P68 Recent developments on fire-spread modeling using the level-set method for coupled wildfire/atmospheric modeling with WRF.

Muñoz-Esparza, Domingo, Branko Kosović and Pedro Jiménez, *National Center for Atmospheric Research/Research Applications Laboratory*

WRF includes a coupled model to simulate wildland fires and its impact on weather conditions, which uses the level-set method to track the fire front and calculate its propagation. In order to improve the accuracy of the level-set method for coupled wildfire/atmospheric modeling, we have carried out major developments of the existing level-set algorithm in WRF as described below. First, we have rewritten the level-set algorithm to be fully parallelized, since the released version of the code only allows for a specific set of low-order numerical schemes and needs to perform additional calculations out of tile dimensions. We have also implemented higher-order numerical discretization schemes for the advection of the level-set method: third- and fifth-order weighted essentially non-oscillatory (WENO) and a third-order explicit Runge–Kutta (ERK) scheme for temporal integration. Finally, we have implemented a reinitialization method that allows the level-set function to remain a signed distance function throughout the entire simulation.

Using validation cases of varying degree of complexity, we show that our new implementation of high-order numerical schemes combined with a reinitialization technique for the level-set method results in a more accurate and stable solution, which in turn allows us to reduce the artificial viscosity used in the released version by 40%. On the contrary, the current level-set method implementation in WRF, which uses low-order discretization schemes and does not solve a reinitialization equation, is found to converge to a different solution due to larger discretization errors combined with non-linearities of the forcing turbulent flow.