



Long Term Effects of CO₂ Increase on Climate and Carbon Cycle in a complex Earth System Model

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A complex coupled earth system model, consisting of an atmosphere and ocean general circulation model (ECHAM-LSG), a dynamic terrestrial vegetation model (LPJ), an ocean biogeochemistry model (HAMOCC) and a thermodynamic icesheet model (SICOPOLIS), is being developed. With this model, 1000 year experiments were performed in which the CO₂ concentration was increased up to two, three or four times the pre-industrial concentration. An additional 1000 year experiment was performed in which the emissions were prescribed from the IPCC-SRES A2 scenario (1750-2000 emission reconstructions, 2000-2100 emission scenario A2, after 2100 scenario trend extrapolated). Remarkable feedbacks take place (1) between the atmosphere-ocean climate in the North Atlantic, the meridional overturning circulation and the Greenland ice sheet, (2) between meridional overturning circulation and CO₂ uptake by the ocean, and (3) between climate, vegetation growth and carbon storage in Northern Hemisphere high latitudes. Carbon storage in the ocean as well as on land increase under increased CO₂ concentrations, but the increase is reduced due to ocean circulation and climate changes resulting from higher CO₂ concentrations.

<http://www.mpimet.mpg.de/en/depts/dep3/oph/deklim.html>