Rebuttal for NHESS Discussion Manuscript

Towards predictive data-driven simulations of wildfire spread – Part II: Ensemble Kalman Filter for the state estimation of a front-tracking simulator of wildfire spread by M.C. Rochoux et al.

We appreciate the positive and constructive comments made by the Reviewer. Detailed answers are given below.

"I understand that the use of the FIREFLY model is not critical in this work and works only as an illustrative example for the methodology but I advise the authors to use other models in the future, which are more realistic in their description of fire behavior"

► As pointed out by the Reviewer, the sensor-driven modeling strategy proposed by the authors is valid for any front-tracking simulator, not only FIREFLY but also FARSITE, FOREFIRE, PROMETHEUS[☆] or PHOENIX RapidFire, as well as for any model of rate of fire spread such as the semi-empirical Rothermel's formulation or the quasi-physical Balbi's[○] formulation. Indeed, the forward model used in the state estimation algorithm can be viewed as a *black-box* model with perturbed environmental conditions as inputs and estimated fire front locations as outputs. From this perspective, FIREFLY is a demonstrator model that was used to develop and test different data assimilation algorithms. As already mentioned in the Conclusion section, future plans include the extension of the sensor-driven modeling strategy to simulator such as FOREFIRE-MESONH. It is worth mentioning that FOREFIRE-MESONH can propagate the fire front on a rate of spread model either due to Balbi or due to Rothermel. While out of the scope of the present study, it would be interesting to investigate the effect of the choice of the rate of spread model on the quality of the forecast obtained through the presented data assimilation algorithms. The following comment will be added in the Conclusion section: *Future plans include the study of the forecast performance with respect to the formulation of the rate of spread model, alternatives to the Rothermel's formulation could be used in the present data assimilation strategies to address the impact of model error.*

[☆]Development and structure of Prometheus: the Canadian Wildland Fire Growth Simulation Model. 2010. Tymstra, C.; Bryce, R.W.; Wotton, B.M.; Taylor, S.W.; Armitage, O.B. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta. Information Report NOR-X-417.

[○]Balbi, J.H., Morandini, F., Silvani, X., Filippi, J.-B., and Rinieri, F., A physical model for wildland fires, Combustion and Flame, 156, 2217-2230, 2009.