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Synoptic ingredients associated to flash flood producing storms – A comparative analysis at European scale.

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Within the framework of the European project HYDRATE, this contribution is devoted to the understanding of the main synoptic ingredients that lead to flash flood producing storms in three hydrometeorology observatories representative of three different climatic European regions. In Romania, flash floods occur in any season, with highest frequency in summer and early autumn. The diversity of physical geography of Romania induces pronounced regional patterns to flash floods, raising many scientific and practical challenges. In Italy, the region is representative of the north-eastern side of the Alps. Here the flash floods occur most likely during the summer and the fall season. The latter region, in the South-East part of France, experiences flash flood mainly in autumn..
Several studies, mainly based on the analysis of simulated fields of few flash-flood events, highlight specific synoptic environments. The objective of this paper is to generalize these event-based analysis using weather-typing approaches. The Grosswetterlagen (GWL) classification is used as well as a weather classification based on the k-means clustering algorithm (Michelangeli et al., 1995). A short comparison is proposed in order to highlight the strength and the weakness of each classification. The results show that the GWL classification properly explains inter annual variability of mean annual rainfall; nevertheless the intra class variability is much lower.

Then, for each weather type and based on the ERA40 fields, composite mean fields are plotted and analyzed in order to highlight the main synoptic factors. The circulation is plotted at Z-700hPa, and the vertically integrated moisture flux, wind, and potential vorticity fields are analyzed.
The analysis shows that the precipitation patterns are strongly correlated to the intensity and the direction of the wind. The location of the trough and its intensity over the Great Britain are also main synoptic features.
For each rainy class, composite maps of anomalies in moisture flux, wind and geopotential fields are proposed to point out the specific meteorological characteristics associated to : i) the flash-flood event; ii) the days before the events.
It is found that each class has is specific synoptic environment, the differences between each class are mainly explained by the moisture flux intensity and orientation. These differences lead to different precipitation patterns as highlighted by composite maps of precipitation obtained for the corresponding precipitation events.

The findings are in good agreement with the literature. It therefore improves our understanding of flash flood triggering environment highlighting the differences between different rainy weather regimes. It especially allows the analysis of the identification of critical meteorological environments for the previous days before the flash-flood event.