Reducing Uncertainties of Carbon Emissions from Land Use-Related Fires with MODIS Data: From Local to Global Scale

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Abstract

The atmospheric and carbon modeling communities are increasingly aware of the importance of fire as a major source of carbon to the atmosphere, and as a key driver of interannual variability of net carbon fluxes from the biosphere. Previous estimates of carbon emissions from fire are based on coarse-resolution satellite data and do not account for varying fire regimes associated with different land uses or for variations in biomass within the model's grid cell. Several groups have estimated fire emissions on global scales using coarse resolution approaches, and the outcomes vary by more than a factor two. We propose to apply MODIS data and the CASA biogeochemical model at the MODIS 250m resolution in two test areas, each covering the extent of a MODIS tile (approximately 10 x 10 degrees). The test areas are the southern Amazon and Kalimantan, two regions of rapid land use change where fire is used extensively for land management. Detailed analyses of these two test areas will allow us to assess sources of uncertainties in the coarser scale estimates. It will also provide a means of partitioning carbon emissions from different land use types, i.e. initial forest clearing vs. maintenance of previously cleared pasture or oil palm plantations. This distinction is essential for assessing carbon emissions from fire because clearing represents a net carbon source, while emissions from pasture maintenance fires will be balanced by carbon uptake during subsequent growing seasons. Using the high-resolution model results, approaches will be developed to realistically scale up estimates of carbon emissions from land use-related fires to regional and global scales. The high-resolution model results will also provide a basis for assessing emissions from possible future land use trajectories in the rapidly-changing tropics. The proposed work builds on regional expertise in each of the study areas and prior NASA-funded studies on global modeling of carbon emissions.