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Modelling wildfire activity in Iberia with different Atmospheric Circulation WTs

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This work focuses on the spatial and temporal variability of burnt area (BA) for the entire Iberian Peninsula (IP) and on the construction of statistical models to reproduce the inter-annual variability, based on Weather Types Classification (WTC). A common BA dataset was assembled for the first time for the entire Iberian Peninsula, by merging BA records for the 66 administrative regions of Portugal and Spain. A normalization procedure was then applied to the various size regions before performing a k-means cluster analysis to identify large areas characterized by similar fire regimes. The most compelling results were obtained for 4 clusters (Northwestern, Northern, Southwestern and Eastern) whose spatial patterns and seasonal fire regimes are shown to be related with constraining factors such as topography, vegetation cover and climate conditions.
The response of fire burnt surface at monthly time scales to both long-term climatic pre-conditions and short-term synoptic forcing was assessed through correlation and regression analysis using: (i) temperature and precipitation from 2 to 7 months in advance to fire peak season; (ii) synoptic weather patterns derived from 11 distinct classifications derived under the COSTaction-733. Different responses were obtained for each of the considered regions: (i) a relevant link between BA and short-term synoptic forcing (represented by monthly frequencies of WTC) was identified for all clusters; (ii) long-term climatic preconditioning was relevant for all but one cluster (Northern). Taking into account these links, we developed stepwise regression models with the aim of reproducing the observed BA series (i.e. in hindcast mode). These models were based on the best climatic and synoptic circulation predictors identified previously. All models were cross-validated and their performance varies between clusters, though models exclusively based on WTCs tend to better reproduce annual BA time series than those only based on pre-conditioning climatic information. Nevertheless, the best results are attained when both synoptic and climatic predictors are used simultaneously as predictors, in particular for the two western clusters, where correlation coefficient values are higher than 0.7. Finally, we have used WTC composite maps to characterize the typical synoptic configurations that favor high values of BA. These patterns correspond to dry and warm fluxes, associated with anticyclonic regimes, which foster fire ignition (Pereira et al., 2005).

Pereira, M.G., Trigo, R.M., DaCamara, C.C., Pereira, J.M.C., Leite, S.M., 2005: “Synoptic patterns associated with large summer forest fires in Portugal”. Agricultural and Forest Meteorology. 129, 11-25.

COST733, 2011: “COST 733 Wiki - Harmonisation and Applications of Weather Type Classifications for European regions or COST733 spatial domains for Europe”. Available at http://geo21.geo.uni-augsburg.de/cost733wiki/Cost733_Wiki_Main [accessed 1 September 2011].