Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03485, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03485
EGU General Assembly 2008

The atmospheric CO2 airborne fraction and carbon cycle feedbacks

C. Jones (1), P. Cox (2), C. Huntingford (3)

(1) Hadley Centre, Met Office, Exeter, UK (chris.d.jones@metoffice.gov.uk) (2) University of Exeter, UK. (3) Centre for Ecology and Hydrology, Wallingford, Oxon, UK.

The 5 decades of the Mauna Loa record of atmospheric CO2 have been instrumental in much increased understanding of the functioning of the global carbon cycle. Although the increased network of measurement sites in recent years has allowed more detailed regional assessment, the global scale behaviour of CO2 on long timescales can be reliably inferred from this one source. One important result is the remarkable fact that the airborne fraction of CO2 (i.e. the fraction of anthropogenic emissions which remain in the atmosphere) has remained almost constant on multi-year timescales throughout the last 50 years.

Interannual changes in the airborne fraction can be large, but are reasonably well understood, being driven by large scale climate modes such as El Nino or the response to volcanic eruptions. However, the longer-term constancy of the airborne fraction also requires explanation.

It is now widely predicted by complex climate-carbon cycle models that future climate change will significantly affect the ability of the natural carbon cycle (both terrestrial and marine) to take up anthropogenic carbon. However, the constancy of the observed airborne fraction has been seen as evidence that climate is not yet affecting these processes - in other words we are not yet seeing a “climate-carbon cycle feedback”. Is this a correct inference?

In this study we attempt to show that although climate feedbacks will certainly alter the airborne fraction from what it would have been in the absence of climate change, the two concepts are not the same. A constant airborne fraction does not imply an

absence of climate feedback on carbon uptake. In fact, we will show that the constant airborne fraction is not a fundamental property of the carbon cycle, but results from the particular time history of anthropogenic emissions. Understanding how the airborne fraction has behaved in response to the emissions history will allow better projections of it in a future, changing, climate.