Global Imager (GLI) Standard Algorithms (Chl-*a*, CDOM and *K*490), Calibration and Validation

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Goals: To make comprehensive measurements in support of ocean color satellite applications for

- phytoplankton pigments
- suspended sediments
- UV-visible attenuation coefficients
- primary production

$R_{rs}(\lambda) = Lu / Ed$

$R(\lambda) = Eu / Ed$

$R_{rs}(\lambda) = f/Q\ bb(\lambda) / [a(\lambda) + bb(\lambda)]$

$P = chl \int a_{ph}^*(\lambda)\, E(\lambda)\, \phi(\lambda)$

ϕ and a_{ph}^* are functions of E, N, T; $\phi_{max} = \alpha / a_{ph}^*$

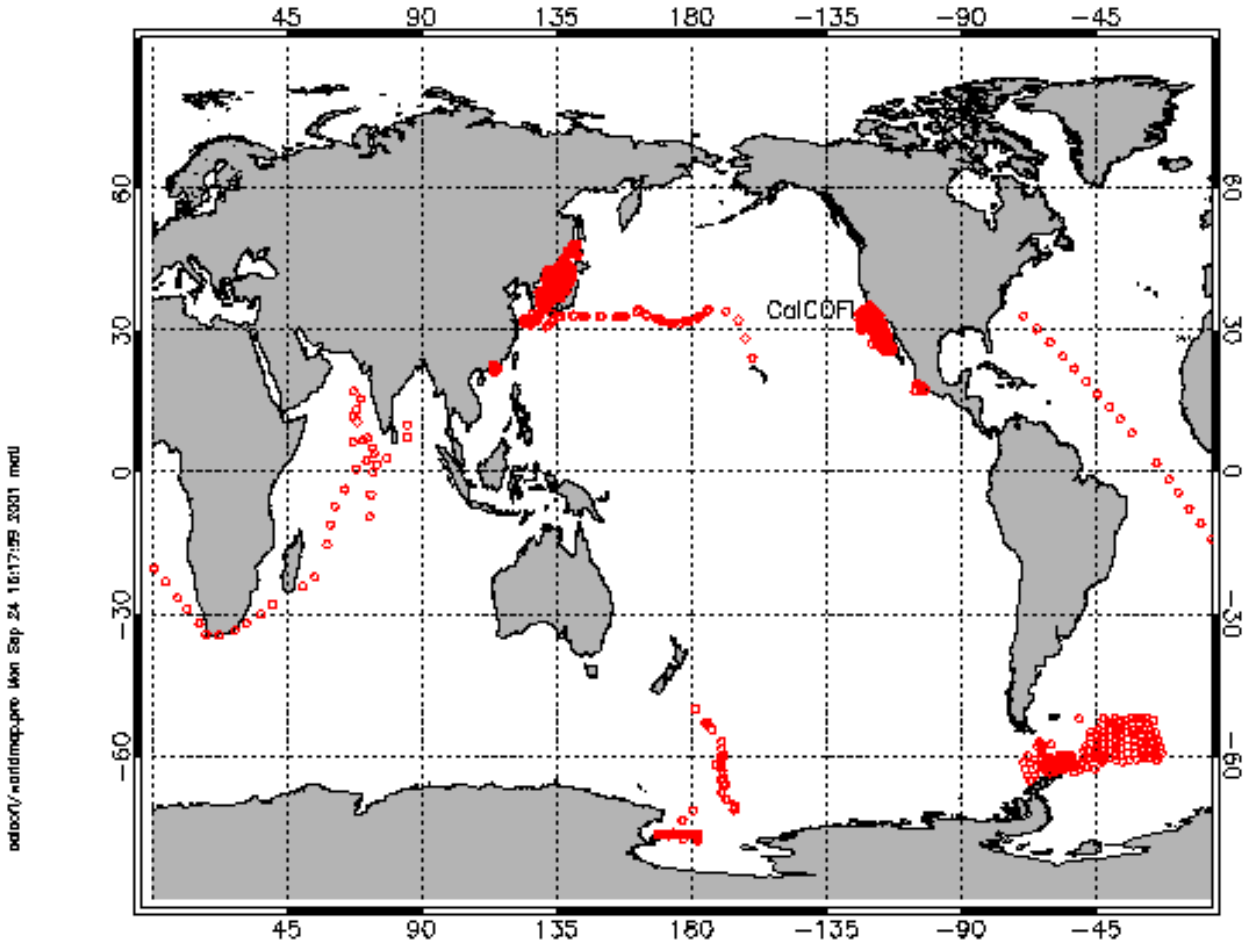
In situ Measurements

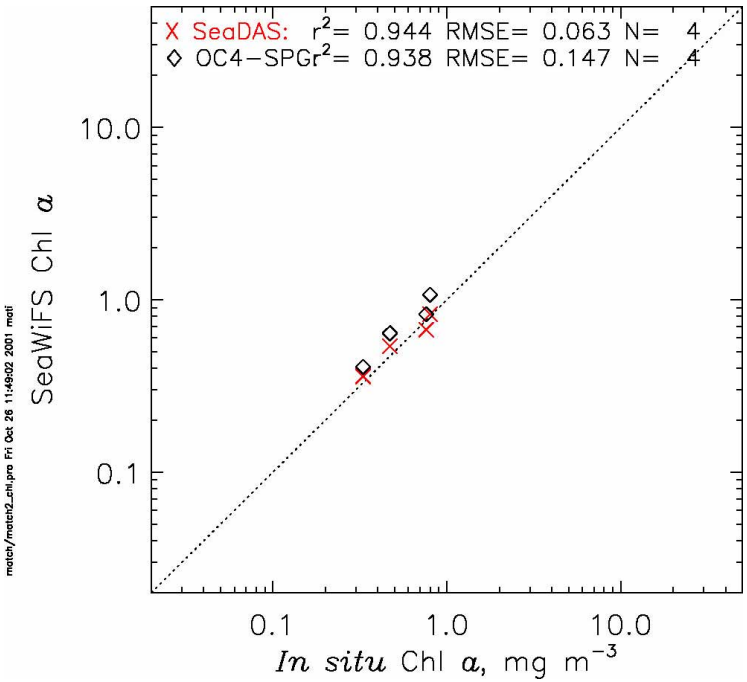
Ed, Lu, Eu MER 2048 and PRR800
AC9
Cstar 660, 490
CTD
In vivo fluorescence
FRRF variable fluorescence
Hydroscat bb

Water Sample Measurements

Absorption
- Phytoplankton, Photosynthesis
- Detritus
- Soluble

Particle size distribution
Fluorometric chlorophyll
HPLC Pigments
Total suspended solids
CDOM fluorescence matrix
Mycosporine amino acids
Flow cytometry
Photosynthesis - Irradiance


45
90
135
180
−135
−90
−45
60
30
0
−30
−60
CalCOFI
pdocV1/worldmap.pro Mon Sep 24 16:17:55 2001 mdl


