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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 1994, 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 11 volumes and consists of 6 sections including: an errata, an addendum (a summary of the SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops), 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. This will cover the topics published in all previous editions of the indices, that is, each new index will include all of the information contained in the preceeding indices.

1. INTRODUCTION

This second in a series of indices, published as a separate volume in the Sea-viewing Wide Field-of-view (SeaWiFS) Technical Report Series, covers information found in the first 11 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.*

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 index published, Volume 6, 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, starting with this volume, errata and addendum 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 which 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 with no page field:

keyword, *Vol. #.*

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

2. ERRATA

1. Vol. 5: In Table 1, page 5 under the first section, *Primary Optical Measurements,* the third item down reads: "Upwelled Spectral Irradiance." It should read: *Upwelled Spectral Radiance.*
2. Vol. 6: The authorship of this volume was incorrectly printed as: "Stanford B. Hooker and Elaine R. Firestone." It should read: *Elaine R. Firestone and Stanford B. Hooker.*
3. Vol. 7: The title of this volume was incorrectly printed as: "Cloud Screening for Polar Orbiting and Infrared (IR) Satellite Sensors." The title of this volume should read: *"Cloud Screening for Polar Orbiting and IR Satellite Sensors."*
4. Note: The expected SeaWiFS launch date has been changed, as of this volume, to 1994.
5. Note: It had been expected that SeaWiFS would utilize the ozone measurement data obtained from the NIMBUS Total Ozone Mapping Spectrometer (TOMS). In May 1993, however, this instrument ceased operations. To date, an alternative sensor that will provide equivalent or similar data for the SeaWiFS mission is being investigated.
6. Note: Since the issuance of previous volumes, a number of the references cited have changed their publication status, i.e., they have gone from "submitted" or "in press" to printed matter. In other instances, some part (or parts) of the citation has changed, for example, the title or year of publication. Listed below are the references in question as they were originally cited in one or more of the first 11 volumes in the series, along with how they now appear in the references section of this volume.

Original Citation

Abel, P., B. Guenther, R. Galimore, and J. Cooper, 1991: Calibration results for NOAA-11 AVHRR channels 1 and 2 from congruent aircraft observations, *J. Atmos. and Ocean. Technol.,* (submitted).

Revised Citation

Abel, P., B. Guenther, R. Galimore, and J. Cooper, 1993: Calibration results for NOAA-11 AVHRR channels 1 and 2 from congruent aircraft observations, *J. Atmos. and Ocean. Technol.,* **10**(4), 493–508.

Original Citation

Austin, R.W., Gulf of Mexico, 1980: Ocean-color surface-truth measurements. *Bound.-Layer Meteor.,* **18,** 269–285.

Revised Citation

Austin, R.W., 1980: Gulf of Mexico, Ocean-color surface-truth measurements. *Bound.-Layer Meteor.,* **18,** 269–285.

Original Citation

Burlov-Vasiljev, K.A., E.A. Gurtovenko, and Y.B. Matvejev, 1991: The Solar Radiation Between 310–680 nm. *SOLARS-22 Conference Proceedings,* Boulder, Colorado, (in preparation).

Revised Citation

Burlov-Vasiljev, K.A., E.A. Gurtovenko, and Y.B. Matvejev, 1992: The Solar Radiation Between 310–680 nm. *Proceedings of the Workshop on the Solar Electromagnetic Radiation Study for Solar Cycle 22,* R.E. Donnelly, Ed., U.S. DOC/NOAA Environmental Research Laboratory, Boulder, Colorado, 49–53.

Original Citation

Hay, B.J., C.R. McClain, and M. Petzold, 1991: Phytoplankton pigment assessment in the Arabian Sea comparing satellite data and *in situ* data. *Remote Sens. Environ.,* (in press).

Revised Citation

Hay, B.J., C.R. McClain, and M. Petzold, 1993: An assessment of the NIMBUS-7 CZCS Calibration for May 1986 using satellite and *in situ* data from the Arabian Sea. *Remote Sens. Environ.,* **43,** 35–46.

Original Citation

McClain, C.R., G. Feldman, and W. Esaias, 1991: A review of the Nimbus-7 Coastal Zone Color Scanner data set and remote sensing of biological oceanic productivity. *Global Change Atlas,* C. Parkinson, J. Foster and R. Gurney, Eds., Cambridge University Press, (in press).

Same, Also Cited As

McClain, C.R., G. Feldman, and W. Esaias, 1992: Oceanic primary production, *Global Change Atlas,* C. Parkinson, J. Foster, and R. Gurney, Eds., Cambridge University Press, (in press).

Revised Citation

McClain, C.R., G. Feldman, and W. Esaias, 1993: Oceanic primary production, *Global Change Atlas,* C. Parkinson, J. Foster, and R. Gurney, Eds., Cambridge University Press, (in press).

Original Citation

Mecherikunnel, A.T., and H.L. Kyle, 1991: Eleven-year cycle of solar constant variation from spacecraft measurements: 1978 to 1990. *Science,* (submitted).

Revised Citation

Mecherikunnel, A.T., and H.L. Kyle, 1991: Eleven-year cycle of solar constant variation from spacecraft measurements: 1978 to 1990. *Science,* (withdrawn).

3. ADDENDUM

This section presents a summary of the SeaWiFS Working Group (SWG) Bio-optical Algorithm and Protocols Workshops, written by Charles R. McClain.

3.1 Introduction

The SWG workshops for bio-optical algorithm development and *in situ* protocols convened a joint meeting at GSFC on May 19–20, 1993. The working group memberships were defined at the January 1993 SWG meeting (Hooker et al. 1993b).

The meeting was held in May because several key team members had cruises in the March–April time frame and could not meet any sooner. The team members and attendance are listed in Table 1. The bio-optics meeting spanned Wednesday and Thursday morning and the protocols meeting was on Thursday afternoon.

Table 1. Team members and invited guests to the SWG Bio-optical Algorithm and Protocols Workshops, held May 19–20, 1993 at GSFC. Attendees are identified with a checkmark (✓).

Team Members	*Present*	*Team Members*	*Present*
J. Aiken		M. Lewis	✓
W. Balch		C. McClain	✓
K. Carder	✓	G. Mitchell	✓
D. Clark †	✓	A. Morel	
C. Davis	✓	J. Mueller ‡	✓
R. Doerffer		F. Muller-Karger	✓
W. Esaias	✓		
H. Gordon	✓	D. Siegel	✓
F. Hoge	✓	R. Smith	
S. Hooker	✓	C. Trees	✓
D. Kamykowski		C. Yentsch	✓
M. Kishino	✓	J. Yoder	✓
O. Kopelevich		R. Zaneveld	
Other Attendees			
S. Ackleson		G. Moore	
R. Arnone		J. Morrison	
F. Chavez		R. Stumpf	
H. Fukushima		A. Weidemann	
S. Gallegos			

†Bio-optics Chairman ‡Protocols Chairman

3.2 Bio-optical Algorithm Workshop

The objectives of the workshop were as follows:

1. Review existing algorithms: pigment, chlorophyll *a*, $K(490)$ only.
2. Survey relevant existing bio-optical data sets.
3. Determine critical voids (deficiencies) in data (algorithms) and make recommendations on resolving data voids and algorithm deficiencies.
4. Define strategy for defining and implementing initial algorithms.
5. Review present field program schedule.
6. Set date for an early Fall 1993 meeting.

The agenda was as follows:

1. *Workshop Charter*
   - A. Introduction (C. McClain)
     - 1) Workshop Objectives
     - 2) SWG and SeaWiFS Project Responsibilities
     - 3) Review SWG Recommendations (Vol. 8, sec. 3.5)
     - 4) Data Processing and Algorithm Refinement Strategies
   - B. Algorithm Issues Overview (D. Clark)
     - 1) Initial Case 1 Algorithm Form(s): CZCS pigment, chlorophyll-like pigment, $K(490)$
     - 2) Initial Case 2 Algorithm Form(s): CZCS pigment, chlorophyll-like pigment, $K(490)$
     - 3) Algorithm Selection and Switching
     - 4) Regional Algorithms
     - 5) Algorithm Seasonality: Impacts of SeaWiFS performance limitations
2. *SeaWiFS Instrument Update* (W. Esaias)
3. *Algorithm Studies and Field Programs*
   - A. Case 1 Water Presentations (D. Clark, G. Mitchell, D. Siegel, C. Trees, and C. McClain)
   - B. Case 2 Water Presentations (K. Carder, M. Kishino, and R. Arnone)
   - C. Discussion and Recommendations (D. Clark)
4. *Quality Control Flags* (C. McClain: Coccolithophores, Sea Ice, Trichodesmium, Turbid Case 2 water, etc.)
5. *Cruise Planning* (S. Hooker: Present Schedule, Piggyback Opportunities, Bio-optical Data Voids/Deficiencies, Community Field Program Coordination, etc.)
6. *Alternative Bio-optical Data Collection Strategies* (K. Carder)
7. *Workshop Wrap-Up* (D. Clark: Summaries, Action Items, Fall Meeting, etc.)

Because this was the first meeting of the bio-optical algorithm working group, the SeaWiFS Project presented an itemization of the responsibilities of the Project and the working group as listed below:

Bio-optical Algorithm Working Group:

- Defines strategy for algorithm development,
- Collects appropriate bio-optical data,
- Develops bio-optical algorithms, and
- Provides SeaWiFS Project with operational algorithms and implementation plan.

SeaWiFS Project:

- Assists in coordination and support of field programs,
- Supports calibration round-robin and archives the data,
- Archives and distributes field data to the SWG and other collaborating groups,
- Provides independent algorithm evaluations and comparisons, (the SeaWiFS Project does *not* develop algorithms), and
- Implements SWG approved algorithms in the SeaWiFS operational processing system.

Several decisions and recommendations were made as a result of the presentations and discussions:

1. A concerted effort will be made by the group to provide existing bio-optical data sets to the SeaWiFS Project by August 1 (deadline does not include data from the Spring 1993 cruises mentioned above). Currently, the Project has only the CZCS NIMBUS Experiment Team (NET) data that are suitable for algorithm development. (The Project does have the responsibility to assemble and distribute data to the SWG and other groups collaborating with the Project. The list of bio-optical data to be contributed and their sources appear in Table 2. Other working group members not present who have data of interest for algorithm development include R. Doerffer, D. Kamykowski, A. Morel, and R. Smith. They will be contacted to determine which data sets they have available for inclusion in the archive.

Table 2. Bio-optical data to be contributed and their sources.

Team Members	*Source*
K. Carder	North Atlantic Gulf of Mexico
J. Mueller C. Trees	North Pacific
D. Clark	CZCS NET data MOCE 1 MOCE 2
C. Davis	Equatorial Pacific North Atlantic U.S. West Coast
M. Kishino	Tokyo Bay Sea of Japan
G. Mitchell	RACER CalCoFI 1 CalCoFI 2
R. Arnone A. Weidemann J. Mueller	Gulf of Mexico
D. Siegel	Bermuda

2. It was decided that a semi-analytical algorithm should be used instead of strictly empirical algorithms, such as those used for the CZCS. This approach should allow much more flexibility in handling seasonal and regional variability due to changes in specific absorption and scattering coefficients, and would provide a physically sound foundation from which more advanced algorithms could evolve. The team of H. Gordon, A. Morel, K. Carder, and R. Doerffer have volunteered to define the initial algorithm by the next bio-optical algorithm meeting, now scheduled for late September.
3. The need to develop a cloud mask and quality control flags for level-2 processing was discussed. The distinction between a mask and a flag is that masked pixels do not get processed and flagged pixels do. Flags will be saved as graphic overlays which are distributed with the data. Table 3 shows the suggested contributors for the development of these masks and flags (not restricted to the SWG).

Table 3. Suggested contributors for the development of masks and flags for level-2 processing.

Masks or Flags	*Team Members*
Cloud Mask	R. Evans C. McClain S. Gallegos R. Stumpf
Coccolithophore Flag	H. Gordon B. Balch F. Hoge C. Brown
Sea Ice Flag	G. Cota J. Aiken K. Arrigo R. Zaneveld G. Moore
Trichodesmium Flag	A. Morel A. Subramaniam
Bottom Reflection Flag	K. Carder C. Davis W. Esaias R. Arnone
Land Mask	R. Evans C. McClain

† Anyone interested in participating in the mask and flag definition development should contact C. McClain.

4. Presentations by C. Trees and R. Arnone on $K(490)$ observations indicate that the Austin-Petzold empirical algorithm holds for a broader range of values and geographic locations than represented in the original data set. Therefore, the working group concurs with the SWG recommendation that the Austin-Petzold algorithm should be used for the initial SeaWiFS $K(490)$ algorithm.

5. It was decided to reconvene the bio-optical algorithm working group this Fall in conjunction with the next MODIS Team meeting. The next MODIS Team meeting has been set for Wednesday–Friday, Sept. 29–Oct. 1, 1993 in the Greenbelt, Maryland area. The SeaWiFS Project is, therefore, suggesting that the working group meet on Monday and Tuesday, Sept. 27–28.

3.3 The Protocols Workshop

The agenda for the meeting was as follows:

1. *Workshop Objectives* (J. Mueller: goals, summary of first Science Team meeting recommendations, etc.)
2. *Issues* (Discussion Leader)
   - A. Ship Shadowing (D. Siegel)
   - B. Instrument Self-Shading (H. Gordon)
   - C. Revision of Instrument Specifications for Bio-optical Algorithms (M. Lewis)
   - D. Protocols for Case 2 Water Algorithm Development and Validation (R. Arnone)
   - E. Aircraft Instrument Specifications and Observation Protocols (F. Hoge and C. Davis)
   - F. Data Quality Control (G. Mitchell)
   - G. Data Formats (S. Hooker)
3. *Second Round-Robin Coordination* (J. Mueller)
4. *Workshop Wrap-Up* (J. Mueller: summaries, action items, Fall meeting, etc.)

All the issues listed were discussed to one degree or another. Key points of discussion on the agenda items are listed below. In a number of cases, subgroups were defined to address specific protocol issues and who would present draft update documents at the next protocols working group meeting.

1. *Ship Shadowing:* D. Siegel presented data from a ship shadowing experiment he conducted. His conclusion is that for certain situations, the distance between the ship and the instrument can be substantially less than the guideline in the protocols. Therefore, the protocol will be modified.
2. *Instrument Self-Shading:* The instrument self shading issue has been addressed theoretically, (Gordon and Ding, 1991) but has yet to be verified with observations.
3. *Bio-optical Algorithm Instrumentation Specifications:* One of the Project's concerns is that too few groups have measurement capabilities that even come close to the present protocol requirements. K. Carder and C. Davis presented an approach based on remote sensing reflectance observations which appears promising. A subgroup including J. Mueller (chairman), K. Carder, C. Davis, G. Mitchell, and R. Arnone will address potential problems with the technique and draft a protocol to be submitted at the next protocols working group meeting.
4. *Case 2 Water Protocols:* The current protocols do not address observations in Case 2 waters to a suitable degree. These protocols should include a section on how to measure dissolved organic matter (DOM). A subgroup composed of K. Carder (chairman), C. Yentsch, R. Doerffer, F. Muller-Karger, C. Davis, W. Esaias, A. Weidemann, R. Arnone, and R. Stumpf will prepare a draft protocol document by the next meeting.
5. *Data Quality Control:* The discussion on optical data quality control procedures was augmented to include data analysis techniques. The present protocols discuss some analysis techniques, but further enhancement seems desirable. Analysis topics specifically mentioned were the extrapolation of data to the surface, normalization, optical weighting of pigments, and cloud detection. It was generally agreed that one quality assurance test should be the comparison of downward and upward traverses of a cast. As a result, an analysis round-robin was proposed with J. Mueller (chairman), D. Siegel, C. Davis, A. Weidemann, and G. Mitchell participating. Each investigator will submit profiles of upwelling radiance, etc., which will be distributed to all participants. A set of derived products will be computed from each profile by each participant. The results will be compiled and distributed by August 15.
6. *Aircraft Protocols:* The present protocols do not address aircraft instruments and sampling strategies in much detail. The protocols working group feels that the instrument characterization and calibration protocols should be similar to those for other types of instruments, but should be tailored to the particular instrument and aircraft. A subgroup with C. Davis (chairman), F. Hoge, K. Carder, M. Lewis, and P. Slater was named to draft the protocols. Others who were not in attendence, but who will be approached about participating include P. Abel and T. Vodacek.
7. *Data Formats:* The format guidelines for data submitted to the SeaWiFS Project are provided in Appendix C in, *Proceedings of the First SeaWiFS Science Team Meeting* (Hooker et al. 1993b). No formal discussion on formats was held. Questions and comments should be directed to S. Hooker.
8. *Second Round-Robin:* The next round-robin will be held at CHORS from June 14–25, 1993. The proceedings from the first round-robin are in press as a SeaWiFS TM (Vol. 14) and preprints will be distributed this summer. The first week of the round-robin will be for intercalibrations and definition of near-real time data analysis and archiving procedures among CHORS, GSFC, and the National Institute of Standards and Technology (NIST). NIST will officially deliver the new

SeaWiFS transfer radiometer at that time. Other investigators will participate during the second week.

9. Several small modifications in the present protocols were discussed and will be incorporated into a revision of the protocols.
10. A date for the next meeting was not selected. Ideally, it would be in conjunction with the next bio-optical algorithm working group meeting. However, because that meeting is linked with the MODIS Team meeting, time would be very tight. The protocols working group will need to decide if another meeting this year is necessary. Certainly, much business has been delegated to subgroups and the SeaWiFS Project would expect closure on these topics by this Fall so that a revision of the protocols can be published by the end of the year.

3.4 Invited Colleagues' Addresses

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Cumulative Index

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.

– A –

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– E –

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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 8-year mission. SeaWiFS is expected to be launched in 1994, 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 11 volumes and consists of 6 sections including: an errata, an addendum (a summary of the SeaWiFS Working Group Bio-optical Algorithm and Protocols Subgroups Workshops), an index to keywords 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. This will cover the topics published in all previous editions of the indices, that is, each new index will include all of the information contained in the preceding indices.

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–Z–

Glossary

– A –

ACC Antarctic Circumpolar Current
ACRIM Active Cavity Radiometer Irradiance Monitor
ACS Attitude Control System
A/D Analog-to-Digital
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).
AOCI Airborne Ocean Color Imager
AOL Airborne Oceanographic Lidar
AOP Apparent Optical Property
AOS/LOS Acquisition of Signal/Loss of Signal
ARGOS Not an acronym, 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
AT Along-Track
AVHRR Advanced Very High Resolution Radiometer
AVIRIS Advanced Visible and Infrared Imaging Spectrometer

– B –

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)
BOMS Bio-Optical Moored Systems
bpi bits per inch
BRDF Bidirectional Reflectance Distribution Function
BUV Backscatter Ultraviolet Spectrometer
BWI Baltimore-Washington International (airport)

– C –

CalCoFI California Cooperative Fisheries Institute
Cal/Val Calibration and Validation
CALVAL Calibration/Validation
Case 1 Water whose reflectance is determined solely by absorption.
Case 2 Water whose reflectance is significantly influenced by scattering.
CCPO Center for Coastal Physical Oceanography (Old Dominion University)
CD-ROM Compact Disk-Read Only Memory
CDOM Colored Dissolved Organic Material
CDR Critial Design Review
CHORS Center for Hydro-Optics and Remote Sensing (San Diego State University)
CICESE *Centro de Investigación Científica y de Educación Superior de Ensenada* (Mexico)
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.
CSL Computer Systems Laboratory
CT Cross-Track
CTD Conductivity, Temperature, and Depth
CVT Calibration/Validation Team
CW Continuous Wave
CZCS Coastal Zone Color Scanner

– D –

DAAC Distributed Active Archive Center
DAT Digital Audio Tape
DC Direct Current
DCF Data Capture Facility
DCOM Dissolved Colored Organic Material
DCP Data Collection Platform
DEC Digital Equipment Corporation
DOC Dissolved Organic Carbon
DOM Dissolved Organic Matter
DOS Disk Operating System
DSP Not an acronym, an image display and analysis package developed at RSMAS University of Miami.

– E –

EAFB Edwards Air Force Base
ECMWF European Centre for Medium Range Weather Forecasts
ECT Equator Crossing Time
EEZ Exclusive Economic Zone
EOS Earth Observing Satellite
EOSAT Earth Observation Satellite Company
EOSDIS Earth Observing Satellite Data Information System
ERBE Earth Radiation Budget Experiment
ERBS Earth Radiation Budget Sensor
ER-2 Earth Resources-2
EPA Environmental Protection Agency
ERS Earth Resources Satellite
ESA European Space Agency
EUVE Extreme Ultraviolet Explorer

– F –

FDDI Fiber Data Distribution Interface
FLUPAC (Geochemical) Fluxes in the Pacific (Ocean)
FNOC Fleet Numerical Oceanography Center
FORTRAN Formula Translation (computer language)
FOV Field-of-View
FRD Federal Republic of Deutschland (Germany)
FTP File Transfer Protocol
FWHM Full-Width at Half-Maximum

– G –

GAC Global Area Coverage, coarse resolution satellite data with a nominal ground resolution of approximately 4 km.
GASM General Angle Scattering Meter
GFF Glass Fiber Filter 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 Geosynchronous Orbital Environmental Satellite
GOFS Global Ocean Flux Study
GPM General Perturbations Model
GPS Global Positioning System
GRGS Groupe de Recherche de Geodesie Spatial
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
HeNe Helium-Neon
HOTS Hawaiian Optical Time Series
HP Hewlett Packard
HPLC High Performance Liquid Chromatography
HQ Headquarters
HRPT High Resolution Picture Transmission
HYDRA Hydrographic Data Reduction and Analysis

– I –

IAPSO International Association for the Physical Sciences of the Ocean
IAU International Astrophysical Union
IBM International Business Machines
ICES International Council on Exploration of the Seas
IDL Interface Design Language
IFOV Instantaneous Field-of-View
IMS Information Management System
I/O Input/Output
IOP Inherent Optical Property
IR Infrared
ISCCP International Satellite Cloud Climatology Project
IUE International Ultraviolet Explorer

– J, K –

JAM JYACC Application Manager
JGOFS Joint Global Ocean Flux Study
JOI Joint Oceanographic Institute
JPL Jet Propulsion Laboratory

– L –

LAC Local Area Coverage, fine resolution satellite data with a nominal ground resolution of approximately 1 km.
LANDSAT Land Resources Satellite
LDGO Lamon-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'Environment* (France)
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

– M –

MAREX Marine Resources Experiment Program
MARS Multispectral Airborne Radiometer System
MASSS Multi-Agency Ship-Scheduling for SeaWiFS
MBARI Monterey Bay Aquarium Research Institute
MERIS Medium Resolution Imaging Spectrometer
MEM Maximum Entropy Method
METEOSAT Meteorological Satellite
MF Major Frame
mF Minor Frame
MIPS Millions of Instructions Per Second
MIZ Marginal Ice Zone
MLE Maximum Likelihood Estimator
MLML Moss Landing Marine Laboratory (San Jose State University)
MOBY Marine Optical Buoy
MOCE Marine Optical Characterization Experiment
MODIS Moderate Resolution Imaging Spectrometer
MODIS-N Moderate Resolution Imaging Spectrometer-Nadir
MODIS-T Moderate Resolution Imaging Spectrometer-Tilt
MTF Modulation Transfer Function

– N –

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
NCDS National Climate Data System
NCSA National Center for Supercomputing Applications
NCSU North Carolina State University
NEΔT Noise Equivalent Delta Temperature
NEδL Noise Equivalent delta Radiance
NER Noise Equivalent Radiance
NERC Natural Environment Research Council
NESDIS National Environmental Satellite Data Information Service
NET NIMBUS Experiment Team
NIMBUS Not an acronym, 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
NORAD North American Air Defense (Command)
NOS National Ocean Service
NRA NASA Research Announcement
NRL Naval Research Laboratory
NSCAT NASA Scatterometer
NSF National Science Foundation

– O –

OAM Optically Active Materials
OCEAN Ocean Colour European Archive Network
OCTS Ocean Color Temperature Sensor (Japan)
ODAS Ocean Data Acquisition System
ODU Old Dominion University
OFFI Optical Free-Fall Instrument
OLIPAC Oligotrophy in the Pacific (Ocean)
OMEX Ocean Marine Exchange
ONR Office of Naval Research
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
PI Principal Investigator
PIKE Phased Illuminated Knife Edge
PML Plymouth Marine Laboratory
POC Particulate Organic Carbon
POLDER Polarization Detecting Environmental Radiometer (France)
PON Particulate Organic Nitrogen
PRIME Plankton Reactivity in the Marine Environment
PST Pacific Standard Time
PSU Practical Salinity Units
PUR Photosynthetically Usable Radiation

– Q –

QC Quality Control

– R –

R&A Research and Applications
R&D Research and Development
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)
RSMAS Rosenstiel School for Marine and Atmospheric Sciences (University of Miami)
RTOP Research and Technology Operation Plan

– S –

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
S/C Spacecraft
SCOR Scientific Committee on Oceanographic Research
SDPS SeaWiFS Data Processing System
SDSU San Diego State University
SEAPAK Not an acronym, 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
SIO Scripps Institution of Oceanography
SIS Spherical Integrating Source
SISSR Submerged *In Situ* Spectral Radiometer
SMM Solar Maximum Mission
SNR Signal-to-Noise Ratio
SOC Spacecraft 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
SRC Satellite Receiving Station (NERC)
SST Sea Surface Temperature or SeaWiFS Science Team (depending on usage)
ST Science Team
SUN Sun Microsystems
SWAP Sylter Wattenmeer Austausch-prozesse
SWG Science Working Group

– T –

T-S Temperature-Salinity
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
TOGA Tropical Ocean Global Atmosphere program
TOMS Total Ozone Mapping Spectrometer
TOPEX Topography Experiment
TOVS TIROS Operational Vertical Sounder
TSM Total Suspended Material
TV Thermal Vacuum

– U –

UARS Upper Atmosphere Research Satellite
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
UPS Uninterruptable Power System
URI University of Rhode Island
USC University of Southern California
USF University of South Florida
UVB Ultraviolet-B
UWG User Working Group

–V–

V0 Version 0
V1 Version 1
VAX Virtual Address Extension
VHF Very High Frequency
VI Virtual Instrument
VISLAB Visibility Laboratory (Scripps Institution of Oceanography)
VISNIR Visible and Near Infrared
VMS Virtual Memory System

–W, X, Y, Z–

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

Symbols

– A –

a The semi-major axis of the Earth's orbit or a constant equal to 0.983 (depending on usage).
$a(z,\lambda)$ Spectral absorption coefficient.
a_{ox} Coefficient for oxygen absorption.
a_{oz} Coefficient for ozone absorption.
a_{wv} Coefficient for water vapor absorption.
$A(\lambda)$ Coefficient for calculating $b_b(\lambda)$.
A_i The intersection area.

– B –

$b(z,\lambda)$ 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.
$B(\lambda)$ 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.
$C_{\rm ref}$ Reference chlorophyll value (0.5).

– D –

D Sequential day of the year.
$\vec{D}$ Orbit position difference vector.
$D_{\rm at}$ Along-track position difference.
$D_{\rm ct}$ Cross-track position difference.
$D_{\rm rad}$ Radial position difference.
DC_{10} Digital counts at 10-bit digitization.

– E –

e Orbit eccentricity of the Earth.
$E_a(\lambda)$ Irradiance in air.
$E_{\rm cal}$ Calibration source irradiance.
$E_d(0^-,\lambda)$ Incident spectral irradiance.
$E_d(z,\lambda)$ Downwelled spectral irradiance.
$E_s(\lambda)$ Surface irradiance.
$E_{\rm sky}(\lambda)$ Spectral sky irradiance distribution.
$E_{\rm sun}(\lambda)$ Spectral sun irradiance distribution.
$E_u(z,\lambda)$ Upwelled spectral irradiance.
$E_w(z,\lambda)$ Irradiance in water.

– F –

f-ratio The ratio of new to total production.
F_0 Extraterrestrial irradiance corrected for Earth-sun distance.
$\overline{F}_0$ Mean solar irradiance.
F_0' Extraterrestrial irradiance corrected for the atmosphere.
$\overline{F}_0(\lambda)$ Mean extraterrestrial irradiance.
F_a Forward scattering probability of the aerosol.

– G –

g_1 A constant equal to 0.82.
g_2 A constant equal to −0.55.
G_e Gravitational constant of the Earth (398,600.5 km^3 s^{-2}).

– H –

$H_{\rm GMT}$ GMT in hours.
H_s Altitude of the spacecraft (for SeaStar 705 km).

– I –

i Inclination angle.
i' Inclination angle minus 90°.
I Rayleigh intensity.
I_0 Surface downwelling irradiance.

– J –

$J2$ The $J2$ gravity field term (0.0010863).
$J3$ The $J3$ gravity field term (−0.0000254).
$J4$ The $J4$ gravity field term (−0.0000161).
$J5$ The $J5$ gravity field term.

– K –

$k_c(\lambda)$ Spectral fit coefficient weighted over the SeaWiFS bands; $k_c'(\lambda)$ also used.
$K(z,\lambda)$ Diffuse attenuation coefficient.
$K_0(\lambda)$ Diffuse attenuation coefficient at $z=0$.
$K_c(\lambda)$ 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 –

$L(z,\theta,\phi)$ Submerged upwelled radiance distribution.
L_a Aerosol radiance.
$L_{\rm cal}$ Calibration source radiance.
$L_g(\lambda)$ Sun glint radiance.
$L_{\rm NER}\lambda)$ Noise equivalent radiance.
$L_r(\lambda)$ Rayleigh radiance.
$L_{\rm sat}(\lambda)$ Saturation radiance for the sensor.
$L_{\rm sky}(\lambda)$ Spectral sky radiance distribution.
$L_t(\lambda)$ Total radiance at the sensor.
$L_u(z,\lambda)$ Upwelled spectral radiance.
$L_W(\lambda)$ Water-leaving radiance.
$L_{WN}(\lambda)$ Normalized water-leaving radiance.

– M –

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.
$M_{\rm oz}$ Path length for ozone transmittance.

– N –

n Index of refraction or mean orbital motion in revolutions per day (depending on usage).
$n_w(\lambda)$ Index of refraction of water.
N The total number of something.

– 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_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.
$\vec{P}$ Orbit position vector.
$P(\theta^+)$ Phase function for forward scattering.
$P(\theta^-)$ Phase function for backward scattering.
P_a Probability of scattering to the spacecraft.

– Q –

$Q(\lambda)$ $L_u(0^-, \lambda)$ 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.
r_2 The radius of circle two.
$R(0^-, \lambda)$ Irradiance reflectance just below the sea surface.
R_e Mean Earth radius (6,378.137 km).
$R_L(z, \lambda)$ Spectral reflectance.
R_z Sunspot number.

– S –

$s(\lambda)$ Slope for the range 0–1,023.
S Solar constant.

– T, U –

t Time variable.
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.
$T_s(\lambda)$ 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.
$T_0(\lambda, \theta_0)$ 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.

– 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, Y, Z –

x Abscissa or longitudinal coordinate, or the pixel number within a scan line depending on usage.
y Ordinate or meridional coordinate.

– Greek –

α The power constant in the Ångström formulation.

β A constant in the Ångström formulation.
$\beta(z, \lambda, \theta)$ Spectral volume scattering function.

δ Great circle distance from $\Psi_s(t_0)$ to $\Psi_s(t - t_0)$.
ΔP The difference in successive pixels.
ΔpCO_2 Partial pressure difference of CO_2 between air and sea water.
Δt Time difference.
$\Delta\omega$ 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.
θ_1 The intersection angle of circle one.
θ_2 The intersection angle of circle two.
θ_0 Solar zenith angle.
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.
θ'_s Scan angle of sensor adjusted for tilt.

λ Wavelength of light.

$\overline{\mu}_d(0^+, \lambda)$ Spectral mean cosine for downwelling radiance at the sea surface.

ξ_{EM} The distance between the Earth and the moon.

ρ Weighted direct plus diffuse reflectance.
$\rho(\theta)$ Fresnel reflectance for viewing geometry.
$\rho(\theta_0)$ Fresnel reflectance for solar geometry.
ρ_n Sea surface reflectance for direct irradiance at normal incidence for a flat sea.
ρ_N Reflectance for diffuse irradiance.

σ Standard deviation of a set of data values.

$\tau(z, \lambda)$ Spectral optical depth.
τ_a Aerosol optical thickness.
τ_r Rayleigh optical thickness.
$\tau_s(\lambda)$ Spectral solar atmospheric transmission.

Φ Spacecraft azimuth angle.
Φ_0 Solar azimuth angle.

Ψ Pixel latitude.
Ψ_d Solar declination latitude.
$\Psi_s(t)$ Sub-satellite latitude as a function of time.

ω Longitude variable.

ω_0 Old longitude value.

ω_a Single scattering albedo of the aerosol.

ω_e Equator crossing longitude.

ω_s Longitude variable.

Ω Solar hour angle.

References

– A –

Abbott, M.R., and P.M. Zion, 1985: Satellite observations of phytoplankton variability during an upwelling event. *Cont. Shelf Res.,* **4,** 661–680.

——, and D.B. Chelton, 1991: Advances in passive remote sensing of the ocean. *U. S. National Report to the International Union of Geodesy and Geophysics 1987–1990, Contributions in Oceanography,* Am. Geophys. Union, Washington, DC, 571–589.

Abel, P., G.R. Smith, R.H. Levin, and H. Jacobowitz, 1988: Results from aircraft measurements over White Sands, New Mexico, to calibrate the visible channels of spacecraft instruments. *SPIE,* **924,** 208–214.

——, B. Guenther, R. Galimore, and J. Cooper, 1993: Calibration results for NOAA-11 AVHRR channels 1 and 2 from congruent aircraft observations. *J. Atmos. and Ocean. Technol.,* **10,** 493–508.

Arking, A., and J.D. Childs, 1985: Retrieval of cloud cover parameters from multispectral satellite images. *J. Climate Appl. Meteor.,* **24,** 322–333.

Austin, R.W., 1974: The remote sensing of spectral radiance from below the ocean surface. *Optical Aspects of Oceanography,* N.G. Jerlov and E. Steemann-Nielsen, Eds., Academic Press, 317–344.

——, 1976: Air-Water Radiance Calibration Factor. *Tech. Memo. ML-76-004t,* Vis. Lab., Scripps Inst. of Oceanogr., La Jolla, California, 8 pp.

——, 1980: Gulf of Mexico, ocean-color surface-truth measurements. *Bound.-Layer Meteor.,* **18,** 269–285.

——, and G. Halikas, 1976: The index of refraction of seawater. *SIO Ref. 76-1,* Vis. Lab., Scripps Inst. of Oceanogr., La Jolla, California, 64 pp.

——, and T.J. Petzold, 1981: The determination of diffuse attenuation coefficient of sea water using the Coastal Zone Color Scanner. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 239–256.

– B –

Baker, K.S., and R.C. Smith, 1982: Bio-optical classification and model of natural waters, 2. *Limnol. Oceanogr.,* **27,** 500–509.

——, and ——, 1990: Irradiance transmittance through the air/water interface. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302,** 556–565.

Balch, W.M., R. Evans, J. Brown, G. Feldman, C. McClain, and W. Esaias, 1992: The remote sensing of ocean primary productivity–use of a new data compilation to test satellite algorithms. *J. Geophys. Res.,* **97,** 2,279–2,293.

Ball Aerospace Systems Division, 1979: Development of the Coastal Zone Color Scanner for Nimbus-7, Test and Performance Data. *Final Report F78-11, Rev. A, Vol. 2,* Boulder, Colorado, 94 pp.

Barale, V., C.R. McClain, and P. Malanotte-Rizzoli, 1986: Space and time variability of the surface color field in the northern Adriatic Sea. *J. Geophys. Res.,* **91,** 12,957–12,974.

——, and R. Wittenburg-Fay, 1986: Variability of the ocean surface color field in central California near-coastal waters as observed in seasonal analysis of CZCS imagery. *J. Mar. Res.,* **44,** 291–316.

Berger, W.H., 1989: *Productivity of the Ocean: Present and Past.* V.S. Smetacek and G. Wefer, Eds., John Wiley & Sons, 471 pp.

Bernstein, R.L., 1982: Sea surface temperature estimation using the NOAA-6 satellite Advanced Very High Resolution Radiometer. *J. Geophys. Res.,* **87,** 9,455–9,465.

Bird, R.E., and C. Riordan, 1986: Simple solar spectral model for direct and diffuse irradiance on horizontal and tilted planes at the Earth's surface for cloudless atmospheres. *J. of Climate and Appl. Meteor.,* **25,** 87–97.

Booth, C.R.B. and R.C. Smith, 1988: Moorable spectroradiometer in the Biowatt Experiment. *Ocean Optics IX,* SPIE **925,** 176–188.

Boyd, R.A., 1951: The development of prismatic glass block and the daylight laboratory. *Eng. Res. Bull. No. 32,* Eng. Res. Inst., Univ. of Mich., 88 pp.

Bricaud, A., A. Morel, and L. Prieur, 1981: Absorption by dissolved organic matter of the sea (yellow substance) in the UV and visible domains. *Limnol. Oceanogr.,* **26,** 43–53.

Brock, J.C., C.R. McClain, M.E. Luther, and W.W. Hay, 1991: The phytoplankton bloom in the northwest Arabian Sea during the southwest monsoon of 1979. *J. Geophys. Res.,* **96,** 20,623–20,642.

——, and ——, 1992: Interannual variability in phytoplankton blooms observed in the northwestern Arabian Sea during the southwest monsoon. *J. Geophys. Res.,* **97,** 733–750.

Brouwer, D., 1959: Solution of the problem of artificial satellite theory without drag. *Astron. J.,* **64**(1274), 378–397.

Brown, O.B., and R.H. Evans, 1985: Calibration of Advanced Very High Resolution Radiometer infrared observations. *J. Geophys. Res.,* **90,** 11,667–11,677.

Burlov-Vasiljev, K.A., E.A. Gurtovenko, and Y.B. Matvejev, 1992: The Solar Radiation Between 310–680 nm. *Proceedings of the Workshop on the Solar Electromagnetic Radiation Study for Solar Cycle 22,* R.E. Donnelly, Ed., U.S. DOC NOAA Environmental Research Laboratory, Boulder, Colorado, 49–53.

– C –

Campbell, J.W., and J.E. O'Reilly, 1988: Role of satellites in estimating primary productivity on the northwest Atlantic continental shelf. *Cont. Shelf Res.,* **8,** 179–204.

