

TORNADIC STORMS IN THE IBERIAN MEDITERRANEAN AREA AND BALEARIC ISLANDS: STUDY OF UPPER AIR CONDITIONS

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Catalonia (NE Spain) is one of the south-western European regions where tornadoes and waterspouts are more frequent (Antonescu *et al.*, 2016), especially in Barcelona and Tarragona metropolitan areas. Due to its social and economical impact, sounding-derived parameters associated with tornado and waterspout events were analyzed in Rodríguez and Bech (2017), with the aim of improving meteorological forecast and surveillance tasks.

In the present communication, the region of study considered is the Iberian Mediterranean area and Balearic Islands (Figure 1). In this zone of 100,382 km² (20% of Spain's surface) there are registered 52% of Spain tornadic events between 2000 and 2012 (Gayà, 2015). Although they usually are weak, around 5% of tornadoes in this area are significant, EF2 or greater in the Enhanced Fujita scale (Doswell *et al.*, 2009).

This study has been performed using sounding data from Barcelona, Palma, Palma – son Bonet, Zaragoza and Murcia (Spain), Gibraltar (United Kingdom) and Nîmes (France) radiosonde stations (Figure 1). To assign a sounding to each tornadic event a new version of the proximity-inflow method (Rasmussen and Blanchard, 1998) has been used. In total, 182 soundings corresponding to 46 EF0, 24 EF1, 8 EF2+ and 14 waterspout events have been analyzed.

We have considered Surface-Based Convective Available Potential Energy (SBCAPE) and wind-shear (WS), which are commonly used in storm forecasting. Several combined parameters have also been analyzed, as Vorticity Generation Parameters (VGP), Universal Tornadic Index (UTI) (Taszarek and Kolendowicz, 2013) and Vertical Wind Maximum Shear (WMAXSHR) (Taszarek *et al.*, 2017).

We have checked that SBCAPE data present a large range of values in tornadic storms, which it indicates that it is not a good tornado forecasting parameter. Nevertheless, it is important to remark that waterspout environments are usually associated with highest SBCAPE 0-3 km values than tornado environments. Furthermore, large wind shear values are related to stronger tornadoes, which it is summarized by high WMAXSHR (over 500 m² s⁻²). UTI presents a significant correlation with the intensity of tornadoes and also with the probability of tornadic storms. It has been also verified that UTI values over 0.3 are related to favourable environments for tornadic events, as it is presented in Taszarek and Kolendowicz (2013) and Rodríguez and Bech (2017).

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Fig. 1.- Area of study (in green) and sounding stations used (red crosses), with its ID number.

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