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Geomorphic Preservation and Formational History near Cape Canaveral, Florida, USA: Implications for Coastal Resiliency and Paleo-Sea Level Characterization

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Summary

The Cape Canaveral (Florida, USA) coastline is an area of critical strategic importance due to the role it plays in access to space, its ecological sensitivity, as well as a center of technological innovation. This area is situated on a passive continental margin where the coastal morphology is primarily influenced by oceanographic processes, including sea level changes and wave dynamics, as well as meteorological processes such as tropical storms and aeolian (wind-driven) sediment transport. Through time, these dominant processes have preserved a set of well-defined beach ridge systems referred to as capes. This study aims to interrogate the preserved and evolved geomorphic elements at Cape Canaveral and its surrounding area, termed the Cape Kennedy Complex, including the Pamlico shoreline in the west through to the present-day Atlantic shoreline in the east, with a well-documented paleo-sea level history spanning the last 150,000 years with the aim to better understand the temporal and spatial evolution of this area.

The geographical setting of the Cape Kennedy Complex makes it highly susceptible to coastal hazards such as sea level rise, storm surges, erosion, and flooding. As such, accurate sea level characterization and resiliency predictions are particularly important because the area is home to critical ecosystems, communities and infrastructure, including the Kennedy Space Center. Ensuring the long-term sustainability and safety of this region requires a deep understanding of both past and future sea level changes. This knowledge helps planners and policymakers make informed long-term coastal planning decisions to mitigate risks and enhance the sustainability of the coastline.

We leverage satellite and aerial imagery as well as GPS and LiDAR data to map the area and understand geomorphological evolution of the region. Detailed analysis of imagery of the region dating back to 1943, prior to the construction of the Kennedy Space Center, allows for unimpeded understanding of preserved geomorphic components and the ability to understand the overall migration of the cape complex through time. In addition to detailed mapping and geomorphic characterization, observations are integrated with available Optically Stimulated Luminescence (OSL) and Carbon-14 (C14) dates in order to reconstruct the formational history

of the Cape Kennedy Complex. These integrated scientific methodologies allow for the generation of high-resolution, site-specific sea level curves, calibrated to

local environmental and geological conditions. This refinement significantly enhances the understanding of paleo-sea level variability, which is critical for reliable trend predictions. These predictions are essential for evaluating potential impacts on coastal regions, such as Cape Canaveral, and for developing robust coastal management strategies.