Capellari, J.O., C.E. Velez, and A.J. Fuchs, 1976: Mathematical Theory of the Goddard Trajectory Determination System. *GSFC X-582-76-77,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 596 pp.

Carder, K.L., G.R. Harvey, R.G. Steward, and P.B. Ortner, 1989: Marine humic and fulvic acids: their effects on remote sensing of ocean chlorophyll. *Limnol. Oceanogr.,* **34,** 68–81.

Cebula, R.P., H. Park, and D.F. Heath, 1988: Characterization of the Nimbus-7 SBUV radiometer for the long term monitoring of stratospheric ozone. *J. Atmos. Ocean. Technol.*, **5,** 215–227.

Chin, R.T., C. Jau, and J.A. Weinman, 1987: The application of time series models to cloud field morphology analysis. *J. Climate Appl. Meteor.*, **26,** 363-373.

Clark, D.K., 1981: Phytoplankton algorithms for the Nimbus-7 CZCS. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 227–238.

——, E.T. Baker, and A.E. Strong, 1980: Upwelled spectral radiance distributions in relation to particulate matter in sea water. *Bound.-Layer Meteor.*, **18,** 287-298.

Coakley, J.A., Jr., and F.P. Bretherton, 1982: Cloud cover from high resolution scanner data: Detecting and allowing for partially filled fields of view. *J. Geophys. Res.*, **87,** 4,917–4,932.

Comiso, J.C., N.G. Maynard, W.O. Smith, Jr., and C.W. Sullivan, 1990: Satellite ocean color studies of Antarctic ice edges in summer and autumn. *J. Geophys. Res.*, **95,** 9,481–9,496.

Cox, C., and W. Munk, 1954: Measurement of the roughness of the sea surface from photographs of the sun's glitter. *J. Mar. Res.*, **44,** 838–850.

Crane, R.J., and M.R. Anderson, 1984: Satellite discrimination of snow/cloud surfaces. *Int. J. Remote Sens.*, **5,** 213–223.

– D –

Darzi, M., 1992: Cloud Screening for Polar Orbiting Visible and IR Satellite Sensors. *NASA Tech. Memo. 104566, Vol. 7,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 7 pp.

Denman, K.L., and M.R. Abbott, 1988: Time evolution of surface chlorophyll patterns from cross spectrum analysis of satellite color images. *J. Geophys. Res.*, **93,** 6,789–6,798.

Detwiler, A., 1990: Analysis of cloud imagery using box counting. *Int. J. Remote Sens.*, **11,** 887–898.

Deuser, W.G., F.E. Muller-Karger, and C. Hemleben, 1988: Temporal variations of particle fluxes in the deep subtropical and tropical North Atlantic: Eulerian versus Lagrangian effects. *J. Geophys. Res.*, **93,** 6,857–6,862.

——, ——, R.H. Evans, O.B. Brown, W.E. Esaias, and G.C. Feldman, 1990: Surface-ocean color and deep-sea carbon flux: how close a connection? *Deep-Sea Res.*, **37,** 1,331–1,343.

Dickey, T., J. Marra, T. Granata, C. Langdon, M. Hamilton, J. Wiggert, D. Siegel, and A. Bratkovich, 1991: Concurrent high-resolution bio-optical and physical time series observations in the Sargasso Sea during the spring of 1987. *J. Geophys. Res.*, **96,** 8,643–8,663.

Duffett-Smith, P., 1979: *Practical Astronomy With Your Calculator.* Cambridge University Press, 129 pp.

– E –

Ebert, E.E., 1992: Pattern recognition analysis of polar clouds during summer and winter. *Int. J. Remote Sens.*, **13,** 97–109.

Eck, T.F., and V.L. Kalb, 1991: Cloud-screening for Africa using a geographically and seasonally variable infrared threshold. *Int. J. Remote Sens.*, **12,** 1,205–1,221.

Eckstein, B.A., and J.J. Simpson, 1991: Cloud screening Coastal Zone Color Scanner images using channel 5. *Int. J. Remote Sens.*, **12,** 2,359–2,377.

England, C.F., and G.E. Hunt, 1985: A bispectral method for the automatic determination of parameters for use in imaging satellite cloud retrievals. *Int. J. Remote Sens.*, **6,** 1,545–1,553.

Eppley, R.W., 1984: Relations between primary productivity and ocean chlorophyll determined by satellites. *Global Ocean Flux Study: Proceedings of a Workshop,* National Academy Press, Washington, DC, 85–102.

Esaias, W., G. Feldman, C.R. McClain, and J. Elrod, 1986: Satellite observations of oceanic primary productivity. *Eos, Trans. AGU,* **67,** 835–837.

– F –

Feldman, G., 1986: Variability of the productive habitat in the eastern equatorial Pacific. *Eos, Trans. AGU,* **67,** 106–108.

——, D. Clark, and D. Halpern, 1984: Satellite color observations of the phytoplankton distribution in the eastern equatorial Pacific during the 1982–1983 El Niño. *Science,* **226,** 1,069–1,071.

——, N. Kuring, C. Ng, W. Esaias, C. McClain, J. Elrod, N. Maynard, D. Endres, R. Evans, J. Brown, S. Walsh, M. Carle, and G. Podesta, 1989: Ocean Color: Availability of the global data set. *Eos, Trans. AGU,* **70,** 634.

Firestone, E.R., and S.B. Hooker 1992: SeaWiFS Technical Report Series Cumulative Index: Volumes 1–5. *NASA Tech. Memo. 104566, Vol. 6,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 9 pp.

Fofonoff, N.P., and R.C. Millard, Jr., 1983: Algorithms for Computation of Fundamental Properties of Seawater. *UNESCO Tech. Papers in Mar. Sci.*, **44,** UNESCO, 53 pp.

Frederick, J.E., R.P. Cebula, and D.F. Heath, 1986: Instrument characterization for detection of long-term changes in stratospheric ozone: An analysis of the SBUV/2 radiometer. *J. Atmos. Ocean. Technol.*, **3,** 472–480.

Frohlich, C., 1979: WMO/PMOD Sunphotometer: Instructions for Manufacture. *World Meteor. Org.*, Geneva, 3 pp (plus tables and drawings).

– G –

Gallaudet, T.C., and J.J. Simpson, 1991: Automated cloud screening of AVHRR imagery using split-and-merge clustering. *Remote Sens. Environ.*, **38,** 77–121.

Garand, L., 1986: *Automated Recognition of Oceanic Cloud Patterns and Its Application to Remote Sensing of Meteorological Parameters.* Doctoral dissertation, Dept. of Meteorology, Univ. of Wisconsin-Madison.

General Sciences Corp., 1991: SeaWiFS Science Data and Information System Architecture Report. *GSC-TR-21-91-006,* General Sciences Corp., Laurel, Maryland, 133 pp.

Gieskes, W.W.C., and G.W. Kraay, 1986: Analysis of phytoplankton pigments by HPLC before, during, and after mass occurrence of the microflagellate corymbellus during the spring bloom in the open north North Sea in 1983. *Mar. Biol.*, **92**, 45–52.

Gordon, H.R., 1981: Reduction of error introduced in the processing of coastal zone color scanner-type imagery resulting from sensor calibration and solar irradiance uncertainty. *Appl. Opt.*, **20**, 207–210.

——, 1985: Ship perturbations of irradiance measurements at sea, 1: Monte Carlo simulations. *Appl. Opt.*, **24**, 4,172–4,182.

——, 1987a: Calibration requirements and methodology for remote sensors viewing the ocean in the visible. *Remote Sens. Environ.*, **22**, 103–126.

——, 1987b: Visible calibration of ocean-viewing sensors. *Remote Sens. of Environ.*, **22**, 103–126.

——, 1988: Ocean color remote sensing systems: radiometric requirements. *Recent Advances in Sensors, Radiometry, and Data Processing for Remote Sensing,* P.N. Slater, Ed., SPIE, **924**, 151–167.

——, 1989: Can the Lambert-Beer law be applied to the diffuse attenuation coefficient of ocean water? *Limnol. Oceanogr.*, **34**, 1,389–1,409.

——, 1990: Radiometric considerations for ocean color remote sensors. *Appl. Opt.*, **29**, 3,228–3,236.

——, 1991: Absorption and scattering estimates from irradiance measurements: Monte Carlo simulations. *Limnol. Oceanogr.*, **36**, 769–777.

——, and D.K. Clark, 1980: Remote sensing optical properties of a stratified ocean: an improved interpretation. *Appl. Opt.*, **19**, 3,428–3,430.

——, ——, J.L. Mueller, and W.A. Hovis, 1980: Phytoplankton pigments from the Nimbus-7 Coastal Zone Color Scanner: Comparisons with surface measurements. *Science,* **210**, 63–66.

——, and D.K. Clark, 1981: Clear water radiances for atmospheric correction of coastal zone color scanner imagery. *Appl. Opt.*, **20**, 4,175–4,180.

——, ——, J.W. Brown, O.B. Brown, and R.H. Evans, 1982: Satellite measurements of phytoplankton pigment concentration in the surface waters of a warm core Gulf Stream ring. *J. Mar. Res.*, **40**, 491–502.

——, ——, ——, ——, ——, and W.W. Broenkow, 1983a: Phytoplankton pigment concentrations in the Middle Atlantic Bight: Comparison of ship determinations and CZCS estimates. *Appl. Opt.*, **22**, 20–36.

——, J.W. Brown, O.B. Brown, R.H. Evans, and D.K. Clark, 1983b: Nimbus 7 CZCS: reduction of its radiometric sensitivity with time. *Appl. Opt.*, **24**, 3,929–3,931.

——, and D.J. Castaño, 1987: Coastal Zone Color Scanner atmospheric correction algorithm: multiple scattering effects. *Appl. Opt.*, **26**, 2,111–2,122.

——, O.B. Brown, R.H. Evans, J.W. Brown, R.C. Smith, K.S. Baker, and D.K. Clark, 1988a. A semianalytic radiance model of ocean color. *J. of Geophys. Res.*, **93**, 10,909–10,924.

——, J.W. Brown, and R.H. Evans, 1988b: Exact Rayleigh scattering calculations for use with the Nimbus-7 Coastal Zone Color Scanner. *Appl. Opt., 27,* **5**, 862–871.

——, and D.J. Castaño, 1989: Aerosol analysis with Coastal Zone Color Scanner: A simple method for including multiple scattering effects. *Appl. Opt.*, **28**, 1,320–1,326.

——, and K. Ding, 1991: Self shading of in-water optical instruments. *Limnol. Oceanogr.*, **37**, 491–500.

Gower, J.F.R, 1985: Reduction of the effect of clouds on satellite thermal imagery. *Int. J. Remote Sens.*, **6**, 1,419–1,434.

Gregg, W.W., 1992: Analysis of Orbit Selection for SeaWiFS: Ascending vs. Descending Node. *NASA Tech. Memo. 104566, Vol. 2,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

——, 1993: The Simulated SeaWiFS Data Set, Version 1. *NASA Tech. Memo. 104566, Vol. 9,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 17 pp.

——, and K.L. Carder, 1990: A simple spectral solar irradiance model for cloudless maritime atmospheres. *Limnol. Oceanogr.*, **35**, 1,657–1,675.

Groom, S.B., and P.M. Holligan, 1987: Remote sensing of coccolithophorid blooms. *Adv. Space Res.*, **7**, 73–78.

Guenther, B., 1991: Accuracy and precisions actually achieved for large aperture sources for aircraft and space investigations. *Metrologia,* **28**, 229–232.

Gutman, G., D. Tarpley, and G. Ohring, 1987: Cloud screening for determination of land surface characteristics in a reduced resolution satellite data set. *Int. J. Remote Sens.*, **8**, 859–870.

– H –

Haury, L.R., J.J. Simpson, J. Pelaez, C. Koblinsky, and D. Wiesenhahn, 1986: Biological consequences of a recurrent eddy off Point Conception, California. *J. Geophys. Res.*, **91**, 12,937–12,956.

Hay, B.J., C.R. McClain, and M. Petzold, 1993: An assessment of the NIMBUS-7 CZCS calibration for May 1986 using satellite and *in situ* data from the Arabian Sea. *Remote Sens. Environ.*, **43**, 35–46.

Helliwell, W.S., G.N. Sullivan, B. MacDonald, and K.J. Voss, 1990: Ship shadowing: model and data comparison. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302**, 55–71.

Herman, J.R., R.D. Hudson, and G.N. Serafino, 1990: An analysis of the 8 year trend in ozone depletion from alternate models of SBUV instrument degradation. *J. Geophys. Res.*, **95**, 7,403–7,416.

Holm-Hansen, O., C.J. Lorenzen, R.W. Holmes, and J.D.H. Strickland, 1965: Fluorometric determination of chlorophyll. *J. du Cons. Int'l. pour l'Explor. de la Mer,* **30**, 3–15.

Hooker, S.B., P.L. Coronado, W.E. Esaias, G.C. Feldman, W.W. Gregg, C.R. McClain, B.W. Meeson, L.M. Olsen, R.A. Barnes, and E.F. Del-Colle, 1992a: *Baselines and Background Documentation,* SeaWiFS Science Team Meeting, January, 1993, Volume 1, S.B. Hooker and W.E. Esaias, Eds., SeaWiFS Proj. Office, NASA Goddard Space Flight Center, Greenbelt, Maryland, 244 pp.

——, W.E. Esaias, G.C. Feldman, W.W. Gregg, and C.R. McClain, 1992b: An Overview of SeaWiFS and Ocean Color. *NASA Tech. Memo. 104566, Vol. 1,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 24 pp., plus color plates.

——, W.L. Barnes W.E. Esaias, G.C. Feldman, W.W. Gregg, R.G. Kirk, C.R. McClain, C.H. Vermillion, D.J. Zukor, R.A. Barnes, 1993a: *SeaWiFS Project Presentations,* SeaWiFS Science Team Meeting, January, 1993, Volume 2. S.B. Hooker and W.E. Esaias, Eds., SeaWiFS Proj. Office, NASA Goddard Space Flight Center, Greenbelt, Maryland, 235 pp.

——, W.E. Esaias, and L.A. Rexrode, 1993b: Proceedings of the First SeaWiFS Science Team Meeting. *NASA Tech. Memo. 104566, Vol. 8,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 61 pp.

Hoots, F.R., and R.L. Roehrich, 1980: Models for Propagation of NORAD Element Sets. *Project Spacetrack Report No. 3,* 100 pp.

Hovis, W.A., 1981: The Nimbus-7 Coastal Zone Color Scanner (CZCS) program. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 213–225.

——, D.K. Clark, F. Anderson, R.W. Austin, W.H. Wilson, E.T. Baker, D. Ball, H.R. Gordon, J.L. Mueller, S. El-Sayed, B. Sturm, R.C. Wrigley, and C.S. Yentsch, 1980: Nimbus-7 Coastal Zone Color Scanner: System description and initial imagery. *Science,* **210,** 60–63.

——, J.S. Knoll, and G.R. Smith, 1985: Aircraft measurements for calibration of an orbiting spacecraft sensor. *Appl. Opt.* **24,** 407–410.

– I –

Iqbal, M., 1983: *An Introduction to Solar Radiation.* Academic Press, 390 pp.

Ishizaka, J., 1990a: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 1. CZCS data description and Lagrangian particle tracing experiments. *J. Geophys. Res.,* **95,** 10,167–10,181.

——, 1990b: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 2. an Eulerian model. *J. Geophys. Res.,* **95,** 10,183–10,199.

——, 1990c: Coupling of Coastal Zone Color Scanner data to physical-biological model of the southeastern U.S. continental shelf ecosystem, 3. nutrient and phytoplankton fluxes and CZCS data assimilation. *J. Geophys. Res.,* **95,** 10,201–10,212.

– J –

Jerlov, N.G., 1976: *Marine Optics,* Elsevier Scientific Publishing Co., 231 pp.

Joint EOSAT–NASA SeaWiFS Working Group, 1987: System concept for wide-field-of-view observations of ocean phenomena from space. *Report of the Joint EOSAT/NASA SeaWiFS Working Group,* Earth Observation Satellite Co., Lanham, Maryland, 92 pp.

Joint Global Ocean Flux Study, 1991: JGOFS Core Measurements Protocols. *JGOFS Report No. 6,* Scientific Committee on Oceanic Research, 40 pp.

Joseph, J.H., 1985: The morphology of fair weather cumulus cloud fields as remotely sensed from satellites and some applications. *Adv. Space Res.,* **5,** 213–216.

Justice, J.O., B.L. Markham, J.R.G. Townshend, and R.L. Kennard, 1989: Spatial degradation of satellite data. *Int. J. Remote Sens.,* **10,** 1,539–1,561.

Justus, C.G., and M.V. Paris, 1985: A model for solar spectral irradiance and radiance at the bottom and top of a cloudless atmosphere, *J. Climate Appl. Meteor.,* **24,** 193–205.

– K –

Kasten, F., 1966: A new table and approximate formula for relative optical air mass. *Geophys. Biokimatol.,* **B14,** 206–223.

Kaufman, Y.J., 1987: The effect of subpixel clouds on remote sensing. *Int. J. Remote Sens.,* **8,** 839–857.

Kelly, K.A., 1985: Separating clouds from ocean in infrared images. *Remote Sensing Environ.,* **17,** 67–83.

Key, J.R., and R.G. Barry, 1989: Cloud cover analysis with Arctic AVHRR data. 1. Cloud detection. *J. Geophys. Res.,* **94,** 18,521–18,535.

——, J.A. Maslanik, and R.G. Barry, 1989: Cloud classification from satellite data using a fuzzy sets algorithm: A polar example. *Int. J. Remote Sens.,* **10,** 1,823–1,842.

Kidwell, K.B., 1991: NOAA Polar Orbiter User's Guide. NOAA NESDIS, Washington D.C., 279 pp.

King, M.D., Y.J. Kaufman, W.P. Menzel, and D. Tanre, 1992: Remote sensing of cloud, aerosol, and water vapor properties from the Moderate Resolution Imaging Spectrometer (MODIS). *IEEE Trans. Geosci. Remote Sens.,* **30,** 2–27.

Kohler, R., R. Pello, and J. Bonhoure, 1990: Temperature dependent nonlinearity effects of a QED-200 detector in the visible. *Appl. Opt.,* **29,** 4,212–4,215.

Kuring, N., M.R. Lewis, T. Platt, and J.E. O'Reilly, 1990: Satellite-derived estimates of primary production on the northwest Atlantic continental shelf. *Cont. Shelf Res.,* **10,** 461–484.

– L –

Lyddane, R.H., 1963: Small eccentricities or inclinations in the Brouwer theory of the artificial satellite. *Astron. J.,* **68,** 555–558.

– M –

Mantoura, R.F.C., and C.A. Llewellyn, 1983: The rapid determination of algal chlorophyll and carotenoid pigments and their breakdown products in natural waters by reverse-phase high-performance liquid chromatography. *Anal. Chim. Acta,* **151,** 297–314.

Marshall, B.R., and R.C. Smith, 1990: Raman scattering and in-water optical properties. *Appl. Opt.,* **29,** 71–84.

McClain, C.R., and L.P. Atkinson, 1985: A note on the Charleston Gyre. *J. Geophys. Res.,* **90,** 11,857–11,861.

——, S.-Y. Chao, L. Atkinson, J. Blanton, and F. de Castillejo, 1986: Wind-driven upwelling in the vicinity of Cape Finisterre, Spain. *J. Geophys. Res.,* **91,** 8,470–8,486.

