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Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

Generación de información climática multi-escala para aumentar la resiliencia del sector energético Español.

Proyecto BOREAS

BOREAS CS4ENERGY

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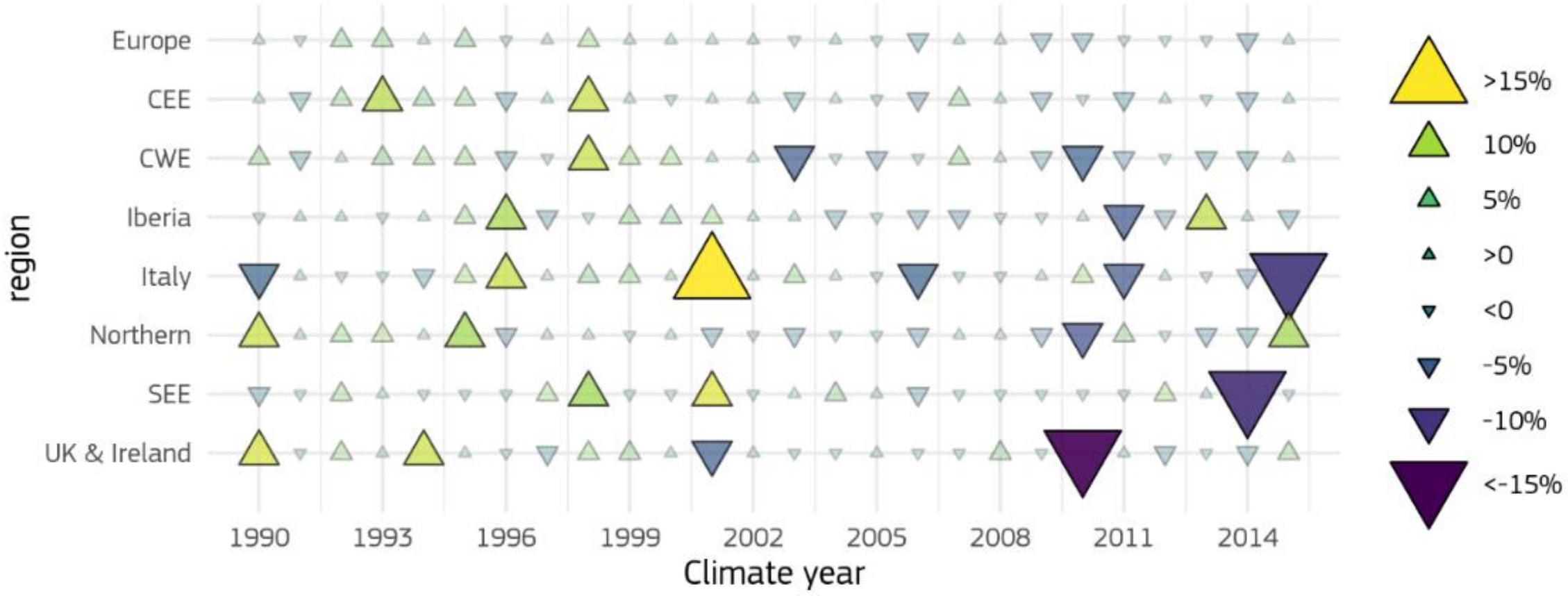
GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

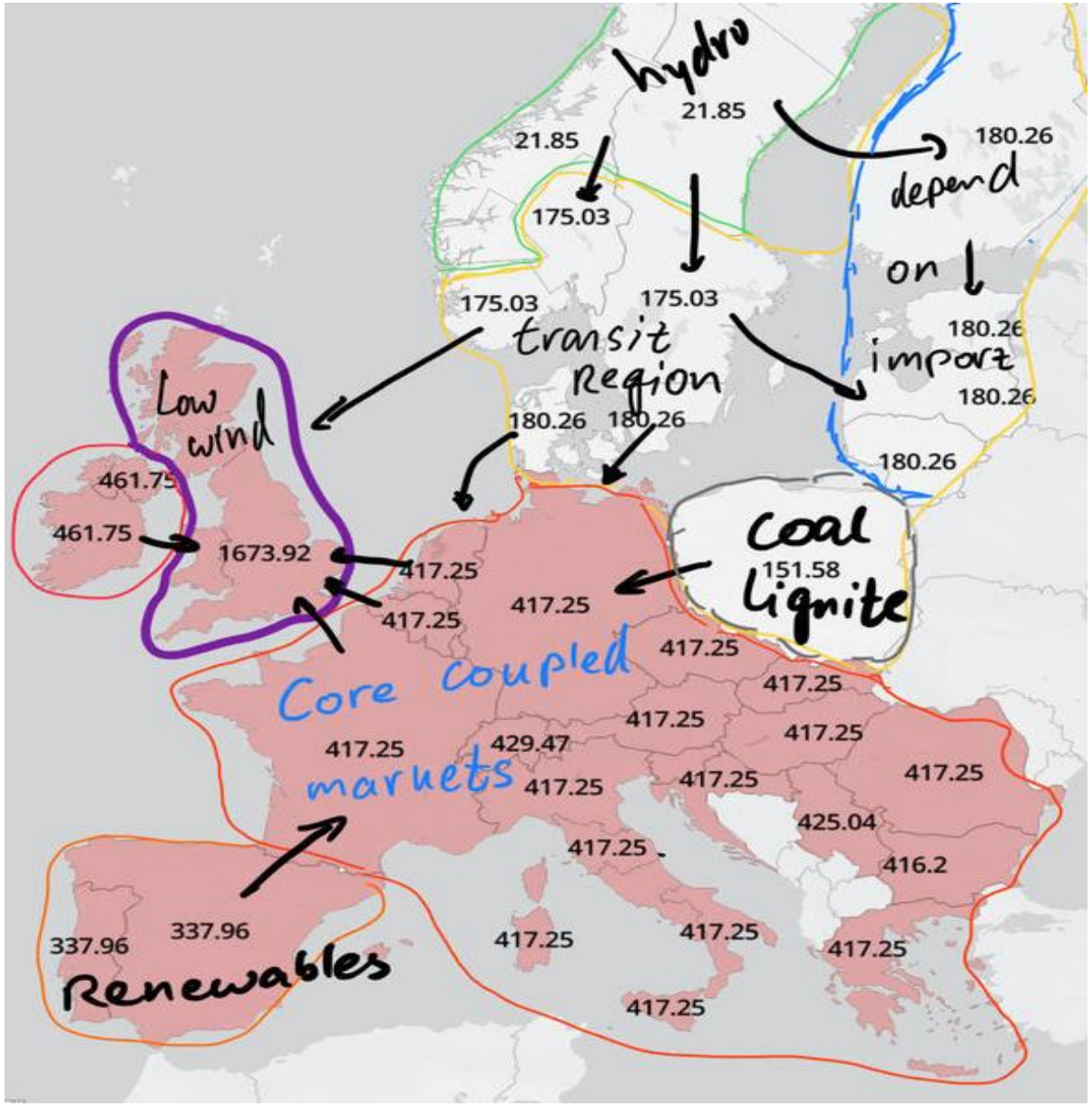
Introduction. Motivation



Annual variability (percentage deviation from the average) of onshore wind resources in the 26 climate years for the considered regions. Source: JRC, 2020

Introduction. Motivation

The day ahead prices for 16/12/2021. Large differences across the continent, with a core region of around €420. UK prices are the highest in Europe due to low wind energy production, while Iberian system prices are the lowest due to high wind resources (source: EnAppSys).



