MODIS Data Product Status Numbers 19, 23, & 26

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July 2002

MOBY
Five Year Time-Series
7/20/97 to 7/20/02

- NIST Radiometric Scale & Overview
- NIST Stray Light Characterizations
- Sensor Spectral Band Matching
- Ocean Color Sensors
  - Japan's OCTS
  - SeaWiFS
  - MODIS Terra and Aqua
  - Japan's GLI (Fall 2002)

MODIS Terra/Aqua-Products

Product 19

- Parameter 13 - CZCS_pigment
  - (Chl *a* +Phaeo) - Fluorometrically determined
- Parameter 14 - chlor_MODIS
  - (Chl *a* (monovinyl and divinyl), Chl *a* allomer, Chl *a* epimer, and chlorophyllide *a*) - HPLC determined
- Parameter 15 - pigment_c1_total
  - (Chl *a* + 27 Accessory Pigments) - HPLC determined

Product 23

- Parameter 19 - Total Suspended Matter
  - Dry Weight

Product 26 - Parameter 23 - K_490

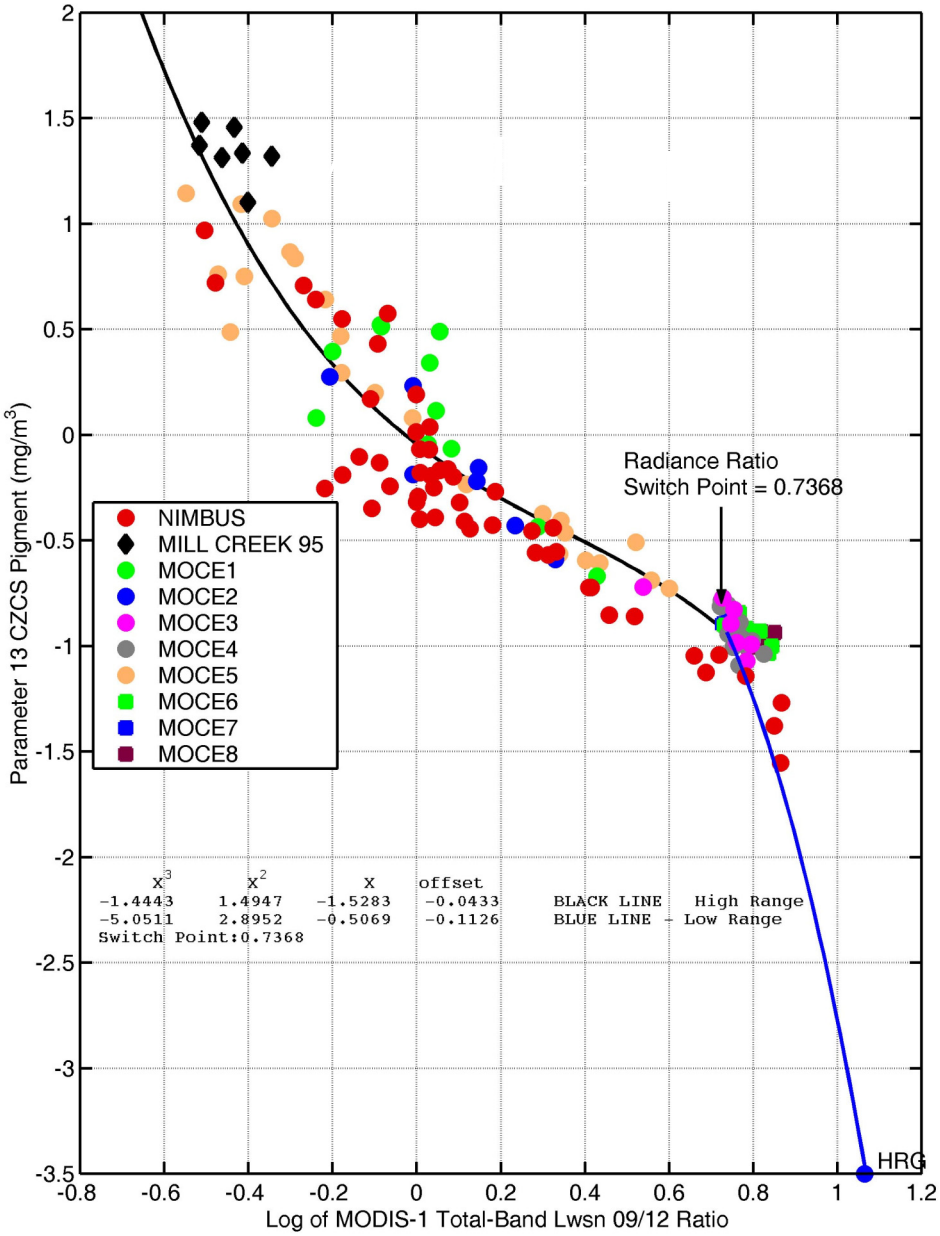
- SeaWiFS - Downwelled Irradiance Diffuse Attenuation Coefficient

nLw calibrations stabilized Product Impacts

- Problem: Chlor_modis > Total pigment concentration
  - In regions with high pigment concentrations
  - At high latitudes
- Reason: nLw 443 (b9) retrievals too low and 490 was stabilizing the 3 band total pigment retrievals.
- Problem: MODIS nLw's scaled to MOBY's stray light corrected nLw's were returning higher pigment concentrations in the low concentration regions.
- Reason: The in-water radiometric measurements were not stray light corrected.

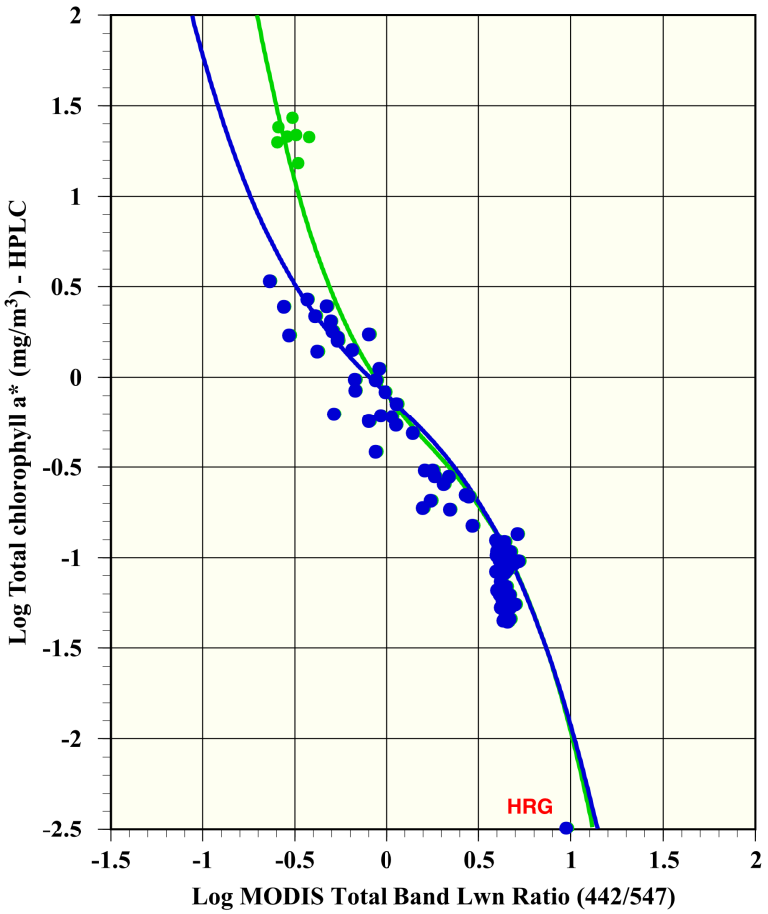
Parameter Modifications

- Parameters 14 & 19 reformulated from 2 band to 3 band ratios (chlor_MODIS & Total Suspended Matter).
- All products forced through Gordon's radiance ratios for pure water.
- *In situ* blue water nLw's were corrected for stray light with the NIST nominal characterizations.
- All parameter algorithms were split into two 3rd order polynomials to optimize the high radiance ratio range.