——, J.A. Yoder, L.P. Atkinson, J.O. Blanton, T.N. Lee, J.J. Singer, and F. Muller-Karger, 1988: Variability of Surface Pigment Concentrations in the South Atlantic Bight. *J. Geophys. Res.,* **93,** 10,675–10,697.

——, J. Ishizaka, and E. Hofmann, 1990a: Estimation of phytoplankton pigment changes on the Southeastern U.S. continental shelf from a sequence of CZCS images and a coupled physical-biological model. *J. Geophys. Res.,* **95,** 20,213–20,235.

——, W.E. Esaias, G.C. Feldman, J. Elrod, D. Endres, J. Firestone, M. Darzi, R. Evans, and J. Brown, 1990b: Physical and biological processes in the North Atlantic during the First Global GARP Experiment. *J. Geophys. Res.,* **95,** 18,027–18,048.

——, M. Darzi, J. Firestone, E.-n. Yeh, G. Fu, and D. Endres, 1991a: SEAPAK Users Guide, Version 2.0, Vol. I—System Description. *NASA Tech. Mem. 100728,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 158 pp.

——, ——, ——, ——, ——, and ——, 1991b: SEAPAK Users Guide, Version 2.0, Vol. II—Descriptions of Programs. *NASA Tech. Mem. 100728,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 586 pp.

——, W.E. Esaias, W. Barnes, B. Guenther, D. Endres, S.B. Hooker, G. Mitchell, and R. Barnes, 1992a: Calibration and Validation Plan for SeaWiFS. *NASA Tech. Memo. 104566, Vol. 3,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 41 pp.

——, G. Fu., M. Darzi, and J.K. Firestone, 1992b: PC-SEAPAK User's Guide, Version 4.0. *NASA Technical Memorandum 104557,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 408 pp.

——, E-n. Yeh, and G. Fu, 1992c: An Analysis of GAC Sampling Algorithms: A Case Study. *NASA Tech. Memo. 104566, Vol. 4,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 20 pp., plus color plates.

——, G. Feldman, and W. Esaias, 1993: Oceanic primary production. *Global Change Atlas,* C. Parkinson, J. Foster, and R. Gurney, Eds., Cambridge University Press, (in press).

McClain, E.P., 1989: Global sea surface temperatures and cloud clearing for aerosol optical depth estimates. *Int. J. Remote Sens.,* **10,** 763–769.

——, W.G. Pichel, and C.C. Walton, 1985: Comparative performance of AVHRR-based multichannel sea surface temperatures. *J. Geophys. Res.,* **90,** 11,587–11,601.

McLean, J.T., and B.W. Guenther, 1989: Radiance calibration of spherical integrators. *Optical Radiation Measurements II,* SPIE, **1109,** 114–121.

Mecherikunnel, A.T., and H.L. Kyle, 1991: Eleven-year cycle of solar constant variation from spacecraft measurements: 1978 to 1990. *Science,* (withdrawn).

Michaelsen, J., X. Zhang, and R.C. Smith, 1988: Variability of pigment biomass in the California Current system as determined by satellite imagery, 2. temporal variability. *J. Geophys. Res.,* **93,** 10,883–10,896.

Mitchell, B.G., 1990: Algorithms for determining the absorption coefficient for aquatic particulates using the quantitative filter technique. *Ocean Optics X,* R.W. Spinrad, Ed., SPIE, **1302,** 137–148.

——, and D.A. Kiefer, 1984: Determination of absorption and fluorescence excitation spectra for phytoplankton. *Marine Phytoplankton and Productivity,* O. Holm-Hansen, L. Bolis, and R. Gilles, Eds., Springer-Verlag, 157–169.

——, and ——, 1988: Chlorophyll–*a* specific absorption and fluorescence excitation spectra for light-limited phytoplankton. *Deep-Sea Res.,* **35,** 639–663.

——, and O. Holm-Hansen, 1991: Bio-optical properties of Antarctic Peninsula waters: differentiation from temperate ocean models. *Deep-Sea Res.,* **39,** 1,009–1,028.

Morel, A., 1980: In-water and remote measurements of ocean color. *Bound.-layer Meteor.,* **18,** 178–201.

——, and L. Prieur, 1977: Analysis of variations in ocean color. *Limnol. Oceanogr.,* **22,** 709–722.

——, and R.C. Smith, 1982: Terminology and units in optical oceanography. *Mar. Geod.,* **5,** 335–349.

Mueller, J.L., 1985: Nimbus-7 CZCS: confirmation of its radiometric sensitivity decay rate through 1982. *Appl. Opt.,* **24,** 1,043–1,047.

——, 1988: Nimbus-7 CZCS: electronic overshoot due to cloud reflectance. *Appl. Opt.,* **27,** 438–440.

——, 1991: Integral Method for Irradiance Profile Analysis. *CHORS Tech. Memo. 007-91,* San Diego State Univ., 10 pp.

——, and R.E. Lang, 1989: Bio-optical provinces of the northeast Pacific Ocean: a provisional analysis. *Limnol. Oceanogr.,* **34,** 1,572–1,586.

——, and R.W. Austin, 1992: Ocean Optics Protocols. *NASA Tech. Memo. 104566, Vol. 5,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 45 pp.

Muller-Karger, F., C.R. McClain, and P. Richardson, 1988: The dispersal of the Amazon water. *Nature,* **333,** 56–59.

——, ——, T.R. Fisher, W.E. Esaias, and R. Varela, 1989: Pigment distribution in the Caribbean Sea: Observations from space. *Prog. Oceanogr.,* **23,** 23–64.

——, ——, R.N. Sambrotto, and G.C. Ray, 1990: A comparison of ship and CZCS-mapped distributions of phytoplankton in the Southeastern Bering Sea. *J. Geophys. Res.,* **95,** 11,483–11,499.

——, J.J. Walsh, R.H. Evans, and M.B. Meyers, 1991: On the seasonal phytoplankton concentration and sea surface temperature cycles of the Gulf of Mexico as determined by satellites. *J. Geophys. Res.,* **96,** 12,645–12,665.

– N –

National Academy of Sciences, 1984: *Global Ocean Flux Study, Proceedings of a Workshop,* National Acad. Press, 360 pp.

National Aeronautics and Space Administration, 1982: The marine resources experiment program (MAREX). *Report* *of the Ocean Color Science Working Group,* NASA Goddard Space Flight Center, Greenbelt, MD, 107 pp.

Neckel, H., and D. Labs, 1984: The solar radiation between 3300 and 12500 Å. *Sol. Phys.,* **90,** 205–258.

– O –

Olesen, F.-S., and H. Grassel, 1985: Cloud detection and classification over the oceans at night with NOAA-7. *Int. J. Remote Sens.,* **6,** 1,435–1,444.

– P, Q –

Palmer, J.M., 1988: Use of self-calibrated detectors in radiometric instruments. *Recent Advances in Sensors, Radiometry, and Data Processing for Remote Sensing.* P.N. Slater, Ed., SPIE, **924,** 224–231.

Paltridge, G.W., and C.M.R. Platt, 1976: Radiative processes in meteorology and climatology. *Developments in Atmospheric Science, Vol. 5.* Elsevier Scientific Publishing Co., 318 pp.

Parikh, J.A., 1977: A comparative study of cloud classification techniques. *Remote Sens. Environ.,* **6,** 67–81.

Patt, F.S., C.W. Hoisington, W.W. Gregg, and P.L. Coronado, 1993: Analysis of Selected Orbit Propagation Models for the SeaWiFS Mission. *NASA Tech. Memo. 104566, Vol. 11,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 16 pp.

Petzold, T.J., 1988: A Method for Obtaining Analytical Curve Fits to Underwater Radiometric Measurements. *Tech. Memo. Oc Op/TJP-88-06t,* Scripps Inst. of Oceanogr., La Jolla, California, 20 pp.

——, and R.W. Austin, 1988: Characterization of MER-1032. *Tech. Memo. EV-001-88t,* Vis. Lab., Scripps Inst. of Oceanogr., La Jolla, California, 56 pp.

Pinder, G.F., and W.G. Gray, 1977: *Finite Element Simulation in Surface and Subsurface Hydrology.* Academic Press, 295 pp.

Phulpin, T., M. Derrien, and A. Brard, 1983: A two-dimensional histogram procedure to analyze cloud cover from NOAA satellite high-resolution imagery. *J. Climate Appl. Meteor.,* **22** 1,332–1,345.

Platt, T., and S. Sathyendranath, 1988: Oceanic primary production: estimation by remote sensing at local and regional scales. *Science,* **241,** 1,613–1,620.

——, ——, C.M. Caverhill, and M.R. Lewis, 1988: Ocean primary production and available light: further algorithms for remote sensing. *Deep-Sea Res.,* **35,** 855–879.

– R –

Raschke, E., P. Bauer, and H.J. Lutz, 1992: Remote sensing of clouds and surface radiation budget over polar regions. *Int. J. Remote Sens.,* **13,** 13–22.

Reynolds, D.W., and T.H. Vonder Haar, 1977: A bispectral method for cloud parameter determination. *Mon. Wea. Rev.,* **105,** 446–457.

Reynolds, R.W., 1988: A real-time global sea surface temperature analysis. *J. Climate,* **1,** 75–86.

Rossow, W.B., L.C. Garder, and A.A. Lacis, 1989: Global, seasonal cloud variations from satellite radiance measurements. Part I: Sensitivity of analysis. *J. Climate,* **2,** 419–458.

——, L.C. Garder, P.-J. Lu, and A. Walker, 1988: International Satellite Cloud Climatology Project (ISCCP) Documentation of Cloud Data. *WMO/TD-No. 266,* World Meteor. Org., Geneva.

——, and R.A. Schiffer, 1991: ISCCP cloud data products. *Bull. Am. Meteor. Soc.,* **72,** 2–20.

– S –

Saunders, R.W., 1986: An automated scheme for the removal of cloud contamination for AVHRR radiances over western Europe. *Int. J. Remote Sens.,* **7,** 867–888.

