



Climate Change

C3S Energy Operational Service

Energy Modelling Platform for Europe

19 May 2020

Online

Alberto Troccoli and the C3S Energy Team



#C3S_ENERGY



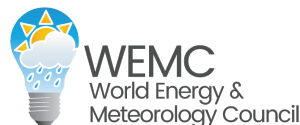


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C3S Energy Rationale: Developing a Climate Service with and for Energy Industry stakeholders

We'd like more than just capacity factors; we'd need W, MWh, MJ, etc. – so we can also easily compare demand with supply

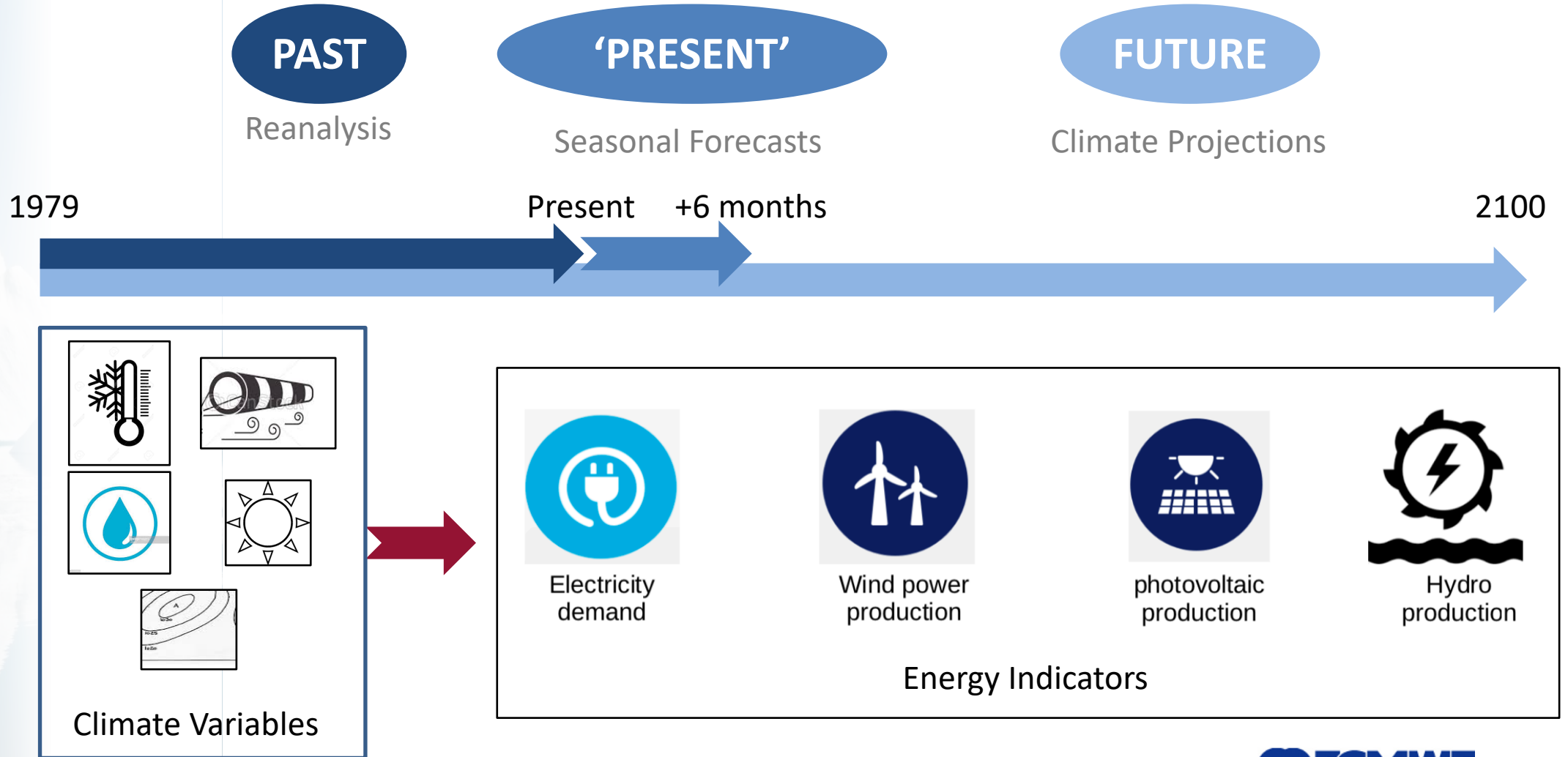
Can we bridge the communication gap between climate and energy, and involve a wider community in the conversation – policy makers, strategists, but also students





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C3S Energy in a Nutshell

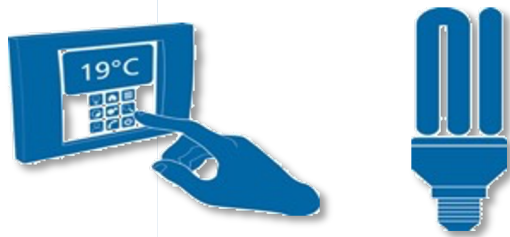




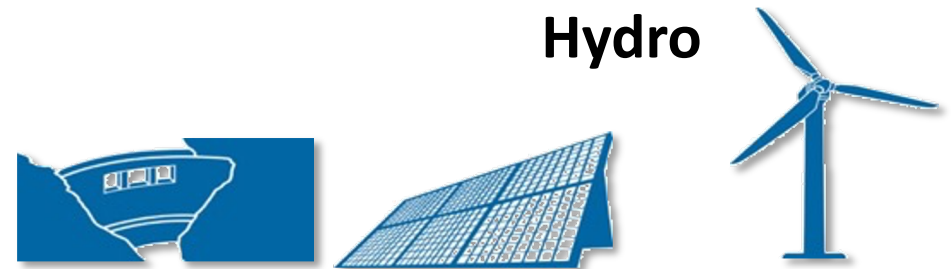
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C3S Energy models strategy

