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Size distribution and hygroscopic properties of aerosol particles from dry-season biomass burning in Amazonia

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Abstract. Aerosol particle number size distributions and hygroscopic properties were measured at a pasture site in the southwestern Amazon region (Rondonia). The measurements were performed 11 September-14 November 2002 as part of LBA-SMOCC (Large scale Biosphere atmosphere experiment in Amazonia - SMOke aerosols, Clouds, rainfall and Climate), and cover the later part of the dry season (with heavy biomass burning), a transition period, and the onset of the wet period.
Particle number size distributions were measured with a DMPS (Differential Mobility Particle Sizer, 3-850nm) and an APS (Aerodynamic Particle Sizer), extending the distributions up to 3.3 µm in diameter. An H-TDMA (Hygroscopic Tandem Differential Mobility Analyzer) measured the hygroscopic diameter growth factors (*Gf*) at 90% relative humidity (RH), for particles with dry diameters (d_p) between 20-440 nm, and at several occasions RH scans (30-90% RH) were performed for 165nm particles. These data provide the most extensive characterization of Amazonian biomass burning aerosol, with respect to particle number size distributions and hygroscopic properties, presented until now. The evolution of the convective boundary layer over the course of the day causes a distinct diel variation in the aerosol physical properties, which was used to get information about the properties of the aerosol at higher altitudes.

The number size distributions averaged over the three defined time periods showed three modes; a nucleation mode with geometrical median diameters (GMD) of ~12 nm, an Aitken mode (GMD=61-92 nm) and an accumulation mode (GMD=128-190 nm). The two larger modes were shifted towards larger GMD with increasing influence from biomass burning.

The hygroscopic growth at 90% RH revealed a somewhat external mixture with two groups of particles; here denoted nearly hydrophobic (*Gf*~1.09 for 100 nm particles) and moderately hygroscopic (*Gf*~1.26). While the hygroscopic growth factors were surprisingly similar over the periods, the number fraction of particles belonging to each hygroscopic group varied more, with the dry period aerosol being more dominated by nearly hydrophobic particles. As a result the total particle water uptake rose

going into the cleaner period. The fraction of moderately hygroscopic particles was consistently larger for particles in the accumulation mode compared to the Aitken mode for all periods. Scanning the H-TDMA over RH (30-90% RH) showed no deliquescence behavior. A parameterization of both *Gf*(RH) and *Gf*(d_p), is given.

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