Geophysical Research Abstracts, Vol. 9, 00391, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00391

An idealized two-dimensional model approach to study the impact of the West African monsoon on the tropospheric ozone latitudinal gradient

M. Saunois (1), C. Mari (1), V. Thouret (1), J.P. Cammas (1), P. Peyrillé (2,3), J.P. Lafore (2) , J.L. Redelsperger (2) , B. Sauvage (1,4), P. Nédélec (1) et J.P. Pinty (1)

(1) Laboratoire d'Aérologie, Toulouse, France, (2) Centre National de Recherches Météorologiques, Toulouse, France, (3) now at University at Albany, New-York, USA, (4) now at Dalhousie University, Halifax, Canada (Marielle.Saunois@aero.obs-mip.fr / Fax: +33 5 61332790)

An idealized vertical-meridian zonally symetric model is used to study the response of tropospheric ozone to the West African monsoon dynamics, the strong meridional gradient of surface emissions and the production of nitrogen oxides by lightning (LiNOx). The 2D version of the Méso-NH model used in this study was originally developped by Peyrillé et al. (2005). The model is able to retrieve the main features of the West African monsoon and allows to investigate its sensitivity to some key forcing (albedo, SSTs in the Gulf of Guinea and Mediterranean Sea). A O3-NOx-VOC chemical scheme has been added to the dynamical model together with a complete set of surface emissions and a parametrization of the LiNOx production. The ozone precursors emitted at the surface are uplifted by deep convection and then advected in the upper branches of the Hadleys cells on both sides of the ITCZ. The simulations recover the ozone latitudinal gradients observed by the MOZAIC aircrafts. The analysis of the convective and chemical tendencies shows that the minimum of ozone at the ITCZ is induced by the venting of poor ozone air masses up to the upper troposphere. The nitrogen oxides produced by lightning promote ozone production in the mid- and upper troposphere via the catalysis of CO and VOC oxidation. The net ozone production rate is up to 2 ppbv/h at the ITCZ and about 0.5 ppbv/h in the upper branches of the Hadley cells. Without LiNOx the latitudinal gradients are weak and adding the LiNOx source substancially increases the simulated gradient up to 1.5 ppbv/deg close to the one observed by MOZAIC (1.13 ppbv/h).