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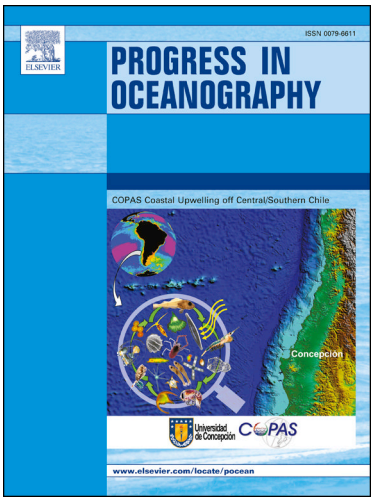

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Coccolithophore growth and calcification in a changing ocean

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Abstract

Coccolithophores are the most abundant calcifying phytoplankton in the ocean. These tiny primary producers have an important role in the global carbon cycle, substantially contributing to global ocean calcification, ballasting organic matter to the deep sea, forming part of the marine food web base, and influencing ocean-atmosphere CO_2 exchange. Despite these important impacts, coccolithophores are not explicitly simulated in most marine ecosystem models and, therefore, their impacts on carbon cycling are not represented in most Earth system models. Here, we compile field and laboratory data to synthesize overarching, across-species relationships between environmental conditions and coccolithophore growth rates and relative calcification (reported as a ratio of particulate inorganic carbon to particulate organic carbon in coccolithophore biomass, PIC/POC). We apply our relationships in a generalized coccolithophore model, estimating current surface ocean coccolithophore growth rates and relative calcification, and projecting how these may change over the 21st century using output from the Community Earth System Model large ensemble. We find that average increases in sea surface temperature of ∼2-3°C leads to faster coccol-

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