Climate Data Records
&
Product Selection

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ESE Data Requirements for Climate Research: Climate Data Records

- **Long-term time series**
  - Must span interannual and short-term natural variability (e.g., ENSO)
  - Necessarily requires data from multiple missions (e.g., CZCS to NPOESS)
  - Must include most recent data, e.g., NPP/VIIRS
    - Ocean color continuous time series starts in 1996 with ADEOS-I/OCTS
  - Must minimize data gaps to avoid aliasing of natural climate oscillations (e.g., ENSO)
- **Highest possible quality**
  - Must not include significant sensor artifacts and trends
    - Decadal scale variability and climate trends are small and can be easily confused with sensor drift
    - Ocean color products are particularly sensitive to sensor characterization/calibration errors (e.g., 1% error in calibration produces about a 10% error in water-leaving radiance)
  - Must be validated with highly accurate field data
  - Requires reprocessings (e.g., SeaWiFS has reprocessed 4 times in 5 years)
- **Consistency between satellite data sets**
  - Must be cross-calibrated and processed using similar algorithms, i.e, no abrupt transitions between data sets
  - Requires reprocessings
    - NPP EDRs will have discontinuities (based on existing IPO contracts)
    - NPP climate quality products required near-term for extending CDRs to support ESE deliverables
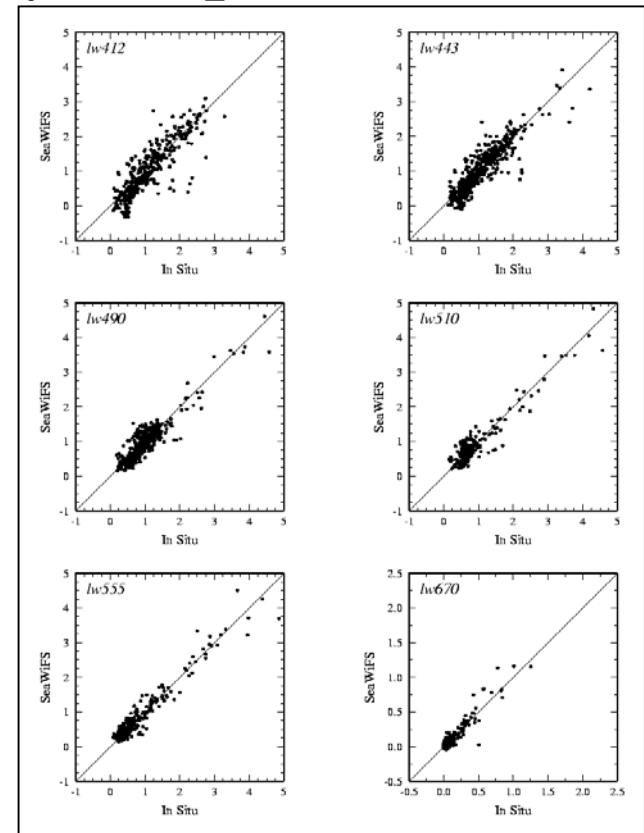
Data Stability & Accuracy Requirements

NOAA AVHRR 8-km NDVI Data Set

**AVHRR analyses require Solar zenith angle correction**
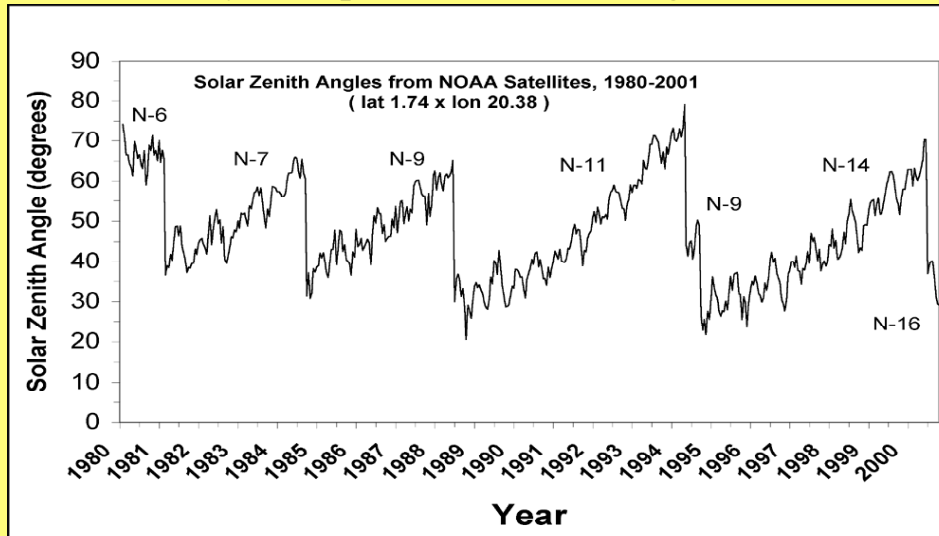

- Many satellite data records have trends & discontinuities resulting from satellite operation & sensor calibration artifacts

