OS21A 0830h POSTER
Towards Closure of In Situ Upwelled Radiance in Coastal Waters
Grace C. Chang1 (805-681-8207; grace.chang@opl.ucsb.edu)
Tommy D. Dickey1 (805-963-7354; tommy.dickey@opl.ucsb.edu)
W. Scott Peggs2 (ospags@ospacc.ostt.com)
1Ocean Physics Laboratory, University of California at Santa Barbara, 6478 Call Real Suite A, Santa Barbara, CA 93101, United States
2College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331, United States

Dynamic coastal processes alter in-water optical properties and have a significant impact on the measurements and interpretation of upwelled radiance and thus, remote sensing data. Upwelled radiance, \( L_o (\lambda, a) \), is an important quantity for the determination of the optical properties of water, water column visibility, and for remote sensing. Traditionally, \( L_o (\lambda, a) \) is measured as the radiances leaving the water surface. This paper provides a method for estimating water-leaving radiances, \( L_w (\lambda, T_s) \), which is the quantity estimated by remote sensors, given measurements of either inherent optical properties (IOPs) or the radiance attenuation coefficient, \( k_g (\lambda) \). In situ observations of upwelled radiances were made during the HYCOCODE project in coastal New Jersey (25 m water depth) using two different methods: 1) HyperTSRB and 2) profiled spectroradiometers. These measurements were compared with radiative transfer model estimates that used complete measurements of IOPs for HydroLight 4.1 model inputs. \( k_g (\lambda) \) was computed using data from the profiling spectroradiometer to determine upwelled radiance at 0.866 m below the sea surface \( L_o (\lambda, 0.66) \), just below \( L_w (\lambda, 0) \). Additionally, a tuning factor, determined using Hydrolight, is introduced to estimate \( L_w (\lambda, 0) \) from HyperTSRB-measured \( L_o (\lambda, 0.66) \). Average agreement between HyperTSRB and Hydrolight-derived \( L_w (\lambda, 0) \) was 10% within 1% at the blue wavelengths, 25% at the green, and within 40% at the red wavelengths. Water column optical properties changed drastically from nearshore (turbid) to offshore (clear) due to the presence of an upwelling front. This front resulted in decreasing magnitudes and flatness of the spectral reflectance curves from nearshore to offshore.

URL: http://www.spl.ucsb.edu/hycodeopl.html

OS21A 0830h POSTER
Errors Generated by the Use of a Linear Model of Optical Diffuse Reflectance in Coastal Waters
Vladimir J. Hilgert1 (228-688-4528; bluetooth@ucnjy.com)
Naval Research Laboratory, Ocean Sciences Branch, Code 7330, Steven E. Gemin, E3 RS, 3952-5884, Washington, DC 20375, United States

Diffuse reflectance coefficient or diffuse reflectance of the water body is an informative tool of remote sensing reflectance of light from the ocean. Biophysical and chemical composition of the dissolved and suspended substances in seawater. Seawater diffuse reflectance is dependent on the ratio of water that does not depend only on inherent optical properties of the seawater, but also on the parameters of illumination. The diffuse reflectance is dependent on the inherent optical properties that are expressed as a dependence on a ratio of backscattering constant \( k_b \) to absorption coefficient \( k_a \). The ocean under diffuse illumination of the sky diffuse reflectance \( R \) is linearly proportional to the ratio of \( k_b \) to \( k_a \) for \( k_b \geq 3.0 \) according to Moler and Prieur. The abovementioned linear equation is very good for the downwelling diffuse reflectance. It is also acceptable for certain types of coastal waters. In fact, it is valid for all types of coastal waters if the ratio of \( k_b \) to \( k_a \) is less than 0.1. From physical considerations \( R \) should always lie between 0 and \( k_b/2k_a \) above zero and infinity. The linear equation fails to pass this restriction. We propose a new \( R \) depends on \( k_b/2k_a \) when \( k_b/2k_a \) becomes greater than \( k_b/2k_a \) (highly scattering water) with a slope of 1. A linear function can indicate if the linear equation of coastal waters, when parameter \( k_b/2k_a \) exceeds limitations of smallness, can cause unacceptable errors in estimating diffuse optical properties and remote optical information. In order to estimate possible error of determining diffuse reflectance we used four approaches to generate diffuse reflectance as a function of the ratio of \( k_b/2k_a \) and empirical model. To study the ocean color remote sensing provides an invaluable tool for mapping heterogeneous seagrass distributions in optically complex coastal waters. Sea-viewing wide field-of-view sensor (SeaWiFS) satellite data obtained in the shallow banks off Eastocking Island, Bahamas, were used to investigate the bathymetry and leaf area index (LAI) of the seagrass, Halodule wrightii (turtlegrass) from remote sensing reflectance. Bathymetry was mapped using spectral ratio that explained 97% of the variability in depth from a depth range of 3000 data points. Bottom reflectance was retrieved from remote sensing reflectance using bathymetry and tables of depth-averaged attenuation coefficients. The computed bottom reflectances were consistent with estimates made using depth sounder measurements made over areas of dense and sparse turtlegrass. These algorithms were also applied to high resolution imagery obtained from the Ocean Portable Hyperspectral Imaging for Low-Light Spectroscopy, Ocean PHILLS, in June 1999 and May 2000. We related LAI measured from divers surveys at stations within the image to modeled bottom reflectance. The relationship between seagrass LAI and bathymetry and the stability of the seagrass bed in this region will be explored.

