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Climate Services for Clean Energy

Workshop on predictability, dynamics and applications research using the TIGGE and S2S ensembles, 2-5 April 2019

# The S2S4E project: Sub-seasonal to seasonal climate predictions for energy

**Andrea Manrique-Suñén[(1)], Llorenç Lledó[(1)], Verónica Torralba[(1)], Hannah Bloomfield[(2)], Paula González [(2)], Andrew Charlton-Pérez[(2)], David Brayshaw [(2)], Nicola Cortesi[(1)], Jaume Ramón Gamón[(1)], Nube González-Reviriego[(1)], Martí Badal [(1)], Pierre-Antoine Bretonnière[(1)], Lluis Palma[(1)], Ilaria Vigo[(1)], Isadora Christel[(1)], Albert Soret[(1)], Francisco J. Doblas-Reyes[(1,3)]**

(1) Barcelona Supercomputing Center (BSC), Barcelona, Spain
(2) University of Reading, UK
(3) Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

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# Outline

- S2S4E: motivation and objectives
- Climate service
- User interviews
- Case studies
- Decision Support Tool (DST)
- Final remarks

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# S2S4E : motivation and objectives

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# Renewable energy and climate

- EU Renewable Energy Directive:  EU is required to fulfil at least 20% of its total energy needs with renewables by 2020.

- Both energy supply and demand are strongly influenced by atmospheric conditions and their evolution over time in terms of climate variability and climate change.

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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

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# S2S4E Objectives

- S2S4E will offer an innovative service to improve RE variability management by developing new research methods exploring the frontiers of atmospheric conditions for future weeks and months.




- The main output of S2S4E will be a user co-designed Decision Support Tool (DST) that for the first time integrates sub-seasonal to seasonal (S2S) climate predictions with RE production and electricity demand.


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# Climate service

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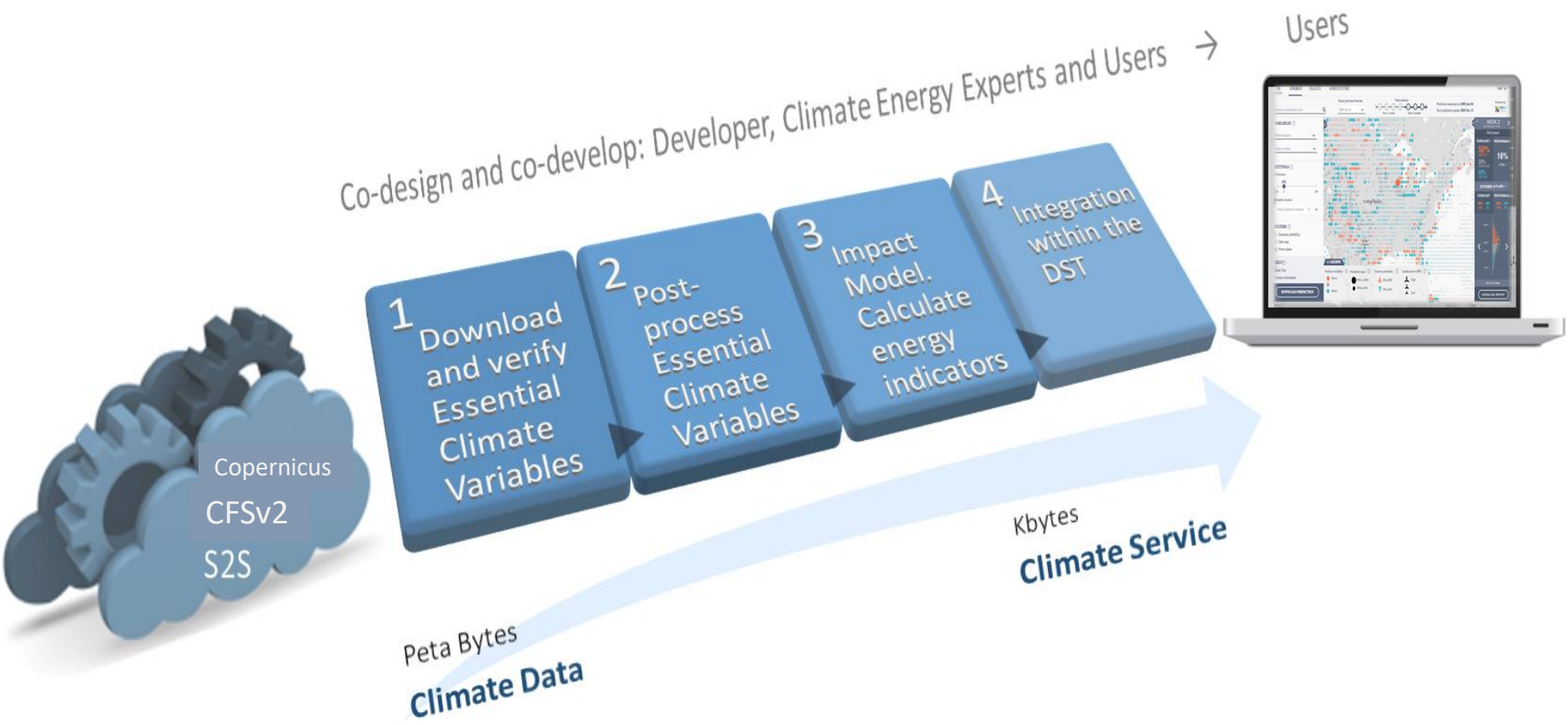
# From climate data to climate services

