First direct evidence that breaking waves cause horizontal eddies

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As ocean waves pass from deeper water into the shallow coastal regions, they begin to break, churning up the surf zone waters. At the edges of the crests of the breaking waves, horizontally-rotating eddies (vertical vortices) are generated, converting some of the waves' kinetic energy into turbulence. These horizontally-rotating eddies are an important mechanism for dispersing nutrients, larvae, bacteria, sediments, and other suspended objects along the coastline.

Using a 10-meter-diameter (33-foot-diameter) ring of submerged current sensors, Clark et al. directly measured for the first time the generation of horizontal eddies by breaking coastal waves in the water off North Carolina. In line with theoretical and numerical modeling efforts, the authors find that turbulent eddies are created at the edges of breaking waves, and that the eddies rotate in different directions depending on whether they are produced by left- or right-handed waves. They find the eddies decayed after 20 to 60 seconds.

Further, they find the eddies were strongest at low tide and weakest at high tide, a finding they attribute either to the sensor array's changing position in the surf zone due to the shifting tide, or to an increase in the amount of energy dissipated by waves breaking in the shallower low-tide water.

They suggest that such horizontal eddies are an important source of dispersive energy for the near-shore environment.

More information: Vorticity generation by short-crested wave breaking, *Geophysical Research Letters*, doi: 10.1029/2012GL054034 , 2012