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Flash floods in Portugal in the period 1950 – 2003 and their interconnection to large scale atmospheric drivers

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This study investigates large-scale atmospheric circulation influence on flash floods in Portugal. For this aimed, weather types (WTs) in a northeastern North Atlantic sector are used and flash floods between 1950 and 2003 were detected in 6 hydrographic basins: 3 in the North of Portugal (Corgo, Paiva and Sabor) and another 3 in the South of Portugal (Cobres, Degebe and Xarrama). An adapted methodology for flash flood detection on daily discharges is useful. A total of 131 flash floods were detected: 35 in the northern basins and 96 in the southern basins. WTs are developed using the NOAA 20th Century Reanalysis V2.

The sea level pressure composites for flash flood days by WT reveal the large-scale atmospheric patterns underlying their occurrence. Thus, 6 WTs relevant to the weather conditions in Portugal were identified: A – anticyclonic; AA – dual anticyclonic; E – easterly wind; R – ridge; NW – northwesterly wind; C – cyclonic. The results show that the C type was strongly associated with flash flood days in the northern basins. The C type pattern features deep low pressure systems north of Iberia, much stronger than average for this WT. For the southern basins, the C type still shows the highest relevance for flood occurrence, but to a lesser extent, since the E and AA types also acquire some importance. The flash flood inducing AA type events are characterized by atypical largely zonal troughs extending towards Portugal. The flash flood inducing E type events hint at the occurrence of anomalously strong cut-off low pressure systems over southern Portugal. Although the significance of these systems to precipitation in Portugal was addressed in previous studies, a systematized assessment of their role on flash flood occurrences is herein provided for the first time.

The present flash flood detection algorithm is applicable to regions where there is insufficient or no hourly data available. A better understanding on the conditions underlying flash floods contribute to the prevention and forecast of resulting weather, with disastrous consequences for populations.