Tropospheric Iodine at Coastal Sites

In coastal regions iodine atoms act set free via photolytic destruction of short lived iodinated hydrocarbons or $\text{IO}_2$ molecules emitted from the seaweed. The emissions are mainly during low tide if they are exposed to the air and are especially enhanced if simultaneously solar radiation is high.

Iodine affects the atmospheric chemistry in different ways:

- Important role in the process of ozone depletion. Iodine reacts quickly with $\text{O}_3$ to form IO. Self and cross reactions with IO, XO leads to autodidactical destruction of $\text{O}_3$.
- Are precursors of particle bursts (e.g. not $\text{CH}_4$ seems to be the main precursor for particle formation in coastal areas). Probably the OIO self reaction or the reaction of OIO with IO form higher oxides, which get further oxidised and or cross-react to form particles.
- Affects the HO, OH and NO,NO ratio.
- Oxidise DMS from pytoplankton.
- Uptake of inorganic iodine compounds (e.g. $\text{HOI}$, $\text{INO}_3$) lead to the liberation of chlorine and bromine from sea salt aerosols.

**Measurement Techniques**

Measurements of seaweed emitted reactive iodine species have mostly been carried out at Mace Head research station at the Irish West Coast using long-path differential optical absorption spectroscopy (DOAS) (e.g. Allicke et al., 1999; Saiz-Lopez et al., 2004; Peters et al., 2005). Derived are average concentrations over several 100m. However, information about the spatial distribution of reactive iodine species and emissions of different species (e.g. Laminaria, Ascophyllum) in the field are still rare. In order to study if reactive iodine species are actually located in so-called “hot-spots”, we combine LP-DOAS with the new in-situ Cavity Enhanced (CE) DOAS technique.

LP-DOAS (averaged over several 100m)

- Measures the absorption of the trace gases on a light path of 180m-190m.
- Royal blue LED light source.
- Telescope with f=50cm transmit the light to a retro reflector array and receive it again.

CE-DOAS (in-situ)

- Absorption path between two high reflective mirrors (~2m distance), peak reflectivity 445nm.
- Light path up to 8km.
- Royal blue LED light source.
- Absorption path open (no reactions on walls and tubes possible), pure flow at mirrors prevent contamination.
- 25kg mobile, set-up in the algae field during low tide possible.

**Conclusions**

- Combination of LP-DOAS + mobile CE-DOAS can observe IO hot-spots.
- IO concentrations are locally very high (up to 70ppt) even at bad weather conditions.
- Averaged LP-DOAS concentrations are at most locations (incl. Mace Head) a factor of ~10 lower.
- IO levels in Ascophyllum algae fields are higher due to their large extend in comparison to the small Laminaria fields.