

Interactive
Comment

***Interactive comment on* “Long-term trends in the middle atmosphere dynamics at northern middle latitudes – one regime or two different regimes?”
by J. Lastovicka et al.**

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Anonymous Referee #1

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Author's responses under each comment.

I would like to thank referee #1 for constructive and helpful comments. Corrections are now included in the paper.

General remarks:

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The paper deals with investigations of long-term trends in the middle atmosphere using different atmospheric and ionospheric parameters. In contrast to earlier review articles of the main author not only trends in the mesosphere and thermosphere are discussed but also the stratosphere and partly the troposphere are included to get a more general scenario of trends in the middle atmosphere.

Specific comments:

The main point of the presented results is directed to the question if there are two different dates of reversal of atmospheric trends near 1990 and near 1995. This point is of course only a special aspect of atmospheric trends but may probably help to get a better understanding of the reasons of the trends in the middle atmosphere. The use of annual mean values of winds in the MLT region (shown in Fig. 3) seems however to be not very suitable for such trend analyses. It would probably be better to use seasonal mean values for summer and winter separately, because the trends may be different in dependence on season as to be seen from the results shown in Fig. 5.

Response: Figure 3 is taken from a paper I am the first author of, but the author of this Figure is co-author Yu.I. Portnyagin (top expert on MLT region winds). Nevertheless referee is right that it would be better to use seasonal winds separately, even though smaller number of data can make results noisier. According to Fig. 5 summertime trends are decisive for yearly trends; wintertime winds are generally more noisy and they are perturbed by stratospheric warming (major warming often reverses MLT wind for a couple of days for investigated stations).I have not approach to Obninsk data but I have approach to Collm data, therefore Collm summertime (June-August; April and May are affected by strong year-to-year variability of the date of spring wind reversal)) zonal winds were analyzed. Summertime winds follow well the interannual variability of yearly average winds and indicate turnaround of trends again near 1990. A comment is introduced in the paper in discussion of Fig. 5.

Another comment: The quality of the experimental data is essential for the quality of

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the trend analyses. Therefore, the authors are totally right if they mention the data problems in the ozone laminae if the ozonesondes have been changed in the early 1990s. Also possible outliers have to be checked carefully (e. g. in 10 hPa winds). Could the unexpected differences in large ozone laminae trends at different geographic regions also be caused by possible data problems? The presented results and their interpretation can only be a first step for further investigations using other experimental trend data and their interpretation by model activities.

Response: Outliers in 10 hPa winds. 10 hPa winds in the paper are taken from ERA-40. We looked at NCEP/NCAR reanalyses – outliers occur in the same years also in NCEP/NCAR data. What is their origin, i.e. are they real or do they reflect some data problems in reanalyses – is out of the scope of the paper and out of our possibilities/capability. This is question for authors of reanalyses. Large ozone laminae trends. A few year difference in turnaround of trends between Europe versus America (Canada) and Japan is not caused by a change of ozonesondes, because there was no such change in the mid-1990s. Moreover, even older types of ozonesondes had sufficient height resolution to catch broader large laminae (contrary to narrower small laminae). European stations had higher frequency of soundings, i.e. more data, but I am afraid this can hardly explain the observed discrepancy. Since we do not know its origin, we do not use large laminae as evidence for trend turnaround estimation. I am well aware of data problems, which is often the main problem in trend estimating in the middle and upper atmosphere. First step. Thank you for this comment. I apologize I forgot to include into the paper important statement from my presentation at the IAGA Assembly in August 2009 in Sopron: “The results form a “skeleton” of scenario of change of trends in the dynamics of the middle atmosphere in the 1990s. This “skeleton” needs to be completed by other results.” This statement, which is included in the corrected version of the paper at the end of Conclusions, means in other words that our results are the first step for further investigation in line with referee statement.

Technical hints and corrections:

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Page 2637, lines 24 - 25: Probably better: . . . which are discussed in more detail, e. g. . . .

Response: Correction made.

Page 2638, lines 13 - 15: It is not necessary to mention 50 hPa values as they are not used in the paper.

Response: Correction made.

Page 2639, lines 4 - 7 and caption for Fig. 1: The different mean curves in Fig. 1 are not explained in detail, probably it would be better to remove some of them.

Response: I cannot remove curves from Fig. 1, it is a Figure taken from literature. One explaining sentence has been added to the text.

Page 2640, lines 6 - 7 and Fig. 2: If possible the different curves in Fig. 2 should be characterized by different colours. Otherwise it is difficult to distinguish them.

Response: Figure 2 was taken from our paper published five years ago, so it is difficult to make from black-and-white Figure a coloured Figure. Moreover, the purpose of the Figure is to illustrate the overall trend (to make general impression about trend), not to follow individual curve, i.e. I prefer that it is rather difficult to distinguish individual curves.

Page 2641, lines 12 - 15 and caption for Fig. 3: The different trend lines should shortly be explained (or one of them removed?).

Response: Explanation of trend lines is added to Fig. 3 caption.

Page 2642, lines 10 - 13 and caption for Fig. 4: What kind of foE values have been analysed: noon values?

Response: Noon values – median from 10-14 LT (added to figure caption).

Page 2643, line 29 - page 2644, line 6 and Fig 6: The presentation of Fig. 6 seems

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to be not necessary for the paper as the results can shortly be summarized in written form.

Response: Since it is the only Figure with wind direction information, I prefer to keep it and do not force readers to believe me without any evidence. However, if editor requires remove this Figure, I will do it.

Page 2646, lines 5 - 14: The results derived for other latitudes can be summarized very shortly as these results should be published in a separate paper as mentioned by the authors.

Response: I am sorry but I am unable to reduce the length of this short paragraph without making it less understandable.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2633, 2010.

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