**Atmospheric
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Discussions**

Interactive
Comment

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.

Anonymous Referee #2

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General Comments: In this paper, the authors describe a model (COMET) that simulates emission and transport of methane. The model is validated using methane observations from two sites, namely the background station Macehead (Ireland) and the tower in Cabauw (The Netherlands). The transport model is very similar to the single-trajectory Lagrangian box models that were developed and used in the 1980s (e.g. RIVM-Model; De Leeuw) and 1990s. There is significant sophistication in the modeling compared to previous work, and the validation results are reasonable. However, the single-trajectory concept as described here can no longer be considered state-of-the art for simulations of air constituents in the absence of complex chemistry. It neglects vertical and horizontal wind shear, vertical transport in general and incorporates dif-

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fusion by simply expanding the box simulated along the single trajectory backward in time (here called "area of influence" regarding the emissions). To the very best of my knowledge, this concept is not suitable and should not be used any more for the computation of source receptor relationships. Source receptor relationships for substances without complex chemical reactions should exclusively be computed with backward runs of fully three-dimensional Lagrangian or Eulerian transport models that take into account all components of transport. The concept, however, is suitable and can be used for quick-look and fast transport computations. If the authors manage to sell their results this way, the paper would be acceptable.

Specific comments:

Page 8: The authors describe their scheme of the so-called area of influence, which is of circular shape and expands backward in time from start of the backward trajectory, incorporating all emissions within this area. They compare this with the usual trajectory concept following an infinitesimal narrow path. They forget, however, that exactly this concept was used in the so-called Lagrangian box models. These authors should include 2-3 literature quotations from earlier work, this is definitely not their invention;

Page 9: I think the authors misinterpret Stohl et al (2002) regarding the conclusion that a single-trajectory model may be more suitable compared with a LPDM due to the fact that convection schemes are more inaccurate than resolved winds; this may well be true, but does not alter the fact that transport can not suitably be described by a single trajectory; if these authors have this concern, they should still use a LPDM and simply switch off diffusion.

Page 28: The authors analyze the sensitivity of model results to variations of their so-called area-of-influence (AOI) radii; They show that model results deteriorate if too small AOI radii are specified; they, however, forget to conclude that this means that the model concept seems to be not suitable to accurately simulate emission variations within a radius of 20-25 km around the receptors.

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

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