Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

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

Quantifying uncertainty in monthly and seasonal forecasts of indices

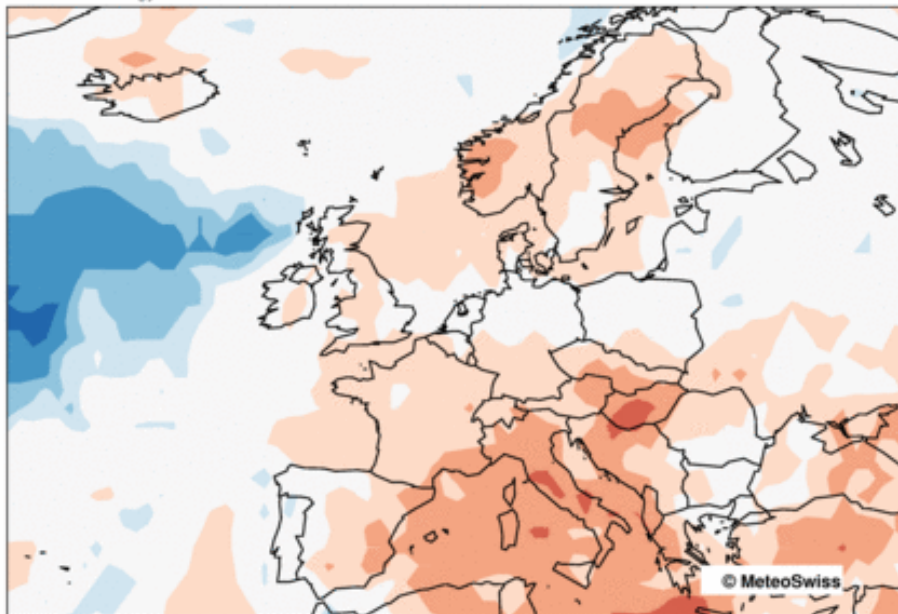Christoph Spirig, Irina Mahlstein, Jonas Bhend, and Mark Liniger

Current monthly and seasonal forecasts

- tercile probabilities

3-monthly (weekly)

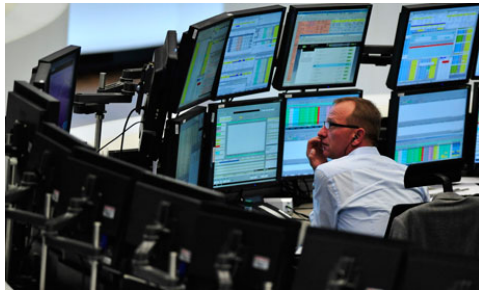averages of temperature

for seasonal (monthly) forecasts

bar plots, maps, climagrams

Customers of ER and SFC

- commercial customers
  - (re)insurance
  - energy providers
 - global perspective

- general public

Improve usability of seasonal forecasts

EUPORIAS

www.euporias.eu

- forecasts of indices in addition to basic met. variables
  - indices: (non-linear) aggregation of meteorological parameter over given period
  - indices often include thresholds
  - direct relevance for users

- forecasts with a user perspective while avoiding complex impact models

UEF 2015 | Monthly and seasonal forecasts of indices
C. Spirig, I. Mahlstein, J. Bhend, M. Liniger
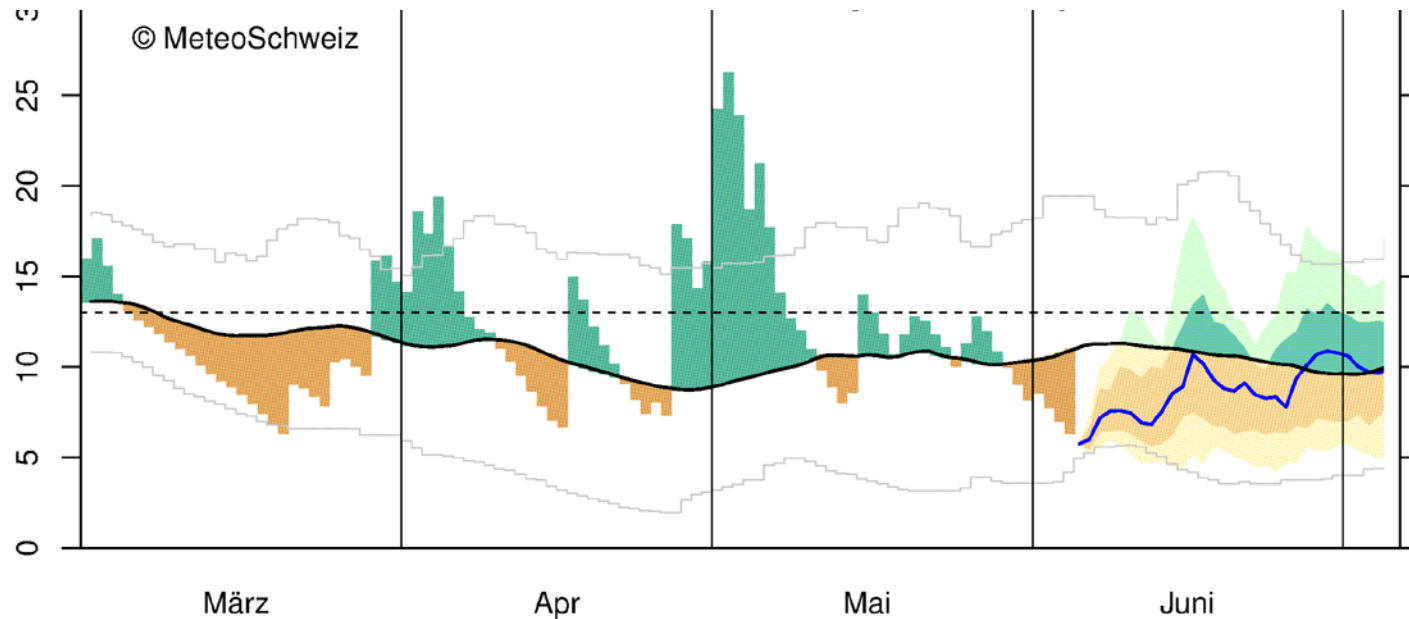
Vision

