Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

EUPORIAS

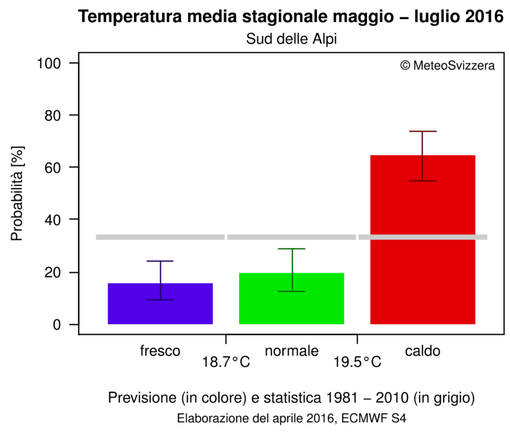
Challenges in creating user relevant seasonal forecasts

Mark Liniger, Jonas Bhend, Irina Mahlstein, Samuel Monhart, Christoph Spirig

Summary

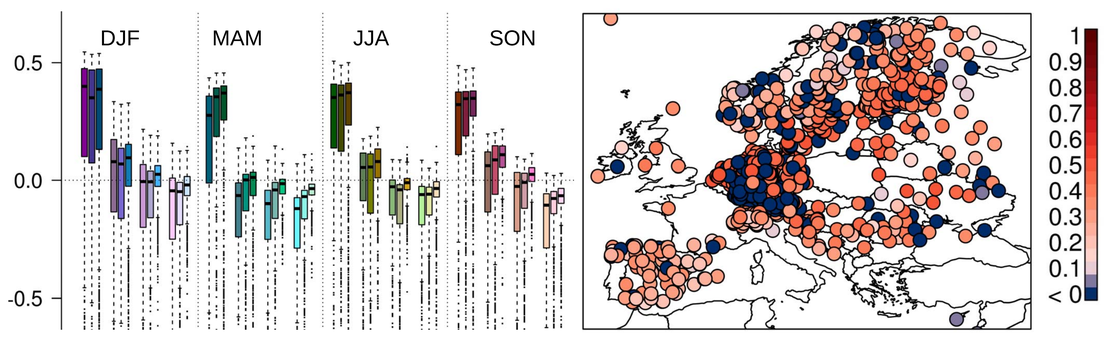
Beside moderate skill in many regions of the world, users struggle with climate predictions based on dynamical models due to the biases and drifts. For many end-user applications, well calibrated forecasts are crucial though. Forecasts must be calibrated in terms of **absolute values**, ideally on a daily basis, in order to derive user oriented quantities like indices. Additionally, forecasts should be calibrated in terms of **statistical reliability**, as overconfident forecasts can lead to disastrous decisions. We present a few approaches to make steps into this direction.

Tercile-Forecasts relative to local observations



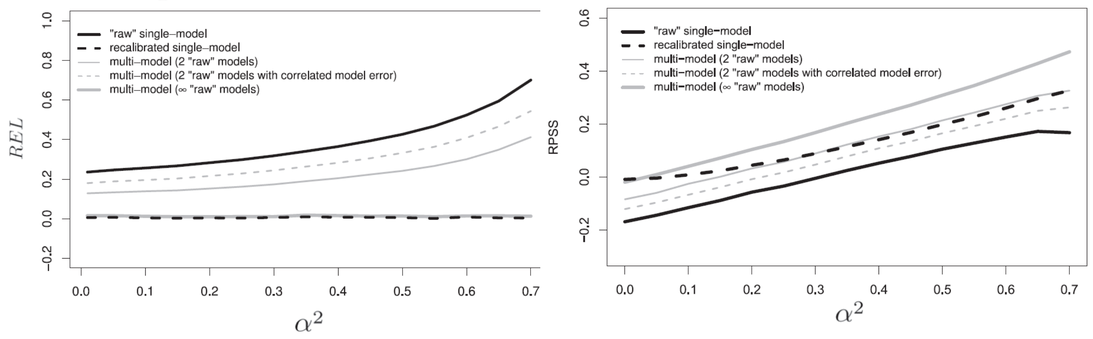
Operational seasonal temperature forecast by MeteoSwiss based on ECMWF System 4 for Southern Switzerland (May-July). To provide statistically reliable forecasts, the seasonal mean temperature values of the 51 members are calibrated using the CCR methodology (Weigel et al., 2009). The forecast is provided as tercile probabilities relative to tercile boundaries derived from station observations. This corresponds to a non-parametric quantile-mapping bias correction based on terciles.

From bias correction to downscaling



CRPSS for ECMWF monthly forecasts for temperature compared to ECA&D station data. Left panel: for each forecasting week, CRPSS is shown based on raw forecasts, mean bias correction and non-parametric quantile mapping. Right panel: CRPSS based on quantile mapping for week 1 (forecast days 5-11).

