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Interactive comment on “Aircraft measurements of bromine monoxide, iodine monoxide, and glyoxal profiles in the tropics: comparison with ship-based and in situ measurements” by R. Volkamer et al.

Anonymous Referee #2

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This is an interesting paper that describes air-borne MAX-DOAS measurements of BrO, IO, glyoxal, NO₂, H₂O, and aerosol vertical profiles performed over the tropical Eastern Pacific Ocean as part of the TORERO project, and their validation using correlative ship-based and in-situ observations. Such data sets are particularly relevant for testing our understanding of the chemical processes involving halogens and organic carbon species in the tropical troposphere – which is a timely subject matter -, as well as for validating satellite observations. The authors show that a good agreement is generally found between the air-borne vertical profiles of the above species and the

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correlative ship-based and in-situ measurements, indicating the strong reliability and robustness of their retrievals. The paper being well written, this is in my opinion a valuable contribution worth publishing in AMT after addressing the following specific comments:

Title of the paper: Since a significant part of the study is also devoted to aerosols, NO₂, and H₂O, these species should also appear in the title.

Abstract: The time period of the TORERO campaign (January/February 2012) is missing and should be mentioned.

Introduction, page 628, lines 10-12: There was a total of 17 TORERO flights but only two case studies are presented here. On which criteria did you select them ? Is there a plan to apply the presented retrieval method to the 15 other flights ?

Sect. 2.7 on the profile retrieval from air-borne and ship-based MAX-DOAS data (pages 634-636): To my opinion, there is a clear lack of information about the OEM settings for both AMAX and SMAX retrievals, e.g. which a priori profiles are used for aerosol but also trace gas species, how a priori covariance matrices are constructed ? Is the linear or non-linear OEM used ? For the error budget of the OEM inversion, it is made reference to Baidar et al. (2013) but how valid is it since Baidar et al. (2013) describes air-borne MAX-DOAS retrievals over terrestrial environment (California) while the present study deals with measurements over ocean ? I encourage the authors to thoroughly revise this section.

Also related to the error budget, what are the error bars associated to the glyoxal and IO profiles presented in Figs. 8 and 9 ? Are they corresponding to the errors coming from the OEM inversion ? Is the impact of the SCDref also included in them ? This should be at least mentioned in the legend of these figures but preferably also discussed in Sect. 2.7 (see my comment above) or in a new ad hoc section.

Page 635, lines 10-14: I think it would be more comfortable for the reader to gather the

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Page 636, lines 23-28: Is the RAQMS model well suited for atmospheric marine chemistry ? For instance, does it contain the most important reactions of halogens on marine aerosols ? Which data are assimilated in the model ? This should be briefly discussed.

Technical corrections:

Page 627, line 20: 'atmoshperic' -> 'atmospheric'

References:

Baidar, S., Oetjen, H., Coburn, S., Dix, B., Ortega, I., Sinreich, R., and Volkamer, R.: The CU Airborne MAX-DOAS instrument: vertical profiling of aerosol extinction and trace gases, *Atmos. Meas. Tech.*, 6, 719–739, doi:10.5194/amt-6-719-2013, 2013.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, 8, 623, 2015.

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