Tide-Induced Gravity Flows on the Fraser River Delta, British Columbia, Canada

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Abstract

Real-time physical and chemical oceanic properties of the Fraser River Delta front reveal episodic downslope flows characterized by a rapid decrease in salinity and concurrent increase in water temperature and turbidity. In a one-year period, three of these events were recorded, and flows coincide with the Fraser River's freshet (i.e., snowmelt induced high flow conditions) and spring ebb tides. Flow deposits are characterized comprise fine-grained sand and silt beds. Observations show that the Fraser River's suspended load settles in the vicinity of the river mouth during ebb tides. During slack tides, these sediments produce very high suspended sediment concentrations near bed that generate offshore-directed hyper-concentrated flows. The effects of these flows last up to 10 hours and are confined to the upper (< 100 m) delta front. Such gravity flows are important because they can initiate slope failures, transport significant amounts of coarse-grained material into the deep basin, threaten delta stability, and impart significant environmental stresses (e.g., high sedimentation rate, decreased salinity, and increased temperature) on burrowing infauna. In shallow-water deltaic systems, tide-supported gravity flows can affect sediment deposition on both the delta front and prodelta where they potentially can form isolated coarse-grained accumulations. Consequently, similar isolated sand bodies should occur in mud-dominated, tidally influenced deltas in ancient systems.