Hüneke et al., The novel HALO mini-DOAS instrument: Inferring trace gas concentrations from air-borne UV/visible limb spectroscopy under all skies using the scaling method

Answers to Reviewer 1

The reviewer's comments are in black, answers are in red.

The manuscript describes the mini-DOAS instrument that has already been operated in a number of science campaigns onboard the German High Altitude and Long-range research aircraft (HALO) together with the so-called "scaling method" to infer trace gas mixing ratios from the mini-DOAS limb measurements. The paper is generally well written and provides an important reference for the mini-DOAS instrument and in particular its data analysis. I recommend publication in AMT after consideration of the following – mostly minor – comments.

Specific comments:

As the instrument has already been flown on a number of science campaigns and this paper gives only a few selected examples, I suggest to include a table listing deployments of the mini-DOAS instrument on HALO campaigns so far.

A new table listing all HALO campaigns in which the mini-DOAS instrument participated is included in the revised manuscript.

p1.l3: please spell out HALO as "German High Altitude and Long-range research aircraft (HALO)" when used for the first time and move the URL reference from the abstract to the introduction section.

The text is rephrased accordingly.

p2.l1: sentence ends early

The text is rephrased accordingly.

p2.l6: better either give an earlier reference for DOAS as well, or explicitly indicate that Platt and Stutz (2008) is a recent review of DOAS and not the original reference

The text is rephrased accordingly.

p2.l22: "German GV" -> "German High Altitude and Long Range Research Aircraft (HALO), that is based on a Gulfstream G550 jet"

The text is rephrased accordingly.

p2.l35: what exactly is meant by "celestial" here?

‚Celestial' is a standard expression in astronomy and it refers to the position of astronomical objects, here the sun and the earth.

p3.l29: "to" -> "to be"

The text is rephrased accordingly.

p4.l11: what exactly does "latter" here refer to? Only CCMs or CTMs and CCMs?

It refers to the incorporated model predictions. The text is rephrased accordingly.

p5.l18: insert "elevation angles"

The text is rephrased accordingly.

p5.l20: why "skylight" and not simply "light"0? I know its picky, but in general there may be other light sources than just skylight.

The text is rephrased accordingly.

p6.l9: Can you explain briefly why surface temperatures are important here and not the much cooler upper tropospheric / lower stratospheric temperatures at cruise altitude?

In this context the relevant time frame is the duration of the pre-flight preparations of the aircraft, while it is located on the apron. Access to the instrument is not possible and at large ambient T's some of the ice-water already melts affecting the instrument in-flight temperature on longer lasting sorties. The text is rephrased to make this clear.

p7.l10: any reference to BAHAMAS ?

No, unfortunately there is no proper reference for BAHAMAS available.

p9.l1: "Polstracc" -> "POLSTRACC"

The text is rephrased accordingly.

P9.l14: "Acridicon" -> "ACRIDICON"

The text is rephrased accordingly.

p10.l27: What is "EA"? Elevation angle?

EA is the elevation angle, as mentioned in section 2.4.

p11.l6: "Fairo" -> "FAIRO"

The text is rephrased accordingly.

p11.l7: "for measuring" -> "for in-situ measuring"

The text is rephrased accordingly.

p11.l16: not sure if "all 13 flights" is still relevant here, as many more flights on more recent campaign have been performed with FAIRO

The statement refers to the fact that the FAIRO instrument was first deployed on HALO during the ESMVal campaign.

p12.l17: horizontal resolution is not well defined for a Lagrangian model. Please give more detail what this refers to.

The horizontal resolution refers to the average distance between two neighboring air parcels in one model layer (see Vogel et al. (2015) and references therein and McKenna, Daniel S., et al. "A new Chemical Lagrangian Model of the Stratosphere (CLaMS) 1. Formulation of advection and mixing." Journal of Geophysical Research: Atmospheres 107.D16 (2002)).

p12/13: EMAC: Maybe include a few sentences about EMAC's chemistry scheme – in contrast or comparison to what has been mentioned for CLaMS.

In contrast to ClaMS, EMAC contains a very detailed tropospheric chemistry scheme. For the present EMAC model run, the submodel MECCA (Module Efficiently Calculating the Chemistry of the Atmosphere) is used to simulate the chemical kinetics, with the photochemical data taken from the JPL compilation (Sander et al., 2011) including recent updates (Jöckel et al., 2016). The details are presented by Jöckel et al. (2016), Section 3.5 on pages 1160/1161.

The text is added to the manuscript.

p14.l12: Suggestion: Say again explicitly that SCD_X and SCD_P are measured by the mini-DOAS, the alpha are from a model and [P] is measured in-situ. (If that is what you are doing.)

The text is rephrased accordingly.

p20.l11: better be a bit more specific of where no elevated BrO concentrations are observed. I assume this statement does not refer to the Antarctic boundary layer?

This refers to the Antarctic free troposphere. The text is rephrased accordingly.

Caption Fig. 2: Suggestion: Include in the caption date, location and campaign of sample measurement.

The text is rephrased accordingly.