BSC: Center Update

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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

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

**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)
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).

DCPP worse than C3S_34c multi-model ← | →DCPP better than C3S_34c multi-model

Delgadot-Torres et al. (2022, J. Climate)
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

Mahmood et al. (2021, GRL; 2022, ESD)
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)

Solaraju-Murali et al. (2021, NPJ Climate)
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.

Bojovic et al. (2021, GEC)
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27 March 2023