Comment on the manuscript "Transport of Asian trace gases via eddy shedding from the Asian summer monsoon" by S. Fadnavis et al.

by Gabriele P. Stiller (gabriele.stiller@kit.edu)

Dear Dr. Fadnavis,

I have read with interest you paper on the transport of trace gases related to the Asian monsoon. I have noticed that you have used MIPAS data generated by my team at Karlsruhe Institute of Technology, IMK, for demonstrating observational evidence, and I am pleased about this. However, if you allow me, I would like to comment on the representation of MIPAS data in your Figures 4 to 6. I feel this representation is misleading. The interpolation routine used has a number of drawbacks:

- In my opinion, the number of data points within a geographical bin is too low that an interpolation provides a meaningful result. We have checked the MIPAS data and we find, in the relevant area, only 1 or 2 data points per 15 deg latitude x 10 deg longitude bin for most cases, and never more than 5.
- The MIPAS data are not recorded synoptically. In particular, for a monsoon pattern moving (and changing its shape) as fast as you show, it makes a huge difference if the data are recorded at the beginning of the first day or the end of the second day. This is another argument against averaging and interpolating the data.
- We have checked the positions of the individual data points against your averaged and interpolated data fields. The interpolation artificially "generates" or "invents" data at locations where there are none in the original data. One prominent example is ozone for the 1-2 July 2003: due to cloud coverage, there is a huge data gap between 20-30 N and 45-110 E; in your representation, this data gap is partly filled (see Fig. 1).

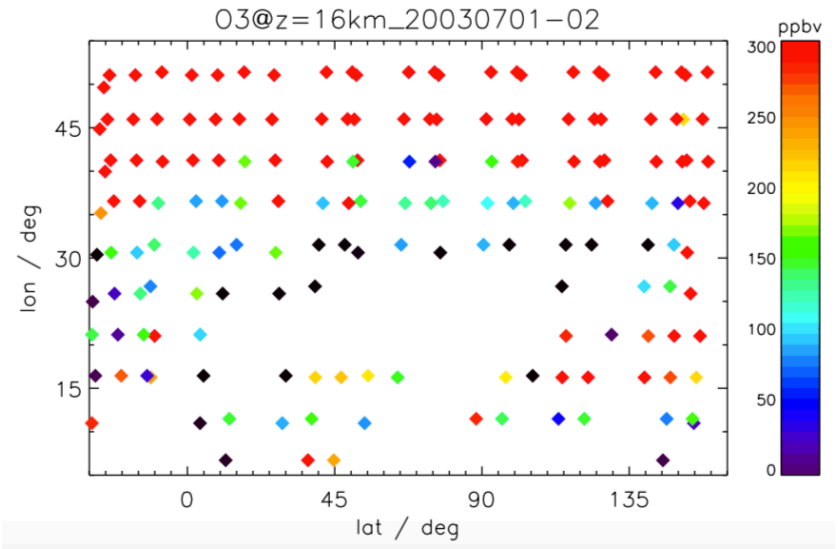

Figure 1: Positions of MIPAS observations and retrieved volume mixing ratios of ozone at 16 km (color scale) for 1 and 2 July 2003, for the latitude/longitude range shown in Figure 4a of Fadnavis et al., 2018.

We would like to suggest a different representation of the MIPAS data: we would find it appropriate to plot the single data points of MIPAS observations above the model fields, in the same color scale. This would provide a quantitative impression whether the model data reproduce the observations in an adequate way. We are, however, aware that the non-synoptic representation contained in the MIPAS data still cannot be avoided in this way. To overcome this problem, the model fields would need to be evaluated at the locations and times of the MIPAS observations.

In Fig. 2 we provide an example of interpolation of the MIPAS data that, in our opinion, is closer to the original data, although it also does not fully avoid to "invent" data where there are none in the original observations. This interpolation of MIPAS data has been done by calculating interpolated data on a fine (similar to model output) geographical grid. For each grid point, the surrounding MIPAS data points are averaged while applying a distance weighting. The maximum distance for which MIPAS data points are considered is $\pm$ 7 deg in latitude and $\pm$ 15 deg in longitude (covering a box of 14 deg in latitude and 30 deg in longitude), and a minimum number of 2 data points per interpolation grid point is requested. In our opinion, the result resembles the MIPAS data field much better, while, again, the problem of non-synoptical observations cannot be avoided.

Besides the comment above, I would like to mention that the referencing of MIPAS data could be improved. The reference provided (von Clarmann et al., 2009) is certainly not the one that was intended to be cited. Please find the correct reference below. The retrievals of CO and PAN are not covered by this paper. I have added the references to be cited for these two species below.