X SeaDAS: r²= 0.944 RMSE= 0.063 N= 4
◇ OC4-SPGr²= 0.938 RMSE= 0.147 N= 4
SeaWiFS Chl a
10.0
1.0
0.1
0.1
1.0
10.0
In situ Chl a, mg m⁻³
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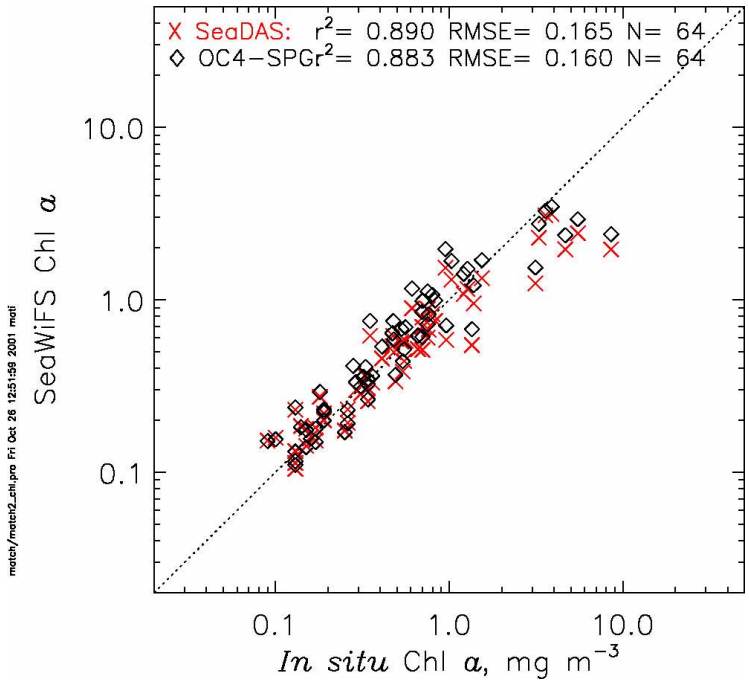
X SeaDAS: r²= 0.890 RMSE= 0.165 N= 64
◇ OC4-SPGr²= 0.883 RMSE= 0.160 N= 64
