1. INTRODUCTION

A better understanding of wildfires is necessary both from physical and operational points of view, which are the goals of the CILIFO (Centro Ibérico para la Investigación y Lucha contra Incendios Forestales) Interreg POCTEP project (http://cilifo.eu). Lightning are the main natural source of wildfires and an important contributor to burned areas in many regions. In 2017, devastating forest fires were reported in Portugal. The fires near Pedrogão Grande created a huge wall of flames, killing at least 60 people.

The goal of this study is to discuss the atmospheric conditions that were supportive of lightning flashes to cause a fire during this event, as well as to check the possibility to correctly diagnose cloud-to-ground flashes using high resolution simulations with the non-hydrostatic atmospheric Meso-NH model (Lac et al., 2018).

2. DATASET

A set of meteorological data was used to validate the model results and to describe the prevailing atmospheric environment during the afternoon of 17th June 2017 over central Portugal. The Portuguese Institute for Sea and Atmosphere (IPMA) provided the data for this study.

3. NUMERICAL MODELLING [ Meso-NH model configuration]

<table>
<thead>
<tr>
<th>Horizontal configuration</th>
<th>Vertical configuration</th>
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</thead>
<tbody>
<tr>
<td>Two nested domains</td>
<td>50 levels</td>
</tr>
<tr>
<td>Large domain with 4km horizontal resolution.</td>
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<tr>
<td>Inner domain with 1km resolution.</td>
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</table>

The model represents explicitly the electrical activity of the clouds, through the activation of the Cloud Electrification and Lightning Scheme (CELLS; Barthe et al., 2012).

The possibility of the afternoon heating create a convective instability condition can be observed in the sounding at 1200 UTC (Fig. 1). Temperatures around 30°C are observed in the lowest hundreds of meters, reaching almost 35°C at surface. As the air is heated up to reach the level of free convection, instability can be released and the possible cloud vertical growth is limited to the freezing level around 600 hPa, and cloud tops above 12 km. It is noteworthy the presence of a drier layer at lower troposphere having approximately 3 km depth.

4. RESULTS

The description of the electrical state of a thunderstorm is based on the monitoring of the electrical charge densities, the computation of the electric field and the production of lightning flashes. The cloud charging involves mostly the non-inductive mechanism, and both Intra-Cloud (IC) and Cloud-to-Ground (CG) flashes are considered. The CELLS scheme provides a realistic representation of the electrical properties of precipitating cloud systems from representing the charge density of each hydrometeor.

5. CONCLUSIONS

The dry thunderstorm environment configured a perfect scenario for the natural ignition and evolution of some fires, since lightning activity came from high-base thunderstorms with relatively dry air at lower levels favouring the evaporation of rain before it reaches the ground, as well as intense outflows. Therefore, the fires on 17th June 2017 occurred in an exceptional hot day, with fire ignitions in places with complex terrain and a favourable vegetation state producing uncontrolled wildfires. The spatial distribution of the simulated CG lightnings showed a good agreement with the lightning strokes obtained from the national lightning detection network. Besides the identification of favourable conditions for the occurrence of wildfires, this study also introduces a possible application of the Meso-NH electrical scheme, namely the study of forest fire ignition by lightning strokes.

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