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Atmospheric Measurement Techniques Discussions

Interactive comment on "Microwave radiometer to retrieve temperature profiles from the surface to the stratopause" *by* O. Stähli et al.

O. Stähli et al.

oliver.staehli@iap.unibe.ch

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Dear Tim Hewison

Thanks a lot for the helpful and constructive comments.

There is no mention in the manuscript of GPS Radio Occultation. This has become an important method of retrieving stratospheric temperature profiles, largely independent of a-priori information. The authors should at least discuss the potential use of GPSRO profiles as a validation dataset of their stratospheric retrievals.

===Answer: We agree. We will mention the GPS Radio Occultation in the introduction with some citations.

The measurement error-covariance matrix, Se, is assumed to be diagonal. This assumption may not be valid if calibration errors are correlated between the instrument's channels. It would be possible to estimate Se statistically from a time series of observations of a stable target. It may be difficult to generate such a time series for scene radiances significantly different from ambient, and the calibration errors will be larger for colder scenes. However, it is also possible to use a time series of atmospheric observations in stable conditions to estimate Se. Such an estimate would include errors of representativeness, due to the instrument's sampling and atmospheric variability. Such errors should be included in the error budget when validating the retrievals against in-situ observations, such as radiosondes, or satellite data.

===Answer: We agree the assumption of Se to be diagonal may not be valid. But we think our assumption is the way that make sense, because to measure the off-diagonal relationship between the channels is very difficult.

The authors have assumed an empirical function for the a-priori covariance matrix, Sa,. However, it would also be possible to estimate this statistically from the same time series of radiosonde profiles used to provide the a-priori temperature profile. This would have the advantage of better representing the discontinuity in correlation between levels above/below temperature inversions.

===Answer: Applying the statistics from radiosondes to our tropospheric and stratospheric retrieval sometimes led to oscillations and choosing an exponentially decreasing covariance helped in this context. Furthermore the radiosonde reach only an altitude of about 30 km. It is not straightforward to merge the empirical Sa with a synthetic one for higher altitudes. To avoid this problem, and to have a coherent approach for Sa at all altitudes, we selected to apply a parametrized Sa. In addition some care is needed when using sonde data to derive Sa. One must take care that seasonal and annual changes do not influence Sa, as that generates correlations in Sa what is not favorable for retrievals.

Such temperature inversions are important meteorological conditions commonly found in Payerne, but maybe less so in Bern. The impact of the different climatology of Payerne and Bern should be discussed further, as should the capability of the retrievals to reproduce such inversions.

===Answer: We agree. We will reflect this in the revision.

It is not clear why the authors have chosen to retrieve the tropospheric and stratospheric temperature profiles independently. The same information could be combined optimally to retrieve a single profile covering the full vertical range, which is consistent with all observations. Although this is mentioned under future work in the conclusions, the benefits and shortfalls of the choice should be discussed further.

===Answer: We have chosen the retrieval independently because the time resolution of the two retrievals are different. Furthermore during cloudy sky (ilw>0.1mm) there is no stratospheric retrieval possible. We describe this in more detail in the retrieval section. Further we discuss the benefits and shortfalls of this topic in the paper. The combination of the retrievals are planned in the future, as mentioned in the outlook, for time intervals where we have measurements of the troposphere and the stratosphere.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2857, 2013.