OBSERVATIONAL AND NUMERICAL STUDY OF THE SEVERE CONVECTIVE STORM OF 29th OCTOBER 2013 IN THE BALEARIC ISLANDS

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Mesoscale convective systems organized as squall lines occasionally occur in the Balearic Islands (Spain) during the fall and these can inflict serious disruptions in populated areas owing to the high precipitation rates and violent wind gusts. One of such high impact weather situations occurred on 29th October 2013 when a NE-SW elongated squall line developed to the west of the islands ahead of an advancing cold front and then crossed the south of the archipelago. We first provide an observational characterization of the event based on surface reports, remote sensing products, radiosoundings and synoptic information. We also achieve, by means of numerical experiments, new insights into the kinematic and thermodynamic factors that governed the genesis and evolution of the linear convective system. Radar and satellite data confirm the fast-moving and linear character of the system, more evident over maritime areas than over land. However, transition into a bow echo structure seems unlikely except in the later stages when the system already passed the island of Mallorca. The synoptic setting at mid-upper tropospheric levels was dominated by a cold trough extended over Western Europe associated with a jet stream along its eastern flank. Convection evolved under the right-entrance region of the jet, and initiated under the crucial influence of a concomitant surface low developed over the Mediterranean Sea ahead of the cold front. The low not only cooperated with the upper-level dynamical forcing to erode a capping inversion initially present over the Balearics and to moisten the atmospheric column above, but also shaped and enhanced a convergence line along which the first convective cells grew and self-aggregated. This scenario is confirmed by the numerical simulations of the case, which also emphasize a relevant action of the regional topography in terms of favouring the previous maritime convergence through the mesoscale modulation of the low-level flow. Additional simulations show that (i) the destabilization of the low-level air mass necessary for triggering and feeding an organized convective system on 29th October 2013 was attributable to the intense evaporation from the Mediterranean that took place during the hours immediately before the event and (ii) regardless of the synoptic and mesoscale dynamical forcing, prescription of accurate sea surface temperatures appears to be critical in this kind of situations for a successful fine-grid numerical forecast of the convective mode, degree of severity, timing and track of the precipitation system.