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Assessing fire risk in Portugal during the summer fire season

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Since 1998, Instituto de Meteorologia, the Portuguese Weather Service has relied on the Canadian Fire Weather Index (FWI) System (van Wagner, 1987) to produce daily forecasts of fire risk. The FWI System consists of six components that account for the effects of fuel moisture and wind on fire behavior. The first three components, i.e. the Fine Fuel Moisture Code (FFMC), the Duff Moisture Code (DMC) and the Drought Code (DC) respectively rate the average moisture content of surface litter, decomposing litter, and organic (humus) layers of the soil. Wind effects are then added to FFMC leading to the Initial Spread Index (ISI) that rates fire spread. The remaining two fuel moisture codes (DMC and DC) are in turn combined to produce the Buildup Index (BUI) that is a rating of the total amount of fuel available for combustion. BUI is finally combined with ISI to produce the Fire Weather Index (FWI) that represents the rate of fire intensity.

Classes of fire danger and levels of preparedness are commonly defined on an empirical way for a given region by calibrating the FWI System against wildfire activity as defined by the recorded number of events and by the observed burned area over a given period of time (Bovio and Camia, 1998). It is also a well established fact that distributions of burned areas are heavily skewed to the right and tend to follow distributions of the exponential-type (Cumming, 2001). Based on the described context, a new procedure is presented for calibrating the FWI System during the summer fire season in Portugal.

Two datasets were used covering a 28-year period (1980-2007); i) the official Portuguese wildfire database which contains detailed information on fire events occurred in the 18 districts of Continental Portugal and ii) daily values of the six components of the FWI System as derived from reanalyses (Uppala et al., 2005) of the European Centre for Medium-Range Weather Forecasts (ECMWF). Calibration of the FWI System is then performed in two steps; 1) a truncated Weibull distribution is fitted to the sample of burned areas and 2) the quality of the fitted statistical model is improved by incorporating components of the FWI System as covariates. Obtained model allows estimating on a daily basis the probability of occurrence of fires larger than a given threshold as well as producing maps of fire risk.

Results as obtained from a prototype currently being developed will be presented and discussed. In particular, it will be shown that results provide additional evidence of the known fact that the extent of burned area in Portugal is controlled by two main atmospheric factors (Pereira et al. 2005): i) a long-term control related to the regime of temperature and precipitation in spring and ii) a short-term control exerted by the occurrence of very intense dry spells in days of extreme synoptic situations.

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