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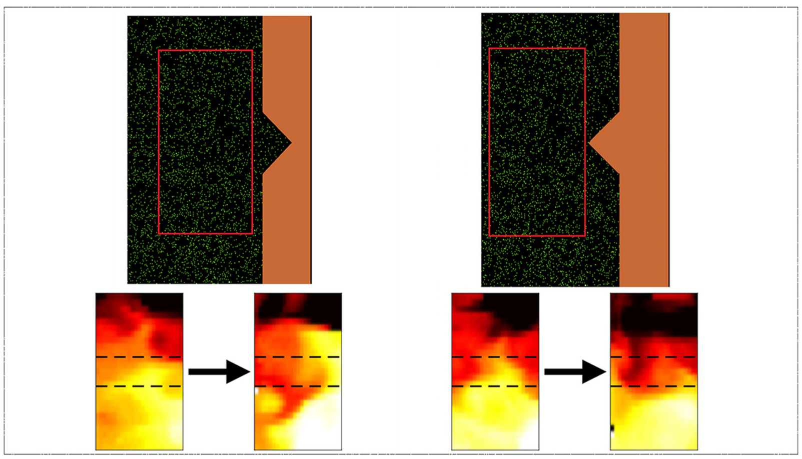
Researchers model how different types of coastline affect offshore mixing, the results of which help inform coastal facility planning.



In the atmosphere and ocean, fluid flows tend to spontaneously organize into structures, or regions of flow that share similar properties persistently over time. One type of structure, called a transport barrier, is described by any distinguishable material line in a fluid. These transport barriers play a key role in organizing transport by creating an invisible line fluid cannot cross, slowing mixing. Scientists believe that different types of ocean coastline shapes might encourage or discourage the creation of transport barriers, but don't know exactly how.

In *Chaos*, researchers answer this question by studying how structures in flow interact with different lateral boundaries found along coastlines. The researchers modeled three different coastline shapes: a uniform, featureless boundary; a sharp embayment, or recessed boundary; and a sharp headland, or protruding boundary. They found that the uniform boundary and embayment had relatively small effects on mixing. The headland, however, significantly slowed mixing far into the flow.

Co-author Nicholas Ouellette said that this work could help inform decisions pertaining to where to put coastal facilities that discharge liquid waste into the ocean, like desalination plants or wastewater treatment plants. These facilities want the flow to mix their waste products into the ocean efficiently, so they need to pick a site that doesn't encourage the creation of transport barriers and slow mixing. The work shows that a featureless coastline or embayment may be a better site for one of these facilities than a headland.

The authors modeled mixing with a transfer operator, a mathematical function that maps material in flow at an instant in time to its location at some other time. Next, they plan to study how the bottom boundary interacts with structures in flow.

Source: "Influence of lateral boundaries on transport in quasi-two-dimensional flow," by Lei Fang and Nicholas T. Ouellette, *Chaos: An Interdisciplinary Journal of Nonlinear Science* (2018). The article can be accessed at https://doi.org/10.1063/1.5003893.