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Ion-molecule reaction laboratory experiments show that iodine oxides explain CIMS atmospheric observations attributed to iodine oxoacids

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Iodine chemistry is a driver of new particle formation in the marine and polar boundary layer, with potential influence on cloud formation and properties. There are however conflicting views about how iodine gas-to-particle conversion proceeds. Laboratory studies indicate that iodine photooxidation yields iodine oxides, which are well-known particle precursors[1]. By contrast, nitrate ion chemical ionization mass spectrometry (CIMS) field and environmental chamber observations have been interpreted as evidence of nucleation of iodine oxoacids[2,3]. Here, we report flow tube laboratory experiments showing that iodine oxides react with nitrate core ions to generate the same ions observed by CIMS instruments. Therefore, we conclude that molecules unlikely to form in the atmosphere in the gas-phase such as iodic acid are not necessary to explain CIMS field measurements, but rather obscure their meaning, whereas iodine oxides explain the field observations and provide a thermochemically feasible mechanism to model the climatic impact of iodine-containing particles. In addition, we propose that a key iodine reservoir species such as iodine nitrate, which we observe as a product of the reaction between iodine oxides and the nitrate anion, can be also detected by CIMS in the atmosphere and has been potentially overlooked in previous field observations[4].

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