Geophysical Research Abstracts,
Vol. 11, EGU2009-664, 2009
EGU General Assembly 2009

Characterization of fire plume heights over North America: Merging MISR and MODIS data into modeling

M. Val Martin (1), J. Logan (1), S. Freitas (2), D. Nelson (3), C. Ichoku (4), R. Kahn (4), D. Diner (3), and F.-Y. Leung (5)

(1) Harvard University, Atmospheric Chemistry Modeling, School of Engineering and Applied Sciences, Cambridge, United States (mvalmart@seas.harvard.edu), (2) Centro de Previsão de Tempo e Estudos Climáticos, Cachoeira Paulista, Brasil, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA, (4) NASA Goddard Space Flight Center, Greenbelt, USA, (5) Department of Civil & Environmental Engineering, Washington State University, Pullman, USA

Wildfires are a major source of reactive trace gases and aerosols in the atmosphere. Fire emissions can be injected above the boundary layer due to strong buoyancy generated from the fires, with important implications for long-range transport of these emissions and their effects on atmospheric composition. Quantifying and modeling fire emission heights is a difficult task, due to the large variability in the types of fire regimes and biomes as well as the scarcity of plume height observations. Here we present a study of aerosol injection heights over North America using five years of stereo-height retrievals and fire radiative power of wildfire plumes obtained from the NASA Terra Multi-angle Imaging SpectroRadiometer (MISR) and MODerate resolution Imaging Spectroradiometer (MODIS), respectively. The analysis of observed MISR plume heights in combination with GEOS meteorological and MODIS vegetation land cover data indicates that 5-30% of emissions from the plumes are injected above the boundary layer, depending on the fire characteristics (e.g., fuel type, fire intensity, etc) and year-to-year variations. In addition, a direct link is observed between the height and thickness layer of the plumes and the intensity and size of the fires. We develop a parameterization of injection heights of wildfire plumes over North America using a 1-D plume-resolving model driven by ambient conditions and MODIS-derived fire properties (e.g., fire area, heat flux). Simulated heights of the plumes are evaluated at a local scale using injection heights observed by MISR. Finally, we assess the importance of considering convective plume rise mechanisms in low resolution models by embedding the 1-D plume-resolving model within the 3-D global chemistry transport model GEOS-Chem. Preliminary results of simulating the vertical transport of North American fire emissions during summer 2008 will be shown.