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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Assimilation of Envisat data (ASSET) project" *by* W. A. Lahoz et al.

Anonymous Referee #2

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General comments:

This paper describes and discusses the main achievements of the ASSET project. The primary goal of ASSET is the assimilation of the ENVISAT plate-form products into numerical weather prediction models or chemistry transport models. The authors are considering data assimilation experiments for observables relevant to NWP (humidity and temperature), and then experiments relevant to CTM, that is trace constituents.

The paper completes the earlier report "The ASSET intercomparison of ozone analyses: method and first results" (acp-6-5445-2006) by Geer et al. This one focusses on the assimilation of ENVISAT products into numerical models. The paper gives a fair and detailed view on current progress on assimilation of satellite data into numerical models. As such, it is interesting and significant.

Yet, as a collection of contributions, it is not so simple to draw a unified picture of the

results from the paper. The conclusion does so, but some effort could be put into a better articulation of the main sections.

Also additional background information could be provided. For example, DA technical terms used in the paper could be explained in a few words (or mentioned as related to DA) since this report does not supposedly only address to DA experts. Also orbital parameters and specifications of ENVISAT could be reminded.

Specific comments:

- There seems to lack references to the works that used ENVISAT instruments data, outside the ASSET group. In that respect, a short paragraph on the broad use of ENVISAT data, which is lacking in the introduction, may offer some perspective to the reader.

- In the third paragraph of page 12776, a brief sentence to explain that the discussion on the Met Office results is postponed to two paragraphs further is desirable, since it is not clear at this point and in the two paragraphs, why there is no comparison to the Met Office data.

- Is there a reference or a technical note on the Met Office work (end of second paragraph, page 12777) ?

- In the second paragraph of page 12778, the bias in the relative humidity cannot be explained only by the vertical correlation in the prior errors (since by definition it correlates the errors and does not set the local magnitude of the field that is studied.)From the curves shown in Fig 2, naively, one would think that (in addition to the reason given) there must be either a significant dose of model error if the level 2 products are to be trusted, or a significant bias on the vertical data retrieval. Are there available data from airborne observational campaigns to validate these profiles against (at least up to 40-50 kms high) ?

- In page 12779, line 24, there is no proper reference to the HALOE experiment.

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- In page 12786, line 12, could you describe what is meant by "a photochemical box model" ? Does it mean it is not a full 3D model ? Such a precision could be useful as several models of different kind for different physics with different approximations are alluded to throughout the paper.

- The retrieval of temperature through assimilation of NO_3 and O_3 is well described and very interesting to read.

- In page 12788, line 9, the first reference to table 1 could be omitted since there is an explicit reference a few words further.

- In page 12788, line 18-19, this part of the work does not encompass the boundary layer, does it ? The present formulation let us think assimilation in the boundary layer is solved altogether. This should be mentioned explicitly since - it is still to formidable task to assimilate ozone satellite data in air quality model in the boundary layer. - the subject is treated in the following section (please consider improving the articulation between the two contributions).

- In page 12789, much emphasis is put on the analysis based on the $a - o$ difference. This is interesting in itself. However from a pure DA point of view, it is the statistics of the analysed state minus the true (unknown) state that should be used for the a posteriori analysis. Was this point addressed ? Note that with an improperly balanced DA system, $a - o$ can be made arbitrarily small.

- Section 2.4 is very well introduced and the results well summarised.

- In page 12795, line 16, could you please quantify the improvement ?

- Gome (ERS-2) and Sciamachy data on NO_2 have been assimilated into a CTM for air quality purposes (Konovalov et al 2006, acp, vol. 6, pp 1747-1770). This is not neither mentioned nor commented.

- Fig.13 is fine but does not really reflect the performance of the assimilation. Why not add a map of the difference between assimilation of all data (satellite + ground) and

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ground data only, as a fourth member of the panel ?

- In page 12801, first item: The statement "One of the first evaluations of the impact of assimilations of NO_x data into a CTM system..." may sound strange to air quality modellers who have assimilated NO_2 from ground stations. Especially in the conclusion, it cannot hurt to be more precise: "...of satellite NO_x data...".

- Figures 2 and 4: could you please use full, dashed, etc, lines for curves in addition to colours so that black and white print out be as much as possible readable.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12769, 2006.