Wetland evaporation in the Baro-Akobo Basin

Location	Baro-Akobo Basin, Sudan
Contractor	Eastern Nile Subsidiary Action Program (ENSAP)
Period	2004

Scope of the project

The Machar wetlands are the major wetland area within the Sobat basin, that contributes about half of the flow of the White Nile. Due to their inaccessibility, little is known about the wetlands in this area, while they have a strong impact on stream flow in the river. The goal of the study was to disaggregate the Baro-Akobo-Sobat system into different wetland ecosystems, map the variations in area, and estimate annual evapotranspiration losses for each system identified.

Study approach

The wetlands were mapped and divided into five wetlands using NDVI time series. Identification of wetlands based on NDVI is based on the fact that wetlands are greener than their surroundings during winter. It remains however difficult to exactly delineate the wetlands by absence of a clear vegetation-nonvegetation boundaries.
SEBAL in conjunction with MODIS data was applied to compute the land surface fluxes, including actual evaporation. The TRMM satellite provided monthly rainfall data. To quantify the effect of hydrologically disconnecting the Baro-Akobo wetlands from the Sobat river, a procedure was used that compared the ET of the area outside the wetlands with the ET within the wetlands. In this way the ET increment of the wetland can be determined. It is assumed that rainfall is equal within and outside each wetland.

Results

For 4 of the 5 wetlands the difference between rainfall and ET in the outer rainfed zone is positive, which means the marshlands will become recharge areas once they get disconnected from the rivers. For one wetland no gain in flow is expected when disconnected. The total potential gain in flow for all five wetlands is 2.06 BCM. The gain is calculated as the increment in ET (mm/year) for the whole wetland area (ET in m^3/year)
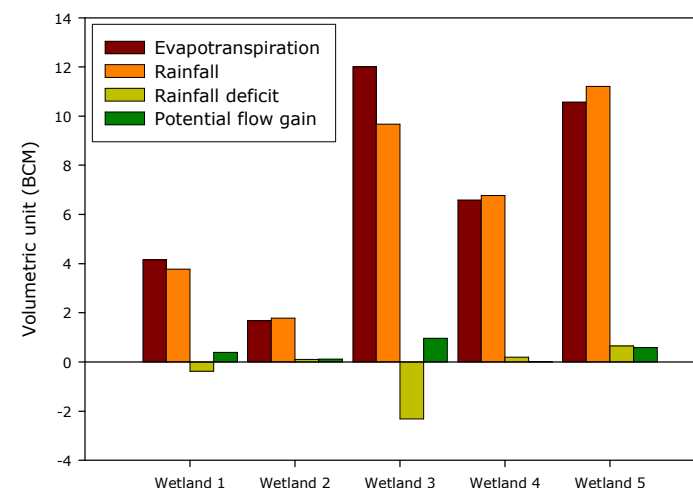
Key properties of the wetlands

The total gain should be corrected with some efficiency factor, that accounts for water seepage, losses from the river bed and creation of new marshlands downstream due to enhanced flows. The efficiency factor is estimated at 0.8, so the estimated gain will be 1.65 BCM. For the majority of wetlands, the biggest gain in flow is in May, June and July at the start of the rainy season, and in December and January after the rainy season.

Conclusions

The rainfall and evapotranspiration show a clear north-south trend in the Baro-Akobo basin, with less rainfall and ET in the north. Disconnecting the wetlands from the rivers will result in more flow in the Sobat river.