

Interactive comment on “Level 2 processing for the imaging Fourier transform spectrometer GLORIA: derivation and validation of temperature and trace gas volume mixing ratios from calibrated dynamics mode spectra” by J. Ungermann et al.

Anonymous Referee #1

Received and published: 28 February 2015

General Comments: This paper describes the retrieval of temperature and H₂O, O₃ and HNO₃ from limb radiances measured by the GLORIA instrument on the German HALO aircraft during 2 campaigns in 2012. The paper is generally well written, and describes the GLORIA instrument (briefly), and the retrieval process. The error analysis is very illuminating. Comparisons of the results from flights during 2 campaigns with the accompanying in situ measurements serve as validation of the results. Some of the descriptions and explanations should be expanded, so that the paper can be read as a stand-alone contribution. GLORIA and its 1-D and 3-D data analysis show promise of

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providing very useful data for UTLS studies.

Specific Comments:

Abstract, l. 12- From capitalization, shouldn't acronym be “BAHAMASS”? l. 14- FAIRO written as acronym, without explanation

l. 24: suggest “The upper troposphere/lowr stratosphere is a highly dynamic region, the composition of which is determined by the interaction . . .”

Page 4: line 2- add references to Nakamura (1996) and Haynes and Shuckburgh (2000). Line 9- add reference to (Gille et al. JGR, 2014), Line 14- add reference (Peevey et al., JGR 2014)

Page 5, ll5-6- Someplace the paper should show or discuss how different the 1-D and 3-D results are. l. 10: Suggest “. . . the configuration used. . .” GLORIA Instrument- More detail is needed, even in this short overview. What are the number of pixels in the horizontal and vertical dimensions, What is the composition of the detector array, and it's temperature. How precisely can the movements of the A/C be compensated by the gimbal mounting? Does this define the pointing angle precision, or are there additional components from the angle measurements? How closely spaced along track are the measured profiles? Is this the spacing of the profiles shown later in the paper? What is the range of GLORIA azimuth angles?

Page 6 line 6: “. . .signals as a function of the interferometer. . .”

Page 7; line 9- please explain what a genetic algorithm is. Also “artifacts”. Tables 1 and 3 mentioned, no mention of Table 2. Why necessary to extend O₃ and HNO₃ to 60 km, so high above A/C. Line 23 ff: The explanation of the regularization is not nearly as clear in the author's earlier papers. It should be made clearer with an equation. Why not follow Rodgers (2000), as is much more usual?

Page 8; l. 7; vertical correlation lengths mentioned here, but no mention of Table 2. l. 19: “. . .the specific parameterization used for the . . .”

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Page 9; l. 20: "...are employed." l. 27: "...for any approximation errors introduced."

Page 10; l. 8: "...based on a C++ operator..." l. 19: "... are computed..."

Page 11, ll 16-17: "... emissivities of all homogeneous gas cells involved." L 29: "...number of required iterations..."

Page 12; l.10: Define F' l. 24: Is noise reduced as square root of number of spectral samples, or linearly?

Page 13; l. 20: Would "somewhat problematic" be better?

Page 15; l. 28: "...using a separate inlet..."?

Page 16; l. 9-10: "The relevant flight test..." l. 20: "...are similarly oriented." l. 23 "An example of a spectrim..." also "The ISW's used ..." l. 24: Can you say more about the problem with the 792 Q branch?

Page 17; l. 11: "nature of the regularization employed, ..." l. 15: Is it clear that the problem is with the measurement of the Q branch, as opposed to modeling its contribution? l. 20: temperature A's biases towards instrument location, but aren't along track data being used to correct for this?

Page 18; l. 7: "...as the best source..." l. 21: In Table 4 the here is a consistent negative bias for the temperatures for the three flights, which appears to contradict the sentence that "...the mean difference is..but of opposite sign, indicating no consistent systematic problem." Please clarify.

Page 19; l. 18: FAIRO is written as an acronym- please explain what it means.

Page 20; l. 13: "...allows thee successful etrieval of several..."

Page 21; l. 8: "...allow exploitation of the full..."

Page 23; l. 23: The explanation of different air masses should be supported by ECMWF or other data- it doesn't have to be shown, but to dismiss all systematic differences as

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due to different air masses is not very convincing.

Page 29; Caption for Table 1: "A list of integrated spectral windows (ISW) employed and ..."

Page 32; Caption for Table 4: State what is being correlated with the Pearson correlation coefficient.

Figure 1: It is hard to distinguish the yellow and green. I could not find the purple tangent points. Are these the same as the blue lines?

Figure 2: Again it is hard to distinguish the green and yellow segments- can the lines be made thicker?

Figure 3: Please explain what the red lines are.

Figure 5: Bottom right should be d).

Figure 7: Caption, 3rd sentence: "...in addition the a priori information employed with ..."

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12037, 2014.

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