Overview of Ocean Color Calibration & Validation Efforts

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NASA/Goddard Space Flight Center

2001 Fall AGU
OS42D: Calibration & Validation Efforts Underway by the Ocean Color Missions
## OCEAN COLOR MISSIONS

### Global

<table>
<thead>
<tr>
<th>Instrument (Mission; Country)</th>
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<td>OCTS (ADEOS-I; Japan)</td>
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<td>POLDER (ADEOS-I/II; France &amp; Japan)</td>
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<td>SeaWiFS (Orbview-2; U.S.)</td>
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<td>VIIRS (NPP; U.S.)</td>
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### Limited Coverage

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<tr>
<th>Instrument (Mission; Country)</th>
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<td>OCI (ROCSAT; Taiwan)</td>
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<td>OCM (IRS-P4; India)</td>
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<td>OSMI (KOMPSAT; South Korea)</td>
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Calibration & Validation Paradigm

\[
L_T(\lambda) = L_T(\lambda) + L_\text{atm}(\lambda) + L_{\text{surface}}(\lambda) + \frac{\Delta L_{\text{water}}(\lambda) + \Delta L_{\text{g}}(\lambda)}{\text{In Situ}}
\]

On Orbit  Atmospheric  Sea Surface  In Situ

SeaWiFS  Sun  Moon

Key:
- Air Molecules
- O2 Molecules
- O2 Molecules
- Particulate
- Water Molecules
- Phytoplankton

- Light pathway
- Calibration only
- Details of multiple interactions
SIMBIOS Objectives

Sensor Intercomparison & Merger for Biological & Interdisciplinary Ocean Studies

- Ensure development of internally consistent research products and time series from multiple satellite ocean color data sources
- Develop methodologies for cross-calibration of satellite ocean color sensors
- Develop methodologies for merging data from multiple ocean color missions
- Promote cooperation between ocean color projects
- Serve as a prototype for other Earth observation programs
Program Requirements/Activities

- Field measurement & data processing protocol definition & development
- Global bio-optical & atmospheric in situ data collection
- Bio-optical & atmospheric database development
- Traceability of laboratory calibration sources to standards
- Instrumented calibration sites
- Prelaunch sensor calibration & characterization protocols
- On-orbit calibration evaluation & methodology development
- Bio-optical & atmospheric correction algorithm development
- Product accuracy evaluation & methodology development
- Data merger algorithm development & data processing
- High volume data processing capabilities
- Technology evaluation & development
- Systematic documentation
Project Structure

- **SIMBIOS Science Team**
  - MODIS Oceans Team

- **SIMBIOS Project Office**
  - Technical, program management, science team coordination & NRA support
  - Technical interface with space agencies (e.g., NASDA, CNES, KARI), other organizations (e.g., NIST, IOCCG, JRC, DLR), and programs (e.g., EOS, AERONET)
SIMBIOS Project Office

- Satellite Data Processing
  - CZCS, SeaWiFS, MOS, OCTS, POLDER-I, & OSMI

- Data Product Validation
  - Algorithm validation
  - Sensor calibration
  - Match-up analysis & SeaBASS interface

- Support Services
  - Scheduling SeaWiFS LAC data & over-flight prediction for MODIS, SeaWiFS, MOS, OCI, OSMI, & OCM
  - Satellite data: OCTS-GAC, MOS & SeaWiFS (diagnostic data set)
  - Near real-time images (SeaWiFS Level-1 & Level-2)
  - SeaDAS international satellite data processing software

- Instrument Calibration & Data Collection Support
  - Field instrument pool & calibrations
  - Calibration RR: SeaWiFS Transfer Radiometer (SXR-II) & SeaWiFS Quality Monitors (SQM)

- Administrative Support
  - Project & Science Team Coordination & Contracting
  - Documentation
SIMBIOS Activities

