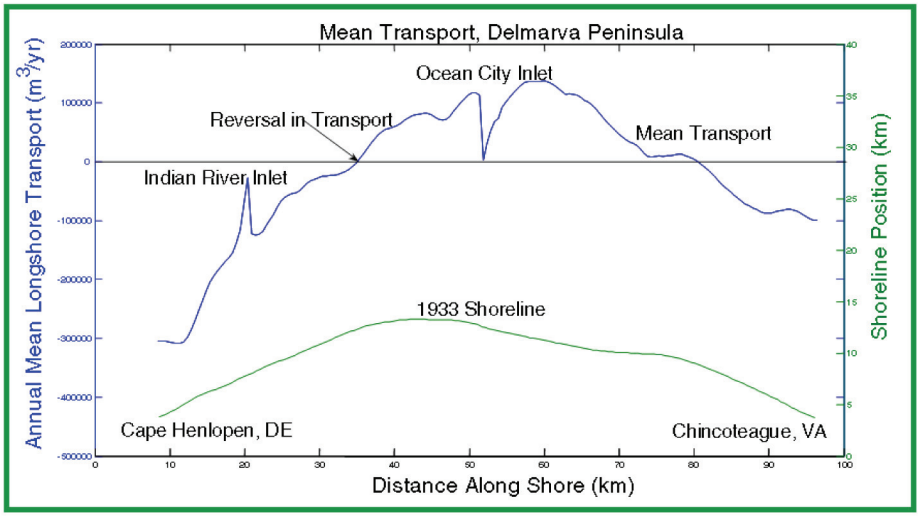
System-Wide Water SWWRP Resources Program

# Cascade, Version 1

**Description:** Cascade is a new class of sediment transport and coastal change numerical model that is being developed along with its support tools to model and examine regional coastal sediment transport, morphology change, and ecological consequences and responses to changes in physical processes in the coastal zone. Cascade simulates shoreline change relative to regional morphologic constraints upon which these processes take place. The evolution of multiple interacting coastal projects and morphologic features, such as those associated with inlets and adjacent beaches can also be simulated. The model name refers to the concept of different time and space scales that cascade from long to short and from large to small, respectively, over which long-term calculations of coastal morphology change occur and must be simulated. Cascade, Version 1 calculates wave-induced longshore sediment transport rates, shoreline change, tidal inlet shoal volume evolution, natural bypassing, and the fate of coastal restoration and stabilization projects.




*Longshore transport along Delmarva Peninsula*

**Application:** Cascade, Version 1 is now available to USACE districts and other users. Cascade setup, model control, and execution are operated within the Cascade Surface-Water Modeling System (SMS) interface. The support tool Regional Morphology Analysis Package (RMAP) is distributed through an ERDC Cooperative Research and Development Agreement (CRADA) partner in the Coastal Engineering Data Analysis System (CEDAS) widely employed at districts, universities, and consulting companies. RMAP contains data analysis and visualization routines for beach profiles, shorelines, and channel cross sections. It can be used for examining project site baseline conditions, initial local and regional shoreline generation, and Cascade output data verification. Case studies have been conducted for regional-scale coastal domains at the south shore of Long Island, New York and at the Delmarva Peninsula along coastal Delaware, Maryland, and Virginia.

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**Benefits:** Engineering projects require considerations at regional scale, which dictates the need for modeling processes and controls at regional spatial scales and long-term temporal scales. Cascade enables users to model local shoreline change emplaced on a curved regional shoreline trend. Existing shoreline change models tend to smooth these regional trends due to large gradients. The Cascade interface allows engineers and scientists to implement and apply Cascade to projects in an efficient way, while reducing potential errors in model setup. The interface is distributed in stand-alone SMS format that is widely known in the coastal modeling community, making menus and project setup familiar to users of other SMS models. The interface gives users the capability to import or create new shorelines and boundary datasets, enter project control parameters, execute Cascade, analyze output of simulations, plot results in report-quality graphics, and export the resulting data for further analysis. Cascade provides the unique capability to represent multiple and interacting projects on the same grid and assess consequences of natural processes by waves and water level, and by engineering actions.

**Future Capabilities:** Version 2 of Cascade is under development and will allow calculation of cross-shore processes such as overwash, breaching, and wind-blown sand transport that contribute in determining long-term coastal change. Other future enhancements include spit evolution, barrier island migration, and ecological components modeling.

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**Additional Information:**

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Connell, K. J., and N. C. Kraus. *Cascade, Version 1: User’s guide.* SWWRP Technical Note in preparation. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Connell, K. J., and N. C. Kraus. *Cascade, Version 1: Theory and model formulation.* SWWRP Technical Note in preparation. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

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