

## Response to reviewer comments for manuscript number: acp-2020-998

Comments by reviewers are shown in italic typeface and the responses shown normal typeface.

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Reviewer 1:

*Review of “Observations of iodine monoxide over three summers at the Indian Antarctic bases, Bharati and Maitri” by Mahajan et al.*

*Mahajan et al present a revised version of their manuscript on IO observations at two Indian stations located in East Antarctica over three summers. The manuscript has improved with additional literature and clarifications of the data. I have remaining questions regarding my previous review and additional suggestions.*

RESPONSE: We thank the reviewer for the comments and have made changes according to the specific comments below.

*If possible, it is encouraged to include a campaign average and stdev of the valid scans in the supporting information. It would be helpful to include this to understand the general range of the profiles during the campaign. In Ln 309-311, you mention that maximum IO mixing ratios were observed near 400m with a decrease above this. Does 400m correspond to a typical boundary layer height in this region? If so, please include this in the discussion.*

RESPONSE: We have now included a table in the supplementary text with the average and standard deviation for each campaign as requested (Table S1). We have also included a sentence regarding the boundary layer height as suggested (Line 311).

*In Ln 315-317, you mention that most models predict a strong IO gradient as the main source is from the surface within the model. Also, in Ln 422-423, a conclusion of “The vertical profiles confirmed past hypothesis of a source from the ground considering a sharp gradient” is made. However, Figure 8 seems like the IO is actually decreasing below ~ 400m towards the surface. Was this trend also observed in other valid vertical profile measurements of IO? It would be interesting to include a discussion of the possible explanations of the decrease in observed IO levels below the boundary layer towards the surface. As it is difficult to see the vertical profiles of IO close to the surface, it is suggested to include a graph similar to Figure 8 but with altitude < 1km in the supporting information.*

RESPONSE: While the ‘high-resolution’ plots show a decrease, there is a lack of enough information available from the radiative transfer model to conclude this. Indeed, considering the uncertainty in Figure 8, we cannot say that the decrease is significant. We would need more information for discerning the vertical profiles close to the surface and hence we do not offer a conclusion either way since the current method does not enable it. The number of datapoints along the vertical dimension in the Figure 8 are subsampled from a profile created by MAPA. Further information regarding the radiative transfer, and the information that can be got from it are given in the MAPA description paper.

*The references for each of the locations are still not added. Please add these in the figure caption.*

RESPONSE: Added.

*Based on the back trajectories in Figure 2, I'm surprised that there's very few airmasses (red dots in Fig. S10) that are categorized 'ocean airmass' as described in Ln 407-413. For example, during ISEA-35 at Bharati, airmasses are coming from all directions including the ocean. Could you add more details on how the categorization was made based on the back trajectories? In Fig. S10, as it is difficult to see which observation profile corresponds to each type of airmass, it is suggested to just add the airmass category (red dots) for the valid profiles.*  
RESPONSE: The back trajectories are classified according to the height, in addition to the location. Although most air masses are 'oceanic', they pass over the ocean above 500 m, and hence are not considered as affected by oceanic emissions.

*Also, please include time zone in the x axis (or top of each graph) for all the figures including figures 3, 4, 5, 6, 7, 8, S2, S3, S4, S5, S6, S7.*

RESPONSE: This is now made clear in all the figure captions.

### **Additional Specific Comments:**

*(Ln 70) Please specify what the measured iodocarbons weren't able to explain high levels of. Was it IO/I2?*

RESPONSE: ...of IO, added.

*(Ln 94) Please specify what measurement technique was used for the vertical profile of IO.*

RESPONSE: It was the MAX-DOAS instrument, this is now added.

*(Ln 96) Please specify what the detection limit and uncertainty of IO was for the cited study.*

RESPONSE: Added.

*(Ln 164) suggested to use 'large' SZA rather than 'high' SZA throughout the manuscript.*

RESPONSE: Changed.

*(Ln 183) change to "...the estimated value ranged between..."*

RESPONSE: Changed.

*(Ln 198) "using the" is used twice*

RESPONSE: Corrected.

*(Ln 279) Just to clarify, the range is for <30m? Please include the average and standard deviation.*

RESPONSE: The details are now added in Table S1.

*(Ln 348) "...shown to peak..."*

RESPONSE: Corrected.