URL: http://www.spl.ucsb.edu

OS21A 0830h POSTER
Hyperpectral Remote Sensing of Sea Surface Temperature and Emissivity With GIFTIS
Xiangqian Wu1 (608-205-2113; fredw@ssec.wisc.edu)
Allen H. L. Huang1 (608-263-5283; allenhuang@ssec.wisc.edu)
W. Scott Peggs2 (ospags@ospacc.ostt.com)
1Space Science and Engineering Center, University of Wisconsin-Madison, Madison, WI 53706, United States
2Earth Science Division, NASA Goddard Space Flight Center, Greenbelt, MD 20771, United States

Geostationary Imaging Fourier Transform Spectrometer (GIFTIS), a revolutionary instrument for remote sensing of the earth’s surface and atmosphere, will be launched in 2004. Revolutionary algorithms are required to process the data collected by such advanced instruments. In this study, a new approach to remote sensing of sea surface properties will be presented that takes full advantage offered by the GIFTIS data. Assuming the atmosphere is non-scattering and reflection is specular, the surface emissivity can be expressed as:

\[
s(\lambda, T_s) = s_0(\lambda, T_s) - \frac{2k(b_b - k_a)}{b_B^2 - k_a^2} \cdot \frac{1}{b_B^2 - k_a^2} \cdot \frac{1}{b_B^2 - k_a^2}
\]

where \( s_0(\lambda, T_s) \) is radiance at the top-of-atmosphere measured by satellite, \( s_0(\lambda, T_s) \) and \( s_0(\lambda, T_s) \) are upward and downward atmospheric radiance; \( T_s \) is surface temperature; \( b_B(b_B = \frac{1 + \pi 2k_B}{1 + \pi 2k_a}) \) is Planck function of skin temperature. \( T_s \) can be estimated from GIFTIS data by the following algorithm. In the spectral region of weak absorption lines, downward radiance increases and surface transmittance decreases, amplifying the difference of derived and actual emissivity as “spikes” in otherwise smooth emissivity spectra. An optimization procedure uses these upward or downward spikes as an extra constraint, reduce interval of uncertainty, and terminate when exact solution is found or, in the presence of instrument noise, the spikes is sufficiently small. URL: http://www.spl.ucsb.edu/nurtor

OS21A 0830h POSTER
Hyper spectral Remote Sensing of Sea Surface Temperature and Emissivity With GIFTIS
Eos. Trans. AGU, 83(4), Ocean Sciences Meeting, Suppl., Abstract "###.###.####.

OS21A 0830h POSTER
Remote sensing of seagrass and turtlegrass Banks using high resolution airborne imagery
Heidi M. Diezmann1 (831-633-7270; haltrin@nrlssc.navy.mil)
Richard C. Zimmerman1 (rzhmw1974@gmail.com)
Robert A. Leathers2
T. Valerie Downes2
Curtis J. Davis2
1Moreland Marine Laboratories, California State University 8272 Moreland Rd., Moreland, CA 95039, United States
2Naval Research Laboratory, 4555 Overlook Ave. SW, Washington, DC 20375, United States

Recent studies of seagrass have over the past decades have focused attention on the need for fast, reliable methods of calculating the rate of new growth. Ocean color remote sensing provides an invaluable tool for mapping heterogeneous seagrass distributions in optically complex coastal waters. Sea-viewing wide field-of-view sensor (SeaWiFS) satellite data obtained in the shallow banks off Eastocking Island, Bahamas, were used to investigate the bathymetry and leaf area index (LAI) of the seagrass, Halodule wrightii (turtlegrass) from remote sensing reflectance. Bathymetry was mapped using spectral ratio that explained 97% of the variability in depth from a depth range of 3000 data points. Bottom reflectance was retrieved from remote sensing reflectance using bathymetry and tables of depth-averaged attenuation coefficients. The computed bottom reflectances were consistent with estimates made using depth sounder measurements made over areas of dense and sparse turtlegrass. These algorithms were also applied to high resolution imagery obtained from the Ocean Portable Hyperspectral Imaging for Low-Light Spectroscopy, Ocean PHILLS, in June 1999 and May 2000. We related LAI measured from divers surveys at stations within the image to modeled bottom reflectance. The relationship between seagrass LAI and bathymetry and the stability of the seagrass bed in this region will be explored.

