

Photos by Andrew Mattox



Time

Time 2

THIS BORE: 1 m breaking head 2 m deep flow 3 m runup 100s of m of inundation

ABSTRACT

A tidal bore is a phenomenon in which the leading edge of the incoming tide forms a steep, sometimes breaking front that travels up tidal channels or rivers against the direction of the current. Tidal bores occur in relatively few locations worldwide, including the Amazon, the Qiantang River in China, Bangladesh, the Bay of Fundy, Mascaret in France, the Severn River in England, And Turnagain Arm near Anchorage, Alaska. In each of these areas, large tides are funneled into a shallow, narrowing channel via a broad bay. The height of a tidal bore increases with the range of the tide and may vary in height from just a ripple to several meters.

Many tsunamis approach the coast as a bore or a breaking wave so tidal bores provide a useful analog. Generally tidal bores propagate up a channel with the wave front running parallel to the shoreline. In certain cases, where the channel geometry refracts the wave out of the main channel path the bore will run directly up a bank or beach, mimicking a tsunami. We selected a suitable site based on earlier informal studies of the bore at Turnagain Arm for our 2004 expedition. The site was located on the south side of Turnagain Arm near Hope, Alaska.

For this preliminary study we observed complex runup patterns and shoreline interaction using photography and videography, and tested sediment seeding and trapping techniques. The bore was unexpectedly small at our primary study location, and we had difficulties with tidal currents excavating our sediment traps.

The main difficulty of using a tidal bore for a tsunami analog in sediment experiments is that the incoming tide behind the bore might confound the experimental results. The height of the bore is difficult to predict and the tidal cycle only provides limited time to set up experiments. However, we still believe that using a tidal bore as a tsunami analog can be very useful and provides horizontal scales that are impossible to obtain in a lab.

TIDAL BORES AS AN ANALOG FOR TSUNAMIS? OS23D-1356

Higman, B (hig314@u.washington.edu), University of Washington, Earth and Space Sciences Bondevik, S (Stein.Bondevik@ig.uit.no), University of Tromso, Department of Geology Borrero, J (jborrero@usc.edu), University of Southern California, Department of Civil Engineering Lynett, P (plynett@civil.tamu.edu), Texas A&M University, Department of Civil Engineering

Photographer unknown 1946 tsunami in Hilo

One and the same?

Time 5 Time 4 Time 3 The Turnagain Arm tidal bore running up the beach...

Distinctive sediment coarse sand and artificial sediment)

Sediment seeding





Time 7 ...to send a reflected bore back out into Turnagain Arm.



In order to retrieve sediment deposited by the bore and distinguish it from sediment carried by following tidal currents, sediment traps and marker grains are used.



Tsunamis and tides are long-wavelength waves that can form a bore.

Symmetric long wavelength wave in deep water

Shoaling wave becomes more steep on its leading edge

In very shallow water, the leading edge becomes a bore



The bore breaks for 100s of meters across tide flats

bore (fewer and grains than base)



Imagine: a tsunami that comes on schedule.