



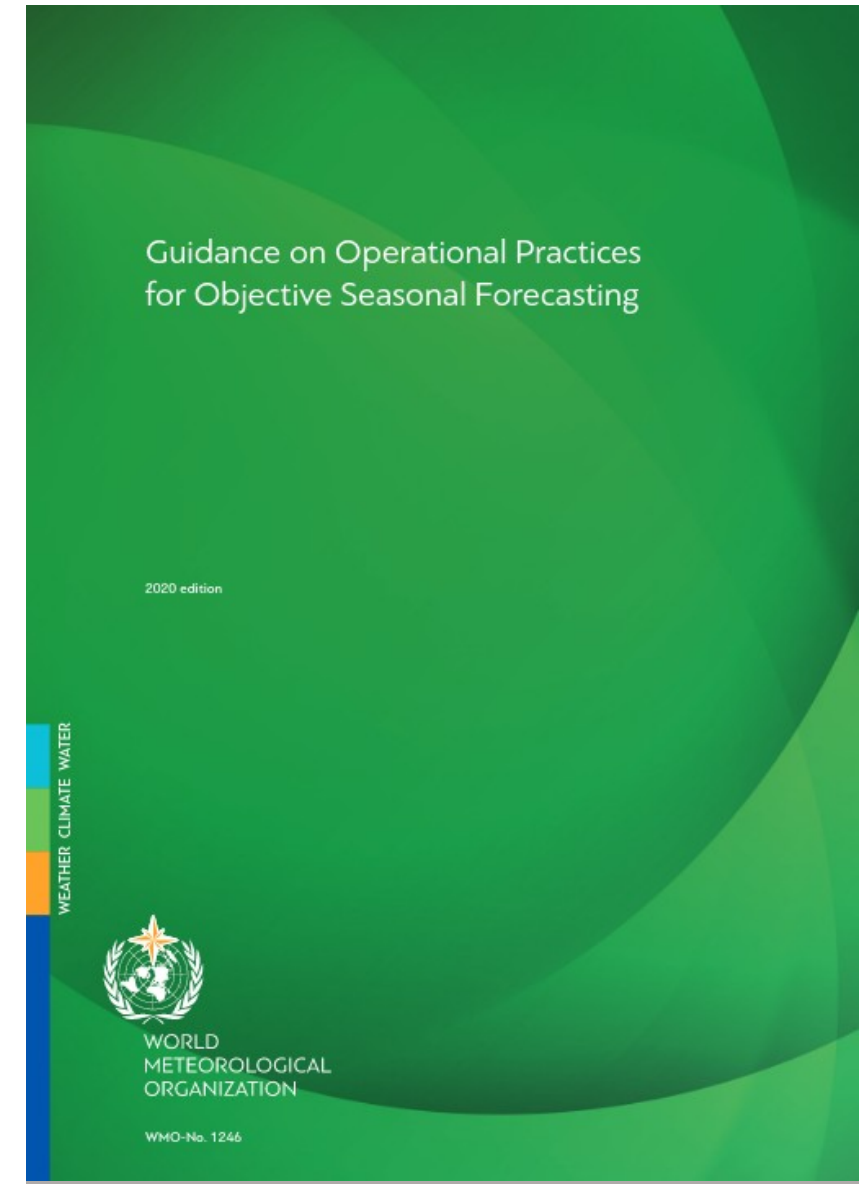
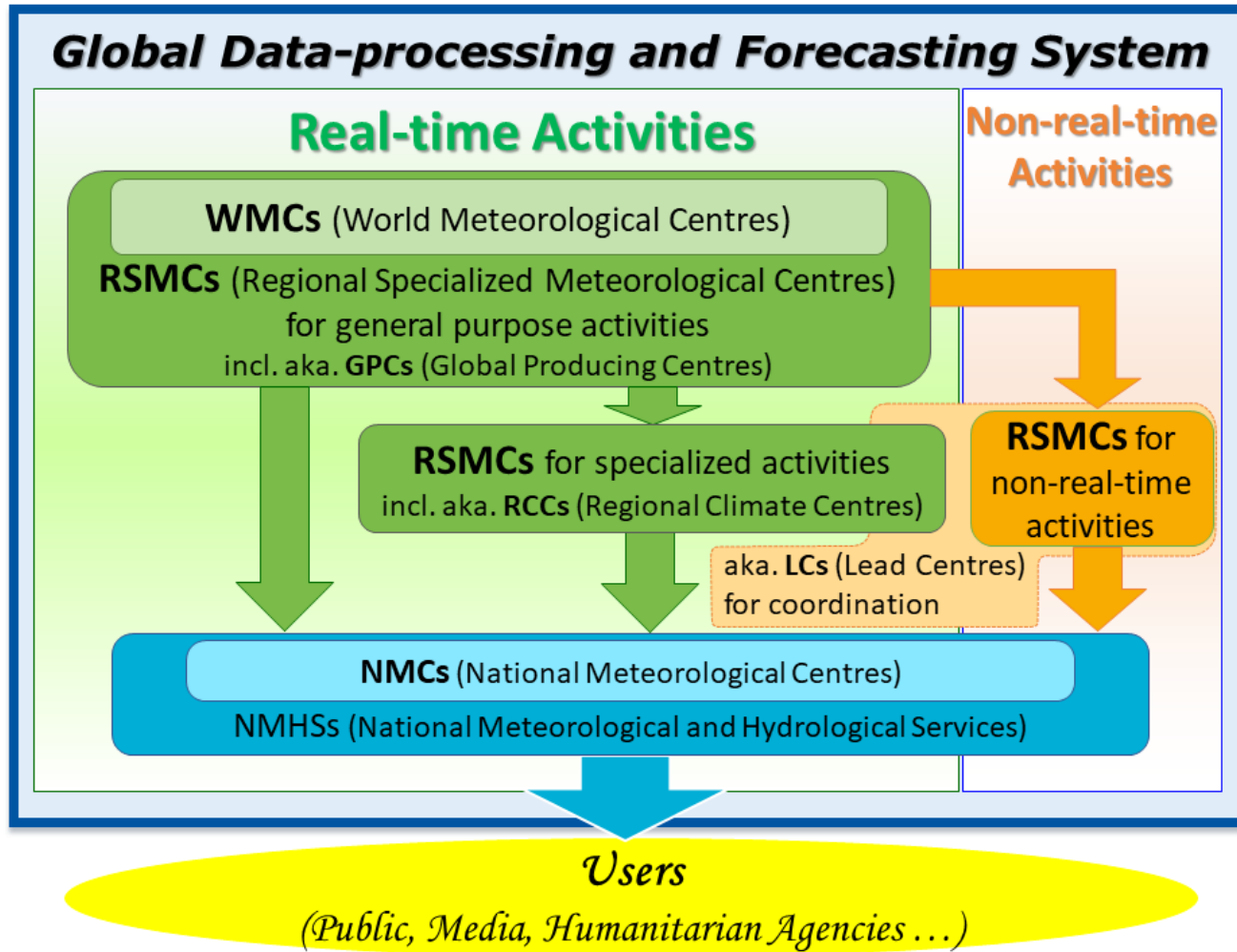
**Barcelona
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BSC: Center Update

