”MOBY site and uncertainties”

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MOBY TEAM (Carol Johnson, NIST, and Mark Yarbrough and many at Moss Landing Marine lab)

12/2/13, ESRIN, Italy.

Requirements for primary ocean color site:

1) Able to reliably observe from space: cloud free as much as possible

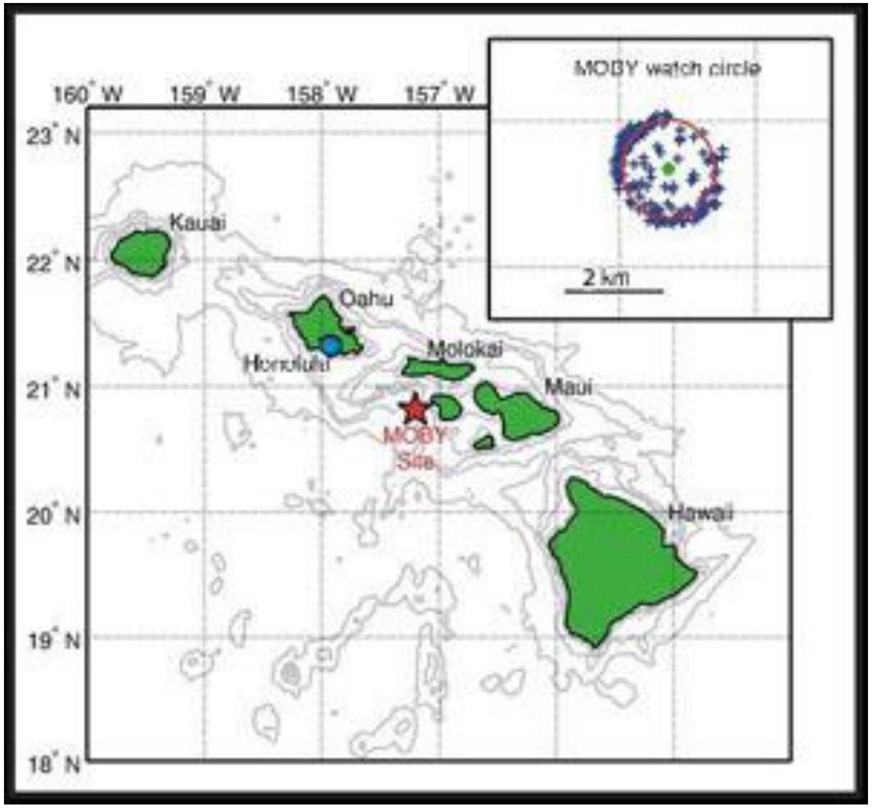
2) clear, clean atmosphere so that the demands on the atmospheric correction are limited

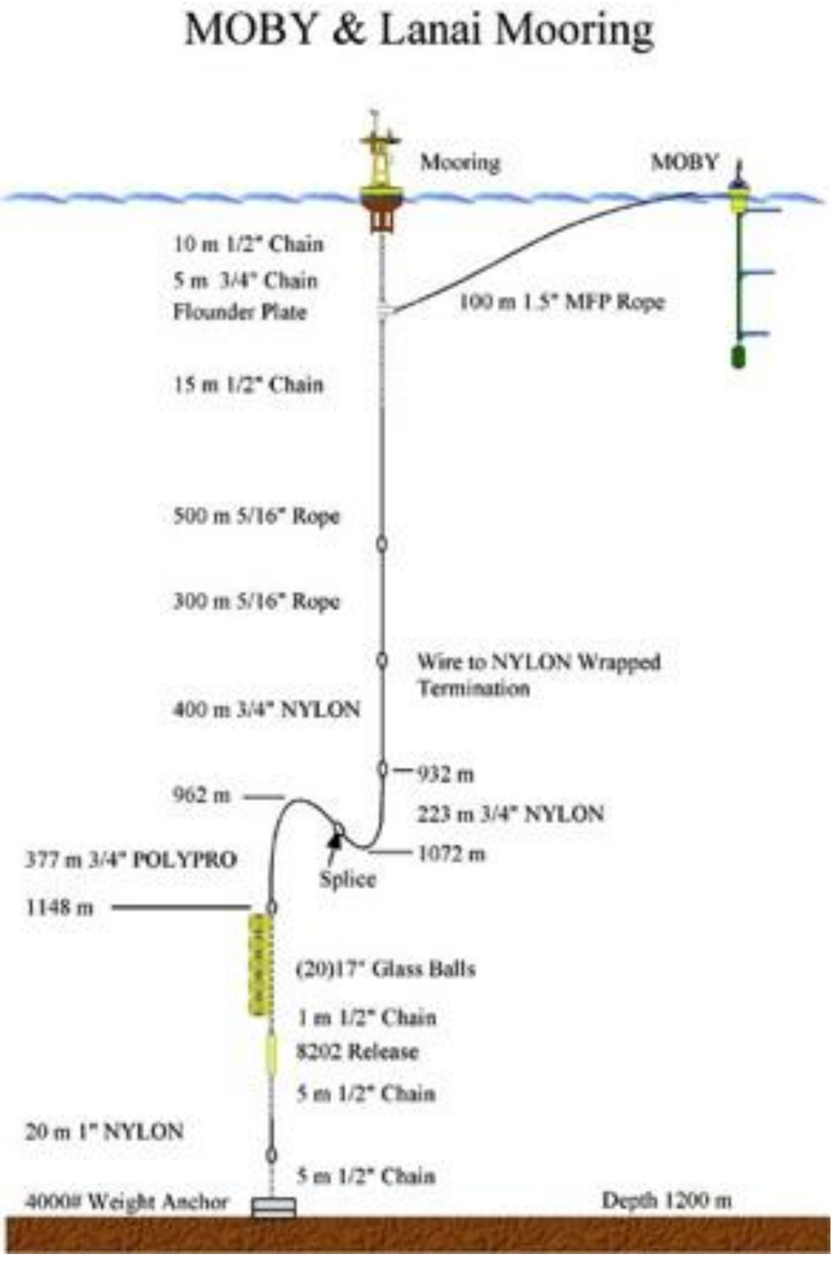
3) stable homogeneous water properties: must be able to extend point measurement of optical properties to that of the 1km pixel (or more) measured by the satellite sensor

