Atmos. Chem. Phys. Discuss., 8, S607–S611, 2008
www.atmos-chem-phys-discuss.net/8/S607/2008/

Atmospheric Chemistry and Physics Discussions

ACPD

8, S607–S611, 2008

Interactive Comment

Interactive comment on "Synergetic aerosol retrieval from SCIAMACHY and AATSR onboard ENVISAT" *by* T. Holzer-Popp et al.

Anonymous Referee #2

Received and published: 7 March 2008

GENERAL COMMENTS

The manuscript of Holzer-Popp et al. presents an adaptation of an aerosol retrieval algorithm originally developed for ATSR-2/GOME and now applied to AATSR and SCIAMACHY. The AATSR instrument is essentially used to retrieve the aerosol optical thickness at 0.55 mum whereas SCIAMACHY is used to define the most plausible aerosol type. Specifically, the paper presents an information content analysis and describes three improvements implemented in the latest version of the algorithm. The three proposed improvements concern (i) the extension of the aerosol model, (ii) cloud screening and (iii) dark field method. Few examples of results are also shown.

The overall scientific objective of the paper is not clearly stated in the introduction.

The realised work is presented as the objective of the manuscript, as is the case for a progress report. Such situation raises several fundamental questions about the organisation of the manuscript. Specifically, it is not clear whether the major original contribution of this paper is the new improvement or the information content analysis or both. No link between these two parts appears in the paper, making its overall structure difficult to follow. In other words, why the information content analysis not used to assess the impact of the proposed improvements?

The paper addresses a relevant question concerning the amount of aerosol properties that can be derived from 10 different spectral information. Unfortunately, the proposed method is inaccurately used.

Section 2 dedicated to the analysis information content with regard to the aerosol composition is rather inaccurate and is applied only on the second step of the algorithm. Some numerical aspects of this section are erroneous (see specific comments) and should therefore be removed or re-elaborated. This remark concerns essentially the elaboration of the non-diagonal terms of the error covariance matrices and the inclusion of the forward model in the error. Should the second option be chosen by the authors, the method should be consistent with the retrieval scheme. It seems that the inversion is simply based on a least-square fitting. Additionally, the gain in the information content resulting from the algorithm improvement clearly established. Finally, as only it concerns only half of the retrieval scheme, its interpretation is rather limited.

To conclude, I would thus suggest to the authors one of the following two options : (i) Remove the information content section and concentrate on the improvements, with a quantitative assessment of their impact on RMSE. (ii) Focus on information content, state correctly the problem, define and discuss correctly the matrix construction (which then should also be used in the retrieval).

SPECIFIC COMMENTS:

1. Introduction: The introduction is too long. It is not clear why such a long review of

ACPD

8, S607–S611, 2008

existing methods (from p2905 line 3 to p2909 line 26) is relevant in the context of this paper. I would suggest to remove these lines or to create a specific section to host this review.

2. Introduction: The paper scientific objective not clearly stated. The relationship between the information content analysis and the algorithm improvement is not clearly established. Is the purpose of this analysis to propose a method to assess the algorithm improvement?

3. Section 2: There is an inconsistency between the retrieval method proposed in Section 2.1 and the DFS analysis proposed in Section 2.2. Error covariance matrices should be the same in both cases.

4. Section 2.2. This type of approach has been developed and used for systems where all the variables have the same physical dimension, eg, number of vertical temperature or humidity values in case of sounding. Hence, it cannot be used as such when variables have different units whose magnitude might be very different. Such method might be applicable if all variables are first scaled for instance between 0 and 1. As it is not the case here, any interpretation of the analysis is meaningless.

5. Page 2913, line 6. Replace 7 by 10.

6. Page 2914. The measurement vector consists in 10 spectral observations. Why are they simulated?

7. Page 2914. Considering 40 a priori aerosol mixtures and 12 a priori surface reflectance as state parameters is erroneous. In principle, the state vector is composed of - the four aerosol micro-physical properties listed in Table 1, ie, the complex refractive index, the mode radius and its standard distribution and the particle density. As these four basic properties can be mixed as can be seen on Table 2, this represent a maximum total of 16 variables (up to four mixing are possible). Note that the extinction coefficient and ssa are derived from the Mie theory and should not be considered as

ACPD
8, S607–S611, 2008

Interactive Comment

state variables. - The relative humidity - The surface reflectance in each spectral band, ie, 10 values.

The information content should thus analyses how much of these 27 or so state variables can be retrieved from the measurement vector and the a priori information.

8. Page 2915. The accurate determination of the measurement and a priori error covariance matrices is absolutely fundamental for a relevant assessment of the information content. The measurement error covariance matrix should be composed of the total measurement system uncertainty, ie, observation, cloud screening and forward model. A diagonal form for such matrix cannot be justified, eg, co-registration error, inter-band calibration error, approximation in the forward model, … As concern the a priori error covariance matrix, it should be composed of the true state variables and in no way might be considered as a diagonal matrix. This matrix should contain information on how the aerosol properties are mixed to generate a pre-defined mixture. The same is true for the surface spectrum. Note that the elaboration of such matrix is not straightforward.

9. Section 3.1. Why only spherical particles are considered for this improvement?

10. Section 3.2. The uncertainty associated to the cloud screening should be included in the measurement error matrix (which is supposed to represent only cloud free observations).

11. Section 4.1. What is the benefit (reduction) between V1 and V2 in term of RMSE? In other words, what are the bias, stdv and corr values for version 1.0.

12. Section 4.2. The purpose of this section is not clear, as it only contains results from version 1.0. It should be remove from the paper.

13. Section 5: This section should be re-organised according to the actual paper objective (see general comments).

ACPD

8, S607–S611, 2008

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2903, 2008.

ACPD

8, S607–S611, 2008