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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "Drift-corrected trends and periodic variations in MIPAS IMK/IAA ozone measurements" *by* E. Eckert et al.

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We thank the reviewer for pointing out the important issue of possible ECMWF temperature drifts. The criticism of Reviewer builds upon the fact that any drifts in ECMWF temperatures affect the transformation of the comparison data from their native pressure grid to the MIPAS geometrical altitude grid. Thus ECMWF temperature trends could easily cause artefact drifts between MIPAS and Aura MLS. Indeed we would have preferred to determine the bias determination on a pressure grid but the application of averaging kernels forces us to go for the geometrical grid. While in theory the reviewers arguments are indeed conclusive, we present some additional facts to corroborate our hypothesis of the MIPAS drift and to refute the hypothesis of the mainly

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artificial ECMWF-generated drift:

1. We have now also presented the MIPAS vs. Aura MLS drift analysis on a pressure grid. This is less accurate than our original analysis because the MIPAS averaging kernels could not be applied but this approach is immune against temperature effects in the grid conversion (Fig.1). When comparing the drift estimation on the pressure grid with that performed on the altitude grid one ought to keep in mind that no averaging kernels could be applied to Aura MLS data. This causes differences in the drifts due to different vertical resolutions of MIPAS and Aura MLS. This technical artefact can best be seen around the ozone maximum (around 10hPa at tropical latitudes). The large drifts there are attributed to this effect and should thus not be taken into account when comparing the drifts on the pressure grid with those on the altitude grid. Apart from the just mentioned area, the drifts on the pressure grid look very similar to those on the altitude grid, even though the values are indeed a bit smaller. These differences might indeed be caused by a temperature drift in the ECMWF data, which were used for the pressure to altitude conversion of Aura MLS ozone values. This effect is, however, rather small, with typical values of approximately 0.05ppmv/decade, as concluded from the present preliminary analysis. Another feature one can see in the comparison on the pressure grid, ignoring the large averaging kernel artefacts around 10hPa in the tropics, is that the drifts do still become more negative with altitude. This is obviously a feature in the MIPAS ozone data and does not or only partly arise from a temperature drift in ECMWF.

2. In addition, a sensitivity analysis was performed which calculates ozone differences from spectra calculated with new dedicated non-linearity coefficients considering detector aging versus those calculated with the still used time-independent non-linearity coefficients. Fig.2 shows the resulting ozone drift due to detector aging. From these results we conclude that a stronger negative ozone drift must be expected above approximately 35km ($\sim$5hPa), compared to lower altitudes. This has already been mentioned in the paper, but no supporting material has been shown to prove this point. The

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obvious discontinuity at 35km in Fig.2 is due to the fact that from this altitude on also radiances from the MIPAS so-called AB-band (1020 - 1170 cm-1) are used in addition to those from the A-band (685 - 970 cm-1). The AB-detector is affected more strongly by these non-linearity and aging effects.

3. The reviewer suspects that residual differences in periodical and quasi- periodical terms between MIPAS and MLS might be due to ECMWF temperature effects. This is an interesting suggestion which we will investigate further, because it is good to have a candidate explanation for the residual periodics, which in the ideal case would be zero because MIPAS and MLS see the same airmass such that all natural variation should cancel out. However, the amplitude of these residual periodics are very small, and they are accounted for in the trend/drift fit, so they cannot affect the drift itself.

In summary, we do not deny that there are temperature uncertainties but we believe that we have made a strong case to show that the MIPAS drifts cannot or only partly be attributed to them. We agree that these affects should have been discussed in the original submission, and we will include these additional results in the revised version of the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 17849, 2013.

