Geophysical Research Abstracts
Vol. 19, EGU2017-2861, 2017
EGU General Assembly 2017

Autogenic processes and deposit signatures in laboratory submarine fan experiments with supercritical alluvial channels

Kyle Strom (1), Paul Hamilton (2), David Hoyal (3), and Juan Fedele (3)

(1) Virginia Tech, Blacksburg, VA, United States (strom@vt.edu), (2) Galveston District, U.S. Army Corps of Engineers, Galveston, TX, (3) ExxonMobil Upstream Research Company, Houston, TX, USA

Submarine fans are an amalgamation of channels and lobes built over time on the continental slope and abyssal plain through multiple avulsion cycles. This research experimentally explores supercritical submarine fan building processes from a hydraulic and sediment transport perspective. Data for this was provided by a new methodology developed to measure the layer-averaged hydraulic variables of small-scale density currents that change with space and time as they construct the fan. In the presentation, we will present the autogenic avulsion cycle observed, discuss why steep systems can potentially produce "perched" lobes, show the characteristics of lobe and channel fill deposits resulting from a single avulsion cycle, and present data describing the overall development of the fan through multiple avulsion cycles. The experiments showed that the primary avulsion cycle consisted of the following phases: channel incision and basinward extension, cessation of channel extension and mouth bar formation, bar aggradation and hydraulic jump initiation, and upstream propagation of the channel-to-lobe transition. The transition from erosion or bypass in the channels to deposition in an expanded-flow region downstream led to a choked-flow condition that caused a hydraulic jump to initiate before reaching the basin floor. Each avulsion cycle was responsible for an associated lobe deposit. Since hydraulic jumps were common during avulsion cycles, they were used to predict the maximum thickness of the lobe deposits as a function of the upstream flow depth and Froude number. The lobes emplaced by discrete avulsion cycles stacked up over time to form the overall fan. Though each cycle contained elements of both basinward extension and upstream backfilling, the fans showed net progradation at a long-term rate that can be representatively modeled using a mass balance approach based on sediment supply and equilibrium fan slope.