Delaware Sea Grant Project:
The remote sensing component for the Delaware Coastal Observing System: A gap to be filled (R/ETE-15)

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Project Abstract:

The interface of terrestrial and marine water masses make the coastal zone complex and dynamic. Variable flow patterns due to river-plumes, eddies and coastal upwelling initiate, concentrate and disperse the biologic response to these flow patterns. While chlorophyll is routinely observed from orbital instruments, little is known about their initiation or ultimate fate because the variable flow patterns before and after a "bloom" event is unknown. A comprehensive remote sensing component (*not just use a single remote sensing data in research*) of a coastal ocean observing system (COOS) can provide a cost effective means of acquiring data at high spatial and temporal resolutions over large swaths of the coastal region. *A COOS without the remote sensing component is incomplete.* ***The DE Sea Grant has invested significantly in coastal observing, however, the DE Bay Observing System (DBOS) does not have a comprehensive remote sensing component. This is a gap that definitely needs to be filled.*** The development and advancement of techniques that can readily incorporate remotely sensed satellite data into a coastal ocean observing system in the Delaware Bay and the adjacent coastal zone is essential for improving the understanding of the coastal zone. The Center for Remote Sensing (CRS) has a proven record of successfully developed techniques and methodologies that address the important and compelling research topics identified by this proposal.

The overall goal of the proposed study is focused on developing the remote sensing component of a coastal ocean observing system and using it for doing good science. This study will focus on the incorporation of surface circulation data into a coastal ocean observing system with a focused examination of physical processes that are coupled with significant biological activity. Specifically, the project objectives are: (1) to collect, process, and archive surface velocity data from satellite, long range HF radar, and the University Delaware's standard range HF radar, so that gridded maps of surface velocity, divergence, and vorticity of the Delaware Bay and its coastal zone are readily accessible to various user groups and the general public; and (2) to improve the understanding of the physical processes in Delaware Bay and its coastal waters through novel and rigorous analyses, focusing particularly on the time-dependent surface circulation and its relationship with biological processes in this region. By following these objectives and overall goals, we can address the following hypotheses: (1) remote sensing based feature tracking can quantify surface velocity features of the highly variable flows in the estuarine and coastal environment of the Delaware Bay and its coastal region; (2) current upwelling indices can be enhanced through the incorporation of additional parameters that are known to effect upwelling, such as bathymetry, which will make the indices more effective on wide, shallow continental shelves, like that of the Delaware coast; (3) there is a quantifiable relationship in the spatial and temporal structure between SST, ocean color, and surface velocity, which represents a potential coupling of physical-biology processes in the Delaware estuary and

its coastal zone; and (4) spatial scales of estuaries and the inner shelf are influenced by small-scale surface divergence and convergence (SDC) on the order of several kilometers. *These objectives, hypotheses are new.*

The proposed research will develop a number of innovative and feasible tools, technologies, and baseline information that can be used by partners/customers to improve ecosystem-based management. The data and products produced from the proposed study are essential to effective ecosystem-based management. The advances represent an important return on investment because the incorporation of the products developed from the proposed study will reduce the cost and increase the sustainability of operations and management of the Delaware Bay and its coastal zone. With regard to information services, the results are expected to have broad applicability, being useful to a wide range of institutions, both those in close proximity to the study region and to those elsewhere in the world as the proposed study represents a case study of the information that can be obtained by using remote sensing data in a coastal ocean observing system. The research team includes remote sensing physical oceanographers, remote sensing biological oceanographer, optical physicist and interdisciplinary coastal oceanographers. The project will also support a postdoc and graduate student. ***Therefore, this project will fill an important gap, and balance the support & priorities put forth by the DE Sea Grant Program.***