Soil moisture index
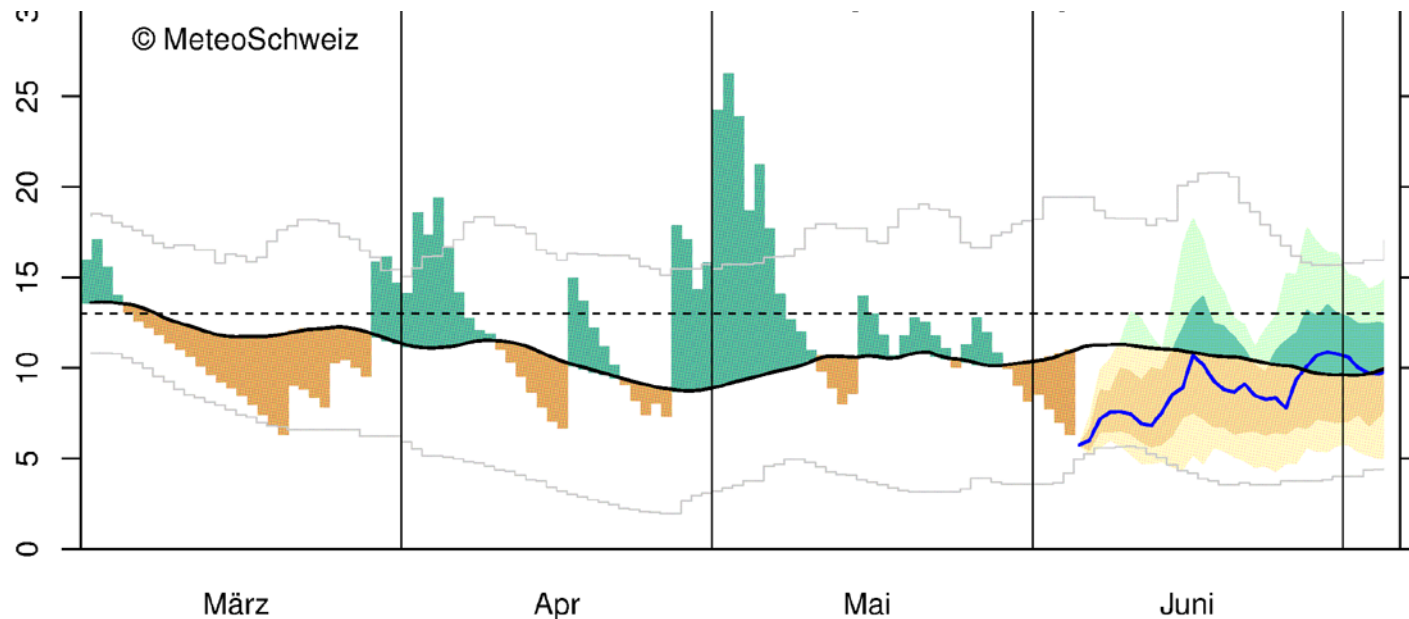
- combining monitoring and forecasts (IFS-ENS, IFS-ENS-EXT, …, seamless)
- input: long-term forecasts @daily resolution, calibrated
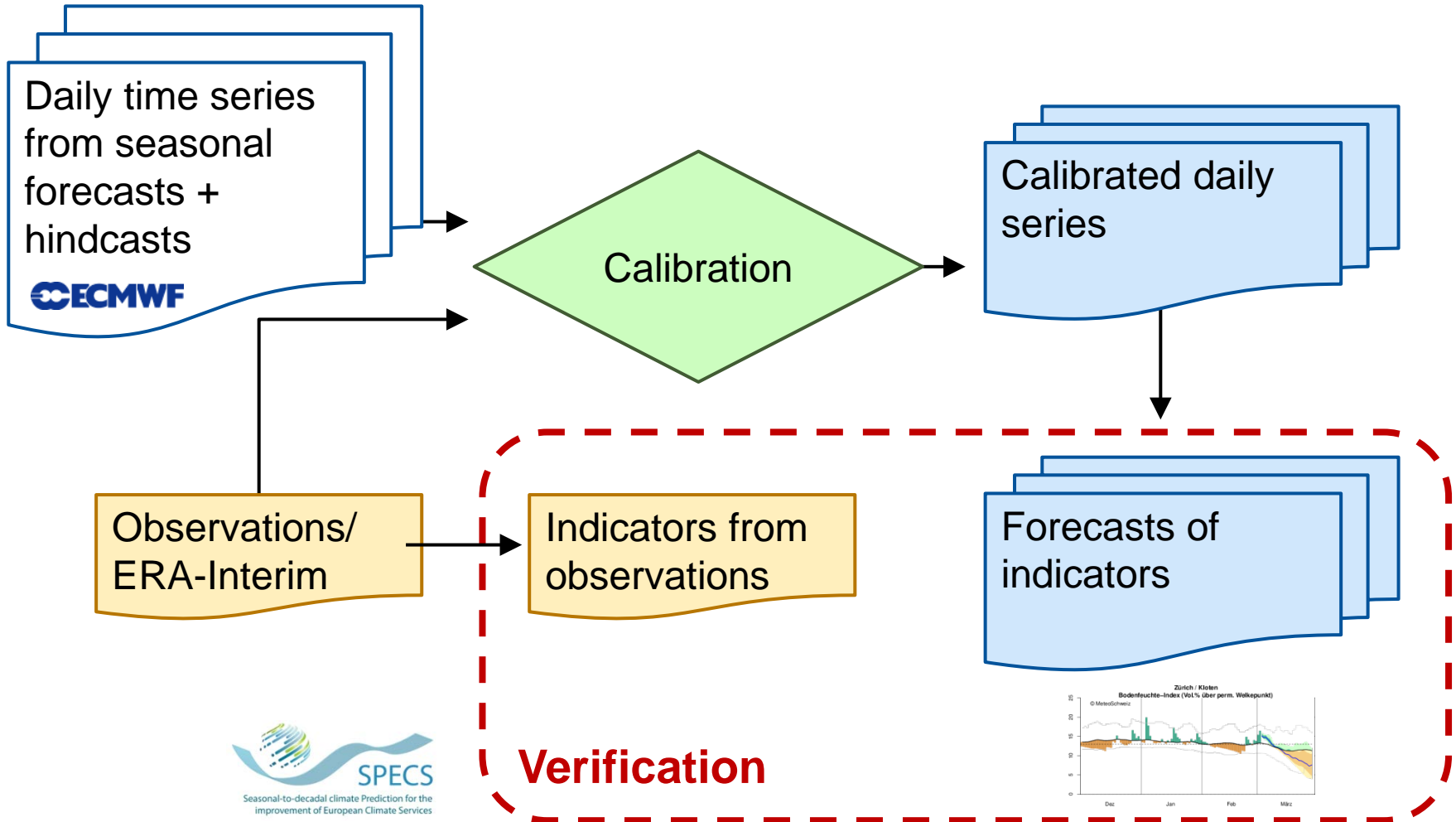
Vision

