The close links between biology and the chemistry of particles and trace gases in Amazonia

PAULO ARTAXO[1], GLAUBER G. CIRINO[2], JOEL F. BRITO[1], LUCIANA V. RIZZO[3], HENRIQUE BARBOSA[1], ANA MARIA Y. SERRANO[2] AND ELISA T. SENA[1]

[1]Institute of Physics, University of São Paulo, Rua do Matão, Travessa R, 187. CEP 05508-090, São Paulo, S.P., Brazil artaxo@if.usp.br.

[2]INPA – Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2.936 - CEP 69067-375, Manaus, Brazil

[3]Department of Earth and Exact Sciences, Federal University of São Paulo, UNIFESP - Campus Diadema, Brazil

Amazonia is a place where the biology of the forest and atmospheric chemistry are very well coupled. Feedbacks are very strong between ecosystem functioning, trace gases and aerosol emissions, cloud cover, precipitation, radiation balance and other key issues. In the wet season, a large portion of the Amazon region constitutes one of the most pristine continental areas, with very low concentrations of atmospheric trace gases and aerosol particles. However, land use change modifies the biosphere-atmosphere interactions in such a way that key processes that maintain the functioning of Amazonia are substantially altered. This study presents long term aerosol and trace gases observations at a preserved forest site in Central Amazonia, with observations from 2008 to 2013. Amazonian aerosols were characterized in detail, including aerosol size distributions, aerosol light absorption and scattering, optical depth and aerosol inorganic and organic composition, among others properties. Trace gases analyzed includes VOCs, ozone and CO. The central Amazonia site showed low aerosol concentrations (PM2.5 of 1.3±0.7 μgm-3 and 3.4±2.0 μgm-3 in the wet and dry seasons, respectively), with a median particle number concentration of alow 220 cm-3 in the wet season. An aerosol chemical speciation monitor (ACSM) shows that organic aerosol accounts to 81% to the non-refractory PM1 aerosol loading. The trace elements associated with natural biogenic aerosols were K, P, Zn, and organic carbon. Aerosol light scattering and absorption coefficients were very low during the wet season, increasing by a factor of 5, approximately, in the dry season due to long range transport of biomass burning aerosols reaching the forest site in the dry season. From this analysis, it is clear that land use change in Amazonia shows alterations of many atmospheric properties, and these changes are affecting the functioning of the Amazonian ecosystem in significant ways.