Wave-Vortex Interactions in the Submesoscale

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The Surface Water and Ocean Topography (SWOT) mission is the next generation of satellite altimetry, set to launch in early 2022. It will be the first of its kind to provide global sea surface height (SSH) measurements fine enough to begin resolving the submesoscale. In this newly resolvable regime, “slow” flows (jets, vortices...) interact with internal waves by redistributing wave energy to other wave-vectors and frequencies. This introduces the challenge of distinguishing “slow” flows from waves, which is of key importance for inferring ocean circulation, from SSH measurements. I run numerical simulations of the one layer rotating shallow water equations to model the interaction between a single internal tide mode and vortices in (cyclo)geostrophic balance to characterize scattering and map its relevant parameter space. Preliminary results show wave scattering by vortices with Rossby numbers ranging from 0.1-4 that are not explained by the standard methods (frozen-field approximation, ray tracing...) which have been successful in the mesoscale. We find that the Rossby number, the Burger number, and the ratio of the length and velocity scales of the wave and vortex are all necessary to characterize the interaction in submesoscale regimes. Harmonic analysis is used to highlight the direction of the scattered wave energy.