Soil moisture index

- appropriate representation of uncertainties

- skill of index forecasts ?

Analysis scheme

Daily time series from seasonal forecasts + hindcasts
ECMWF

Calibration

Calibrated daily series

Observations/ ERA-Interim

Indicators from observations

Forecasts of indicators

SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

Verification

Challenge: bias correction of daily data

Problem: 30 years of observations not enough to calculate daily climatology

- approach: apply low-pass filter
- evaluated using perfect model approach
  (Mahlstein et al., JGR 2015)

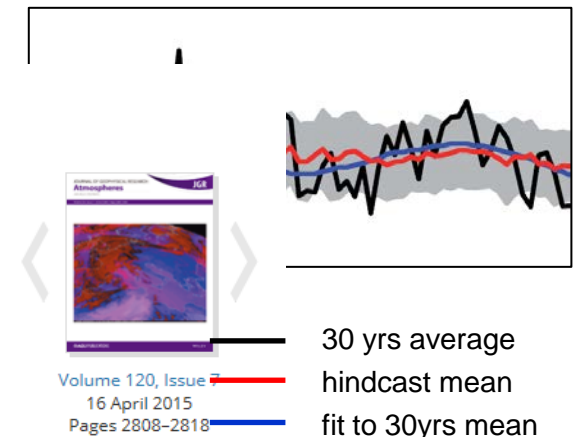JOURNAL OF GEOPHYSICAL RESEARCH
Atmospheres
AN AGU JOURNAL

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Research Article

Estimating daily climatologies for climate indices derived from climate model data and observations

