



Quantification of Coastal Macro Algae Iodine Emissions and its Spatial Variability at the West Coast of Ireland

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Reactive iodine species are emitted by macro algae in the intertidal zone of coastal sites during low tide. Due to the oxidation to iodine oxide (IO) and thus reduction of ozone, they may have a significant influence on the local atmosphere. Further high iodine oxide levels may act as precursors for particle formation and therefore have a potential impact on climate. A correlation between iodine oxide and particle formation could be observed in previous field studies. However, previous measurements of iodine and iodine oxide have been performed only at very few sites, mainly at the atmospheric research station Mace Head located at the west coast of Ireland. An observation of the dominant sources, the spatial distribution and the impact on larger scales was not possible so far.

To investigate these questions we performed intensive measurements at eight different sites along the west coast of Ireland in 2011 and 2012. Therefore, we applied a mobile Long Path (LP)-DOAS for path averaged IO measurements and a mobile Cavity Enhanced (CE)- DOAS instrument for in-situ IO measurements at different locations. Additionally, a static Long Path-DOAS system for IO, OIO and I₂ measurements located at Mace Head was applied. This allows comparing directly different locations with the reference station Mace Head without the influence of locally varying meteorology and comparing results also to former observations.

We could confirm previous results that the macro algae species *Laminaria digitata* is the strongest iodine emitting algae. However, we observed significant differences to former investigations and conclusions.

First, iodine oxide concentrations were much higher (typically factor of 10 and more) on every measuring site compared to Mace Head. IO reaching levels up to 40ppt observed with the LP-DOAS and 70ppt (@ 1.2m height) with the CE-DOAS. Second, we found out that *Laminaria digitata* is not a dominant iodine source to the atmosphere, while *Ascophyllum nodosum* due to its high abundance in the intertidal zone, is by far the strongest source. Third, we observed also high iodine oxide levels above 30ppt at rainy, cold and windy weather. Thus former observations that these emissions arise only at sunny and warm weather could not be confirmed. Fourth, we investigated that iodine oxide increase exponentially with decreasing distance to the emitting seaweed patches reaching concentrations much above 100ppt being sufficient to start particle nucleation events.

We conclude that coastal macro algae emissions are thus much more relevant for the atmosphere than so far expected from previous observations performed at Mace Head which is rather characterized by low IO levels in comparison to other locations. Reasons and explanations for these findings will be presented. A review of the coastal macro algae iodine emissions and its influence on the atmosphere is thus urgently needed.