URL: http://www.spl.ucsb.edu

OS21A 0830h POSTER
A Comparison of Hyper-spectral and Multispectral Imagery of Monterey Bay
Andreja J. Vander Vondel1 (631-459-4298; andreja.vondel@nps.gov)
Dr. Raphael Kudela1 (rudepp@ucsc.edu)
Dr. John Ryan2 (jryan@mbari.org)
1University of California, Santa Cruz, 1156 High St. Santa Cruz, CA 95064, United States
2Monterey Bay Research Aquarium, 7700 Sandhill Rd., Moss Landing, CA 95039, United States

New advancements in the realm of satellite oceanography have opened up avenues to describe the oceans from a more syoptic perspective. Imagery used to study large-scale ocean dynamics has improved to include higher spectral, spatial and temporal resolution. One example of these improvements comes from Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) and Advanced Very High Resolution Radiometer (AVHRR). AVHRR AVIRIS is a unique airborne sensor that uses a channel range of 224 banded for each scene and has a spatial resolution of 20 meters per pixel. The multispectral and hyper-spectral sensors have 8 and 5 bands, respectively, and a nominal resolution of 1100 meters. With the use of 224 spectral bands and a 50 fold increase in spatial resolution, these hyperspectral images can be described in greater detail and new tracts may be extracted from it. AVIRISderived AVIRIS performed an over flight of the Monterey Bay region and five lines of data were acquired with a total
of 33 scenes of the bay. The data were processed for geometric and atmospheric corrections. The first processing step consisted of a normalization to the AVIRIS data to correct for path adjacency effects. Following this, the data were deconvolved using the new SeaWiFS K (490) algorithm to derive the diffuse attenuation coefficient of seawater at 490nm, which is used to correct for the water contribution to the measured reflectance. The small angle scattering was measured through the General Anisotropy Scattering Function (GASF) method. Measurements were performed at 4 depths and 6 visible wavelengths. Over the 2 week period of measurements the VSF varied between very constant at the top and bottom of the water column. At intermediate depths the VSF varied between very constant at the top and bottom of the water column, and on other occasions increased to values over 160. The VSF was also measured in clear water near 90°, used in the back direction. The data were corrected for the water contribution to the measured reflectance. The small angle scattering was measured through the General Anisotropy Scattering Function (GASF) method. Measurements were performed at 4 depths and 6 visible wavelengths. Over the 2 week period of measurements the VSF varied between very constant at the top and bottom of the water column. At intermediate depths the VSF varied between very constant at the top and bottom of the water column, and on other occasions increased to values over 160. The VSF was also measured in clear water near 90°, used in the back direction. The data were corrected for the water contribution to the measured reflectance. The small angle scattering was measured through the General Anisotropy Scattering Function (GASF) method. Measurements were performed at 4 depths and 6 visible wavelengths. Over the 2 week period of measurements the VSF varied between very constant at the top and bottom of the water column. At intermediate depths the VSF varied between very constant at the top and bottom of the water column, and on other occasions increased to values over 160. The VSF was also measured in clear water near 90°, used in the back direction. The data were corrected for the water contribution to the measured reflectance. The small angle scattering was measured through the General Anisotropy Scattering Function (GASF) method. Measurements were performed at 4 depths and 6 visible wavelengths. Over the 2 week period of measurements the VSF varied between very constant at the top and bottom of the water column. At intermediate depths the VSF varied between very constant at the top and bottom of the water column, and on other occasions increased to values over 160. The VSF was also measured in clear water near 90°, used in the back direction. The data were corrected for the water contribution to the measured reflectance.
OS92 2002 Ocean Sciences Meeting

1Florida Environmental Research Institute, 4807 Bayshore Style Suite 101, Tampa, FL 33614, United States
2Naval Research Laboratory, Code 7212 4555 Overlook Ave SW, Washington, DC 20375, United States
3National Oceanic and Atmospheric Administration, msd375/111, MS 3004, MD 20901, United States
4University of South Florida, Department of Marine Science 146 7th Ave. S, St. Petersburg, FL 33701, United States
5Rutgers University, Institute of Marine & Coastal Sciences T1 Dudley Road, New Brunswick, NJ 08901-8564, United States
6California Polytechnic State University, Biological Sciences Department, San Luis Obispo, CA 93407, United States

