Stochastic Model for Fire Risk Prediction based on Meteorological and Historical Data.

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This paper intends to couple a dynamic model of meteorological risk of forest fires with stochastic modelling in order to predict forest fires risk maps.

Daily Severity Rating (DSR), a meteorological risk of forest fire index, from the Canadian Forest Fire Weather Index System (CFFWIS), results from the transformation of daily weather observations into relatively simple indices that can be used to predict fire occurrence, behaviour and impact (Stocks et al., 1989). DSR is calculated on a daily basis in two sequential steps: first it is forecasted for the day after, for a limited set of control points. In our case study DSR was calculated for the set of monitoring stations of Portugal, and local pdfs of $R(x)$ were interpolated for any location using direct sequential simulation.

DSR is an extremely important index for forest fires risk assessment but it is restricted to climatic factors. For the entire country one also have historical data of occurred forest fires, i.e., the dimension and the boundaries of each fire larger more than 1ha. Durão et al (2007) proposed one Bayesian approach to calculate the local conditional probabilities of a forest fire occur at any location x, given the class of predicted DSR for same location. Suppose an indicator variable $I(x)$ that takes the value 1 if a fire occurred in x, otherwise $I(x)=0$. Let us call $R(x)$ as the classes of Daily Severity Rating (DSR) predicted for control points and inferred by simulation for any location x.

In this paper, we intend to calculate the probability of a forest fire occurrence in x, given $R(x)$ and the historical data of fires occurrence in x, $d(x)$:

$$Prob\{I(x)| R(x), d(x)\} \quad (1)$$

Both conditional probabilities $Prob\{I(x)| R(x)\}$ and $Prob\{I(x)| d(x)\}$ can be inferred at any location x. Hence conditional probability (1) can be calculated with the tau model (Journel, 2002). Risk maps of forest fires can be driven from these conditional probabilities. A case study was conducted for the period 2003-2004.