2018)
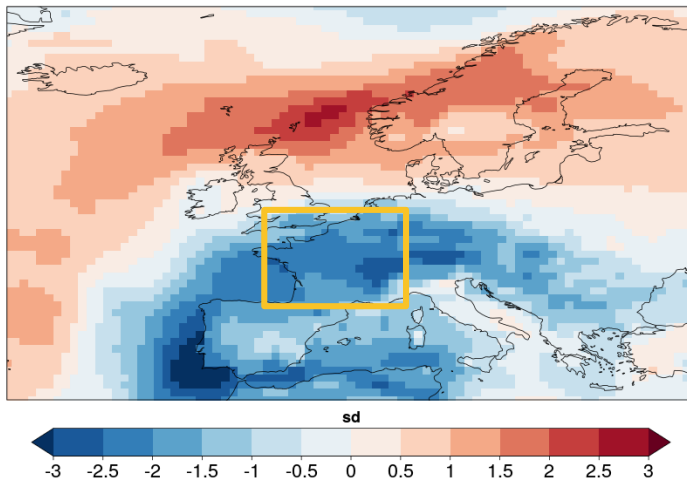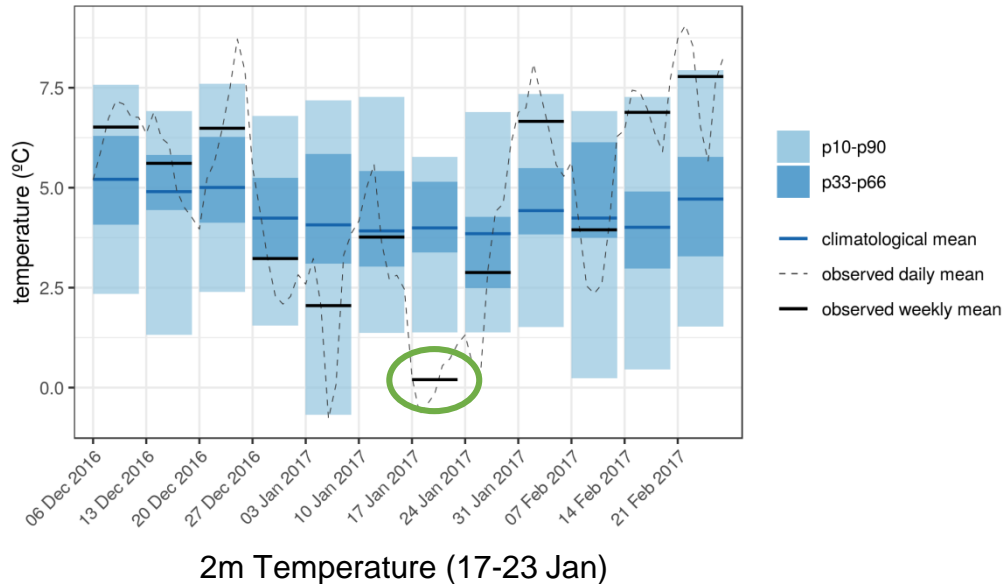
.. and its consequences in monthly electricity demand in France:

2m Temperature (17-23 Jan)

Source: https://www.rte-france.com

On 20/01/2017 demand reached a peak high of 94.2 GW (highest since Feb 2012)
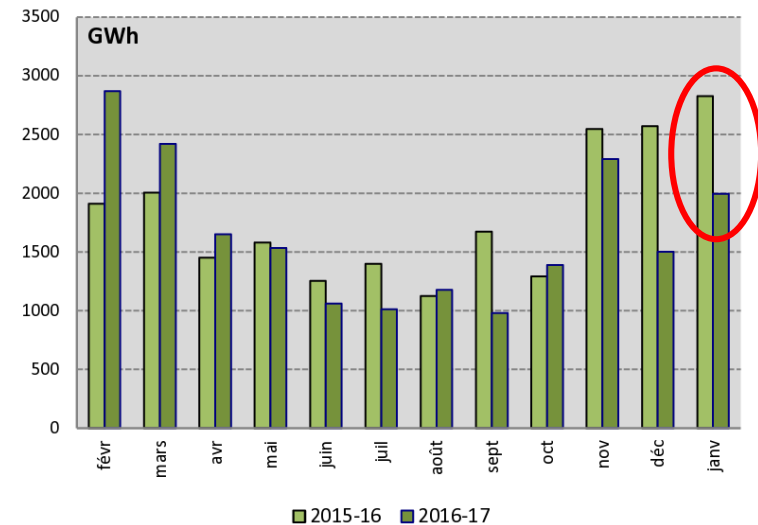
Analysis of the wind speed anomalies ...