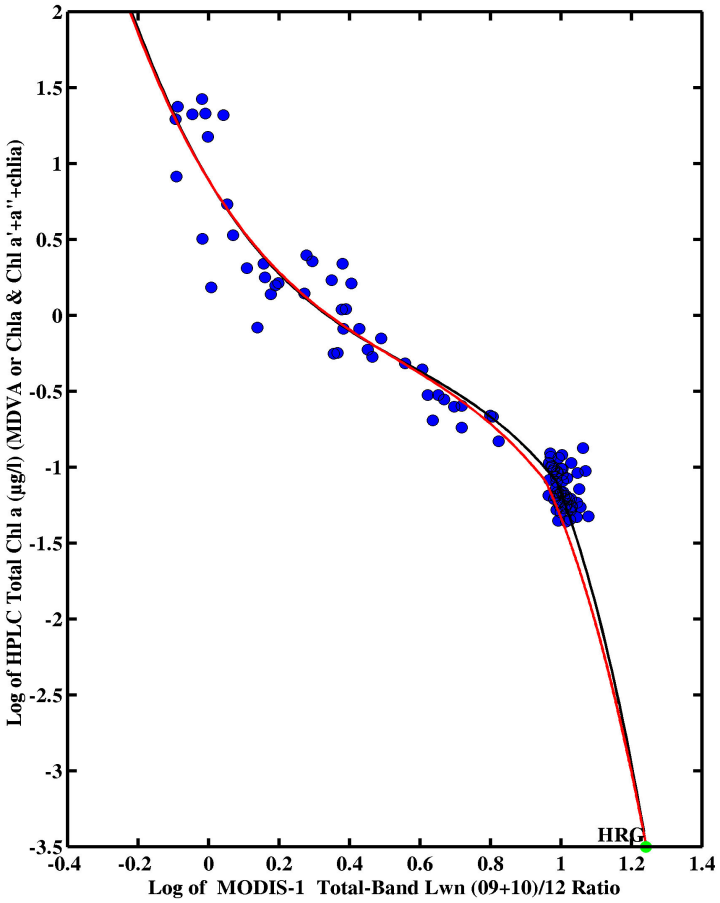

Parameter 13 CZCS Pigment (mg/m3)
Log of MODIS-1 Total-Band Lwsn 09/12 Ratio
NIMBUS
MILL CREEK 95
MOCE1
MOCE2
MOCE3
MOCE4
MOCE5
MOCE6
MOCE7
MOCE8
Radiance Ratio
Switch Point = 0.7368
HRG
X3 X2 X offset
-1.4443 1.4947 -1.5283 -0.0433 BLACK LINE High Range
-5.0511 2.8952 -0.5069 -0.1126 BLUE LINE - Low Range
Switch Point:0.7368

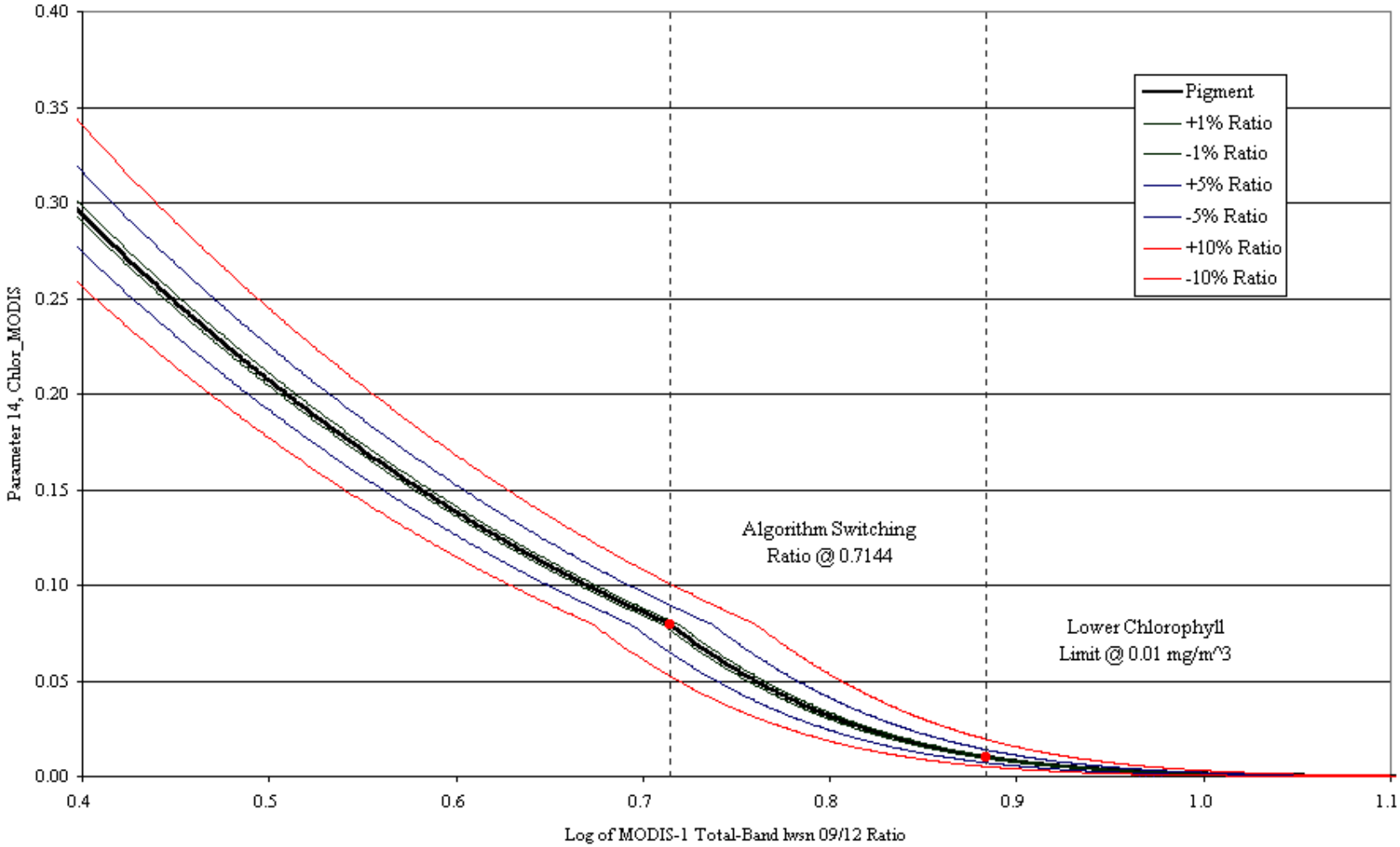
Effect of stray light correction on the chl_MODIS Product