SeaWiFS Chl a
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1.0
0.1
0.1
1.0
10.0
In situ Chl a, mg m⁻³
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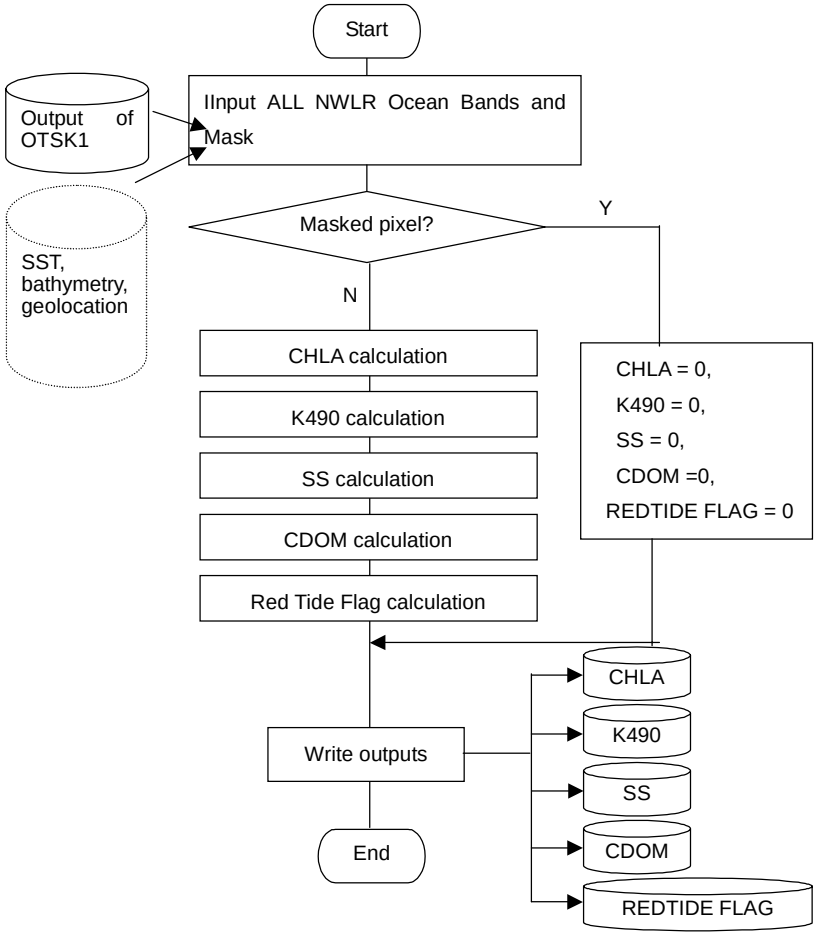
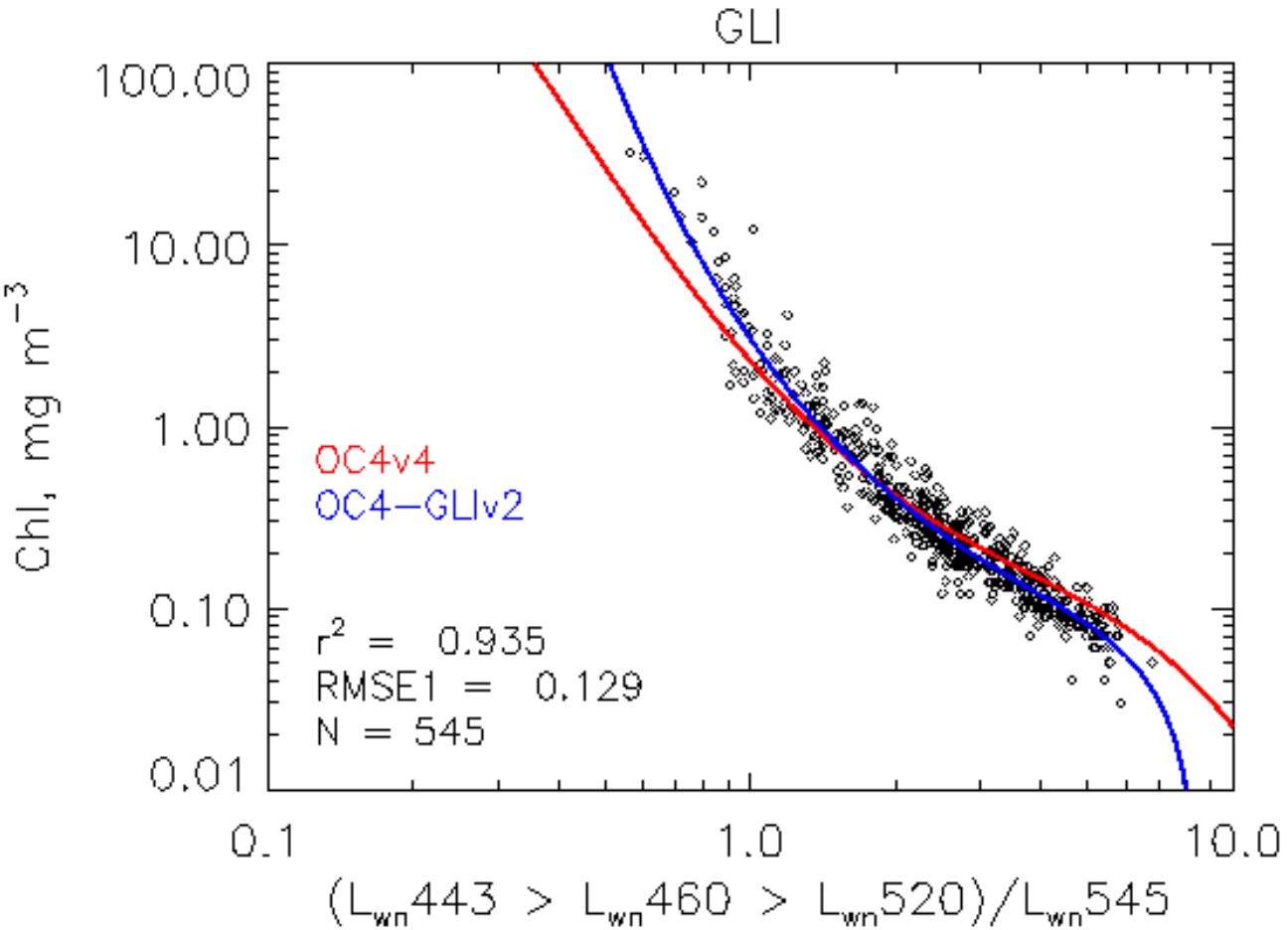
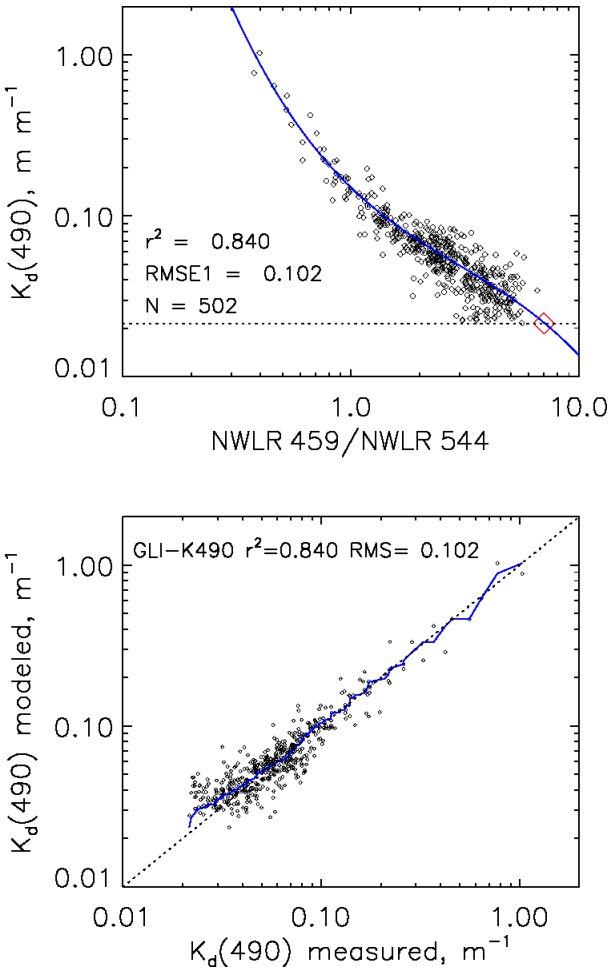


