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Assessment of realistic nowcasting lead-times based on predictability analysis of Mediterranean Heavy Precipitation Events

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Operational quantitative precipitation forecasts (QPF) are provided routinely by weather services or hydrological authorities, particularly those responsible for densely populated regions of small catchments, such as those typically found in Mediterranean areas prone to flash-floods. Specific rainfall values are used as thresholds for issuing warning levels considering different time frameworks (mid-range, short-range, 24h, 1h, etc.), for example 100 mm in 24h or 60 mm in 1h. There is a clear need to determine how feasible is a specific rainfall value for a given lead-time, in particular for very short range forecasts or nowcasts typically obtained from weather radar observations (Pierce et al 2012). In this study we assess which specific nowcast lead-times can be provided for a number of heavy precipitation events (HPE) that affected Catalonia (NE Spain).

The nowcasting system we employed generates QPFs through the extrapolation of rainfall fields observed with weather radar following a Lagrangian approach developed and tested successfully in previous studies (Berenguer et al. 2005, 2011).Then QPFs up to 3h are compared with two quality controlled observational data sets: weather radar quantitative precipitation estimates (QPE) and raingauge data. Several high-impact weather HPE were selected including the 7 September 2005 Llobregat Delta river tornado outbreak (Bech et al. 2007) or the 2 November 2008 supercell tornadic thunderstorms (Bech et al. 2011) both producing, among other effects, local flash floods. In these two events there were torrential rainfall rates (30' amounts exceeding 38.2 and 12.3 mm respectively) and 24h accumulation values above 100 mm.

A number of verification scores are used to characterize the evolution of precipitation forecast quality with time, which typically presents a decreasing trend but showing an strong dependence on the selected rainfall threshold and integration period. For example considering correlation factors, 30' precipitation forecasts showed some skill (improvement over persistence) for lead times up to 60' for moderate intensities (up to 1 mm in 30') and up to 2.5h for lower rates (above 0.1 mm). However an important event-to-event variability has been found as illustrated by the fact that hit rates of rain-no-rain forecasts achieved the 60% value at 90' in the 7 September 2005 and only 40' in the 2 November 2008 case. The discussion of these results provides useful information on the potential application of nowcasting systems and realistic values to be contrasted with specific end-user requirements. This work has been done in the framework of the Hymex research programme and has been partly funded by the ProFEWS project (CGL2010-15892).

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