DETAILED SIZE DISTRIBUTION OF THE PARTICULATE MASS AND OVER 20 ELEMENTS IN RONDÔNIA, BRAZIL, DURING SEPTEMBER-NOVEMBER 2002

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INTRODUCTION

The LBA/CLAIRE/SMOCC-2002 experiment in Amazonia, September-November 2002, aimed at investigating the interactions between smoke from biomass burning, cloud microphysics, precipitation, and climate. The campaign spanned from the peak of the burning season, with high smoke concentrations, to fairly clean conditions in the early rainy season. We participated in the ground-based component of the experiment and utilised various collection devices to obtain aerosol samples for laboratory analysis. Here, we present the results from detailed mass size distribution measurements for the particulate mass (PM) and about 20 elements.

METHODS

The ground-based component of the LBA/CLAIRE/SMOCC-2002 experiment took place at Fazenda Nossa Senhora (FNS), a pasture site in the state of Rondônia, Brazil. From 9 September to 14 November 2002, a 10-stage microorifice uniform deposit impactor (MOUDI) and a 12-stage small deposit area low pressure impactor (SDI) were operated in parallel at the site, using mostly separate day and night collections. The collection surfaces in the MOUDI were 37-mm diameter aluminium foils (4 mg/cm^2) and Whatman QM-A quartz fibre back-up filter, which had been pre-heated at 550°C to remove organic contaminants. In the SDI, thin (1.5 μm thick) greased polycarbonate films were used as collection surfaces. Eighty samples and a number of field blanks were collected with each device. The MOUDI samples were analysed for the PM by weighing. The weighings were done at 20°C and 50% relative humidity and the samples were pre-equilibrated at these conditions for at least 24 hours. The SDI samples were analysed for 28 elements by particle-induced X-ray emission spectrometry (PIXE) (Maenhaut *et al.*, 1996a).

RESULTS AND DISCUSSION

Most of the PM occurred in the submicrometer size fraction during the main burning period (which extended from the beginning of the campaign until 8 October 2002). The mass median aerodynamic diameter (MMAD) for the PM was somewhat larger during the night than during the day. During the main burning period, the average MMAD and associated standard deviation for the PM were 0.53±0.11 μm for the night samples and 0.38±0.03 μm for the day samples. The larger MMAD during night is a consequence of the higher relative humidity and of the hygroscopic growth of the bulk of the aerosol. A night-day difference in MMAD was also seen for elements such as S and K (which had similar MMADs as the PM), but not for the crustal elements Al, Si, Ti, Mn, and Fe, or for the biogenic element P, indicating that the crustal or biogenic aerosol components are non-hygroscopic. The MMADs of the crustal elements and of P were around 4 μm.

Figure 1 shows the average mass size distributions of the PM, S, K, and Zn for the night samples from the main burning period. Most of the PM originated undoubtedly from regional biomass burning; K and Zn are well-known indicator elements for pyrogenic emissions (e.g., Maenhaut *et al.*, 1996b). Also S is probably to a large extent attributable to biomass burning, and this is likely also so for other elements (i.e., Se, Br, Rb, and Pb), which exhibited similar size distributions as those shown in Figure 1. It can be seen in this figure that there is a tendency for two major modes in the submicrometer size range and one minor mode in the coarse size range. This was confirmed by performing inversions on the raw size distribution data with the computer program MICRON (Wolfenbarger & Seinfeld, 1990). The two submicrometer modes were centered at around 0.3 and 0.7 µm; they correspond to the condensation and droplet modes, as defined and seen in other studies (e.g., Ricard *et al.*, 2002). The droplet mode was particularly pronounced during the night.

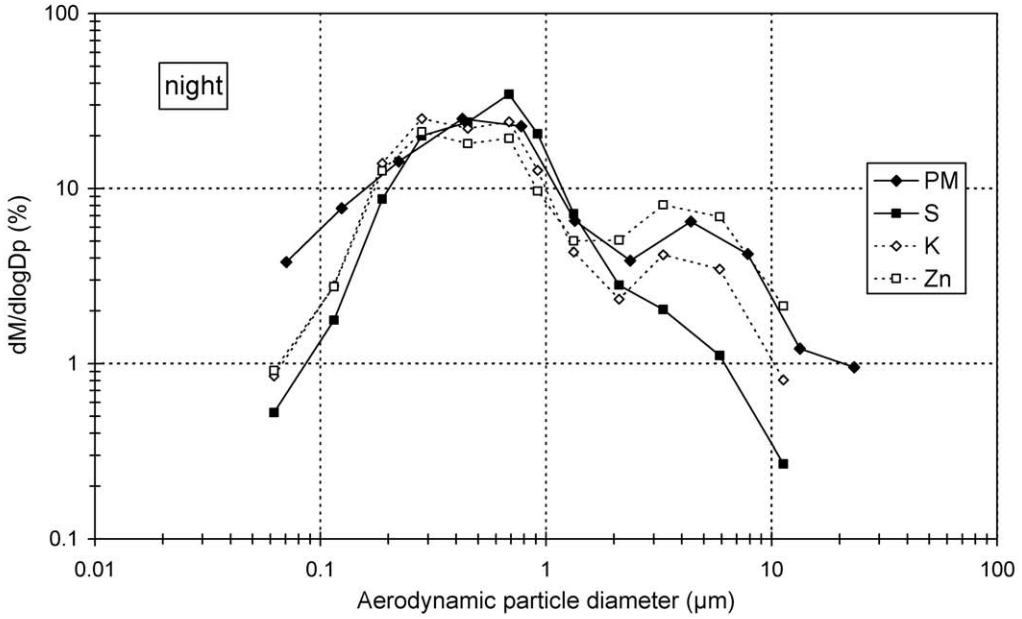

Figure 1. Average mass size distributions for the PM and 3 elements for the night samples from the main burning period (9 Sept. – 8 Oct. 2002) at the FNS site in Rondônia, Brazil.

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