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Towards a better understanding of the role of topography in the motion of severe storms in Catalonia: First results with C-band dual-Doppler analysis

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In the northeastern region of Spain's Iberian Peninsula, Catalonia's convective activity mainly occurs during summer and autumn and most of the thunderstorms tend to produce severe weather, causing economical losses to the population. In some of the cases, the storms have unexpected propagation characteristics, likely due to a combination of the complex topography, the sea-land interaction (forced propagation), and their own autopropagation mechanisms related to their internal dynamics.

The Meteorological Service of Catalonia (SMC) utilizes real-time radar reflectivity data to identify deep convection with the operational storm identification, tracking and nowcasting, a centroid-type tracker system which is based on the Storm Cell Identification and Tracking algorithm (SCIT). This algorithm, along with the new Lightning Jump tool, helps to understand the life cycle of the convective cells and to forecast severity in operational tasks. The SMC plans to implement a new version of the nowcasting radar tool based on the recent studies of the authors. Another option for improving the identification and nowcasting skill is the use of the 3D wind field retrieved from radar volumes. Currently, the SMC only uses the lowest 2D radial velocity fields in post-event analysis, when the forecaster is notified about the occurrence of some phenomena such a downburst or/and tornado. The present work investigates whether the nowcasting of the anomalous propagation characteristics is improved via 3D wind field retrievals, which may provide a better dynamical understanding of the thunderstorms.

In the present study, we explore the capabilities of the XRAD (Xarxa de RADars) meteorological radar network at the SMC, in Catalonia, to retrieve dual-Doppler wind fields by using a free software program within The Lidar Radar Open Software Environment (LROSE) project (Colorado State University and National Center for Atmospheric Research-Earth Observing Laboratory); the Spline Analysis at Mesoscale Utilizing Radar and Aircraft Instrumentation (SAMURAI).

Two different splitting severe storms and a channeling tornado case in Catalonia are analyzed to study the role of the topography in the dynamics of these complex storms. The limitations of retrieving dual-Doppler winds with operational radars tied to fixed scanning strategies and over complex terrain area will be presented.