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Effects of Small-Scale Turbulent Mixing on Upper Ocean Carbonate Chemistry PETER HAMLINGTON, KATHERINE SMITH, University of Colorado, Boulder, KYLE NIEMEYER, Oregon State University, BAYLOR FOX-KEMPER, Brown University, NIKKI LOVENDUSKI, University of Colorado, Boulder — The effects of both shear- and wave-driven turbulence on the evolution of carbonate chemical species in the upper ocean are examined at scales from one to several hundred meters using large eddy simulations. The simulations model reactive carbonate species in the presence of realistic upper-ocean turbulence by solving the wave-averaged Boussinesq equations with and without an imposed Stokes drift velocity, leading to wave- (i.e., Langmuir) and shear-driven turbulence, respectively. Carbonate chemistry is represented in the simulations using a reduced seven-species mechanism solved using a Runge-Kutta-Chebyshev method, and comparisons are made between simulations with time-dependent chemistry, equilibrium chemistry, and no chemistry. By examining different reaction chemistries and surface forcing scenarios, coupled turbulence-reactive tracer dynamics are connected to spatial and statistical properties of the resulting species fields. In particular, Langmuir turbulence has a pronounced effect by increasing the uptake of carbon dioxide in the upper ocean. Implications of these results for coarse-resolution models of the global carbon cycle are discussed.

Peter Hamlington
University of Colorado, Boulder

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