EMS Annual Meeting Abstracts
Vol. 13, EMS2016-300, 2016
16th EMS / 11th ECAC

High-resolution analysis of 1 day extreme precipitation in a wet area centred over eastern Liguria

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The north of Tuscany and eastern Liguria have experienced several exceptional precipitation episodes and floods during the last century, with serious damage to human life and the environment. In recent years, the damage related to these extreme events appears to increase.
In this context, we perform a detailed investigation of observed 1-day precipitation extremes and their frequency distribution, based on a dense data set of high-quality, homogenized station records in 1951–2010.
Our dataset is composed of about 900 precipitation series coming from the databases of various regional agencies of central and northern Italy (ARPA Emilia Romagna, ARPA Liguria, SIR Toscana and ARPA Piemonte).
As well as for any other meteorological measure, physical signals in raw precipitation data series are often hidden behind measuring errors and non-climatic noise caused mainly by station relocation and changes in instruments, in the environment around the station or in the observing conventions. Therefore, we developed specific codes to control the possible outliers, identify periods of failure and malfunction of the weather station, and to control of the values recorded after periods of missing data (suspected cumulative values). Finally, we have subjected the longer series to the Craddock homogeneity test to verify the relative homogeneity of the records and, if necessary, we have homogenized them, to remove all signals of non-climatic origin.
After this process of control and homogenization of the data, we have about 400 validated precipitation series available for the study area centred on the eastern Liguria (8.25°E – 43.50 °N to 11.00°E – 45.00 °N, of about 30.000 km2) that we use to estimate very high quantiles (return levels) corresponding to 10-, 50- and 100-year return periods, as predicted by a generalized extreme value distribution. Return level estimates are produced on a regular high-resolution grid (30 arcsec) using a variant of regional frequency analysis combined with regression techniques. The results reflect the morphological complexity of the area of interest.