Spanish study matches forest fires to the last two years high temperatures

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A study led by some University of Barcelona researchers analyses the impact of interannual and seasonal climate variability on the fires occurred in Catalonia last summer. The study concludes that summer fires, related to summer climate conditions, are correlated with antecedent climate conditions, especially winter and spring ones with a lag time of two years. The results suggest that precipitation and temperature conditions regulate fuel flammability and fuel structure. According to the correlations observed, the study provides a model to produce long-term predictions.

The study, published in the journal Climatic Change, comes out of the doctoral thesis of the researcher Marco Turco, directed by the UB researcher Maria del Carme Llasat, co-author of the article. From 1983 to 2007, period analysed in the study, more than 16000 fires events were recorded and the total burned area was more than 240000 hectares, around 7.5 % of Catalonia. The work develops a statistical analysis of these fires and shows that, from a climate point of view, according to Maria del Carme Llasat, "is possible to develop a model that gives us an estimation of the number of fires and the extension of the burned area related to monthly average temperature and rainfall. We developed a simple regression model which includes the influence of spring-summer climate conditions of the studied year, but specially other variables which are determinant, although they do not seem to."

The established correlations allow us to prove that, for example, low minimum temperatures in winter and summer contribute to an increase

in the number of fires. However, the extension of the burned area highly depends on the winter months' rainfall, and in both cases on the winter-spring temperatures with a time lag of two years.

Specifically, the number of fires is correlated with the minimum temperature in the period February-June of the previous two years, and the number of burned hectares is correlated with the maximum temperature in the period March-April of the previous two years. "Even if it is not confirmed yet, this relation with climate data of two previous years has to do with the vegetation cycle of the region studied", explains Llasat, head of the group Metereological Hazard Analysis (GAMA). This two years relation has also been observed on other works developed in the Mediterranean area.

Fires are a complex processes associated with factors of different origin, such as climate and weather, human activities and vegetation conditions. As a first approximation a concept model was proposed suggesting that climatic processes act as top-down controls on the regional pattern of fire controlling both fuel moisture (fuel flammability) and nature and availability of fuel (fuel structure). Catalonia can be classified as an ecosystem in which climate acts in two main ways: antecedent climate regulates the fuel amount and its continuity, whilst current climate (for example, drought) promotes the fuel load.

Adopting the view that climate is the main controlling factor of the interannual variability of fire, on this work the links between climate and fire variability are analysed using the high resolution (20 km x 20 km) gridded data set, called Spain02. This data set is produced by the Spanish Metereological Agency (AEMET). Accurate data for fire occurrence and burned are were obtained from the Forest Fire Prevention Service of the Generalitat de Catalunya (SPIF). The data consists in the characteristics of 16753 fire events occurred in Catalonia during the 25 years period studied. Although fires in this region occur throughout the

year, about 60% of the fires occur in summer, from June to September, which amounts to be about 86% of the annual burned area.

Model applications

In the study a simple regression model is presented that links the variability of summer fires in Catalonia to climatic variables, and produces reliable out-of-sample seasonal and climatic predictions.

Llasat points out: "With this model we can make reliable predictions about the impact of climate variability on summer fires, but it is not the right model to be used for risk evaluations of prompt fires. In order to do that we have other resources, such as the one used by the SPIF and developed in the UB, which take into account other variables, for example the wind."

"We performed a first out-of-sample prediction that in general fits well, except for the 1994 big fires. We also studied this year meteorologically and we know that it was exceptional," explains the researcher. The model explains up to 76 % of the variance of the burned area and up to 91 % of the variance of the number of fires.

UB researchers are working in order to use the model to estimate fire response to different climate change scenarios, assuming that climate, vegetation, humans, fire interactions will not change significantly.

More information: Marco Turco, Maria Carme Llasat, Jost von Hardenberg and Antonello Provenzale. Impact of climate variability on summer fires in a Mediterranean environment (northeastern Iberian Peninsula). *Climatic Change*, 2012. DOI: 10.1007/s10584-012-0505-6

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