4) far enough from shore to avoid near-field optical influences

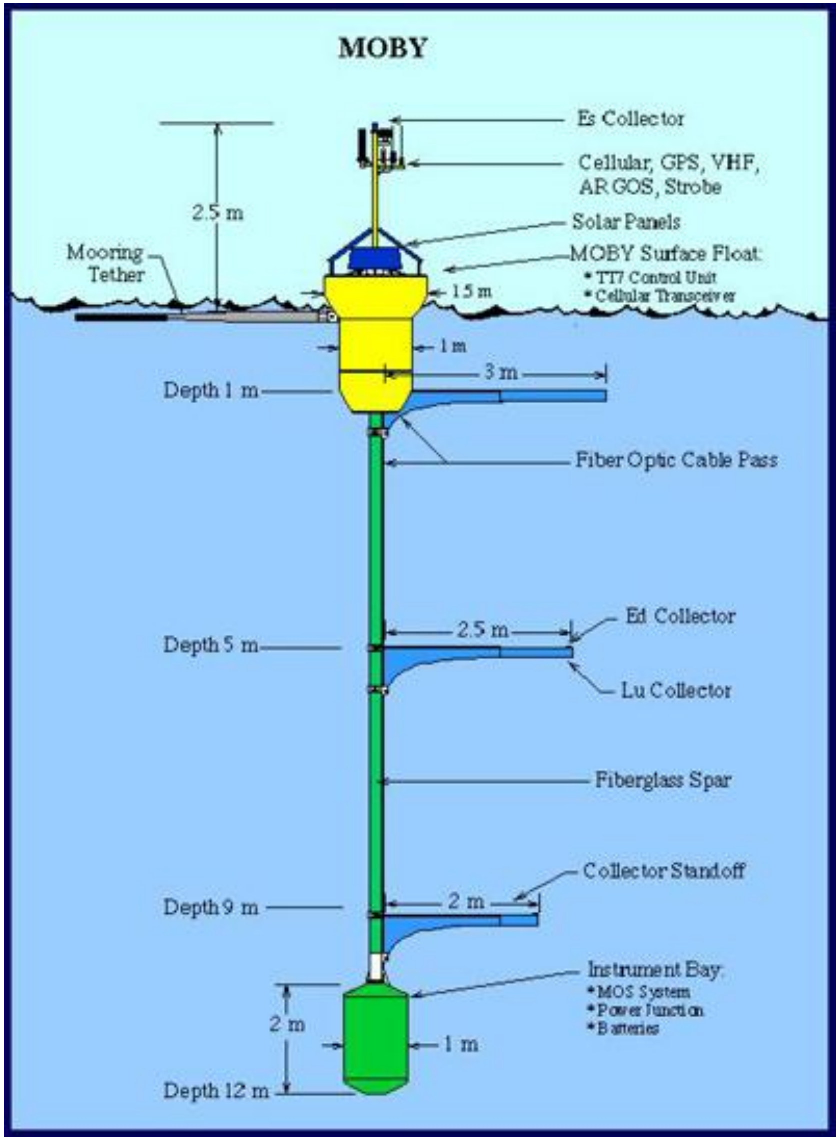
5) deep water so that shallow water influence is gone

Dennis Clark (NOAA/NESDIS) chose the site shown below off of Lanai, Hawaii.