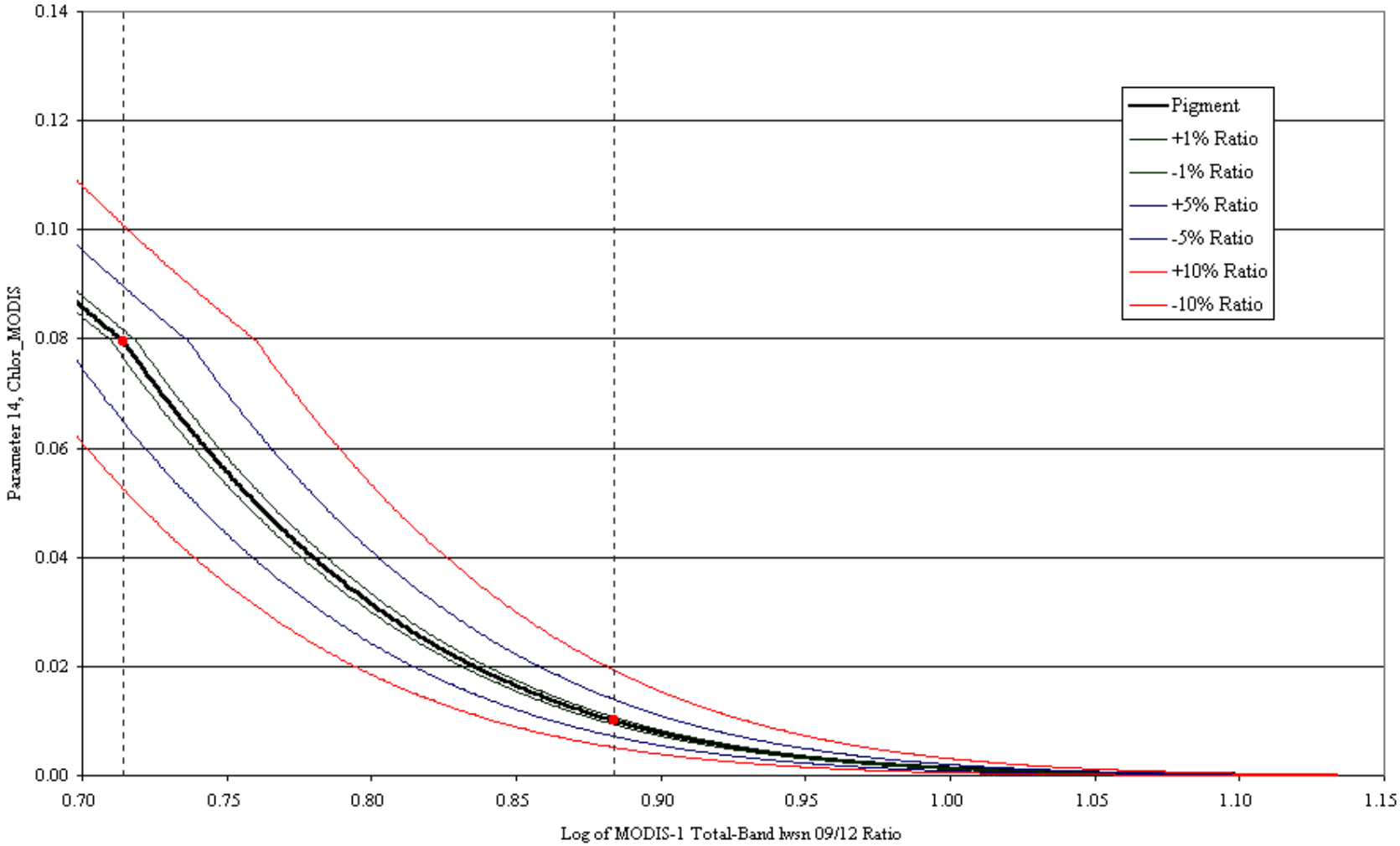
December 2001

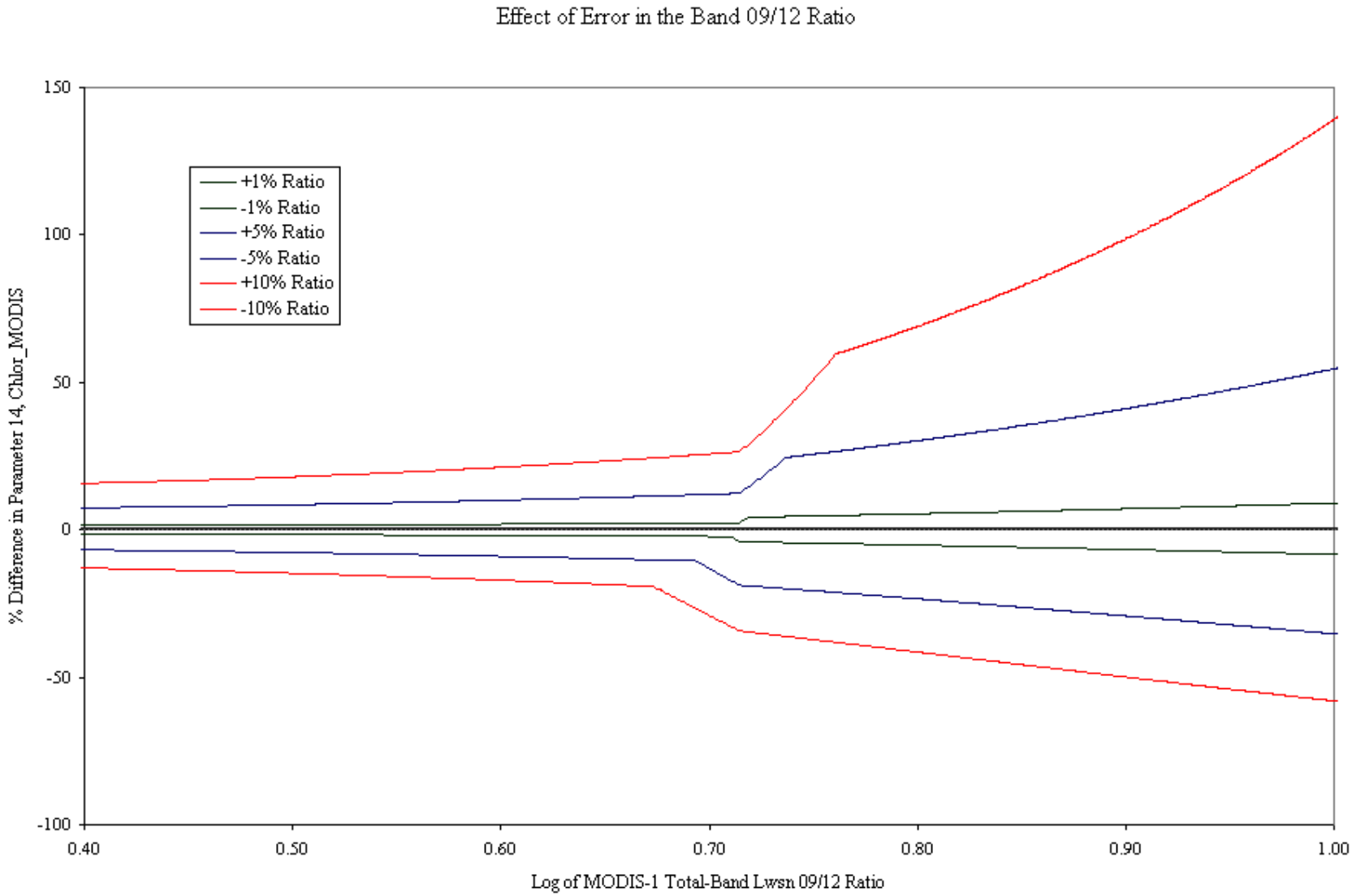


July 2002




Effect of Error in Band 9/12 Ratio
Parameter 14, Chlor_MODIS
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
Log of MODIS-1 Total-Band lwsn 09/12 Ratio
Pigment
+1% Ratio
-1% Ratio
+5% Ratio
-5% Ratio
+10% Ratio
-10% Ratio
Algorithm Switching
Ratio @ 0.7144
Lower Chlorophyll
Limit @ 0.01 mg/m^3


Effect of Error in Band 9/12 Ratio
Parameter 14, Chlor_MODIS
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.70
0.75
0.80
0.85
0.90
0.95
1.00
1.05
1.10
1.15
Log of MODIS-1 Total-Band lwsn 09/12 Ratio
Pigment
+1% Ratio
-1% Ratio
+5% Ratio
-5% Ratio
+10% Ratio
-10% Ratio


Effect of Error in the Band 09/12 Ratio
+1% Ratio
-1% Ratio
+5% Ratio
-5% Ratio
+10% Ratio
-10% Ratio
% Difference in Parameter 14, Chlor_MODIS
150
100
50
0
-50
-100
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Log of MODIS-1 Total-Band Lwsn 09/12 Ratio

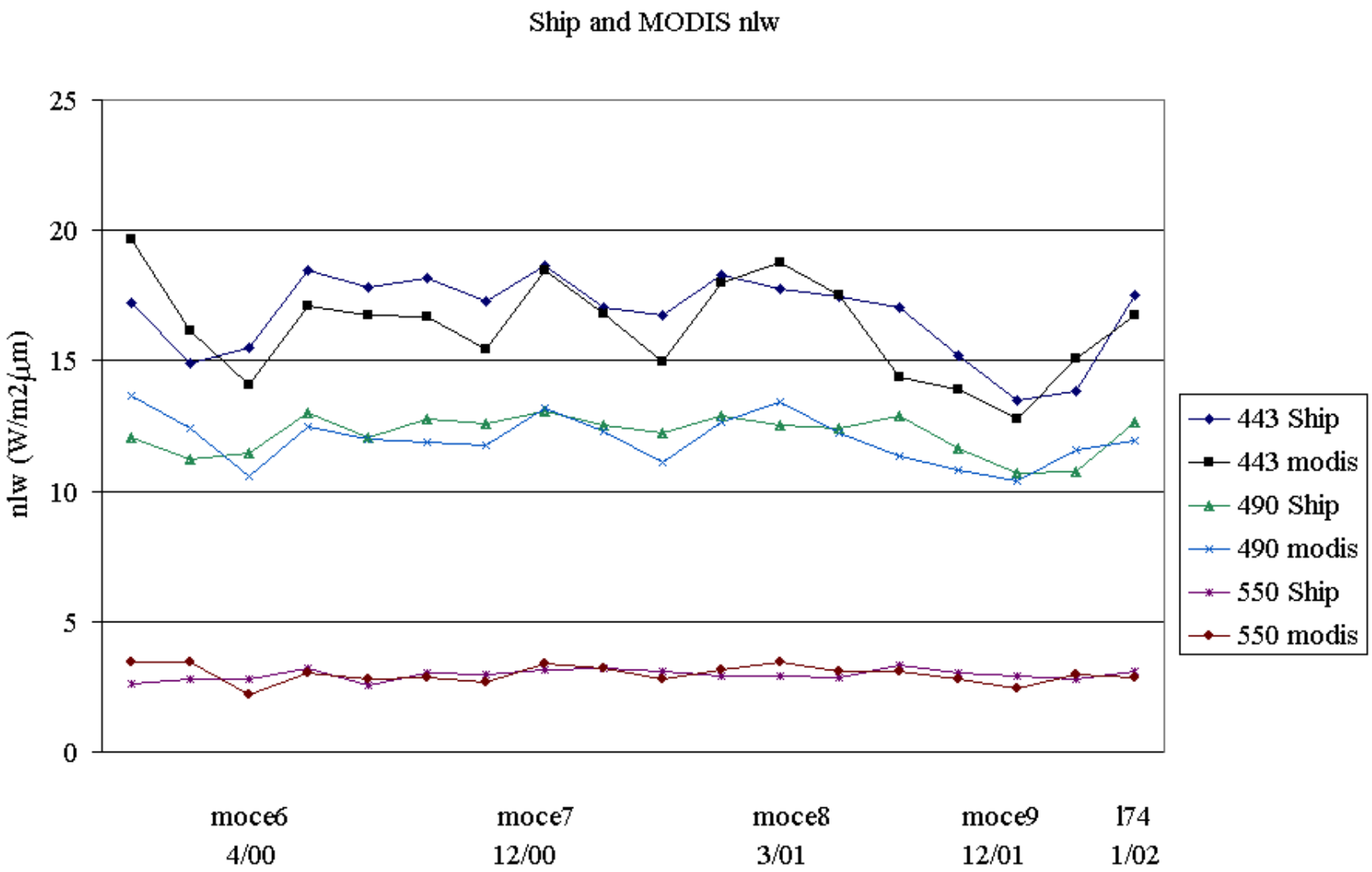
Generalized Form for Product Computation

