Geophysical Research Abstracts
Vol. 21, EGU2019-7977, 2019
EGU General Assembly 2019

Application of Machine Learning for Wildfire Susceptibility Mapping in Liguria (Italy)

Paolo Fiorucci (1), Guido Biondi (1), Mirko D'Andrea (1), Silvia Degli Esposti (1), and Marj Tonini (2)

(1) CIMA Research Foundation, Savona, Italy (paolo.fiorucci@cimafoundation.org), (2) Institute of Earth Surface Dynamics, Faculty of Geosciences and the Environment, University of Lausanne, Lausanne, Switzerland (marj.tonini@unil.ch)

The identification of areas most vulnerable to fire risk is a key tool in wildfire management, particularly in view of the limited availability of fire risk management resources, most of which are used for national and regional air services. The few resources available can thus be used on a yearly basis to mitigate problems in the areas at highest risk by defining a program of interventions. In this contest, the main objective of the present study is to elaborate wildfire susceptibility mapping for Liguria region (Italy), and to compare results obtained by a statistical driven partitioning models with the ones obtaining by applying a machine learning approach, based on Random Forest algorithm. The availability of a mapping of fire perimeters spans almost 20 years (1996-2016), and this, combined with a detailed knowledge of topography, climate and land cover, allowed to understand the main features involved in wildfire occurrences and their behavior. The seasonality of the fire regime was also considered, partitioning the analysis in two macro season (November-April and May- October). The partitioning model consisted on a recursive-quantiles subdivision of the territory in classes, based on the different available information layers: elevation, slope, aspect, rainfall height, temperature (the latter subdivided in winter and summer periods). The algorithm was designed in order to assure the equal representation of each class, in which the number of fires occurred in the period of analysis is considered, in order to have an estimation of the fire hazard with a constant statistical confidence. Results were then compared with the ones obtained by applying an approach based Machine Learning (ML). ML algorithms allow modelling the hidden relationships between a set of observations and the environmental predictors (i.e. the occurrence of the event and the predisposing factors), with the final objective of elaborating probabilistic outputs. After a training procedure, allowing to calibrate the parameters of the model, susceptibility maps can be displayed. In this study, we introduce Random Forest (RF), an ensemble supervised ML algorithm based on decision trees. RF, as in general ML approaches, is defined "data driven", meaning that is able to extract knowledge and insights directly from data, rather than by intuition or by personal experience. Moreover, RF directly provides the measurement of the importance of each variable, allowing to rank the predisposing factors based on their relative contribution to the model. The results show that both the approaches identify shrubs as the vegetation most affected by wildfire both in summer and winter season. RF algorithm seems to perform better, detecting 90% of the of the BA within 10% of the entire territory instead of 60% of burned area within the 20% of the territory for the statistical driven partitioning. These results are preliminary and need to be further evaluated in detail by establishing a working plan accounting for a common validation dataset for the two approaches. In summary, RF seems to be a promising alternative to deterministic or statistical expert- based method for wildfire susceptibility mapping.