**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Technical Note: A new coupled system for global-to-regional downscaling of CO$_2$ concentration estimation" *by* K. Trusilova et al.

Anonymous Referee #2

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This paper illustrates the validation of a transport model that combines the global TM3 model and the regional STILT model over some of Europe. It prepares the inversion of CO$_2$ surface fluxes with a system that has been described in Roedenbeck et al. (2009). It does not show any ground breaking science, but still shows some nice results, that fit the 'Technical Note' format of Atmos. Chem. Phys. A few items could be clarified or modified to improve the paper. The ones about the length of the PoI, the local-time selection and the model level for sampling are major, while the other ones are minor.

- p. 23191, l. 4: the 13% figure was obtained by Gerbig et al. (2003) in specific conditions. Does it apply to the present study with its domain and its 72h

trajectory length?

- Equation (2) and (3): the integral on x should be written with the same typeset in both equations

- p. 23191: since this paper is devoted to validation, it is a pity that the PoI does not cover a full year.

- p. 23194: why are the C$_{NF}$s not assigned from F$_{posterior}$, consistent with the framework described in Roedenbeck et al. (2009)?

- p. 23195, l.19: the restriction to hours between 10:00 and 17:00 UTC is arbitrary and should actually vary from station to station (or at least with respect to station height). In any case, in a validation study, data selection can be relaxed and other times could be studied.

- p. 23197, l.2: since not all hours are included, the autocorrelation includes a varying number of points for each lag. This may be confusing and should be avoided.

- Table 1: how did the authors choose the sampling level for each model? For instance, it would not be fair to use the lowest level for TM3 in the case of high-altitude stations.

- Table 2: The unit of the RMSD cannot be guessed.

- Table 2: what the authors call 'variance' is actually the standard deviation. The former is the square of the latter. This should be changed.

- Fig. 2: Some points seem to be linked over data-void period, which should be avoided.