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# Co-development of the climate service

**Involvement of users as project partners**

- They should represent the sectorial expertise.
- User engagement in early stages of the service is crucial to understand the user chain, sectorial needs and co-develop the service.
- Their continuous feedback will contribute to the improvement of the service.

# User interviews

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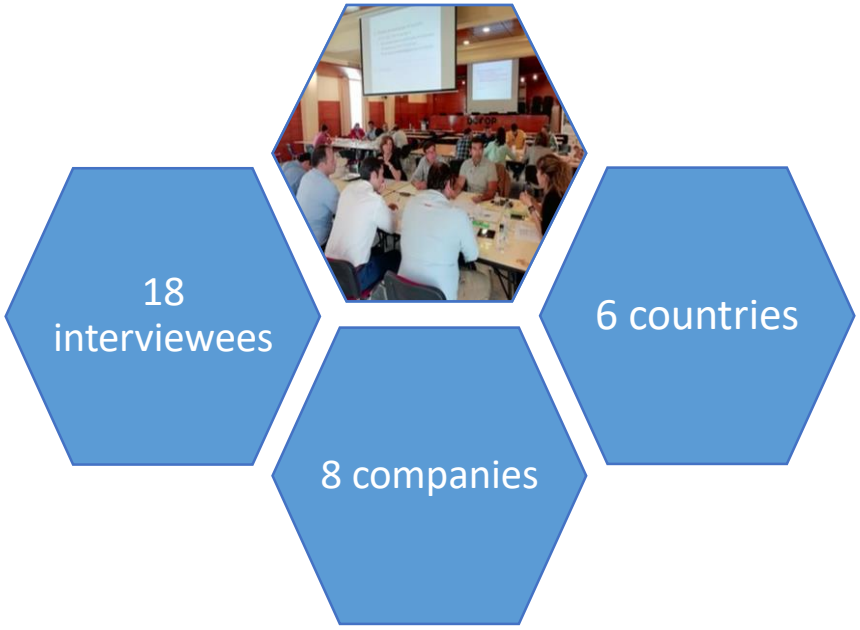
# Interaction with users

Participatory approaches to understand user needs, expectations, decision making processes and other relevant factors in the user's decision making process.

## User interviews

- Energy producers
- Energy providers
- Meteorologists
- Transmission system operators (TSO)
- Distribution system operators (DSO)
- Energy traders




Energy users are already advanced users of weather forecasts

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# User interviews: Current practice

- **Short range**: Users in the energy sector already integrate weather forecasts (T, precip, wind), in their daily operational planning and decision making (e.g. energy production for the day ahead market, price models, etc.).

**What about sub-seasonal to seasonal timescales?**

We don´t use it

We look at it, but would not base our decisions on it

- **S2S time scale:** 50% of the interviewees stated that they already use S2S data in a 'qualitative' way (i.e. it is not fed into energy production/ price models but used as supportive information)

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# User interviews: Decision-making processes that can benefit from S2S forecasts

**In what decision-making processes can S2S times scales be useful?**

Maintenance planning (including predictive maintenance)

Buy / sell electricity

Water resource management

Predict the electricity demand

Scheduling of maintenance of nuclear and hydro power plants.

