Insights from field observations into controls on flow front speed in submarine sediment flows

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Abstract Text:

Seafloor avalanches of sediment called turbidity currents are one of the most important processes for moving sediment across our planet. Only rivers carry comparable amounts of sediment across such large areas. Here we present some of the first detailed monitoring of these underwater flows that is being undertaken at a series of test sites. We seek to understand the factors that determine flow front speed, and how that speed varies with distance. This frontal speed is particularly important for predicting flow runout, and how the power of these hazardous flows varies with distance. First, we consider unusually detailed measurements of flow front speed defined by transit times between moorings and other tracked objects placed on the floor of Monterey Canyon offshore California in 2016-17. These measurements are then compared to flow front speeds measured using multiple moorings in Bute Inlet, British Columbia in 2016; and by cable breaks in Gaoping Canyon offshore Taiwan in 2006 and 2009. We seek to understand how flow front velocity is related to seafloor gradient, flow front thickness and density. It appears that the spatial evolution of frontal speed is similar in multiple flows, although their peak frontal velocities vary. Flow front velocity tends to increase rapidly initially before declining rather gradually over tens or even hundreds of kilometres. It has been proposed that submarine flows will exist in one of two states; either eroding and accelerating, or depositing sediment and dissipating. We conclude by discussing the implications of this global compilation of flow front velocities for understanding submarine flow behaviour.

Session Selection:

Towards a step change in understanding of sedimentary processes in the deep-sea