

Sediment Transport and Inlet Channel Avulsion at Isle of Palms (SC)

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Isle of Palms (the site of a field trip associated with the present conference) is an 11-km-long, “drumstick” barrier island typical of the southern South Carolina coast. The majority of the island has been accretional in recent decades, due to episodic inputs of sand from the Dewees Inlet delta at the northeastern end of the island. Sediment bypassing at the northeastern end of Isle of Palms has been well documented and was used as a case study by Williams and Kana (1987) to model what they termed the “shoal-bypass cycle,” which included the formation of an incipient shoal as stage 1, formation of erosional arcs and an accretional tombolo as the shoal was nearing shore in stage 2, and natural renourishment as the incoming sand attached to the shore and spread laterally in stage 3. Subsequent research suggested that the interval of these events was typically 6 years and involved an average of 55,700 m³ of sand (which is considered a low estimate due to the method used—actual volumes may be an order of magnitude higher). Erosion associated with the shoal-bypass events has often encroached on development at the northeastern end, requiring implementation of several small-scale projects. A large bypass event occurring from 2005 through 2008 necessitated a large-scale nourishment project, which added ~650,000 m³ of sand to the northeastern end.

Topographic surveys conducted before and after the 2008 project have shown, for the first time, detailed movements of offshore shoals associated with the Dewees Inlet delta. Six surveys, conducted between July 2007 and March 2010, encompassed all or portions of the inlet delta, including shoals attaching to the beach and shoal platforms on the seaward side of the Dewees Inlet channel. Survey data were used to produce 3D digital terrain models (DTMs), which are compared to show sediment transport patterns. The DTMs show the original shoal-bypass event was much larger scale than typical events, which is most likely why it had an impact significant enough to warrant nourishment. The DTMs also show there is a large platform of sand attached to the beach, which has spawned two additional shoal-bypass events, one attaching in 2009 and the other currently in stage 1 of the bypass cycle.

Of potentially greater significance, the DTMs show that the main channel of Dewees Inlet is narrowing and shoaling, while a secondary channel further north is widening and deepening, suggesting that a channel avulsion event may be underway. This process has not been documented at Isle of Palms and has the potential to cause dramatic changes to the shoreline since a large quantity of sand currently “locked” in the inlet may be released and made available to migrate onshore. Approximately 3.3 million m³ of sand are currently stored in the platform on the landward side of the main channel, and several million cubic meters more on the seaward side may be worked toward shore if the channel avulsion continues. Continued monitoring events will document whether the channel avulsion continues and will provide rates and quantities of sediment transport to the island, which may be useful in planning for potential changes to the shoreline as erosion and accretion associated with the changes in the delta impact the local community.