Dealing with climate data uncertainty for agricultural impact assessments in West Africa

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PIK RD2 Climate Resilience

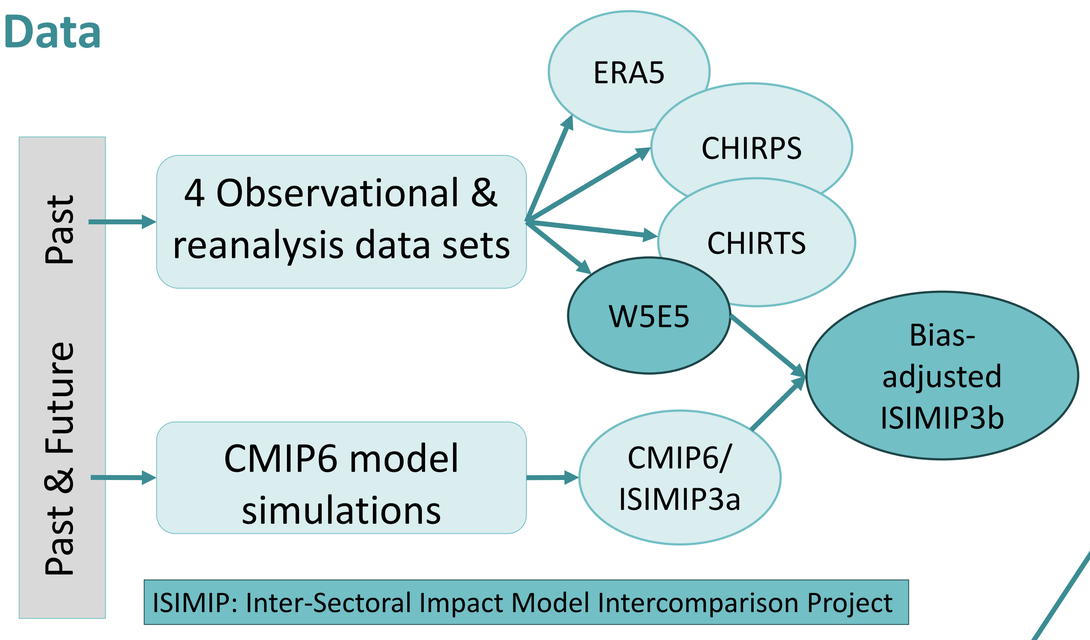
Background

- Crop production has already declined in West Africa due to climate change.
- Impacts of climate change on agriculture will become stronger in the near future.
- Uncertainties regarding climate impacts and the suitability of adaptation strategies on a global and local scale are still high.

Aim

We aim at providing a better understanding of the quality and limitations of climate data sets which are used for agricultural impact assessments in West Africa. This can support reducing uncertainties of future climate impacts on agricultural production and improve the assessment of adaptation strategies in West Africa.

Data



Method

Assess the differences between observational/ reanalysis, CMIP6 and ISIMIP3b data in:

1. **Temperature and precipitation mean**
2. **Agroclimatic Indices**

Agroclimatic indices

- Rainy season onset and cessation
- Heavy precipitation (>20 mm/day and >40 mm/day)
- Dry spells (7 and 15 days)
- 95th and 99th percentile of maximum temperature
- 1st and 5th percentile of minimum temperature
- Temperature range

