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Coupled fire-atmosphere-fuel moisture online modeling system WRF-SFIRE

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We present an integrated wildlan fire model based on combining a high resolution, multi-scale weather forecasting model, with a semi-empirical fire spread model and a prognostic dead fuel moisture model. The fire-released heat and moisture impact local meteorology. The system is coupled with a fuel moisture model, which is driven by the atmospheric component of the system in order to render the diurnal and spatial fuel moisture variability. The wind and the fuel moisture in turn impact the fire rate of spread.

The sub-kilometer model resolution enables detailed representation of complex terrain, and small-scale variability in surface properties. The fuel moisture model assimilates surface observations of the 10h fuel moisture from RAWS stations, and generates spatial fuel moisture maps, which influence fire spread. The dead fuel moisture is traced in three different fuel classes (1h, 10h and 100h fuel), which are combined to provide the total dead fuel moisture content at the fire model resolution (tens of meters) using fuel properties at the location. The fire simulations are initialized by a web-based control system allowing a user to define a fire as well as basic simulation properties such as simulation length, type of meteorological forcing and resolution, anywhere in CONUS and any time meteorological products are available to initialize the weather model. The data is downloaded automatically, and the system monitors execution on a cluster. The simulation results are processed while the model is running and displayed as animations on a visualization portal.

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