

Interactive comment on “HDO and H₂O total column retrievals from TROPOMI shortwave infrared measurements” by Remco Scheepmaker et al.

Anonymous Referee #2

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This paper showcased potential bias and uncertainty of TROPOMI instrument to measure delta-D of total column atmospheric vapor and the overall performance of the retrieval algorithm with a simulation over a North American domain. The resulted performance was acceptable range to study the hydrological cycle in the atmosphere in addition to previous satellite-based instruments. The TROPOMI is planned to launch in the end of 2016.

I found this paper very interesting and well written. Since delta-D in the atmospheric vapor is indeed a useful quantity to understand the atmospheric hydrology and potentially to constrain the atmospheric dynamics through data assimilation, it is very important to improve the instrument. According to the results, the bias and uncertainty of the

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retrieved delta-D is only up to 20 permil and 25 permil, respectively. These will lead significant improvement in time and special resolution of the final product due to absence of large number of averaging. So it will be far better than previous instruments, like SCIAMACHY. It is indeed promising.

Only minor revision is needed. Please consider followings:

1. L34: Why don't you add instruments like TES and IASI? For users' point of view, they are all retrieving delta-D to understand the atmospheric hydrology.
2. L40: Not only understanding the hydrological processes, but also constraining the atmospheric circulation is important usefulness of vapor dD observation. Refer Yoshimura et al., 2014, JGR-A.
3. L92: What is SICOR?
4. L105: What is ISRF?
5. L196: What is interference kernel? (with regards to averaging kernel)
6. L250: These parts I was confused. I understood that this cloud filtering was optimized for methane retrieval. Is there any justification that this filtering is also optimized for deltaD retrieval? Why don't you similar figures like Fig 3 for delta-D?
7. L295: Why don't you refer delta18O's performance if you added the delta18O profile? Otherwise there is no reason to add this information in the paper.
8. L374: I don't understand "typical temporal and spatial gradients". Did you mean the range of seasonality or meridional variation? The reasons of those ranges are quite well known. What TROPOMI will add is something like daily variability and/or local (~100km interval) variations of vapor dD associated synoptic scale weather patterns. If so, the variation interval of at least 10 permil would be needed.
9. L408: What is FWHM?

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10. L414: It is likely not true to state that “uncertainties in the input profiles are expected to be random in nature”. Particularly for dD, we still don’t know the true vertical profile. So there are highly likely to be biased with the current assumption.

11. L423: What is HITRAN? Also, previously S-LINTRAN was used. Why different radiative transfer model is used for this purpose?

12. L451: Probably modeled profiles (especially ECMWF’s temperature and humidity and LMDZiso’s isotopic profiles) are simpler than the reality. What if the real profiles are complicated (when there are multiple inversions for temperature, vapor, dD)? My guess is that if the profiles are as simple as a-priori profiles, the retrieved values would become closer to the “truth”.

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