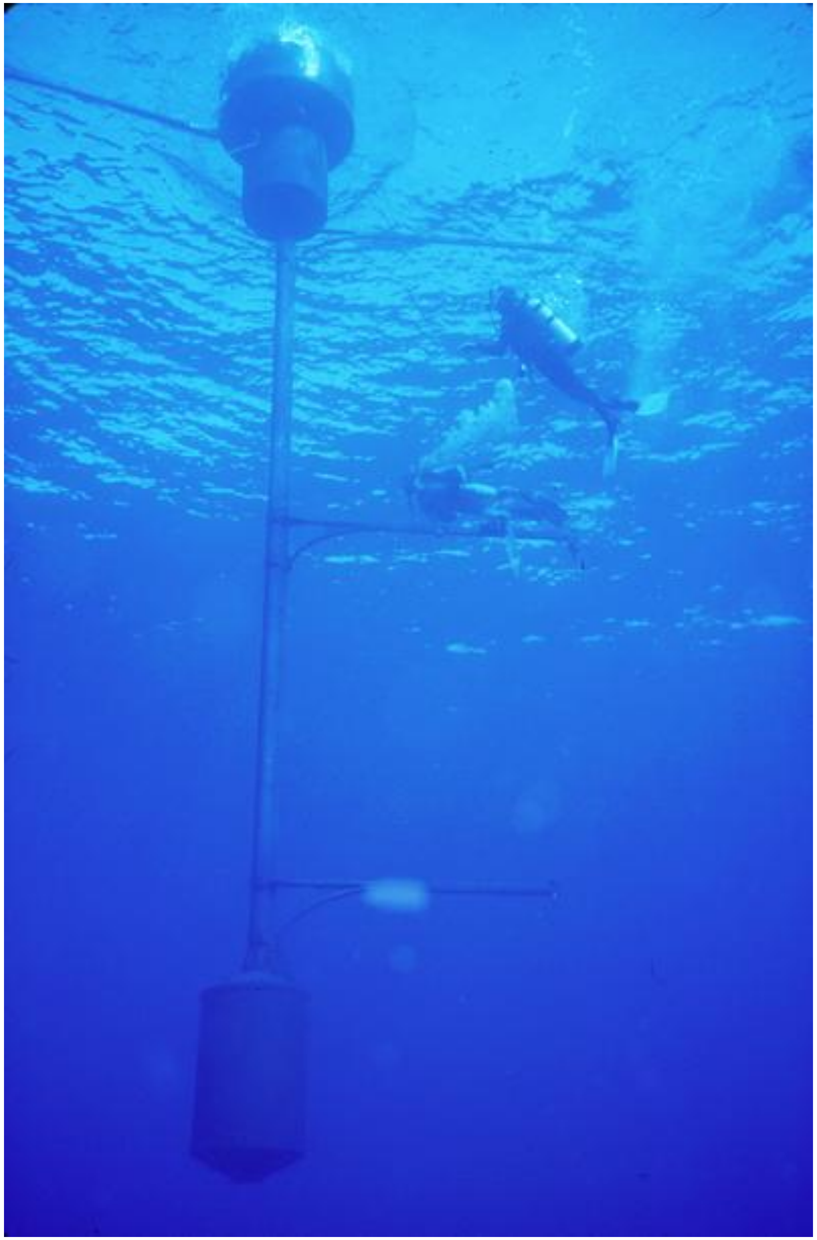




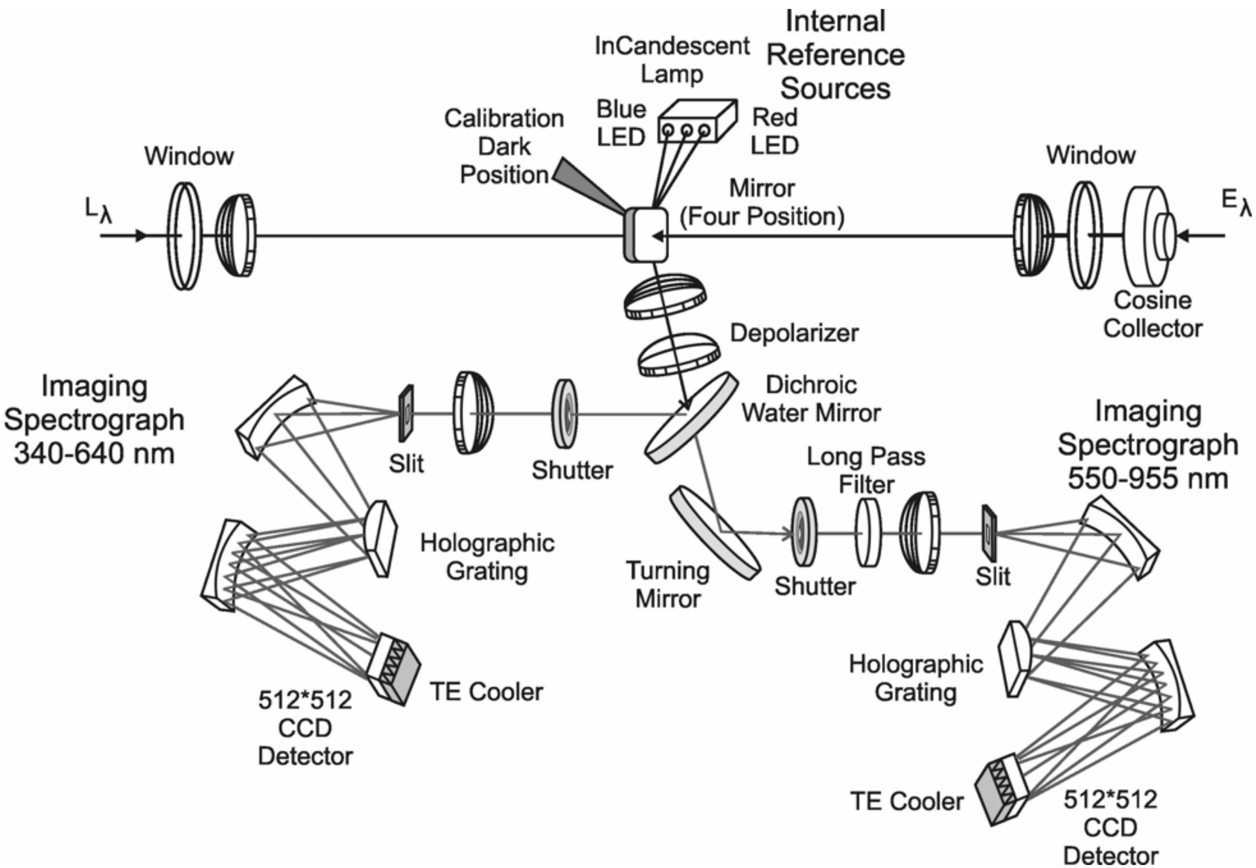
MOBY



MOBY
Es Collector
Cellular, GPS, VHF, ARGOS, Strobe
2.5 m
Solar Panels
Mooring Tether
MOBY Surface Float:
* TT7 Control Unit
* Cellular Transceiver
1.5 m
1 m
3 m
Depth 1 m
Fiber Optic Cable Pass
Ed Collector
2.5 m
Depth 5 m
Lu Collector
Fiberglass Spar
Collector Standoff
Depth 9 m
2 m
Instrument Bay:
* MOS System
* Power Junction
* Batteries
2 m
1 m
Depth 12 m