Electricity Demand



Generation from



Wind
Solar PV
Hydro

The energy conversion models are chosen to be applied for:

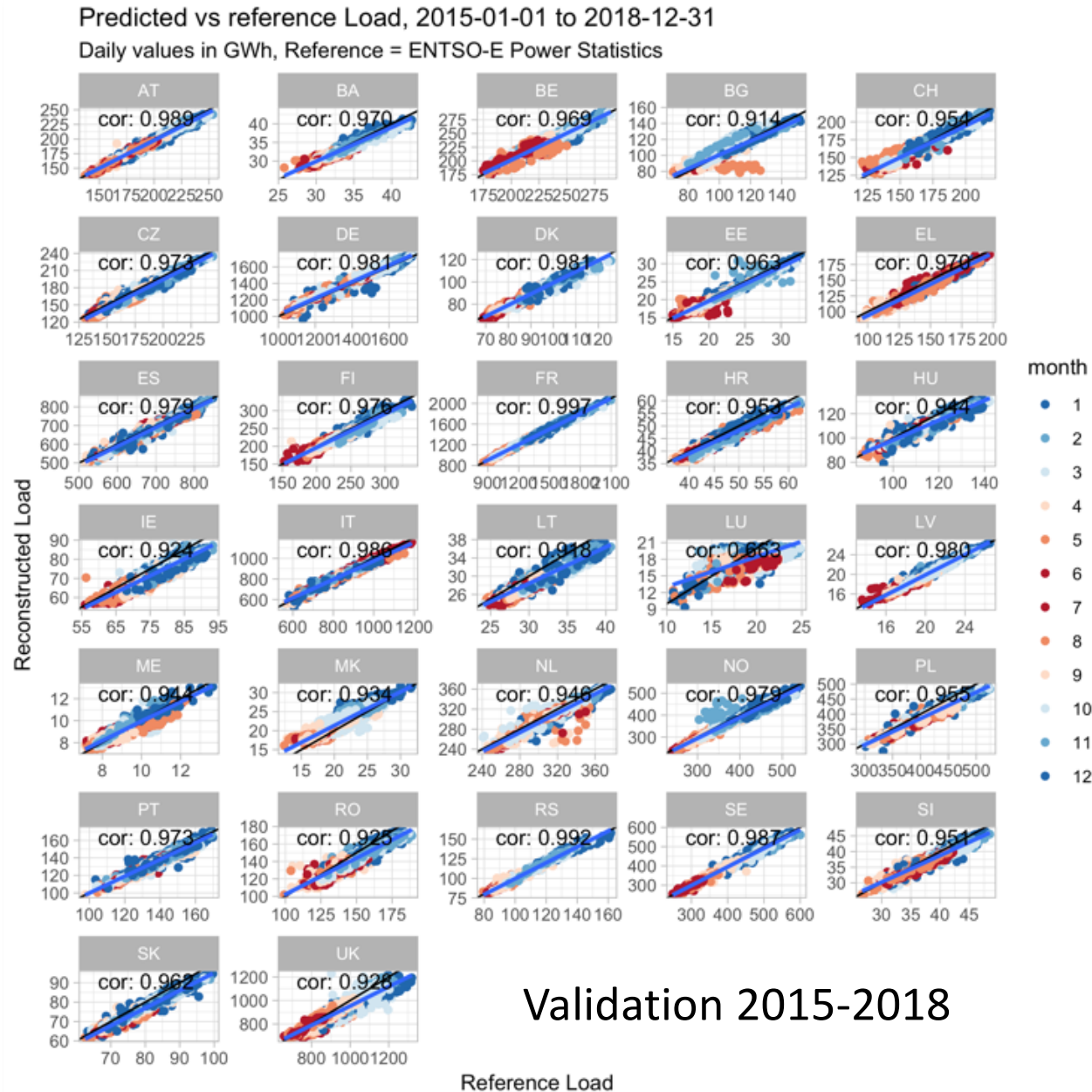
- Three different kinds of input climatic data covering 1979 to 2100 with different time resolutions
- Any location in Europe even if no specific information is available (installed systems or time series of generation)

→ The flexibility of the conversion models is favoured over accuracy



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Electricity Demand: Global Validation



