



## **Role of Climate Variability and Land Use on Fire Emissions of Carbon gasses in the 21st Century**

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Large scale reductions in biomass burning are observed across the globe from 2002 through the present through measurements of burnt area and carbon monoxide. These reductions are likely due to shifts in land-use changes as most declines are related to agricultural expansion. However, these reductions are in the context of environmental variability that can create dry conditions in Indonesia and the N. American Western states and possibly increased lightning in the Boreal forest that in turn can create large-scale fires. The changing character of fires has also altered the expected emissions. For example, emissions from fires in 2007 from South America were found to be larger than those in 2010 despite increased burnt area in 2010, likely because of changes in biomass density and combustion efficiency. Across the tropics, emissions in CO are decreasing faster than burnt area, also suggesting that the widespread shift in land-use is resulting in (not unexpectedly) changing fire combustion characteristics. Here we use data from the Terra MOPITT, Aura TES, OCO-2, and MODIS instruments as well as a state-of-the art land/atmosphere/ocean carbon cycle modeling data/model system to quantify emissions of carbon gasses using CO emissions and the range of emission factors up-scaled from vegetation type. We show that at least over the last two decades these changes in land-management practices has a substantial effect on the fire-component of global respiration that is much larger in aggregate than environmental variability.