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A hybrid numerical-experimental study of fluid transport by migrating zooplankton aggregations MONICA MARTINEZ, California Institute of Technology, JOHN DABIRI, Graduate Aeronautical Laboratories and Bioengineering, California Institute of Technology, JANNA NAWROTH, Harvard University, BRAD GEMMELL, Marine Biological Laboratory, SAMANTHA COLLINS, Polytechnic School — Zooplankton aggregations that undergo diel vertical migrations have been hypothesized to play an important role in local nutrient transport and global ocean dynamics. The degree of the contributions of these naturally occurring events ultimately relies on how efficiently fluid is transported and eventually mixed within the water column. By implementing solutions to the Stokes equations, numerical models have successfully captured the time-averaged far-field flow of self-propelled swimmers. However, discrepancies between numerical fluid transport estimates and field measurements of individual jellyfish suggest the need to include near-field effects to assess the impact of biomixing in oceanic processes. Here, we bypass the inherent difficulty of modeling the unsteady flow of active swimmers while including near-field effects by integrating experimental velocity data of zooplankton into our numerical model. Fluid transport is investigated by tracking a sheet of artificial fluid particles during vertical motion of zooplankton. Collective effects are addressed by studying different swimmer configurations within an aggregation from the gathered data for a single swimmer. Moreover, the dependence of animal swimming mode is estimated by using data for different species of zooplankton.

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