Ángel G. Muñoz

27 March 2023

The operational context



Recent operational requests

Components of Proposal
Endorsed by Decision 9 (EC-72)



Regional climate data

Global forecast data access

Global model evaluation and selection

Regional calibration and bias correction

Regional climate outlook statement

Tailored seasonal forecast products

Forecast schedules and updates

Quality management



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WMO OMM

From R. Kumar Kolli and W. Moufouma-Okia

Addressing requests via standard definition

- Standards for **search, identification and dissemination** of decadal forecast data.
- The Met Office as **WMO Lead Centre** representative ensures compatibility of new data standards with its prediction activities.
- A **minimum** list of **variables** and their frequencies to be disseminated by C3S, including all realms available (atmosphere, ocean, sea ice) was provided.
- Definition and adoption of methods for **post-processing** of forecast data, including the generation of **multi-model products** comparing different formulations and the benefits of **calibration**.
- Best practices with recommendations on 1) **forecast system characteristics** (start date frequency, hindcast length, ...), 2) **forecast product generation** (forecast and reference period, bias adjustment and calibration, downscaling, ...), 3) **forecast quality assessment** (observational uncertainty, scores and reference forecasts, statistical significance, ...), 4) **user-oriented** climate service development (higher frequency for variables and indices, need for co-development).

What for? Non-trivial climatology definitions

ECMWF-Ext-Ens 2016
Period: 1996-2015 Month: April
Reference: ERA Int
Variable: 2-m temperature

Weekly: too noisy

Monthly: good skill, but suspiciously high

...

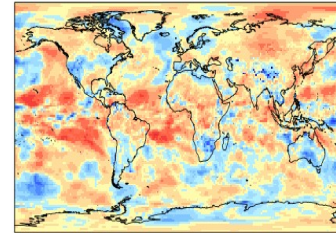
Monthly running window, but **weekly** for the bias adjustment: lower skill, and too noisy for the adjustment

Monthly running window: more credible quality estimates

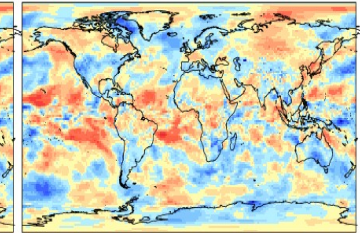
Manrique-Suñén et al. (2020, MWR)

april Fair CRPSS - Fcst time: Days 12-18

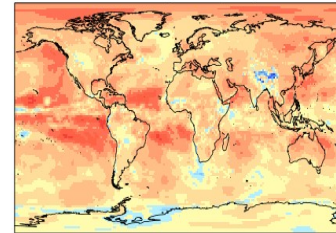
Single startdate (raw)