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Aplications

Weather forecast	Climate predictions		Climate projections
	Sub-seasonal	Seasonal	Decadal	
1-15 days	10 d-1 month	1 month–6 months	1-10 years	20-100 years

Time

Applications for wind/solar/hydro generation

Post-construction decisions	Post-construction decisions	Pre-construction decisions
Energy producers: commit energy sales for next day **Grid operators:** market prices and grid balance **Energy traders:** anticipate energy prices **Plant operators:** plan cleaning and O&M	**Energy producers:** resource management strategies **Energy traders:** resource effects on markets **Plant operators:** O&M, especially offshore wind **Plant investors:** anticipate cash flow, optimize investments	**Power plant developers:** Site selection. Future risks assessment. **Investors:** Evaluate return on investments **Policy-makers:** Assess changes to energy mix **River-basin managers**: manage the river flow

Applications for demand

Daily operation decisions	Mid-term planning	Long-term planning
Grid operators: Anticipate hot/cold days. Schedule power plants to reinforce supply. **Energy traders:** Anticipate energy prices.	**Grid operators:** Anticipate hotter/colder seasons. Schedule power. **Energy traders:** Anticipate energy prices.	**Grid operators:** Anticipate addition of more capacity. Adaptation of transmission lines **Policy-makers:** Plan addition of more capacity. Understand changes to energy mix

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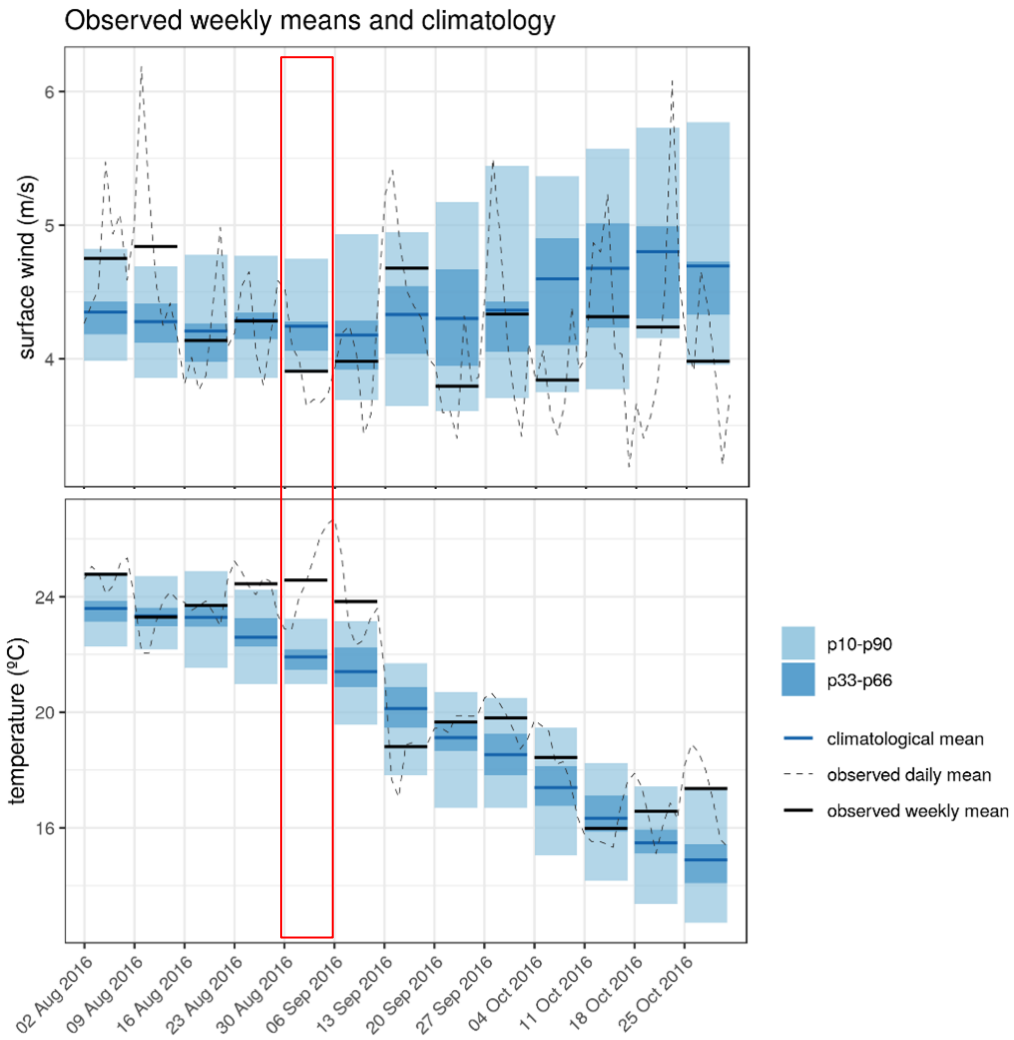
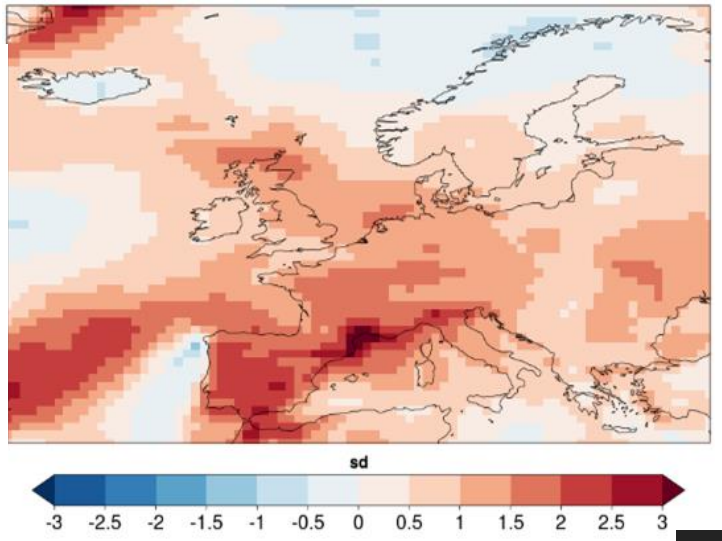
Heat wave and wind drought in Spain. Sep 2016



A heat wave and wind drought over Iberian Peninsula created a combination of:

- large increase in electricity demand
- lower than usual wind power generation



Surface wind and temperature anomalies for the week 30/08/2016-5/09/2016. ERA-Interim with respect to climatology (1981-2017)

