

Atmos. Chem. Phys. Discuss., referee comment RC2  
<https://doi.org/10.5194/acp-2021-680-RC2>, 2021  
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## Comment on acp-2021-680

Anonymous Referee #2

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Referee comment on "Full latitudinal marine atmospheric measurements of iodine monoxide" by Hisahiro Takashima et al., Atmos. Chem. Phys. Discuss.,  
<https://doi.org/10.5194/acp-2021-680-RC2>, 2021

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This paper presents measurements of iodine monoxide obtained using MAX-DOAS from 7 cruises from 2014-2018. The authors combine this work with box modelling and complementary measurements to suggest a larger role for iodine emissions under low ozone conditions. This work is based on an extensive dataset and the conclusions presented are interesting. There are some aspects of the work that should be further clarified prior to publication which are detailed below.

Specific Comments:

Section 2.1:

An explanation of the a priori choice is needed. Is it appropriate to use an identical a priori given the wide range of regions covered? Similarly, explanations for the choice of aerosol single scattering albedo, asymmetry parameter, and surface albedo should be given, preferably with references.

The authors characterize the experimental uncertainty for the dSCDs, but then do not provide any comparable information for the retrieved IO VCDs or mixing ratios in the lowest 200m. The reader needs this information to interpret the level of support provided by the data for the conclusions. Similarly, given the importance placed on the near surface mixing ratios, the authors need to demonstrate the retrieval is sensitive to the near surface mixing ratio particularly given later comments suggesting that a priori selections play a large role in determining the retrieved surface mixing ratios. How large of an effect

is this? If it is minimal compared to daily variations, that statement needs more support. This comment suggests the retrieval does not reflect the true atmospheric state, which raises questions about the ability of the authors to quantify the amount of IO present beyond a dSCD. These questions can be answered by showing averaging kernels that reflect the ability to retrieve the IO mixing ratio in the lowest layer (Peak near 1 near the surface with minimal values in other layers). To summarize over the entire data set the authors should provide statistics on the total DOFS for the retrieval as well as the DOFS in the near surface layer. This information will give the reader confidence that the IO values being presented are meaningful, and the papers conclusions are well supported.

## Section 2.4

A characterization of the uncertainties associated with the in situ ozone and CO measurements should be added to this section.

Line 157. The authors mention insufficient data to show diurnal variations. This statement needs more clarification. You have a lot of data, more than most folks trying to measure IO, why do you not feel good about showing diurnal variations?

Line 207: Figure 6 doesn't support the statement of no correlation by itself. I just see timeseries of wind speed and SST, with no attempt to relate these quantities to IO or ozone.

Section 4: Why is it important that IO was detected at low latitudes?

Figure 3: This figure needs error bars on the IO and ozone measurements to show the spread over the data set. I'm also unclear why the linear fit is calculated/shown. I didn't see a reference to it in the text, unless the goal is simply to show anti-correlation, in which case showing an R value makes more sense than the linear fit equation. If there is something important about the fit equation, it would be helpful to know what type of linear fit was done, particularly since the temporal variability of the IO measurements and ozone measurements are not necessarily linked.

Figure 4: Why plot dSCDs rather than VCDs or the surface mixing ratio? dSCDs don't really have much meaning to folks outside the DOAS community. While I find this figure very helpful for showing the cruise tracks and overall spatial extent of the data set, I find myself also wanting to be able to see each cruise plotted individually so I can examine the dataset for each cruise individually. Right now it seems like there are a lot of data points

plotted on top of each other. Can you put plots for each cruise in the supplement for the curious reader?

Why are figures 5-7 only shown for 1 cruise?

Data availability: I don't see a data availability statement showing where the data underlying this paper can be obtained, which I believe is a requirement for publication in ACP, and also a generally helpful thing to do for the broader scientific community.

Technical Corrections:

Line 34: regiona006C to regional?