Assessment of RCM output from the ENSEMBLES RT3 project in AMMA-region: focus on Senegal actual climate reproduction and effects on simulated crop yields

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In West-Africa countries, most economies and people depend on rainfed agriculture. In this area, rainfall is highly variable and, from the period 1931-1960 to 1968-1990, the annual rainfall has decreased 15 to 40%. Since the mid 1990's, an increase in rainfall is detected, but only to reach the level of 1970's rainfall. The aim of this study is to determine if large-scale fields, interpolated at local-scale are able (i) to reproduce observed climate at station and (ii) to simulate observed crop yields. Another objective of this study is to see if a combination of dynamical and statistical downscaling methods is useful to correct biases due to scale change.

For that, we use data from some synoptic stations in Senegal and simulated data provided by the European project ENSEMBLES. Among research themes (RT) of this project, one (RT3) had the responsibility for providing improved climate model tools developed in the context of regional climate models (RCMs), at spatial scales of 50km at AMMA-region. RT3 provides 15-year experiments over West Africa driven by the ERA-INTERIM reanalysis of the ECMWF. A statistical method (CDF-transform), developed to generate local cumulative distribution functions of surface climate variables from large-scale fields is used to correct biases in RCM output, due to large-scale information basically interpolated at local-scale.

In the present study, a deterministic crop model, SARRA-H, is used to simulate sorghum yields for the actual period, at local scale. This crop model simulates yield attainable under water-limited conditions by simulating the soil water balance, potential and actual evapotranspiration, phenology, potential and water-limited carbon assimilation, and biomass partitioning. SARRA-H model is driven by 4 meteorological datasets, at synoptic station scale:

- observations,
- ERA-INTERIM,
- original RCM output,
- corrected RCM output.