

Interactive comment on “Accuracy of analyzed temperatures, winds and trajectories in the Southern Hemisphere tropical and midlatitude stratosphere as compared to long-duration balloon flights” by B. M. Knudsen et al.

B. M. Knudsen et al.

Received and published: 28 October 2006

To follow is our reply to the reviewers comments. We have included what the reviewers wrote for convenience. Our reply is preceded by 'Reply:'

*** Anonymous Referee #1 ***

The study is of highly scientific interest as it provides a new intercomparison between the operational ECMWF (NCEP/REA) data and independent in-situ measurements. These new results are very important for research studies which depend on the accuracy of assimilations systems such as for example chemical transport studies in the

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

stratosphere do. Although the authors clearly point out their new work, the motivation (e.g. as mentioned above) is somehow missing in the introduction. The paper would be a bit short if it would stand for its own. Due to the fact that it belongs to the special issue of the HIBISCUS campaign and that they are other accompanying papers (e.g. Pommereau al., Christensen et al. cited) this doesn't seem to be a problem. The publication of the paper is recommended with minor revisions as described below. General comments: 1) The introduction is a bit short and the motivation for the paper is missing. The paper is investigating not only the analyses accuracy but also the trajectory codes. In fact it also gives a trajectory code evaluation, which is also an important contribution for the research community. This latter point could be a bit more strengthened by the authors.

Reply: We have motivated the paper better in the introduction

2) Due to point 1) a bit more detailed description of the trajectory codes is missing, which is important and should be added.

Reply: Done

Specific comments: Title: As you are only comparing analysed horizontal winds with in-situ measurements you should change the title accordingly to: "Accuracy of analysed temperatures, horizontal winds...."

Reply: The term 'wind' incorporates horizontal winds, so in order not to make the title even longer we have stuck to this term.

Section 2: The abbreviation BP is not explained.

Reply: done

3. Analyses: It remains unclear why you are using two different trajectory codes here?

Reply: The two codes were used by different coauthors. The differences due to the use of different codes should have an insignificant influence on the results presented.

5. Trajectories "this figure also shows that the major part of the wave perturbations seen on BP4 trajectory is not caught by the ECMWF analyses." Could this be due to the fact that you use rather coarse resolution (T79) of the input data? So if you would use the 0.5x0.5 deg data from T511 ECMWF you would analyse the wave perturbations? Change the text to a more cautious argument!

Reply: Good point. We have added the following: We have tried to run trajectories at the highest possible resolution (0.5x0.5 deg from a T511 truncation) for the second revolution of the balloon (not shown). This leads to small changes in the calculated trajectories, but the major part of the wave perturbations are still not caught.

6. Conclusions -After 5 days the average trajectory error is about 500km. In the abstract you write 700 km? Please correct one of the values!

Reply: Actually, there is no discrepancy, since the 500 km is valid when one flight with large errors is omitted

- The ERA40 results (Page 7508, line 15-21) are not your results! They belong to an other study in the HIBISCUS special issue. Cut them out of your conclusions and put them into the discussion of your results!

Reply: Done

Figure 2: Six-hourly data are compared?

Reply: This is added where the figure is introduced

Figure 5: Where does the lonely green vertical line come from in the upper right corner of your plot? It looks suspicious.

Reply: This is the remainder of the BP7 line

*** Anonymous Referee #2 *** General comments: I think this could be a useful paper for the scientific community. However, I think it still needs a lot of work before it is suitable for publication in ACP. In my view, the main shortcoming of the paper is that

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

it does not have a clear statement of its motivation. The title does give a clue, but the text does not. For example, at least the abstract, introduction and conclusion should include a description of the motivation of the paper and a description and motivation of the HIBISCUS project.

Reply: We have included a motivation of the paper in the introduction, but we refer to the overview paper of the HIBISCUS special issue for a motivation of the project.

Furthermore, I find a lot of the discussion confusing and difficult to set in the context of the paper. For example, it is not clear to me why the paper discusses Arctic trajectories (section 5).

Reply: Most results concerning trajectory accuracy so far have been concentrated in the Arctic, so a comparison is valuable. We acknowledge that it may make the paper a bit harder to read, but decided to keep the information because it might be of interest to others.

Finally, the paper needs clarification in several places, details of which I give in the specific comments section below. Specific comments: P. 7500, line 5 and following: A description of the HIBISCUS project and a motivation for the paper are needed.

Reply: Done, but see above

Line 24: Equador -> Ecuador

Reply: Done

P. 7501, lines 4-9: Acronyms should be identified here and elsewhere in the paper.

Reply: Done

Lines 17-18: What is the motivation for comparison of the ERA-40 re-analyses against the balloon flights?

Reply: Please refer to the Christensen et al paper.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Line 19: A description of HIBISCUS and a motivation of the paper are needed.

Reply: See above

P. 7502, line 4: Is the special issue in preparation as indicated in footnotes 1-2 or is it a special issue to which this paper has been submitted? Reading the paper I got the impression that it had not been submitted to the HIBISCUS special issue.

