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Modelling molecular iodine emissions in a coastal marine environment: the link to new particle formation

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Abstract. A model of iodine chemistry in the marine boundary layer (MBL) has been used to investigate the impact of daytime coastal emissions of molecular iodine (I_2). The model contains a full treatment of gas-phase iodine chemistry, combined with a description of the nucleation and growth, by condensation and coagulation, of iodine oxide nano-particles. In-situ measurements of coastal emissions of I_2 made by the broadband cavity ring-down spectroscopy (BBCRDS) and inductively coupled plasma-mass spectrometry (ICP/MS) techniques are presented and compared to long path differential optical absorption spectroscopy (DOAS) observations of I_2 at Mace Head, Ireland. Simultaneous measurements of enhanced I_2 emissions and particle bursts show that I_2 is almost certainly the main precursor of new particles at this coastal location. The ratio of IO to I_2 predicted by the model indicates that the iodine species observed by the DOAS are concentrated over a short distance (about 8% of the 4.2 km light path) consistent with the intertidal zone, bringing them into good agreement with the I_2 measurements made by the two in-situ techniques. The model is then used to investigate the effect of iodine emission on ozone depletion, and the production of new particles and their evolution to form stable cloud condensation nuclei (CCN).

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