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Observations of IO hot-spots at coastal sites with the combination of a mobile CE- and LP- DOAS

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Reactive iodine species are emitted by seaweed in the intertidal zone of coastal sites during low tide. Beside their oxidation to iodine oxide (IO) and reduction of ozone, they 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 several field studies. However, modelling studies suggest that the so far observed mixing ratios of iodine oxide are too low to explain the observed particle formation. This may be caused by the so far applied measurement techniques which either average over a long measurement path of several km (LP-DOAS) or by immobile in-situ techniques (LIF or BB-CEAS) located typically few 10-100m of the intertidal area. Thus both techniques could not observe local "hot-spots", locations with locally elevated IO levels above the background with small spatial extend (e.g. above a source).
We present a new developed Cavity Enhanced Differential Optical Absorption Spectroscopy (CE- DOAS) instrument for the direct identification of IO down to 1ppt. This technique gives the possibility to achieve long absorption light paths in a compact setup (<2.0m) and thus apply the DOAS principle to in-situ measurements. The resonator of the cavity is formed by two high reflective mirrors in the spectral window from 430-460nm. To avoid any interference of reactive iodine compounds with tubes, walls or filters, the resonator is open similar to a LP-DOAS setup. A blue LED is used as light source. The total instrument setup is relatively light (25kg) and can easily be located at different locations. Hence it is possible to setup this instrument directly over the macro algae in the intertidal area during low tide to investigate the IO spatial distribution and "hot-spots". As IO concentrations vary strongly due to different meteorological parameters, the CE-DOAS measurements are combined with LP-DOAS in the same area. Thus the combination allows deriving a spatial variability.
The results from the first application during the HaloCave2010 campaign on Cape Verde will be presented. Opposite to former measurements both instruments could not observe IO at any coastal site close to the CVAO station.
Recently measurements were performed along the Irish west coast (partly at the research station Mace Head during MaCloud field campaign) to investigate the IO levels emitted by macro algae. During low tide the CE-DOAS instrument was regularly set-up directly in the intertidal area above the macro algae. Results of different coastal sites will be presented in detail. Elevated IO concentrations up to several 10ppt could be observed with the CE-DOAS instrument regularly, but LP-DOAS concentrations are typically more than an order of magnitude lower. The data will be discussed according to the IO "hot-spot" theory. Even at unfavorable meteorological conditions (clouds, strong wind) the CE-DOAS instrument could regularly observe enhanced IO levels. Different coastal sites show different IO emission strength and spatial distribution. The spatial distribution of IO at different coastal sites and its impact on atmospheric chemistry will be discussed.