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Understanding Present-Day North American Fires from Satellite Observations to Enhance Predictability

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Wildfires and other types of biomass burning affect most vegetated parts of the globe, contributing 34%-38% of the annual global atmospheric loading of carbonaceous aerosols and significant amounts of numerous trace gases, such as carbon dioxide, carbon monoxide, and methane. Many of these smoke constituents affect the air quality and/or the climate system directly or through their interactions with solar radiation and cloud properties. Adequate understanding of these interactions requires the synergistic use of observations and climate models. However, fires are poorly constrained in global and regional models, resulting in high levels of uncertainty in evaluating their real impacts. In an effort to characterize fire emissions uncertainties, we have comparatively analyzed several major fire emissions datasets and investigated their relative efficacies in global modeling using the NASA GEOS-5 model. The results of aerosol simulations based on these emissions were compared against satellite-retrieved aerosol products as well as ground-based AERONET measurements. One of the regions showing the least consensus between the results is North America. To understand the possible causes of such lack of consensus in this region, we are conducting detailed analyses of the fire products from a variety of satellite missions within the context of the regional land-cover diversity and relevant environmental parameters from the MERRA-2 assimilation system. This will help us to clearly establish the various environmental and climatic influences on North American fire occurrence (e.g., ignition, distribution), characteristics (e.g., seasonal/diurnal cycles, duration), and emissions (e.g., source strength, plume injection), in order to accurately inform fire prediction modeling.