SeaWiFS Technical Report Series
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ABSTRACT

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is the follow-on ocean color instrument to the Coastal Zone Color Scanner (CZCS), which ceased operations in 1986, after an eight-year mission. SeaWiFS is expected to be launched in 1995, on the SeaStar satellite, being built by Orbital Sciences Corporation (OSC). The SeaWiFS Project at the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC), has undertaken the responsibility of documenting all aspects of this mission, which is critical to the ocean color and marine science communities. This documentation, entitled the SeaWiFS Technical Report Series, is in the form of NASA Technical Memorandum Number 104566. All reports published are volumes within the series. This particular volume serves as a reference, or guidebook, to the previous 23 volumes and consists of 6 sections including: an errata, an addendum (summaries of various SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops, and other auxiliary information), an index to key words and phrases, a list of all references cited, and lists of acronyms and symbols used. It is the editors' intention to publish a cumulative index of this type after every five volumes in the series. Each index covers the topics published in all previous editions, that is, each new index will include all of the information contained in the preceding indices.

1. INTRODUCTION

This is the fourth in a series of indices, published as a separate volume in the Sea-viewing Wide Field-of-view (SeaWiFS) Technical Report Series, and covers information found in the first 23 volumes of the series. The Report Series is written under the National Aeronautics and Space Administration's (NASA) Technical Memorandum (TM) Number 104566. The volume numbers, authors, and titles are as follows:


Vol. 7: M. Darzi, *Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors*.


Vol. 21: Acker, J.G., *The Heritage of SeaWiFS: A Retrospective on the CZCS NIMBUS Experiment Team (NET) Program*.


This volume within the series serves as a reference, or guidebook, to the aforementioned volumes. It consists of the four main sections included with the first two indices published, Volumes 6 and 12, in the series: a cumulative index to key words and phrases, a glossary of acronyms, a list of symbols used, and a bibliography of all references cited in the series. In addition, as in Volumes 12 and 18, errata and addenda sections have been added to address issues and needed corrections that have come to the editors’ attention since the volumes were first published.

The nomenclature of the index is a familiar one, in the sense that it is a sequence of alphabetical entries, but it utilizes a unique format since multiple volumes are involved. Unless indicated otherwise, the index entries refer to some aspect of the SeaWiFS instrument or project, for example, the mission overview index entry refers to an overview of the SeaWiFS mission. An index entry is composed of a keyword or phrase followed by an entry field that directs the reader to the possible locations where a discussion of the keyword can be found. The entry field is normally made up of a volume identifier shown in bold face, followed by a pages identifier, which is always enclosed in parentheses:

**keyword, volume(pages).**

If an entry is the subject of an entire volume, the volume field is shown in slanted type without a page field:

**keyword, Vol. #.**

An entry can also be the subject of a complete chapter, as in Volumes 13 and 19 (to name a few). In this instance, both the volume number and chapter number appear without a page field:

**keyword, Vol. # ch. #.**

Figures or tables that provide particularly important summary information are also indicated as separate entries in the page field. In this case, the figure or table number is given with the page number on which it appears.

### 2. ERRATA

1. In Volume 23, Table 1, the headers entitled *Radiance* and *Counts* should be switched.

### 3. ADDENDA

This section presents a summary of the Fifth SeaWiFS Bio-optical Algorithm and Optical Protocols Workshop (BAOPW-5) held on 21 February 1995 at the Rosenstiel School of Marine and Atmospheric Sciences in Miami, Florida; submitted by C. McClain.

The primary workshop objectives were to:

1. finalize the initial operational SeaWiFS pigment, \( K(490) \), and chlorophyll \( a \) algorithms;
2. review the field programs and bio-optical data sets; and
3. discuss proposed changes in standard data products.

The team members and invited guests are listed in Table 1.

**Table 1.** Team members and invited guests to the BAOPW-5, held 21 February, 1995 at the Rosenstiel School of Marine and Atmospheric Sciences (RS-MAS) in Miami, Florida. The subgroup memberships are as listed in Hooker et al. (1993). Attendees are identified with a checkmark (✓).

<table>
<thead>
<tr>
<th>Team Members</th>
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<tbody>
<tr>
<td>J. Aiken</td>
<td>✓</td>
<td>O. Kopelevich</td>
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<tr>
<td>(G. Moore)</td>
<td></td>
<td>M. Lewis</td>
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<td>W. Balch</td>
<td>✓</td>
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<tr>
<td>K. Carder</td>
<td>✓</td>
<td>G. Mitchell</td>
<td>✓</td>
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<tr>
<td>D. Clark</td>
<td>✓</td>
<td>A. Morel</td>
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<tr>
<td>G. Cota</td>
<td>✓</td>
<td>J. Mueller</td>
<td>✓</td>
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<tr>
<td>C. Davis</td>
<td>✓</td>
<td>F. Muller-</td>
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<td>R. Doerffer</td>
<td>✓</td>
<td>Karger</td>
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<td>W. Esaias</td>
<td>✓</td>
<td>D. Siegel</td>
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<tr>
<td>H. Gordon</td>
<td>✓</td>
<td>R. Smith</td>
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<td>F. Hoge</td>
<td>✓</td>
<td>C. Trees</td>
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<td>S. Hooker</td>
<td>✓</td>
<td>C. Yentsch</td>
<td>✓</td>
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<td>D. Kamykowski</td>
<td>✓</td>
<td>J. Yoder</td>
<td>✓</td>
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<tr>
<td>M. Kishino</td>
<td>✓</td>
<td>R. Zaneveld</td>
<td>✓</td>
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</table>

**Other Attendees**

- R. Arnone    ✓
- J. Campbell  ✓
- R. Evans     ✓
- R. Frouin    ✓
- H. Fukushima ✓

S. Gallegos    ✓
S. Hawes      ✓
N. Maynard    ✓
J. Morrow     ✓
3.1 BAOPW-5

1. Introduction (C. McClain):
   A. Workshop Objectives and Agenda
   B. Review of Action Items from the November Workshop
   C. SeaStar/SeaWiFS Update

2. Data Set Development for Algorithm Evaluation (J. Campbell): At the last bio-optical algorithm workshop in November, it was agreed that investigators would submit data for the verification of certain components of the operational chlorophyll algorithm, as well as evaluate the final chlorophyll retrievals. Campbell agreed to be the point of contact for the data submissions and will provide a status report. She gave a brief summary of what she personally has received others have sent data directly to the SeaWiFS Bio-Optical Archive and Storage System (SeaBASS). She received data from A. Bricaud, C. Yentsch, and M. Kishino. She will provide these data to the SeaWiFS Project after some editing and reformatting. Also, permission is being sought to release Bricaud’s data to the SeaBASS archive.

3. Operational Chlorophyll a Algorithm (K. Carder): Only minor modifications have been made to the algorithm since the November 1994 meeting. Preliminary analyses of Arabian Sea data and results from airborne oceanographic lidar (AOL) data obtained from the Mid-Atlantic Bight compare well with the algorithm. Initial analyses of California Cooperative Fisheries Institute (CalCoFI) data, by G. Mitchell, indicate that the algorithm underestimates chlorophyll by a factor of 2-5. Mitchell’s analysis, however, was based on the ratios of subsurface upwelling radiance to subsurface downwelling irradiance and not remote sensing reflectances. D. Siegel made a recommendation that should improve the chlorophyll retrieval at low concentrations and will provide the details to Carder later.

4. CZCS Pigment Algorithm (G. Moore): At the November workshop, G. Moore presented a draft document for the bio-optics group to review and made a recommendation on a radiance ratio algorithm. The group suggested that the algorithm should include a band ratio in the green. Moore has incorporated this suggestion and others and has submitted a revised version of the document to the SeaWiFS Project for publication in the SeaWiFS Technical Report Series.

