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Understanding changes in precipitation patterns in Tuscany

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In the context of climate change science is important to understand if hydro-meteorological and environmental variables are already subjected to modifications and eventually quantify these changes as trends or general non-stationary behaviors. An important issue related to this science is covered by the modification of precipitation regime and its implications in term of drought periods, water resources availability or flood risk modification. The general lack of long sequences of data and the frequent gaps in time series increase the difficulties in analyze long periods of climatic events. Here the authors provide a spatial analysis of trends of several indexes of precipitation regime. Through spatial interpolation techniques, a specific methodology is adopted to include a number of data higher than usual, which include the gauges with very short time series, even only 1 year long. The characteristics of precipitation regime analyzed include common indexes as Total Annual Precipitation (TAP) and number of wet days (precipitation > 1 mm), and other indexes able to characterize specific precipitation features like the Precipitation Concentration Index (PCI), the number of days with more than 10 mm of precipitation, the maximum number of consecutive dry days (precipitation < 1 mm), the Standardized Precipitation Index (SPI), the 1 day maximum precipitation. The study is carried out in the central part of Italy (Tuscany), using a dataset containing totally 896 recording rain gauges. The period of analysis, ranging from 1916 to 2008, is quite long in comparison to other studies. The territory analyzed is subdivided in a 1 km square grid, every time series of the indexes for every cell is investigated by means of the Mann-Kendall test, modified to take into account the autocorrelation, thus realizing a distributed trend analyses. The results show a significant reduction of the number of days with more than 10 mm of precipitation and of the maximum number of consecutive dry days. A less evident reduction of total annual precipitation can be hypothesize for a certain portion of territory. These results contrast with similar analysis realized with a dataset where the last 7 years were not included for which signals of changes in the precipitation regime were less appreciable.