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Mean and eddy kinetic energy of the Gulf Stream from multiyear underwater glider surveys

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Subtropical western boundary currents play a key role in ocean energy storage and transport and are characterized by elevated mean and eddy kinetic energy. Due to a lack of spatially broad subsurface observations of velocity, most studies of kinetic energy in western boundary currents have relied on satellite-based estimates of surface geostrophic velocity. Since 2015, Spray autonomous underwater gliders have completed more than 175 crossings of the Gulf Stream distributed over more than 1,500 km in along-stream extent between between Miami, FL (~25°N) and Cape Cod, MA (~40°N). The observations include roughly 14,000 absolute ocean velocity profiles in the upper 1000 m. Novel three-dimensional estimates of mean and eddy kinetic energy are constructed along the western margin of the North Atlantic at 10-m vertical resolution. The horizontal and vertical distributions of mean and eddy kinetic energy are analyzed in light of existing independent estimates and theoretical expectations. Observation-based estimates of mean and eddy-kinetic energy such as these serve as important metrics for validation of global circulation models that must adequately represent western boundary currents.