Management of the electricity transmission bill

- Maintenance scheduling for the various sectors
- Coherent estimation of demand and supply for distribution and transmission grids

# Case studies: assessing the DST and the added value of S2S

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

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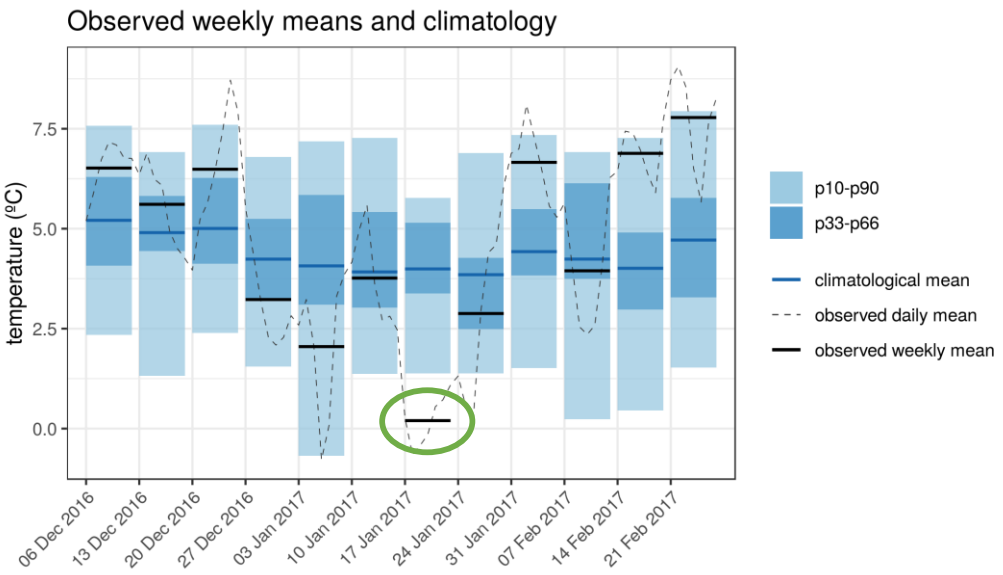
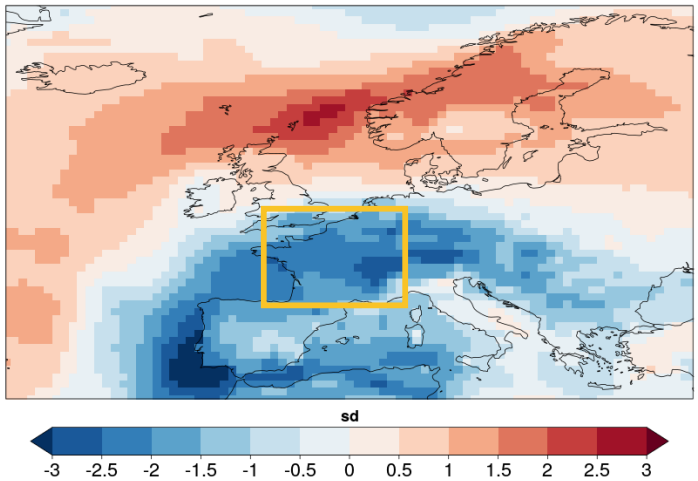
# Analysis of the 2m temperature anomalies …

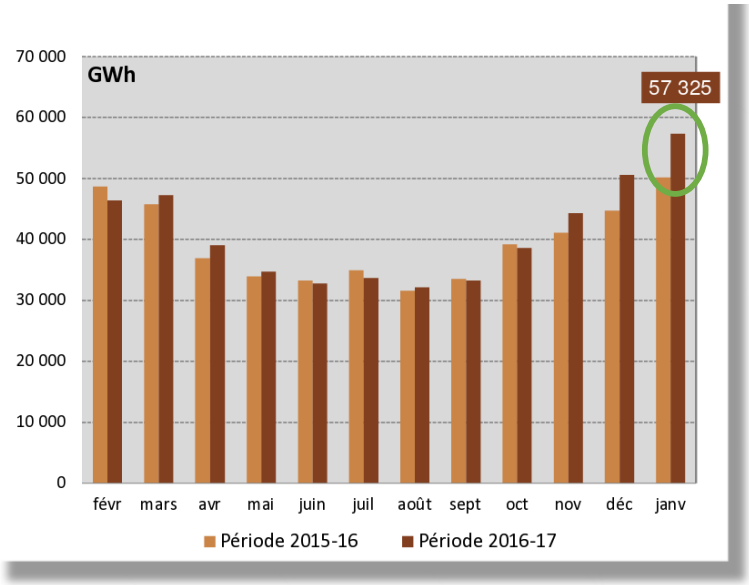
Observed weekly means and climatological values averaged over 5W–12E, 47–54N during Dec 2016 to Feb 2017 (ERA-Interim 1979-2018)




2m Temperature (17-23 Jan)




## .. and its consequences in monthly electricity demand in France:




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

On 20/01/2017 demand reached a peak high of 94.2 GW (highest since Feb 2012)

