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Interactive comment on “Gimballed Limb Observer for Radiance Imaging of the Atmosphere (GLORIA) scientific objectives” by M. Riese et al.

Anonymous Referee #3

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General Comments:

This paper presents the scientific objectives that partly already has been and that will be addressed with the GLORIA instrument as well as some technical basics of an airborne infrared limb-imaging instrument. GLORIA has such an unprecedented combination of high vertical and horizontal resolution and wide spectral range and high spectral resolution that it offers many opportunities for new scientific missions, especially in the UT/LS region.

The paper is very well written, coherent and comprehensive and the topic is of high relevance and there are hardly any specific comments from my side. However, I personally have a problem with this paper, because it is not clear to me what the primarily

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intention and the new aspect really is. The paper feels like something between a scientific proposals (I assume some parts are more or less transferred from the individual mission proposals) and an overview of instrumental and scientific work that has been done and that is in progress at the moment. In fact, there are 3x AMT and 2x ACP papers in preparation and five (2x Adv. Space Res. and 3x AMT) GLORIA related papers has already been published.

My impression about this paper might be triggered by the fact that the GLORIA instrument is in a kind of intermediate state. The technical implementation of the instrument is done and it has been deployed to the first scientific missions. However, only a few papers about the first scientific results has already been published, most papers referenced here are still in preparation. Therefore, it seems too early to write a GLORIA overview paper. On the other hand, the general scientific objectives has already been formulated, discussed and published (e.g. Riese et al., 2005). So, this paper only updates the general objectives with a more detailed specification of upcoming missions, in which GLORIA will be deployed. All of these missions are in the field of UT/LS research and are mostly thematically covered (not in detail) by the general scientific objectives that has been proposed for the PREMIER satellite instrument.

One thing the authors should definitely do is to define the scope of this paper here, especially in comparison to the Riese et al. paper "GLObal limb Radiance Imager for the Atmosphere (GLORIA): scientific objectives" [Adv. Space Res., 36, 989–995, 30 doi:10.1016/j.asr.2005.04.115, 2005]. This would maybe clarify what this paper here aims for. Something one could think of is to extent the AMT special issue "Atmospheric limb imaging with GLORIA" to a combined AMT/ACP special issue. In this case this paper could serve as a link between the scientific applications (ACP) and the technical descriptions of the realisation (AMT) of the GLORIA instrument.

Maybe I am totally wrong, so I would like to leave the decision to the editor(s). In order to not get misinterpreted, I would like to argue for a publication in AMT (or maybe ACP, if a combined ACP/AMT special issue is planned). From my side, there are only minor

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revisions to be done (see below), but a more precise focus and orientation of the paper would be worthwhile.

Specific Comments:

Page 1542, Line 8ff:

“As an example, Fig. 6 shows measurements of ethane . . .”

It should be mentioned from which campaign these data stem from.

Page 1543, Line 25ff:

“Below 420 K, transport maximizes during summer and fall.”

I would add ‘quasi-horizontal’ for clarification.

Transport, in the sense of residual mean meridional mass circulation, below 420 K does not maximise in summer and fall, e.g. see streamlines in Fig. 1: Seasonal mean residual streamfunction DJF vs. JJA, in Birner and Boenisch (2011). Transport in the sense of tracer transport can hardly be quantified from solely meteorological data (frequency and covered area of wave breaking) because the tracer distribution and its gradients between the mixed air masses must be taken into account. Par example, if upwelling in the tropics and dowelling in the extratropics is stronger (NH winter) than the tracer gradient between tropics and extratropics of a typical tracer degraded in the stratosphere (e.g. N₂O) will be stronger in NH winter than in NH summer. This means that a mixing event of same strength between both reservoirs is more efficient in NH winter than in NH summer due to the underlying tracer distribution.

Birner, T., and H. Bönisch (2011), Residual circulation trajectories and transit times into the extratropical lowermost stratosphere, *Atmos. Chem. Phys.*, 11(2), 817-827, doi:10.5194/acp-11-817-2011.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, 7, 1535, 2014.

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