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SeaWiFS Technical Report Series

Stanford B. Hooker and Elaine R. Firestone, Editors

Volume 24, SeaWiFS Technical Report Series Cumulative Index: Volumes 1-23

Elaine R. Firestone and Stanford B. Hooker



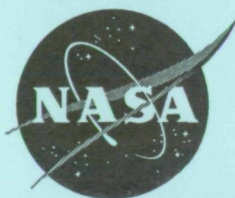
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ABSTRACT

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. 1: S.B. Hooker, W.E. Esaias, G.C. Feldman, W.W. Gregg, and C.R. McClain, *An Overview of SeaWiFS and Ocean Color*.
- Vol. 2: W.W. Gregg, *Analysis of Orbit Selection for SeaWiFS: Ascending vs. Descending Node*.
- Vol. 3: C.R. McClain, W.E. Esaias, W. Barnes, B. Guenther, D. Endres, S.B. Hooker, B.G. Mitchell, and R. Barnes, *SeaWiFS Calibration and Validation Plan*.
- Vol. 4: C.R. McClain, E. Yeh, and G. Fu, *An Analysis of GAC Sampling Algorithms: A Case Study*.
- Vol. 5: J.L. Mueller and R.W. Austin, *Ocean Optics Protocols for SeaWiFS Validation*.
- Vol. 6: E.R. Firestone and S.B. Hooker, *SeaWiFS Technical Report Series Cumulative Index: Volumes 1-5*.
- Vol. 7: M. Darzi, *Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors*.
- Vol. 8: S.B. Hooker, W.E. Esaias, and L.A. Rexrode, *Proceedings of the First SeaWiFS Science Team Meeting*.
- Vol. 9: W.W. Gregg, F. Chen, A. Mezaache, J. Chen, and J. Whiting, *The Simulated SeaWiFS Data Set*.
- Vol. 10: R.H. Woodward, R.A. Barnes, W.E. Esaias, W.L. Barnes, A.T. Mecherikunnel, *Modeling of the SeaWiFS Solar and Lunar Observations*.
- Vol. 11: F.S. Patt, C.M. Hoisington, W.W. Gregg, and P.L. Coronado, *Analysis of Selected Orbit Propagation Models*.
- Vol. 12: E.R. Firestone and S.B. Hooker, *SeaWiFS Technical Report Series Cumulative Index: Volumes 1-11*.
- Vol. 13: C.R. McClain, J.C. Comiso, R.S. Fraser, J.K. Firestone, B.D. Schieber, E-n. Yeh, K.R. Arigo, and C.W. Sullivan, *Case Studies for SeaWiFS Calibration and Validation, Part 1*.
- Vol. 14: J.L. Mueller, *The First SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-1, July 1992*.
- Vol. 15: W.W. Gregg, F.S. Patt, and R.H. Woodward, *The Simulated SeaWiFS Data Set, Version 2*.
- Vol. 16: Mueller, J.L., B.C. Johnson, C.L. Cromer, J.W. Cooper, J.T. McLean, S.B. Hooker, and T.L. Westphal, *The Second SeaWiFS Intercalibration Round-Robin Experiment, SIRREX-2, June 1993*.
- Vol. 17: Abbott, M.R., O.B. Brown, H.R. Gordon, K.L. Carder, R.E. Evans, F.E. Muller-Karger, and W.E. Esaias, *Ocean Color in the 21st Century: A Strategy for a 20-Year Time Series*.

