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High-resolution rain analysis in FVG, Northeastern Italy

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The Julian Alps, located in the region of Friuli Venezia Giulia (*FVG,* Northeastern Italy), record the heaviest precipitation annual totals in the country. Due to the complex orography and several other prone factors, effects of both prolonged and extreme precipitation can be particularly damaging in this area, causing debris flow, flash floods, avalanches. A proper planning of protection against natural hazards then requires the understanding of possible modification in rainfall characteristics. Since the mountain watersheds of the Alpine area are characterized by a very short time of concentration and hydrological response, extreme events are of particular interest, and rainfall analyses at sub-daily scale could not be appropriate.

The region counts on a dense ground-station network which is managed by the regional Civil Protection Agency, constituted by 2 main rain-gauges networks, based on CAE and Micros-SIAP technology, respectively; this last is co-managed by the OSMER-ARPA (*OSservatorio MEteorologico Regionale-Agenzia Regionale per la Protezione dell'Ambiente*) FVG. The networks count a total of about 200 rain-gauges; for some stations, data at 5-minute resolution are available since the 1996 (CAE network), whereas Micros-SIAP works continuously and at high resolution since the early 2000s. Over the last two decades, the temporal resolution of stations has been progressively increased up to 1-minute step.

In this work, we propose a comprehensive analysis of the available dataset at high temporal resolution (i.e. 30 min, 5 min and 1 min) in order to verify whether trends in very short rainfall duration are underway. At this aim, we first analyzed the continuous time series of data recorded by a sample of rain-gauges by the two networks. A preliminary analysis aims at verifying the consistency of the dataset at the higher resolutions. Statistical trends are then assessed by comparing two methods, i.e., the classical Mann-Kendall and the quantile regression at different thresholds and durations. The quantile regression method, which is increasingly used in hydrology, allows to detect changes in the tails of the rainfall distributions and to screen the whole rainfall time series, differently than the traditional methods that require a subset of data (e.g., the rainfall annual maxima).