Irina Mahlstein ✉, Christoph Spirig, Mark A. Liniger, Christof Appenzeller

First published: 13 April 2015   Full publication history

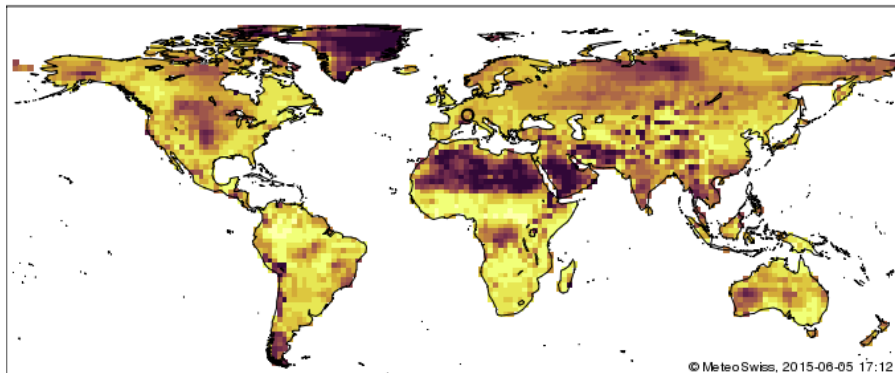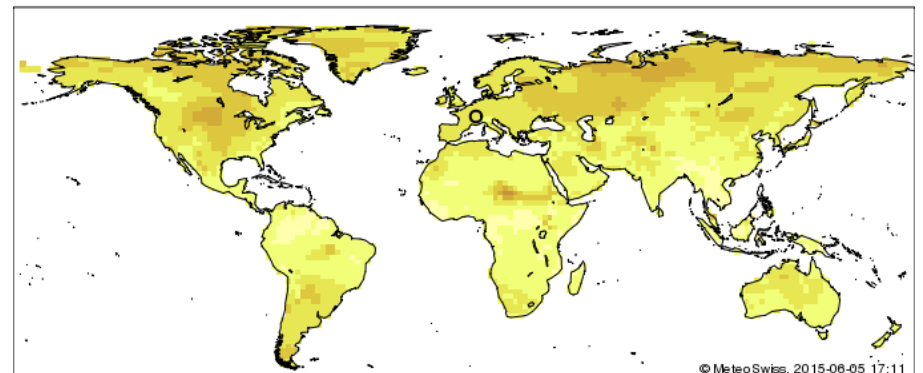DOI: 10.1002/2014JD022327   View/save citation

Volume 120, Issue 7
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— 30 yrs average
— hindcast mean
— fit to 30yrs mean

Bias correction of daily data

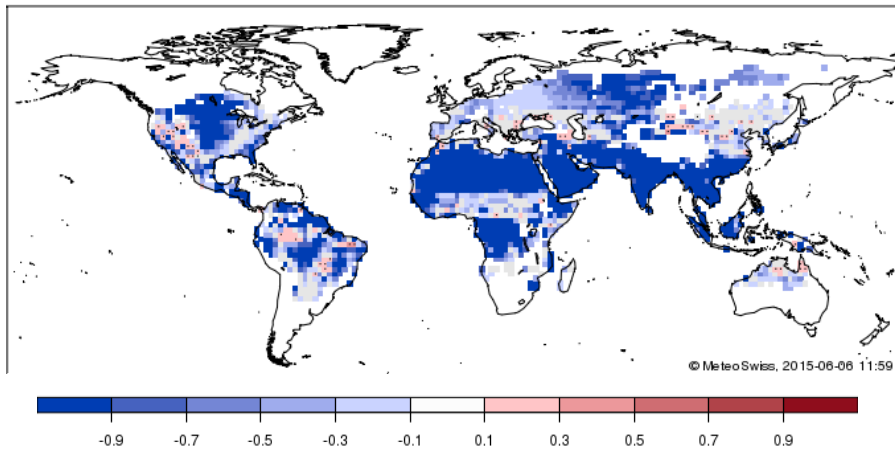- CRPS of average temperature forecast in JJA (May init)

raw

corrected

Skill of CDD forecast

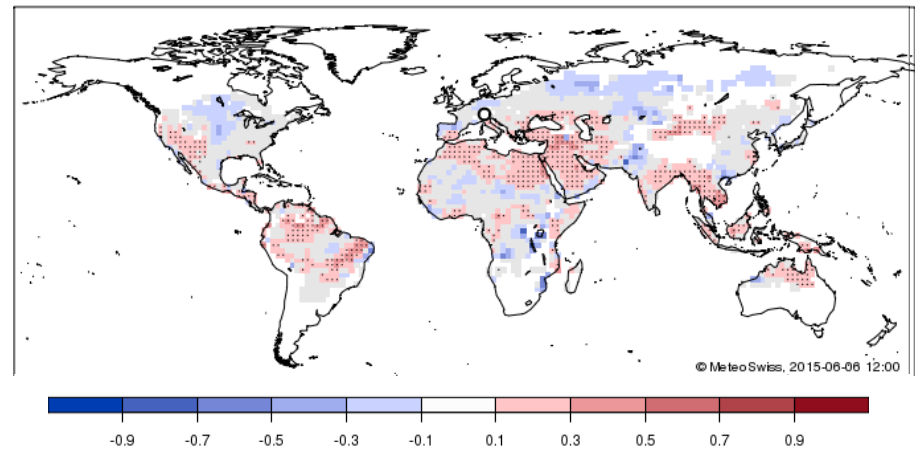- CRPSS of average temperature forecast in JJA (May init)

