Evaluation of Novel NASA Aerosol Fire Products Over Extreme Fire Events in the Semi-arid Western U.S.

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Climate change has increased the frequency of droughts in recent decades and consequently, the occurrence and severity of wildfires have amplified. Smoke emissions are a public health problem that is continuously impacting vulnerable populations worldwide. Near extreme fire events, satellite characterization of aerosol pollution is desired because it can capture the horizontal extent of the fires at a reasonable spatial resolution. Previous studies have shown that former algorithms related to the retrieval of aerosol properties from satellite remote sensing have limitations in characterizing aerosol loading during fire events. However, the horizontal transport and the aerosol vertical mixing within the atmosphere are relevant phenomena to understand health effects due to wildfire smoke exposure and the impact in climate change. New versions of aerosol products from NASA MODIS instruments promise a better characterization of aerosol pollution from wildfires. This study will present a review of the new NASA MODIS collection 6.1 Deep-Blue, Multiangle Implementation of Atmospheric Correction (MAIAC), and Aerosol Single scattering albedo and height estimation (ASHE) satellite algorithms near an extreme fire event to evaluate aerosol loading and plume injection height (PIH) products using ground-based sunphotometry and aerosol lidar techniques. Preliminary results show an improvement in fire detection and aerosol concentrations from the new algorithms. A high spatial-temporal correlation (r~0.9) between satellite-derived aerosol optical depth and ground-based sunphotometry was found. In addition, MAIAC and ASHE PIHs agreed with ground-based lidar observations. Finally, a first-order approximation air quality ratio (AQR) was developed to distinguish between aerosol pollution within the planetary boundary layer and the free troposphere using information of aerosol vertical profiles from satellite-derived PIH products and weather forecast model outputs. This AQR has the potential to improve air quality forecasting due to smoke from wildfires through quantifying the percentage of the smoke at near-ground level.

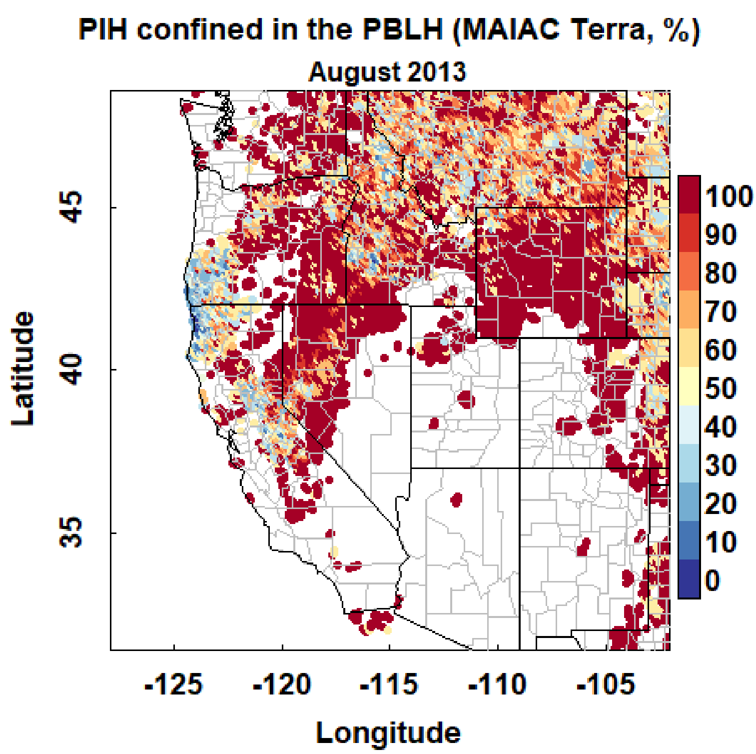

Figure 1. Percentage of occasions when the fire plumes were found within the PBLH.