- Magnitude of trends & biases can far exceed climate signals

- SeaWiFS Lwn validation requires highly accurate satellite and in situ observations of radiometry

- SeaWiFS on-orbit calibrations accurate to ~0.1% based on ongoing rigorous calibration program

SeaWiFS Lunar Calibrations

SeaWiFS (ST00) Water-Leaving Radiances, Deep Water Subset

CHLOR_A

CDR Requirements:
• Highly accurate satellite calibrations over time
• Highly accurate field observations for algorithm development & validation
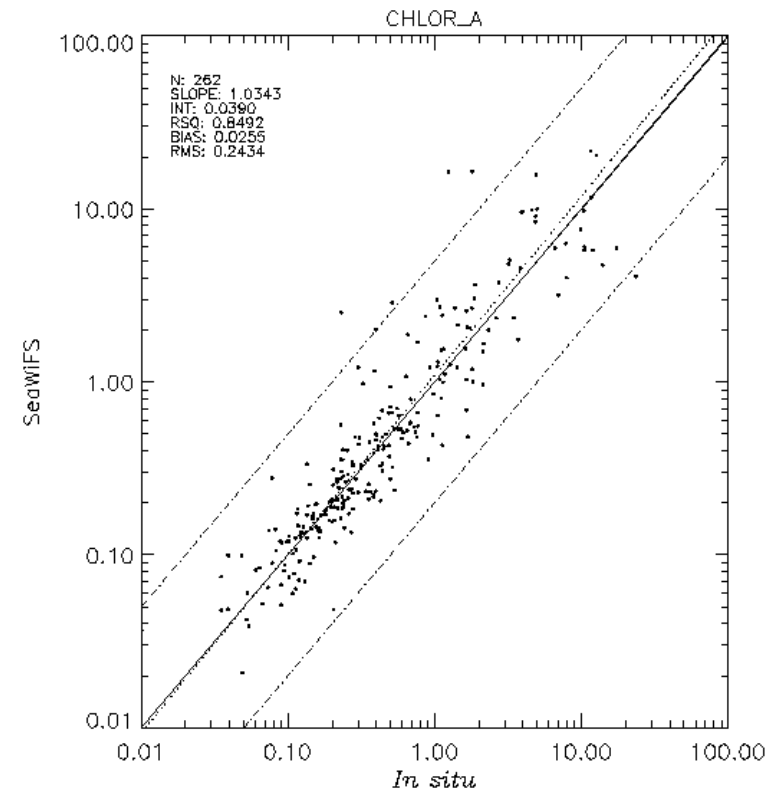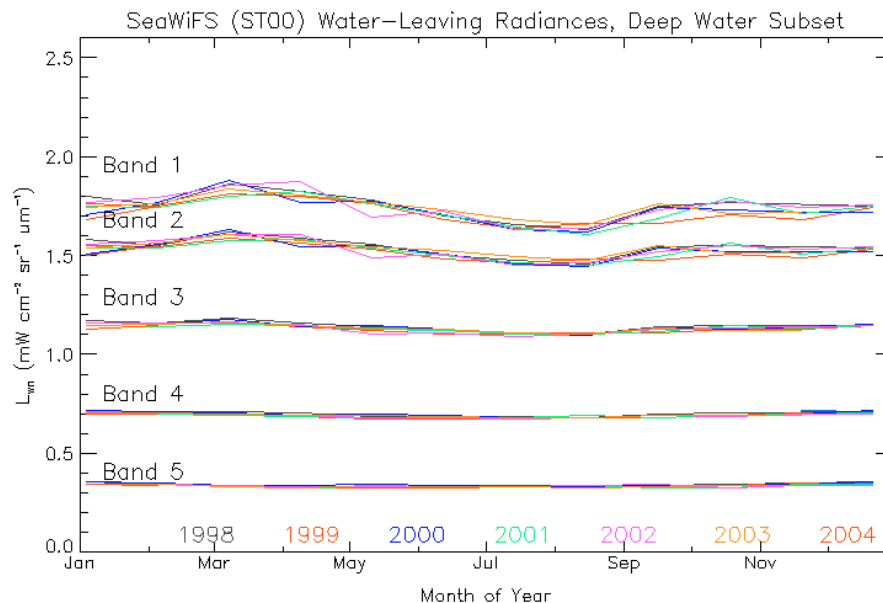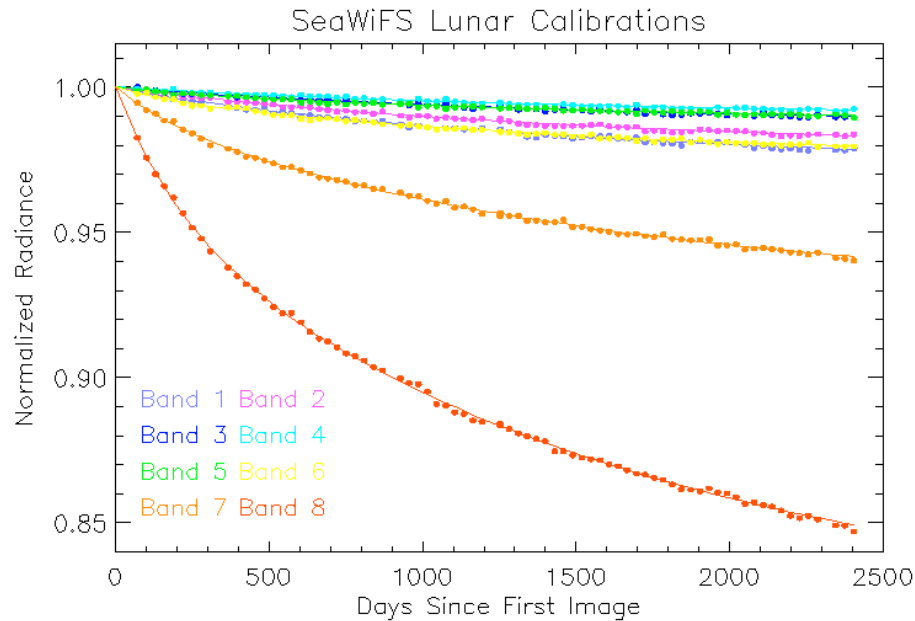
Ocean Color Parameters

