

Interactive comment on “Simulation study for the Stratospheric Inferred Winds (SIW) sub-millimeter limb sounder” by Philippe Baron et al.

Anonymous Referee #2

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Review of: Simulation study for the Stratospheric Inferred Winds (SIW) sub-millimeter limb sounder

Baron et al. ATMD

— General comments

This is a very nice paper that does a thorough job of describing the theoretical capabilities of an exciting new instrument under development. I have no hesitation in recommending that this paper be published in pretty much its current form, pending the authors addressing the mostly minor comments I have below.

My only broad comment is that I think the authors have somewhat glossed over the trade inherent in such measurements between precision and resolution (vertical res-

olution mainly in this case). They can afford not to dwell on it in this study because they've chosen a rather coarse 5km spacing for their state vector resolution, but I do think it deserves some mention (but probably not any new calculations). At no point do they discuss averaging kernels, but I imagine they've computed them, or could do so very easily. I expect that such kernels indicate that the information content is a good match for their 5 km grid (i.e., that A is a good approximation to the identity matrix, except perhaps at the top and the bottom of the profiles). I would however like them to add a discussion to that effect somewhere in the text. Their mention of the potential of finer 3km resolution for temperature (page 17, line 7) implies that they have looked into this issue somewhat. I encourage them to talk about it just a bit more.

One other minor point. The authors make no mention of frequency stability requirements for the instrument Local Oscillator (presumably tied to some lower frequency clock source). I presume the instrument (or spacecraft) design includes some suitable source, possibly tied to GPS signals. If is better than ~ 1 part in 10^9 , then I think it's OK to ignore it, otherwise it should probably be investigated for its impact on wind accuracy. Either way, it should probably be discussed. Measuring lines on either side of the LO can significantly reduce sensitivity to that term (at the expense of wind precision), but if the measurement approach relies on that it should certainly be discussed.

Overall, the level of detail is well suited to the topic, and the standard of English and graphics is very good (though there are few points here and there I tried to capture in my comments below).

— Specific comments

— Page 1

Line 2: "... platform, with a launch planned for near 2022. It is ..."

Line 6: "... perpendicular directions in order to reconstruct ..."

Line 7: Consider putting commas before and after "near 655 GHz"? Also add "amount

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of" between "small" and "wind"

Line 10: First word "the" -> "a"

Line 17: "... parameters and for study of methods ..."

— Page 2

Line 7: First word "of" -> "in"

Sentence spanning lines 7, 8, and 9: I'd turn this sentence around: "Some important species, such as HO₂ and ClO, have their clearest signals in this region of the spectrum (refs.)" or something similar.

Line 11: "... and measurements are not perturbed by ..."

Line 16: "... have difficulties in reproducing it where ..."

Sentence spanning lines 20-22: Again, I'd turn this around: "As climate and weather models increase their vertical range to encompass more of the stratosphere and mesosphere, the need for measurements to improve the accuracy of models in this region, and hence at lower altitudes, can be expected to rise", or something like that.

— Page 3

Discussion in first paragraph: Would be good to mention the WINDII and HRDI instruments and UARS. Was the information they provided not useful for your purpose, or at least some aspects of your purpose? Even though it was a while ago, were there not some questions that those instruments answered?

— Page 4

Lines 5-10: If you're nodding the spacecraft, presumably the rotation axis of that nod is along the flight direction. Does that not give the two tangent points a non-vertical locus? Is the choice to alternate the two views between the up and down scans intended to make them more vertical? If so it would be good to mention that explicitly.

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— Page 5

Table 1: 1 MHz for the spectrometer resolution seems a bit on the coarse side to me, given the upper stratosphere / mesosphere target. Have studies been performed to see if finer resolution (e.g., some "zoomed in" lower bandwidth spectrometers on selected lines) might not improve the wind measurements?

— Page 9

Line 24: If it's not too difficult, it would be nice to quantify "small" (e.g., of order 10 cm/s?)

— Page 11

Line 21: "AURA/MLS" -> "Aura MLS"

Line 27: You cite Figure 2, but that figure shows the coverage for the SIW orbit, not the Aura orbit. I don't see the need for a second figure, so perhaps it's simpler just to remove the citation of Figure 2 here?

— Page 12

Line 13: "that corresponds to" -> ", corresponding to"

— Page 13

Line 4: I completely understand your dropping the non-diagonal terms in S_y , but it seems a shame after you went to such lengths to compute them long hand. Given the power of computers these days, is it still too much work to compute the full matrix inverse, at least once, and see what difference it makes? I guess it is rather large, so probably not. In which case, why to go such lengths to take up space in the earlier sections defining it? It might simply be easier to tell us up front that you plan to ignore those terms and explain why that's OK, rather than exposing the reader to the full algebra only to discard it.

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— Page 17

Line 18: "First, we note that, except for O₃ and H₂O, all ..."

Line 30: Actually, ClO can be non-zero at night in some cases.

— Page 18

Line 24: Comma needed after "On the other hand"

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