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Calibration of the Fire Danger Classes and Trend analysis over the Mediterranean basin, based on the Canadian Forest Fire Weather Index System and the Fire Released Energy from SEVIRI/MSG.

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Fire danger rating systems (FDRS) are widely used for many purposes from planning for daily deployment of fire suppression resources to the evaluation of fire management strategies. FDRS can also be incorporated in different types of models to assess the short and long-term effects of specific fire regimes and fire management policies.

The Canadian Forest Fire Weather Index System (CFFWIS) is one of the most known FDRS's, being extensively used for a fire early warning in several regions around the world, namely in Europe. The CFFWIS includes a set of 6 indices, based on meteorological data, which is used to predict fire weather danger and fire behavior over regions under study. To obtain a reliable assessment of the fire danger based on the CFFWIS it is crucial to determine the threshold values for each class of the CFFWIS sub-indices over different regions. One of the simplest methods to define the classes is to use percentiles based on historical data, but this method lacks information regarding wildfire history and its relation to CFFWIS sub-indices.

The proposed method is based on Fire Radiative Energy (FRE) released by fires, computed from Fire Radiative Power (FRP) product, that is generated, and disseminated in near real-time by EUMETSAT Land Surface Analysis Satellite Applications Facility. Since FRP estimates the radiative power emitted by a fire, it can be linked to fuel burned amounts and used as a proxy of fire intensity. By integrating FRP measures over a fire's lifetime, an estimate of the total FRE released can be obtained for each event. In this work, daily FRE was derived for the 2010-2021 period, over the Mediterranean region countries. Thresholds values of each defined danger class for the FWI, FFMCI, and ISI indices were obtained considering the FRE percentiles computed for different regions of the Mediterranean basin and discussed based on the different fire regimes for the region. A trend analysis of the CFFWIS sub-indices was performed to assess the fire danger behavior and the extreme fire weather over the different Mediterranean regions.

The regions where the extreme fire weather conditions have become more prevalent were identified considering the spatial correlations, and applying field significance testing allows the identification of the regions with significant trends. Since fire regimes in Southern Mediterranean

countries have been changing over the last two decades, mostly due to climate-driven factors changes and to the load and structure of fuels, the observed trend towards warmer and drier conditions are expected to continue in the next years, possibly leading to an increased risk of large fires. In this context, the knowledge of fire danger trends and variability is a key factor for fire managing activities, planning and preparedness, and resources allocation.

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