Observed weekly means and climatological values averaged over 5 W–12E, 47–54N during Dec 2016 to Feb 2017 (ERA-Interim 1979-2018)

10m wind speed (17-23 Jan)
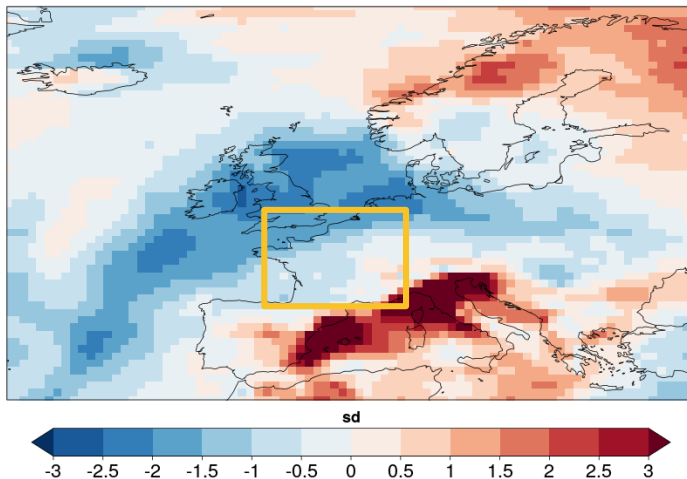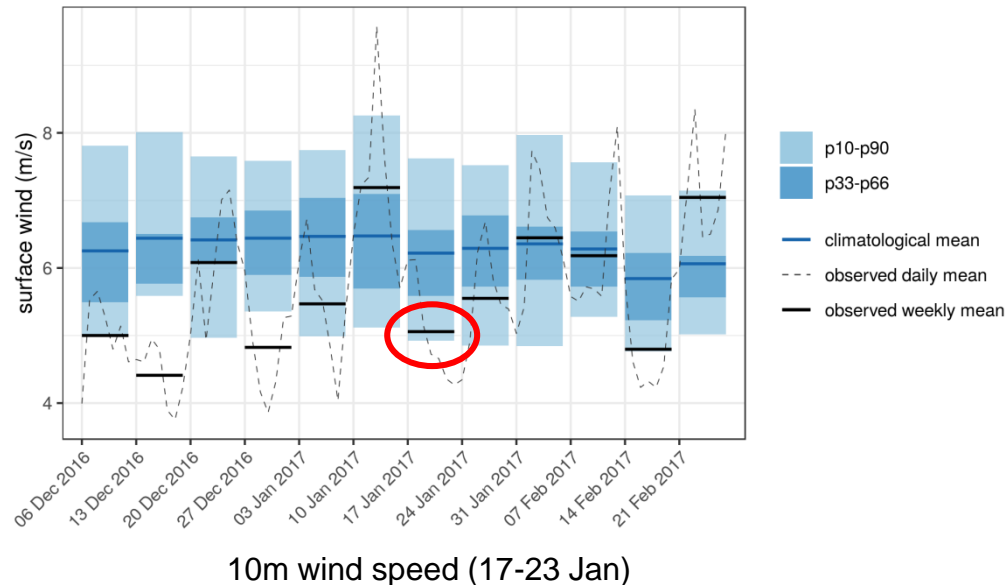
Monthly wind power generation in France:

Source: https://www.rte-france.com
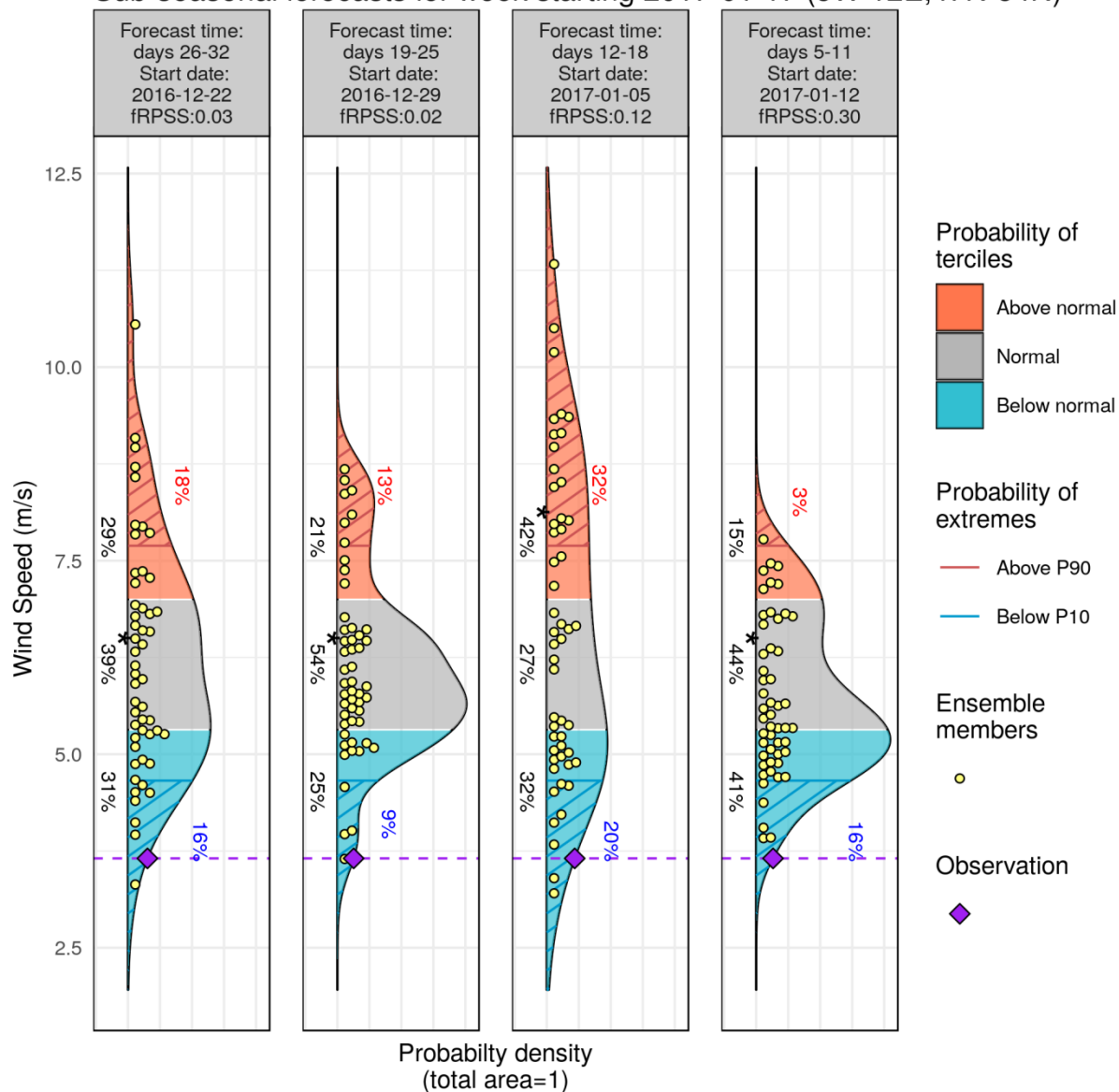
The high demand and low winds led to an increase in energy prices