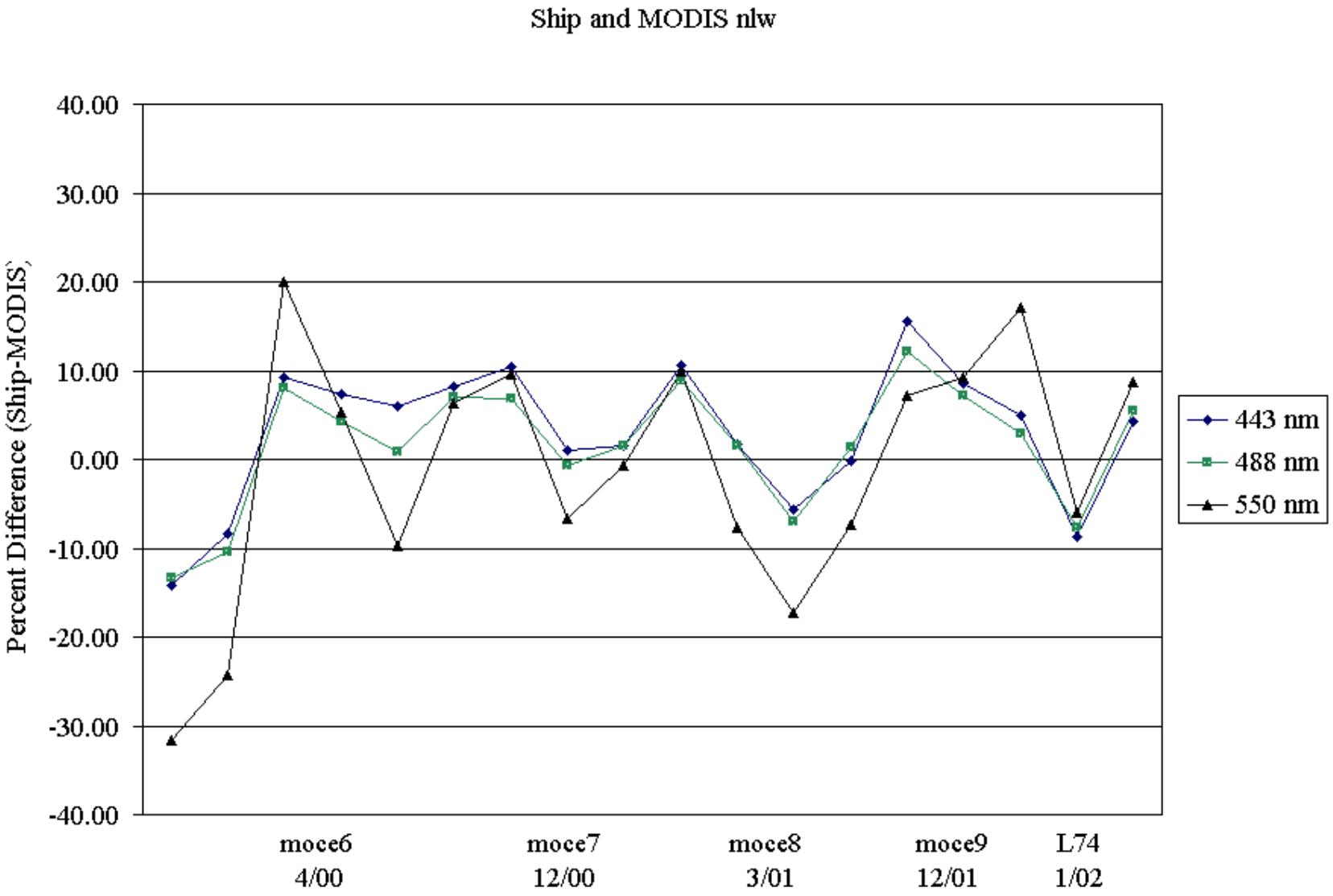
HIGH Lwn Ratio Range Log Product = (A(Log X) ^3 + B(Log X)^2 + C(Log X) + D) / E
LOW Lwn Ratio Range Log Product = (A(Log X) ^3 + B(Log X)^2 + C(Log X) + D) / E

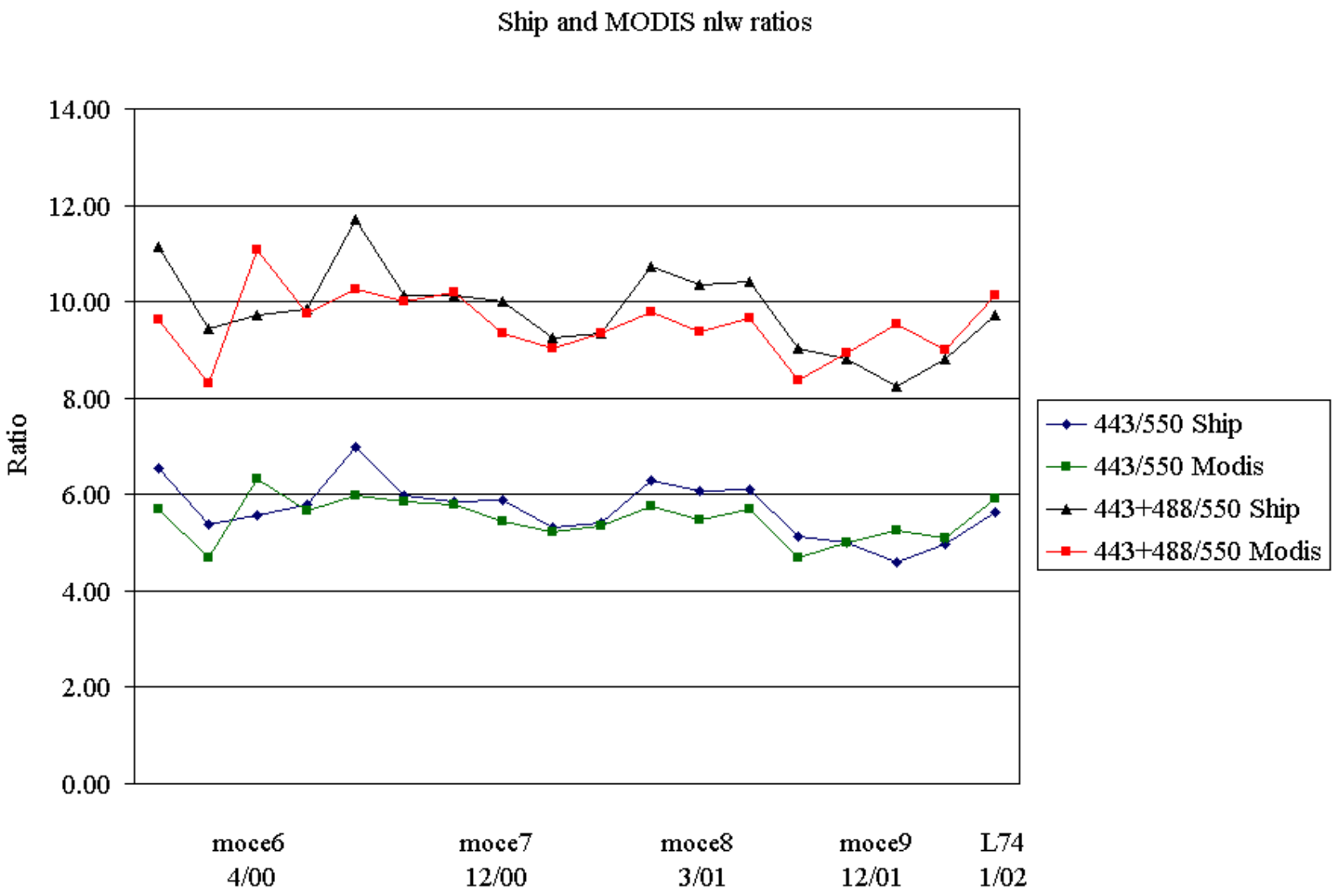
Switch Point (SP) is the value of the log Lwn ratio where :
the HIGH range form is replaced with the LOW range form.

