

Interactive comment on “Stratospheric methane profiles from SCIAMACHY solar occultation measurements derived with onion peeling DOAS” by S. Noël et al.

Anonymous Referee #2

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The paper presents vertically resolved methane data for the atmospheric altitude range of 20 to 40 km in the latitude band of 50 to 70°N derived from solar occultation measurements of SCIAMACHY. The retrieval approach which is a simple onion peeling method is introduced. Necessary corrections are described, and comparisons to ACE-FTS profiles are performed. Finally, time series of methane profiles covering the SCIAMACHY mission lifetime from August 2002 to December 2010 are presented.

The paper is generally well organized and clearly written. A related retrieval approach has been used in earlier retrievals of water vapour from SCIAMACHY solar occulta-

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tions and has been presented in more detail there (Noel et al., 2010). A more explicit reference to this earlier paper including also the discussion of differences to this earlier method would be helpful to the reader. Although not able to provide the state-of-the-art retrieval diagnostics like averaging kernels, the onion peeling approach seems to be justified here because of its simplicity. Necessary corrections are justified and described in some detail. The comparisons to ACE-FTS and their discussion show a clear picture on the capability of SCIAMACHY solar occultation measurements to provide CH₄ profiles. The time series demonstrate high variability during winter time as it would be expected from the highly variable polar vortex conditions in boreal winter. Some more discussion on the time series, in particular regarding the sharp peaks seen during various winters (Fig. 5) would be nice.

Overall, I recommend the paper for publication in AMT after the following mostly minor comments have been addressed:

- p 4804, l8-10: Please provide a few more lines on the differences between the onion peeling retrieval methods applied here and in (Noel et al., 2010).
- p 4807, l 25: convolved instead of convoluted?
- p 4809, l 25: how has the error threshold of 1 ppmv been determined? This seems quite a lot, certainly more than 100% relative error. Are there criteria available from independent quantities like χ^2 , or convergence criteria?
- p 4810, l 2: Why has the retrieval been set up on a constant 1-km grid, and not on a tangent height grid, as it would be natural for onion peeling approach? This would avoid the necessity to smooth in a post-processing step. Has it been verified that the mass (number of molecules) along the slant path is conserved by the smoothing step?
- p 4813, l 10: please clarify what the 'mean error of SCIAMACHY VMRs' is. The standard error of the mean? Or the averaged error of the single SCIAMACHY profiles?
- p 4813, l 22 ff.: Since comparisons are presented in vmr, what contribution to the

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differences could come from differences in pressure and temperature between ACE-FTS and SCIAMACHY? Have you compared the pressure-temperature profiles of the correlative measurements? Further, which systematic error contribution could come from spectroscopic uncertainties in case of SCIAMACHY?

- p 4815, l 13: It is not necessarily mesospheric air which is observed in the stratosphere during polar winter (these vmrs should be much smaller), but just subsidence of the stratospheric air masses.

- p 4815, l 15: Some more discussion on the variations during polar winter, particularly the sharp peaks which occur most pronouncedly at 30 and 35 km, would be appropriate.

- p 4816, l 4: What do you mean with 'tropospheric influence'? Please specify.

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