

## ***Interactive comment on “Importance of fossil fuel emission uncertainties over Europe for CO<sub>2</sub> modeling: model intercomparison” by P. Peylin et al.***

**Anonymous Referee #2**

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### General comments

This looks like a useful contribution to the literature but there are some issues I would like to be clarified/addressed. First, I agree with Gurney that some of these results are intuitive (in some circumstances similar results have been published elsewhere) and therefore require less text and figures. I have refrained from correcting grammar and spelling.

What I took away from this work is that forward and inverse model uncertainties from neglecting the sub-annual temporal variation of fossil fuel emissions are small compared to uncertainties due to model transport. (Only when monthly mean concentra-

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tions are considered is the spread of forward model concentrations due to assuming constant fossil fuel emission estimates comparable with the forward model spread due to transport uncertainty.) However, there remains an aspiration in the CO<sub>2</sub> modeling community to move towards progressively finer temporal and spatial resolution inventories, which is clearly not justified if there is 1) no ground-truthing of the resulting CO<sub>2</sub> fluxes/concentrations, and 2) no verifiable improvement in flux estimates (as suggested here for Europe). How well do hourly/daily fossil fuel emission inventories describe regional rush-hour traffic, country-specific vacation periods (particularly over Europe), anomalous hot/cold winters and summers, etc, etc? Incorrect specification of fine temporal and spatial emission distributions (and uncertainties) could potentially lead to incorrect flux estimates via inverse model calculations in just the same way that coarse resolution inventories can. This could easily be addressed via simulations. I think it would be useful for the paper to include some discussion about some of these issues.

### Specific details

Page 7471, line 1. I would not make the connection between a) the amplitude of model concentrations at HUN being half of what was observed at this site and b) day-to-day fossil fuel emissions are therefore essential to understand day-to-day variations of CO<sub>2</sub> concentrations at HUN. Surely model transport alone could explain this model bias?

Page 7472, line 6. Please provide a reference for the boreal rectifier effect being more pronounced than elsewhere.

Page 7473, line 10. Figure (5) (bottom)?

Page 7474, line 28. Hot spots are less pronounced during summer due to enhanced vertical mixing during daytime. Is that a statement from work done in this study? Does this mean that resulting flux estimates are less sensitive to temporal and spatial resolution during summer?

Discussion. Improving the representation of fossil fuel CO<sub>2</sub> emissions is worthy

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goal iff they can be verified, but there is still nothing in the current observations that can be used to help attribute observed CO<sub>2</sub> concentration variations on daily/weekly timescales. I think this should be stated explicitly.

Figures in general. Legend text could be larger.

Figure 2. Can the authors explain why there is so much variability in the German weekly fluxes during summer months?

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 7457, 2009.