Glider observations of sediment resuspension in a Middle Atlantic Bight fall transition storm

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ABSTRACT: In October of 2003 a fleet of autonomous underwater gliders began a time series of transects across the New Jersey shelf. The gliders are equipped with a conductivity-temperature-depth sensor, and some carry optical ECO-sensor pucks. The physical-optical data are used to examine storm-induced sediment resuspension. There are two types of storm response found. In summer, the seasonal stratification limits midshelf sediment resuspension to below the pycnocline even during hurricanes. In contrast, winter storms suspend sediment throughout the full water column. The transition between summer and winter seasons starts with surface cooling that preconditions the shelf for rapid mixing during fall storms. The mixing storm of October 2003 was a classic northeaster. Early in the storm when waves were high, sediment resuspension was limited to below the pycnocline. After the pycnocline eroded through growth of the bottom boundary layer, particles immediately filled the full water column. The spectral ratio of backscatter indicated that the particles were likely similar materials both before and after the stratification was eroded. The backscatter profiles in the bottom boundary layer decay with distance from the bed at rates consistent with theory but with variable slopes. The reduced slope of the backscatter profiles increased after stratification was lost, which is consistent with an increase in vertical transport or turbulent mixing. Wave bottom orbital velocities during this time were decreasing, and the glider vertical velocities showed no enhancement consistent with Langmuir cells. Enhanced mixing was related to the interaction of the surface and bottom boundary layers while the stratification was eroded, and the observed variability in the resuspension during the event was also due to the tide.