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Airborne measurements of aerosols from burning biomass in Brazil related to the TRACE A experiment

E. B. Pereira
A. W. Setzer
F. Gerab
P. E. Artaxo
M. C. Pereira
G. Monroe

Results are reported from an airborne campaign to investigate the impacts of burning biomass upon the loading of lower-tropospheric aerosols and its composition over the Brazilian tropics. The flights, conducted as part of the NASA/Transport and Atmospheric Chemistry Near the Equator-Atlantic (TRACE A) mission, started on September 1, 1992, when the dry (fire) season still prevailed in the central part of Brazil, and ended on September 29. Of the total number of burnings detected in Brazil by the advanced very high resolution radiometer (AVHRR)/NOAA satellite sensor, 74% were concentrated in the states of Amazonas, Maranhão, Mato Grosso, Pará, Roraima, and Tocantins during this period. Aerosol particles were sampled from a twin-engine aircraft in transit and vertical profile flights were made up to 4,000 m altitude. Black carbon measurements made in real time and in areas of burning biomass peaked at ~2,500 m above the ground, increasing to ~12,000 ng/m³. In other areas these values were lower by 1 order of magnitude. A condensation nuclei counter measuring small particles (>0.014 μm) produced values ranging from 2,000 to 16,000/cm³ for areas with low and high burning biomass, respectively. Deposition filters in a two-stage cascade impactor, and Nuclepore filters collected aerosols for analysis of 13 elements through particle-induced X ray emissions (PIXE). Primary elements associated with soil dust (Al, Si, Mn, Fe, Ni) prevailed in the aerosol coarse mode (>1 μm) while the fine mode aerosols were enriched in S, K, Br, and Rb, which are tracers normally associated with burning of biomass. The good correlation between fire spot counts, obtained via AVHRR aboard NOAA satellites, and black carbon, counts of small particles and total aerosol mass, suggests the determining of local concentrations of fire-derived aerosol fire emissions by satellite to be a new and useful approach.

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