Response to Reviewer #2, 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. – posted on the AMTD website on 5 Mar 2015.

We thank the reviewer for the evaluation of our paper, the valuable suggestions and the references. The reviewer comments are copied below in bold, followed by our detailed response that is typed in blue color below.

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 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.

This has been corrected.

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

We now mention Jan/Feb 2012 in the abstract, and give the detailed dates in the main text.

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?

The flights in this paper were selected from a perspective of method validation of our aircraft instrument. Yes - the methods described here are transferrable to the other flights. Several follow up papers, including an overview article of the TORERO campaign are currently in preparation.

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 airborne 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.

We have used a linear OE for inversion, as is now stated in Section 2.7.

There are no a priori profiles used for the aerosol retrieval, since extinction is derived by iterative forward modelling comparing measured and modeled O_4 as described in Section 2.7.

We have added a new Figure that shows the a priori profiles used for the trace gas inversions in the Supplement text. Baidar et al. considered a fairly large parameter space for surface albedo, and

aerosol optical properties (i.e., single scattering albedo, g parameter etc.). These conditions include those seen over the ocean. Furthermore, OEM works identical over ocean and land, and consequently the error analysis is the same. The primary difference over oceans consists in the smaller surface albedo (see Table4). We see no reason to repeat the detailed error discussion from Baidar et al., 2013 here.

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.

The error bars are coming from the OEM inversion. The impact of SCDref is not included, because for both glyoxal and IO it is smaller than the fit error. We have added a new Table 3 to make this transparent, and added some discussion in Section 2.7 and the Figure legends.

Page 635, lines 10-14: I think it would be more comfortable for the reader to gather the SCDref values in a table.

We have compiled the SCDref values and fit errors in a new Table 3.

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.

Section 2.8 has been expanded to describe which data is assimilated in the model. RAQMS halogen chemistry is not optimized, and no attempts were made to compare RAQMS with our halogen observations.

Technical corrections:

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

Corrected.

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.