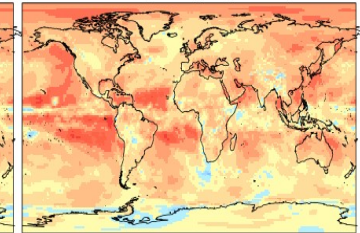
Single startdate (simple bias)



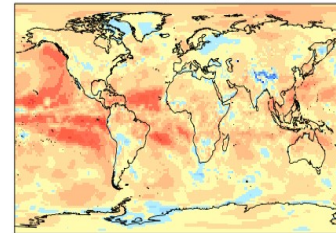
Monthly startdates, monthly clim (raw)



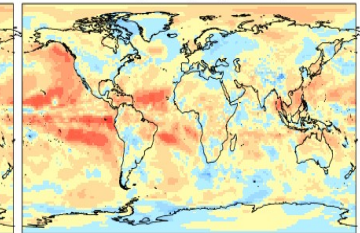
Monthly startdates, monthly clim (simple bias)



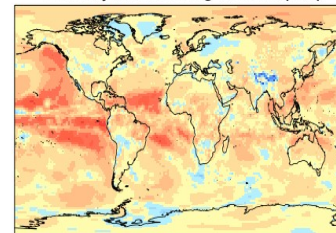
Monthly startdates, weekly clim (raw)



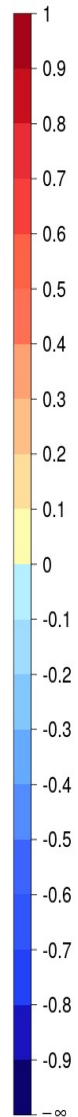
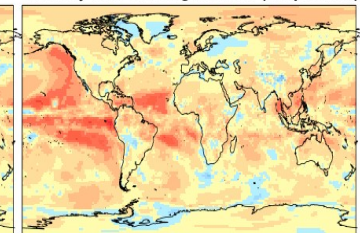
Monthly startdates, weekly clim (simple bias)



Monthly startdates, monthly clim running window (raw)



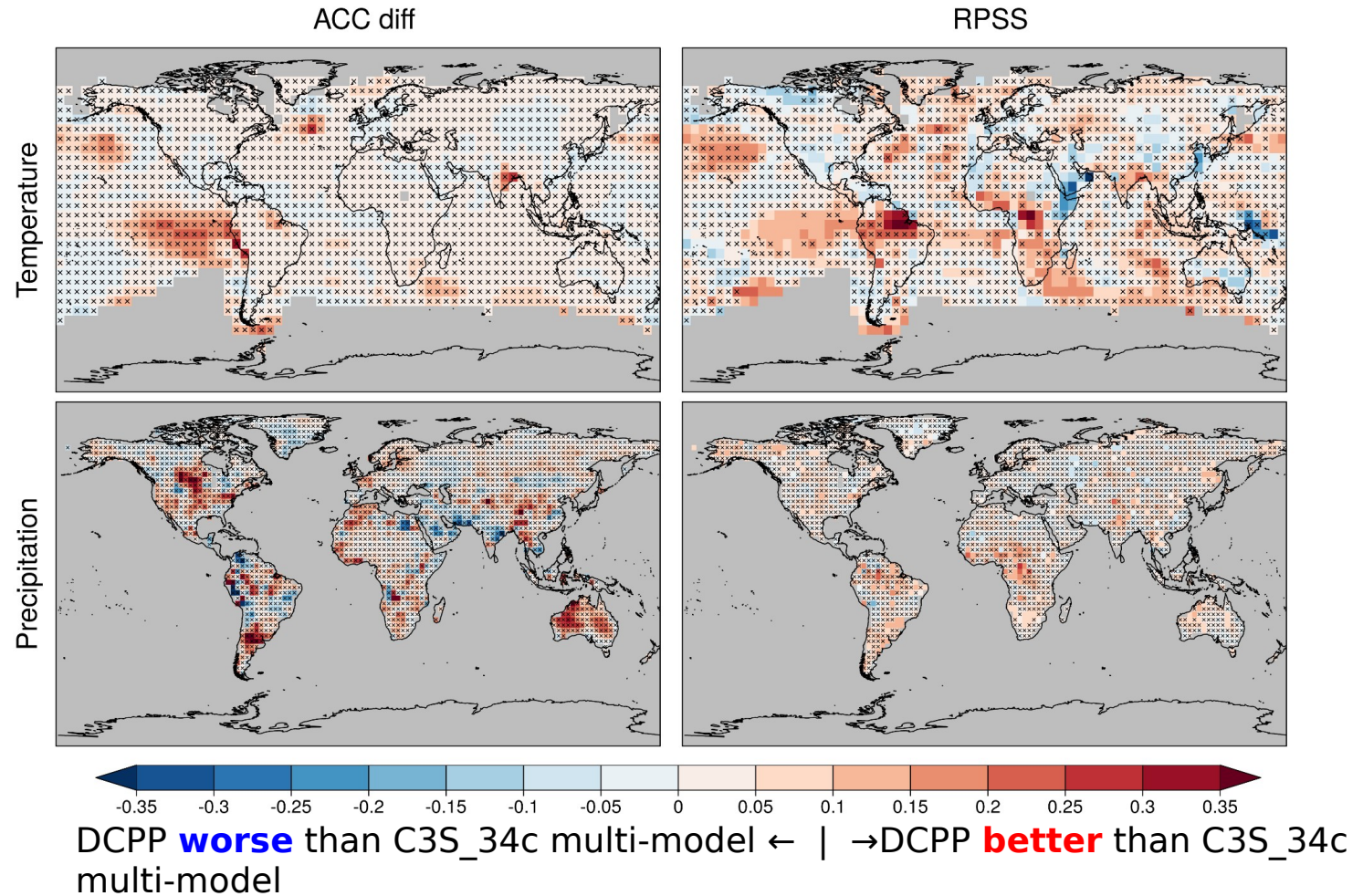
Monthly startdates, monthly clim running window (simple bias)



