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Discharge prediction in the Upper Senegal River using remote sensing data

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The Upper Senegal River, West Africa, is a poorly gauged basin. Nevertheless, discharge predictions are required in this river for the optimal operation of the downstream Manantali reservoir, flood forecasting, development plans for the entire basin and studies for adaptation to climate change. Despite the need for reliable discharge predictions, currently available rainfall-runoff models for this basin provide only poor performances, particularly during extreme regimes, both low-flow and high-flow. In this research we develop a rainfall-runoff model that combines remote-sensing input data and a-priori knowledge on catchment physical characteristics. This semi-distributed model, is based on conceptual numerical descriptions of hydrological processes at the catchment scale. Because of the lack of reliable input data from ground observations, we use the Tropical Rainfall Measuring Mission (TRMM) remote-sensing data for precipitation and the Global Land Evaporation Amsterdam Model (GLEAM) for the terrestrial potential evaporation. The model parameters are selected by a combination of calibration, by match of observed output and considering a large set of hydrological signatures, as well as a-priori knowledge on the catchment. The Generalized Likelihood Uncertainty Estimation (GLUE) method was used to choose the most likely range in which the parameter sets belong. Analysis of different experiments enhances our understanding on the added value of distributed remote-sensing data and a-priori information in rainfall-runoff modelling. Results of this research will be used for decision making at different scales, contributing to a rational use of water resources in this river.