

Satellite Characterization of Bio-Optical and Thermal Variability in the Japan/East Sea

Robert Arnone and Richard Gould

Code 7343

Naval Research Laboratory

Stennis Space Center, MS 39529

phone: (228) 688-5268 fax: (228) 688-4149 email: arnone@nrlssc.navy.mil

N0001498WX30290

http://www.onr.navy.mil/sci_tech/ocean/onrpgahj.htm

LONG-TERM GOAL

My long term goal is to characterize the physical and optical signatures of the Japan/east Sea through the use of satellite remote sensing. Our effort is to determine a climatology of the inherent optical properties (IOP's) using seaWiFS satellite to define how the bio-optical cycle is driven by the physical circulation and processes.

OBJECTIVES

Our objective in this research is to exploit SeaWiFS and AVHRR satellite data to understand physical and bio-optical processes in the East Sea. Specifically: 1. Compare the location of SST and bio-optical fronts to determine the coupling between the optical and physical signatures. 2. Define the seasonal position and variation of the subpolar front. 3. Characterize the changes in the bio-optical properties, which occur following the passage of a strong winter cold front. 4. Trace the bio-optical and SST signature of coastal waters from the EKWC as these waters transition to central basin waters along the subpolar front. 5. Validate and tune the SeaWiFS algorithms and vicarious sensor calibration to extend bio-optical properties to inherent optical properties.

These objectives are aimed to 1. Provide a link between the satellite surface features and the subsurface measurements. 2. Provide an initialization and validation for circulation models. 3. Ensure that ship time is optimized during the location and mapping of the front during SeaSoar deployments and 4. Provide a context to interpret the in situ measurements over broader spatial and temporal scales.

APPROACH

We plan on establishing a time series of SeaWiFS and AVHRR products for the Japan/East sea to characterize the spatial and temporal variability of the bio-optical and seasurface temperature for a period of several years.

We plan on collection of SeaWiFS and AVHRR imagery aboard the Reville on two SeaSOAR cruises (May 1999 and January 2000). These real-time collection will provide the ship sampling to measure the subpolar front and East Korean Warm Current. We plan on collection of remote sensing reflectance of IOP measurements to tune and validate the satellite products and determine how the surface bio-optical properties are linked with the subsurface SEASOAR measurements.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1998		2. REPORT TYPE		3. DATES COVERED 00-00-1998 to 00-00-1998	
4. TITLE AND SUBTITLE Satellite Chracterization of Bio-Optical and Thermal Variability in the Japan/East Sea				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory, Code 7343, Stennis Space Center, MS, 39529				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM002252.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 3	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

WORK COMPLETED

We have established methods of transferring and processing Satellite AVHRR and SeaWiFS imagery from the Japan / East Sea. We have automated the procedures for collection, processing and archiving. We have established a web site for viewing the archived data. We have started the archives site from March 1998 and is current through December 1998. We have over 200 SeaWiFS imagers and 200 AVHRR imagers of the Japan / East Sea.

We have processed all SeaWiFS imagery using version 1 and version 2 software for IOP and chlorophyll products. Version 2 which improves the IOP products was implemented in Sept. 1998 and we are reprocessing now. We have processed AVHRR imagery for SST and channel 4 radiance.

We have developed procedures for compositing SeaWiFS IOP and Chlorophyll and AVHRR SST products. We have generated weekly and monthly composites of SST and chlorophyll. These products are currently under review and being improved to handle problems with cloud cover and scaling properties.

Results can be observed on our web site.

We are updating the shipboard satellite receiving with new software and hardware in preparation for the cruises in May 1999.

RESULTS

Images from SeaWiFS processing have been used to show the development of the spring bloom in the Japan Sea. The Subpolar front is shown to bloom in chlorophyll in May and to occur within a 2-3 week period. During this time the SST shows strong thermal variation associated with the subpolar front.

Difficulties in cloud screening of AVHRR imagery have prompted us to use the AVHRR Pathfinder cloud screening algorithm. The SST imagery illustrates the subpolar front and Korean Coastal Warm Current in spring. These features are less noticeable in summer. The SeaWiFS ocean color imagery clearly illustrates the subpolar front in spring and is less noticeable in summer and fall.

Coastal eddies associated with the EKWC are observed developing and extending off the coast into the central basin. These coastal features will be characterized during the cruises.

The subpolar front is characterized by a series of eddy features and not a single linear front. The eddy features characterize a diffuse field of highly energetic features which are observed in the SST and the bio-optical signatures. The bio-optical features are different than the SST features and will be examined in detail in the cruises.

IMPACT/APPLICATION

The seasonal development of the bio-optical and physical surface properties have been characterized using satellite imagery. We are now attempting to understand the coupling and processes governing these characteristics. Further we will determine in the next years cycle is similar or different than the 1998 characteristics.

We have shown that SeaWiFS imager can be used to define the bio-optical cycle. We will be defining accuracy and validation of these products and defining how these products can be linked with numerical models and in situ measurements.

\TRANSITIONS

Algorithms being developed for SeaWiFS are being used by the NAVAL Optical products (6.4 SPAWARS) program for transition into the naval oceanographic Office and the regional centers. These algorithms are being improved for Case 2 waters which occur along the Korean and Japan Coastal and are advected into the central basin. These improvements to the algorithms are providing better estimates of the IOP and the chlorophyll concentrations.

RELATED PROJECTS

1 – Spectral Signatures in littoral Zones NRL 6.1 program for understanding ocean color signatures for inversion to IOP's (Curt Davis, A. Weidemann, S. Ackleson)

2 – Nesting of satellite ocean color products NRL 6.2 program to understanding the spatial and temporal variability of the optical properties.

3. HYCODE ONR/NRL – 6.1-6.2 program to prepare for the launch of the hyperspectral ocean color satellite NEMO.

REFERENCES

PUBLICATIONS

Arnone, R.A. Characterizing Optical Properties in Coastal and Shelf Waters from SeaWiFS. Pacific Ocean Remote Sensing Conference (PORSEC '98) June 28 – 31, 1998 Qingdao, China

Arnone, R. A. P. Martinovich, R. W. Gould, M. Sydor, R. P. Stumpf Coastal Optical Properties Using SeaWiFS, Ocean Optics XIV Kailua-Kona Hawaii, Nov 10-13, 1998 SPIE – the International Society for Optical Engineering

Gould, R.W. R. A. Arnone, M. Sydor Testing a new remote sensing reflectance algorithm to estimate absorption and scattering in Case 2 waters. Ocean Optics XIV Kailua-Kona Hawaii, Nov 10-13, 1998 SPIE – the International Society for Optical Engineering