Schematic of Current MOBY



Hyperspectral,0.57 nm spacing in blue spectral region, 0.91 nm FWHM 0.81 nm and 1.2 nm FWHM in red.

Hyperspectral, with this much resolution, allows the same system (one site) to be used for multiple satellite sensor systems, including out-of-band response, to tie these systems together.

This system has been extensively characterized

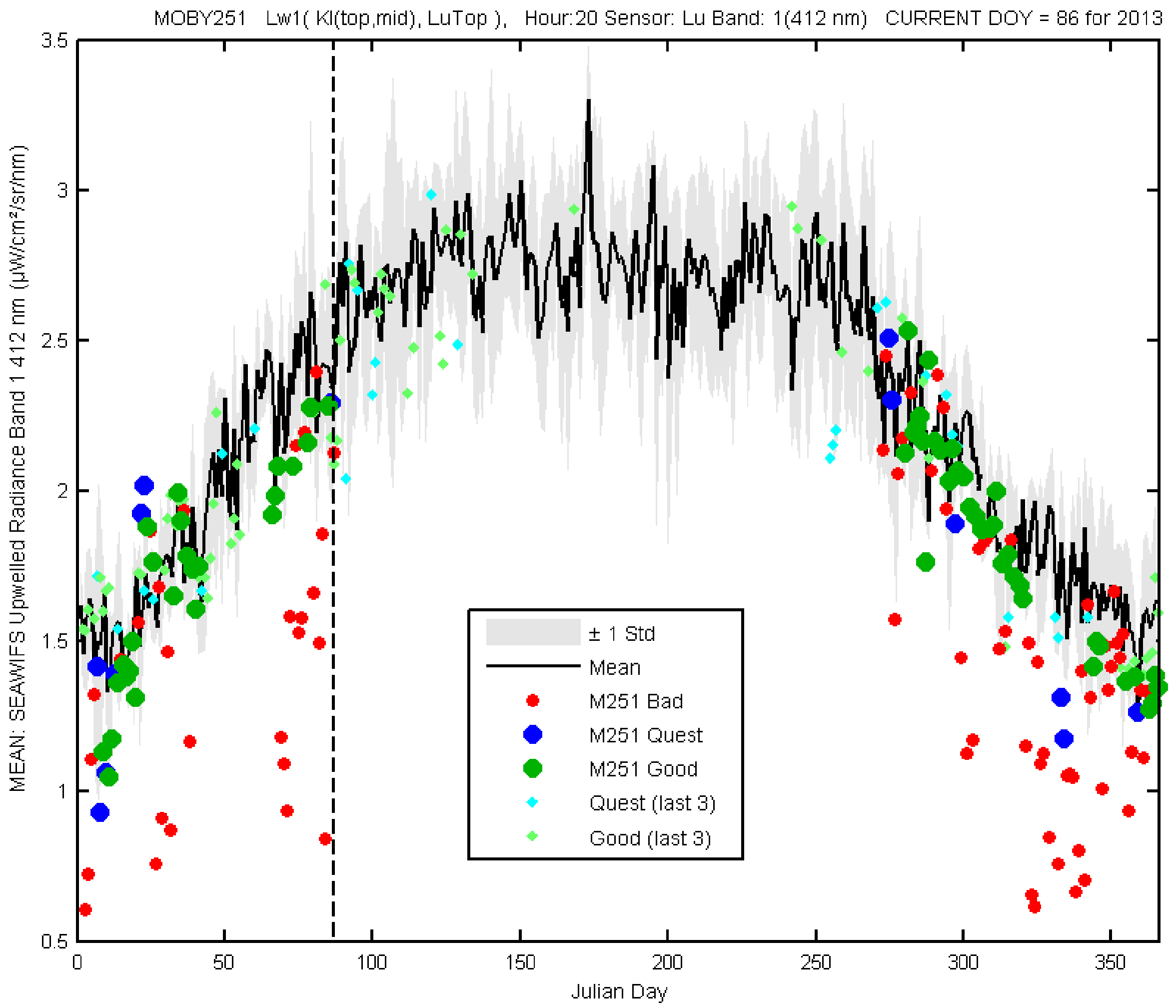
- Stray light characteristics on SIRCUS repeatedly measured, with corrections added to data
- Pre-post radiometric response with direct traceability to NIST scales
- Additional monitoring of calibration sources with custom instruments
- Diver calibrations/cleaning monthly
- Daily on board sources monitored
- Site has been extensively characterized

