ULAQ climate-chemistry coupled model

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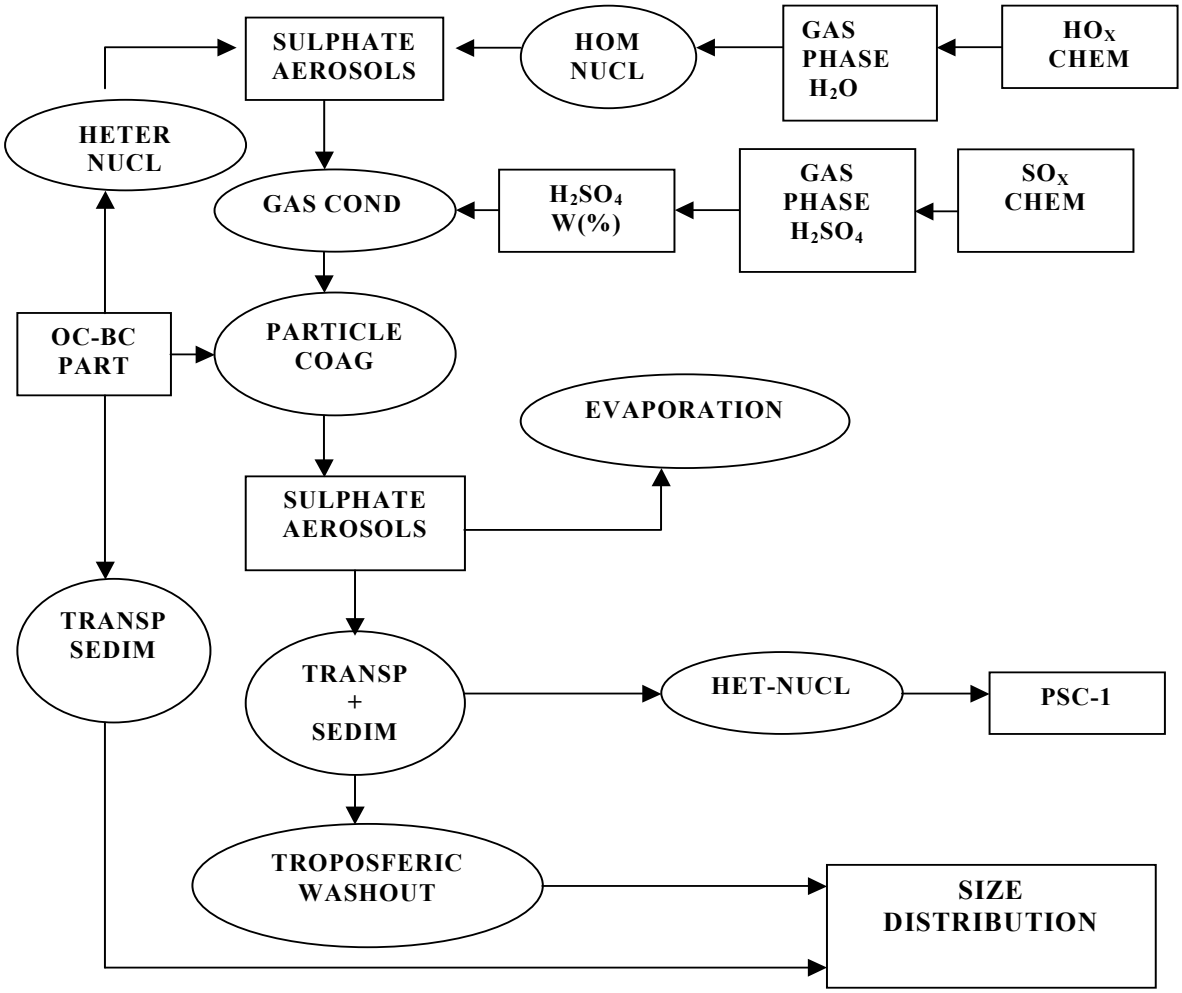
- Low-resolution climate model coupled with a stratosphere-troposphere chemical model.
- On-line inclusion of a microphysics code for sulphuric acid aerosol formation and growth.
- Sources,transport and removal mechanisms for carbonaceous and mechanically generated aerosols.
- Gas and aerosol fluxes taken from WMO (2002) and IPCC (2001) for 1970-2030 model boundary conditions.

