Atmospheric Chemistry and Physics Discussions

Interactive comment on "Photochemical modelling in the Po basin with focus on formaldehyde and ozone" *by* L. Liu et al.

L. Liu et al.

Received and published: 21 September 2006

Answer to comments of the Referee #1

Specific Comment 1: My main criticism is that the comparison between observations and simulations is mostly qualitative. E.g., on page 5068 the authors state that the model results for HCHO agree well with the Hantzsch measurements at Alzate, but closer inspection of Figure 4 shows large differences in absolute concentrations (up to a factor of 2) and a phase shift in the peak values of diurnal variations between measurements and simulations after August 15. In order to get a fair idea how good the agreement is, the authors should perform the comparison in a more quantitative way. To some extent the do so, by comparing average and median values (but without citing variability reflected in the standard deviations). But it would be better to include some additional graphs, e.g. showing scatter plots between observations and simulations or

relative deviations between these two. This will help the reader to judge how good the agreement really is.

Reply to Comment 1: As the referee suggests we will include the scatter plots (Figure 5 in revised manuscript, http://folk.uio.no/lil/PUBLICATIONS/authors%20comments%20plots.pdf) for both O3 (left panel) and HCHO (right panel) at Alzate. The afternoon data from the good weather period were used, and the model results were compared with both in-situ (UV absorption) and remote measurements (LP-DOAS). We focus on the comparison with the Alzate data because we cannot expect that the model with 15 km horizontal resolution can reproduce the concentrations at a rather polluted site like Bresso perfectly. The regression analysis shows that model simulated O3 agrees well with the measurements, both with measurements from in-situ and from remote instruments. A high correlation value (0.89 and 0.84) and a slope close to 1 (0.81 and 0.83) are found between measured and modelled O3. A small average difference of 1.9 ppbv is found between model results and in-situ measurements, and the average difference between LP-DOAS and model results is about 9.1 ppbv. Similar standard deviations were found for three data sets, values of 14.3 for model results, 15.6 for in-situ measurements, and 14.4 for LP-DOAS. All the data points fall well within the 1:2 and 2:1 lines.

As for the scatter plot of modelled HCHO against measured HCHO at Alzate, the average difference between modelled and in-situ measurements (Hantzsch) is small, about 0.09 ppbv, although the correlation is low (0.42), since the model simulated peaks occur at an earlier time than the measured. Also the low concentration range leads to a rather low correlation coefficient in spite of the good absolute concentration agreement. The model output was given every three hours, the instrument recordings have much higher time resolution, therefore, some measured peaks may not be included in the model time series. Another reason is the difference between simulated and real wind direction. The last few days of the campaign period, simulated and real wind directions generally agree well, but the simulated winds are generally more monotonic, compared

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU

to the real wind direction. Because HCHO has a lifetime of a few hours and O3 of a few days, these factors can have higher impact on HCHO than on O3 concentration. The average difference between measured HCHO from remote instrument (LP-DOAS) and model results is 1.55 ppbv, with a correlation of 0.58. The modelled levels are between those of in-situ and remote measurements, and more close to the in-situ measurements. Because of the short lifetime of HCHO and its diverse sources, it can easily be influenced by transported air masses and small scale fluctuations, whereas the model results are representing the average situation over 125 km2. The data points between model and in-situ measurements mostly fall within the 1:2 and 2:1 lines. The standard deviation is 0.39 for model results and 0.46 for Hantzsch measurements, which shows that the model captures the HCHO levels fairly well. The data points in the model against LP-DOAS plot are often outside the 1:2 and 2:1 lines, and the standard deviation is high (1.34 ppbv). As explained earlier, these high values are caused by local biogenic emissions from the nearby forest.

Specific Comment 2: The authors cite a number of measurement techniques that have been recently used for tropospheric HCHO measurements, but don't even mention the TDLAS technique, which has been applied successfully e.g. by Alan Fried (NCAR) in a number of measurement campaigns. Why was the TDLAS technique not included in the HCHO intercomparion?

Reply to Comment 2: During the planning phase of the project there was the intention to include a European group capable of performing HCHO measurements with the TDLAS technique. Unfortunately, they decided not to participate in this project and campaign due to other obligations. We know that it would have been very beneficial to include this technique in this whole analysis and especially the instrumental intercomparisons would have been more complete.

Specific Comment 3: In the conclusions the authors state that the comparison of LP-DOAS and Hantzsch point-measurements demonstrate the importance of experimental configurations, since differences can lead to quite large deviations. This is a valid point,

but the same is true for a comparison between observations and 3D model results. The grid box of the model (even at 15 km2 resolution) is generally much larger that the fetch of the observations. It would be nice if the authors could comment on the value of comparing a point measurement with an area averaged model simulation.

Reply to Comment 3: We agree with the referee on this comment. We will include a sentence in the conclusion: Not only the uncertainties have to be considered when comparing the measurements from different instruments, but it is also necessary to take into account how representative model results are compared with point-measurements. With 15 km x 15 km horizontal resolution, the model results represent an average situation over the grid box, whereas the point measurements represent the situation at a specific location. This is particularly important for measurements at polluted locations such as Bresso.

Technical comments: Page 5068, lines 26 and 29: it should read Steinbacher et al., 2005 Changed

Page 5078, line 14: "the model results isclose to" Corrected to "the model results are close to"

All these comments and plots are included in the revised version of the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5057, 2006.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU