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Scientific advances in fire modeling and its integration in FFDSS for practical fire fighting activities

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ABSTRACT

At present, there exists a wide range of fire behavior models and studies aiming to simulate fire. Nevertheless there is still an important gap between the scientific research in this field and its practical use by fire fighting agencies. In this work, we intend to narrow this gap by the introduction of a complete fire combustion model integrated within an easy to use GIS environment aiming to give real and practical solutions for fire fighting agencies.

The present paper focuses on the combustion model fire behavior implementation carried out in this GIS platform. Combustion models describe the evolution of physical quantities inside of the vegetation, considered as a porous medium, and as a consequence provide the evolution of the fire front. Between combustion models we can distinguish two groups:

1) Complex models, where general conservation laws are considered and several phases, solid phase and gas phase with different temperatures, two layers model, etc.

2) Simplified models, where in general an average media is considered with average magnitudes. Usually only one temperature is considered and only one phase (the other phase is parameterized).

The simplified models are more realistic than models based on cellular automata, geometric models and other empirical models, but allow faster computations than complex models, providing computation times below real time and at the same time taking into account the main physical mechanisms concerning the fire propagation.

The models in this work takes into account three of the main mechanisms in fire spread, that is:

1) Water content
2) Radiation
3) Wind and topography effects

Concerning the final GIS product. It is part of the European Eurorisk-Preview project (Geo-information services for risk management on a European level), and offers the following useful services:

1) Access to long lasting layer information: High definition fuel types, terrain, fire breaks (rivers and roads).
2) Access to real time web based updated layer information: Meteorological wind, moisture content of the terrain.
3) Rothermel based fire simulator.
4) Combustion fire behavior model
5) High Definition Wind Model

All integrated within an easy to use environment, 3D mapping, and easy inputs and outputs in all standard formats.

REFERENCES

[1] L. Ferragut, M.I. Asensio, S. Monedero. "Modelling radiation and moisture content in fire spread", *Commun. Numer. Meth. Engng.*, Vol. **23**, pp.819-833, (2007).

[2] M.I. Asensio, L. Ferragut, J. Simons. "A convection model for forest fire spread simulation", *Applied Mathematica Letters*, Vol. **18**, pp 673-677, (2005).

[3] R.C. Rothermel. A mathematical model for predicting fire spread in wildland fuels. General Technical Report INT-115, USDA Forest Service, Intermountain Forest and Range Experiment Station, 1972.