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Identifying historic droughts in Africa using different sources of model simulated evaporation

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The history of droughts in Africa in the period 1979-2010 was analysed using evaporation results from a large scale hydrological model PCR-GLOBWB and a land surface model HTESSEL. Evaporation estimates from both models derived at a spatial resolution of 0.5° at a daily time scale were applied for the African continent for the period 1979-2010. While HTESSEL is part of the integrated forecast system at European Centre for Medium-Range Weather Forecasts (ECMWF), PCR-GLOBWB was forced with daily precipitation, temperature and other meteorological variables resulting from the ECMWF meteorological model. The monthly actual evaporation resulting from the models were used to compute the running average (over 12 months) of the monthly relative anomaly of evaporation. Agricultural droughts are defined as a lack of soil moisture to fulfil crop demands, and are therefore directly linked to lower values of evaporation than in normal conditions. The developed index, which represents the deviation of the monthly actual evaporation in a specific year with the long term average, serves as a simple method to identify agricultural droughts. Moreover, it is possible to make a preliminary characterization on the drought severity, indicated by its duration and intensity. Three specific drought prone areas in Southern Africa, the horn of Africa and Western Africa were studied with a view to identifying the most severe past droughts in the African continent. The results show that at these specific locations, the proposed evaporation-based index (resulting from the PCR-GLOBWB model) may serve as a means for identifying the most severe historical droughts. To a large extent both of these model results are able to identify the severe drought periods. The two results however differ in the magnitude of the indices and in some cases show opposite sign. It is expected that a regional drought index contrary to the grid point index could result in more similar characterizations by the two models.