A Modified Marine Carbon Cycle Under RCP8.5: Implications for Ocean Carbon Storage

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The modern ocean absorbs ~25% of our annual anthropogenic carbon emissions (1), slowing the rise in atmospheric partial pressure of carbon dioxide gas (pCO_2) and global temperature. This ocean carbon uptake is known to be nonuniform and nonstationary due to natural climate oscillations, making it challenging to discern carbon storage trends from existing observations (2). Perhaps a more critical issue for understanding long-term carbon storage is the sensitivity of ocean carbon uptake to interactions between natural and anthropogenic marine carbon pools. Anthropogenic carbon was previously thought to imprint on top of the natural marine carbon cycle; however, global changes in surface ocean pCO_2 seasonal cycle amplitudes have now been found in observations and models (3, 4) and can be attributed to natural-anthropogenic carbon pool interactions. To build on these findings, we use the Geophysical Fluid Dynamics Laboratory ESM2M large ensemble to quantify the influence of carbon pool interactions on air-sea CO_2 fluxes under the RCP8.5 scenario. We focus on how these interactions manifest in seasonally asymmetric ways and the resulting implications for ocean carbon uptake. Finally, our study considers the importance of a changing ocean physical state in modifying the amplitude and phasing of the marine carbon cycle, and the associated impact on carbon storage efficiency through 2100.

References:

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