
Rebuttal for NHESS Discussion Manuscript

Towards predictive data-driven simulations of wildfire spread – Part I: Reduced-cost Ensemble Kalman Filter based on a Polynomial Chaos surrogate model for parameter estimation by M.C. Rochoux et al.

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

“What is unclear to me is why use FIREFLY as a new way to expand the model of Rothermel to a two-dimensional setting?”

► It is worth noting that the sensor-driven modeling strategy proposed by the authors is valid for any model of rate of surface fire spread such as FIREFLY or FARSITE. The forward model in the parameter estimation strategy can be viewed as a *black-box* model with estimated environmental conditions as inputs and predicted fire front locations as outputs. From this perspective, FIREFLY is a demonstrator model that allows for more flexibility and adequation with the proposed data assimilation algorithms. While still at an early stage of development, FIREFLY allowed to perform a wide range of tests with increasing complexity to evaluate the parameter estimation strategies.

Consistently, the following comment will be added at the end of the FIREFLY model section (section 2): *It is worth mentioning that the parameter estimation strategies presented in the following section (EnKF and PC-EnKF) are valid for any simulator of surface fire spread. Indeed, FIREFLY provides typical outputs of front-tracking simulators such as FARSITE, FOREFIRE, PROMETHEUS*, and PHOENIX RapidFire.*

*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.