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Interactive comment on "Probing ETEX-II data set with inverse modelling" *by* M. Krysta et al.

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General comments

The manuscript submitted by Krysta et al. attempts to shed some light on the reasons of the large discrepancies between the ETEX-II data and the modelling results. Authors point out that the reasons may lie in a systematic error in measurements, and try to justify their hypothesis by means of inverse modelling.

The proposed explanation is tempting, as this might send a relaxing message to the modelling community: the models have proved successful in ETEX-I, and the gross discrepancy in ETEX-II may be due to measurement errors rather than to the models. However, there may be a flaw in this reasoning: it is not completely clear, what could be the proper extent of generalization of the conclusions from the ETEX-I modelling effort? Authors state quite generally (p. 2797) that the "meteorological conditions were quite similar", so that, given the similar experiment scenario, one should rather anticipate

similar model performance. Further, they appear to assume that the apparently good model forecasts in ETEX-I allow to assume that the model would not be the principal source of error in a "similar" case, that is, in ETEX-II.

But, there can be other explanations. For example, there could have been some processes (e.g. subgrid-scale) acting in ETEX-II that led to tracer plume to diverge. Also, factors, which were absent in ETEX-II, could have contributed to ETEX-I simulation success. I believe that a good agreement between the modelling results and the experimental data does not constitute a sufficient condition for qualifying the model as good; rather than, it may be seen as adequate for a certain set of classes of particular physical situations. Unfortunately, it appears that the main conclusion rests on the aforementioned assumption. Obviously, this is not to say that this conclusion is incorrect; rather than, it was not convincingly supported.

It is also not completely clear, what is the advantage of the inverse modelling in supporting the paper conclusions, over the "direct" modelling? Suppose $y = Hx$ and $x = H^{-1}y$; the authors try to demonstrate that an estimate of y, taken from measurements, is grossly distorted, knowing that x is accurate. But, using H^{-1} requires H to be correct. It is not completely clear to the reader, what particular gains are achieved by using second equation instead of the first? Note also, that if H is inadequate to the particular ETEX-II situation, H^{-1} would be inadequate, too. Using the inversion does not circumvent this difficulty. Or, does it? If so, it should be clearly emphasized.

The manuscript focuses attention on the modelling technique and its application (section 2); section 3 provides an overview of the modelling results. While these parts provide information necessary for understanding the method, they offer little support to the conclusion. I think some re-orientation, or re-focusing might be helpful. It is worth noting here that coarsening the model grid results in an increase of the reconstructed mass, while refining the grid causes the model to break; this contrasts with the ETEX-I results.

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To summarize, the conclusions of the paper would be easier to accept by the readers, if the authors (1) brought substantially more attention to the meteorological conditions, especially to the factors that might have given rise to diverging results - keeping in mind the chaotic nature of the transport phenomena (some sensitivity tests with the model might be illuminating); (2) explained, what is the particular advantage of the inverse modelling for supporting the conclusions.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2795, 2008.