



Modelling a large watershed using the CEQUEAU model and GIS: The case of the Senegal River at Bakel

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The discharge on the Senegal River has been measured at the Bakel hydrometric station (situated at the border between Senegal and Mali) since the beginning of the 20th century, and a relatively long time series of flows is thereby available. Several hydrological studies have been performed on the Senegal watershed, all of which report a basin area of approximately $218 \times 10^3 \text{ km}^2$, on the basis of topographical maps drawn by IGN-France in the 1950s. The basin encompasses very different climatic conditions, reaching from yearly precipitation depths of 2000 mm in the South to 50 mm in the North.

The present study is concerned with the modelling of daily flows using the distributed hydrological model CEQUEAU and the geographic information system (GIS) IDRISI for a succinct representation of the physiographic parameters of the basin. We have used images of the SRTM radar (Shuttle Radar Topography Mission, US Geological Survey) at a horizontal resolution of $30''$ ($\approx 1 \text{ km}$) to define the boundaries of the watershed, and our results show that the basin area corresponding to the Bakel station has been largely underestimated in the past, indicating that an area of $418 \times 10^3 \text{ km}^2$ rather than $218 \times 10^3 \text{ km}^2$ should be employed. We have therefore recalculated the physiographic parameters of the basin, taking into account a large area situated in Mauritania, which had not been considered as part of the basin before. Considering the large area of the watershed, a hydrogeomatic module has been used for its discretisation and input into the CEQUEAU model, for flow modelling purposes. Simulations of daily flows from 1970 to 2006 give very good results (Nash coefficients over 0.8), and we can conclude that our modelling concept is more realistic than those used up to date.