Geophysical Research Abstracts
Vol. 18, EGU2016-17143-3, 2016
EGU General Assembly 2016

Detailed predictions of climate induced changes in the thermal and flow regimes in mountain streams of the Iberian Peninsula

José M. Santiago (1,*), Rafael Muñoz-Mas (2), Diego García de Jalón (1), Joaquín Solana (1), Carlos Alonso (1), Francisco Martínez-Capel (2), Jaime Ribalaygua (3), Javier Pórtoles (3), and Robert Monjo (3)

(1) Laboratorio de Hidrobiología. ETSI Montes, Forestal y Medio Natural. Universidad Politécnica de Madrid, Avda. Ramiro de Maeztu S/N, Madrid 28040, Spain, (2) Institut d'Investigació per a la Gestió Integrada de Zones Costaneres (IGIC), Universitat Politècnica de València. C/ Paranimf 1, Grau de Gandia, València 46730, Spain, (3) Fundación para la Investigación del Clima. C/ Tremps 11. Madrid 28040, Spain, (*) correspondence to: jmsant@picos.com

Streamflow and temperature regimes are well-known to influence on the availability of suitable physical habitat for instream biological communities. General Circulation Models (GCMs) have predicted significant changes in timing and geographic distribution of precipitation and atmospheric temperature for the ongoing century. However, differences in these predictions may arise when focusing on different spatial and temporal scales. Therefore, to perform substantiated mitigation and management actions detailed scales are necessary to adequately forecast the consequent thermal and flow regimes. Regional predictions are relatively abundant but detailed ones, both spatially and temporally, are still scarce.

The present study aimed at predicting the effects of climate change on the thermal and flow regime in the Iberian Peninsula, refining the resolution of previous studies. For this purpose, the study encompassed 28 sites at eight different mountain rivers and streams in the central part of the Iberian Peninsula (Spain). The daily flow was modelled using different daily, monthly and quarterly lags of the historical precipitation and temperature time series. These precipitation-runoff models were developed by means of M5 model trees. On the other hand water temperature was modelled at similar time scale by means of nonlinear regression from dedicated site-specific data. The developed models were used to simulate the temperature and flow regime under two Representative Concentration Pathway (RCPs) climate change scenarios (RCP 4.5 and RCP 8.5) until the end of the present century by considering nine different GCMs, which were pertinently downscaled.

The precipitation-runoff models achieved high accuracy (NSE>0.7), especially in regards of the low flows of the historical series. Results concomitantly forecasted flow reductions between 7 and 17 % (RCP4.5) and between 8 and 49% (RCP8.5) of the annual average in the most cases, being variable the magnitude and timing at each site. The largest predicted changes will occur in summer and the complete depletion of some river segments was forecasted. Winter was the only season predicted flows to remain mostly unaffected by climate change. Mean annual stream temperature was predicted to experience heavy increases, especially during the second half of the century, varying from 0.3 to 1.6°C (RCP4.5), and 0.8 to 4.0°C (RCP8.5). Annual maximum and minimum average temperature increases were predicted to be between 0.1 and 1.5°C (RCP4.5) and between 0.2 and 3.0°C (RCP8.5), and between 0.4 and 1.8°C (RCP4.5) and between 1.1 and 4.5°C (RCP8.5), respectively. The most important increases were predicted to occur in summer while winter will experience the lesser ones. Geology attributable differences on thermal regime were observed between rivers.

These results suggested the exacerbation of the principal characteristics of the Mediterranean climate-induced flow regimes with increased summer water temperatures and reduced low flows. Consequently, the synergistic effects of these climate induced changes may significantly impacts instream communities. Predictions of this study will be useful for designing habitat managing strategies for climate change adaptation at the local level. The revealed particularities reinforce the convenience of refining local predictions to design effective management policies.