raw

calibrated

worse ┆ better

than climatology

worse ┆ better

than climatology

Example of index forecasts

- temperature based indices Heating Degree Days (HDD) and Cooling Degree Days (CDD)
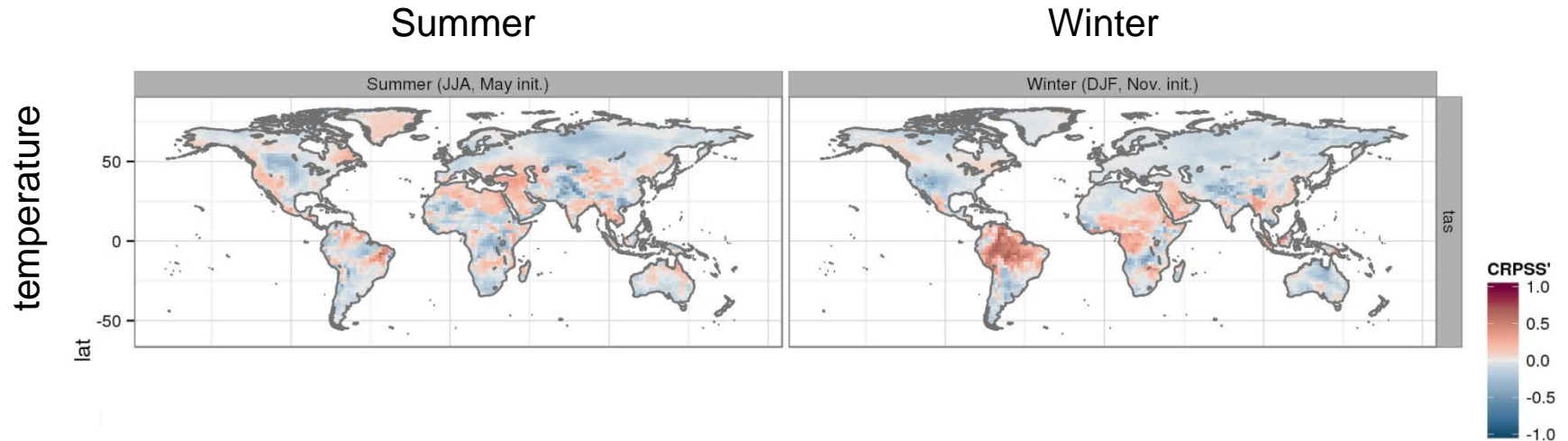
- sums of daily temperatures T_i below / above given threshold (TH)

$$\sum_{i=1}^{n} \text{MAX}(\text{TH} - T_i, 0) \qquad \sum_{i=1}^{n} \text{MAX}(T_i - \text{TH}, 0)$$

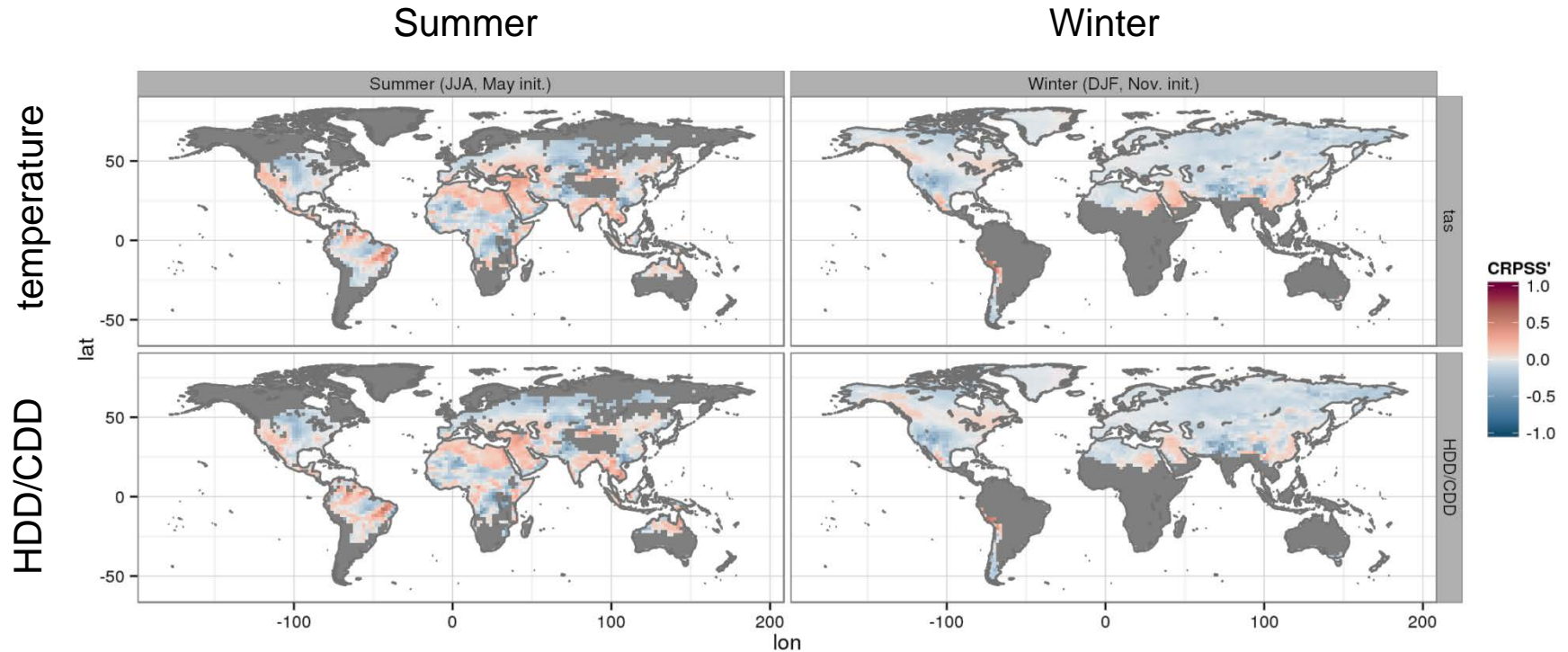- proxies for heating/cooling energy demand