Standards and system design

Systematic assessment of the multi-model decadal prediction forecast quality helps illustrating, among other things, the importance of a large enough operational multi-model.

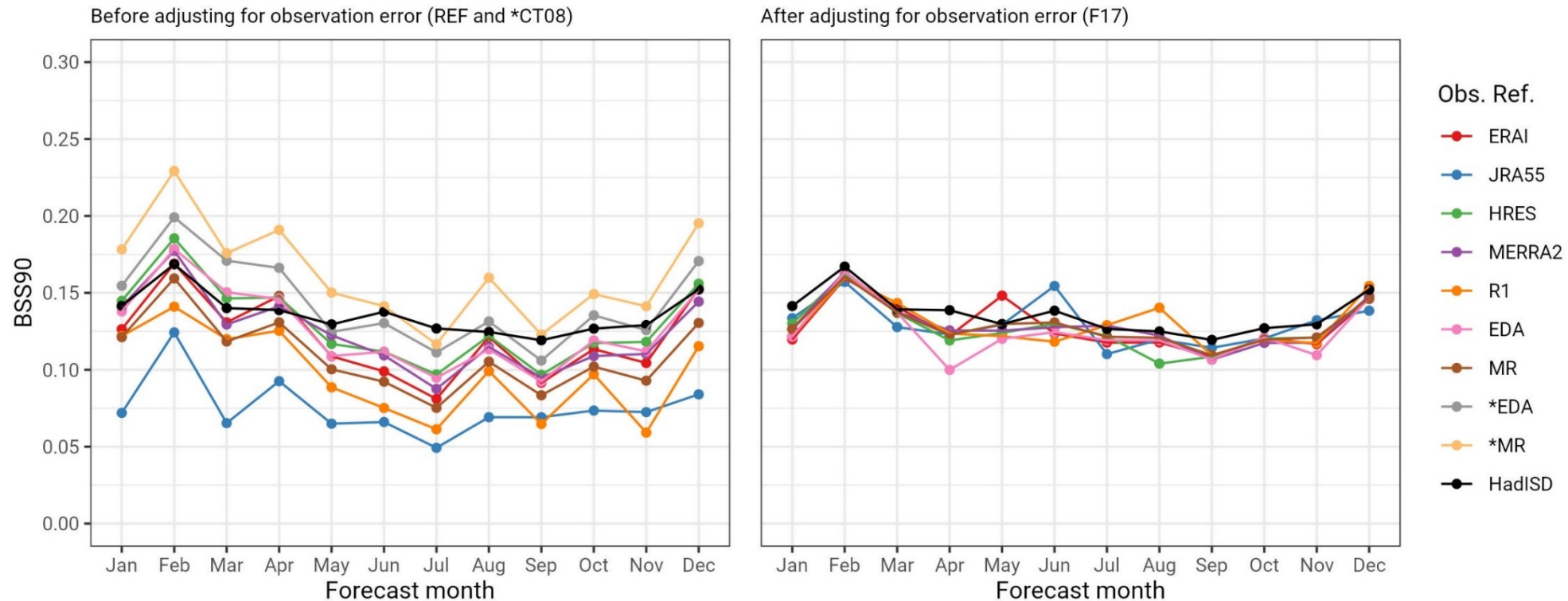
Comparison between a research (DCPP, **169 members, 13 forecast systems**) and an operational (C3S_34c, **40 members, 4 forecast systems**, CMCC-CM2-SR5, EC-Earth3-i1, HadGEM3-GC3.1-MM and MPI-ESM1.2-HR).



Beware of the observational uncertainty

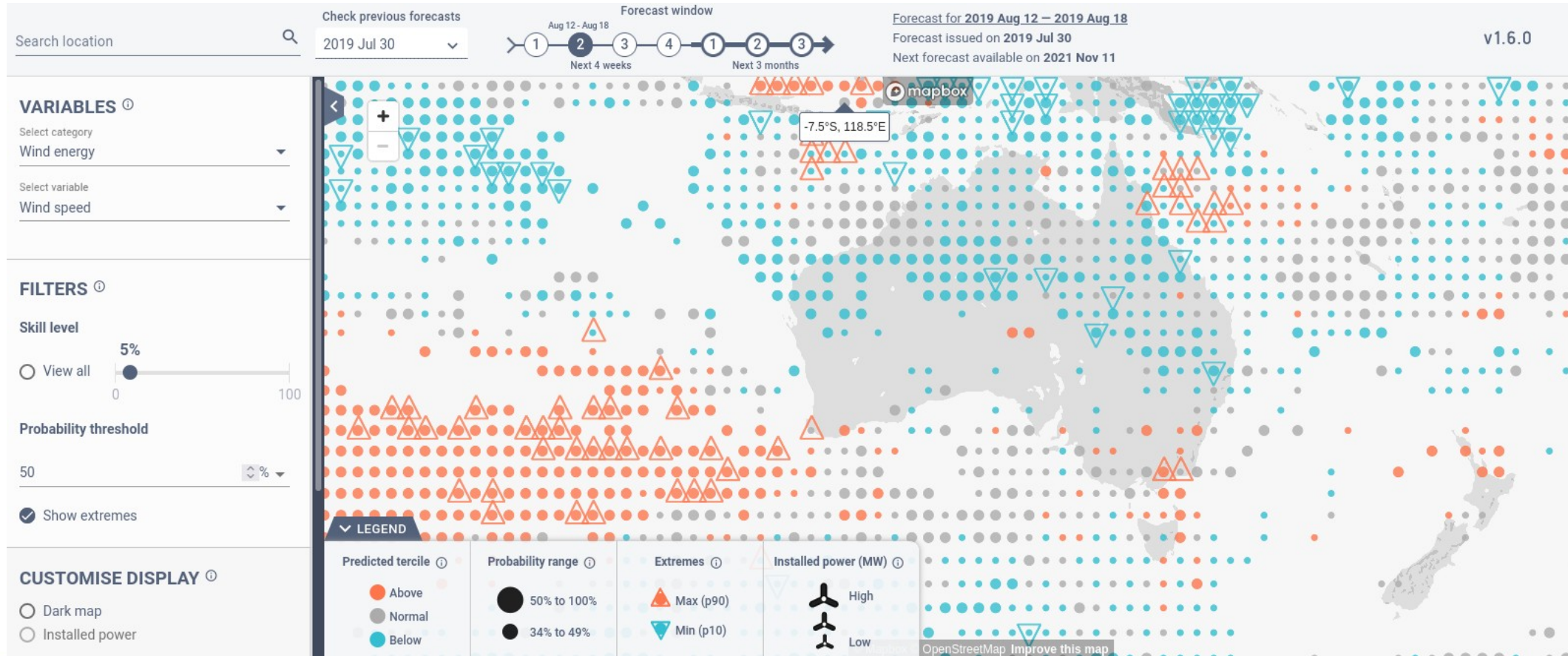
Verification against several reanalysis-based references gives different results. Adjustment of the observational references to in-situ observations (HadISD) shows that this uncertainty can be reduced. 10 m wind speed, BSS90 for zero-month lead one-month forecasts from ECMWF S5 (1981-2017).

“Failing to account for the effects of observation error when deciding between two forecasting systems could lead to the wrong choice and a high opportunity cost” (Ferro, 2017)



