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***Interactive comment on “CO₂, δO₂/N₂ and APO:
observations from the Lutjewad, Mace Head and
F3 platform flask sampling network” by
I. T. van der Laan-Luijkx et al.***

Anonymous Referee #1

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General comments:

This paper presents data sets of CO₂, δO₂/N₂ and resulting APO from three European flask observation sites: Lutjewad, Mace Head and F3. Data from F3 station are new data collected since June 2006 whereas the data from Mace-Head and Lutjewad represent an update of the existing records (respectively since December 1998 and October 2000) already published by Sirignano et al. (2010) over the period 2005–2009. In the first half of the paper (sections 1 to 3) the authors describe the sampling sites, and the measurements protocols and techniques, then remind us with the APO definition and usual interpretation and define the APO* as already done in Sirignano et al.

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(2010). Section 3.4 presents the REMO atmospheric transport model that is used to derive oxidative ratio (OR) for the different site locations. There is nothing really new in this first half of the paper compared to the previous paper, but this is well written and clearly explained even for non specialist or people having no knowledge on the topic or previous papers. In the second half of the paper, the authors focus on the results for CO₂, O₂ and resulting APO. They present the data set and the way they were treated. Then they analyse the long term and seasonal variations, and propose interpretation of the results using simulations performed by REMO, and comparing with other data sets from European stations. Finally they end up with a global estimation of marine CO₂ uptake based on the presented data series. The main results of this second part of the paper is a confirmation of the previous work presented in Sirignano et al. (2010) over a longer time period, leading to a better estimate of the marine CO₂ uptake with lower uncertainties and confirming the existence of an increasing gradient between Lutjewad and Mace-Head and the importance of local perturbation for regional OR (in particular for urban or semi urban areas such as Lutjewad or F3). This second half of the paper also follows the work done by Sirignano et al. (2010) and similar techniques are applied to the extended data set and to the new data series of F3 leading to similar conclusions. I would have appreciated that the authors try to get one step further on the interpretation (if possible) and also on the comparison (see specific comments below).

In conclusion, I would recommend the publication of this paper in ACPD but would also encourage the authors to go a bit deeper in the interpretation of the data series. This would in my opinion strengthen and give more value to the present data series and the paper. Enclosed are some specific comments and question to the authors that I hope could help them in that way.

Specific Comments:

Page 13058, line 2-4: “extending earlier work, . . .” Could you please detailed the period of extension for each site?

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Page 13059: line 2-3: Is there a reference for the Mace Head station being a good background station. Please add it in that case.

Page 13060: line 7-8: You state the flasks in Mace Head are filled manually? Could you please give more details on the procedure and the sampling protocol? Do you use a sampling unit for this ?

Page 13061: line 13-14: "... While an exchange of a certain ... of 4.77 per meg in iAd'O2/N2. This sentence is not clear to me, could you please reword it?

Page 13061: line 15-27 and page 13062, line 1-5: this paragraph deals with the scale change from CIO to Scripps scale. The authors state that the working gas cylinders have been increasing over time leading to a better accuracy of the data. Could you please give us more details about the evolution of the accuracy of each data series in a table for example or by using different colours in corresponding to the data series accuracy? Could you please detail the measurement accuracy of each part of the data series? In page 13062 the authors say that the machine reference gas has been changed several times at the start up of measurement, but they also say that the SIO reference cylinders have been only measured against the current machine reference gas. So could the authors detail the procedure they have applied to correct and convert the primary data to the SIO scale (the one obtained using the first machine reference gases)? This for sure also impacts the data precision? This part needs to be detailed a bit more, it is of importance as there is still no international scale for O2 measurements.

Page 13064: line 1: Please give a reference for the OR value of 1.7.

Page 13065: line 1-6: Could the authors justify the reason why they choose the "data from the closest grid cell" for OR value in Lutjewad? First which cell is it? Could you please add the station site location on figure 2b as it is not readable that way? Second the values are highly variable around Lutjewad, so why not using a mean or weighted value instead or just choosing the closest grid (there are many anyway?). Is there no way of comparing this data with other sources of OR estimation.

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Page 13065, line 5: "... which are subject to" instead of "... which are subjected to"

Page 13065, line 20: What is a "long storage"? What are the contamination criteria (except for the local influence as described below in this paragraph?

Page 13066: Could the authors tell us about the influence of the data quality and filtering procedure on the initial data series? For example which percentage of the data is kept or removed after this procedure for each sites?

Page 13066: line 24 and following paragraphs: in the different paragraph of section 4.1 and 4.2 the authors describe seasonal amplitudes or trends but never referring to the time period considered? Is it the full time period for each site, the extended time period only (2005-2009)? Stating this would help better clarify or identify the evolution of the different trend over time and could give new information for comparison. See also paragraph 4.2 trend analysis.

Page 13067: Line 4 "Troughs", this holds also true for the Low! End of paragraph, and figure 3c. There are significant and recurrent double peaks on the O₂/N₂ ratio records. No comments or explanations by the authors?

Page 13068: line 13: 2 ppm/year: This holds not true for PUY site ! Page 13074: End of paragraph: There are continuous data series available for Mace Head. I suppose using these data series could help identify the better fit and evaluate the influence of the latter parameter on the results. This could also help estimate the slope. Why not using this data series independently and compare the results to the one presented here?

Figure 5: F3 series, same "double peak" modelled as in the data, no words from the authors.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 13055, 2010.

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