Spectral GCM

dynamics $\Downarrow$ $\Uparrow$ *chemical species*

Grid point CTM

- Full chemistry on-line including both tropospheric and stratospheric species (NMHC, NO_x, Cl_x, Br_x, HO_x, O_x, long-lived species, etc.).
- Explicit microphysics scheme for sulphuric acid aerosols and PSCs, with gas-particle interaction and prediction of size distribution. Sulphate precursors are: SO_2, DMS, H_2S,OCS, CS_2.
- Radiative code for CO_2, O_3, H_2O, NO_2, other GHGs, aerosols.
- 19x16 points in latitude-longitude, 26 vertical log-pressure levels, from the surface to about 0.04 hPa.



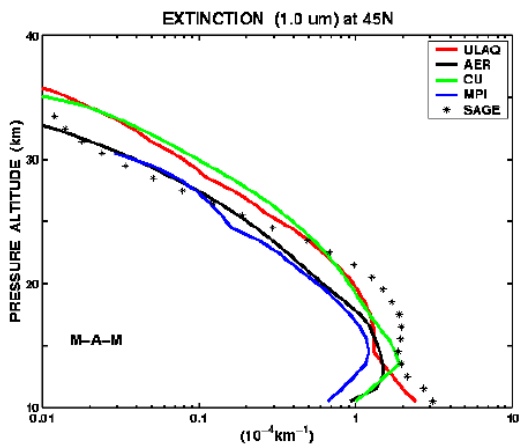
•SULPHATE AEROSOL	0.4 nm → 10.2 μm	16 bins
•BLACK CARBON	10 nm → 0.16 μm	5 bins
•ORGANIC CARBON	20 nm → 0.32 μm	5 bins
•SOIL DUST	0.32 μm → 10.2 μm	6 bins
•SEA SALT	0.32 μm → 10.2 μm	6 bins
•PSC (NAT)	0.08 μm → 10.2 μm	9 bins
•PSC (ICE)	0.32 μm → 82.0 μm	9 bins

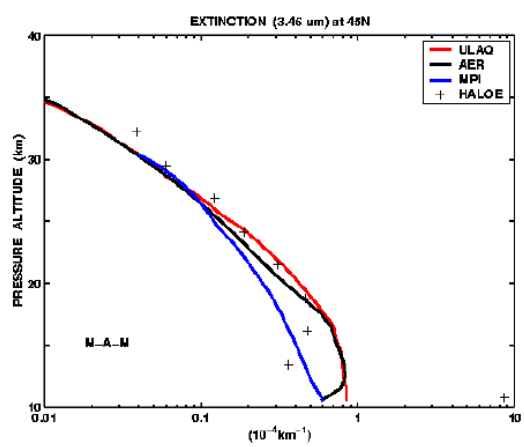
BC – OC emissions distributed in size following the size distribution of Pueschel et al. (1992) for BC, and following the mean sulphuric acid aerosol size distribution for OC. Soil dust and sea salt emissions are binned as in IPCC (2001).

The ULAQ model is participating in the SPARC assessment on stratospheric aerosols (Chapter 5). Global models (2D and 3D) are asked to provide the following quantities:

- Source gas mixing ratios (SO_2, OCS)
- Extinction at 4 wavelength channels (0.525 and 1.02 μm; 3.46 and 5.26 μm)
- Surface area density
- Effective radius
- Sulphate mass mixing ratio and density

ULAQ is responsible for the task 'Validation with satellite extinction data', and SAGE-II and HALOE datasets from 1996 to 2000 have been used for this purpose.
Four models have provided data for the validation exercise:
•AER (2D)
•Univ. Colorado (2D)
•Univ. L'Aquila (3D)
•MPI Hamburg (3D)





CONCLUSIONS

- The primary focus of the ULAQ-CCM is on the lower stratosphere and its interactions with the upper troposphere and climate changes.
- The horizontal resolution does not appear to be critical in this respect, but it does not allow a proper representation of land-ocean sources and transport in the boundary layer for both aerosols and precursor gases.
- The major shortcoming of the ULAQ-CCM is that the vertical resolution is too coarse to give a proper representation of the tropopause and strat/trop exchanges.
- One major task in the next future (6 –12 months) will be to increase the vertical resolution of the model.
- We also plan to include the calculation of the ammonium distribution in the troposphere.
- The AEROCOM activity will be continued with model runs including prescribed sources for aerosol and precursor gases.