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Calibration of the Fire Weather Index over Mediterranean Europe based on fire activity retrieved from MSG satellite

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Mediterranean Europe is characterized by cold wet winters followed by hot dry summers that make the region especially prone to the occurrence of a large number of fires, especially when the summer season is affected by extreme weather events. There are a number of rating systems of fire danger, but the Canadian Forest Fire Weather Index System (CFFWIS) is one of the most used throughout the world. Although CFFWIS is particularly adequate to rate fire danger in the Mediterranean, the system was specifically developed for boreal forest in Canada and calibration procedures are therefore required when applying the system to different regions in order to take into account specific characteristics of climate, fuel type and fire regime.

The calibration approach adopted in this study is based on an integrated use of information about meteorological conditions provided by the European Centre for Medium-Range Weather Forecasts (ECMWF), vegetation land cover from Global Land Cover 2000 (GLC2000) and fire duration as detected by the SEVIRI instrument on-board Meteosat Second Generation (MSG) satellites. The study covers the period of July-August 2007 to 2009. It is demonstrated that statistical models based on two-parameter Generalized Pareto (GP) distributions adequately fit the observed samples of fire duration and that these models are significantly improved when the Fire Weather Index (FWI), that rates fire danger, is integrated as a covariate of scale parameters of GP distributions. Probabilities of fire duration exceeding specified thresholds are then used to calibrate FWI leading to the definition of five classes of fire danger. Considering all observed fire events with duration above 1 h, the relative number of events steeply increases with classes of increasing fire danger and no fire activity was recorded in the class of low danger. The main advantage of the proposed methodology is that it takes full advantage of the temporal resolution of SEVIRI that allows the detection of fire events every 15 minutes, then used to make daily records of fire duration. Such records are essential to calibrate meteorological danger and establish classes of fire danger. They have the advantage of being more consistent in space and time and they benefit from not depending on the availability of ground fire records from each country, which are neither easily obtainable, nor available in the short term.

Defined classes of fire danger provide useful information for wildfire management and are on the basis of the Fire Risk Mapping (FRM) product that is being disseminated on a daily basis by the EUMETSAT Satellite Application Facility on Land Surface Analysis (LSA SAF). It should be stressed that the rating of fire danger is entirely based on a set of estimated probabilities, in particular meteorological danger. These probabilities are derived from statistical models that may be readily updated and continuously tuned, which represents an advantage from the operational point of view. On the other hand, the fact that the FRM product is currently being disseminated will allow tailoring the product according to the specific needs of a broad community of users.