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Validation of CORDEX Rainfall in the northwest Ethiopian highlands and the role of the model orography

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Precipitation patterns over the Ethiopian highlands are known to be very complex but are of strong socio-economic importance due to a high population density. Unfortunately, the region suffers from a lack of reliable observational datasets. A better understanding of the spatio-temporal rainfall variability could therefore be accomplished by running climate models. Precipitation modelling, however, is challenging in this region because of the complex orography including the Simien mountains peaking at 4550 m, the presence of Lake Tana and the seasonal convective rainfalls. Also, observations are still required for model validation to gain confidence in climate projections that assess how global climate change affects precipitation and associated impacts, for example, on agriculture.

In this work, model precipitation from the CORDEX project is evaluated for northwest Ethiopia against multiple sets of gridded observational data sets (Van Vooren et al. 2018). Thereby the role of the model orography is highlighted. Despite the model overestimation, observations generally lie within the range of the model ensemble. The climate models overestimate the elevational sensitivity, i.e. rainfall is too large for high elevations and too small for low elevations. Surprisingly, the models that use the most smoothed representation of the model orography are closest to observations but these positive results could be a mere consequence of their very poor orographic representation or an underestimation of orographic rainfall in the observational datasets. A second group of six models also has a poor orographic representation but provides the largest ensemble contribution to the overestimation of rainfall at high elevations. Given their strong elevation–precipitation correlation even larger biases could be expected in case these models incorporate a correct orography.

Van Vooren, S., Van Schaeybroeck, B., Nyssen, J., Van Genderachter, M., & Termonia, P. (2019). Evaluation of CORDEX rainfall in northwest Ethiopia: sensitivity to the model representation of the orography. *International Journal of Climatology*, Online Early View.