Skill in forecasts of indicators vs skill of the underlying variable

Summer

Winter

Skill in forecasts of indicators vs skill of the underlying variable

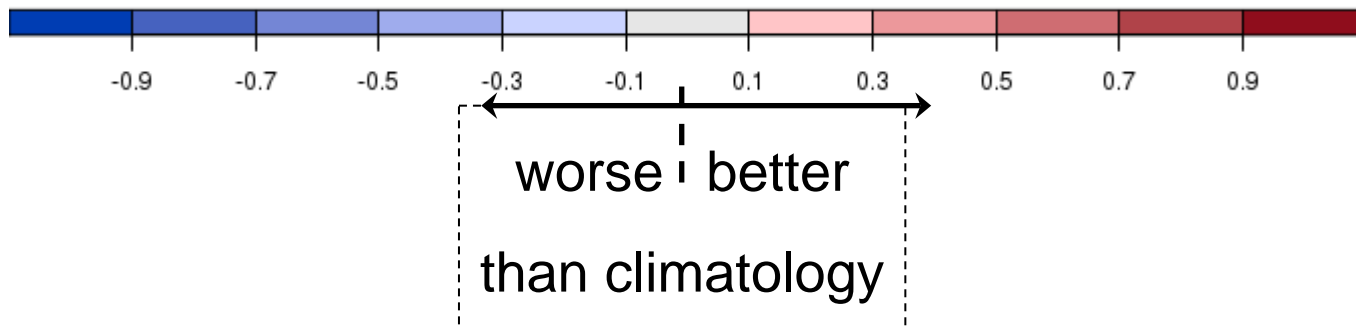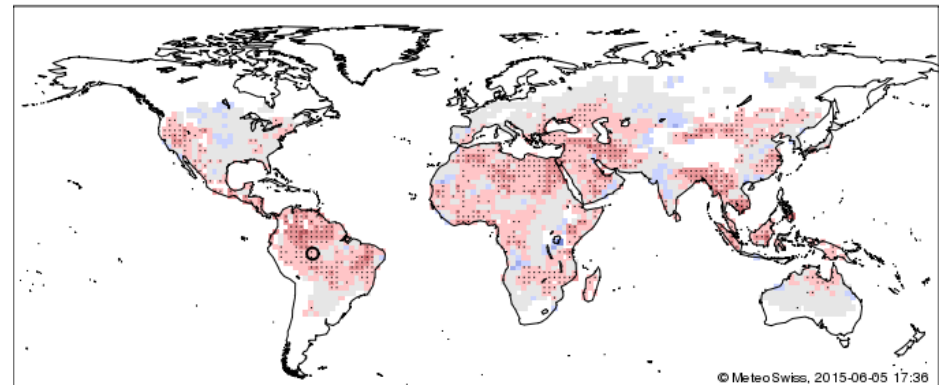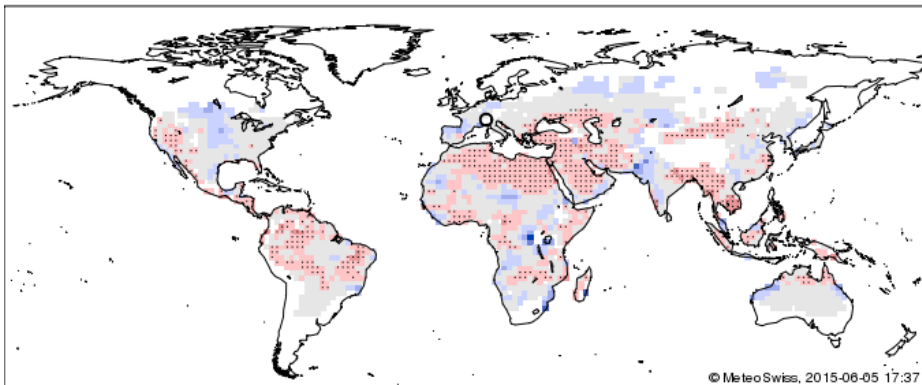Summer   Winter

Skill of absolute vs tercile forecasts

CDD forecast JJA, May initialization

CRPSS (absolute)

