

## ***Interactive comment on “Iodine emissions from the sea ice of the Weddell Sea” by H. M. Atkinson et al.***

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The manuscript of Atkinson et al. presents a very comprehensive set of measurements from a ship cruise in the Wedell Sea. The suite of iodine compounds measured during this campaign represents a unprecedented dataset which offers the opportunity to study the mechanisms of iodine release in detail. However, in my opinion some questions regarding the measurement technique and the influence of  $I_2$  on ozone chemistry in the marine boundary layer remain.

The first question is related to the IO dataset measured by the MiniDoas instrument. From our experience, scattered light measurements by an Ocean Optics 2000 spectrometer in a MiniDOAS setup results in residual structures with an RMS of at least  $5 \cdot 10^{-4}$ . The peak cross section of IO amounts to about  $3 \cdot 10^{-17} \text{ cm}^2$ , resulting in a

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detection limit for the IO slant column of approximately  $2 \cdot 10^{13}$  molec cm<sup>-2</sup>. With an AMF of about 10 for elevation angles of 4° and 50° for measurement and reference, respectively, the detection limit is only slightly below the observed VCD values of  $3 \cdot 10^{12}$  molec cm<sup>-2</sup>. Therefore it would be useful for the reader to provide a more detailed discussion of random and systematic error sources in addition to the uncertainty in mixing layer height which is the only error source mentioned in the manuscript. A plot showing the fitted cross sections and the residual of a spectral analysis and another plot showing the diurnal variation of the IO dSCDs for different elevation angles would help to estimate the trustworthiness of these measurements, which are very close to (if not below) the detection limit achievable by an USB2000 spectrometer.

A very large wavelength range (409 – 474 nm) has been chosen for the IO spectral retrieval. This wavelength range contains a relatively strong water vapour absorption band centered around 443 nm. It is well known that, both owing to saturation effects and uncertainties in the water vapour absorption cross section, including this absorption band leads to unreasonably high residuals. To our experience, the residual including this absorption band is significantly higher than if the upper limit of the fitting window is below 440 nm, making the IO retrieval very difficult even in the dry Antarctic atmosphere. Again, to give the reader an impression of the fit quality, it would be useful to include an example plot of the spectral retrieval.

The second question relates to the very high I<sub>2</sub> mixing ratios of up to 12 ppt observed during the campaign. Given a photochemical lifetime of 1.2 s and a complete oxidation of the resulting I atoms to IO by ozone would result in a ozone loss rate of 20 ppt/s (not including the additional ozone loss by the catalytic IO/IO and IO/HO<sub>2</sub> cycles). This means that not only exorbitantly high IO concentrations should be expected, as you discuss based on the THAMO model results, but also that the background ozone of typically 20 ppb in the lowermost 20 m of the atmosphere would be destroyed within 15 min, or within the whole boundary layer within approximately three hours. Apparently, a significant ozone destruction has not been detected. How do your ozone observations

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fit into this picture?

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