USGS NSF GRIP Opportunity

USGS Center:	Pacific Coastal and Marine Science Center
Project Title:	Marsh resilience to sea-level rise: understanding mechanisms of sediment supply
Project Hypothesis or Objectives:	Coastal marshes are highly productive ecosystems that also provide shoreline protection. Marsh vegetation is restricted to a narrow range of elevations relative to mean sea level. To remain healthy as sea level rises, marshes must maintain elevation by accreting a combination of mineral and organic sediment. Vertical accretion in San Francisco Bay marshes is adequate to keep up with current rates of sea-level rise, but according to predictive models most San Francisco Bay marshes will be submerged and lost within the next century. In these predictive models, the most important sources of uncertainty are the rate of sea level rise and the supply of sediment. The U.S. Geological Survey Pacific Coastal and Marine Science Center (PCMSC) is studying the dynamics of sediment delivery to marshes to reduce uncertainty in predicting the resilience of marshes, and to support the design of adaptation measures to preserve marshes as sea level rises. Our current study site is the marsh in China Camp State Park, adjacent to San Pablo Bay (northern San Francisco Bay), which is part of the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR). Sediment flux data collected during the 2014 and 2015 winters show that during the largest tides, when the marsh is inundated, a significant amount of sediment is exported from the system through tidal creeks. Furthermore, the data suggest that sediment may be supplied to the marsh through another pathway: directly across the bayward edge of the marsh. The goal of this opportunity is to investigate the dynamics of sediment supply at the edge of the marsh, using data collected in winter 2015. These dynamics involve the interactions of waves, vegetation, currents, bathymetric slope, and suspended-sediment concentration and their influence on sediment deposition or erosion in the marsh. Our goal is to develop an idealized one-dimensional model of processes controlling sediment delivery across a marsh edge exposed to waves, and to use data collected at the China Camp marsh to test and improve the model. We anticipate collection of additional data in May or June

	2016 to investigate the influence of seasonal variations such as changes in vegetation density and wind wave climate.
Duration:	3 to 6 months
Internship Location:	Santa Cruz, CA
Area of Discipline:	Environmental engineering, marine geology, fluid mechanics, physical oceanography, wetlands science, earth science, geomorphology.
Expected Outcome:	The intern's contribution will advance understanding of the processes governing sediment supply to marshes, which will support planning for marsh preservation and restoration as sea level rises. The intern's results will be integrated with those of PCMSC scientists working on sediment supply through tidal creeks to compare the relative importance of these two pathways. We expect the intern to synthesize his or her results for publication, either as a first or contributing author, as appropriate to the results and length of the internship.
Special skills/training Required:	Experience in data analysis. Strong Matlab skills. Completion of a bachelors or masters degree in engineering, earth science, or physical science. Graduate-level coursework in fluid mechanics, sediment transport, and/or physical oceanography. Experience with measuring accretion and/or training in geomorphology preferred.
Duties/Responsibilities:	1) Contribute to the development of an idealized one-dimensional model of processes controlling sediment delivery across a marsh edge exposed to waves. Contributions could include: • identifying the important processes and the factors governing their relative importance through data analysis • developing the model, by adapting existing formulations for coastal processes • using the data to parameterize one or more of the important processes, such as wave attenuation by vegetation. 2) Participate in data collection at China Camp State Park in May/June 2016, and in processing the new data. 3) Optionally, the intern can propose and collect additional data types relevant to the problem through collaboration with PCMSC and/or the SF Bay NERR.
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