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The performance of Mediterranean intense cyclone sensitivity climatologies tested against a human severe weather meteorologist

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Sensitivity analysis highlight precursing atmospheric features that have a relevant effect on a particular forecast aspect of interest. In particular, sensitivity fields determine how changes to an initial condition causes a modification in the forecast. Conclusions derived from such analyses provide basic guidance to decision makers regarding the design of an efficient routine observing network and targeted observation strategies. Therefore, verification is essential to ensure the reliability of the sensitivity products and add confidence to network and field campaign managers.
Previous studies of ensemble sensitivities of Mediterranean intense cyclones showed that in average, the evolution of intense Mediterranean cyclones 24h prior to their maturity stage depends largely on structures located over Western Europe, the Northern African lands and parts of east North-Atlantic ocean. These results complement and are in agreement with sensitivity results obtained with the adjoint model in previous studies. In order to quantify the reliability of the sensitivity results derived from the available adjoint and ensemble sensitivity climatologies, a verification testbed for sensitivity fields is set up. Numerical experiments with the NCAR Advanced Research WRF ARW model are conducted for the 15 most intense Mediterranean cyclones of the ERA-40 database to test the ability of each method in identifying areas where perturbations in the initial conditions derived from the sensitivity fields lead to a greater impact on the forecast of the intense cyclone. For the sake of credit of the verification results, the performance of the available sensitivity climatologies is tested against a reference sensitivity proxy consisting of an experienced severe weather meteorologist who was asked to indicate the region where a perturbation in the initial conditions would have the largest impact on the forecasted cyclone's depth. Results confirm the skill of the human sensitivity fields against the other automatic methods and show the moderate advantage of adjoint sensitivity method against the ensemble sensitivity technique.