in France (highest since Feb 2012)
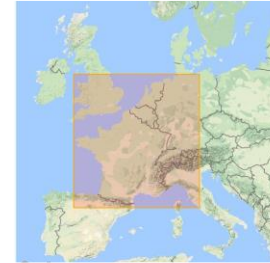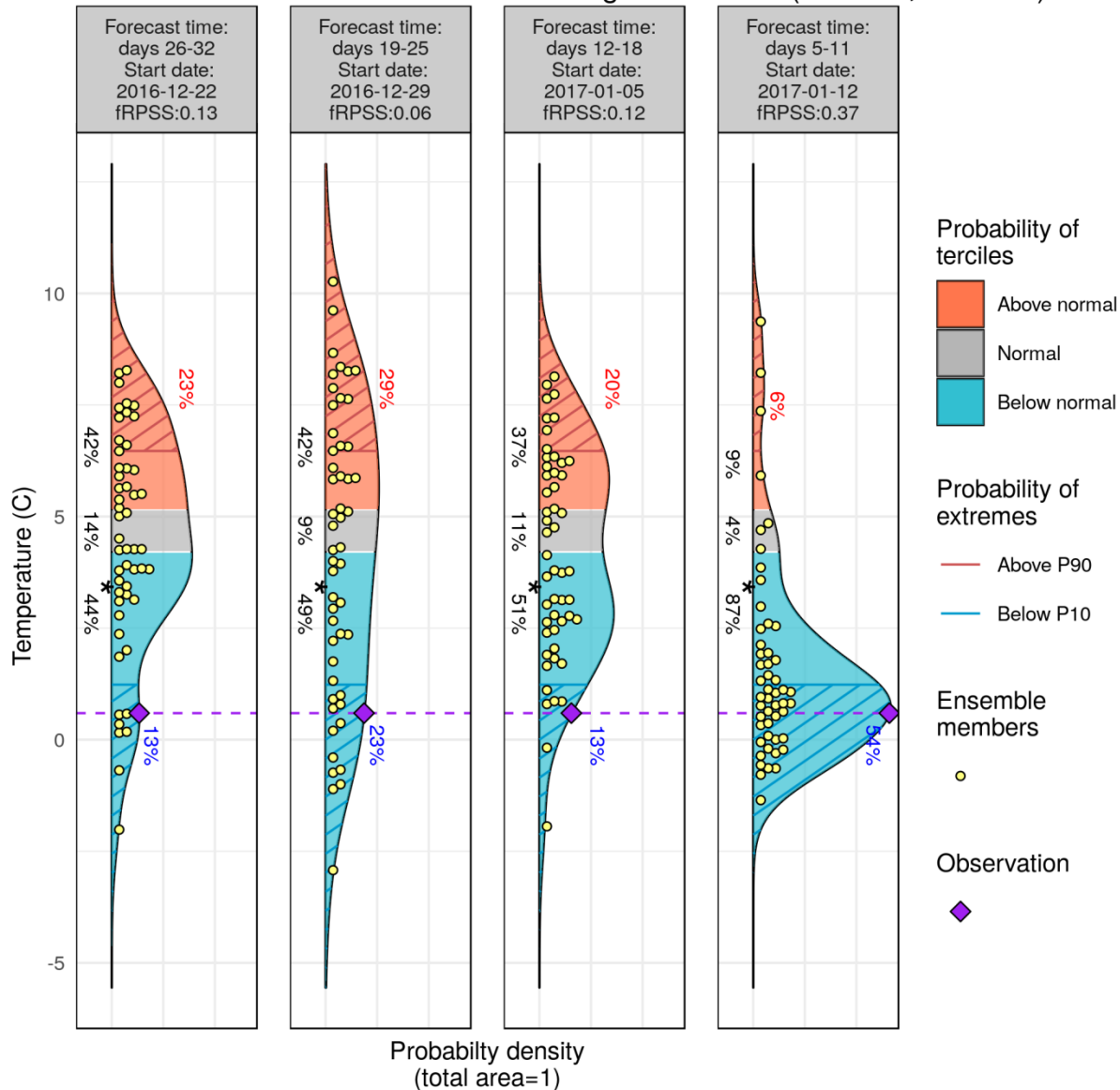
Forecasts: 10m wind speed

