Geophysical Research Abstracts
Vol. 19, EGU2017-10508, 2017
EGU General Assembly 2017

Quantifying Wildfire Emissions and associated Aerosol Species using Assimilation of Satellite Carbon Monoxide Retrievals

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Intense and costly wildfires tend are predicted to increase in frequency under a warming climate. For example, the recent August 2015 Washington State fires were the largest in the state's history. Also in September and October 2015 very intense fires over Indonesia produced some of the highest concentrations of carbon monoxide (CO) ever seen from satellite. Such larges fires impact not only the local environment but also affect air quality far downwind through the long-range transport of pollutants.

Global to continental scale coverage showing the evolution of CO resulting from fire emission is available from satellite observations. Carbon monoxide is the only atmospheric trace gas for which satellite multispectral retrievals have demonstrated reliable independent profile information close to the surface and also higher in the free troposphere. The unique CO profile product from Terra/MOPITT clearly distinguishes near-surface CO from the free troposphere CO. Also previous studies have suggested strong correlations between primary emissions of fire organic and black carbon aerosols and CO.

We will present results from the Ensemble Adjustement Kalman Filter (DART) system that has been developed to assimilate MOPITT CO in the global-scale chemistry-climate model CAM-Chem. The ensemble technique allows inference on various fire model state variables such as CO emissions, and also aerosol species resulting from fires such as organic and black carbon. The benefit of MOPITT CO profile assimilation for estimating the CO emissions from the Washington and Indonesian fire cases will be discussed, along with the ability of the ensemble approach to infer information on the black and organic carbon aerosol distribution. This study builds on capability to quantitatively integrate satellite observations and models developed in recent years through projects funded by the NASA ACMAP Program.