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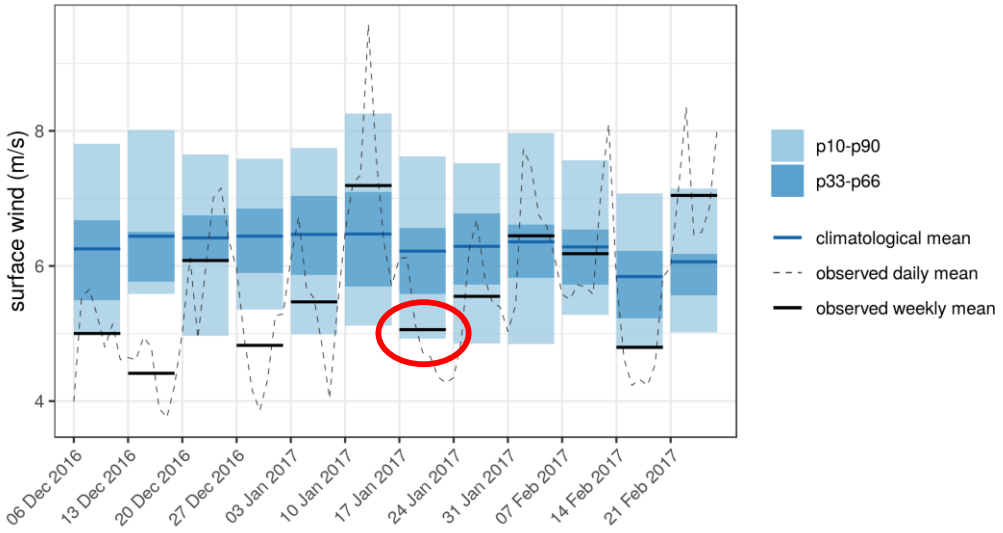
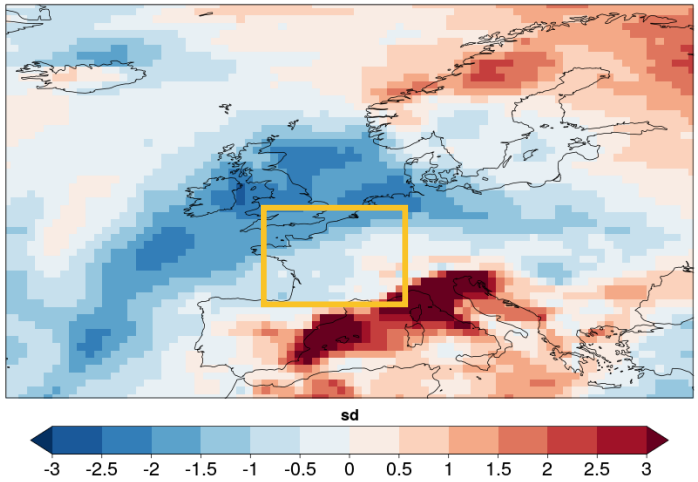
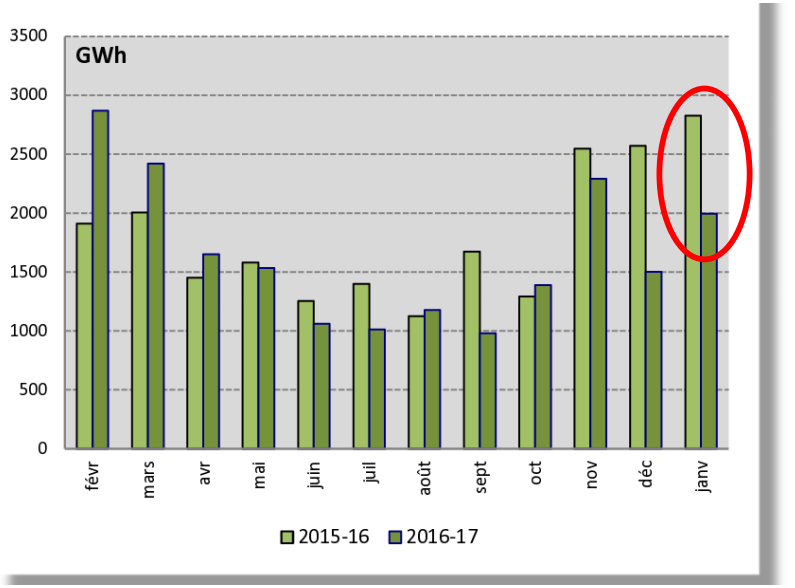
Observed weekly means and climatological values averaged over 5W–12E, 47–54N during Dec 2016 to Feb 2017 (ERA-Interim 1979-2018)




