4.051 A global modelling study of the release of ClNO2 from tropospheric aerosol and its impact on tropospheric oxidation.

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Abstract:

Nitrogen oxides play a central role in the chemistry of the atmosphere, affecting levels of both ozone and OH. Heterogeneous removal of the NOx reservoir, N2O5, onto aerosol particles can be a major loss route for NOx with modelling work by Tie et al. (2003) suggesting that, at high latitudes, N2O5 hydrolysis can reduce NOx levels by as much as 90 %. The reactivity of the aerosol towards N2O5 has been shown to be a complex function of ambient temperature and RH as well as aerosol composition.
Folllowing measurements by Osthoff (2008), Thornton and co-workers demonstrated that the presence of chloride ions in the aerosol can release of nitryl chloride, ClNO2, following uptake of N2O5. The night-time chemistry leads to a build-up of nitryl chloride, which can subsequently be photolysed to yield chlorine radicals, an atmospheric oxidant, and NO2, regenerating NOx. The yield of ClNO2 depends on particulate levels of chloride and nitrate, as well as factors controlling initial N2O5 uptake. The production of ClNO2 at the air-sea interface has been studied by Kim et al., and the important role of surface active organics demonstrated by Ryder et al.
We have included these processes in a chemistry-climate mode, the UK Met Office Unified Model, UM/UKCA-MODE, using a parameterised yield of ClNO2 from N2O5 aerosol uptake. In this paper, the performance of the parameterisation is examined and the effect of the halogen chemistry on levels of e.g. ozone and particulate nitrate will be investigated. Comparison with field measurements e.g. Tang et al. will also be made, and the impact of ClNO2 release on oxidative chemistry in the tropopshere quantified.