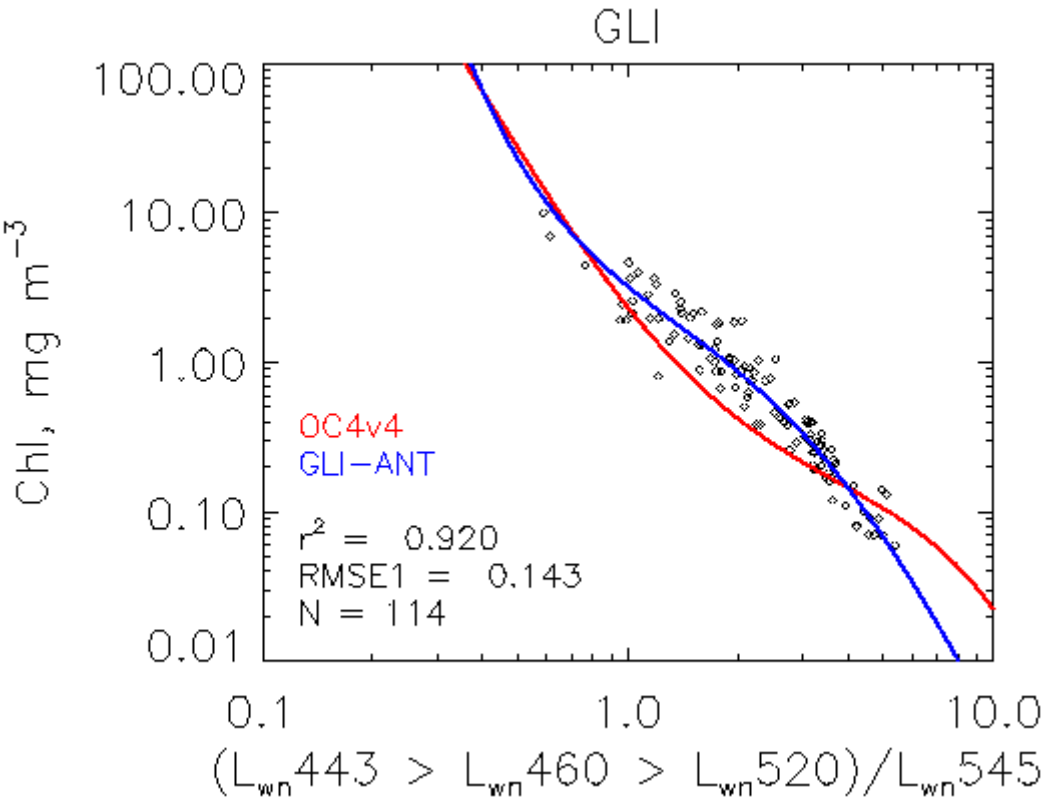
Algorithm flow chart of OTSK2, 5, 6 and 7