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)

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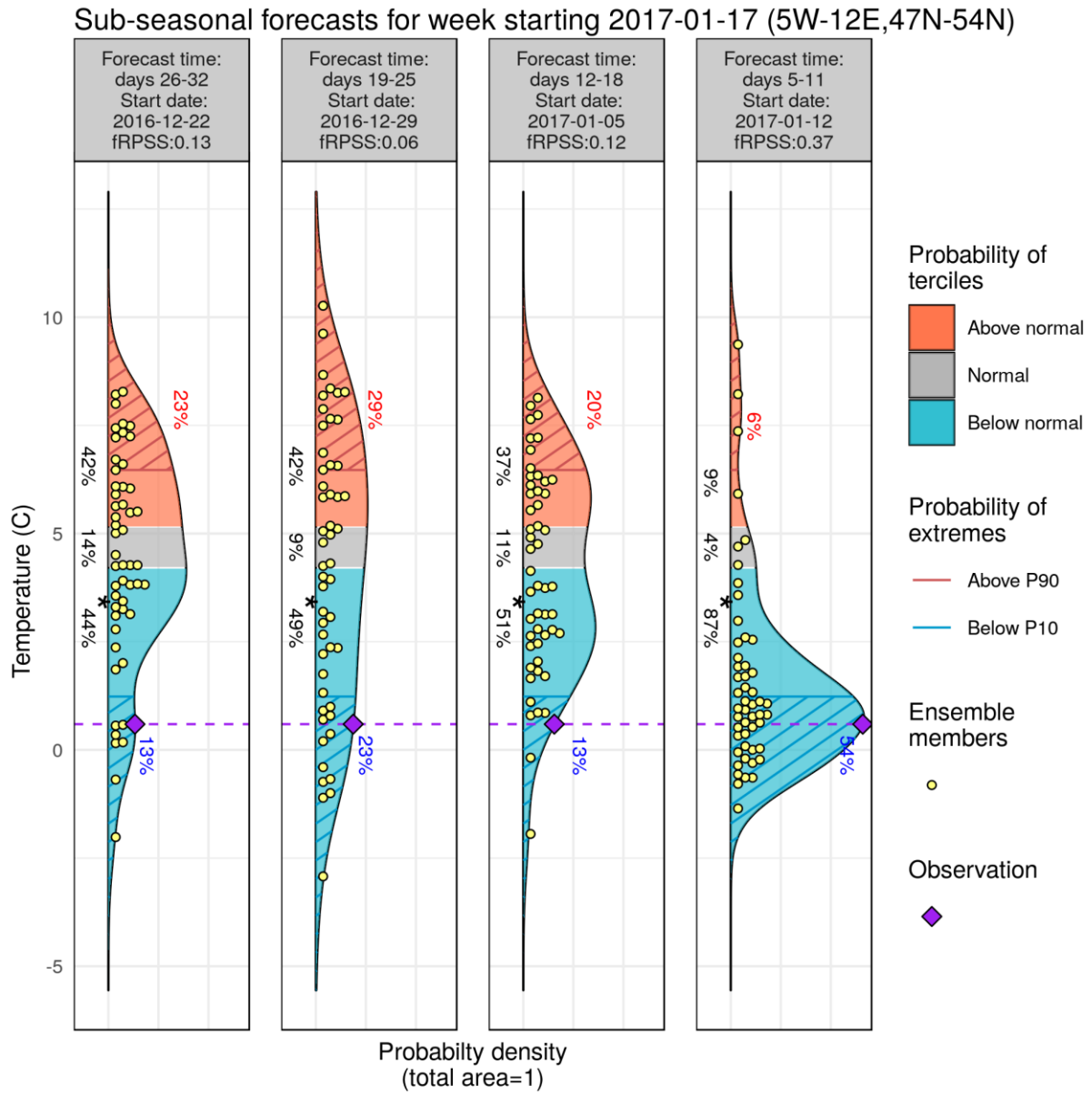
# Forecasts: 2m temperature