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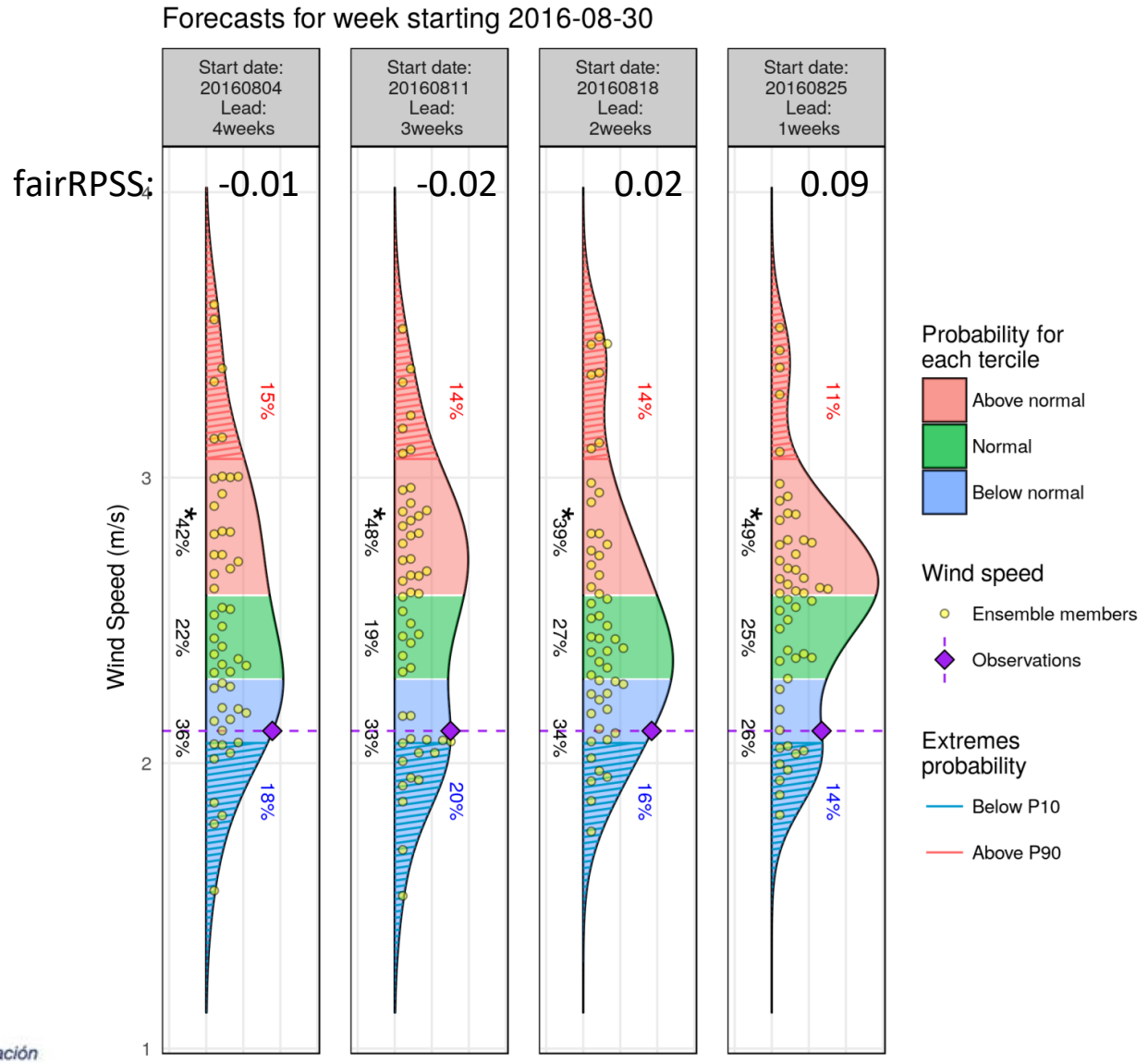

System: ECMWF monthly prediction system
Reanalysis: ERA-Interim
Bias adjusted –calibrated
Hindcast: 1996-2015
Lat= 40.5 N/Lon = 358.5 E

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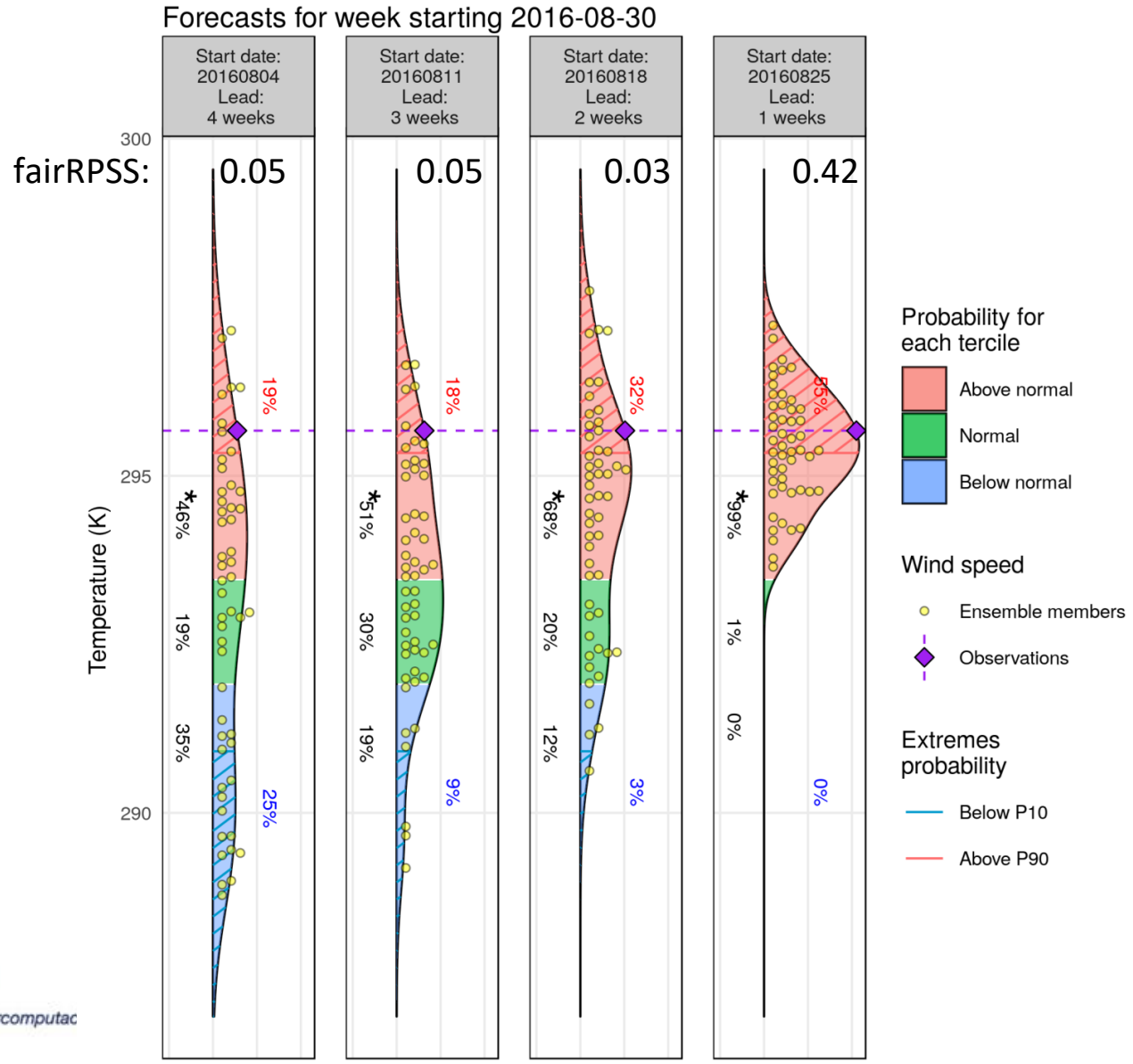

