AGU Meeting of the Americas 2013, Mexico.

Urban, Regional and Global Impacts of Biomass Burning Emissions

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Biomass burning is a major regional and global driver for atmospheric composition. Its effects in regional and global climate are very significant, but still difficult to assess. Even in large urban areas in Latin America such as Mexico City, Sao Paulo and Santiago, and in developed areas such as Paris and Californian cities it is possible to observe significant biomass burning effects air quality. The wood burning components as well as inner city and vicinities burning if agricultural residues impact heavily the concentration of organic aerosol, carbon monoxide and ozone in urban areas. Regionally, regions such as Amazonia and Central America show large plumes of smoke that extend their impact over continental areas, with changes in the radiation balance, air quality and climate. The deforestation rate in Amazonia have dropped strongly from 27,000 Km2 in 2004 to 6,200 Km2 in 2011, a very significant reduction, but this reduction was not observed in Africa and Southeast Asia. Health effects of biomass burning emissions are very significant, and observed in several key regions. Remote sensing techniques for fire detection have progressed significantly and long time series (10-15 years) are now feasible. The black carbon associated with biomass burning has important impacts in formation and development of clouds in Amazonia and other regions. The organic component of biomass burning emissions scatter light and increase diffuse radiation that alters carbon uptake in large regions of Amazonia and certainly other forested areas. Increase of up to 30% in carbon uptake associated with biomass burning emissions was observed in Amazonia, as part of the LBA Experiment. New analytical methods that quantify the absorption angstrom exponent of biomass burning and fossil fuel black carbon (BC) can differentiate BC from different burning sources. In addition, the hygroscopic properties of particles with a core shell of BC coated with organic compounds can be measured and shows very significant cloud nucleation properties of these complex particles that can change cloud formation and development mechanisms. Recent papers on the radiative forcing of black carbon estimate that BC can have a very high positive forcing of +0.5 watts/m2, and at the same time the organic compounds associated with BC emissions can bring the total radiative forcing to zero. This would imply that policies to reduce BC emissions as a strategy to quickly reduce global warming could not be that much effective. BC continues to be a critically important global driver of climate change, but its effects are still quite unknown.

Publication:	American Geophysical Union, Spring Meeting 2013, abstract id. A31D-02
Pub Date:	May 2013
Bibcode:	2013AGUSM.A31D..02A
Keywords:	0305 ATMOSPHERIC COMPOSITION AND STRUCTURE / Aerosols and particles; 0345 ATMOSPHERIC COMPOSITION AND STRUCTURE / Pollution: urban and regional; 0315 ATMOSPHERIC COMPOSITION AND STRUCTURE / Biosphere/atmosphere interactions