Supercell Pre-Convective Environments in Spain: a dynamic downscaling of ERA-5 Reanalysis

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**OBJECTIVES**

1. Create a supercell-upper-air environment climatology in Spain to know the average environmental conditions for supercell formation.
2. Improve the prediction of severe weather events in Spain.

**INTRODUCTION**

- Supercells are the least common type of thunderstorm, however it is responsible for most severe weather reports: hail greater than 5 centimetres, tornadoes and/or high-lightning activity (greater than 200 lightning per minute).
- During the last decades, several studies have analysed upper-air conditions that favour the development of severe thunderstorms (Rasmussen and Blanchard, 1998; Groenemeijer and van Dellen, 2007; Taszarek et al., 2007). Most of them used proximity sounding data, but in last years studies developed with reanalysis data are more common due to increase in spatial and temporal resolution of models.

- **Data**
  - Supercells events (703 events, in Figure 1) were retrieved from the Spanish Supercell Database (Martín et al., 2020) for the 2014-2019 period.
  - 9-km, 54 pressure levels and 1-hourly temporal resolution ERA-5 reanalysis downscaling by WRF-ARW model was used to obtain vertical temperature, dew point and winds profiles for each supercell event.
  - The selection of the thermodynamic and kinematic parameters was based on similar previous studies (Rasmussen and Blanchard, 1998; Romero et al., 2007; Pückl et al., 2015; Rodríguez and Beck, 2020): Temperature at 2-meters (T2M) and Dew-Point Temperature (DWPT), Lapse-Rate (LR), Convective Available Potential Energy (CAPE), Wind-Shear (WS), Storm-Relicative Helicity (SRH) and composite parameters (SCP, SHP and STP).
  - Calculations of the parameters were carried out using Sounding and Hodograph Analysis and Research Program in Python (SHARP) and data analysis in R.

**CONCLUSIONS**

1. Spanish supercells form, on average, in 1000 J/Kg CAPE, 18 m/s WS06 and 90 m2/s2 SRH03 environments.
2. The majority of Spanish supercells are developed in the Warm Season due to the values of T2M and DWPT.
3. The average values of thermodynamic and kinematic parameters of Supercell formation in Spain are somehow similar to the ones measured in the USA, however, the average values of the main composite parameters differ significantly.
4. This study will help forecasters to better predict severe weather in Spain.