

## ***Interactive comment on “What can be learned about carbon cycle climate feedbacks from CO<sub>2</sub> airborne fraction?” by M. Gloor et al.***

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Received and published: 16 May 2010

This review makes a number of wrong statements about the IPCC AR4 WG1 Chapter 5 which I would like to correct here.

IPCC Chapter 5 did not use the change in AF as a demonstration that ocean biogeochemistry was changing. The chapter said that ocean biogeochemistry was changing because the ocean has taken up anthropogenic CO<sub>2</sub>, which affects pH, carbonate chemistry, and the saturation state of CaCO<sub>3</sub>. Although this had been known from models (and simple physical principles), it had never been shown with observations at the global scale before IPCC-2007. A paper by Sabine et al and Feely et al, both published in Science in 2004, showed the first extensive synthesis of observations that demonstrated changes in the ocean carbonate system. As far as I know, nobody

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disputes these results, hence the first sentence of the Summary for Policy makers highlighted by the reviewer is very strongly worded.

The IPCC chapter 5 did look at the change in ocean uptake fraction (OF) in detail. Note that OF is not the same as AF. OF is defined as  $\text{OceanCO}_2 / (\text{oceanCO}_2 + \text{atmosphericCO}_2)$  as in Sarmiento et al GBC 2005. OF is far better constrained than AF because the definition does not include land use change. As pointed out in Table 5.1, the observations available showed an ocean uptake fraction of  $42 \pm 7$  for 1750-1994 and  $37 \pm 7$  for 1980-2000. A decrease in OF would be consistent with our understanding of ocean CO<sub>2</sub> uptake dynamics, as included in ocean models such as those published by OCMIP. Such a decrease does not refer to any climate impact, but only to the time scale of ocean circulation that control CO<sub>2</sub> uptake and to the non-linearity of carbon chemistry (both included in the OCMIP models). The text in the chapter states this very clearly, and reflects both the uncertainty and the theoretical understanding.

The reviewer misinterprets the conclusions of Chapter 5 in the light of the recent debate on the potential impact of recent climate change on the ocean CO<sub>2</sub> uptake. However the debate on climate impact largely occurred after the IPCC-2007 was published. The information presented in the IPCC-2007 Chapter 5 is more basic, and should be read as such. The discussion in Gloor et al. regards whether or not we can detect an impact of recent climate change on top of the more fundamental limitations caused by ocean circulation (and land uptake processes). This surely will be an important topic discussed in the upcoming IPCC and I welcome the discussion triggered by Gloor et al's paper.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 9045, 2010.