Innovative Approaches Using Multispectral Imagery to Detect Nearshore Bars and Elucidate Beach-Dune System Dynamics

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Nearshore bars naturally protect the coast against erosion by dissipating wave energy. They are significant reservoirs of sand, and thus, they may impact the response of beaches to different wave conditions. Nearshore bar position and morphologic variability also influences long- and short-term beach and dune stability. This study intends to understand how nearshore bars influence beach-dune dynamics using very high-resolution (VHR) imagery. A new low-cost identification approach for bar identification was applied by integrating VHR imagery. Nearshore bar research will benefit from integrating the larger spatial scale provided by satellite sensors. The rule-based OBIA approach was successful in identifying and characterizing nearshore bars. This study also studied the interactions of nearshore dynamics and the beach-dune system by investigating the coastal system holistically instead of each feature (dunes, beach, and bars) as separate entities. Knowing how the dunes, the beach and the bars dynamics are related and how each component affects the response of the other during storm conditions will also significantly improve the way that we manage, protect, and develop our coastlines. It is important to recognize that because of their geographic location the coastal system will be influenced by variables particular to those locations. Results showed that longshore bars offered the most protection against storm generated waves, while discontinuous longshore bars and crescentic bars offer some protection but the variability in their morphology causes variability in the responses causing hotspots of erosion in the dunes and beach.