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Turbulence from a microorganism's perspective: Does the open ocean feel different than a coral reef? RACHEL PEPPER, EVAN VARIANO, M.A.R. KOEHL, University of California, Berkeley — Microorganisms in the ocean live in turbulent flows. Swimming microorganisms navigate through the water (e.g. larvae land on suitable substrata, predators find patches of prey), but the mechanisms by which they do so in turbulent flow are poorly understood as are the roles of passive transport versus active behaviors. Because microorganisms are smaller than the Kolmagorov length (the smallest scale of eddies in turbulent flow), they experience turbulence as a series of linear gradients in the velocity that vary in time. While the average strength of these gradients and a timescale can be computed from some typical characteristics of the flow, such as the turbulent kinetic energy or the dissipation rate, there are indications that organisms are disproportionally affected by rare, extreme events. Understanding the frequency of such events in different environments will be critical to understanding how microorganisms respond to and navigate in turbulence. To understand the hydrodynamic cues that microorganisms experience in the ocean we must measure velocity gradients in realistic turbulent flow on the spatial and temporal scales encountered by microorganisms. We have been exploring the effect of the spatial resolution of PIV and DNS of turbulent flow on the presence of velocity gradients of different magnitudes at the scale of microorganisms. Here we present some results of PIV taken at different resolutions in turbulent flow over rough biological substrata to illustrate the challenges of quantifying the fluctuations in velocity gradients encountered by aquatic microorganisms.

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