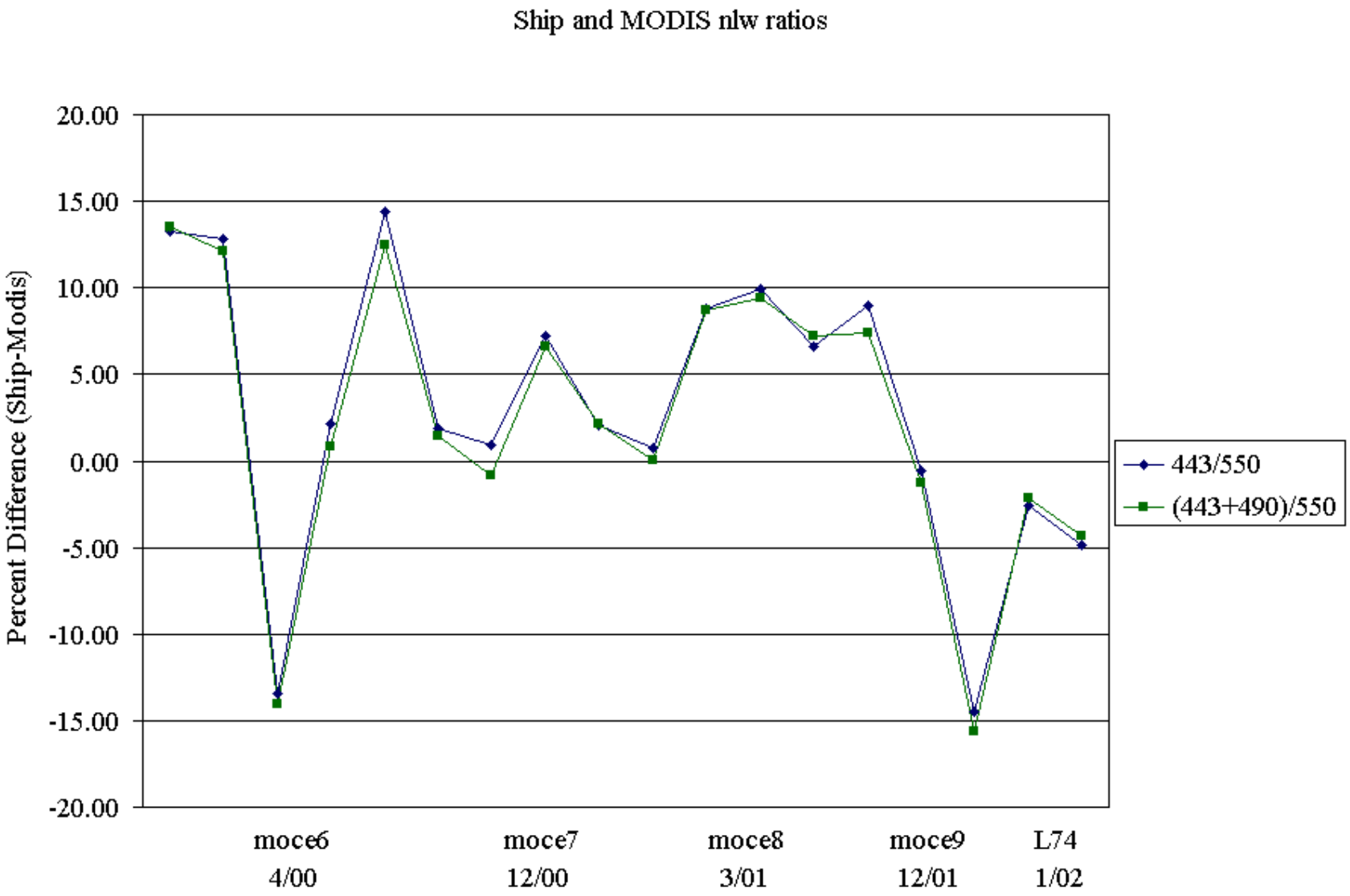
- Products 19 and 23
  - Two Least Squares Regressions (Log, Log)
  - 3rd order polynomials
  - $R^2 > 0.91$; $S_{yx} \sim .045$
- Product 26
  - Least Squares Regression
  - Linear
  - $R^2 = 0.94$; $S_{yx} = 0.167$

