Atmos. Chem. Phys. Discuss., 5, S4434–S4437, 2005
www.atmos-chem-phys.org/acpd/5/S4434/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size distribution and hygroscopic properties of aerosol particles from dry-season biomass burning in Amazonia" *by* J. Rissler et al.

J. Rissler et al.

Received and published: 13 December 2005

First we wish to thank the reviewer for carefully reading the article, for the ideas and suggestions for improving the article.

Answer and discussion of the suggestions for consideration:

1) For the wet and transition period, the mode around 100 nm was clearly bimodal. In the article the modes are denoted the Aitken mode ($<$100 nm) and the accumulation mode ($>$100 nm). For these two periods, the mass (or volume) size distributions of the accumulation mode had a maximum just above 300 nm. For the heavily polluted period the freshly produced particles were quite large and continuously injected to the

atmosphere in high concentrations. Consequently the distribution around 100 nm did not show the same clear bimodality and the accumulation mode particles could not be clearly separated from the fresh particles. For the dry period the fitted accumulation mode had a GMD around 200 nm (sg˜1.5, Table 2), corresponding to a maximum in the mass size distribution ˜350 nm. The mass size distribution can be calculated from the values given in Table 2, and we chose not to include it in the article.

In order to describe the observed distributions, three lognormal modes are needed; the nucleation mode, the Aitken mode and the accumulation mode (the fitted parameters are presented in Table 2). However, we cannot prove that the Accumulation mode is the droplet mode. Other processes might produce particles of this size. Furthermore, the diameter of the droplet mode can vary a lot due to the original size distribution, number of cloud cycles, precipitation etc.

One mechanism that we suggest for the shift in the number size distribution towards larger sizes in the aged RL is cloud processing. This is based on the observations made by Guyon et al., 2005 where a shift of ˜25 % was observed as the aerosol passed through a cloud.

2) As the referee correctly points out levoglucosan etc. has a smaller diameter growth factor than some simple dicarboxylic and multifunctional acids.

The chemical composition showed higher ratios of levoglucosan to WSOC during the night (relatively fresh aerosol trapped in the NL) than during the day, while the ratio of polyacidic compounds to WSOC were higher during daytime (Fuzzi et al., 2006). This is in agreement with the possible conversion of levoglucosan to simple dicarboxylic acids. Fuzzi (Fuzzi et al., 2006) explained the higher concentrations of levoglucosan by higher emission factors for levoglucosan and anhydrosugars from smouldering combustion than from flaming fires. This is also discussed in Gao et al. (2003). The hygroscopic growth is also largely affected by the non-soluble fractions as well as the inorganic compounds. For example the fraction of SO42- is higher during daytime than during

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nighttime.

The comment is very interesting, but since no chemical analysis is presented in the article we decided not to speculate about this. Instead we direct to Fuzzi et al., 2006, Decesari et al., 2005, and in Mircea et al., 2005 where the chemical composition is discussed in more detail. However, in the article we add the reference Gao et al. (2003) and a sentence about the suggested possibility.

The hygroscopic growth of macromolecular compounds such as HULIS, extracted from samples collected during the campaign, were measured. The diameter growth at 90% RH were 1.05-1.1, i.e. considerably lower than that of levoglucosan. That study - Swietlicki et al. (2005) - is referred to on page page 33 (8181). However, from what we write in the article it is not clear that the HULIS were collected during SMOCC field study. Therefore we write this more clearly in the revised version of the article, and add a value on the Gf of the HULIS samples. The study of HULIS in Gysel et al. (2004) is already referred to.

Answer to the minor comments: 1) We are not entirely sure we understood what the referee means. Since Gf includes the Kelvin curvature correction factor, introducing kappa or epsilon gives more information about how the chemical composition varies over size than Gf. For activation into CCN kappa or epsilon is very relevant. 2) The typo is corrected (page 8157?).

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