Atmos. Chem. Phys., 7, 5341–5342, 2007
www.atmos-chem-phys.net/7/5341/2007/

Atmospheric Chemistry and Physics

Corrigendum to

"First direct observation of the atmospheric CO_2 year-to-year increase from space" published in Atmos. Chem. Phys., 7, 4249–4256, 2007

M. Buchwitz, O. Schneising, J. P. Burrows, H. Bovensmann, M. Reuter, and J. Notholt

Institute of Environmental Physics (IUP), University of Bremen FB1, Bremen, Germany

After the ACPD open review process and after our manuscript Buchwitz et al. (2007), entitled "First direct observation of the atmospheric CO_2 year-to-year increase from space", appeared in ACP, we have received some relevant private communications, which we would now like to address. In summary, we conclude that we would like to refer readers of our manuscript to information given in three other manuscripts not cited in Buchwitz et al. (2007), namely Chédin et al. (2002, 2003) and Strow et al. (2006). We also conclude that the title of our paper now appears somewhat general and not sufficiently specific to atmospheric CO_2 columns. In our manuscript we report that the CO_2 annual increase has been observed indirectly already by Aumann et al. (2005) by analying AIRS brightness temperatures in the thermal infrared (TIR) spectral region. We have used the term indirectly because Aumann et al. (2005) is not focussing on CO_2 retrieval but on the sensitivity of AIRS temperature measurements to CO_2 variability, including CO_2 trends. We were not aware of results shown in other relevant manuscripts also discussing mid tropospheric CO_2 trends using satellite measurements in the TIR spectral region, namely Chédin et al. (2002, 2003) using HIRS and Strow et al. (2006) using AIRS. In the following we would like to shortly discuss the results presented in these manuscripts focussing on aspects related to the interpretation of the title of our manuscript. As written in Chédin et al. (2002) the TIR radiances in the CO_2 absorption bands "mostly depend on the temperature of the atmosphere but also on the CO_2 concentration". In contrast, our results are based on absorption spectroscopy in the near-infrared (NIR) spectral region using reflected solar radiation, which primarily depends on CO_2 and only weakly depends on temperature. Because of this the NIR CO_2 retrievals may be characterized as more direct but we used direct in our title primarily because of the results shown in Aumann et al. (2005) as explained above. In contrast to Aumann et al. (2005), Chédin et al. (2002, 2003) are not focussing on temperature but on CO_2 retrieval and they show in both manuscripts that the annual CO_2 increase in the tropical middle troposphere can be retrieved from HIRS TIR radiances. Because of the strong temperature dependence of the HIRS TIR radiances atmospheric temperature variability has to be constrained. This is accomplished in Chédin et al. (2002) by using collocated radiosonde measurements and in Chédin et al. (2003) by using MSU microwave measurements. In addition, both papers focus on the tropical region because this enables to better decorrelate CO_2 from temperature variations. Strow et al. (2006) focusses on AIRS radiances and discusses differences to radiative transfer simulations based on ECMWF temperature profiles. Apart from the different temperature sensitivities there are several other important differences between the NIR and the TIR measurements. An important difference is is that the NIR measurements have nearly equal sensitivity to CO_2 concentration changes at all altitude levels, including the boundary layer, and therefore enable the retrieval of CO_2 total columns, in contrast to TIR measurements which have highest sensitivity in the middle troposphere. We refer in the title of our manuscript to atmospheric CO_2, in contrast to the mid tropospheric CO_2 observed by the TIR CO_2 retrievals, but we now think that it would have been clearer to explicitely mention in the title of our manuscript that our results refer to CO_2 columns (in our abstract this is mentioned). In conclusion, we would like to take this opportunity to cite and draw attention to the results provided in Chédin et al. (2002, 2003) and Strow et al. (2006), which we consider important examples of the use of remote sensing to understand the behavior of CO_2 in the atmosphere. Similarly we consider that one optimal way to obtain global information about CO_2 is to combine satellite NIR and TIR measurements as discussed in for example Burrows et al. (2004) for several tropospheric trace gases.

Correspondence to: M. Buchwitz
(michael.buchwitz@iup.physik.uni-bremen.de)

Published by Copernicus Publications on behalf of the European Geosciences Union.

Edited by: T. Wagner

References

Aumann, H. H., Gregorich, D., and Gaiser, S.: AIRS hyperspectral measurements for climate research: Carbon dioxide and nitrous oxide effects, Geophys. Res. Lett., 32, L05806, doi:10.1029/2004GL021784, 2005.

Burrows, J. P, Bovensmann, H., Bergametti, G., Flaud, J. M., Orphal, J., Noël, S., Monks, P. S., Corlett, G. K., Goede, A. P., von Clarmann, T., Steck, T., Fischer, H., and Friedl-Vallon, F.: The geostationary tropospheric pollution explorer (GeoTROPE) mission: objectives, requirements and mission concept, Adv. Space Res., 34, 682–687, 2004.

Buchwitz, M., Schneising, O., Burrows, J. P., Bovensmann, H., Reuter, M., and Notholt, J.: First direct observation of the atmospheric CO_2 year-to-year increase from space, Atmos. Chem. Phys., 7, 4249–4256, 2007.

Chédin, A., Hollingsworth, A., Scott, N. A., Serrar, S., Crevoisier, C., and Armante, R., Annual and seasonal variations of atmospheric CO_2, N_2O and CO concentrations retrieved from NOAA/TOVS satellite observations, Geophys. Res. Lett., 29(8), 1269, doi:10.1029/2001GL014082, 2002.

Chédin, A., Serrar, S, Scott, N. A., Crevoisier, C., and Armante, R.: First global measurement of midtropospheric CO_2 from NOAA polar satellites: Tropical zone, J. Geophys. Res., 108(D18), 4581, doi:10.1029/2003JD003439, 2003.

Strow, L. L., Hannon, S. E., De-Souza Machado, S., Motteler, H. E., and Tobin, D. C.: Validation of the Atmospheric Infrared Sounder radiative transfer algorithm, J. Geophys. Res., 111, D09S06, doi:10.1029/2005JD006146, 2006.