Need for seamless: what the user sees

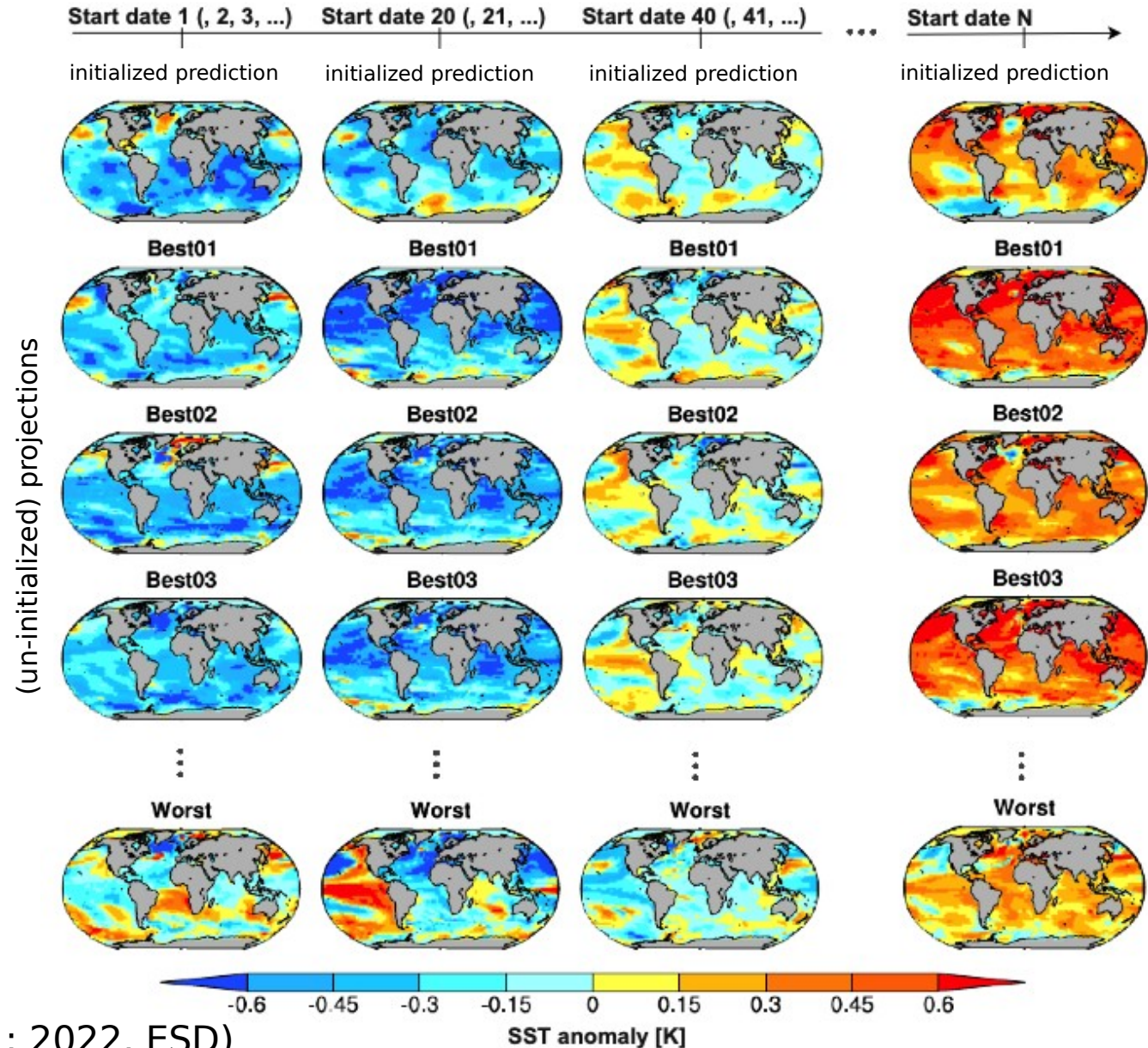
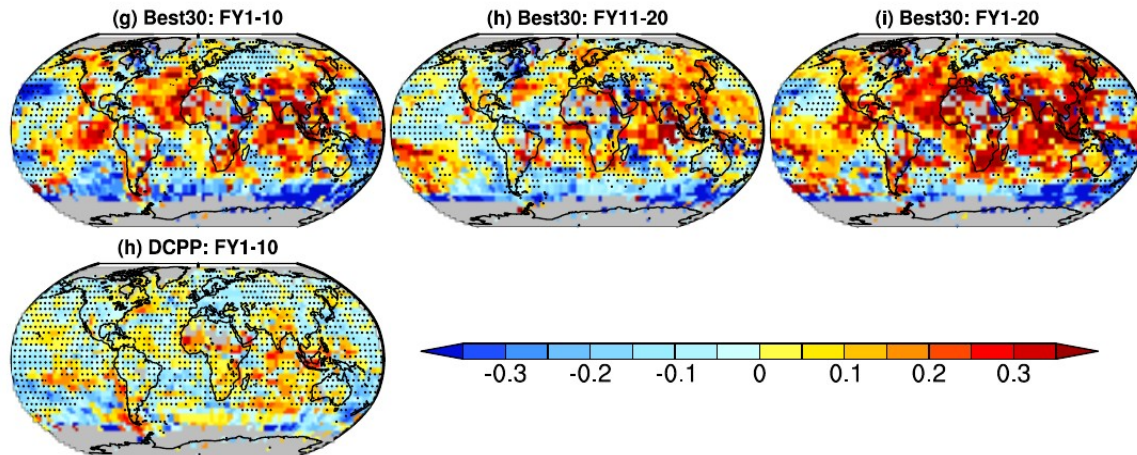
S2S4E developed a [decision support tool](#) for the renewable energy sector based on sub-seasonal and seasonal forecasts from C3S, S2S, and NCEP co-designed with the industry for periodic updates on the state of relevant climate variables.



Near-term seamless climate information

Projections: **223 members** from 35 models
 Decadal predictions: **93 members** from 9 models
 Sub-selecting the 30 projections members in closest agreement with the predictions over years 1-9

- There is substantial multi-decadal predictability by aligning internal variability
- Skill in constrained projections can be larger than in decadal predictions used to constrain



Quality control

Evaluation and quality control (EQC) supports trust and helps to remove usability barriers to make a product useful, but applicability is also important.



If poisoned,
dangerous (trust)



I don't manage to
reach it (usability)



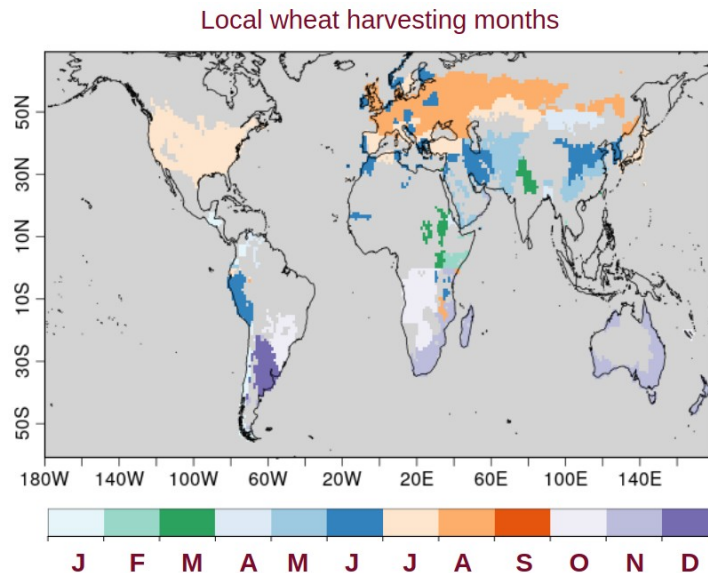
I'm vegan! It
doesn't fit my
purpose
(applicability)



Users

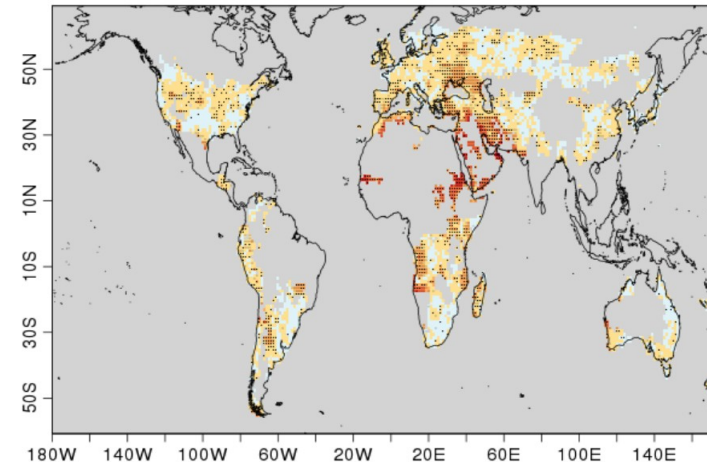
Forecasts for crop yield

WMO recognised global producing centres of decadal predictions contribute with the **definition of standards** for decadal predictions data and products, while C3S promotes the **evaluation** of the European multi-model and the illustration of the decadal prediction use in, among other sectors, the agricultural sector using indicators.



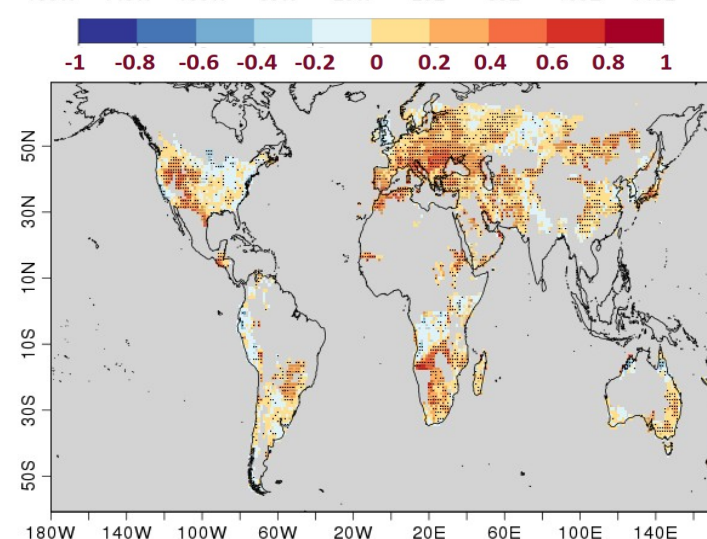
Indicators:

