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What determines submarine turbidity current runout distances?

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Underwater avalanches of sediments, turbidity currents, are the principle mechanism of moving sediment across our planet. Only rivers carry comparable volumes of sediment. Basic modes of flow behaviour have been proposed. Submarine flows can erode and accelerate, thereby causing increased erosion (ignite).

Alternatively, flows can deposit sediment and decelerate (dissipate). Finally, flows can find a near-uniform state, balancing out erosion and deposition (autosuspension). However, turbidity currents are notoriously difficult to monitor in action, due to their location, episodic occurrence and ability to damage instruments placed in their path.

Here we analyse the most detailed measurements yet from oceanic turbidity currents in action. Seven moorings were placed in Monterey Canyon, offshore California, over 18 months. These moorings captured 13 separate flows, and include the fastest flows yet measured by moorings, with some flows that ran out for over 50 km.

We examine observed patterns of flow behaviour in Monterey Canyon. First, we look into spatial patterns in Monterey Canyon, which can have implications on basic modes of flow behaviour. We will use canyon topography to make inferences about influences of width and gradient on spatial changes. Next, we look into what determines if a flow runs out for longer distances. In studies of other granular flows, it has been found that the properties of the substrate can have a disproportional effect on flow behaviour. We compare the average velocities from Monterey Canyon with other locations globally, to infer if there are consistent trends amongst different submarine systems. We conclude with a generalised model for how flows behave in sandfloored canyons.