Dealing with overconfident forecasts

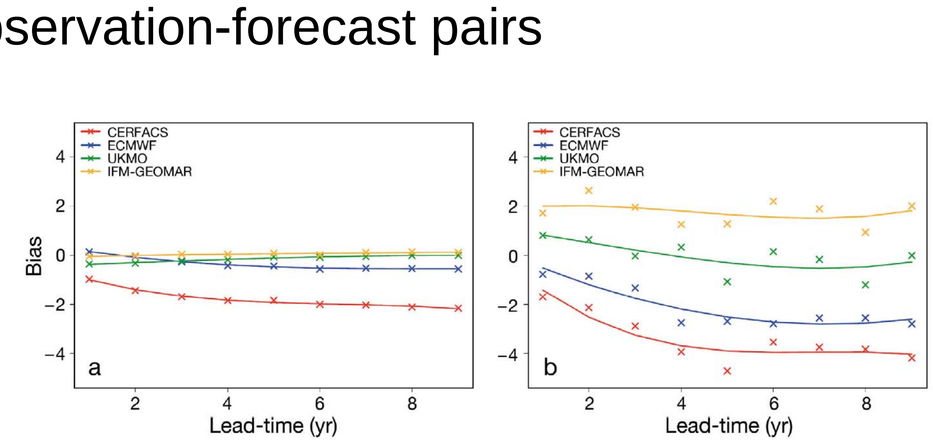


Climate conserving recalibration (CCR) following Weigel et al (2009) inflates the spread and adjusts the signal to obtain perfect reliability. Left: CCR results in perfect reliability. The same can be achieved by using many independent models in a multimodel. Resolution is not influenced Right: In contrast to a large multi-model, the CCR reduces the potential predictability (correlation) due to the signal adjustment resulting in a lower RPSS. CCR maintains resolution, a large multi-model could also improve resolution though (not shown).

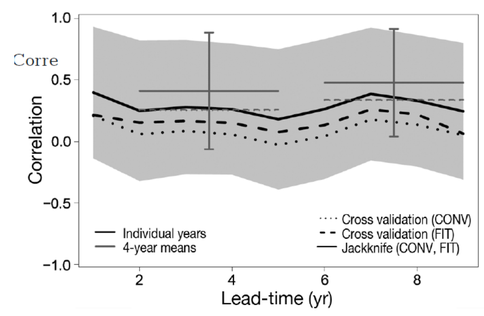
References

- Weigel, A. P., Liniger, M. a., & Appenzeller, C. (2009). Seasonal Ensemble Forecasts: Are Recalibrated Single Models Better than Multimodels? Monthly Weather Review, 137(4), 1460–1479. http://doi.org/10.1175/2008MWR2773.1
- Gangstø, R., Weigel, A., Liniger, M., & Appenzeller, C. (2013). Methodological aspects of the validation of decadal predictions. Climate Research, 55(3), 181–200. http://doi.org/10.3354/cr01135
- Mahlstein, I., Spirig, C., Liniger, M. A., & Appenzeller, C. (2015). Estimating daily climatologies for climate indices derived from climate model data and observations. *Journal of Geophysical Research. Atmospheres : JGR*, *120*(7), 2808–2818. http://doi.org/10.1002/2014JD022327

Estimating biases with little observation-forecast pairs

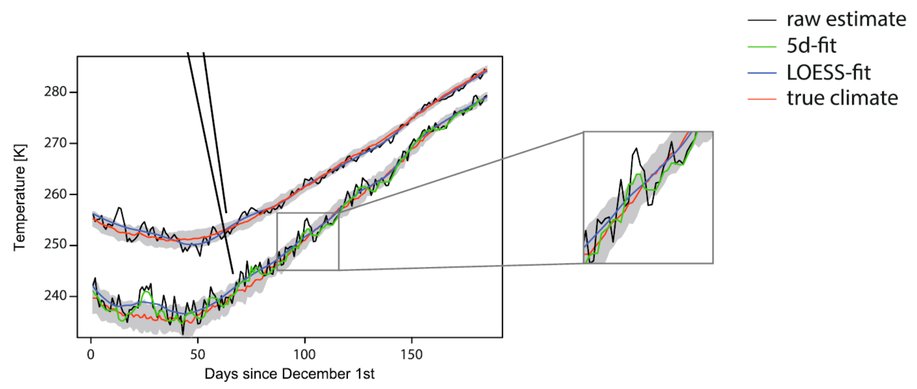


Lead-time dependent bias for global mean temperature (left) and arbitrary grid point (right) in the EU FP6 ENSEMBLES decadal forecast set. Crosses denote bias estimates based on the conventional approach (CONV), solid lines represent the model drift estimated by a relaxation curve (FIT). (Gangsto et al, 2013).



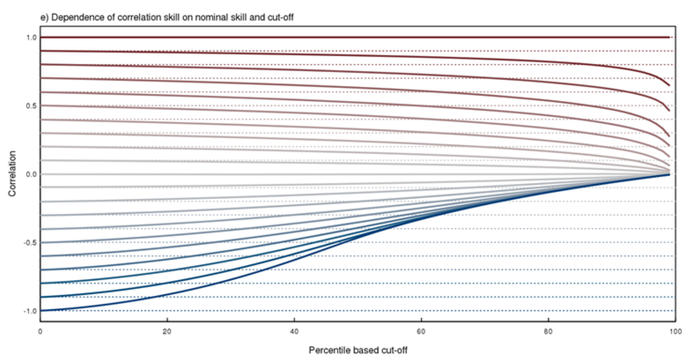
Correlation of decadal predictions of 2m temperature calculated at each grid-point (multi-model mean) and then averaged over the glob. For annual values, results based on FIT approach (dashed) show higher skill than based on CONV approach (dotted). (From Gangsto et al, 2013), for 4-year averages, effect is minor.

Estimating biases from a non-robust climatology



Comparing methods to estimate daily climatologies in a perfect model approach (ECMWF System 4) for mean temperature and 5th percentile (lower curves). True climate is based on an estimate of all 51 members. LOESS-filter shows better results than raw averages or a 5-d moving window. (Mahlstein et al, 2015).

Calculating indices to “improve” skill.



Situations with negative skill strongly profit from calculating indices of rare events due to the additional noise. For positive skill, indices degrade skill slightly. (Bhend et al., in prep)

Operation Center 1
8058 Zürich-Flughafen, Switzerland

Further information:
www.meteoswiss.ch

Contact: mark.liniger <at> meteoswiss.ch