# DGVMII – QUANTIFYING UNCERTAINTIES IN THE FUTURE LAND-ATMOSPHERE EXCHANGE


S. Sitch[1], W. von Bloh[2], P. Ciais[3], P. Cox[4], P. Friedlingstein[3], N. Gedney[1], C. Huntingford[5], P. Levy[6], M. Lomas[7], S. Piao[3], I.C. Prentice[8], and F.I. Woodward[7]

*[1] MetOffice (JCHMR), Maclean Building, Crowmarsh-Gifford, Wallingford, Oxon OX10 8BB, UK; stephen.sitch@metoffice.gov.uk*
*[2] Potsdam Institute for Climate Impact Research, Potsdam, Germany.*
*[3] Laboratoire des Sciences du Climat et de L'Environnement, Gif sur Yvette, France.*
*[4]Centre of Ecology and Hydrology (CEH) Dorset, Winfrith Newburgh, Dorchester, Dorset, UK.*
*[5] CEH Wallingford, Crowmarsh-Gifford, Wallingford, UK.*
*[6] CEH Bush Estate, Penicuik, Midlothian, UK.3*
*[7]University of Sheffield, Sheffield, UK.*
*[8]University of Bristol, Bristol, UK.*



**ABSTRACT**

In recent years attention has focused on the role of terrestrial biosphere dynamics in the climate system, and the possibility of large land-atmosphere carbon cycle feedbacks under human-induced future climate warming. During the 1990s rapid development of Dynamic Global Vegetation Models (DGVMs) led a growing community to soon recognize the need for model evaluation and intercomparison. In Cramer et al. 2000 six DGVMs were run using identical forcing data based on the HadCM2 GCM climatology (1860-2100) and the IS92a emission scenario.

Despite differences in model complexity and process representation, model results were in broad qualitative agreement. Terrestrial uptake increased during the first half of the 21st Century, due to enhanced production with increasing atmospheric $CO_2$ concentrations, reaching a peak mid-century, as the $CO_2$ fertilization effect saturated. Thereafter terrestrial uptake declined, with one DGVM simulating a net release of $CO_2$ by 2100. However, DGVMs were run "Uncoupled" with no feedback of terrestrial carbon exchange on atmospheric $CO_2$ concentration, and hence climate.

Cox et al. [2000] addressed the latter issue, running one DGVM coupled with the Hadley General Circulation Model (GCM) in a fully interactive carbon cycle experiment for one future emission scenario. This study highlighted the large potential land-atmosphere carbon cycle feedbacks in accelerating future climate warming, with important ramifications for climate change mitigation. A more comprehensive study with multiple DGVMs and emission scenarios is needed to assess uncertainty in future land-atmosphere exchange and the magnitude of future climate carbon cycle feedbacks and atmospheric $CO_2$ concentrations.

Here we present results from DGVMII, where 5 DGVMs are run with both uncoupled and coupled climate-carbon cycles for 4 SRES concentration/emission scenarios and one GCM analogue climate pattern (based on HadCM3). To enable computationally efficient climate carbon cycle studies, a GCM analogue model and a simple ocean carbon cycle model, are used. We address the following question: What is the uncertainty in the future atmospheric $CO_2$ concentration/Climate associated with climate-carbon feedbacks due to choice of DGVM/land surface model?

## REFERENCES

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