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Experimental characterization of the breakup strength of marine diatom aggregates in oscillatory shear flow[1] YIXUAN SONG, MATTHEW RAU, Pennsylvania State University — While the aggregation of marine snow has been studied extensively, little is known about its breakup in response to turbulence, which limits our ability to quantify and predict particulate mass transport in marine ecosystems. To understand the hydrodynamic influence on the size of this particulate matter, we conducted breakup experiments on aggregates of laboratory-cultured diatoms, which are an abundant type of phytoplankton in the ocean. First, we produced marine aggregates in artificial sea water inside a cylindrical tank with solid body rotation. Next, we superimposed a harmonic oscillation at the tank wall and thus exposed the aggregates to a laminar oscillatory shear flow, which we quantified analytically. The local velocity gradients inside this facility were similar in magnitude to shear in the surface ocean. Finally, we implemented particle tracking techniques to identify and capture the breakup events with a high-speed camera and determined the local fluid shear stress causing aggregate breakup. With a large database of disruption events, we discuss the breakup behaviors of diatom aggregates in a size range from 100 μm to 10 mm and quantify their breakup strength.

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