BAA 99-003 National Ocean Partnership Program Topic B1 - Ocean Observation Systems

Defining the Physical Forcing of Primary Productivity on the Mid-Atlantic Continental Shelf Using a Distributed Real-time Multi-Disciplinary Observation Network

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This partnership seeks to link several ongoing research programs to observationally span the scales from the nearshore to the deep ocean both physically and biologically. New physical/bio-optical observation systems on satellite, aircraft and shore based remote sensing platforms, subsea autonomous nodes, surface ships, and autonomous underwater vehicles will be integrated through acoustic, radio and satellite communications for smart adaptive sampling of biologically significant events on the continental shelf.

The objective is to develop a distributed real-time observation system which collects data over the appropriate spatial/temporal scales required to characterize key hydrographic and optical parameters to define the physical forcing of biological productivity for both the mid-continental shelf and nearshore coastal waters. Over the three year period, the partnership will focus on the following specific tasks:

1) Develop and demonstrate systems to acquire real-time remote sensing surface current observations across the entire continental shelf from the littoral zone to the deep ocean by extending CODAR HF-Radar observations offshore and satellite altimeter observations (standard and delay/Doppler) onshore.

2) Spatially expand and equip with new physical/bio-optical sensors a network of autonomous nodes surrounding the LEO-15 site to provide real-time subsurface time series of physical, biological and optical parameters.

3) Cross-calibrate and ground-truth the international community's ocean color remote sensing platforms using the in situ optical network across a wide optical gradient from the sediment dominated nearshore waters to the biologically dominated waters at mid-shelf.

4) Add biological/optical sensors and real-time communications to existing ship-towed and AUV sampling systems for multi-scale adaptive sampling of physical/bio-optical events ranging from the shelf-wide spring bloom to local recurrent upwelling events.

5) Use the physical/optical measurements for both the spring bloom and the summer coastal upwelling events to refine and test optically based ecosystem models being coupled to physical circulation models as part of the HyCODE program.

6) Operate the appropriate components of the observation/modeling system each year during the spring bloom and the summer recurrent upwelling events.

7) Expand existing K-12 education and public outreach programs using the same real-time datasets available to researchers.

RELATIONSHIP TO EXISTING PROGRAMS. This proposed partnership benefits from several ongoing projects at LEO-15. Currently, ONR's Coastal Ocean Modeling and Observation Program (COMOP) program is developing adaptive sampling networks for the nearshore coastal ocean. The COMOP program provides a significant portion of the salary costs associated with Rutgers personnel through 2001. These efforts were greatly expanded by NOPP-funded efforts focused on using autonomous forecasting networks for forecasting local circulation patterns using a data assimilative model, coupling an advanced atmospheric model to the ocean circulation model, and demonstrating the relocatability of these forecasting approaches as part of the Gulf of Maine EcoHAB program (Dr. Anderson, lead PI). The COMOP and NOPP awards provide 90% of the funding for the field efforts through 1999. The biological capabilities of LEO were greatly expanded as part of a recent award from ONR's Hyperspectral Coastal Ocean Dynamic Experiment (HyCODE). The HyCODE program is focused on 1) quantifying the processes which define the spatial/temporal variability in the inherent optical properties for the nearshore coastal ocean, 2) developing hyperspectral optical models to derive in-water optical patterns from remotely sensed data, and 3) coupling the resulting radiative transfer ecosystem model to the existing hydrodynamic data assimilation model. This program provides the majority of the salary and infrastructure costs for planned Coastal Predictive Skill Experiments through the year 2001 and serves as the foundation for several other HyCODE awards (from four individual institutions) redirected to work at the LEO site. The physical/optical efforts will provide critical support for independently-funded biology projects being conducted at LEO-15. A NSF-sponsored effort (Dr. Lee Kerkhof) will utilize the real-time adaptive sampling capability being developed by COMOP, NOPP, and HyCODE to assess the biological linkages between specific phytoplankton and bacterial groups during episodic upwelling. The network will also be used to coordinate NOAA-sponsored efforts (Dr. judy Grassle) for characterizing shellfish larval settlement which is strongly coupled to episodic physical events such as upwelling/downwelling.

SENTENCE ABOUT LEE AND JUDY. Significant ship costs and the majority of the LEO-15 maintenance is provided by the Mid-Atlantic National Undersea Research Center (NURC). The NOAA Middle Atlantic Bight (MAB) NURC has provided an average of $1,000,000 annually in peer-reviewed support for LEO-15 research and technology development projects and infrastructure support for the LEO-15 system.