ECMWF

Copernicus
Europe's eyes on Earth

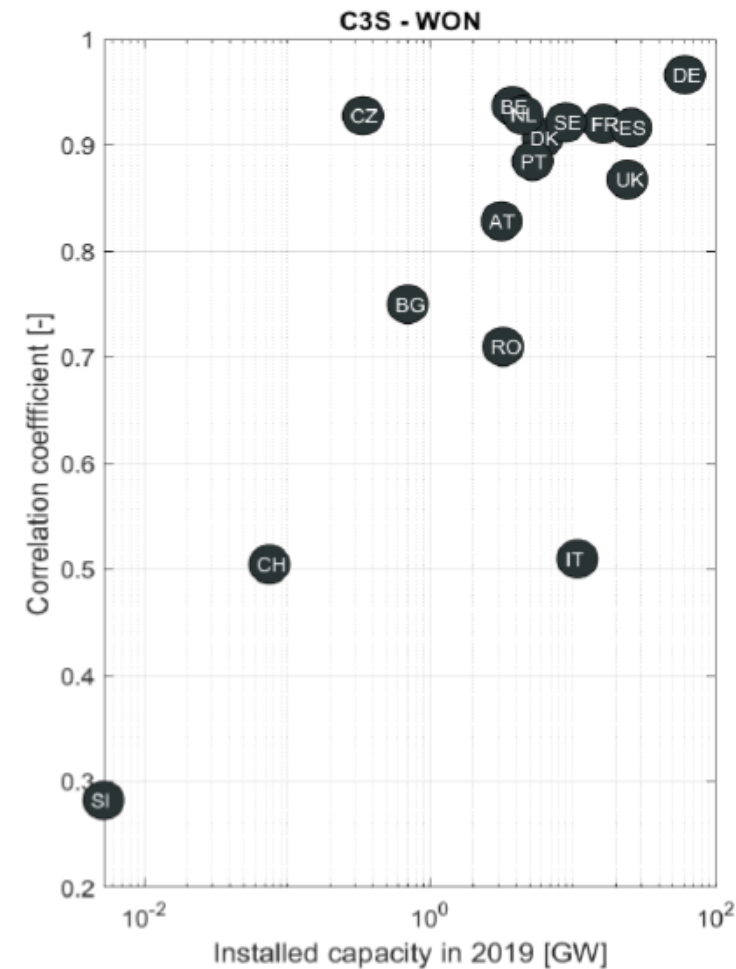
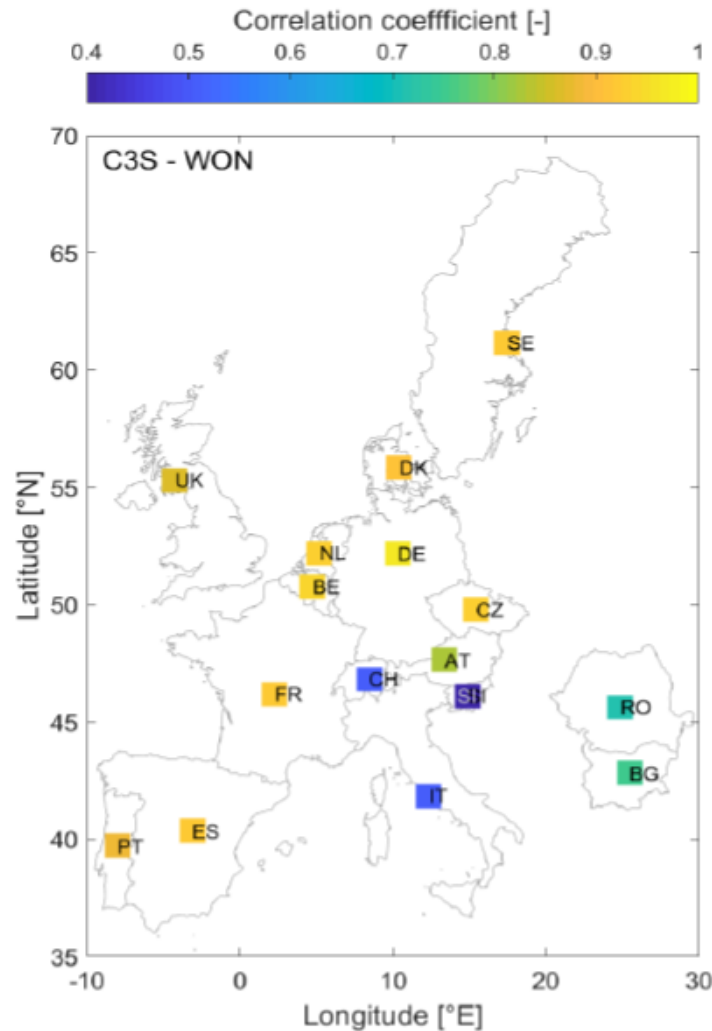
European
Commission