5. K(490) Algorithm (J. Mueller): The results of Mueller’s analysis of the effect of the 5 nm shift in the 555 nm SeaWiFS band from the 550 nm CZCS band indicates the effect is small and that no change in the prelaunch algorithm [the Austin-Petzold CZCS K(490) algorithm] is required. The analysis was based on 44 optical profiles provided by C. Trees, D. Siegel, and G. Mitchell.

6. Final Results from the First Data Analysis Round-Robin (DARR-1) (D. Siegel): Siegel reviewed the results of the first data analysis round-robin, which had not changed since the November meeting. For Case-1 water, all the methods worked equally well below 600 nm, but diverged in the near-infrared. Turbid water cases were not considered. The summary document has also been submitted to the SeaWiFS Project for publication in the series.

7. Second Data Analysis Round-Robin (DARR-2) Planning (D. Siegel): Two topics of interest were discussed, turbid water and the extrapolation of values to the surface from observations at discrete levels only as is the case for moorings and drifters. C. Davis volunteered to hold a workshop to discuss measurement protocols for Case-2 waters, but thought it was premature to hold a data analysis round-robin. D. Clark volunteered to host DARR-2 to evaluate the analysis issue associated with moorings and drifters. The dates for these events will not be scheduled until the SeaWiFS launch schedule is clarified in April.

8. 18-Month Time Series of MER-2040/2041 Calibration (G. Mitchell): The time series of the Scripps Photobiology Group’s MER-2040/2041 instrument calibration for 18 months was presented. During this time, radiometric calibrations at Biospherical Instruments, Inc. (BSI) and the San Diego State University (SDSU) Center for Hydro-Optics and Remote Sensing (CHORS) have been completed with both integrating spheres and reflectance plaques at each facility (total of three separate spheres and three separate plaques). Immersion coefficients have been determined as well. The CHORS and BSI calibrations are in good agreement for most wavelengths. The calibrations are particularly consistent over the past three calibrations, the UV bands being a notable exception. These results are tangible evidence that the calibration round-robin analyses are helping to improve the reliability, consistency, and traceability of the ocean color community’s instrument calibrations.

9. Protocol for Determining Algorithm Accuracy (J. Campbell): In reporting the accuracy of a model or algorithm, it is important to distinguish between systematic errors and random errors. A statement such as “This algorithm is accurate to within 30%,” is very ambiguous. It says nothing about whether errors are random or systematic, and whether the range is 1 or 3σ. A protocol is presented here for determining the accuracy of an algorithm, and for testing and reporting both systematic and random errors. Campbell distributed a document describing the protocol and analysis based on the CZCS NET algorithm data set.

10. Band-to-Band Correlation Analysis (J. Mueller): The issue of instrumental band center wavelength differences was discussed at the May 1994 workshop (Firestone and Hooker 1995) and remains unresolved. Mueller has performed further empirical orthogonal function
(EOF) analyses on the NET data from D. Clark. The analysis showed that in order to obtain a meaningful result, the radiances had to be extrapolated to a common depth, e.g., the surface. For the irradiance fields, the variance was contained in the first few EOFs, but for upwelling radiances, a large number were required. His conclusion was that the data was too noisy for this analysis and that more recent data from higher quality spectrometers should be used. Such data exists from a number of sources and he will pursue this work further.

11. Field Program Reports: The intent of these reports is not to present results, but activities. Updates should review recent and future cruise plans, numbers of stations, data collected, status of analysis and data delivery to the SeaWiFS Project, etc. Each presentation should be no longer than 15 minutes.

A. Bermuda Bio-Optical Time Series (D. Siegel): The bio-optical data collection will continue until at least December 1995. After that time, Siegel is unclear how the time-series will be supported. It appears unlikely, at this time, that the National Science Foundation (NSF) will support the program in fiscal year (FY) 1996 and he is not optimistic about NSF support in FY97.

B. CalCoFI Bio-Optical Data Set (G. Mitchell): Mitchell has cruises planned in April, July, and October 1995. During each cruise, about 70 bio-optical stations will be taken.

C. Navy Field Program Update (C. Davis): The Navy, NASA, and NSF will support a total of eight cruises with optics in the Arabian Sea. During the last cruise, much of the time was spent towing an instrument array. Nonetheless, 20 bio-optical stations were collected. Their bio-optical measurement suite included radiometer profiles, remote sensing reflectance measurements, and Q measurements.

D. United Kingdom Field Program Update (G. Moore): The British have a fair number of cruises scheduled for 1995 and 1996. Of particular interest is the Antarctic Survey's transects of the Atlantic during May and September of each year. These cruises have many berths available and will stop daily for bio-optical casts (2 hours maximum station time). The Falkland Islands would be the point of departure for the September leg and the point of embarkation for the May leg.

E. Japanese Field Program Update (M. Kishino): The Japanese have an impressive manifest of bio-optical cruises scheduled in the Pacific (from the Bering Sea to Antarctica) during 1995 and 1996. (The manifest is too long to recite here.) The Yamato Bank Optical Mooring (YBOM) will be deployed during April–July 1996 [Ocean Color Temperature Sensor (OCTS) check-out] and again in September 1996 after refurbishment. YBOM will be in a year-long cycle whereby it will be in the water for nine months, and then out of the water for three months, for refurbishment.

F. German Field Program Update (R. Doerffer): The Germans will be in the Arabian Sea during July and will collect in-water bio-optical and remote sensing reflectance data. Doerffer described the Picasso Program proposal to put four optical platforms in place. Picasso participants include the Joint Research Center (JRC) and the British. The platform sites are the northern Adriatic, Baltic, and North Seas.

12. Proposed Scheme for Variable Quality Level-3 Products (R. Evans): Evans described his proposal for incorporating variable quality data into the level-3 products. The scheme allows for level-2 data, which is deemed less accurate or reliable, to be binned when no higher quality data is available for a particular binning cell. The scheme can be applied in either space or time binning. Before the scheme can be accepted, the Science Working Group (SWG) must approve it. The bio-optics group voice general support for the concept. A more detailed description will be circulated to the SWG for comment.

13. Proposed Revisions in the Level-3 Products (C. McClain): The present set of quality masks and flags used as exclusion criteria in the level-3 binning process are defined so as to yield high quality pigment and \(K(490)\) level-3 products; all other parameters binned in the level-3 product are subject to the same criteria. At the present time, there is only one level-3 product containing several binned quantities. As a result, the level-3 product eliminates useful information on some quantities of interest, e.g., coccolithophore blooms and high aerosol radiances. Defining additional level-3 products, using exclusion criteria appropriate to each product while eliminating parameters of limited utility from the present level-3 product, would extend the applications for SeaWiFS, but not substantially increase the number of data granules or volumes submitted to the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC). Examples of this might be a pigment product, a coccolithophore product, or an aerosol product. The bio-optics group endorsed the idea of smaller, but more numerous level-3 products and McClain will circulate a strawman to the SWG for comment.

3.1.1 Action Items

The following are the action items, and people responsible for them, that arose from the meeting.
1. J. Campbell will submit the Bricaud and Morel absorption data and the Yentsch pigment data to the SeaWiFS Project for inclusion in the SeaBASS database.
2. K. Carder will submit the data set he is using for the chlorophyll algorithm.
3. D. Clark will organize and host DARR-2.
4. C. Davis will organize and host a workshop on turbid Case-2 data collection and analysis.
5. D. Siegel will work with K. Carder on a modification to the chlorophyll $a$ algorithm to improve estimates at low values.
6. J. Mueller will pursue higher quality spectral data for the EOF analysis. Possible sources of this are D. Clark and C. Davis.
7. C. McClain and R. Evans will draft strawmen proposals for revisions in the level-3 products. These will be circulated together for comment by the SWG.
CUMULATIVE INDEX

Unless indicated otherwise, the index entries that follow refer to some aspect of the SeaWiFS instrument or project. For example, the mission overview index entry refers to an overview of the SeaWiFS mission.

