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Applying genetic algorithm to constrain spread in ocean carbon sink projections

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The multi-model spread of the projected ocean carbon uptake increases by two-fold from the present day to the end of the 21st century. The model spread is spatially heterogeneous due to different climate feedback acting on different regions. Earlier study discovered a linear relationship among the CMIP5 models between the future global vs. contemporary Southern Ocean carbon sinks, suggesting that the latter is a hot-spot for constraining future projected models spread. Using genetic algorithm approach, we redo the exercise. A linear fitting of the models can indeed be achieved, but the identified regions are irregular resembling a global checker board-like pattern. Next, the models are interpolated into lower regular resolutions of ten, five, and two degrees. In all optimizations wit lower resolution model data, linear relationships can be achieved with better multi-model correlation than that found in earlier study. Part of the Southern Ocean and the eastern Pacific Ocean always emerge as the key regions for constraining the projected model spread. Both regions are key upwelling regions and dynamically offer pathways to export adsorbed anthropogenic carbon away from the region. With increasing number of models and size of their outputs, our exercise show promising result for combining 'big data' approach with ensemble of climate model outputs to analyze and constraint the uncertainties of Earth System Model projections.