Table 1. Uncertainty in $L_u(Top)$

Uncertainty Component [%]	8	9	10	11	12	13
	411.8 nm	442.1 nm	486.9 nm	529.7 nm	546.8 nm	665.6 nm
Responsivity						
Radiometric Calibration Source						
Spectral radiance	0.65	0.60	0.53	0.47	0.45	0.35
Stability	0.41	0.46	0.51	0.53	0.53	0.48
Transfer to MOBY						
Interpolation to MOBY wavelengths	0.2	0.15	0.03	0.03	0.03	0.03
Reproducibility	0.37	0.39	0.42	0.44	0.42	0.3
Wavelength accuracy	0.29	0.08	0.04	0.03	0.01	0.04
Stray light	0.75	0.3	0.1	0.15	0.3	0.3
Temperature	0.25	0.25	0.25	0.25	0.25	0.25
Measurements of L_u						
MOBY stability during deployment						
System response	1.59	1.3	1.19	1.11	1.08	0.92
In-water internal calibration	0.43	0.42	0.44	0.46	0.51	0.55
Wavelength stability	0.132	0.138	1.122	0.816	1.368	0.65
Environmental						
Type A (good scans &all days)	4.1	4.4	4.5	4.4	4	3.2
(good days only)*	***0.80***	***0.83***	***0.87***	***1.02***	***0.64***	***1.31***
Temporal overlap	0.3	0.3	0.3	0.3	0.3	0.3
Self-shading (uncorrected)	1	1	1.2	1.75	2.5	12
(corrected)*	***0.200***	***0.200***	***0.240***	***0.350***	***0.500***	***2.400***
In-water bio-fouling	1	1	1	1	1	1
Combined Standard Uncertainty	4.7	4.8	5.1	5.1	5.2	12.5
Combined Standard Uncertainty*	***2.4***	***2.1***	***2.4***	***2.3***	***2.4***	***3.3***

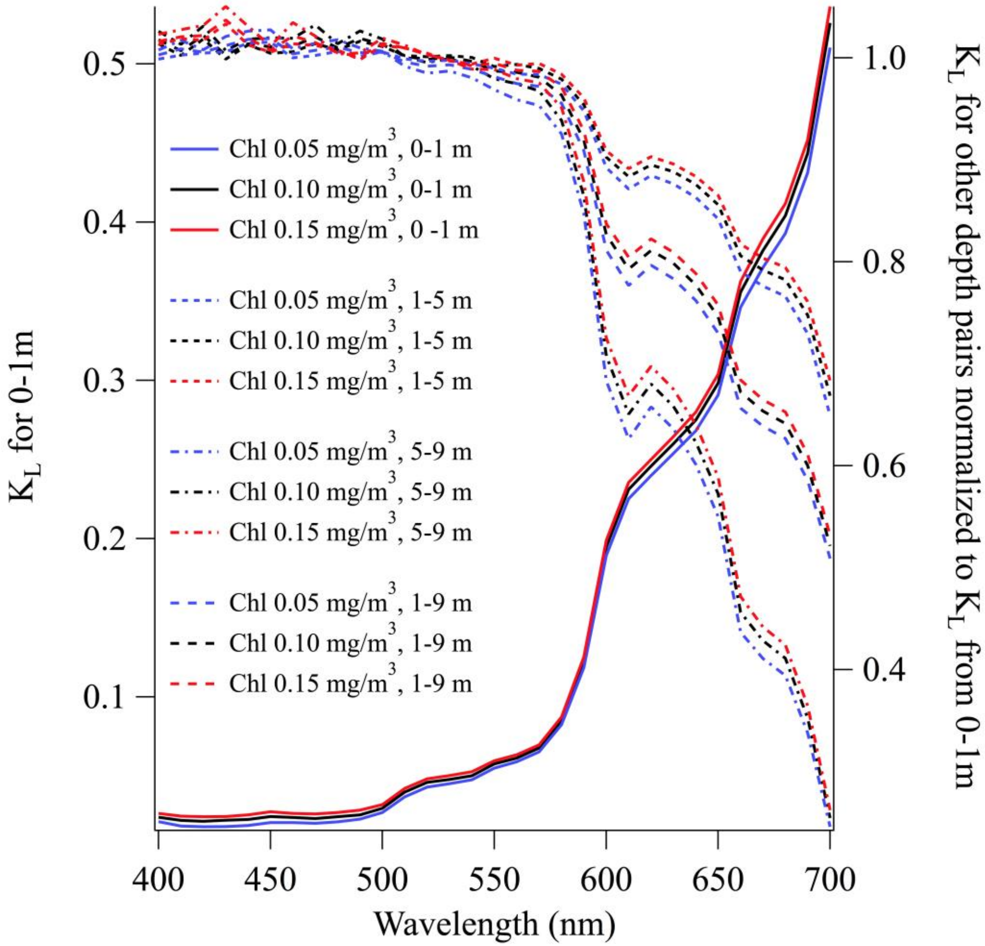
From Brown et al., 2007 SPIE, 6744:67441M.

