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Hydrological modeling of stream flow in small Mediterranean dams and impact of climate change : case study of wadi Rmel catchment

Hamadi HABAIEB (1), Taoufik HERMASSI (), Mohamed Moncef MASMOUDI (), and Nétij BEN MECHLIA ()
(1) INAT-INRGREF (habaieb.hamadi@yahoo.fr), (2) INRGREF (taoufikhermassi@yahoo.com), (3) INAT (masmoudi.med@inat.agrinet.tn), (4) INAT (netij.benmechlia@iresa.agrinet.tn)

Northern Tunisia is characterized by a semi-arid climate with an irregular and high spatial variability of rainfall. This situation is expected to aggravate under the expected increase of temperature and modification of rainfall regime predicted by most climate models for the Mediterranean region. Water is a major limiting factor for agriculture in Tunisia and mobilization of surface water resources is approaching its maximum. Dams are installed on almost all large watersheds and concerned also medium size and small ones. Hydrological functioning of such structures and their capacity to satisfy user's demand under the changing climate will be addressed using simple models and results will be discussed in this paper. The small catchment of Wadi Rmel is considered here for methodological development. This watershed (675 Km2) is situated in North-East Tunisia with average annual rainfall of 420 mm and was equipped in 1998 with a small dam. Data on rainfall collected at 12 rainfall stations during the period 1908 – 2012 are analyzed and used to build a coherent series of monthly rainfalls and spatially averaged on the watershed by the Thiessen method. In a second step, rainfall-runoff modeling was used to estimate runoff and water budget of the dam. Tow rainfall-runoff models GR2M and SWAT were considered and evaluated when using i) the rainfall observed at the dam and ii) the average rainfall on the watershed. The observed and simulated level in the dam were compared for both models and situations. Results showed that taking into account the spatial distribution of rainfall improved the simulation of stream flows and that SWAT model performs better than GR2M. The use of such models to make prediction of stream flow using downscaled climatic data from GCM will be discussed. Analysis of the results considering tow standardized sets of future greenhouse gas emissions used by the General Circulation Models for the IPCC 5th approximation RCP4.5 and RCP8.5 and three future horizons 2025, 2055 and 2085 will be presented.

Key words: Hydrogical modeling, streamflow, Rmel dam, Tunisia, climate change.