Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Marine floc strength and breakup response in turbulent flow[1]
MATTHEW RAU, The Pennsylvania State University, STEVEN ACKLESON, GEOFFREY SMITH, US Naval Research Laboratory — The effect of turbulence on marine floc formation and breakup is studied experimentally using a recirculating breakup facility. Flocs of bentonite clay particles are grown in a large, stirred aggregation tank of salt water (salinity of 10 ppt) before being subjected to fully-developed pipe flow. Pipe flow conditions range from laminar to turbulent with dissipation rates up to 2.1 m^2/s^3. Particle size distributions are measured through in-situ sampling of the small-angle forward volume scattering function and through microscopic imaging. Floc size is compared before and after exposure to turbulence and found to be a strong function of the dissipation rate of turbulent kinetic energy. Hydrodynamic conditions within the aggregation tank have a large influence on overall floc strength; flocs formed with stirred aggregation resist breakup compared to flocs formed without stirring. Floc shape and structure statistics are quantified through image analysis and the results are discussed in relation to the measured floc breakup response. Finally, the relevance of these findings to quantifying and predicting marine floc dynamics and the eventual fate of particles in the ocean is presented.

[1]The authors thank the National Research Council Postdoctoral Program for their support of this work.

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Date submitted: 31 Jul 2017 Electronic form version 1.4