EMISSIONS OF ATMOSPHERIC POLLUTANTS FROM FIRES AND AIR QUALITY FORECASTING BASED ON REAL-TIME SATELLITE DATA

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Abstract: We have developed an integrated operational system to quantify the emission rates of atmospheric pollutants and greenhouse gases from fires in near real-time twice daily at a 1 km x 1 km resolution in the continental United States. The objectives are (1) to assess quantitatively in near real-time the contribution of fires, in comparison to other anthropogenic sources, to air quality and the carbon cycle on a local and regional scale, and (2) to provide the input parameters to the air quality forecasting model WRF–SD (Weather Research and Forecasting–Smoke Dispersion). The estimations are based on real-time fire locations and burn scars mapped by MODIS (Moderate Resolution Imaging Spectroradiometer) instruments, a fuel map, the daily fuel moisture content, and the emission factor of each compound from fires in different ecosystems. The MODIS were key instruments aboard NASA’s Terra and Aqua satellites. The fire locations and burn scars were generated within 40 minutes after the Terra and Aqua satellite overpasses by our MODIS Direct Broadcast System four times per day. Considerable efforts were devoted to validation of MODIS fire detections and burned scar algorithms, using fire perimeter polygons for 966 fires and the burned area reflectance classification maps for 142 fires in 2006 and 2007. I will present (1) the methodology, validation, and uncertainty of our MODIS-derived burned area algorithms, (2) a time series of daily emissions of carbon monoxide (CO) and PM2.5 (particulate matter smaller than 2.5 µm) from fires at a 1 km x 1 km resolution in the western U.S. in 2007, (3) the assimilation of high resolution fire emission rates and plume rise models into the WRF–SD model, and (4) the results of the three-day forecast of atmospheric CO and PM2.5 concentrations in the continental U.S. as a result of large fires in the northwestern U.S.

Keywords: fires, satellite data, emissions, air quality forecasting