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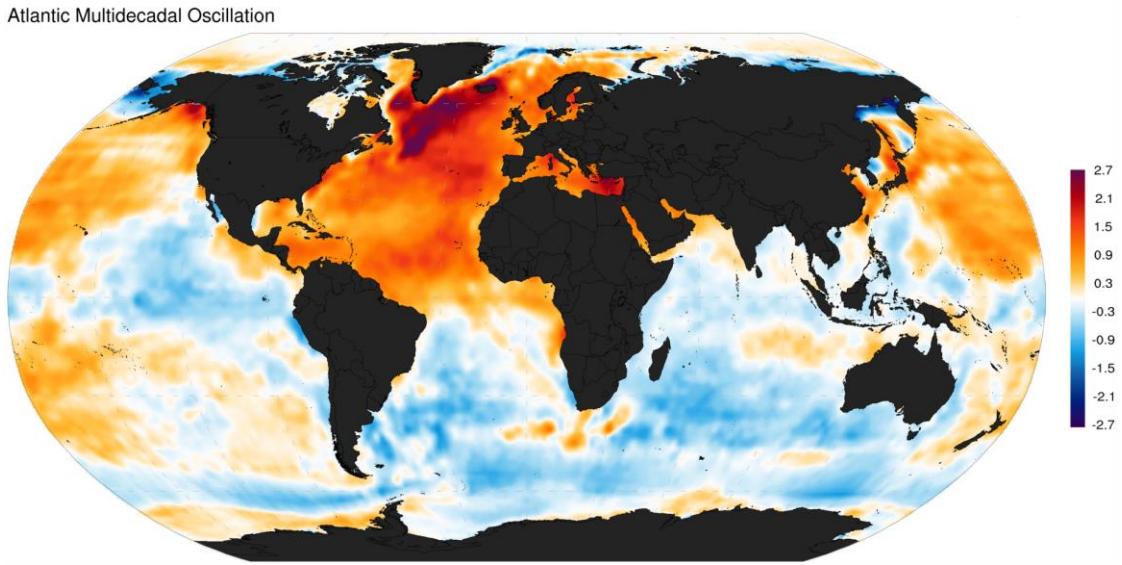
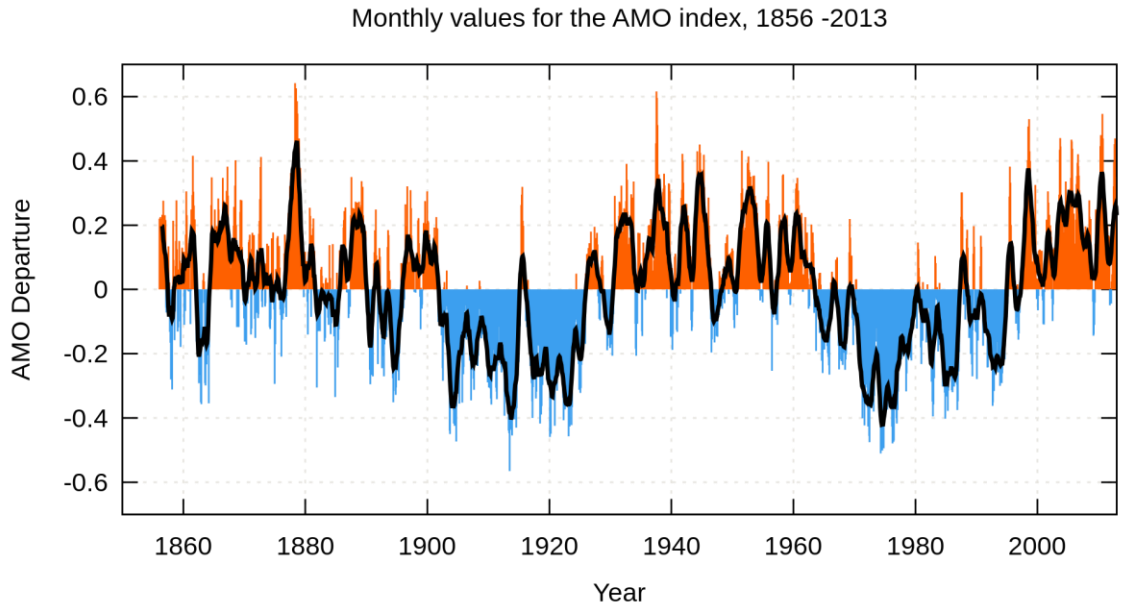
Novel research lines: Decadal predictions

- Between seasonal predictions and climate projections
- Both initial value and boundary condition problems
- Different sources of predictability





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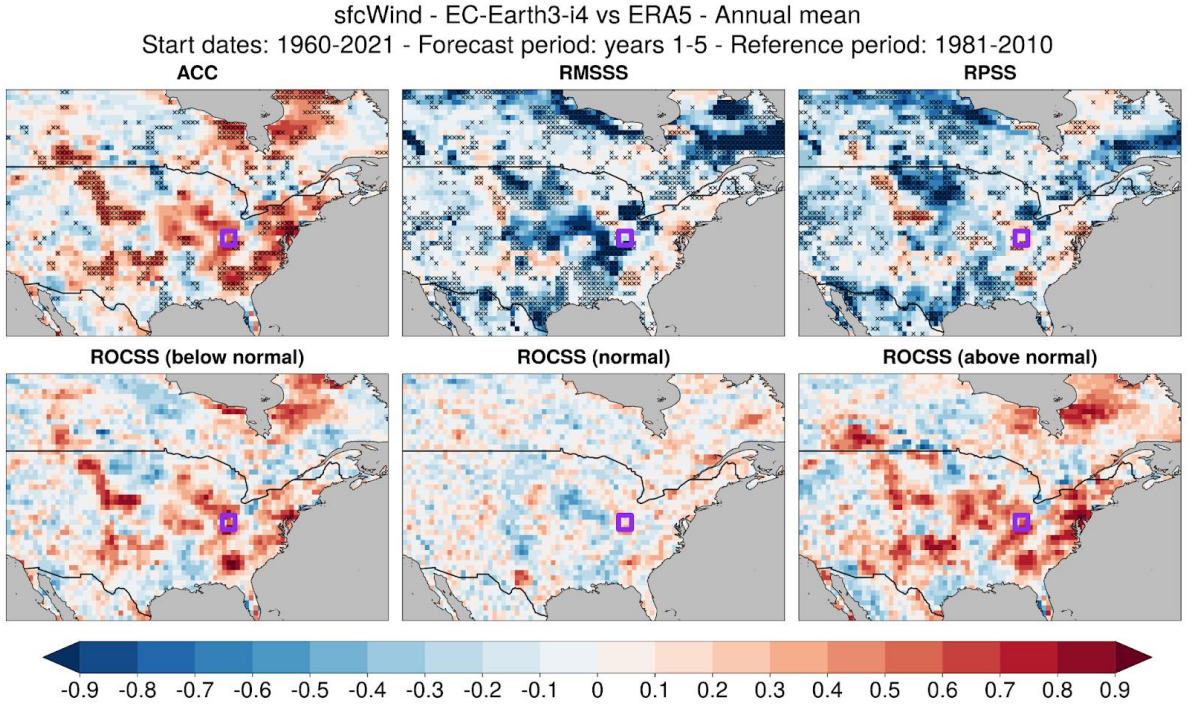