——, 1989: A comparison of satellite-retrieved parameters with mesoscale model results. *Quart. J. Roy. Meteor. Soc.,* **115,** 551–572.

——, and K.T. Kriebel, 1988: An improved method for detecting clear sky and cloudy radiances from AVHRR data. *Int. J. Remote Sens.,* **9,** 123–150, *Errata,* ibid., **9,** 1,393–1,394.

Shaw, G.E., 1976: Error analysis of multiwavelength sun photometry. *Pure Appl. Geophys.,* **114,** 1–14.

Simpson, J.J., and C. Humphrey, 1990: An automated cloud screening algorithm for daytime Advanced Very High Resolution Radiometer imagery. *J. Geophys. Res.,* **95,** 13,459–13,481.

Smith, R.C., and K.S. Baker, 1981: Optical properties of the clearest natural waters (200–800 nm). *Appl. Opt.,* **20,** 177–184.

——, ——, and P. Dustan, 1981: Fluorometric techniques for the measurement of oceanic chlorophyll in the support of remote sensing. *SIO Ref. 81-17,* Scripps Inst. of Oceanogr., La Jolla, California 14 pp.

——, and W.H. Wilson, 1981: Ship and satellite bio-optical research in the California Bight. *Oceanography from Space,* J.F.R. Gower, Ed., Plenum Press, 281–294.

——, and K.S. Baker, 1984: Analysis of ocean optical data. *Ocean Optics VII,* M. Blizard, Ed., SPIE **478,** 119–126.

——, and ——, 1986: Analysis of ocean optical data. *Ocean Optics VIII,* P.N. Slater, Ed., SPIE, **637,** 95–107.

——, X. Zhang, and J. Michaelsen, 1988: Variability of pigment biomass in the California Current system as determined by satellite imagery, 1. Spatial variability. *J. Geophys. Res.,* **93,** 10,863–10,882.

——, K.J. Waters, and K.S. Baker, 1991: Optical variability and pigment biomass in the Sargasso Sea as determined using deep-sea optical mooring data. *J. Geophys. Res.,* **96,** 8,665–8,686.

Smith, S.L., W. Balch, K. Banse, W. Berelson, P. Brewer, O. Brown, K. Cochran, H. Livingston, M. Luther, C. McClain, D. Olson, L. Peterson, W. Peterson, W. Prell, L. Codispoti, A. Devol, H. Ducklow, R. Fine, G. Hitchcock, D. Lal, D. Repeta, E. Sherr, N. Surgi, J. Swallow, S. Wakeham, and K. Wishner, 1991: U.S. JGOFS: Arabian Sea Process Study. *U.S. JGOFS Planning Report No. 13,* Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, 164 pp.

Smith, W.L., P.K. Rao, R. Koffler, and W.P. Curtis, 1970: The determination of sea surface temperature from satellite high-resolution infrared window radiation measurements. *Mon. Wea. Rev.*, **98,** 604–611.

Stone, R.S., G.L. Stephens, C.M.R. Platt, and S. Banks, 1990: The remote sensing of thin cirrus cloud using satellites, lidar and radiative transfer theory. *J. Appl. Meteor.*, **29,** 353–366.

Stowe, L.L., E.P. McClain, R. Carey, P. Pellegrino, G. Gutman, P. Davis, C. Long, and S. Hart, 1991: Global distribution of cloud cover derived from NOAA/AVHRR operational satellite data. *Adv. Space Phys.*, **11**(3), 51–54.

——, C.G. Wellemeyer, T.F. Eck, H.Y.M. Yeh, and the Nimbus-7 Cloud Data Processing Team, 1988: Nimbus-7 global cloud climatology. *J. Climate,* **1,** 445–470.

Stramski, D., 1990: Artifacts in measuring absorption spectra of phytoplankton collected on a filter. *Limnol. Oceanogr.*, **35,** 1,804–1,809.

Strickland, J.D.H., and T.R. Parsons, 1972: *A Practical Handbook of Sea Water Analysis.* Fish. Res. Board. Canada, 310 pp.

Strub, P.T., C. James, A.C. Thomas, and M.R. Abbott, 1990: Seasonal and nonseasonal variability of satellite-derived surface pigment concentration in the California Current. *J. Geophys. Res.*, **95,** 11,501–11,530.

Sullivan, C.W., C.R. McClain, J.C. Comiso, and W.O. Wood, 1988: Phytoplankton standing crops within an Antarctic ice edge assessed by satellite remote sensing. *J. Geophys. Res.*, **93,** 12,487–12,498.

– T, U –

Thiermann, V., and E. Ruprecht, 1992: A method for the detection of clouds using AVHRR infrared observations. *Int. J. Remote Sens.*, **13,** 1,829–1,841.

Toll, R.F., Jr., and W.M. Clune, 1985: An operational evaluation of the Navy Operational Global Atmospheric Prediction System (NOGAPS): 48-hour surface pressure forecasts. *Mon. Wea. Rev.*, **113,** 1,433–1,440.

Trees, C.C., M.C. Kennicutt, II, and J.M. Brooks, 1985: Errors associated with the standard fluorometric determination of chlorophylls and phaeopigments. *Mar. Chem.*, **17,** 1–12.

Trenberth, K.E., and J.G. Olson, 1988: An evaluation and intercomparison of global analyses from the National Meteorological Center and the European Centre for Medium Range Weather Forecasts. *Bull. Am. Meteor. Soc.*, **69,** 1,047–1,057.

Tyler, J.E., and R.C. Smith, 1979: *Measurements of Spectral Irradiance Underwater.* Gordon and Breach, 103 pp.

– V –

Viollier, M., 1982: Radiance calibration of the Coastal Zone Color Scanner: a proposed adjustment. *Appl. Opt.*, **21,** 1,142–1,145.

——, D. Tanre, and P.Y. Deschamps, 1980: An algorithm for remote sensing of water color from space. *Bound.-Layer Meteor.*, **18,** 247–267.

Voss, K.J., J.W. Nolten, and G.D. Edwards, 1986: Ship shadow effects on apparent optical properties. *Ocean Optics VIII,* M. Blizard, Ed., SPIE, **637,** 186–190.

——, and G. Zibordi, 1989: Radiometric and geometric calibration of a spectral electro-optic "fisheye" camera radiance distribution system. *J. of Atmos. and Ocean. Technol.*, **6,** 652–662.

– W, X –

Walker, J.H., C.L. Cromer, and J.T. McLean, 1991: Technique for improving the calibration of large-area sphere sources. *Ocean Optics,* B.W. Guenther, Ed., SPIE, **1493,** 224–230.

Walsh, J.J., G.T. Rowe, R.L. Iverson, and C.P. McRoy, 1981: Biological export of shelf carbon is a sink of the global CO_2 cycle. *Nature,* **291,** 196–201.

Waters, K.J., R.C. Smith, and M.R. Lewis, 1990: Avoiding ship induced light field perturbation in the determination of oceanic optical properties. *Oceanogr.*, **3,** 18–21.

Weare, B.C., 1992: A comparison of the ISCCP C1 cloud amounts with those derived from high resolution AVHRR images. *Int. J. Remote Sens.*, **13,** 1,965–1,980.

Weinreb, M.P., G. Hamilton, S. Brown, and R.J. Koczor, 1990: Nonlinear corrections in calibration of Advanced Very High Resolution Radiometer infrared channels. *J. Geophys. Res.*, **95,** 7,381–7,388.

Williams, S.P., E.F. Szajna, and W.A. Hovis, 1985: Nimbus 7 Coastal Zone Color Scanner (CZCS) Level 1 Data Product Users' Guide. *NASA Tech. Memo. 86203,* NASA Goddard Space Flight Center, Greenbelt, Maryland, 49 pp.

Wilson, W.H., R.C. Smith, and J.W. Nolten, 1981: The CZCS Geolocation Algorithms. *SIO Ref. 81-32,* Scripps Inst. of Oceanogr., La Jolla, California, 37 pp.

Woodward, R.H., R.A. Barnes, C.R. McClain, W.E. Esaias, W.L. Barnes, and A.T. Mecherikunnel, 1993: Modeling of the SeaWiFS Solar and Lunar Observations. *NASA Tech. Memo. 104566, Vol. 10,* S.B. Hooker and E.R. Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 26 pp.

World Meteorological Organization, 1990: Report of the International Ozone Trends Panel, 1988: *World Meteorological Organization Global Ozone Research and Monitoring Project, Report No. 18, 2 Vols.*, Geneva.

Wroblewski, J.S., J.L. Sarmiento, and G.R. Flierl, 1988: An ocean basin scale model of plankton dynamics in the North Atlantic 1. solutions for the climatological oceanographic conditions in May. *Global Biogeochem. Cycles,* **2,** 199–218.

Wu, R., J.A. Weinman, and R.T. Chin, 1985: Determination of rainfall rates from GOES satellite images by a pattern recognition technique. *J. Atmos. Ocean. Technol.*, **2,** 314–330.

– Y, Z –

Yamanouchi, T., and S. Kawaguchi, 1992: Cloud distribution in the Antarctic from AVHRR data and radiation measurements at the surface. *Int. J. Remote Sens.*, **13,** 111–127.

Yentsch, C.S., and D.W. Menzel, 1963: A method for the determination of phytoplankton, chlorophyll, and phaeophytin by fluorescence. *Deep-Sea Res.*, **10,** 221–231.

——, and D.A. Phinney, 1985: Rotary motion and convection as a means of regulating primary production in warm core rings. *J. Geophys. Res.*, **90,** 3,237–3,248.

Yoder, J.A., C.R. McClain, J.O. Blanton, and L.-Y. Oey, 1987: Spatial scales in CZCS-chlorophyll imagery of the southeastern U.S. continental shelf. *Limnol. Oceanogr.*, **32,** 929–941.

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