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

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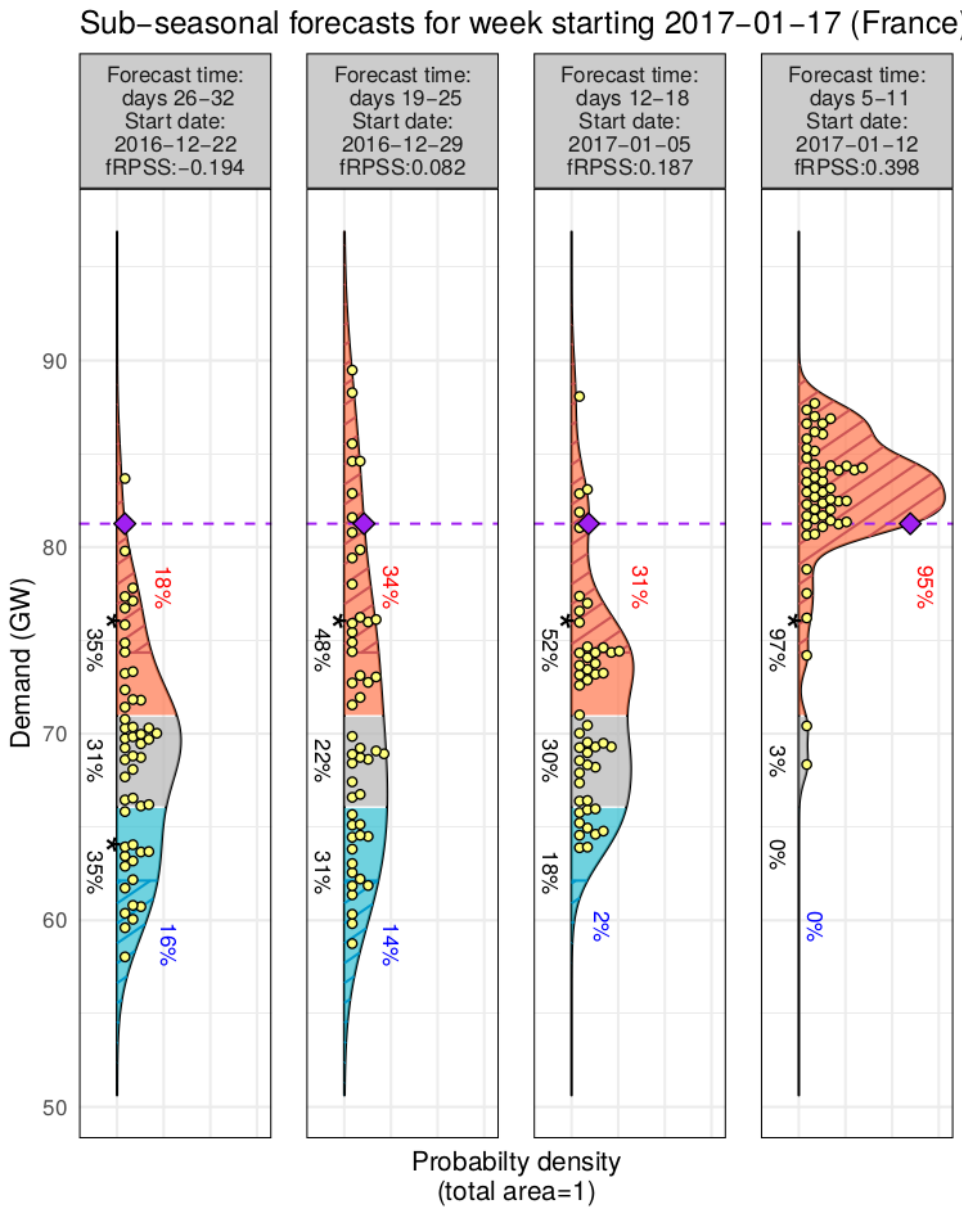
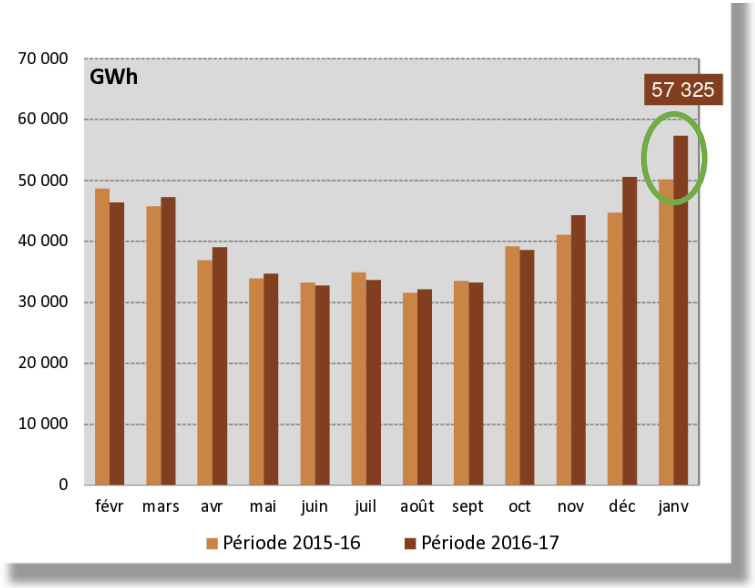
# Forecasts: Energy demand in France




