Supplement

The RVMR type concept is relatively new. Details on various approaches can be found in Beer et al. (2008), Payne et al. (2009) and Shephard et al. (2011). This section will present some results from simulated retrievals that illustrate the robustness of this approach for model/satellite comparisons. Using the same set of simulated retrievals described in the manuscript (Section 3.2), sample pairs of true and retrieved profiles were compared as profiles and as RVMR values (Figure S1). Note that the true profile in these plots has had the TES averaging kernel applied. In the cases where the true and retrieved profiles are similar (upper left and lower right), the corresponding RVMR values are also consistent. Conversely, when the profiles differ, so do the RVMR values (upper right and lower left).

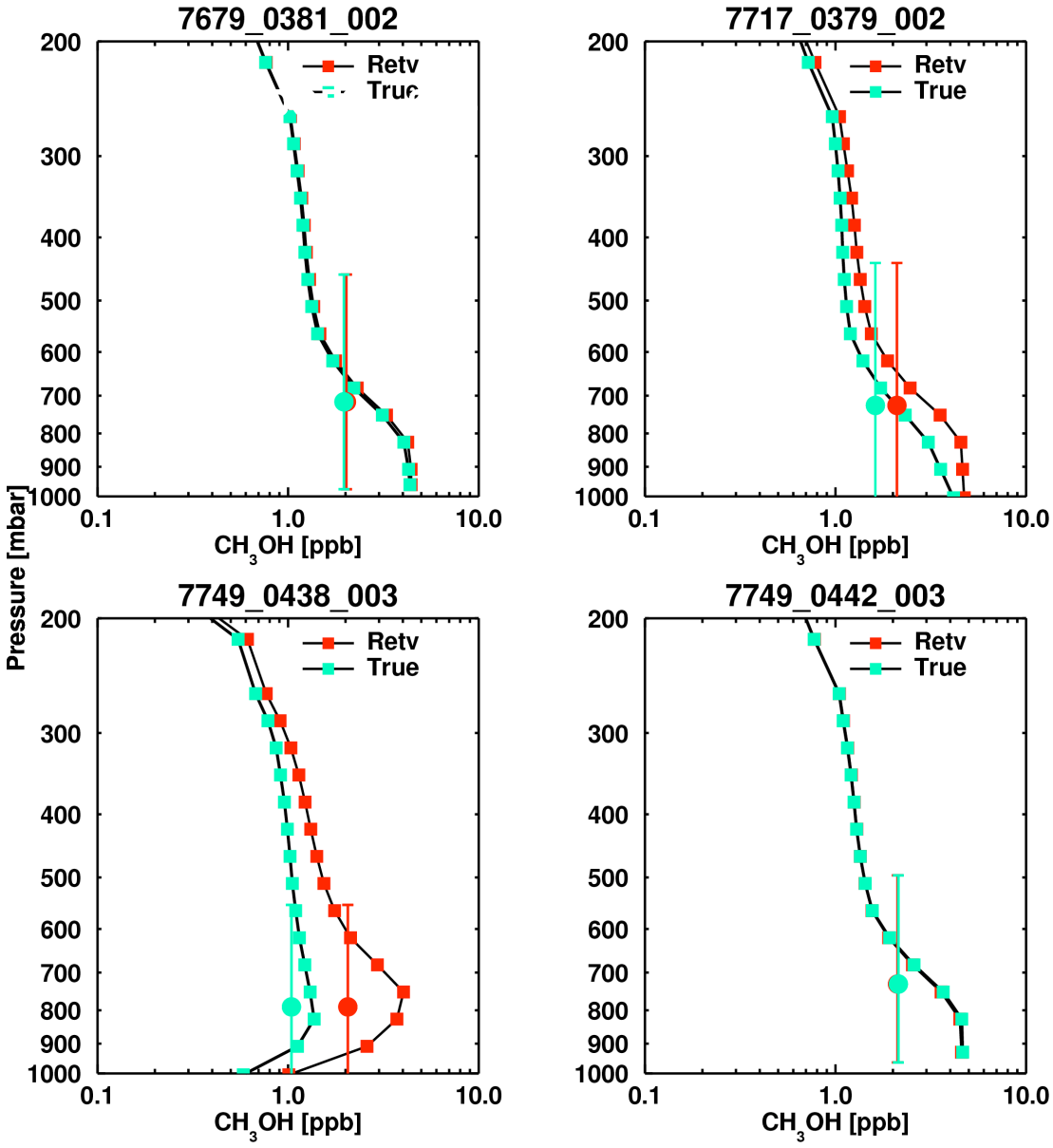

Figure S1: Four simulated retrievals; green squares: true profile, red squares: retrieved profile, circles: corresponding RVMR values. Vertical bars indicate region over which the RVMR is representative.

When all the profiles from this data set are compared there is only a small (0.16 ppbv bias) in retrieved RVMR. While calculating the RVMR for model output adds an extra level of complexity, it allows for better visual comparisons on a map, as selecting just one retrieval level value for a species with limited amount of information would result in a map dominated by a priori information (since retrieved values at most levels are sensitive to the a priori level values). Due to the low DOFS for methanol, profile comparisons are only useful in a simulation environment, where they allow for evaluation of the retrieval behavior. For example, in the lower left hand panel of Fig. S1 one might conclude that the retrieval performs quite well near the surface but very badly between 800 and 600 mbar, when in fact, given the lower sensitivity near the surface this value is not very meaningful in terms of the information TES is providing. On the other hand the RVMR shows clearly that this retrieval overestimates the true value.

In this paper we have closely followed the Shephard et al. (2011) method, in which all levels whose averaging kernel row peak are above a threshold are included. Deriving the mapping from the profile levels to the RVMR is still an active area of research. However, since the RVMR mapping is being applied in the same way to both the model and TES observations, the relative differences are shown not significantly affected by the RVMR refinements (e.g. two versions we have experimented with are within 2 %). Therefore, the exact choice of the RVMR mapping will not likely impact the conclusions reached in the paper.

References

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