Statistical model for the prediction of the forest fire peaks in Galicia (NW of Spain)

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Abstract

After getting a Forest Fire Risk Index specific for Galicia, next step in fire prevention was to get predictions at medium term, which permit to plan with longer time the strategy to manage the resources available for fire extinction. Based on the concept of forest fire peak (30 consecutive day period of the year at which the number of forest fires is the highest registered), defined by Vonskiy, and extending this concept to more than one peak, a statistical model was elaborated, which accurately predicts at medium term (3 months in advance) not only the temporal location but also the initiation dates of these peaks for each year. The Galicia historic (1980-2005) forest fire and meteorological databases were used. In Galicia the daily distribution of the forest fires for each year exhibited two periods over the year where the number of fires was particularly high: the winter fire peak, located between February and March, and the summer fire peak, that begins between July and August, both periods accounting for 52% in average of the total forest fires produced each year. Taking into account the forest fires behaviour and the strong correlation found between forest fire occurrence and meteorological conditions, a statistical ARIMA model was built, whose algorithm was elaborated combining selected meteorological variables, precipitation and temperature, and forest fire data, the new variables being taken as random variables and treated as temporal series. Validation of this model for the last four years data showed that the fitting of the data predicted by the model to the real data was very good, particularly in what concerns the temporal location of both forest fire peaks. Combining the results given by this model with the history of the forest fire peaks, a method was obtained which permits to estimate the most probable initiation dates of the forest fire peaks. Although the predictions very much depend on the precision of the meteorological forecasts, validation of the model for 2002-2005, showed that the estimated initiation dates of the forest fire peaks did not separate for more than 10 days on average from the real ones. This small error can be even smaller because the Model automatically will correct the dates when approaching the initiation dates of the peaks and the meteorological conditions are being modified and better predicted. The Model will be visualised, by means of a GIS coupled to the Model, on a map of Galicia where each climatic zone will show, three, two or one month in advance, the initiation date of each peak predicted by the model.

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