**Atmospheric
Chemistry
and Physics
Discussions**

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Comment

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

Anonymous Referee #1

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General comments

Why is the focus on MIPAS? Is this a deliberate choice? If so, what were the arguments? Could the same results be achieved with SCIAMACHY, MOPITT, GOME, OMI, etc. Data?

Many sensors / retrievals perform quite differently over land and sea. This is not addressed. Is it because it is not a problem? Why not? or is it in some other way eliminated by the data assimilation process, or in other way - How?

The use of "above" (and below) a certain level of pressure, e.g. 12776-27 "Above 1.0 hPa" Thia can be interpreted as "at higher altitudes than that of 1.0 hPa" but it could also (wrongly?) be interpreted as "region with pressure greater than 1.0 hPa". where possible and appropriate it would diminish confusion if such references could be avoided.

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Specific comments

p12772-25 You do not, at this point, reflect on the use of Level1 data for DA. It is fully justified later in the text, but a short notice at this early stage might be useful to the reader, as Level1 data are not routinely used for this purpose.

p12775-01 "satellite"? Don't you mean "balloon"?

p12775-16ff "following their recommendations, any correlation between temperature and specific humidity is removed from the control variable" Though this is documented elsewhere, and properly sited, it would help the reader with a few lines of detail on how "any correlation is removed".

p12755-22 "NMC method" .. "ensemble method" A few lines on how the differences between these methods may influence the present work would improve the understanding of the importance, to the non-DA-expert reader.

p12775-24 "The Oberservation operator" This term is never explained, nor are any sitations given to background reading. The Non-DA-expert reader will have little chance to understand how: "The operator averages the information from the eight grid points..."

p12776-14ff Figure 1: Despite the explanations, this figure is quite difficult to follow in details. Especially the text mentions a number of should be, well known locations and features ("the very dry tropical tropopause", "poleward propagation of the dry air entering the stratosphere", "the tropical tropopause", "relatively moist upper stratosphere and lower mesosphere", "UTLS region", "the vertical gradient in specific humidity in the lower stratosphere" and "The southern hemisphere polar vortex") Sorry to say, but I find that it is difficult to point out these features on the figure. To make room for the possibility that I am insignificantly updated, I asked two fellow climate researchers. They too had difficult pointing out the specified features on the figure. That the features are not all well defined by change in pressure, but rather from temperature can also be seen from, eg. http://www.metoffice.gov.uk/education/secondary/teachers/atmosphere.html

If it is possible to overlay the figure with some sort of dotted lines indicating, e.g. the tropopause and stratopause I believe that would be helpful.

p12777-10 "The lack of any horizontal error correlations in the BASCOE assimilation scheme appears not to be a problem due to the high spatial and temporal frequency of the MIPAS humidity data" This is an important observation for others to follow. Could you elaborate a bit on what resolution, spatial and temporal, should be required from EO data in order to reduce/eliminate problems from the assumption of horizontal homogeneity.

p12778-01 "the analyses being consistently too dry." That would be compares to the MIPAS retrieval, here called measurement. What is the accuracy of the retrieval in this region?

P12779-10 "all available operational data". What does that include?

p12779-12ff "The test experiment also assimilates height-resolved MIPAS temperature, humidity and ozone retrievals. Comparison of the results against MIPAS observations shows that assimilating MIPAS data has..." Can we then conclude that the model better fits the EO retrieval after the EO retrieval have been assimilated? If this is the case, it would be relevant to explain why this is not self evident.

p12799-24 "The ECMWF analyses were also compared against independent data from HALOE. These results generally support the findings from the comparisons with MIPAS observations described above." This considerably strengthens the statements in p12779-12ff

p12780-05 "results in a slight degradation" I fact it is so small that it is hardly significant, except for maybe in the uppermost stratosphere.

p12781-12 "and the bias correction of the higher-peaking satellite channels is also less well characterized than at lower levels." Is this in fact an argument that supports the finding? Would one expect a better analysis (reduced bias) from the fact that the bias

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correction of the satellite is less well characterized?

p12783-01 "direct radiance assimilation" Like: Direct assimilation of radiance, or Assimilation of direct radiation?

p12783-03 "assumes local horizontal homogeneity" Is this safe? If not how could potential errors be identified (when/when should one be suspicious of later results)

p12784-22 "The developments for the MIPAS limb radiance assimilation allow a range of different aspects to be studied in greater detail, and some of these will be further described in upcoming papers."... It is indeed promising. We are looking very much forward to that.

p12786-13 "The CTM (a photochemical box model) is coupled to a 4D-Var scheme that assumes that the model is perfect." Is this problematic? What happens, worst case, is the model is not perfect?

p12787-23 "Most systems assimilated a common ozone observational dataset, i.e., MIPAS, though some assimilated SCIAMACHY". Are they inter compatible? What differences, if any, are expected from assimilating MIPAS vs. SCIA retrievals.

p12789-11 "Figure 10 shows that, through most of the stratosphere (50-1 hPa)" I would rather say (50-2 hPa) from looking at the graph...

p12789-26 "These analyses are those using Cariolle..." I would prefer a proper listing here. ECMWF-MIPAS is the only one you do not all ready mention.

P12790-28 "Ozone has photochemical relaxation timescales of O(1 month) in the UTLS, and O(1 day) in..." This O is confusing, can you just use the values in parentheses?

p12793-11 "the general paucity of global tropospheric measurements from satellites" What general paucity? Some would argue that an enormous amounts of information is pouring down every second.

p12795-05 "Similar" No - The upper scatter plot shows, as stated, blue dots that are immediately visible and significantly closer to the 1:1 line than the red dots. The lower plot do not, in any convincing way, show that the blue and red dots have significantly different distributions. They may well have, but this can not be seen from the graph.

p12795-22 .. p12769-01 "MIPAS measures the atmospheric limb emission ... key atmospheric species (known as "target species"): H2O, O3, HNO3, CH4, N2O and NO2." This entire paragraph (7-8 lines) give good introductory explanation. It might serve better if moved to an earlier location in the document.

P12797-28 "The largest differences between the two algorithms are in regions where atmospheric meridional variability is greatest (e.g. near the Antarctic polar vortex)." "I am aware what meridional means, but what exactly is "meridional variability"? Is it where the value at local solar noon varies considerably from day to day?

Figure 1. Have some problems. See: p12776-14ff above

Figure 7. Quite impressive and convincing.

Figure 14. It would be nice, if possible, if the same legend could be used for all 8 "globes"

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