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JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 93, NO. D2, PP. 1509-1527, 1988
doi:10.1029/JD093iD02p01509

Biomass-Burning Emissions and Associated Haze Layers Over Amazonia

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Biomass-burning plumes and haze layers were observed during the ABLE 2A flights in July/August 1985 over the central Amazon Basin. The haze layers occurred at altitudes between 1000 and 4000 m and were usually only some 100 to 300-m thick but extended horizontally over several 100 km. They could be traced by satellite imaging and trajectory studies to biomass burning at the southern perimeter of the Amazon Basin, with transport times estimated to be 1–2 days. These layers strongly influenced the chemical and optical characteristics of the atmosphere over the eastern Amazon Basin. The concentrations of CO, CO_2, O_3, and NO were significantly elevated in the plumes and haze layers relative to the regional background. The NO/CO ratio in fresh plumes was much higher than in the aged haze layers, suggesting that more than 80% of the NO_x in the haze layers had been converted to nitrate and organic nitrogen species subsequent to emission. The haze aerosol was composed predominantly of organic material, NH_4^+, K^+, NO_3^-, $SO_4^=$, and anionic organic species (formate, acetate, and oxalate). While the concentrations of most aerosol ions were substantially higher in the haze layers than in the regional background aerosol, the ratios between the aerosol ions in the haze layer aerosols were very similar to those in the boundary layer aerosol over the central Amazon region. Simultaneous measurements of trace gas and aerosol species in the haze layers made it possible to derive emission ratios for CO, NO_x, NH_3, sulfur oxides, and aerosol constituents relative to CO_2. Regional and global emission estimates based on these ratios indicate that biomass burning is an important contributor in the global and regional cycles of carbon, sulfur, and nitrogen species. Similar considerations suggest that photochemical ozone production in the biomass-burning plumes contributes significantly to the regional ozone budget.

Received 8 January 1987; accepted 6 May 1987; .

Citation: Andreae, M. O., et al. (1988), Biomass-Burning Emissions and Associated Haze Layers Over Amazonia, *J. Geophys. Res.*, 93(D2), 1509–1527, doi:10.1029/JD093iD02p01509.