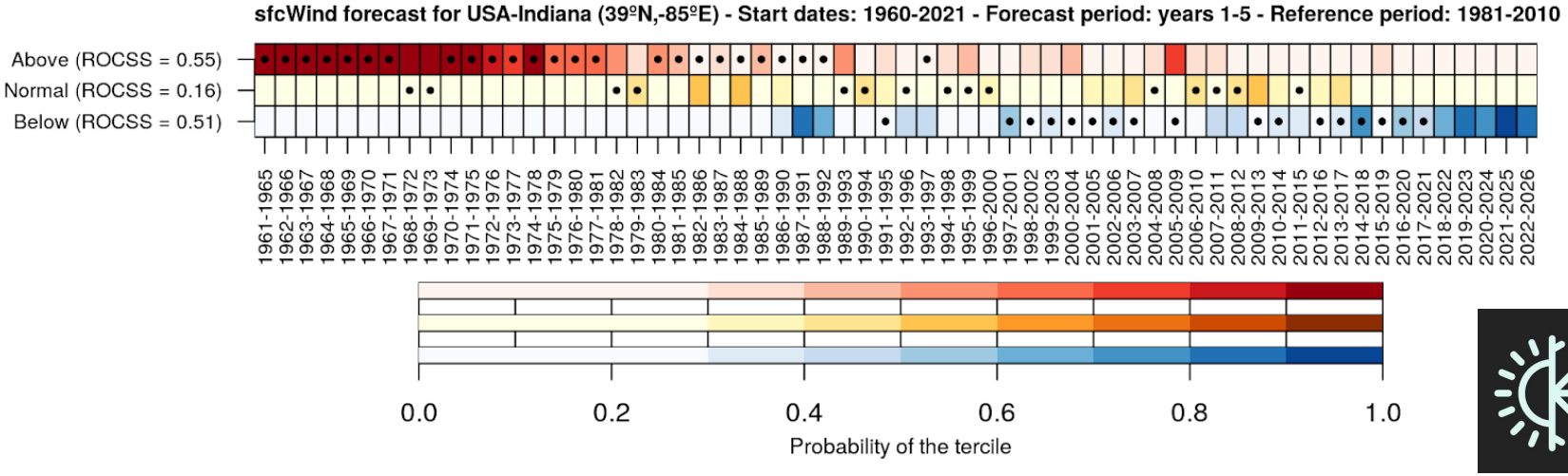

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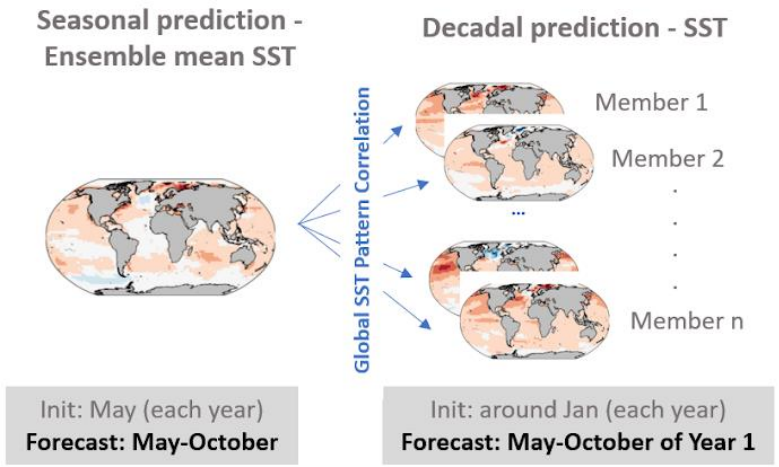
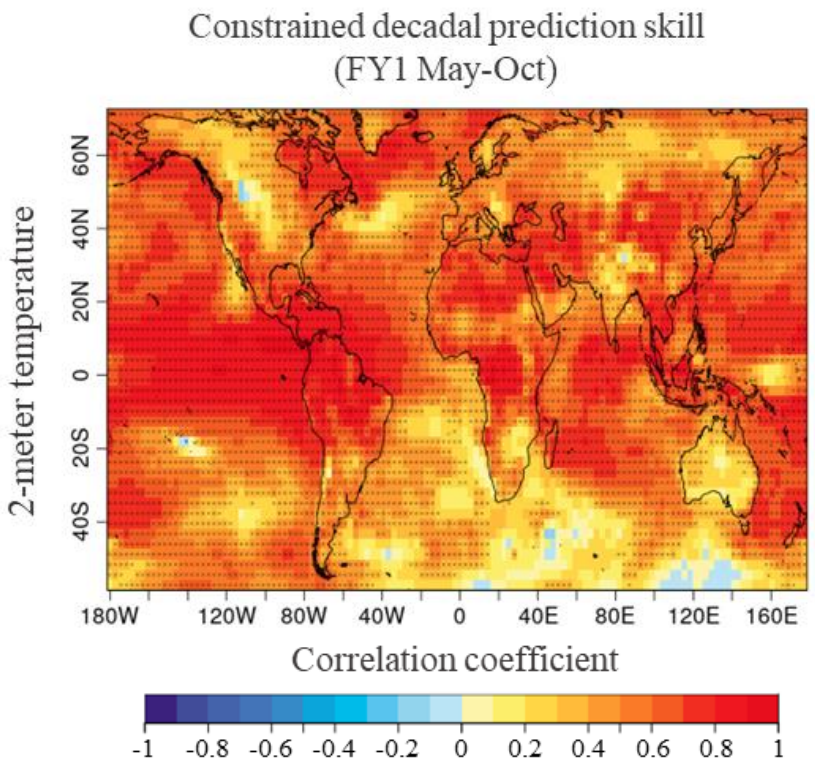
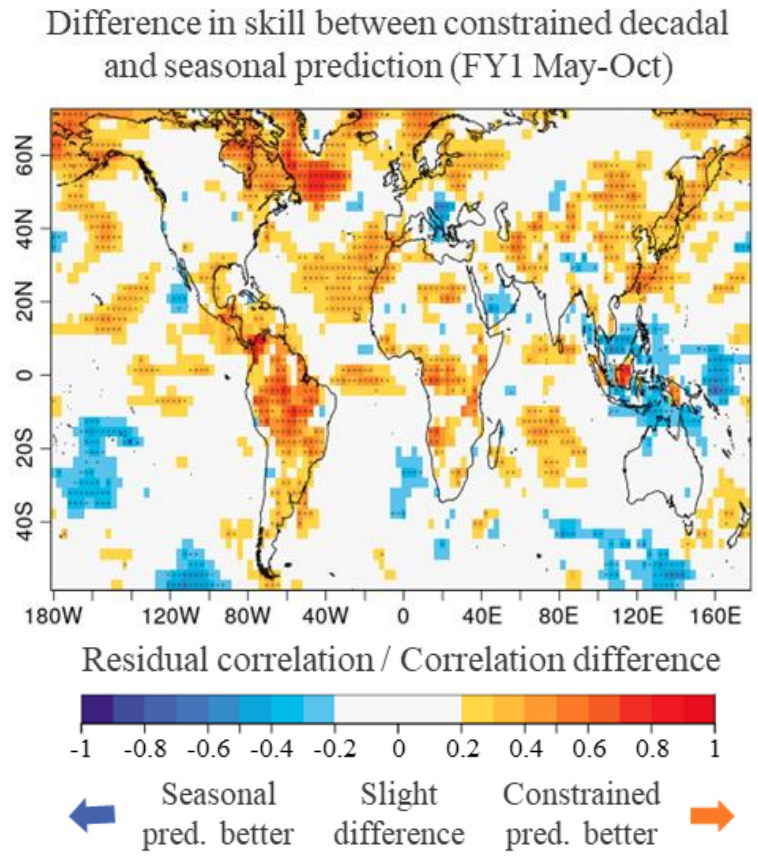
Novel research lines: Seamless seasonal to decadal predictions