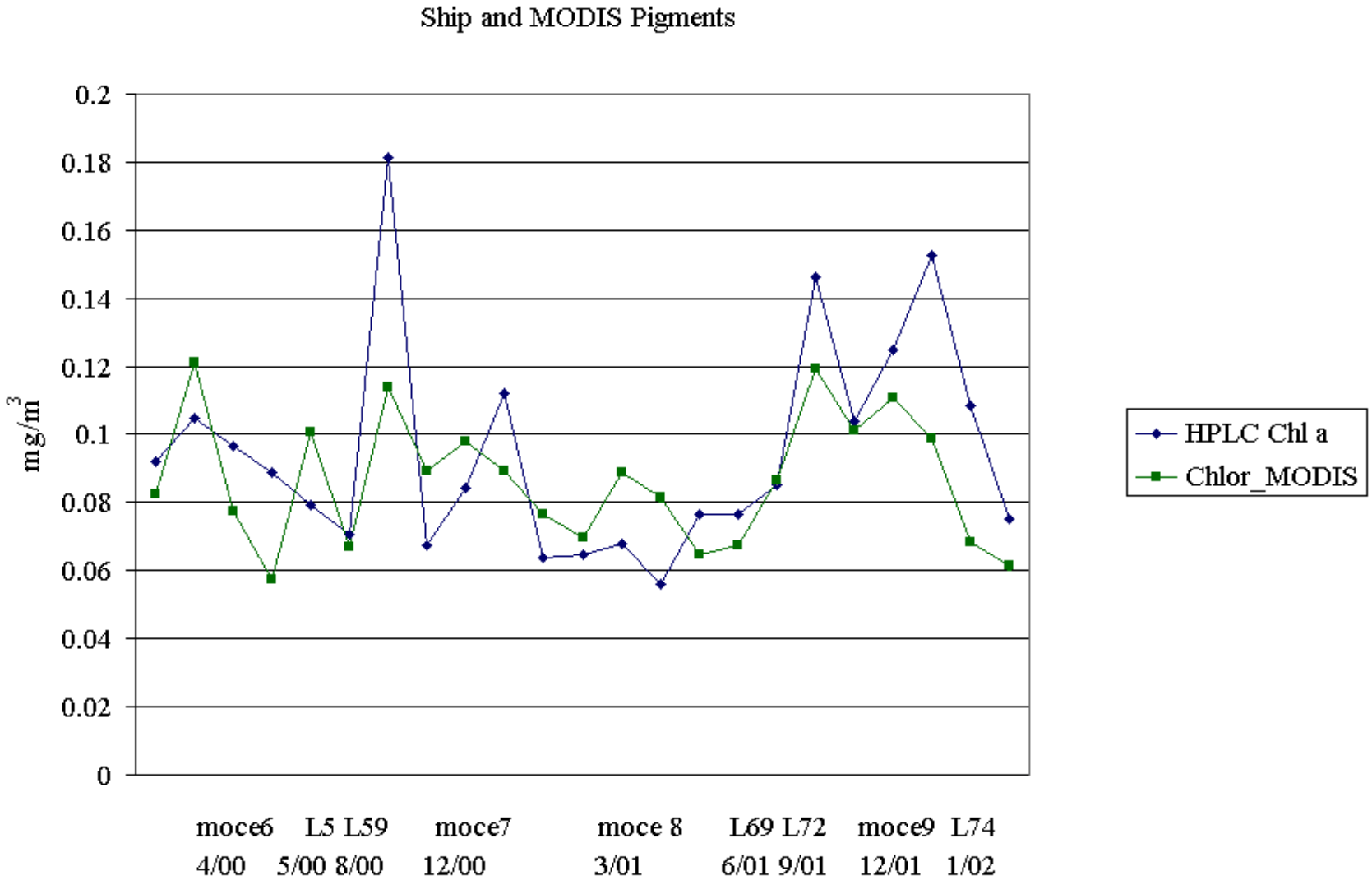
Initial MOCE Validations

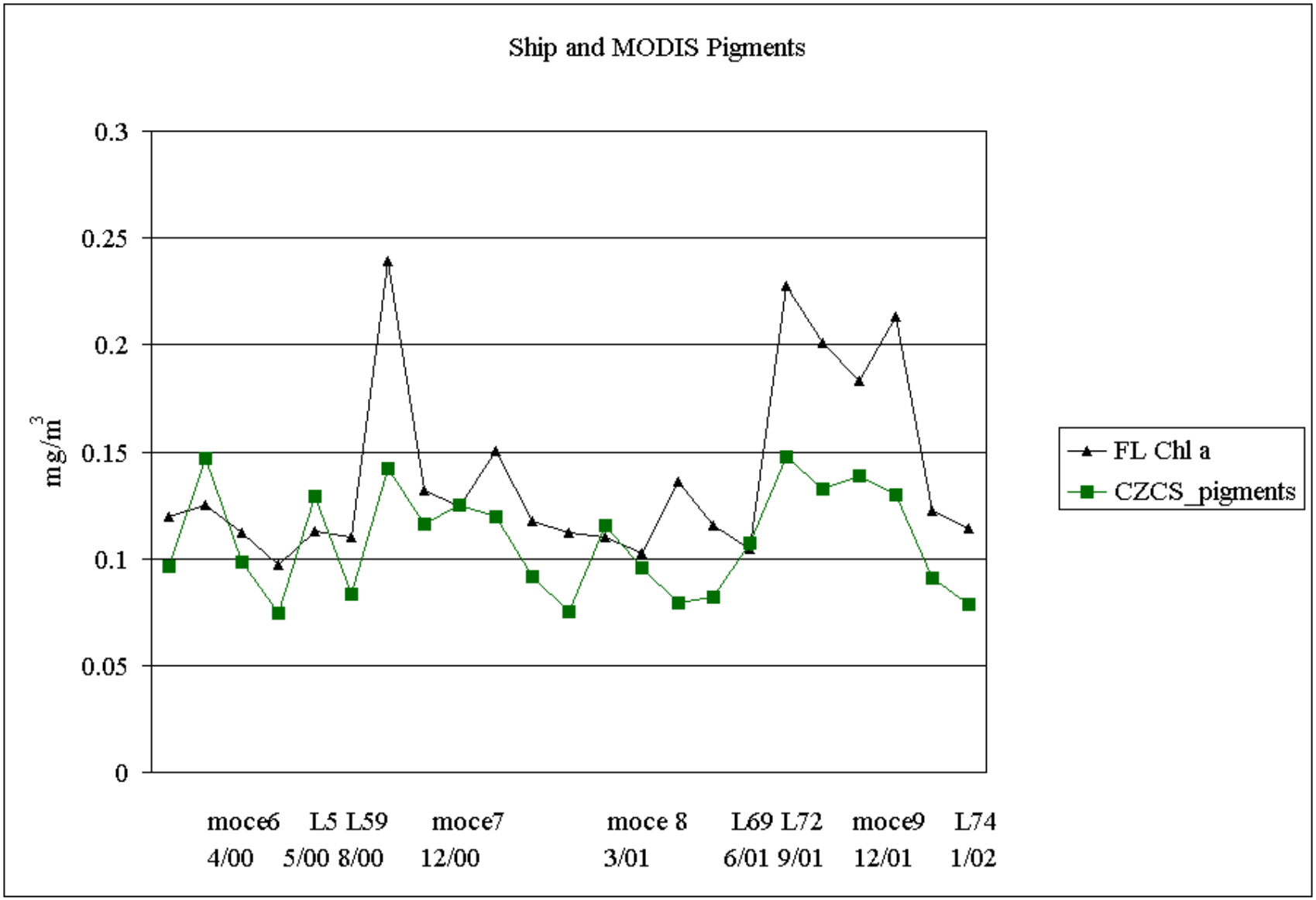

Ship and MODIS nlw
nlw (W/m2/µm)
25
20
15
10
5
0
moce6
4/00
moce7
12/00
moce8
3/01
moce9
12/01
l74
1/02
443 Ship
443 modis
490 Ship
490 modis
550 Ship
550 modis

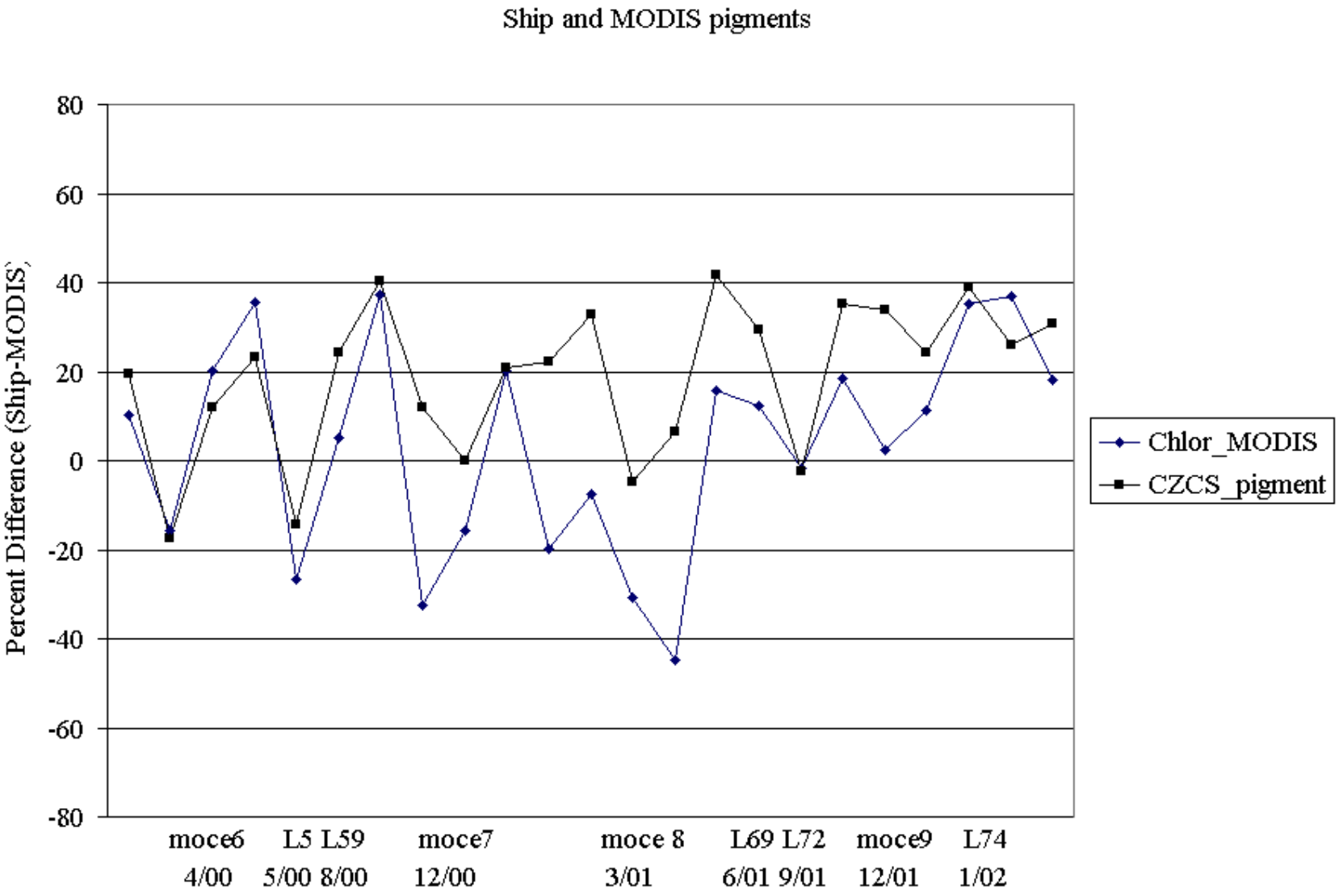

Ship and MODIS nlw
Percent Difference (Ship-MODIS)
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
moce6
4/00
moce7
12/00
moce8
3/01
moce9
12/01
L74
1/02
443 nm
488 nm
550 nm


