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A stochastic Forest Fire Model for future land cover scenarios assessment

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Land cover change and forest fire interaction under climate and socio-economics changes, is one of the main issues of the 21th century. The capability of defining future scenarios of land cover and fire regime allow forest managers to better understand the best actions to be carried out and their long term effects. In this paper a new methodology for land cover change simulations under climate change and fire disturbance is presented and discussed.
The methodology is based on the assumption that forest fires exhibits power law frequency-area distribution. The well known Forest Fire Model (FFM), which is an example of self organized criticality, is able to reproduce this behavior. Starting from this observation, a modified version of the FFM has been developed. The new model, called Modified Forest Fire Model (MFFM) introduces several new features. A stochastic model for vegetation growth and regrowth after fire occurrence has been implemented for different kind of vegetations. In addition, a stochastic fire propagation model taking into account topography and vegetation cover has been introduced. The MFFM has been developed with the purpose of estimating vegetation cover changes and fire regimes over a time windows of many years for a given spatial region.
Two different case studies have been carried out. The first case study is related with Liguria (Italy), a region of 5400 km2 lying between the Cote d'Azur, France, and Tuscany, Italy, on the northwest coast of the Tyrrhenian Sea. This region is characterized by Mediterranean fire regime. The second case study has been carried out in California (Florida) on a region having similar area and characterized by similar climate conditions. In both cases the model well represents the actual fire regime in terms of power law parameters proving interesting results about future land cover scenarios under climate, land use and socio-economics change.