Atmos. Chem. Phys. Discuss., 11, C1120–C1123, 2011
www.atmos-chem-phys-discuss.net/11/C1120/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The CO₂ release and Oxygen uptake from Fossil Fuel Emission Estimate (COFFEE) dataset: effects from varying oxidative ratios" *by* J. Steinbach et al.

Anonymous Referee #1

Received and published: 24 March 2011

General: The paper presents a newly constructed dataset for the CO2 release and oxygen uptake from fossil fuel emissions (COFFEE) based on high resolution CO2 emissions from the EDGAR inventory and country level information on oxidative ratios from fossil fuel consumption data of the United Nations energy statistics database. These hourly global maps with a spatial resolution of 1°x1° span over the years 1996-2008. This dataset allows investigating where significant and measureable signals in the in-situ oxidation ratios due to variable fossil fuel oxidative ratios are to be expected. This becomes increasingly important because the mix of fossil fuels varies with time as expressed by the recent decrease since 2000 due to higher coal consumption particularly in China. In addition, the authors have used this dataset to evaluate the influence

of variable fossil fuel oxidative ratios on Atmospheric Potential Oxygen (and APO inversions) that is generally calculated assuming a constant (global mean) oxidation ratio of 1.4.

The paper is well structured and well written. It should be published in ACP after some revisions. To support these revisions, I would like to mention the following points:

1) As pointed out by the authors TM3 has a lower sensitivity than the REMO model regarding synoptic events, which is expected based on their differences in temporal as well as spatial resolutions. This leads, for instance, to a difference of a factor of 4 at Ochsenkopf station (Figure 4 a,b) for CO2 and O2 fossil fuel derived variations. In Figure 5, they compare the TM3 model output with observations at Hateruma Island. In order to compare the model dependent sensitivity differences, it would be beneficial to additionally compare either the REMO model output with Ochsenkopf observations that have been published by Thompson et al., 2009 or to select another station that can be compared with both models.

2) Related to point 1), could the authors indicate in the paper whether the lower sensitivity of CO2 and O2 variations of TM3 with regard to synoptic events is more due to the lower spatial rather than the lower temporal resolution of TM3 compared to REMO?

3) It would be worthwhile information to state the percentage of CO2 emissions in NH, TR and SH to the total CO2 emissions. This information can either be included into Figure 2a or mentioned in the text.

4) The daily variations of ORff are expected to vary with seasons (heating vs. mobility issues). I miss information regarding this additional effect.

5) Would it be feasible to include the in-situ oxidation ratios (observed O2 vs observed CO2) in Figure 6a to compare the actually observed O2/CO2 ratios with the fossil fuel influence?

Detailed comments:

P6188, l6: UN should be defined: United Nations (UN)

P6189, l22-24: Sturm et al., ACP 2006 also mentioned variable oxidation ratios.

P6191, l5: UN should be defined: United Nations (UN)

P6191, l15: How were these categories merged? What was done? A bit more information on that would be beneficial.

P6192, l14-19: Could you indicate with a percentage number how many data were missing?

P6192: Are the ORff only available on country level or even more detailed?

P6192, l25: Temporal factors ....where it seemed reasonable. This is too poor information. Be more precise, what which categories have you suppressed in the south?

P6193, l13: Is there a specific reason to select the year 2006?

P6193, l19-20: What is the percentage of those omitted gridcells to respect to the total and where are those gridcells located?

P6194, l4: You list Russia, Argentina and Canada, why not Mexico?

P6194, l12: ...for the year 2006, results for the other years are comparable). Does this statement also hold for the spatial distribution? If yes, it should be added under 3.1.

P6194, l20ff: As already mentioned in the section "General", the daily structure is expected to change throughout the year (seasonal dependencies), Could you add some information here.

P6194, l20ff: It would be worthwhile to add here number of percentages of CO2 emissions to the total emissions for the NH, TR and SH.

P6195, l1-6: Figure 2 b and d. are the x-axis scales correct? To me, it would seem more realistic when the lower CO2 emissions occur on Saturday and Sunday? Check!

P6195, l19-20: The plot shows no.... Suggestions to change to: There is no ..

P6195, l17ff: In Figure 3, it would be good to include the CO2 emission changes (geographically) besides the ORff.

P6198, l10: As expected, the signals ...As expected based on what? The higher temporal or the better spatial resolution?

P6199: Comparison with Hateruma Island data should be extended with a comparison at Ochsenkopf in order to close the gap of model comparison with observations (point under "General").

P6200, l3: What means an error larger than 0.05? Can you express this with a criteria on the linear correlation (r, r2).

P6200, l5: ...that a significant part...From Figure 5c, about 30% seems to statistically reliable (see previous point)

P6200, l11-12: The statement about using the ORff information to test and improve the transport models is quite strong. Is this more a wish or do you really believe that this is important data for that particular purpose.

P6200, l 23ff: however, with significant sensitivity differences (this should be mentioned here)

P6206, l13-14: There is a mislabelling of the Figures 8a, 8b

P6206: Have you investigated the long term changes of seasonal FAPO to the long-term mean of FAPO?

P6207, l15: ....in one direction. Suggested to be changed to ...in either direction. References: There are references given for which no statement about the type of publication is given, for instance Heimann and Körner, 2003; Rödenbeck, C, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6187, 2011.