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Experimental and modelling studies of iodine emissions from the ocean interfacial layer

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The atmospheric budget of iodine remains unreconciled, with organic sources believed to contribute only around 20-25% of reactive iodine to the tropical marine boundary layer (MBL). Molecular iodine (I2) formed via the reaction of ozone with iodide on the sea surface has been invoked to explain observed atmospheric concentrations of iodine monoxide (IO) in the tropical MBL. Here we show that a kinetic model of the sea-surface interfacial layer successfully simulates iodine emissions from laboratory experiments. We describe the effects of organic substrates, halides and physical conditions including wind speed on the modeled iodine emissions, and extrapolate the emissions to the marine environment. We also show that despite its low vapour pressure, HOI can be emitted from the sea surface at a significant rate. Our model calculations show that the reaction of ozone with iodide on the sea surface contributes typically 5 times the flux of organic iodine compounds. This overturns the long-held view that organic iodine compounds are the main carrier of iodine from the oceans to the atmosphere, and also represents a negative feedback mechanism whereby O_3 deposition to the sea surface, itself an important sink, leads to further O_3 destruction via emission of halogens.