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Measurements and Modelling of Reactive Iodine Oxides in the Coastal MBL

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The release of iodine compounds into the marine atmosphere can affect a number of aspects of atmospheric composition: Iodine species can participate in catalytic ozone destruction cycles, which may be augmented by bromine species; reactions of iodine compounds can perturb the OH:HO_2 and NO:NO_2 ratios, heterogeneous loss of reservoir compounds such as HOI and INO_3 can lead to removal of HO_x and NO_x, and higher iodine oxides can contribute to the formation and/or growth of aerosol particles.

In this work, we focus upon understanding the effect of the spatial distribution of iodine emissions upon local HO_x and NO_x levels in the immediate vicinity of a coastal sites, using new observations to re-evaluate previous field campaign data.

We present an analysis of results from a new instruments which measures point inorganic iodine species concentrations. The technique of resonance fluorescence (RF) is employed for the detection of iodine atoms, and the total photolabile iodine content. Measurements made at Mace Head, Ireland during July-August 2007 and May 2011 are presented. A detailed 1-dimensional photochemical box model is employed in a lagrangian sense to simulate the evolving chemical composition of an air column advected across the coastal margin. The model is compared with the observed iodine species, and then used to explore the transient response of the NO_x and HO_x families at the Mace Head site to heterogeneous iodine emissions: The transit time between the intertidal iodine emission zone and the shoreline site where previous measurements of HO_x, NO_x etc. have been made is insufficient for steady-state to become established, although this assumption has been used in earlier model studies of such data.

Finally, we consider the limitations in our ability to quantify the impacts of iodine chemistry, which arise from uncertainties in the iodine kinetics and photochemistry – for example, what is the atmospheric lifetime of inorganic iodine ? – and explore their consequences for field measurement – model comparisons.