We would appreciate if you considered our comments in the revised version of your manuscript.

Sincerely,
Gabriele Stiller
for the MIPAS teams at KIT, IMK, Karlsruhe, and CSIC/IAA, Granada

References

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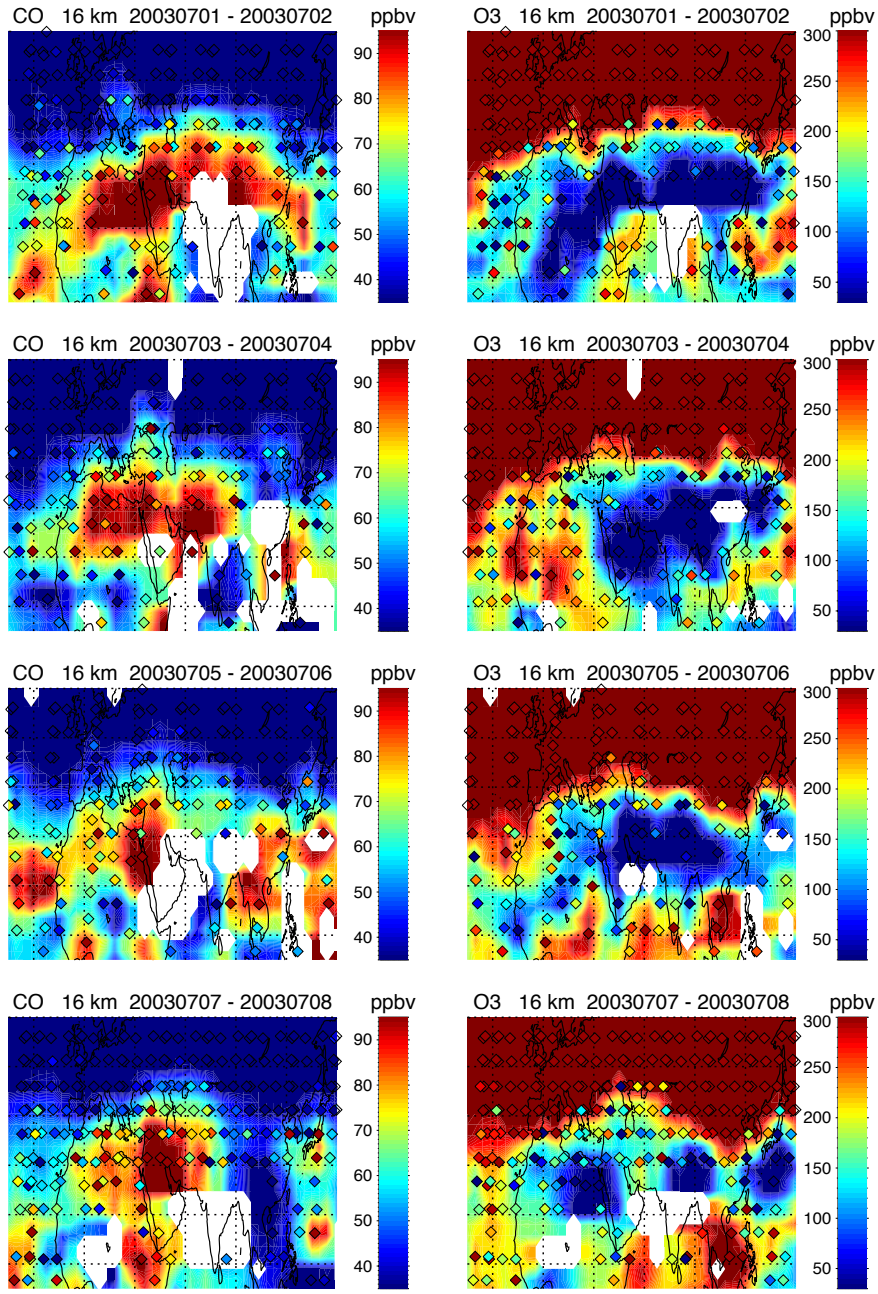

Figure 2: MIPAS observations (in terms of vmr) of CO (left) and ozone (right) at 16 km altitude for the following days: 1 and 2 July 2003 (top row), 3 and 4 July 2003 (second row), 5 and 6 July (third row), and 7 and 8 July (bottom row). The diamonds indicate the positions of the observations and the individually retrieved values (color scale on the right of each panel). The color shading provides an interpolated field using the observed data. For description of the interpolation method, see text. The latitude/longitude range is similar to that of Figs. 4 and 5 in Fadnavis et al., 2018.