The non-linear responses of marine optical signals have made coastal ocean areas of Case-2-type waters a challenging environment for remote sensing. Hyperspectral remote sensing with its continuous, high-resolution spectral information has long promised to help in unraveling some of the difficulties by bringing to bear the mathematics of signal processing. As spectroscopy transcends the non-linear problem. However, these techniques are hindered by the absolute radiometric calibration of the hyperspectral sensor. During the 2001 Hyperspectral Coastal Ocean Dynamics Experiment (HYCOCO) off the coast of New Jersey, we collected multiple days of high altitude images of coastal New Jersey from the HY-2B. Our objectives were to develop in-situ hyperspectral algorithms and non-constant slope corrections for the HY-2B sensor, and to present techniques and data produced by the Portable Hyperspectral Imager (PHILLS II) will be presented, as well as comparisons between the hyperspectral imagery and in-situ data.

OS21A.14 0830h POSTER
Application of Remote Sensing Multitemporal/Multisensor Data Analysis and GIS Database for Coastal Change Monitoring and Nongeology Detection in Rio Grande do Norte State, Northeast Brazil
Vanderlei Eustáquio Amaro1 (55.84.215.3831; amaro@geologia.ufro.br); Helencio Vital1 (55.84.215.3831; helencia@geologia.ufro.br); Adriano Lima Alves1 (55.84.215.3831; alvase@geologia.ufro.br); Zulide Corrêa Carvalho Lima1 (55.84.215.3831); Padre Parka Tathô1 (55.84.215.3831); forkatt@ufrn.br; Lucione Bruno Caldas2 (55.84.215.3831; lcb@uol.com.br); Michael Vandevoordt3 (55.84.215.3831; vandevoordt@ufl.edu; 55.84.215.3831; vandevoordt@ufl.edu).

1Universidade Federal do Rio Grande do Norte - Geodinâmica e Geofísica - ANP/PBHR2, Caixa Postal 1589, Natal, RN 59078-970, Brazil
2Universidade Federal de Santa Catarina - Instituto de Geociências - Departamento de Geociências, 79890-970, Florianopolis, Brazil
3Old Dominion University, Norfolk, VA 23529, United States

The objective of this study was to define an operational methodology for remote sensing and geomatic system techniques for monitoring and potential changes in coastal change and nearshore position/structure identification in northeast Brazilian KW-oriented coastline. This area is inserted in the PETROBRAIS oil exploration research. The multitemporal approach used remote sensing techniques either on a large scale with the most aerial photos and medium scale with SPOT-HRV/HRVIR and Landsat TM/ETM+ satellite data integrated through a GIS database with ancillary maps (e.g. topography, bathymetry, geology), physical parameters (e.g. currents and wind velocity/direction, tidal observation, beach profile/slope and position/structure identification in northeast Brazil). Thus, the multimodal of the stains to various cell and virus types need to be investigated.

OS21B.15 0830h POSTER
Mass spectrometric characterization of 13C-tracers: applications for biogeochemical study
Bridget A Bergquist
Rutgers University, L Minor, Old Dominion University

The study confirmed that remote sensing and GIS integration techniques are essential tools for shoreline change monitoring and quantifying the marine geochemistry of ancient and modern sediments. In addition to the potential approach for demonstrating the morphological and biological importance of these features, her investigations have made the 2001 Hyperspectral Coastal Ocean Dynamics Experiment (HYCOCO) at the Long-term Ecological Research (LTER) site a successful event. This research project was a joint effort between the University of Georgia, University of Florida, and the University of South Florida. The mission of the project was to collect hyperspectral data on the barrier islands of the South Carolina coast using the Portable Hyperspectral Imager (PHILLS II) and to analyze the data in a GIS database with ancillary maps (e.g. topography, bathymetry, geology), physical parameters (e.g. currents and wind velocity/direction, tidal observation, bathymetry, geology), and land use/land cover. The project also sought to develop methods and data to be used in future long-term ecological research projects. The result of the research was a better understanding of the interactions between the island and the ocean, which is essential for the management of these coastal ecosystems.

OS21B.16 0830h POSTER
Isotope Compartment of Marine Samples
Edward A Boyle1 ((617)253-5739; eaboyle@mit.edu)

1Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA 23529

Flow cytometry sorting is a useful technique for identifying and isolating sub-populations of particles within a natural population (e.g. diatom) that are enriched in iron. Since iron is an essential microelement in the ocean and a limiting nutrient in high nitrate, low chlorophyll (HNLC) regions of the ocean, although the iron isotopic compositions in iron in the upper ocean has been recognized in the past yet the role of benthic macrofauna in sediment diagenesis of algal material is considered by the degree of iron utilisation in the upper ocean.

Cite abstracts as: EOS. Trans. AGU, 84(4), Ocean Sciences Meet. Suppl., Abstract ####-####, 2002