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Global Modelling of Tropospheric Iodine

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Halogen species play an important role in tropospheric chemistry. Iodine is believed to enhance catalytic ozone loss (acting synergistically with bromine) and can lead to the formation of new particles. Recent observations have increased our knowledge on the role of iodine but key processes need to be tested and quantified by inclusion in numerical models.

We describe the development of an iodine chemistry scheme within the TOMCAT global 3-D chemical transport model (CTM). The existing model contained a detailed tropospheric chemistry scheme (including bromine) along with the GLOMAP aerosol scheme. The new iodine scheme contains a treatment of organic source gas emissions along with a simple parameterisation of I2 emission from the ocean based on ozone deposition. The model has been integrated at a horizontal resolution of 2.8 x 2.8 degrees and is forced by ECMWF analyses for annual integrations.

We have used the model, coupled to a detailed size-resolved aerosol microphysics module, to study iodine chemistry in the troposphere. The model reproduces observed CH3I distributions. Mixing ratios of other organic iodine compounds are small due to shorter lifetimes. Our simulations show the observed IO at Cape Verde in the Tropical East Atlantic cannot be reproduced with the measured organic iodine source fluxes alone and requires an additional iodine source, in agreement with other studies. Our simulations show iodine chemistry significantly perturbs tropospheric ozone. Emissions of organic iodine species result in a 17 Tg reduction in the troposphere ozone burden. The dominant iodine-driven ozone sink is the reaction of HO_2 + IO (175 Tg O_3 yr^{-1}).