Verification of precipitation and drought indices forecasts at subseasonal to seasonal time scales

Christoph Spirig, Jonas Bhend, Samuel Monhart, and Mark Liniger
Overview

• User tailoring of climate forecasts: prediction of indices

• Verification of monthly forecasts
  • surface temperature and precipitation against ECA&D
  • drought index SPEI in Switzerland

• Verification of seasonal forecasts
  • precipitation and water balance in E. Africa
Prediction of indices

• indices: (non-linear) aggregation of meteorological parameter(s) over given period

• direct relevance for users

• forecasts with a user perspective while avoiding complex impact models
Prediction of drought indices

• Interest from various sectors
  • eg. agriculture, energy, public health

• Ongoing projects:
  • hydrological ensemble predictions for hydropower operations
  • Improve usability of seasonal forecasts

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Analysis scheme

Daily time series from monthly + seasonal hindcasts

Observations/Re-analyses

Calibration

Calibrated daily series

R packages:
SpecsVerification
easyVerification

Verification
Analysis scheme

- **Daily time series from monthly + seasonal hindcasts**
- **Observations/Re-analyses**
- **Indicators from observations**
- **Calibration**
- **Calibrated daily series**
- **Forecasts of indicators**

**Verification**
Verification monthly forecasts

- ECA&D data set (www.ecad.eu)
- ~1000 observation sites
- Hindcasts of cycle 40r1, complete yearly cycle
Skill of raw and bias-corrected hindcasts

Weekly mean CRPSSLOO

DJF  MAM  JJA  SON
CRPSS

temperature

precipitation

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ROCSS

temperature

precipitation
Skill temperature and precipitation

• Skillful forecasts (T) for up to 4 weeks lead time (discrimination) and up to two weeks (CRPSS)
• Quantile mapping outperforms mean debiasing technique
• Spatial skill patterns quite homogenous
• Winter and autumn with higher skill and with more pronounced regional differences
SPEI Index

- cumulative water balance (WB)

- different time periods: 1 – 24 months

- index = value of standardized WB, negative values = dryer than norm, positive values = wetter than norm

- model case for long term forecasts: system with different degrees of memory

Vicente-Serrano et al., 2010, Buegería et al., 2014
Climate observation network
SPEI verification

- 27 observation sites
- hindcasts of current operational IFS cycle i.e. March – April initial dates of 1996-2015
SPEI verification

MAE of SPEI, average of 27 stations

- 1 month
- 3 months
- 6 months
- 12 months

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climatological T/prec forecasts

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SPEI verification

CRPS of SPEI, average of 27 stations

- 1 month
- 3 months
- 6 months
- 12 months

lead time (days)
SPEI predictions

Zürich / Fluntern SPEI 3M

ECMWF Monatsvorhersagen:

- 10–90%–Quantil
- 25–75%–Quantil
- 2.5–97.5%–Quantil

Stand: 02.06.2016
Seasonal forecasts in East Africa

EUPORIAS

- Ethiopia’s food security early warning system
- Main cropping season: June-September
- Skill of seasonal forecasts (ECMWF System 4) for predicting precipitation and cumulative water balance?
May forecasts for JJAS

RPSS of cum. water balance from raw model output

RPSS of cum. water balance from bias-corrected model output

bias-correction of $T_{\text{min}}$, $T_{\text{max}}$, and precipitation
Resolution

ROCSS (lower tercile) precip sum

ROCSS (lower tercile) water balance
Precipitation vs water balance

- Similar skill for water balance \(= f(T_{\text{min}}, T_{\text{max}}, \text{prec}) \) and precip
- Significant regional and temporal (skill of ind. months) differences
Conclusions

- Skill of SPEI monthly forecasts
- Better skill for dry anomalies?
- Water balance seasonal forecast for E Africa with similar or better skill than precipitation
- Indicators with inherent memory call for seamless approaches
Thank you