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GLOSSARY

- A -

A/D Analog-to-Digital; also written as: AD
A&M (Texas) Agriculture and Mechanics (University)
AC Alternating Current
ACC Antarctic Circumpolar Current
ACRIM Active Cavity Radiometer Irradiance Monitor
ACS Attitude Control System
ADC Analog-to-Digital Converter
ADEOS Advanced Earth Observation Satellite (Japan)
AE Ångström Exponent
ALSCAT ALPHA and Scattering Meter (Note: the symbol α corresponds to c(λ), the beam attenuation coefficient, in present usage).
AM-1 Not an acronym, used to designate the morning platform of EOS.
AMC Angular Momentum Compensation
AOCl Airborne Ocean Color Imager
AOL Airborne Oceanographic Lidar
AOP Apparent Optical Property
AOS/LOS Acquisition of Signal/Loss of Signal
APL Applied Physics Laboratory
ARGOS Not an acronym, but the name given to the data collection and location system on the NOAA Operational Satellites.
ARI Accelerated Research Initiative
ASCII American Standard Code for Information Interchange
ASI Italian Space Agency
ASR Absolute Spectral Response
AT Along-Track
AU Astronomical Unit
AVHRR Advanced Very High Resolution Radiometer
AVIRIS Advanced Visible and Infrared Imaging Spectrometer
AXBt Airborne Expendable BathytIermograph

- B -

BAOPW-1 First Bio-optical Algorithm and Optical Protocols Workshop
BAOPW-2 Second Bio-optical Algorithm and Optical Protocols Workshop
BAOPW-3 Third Bio-optical Algorithm and Optical Protocols Workshop
BAOPW-4 Fourth Bio-optical Algorithm and Optical Protocols Workshop
BAOPW-5 Fifth Bio-optical Algorithm and Optical Protocols Workshop
BAS British Antarctic Survey
BATS Bermuda Atlantic Time-Series Station
BBOP Bermuda Bio-Optical Profiler
BBR Band-to-Band Registration
BCRS Dutch Remote Sensing Board
BEP Benguela Ecology Programme
BER Bit Error Rate
BMFT Minister for Research and Technology (Germany)
BOFS British Ocean Flux Study
BOMS Bio-Optical Moored Systems
bpi bits per inch
BRDF Bidirectional Reflectance Distribution Function
BSI Biospherical Instruments, Incorporated
BSIXR BSI’s Transfer Radiometer
BTR Bright Target Recovery
BUV Backscatter Ultraviolet Spectrometer
BWI Baltimore-Washington International (airport)

- C -

CalCoFi California Cooperative Fisheries Institute
Cal/Val Calibration and Validation
CALVAL Calibration and Validation
Case-1 Water whose reflectance is determined solely by absorption.
Case-2 Water whose reflectance is significantly influenced by scattering.
CCD Charge Coupled Device
CCPO Center for Coastal Physical Oceanography (Old Dominion University)
CDF (NASA) Common Data Format
CDOM Colored Dissolved Organic Material
CD-ROM Compact Disk-Read Only Memory
CDR Critical Design Review
CEC Commission of the European Communities
CENR Committee on Environment and Natural Resources
CHORS Center for Hydro-Optics and Remote Sensing (San Diego State University)
CICESE Centro de Investigación Científica y de Educación Superior de Ensenada (Mexico)
CIIRES Cooperative Institute for Research in Environmental Sciences
COADS Comprehensive Ocean-Atmosphere Data Set
COOP Coastal Ocean Optics Program
COTS Commercial Off-The-Shelf (software)
CRP Continuous Plankton Recorder
cpu Central Processing Unit
CRM Contrast Reduction Meter
CRN Italian Research Council
CRSEO Center for Remote Sensing and Environmental Optics (University of California at Santa Barbara)
CRT Calibrated Radiance Tapes; or Cathode Ray Tube.
CRTT CZCS Radiation and Temperature Tape
CSIRO Commonwealth Scientific and Industrial Research Organization (Australia)
CSC Computer Sciences Corporation
CSL Computer Systems Laboratory
CT Cross-Track
CTD Conductivity, Temperature, and Depth
CVT Calibration and Validation Team
CW Continuous Wave
CWR Clear Water Radiance
CZCS Coastal Zone Color Scanner

- D -

DAAC Distributed Active Archive Center
DAO Data Assimilation Office
DARR-1 First Data Analysis Round-Robin
DARR-2 Second Data Analysis Round-Robin
DAT Digital Audio Tape
DC Direct Current
DCF Data Capture Facility
DCOM Dissolved Colored Organic Material
DCP Data Collection Platform
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<th>Acronym</th>
<th>Full Form</th>
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<td>JAM</td>
<td>JYACC Application Manager</td>
</tr>
<tr>
<td>JARE</td>
<td>Japanese Antarctic Research Expedition</td>
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<tr>
<td>JGOFJS</td>
<td>Joint Global Ocean Flux Study</td>
</tr>
<tr>
<td>JHU</td>
<td>Johns Hopkins University</td>
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<tr>
<td>JOI</td>
<td>Joint Oceanographic Institute</td>
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<td>LAC</td>
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<td>LDTNL2</td>
<td>Level-1 Calibrated radiances.</td>
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<td>LDTNL3</td>
<td>Level-2 Derived products.</td>
</tr>
<tr>
<td>LDCLS</td>
<td>Level-3 Gridded and averaged derived products.</td>
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<td>LMCE</td>
<td>Laboratoire de Modelisation du climat et de l'Environnement (France)</td>
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<td>LOC</td>
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<td>LODYC</td>
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<tr>
<td>LOI</td>
<td>Land Ocean Interaction in the Coastal Zone</td>
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<tr>
<td>LPCM</td>
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<tr>
<td>LRER</td>
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<td>LSB</td>
<td>Least Significant Bits</td>
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<td>LSF</td>
<td>Line Spread Function</td>
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<td>MARS</td>
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<td>MASSS</td>
<td>Multi-Agency Ship-Scheduling for SeaWiFS</td>
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<tr>
<td>MBARI</td>
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<tr>
<td>MEM</td>
<td>Maximum Entropy Method</td>
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<tr>
<td>MER</td>
<td>Marine Environmental Radiometer</td>
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<tr>
<td>MERIS</td>
<td>Medium Resolution Imaging Spectrometer</td>
</tr>
<tr>
<td>METEOSAT</td>
<td>Meteorological Satellite</td>
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<tr>
<td>MF</td>
<td>Major Frame</td>
</tr>
<tr>
<td>mF</td>
<td>Minor Frame</td>
</tr>
<tr>
<td>MIPS</td>
<td>Millions of Instructions Per Second</td>
</tr>
<tr>
<td>MIT</td>
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<td>MIZ</td>
<td>Marginal Ice Zone</td>
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<td>MLF</td>
<td>Maximum Likelihood Estimator</td>
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<td>MLML</td>
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<td>Magneto-Optical</td>
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<td>MOBY</td>
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<td>MOCE</td>
<td>Marine Optical Characterization Experiment</td>
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<td>MODIS Document Archive</td>
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<td>Moderate Resolution Imaging Spectroradiometer</td>
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<tr>
<td>MODIS-N</td>
<td>Nadir-viewing MODIS instrument</td>
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<tr>
<td>MODIS-L</td>
<td>Tilted MODIS instrument to minimize sun glint</td>
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<tr>
<td>MOS</td>
<td>Marine Optical Spectroradiometer</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>MS/DOs</td>
<td>MicroSoft/Disk Operating System</td>
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<td>MTF</td>
<td>Modulation Transfer Function</td>
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<td>North Atlantic Bloom Experiment</td>
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<td>NAS</td>
<td>National Academy of Science</td>
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<td>NASA Communications</td>
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<td>NASAJ</td>
<td>National Space Development Agency (Japan)</td>
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<tr>
<td>NASIC</td>
<td>NASA Aircraft/Satellite Instrument Calibration</td>
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<tr>
<td>NAVSPASUR</td>
<td>Naval Space Surface Surveillance</td>
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<td>NCAR</td>
<td>National Center for Atmospheric Research</td>
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<tr>
<td>NCCOSC</td>
<td>Navy Command, Control, and Ocean Surveillance Center</td>
</tr>
<tr>
<td>NCDC</td>
<td>(NOAA) National Climatic Data Center</td>
</tr>
<tr>
<td>NCDS</td>
<td>NASA Climate Data System</td>
</tr>
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<td>NCSA</td>
<td>National Center for Supercomputing Applications</td>
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<td>NCSU</td>
<td>North Carolina State University</td>
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<td>NDBC</td>
<td>National Data Buoy Center</td>
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<tr>
<td>NDVI</td>
<td>Normalized Difference Vegetation Index</td>
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<tr>
<td>NE3L</td>
<td>Noise Equivalent Differential Spectral Radiance</td>
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<tr>
<td>NEAT</td>
<td>Noise Equivalent Delta Temperature</td>
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<tr>
<td>NE5L</td>
<td>Noise Equivalent Delta Radiance</td>
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<tr>
<td>NER</td>
<td>Noise Equivalent Radiance</td>
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<td>NERC</td>
<td>Natural Environment Research Council</td>
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<tr>
<td>NESDIS</td>
<td>National Environmental Satellite Data Information Service</td>
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<td>NESS</td>
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<tr>
<td>NET</td>
<td>NIMBUS Experiment Team</td>
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<tr>
<td>netCDF</td>
<td>(NASA) Network Common Data Format</td>
</tr>
<tr>
<td>NFS</td>
<td>Network File System</td>
</tr>
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<td>NGDC</td>
<td>National Geophysical Data Center</td>
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<tr>
<td>NIMBUS</td>
<td>Not an acronym. but a series of NASA experimental weather satellites containing a wide variety of atmosphere, ice, and ocean sensors.</td>
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<tr>
<td>NIST</td>
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<tr>
<td>NMFS</td>
<td>National Marine Fisheries Service</td>
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<tr>
<td>NOA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NOARL</td>
<td>Naval Oceanographic and Atmospheric Research Laboratory</td>
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<tr>
<td>NODC</td>
<td>National Oceanographic Data Center</td>
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<tr>
<td>NORAD</td>
<td>North American Air Defense (Command)</td>
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<td>NOPS</td>
<td>NIMBUS Observation Processing System</td>
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<tr>
<td>NOS</td>
<td>National Ocean Service</td>
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<td>NRA</td>
<td>NASA Research Announcement</td>
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<td>NRDC</td>
<td>National Research and Development</td>
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<td>NROF</td>
<td>National Research Institute of Far Seas Fisheries (Japan)</td>
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<tr>
<td>NRL</td>
<td>Naval Research Laboratory</td>
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<td>NRT</td>
<td>Near-Real Time</td>
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<td>NSF</td>
<td>National Science Foundation</td>
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<td>NSSDC</td>
<td>National Space Science Data Center</td>
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<tr>
<td>OAM</td>
<td>Optically Active Materials</td>
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<tr>
<td>OCM</td>
<td>Ocean Color Data Mission</td>
</tr>
<tr>
<td>OCEAN</td>
<td>Ocean Colour European Archive Network</td>
</tr>
<tr>
<td>OCS</td>
<td>Ocean Color Scanner</td>
</tr>
<tr>
<td>OCTS</td>
<td>Ocean Color Temperature Sensor (Japan)</td>
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</table>
ODAS Ocean Data Acquisition System
ODEX Optical Dynamics Experiment
ODU Old Dominion University
OFFI Optical Free-Fall Instrument
OI Original Irradiance
OLIPAC Oligotrophy in the Pacific (Ocean)
OMEX Ocean Marine Exchange
ONR Office of Naval Research
OPT Ozone Processing Team
OS Operating System
OSC Orbital Sciences Corporation
OSFI Optical Surface Floating Instrument
OSSA Office of Space Science and Applications
OSU Oregon State University

- P -
PAR Photosynthetically Available Radiation
PC (IBM) Personal Computer
PDR Preliminary Design Review
PDT Pacific Daylight Time
PPF Programmable Frame Formatter
PI Principal Investigator
PIKE Phased Illuminated Knife Edge
PM-1 Not an acronym, used to designate the afternoon.
PMEL Pacific Marine Environmental Laboratory
PML Plymouth Marine Laboratory
POC Particulate Organic Carbon
POLDER Polarization Detecting Environmental Radiometer (France) or Polarization and Directionality of the Earth's Reflectances (depending on usage).
PON Particulate Organic Nitrogen
PR Photo Research
PRIME Plankton Reactivity in the Marine Environment
PST Pacific Standard Time
PSU Practical Salinity Units
PTFE Polytetrafluoroethylene
PUR Photosynthetically Usable Radiation

- Q -
QC Quality Control
QED Quantum Efficient Device

- R -
R&A Research and Applications
R&D Research and Development
R/V Research Vessel
RACER Research on Antarctic Coastal Ecosystem Rates
RDBMS Relational Database Management System
RDF Radio Direction Finder
RF Radio Frequency
RFP Request for Proposals
RISC Reduced Instruction Set Computer
rms root mean squared
ROSIS Remote Sensing Imaging Spectrometer, also known as the Reflective Optics System Imaging Spectrometer (Germany)
RR Round-Robin
RSMAS Rosenstiel School for Marine and Atmospheric Sciences (University of Miami)
RSS Remote Sensing Systems (Inc.)
RTOP Research and Technology Operation Plan

- S -
S/C Spacecraft
S/N Serial Number
SAC Satellite Applications Centre
SARSAT Search and Rescue Satellite
SBRC (Hughes) Santa Barbara Research Center
SBUV Solar Backscatter Ultraviolet Radiometer
SBUV-2 Solar Backscatter Ultraviolet Radiometer-2
SCADP SeaWiFS Calibration and Acceptance Data Package
SCOR Scientific Committee on Oceanographic Research
SDPS SeaWiFS Data Processing System
SDS Scientific Data Set
SDSU San Diego State University
SeaBASS SeaWiFS Bio-Optical Archive and Storage System
SEAPAK Not an acronym, but an image display and analysis package developed at GSFC.
SeaSCOPE SeaWiFS Study of Climate, Ocean Productivity, and Environmental Change
SeaWiFs Sea-viewing Wide Field-of-view Sensor
SES Shelf Edge Study
SGI Silicon Graphics, Incorporated
SI Système International d'Unités or International System of Units
SIG Special Interest Group
SIO Scripps Institution of Oceanography
SIO/MPL Scripps Institution of Oceanography/Marine Physical Laboratory
SIRREX SeaWiFS Intercalibration Round-Robin Experiment
SIRREX-1 The First SIRREX (July 1992)
SIRREX-2 The Second SIRREX (June 1993)
SIRREX-3 The Third SIRREX (September 1994)
SIS Spherical Integrating Source
SISSR Submerged In Situ Spectral Radiometer
SJSU San Jose State University
SMM Solar Maximum Mission
SNR Signal-to-Noise Ratio
SO Southern Ocean (algorithm)
SOC Simulation Operations Center
SOGS SeaStar Operations Ground Subsystem
SOH State of Health
SOW Statement of Work
SPM Suspended Particulate Material or Special Perturbations Model (depending on usage).
SPO SeaWiFS Project Office
SPOT Satellite Pour l'Observation de la Terre (France)
SPSWG SeaWiFS Prelaunch Science Working Group
SQL Sequential Query Language
SRC Satellite Receiving Station (NERC)
SRT Sigma Research Technology, Incorporated
SSM/1 Special Sensor for Microwave/Imaging
SST Sea Surface Temperature or SeaWiFS Science Team (depending on usage).
ST Science Team
STM Science Team Member
SUN Sun Microsystems
SWAP Sylter Wattenmeer Austausch-prozesse
SWG SeaWiFS Working Group
SXR SeaWiFS Transfer Radiometer
<table>
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<tr>
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<tr>
<td>T-S</td>
<td>Temperature-Salinity</td>
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<td>TAE</td>
<td>Transportable Applications Executive</td>
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<tr>
<td>TAO</td>
<td>Thermal Array for the Ocean or more recently, Tropical Atmosphere-Ocean</td>
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<tr>
<td>TBD</td>
<td>To Be Determined</td>
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<tr>
<td>TBUS</td>
<td>Not an acronym, but a NOAA orbit prediction</td>
<td></td>
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<tr>
<td>TDI</td>
<td>Time-Delay and Integration</td>
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<tr>
<td>TDRSS</td>
<td>Tracking and Data Relay Satellite System</td>
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<td>TIROS</td>
<td>Television Infrared Observation Satellite</td>
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<td>TLM</td>
<td>Telemetry</td>
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<tr>
<td>TOA</td>
<td>Top of the Atmosphere</td>
<td></td>
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<tr>
<td>TOGA</td>
<td>Tropical Ocean Global Atmosphere program</td>
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<td>TOMS</td>
<td>Total Ozone Mapping Spectrometer</td>
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<td>TOPEX</td>
<td>Topography Experiment</td>
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<td>TOVS</td>
<td>TIROS Operational Vertical Sounder</td>
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<td>TRMM</td>
<td>Tropical Rainfall Measuring Mission</td>
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<tr>
<td>TSM</td>
<td>Total Suspended Material</td>
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<td>TV</td>
<td>Thermal Vacuum</td>
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<td>UA</td>
<td>University of Arizona</td>
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<tr>
<td>UARS</td>
<td>Upper Atmosphere Research Satellite</td>
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<tr>
<td>UAXR</td>
<td>University of Arizona's Transfer Radiometer</td>
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<td>UCAR</td>
<td>University Consortium for Atmospheric Research</td>
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<td>UCMBO</td>
<td>University of California Marine Bio-Optics</td>
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<td>UCSB</td>
<td>University of California at Santa Barbara</td>
<td></td>
</tr>
<tr>
<td>UCSD</td>
<td>University of California at San Diego</td>
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</tr>
<tr>
<td>UH</td>
<td>University of Hawaii</td>
<td></td>
</tr>
<tr>
<td>UIM/X</td>
<td>User Interface Management/X-Windows</td>
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<td>UM</td>
<td>University of Miami</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific, and Cultural Organizations</td>
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<td>UNIX</td>
<td>Not an acronym, a computer operating system.</td>
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<tr>
<td>UPS</td>
<td>Uninterruptable Power System</td>
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<td>USC</td>
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</tr>
<tr>
<td>USF</td>
<td>University of South Florida</td>
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</tr>
<tr>
<td>UTM</td>
<td>Universal Transverse Mercator (projection)</td>
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<tr>
<td>UV</td>
<td>Ultraviolet</td>
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</tr>
<tr>
<td>UVT</td>
<td>Ultraviolet-B</td>
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<tr>
<td>UWG</td>
<td>User Working Group</td>
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<td>Version 1</td>
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<td>Virtual Address Extension</td>
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<td>VCS</td>
<td>Version Control Software</td>
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<tr>
<td>VDC</td>
<td>Volts Direct Current</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VI</td>
<td>Virtual Instrument</td>
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<tr>
<td>VISLAB</td>
<td>Visibility Laboratory (Scripps Institution of Oceanography)</td>
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<td>VISNIR</td>
<td>Visible and Near Infrared</td>
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<td>VMS</td>
<td>Virtual Memory System</td>
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<td>VSF</td>
<td>Volume Scattering Function</td>
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<td>Woods Hole Oceanographic Institute</td>
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<td>WMO</td>
<td>World Meteorological Organization</td>
</tr>
<tr>
<td>WOCE</td>
<td>World Ocean Circulation Experiment</td>
</tr>
<tr>
<td>WORM</td>
<td>Write-Once Read-Many (times)</td>
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<td>WVS</td>
<td>World Vector Shoreline</td>
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<tr>
<td>XDR</td>
<td>External Data Representation</td>
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<th>- Y, Z -</th>
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<tr>
<td>YBOM</td>
<td>Yamato Bank Optical Mooring</td>
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**SYMBOLS**

- **A** -
  - $a(z, \lambda)$ Spectral absorption coefficient.
  - $a_{\text{ox}}$ Oxygen absorption coefficient.
  - $a_{\text{oz}}$ Coefficient for ozone absorption.
  - $a_{\text{water}}$ Coefficient for water vapor absorption.
  - $A_0$ Coefficient for the linear term in the scan modulation correction equation.
  - $A_d$ The detector aperture.
  - $A_f$ The foam reflectance.
  - $A_{\text{int}}$ The intersection area.
  - $A(\lambda)$ Coefficient for calculating $b_2(\lambda)$.
  - $b(\lambda, \lambda)$ Formulation coefficient or a constant equal to 1/3 (depending on usage).
  - $b(\theta, z, \lambda_0)$ Volume scattering coefficient.
  - $b_2(z, \lambda)$ Spectral backscattering coefficient.
  - $b_2^{\text{phytoplankton}}(\lambda)$ Spectral backscattering coefficient for phytoplankton.
  - $b_2^{\text{seawater}}(\lambda)$ Total scattering coefficient.
  - $b_2^{\text{pure seawater}}(\lambda)$ Total scattering coefficient for pure seawater.
  - $b_1(k)$ Input data for polarization calculations for SeaWiFS band 1.
  - $b_7(k)$ Input data for polarization calculations for SeaWiFS band 7.
  - $B$ Excess target radiance.
  - $B_0$ Coefficient for the power term in the scan modulation correction equation.
  - $B(\lambda)$ Coefficient for calculating $b_2(\lambda)$.

- **B** -
  - $c(z, \lambda)$ Spectral beam attenuation coefficient.
  - $c(z, \lambda_0)$ Red beam attenuation (at 660 nm).
  - $[\text{chl. a}]/K$ Concentration of chlorophyll $a$ over $K$, the diffuse attenuation coefficient.
  - $C$ Chlorophyll $a$ pigment, or just pigment concentration.
  - $C_1$ Measured value for the flight diffuser on a given scan line, in counts.
  - $C_{12}$ Pigment concentration derived using CZCS bands 1 and 3.
  - $C_2$ Measured value of the flight diffuser for the scan line immediately sequential to the first scan line used to measure the flight diffuser, i.e., $S_1$, in counts.
  - $C_{23}$ Pigment concentration derived using CZCS bands 2 and 3.
  - $C_{\text{dark}}$ Instrument dark restore value, in counts.
  - $C_{\text{ext}}$ Average total extinction cross-section of a particle.
  - $C_F$ The calibration factor.
  - $C_{\text{out}}$ Instrument output, in counts.
  - $C_{\text{ref}}$ Reference chlorophyll value (0.5).
  - $C_{\text{temp}}$ Temperature sensor output, in counts, represented by an 8-bit digital word in the SeaStar telemetry.
  - $[C + P]$ Pigment concentration defined as mg chlorophyll $a$ plus phaseopigments m$^{-3}$.

