Data Assimilation for Fuel Moisture in WRF-SFIRE: Method and Implementation

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Fuel moisture is a major influence on the behavior of wildland fires and an important underlying factor in fire risk. In this presentation, we report on experiences with a recently developed method \cite{Vejmelka2013} which assimilates ground station fuel moisture observations into the fuel moisture model of WRF-SFIRE \cite{Mandel2011, Kochanski2012}.

The method uses a weather model (WRF) forecast together with additional covariates in a trend surface model approach to model the spatial structure of the fuel moisture field. These predictions are then combined with the moisture model forecast using a nonlinear Kalman filter to obtain the analysis. We report on two applications of the method: spin-up of the fuel moisture content for a wildland fire simulation and continuous dead fuel moisture mapping.

In the first application, this method was used to generate a realistic spatial distribution of the fuel moisture required for fire spread modeling. The available fuel moisture observations prior to the 2007 San Diego fires have been fed into the system in order to prepare the best estimate of the fuel moisture at the time ignition of Witch fire \cite{Kochanski2013}. In order to assess the effects of the fuel moisture assimilation on the simulated fire spread two numerical experiments have been performed, one with the assimilated fuel moisture and one without it. We report on the improvements in the simulation following assimilation of ground station observations as the result of the applied data assimilation method.

The second application is the mapping of dead fuel moisture on a domain enclosing Colorado, which has been embodied in a server-side system for continuous operation. We report on our experiences with long-term operation of the model and its monitoring.

References