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1 Changes in the Marine Carbon Cycle Under Altered Low Latitude Surface Wind Stress Conditions

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This study aims to analyse the sensitivity of the ocean's carbon uptake and storage characteristics to changes in low latitude surface wind stress. For this a global climate model of intermediate complexity (UVic ESCM v2.9) is forced using seven different scenarios with wind climatologies based on NCAR reanalysis data. The suite of scenarios consists of one control experiment which uses the unchanged NCAR surface wind stress and six experiments perturbed by a surface wind stress reduction or intensification by 10%, 20% and 30% between 30˚S and 30˚N. All other forcing is kept identical across the seven experiments.

Initial results suggest that the applied changes in surface wind stress cause significant alterations in ocean circulation that lead to major modifications in the behaviour of the solubility and the biological carbon pumps. The response of the global ocean carbon cycle differs strongly between the reduced surface wind stress scenarios and those with enhanced wind forcing. The system seems to react in an almost linear manner to the enhancement of low latitude wind stress exhibiting a progressive decrease in total DIC. The response to a reduction is more complex and shows a slight increase in total DIC for the 10% and 20% reduction cases and a slight decrease in total DIC for the 30% reduction case. The study presented here analyses this behaviour in detail and identifies the main drivers of this response of the marine carbon cycle. This provides insight into the processes that govern the ocean carbon cycle and furthermore offers indications about the evolution of the global carbon cycle under climate change, which could have a high impact on low latitude surface wind stress.