RPSS (terciles)

worse ¦ better

than climatology

Verification against observation data sets

HDD/CDD forecasts for months 2-4, Nov/May init

Summer   Winter

ERA-Interim
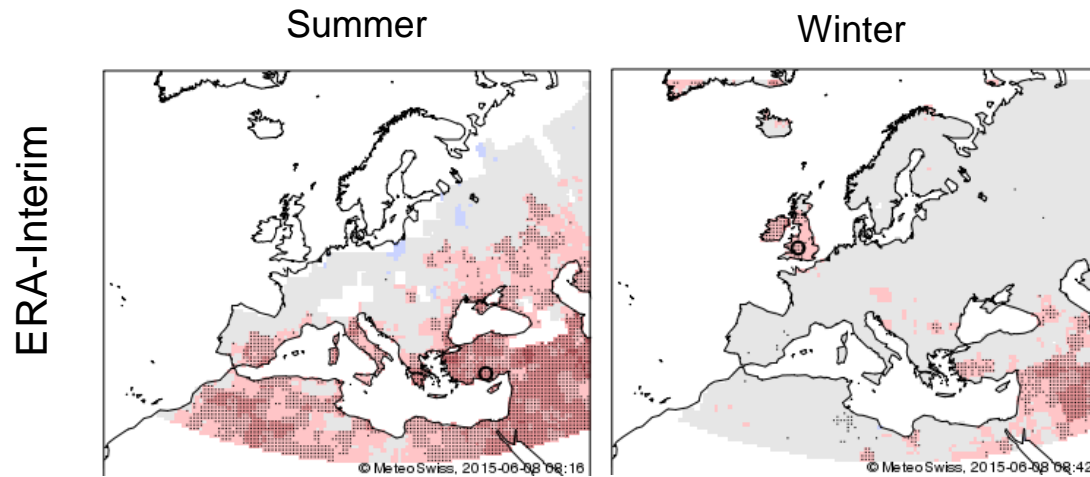
Lessons learnt

- Daily calibration improves skill in forecasts of climate indices

- Skill largely insensitive to choice of calibration method

- Skill in index at most as large as skill in underlying variable

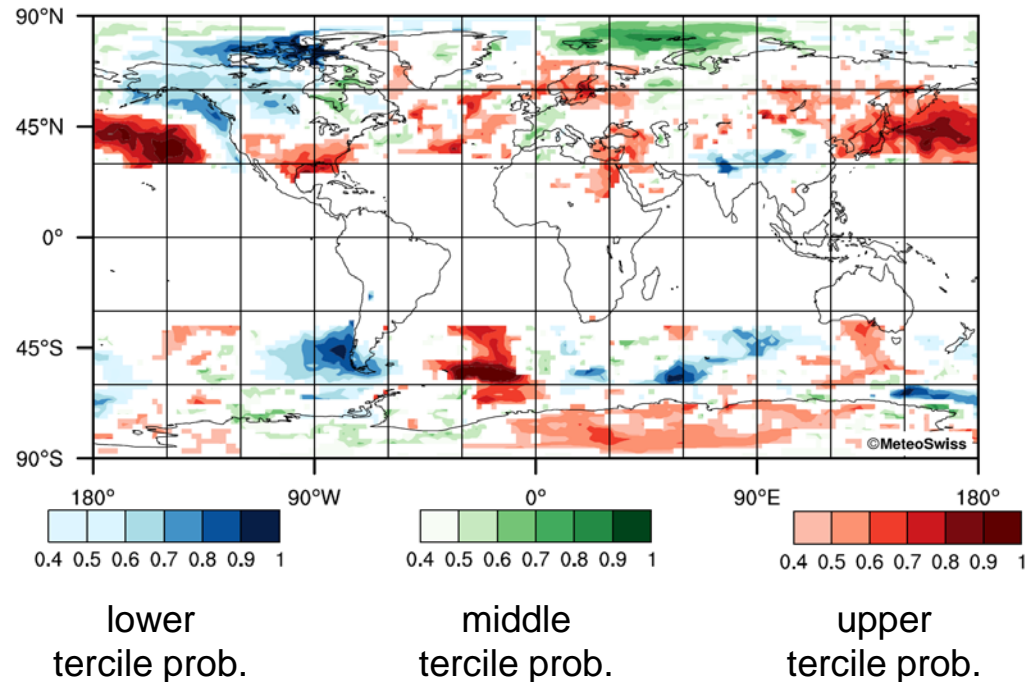- Skill in seasonal index predictions is limited
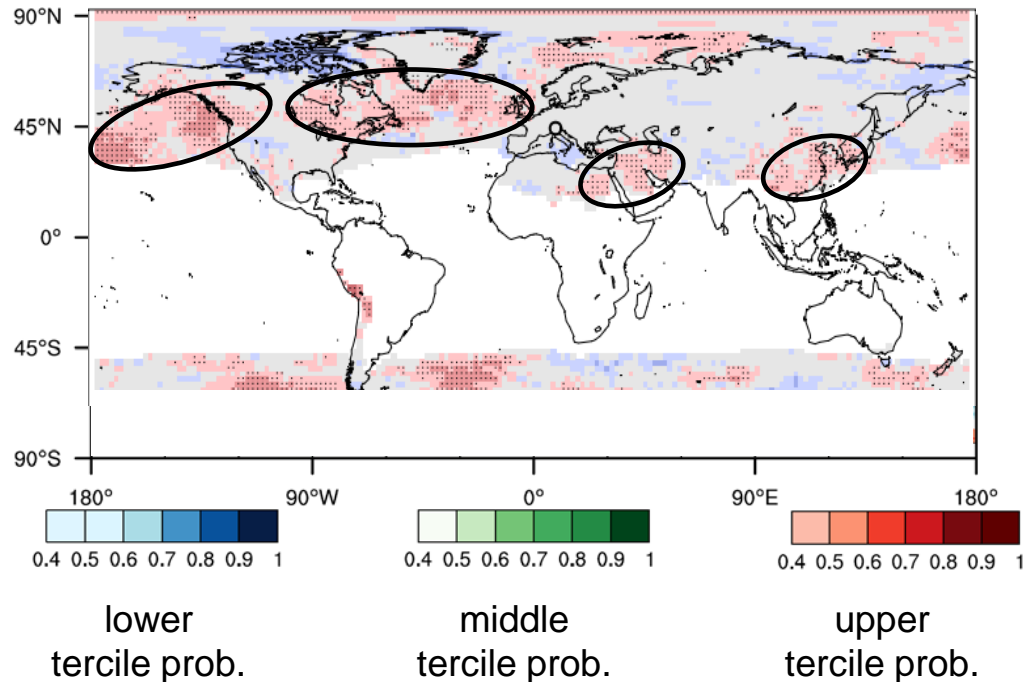
Implications for use of forecasts