Sub-seasonal forecasts for week starting 2017-01-17 (5W-12E,47N-54N)

System: ECMWF MPS
Reanalysis: ERA-Interim
Bias adjustment: Variance inflation
Hindcast: 1997-2016
Area: 5W-12E, 47-54N

Forecasts: 2m temperature

Sub-seasonal forecasts for week starting 2017-01-17 (5W-12E,47N-54N)
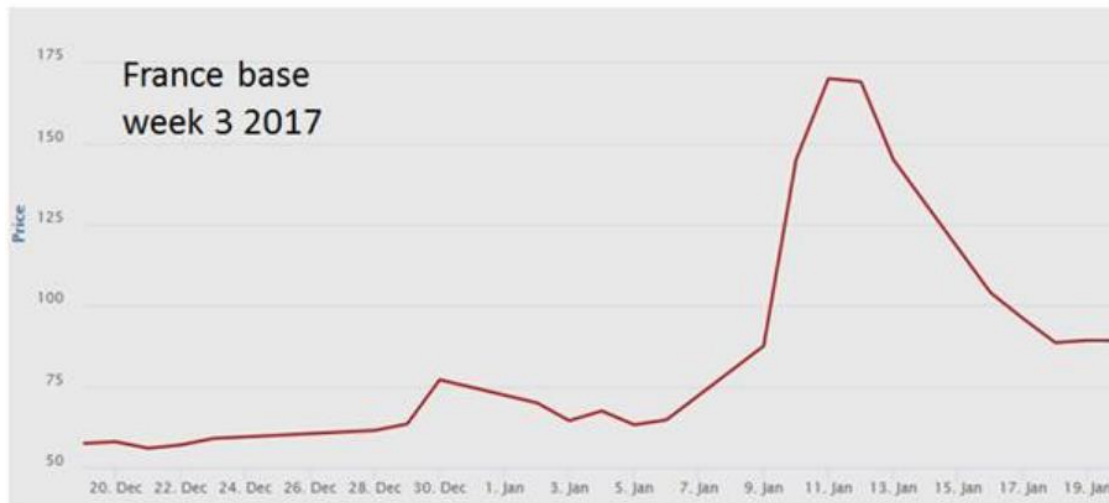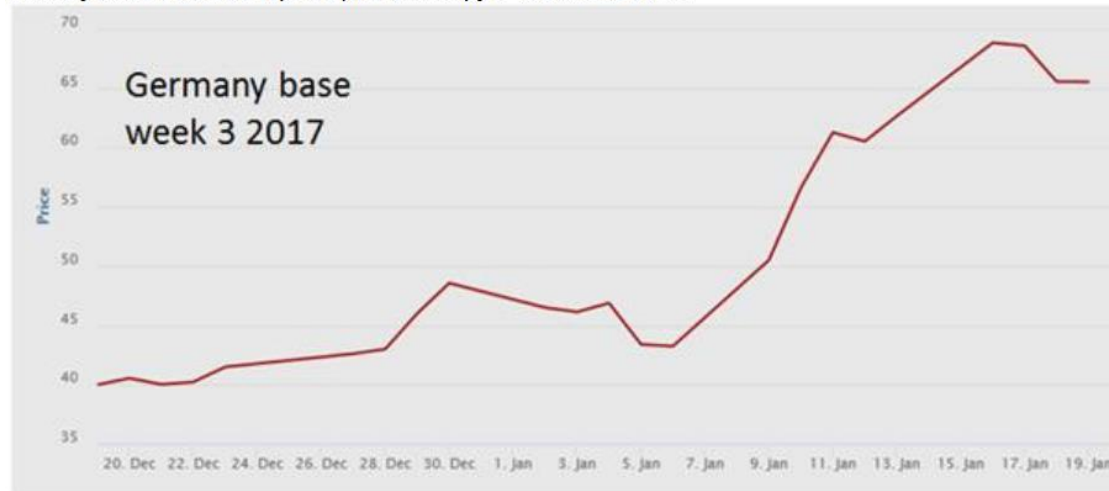
