Review of W. Woiwode et al. "Technical note: Lowermost-stratospheric moist bias in ECMWF IFS model diagnosed from airborne GLORIA observations during winter/spring 2016"

The technical note by Wolfgang Woiwode and coauthors addresses the quality of ECMWF Integrated Forecast System analysis and forecast data on upper troposphere and lowermost stratosphere humidity using remote sensing measurements onboard HALO aircraft. The validation of IFS analysis makes use of high-resolution observations by GLORIA thermal infrared spectrometer observations of water vapour collected during five HALO flights above Europe in January-March 2016 sampling polar sub-vortex air masses. The model output is interpolated to the geolocations of GLORIA two-dimensional measurements and the intercomparison is performed in consideration of potential vorticity provided by IFS, which serves an indicator of the air mass origin and therefore its properties. The key outcome of the study is a confirmation of the moist bias in ECMWF LMS humidity already reported in the literature. The key figure pointed out throughout the article is the peak +50% wet bias compared to GLORIA.

The biases in UT/LS humidity data in ECMWF (re)analysis is certainly an important issue and even though the representability of the reported results may be questioned, the unique experimental setup and the thorough comparison approach render the study suitable for a technical note in ACP journal. The manuscript is well written and the graphical material is excellent.

My major concern on the manuscript is the oversold magnitude of wet bias in ECMWF and lacking discussion of the obtained results in the context of previous surveys. I believe the scientific value of this study could be enhanced by addressing the following remarks.

General remarks

- The introduction is too lengthy for a technical note and also misleading at times (see specific remarks). I would suggest to move most of it into discussion, where the results from the literature could be compared with the outcome of this study.

- I was surprised to see H2O mixing ratios down to 2 ppmv or less reported by GLORIA in this region of the atmosphere. I am not aware of any published or unpublished H2O measurements revealing such dry values in the sub-polar UT/LS. One might hypothesize that HALO has sampled an impressive dehydration event, however the anomalously dry values occur form one flight to another. The occasional dry artefacts in GLORIA can also be seen in Fig.10d of Johansson et al. I wonder how the individual and global difference profiles would look after a more rigorous filtering of GLORIA retrievals in the LMS.

- As an IFS data user, I would be interested to see more statistical figures in the abstract and conclusions beside the peak value of 50%. Although the figures do give a good idea on the bias distribution as a function of mixing ratio and PV, I believe the concluding statements could be smoother about the IFS moist bias.

Specific remarks

p.2, ll.47-52. It makes one wonder why the most advanced ECMWF model with highest possible resolution still suffers from the moist and cold biases. Is this specific to the operational analysis/forecasts only or applies to any products including reanalysis?

p.2,ll.49-57. The paragraph mentions several potential reasons for the model wet biases, which should belong to the discussion. Could the reported findings support one or the other assumption?

p.2. l.65. What sort of gap is implied here?