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Long range transport of Saharan mineral dust to the Amazon Basin

Qiaoqiao Wang (1,2), Jorge Saturno (2), Xuguang Chi (2), David Walter (2), Jost V. Lavric (3,4), Daniel Moran-Zuloaga (2), Florian Ditas (2), Christopher Pöhlker (2), Joel Brito (5), Samara Carbone (5), Paulo Artaxo (5), and Meinrat O. Andreae (2)

(1) Institute for Environmental and Climate Research, Jinan University (qwang@jnu.edu.cn), (2) Biogeochemistry Department, Max Planck Institute for Chemistry, 55131 Mainz, Germany, (3) Department of Biogeochemical Systems, Max Planck Institute for Biogeochemistry, 07745 Jena, Germany, (4) ICOS ERIC Head Office, Helsinki, Finland, (5) Department of Applied Physics, University of São Paulo, São Paulo 05508, Brazil

Transatlantic transport of Saharan mineral dust to the Amazon Basin not only affects air quality but also supplies essential nutrients to the rain forest. We use a global chemical transport model (GEOS-Chem) to simulate the long-range transport of Saharan dust plumes as well as to interpret observed aerosol concentrations and aerosol optical properties in Amazonia during the wet season (January-April) when the dust sources become main contributors to the basin.

The model successfully captured observed daily variation of aerosol optical depth (AOD) and aerosol concentrations in both source regions and the Amazon Basin. During the wet season in 2014, Sahara contributed to more than 75% of global dust emissions, with February being the most active month (30% higher than the seasonal average). The dust plumes extended to 3 km close to the Africa, and descended to below 1 km when crossing the Atlantic Ocean. The transatlantic transport of Saharan dust was generally mixed with African biomass burning plumes and took around 11 days to be arriving at the central of Basin. This dust source was the major factor driving the variation in aerosol concentrations in the Amazon Basin, contributing to 59% and 85-92% of total aerosol mass on average and during dusty periods, respectively. Although less absorptive compared to black carbon aerosols, the contribution of mineral dust to absorption aerosol optical depth (AAOD) could be significant (up to 35%) in the northeastern Amazon. The distribution of dust deposition generally followed the pattern of dust burden over the Amazon Basin.

Through tagged tracer simulations, we found that more than half of the dust over Central America and northern South America were from the northwestern Sahara, followed by western Sahel (20–30 %). The emission from Bodélé was important in eastern Brazil (east of 45°W and south of 0°) but contributed less than 20% of the total dust over other Amazonian regions. There was also significant intraseasonal variability for the sources of dust arriving over the Amazon Basin, mainly driven by the intraseasonal variability in precipitation fields.