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Wind Power: Validation

Spatial dependency of the correlation between simulated and reference



ECMWF



Meteorology Council

FRANCE

Met Office

ARVIRES

Europe's eyes on Earth

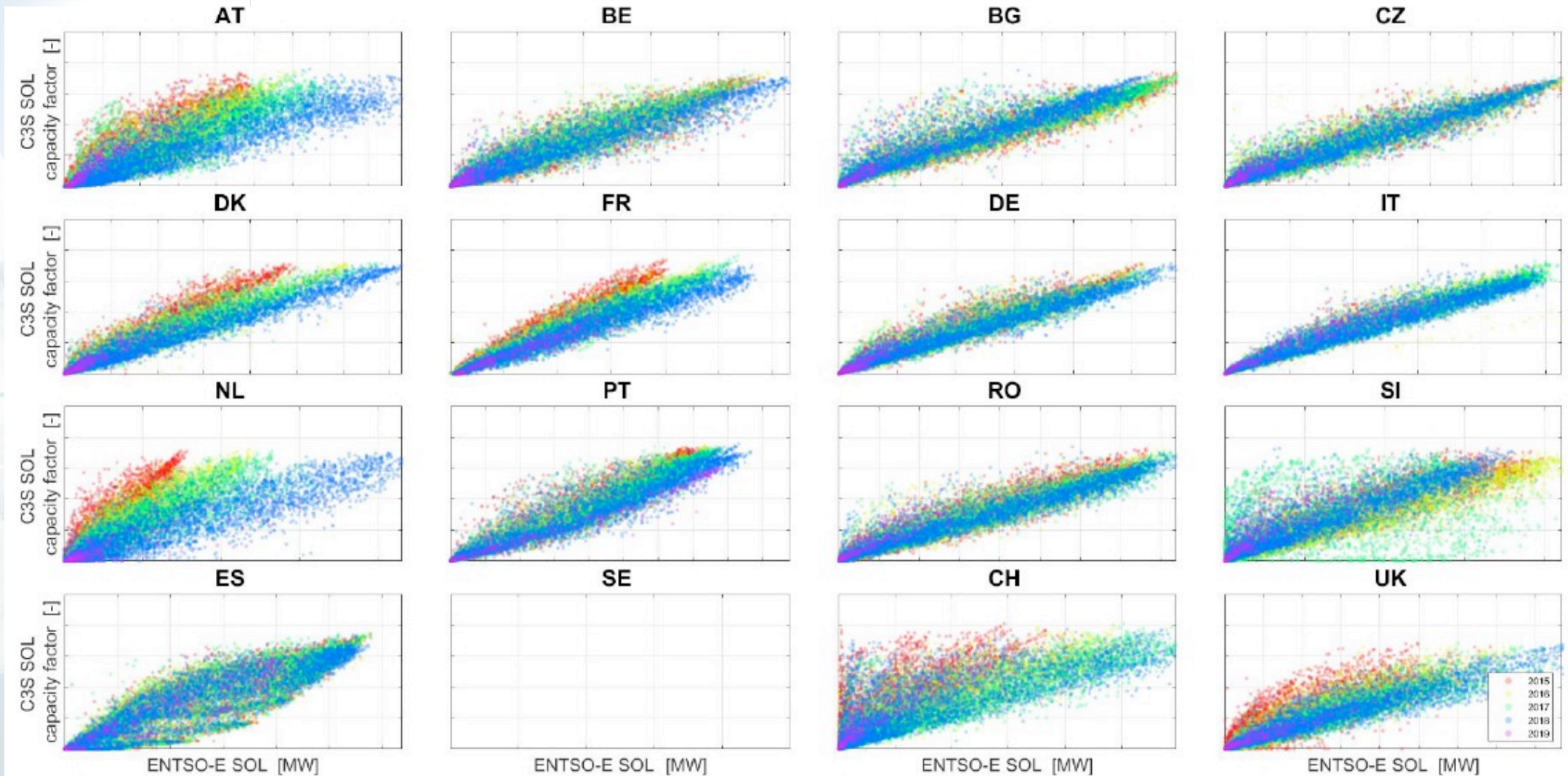




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Solar Power: Validation

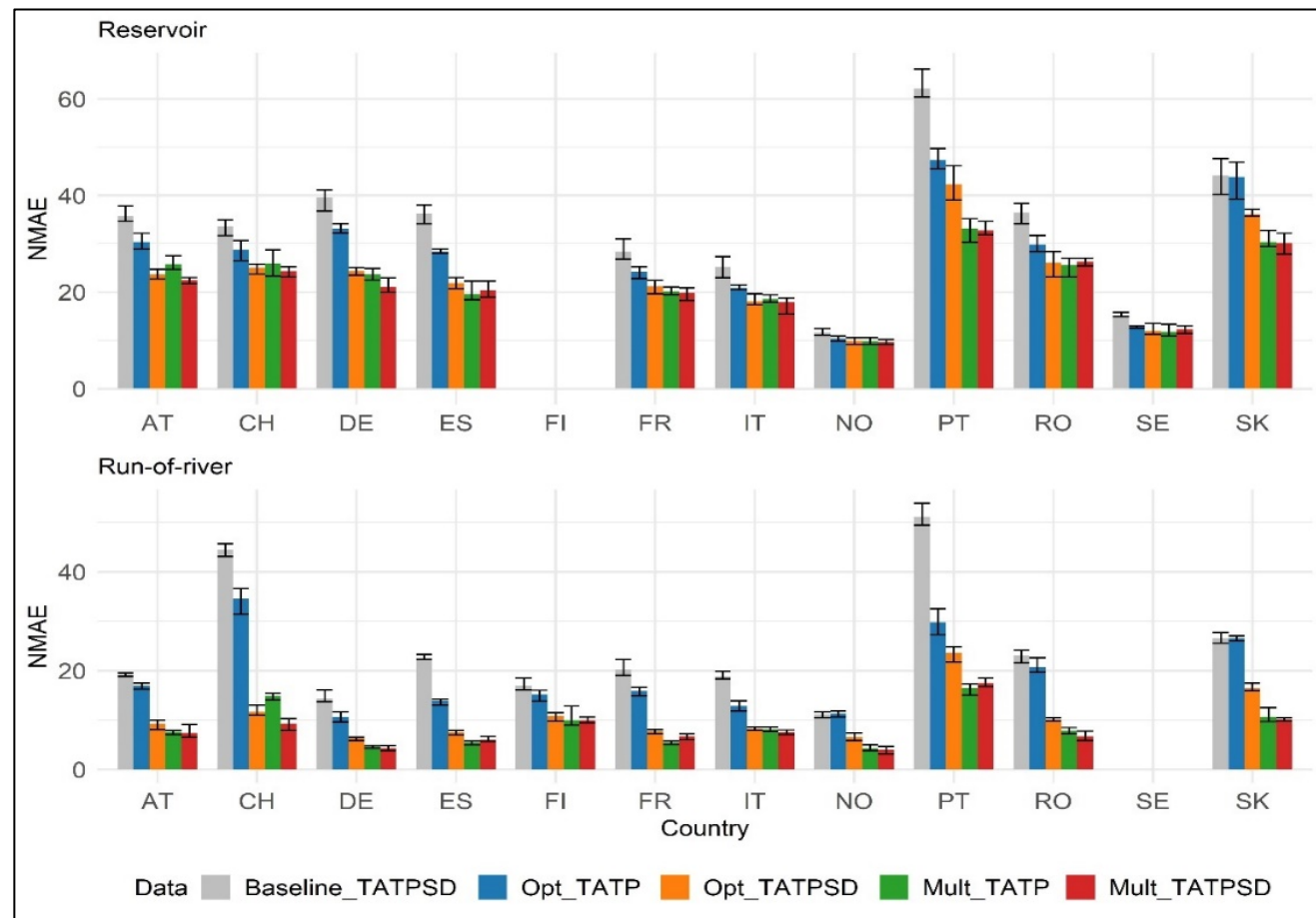
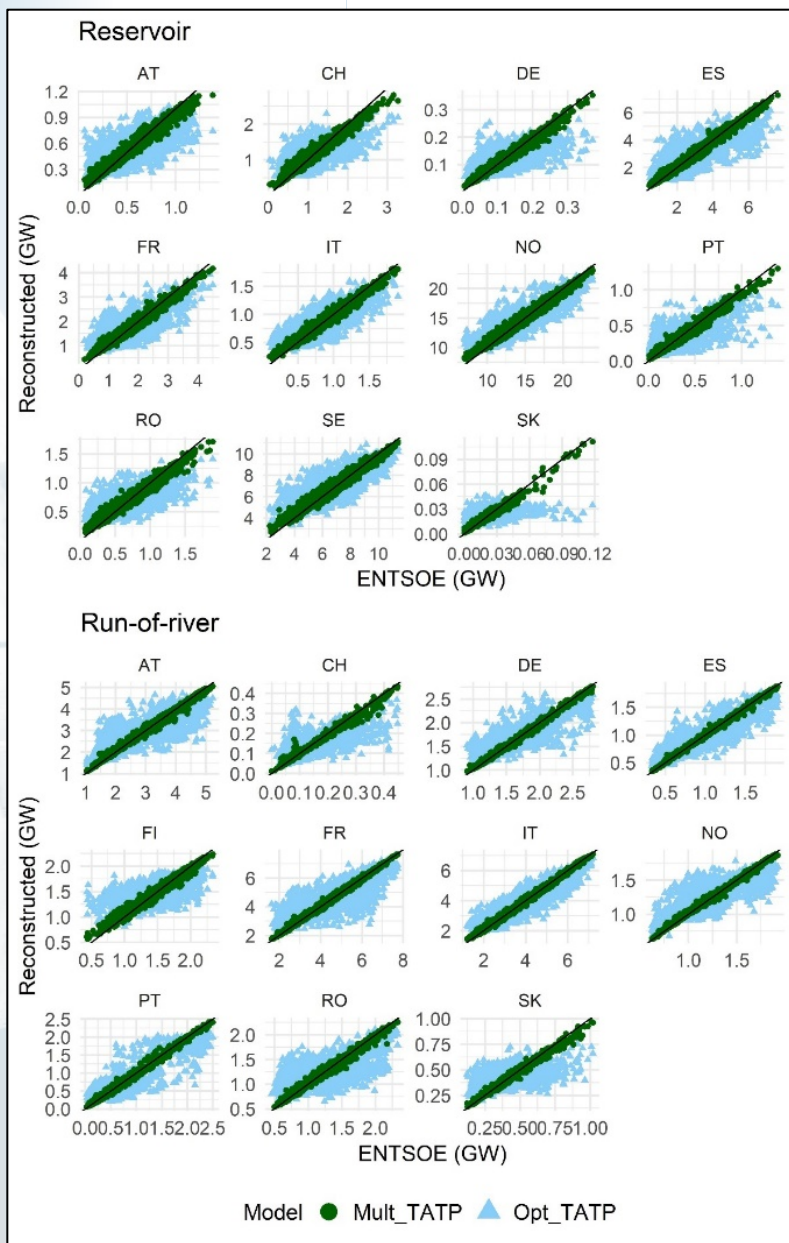
Scatter plots of the simulated against reference power production





