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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Latitudinal distribution of reactive iodine in the Eastern Pacific and its link to open ocean sources" *by* A. S. Mahajan et al.

Anonymous Referee #1

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The manuscript by Mahajan et al. presents remote sensing observations of BrO and IO slant column densities take during a cruise in the Eastern Pacific from South to North-America. The observations are converted to IO mixing rations using radiative transfer based retrievals and then converted to IO_x (IO + I) with the help of model data. Using a correlation analysis of IOx vs a number of different parameters a positive correlation of IO_x with SST and salinity, and a negative correlation of O_3 and Chl-a are identified. The authors also point to a disagreement between their observations and those made by satellite.

The data set presented in this manuscript provides new insight into the latitudinal distribution of reactive iodine and possible sources of these species. Unfortunately

the description of the analysis methods is, in many cases, not detailed enough to gain confidence in the observations. Details pointing out areas in which the manuscript needs to be improved are outlined below. The manuscript is worthy of publication in ACP after the detailed comments have been addressed.

Detailed Comments:

Page 15545 lines 8-9 and Figure 3: Please explain how the inclinometer data was used to correct for the ship oscillations in the analysis routine. Do the colors of Figure 3 refer to discrete angles or is there variation in the elevation angles due to the ship?

Page 15545 lines 23-25: Why was glyoxal not included in the fitting procedure (see Sinreich et al., 2010)?

Page 15545 line 26: Please give more details on the BrO retrieval. Was HCHO included in the fit? Why was the Alliwell et al (2002) wavelength range not used?

Page 15546, lines 10-15: As the instrument and the scanning geometry is different from the one used by Sinreich et al, please give more details on the cloud filtering algorithm, i.e. which elevation angles and wavelengths were used, what are the uncertainties, etc.

Page 15546, line 15 ff. Please add more detail on the uncertainties of the CH_3I observations.

Page 15547, equation 1: How was k_w determined?

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Page 15548, lines 19-21: Which method was ultimately used to determine the IO mixing ratios? The manuscript states that an optimal estimation retrieval using a radiative transfer model was used, while the SI gives the impression that the method from Sinreich et al (2010), i.e. using O_4, was used. Also there needs to be a discussion how the uncertainty of the retrieval propagates though to the IO mixing ratios.

Page 15548, lines 21-22: This sentence states that IO vertical concentration profiles were retrieved. Why are they not shown?

Page 15548, line 24: Why was the NO_2 from the MAX-DOAS not used to constrain the calculations? Please state that NO_2 was indeed measured.

Page 15549, line 4 ff: The use of the model to determine the IO_x correction factor needs to be explained further. For example, the authors talk about observed surface IO, while my understanding is that the IO mixing ratios are more representative of the MBL average. Why can a daily average be used for this approach, doesn't the IO/I ratio change throughout the day? As the MAX-DOAS can be used to retrieve vertical profiles, why was not the entire profile compared with the model?

Page 15549 line 4: Since the O_3 was not measured, how does the uncertainty in the O_3, i.e. the potential difference between true and modeled O_3, affect IO_x.

Page 15549, line 10 -12: There is no supporting analysis for this statement. Also, because only modeled NO_x and O_3 were used, the question is whether this actually reflects what is happening in the atmosphere or rather what happens in the model.

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The statement would be more convincing if actual NO_2 data from the MAX-DOAS were used.

Page 15549, lines 15-17: As already mentioned above, which IO mixing ratios were used, those from the optimal estimation or those from scaling IO DSCDs with O_4?

Figure 5: Please explain what the error bars in Figure 5 mean. The IO_x mixing ratio error bars seem very low considering the errors of the IO DSCDs and the complex calculations that are needed to convert DSCDs into mixing ratios followed by the calculation to determine IO_x. A detailed explanation of the error calculation, including all uncertainty terms is needed to convince the reader that the authors truly know IO_x mixing ratios to within 0.1-0.2 ppt.

Figure 5: What are the error bars for CH_3I air and water? If these are statistical uncertainties, is it even possible to calculate a statistically significant CH_3I flux? If the flux can indeed be calculated, please add the data to Figure 5.

Page 15552, line 7-9: The authors could test this hypothesis with CH_3I, for which water concentrations and fluxes have been measured.

Page 15552, line 19: I disagree with the authors that the parameters used in the correlation analysis do not co-vary. Figure 5 shows that SST and salinity do, to a certain extent, co-vary. Consequently the statement in line 19 needs to be backed up with a cross-correlation analysis of the different parameters. Should this analysis find a correlation between any of the parameters, the correlation analysis of IO with the respective parameters would need to be revisited.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 15541, 2012.

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