SCCWRP #1187

Multi-decadal simulation of estuarine sedimentation under sea level rise with a response-surface surrogate model

Matthew W. Brand[1], Leicheng Guo[2], Eric D. Stein[3], Brett F. Sanders[1,4]

[1]*Department of Civil and Environmental Engineering, Calit2 Building, University of California, Irvine, Irvine, CA*
[2]*State Key Lab of Estuarine and Coastal Research, East China Normal University, Shanghai, China*
[3]*Southern California Coastal Water Research Project, Costa Mesa, CA*
[4]*Department of Urban Planning and Public Policy, University of California, Irvine, Irvine, CA*

Abstract
Multi-decadal prediction of estuarine sedimentation with high-fidelity hydromorphodynamic modelspresents high computation costs, especially when accounting for stochasticity and uncertainty. A StochAstic model for Multi-decadaL Estuarine Sedimentation (SeAMLESS) is formulated here to support a specific decision-need re- lated to resilience planning and coastal management: estimating future sedimentation and dredging within a sedimentation basin for different scenarios of sea level rise and rules for dredging. SeAMLESS combines a reduced-dimension process model and a response-surface surrogate model to yield an ordinary differential equation that can be integrated over stochastic time series of storm events. Applications show that SeAMLESS can predict prob- abilities and amounts of future basin sedimentation and dredging with minimal loss of accuracy, compared to a high-fidelity model, while delivering $O(10^4 - 10^5)$ reduction in computational costs.