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Wave-induced tracer dispersion by ocean surface waves

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Material tracers at the ocean surface disperse under the influence of the quasi-random forces that act on the ocean surface. These forces may include ocean turbulence, wind, and surface waves. Currently, wind and ocean turbulence are assumed to be the important drivers of dispersion of the floating tracer particles. Despite some theoretical results and laboratory experiments, the experimental proof of the significant contribution of wave induced dispersion in overall transport of large-scale geophysical systems remains elusive. This is mainly due to a lack of practical observations.

In this study we aim to estimate the contribution of wave-induced dispersion in comparison with conventional mechanisms of dispersion due to ocean turbulence. We do so through the analysis of in-situ observations of surface drifters deployed across the seas and oceans. The experimental dataset include data from the Global Drifter Program and newly obtained data through cluster deployment of Spotter wave buoys. The results suggest that waves during marine storm conditions may be a critical driver of surface tracer dispersion during the first ten days after the storm and at horizontal length scales up to the order of 10 km. Our results imply that accurate information of wave conditions is required for accurate prediction of tracer dispersion at short to intermediate time and length scales.