- **Previous OC Parameter Set**
    - Normalized water-leaving radiances (7)
    - Aerosol optical thickness (865 nm)
    - Atmospheric correction epsilon
    - Aerosol model numbers (2)
    - Clear water aerosol correction epsilon
    - CZCS pigment concentration
    - Chlorophyll-a concentration (3)
    - Total pigment concentration
    - Chlorophyll fluorescence line height
    - Chlorophyll fluorescence baseline
    - Chlorophyll fluorescence efficiency
    - Total suspended matter
    - Coccolithophore pigment concentration
    - Detached coccolithophore concentration
    - Calcite concentration
    - Diffuse attenuation at 490 nm
    - Phycoerythobilin concentration
    - Phycourobilin concentration
    - Instantaneous PAR
    - Instantaneous absorbed radiation for fluorescence
    - Gelbstoff absorption coefficient at 400 nm
    - Phytoplankton absorption coefficient at 675 nm
    - Total absorption coefficients (5)
    - Primary production (2 at Level-4)

- **Current Parameter Set**
    - Normalized water-leaving radiances (6)
    - Aerosol optical thickness (865 nm)
    - Atmospheric correction epsilon
    - Ångström exponent at 510 nm
    - Chlorophyll-a (1)
    - Diffuse attenuation coefficient at 490 nm
    - Daily mean PAR

Previous OC Parameter Set   38
(does not include archived ancillary data &
quality control fields)

Current OC Parameter Suite   12
(does not include archived ancillary data)

Ocean Color Product Suite Parameters: A Suggested Baseline

- Normalized Water Leaving Radiance (412, 445, 488, 555 nm)
- Chlorophyll-a
- Daily Mean Photosynthetically Available Radiation (PAR)
- Diffuse Attenuation for PAR
- Primary Production
- Particulate Organic Carbon
- Calcite
- Dissolved Organic Carbon or Colored Dissolved Organic Matter
- Total Suspended Matter
- Gelbstoff Absorption (412 nm)
- Total Absorption Coefficient (412 nm)
- Aerosol optical thickness (865 nm; not derived from ocean color processing)
- Epsilon or Angstrom Exponent

NPOESS EDRs

Process for Determining Ocean Color Product Suite: A Strawman Community Approach

- Establish a standing working group for product selection
  - Define mandate and reporting requirements (time lines, format, etc.)
- Define/review ocean biogeochemistry goals and objectives
  - Refer to NASA theme roadmaps, e.g., Carbon & Ecosystems
- Identify geophysical parameters required by roadmaps that fall under the NASA Ocean Biogeochemistry Program
- Select geophysical parameters that are amenable to satellite remote sensing observation or have the potential to be.
  - Establish algorithm selection process, e.g., working group(s)
- Prioritize parameter set and establish algorithm development & validation resource requirements.
  - Outline strategy, budget, and time line for each.
    - Identify the field data collection requirements and potential opportunities
    - Stagger development depending on priority, feasibility, and cost
    - Include review &/or development of measurement protocols
    - Include an assessment of in situ instrumentation
  - Include feasibility and processing system impact assessment
- Develop a process whereby the status of each product is periodically evaluated in view of the entire product suite.
  - Allows re-evaluation of priorities and strategies