Process-conditioned bias correction for seasonal forecasting: A case-study with ENSO in Peru

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Motivation & aim

Region of study

The SOI-conditioned bias correction method

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Motivation

• Bias Correction (BC) methods can introduce arbitrary changes in the temporal structure of the predictions (Maraun 2013*), leading to unrealistic time-series for particular regions (e.g. Peru; see Maraun et al. 2017**).

• IPCC 2015*** and Maraun et al. 2017** advocated the development of process-informed BC methods. However, the application of these methods to seasonal forecasts remains unexplored yet.

Aim

• Assessing the suitability of a first, simple attempt for process-informed BC in the context of seasonal forecasting. To do this, we focus on DJF precipitation over northwestern Peru (1981-2010) and analyze different forecast quality aspects.

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Region of study

- Complex orography (land-sea contrast, Andes)
- High-quality observations (71 SENAMHI stations)
- Complex ENSO-driven teleconnections pattern

Observed values

Spearman corr. (precip-SOI)

(d) corr = -0.9

[Graphs and maps showing regional climate patterns and observational data]
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The SOI-conditioned BC method

Significant observed SOI-teleconnections

ECMWF Sys4: good performance for predicting the SOI

corr(ensemble mean)=0.91; corr(members)=0.81±0.05 (μ±σ)

Window of opportunity for seasonal forecasting based on the state of SOI?
The SOI-conditioned BC method

- Leave-one-year-out cross-validation
- Three categories (terciles)
- Member-wise
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Beyond the model bias reduction, the SOI-BC method is found to modify the temporal structure given by the raw output, leading to an improved temporal representativity.
The SOI-BC method also provides better skill and reliability, which suggests its potential usefulness for decision-making.
The SOI-BC method is better at reproducing the observed SOI-driven teleconnections (especially in cluster 2)
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Conclusions

- The unconditioned BC method broadly preserves the temporal structure of the raw model precipitation and, as a consequence, does not improve its unskillful predictions (beyond correcting the mean biases).

- However, the SOI-conditioned BC method can modify the temporal sequence of the raw model output, providing more realistic local time-series, and yielding better correlations, ROC skill scores and reliability.
  - Nevertheless, this new method should not be expected to properly capture precipitation due to small-scale processes (e.g. convection) or other local features which are not directly related to the SOI.

Future work

- We plan to extend this kind of conditioned method to other regions and/or teleconnection patterns (e.g. NAO over Europe).
Thank you

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