Select **Top30 decadal prediction members** with **highest global SST pattern correlation** for the year 1981





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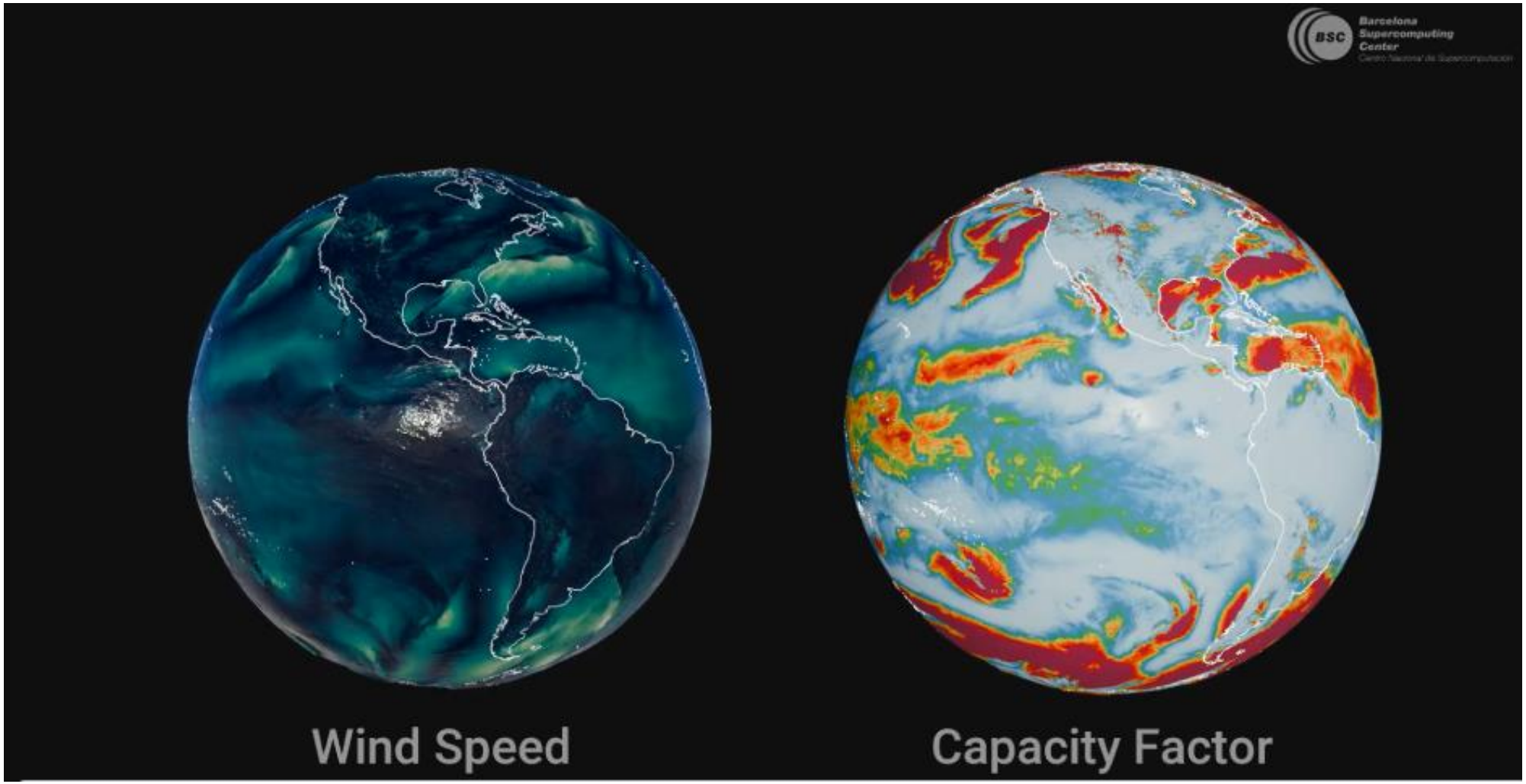
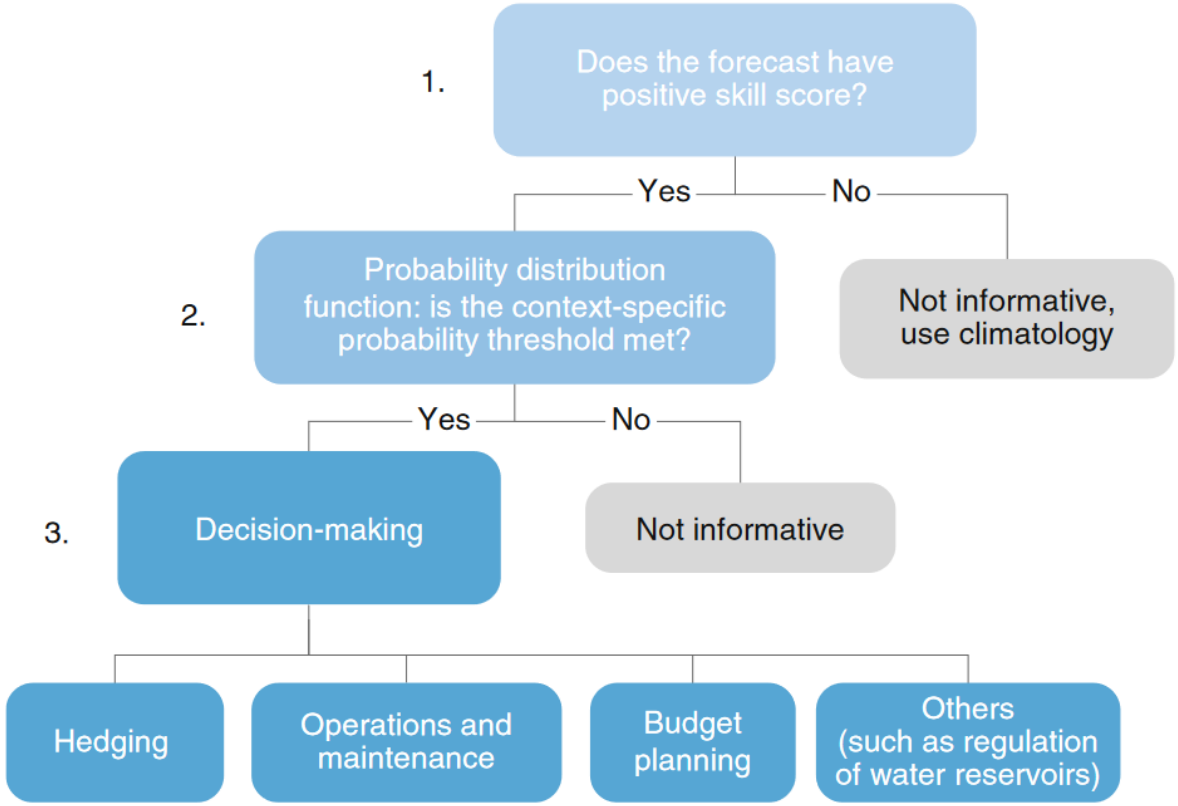
Novel research lines: DestinationEarth



