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Floc Depositional Characteristics within the Sacramento–San Joaquin River

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The Sacramento–San Joaquin River Delta (Delta) is where the rivers of the Central Valley of California merge to become the San Francisco Estuary. The rivers deliver sediment from the Central Valley watershed (approximately 96,000 km2) to the Delta. One of the major drivers of sediment transport and turbidity in the Delta is the supply of fine sediment from the watersheds, particularly the Sacramento River. Deposited sediment helps create and sustain the landscape in the Delta, including desirable habitats such as tidal marsh, shoals, and floodplains. Massive sediment supply during the period of hydraulic mining in the late 1800s caused deposition in Sacramento Valley rivers, the Delta, and San Francisco Bay. Today, a key management question is whether the existing Delta landscape can be sustained as sea level rises. The erosion and deposition processes are strongly dependent on the local sediment properties, particularly when cohesion and flocculation are important, as they are in the Delta.

The U.S. Geological Survey (USGS) collects data that supports the development, calibration, and validation of numerical models of sediment transport and turbidity in the Delta. Research questions include: How much flocculation of sediment particles occurs in the Delta, and what are the settling velocities of the flocs? How do floc settling properties vary spatially and temporally? To address these questions, a Co-operative Agreement was established between the USGS and HR Wallingford (UK).

This abstract presents preliminary findings from measurements of floc depositional properties throughout the Delta during 2010-2011. Individual floc properties and dynamics were measured with the LabSFLOC-1 instrument; a high resolution video-based device. Thirty-one floc population samples were obtained from 21 sites within the Delta. Flocculated particles were observed throughout the Delta including in freshwater. Suspended-sediment concentrations in the near-bed region ranged from 4-52 mg.l-1. A combined total of more than 2,200 individual flocs were measured. Floc sizes (D) ranged from 27 [U+F06D]m microflocs (D < 160 [U+F06D]m) to macroflocs (D > 160 [U+F06D]m) of 500 [U+F06D]m. Macrofloc settling velocities (Ws) were 0.7-5 mm/s (mean 2.25 mm/s) and macroflocs comprised 1-56% (mean 24%) of the suspended mass. Microfloc Ws was smaller (0.3-4.0 mm/s, mean 1.63 mm/s), but comprised more (44-99%, mean 76%) of the suspended mass and thus, mass settling fluxes (spanning 0.1-80 mg.m-2s-1) were dominated by microflocs, albeit Delta depositional fluxes were generally an order of magnitude less than within San Francisco Bay.