- MOS-SeaWiFS cross calibration
  - German Aerospace Research Establishment (DLR)
- MOS data acquisition at NASA Wallops Flight Facility
  - Indian Space Research Organization (ISRO)
- OCTS-POLDER cross calibration
  - NASDA (Japan) & CNES (France)
- OCTS global GAC reprocessing
  - NASDA
- OSMI data processing and calibration
  - Korean Aerospace Research Institute (KARI)
- GLI calibration & validation team
  - NASDA
- POLDER-2 calibration & validation team
  - CNES
- MODIS product validation & data merger
  - MODIS Oceans Team
SIMBIOS Activities continued

- Calibration round-robin
  - 1997: NASA/GSFC, PML (UK), JRC (Italy), SDSU, Biospherical Instruments Inc., UCSB, NRL, DLR (Germany), NASA/WFF, Satlantic Inc. (Canada)
  - 2001: NASA/GSFC, Satlantic Inc., Biospherical Instruments Inc., HOBI Labs, UCSB, NRL, SIO

- Chlorophyll round-robin
  - 2000: ONR, UMD, SIO, SDSU, Bigelow, USF, NOAA & NASA/SSC
  - 2001: SDSU, UMD, CNR (Italy), LODYC (France) and BBRS

- Sunphotometer deployment, maintenance, data processing
  - Cimel (NASA-GSFC, AERONET)
  - PREDE MKII, SIMBAD, MicroTops and MPL

- International coordination & outreach
  - International Ocean Color Coordinating Group (IOCCG)
  - SeaDAS training

- Technology development
  - Satlantic
  - Yankee Environmental Instruments
SIMBIOS Activities continued

- International field experiments
  - INDOEX (1999)
  - ACE-Asia (2001)
  - R/V Akademik Ioffe (2001)

- Field support
  - Satellite overflight & coverage info, real-time data
  - Over 276 field experiments supported

- Bio-optical data archival & distribution
  - SeaBASS
  - NODC

- Diagnostic Data Set Generation
  - SeaWiFS
  - OCTS-GAC (future)
  - MOS (future)
MOBY: On-Orbit Vicarious Calibration

- The Marine Optical Buoy (MOBY)
  - Supported by MODIS & SeaWiFS
  - Moored off the coast of Lanai in “clear water”
  - Initial deployment in late 1996
  - Operational since mid-1997
  - Used to calibrate OCTS, POLDER, SeaWiFS, MODIS, OSMI
Bio-optical & Atmospheric Data archived in SeaBASS
SeaWiFS:
Equatorial crossing time: 12:00 am
Resolution (km): 1.13
Swath (km): 2800
Repeak period: 16 days
2-day global coverage

MOS:
Equatorial crossing time: 10:30 am
Resolution (km): 0.52
Swath (km): 200
Repeak period: 24 days
No global coverage
OCTS-POLDER Comparison

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<th>POLDER</th>
<th>OCTS</th>
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<tbody>
<tr>
<td>Resolution</td>
<td>6 x 7 km</td>
<td>700 x 700 m</td>
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<tr>
<td>Global coverage</td>
<td>1 day quasi-global</td>
<td>3 days</td>
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<tr>
<td>Recurrent period</td>
<td>41 days</td>
<td>41 days</td>
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NASDA-NASA Collaboration: OCTS-GAC

- Web browse and download utility for Level-1, Level-2 and Level-3 products can be found at:

  http://seawifs.gsfc.nasa.gov/cgibrs/octs_browse.pl

- SeaDAS 4.03p released on 11/9/01 - supports OCTS-GAC
Sun Photometer Calibration Activities

- GSFC integrating sphere* used to calibrate SIMBIOS radiometers and sun photometers
- Roof platform at GSFC* used for transferring calibration to sun photometers
- Project completed ~ 55 instrument calibrations per year

* AERONET facilities
Diagnostic Data Set

- 33 sites
- SeaWiFS time series
- On-line browse
- Subscene download via web or FTP

MOS (above) and SeaWiFS (right) data extracts of Bermuda collected on 15 March 2000

S2000075165409_L1A_HNSG_BBOP_extract
S2000075165409_L2_HNSG_BBOP_extract