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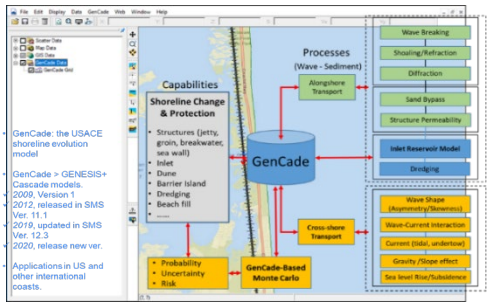
GenCade Model, Version 1.1 (FY21)

Background: Predicting shoreline change plays an important role in planning and management of coastal zones and regional sediment budgets. Shoreline change is driven not only by natural processes such as wave- and current-induced sediment transport, but also by engineering activities such as placement of structures and beach nourishment. The shoreline evolution model GenCade has been developed to calculate long-term shoreline change driven by wave-induced longshore sand transport and morphology change along open coasts and at inlets on a local to regional scale. It also accounts for engineering structures such as jetties, seawalls, and groins, as well as engineering activities such as dredging and beach nourishment. Operated within Surface-water Modeling System (SMS), GenCade is capable of providing quick assessment of long-term impact of coastal engineering projects on shorelines and sediment movement. New features are presently being developed to better constrain the effects of coastal processes on cross-shore sediment transport, model uncertainty, and sea level rise. Fusing new knowledge of nearshore processes from field studies and continuing model validation is a long-term strategic goal to provide more accurate and efficient solutions of shoreline evolution for coastal erosion protection and sediment management. GenCade is being developed by the Coastal Inlets Research Program and the Regional Sediment Management Program.



Approach: Two approaches have been adopted to develop, improve, and apply GenCade: (1) Incorporating semi-empirical closure models of longshore and cross-shore sediment transport, and continued efforts of model validation and verification, make GenCade reliable and efficient for predicting long-term shoreline evolution. (2) Providing technical transfer and user service solving practical problems, in turn, improves applicability of the model. In addition, Monte-Carlo shoreline simulation of GenCade provides an application tool for engineers to assess uncertainty and risk of predicted shoreline changes. Improvement of the graphical user interface with new features (Monte-Carlo and cross-shore transport) facilitates model applications and simulation result analysis.

Technical Advancements: GenCade combines the engineering power of GENESIS and the regional processes capability of the Cascade model. It provides reliable and efficient solutions of shoreline changes due to various conditions of waves, sediments, and erosion protection measures. The Monte-Carlo shoreline simulation gives probabilistic solutions of shoreline changes. GenCade is operated within the SMS, supporting pre- and post-processing of shoreline data in a georeferenced environment.

Payoff: GenCade provides a rapid assessment of engineering alternatives in a robust self-contained operating platform that can be setup and executed with minimal preparation. As such, it serves as an economically viable application for shoreline change analysis and lifecycle impacts to coastal navigation and shore protection projects.

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