- Drought: Standardized Precipitation Evapotranspiration Index (**SPEI6**)
- Heat stress: Heat Magnitude Day Index (**HMDI3**)



SPEI6

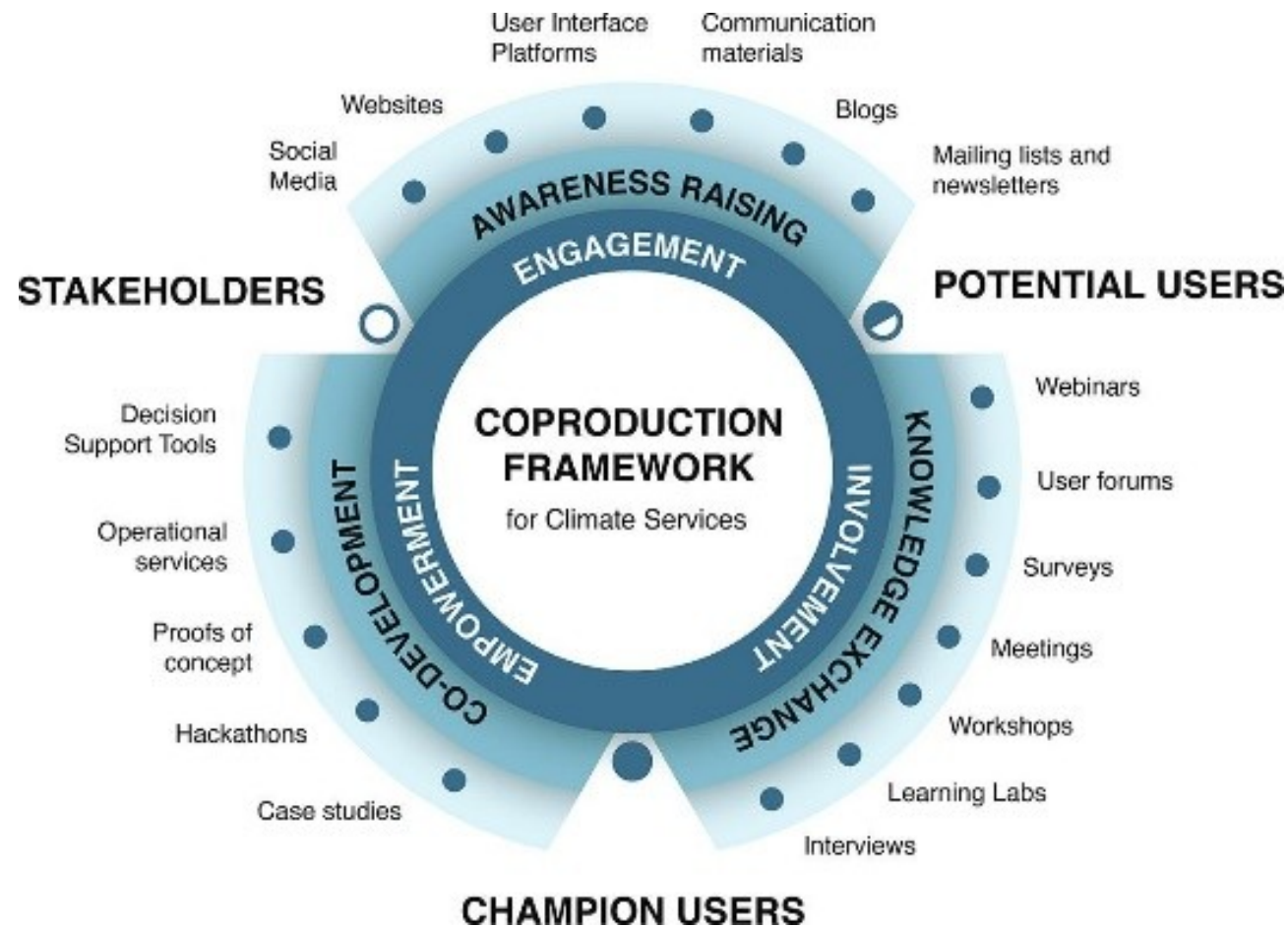
**RPSS
(3 categories)**



HMDI3

Engaging users

Social sciences and humanities play an increasingly important role in the services work. **The impact of environmental research (including model development, observations and operations) depends heavily on the ability to reach users, policy makers and citizens.** New approaches are leading to more efficient and successful links to both public administrations and the private sector.





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