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Observations of Coastal IO Emissions on the Southern Hemisphere and Emission Potential of Different Seaweed Species

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At coastal sites reactive iodine species emitted by seaweed in the intertidal zone during low tide are known to have an important influence on the atmospheric chemistry. However, many underlying mechanisms are presently not understood. Also coastal studies were focused on a few locations on the northern hemisphere and their predominant seaweed species laminaria digitata and ascophyllum nodosum. Therefore the spatial emission and extent of the areas where halogen chemistry is of importance needs to be much better quantified. Especially in the mid latitudes of the southern hemisphere RHS measurements are very sparse.

Here we report the first observations of coastal iodine monoxide (IO) in the southern hemisphere during the HALMA/MAORI campaign which was carried out in February to March 2013 on the east coast of New Zealand's South Island at Shag Point located north of Dunedin. To detect IO we used a mobile Open Light Path Cavity Enhanced Differential Optical Absorption Spectroscopy (CE-DOAS) instrument and a stationary Long Path (LP)-DOAS Instrument, which was furthermore used to measure BrO, O_3 and I_2. The measurement path was positioned over the water and mainly measured air masses that only passes over submerged seaweed forests. With the CE-DOAS placed close to exposed seaweed patches (mainly Macrocystis Pyrifera) we were able to observe high IO mixing ratios of up to 50 ppt (2ppt detection limit). However, the LP-DOAS did not detect IO above the detection limit of 0.7 ppt. This is consistent with previous observations which found that seaweed only emits halogens when exposed to air.

To further investigate the emission potential of the seaweed species we setup a Teflon chamber around the CE-DOAS and measured the emissions of five different species for several hours. Additionally the air in the chamber was probed by a compact gas chromatograph (μDIRAC) for measurements of halocarbons and a TEI Ozone monitor. We found very high IO mixing ratios of up to 500 ppt for four seaweed species which correlated with high levels of halocarbons (CH_3I, CH_2Br_2, CH_2BrI and CH_2BrCl up to 100ppt, $CHBr_3$ up to 600ppt). These results, the similarities and differences in the emission behavior and implications for atmospheric chemistry are discussed.