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Circulation types and extreme daily precipitation in the Italian Peninsula

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In the Italian Peninsula the complex topography, the latitudinal extension and the interaction with Mediterranean Sea yield a high precipitation variability with several precipitation regimes and with a very complex climate variability. In Italy as well as in whole the Mediterranean Basin the precipitation shows a huge spatial and temporal variability with frequent dry spells and heavy precipitation events inducing flash flood and many related hazards. In the last year, many efforts have been devoted to analyze the linkages of precipitation with atmospheric circulation, thanks also to the contribution of COST (European Cooperation in Science and Technology) Action 733.
The present study was focused to verify the relationship between circulation types and heavy rainfall (90th and 95th percentile) for Italian Peninsula on a monthly basis and on a regional scale.
For this purpose, a circulation type classification derived from the COST733class-1.2 software package using the principal component transversal method was selected to have the best linkage with daily precipitation over Italy when computed on mean sea level pressure and nine types. Twenty-six meteorological stations distributed across the Italian landmass covering the period September 1979 to December 2008 was analyzed for daily precipitation.
The 26 weather stations used in this study highlighted that only few circulation types were favourable to the occurrences of heavy precipitation events with a strong spatial and seasonal heterogeneity. South westerly flow due to a deep low between Gulf of Lyon and Gulf of Genoa was often related to high risk of severe precipitation on central-northern Italy, while the southern Italy resulted more vulnerable to a cut-off circulation over the Sicilian Channel, particularly during the autumn and the winter season. In addition, some positive trend in the last thirty years were detected in circulation type frequencies for some season according to the increase of extreme precipitation events on Mediterranean Area.