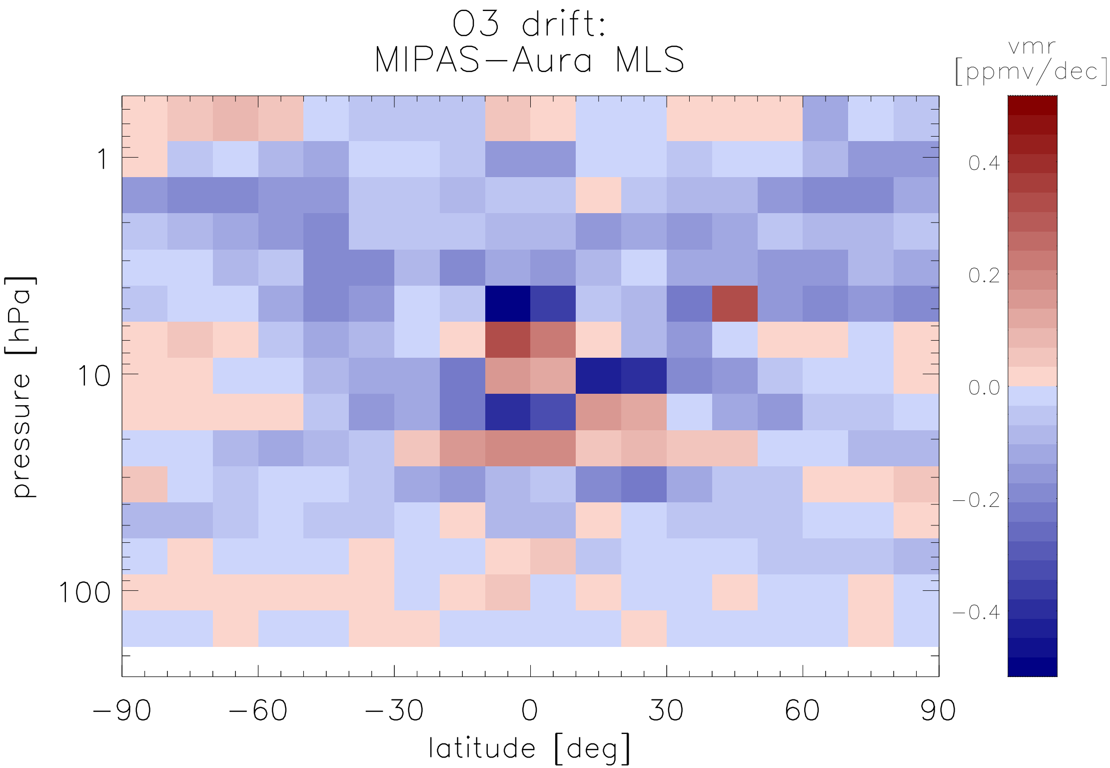

Fig. 1. Drift MIPAS-AuraMLS on pressure grid.

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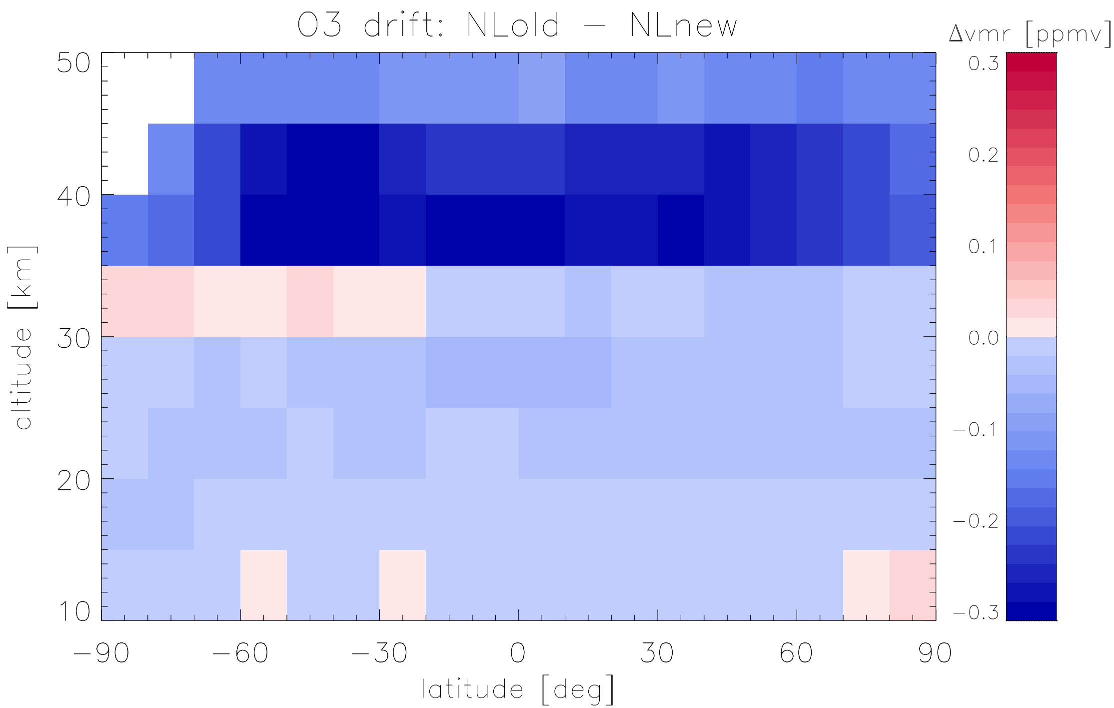

Fig. 2. Drift MIPAS calculated with old non-linearity coefficients–MIPAS calculated with new non-linearity coefficients (Poster by Kiefer et al. at ACVE: Non-Linearity-correction (2013)).

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