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Hydropower: Validation





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Energy modelling summary

The objectives of C3S is to produce a dataset of plausible energy indicators in Europe for all energy sources and different climate datasets.

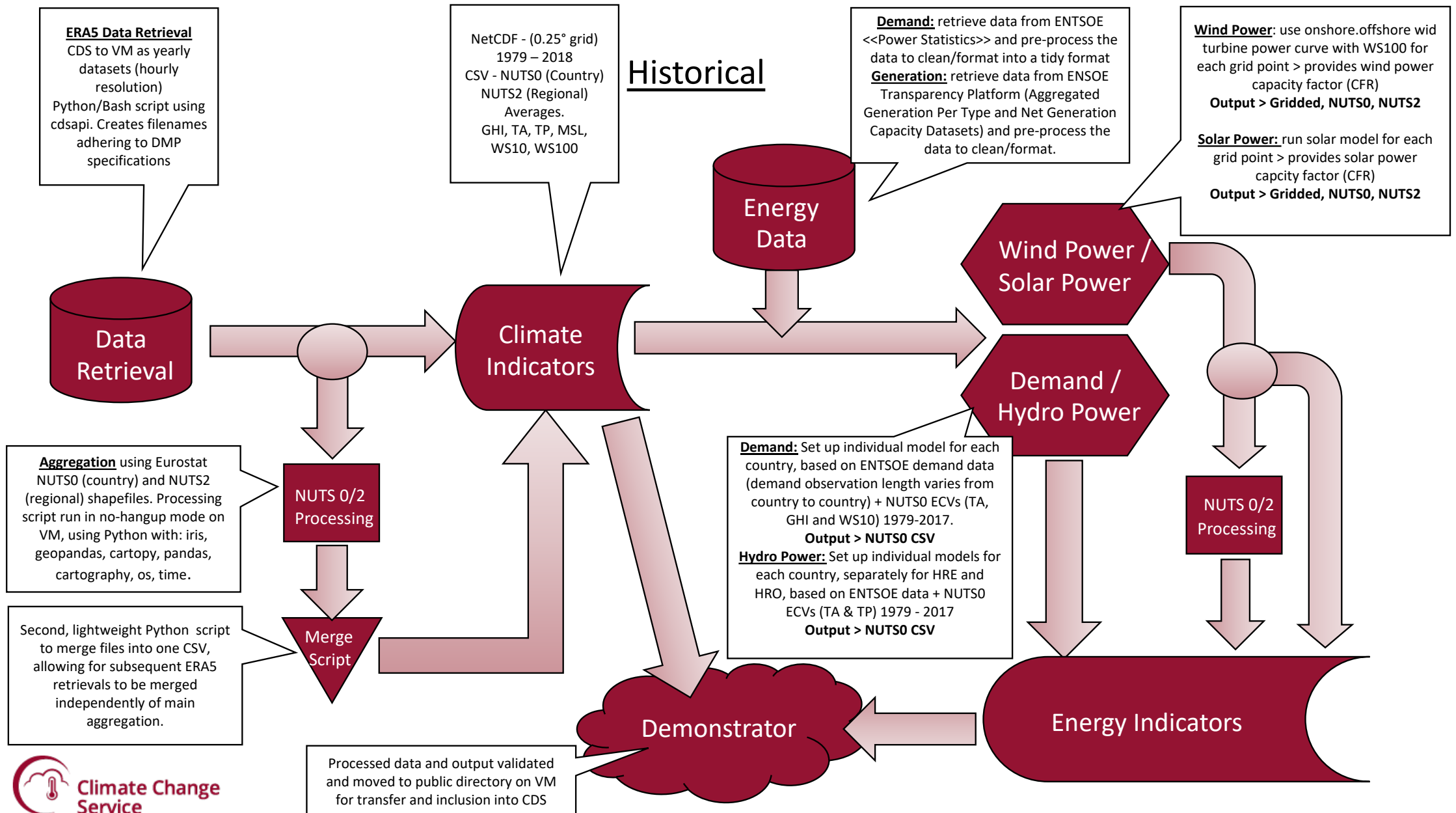
- The validation confirms that the simulated data are plausible
- The validation is hindered by uncertainty in the reference data
- An update of the models is needed to improve the simulations
- Strong need for data QC and homogenization in energy databases to help progress in energy modelling and climate related studies





