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Mesoscale short-range ensemble predictions for three high impact weather events in the Western Mediterranean

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The Western Mediterranean is a well known area where active cyclones regularly develop leeward of the major mountain ranges that surround the Mediterranean basin, such as the Atlas, the Pyrenees and the Alps. When leeward cyclogenesis is reinforced by other mechanisms such as baroclinic growth or adiabatic contributions, the resulting cyclone has potential to become intense and produce hazardous weather on the highly populated Mediterranean seashores. Predicting severe weather, such as strong winds and heavy rains, that may result from these intense cyclones becomes a great challenge due to the multiple mechanisms involved in their genesis and evolution. Numerical ensemble prediction systems (EPS) are used in the major forecasting offices for medium-range forecasts to cope with the ever-present sources of error in the forecast system and to produce a statistical estimate of the possible future states. The generation and interpretation of EPS for the mesoscale pose new problems with respect to the global scale prediction owed principally to the largely unknown analysis errors and the larger model uncertainties.

This study proposes the analysis of three intense lee cyclogenesis events by means of various tests of EPS configurations (multi-physics, multi-model and perturbing initial and boundary conditions) applied to the Western Mediterranean to investigate the predictability of the factors that favour the development of these phenomena. To concentrate on sensible weather, EPS verification focus mainly on near-surface weather variables, especially precipitation, 10-m wind and sea level pressure for the three considered episodes.