

EGU21-6225

<https://doi.org/10.5194/egusphere-egu21-6225>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Improving heavy precipitation forecasting over the western Mediterranean: Benefits of stochastic techniques for model error sampling

**Alejandro Hermoso**<sup>1</sup>, Victor Homar<sup>1</sup>, and Robert Plant<sup>2</sup>

<sup>1</sup>Universitat de les Illes Balears, Physics, Palma de Mallorca, Spain (alejandro.hermoso@uib.es)

<sup>2</sup>Department of Meteorology, University of Reading, Reading, United Kingdom

The western Mediterranean region is frequently disrupted by heavy precipitation and flash flood episodes. Designing convection-permitting ensembles capable of accurately forecasting socially relevant aspects of these natural hazards such as timing, location, and intensity at basin scales of the order of a few hundred of squared kilometers is an extremely challenging effort. The usual forecast underdispersion prevailing at these scales motivates the research of sampling methodologies which are able to provide an adequate representation of the uncertainties in the initial atmospheric state and its time-integration by means of numerical models. This work investigates the skill of multiple techniques to sample model uncertainty in the context of heavy precipitation in the Mediterranean. The performance of multiple stochastic schemes is analyzed for a singular event occurred on 12 and 13 September 2019 in València, Murcia, and Almería (eastern Spain). This remarkable and enlightening episode caused seven casualties, the flooding of hundreds of homes and economic exceeding 425 million EUR.

Stochastic methods are compared to the popular multiphysics strategy in terms of both diversity and skill. The considered techniques include stochastic parameterization perturbation tendencies of state variables and perturbations to specific and influential parameters within the microphysics scheme (cloud condensation nuclei, fall speed factors, saturation percentage for cloud formation). The introduction of stochastic perturbations to the microphysics parameters results in an increased ensemble spread throughout the entire simulation. A conclusion of special relevance for the western Mediterranean, where local topography and deep moist convection play an essential role, is that stochastic methods significantly outperform the multiphysics-based ensemble, indicating a clear potential of stochastic parameterizations for the short-range forecast of high-impact events in the region.