SPARC Workshop SHARP2016

Aerosol microphysics in the stratosphere

Dr. René Hommel[1], Prof. Christian von Savigny[2], Dr. Alexei Rozanov[1], Prof. Dr. John P. Burrows[1]

[1] University of Bremen

[2] Ernst-Moritz-Arndt-University Greifswald

rene.hommel@iup.physik.uni-bremen.de

The stratospheric aerosol layer (so-called Junge layer) is an inherent part of the Brewer-Dobson circulation (BDC). Stratospheric aerosols play a large role in the Earth's climate system because they interact with catalytic cycles depleting ozone, directly alter the atmosphere's radiative balance and modulate the strength of polar vortices, in particular when this system is perturbed. In terms of mass the layer is predominantly composed of liquid sulphate-water droplets and is fed from the oxidation of gaseous precursors reaching the stratosphere either by direct volcanic injections (mainly supplying SO2) or troposphere-stratosphere exchange processes. In volcanically quiescent periods, latter processes predominantly maintain the so-called background state of aerosol layer through oxidation of OCS above 22 km, and SO2 below.

The layer resides directly above the tropopause and reaches a height of about 35 km, with a largest vertical extent in the tropics and spring-time polar regions. Above the TTL, the layer's vertical extent varies between 2 km and 8 km (about 35% of its mean vertical expansion), depending on the phase of the QBO (Hommel et al., ACP, 2015). The authors showed that the QBO-induced meridional circulation, overlying the BDC, and accompanied signatures in the stratospheric temperature directly affect the life cycle of stratospheric aerosol. Mainly by modulating the equilibrium between microphysical processes that maintain the layer. And to a lesser extent by QBO modulations of the thermodynamical state of the upwelling region of the BDC.

In this study we further explore relationships between QBO forcing and aerosol processes in the lower stratosphere. We provide indications that similar process interferences are likely caused by variations of the spectral solar irradiance. We compare our modeling studies with observations from the Envisat/SCIAMACHY limb sounder. The data set has recently been released in a new version (von Savigy et al., AMTD, 2015).