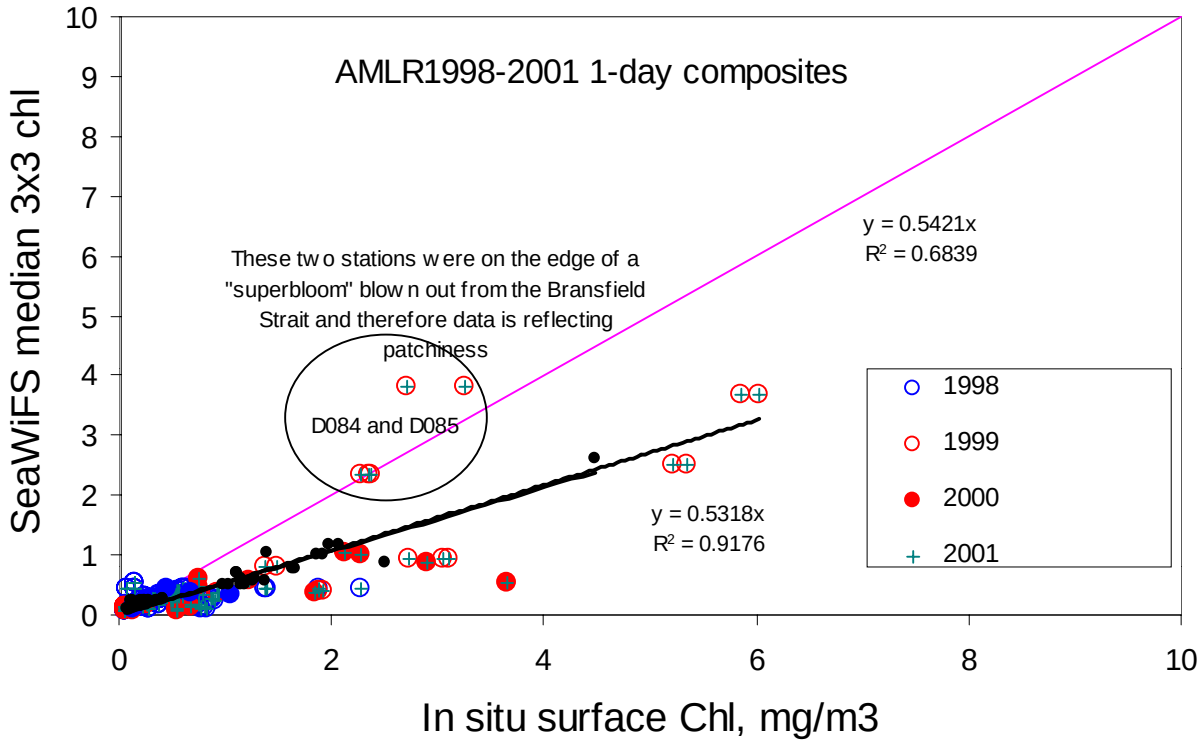
GLI CHLA algorithm (OC4-GLI version 2) using the maximum band ratio of NWLR443, NWLR460, NWLR520 to NWLR545 shown as the blue line. As a comparison we show the current SeaWiFS OC4v4 algorithm red line) that uses a different set of bands (MBR of NWLR443, NWLR490, NWLR510 to NWLR555). Primarily due to using a shorter wavelength for normalizing, the fitting function for GLI is more nonlinear.