Results

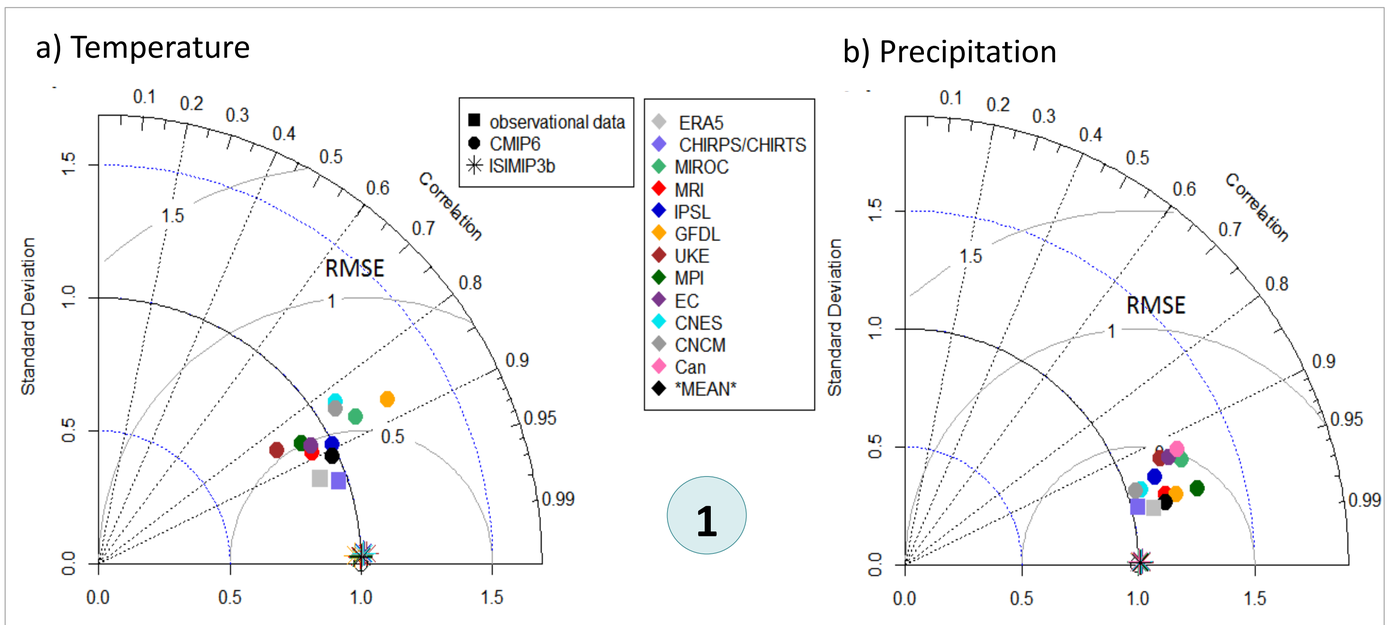


Figure 1: Taylor diagram showing the agreement of observational, CMIP6 and ISIMIP3b data in a) monthly precipitation and b) monthly temperature over West Africa in reference to the W5E5 data set. The Taylor diagram is based on three statistics: (1) the Pearson correlation coefficient (azimuthal angle), the root-mean-square error (distance to the centre point), and the standard deviation (radial distance from the origin, normalized to 1).

- The observational data sets highly differ spanning a range close to the one of the CMIP6 models.
- CMIP6 and CMIP5 models show similar systemic biases over West Africa.
- The bias adjustment alligns mean precipitation and temperature to the reference data set.

- The multi-model ensemble mean is consistently closer to the reference data set than individual models.
- No single model outperforms the other models in a majority of the agroclimatic indices.
- The bias-adjusted ISIMIP3b data agrees well with the reference data set for the mean, but shows some regionally-varying differences for the indices.

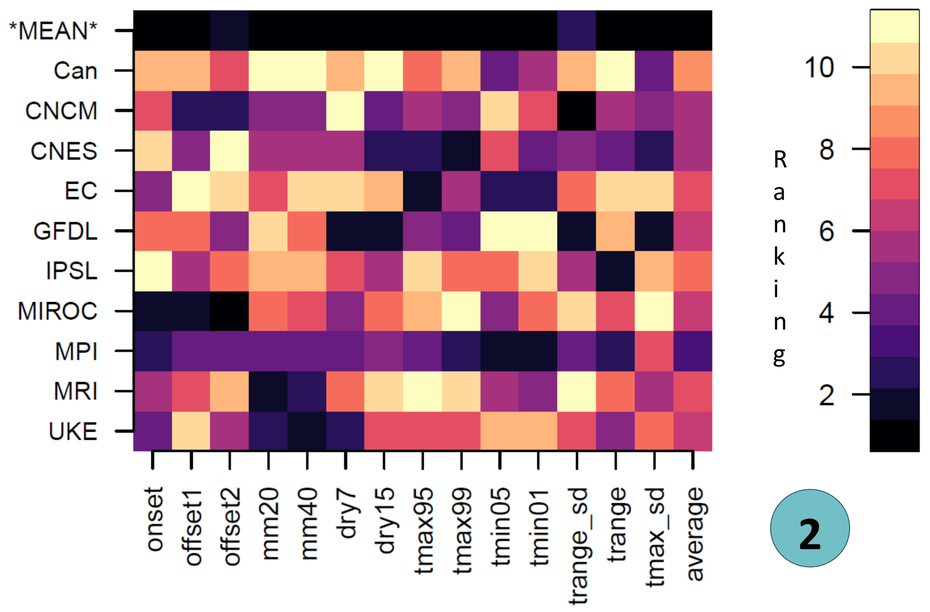


Figure 2: Diagram showing a ranking of the individual bias adjusted models (ISIMIP3b) and the multi-model mean for individual agroclimatic indices. The ranking is based on the Pearson correlation coefficient comparing the model data to W5E5.

Conclusions

- High uncertainty in observational data remains over West Africa in the most recent data sets.
- Using the multi-model mean of the whole ensemble of ISIMIP models reduces the discrepancy from observations.
- Considering results from all individual models helps to understand the range of uncertainties.

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We highly appreciate comments on the methods, results and conclusions.