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Interactive comment on "A tandem approach for collocated in-situ measurements of microphysical and radiative cirrus properties" *by* Marcus Klingebiel et al.

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Dear Authors ..

first of all congratulations to very interesting experimental approach and to a great manuscript

With regard to the description of the use of the SEALDH instrument during the AIR-TOSS campaign (line 250 to 257 of the manuscript) i have however a few comments and background informations which i think should be (at least partially) incorporated into the manuscript :

The SEALDH instrument development was started in Heidelberg University, Germany

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and went on at Physikalisch-Technische Bundesanstalt , PTB. In the course of this development several versions of SEALDH were developed (Main versions 0, I and II), which actually have different performance parameters with respect to accuracy, sensitivity and concentration range. It is therefore necessary in the manuscript to clearly state which instrument version was used, to update the relevant performance parameters in the article, and to cite the suitable articles as well as the reference for the most recent SEALDH version.

The instrument which was flown during AIRTOSS shouldn't be named "SEALDH". The correct version of SEALDH flown during AIRTOSS was (a first version of) "SEALDH-II". This should be adopted in the manuscript. Further we would recommend to add/replace the description of SEALDH and incorparate an extract of the relevant information related to SEALDH-II.

SEALDH-II's measurement uncertainty is calculated based on a physical model of the instrument (Buchholz et al., 2016 > SENSORS). The measurement technique used is correctly named as dTDLAS (direct TDLAS) which indicates that the raw data evaluation is based on physical, first-principle model and thus leads without any previous gas-based instrument calibration to an absolute [H2O] concentration value. In this proprietary evaluation mode SEALDH-II has a 4.3% linear and a $\pm$ 3 ppmv offset uncertainty. Assuming an 11% maximum acceptable uncertainty, the design concentration range of SEALDH-II starts at about 30 ppmv and reaches to near the water vapor condensation point in the instrument, which in the current version is reached when the dew point temperature gets close to the instrument temperature (this leads roughly to 40 000 ppmv). The long-term stability of the most up to date version of SELADH II was recently validated over a consecutive period of 18 month with respect to the highest metrological humidity standard of Germany at PTB. This validation indicated (relative to the primary standard) an average offset term of 0.17% and an average scatter of 0.35% (1ïĄş). In terms of the procedures described in the paper by Klingebiel et al , this number indicate the "accuracy/uncertainty" of SEALDH-II, und the assumption

SEALDH had been calibrated using the primary standard data. SEALDH-II resembles a new hygrometer generation, as it is the first calibration-free airborne hygrometer with a direct primary metrological long term validation (Buchholz and Ebert, 2017» AMT . Hence AIRTOSS is the first airborne hygrometer campaign with a direct metrological linkage to a primary humidity standard.

The rest of this paragraph concerning SEALDH is fine (time resolution etc.), I would however recommend using the word “measure” rather than “estimate” the concentration.

Up to date references for SEALDH II: Buchholz, B. and Ebert, V.: SEALDH-II – a calibration-free transfer standard for airborne water vapor measurements: Pressure dependent absolute validation from 5 – 1200 ppmv at a metrological humidity generator, Atmospheric Measurement Techniques Discussions, (February), 1–22, http://dx.doi.org/10.5194/amt-2016-413, 2017.

Buchholz, B., Kallweit, S. and Ebert, V.: SEALDH-IIâĂŤAn Autonomous, Holistically Controlled, First Principles TDLAS Hygrometer for Field and Airborne Applications: Design–Setup–Accuracy/Stability Stress Test, Sensors, 17(1), 68, http://dx.doi.org/10.3390/s17010068, 2016.

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