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C3S ENERGY Workflow – Historical stream




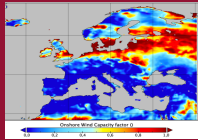


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Comms and documentation

- Communication with stakeholders:
 - Social media (Twitter, LinkedIn)
 - Tech blogs
 - Six webinars (list on next slide)
 - Advisory Board meetings
- Documentation:
 - Variable Fact Sheets, Data quality assessment, Methods & Limitations, Bias adjustment, User guide for seasonal forecasting
 - Case Studies & Key Messages
 - FAQs, Tutorial videos, Blogs, Team stories




C3S Energy
KEY MESSAGES
C3S Energy
KM 01
Wind Power Calculation

A series of Key Messages for the European energy sector based on the analysis of data in the C3S-ENERGY Sectoral Information System

Key Messages: A simplified approach for both Onshore and Offshore Wind Power

- Wind power is modelled in a simplified way.
- The purpose is to provide an easy and flexible way to calculate wind capacity factor (CFR) for all countries in Europe, for both onshore and offshore wind power.
- The calculated CFR cannot, by construction, fit the observed capacity factor on the historical period.
- There is a systematic bias with respect to actual wind power data, but the correlation is as good as ERA5's wind variability is.
- It may seem counterintuitive to have CFR for the offshore wind turbine smaller than for the onshore one.
- In practice, one needs to multiply the CFR by the nominal power of each turbine to get the actual generated power.

The Methodology

- One single turbine model is considered for onshore areas, and one for offshore areas.
- All turbines are considered to be 100 m high.
- Wind speed at 100 m is used with the turbine power curve to compute the generated power at each grid point, onshore or offshore.
- Generated power is then divided by the nominal power capacity of the turbine, to get the capacity factor:
$$CFR(lon, lat, time) = \frac{P(lon, lat, time)}{P_{max}}$$
- Gridded CFR is then aggregated at NUTS2 and NUTS0 levels (onshore) and MAR1 and MAR0 levels (offshore)



Find out more

 [climate.copernicus.eu/energy](https://github.com/climate.copernicus.eu/energy)  [company/copernicus-ecmwf](https://www.linkedin.com/company/copernicus-ecmwf)  [@CopernicusECMWF](https://twitter.com/CopernicusECMWF)  [@copernicusecmwf](https://www.instagram.com/copernicusecmwf)

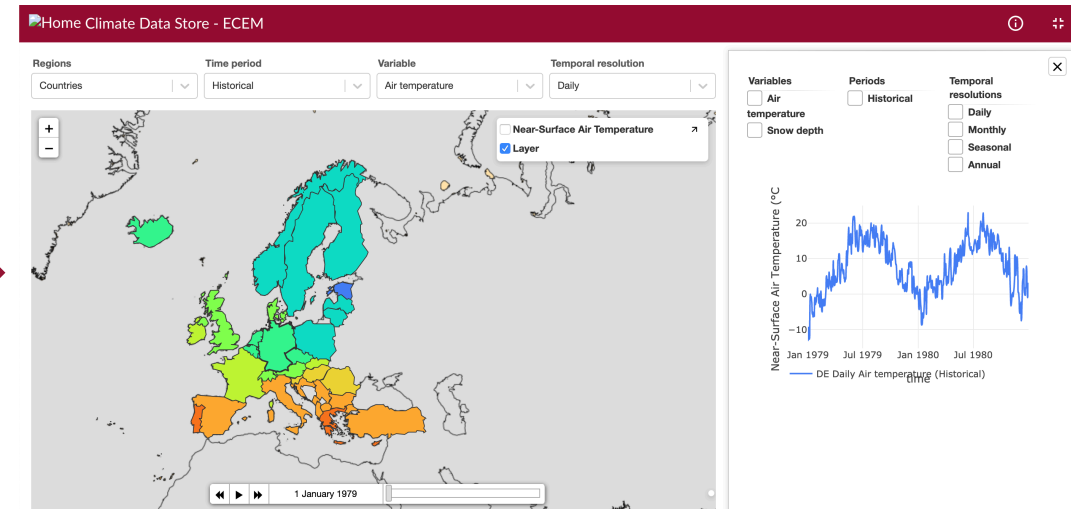
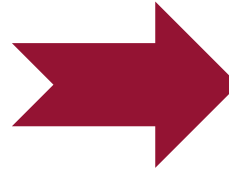
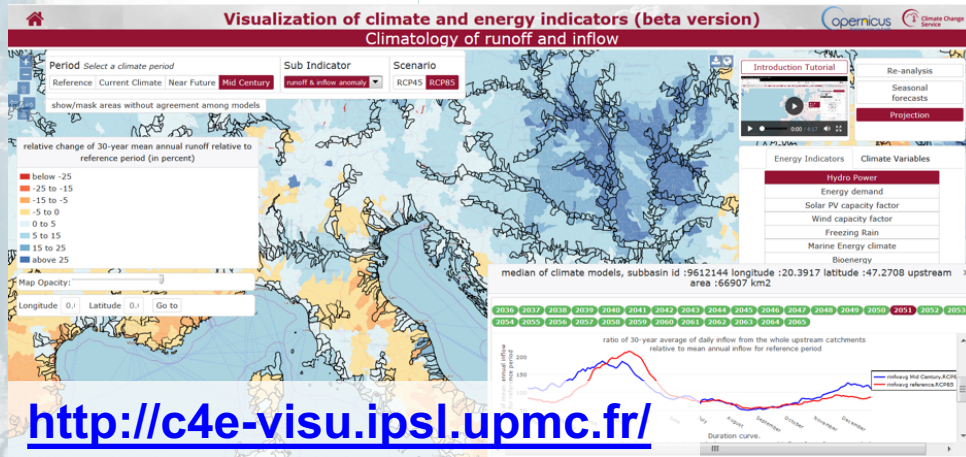
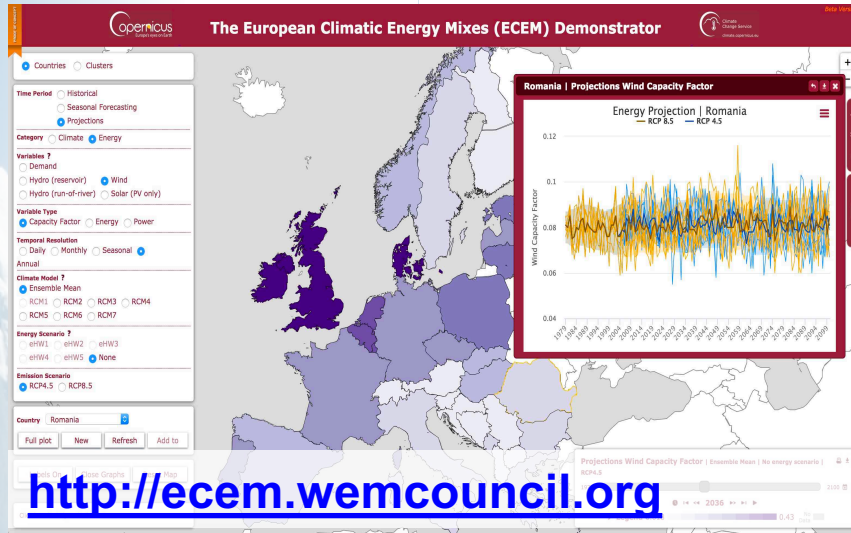
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Alberto Troccoli | C3S Energy Contract Lead | World Energy & Meteorology Council | albertotroccoli@wemcouncil.org





