3rd International Conference on Earth System Modelling
Vol. , 3ICESM-184-2, 2012
3rd International Conference on Earth System Modelling
© Author(s) 2012

Uncertainty in land carbon storage for the RCP 4.5 scenario

K. Tachiiri (1), J. C. Hargreaves (1), J. D. Annan (1), C. Huntingford (2), T. Hajima (1), and M. Kawamiya (1)

(1) Japan Agency for Marine-Earth Science and Technology, Research Institute for Global Change, Yokohama, Japan (tachiiri@jamstec.go.jp), (2) Centre for Ecology and Hydrology, Benson Lane, UK

The world climate research centres are currently running Earth System Models (ESMs) forced by Representative Concentration Pathways (RCP) scenarios. Based on these future pathways in atmospheric greenhouse gas concentrations, the emphasis has been mainly on estimating the associated levels of global warming that might be expected. However, there is also the important task of determining emission trajectories (called "allowable emissions") associated with the pathways, that may then be assessed by socio-economists for feasibility. The key processes determining the allowable emissions are ecosystem carbon uptake by both the land and ocean. In particular, the change and uncertainty in the land carbon uptake is considered to be large. In this study, the change and uncertainty in the land carbon storage for RCP4.5 concentration scenario was investigated by perturbing important physical and biogeochemical parameters and aerosol forcing in a loosely coupled earth system model (Sim-CYCLE is used as the vegetation model). The parameter perturbation results are comparable to ranges implicit in climate response and ecosystem feedbacks across C4MIP model simulations. Just as importantly, our model simulations are then constrained by observation data of physical and biochemical variables. The averages of weighted land carbon storage change are 81 PgC (5 and 95 percentiles are +242 and -52 PgC) for 2010-2100 and -103 PgC (+52 $\sim$ -273 PgC) for 2100-2300. Geographical changes, which are possible with an EMIC framework, are also investigated. For the change between years 2010 and 2100, the greatest uncertainty is found in the Tibetan Plateau and the Amazon, the latter of which has major reduction in the averaged projected land carbon storage. In the period 2100-2300, the northern high latitudes and the Tibetan Plateau have the greatest uncertainty, and then the former region shows a major decrease in carbon storage for the average projected land carbon storage.