Geophysical Research Abstracts
Vol. 15, EGU2013-3374, 2013
EGU General Assembly 2013

Prediction of fire smoke exposure and air quality degradation: toward a high resolution coupled fire-atmosphere model

Céline Mari (1), Susanna Strada (1), Jean-Baptiste Filippi (2), Frederic Bosseur (2), Xavier Pialat (2), Jorge Humberto Amorin (3), Carlos Borrego (3), Saulo Freitas (4), Karla Longo (4), Vera Martins (3), Ana Isabel Miranda (3), Alexandra Monteiro (3), and Ronan Paugam (5)

(1) University of Toulouse, CNRS, Laboratoire d Aerologie, Toulouse, France (marc@aero.obs-mip.fr), (2) SPE, University of Corsica, CNRS, Corte, France , (3) CESAM, University of Aveiro, Aveiro, Portugal , (4) Center for Weather Forecasting and Climate Studies, INPE, Cachoeira Paulista, Brazil, (5) Department of Geography, King's College London, London, United Kingdom

Wildfires release significant amounts of trace gas and aerosols into the atmosphere. Firefighters are exposed to wildland fire smoke with adverse health effects. At larger scale, depending on meteorological conditions and fire characteristics, fire emissions can efficiently reduce air quality and visibility, even far away from emission sources. Uncertainties in fire emissions and fire plume dynamics are two important factors which substantially limit the capability of current models to predict smoke exposure and air quality degradation.
A collaborative effort recently started in France to develop a coupled fire-atmosphere model based on the fire propagation model ForeFire, developed at the University of Corsica, and the mesoscale non-hydrostatic meteorological model Meso-NH, developed by the University of Toulouse and Meteo-France. ForeFire is a semi-physical model based on an analytical estimation of the rate of spread and an integration with a front tracking method. The fire model is used to provide gridded heating, water vapor and chemical fluxes at high temporal and spatial resolutions to Meso-NH.
The coupled model was used in two configurations depending on the spatial resolution: with or without the feedback of the atmosphere on the fire propagation.
At kilometric resolution, the model is used off-line to simulate two Mediterranean fires: an arson wildfire that burned in 2005 near Lancon-de-Provence, south-eastern France, and a well documented episode of the Lisbon 2003 fires (in collaboration with the University of Aveiro, Portugal). The question of the injection height is treated with an adaptation of the eddy-diffusivity/mass flux approach for convective boundary layer and compared to the 1D Plume Rise Model (developed at INPE) in contrasted meteorological scenarios.
At higher resolution, the two-way coupled model is tested on idealized and real fire cases including ozone chemistry. Future required developments on surface emissions and combustion chemistry will be discussed in the framework of the fully coupled fire-atmosphere model.