Atmos. Chem. Phys. Discuss., 11, C4740–C4742, 2011
www.atmos-chem-phys-discuss.net/11/C4740/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "1997–2007 CO trend at the high Alpine site Jungfraujoch: a comparison between NDIR surface in situ and FTIR remote sensing observations" *by* B. Dils et al.

B. Dils et al.

bart.dils@oma.be

Received and published: 10 June 2011

First of all we would like to thank the referee for her/his valuable comments. Below we address each comment posed

Comment #1: As stated in the text the humidity correction is applied to the NDIR data only and converts the dry NDIR CO measurements to wet NDIR CO measurements. Thus the RH value used corresponds with the ambient air, not in any way with a slant column profile as suggested in the comment. Therefore we do not correct for a potential humidity variability as a function of altitude and its impact on the FTIR column. Given the limited impact of this humidity correction, a further correction dealing with

the variability of the humidity with height or alternatively converting FTIR data to dry air measurements (not done for practical reasons) are deemed to change little on the overall trends. A line is added to the article to clarify this distinction.

Comment #2: As requested we have added this information in section 4.3. There is little information on the exact altitude of the boundary layer above the Jungfraujoch station and it depends strongly on the meteorological conditions. While the convective boundary layer (CBL) above the Alps might not reach the station altitude, due to the large static stability in the upper air layers, it is not necessarily identical with the mixing height of surface pollutants (De Wekker et al.,Bound.-Layer Meteor., 2004). A so called injection (or aerosol) layer can form above the CBL top which intermittently receives CBL air Henne et al. (Atmos. Chem. Phys., 2004). It has been shown from airborne Lidar observations (Nyeki et al., Geophys.Res.Atmos., 2000) and model studies (De Wekker et al., Bound.-Layer Meteor., 2004) that JFJ can be situated within the injection layer during summer, day-time, fair-weather conditions. In any case it is clear that the airmass for which the NDIR measurements are representative is much smaller than the 3.6 km high column sampled by FTIR.

Comment #3: The anomalous data is rejected. This is stated several times in the procedure. We added explicitly that the data are removed to avoid confusion.

Comment #4: It is true that the instruments measure the mole fractions. However it is standard practice for both techniques to have their output written as vmrs. Nor is the discrepancy between CO and an ideal gas of an order that it would have any impact on the conclusions drawn in this article. We appreciate the point raised by the referee but decided against explicitly expanding on this in the article.

Comment #5: We acknowledge that trajectory ensembles (in this case even of more than 16000 individual trajectories) do not necessarily remove the problem of resolving convective events and turbulent mixing, but we feel that it does give a reliable estimation of the sensitivity of the trajectories. It was therefore not our intention to claim that the

Jungfraujoch site yields reliable emission estimates for Asia. Instead we simply wanted to verify the claim that the FTIR and NDIR stations are influenced by different source regions, thus confirming the work of Pfister et al. And if this were the case, using the known emission inventories, we intended to see if realistic trends could be obtained. For NDIR this was shown to be the case, for FTIR the model outcome could not be reconciled with our measurements. We certainly appreciate the fact that our model, given its limitations, could be significantly under- or overestimating the impact of Asian emissions on the FTIR signal. However, taking the model outcome aside, looking at the FTIR and NDIR evolution on one hand and the EDGAR/REAS emission timeline on the other hand, the hypothesis that the observed negligible trend of the FTIR data is caused by a tempering of the American and European emission decreases by an Asian increase could only explain the NDIR-FTIR difference after 2001. Therefore either this hypothesis is flawed or the emission data are or a hitherto unknown mechanism is at work. We have added a discussion on the reliability and have reworded a phrase stating that the ensemble yields an accurate picture. Also we have added 1 std error bars on the seasonality plots derived from splitting the entire dataset into yearly blocks to have an indication of the uncertainty.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 8977, 2011.