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Regional scale hydrological modelling to assess surface water resources: a case study in the Medjerda basin, Northwest Africa

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The Medjerda River is a transboundary river basin located in Northeast Africa, with 33% of the drainage area in Algeria and its outlet in Tunisia. Within this catchment, Ain Dalia dam was built in Algeria to supply drinking water to the surrounding regions and nine dams were implemented in Tunisia with a storage capacity of 1056Mm3 in 2010. These reservoirs enable to irrigate 65288ha and to supply approximately 60% of drinking water in Tunisia (391Mm3 in 2016).
The surface water resources are mobilized through the dams, natural drainage network, pipelines and numerous pumping stations to external water demand sites in the North as well as in the coastal and the center of the country. The water resources management in such a complex system of water transfers requires first of all to assess the available water in the reservoirs and in the channels during a long reference period in order to predict the plausible future changes. In such case the hydrologic simulation is essential to understand the impact of anthropogenic changes like the construction of dams on the river network.
The semi-distributed model HEC-HMS was used to simulate the precipitation-runoff process. It includes the main parameters determining the water balance: transform model, routing model, loss model and reservoir model. Daily rainfall data during twenty years (1996/1997 to 2015/2016) were derived from the Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks - Climate Data Record (PERSIANN-CDR) at 0.25 degree. The daily meteorological data of temperature, wind speed and dew point temperature were obtained from the National Data Climatic Center (NDCC) in two stations for the same period. To assess the direct runoff SCS unit hydrograph and Clark unit hydrograph methods were performed separately in order to identify the most reliable for the Medjerda basin. The Soil Conservation Service (SCS) curve number (CN) model was used to quantify the amount of rainfall infiltrated into the soil by considering the land use and soil texture in each sub-basin. The Modified Puls model was used to evaluate the outflow within the reach, which consists of establishing the storage-discharge relationship.
The model was first simulated without taking into account the effect of dams and secondly considering their impact according to the year of beginning of use of each dam.