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Quantifying uncertainty in observational rainfall datasets

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The CO-ordinated Regional Downscaling Experiment (CORDEX) has to date seen the publication of at least ten journal papers that examine the African domain during 2012 and 2013. Five of these papers consider Africa generally (Nikulin et al. 2012, Kim et al. 2013, Hernandes-Dias et al. 2013, Laprise et al. 2013, Panitz et al. 2013) and five have regional foci: Tramblay et al. (2013) on Northern Africa, Mariotti et al. (2014) and Gbobaniyi el al. (2013) on West Africa, Endris et al. (2013) on East Africa and Kalagnoumou et al. (2013) on southern Africa. There also are a further three papers that the authors know about under review.

These papers all use an observed rainfall and/or temperature data to evaluate/validate the regional model output and often proceed to assess projected changes in these variables due to climate change in the context of these observations. The most popular reference rainfall data used are the CRU, GPCP, GPCC, TRMM and UDEL datasets. However, as Kalagnoumou et al. (2013) point out there are many other rainfall datasets available for consideration, for example, CMORPH, FEWS, TAMSAT & RIANNAA, TAMORA and the WATCH & WATCH-DEI data. They, with others (Nikulin et al. 2012, Sylla et al. 2012) show that the observed datasets can have a very wide spread at a particular space-time coordinate.

As more ground, space and reanalysis-based rainfall products become available, all which use different methods to produce precipitation data, the selection of reference data is becoming an important factor in model evaluation. A number of factors can contribute to a uncertainty in terms of the reliability and validity of the datasets such as radiance conversion algorithims, the quantity and quality of available station data, interpolation techniques and blending methods used to combine satellite and guage based products. However, to date no comprehensive study has been performed to evaluate the uncertainty in these observational datasets.

We assess 18 gridded rainfall datasets available over Africa on monthly, daily and sub-daily time scales as appropriate to quantify spatial and temporal differences between the datasets. We find regional wet and dry biases between datasets (using the ensemble mean as a reference) with generally larger biases in reanalysis products. Rainfall intensity is poorly represented in some datasets which demonstrates some datasets should not be used for rainfall intensity analyses. Using 10 CORDEX models we show in east Africa that the spread between observed datasets is often similar to the spread between models. We recommend that specific observational rainfall datasets datasets be used for specific investigations and also that where many datasets are applicable to an investigation, a probabilistic view be adopted for rainfall studies over Africa.

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