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An evaluation of dry spells in central Italy (Tuscany)

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Climate change affects precipitation regime and this can compromise water availability, especially in areas, like central Italy and Tuscany, characterized by a climate ranging from dry sub-humid to semi-arid and by a rainfall seasonality. Drought, in particular, is a creeping phenomenon often defined as an important temporary decreasing in water availability below the expected value in a certain period and in a specific area. Because the impacts of drought depend on the duration and extent of precipitation deficiency together with water demand, it is crucial to characterize this event also at local scale to better support the decision makers.
Among several methodologies existing to analyse drought periods, one of the most applied is the evaluation of dry spells. The aim of this study is to analyse long-term time series (1955-2015 period) of rainfall data for evaluating both frequency and persistence of drought events in Tuscany region and their trends at seasonal and annual level. The analysis is carried out using daily records from 38 rain gauges. A dry spell can be defined in different ways depending on its length and according to the rainfall amount thresholds used to define the dry day. Here the 75th and 90th percentiles are used as critical length of dry spells while three precipitation thresholds are selected: 1, 5 and 10 mm; the former considering the dry day index definition, the second taking into account the minimum amount of water needed for the vegetation growth, the third because lower thresholds may not necessarily conclude a drought episode. To detect seasonal trends, a 10-year moving window was used in order to overcome statistical problems related to the rarity of critical dry spells.
At annual level, main results showed a prevalence of positive trends in frequency, mean and maximum length of dry spells, both for the three thresholds and the 75th and 90th critical lengths. However, few of these trends were statistically significant ($p < 0.05$). Seasonal analysis showed a prevalence of positive significant trends during winter, spring and summer. An opposite behaviour was found in autumn, when 34 out of 38 series reported significant decreasing trends.
Mediterranean area is considered a climate change Hot-Spot from the viewpoint of vulnerability and from that of climate response. An increase in dry spells especially in seasons like winter and spring, important for water recharge and agriculture, can exacerbate the problems linked to water management and demand during the dry season.