Geophysical Research Abstracts
Vol. 14, EGU2012-7380, 2012
EGU General Assembly 2012

A permanent aerosol layer at the tropical tropopause layer driven by the intertropical convergence zone

Q. Bourgeois (1), I. Bey (2), and P. Stier (3)

(1) Center for Climate Systems Modeling, Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland (quentin.bourgeois@env.ethz.ch), (2) Center for Climate Systems Modeling, Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland (isabelle.bey@env.ethz.ch), (3) Atmospheric, Oceanic and Planetary Physics, Department of Physics, University of Oxford, UK (philip.stier@physics.ox.ac.uk)

We use observations from the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) satellite instrument and a global aerosol-climate model to document an aerosol layer that forms in the vicinity of the tropical tropopause layer (TTL) over the southern Asian and Indian Ocean region. CALIOP observations suggest that the aerosol layer is present throughout the year and follows the migration of the Intertropical Convergence Zone (ITCZ). The layer is located at about 20°N during boreal summers and at about 15°S in boreal winters. The ECHAM5.5-HAM2 aerosol-climate model reproduces such an aerosol layer close to the TTL but overestimates the observed aerosol extinction. The mismatch between observed and simulated aerosol extinctions are discussed in terms of uncertainties related to CALIOP and possible problems in the model. Sensitivity model simulations indicate that i) sulfate particles resulting from SO_2 and DMS oxidation are the main contributors to the mean aerosol extinction in the layer throughout the year, and ii) transport of sulfate precursors by convection followed by nucleation is responsible for the formation of the aerosol layer. The reflection of shortwave radiations by aerosols in the TTL may be negligible, however, cloud droplets formed by these aerosols may reflect about 6 $W.m^{-2}$ back to space. Overall, this study provides new insights in term of composition of the tropical upper troposphere.