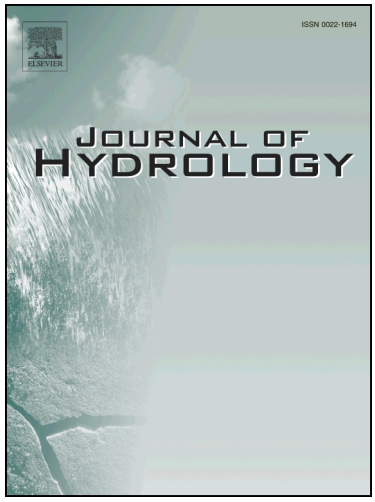


Research papers

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# Historical trends and high-resolution future climate projections in Northern Tuscany (Italy)

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**Abstract**

This paper analyzes the historical precipitation and temperature trends and the future climate projections with reference to the northern part of Tuscany (Italy). The trends are identified and quantified at monthly and annual scale at gauging stations with data collected for long periods (60-90 years). An ensemble of 13 Regional Climate Models (RCMs), based on two Representative Concentration Pathways (RCP4.5 and RCP8.5), was then used to assess local scale future precipitation and temperature projections and to represent the uncertainty in the results. The historical data highlight a general decrease of the annual rainfall at a mean rate of 22 mm per decade but, in many cases, the tendencies are not statistically significant. Conversely, the annual mean temperature exhibits an upward trend, statistically significant in the majority of cases, with a warming rate of about 0.1 °C per decade.

With reference to the model projections and the annual precipitation, the results are not concordant; the deviations between models in the same period are higher than the future changes at medium- (2031-2040) and long-term (2051-2060) and highlight that the model uncertainty and variability is high.

According to the climate model projections, the warming of the study area is unequivocal; a mean positive increment of 0.8 °C at medium-term and 1.1 °C at long-term is expected with respect to the reference period (2003-2012) and the scenario RCP4.5; the increments grow to 0.9 °C and 1.9 °C for the RCP8.5. Finally, in order to check the observed climate change signals, the climate model

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