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Impact of GPS-Integrated Water Vapour assimilation in the simulation of heavy precipitation events in the western Mediterranean region

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Water vapour is considered one of the most variable components of the atmosphere, given the manifold multiscale mechanisms through which it is supplied. Being an essential component in the development of deep convection, an adequate description of its temporal and spatial distribution is crucial to improve the prediction of heavy precipitation events in weather prediction models. The assimilation of precipitable water retrievals, with a high sampling resolution in model simulations is, thus, envisioned as a promising method to reduce model uncertainties related to the misrepresentation of the humidity fields.

The presented research work investigates the impact of assimilating GPS-derived Integrated Water Vapour (IWV) measurements on the simulation of heavy precipitation episodes in the western Mediterranean region.

A GPS-derived IWV data set, specially homogenized for the Hydrological cycle in the Mediterranean eXperiment (HyMeX) with a dense coverage of the Mediterranean basin and a high temporal resolution (5 minutes) is assimilated in the COSMO numerical weather prediction model. The COSMO model with three different model grid spacings (7 km, 2.8 km and 500 m) is employed to reproduce selected Intensive Observation Periods (IOPs) that occurred in the western Mediterranean region during the autumn of 2012. Observational data sets obtained from CMORPH, MODIS or the dense network of HyMeX are used to validate our model output. In anticipation to the data assimilation, the impact of refining the model horizontal resolution on the simulated moisture fields and convective processes is investigated. Results show relevant differences among simulations concerning the distribution and evolution of atmospheric moisture, hence convection.