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National Regional Sediment Management Program Honolulu District (POH) & Coastal Hydraulics Laboratory (CHL):

Hawaii Regional Sediment Management – Sunset Beach Remote Sensing

Description

The Sunset Beach region extends along the three (3) miles of shoreline from Pupukea to Velzyland on the north shore of the island of Oahu, Hawaii (Figure 1). Previous RSM work in this region, including shoreline change analysis and coastal modeling, has aided in the understanding of the coastal processes in this region. However, the dynamic interactions of the waves, currents, bathymetry, and coastal morphology in this region are very complex and several uncertainties remain. Due to this high uncertainty and variability, local stakeholders are hesitant to implement engineering solutions that may end up having unanticipated negative impacts. Meanwhile, the properties and infrastructure along this coastline are highly vulnerable to episodes of severe erosion and inundation. This study will use remote sensing technology developed in recent years by ERDC-CHL to better quantify sediment pathways in the nearshore, validate previous modeling results, and measure coastal hazards such as runup. The results of this study will inform the decisions of coastal managers as they determine how to best manage the sediment in this region, including what actions can be taken to address severe erosion. Additionally, the performance of these remote sensing systems, mini-Argus and mobile RIOS, will be evaluated in an environment with reefs and large extra-tropical storm waves.

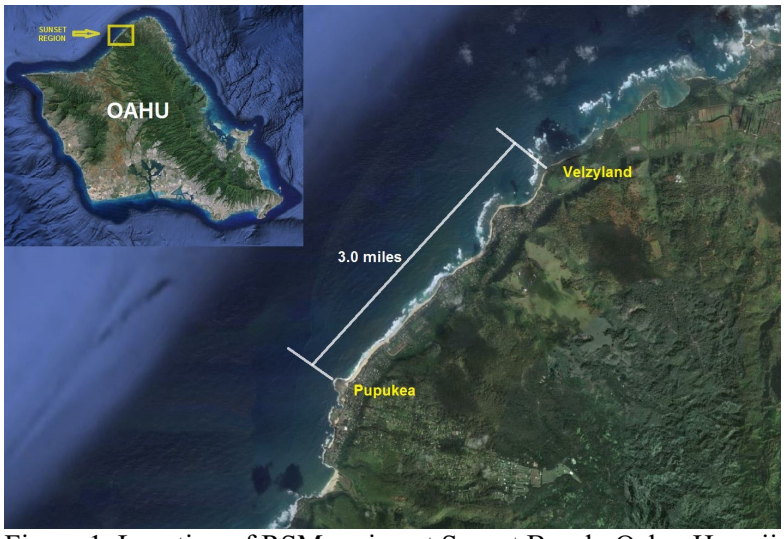

Figure 1. Location of RSM region at Sunset Beach, Oahu, Hawaii.

Issue/Challenge To Address

Over the last decade, shoreline erosion in the Sunset Beach region has progressed on an unprecedented scale. Previous studies in this region have observed that seasonal variability dominates changes in shoreline position, with large northwest swells in the winter causing swift changes, and steadier tradewind generated waves providing recovery in the summer. Due to the constantly changing shoreline, it has been difficult to track the movement of sediment in the littoral system in correlation to the nearshore hydrodynamics.

Application of the mini-Argus and mobile-RIOS technology will help to answer these questions by providing continuous and/or recurring data on shoreline position, runup, wave measurements, surface currents, bathymetry estimates and changes. Results from this study will inform stakeholders, including state/county agencies, NGOs, and private interests, who are searching for viable sediment management strategies that will serve multiple interests and remain sustainable in the face of future climate changes such as sea level rise

and variable meteorological forcings. Coastal flood risk management solutions in an area with valuable resources such as coral reefs, surf sites, limited carbonate sand supply, and public/tourist cultural value are a challenging problem that requires innovative application of RSM principles.

Successes Lessons Learned

Successes and lessons learned will be compiled during the duration of this study.

Projected Benefits Cost Savings Value Added

This RSM initiative will provide monetary benefit to the non-Federal sponsor in optimizing ongoing sediment management practices such as "sand pushing" and future practices such as beach restoration through identification of sand borrow sources. This deployment will provide valuable information on the viability of sediment management measures in an extreme wave environment, as well as on the utility and/or limitations of these technologies along a fringing reef shoreline. The data collected will also provide key measurements for validation of phase-resolving numerical models being utilized in the region, particularly for the difficult to quantify parameters of wave runup and infragravity wave effects. Lessons learned from this project could be applied to sediment management practices and numerical model applications along other island coastlines.

Expected Products

- Instrument data collected and analyzed including geo-rectified imagery, wave measurements, shoreline position, bathymetry, runup/swash extents, bedform migration rates/pathways, surface currents
- Identification of offshore sediment sinks
- Refined sediment budget
- Technical Note and Presentation

Stakeholders/Users

Stakeholders involved in this RSM effort include the State of Hawaii Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL), Sunset Beach homeowners within the region, and the North Shore community.

Leveraging Opportunities

Several leveraging opportunities exist for this project: 1) Use of previous FY15 RSM work (shoreline change/modeling/sediment budget); 2) Use of ongoing topographic LiDAR and profile surveys of project area by University of Hawaii and others to ground truth data collected; 3) Use of Flood and Coastal Systems R&D and DOTS funds for additional UAS topographic surveys; 4) Collaboration with the Coastal Imaging Research Network (USGS, NRL, academia) for coastal imaging processing codes; 5) Use of mini-Argus cameras to supplement runup measurements for FRM-funded infragravity wave research (CHL and Scripps); 6) Sharing of data collected with PacIOOS researchers for model calibration and future research collaborations; 7) Use of existing JABLTCX LiDAR bathymetry and CDIP buoy data for the region; and 8) Involvement of the Sunset Beach community in coordinating instrument mount sites and continued use of real-time camera imagery throughout project and potentially into the future.

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Participating Partners

Participating partners include the DLNR OCCL, UH SeaGrant, PacIOOS, Sunset Beach homeowners, and the North Shore community.