Using Data to Improve a Global Fire Model for Use in Climate Models and Earth System Models

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We present a brief overview of Geophysical Fluid Dynamics Laboratory Earth System Modeling framework, and then discuss the development and implementation of an improved fire model for use in the coupled climate-biogeochemical cycles models. We discuss the observations we already use to improve the simulations, as well as what additional measurements would be useful. Thus, this presentation highlights the intersection of measurements and modeling with respect to biomass burning.

Biomass burning is a major disturbance in terrestrial ecosystems and a large source of carbon to the atmosphere. Natural and anthropogenic fires have been a part of the Earth system for millennia, but our understanding of global fire activity and the subsequent impacts on ecosystems and the atmosphere has only advanced significantly in the past three decades as a result of the availability of satellite-based data products. While climate is generally considered to be the dominant control on the distribution and timing of global fires, human activities directly shape global fire distribution through practices such as land-clearing, crop and pasture management, and fire suppression, and indirectly through anthropogenically driven climate change. This complex interplay results in fire characteristics that are dependent on the particular use of fire.

The fire model development is constrained by both global and regional scale datasets that are based on observations. The fire model simulates seasonal patterns in fire activity, burned area, and fire emissions, accurately reproducing timing and magnitude at regional scales when compared to observationally-based constraints such as fire counts from the NASA Moderate Resolution Imaging Spectroradiometer, burned area from the Global Fire Emissions Database (GFED) as shown in Figure 1, and emissions from fire emissions inventories. The goal of this research is to link the land process of fire to the atmosphere through emissions. Modeled aerosol optical depths can then be evaluated against satellite and ground-based data products.

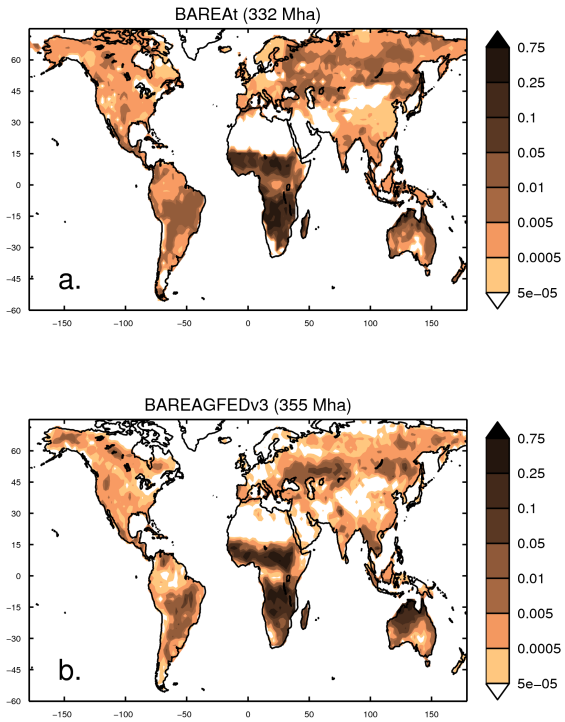

Figure 1. Mean annual burned fraction of the gridcell simulated by (a) the fire model (BAREAt) and (b) reported by GFED Version 3 (BAREAGFEDv3). Total mean annual burned area is listed in the title in units of Mha (1 Mha = 10,000 km2).