Reply: The paper has been submitted to the existing HIBISCUS special issue

Line 9: stay-> stayed

Reply: Done

Lines 12-13: Are the errors quoted random errors?

Reply: No

Line 19: “As expected”? Is this obvious? Perhaps a brief explanation would help.

Reply: Done

Line 25: “to 0.1 K” -> “as 0.1 K”. I think this makes it clearer that the bias is estimated as 0.1 K (as I understand the text).

Reply: Done

P. 7503, lines 5-6: I do not understand the text. As I interpret it, only night-time measurements from MIR are meaningful (I presume this means useful to the study), so that implies day-time measurements are not meaningful. As night-time measurements are not going to be used in the present study, presumably day-time MIR measurements will be used, which as suggested above are not meaningful. Please clarify.

Reply: We have rephrased the sentence

Lines 16-17: “ α Eoperational analyses in 2004 α Eand are used at 6 hourly α E”

Reply: Corrected

Lines 24-27: Why the difference in the way the trajectory calculations are done?

Reply: The two codes were used by different coauthors. The differences due to the use of different codes should have an insignificant influence on the results presented.

P. 7504, line 3: Presumably you mean the ECMWF operational analysis?

Reply: 'operational added'

Line 10: When you say “ α E started already in 1998 α E” do you mean the problem was already known then, or changes in the system caused it to appear then. Could you say what caused the problem?

Reply: It appeared then as now clarified. I do not know the cause.

Line 20: “north of 30S”: do you mean between the equator and 30S? Is the zonal velocity under discussion that of ECMWF?

Reply: Its 0-30S and ECMWF velocities, as now written

Line 23: Why do the ECMWF analyses not capture the inertia-gravity waves? Is this a resolution issue?

Reply: We have added: Several factors can explain that the inertia-gravity waves are not well represented by ECMWF: The first is that at the BP flight altitude, the ECMWF vertical resolution was about 1 km in 2004, while the dominant vertical wavelength of gravity waves in the lower stratosphere is about 2 km. The vertical resolution was thus a bit too short to fully resolve those waves. The second is that analysis outputs are stored every 6 hours, which is an undersampling of the model time resolution. Gravity waves, which have periods of about 1 day, may be damped by this undersampling. The third is that a major source of gravity-waves in the tropics is convection, which is parameterized in the ECMWF model, so that the model may miss the physical processes that generate the waves.

P. 7505, line 7: I think it is better to say: “ α E vertical motion of the trajectories is taken

account of.”

Reply: Done

Line 9: Identify what you mean by “tropical reservoir”.

Reply: The region between the northern and southern tropical edges.

Lines 13-15: Explain your statement. From the figure, I see the trajectories are smoother than the BP4 trajectory. Is this (partly) due to the relatively coarse resolution at which the trajectories are implemented (see section 3)?

Reply: See our answer to referee #1.

P. 7506, line 1: Is the assumption about the autocorrelations reasonable? Has it been tested?

Reply: We find this assumption very reasonable, so we did not test it.

Line 3: The shadings do not overlap for durations > 10 days. Please comment.

Reply: Done

Lines 5-8: What data assimilation scheme is used by NCEP/NCAR? Your statement suggests they do not use 4d-var.

Reply: They use 3D-VAR, which is now written in section 3

Lines 11-12: I do not understand the statement “ q Epressure permanently below 10 hPa q E”

Reply: We meant permanently larger than 10 hPa, as now stated.

Line 13: First discussion of Arctic trajectories in the paper (unless I have missed something). Why bring them in to the discussion? Why the comparison between the tropics and the Arctic? The title of the paper refers to the Southern Hemisphere.

Reply: See above

Lines 18-21: I do not understand the steps in the argument. Please clarify.

Reply: We now write: The longest MIR and BP flights have 3.7 times more calculated trajectories of duration of 5 days than all the other flights together. Therefore we can concentrate on these two longest flights. The results of the other flights do not seem to be significantly different due to the large confidence limits of these other flights.

Lines 21-23: The trajectory error should be defined earlier in the section (e.g. when discussing Fig. 4).

Reply: This is the first place where zonal and meridional errors are used.

Lines 26-29: Why discuss the Arctic trajectories? Is it for comparison against tropical trajectories? I find the discussion confusing.

Reply: See above.

P. 7507, lines 13-14: Quantify the trajectory errors discussed here and later in the paragraph. For example, quantify the statement: “ Δ Eare in fact close to the errors in the Arctic”.

Reply: This line and the following is now omitted since it was somewhat overstated. On page 7506 line 26 we have added how large the Arctic errors are.

P. 7508, conclusions section: There is no motivation for the paper, and no discussion of the HIBISCUS project. How are results useful to the scientific community?

Reply: We have put a motivation in the introduction

Lines 13-14: Why the comparison against the Arctic?

Reply: See above

Line 15: Is comparison against ERA-40 discussed in the paper? Section 1 suggests that this will be done in a future paper. A motivation is needed for discussing ERA-40 here - perhaps comparison between ECMWF operational analyses and ERA-40 as

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

part of future work.

Reply: This discussion is moved to the section above.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 7499, 2006.

ACPD

6, S4120–S4128, 2006

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper