

Analysis of Extreme Rainfall Trends in Central Italy

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Abstract : The trend of magnitude and frequency of extreme rainfalls seems to be different depending on the investigated area of the world. In this work, the impact of climate change on extreme rainfalls in Umbria, an inland region of central Italy, is examined using data recorded during the period 1921-2015 by 10 representative rain gauge stations. The study area is characterized by a complex orography, with altitude ranging from 200 to more than 2000 m asl. The climate is very different from zone to zone, with mean annual rainfall ranging from 650 to 1450 mm and mean annual air temperature from 3.3 to 14.2°C. Over the past 15 years, this region has been affected by four significant droughts as well as by six dangerous flood events, all with very large impact in economic terms. A least-squares linear trend analysis of annual maximums over 60 time series selected considering 6 different durations (1 h, 3 h, 6 h, 12 h, 24 h, 48 h) showed about 50% of positive and 50% of negative cases. For the same time series the non-parametrical Mann-Kendall test with a significance level 0.05 evidenced only 3% of cases characterized by a negative trend and no positive case. Further investigations have also demonstrated that the variance and covariance of each time series can be considered almost stationary. Therefore, the analysis on the magnitude of extreme rainfalls supplies the indication that an evident trend in the change of values in the Umbria region does not exist. However, also the frequency of rainfall events, with particularly high rainfall depths values, occurred during a fixed period has also to be considered. For all selected stations the 2-day rainfall events that exceed 50 mm were counted for each year, starting from the first monitored year to the end of 2015. Also, this analysis did not show predominant trends. Specifically, for all selected rain gauge stations the annual number of 2-day rainfall events that exceed the threshold value (50 mm) was slowly decreasing in time, while the annual cumulated rainfall depths corresponding to the same events evidenced trends that were not statistically significant. Overall, by using a wide available dataset and adopting simple methods, the influence of climate change on the heavy rainfalls in the Umbria region is not detected.

Keywords : climate changes, rainfall extremes, rainfall magnitude and frequency, central Italy

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