- Vol. 18: Firestone, E.R., and S.B. Hooker, *SeaWiFS Technical Report Series Summary Index: Volumes 1-17*.
- Vol. 19: McClain, C.R., R.S. Fraser, J.T. McLean, M. Darzi, J.K. Firestone, F.S. Patt, B.D. Schieber, R.H. Woodward, E-n. Yeh, S. Mattoo, S.F. Biggar, P.N. Slater, K.J. Thome, A.W. Holmes, R.A. Barnes, and K.J. Voss, *Case Studies for SeaWiFS Calibration and Validation, Part 2*.
- Vol. 20: Hooker, S.B., C.R. McClain, J.K. Firestone, T.L. Westphal, E-n. Yeh, and Y. Ge, *The SeaWiFS Bio-Optical Archive and Storage System (SeaBASS), Part 1*.
- Vol. 21: Acker, J.G., *The Heritage of SeaWiFS: A Retrospective on the CZCS NIMBUS Experiment Team (NET) Program*.
- Vol. 22: Barnes, R.A., W.L. Barnes, W.E. Esaias, and C.R. McClain, *Prelaunch Acceptance Report for the SeaWiFS Radiometer*.
- Vol. 23: Barnes, R.A., A.W. Holmes, W.L. Barnes, W.E. Esaias, C.R. McClain, and T. Svitek, *SeaWiFS Prelaunch Radiometric Calibration and Spectral Characterization*.

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 19, 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 (✓).

Team Members	Present	Team Members	Present
J. Aiken		O. Kopelevich	
(G. Moore)	✓	M. Lewis	✓
W. Balch	✓	C. McClain	✓
K. Carder	✓	G. Mitchell	✓
D. Clark	✓	A. Morel	
G. Cota	✓	J. Mueller	✓
C. Davis	✓	F. Muller-Karger	✓
R. Doerffer	✓	D. Siegel	✓
W. Esaias	✓	R. Smith	
H. Gordon	✓	C. Trees	✓
F. Hoge	✓	C. Yentsch	
S. Hooker	✓	J. Yoder	✓
D. Kamykowski		R. Zaneveld	✓
M. Kishino	✓		
Other Attendees			
R. Arnone		S. Gallegos	
J. Campbell		S. Hawes	
R. Evans		N. Maynard	
R. Frouin		J. Morrow	
H. Fukushima			

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-robins 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 1σ 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 radiance, 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 Sea-BASS 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 $c(\lambda)$, the beam attenuation coefficient, in present usage).
 AM-1 Not an acronym, used to designate the morning platform of EOS.
 AMC Angular Momentum Compensation
 AOCI 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 Bathythermograph

- 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)
 CIRES Cooperative Institute for Research in Environmental Sciences
 COADS Comprehensive Ocean-Atmosphere Data Set
 COOP Coastal Ocean Optics Program
 COTS Commercial Off-The-Shelf (software)
 CPR 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 (of 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

DEC Digital Equipment Corporation
 DMS dimethyl sulfide
 DOC Dissolved Organic Carbon
 DoD Department of Defense
 DOM Dissolved Organic Matter
 DOS Disk Operating System
 DSP Not an acronym, but an image display and analysis package developed at RSMAS University of Miami.
 DU Dobson Units
 DXW Not an acronym, but a lamp designator.

- E -

E-mail Electronic Mail
 EAFB Edwards Air Force Base
 ECEF Earth-Centered Earth-Fixed
 ECMWF European Centre for Medium Range Weather Forecasts
 ECT Equator Crossing Time
 EDT Eastern Daylight Time
 EEZ Exclusive Economic Zone
 ENSO El Niño Southern Oscillation
 ENVISAT Environmental Satellite
 EOF Empirical Orthogonal Function
 EOS Earth Observing System
 EOSAT Earth Observation Satellite Company
 EOSDIS EOS Data Information System
 EPA Environmental Protection Agency
 EP-TOMS Earth Probe-Total Ozone Mapping Spectroradiometer
 EqPac Equatorial Pacific (Process Study)
 ER-2 Earth Resources-2
 ERBE Earth Radiation Budget Experiment
 ERBS Earth Radiation Budget Sensor
 ERL (NOAA) Environmental Research Laboratories
 ERS Earth Resources Satellite
 ESA European Space Agency
 EST Eastern Standard Time
 EURASEP European Association of Scientists in Environmental Pollution
 EUVE Extreme Ultraviolet Explorer