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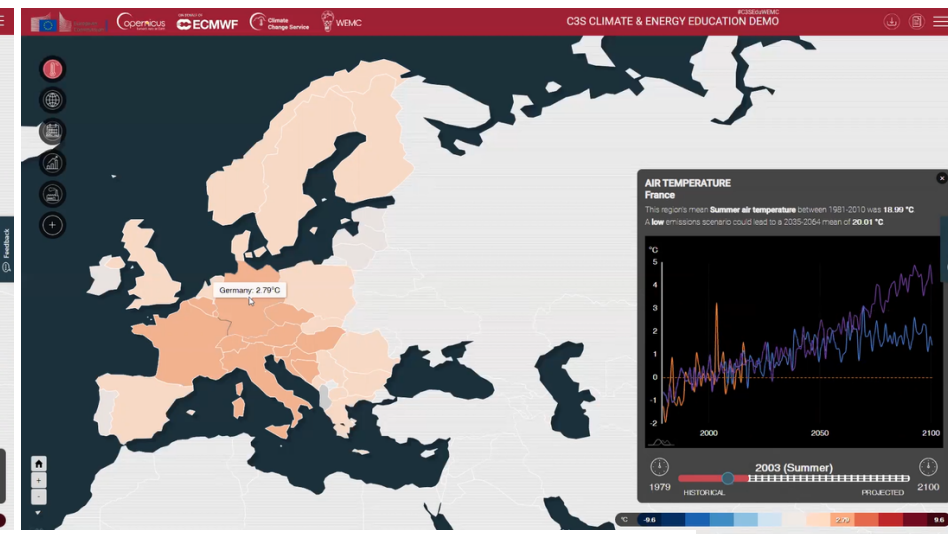
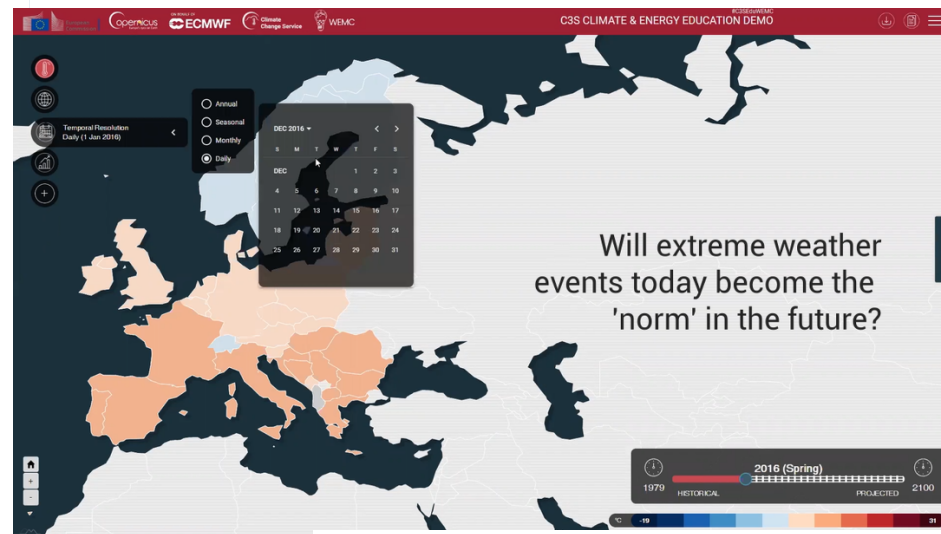
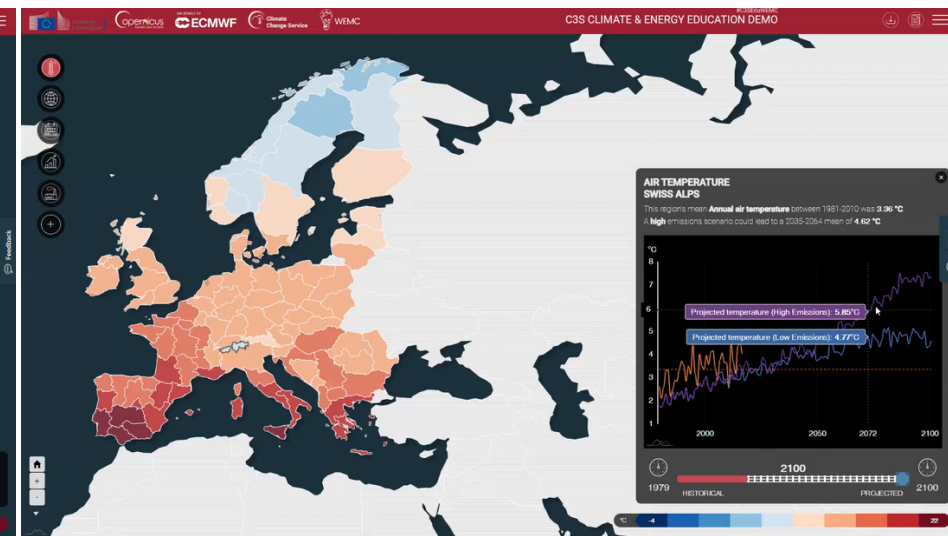
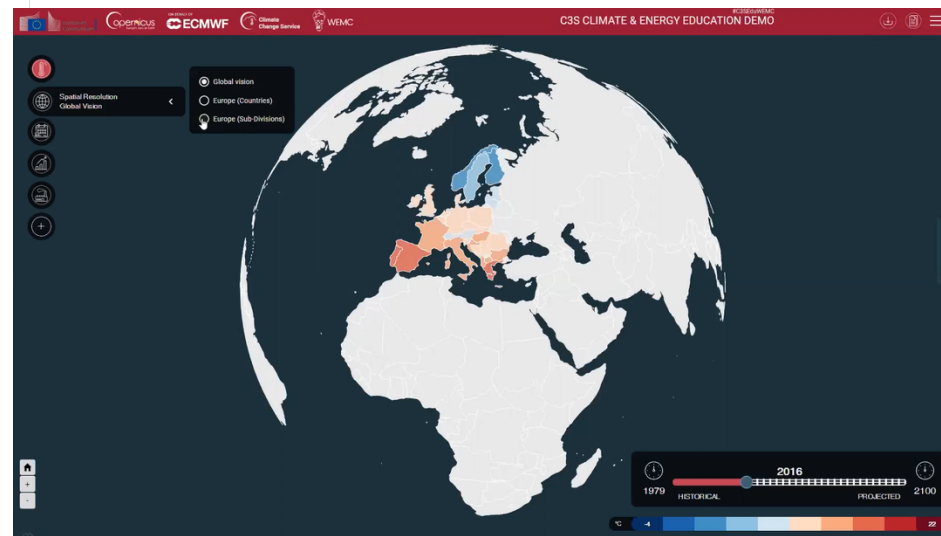
C3S ENERGY: The visual demonstrator





