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# Barrier Island Response to Hurricane Ivan: Santa Rosa Island, Florida, USA

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Extensive overwash, washover deposition and dune erosion occurred along northern Florida's Gulf facing barrier islands in 2004 during the passage of Hurricane Ivan, a strong, slow moving Category 3 storm (Saffir-Simpson scale). The passage of Ivan provided a unique opportunity to study fresh washover deposits, and overall barrier response to regional scale overwash processes ranging in magnitude from inundation to collision regime. This study examines the impacts to Santa Rosa Island, an 85 km long barrier island located in the western Panhandle region of Florida, USA. Through coring, trenching, sediment analysis, ground penetrating radar (GPR) surveys, pre- and post-storm aerial photography, and time series LiDAR data, new insights into the sedimentological characteristics and 3-D internal architecture of the washover deposits and barrier dune response to the overwash event are revealed.

The distribution of washover deposits is largely controlled by sediment supply, accommodation space, and the extent of cross-shore penetration of overwash flow. While antecedent morphology of the barrier island is the primary factor governing sediment supply and accommodation space, spatio-temporal factors including storm track, intensity, speed, duration, and attendant surge levels, in conjunction with barrier morphology govern the extent of landward excursion of overwash flow. Within the washover deposits, four sedimentary facies are recognized. Berm washover facies dominates the beach and seaward side of the foredune, and is characterized by a basal erosional surface and seaward dipping planar stratification. Dune-flank facies extends landward from the foredune crest down the backside of the dune, exhibits little evidence of erosion along the basal contact, and is dominated by landward inclined parallel to nonparallel stratification. Washover-terrace facies, largely confined to the interior platform, exhibits little evidence of erosion along the pre-storm surface, and horizontal to gently landward dipping parallel stratification, which merges landward with, and commonly overlies steeply landward dipping foreset stratification. Backbay washover facies, the landward most facies, is dominated by deposition in the backbay, and is characterized by steeply landward dipping tabular foreset and sigmoidal stratification. In the longshore direction, backbay facies locally exhibit trough and mound GPR reflective patterns, representing washover sediment lobes oriented parallel to the primary flow direction, and illustrate the locally complex 3-dimesional nature of the washover deposits.

In conjunction with similar spatio-temporal factors as those described above, dune response to the overwash event is governed by a range of morphological parameters including width of the barrier island, height and width of the dunefields, vegetation type, distance of the dunes to the ocean, and lateral continuity of the dunefields. While significant longshore and cross-shore variability in dune response is observed along the foredune systems, geophysical data reveal low-lying interior hummocky dunes are commonly preserved below washover deposits, further indicating that overwash processes in the barrier-island interior are dominated by deposition with little erosion. Established dunes populating the backbarrier region exhibit limited scarping and remain largely intact. Based on pre- and post-storm subaerial sediment volumes, along non-inundated overwashed stretches of the barrier, barrier mass tends to be conserved, with the volume of sediment eroded from the dunes closely approaching washover sediment volumes. However, along inundated stretches, a deficit in barrier mass is indicated, suggesting sediment is lost to offshore/nearshore regions. An improved understanding of the factors controlling washover deposition, dune erosion, and regional scale barrier island response to large magnitude storm events can aid coastal managers in designing more effective approaches to resource and habitat management, and storm impact mitigation.