**Biogeosciences
Discussions**

Interactive
Comment

Interactive comment on "Anthropogenic and biophysical contributions to increasing atmospheric CO_2 growth rate and airborne fraction" by M. R. Raupach et al.

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Overall, this is a well written manuscript that builds on and extends and earlier analysis in Canadell et al. 2007. In particular, the manuscript examines: 1) the statistical connections between atmospheric CO2 growth rate and physical and volcanic forcing; 2) the growth trends in the drivers behind human CO2 emissions and atmospheric growth rate The analysis is framed in terms of the airborne CO2 fraction, a useful concept that has been in the literature for a while but is seeing increasing use (e.g., Fung et al., PNAS, 2005). The subject matter is relevant to Biogeosciences and this will be a useful contribution to the field. I have no major scientific concerns with the manuscript, and my

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comments listed below are related primarily to improving the manuscript presentation and clarifying the text.

Specific points:

Page 2868, line 12: The "Kaya identity" needs to be defined or described briefly to make the abstract more accessible to the non-specialist.

Page 2868, line 17: The phrase "decline in the negative growth (improvement) in the carbon intensity" is hard to follow because of the double negative. Perhaps better just to use "decline in the improvement in the carbon intensity"

Page 2872, line 20: The left panel of Figure 1 is not discussed in the text after the introduction of the figure. Many readers may not be as familiar with the interpretation of cumulative spectra, and it would be useful to explain briefly to the reader why the cumulative spectrum of atmospheric CO2 growth rate differs so significantly from ENSO.

Page 2873, line 8: Since the reasonable argument is made that the mechanistic links are to the surface-air exchange, not the atmospheric growth rate, would it make more sense to analyze surface-air exchange (Fs) on Page 2872 and in Figure 1.

Page 2878, line 20: It is inappropriate to infer properties for all of the climate-carbon models in the Friedlingstein et al. 2006 study based on multi-model average of the airborne fraction, which has a large range -0.27 +/-0.36 including several models with positive trends (e.g., NCAR CSM; Fung et al. PNAS 2005; there are likely others but that is one I am personally familiar with). The text should be modified to reflect the range of variability in the models (not that I am arguing any of the models is right or for the right reasons) and to be more careful in the conclusions drawn, particularly given the fact that a careful statistical analysis was required to show that the observational based estimate is likely positive within some probability bounds.

Page 2880, line 6: change "with series are normalised to 1" to "with series normalised

to 1"

Page 2892, Figure 1 caption: units are needed for the frequency x-axis, "(1/y)".

Page 2895, Figure 4 caption: It would be useful to explain the Kaya identity and some of the terms in more detail in the caption.

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