Comment on acp-2022-505

Anonymous Referee #2

Referee comment on "Vertical structure of the lower-stratospheric moist bias in the ERA5 reanalysis and its connection to mixing processes" by Konstantin Krüger et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-505-RC2, 2022

This is an excellent evaluation of ERA5 water avpor using a large airborne dataset from HALO. The techniques used to assess biases are varied and comprehensive and complement existing assesments for other reanalysis models. Overall, I find the manuscript to be in great shape and have only a handful of what I hope are helpful suggestions to the authors as they work to finalize the paper.

Comments:

Lines 97-102: While these outlines have become unfortunately common, I find them to be absolutely unnecessary. Recommend removing

The maximum in humidity bias in the lower stratosphere is highlighted throughout and first introduced in Figure 5. In considering this bias and the accompanying discussion, the thought occurred to me that temperature in that layer was not evaluated in great detail. Are their sufficient temperature profile data in the HALO measurements to also assess temperature biases in these environments? That seems to be incredibly important to understanding the context for such humidity biases. Perhaps this layer, commonly characterized by containing a strong tropopause inversion layer (of similar shape to the humidity bias even), is driven in part by a warm bias in the model? For these reasons, if possible, I would strongly suggest the authors evaluate temperature bias and add that here to provide further context on the likely nature of this bias (and its variability between environments).

Technical Edits:

Line 19: delete "located"

Line 193: delete "on"

Line 268: a word appears to be missing here. I think the authors meant to write "the systematic **nature** of the diagnosed"

Line 461: delete "the"

Line 473: "This supported" should be "This is supported"

Line 514: "profile" should be "profiles"