Ship and MODIS nlw ratios
Ratio
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
moce6
4/00
moce7
12/00
moce8
3/01
moce9
12/01
L74
1/02
443/550 Ship
443/550 Modis
443+488/550 Ship
443+488/550 Modis

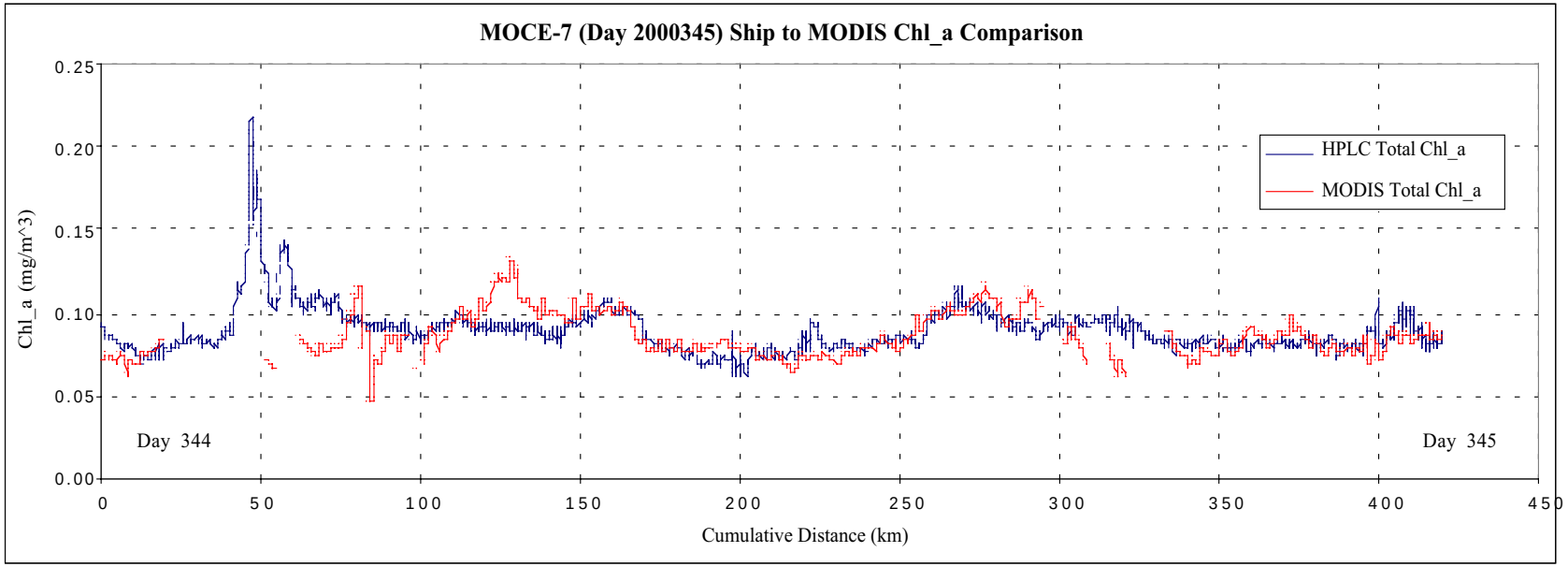

Ship and MODIS nlw ratios
Percent Difference (Ship-Modis)
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
moce6
4/00
moce7
12/00
moce8
3/01
moce9
12/01
L74
1/02
443/550
(443+490)/550

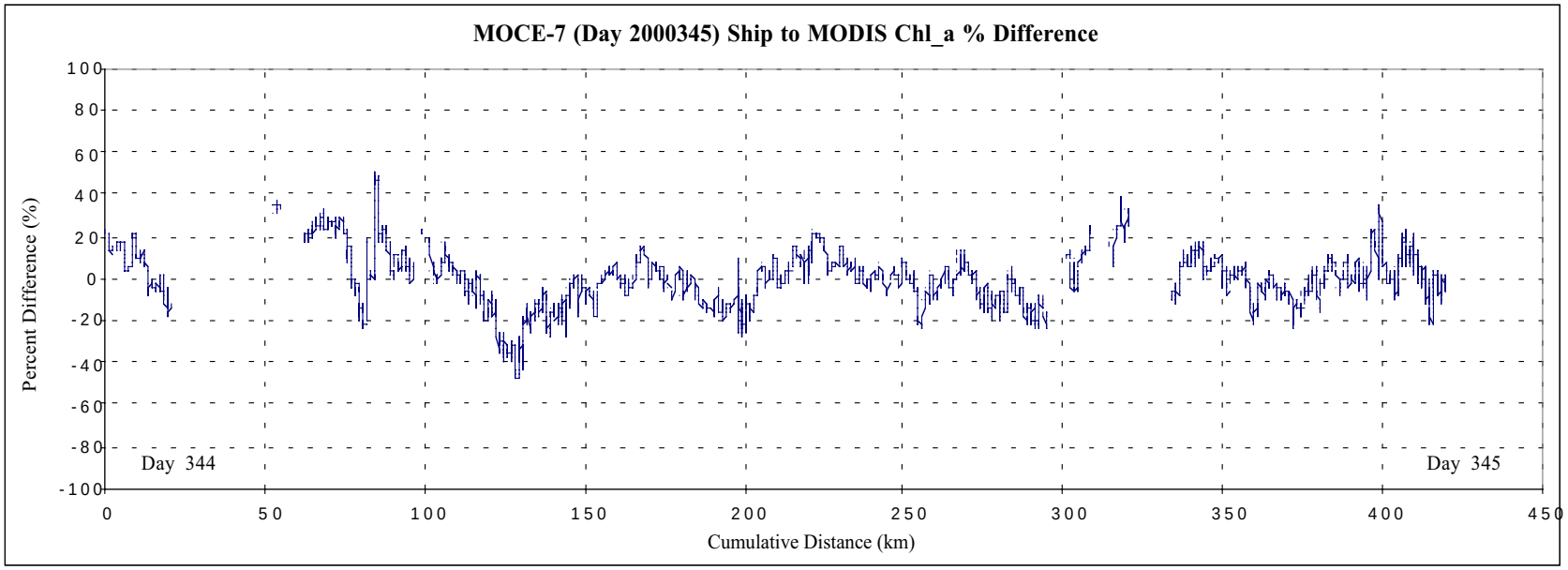

Ship and MODIS Pigments
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
mg/m3
moce6 4/00
L5 5/00
L59 8/00
moce7 12/00
moce 8 3/01
L69 6/01
L72 9/01
moce9 12/01
L74 1/02
HPLC Chl a
Chlor_MODIS


Ship and MODIS Pigments
0.3
0.25
0.2
0.15
0.1
0.05
0
mg/m3
moce6 4/00
L5 L59 5/00 8/00
moce7 12/00
moce 8 3/01
L69 L72 6/01 9/01
moce9 12/01
L74 1/02
FL Chl a
CZCS_pigments

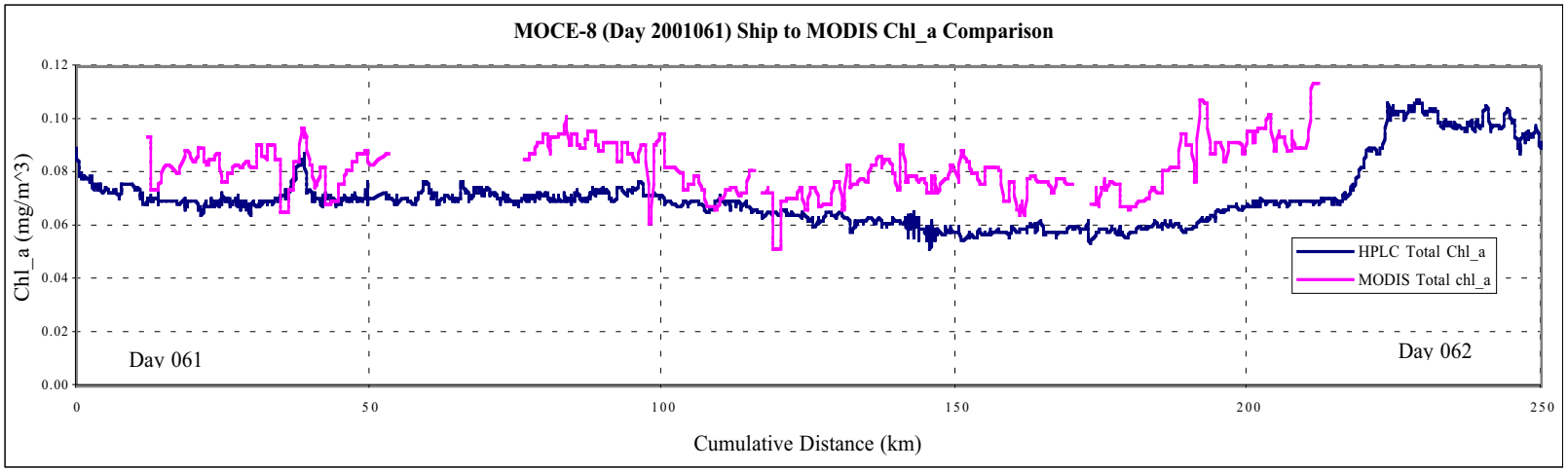

Ship and MODIS pigments
Percent Difference (Ship-MODIS)
80
60
40
20
0
-20
-40
-60
-80
moce6 4/00
L5 L59 5/00 8/00
moce7 12/00
moce 8 3/01
L69 L72 6/01 9/01
moce9 12/01
L74 1/02
Chlor_MODIS
CZCS_pigment