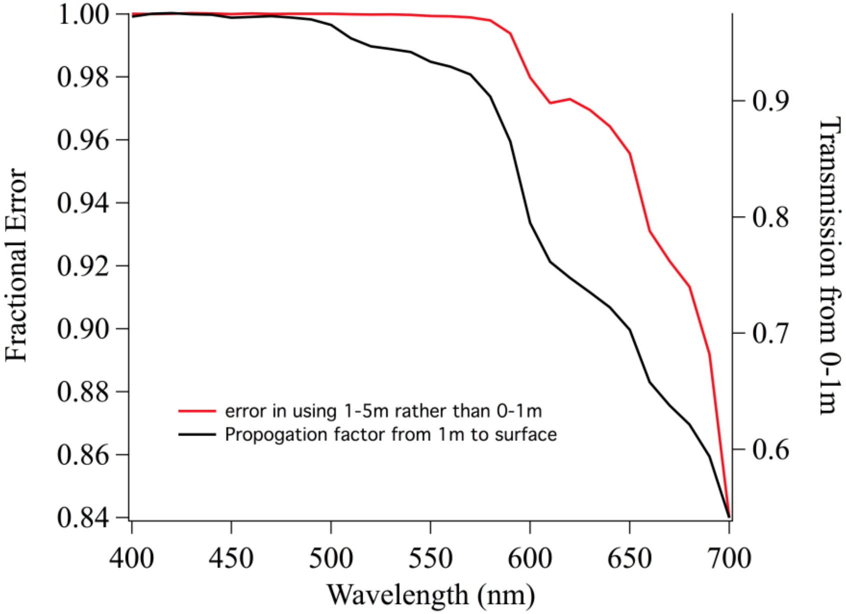
Obtain a time series of Lw, individual measurements used in VC



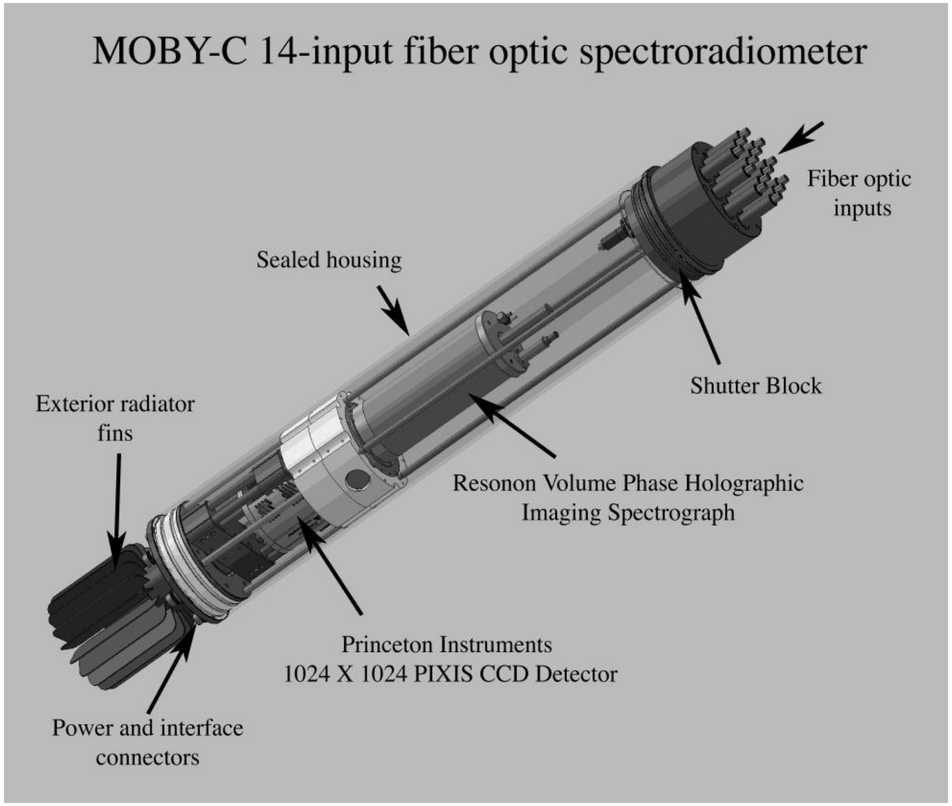
Each good measurement if a corresponding satellite measurement is found, can be be used to generate a gain factor to adjust the calibration of the satellite sensor