System: ECMWF MPS
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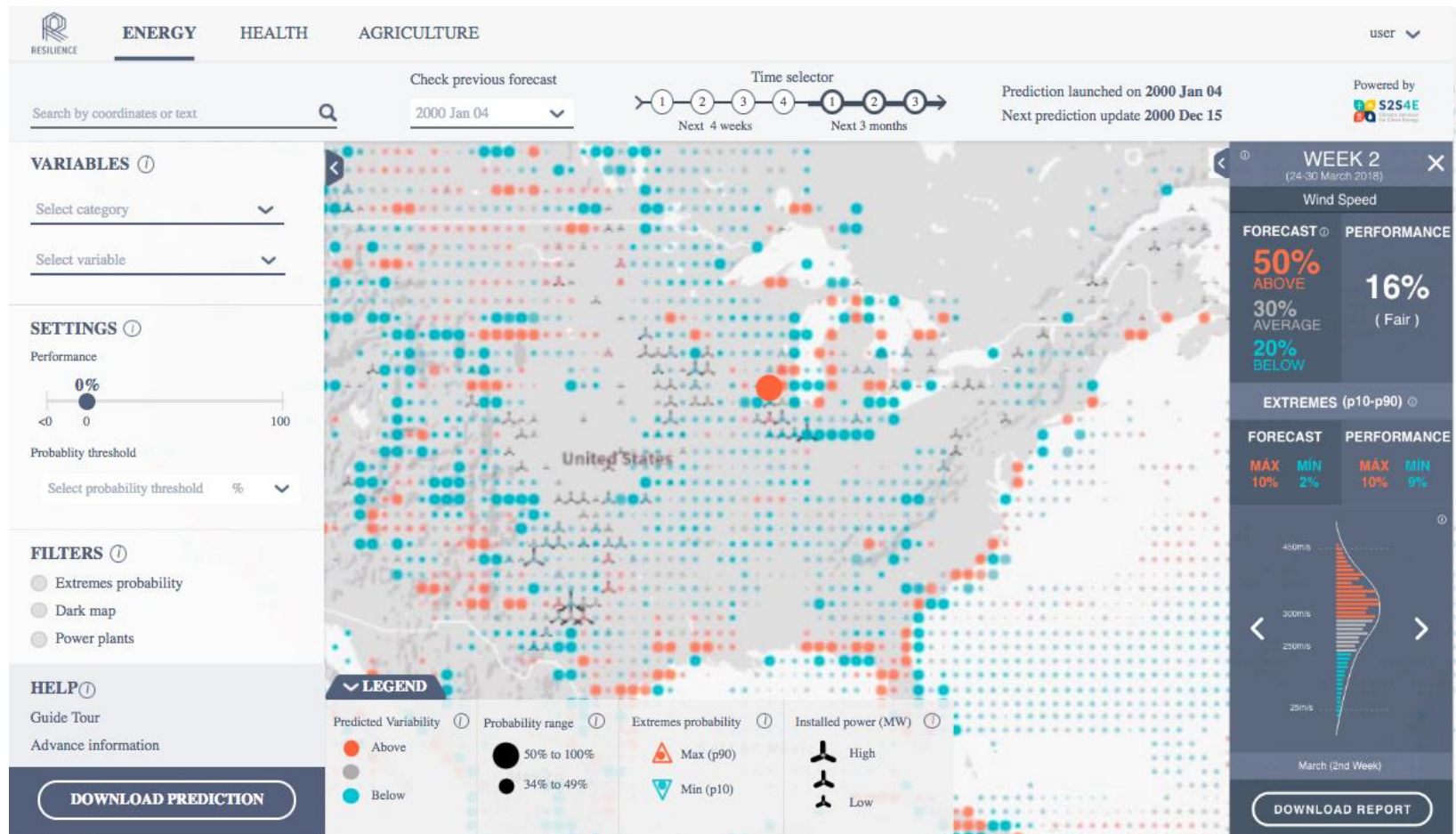# Future work: economic assessment of the case studies

▶ Power Future Settlement Price / France & Germany Jan, 19th 2017

Power future settlement price (EUR/MWh) for week 3 in 2017:

Launch event. EUSEW 2019
20 June, 20th 2019

http://www.bsc.es/ess/resilience/map.html