- **D** -
  - $d$ The distance between source and detector apertures.
  - $d_i$ Distance from the $i$th observation point to the point of interest.
  - $d_j$ Distance from the $j$th observation point to the point of interest.
  - $d(I(\lambda))$ An increment in detector current.
  - $d\lambda$ An increment in wavelength.
  - $d_\alpha$ Detector configuration datum.
  - $D$ Sequential day of the year.
  - $D_\alpha$ Orbit position difference vector.
  - $D_{\delta_{\text{t}}}$ Along-track position difference.
  - $D_{\varepsilon_{\text{t}}}$ Cross-track position difference.
  - $D_{\alpha_{\text{t}}}$ Radial position difference.
  - $D(C)$ Digital count (value) or direct current (depending on usage).
  - $D_{\text{10}}$ Digital counts at 10-bit digitization.
  - $D_{\text{meas}}$ The digital counts measured unshadowed.
  - $D_{\text{catt}}$ The digital counts due to scattered sunlight.
  - $D(C)_{\text{TOA}}$ The digital counts measured at the top of the atmosphere.

- **E** -
  - $e$ Orbit eccentricity of the Earth.
  - $E(\lambda)$ Spectral irradiance.
  - $E_\alpha(\lambda)$ Irradiance in air.
  - $E_{\text{beg}}$ Beginning irradiance value.
  - $E_{\text{end}}$ Calibration source irradiance.
  - $E_{\text{down}}$ Incident downwelling irradiance.
  - $E_{\text{obs}}(0^-, \lambda)$ Incident spectral irradiance.
  - $E_{\text{d}}(z, \lambda)$ Downwelled spectral irradiance.
  - $E_{\text{end}}$ Ending irradiance value.
  - $E_{\text{meas}}(\lambda)$ Measured radiance.
  - $E_{\text{ref}}(\lambda)$ Reference radiance.
  - $E_{\text{sun}}(\lambda)$ Surface irradiance.
  - $E_{\text{rem}}$ Percentage of energy removed from a wavelength band.
  - $E_{\text{sky}}(\lambda)$ Spectral sky irradiance distribution.
  - $E_{\text{sun}}(\lambda)$ Spectral sun irradiance distribution.
  - $E_{\text{sky}}(\lambda)$ Upwelled spectral irradiance.
  - $E_{\text{w}}(z, \lambda)$ Irradiance in water.

- **F** -
  - $f$ The fraction of the surface covered by foam.
  - $f_i$ Filter number, $i=0-11$.
  - $f_{\text{ratio}}$ The ratio of new to total production.
  - $F$ Arithmetic average.
  - $\bar{F}(\lambda)$ A mean conversion factor.
  - $F(\lambda)$ Calibration factor.
  - $F(\lambda)$ A conversion factor to convert PR714 readings to the GSFC sphere radiance scale.
  - $F(\lambda)$ Average of calibration factors.
  - $F_0$ Extraterrestrial irradiance corrected for Earth-sun distance.
  - $F_0$ The scalar value of the solar spectral irradiance at the top of the atmosphere, multiplied by a columnar matrix of the four Stokes parameters $(1/2, 1/2, 0, 0)$.
  - $\bar{F}_0$ Mean solar irradiance.
  - $F_0$ Extraterrestrial irradiance corrected for the atmosphere.
  - $F_0(\lambda)$ Mean extraterrestrial spectral irradiance.
  - $F_0(\lambda)$ Mean extraterrestrial irradiance.
\( F_r \) Forward scattering probability of the aerosol.
\( F_d \) The total flux incident on the surface if it did not reflect light.
\( F_d' \) The total flux incident on the surface, corrected for surface reflection.
\( F_s' \) The scalar value of the total flux incident on the surface, corrected for surface reflection, multiplied by a columnar matrix of the four Stokes parameters.
\( F_1 \) A correction factor.

\[ G \]
\( g_i \) A constant equal to 0.82.
\( g_s \) A constant equal to \(-0.55\).
\( g_s' \) Gain selection datum.
\( G \) Gain factor.
\( G_1 \) Gain setting 1.
\( G_2 \) Gain setting 2.
\( G_3 \) Gain setting 3.
\( G_4 \) Gain setting 4.
\( G_n \) Gain factor at gain setting \( n \).

\[ h(k) \]
\( H_{GMT} \) GMT in hours.
\( H_M \) The measured moon irradiance.
\( H_s \) Altitude of the spacecraft (for SeaStar 705 km).

\[ i \]
\( i \) Inclination angle or interval index (depending on usage).
\( i' \) Inclination angle minus 90°.
\( I \) Rayleigh intensity.
\( I_0 \) Surface downwelling irradiance.
\( I_1 \) Radiant intensity after traversing through an absorbing medium.
\( I_2 \) Reflected radiant energy received by the satellite sensor.
\( I_{max} \) Recorded maximum instrument output in response to linearly polarized light.
\( I_{min} \) Recorded minimum instrument output in response to linearly polarized light.
\( I(\lambda) \) Detector current.
\( ICS \) Current from the current source diode.

\[ j \]
\( J \) Interval index.
\( J_2 \) The J2 gravity field term (0.0010863).
\( J_3 \) The J3 gravity field term (-0.0000234).
\( J_4 \) The J4 gravity field term (-0.0001616).
\( J_5 \) The J5 gravity field term.

\[ k \]
\( k \) Wavenumber of light (1/\( \lambda \)).
\( k_1 \) Beginning wavenumber.
\( k_2 \) Ending wavenumber.
\( k_s(\lambda) \) Spectral fit coefficient weighted over the SeaWiFS bands; \( k_s'(\lambda) \) also used.
\( K(\lambda, \lambda) \) Diffuse attenuation coefficient.

\[ K(490) \] Diffuse attenuation coefficient of seawater measured at 490 nm.
\( K_0(\lambda) \) Diffuse attenuation coefficient at \( z = 0 \).
\( K_1 \) Primary instrument sensitivity factor.
\( K_2 \) Gain factor.
\( K_3 \) Temperature dependence of detector output.
\( K_4 \) Scan modulation correction factor.
\( K_5 \) Spacecraft analog to digital conversion factor.
\( K_6 \) Analog-to-digital offset in spacecraft conversion.
\( K_7 \) Current from the diode at 20°C.
\( K_c(\lambda) \) Attenuation coefficients for phytoplankton.
\( K_E(\lambda) \) Attenuation coefficient downwelled irradiance.
\( K_G(\lambda) \) Attenuation coefficients for Gelbstoff.
\( K_L(\lambda) \) Attenuation coefficient upwelled irradiance.
\( K_w(\lambda) \) Attenuation coefficients for pure seawater.

\[ L \]
\( L(\lambda) \) Spectral radiance.
\( L(\lambda_m) \) The radiance of a calibration sphere at the nominal peak wavelength of a filter.
\( L(z, \theta, \phi) \) Submerged upwelled radiance distribution.
\( L_0 \) The radiance of the atmosphere.
\( L_a \) Aerosol radiance.
\( L_c(\lambda) \) Cloud radiance threshold.
\( L_{cal} \) Calibration source radiance.
\( L_d \) A matrix of the four Stokes parameters for radiance incident on the sea surface.
\( L_{cloud} \) Maximum radiance from reflected light off of clouds.
\( L_{sfc} \) The radiance of the ocean-atmosphere system measured at a satellite.
\( L_m \) The radiance of the ocean-atmosphere system measured at nadir.
\( L_{max} \) Maximum saturation radiance.
\( L_{rad} \) Measured radiance at nadir.
\( L_{NEK} \) Noise equivalent radiance.
\( L_o(\lambda) \) Rayleigh radiance.
\( L_{ro}(\lambda) \) Rayleigh radiance at standard atmospheric pressure, \( P_0 \).
\( L_s(\lambda) \) Subsurface water radiance.
\( L_{sat} \) Saturation radiance for the sensor.
\( L_{scan} \) Measured radiance at any pixel in a scan.
\( L_{sfc} \) The radiance of the light reflected from the sea surface.
\( L_{sat} \) The columnar matrix of the four Stokes parameters (\( L_{sat,1}, L_{sat,2}, L_{sat,3}, L_{sat,4} \)).
\( L_{sky} \) Spectral sky radiance distribution.
\( L_t(\lambda) \) Total radiance at the sensor.
\( L_{typical} \) Expected radiance from the ocean measured on orbit.
\( L_u(\lambda) \) Upwelled spectral radiance.
\( L_{up} \) The columnar matrix of light leaving the surface containing the values \( L_{up,1}, L_{up,2}, L_{up,3}, L_{up,4} \).
\( L_{up,i} \) The \textsc{radtran} radiance parameters (for \( i = 1, 4 \)).
\( LW \) The water-leaving radiance of light scattered from beneath the surface and penetrating it.
\( LW(443) \) Water-leaving radiance at 443 nm.
\( L_W(520) \) Water-leaving radiance at 520 nm.
\( L_W(550) \) Water-leaving radiance at 550 nm.
\( L_W(670) \) Water-leaving radiance at 670 nm.
\( L_w \) The scalar value of the water-leaving radiance multiplied by a columnar matrix of the four Stokes parameters.
\( L_{WN}(\lambda) \) Normalized water-leaving radiance.
\( LS_1 \) Measured radiance for mirror side 1.
\( LS_2 \) Measured radiance for mirror side 2.

\[ -M- \]
\( m \) Index of refraction.
\( M \) Path length through the atmosphere.
\( M'_m \) The corrected mean orbit anomaly of the Earth, which is a function of date, and refers to an imaginary moon in a circular orbit.
\( M_{oa} \) Path length for ozone transmittance.

\[ -N- \]
\( n \) The index of refraction, the mean orbital motion in revolutions per day, or the gain setting (depending on usage).
\( n(\lambda) \) An exponent conceptually similar to the Ångström exponent.
\( n_w(\lambda) \) Index of refraction of water.
\( N \) The total number of something.
\( N_D \) The compensation factor for a 4 log neutral density filter.
\( N_t \) Total number density.
\( N_i \) Total number density of either the first or second aerosol model when \( i = 1 \) or 2, respectively.

\[ -O- \]
\( \overrightarrow{\Phi} \overrightarrow{P} \times \overrightarrow{V} \).

\[ -P- \]
\( p_a \) A factor to account for the probability of scattering to the spacecraft for three different paths from the sun.
\( p_w/(4\pi) \) Aerosol albedo of the scattering phase function.
\( p_w \) The probability of seeing sun glitter in the direction \( \theta, \Phi \) given the sun in position \( \theta_0, \Phi_0 \) as a function of wind speed (W).
\( P \) Nodal period, phaeopigment concentration or local surface pressure (depending on usage).
\( \overrightarrow{P} \) Orbit position vector.
\( P(\theta^+) \) Phase function for forward scattering.
\( P(\theta^-) \) Phase function for backward scattering.
\( P_0 \) Standard atmospheric pressure (1,013.25 mb).
\( P_a \) Probability of scattering to the spacecraft.
\( P_1 \) PR714 raw radiance.
\( P_w \) Phaeopigment concentration.
\( PF \) Polarization factor.
\( Pxd \) Pixel number, i.e., the numerical designation of a pixel in a scan line.

\[ -Q- \]
\( q \) Water transmittance factor.
\( Q(\lambda) \) \( L_w(0^+, \lambda) \) to \( E_w(0^-, \lambda) \) relation factor (theoretically equal to \( \pi \)).

\[ -R- \]
\( r \) Water-air reflectance for totally diffuse irradiance.
\( r_1 \) The radius of circle one or source aperture (depending on usage).
\( r_2 \) The radius of circle two or detector aperture (depending on usage).
\( r_t \) The geometric mean radii of either the first or second aerosol model when \( i = 1 \) or 2, respectively.
\( R \) Reflectance.
\( R \) The reflection matrix.
\( R^2 \) The square of the linear correlation coefficient.
\( R(0^-, \lambda) \) Irradiance reflectance just below the sea surface.
\( R_1 \) Multiplier for mirror side 1.
\( R_2 \) Multiplier for mirror side 2.
\( R_a \) Aerosol reflectance.
\( R_a R_w/(qT_{2r}) \).
\( R_e \) Mean Earth radius (6,378 137 km).
\( R_e \) Effective resistance for the thermistor-resistor pair.
\( R_L(z, \lambda) \) Spectral reflectance.
\( R_t \) Rayleigh reflectance.
\( R_{rs} \) Remote sensing reflectance.
\( R_s \) Subsurface reflectance.
\( R_{tot} \) Total reflectance at the sensor.
\( R_t \) (\( R_{tot} - R_s \))/(\( qT_{2r} \)).
\( R_T \) Resistance of the thermistor.
\( R_s \) Sunspot number.

\[ -S- \]
\( s \) The reflectance of the atmosphere for isotropic radiation incident at its base.
\( s(\lambda) \) Slope for the range 0–1,023.
\( S \) Solar constant.
\( S_i \) Initial detector signal.
\( S_n \) Detector signal with gain.
\( S(\lambda) \) \( L_a(\lambda)/L_a(670) \).

\[ -T, U- \]
\( t \) Time variable or the transmission of \( L_{tot} \) through the atmosphere (depending on usage).
\( t' \) The transmission of \( L_W \) through the atmosphere.
\( t(k) \) Spectral transmission as a function of wavenumber.
\( t(\lambda) \) Diffuse transmittance of the atmosphere.
\( t_0 \) The sum of the direct and diffuse transmission of sunlight through the atmosphere.
\( t_1 \) First observation time.
\( t_2 \) Second observation time.
\( t_0 \) Initial time.
\( t_{as} \) Aerosol transmittance after absorption.
\( t_{as} \) Aerosol transmittance after scattering.
\( t_{dt} \) Direct component of transmittance after absorption by the gaseous components of the atmosphere, scattering and absorption by aerosols, and scattering by Rayleigh.
\( t_{dt} \) Time difference in hours between present position and most recent equator crossing.
\( t_{EC} \) Equator crossing time.
\( t_{as} \) Transmittance after absorption by ozone.
\( t_r \) Transmittance after Rayleigh scattering.
\( t_s \) Diffuse component of transmittance after absorption by the gaseous components of the atmosphere, scattering and absorption by aerosols, and scattering by Rayleigh.
\( t{uv} \) Transmittance after absorption by water vapor.
$T$  Tilt position.
$T(\lambda)$  The transmittance along the slant path to the sun.
$T_r(\lambda)$  Transmittance through the surface.
$T(\lambda, \theta)$  Total transmittance (direct plus diffuse) from the ocean through the atmosphere to the spacecraft along the path determined by the spacecraft zenith angle $\theta$.
$T_{2r}$  Two-way diffuse transmittance for Rayleigh attenuation.
$T_0(\lambda, \theta_0)$  Total downward transmittance of irradiance.
$T_0$  Equation of time.
$T_{o_{\text{ea}}}$  Transmittance of oxygen (O$_2$).
$T_{o_{\text{e}}}$  Transmittance of ozone (O$_3$).
$T_{o_{\text{w}}}$  Transmittance through the surface.
$T_{w_{\text{v}}}$  Transmittance through a water path.
$T_{w_{\text{o}}}$  Transmittance of water vapor (H$_2$O).

$-V-$

$V(t_j)$  The $i$th spatial location at observation time $t_j$.
$V_M$  The radiance detector voltage while viewing the moon.
$V_S$  The irradiance detector voltage while viewing the sun.
$V_T$  Focal plane temperature sensor voltage output.

$-W-$

$W$  Wind speed.
$W_d$  Direct irradiance divided by the total irradiance at the surface.
$W_s$  Diffuse irradiance divided by the total irradiance.

$-X-$

$x$  Abscissa or longitudinal coordinate, or the pixel number within a scan line (depending on usage).
$X$  ECEF $x$ component of orbit position.
$X$  ECEF $X$ component of orbit velocity.

$-Y-$

$y$  Ordinate or meridional coordinate.
$Y$  ECEF $y$ component of orbit position.
$Y$  ECEF $Y$ component of orbit velocity.

$-Z-$

$Z$  ECEF $z$ component of orbit position.
$Z$  ECEF $Z$ component of orbit velocity.

$-\text{GREEK}-$

$\alpha$  Percent albedo, tilt angle, formulation coefficient (intercept), the power constant in the Ångström formulation, or the exponential value in the expression relating the extinction coefficient to wavelength (depending on usage).
$\beta$  A formulation coefficient (slope) or a constant in the Ångström formulation (depending on usage).
$\beta$, The extinction coefficient of either the first or second aerosol model when $i = 1 \text{ or } 2$, respectively.
$\beta(z, \lambda, \theta)$  Spectral volume scattering function.
$\gamma$  The Ångström exponent.
$\gamma(\lambda)$  The ratio of the aerosol optical thickness at wavelength $\lambda$ to the aerosol optical thickness at 670 nm.
$\delta$  The great circle distance from $\Psi_s(t_0)$ to $\Psi_s(t-t_0)$, the departure of each individual conversion factor from the mean, a relative difference, or the absorption coefficient (depending on usage).
$\Delta\lambda$  Equivalent bandwidth.
$\Delta L_{W_{\text{670}}}$  The error in the water-leaving radiance for the red channel.
$\Delta p_{\text{CO}_2}$  Partial pressure difference of CO$_2$ between air and sea water.
$\Delta P$  The difference in successive pixels or the pressure deviation from standard pressure, $P_0$ (depending on usage).
$\Delta t$  Time difference.
$\Delta T(\lambda)$  The error in transmittance.
$\Delta\theta_s$  The error (in radians) in the knowledge of $\theta_s$.
$\Delta\lambda$  An interval in wavelength.
$\Delta\rho_{w_{\text{670}}}$  The error in the water-leaving reflectance for the red channel.
$\Delta\sigma(\lambda)$  The absolute error in spectral optical depth.
$\Delta r_{\text{a}}$  The error in the aerosol optical thickness.
$\Delta\omega$  The longitude difference from the sub-satellite point to the pixel.
$\Delta\omega_s$  Longitude difference.

$\eta$  Bearing from the sub-satellite point to the pixel along the direction of motion of the satellite.

$\theta$  Spacecraft zenith angle, spacecraft pitch, or polar angle of the line-of-sight at a spacecraft (depending on usage).
$\theta$  Pitch rate.
$\theta_0$  Polar angle of the direct sunlight.
$\theta_1$  The intersection angle of circle one.
$\theta_2$  The intersection angle of circle two.
$\theta_s$  Solar zenith angle.
$\theta_n$  The zenith angle of the vector normal to the surface vector for which glint will be observed.
$\theta_N$  The angle with respect to nadir that the sea surface slopes to produce a reflection angle to the spacecraft.
$\theta_s$  Scan angle of sensor or the solar zenith angle (depending on usage).
$\theta_s'$  Scan angle of sensor adjusted for tilt.
$\kappa$  An integration constant: $\kappa = A_d\pi r_1^2(r_1^2 + r_2^2 + d^2)^{-1}$.
$\lambda$  Wavelength of light.
$\lambda_1$  Starting wavelength.
$\lambda_2$  Ending wavelength.
$\lambda_m$  Nominal center wavelength.
$\mu$  Mean value or cosine of the satellite zenith angle (depending on usage).
$\mu_0$  Cosine of the solar zenith angle.
$\Pi_{d}(0^+, \lambda)$  Spectral mean cosine for downwelling radiance at the sea surface.
$\mu_s$  The reciprocal of the effective optical length to the top of the atmosphere, along the line of sight to the sun.
$\nu_j$  The $j$th temporal weighting factor.
$\xi_{EM}$  The distance between the Earth and the moon.
The Fresnel reflectivity, the weighted direct plus diffuse reflectance, or the average reflectance of the sea (depending on usage).

$\rho(\theta)$ Fresnel reflectance for viewing geometry.

$\rho(\theta_0)$ Fresnel reflectance for solar geometry.

$\rho_{c,i}$ Reflectance of clouds and ice.

$\rho_i$ Sea surface reflectance for direct irradiance at normal incidence for a flat sea.

$\rho_i$ The reflectance of the sea of either the first or second aerosol model when $i$ = 1 or 2, respectively.

$\rho_i(\lambda)$ The reflectance where $i$ may represent any of the following: $m$ for measured; $LU$ for look-up table; $o$ for light scattered by the atmosphere; $sfc$ for reflection from the sea surface; and $w$ for water-leaving radiance.

$\rho_N$ Reflectance for diffuse irradiance.

$\sigma$ One standard deviation of a set of data values.

$\sigma^2$ The mean square surface slope distribution.

$\sigma(\lambda)$ The spectral optical depth.

$\sigma^2 = \frac{1}{N} \sum (\log r - \log \sigma_i)^2$.

$\tau(z, \lambda)$ Spectral optical depth.

$\tau_a$ Aerosol optical thickness.

$\tau_{ox}$ Oxygen optical thickness at 750 nm.

$\tau_{oa}$ The optical thickness of ozone.

$\tau_r$ Rayleigh optical thickness (due to scattering by the standard molecular atmosphere).

$\tau_r'$ Pressure corrected Rayleigh optical thickness.

$\tau_{r0}$ Rayleigh optical thickness at standard atmospheric pressure, $P_0$.

$\tau_s(\lambda)$ Spectral solar atmospheric transmission.

$\tau_{wv}$ The absorption optical thickness of water vapor.

$\phi$ Azimuth angle of the line-of-sight at a spacecraft.

$\phi_0$ Azimuth angle of the direct sunlight.

$\Phi$ Spacecraft azimuth angle or roll (depending on usage).

$\phi_D$ Roll rate.

$\Phi_D$ The detector solid angle.

$\Phi_M$ The solid angle subtended by the moon at the measuring instrument.

$\phi_0$ Solar azimuth angle.

$\Psi$ Pixel latitude or yaw (depending on usage).

$\Psi'$ Yaw rate.

$\Psi_d$ Solar declination latitude.

$\Psi_s(t)$ Sub-satellite latitude as a function of time.

$\omega$ Longitude variable or the surface reflection angle (depending on usage).

$\omega_0$ Old longitude value.

$\omega_a$ Single scattering albedo of the aerosol.

$\omega_e$ Equator crossing longitude.

$\omega_l$ Spatial weighting factor.

$\omega_s$ Longitude variable.

$\Omega$ Solar hour angle or the amount of ozone in Dobson units (depending on usage).
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# SeaWiFS Technical Report Series


### Abstract

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is the follow-on ocean color instrument to the Coastal Zone Color Scanner (CZCS), which ceased operations in 1986, after an eight-year mission. SeaWiFS is expected to be launched in 1995, on the SeaStar satellite, being built by Orbital Sciences Corporation (OSC). The SeaWiFS Project at the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC), has undertaken the responsibility of documenting all aspects of this mission, which is critical to the ocean color and marine science communities. This documentation, entitled the *SeaWiFS Technical Report Series*, is in the form of NASA Technical Memorandum Number 104566. All reports published are volumes within the series. This particular volume serves as a reference, or guidebook, to the previous 23 volumes and consists of 6 sections including: an errata, an addendum (summaries of various SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops, and other auxiliary information), an index to key words and phrases, a list of all references cited, and lists of acronyms and symbols used. It is the editors' intention to publish a cumulative index of this type after every five volumes in the series. Each index covers the topics published in all previous editions, that is, each new index will include all of the information contained in the preceding indices.

### Subject Terms

SeaWiFS, Oceanography, Cumulative, Index, Summary, Overview, Errata, Addendum, Glossary, Symbols, References, Bio-optical, Algorithm Workshop, Protocols Subgroup Workshop

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