Delivery of Sediment to the Continental Slope via Plume Transport and Storm Resuspension: Numerical Modeling for the Northern Gulf of Mexico

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Supply from the continental shelf to deeper waters is of critical importance for building continental margin sediment repositories, and may also factor into episodic events on the slope such as turbidity currents and slope failures. While numerical sediment transport models have been developed for coastal and shelf areas, they have not often been used to infer sediment delivery to deeper waters. A three-dimensional coupled hydrodynamic – suspended sediment transport model for the northern Gulf of Mexico has been developed to evaluate the types of conditions that are associated with delivery of suspended sediment to the continental slope. Accounting for delivery by riverine plumes and resuspension by energetic waves and currents, the sediment transport calculations were implemented within the Regional Ocean Modeling System (ROMS). The model domain represents the northern Gulf of Mexico shelf and slope including the Mississippi birdfoot delta and the Mississippi and DeSoto Canyons. To investigate the role of freshwater pulses and storms in driving down-slope sediment fluxes, model runs encompassed fall, 2007 through late summer 2008. This time included a period of elevated river discharge, several winter storms, and the passage of Hurricanes Ike and Gustav. Sediment delivery to the continental slope was triggered by the passage of large storm events, and enhanced during periods of elevated freshwater delivery. Additionally, analysis indicates that storm track influences both the wind-driven currents and wave energy on the shelf, and as such plays an important role in determining which storms trigger delivery of suspended continental shelf sediment to the adjacent slope.