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Interactive comment on "Validation of ENVISAT/SCIAMACHY columnar methane by solar FTIR spectrometry at the Ground-Truthing Station Zugspitze" *by* R. Sussmann et al.

Anonymous Referee #1

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General comments

The paper discusses the validation of the SCIAMACHY dry-air normalized columns of CH4 (XCH4) retrieved from the WFM-DOAS algorithm versions 0.4 and 0.41, using ground-based FTIR data from the Zugspitze station. The validation effort covers 153 days in 2003. The most important conclusions drawn from the work are (1) that the correction implemented in WFMD v0.41 for a time-dependent bias observed in the v0.4 SCIAMACHY data, related to the decontamination process, leads to a major improvement of the data. Still additional corrections for the time-dependent bias are needed.

(2) that the intrinsic precision of the SCIAMACHY v0.41 data, i.e., in the absence of any time-dependent bias, when averaged over a 2000 km or 1000 km radius, reaches 0.3% or 0.6%, respectively. These figures indicate, according to the authors, that SCIAMACHY has the potential to capture the XCH4 atmospheric day-to-day variability and the annual cycle on these spatial scales. The conclusions are clearly stated. The validation methodology is described in large detail. The statistical analysis is clearly explained. Some interesting quantitative evaluations of the impact of the smoothing error are given. Figures and Tables provide appropriate material and are of good quality.

Nevertheless, I have serious doubts about the approach used to reach the conclusion that SCIAMACHY has the potential to capture the XCH4 atmospheric day-to-day variability and the annual cycle on spatial scales of the order of 2000 to 1000 km radius, for the following reason: A circle with radius 2000 km around the Zugspitze (the location of the reference FTIR data set) encompasses the whole of Europe, up to high polar latitudes, down to North Africa, eastwards well in Russia and westwards over the Atlantic Ocean. It is clear that within this large region CH4 is not homogeneously distributed, and total column gradients from one region to another may be as large as 5 to 10%. The statistics underlying the conclusions suppose that all samples in the 2000 or 1000 km radius area are drawn from the same population which is no more the case. Moreover, what is the sense of using the Zugspitze data, at one single site, as the reference to compare the 2000km radius averaged SCIAMACHY data with? For example, what is the meaning of the so-called bias (section 4.1.1) if one is not comparing comparable quantities? The same question holds true for the comparison of the scatter: how can one compare the day-to-day variability at the site of the Zugspitze, dominated by local tropopause variations, with the residual scatter on the SCIAMACHY data that represent averages over such a large area as the whole of Europe? To my opinion, the underlying concept of the study that is to average the SCIAMACHY data over an increasing area, for the purpose of enlarging the statistical ensemble, is erroneous, because one is changing the population in the ensemble. The SCIAMACHY data and the Zugspitze reference data are no longer comparable quantities.

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The above fundamental questions have to be answered before going into the discussion of more specific scientific and technical comments/questions.

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