**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "A method for improved SCIAMACHY CO_2 retrieval in the presence of optically thin clouds" *by* M. Reuter et al.

Anonymous Referee #1

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This is a well-written paper that documents the development of a CO2 retrieval algorithm to supersede WFM-DOAS. The paper contains a detailed description of the retrieval algorithm and a thorough error analysis. Consequently, I have only very minor comments that need addressing. It will be very interesting to see how this new optimal estimation retrieval performs when (a) applied to real SCIAMACHY data which will be the real acid test and (b) when it is optimised with respect to processing speed.

Introduction

Please put in a definition of XCO2.

Please mention that OCO was an unsuccessful launch and cite the article by Palmer and Rayner (Nature, 2009) which discusses this event.

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Page 2486 Line 10: Typo. Something has gone amiss with brackets around the references.

Page 2488, Lines 16-24: Please rephrase the following paragraph as it contains unnecessary information:

"Unfortunately, thin clouds with optical thicknesses below 0:1 cannot easily be detected within nadir measurements in the visible and near infrared spectral region.For example, Reuter et al. (2009) and Rodriguez et al. (2007) found that the cloud detection quality is reduced for thin clouds. Reuter et al. (2009) analyzed data of two cloud detection methods for the SEVIRI (spinning enhanced visible and infrared imager) instrument aboard MSG (METEOSAT second generation) and Rodriguez et al. (2007) analyzed data of a cloud detection method for the GOME instrument aboard the ERS-2 (European remote sensing) satellite."

to:

"Unfortunately, thin clouds with optical thicknesses below 0:1 cannot easily be detected within nadir measurements in the visible and near infrared spectral region (see e.g., Reuter et al. (2009) and Rodriguez et al. (2007))."

Style: Please make sure all acronyms are capitalized e.g, ". . . NOAA (National Oceanic and Atmospheric Administration). . ." and elsewhere.

Please state what 'ASP' is, as it introduced without a definition (I assumed it is aerosol scaling profile).

Page 2495 Line 1: Typo: "These elements are better constrainted because simultaneous fitting implicitly utilizes the knowledge that the retrieved quantity. . ."

Page 2498 Paragraph starting line 24 : It is not clear to me how the ECMWF profiles are interpolated with regards to the surface pressure; is it the radiosonde station or the satellite ground pixel? Please provide a better explanation.

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Page 2500 Line 13: Typo: "...as the fraction of air molecules..."

Question: How good is the spectroscopy in the O2-A fit window? How does this impact the subsequent retrieved parameters?

Question: Is the any benefit, with regards to the retrieval of aerosol and cloud parameters, from using a full spherical radiative transfer model rather than by assuming a plane parallel atmosphere?