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Review and meta-analysis of trends in precipitation regime in Italy

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Research to detect changes in climatic variables has become a topic of particular interest to observe signals of climate change as well as to understand drivers of modifications in water resources availability and suggest management adaptations.
We specifically focus on Italy, outlining the "state of the art" of the Italian precipitation regime through a review of 46 published studies on rainfall trend analyses. The aim is to combine a large body of knowledge in a single review and to explain the main patterns of rainfall changes occurred in the last decades. The review results are analyzed for the entire Italian peninsula and separately for three macro areas: North, Central and South&Islands. The attention is focused on three indexes at the annual and seasonal scale: mean Total Precipitation (TP), number of Wet Days (WDs) and Precipitation Intensity (PI). Two other aspects are briefly investigated: drought and extreme rainfall events. Different geographic areas, time series length and number of stations, are taken into account using a "weight factor Fi". Subsequently, for each index, findings in terms of increasing or decreasing trends are collected into five principal categories: Negative (N), Negative Significant (NS), Positive (P), Positive Significant (PS), and No Trend (NT).
Overall, there is an agreement about the tendency of the WDs that are decreasing on the whole Italy, with some discrepancies regarding the spring and the summer seasons. This is substantially in agreement with the tendency of the TP, especially at annual scale where the presence of a decreasing trend is detected. An opposite behavior is detected for PI, which increases both on an annual and on a seasonal basis. It is worth to point out that PI is analyzed just in few studies and it is strongly influenced on the classification in precipitation intensity intervals. A general finding is that signal to noise ratio on precipitation metrics is quite low, which hampers a clear definition of changes in rainfall occurred in Italy, especially for extreme events the large variability in space and time precludes robust conclusions despite the long-term records available.