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Atmospheric Measurement Techniques Discussions

Interactive comment on "A New Differential Optical Absorption Spectroscopy Instrument to Study Atmospheric Chemistry from a High-Altitude Unmanned Aircraft" *by* Jochen Stutz et al.

Anonymous Referee #1

Received and published: 6 January 2017

This manuscript describes a new and novel DOAS instrument for observations of trace gases from an unmanned aircraft. The article is generally readable, although the language is a bit conversational in places, and fully explores issues with these types of measurements. The methods compare constraint of the radiative transfer model via O4 observations to a novel O3 scaling method and demonstrate that use of O4 is challenging and the O3 method resolves many of these issues. The work clearly demonstrates an advance in airborne DOAS observations, including the first observations from a high-altitude unmanned platform and is appropriate for publication in AMT.

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Discussion paper

Specific Comments:

page 1, line 12: The wording of "due to frequent presence of low altitude clouds" is not very clear here as the sentence is talking about O4, not clouds. The wording could be made more clear.

page 1, line 15: I believe the "precision" of the measurement is being discussed, not the "accuracy"

page 2, line 10: Bry is certainly common, but should be defined here. The text defines it as a sum of organic and inorganic Bry, but fails to define Bry in general.

page 2, line 22: Photolysis rate of BrO (JBrO) also affects partitioning.

page 3, line 14: I don't think "nadir" is all caps. Also, these column-sensitive instruments "...provide no _altitude specific_ information on the UTLS."; they quantify the column including the UTLS contribution to the column.

page 3, line 22: Fix wording: "...interpretation of the data..."

page 4, line 16: Multiple parameters can be used for aerosol extinction constraint (e.g. use of radiances and O4 observations).

page 4, line 18: O4 does vary in time (as pressure and to a lesser extent temperature vary).

page 5, line 14: The citation to ground-based MAX-DOAS systems should include an "e.g." because these are a small subset of those references. Also, Hoenninger et al. (doi:10.5194/acp-4-231-2004, 2004) should be cited here as a seminal paper in ground-based MAX-DOAS.

page 7, line 3: How many fibers in bundle? Optical core diameters? This is in the table, so a reference to the table (2) can work.

page 8, line 8: I believe it should say "low solar zenith angle" rather than "...elevation"

page 9, line 8: This is a slant path for the integration; make more clear.

page 13, line 18: The albedo of ocean (0.2 in visible) seems high. Why is this chosen? Reference?

page 16, line 3: Replace "it" with "O4 reference", and indicate "for general (e.g. not fully clear sky) conditions."

page 18, line 13: There are three citations to theses in this line, and in general these theses may not always be accessible, nor are they fully peer reviewed. Other instances of theses also exist in the citations. It should be made clear that this method is described in those theses, but was not published in peer-reviewed form in those theses. See AMT reference guidelines.

page 20, line 33: Please also show the ratio of alpha factors to demonstrate the degree of "cancellation" of the variability of the individual factors.

page 22, line 7: I believe the column of overhead ozone is varied, not the shape of the profile. Please clarify.

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