



Water availability and demand in West Africa in the 21st century: impacts of climate change and population growth

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The countries in West Africa are highly dependent on rainfed agriculture. Changes in the magnitude and timing of precipitation will affect the agricultural output and the economies as a whole. Irrigation is increasingly being considered an important adaptation option to help improve food security of the population that is expected to double in less than 50 years. West Africa is one of the regions where general circulation models (GCM) show the highest disagreements in the direction of future trends of precipitation, making assessments of water availability and the potential for irrigation a difficult task.

We use output from a set of dynamically downscaled climate data sets from regional climate modes (RCM) from the CORDEX CMIP5 collection to drive WBMplus, a macroscale hydrological model and simultaneously calculate water demand (livestock, domestic, and irrigation) and availability for a set of land use, and socio economic scenarios around the 2050's for river basins in the ten countries participating in the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) project.

Contrary to earlier results from GCMs, the set of RCMs suggest a consistent increase (~5-10%) in annual precipitation for a majority of the land area in West Africa that translates to slight increases in river flow under natural conditions for most river basins and a opportunities for increasing irrigation during the dry season.

However, water demand is projected to more than double for livestock and domestic needs as a result of population growth. Demand for irrigation will rise sharply if irrigation is expanded from the current area (representing less than 3% of all croplands in the region), closer to its potential which is multiple times higher than the existing area. The pressures on water resources in the region will therefore be dominated by pressures arising from increased demand rather than changes in the availability of water and can potentially lead to increased water scarcity locally. Shifts in the timing of precipitation as indicated by some RCMs can exert additional pressures that challenge the sustainable management of water resources. These challenges can be addressed with improved water management options, particularly water storage.