Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 5, 1787-1803, 2005
www.atmos-chem-phys.net/5/1787/2005/

Observations and model calculations of trace gas scavenging in a dense Saharan dust plume during MINATROC

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Abstract. An intensive field measurement campaign was performed in July/August 2002 at the Global Atmospheric Watch station Izaña on Tenerife to study the interaction of mineral dust aerosol and tropospheric chemistry (MINATROC). A dense Saharan dust plume, with aerosol masses exceeding 500 µg m^{-3}, persisted for three days. During this dust event strongly reduced mixing ratios of RO_x (HO_2, CH_3O_2 and higher organic peroxy radicals), H_2O_2, NO_x (NO and NO_2) and O_3 were observed. A chemistry boxmodel, constrained by the measurements, has been used to study gas phase and heterogeneous chemistry. It appeared to be difficult to reproduce the observed HCHO mixing ratios with the model, possibly related to the representation of precursor gas concentrations or the absence of dry deposition. The model calculations indicate that the reduced H_2O_2 mixing ratios in the dust plume can be explained by including the heterogeneous removal reaction of HO_2 with an uptake coefficient of 0.2, or by assuming heterogeneous removal of H_2O_2 with an accommodation coefficient of $5x10^{-4}$. However, these heterogeneous reactions cannot explain the low RO_x mixing ratios observed during the dust event. Whereas a mean daytime net ozone production rate (NOP) of 1.06 ppb_v/hr occurred throughout the campaign, the reduced RO_x and NO_x mixing ratios in the Saharan dust plume contributed to a reduced NOP of 0.14-0.33 ppb_v/hr, which likely explains the relatively low ozone mixing ratios observed during this event.

Final Revised Paper (PDF, 410 KB) Supplement (79 KB) Discussion Paper (ACPD)

Citation: de Reus, M., Fischer, H., Sander, R., Gros, V., Kormann, R., Salisbury, G., Van Dingenen, R., Williams, J., Zöllner, M., and Lelieveld, J.: Observations and model calculations of trace gas scavenging in a dense Saharan dust plume during MINATROC, Atmos. Chem. Phys., 5, 1787-1803, 2005. Bibtex EndNote Reference Manager