



Changes in precipitation regime in Tuscany Region (Italy)

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Changes in the rainfall patterns cause relevant effects on ecosystems, on water resource availability and on human activities. In the last decades, research on precipitation trend analysis has become a topic of particular interest to guide water resources planning and management, as well as a signal of climate change. The first step of the analysis is the accurate validation and quality control procedure of the available rainfall data, recorded from 1916 to 2010, by rain gauges with at least 30 years of measurements, located in the Tuscany Region, over an area of about 23.000 km², in Central Italy. The time series of annual daily rainfall maxima recorded in 348 stations and of annual rainfall maxima of short duration (i.e. 1, 3, 6, 12, 24 hours) recorded in 149 stations are analyzed. In order to assess changes and possible presence of a trend in the precipitation patterns, three different statistical tests (Mann-Kendall, Spearman Rho and Cox–Stuart) for three different confidence levels ($\alpha=0.1, 0.05, 0.01$) are applied. The analysis on the whole 1916–2010 period is carried out. However, with the aim to estimate whether trends appear mainly critical during a particular time interval, rainfall time series are also subdivided and analyzed over three partially overlapping 35-years periods: 1916–1950, 1945–1980 and 1975–2010. The proposed statistical analysis does not show strong evidence of nonstationarity, a slight trend appears in a certain number of stations and only few stations show a significant trend. Particularly, there is a prevalence of trends absence in the precipitation regime in Tuscany Region for the period 1916–2010 and during the 35 years overlapping sub-periods, except in the period 1945–1980 where the presence of a slight higher percent of “significant negative trend” is observed. Afterward, in order to investigate the presence of geographic patterns or correlation with topography or other morphologic characteristics, the trends over the whole study area are detected through the Inverse Distance Weighted (IDW) interpolation technique. The results confirm a substantial absence of significant changes in precipitation regime in Tuscany Region. Few changes are detectable near the coasts and in the north-west area.