"Modelling wildland fire propagation by tracking random fronts" by G. Pagnini & A. Mentrelli.

General comments

The paper by Pagnini & Mentrelli presents a numerical study of wildfire spread dynamics using an original approach that tries to combine the two classical level-set and field equation(s) view points. The approach is based on a generalized level-set equation with a random component. This random component is introduced to represent the effects of both preheating by hot air being blown downwind and the transport of firebrands. Note that the standard level set approach is generally proposed to represent surface fires (it does not apply directly to crown fires, to ground fires or to fires spreading as a result of firebrand transport). The proposed model requires values of the fire intensity, a turbulent diffusion coefficient, and two ignition delays (see Table 1). The model is illustrated in test simulations of fire spread on flat terrains with different wind conditions and with/without the presence of a firebreak.

Specific comments

The paper is interesting and provides novel modeling ideas, in particular with respect to the effects of fire spotting. I have two major concerns.

My first concern is that the paper does not explain in enough detail what is meant by the effect of preheating by hot air. This effect is treated as an additional process that is apparently not included in the baseline level-set formulation but one could argue that this effect is already accounted for in the standard models of the rate of spread (ROS). This important point needs to be clarified.

My second concern is that the proposed formulation appears to be unnecessarily complex: the proposed randomization process could easily be included in a standard level-set approach by performing an ensemble of simulations that would account for uncertainties in the ROS model parameters. In fact, this stochastic approach based on an ensemble Kalman filter (EnKF) has recently been explored in the literature (see Refs. [1-4] below). The advantage of an ensemble-based approach is that there is a clear differentiation between the fire physics (represented by the ROS model) and the sources of uncertainties (represented for instance by variations in the input parameters to the ROS model). The authors should compare their proposed method to a more straightforward ensemble-based alternative.

Technical corrections

Additional minor points are listed below:

- (p. 6529) spelling error: "The above argument" (instead of "argoument")
- (p. 6531) wording: "its range is the compact interval [0,1]" (instead of "being its range the compact interval [0,1]")
- (p. 6536) typographical error: "here long" (instead of "here-long")
- (p. 6537) spelling error: "and then established according to the ROS" (instead of "and than established according to the ROS")

- (Table 2) clarification: the values of the wind velocities are very high (as high as 17.88 m/s) and need to be justified.

References

[1] Mandel, J., Beezley, J.D. Morphing Ensemble Kalman filter. *Tellus 60A* , 2007.

[2] Mandel, J., Bennethum, L.S., Beezley, J.D., Coen, J.L., Douglas, C.C., Minjeong, K. and Vodacek, A. A wildland fire model with data assimilation. *Mathematics and Computers in Simulation*, 79:584-606, 2008.

[3] Rochoux, M.C., Cuenot, B., Ricci, S. and Trouvé, A. (2012) "Towards predictive simulations of wildfire spread using data assimilation and uncertainty quantification", *Proc. 2012 Summer Program*, Center for Turbulence Research, Stanford University, California.

[4] Rochoux, M.C., Emery, C., Ricci, S., Cuenot, B. and Trouvé*, A. (2013) "Towards predictive simulation of wildfire spread at regional scale using ensemble-based data assimilation to correct the fire front position," *Fire Safety Science – Proc. Eleventh International Symposium*, International Association for Fire Safety Science, *accepted for publication.*