Attributing differences between RCMs and their driving models over Africa

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Differences between Regional Climate Models (RCMs) and their driving Global Climate Models (GCMs) are often attributed to higher resolution of RCMs, so called added value, and RCM simulations are considered as more reliable because of higher resolution. However, differences between RCMs and GCMs can simply indicate different physics and parametrization of RCMs and GCMs (not necessary better in RCMs) and cannot be directly attributed to added value of downscaling. Additionally, often there are expectations that high-resolution RCMs, set up and tuned for a specific region, can simulate local processes better than GCMs and should reduce large-scale biases originated in the driving GCMs. Indeed, such situation may happen but because of different reasons: "right reason" - better description of regional process in RCMs impacting large-scale circulation or "wrong reason" - simply cancelation of biases of opposite sign in GCMs and RCMs. RCMs may also amplify GCM biases or even change their sign.

To address the added value issue we run downscaling of the ERA-Interim reanalysis (about 0.75deg resolution) over Africa at a range of resolutions, namely: 1.76, 0.88, 0.44 and 0.22 deg. At the first two steps 1.76 (upscaling) and 0.88deg (similar resolution to ERA-Interim) we cannot expect any resolution-dependent added value and all differences between RCMs and ERA-Interim can be attributed to different physics/parameterization. Increasing resolution to 0.44 and 0.22deg we can expect and attribute added value of higher resolution with already known differences between ERA-Interim and RCMs at the coarser resolution. To test sensitivity of the experiment to different RCMs and their configuration we run the downscaling by two configurations of a regional climate model - SMHI-RCA4 and by another regional model - HCLIM-ALADIN. The experiment design is not new but we still think that such experiment provides a necessary insight on performance of RCMs and can be one of standard experiments in the CORDEX framework.