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A Preliminary Exploration of the Gulf Stream System with SOFAR Floats

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ABSTRACT

SOFAR (sound fixing and ranging) floats deployed for engineering tests during 1977–79 yield the first long-term quasi-Lagrangian observations in the subsurface Gulf Stream System. The character of these float tracks supports the premise that the Gulf Stream is a persistent, large-scale, vertically coherent jet at depths (approximately) within and above the main thermocline. where mean and eddy kinetic energies are roughly the same and lateral motions of the Stream are clearly delineated. A float track at thermocline depth is visually coherent with the track of a concurrently launched surface drifter over the larger horizontal scales traversed during the first few months of their trajectories. Below thermocline depths, fluctuation or eddy kinetic energies are normally larger than the mean and a persistent Gulf Stream is difficult to detect. However, deep motions that are visually coherent with upper level flows may be observed for an intermediate range of space and time scales.

Eddy kinetic energies based on the float data are compatible with existing Eulerian estimates to the extent comparable. The consistency of a quasi-Lagrangian eddy kinetic energy estimate in the vicinity of the thermocline, roughly 400 $cm^2\ s^{-2}$, the first such observation to our knowledge, is indirect but relatively convincing. Zonal and meridional variances for the float data are also in line with existing Eulerian results. Estimates of the frequency distribution of eddy kinetic energy for the longest float trajectory available are nearly identical to comparable Eulerian results at frequencies less than about a cycle per 20 days.

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