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Atmospheric Chemistry and Physics Discussions

Interactive comment on "COMET: a Lagrangian transport model for greenhouse gas emission estimation – forward model technique and performance for methane" *by* A. T. Vermeulen et al.

A. T. Vermeulen et al.

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First of all we would like to thank referee Christoph Gerbig for his useful comments and suggestions. We will address most of the comments in the revised manuscript. In this Author Comment we will address only those items where we think that some discussion would be necessary.

General comments.

The referee raises the point that the COMET model might work well for Cabauw, but not for other stations. As the COMET model describes the transport of vertical column integrated concentrations, model comparison is limited to stations where vertical profiles of the concentrations are measured, for example along Tall Towers. Unfortu-

nately at this moment long term observational Tall Tower data for methane at sites in the COMET model domain other than Cabauw is not available yet. As the referee rightfully points out, more data will become available due to the results of for example the CHIOTTO project. We will certainly extend our analysis to these data as soon as these become available and also extend our analysis to other greenhouse gas tracers like CO2, 222Rn and SF6. The preliminary results of these analyses are quite promising.

Specific comments.

Pg 8732, line 20: Irreversibility of atmospheric mixing implies that specific source information in time and space is gradually lost in the random noise, so that after all only some mean signal can be detected.

Pg 8735, line 15: The indicated suppression of coherent structures was our experience in using the Flexpart LPDM. We would welcome improvements in the turbulence schemes of models like Flexpart.

Pg 8738, line 33: The scanning routine was introduced to handle high resolution emission data or to handle geo-referenced data with statistical source information on for example administrative regions, represented by high resolution (1 minute lon-lat) maps. We will extend the description of the scanning procedure to explain this. In the analyses described in this paper the advantages of the scanning approach are indeed not very obvious. The scanning procedure would also be useful to enforce that grid cell emissions from for example sources bound to land or water surfaces in the model are only emitted from these surfaces. This is important for handling regional inversions on country or region basis for countries or regions located along big water masses.

Pg 8737-8741: Allthough subsidence is not treated explicitly in the model we see that for periods with significant subsidence the COMET model still explains the concentration changes quite well. We suspect that the increased atmospheric stability during subsidence events enhances the accumulation in the boundary layer, possibly compensating to a large extent the effect of enhanced entrainment at the top of the boundary

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layer.

Pg 8747, line 7: We will add to the revised manuscript a table with a comparison of emission inventory values for the countries in the model domain.

Pg 8754, line 11: When comparing only the 20 m AGL observation of methane at Cabauw with the COMET model value we see a very similar performance as for Macehead where only a near-surface observation is available

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 8727, 2006.