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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.

T. J. Hewison

tim.hewison@eumetsat.int

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The manuscript describes a novel technique for retrieving tropospheric and stratospheric temperature profiles from a ground-based microwave radiometer. The paper is well presented, appears to be technically correct and suitable for publication in Atmospheric Measurement Techniques. However, a number of important aspects are missing from the discussion.

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 GPS-RO profiles as a validation dataset of their stratospheric retrievals.

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.

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.

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.

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.

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