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Built on the C3S
ECMWF tool, it will
soon be updated
with the most recent
climate data, and
also extended to the
rest of the globe



<http://c3s-edu.wemcouncil.org/>

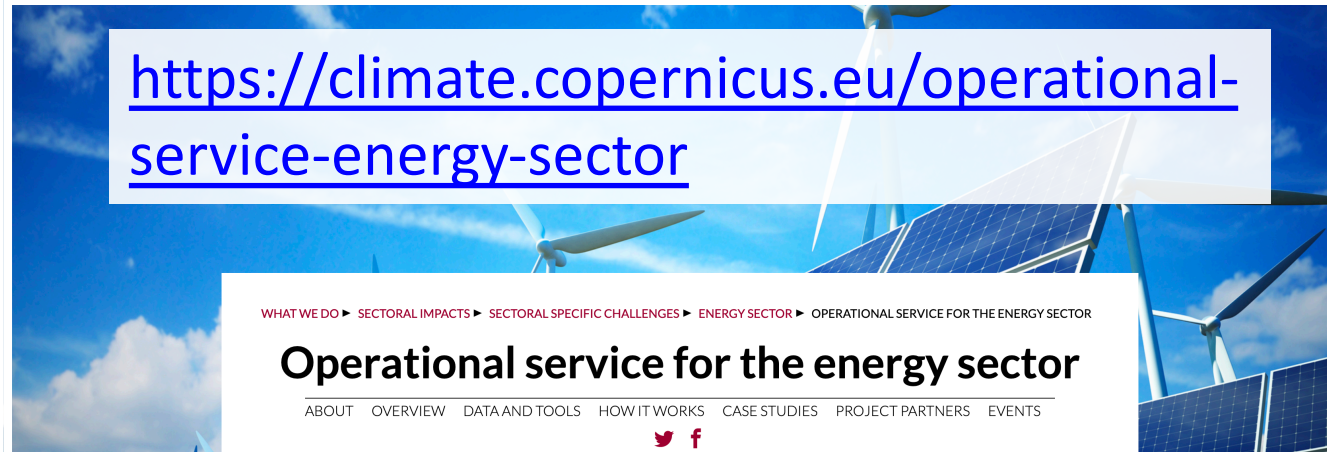




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Want to know more?

<https://climate.copernicus.eu/operational-service-energy-sector>



See also two **poster presentations** related to C3S Energy, Wednesday 7 October
Dubus et al. - <https://www.youtube.com/watch?v=Xbfu3plYojw>
Bloomfield et al. - <https://www.youtube.com/watch?v=xMB7GPDs9h0>