Forecast presentation

Basis: HDD forecast as tercile summary

Forecast presentation

Basis: HDD forecast as tercile summary

combine with
skill information!

lower tercile prob.   middle tercile prob.   upper tercile prob.
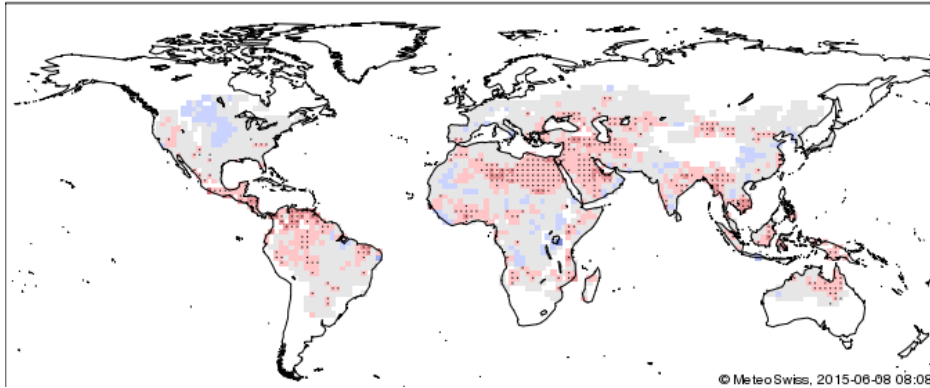
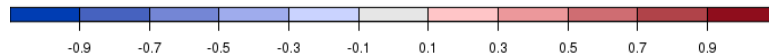# User perspective for aggregation of forecast information

- example of CDD forecast

- energy perspective:
  - cooling energy demand

- health perspective
  - how many people are affected?

→ use **population density** for weighting of CDD forecast/obs
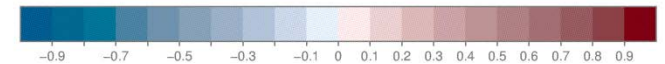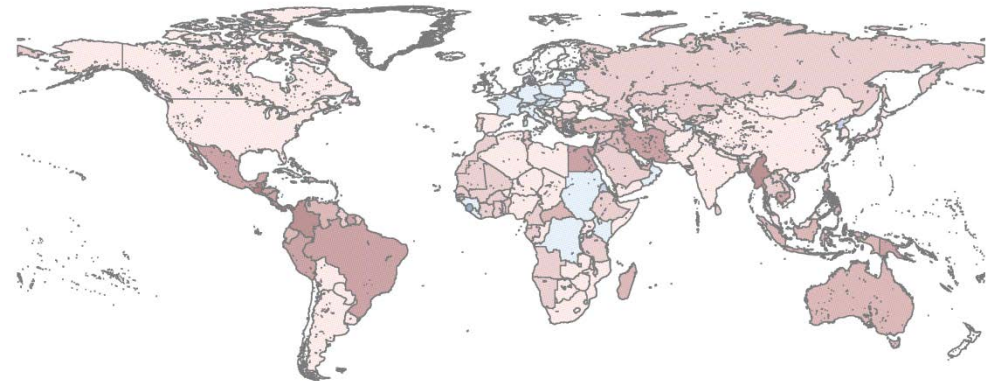
Skill of CDD forecast (RPSS)

CDD prediction for August
(May initialization)

same analysis for
CDD weighted by population
density, aggregated to
country level

Conclusions

- potential to provide added value in certain areas

- be careful in not provoking overinterpretation
  - combine skill and forecast information

- promote the use of «climatological forecast»
  - added value by considering natural variability

Thank you !