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Impacts of Iodine Monoxide in the Marine Boundary Layer

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The iodine monoxide (IO) radical plays an important role in marine boundary layer chemistry. IO catalytically destroys ozone, affects HO_x and NO_x partitioning and has been implicated as a precursor to new particle formation. IO is formed by the reaction of ozone with iodine atoms generated by the photolysis of molecular iodine and photo-labile iodocarbons. IO can also be formed at night from the reaction of NO_3 with I_2. IO has been measured previously using LP-DOAS, with absorption paths of several kilometres, which is associated with significant spatial averaging over the halogen source regions.

Point measurements of IO mixing ratios in the marine boundary layer have been made using two laser-induced fluorescence (LIF) instruments (Whalley et. al. (2007), J. Atmos. Chem. 58: 19 - 39; instrument accuracy 20%) in a variety of conditions. Clean marine air was sampled at Mace Head by the portable LIF instrument. IO mixing ratios up to 33 pptv (10 s integration) at daytime low tide were observed. In the polluted conditions observed in Roscoff, France as part of the RHaMBLe project, the ground-based instrument observed IO mixing ratios up to 30 pptv (10 s integration) at daytime low tide, with lower, but significant mixing ratios observed at night. At these levels, the IO radical significantly alters the local chemistry (HO_x and NO_x cycles). These impacts are investigated by comparison with zero-dimensional box models, based on the Master Chemical Mechanism (MCM), with varying chemical complexity.

The first open-ocean measurements of IO were made aboard the RRS Discovery as part of the RHaMBLe cruise, with a daytime average IO mixing ratio of 1.2 pptv (30 minute integration). These mixing ratios may have implications for global chemistry

models which have not included halogen chemistry.