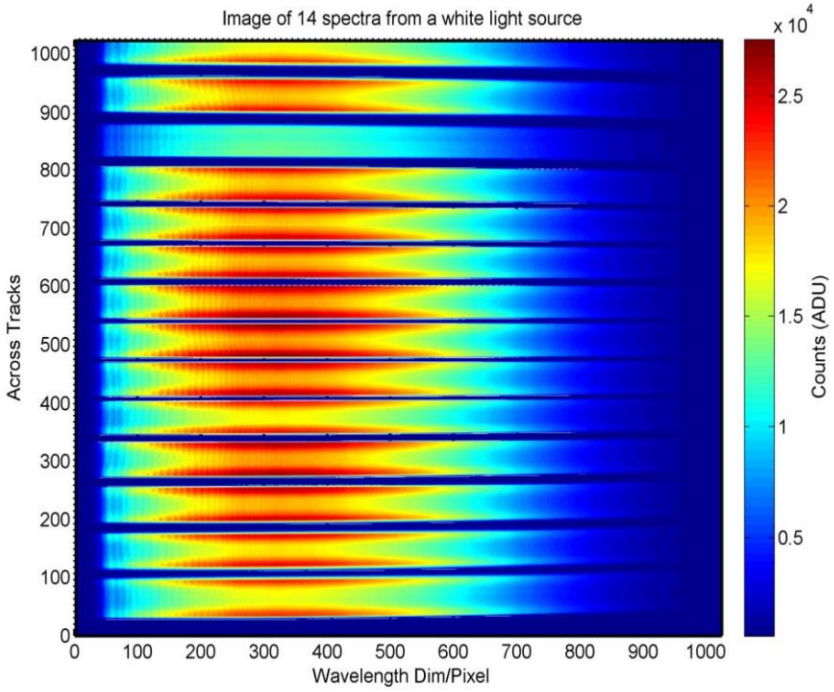
KL (0-1m) from a model

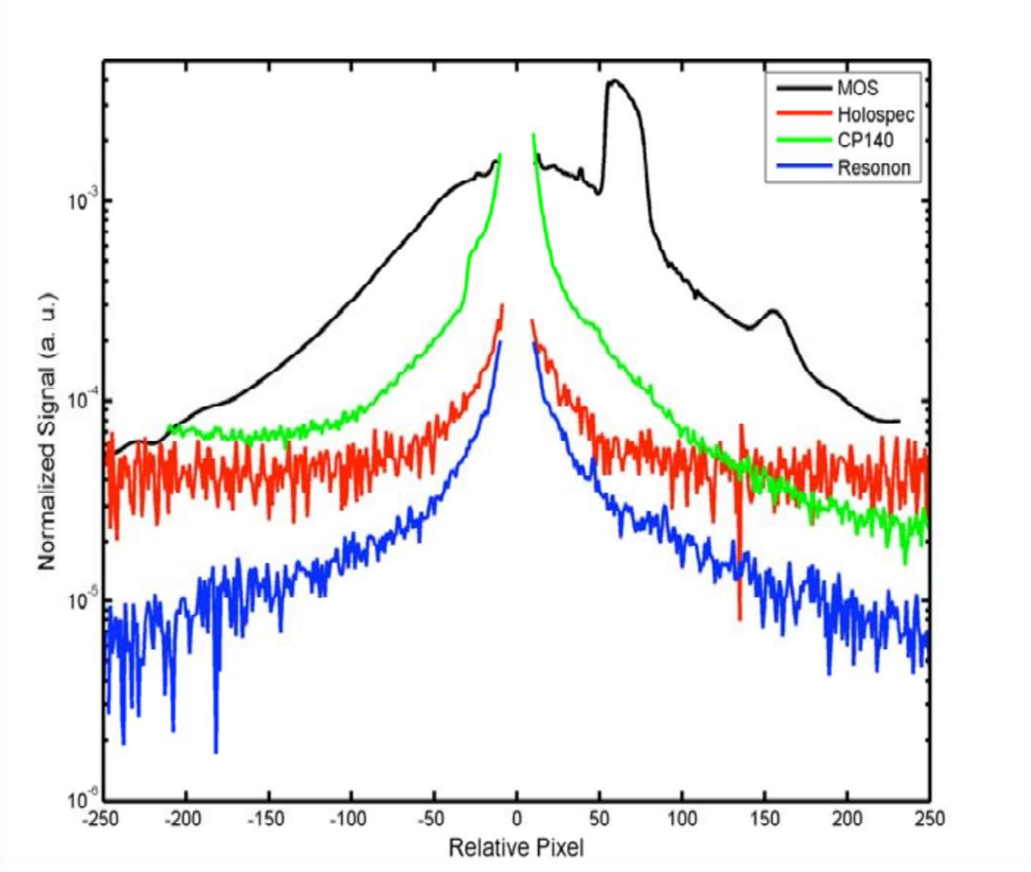




MOBY Refresh



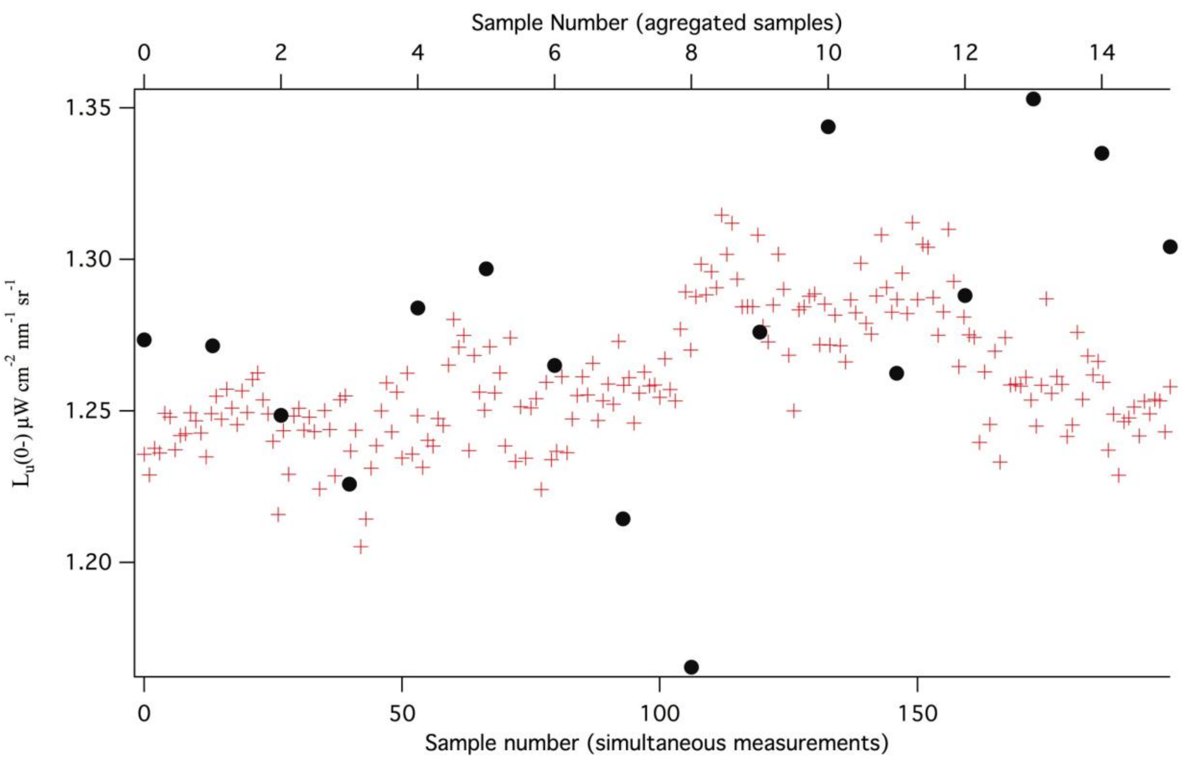




New system has much better stray light characteristics, so uncertainties due to straylight correction much reduced.

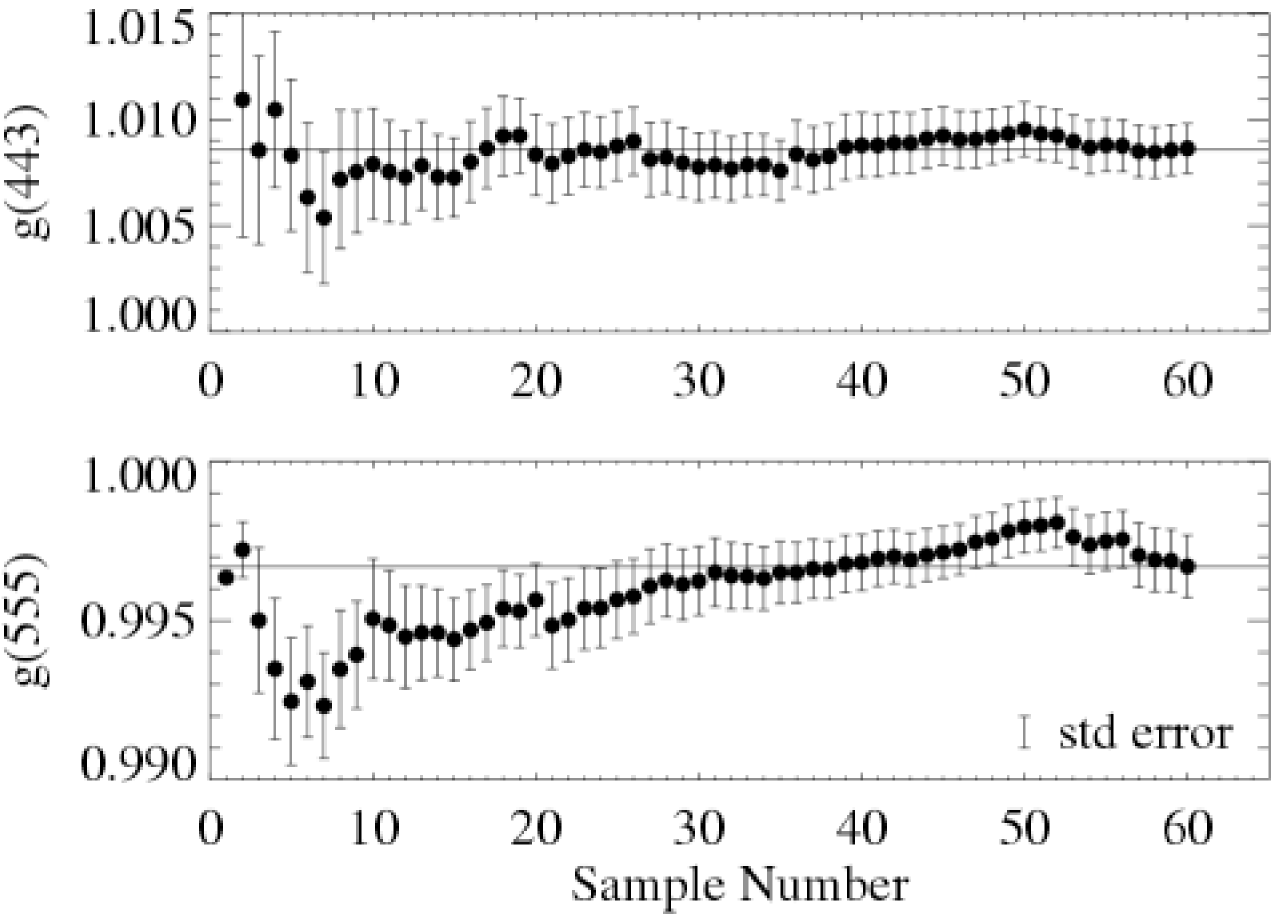
Reduced Environmental Noise with new instrument

Comparison of simultaneous measurements and sequential with test data set. Sequential measurement has %std around 0.04, while simultaneous has 0.01. Because of correlations, simultaneous much better. Reduced noise here reduces noise in *g*, reducing number of matchups required to obtain *g* within desired accuracy.



Instrument used was a prototype of the new optical system with simultaneous measurements at different depths.

Because of measurement uncertainties and variabilities, one measurement is not sufficient.



Once again, this is with SeaWIFS which had very good stability characteristics and had frequent lunar looks to keep temporal stability in check.

Werdell et al., 2006, Ocean Optics XVIII,
http://oceancolor.gsfc.nasa.gov/cgi/obpgpubs.cgi