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PROPAGATOR: a rapid and effective tool for active fire risk assessment

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An experimental propagation model provides Italian Civil Protection Department (DPC) with rapid active fire risk assessment. The model has been implemented and made operational over the Italian territory. The propagation model is based on stochastic cellular automata. The model is implemented on a regular grid of 20 meters. The high resolution is essential to recognize and represents the discontinuity of the territory, both in terms of vegetation and topography, in terms of road network, streams or other barriers that may stop or reduce the fire spread. Propagation maps, provided at each iteration, represent the probability of each cell to be burnt by the fire. This probability is obtained by evaluating the fire frequency for each cell, on the basis of a significant number of stochastic simulations. All the simulations starts from the same ignition point. Each simulation ends with the self-extinction of the fire front. The model requires defining only the ignition point and the wind vector. The wind vector is assumed to change randomly on the basis of a distribution function assigned a priori. Each cell is characterized by its elevation and by its vegetation class. The vegetation cover has been aggregated in 7 different classes, nominally, broadleaf forest, shrubland, grassland, Mediterranean conifer forest, conifer mountain forest, non-vegetated areas. A nominal fire spread probability is defined for each vegetation class. In addition, a fire spread probability is defined for each different couple of vegetation class to simulate the transition of fire front from a vegetation class to another. The nominal fire spread probability is modified by wind and slope contributions. The fire spread randomly from an ignited cell to a non-ignited neighbourhood cell, according to the fire spread probability obtained using wind and slope contributions. The model is implemented in a web gis based system according with the OGC-INSPIRE standard. The end-user can select directly the ignition point on a map or by inserting in the system the coordinates of the ignition point in a simple web interface. The model runs on a concurrent remote server implemented in Matlab. Since the simulation is not physically based, the model run very fast and can provide simulated burned areas greater than 1000 hectares in few minutes. The output information is provided on a web based GIS. The propagation model has been tested on several case studies. In most cases the perimeter of the simulated burned area with highest probability coincides with the perimeter of the actual burned area. The model provides in a fast and simple way realistic scenarios useful for active fire management, highlighting the zones where the fire attack can be more effective. This work was funded by the Italian Civil Protection.