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Ocean acidification: Towards a better understanding of calcite dissolution MONICA M. WILHELMUS, University of California Riverside, JESS ADKINS, California Institute of Technology, DIMITRIS MENEMENLIS, Jet Propulsion Laboratory — The drastic increase of anthropogenic CO₂ emissions over the past two centuries has altered the chemical structure of the ocean, acidifying upper ocean waters. The net impact of this pH decrease on marine ecosystems is still unclear, given the unprecedented rate at which CO₂ is being released into the atmosphere. As part of the carbon cycle, calcium carbonate dissolution in sediments neutralizes CO₂: phytoplankton at the surface produce carbonate minerals, which sink and reach the seafloor after the organisms die. On time scales of thousands of years, the calcium carbonate in these shells ultimately reacts with CO₂ in seawater. Research in this field has been extensive; nevertheless, the dissolution rate law, the impact of boundary layer transport, and the feedback with the global ocean carbon cycle remain controversial. Here, we (i) develop a comprehensive numerical framework via 1D modeling of carbonate dissolution in sediments, (ii) approximate its impact on water column properties by implementing a polynomial approximation to the system's response into a global ocean biogeochemistry general circulation model (OBGCM), and (iii) examine the OBGCM sensitivity response to different formulations of sediment boundary layer properties. We find that, even though the burial equilibration time scales of calcium carbonate are in the order of thousands of years, the formulation of a bottom sediment model along with an improved description of the dissolution rate law can have consequences on multi-year to decadal time scales.

Monica Martinez Ortiz
University of California Riverside

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