## Monthly electricity demand in France:




on

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

On 20/01/2017 demand reached a peak high of 94.2 GW (highest since Feb 2012)

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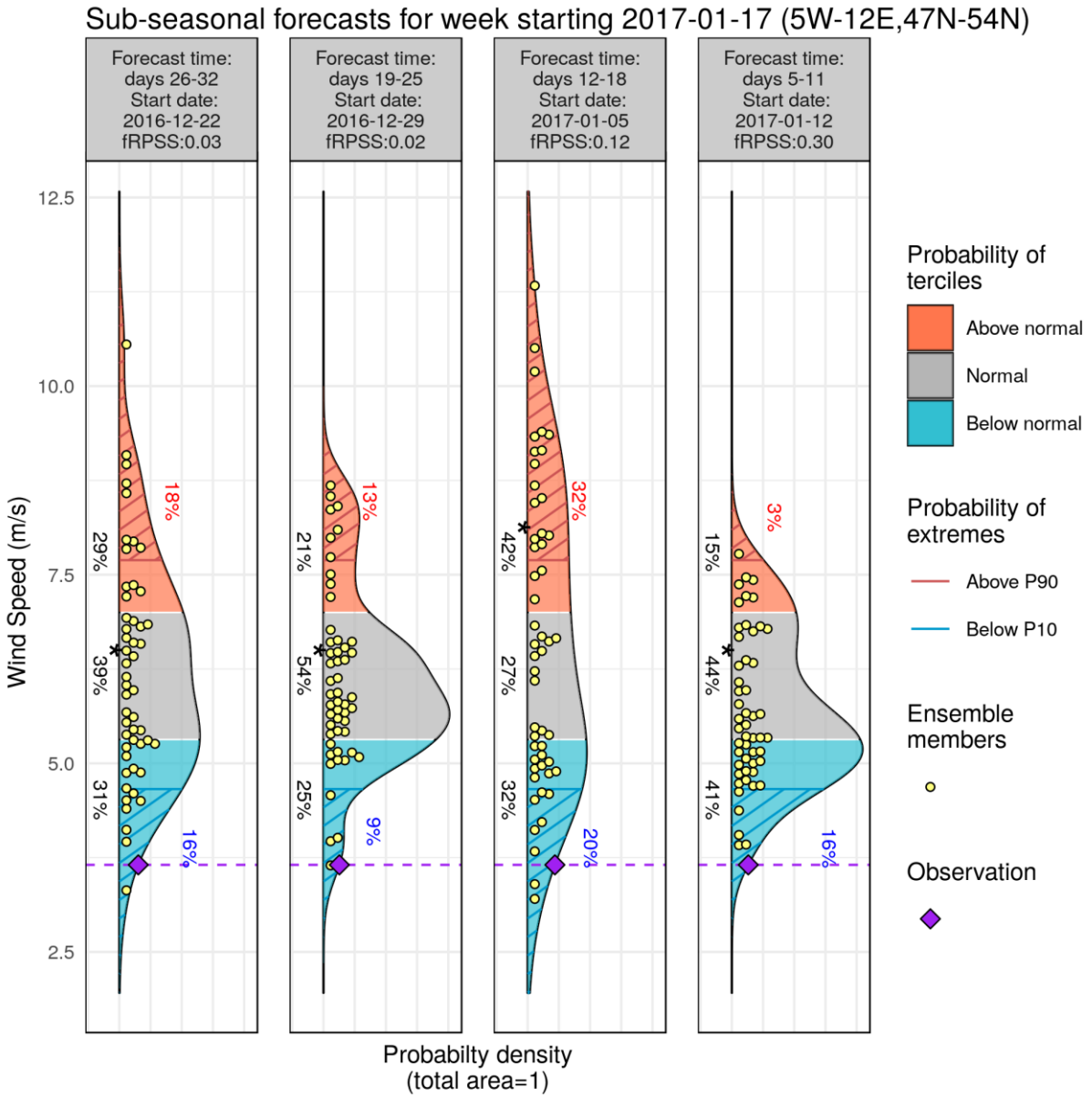
# Forecasts: 10m wind speed




