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Inter-comparison of drought indicators derived from multiple precipitation datasets in Africa

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This study investigates the potential of implementing different drought indicators to improve drought monitoring capabilities at continental scale. Several global and continental datasets based on re-analysis, gridded observation, and remote sensing data were tested. At regional level the capabilities of each indicator and dataset on five regions on the African continent (Oum er-rbia, Blue Nile, Upper Niger, Limpopo and the Great Horn of Africa) were compared.

The five precipitation datasets used were the ERA – Interim reanalysis (0.5°x0.5° resolution from 1979 to 2010), Tropical Rainfall Measuring Mission (TRMM) satellite monthly rainfall product 3B43 (0.25°x0.25° resolution from 1998 to 2010), the Global Precipitation Climatology Centre (GPCC) gridded precipitation dataset V.5 (1°x1° resolution from 1901 to 2010), the Global Precipitation Climatology Project (GPCP) Global Monthly Merged Precipitation Analyses (2.5°x2.5° resolution from 1979 to 2010), and the Climate Prediction Center Merged Analysis of Precipitation (CMAP, 2.5°x2.5° resolution from 1979 to 2010).

The set of indicators proposed included Standardized Precipitation index (SPI), Standardized Precipitation-Evaporation Index (SPEI), Standardized Run-off index (SRI), Soil Moisture Anomalies (SMA).

A comparison of the annual cycle and monthly precipitation time series shows a general agreement in the timing of the peaks including the Great Horn of Africa where there are two rainy seasons. The main differences are observed thus in the ability to represent the magnitude of the wet seasons and extremes. Moreover, for the areas that are under drought, all the datasets agree with the certain time of onset and recovery but there are sometimes disagreements on the area affected. The agreement between datasets depends on the threshold selected to define the drought conditions.

The comparison between SPI estimations suggest that the main sources of uncertainties (due by lack of ground information, estimation algorithms, parameterization of the convection, etc.) are the differences in the precipitation datasets rather than the estimation of the distribution parameters that defines each indicator. Particularly, the estimations of the indicators over Central Africa reflect the high uncertainty present in the precipitation datasets.