- F -

FASCAL Fast Calibration (Facility)
 FDDI Fiber Data Distribution Interface
 FEL Not an acronym, but a lamp designator.
 FGGE First GARP Global Experiment
 FLUPAC (Geochemical) Fluxes in the Pacific (Ocean)
 FNOF Fleet Numerical Oceanography Center
 FORTRAN Formula Translation (computer language)
 FOV Field-of-View
 FPA Focal Point Assembly
 FRD Federal Republic of Deutschland (Germany)
 FTP File Transfer Protocol
 FWHM Full-Width at Half-Maximum
 FY Fiscal Year

- G -

GAC Global Area Coverage, coarse resolution satellite data with a nominal ground resolution at nadir of approximately 4 km.
 GARP Global Atmospheric Research Program
 GASM General Angle Scattering Meter

GF/F Not an acronym; a specific type of glass fiber filter manufactured by Whatman
 GIN Greenland, Iceland, and Norwegian Seas
 GISS Goddard Institute for Space Studies
 GLI Global Imager
 GLOBEC Global Ocean Ecosystems dynamics
 GMT Greenwich Mean Time
 GOES Geostationary Operational Environmental Satellite
 GOFS Global Ocean Flux Study
 GOMEX Gulf of Mexico Experiment
 GP Global Processing (algorithm)
 GPM General Perturbations Model
 GPS Global Positioning System
 GRGS Groupe de Recherche de Geodesie Spatial
 GRIB Gridded Binary
 GRIDTOMS Gridded TOMS (data set)
 GSFC Goddard Space Flight Center
 GSO Graduate School of Oceanography (University of Rhode Island)
 G/T System Gain/Total System Noise Temperature
 GUI Graphical User Interface

- H -

HDF Hierarchical Data Format
 HEI Hoffman Engineering, Incorporated
 HeNe Helium-Neon
 HHCRM Hand-Held Contrast Reduction Meter
 HIRIS High Resolution Imaging Spectrometer
 HN (Polaroid) Not an acronym; a linear sheet polarizer used to check the polarization sensitivity of bands 7 and 8.
 HOTS Hawaiian Optical Time Series
 HP Hewlett Packard
 HPGL Hewlett Packard Graphics Language
 HPLC High Performance Liquid Chromatography
 HQ Headquarters
 HR (Polaroid) Not an acronym; a linear sheet polarizer used to check the polarization sensitivity of bands 1-6.
 HRPT High Resolution Picture Transmission
 HST Hawaii Standard Time
 HYDRA Hydrographic Data Reduction and Analysis

- I -

I/O Input/Output
 IAPSO International Association for the Physical Sciences of the Ocean
 IAU International Astrophysical Union
 IBM International Business Machines
 ICD Interface Control Document
 ICES International Council on Exploration of the Seas
 IDL Interactive Data Language
 IFOV Instantaneous Field-of-View
 IMS Information Management System
 IOP Inherent Optical Property
 IP Internet Protocol
 IPD Image Processing Division
 IR Infrared
 ISCCP International Satellite Cloud Climatology Project
 ISIC Integrating Sphere Irradiance Collector
 ISTEP International Solar Terrestrial Program
 IUCRM Inter-Union Commission on Radio Meteorology
 IUE International Ultraviolet Explorer

- J -

JAM JYACC Application Manager
 JARE Japanese Antarctic Research Expedition
 JGOFS Joint Global Ocean Flux Study
 JHU Johns Hopkins University
 JOI Joint Oceanographic Institute
 JPL Jet Propulsion Laboratory
 JRC Joint Research Center

- K, L -

L&N Leeds & Northrup
 LAC Local Area Coverage, fine resolution satellite data with a nominal ground resolution at nadir of approximately 1 km.
 LANDSAT Land Resources Satellite
 LDEO Lamont-Doherty Earth Observatory (Columbia University)
 LDGO Lamont-Doherty Geological Observatory (Columbia University)
 LDTNLR Local Dynamic Threshold Nonlinear Raleigh
 Level-0 Raw data.
 Level-1 Calibrated radiances.
 Level-2 Derived products.
 Level-3 Gridded and averaged derived products.
 LMCE *Laboratoire de Modelisation du climat et de l'Environnement* (France)
 LOC Local Time
 LODYC *Laboratoire d'Océanographie et de Dynamique du climat* (France)
 LOICZ Land Ocean Interaction in the Coastal Zone
 LPCM *Laboratoire de Physique et Chimie Marines* (France)
 LRER Long-Range Ecological Research
 LSB Least Significant Bits
 LSF Line Spread Function

- M -

MAREX Marine Resources Experiment Program
 MARS Multispectral Airborne Radiometer System
 MASSS Multi-Agency Ship-Scheduling for SeaWiFS
 MBARI Monterey Bay Aquarium Research Institute
 MEM Maximum Entropy Method
 MER Marine Environmental Radiometer
 MERIS Medium Resolution Imaging Spectrometer
 METEOSAT Meteorological Satellite
 MF Major Frame
 mF Minor Frame
 MIPS Millions of Instructions Per Second
 MIT Massachusetts Institute of Technology
 MIZ Marginal Ice Zone
 MLE Maximum Likelihood Estimator
 MLML Moss Landing Marine Laboratory (San Jose State University)
 MO Magneto-Optical
 MOBY Marine Optical Buoy
 MOCE Marine Optical Characterization Experiment
 MODARCH MODIS Document Archive
 MODIS Moderate Resolution Imaging Spectroradiometer
 MODIS-N Nadir-viewing MODIS instrument
 MODIS-T Tilted MODIS instrument to minimize sun glint
 MOS Marine Optical Spectroradiometer
 MOU Memorandum of Understanding
 MSB Most Significant Bits
 MS/DOS MicroSoft/Disk Operating System
 MTF Modulation Transfer Function

- N -

NABE North Atlantic Bloom Experiment
 NAS National Academy of Science
 NASA National Aeronautics and Space Administration
 NASCOM NASA Communications
 NASDA National Space Development Agency (Japan)
 NASIC NASA Aircraft/Satellite Instrument Calibration
 NAVSPASUR Naval Space Surface Surveillance
 NCAR National Center for Atmospheric Research
 NCCOSC Navy Command, Control, and Ocean Surveillance Center
 NCDC (NOAA) National Climatic Data Center
 NCDS NASA Climate Data System
 NCSA National Center for Supercomputing Applications
 NCSU North Carolina State University
 NDBC National Data Buoy Center
 NDVI Normalized Difference Vegetation Index
 NEdL Noise Equivalent Differential Spectral Radiance
 NE Δ T Noise Equivalent Delta Temperature
 NE δ L Noise Equivalent delta Radiance
 NER Noise Equivalent Radiance
 NERC Natural Environment Research Council
 NESDIS National Environmental Satellite Data Information Service
 NESS National Environmental Satellite Service
 NET NIMBUS Experiment Team
 netCDF (NASA) Network Common Data Format
 NFS Network File System
 NGDC National Geophysical Data Center
 NIMBUS Not an acronym, but a series of NASA experimental weather satellites containing a wide variety of atmosphere, ice, and ocean sensors.
 NIST National Institute of Standards and Technology
 NMC National Meteorological Center
 NMFS National Marine Fisheries Service
 NOAA National Oceanic and Atmospheric Administration
 NOARL Naval Oceanographic and Atmospheric Research Laboratory
 NODC National Oceanographic Data Center
 NORAD North American Air Defense (Command)
 NOPS NIMBUS Observation Processing System
 NOS National Ocean Service
 NRA NASA Research Announcement
 NRaD Naval Research and Development
 NRIFS National Research Institute of Far Seas Fisheries (Japan)
 NRL Naval Research Laboratory
 NRT Near-Real Time
 NSCAT NASA Scatterometer
 NSF National Science Foundation
 NSSDC National Space Science Data Center

- O -

OAM Optically Active Materials
 OCDM Ocean Color Data Mission
 OCEAN Ocean Colour European Archive Network
 OCS Ocean Color Scanner
 OCTS Ocean Color Temperature Sensor (Japan)

- S -

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
 PFF 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/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
 SISR 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/I 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 Science Working Group
 SXR SeaWiFS Transfer Radiometer

- T -

T-S Temperature-Salinity
 TAE Transportable Applications Executive
 TAO Thermal Array for the Ocean or more recently,
 Tropical Atmosphere-Ocean
 TBD To Be Determined
 TBUS Not an acronym, but a NOAA orbit prediction
 TDI Time-Delay and Integration
 TDRSS Tracking and Data Relay Satellite System
 TIROS Television Infrared Observation Satellite
 TLM Telemetry
 TM Technical Memorandum
 TOA Top of the Atmosphere
 TOGA Tropical Ocean Global Atmosphere program
 TOMS Total Ozone Mapping Spectrometer
 TOPEX Topography Experiment
 TOVS TIROS Operational Vertical Sounder
 TRMM Tropical Rainfall Measuring Mission
 TSM Total Suspended Material
 TV Thermal Vacuum

- U -

UA University of Arizona
 UARS Upper Atmosphere Research Satellite
 UAXR University of Arizona's Transfer Radiometer
 UCAR University Consortium for Atmospheric Research
 UCMBO University of California Marine Bio-Optics
 UCSB University of California at Santa Barbara
 UCSD University of California at San Diego
 UH University of Hawaii
 UIM/X User Interface Management/X-Windows
 UM University of Miami
 UNESCO United Nations Educational, Scientific, and Cultural Organizations
 UNIX Not an acronym, a computer operating system.
 UPS Uninterruptible Power System

URI University of Rhode Island
 USC University of Southern California
 USF University of South Florida
 UTM Universal Transverse Mercator (projection)
 UV Ultraviolet
 UVB Ultraviolet-B
 UWG User Working Group

- V -

V0 Version 0
 V1 Version 1
 VAX Virtual Address Extension
 VCS Version Control Software
 VDC Volts Direct Current
 VHF Very High Frequency
 VI Virtual Instrument
 VISLAB Visibility Laboratory (Scripps Institution of Oceanography)
 VISNIR Visible and Near Infrared
 VMS Virtual Memory System
 VSF Volume Scattering Function

- W -

WFF Wallops Flight Facility
 WHOI Woods Hole Oceanographic Institute
 WMO World Meteorological Organization
 WOCE World Ocean Circulation Experiment
 WORM Write-Once Read-Many (times)
 WVS World Vector Shoreline

- X -

XDR External Data Representation

- Y, Z -

YBOM Yamato Bank Optical Mooring

SYMBOLS

- A -

- a The semi-major axis of the Earth's orbit, a formulation constant, a constant equal to 0.983, a constant equal to $-20/\tanh(2)$ or an exponential value in the expression relating the radiance of scattered light to wavelength (depending on usage).
- $a(z, \lambda)$ Spectral absorption coefficient.
- a_{\leq} Oxygen absorption coefficient.
- a_{ox} Coefficient for oxygen absorption.
- a_{oz} Coefficient for ozone absorption.
- a_{wv} 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_i The intersection area.
- $A(k)$ Absorptivity.
- $A(\lambda)$ Coefficient for calculating $b_b(\lambda)$.

- B -

- b Formulation coefficient or a constant equal to $1/3$ (depending on usage).
- $b(z, \lambda)$ Total scattering coefficient.
- $b(\theta, z, \lambda_0)$ Volume scattering coefficient.
- $b_b(z, \lambda)$ Spectral backscattering coefficient.
- $b_{bc}(\lambda)$ Spectral backscattering coefficient for phytoplankton.
- $b_r(\lambda)$ Total Raman scattering coefficient.
- $b_w(\lambda)$ Total scattering coefficient for pure seawater.
- $b1(k)$ Input data for polarization calculations for SeaWiFS band 1.
- $b7(k)$ 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 $b_b(\lambda)$.

- C -

- $c(z, \lambda)$ Spectral beam attenuation coefficient.
- $c(z, 660)$ Red beam attenuation (at 660 nm).
- $[chl. a]/K$ 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_{13} 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_{dark} Instrument dark restore value, in counts.
- C_{ext} Average total extinction cross-section of a particle.
- C_F The calibration factor.
- C_{out} Instrument output, in counts.
- C_{ref} Reference chlorophyll value (0.5).
- C_{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 phaeopigments 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.
- ds Detector configuration datum.
- D Sequential day of the year.
- \vec{D} Orbit position difference vector.
- D_{at} Along-track position difference.
- D_{ct} Cross-track position difference.
- D_{rad} Radial position difference.
- DC Digital count (value) or direct current (depending on usage).
- DC_{10} Digital counts at 10-bit digitization.
- DC_{meas} The digital counts measured unshadowed.
- DC_{scat} The digital counts due to scattered sunlight.
- DC_{TOA} The digital counts measured at the top of the atmosphere.

- E -

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

- F -

- f The fraction of the surface covered by foam.
- f_i Filter number, $i=0-11$.
- f -ratio The ratio of new to total production.
- \bar{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.
- $\bar{F}(\lambda)$ Average of calibration factors.
- F_0 Extraterrestrial irradiance corrected for Earth-sun distance.
- \mathbb{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.
- $\bar{F}_0(\lambda)$ Mean extraterrestrial irradiance.

- F_a 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.
 \mathbb{F}'_d 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_i A correction factor.

- G -

- g_1 A constant equal to 0.82.
 g_2 A constant equal to -0.55.
 gs 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.
 $G(\lambda)$ $\hat{R}_a(\lambda_i)/\hat{R}_a(670) = (670/\lambda)^{\gamma} T_{2r}(670)/T_{2r}(\lambda_i)$.
 G_e Gravitational constant of the Earth ($398,600.5 \text{ km}^3 \text{ s}^{-2}$).
 G_n Gain factor at gain setting n .

- H -

- $h(k)$ Residual values without the calculated sinusoidal response.
 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 J_2 gravity field term (0.0010863).
 J_3 The J_3 gravity field term (-0.0000254).
 J_4 The J_4 gravity field term (-0.0000161).
 J_5 The J_5 gravity field term.

- K -

- k Wavenumber of light ($1/\lambda$).
 k_1 Beginning wavenumber.
 k_2 Ending wavenumber.
 $k_c(\lambda)$ Spectral fit coefficient weighted over the SeaWiFS bands; $k'_c(\lambda)$ also used.
 $K(z, \lambda)$ 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.
 $K_L(z, \lambda)$ Attenuation coefficient upwelled radiance.
 $K_w(\lambda)$ 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.
 \mathbb{L}_d A matrix of the four Stokes parameters for radiance incident on the surface.
 L_{cloud} Maximum radiance from reflected light off of clouds.
 $L_g(\lambda)$ Sun glint radiance.
 $L_i(\lambda)$ Spectral radiance for run number i , or radiance, where i may represent any of the following: m for measured; LU for look-up table; 0 for light scattered by the atmosphere; sfc for reflection from the sea surface; and w for water-leaving radiance.
 L_{LU} The radiance calculated for the look-up tables.
 L_m The radiance of the ocean-atmosphere system measured at a satellite.
 L_M The radiance of the moon.
 L_{max} Maximum saturation radiance.
 L_{nadir} Measured radiance at nadir.
 $L_{\text{NER}}(\lambda)$ Noise equivalent radiance.
 $L_r(\lambda)$ Rayleigh radiance.
 $L_{r0}(\lambda)$ Rayleigh radiance at standard atmospheric pressure, P_0 .
 $L_s(\lambda)$ Subsurface water radiance.
 L_{sa} $L_0 + L_{sfc}$.
 $L_{\text{sat}}(\lambda)$ 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.
 \mathbb{L}_{sfc} The columnar matrix of the four Stokes parameters ($L_{u,1}$, $L_{u,2}$, $L_{u,3}$, $L_{u,4}$).
 $L_{sky}(\lambda)$ Spectral sky radiance distribution.
 $L_t(\lambda)$ Total radiance at the sensor.
 L_{typical} Expected radiance from the ocean measured on orbit.
 $L_u(z, \lambda)$ Upwelled spectral radiance.
 \mathbb{L}_{up} The columnar matrix of light leaving the surface containing the values $L_{up,1}$, $L_{up,2}$, $L_{up,3}$, and $L_{up,4}$.
 $L_{up,i}$ The RADTRAN radiance parameters (for $i = 1, 4$).
 L_w The water-leaving radiance of light scattered from beneath the surface and penetrating it.
 $L_w(443)$ 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.
 \mathbb{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_{oz} 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 Total number density.
 N_i Total number density of either the first or second aerosol model when $i = 1$ or 2, respectively.

- O -

$$\vec{O} \vec{P} \times \vec{V}.$$

- P -

- p_a A factor to account for the probability of scattering to the spacecraft for three different paths from the sun.
 $p_a/(4\pi)$ Aerosol albedo of the scattering phase function.
 p_w The probability of seeing sun glitter in the direction θ, Φ given the sun in position θ_0, Φ_0 as a function of wind speed (W).
 P Nodal period, phaeopigment concentration or local surface pressure (depending on usage).
 \vec{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_i PR714 raw radiance.
 P_σ Phaeopigment concentration.
 PF Polarization factor.
 P_{xl} Pixel number, i.e., the numerical designation of a pixel in a scan line.

- Q -

- q Water transmittance factor.
 $Q(\lambda)$ $L_u(0^-, \lambda)$ to $E_u(0^-, \lambda)$ relation factor (theoretically equal to π).

- 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_i The geometric mean radii of either the first or second aerosol model when $i = 1$ or 2, respectively.
 R Reflectance.
 \mathbb{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.
 \dot{R}_a $R_a/(qT_{2r})$.
 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_r Rayleigh reflectance.
 R_{rs} Remote sensing reflectance.
 R_s Subsurface reflectance.
 R_t Total reflectance at the sensor.
 \dot{R}_t $(R_t - R_r)/(qT_{2r})$.
 R_T Resistance of the thermistor.
 R_z Sunspot number.

- S -

- s The reflectance of the atmosphere for isotropic radiance 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_{sfsc} 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_{aa} Aerosol transmittance after absorption.
 t_{as} Aerosol transmittance after scattering.
 t_d Direct component of transmittance after absorption by the gaseous components of the atmosphere, scattering and absorption by aerosols, and scattering by Rayleigh.
 t_e Time difference in hours between present position and most recent equator crossing.
 t_{EC} Equator crossing time.
 t_{oz} 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_{wv} Transmittance after absorption by water vapor.

- T Tilt position.
 $T(\lambda)$ The transmittance along the slant path to the sun.
 $T_s(\lambda)$ 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 θ .
 T_{2r} Two-way diffuse transmittance for Rayleigh attenuation.
 $T_0(\lambda, \theta_0)$ Total downward transmittance of irradiance.
 T_e Equation of time.
 T_{ox} Transmittance of oxygen (O_2).
 T_{oz} Transmittance of ozone (O_3).
 $T_s(\lambda)$ Transmittance through the surface.
 $T_w(\lambda)$ Transmittance through a water path.
 T_{wv} Transmittance of water vapor (H_2O).
- V -
- \vec{V} Orbit velocity vector.
 $V_i(t_j)$ 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.
 \dot{X} ECEF X component of orbit velocity.
- Y -
- y Ordinate or meridional coordinate.
 Y ECEF y component of orbit position.
 \dot{Y} ECEF Y component of orbit velocity.
- Z -
- Z ECEF z component of orbit position.
 \dot{Z} ECEF Z component of orbit velocity.
- GREEK -
- α 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).
 β A formulation coefficient (slope) or a constant in the Ångström formulation (depending on usage).
 β_i The extinction coefficient of either the first or second aerosol model when $i = 1$ or 2 , respectively.
 $\beta(z, \lambda, \theta)$ Spectral volume scattering function.
 γ The Ångström exponent.
 $\gamma(\lambda)$ The ratio of the aerosol optical thickness at wavelength λ to the aerosol optical thickness at 670 nm.
- δ 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).
 Δk Equivalent bandwidth.
 $\Delta L_W(670)$ The error in the water-leaving radiance for the red channel.
 ΔpCO_2 Partial pressure difference of CO_2 between air and sea water.
 ΔP The difference in successive pixels or the pressure deviation from standard pressure, P_0 (depending on usage).
 Δt Time difference.
 $\Delta T(\lambda)$ The error in transmittance.
 $\Delta \theta_s$ The error (in radians) in the knowledge of θ_s .
 $\Delta \lambda$ An interval in wavelength.
 $\Delta \rho_w(\lambda)$ The error in the water-leaving reflectance for the red channel.
 $\Delta \sigma(\lambda)$ The absolute error in spectral optical depth.
 $\Delta \tau_a$ 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.
 η Bearing from the sub-satellite point to the pixel along the direction of motion of the satellite.
 θ Spacecraft zenith angle, spacecraft pitch, or polar angle of the line-of-sight at a spacecraft (depending on usage).
 $\dot{\theta}$ Pitch rate.
 θ_0 Polar angle of the direct sunlight.
 θ_1 The intersection angle of circle one.
 θ_2 The intersection angle of circle two.
 θ_0 Solar zenith angle.
 θ_n The zenith angle of the vector normal to the surface vector for which glint will be observed.
 θ_N The angle with respect to nadir that the sea surface slopes to produce a reflection angle to the spacecraft.
 θ_s Scan angle of sensor or the solar zenith angle (depending on usage).
 θ'_s Scan angle of sensor adjusted for tilt.
 κ An integration constant: $\kappa = A_d \pi r_1^2 (r_1^2 + r_2^2 + d^2)^{-1}$.
 λ Wavelength of light.
 λ_1 Starting wavelength.
 λ_2 Ending wavelength.
 λ_m Nominal center wavelength.
 μ Mean value or cosine of the satellite zenith angle (depending on usage).
 μ_0 Cosine of the solar zenith angle.
 $\bar{\mu}_d(0^+, \lambda)$ Spectral mean cosine for downwelling radiance at the sea surface.
 μ_s The reciprocal of the effective optical length to the top of the atmosphere, along the line of sight to the sun.
 ν_j The j th temporal weighting factor.
 ξ_{EM} The distance between the Earth and the moon.

- ρ 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.
- ρ_n Sea surface reflectance for direct irradiance at normal incidence for a flat sea.
- ρ_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.
- ρ_N Reflectance for diffuse irradiance.
- σ One standard deviation of a set of data values.
- σ^2 The mean square surface slope distribution.
- $\sigma(\lambda)$ The spectral optical depth.
- σ_i^2 $\sigma_i^2 = \langle (\log r - \log r_i)^2 \rangle$.
- $\tau(z, \lambda)$ Spectral optical depth.
- τ_a Aerosol optical thickness.
- τ_{ox} Oxygen optical thickness at 750 nm.
- τ_{oz} The optical thickness of ozone.
- τ_r Rayleigh optical thickness (due to scattering by the standard molecular atmosphere).
- τ_r' Pressure corrected Rayleigh optical thickness.
- τ_{r0} Rayleigh optical thickness at standard atmospheric pressure, P_0 .
- τ_{ro} Rayleigh optical thickness weighted by the SeaWiFS spectral response.
- $\tau_s(\lambda)$ Spectral solar atmospheric transmission.
- τ_{wv} The absorption optical thickness of water vapor.
- ϕ Azimuth angle of the line-of-sight at a spacecraft.
- ϕ_0 Azimuth angle of the direct sunlight.
- Φ Spacecraft azimuth angle or roll (depending on usage).
- $\dot{\Phi}$ Roll rate.
- Φ_D The detector solid angle.
- Φ_M The solid angle subtended by the moon at the measuring instrument.
- Φ_0 Solar azimuth angle.
- Ψ Pixel latitude or yaw (depending on usage).
- $\dot{\Psi}$ Yaw rate.
- Ψ_d Solar declination latitude.
- $\Psi_s(t)$ Sub-satellite latitude as a function of time.
- ω Longitude variable or the surface reflection angle (depending on usage).
- ω_0 Old longitude value.
- ω_a Single scattering albedo of the aerosol.
- ω_e Equator crossing longitude.
- ω_i Spatial weighting factor.
- ω_s Longitude variable.
- Ω Solar hour angle or the amount of ozone in Dobson units (depending on usage).

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