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

Next steps:
Economic analysis of the case studies

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# Decision Support Tool

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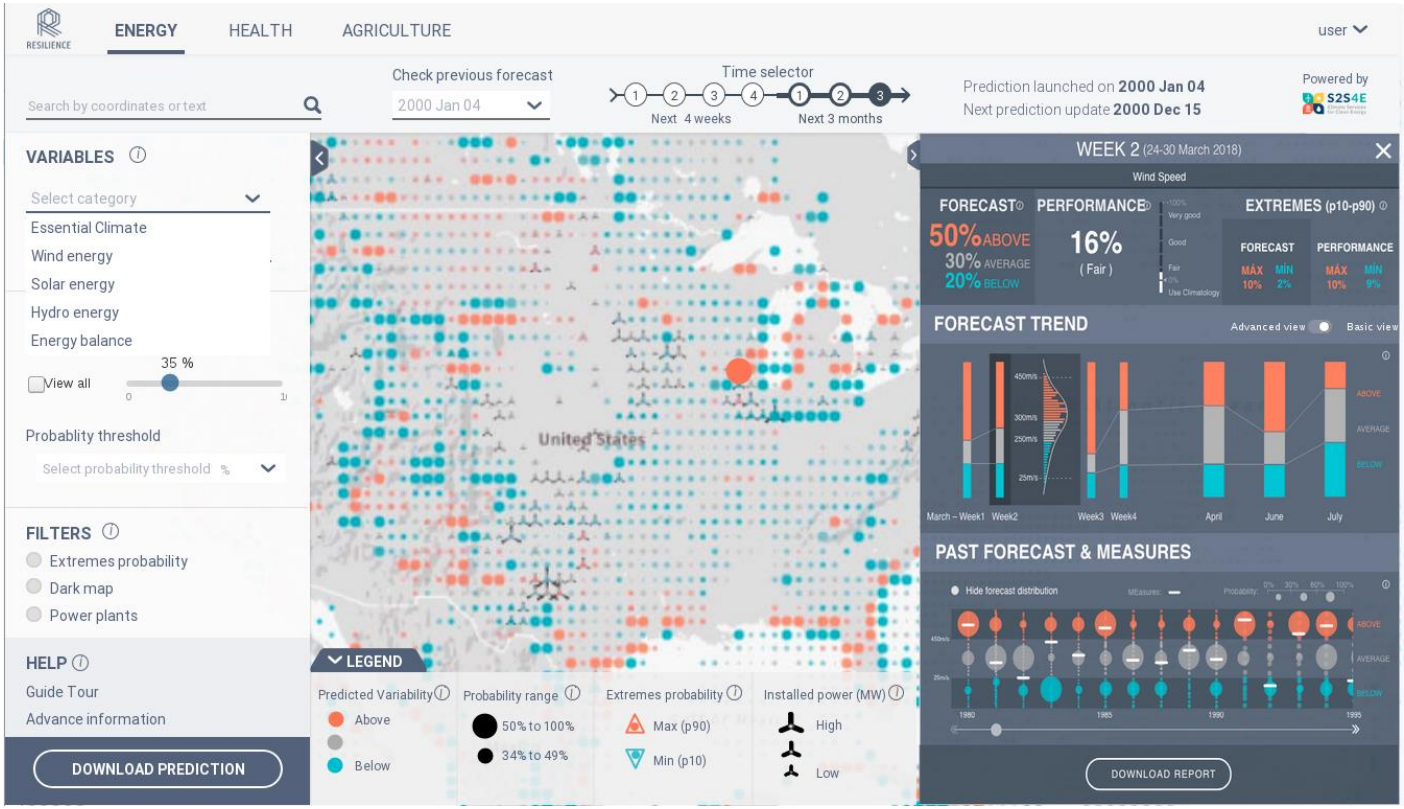
# DECISION SUPPORT TOOL




Check out the prototype! https://ahv718.axshare.com/prototype.html

To be launched on the 20th June in Brussels during the EU Sustainable Energy Week

17-21 JUNE 2019
EU SUSTAINABLE ENERGY WEEK

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# Final remarks

- The energy sector already integrates short-range forecasts in daily operational decisions.
- There is interest in S2S climate predictions, since many operational decisions fall in this timescale.
- A climate service aims to convert ‘climate data’ into a tailored product that can provide added value to a user.
- Interdisciplinary groups are needed to co-develop a climate service.

# Ongoing work

- Economic analysis of the case studies
- Operational implementation for DST
- Assessing predictability in atmospheric weather patterns

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# Thank you

## Get in touch for more information!

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Public reports of the project will be available for download on the S2S4E website: **www.s2s4e.eu**

**Project coordinator:** Albert Soret, Barcelona Supercomputing Center (BSC)
**Contact us:** s2s4e@bsc.es

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