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Modelling forest fire weather risk in Continental Portugal

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Along with other Southern European countries, Portugal has, each year, enormous damages resulting directly and/or indirectly from forest fire activity, with obvious ecological, financial and social implications. In the last thirty years, more than 3 million hectares of the Portuguese territory have been burnt, placing Portugal on the top-five European Countries most affected by forest fires.

Prevention and planning arise as one the most important strategies to minimize the consequences of these hazardous events. To fulfil those goals, information, either to be used by decision makers or for public awareness plays a major role. Thus, the importance of the development and use of different forest fire danger estimation systems is clearly obvious. The Canadian Forest Fire Weather Index System (FWI), developed by the Canadian Forestry Service is based on daily values of temperature, relative humidity, wind at noon and 24-hour accumulated precipitation and is used to estimate the fire risk in Portugal.

Advances in computer power in association with state-of-the-art numerical weather prediction models enables increasingly higher resolution weather forecasts, which can be used to replace the initial weather station data dependency, to produce finer detail on local and regional atmospheric circulation patterns, not always possible with a weather station network.

The Weather Research and Forecasting model (WRF), via it's Advanced Research WRF (ARW) core can be used to generate inputs for the estimation of the Canadian Forest Fire Weather Index (FWI). Forecasts (day +1 and day +2) of meteorological variables, allows the computation of the FWI system components in each gridpoint of a high resolution domain (3 km), covering the Portuguese territory.

Thus, the main objectives of this preliminary study are: 1) to investigate if the WRF-based FWI components can mimic the spatial distribution of area burned, both for an exceptional and average fire seasons; 2) to evaluate if these high-resolution weather forecasts can provide an added-value for forest fire danger estimation and 3) to analyze the potential use of the coupled WRF-FWI system as a tool for producing fire weather risk maps to the community, contributing, thus, for the prevention of wildfires.

The WRF model setup, data sources characteristics used for its initialization and the FWI computation scheme are thoroughly described. Results evaluation are based on the comparison of grid-based and station-based FWI and with fire-scars locations, for 2003 and 2009 fire seasons. The 2003 fire season was, both in terms of number of occurrences and area burned, the worst of the last 25 years fire season in Portugal while, on the other hand, 2009 fire season has been considered as an average year in terms of number of fires.