INUNDATION OF A SLOPE-TERMINATED BEACH PLAIN: This is model output from a depth-integrated runup model that implements wave breaking (Lynett et al., 2002). It shows a simple positive wave inundating a flat coastal plain and forming a reflected bore that propagates back out to sea.


By assuming that substantively decelerating water deposits sediment, and that faster water deposits coarser sediment than slower water, we can begin to predict depositional trends using hydrodynamic models such as this one.

In this case, still water (A) is accelerated by an approaching tsunami (B). Substantive acceleration is particularly strong right near the beach where the flow concentrates, however this acceleration transitions to substantive deceleration by time (C) except at the breaking front of the wave. Deposition occurs all across the beachplain following the leading front, leaving a normally graded sheet of sand.

When the reflected bore (D) propagates back across the beach plain it leads to a sudden shift in the flow toward the ocean, followed by a long period of substantively non-accelerated withdrawal that neither deposits nor erodes much.

The exception is the first 1.5 km of beachplain where the withdrawal begins before the reflected bore arrives, and does erode some of the top of the sand sheet. Right at the top of the beach flow is spatially concentrated during inundation and much more so during withdrawal, leading to much greater erosion there than anywhere else (E, F).

During the withdrawal, a hydraulic jump forms lower on the beachface (E, F). This is a location of strong substantive deceleration that leads to more deposition than anywhere else.

At the bottom of this figure a plot of the integral of substantive deceleration is plotted colored by speed (same scale as on the water speed plot. This can be thought of as a rough cartoon of the deposit, where high points represent more deposition, low points erosion, yellow represents coarse sediment, and blue fine sediment. Because of poor interpolation on my part the reflected bore leads to noisy erosion across the beach-plain.