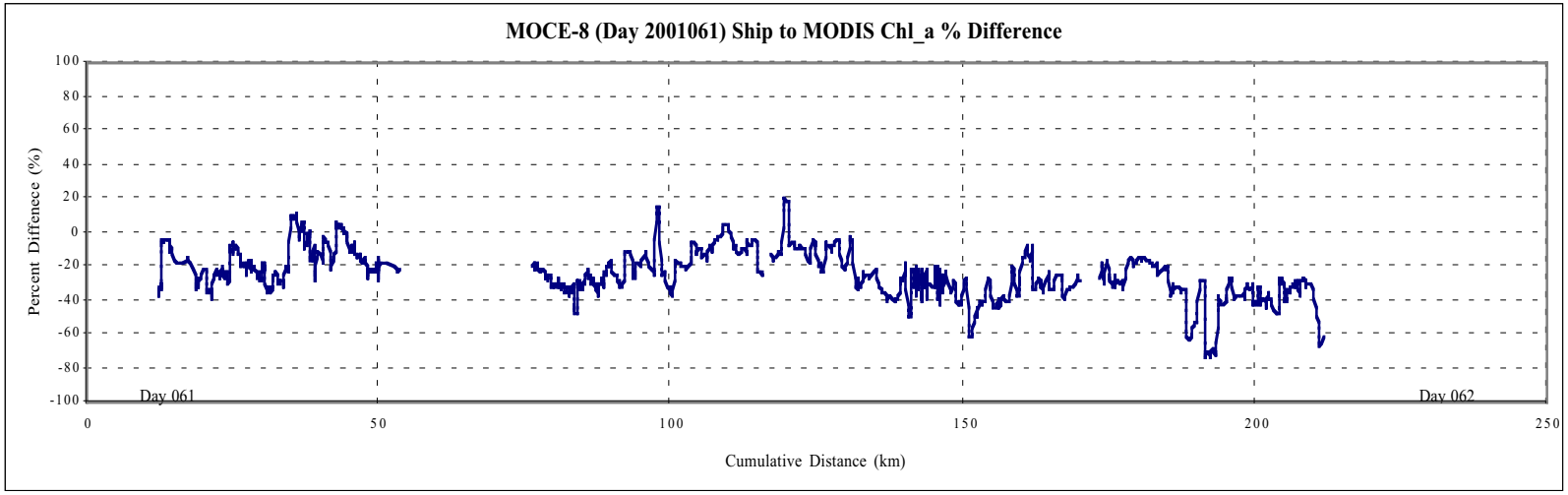
MOCE 7 - MODIS_Chl Ship Track

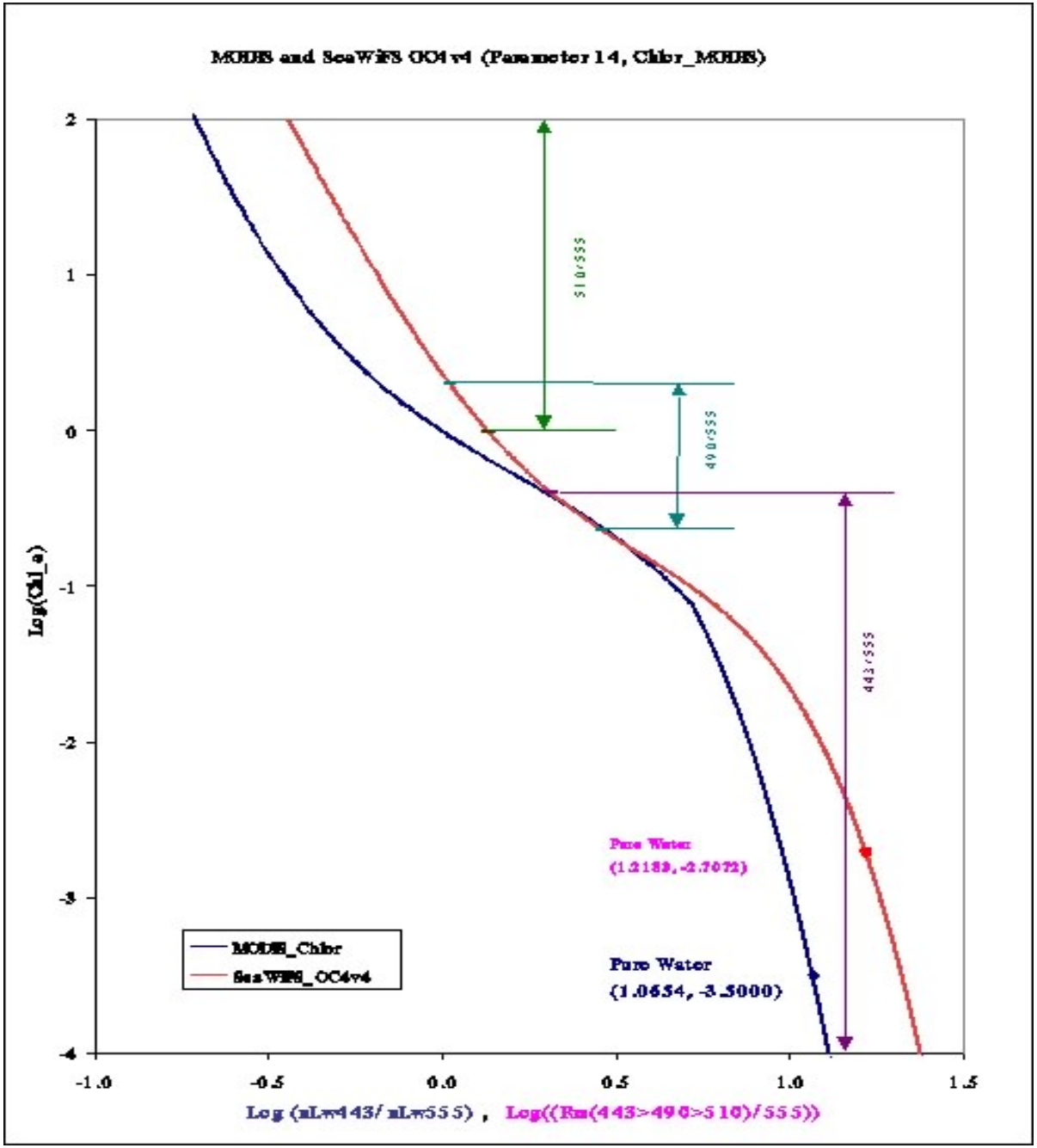




MOCE 8 - MODIS_Chl Ship Track






MODIS and SeaWiFS OC4v4 (Parameter 14, Chlor_MODIS)
2
1
0
-1
-2
-3
-4
-1.0
-0.5
0.0
0.5
1.0
1.5
Log(Chl_a)
Log (nLw443/ nLw555) , Log((Rm(443>490>510)/555))
510/555
490/555
443/555
Pure Water
(1.2189, -2.7072)
Pure Water
(1.0654, -3.5000)
MODIS_Chlor
SeaWIFS_OC4v4

Present Status - Future Validation

- Recent Miami characterizations/calibration results have solved most of the major nLw retrieval problems.
- Present products are computationally validated and initial validation results indicate that the pigment retrievals are within 30%.
- MOBY observations now operational for Aqua.
- July - Two cal/val data sets with Modis Terra,Aqua &SeaWiFS overpasses.
- MODIS Validation/Initialization cruises scheduled for Sept. and Oct. 2002 in the Chesapeake Bay and Hawaii.