Novel research lines: Economic assessment

Decision tree explaining user choices based on skill scores and probability distribution functions. In step 1, decision-makers look at the skill. In step 2, decision-makers look at the probability distribution of the forecast compared to the climatology of the weather variable of interest and, if this is informative, it can be incorporated into the decision-making either as qualitative or quantitative information in step 3.



Forecast outlooks

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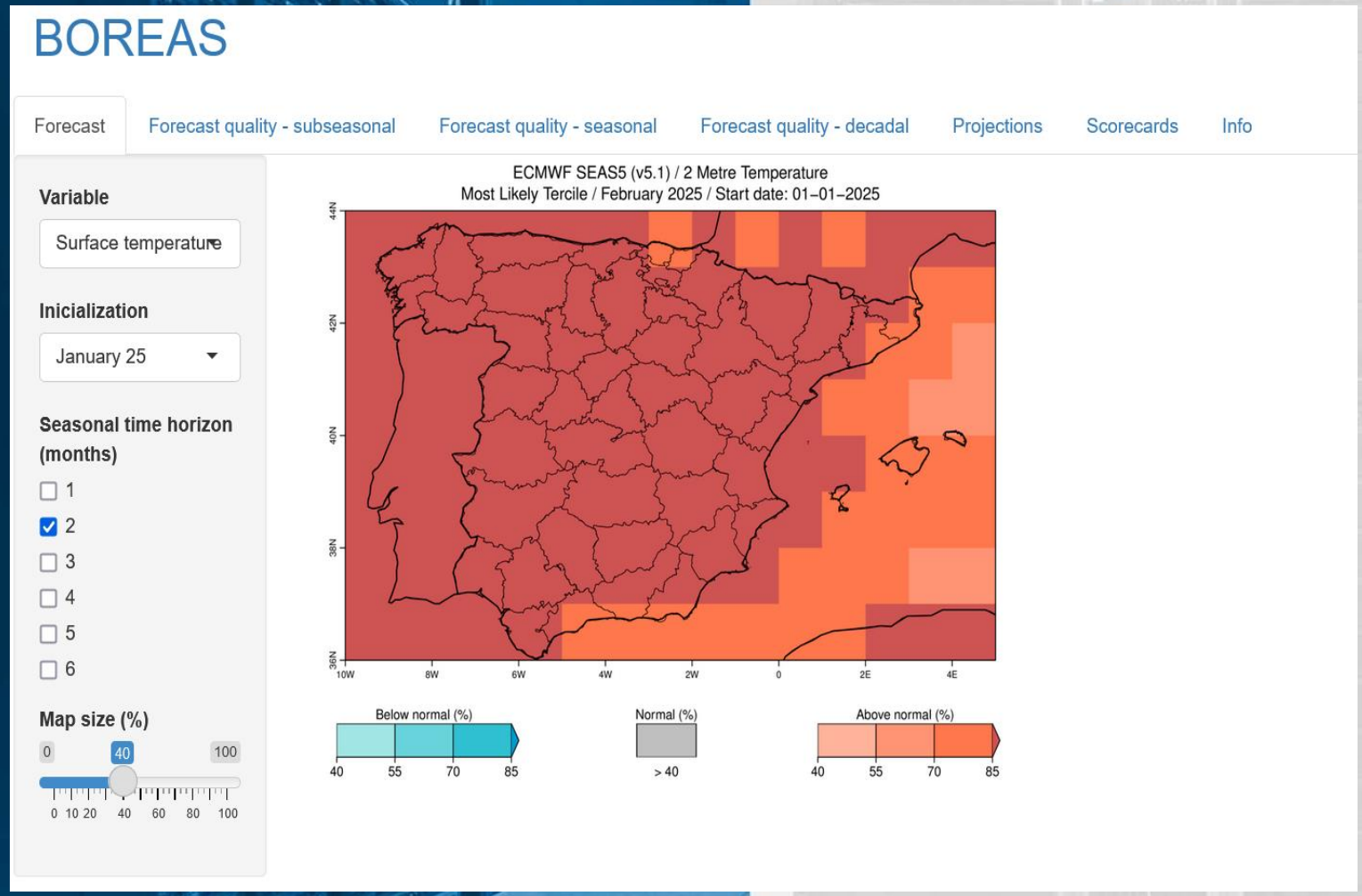

If you have exciting case studies or see a connection with our research, let's collaborate—reach out to us!

albert.soret@bsc.es

https://ess.bsc.es/

Forecast outlooks

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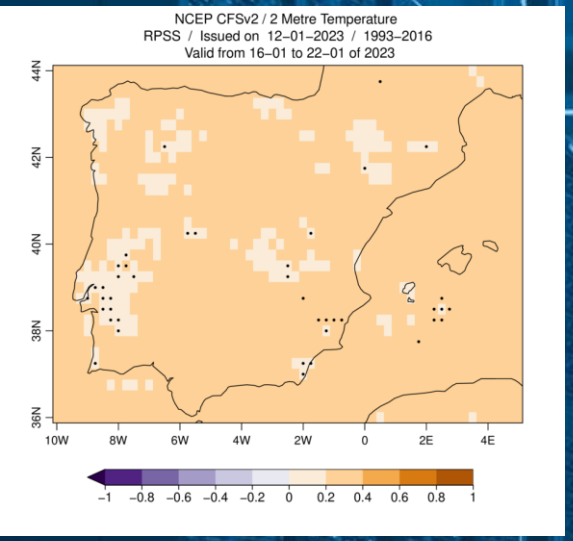

