



Understanding the impacts on runoff of the spatial pattern of hydrometeorological variables in a changing climate: case study of the Segura River Basin (Spain)

Sandra G. Garcia Galiano (1), Juan Diego Giraldo Osorio (1), Claudia N. Tetay Botá (1), Mario A. Urrea Mallebrera (2), and Adolfo Mérida Abril (2)

(1) Technical University of Cartagena, Department of Civil Engineering, R&D Group of Water Resources Management, Cartagena, Spain (sandra.garcia@upct.es), (2) Confederación Hidrográfica del Segura (CHS), Plaza Fontes, 1. 30001. Murcia, Spain

Abstract: In basins of the southeast of Spain, such as the Segura River Basin (SRB), from the 1970s a sharp decrease in runoff has been observed. The SRB, affected by recurrent drought and water scarcity episodes, presents the lowest percentage of renewable water resources of all the Spanish basins. It was selected as a pilot basin in the context of the European Expert Group of Water Scarcity and Droughts. In the SRB, intensive reforestation has been carried out to halt desertification and erosion, which added to climate change and variability, do not allow the default assumption of stationarity in the water resources systems. Therefore, the study of effects in hydrometeorological series – annual and seasonal – should be addressed by nonstationary probabilistic models that allow to describe the time evolution of their pdfs (probability distribution functions). In the present work, a GAMLSS (Generalized Additive Models for Location, Scale and Shape) model is used to identify and increase knowledge of spatio-temporal trends in precipitation (P) and potential evapotranspiration (PET), at basin scale. Grids of observed P and estimated PET for the time period 1950-2009 are worked with. Several previous studies have addressed the potential impact of climate change in water supply systems, focusing on the sensitivity analysis of runoff to climate. In this paper, the issue at basin scale is addressed, working on both monthly and annual information. At annual mean scale, the effects of climate change in runoff are assessed based on historical hydrometeorological time series. An approach for the evaluation of climate elasticity, defined as the sensitivity of runoff to changes in rainfall and temperature, is applied considering plausible scenarios from Regional Climate Models (RCMs), provided by the European ENSEMBLES project. On a monthly basis, considering the use of a conceptual hydrological model with few parameters, the impacts on availability of water resources and their trend from historical data and projections, are assessed. The conclusions of this study represent a breakthrough in the development of methodologies to understand and anticipate the impacts on water resources systems, in the light of current and future climate conditions, respectively. These findings are expected to contribute to the management of conditions of water resources scarcity and droughts, as support to decision-making process by stakeholders.

Key words: water scarcity management, climate change, Segura River Basin.