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Using Vertical Integrated Liquid Density from a Weather Radar Network to Nowcast Severe Events

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This contribution has the main goal of identifying, characterizing, tracking and nowcasting severe thunderstorms using the Density of the Vertical Integrated Liquid (DVIL). The DVIL can synthesize all the volumetric information of a column of the weather radar in a 2D plane. This is, it estimates the quantity of precipitable liquid water in the column but, besides, it reduces the dependency on the height of the column. This point becomes crucial to give an appropriate weight of potential danger to thunderstorms that occurred out of the typical convective season. . This is particularly useful to improve the decision-making and early warning in critical environments and infrastructures, like airports and air traffic management (ATM). The usage of DVIL has multiple advantages, for instance, reducing the computational time consumed on the analysis of large areas. Also, to obtain a good and simple description of the potentially dangerous thunderstorms, and to have an easily integrating into other systems for ATM decision making. The main disadvantage is a less precise characterization of the atmospheric objects than with the whole radar volumetric data. Nevertheless, the differences are scarce and do not produce any significant inconvenience in the procedure. The algorithm first identifies those areas exceeding a DVIL threshold, which is established for thunderstorms with a certain probability of producing severe weather. The characterization module turns out simpler than in other methodologies because of the data type (2D instead of 3D reflectivity fields), but it can be combined with other data types if needed. The tracking and nowcasting procedure obtain the past trajectory of the thunderstorm and then use it to weather forecast from 5 to the next 60 minutes, with 5 minutes steps. Different convective episodes that have affected the proximity of Italian and Spanish airports have been analysed to evaluate the following points: (1) the performance of the correct identification of potentially dangerous thunderstorms, (2) the capability of tracking the path and characterizing the life cycle of those storms, and (3) the ability of the nowcasting to correctly forecast the time and the most dangerous area.

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