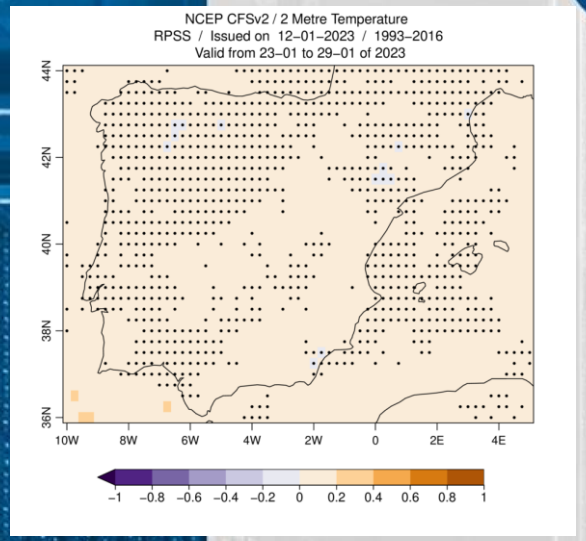

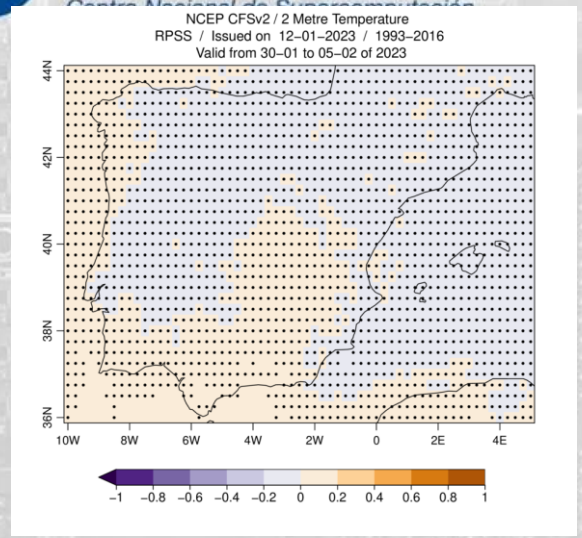

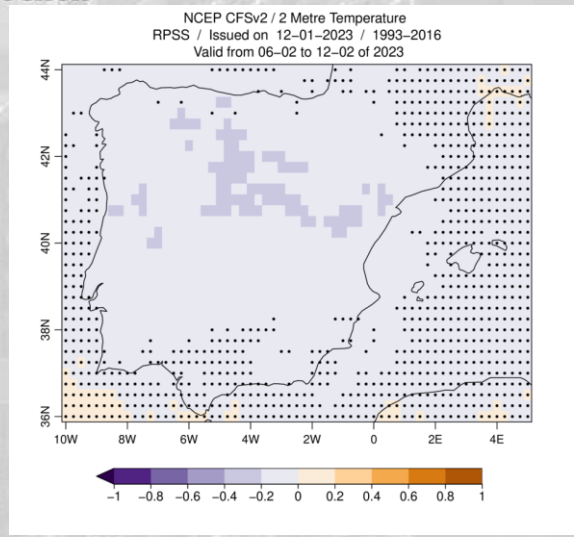

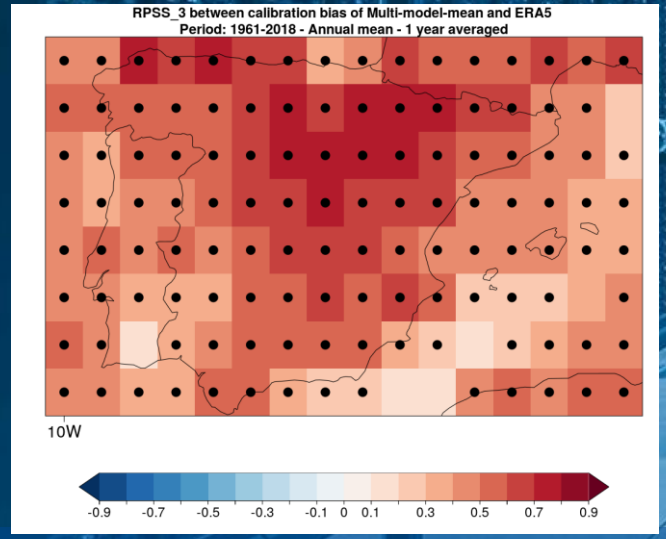

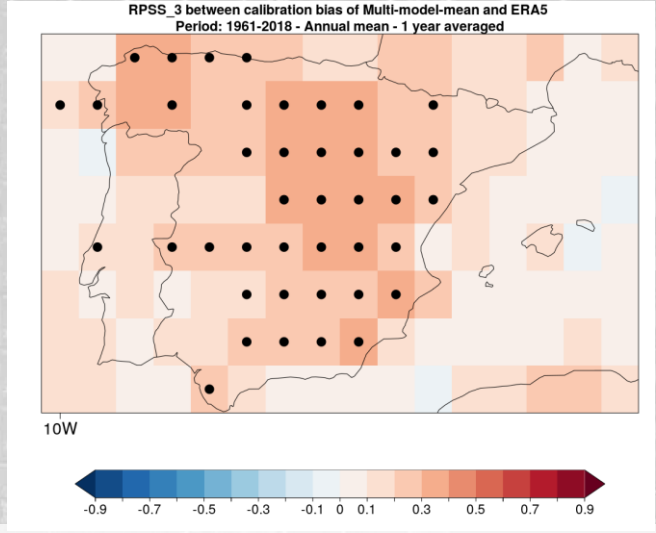

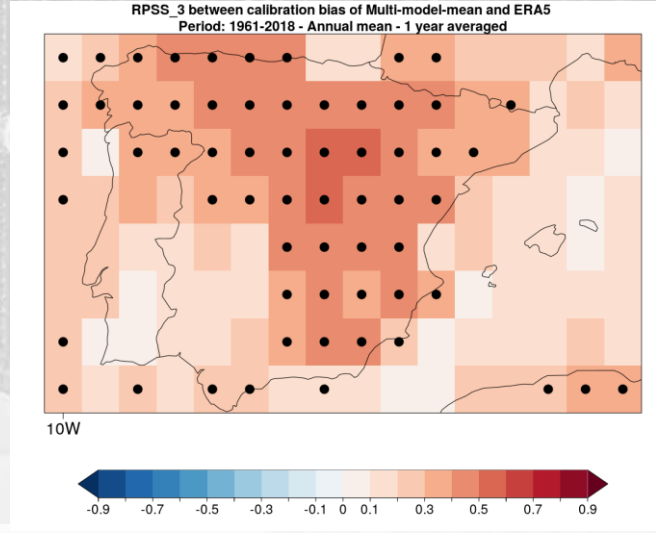

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