



## **Numerical and experimental study of extreme fire behaviour processes: fire lines and fire whirls**

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Under project FireStorm - Weather and Behaviour of Fire Storms, which aims at understanding several uncomprehend fire-related phenomena that typically occur in Extreme Wildfire Events (EWE), as well as the climatological and meteorological conditions which are associated with these events in Portugal in 2017, two main topics will be presented: experimental and numerical study a) of fire lines and b) of fire whirls. These topics are addressed to tasks number 3, 4 and 6 of the project.

The behaviour of fire lines will be analysed, starting by the case of October the 15<sup>th</sup> of 2017 in Quiaios, where two separate parallel fire lines experienced an uncontrolled increase in their spread, due to their alignment with the wind's direction. This event motivated several experimental and numerical studies to fire lines: ADAI conducted experiments on the progression of two fire lines with a setup similar to the Quiaios fire, with and without wind, as well as with variable distance between the fire lines. IDMEC numerically studied the behaviour of a fire line under non-perpendicular wind conditions, and has been developing a library for Star-CCM+ that simulates bi-dimensional fire line propagation, including the combustion process.

Fire whirls will also be discussed, starting by a brief description of the phenomenon and videos of two factual cases that occurred in Arganil (in October of 2017) will be showcased. Subsequently, the experimental work currently being developed by ADAI on the several flame regimes observed in fire whirls and the conditions in which these may occur will be presented. These flame regimes were firstly distinguished and separated for a small scale and ADAI is increasing the study to a medium-high scale. The study on the origin of vorticity in buoyancy driven whirls that has been developed by IDMEC will be mentioned, as well as the experimental studies developed by ADAI that have been numerically reproduced by IDMEC.

Lastly, the main conclusions retrieved from the studies that have been carried out thus far will be presented, along with the future work to be developed by both institutions.