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Importance of the organic aerosol fraction for modeling aerosol hygroscopic growth and activation: a case study in the Amazon Basin

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Abstract. The aerosol in the Amazon basin is dominated throughout the year by organic matter, for the most part soluble in water. In this modeling study, we show how the knowledge of water-soluble organic compounds (WSOC) and the associated physical and chemical properties (e.g. solubility, surface tension, dissociation into ions) affect the hygroscopic growth and activation of the aerosol in this area. The study is based on data obtained during the SMOCC field experiment carried out in Rondônia, Brazil, over a period encompassing the dry (biomass burning) season to the onset of the wet season (September to mid-November, 2002). The comparison of predicted and measured cloud condensation nuclei (CCN) number concentration shows that the knowledge of aerosol WSOC composition in terms of classes of compounds and of their relative molecular weights and acidic properties may be sufficient to predict aerosol activation, without any information on solubility. Conversely, the lack of knowledge on WSOC solubility leads to a high overestimation of the observed diameter growth factors (DGF) by the theory. Moreover, the aerosol water soluble inorganic species fail to predict both DGFs and CCN number concentration. In fact, this study shows that a good reproduction of the measured DGF and CCN concentration is obtained if the chemical composition of aerosol, especially that of WSOC, is appropriately taken into account in the calculations. New parameterizations for the computed CCN spectra are also derived which take into account the variability caused by chemical effects (surface tension, molecular composition, solubility, degree of dissociation of WSOC).

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