The GLI K490 algorithm using band ratio of NWLR460 and NWLR545 (top). The pure water value is shown with a horizontal dashed line, estimated pure water reflectance and K490 are shown as a big red diamond. The quantile-quantile plot is shown in bottom panel.



GLI Southern Ocean CHLA algorithm (GLI-ANT) using the maximum band ratio of NWLR443, NWLR460, NWLR520 to NWLR545 (bleu line) compared to current SeaWiFS OC4v4 algorithm (red line).


AMLR1998-2001 1-day composites
SeaWiFS median 3x3 chl
In situ surface Chl, mg/m3
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
10
y = 0.5421x
R² = 0.6839
y = 0.5318x
R² = 0.9176
These two stations were on the edge of a "superbloom" blown out from the Bransfield Strait and therefore data is reflecting patchiness
D084 and D085
1998
1999
2000
2001

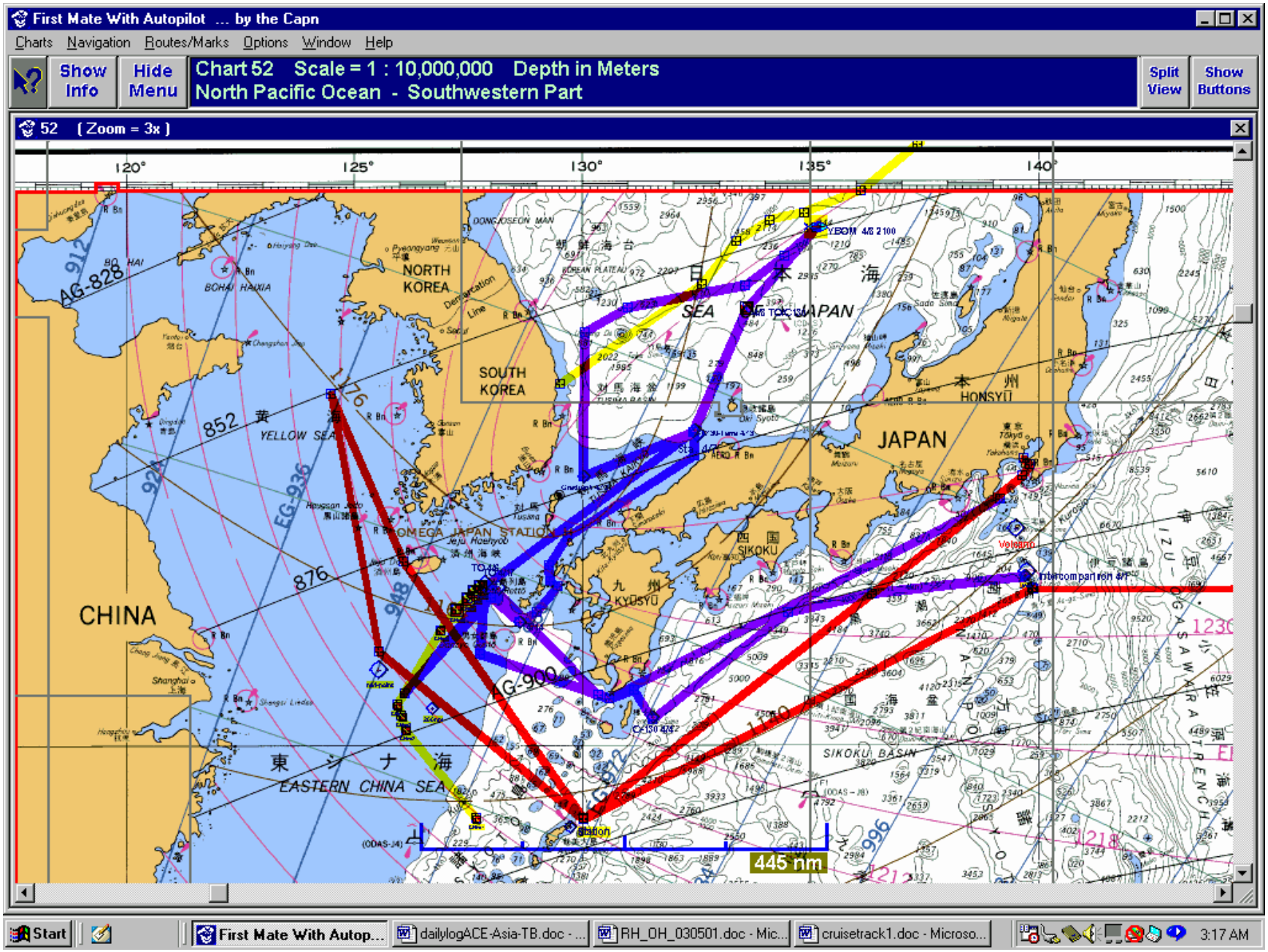
ACE Asia Cruise: Cal/Val case study

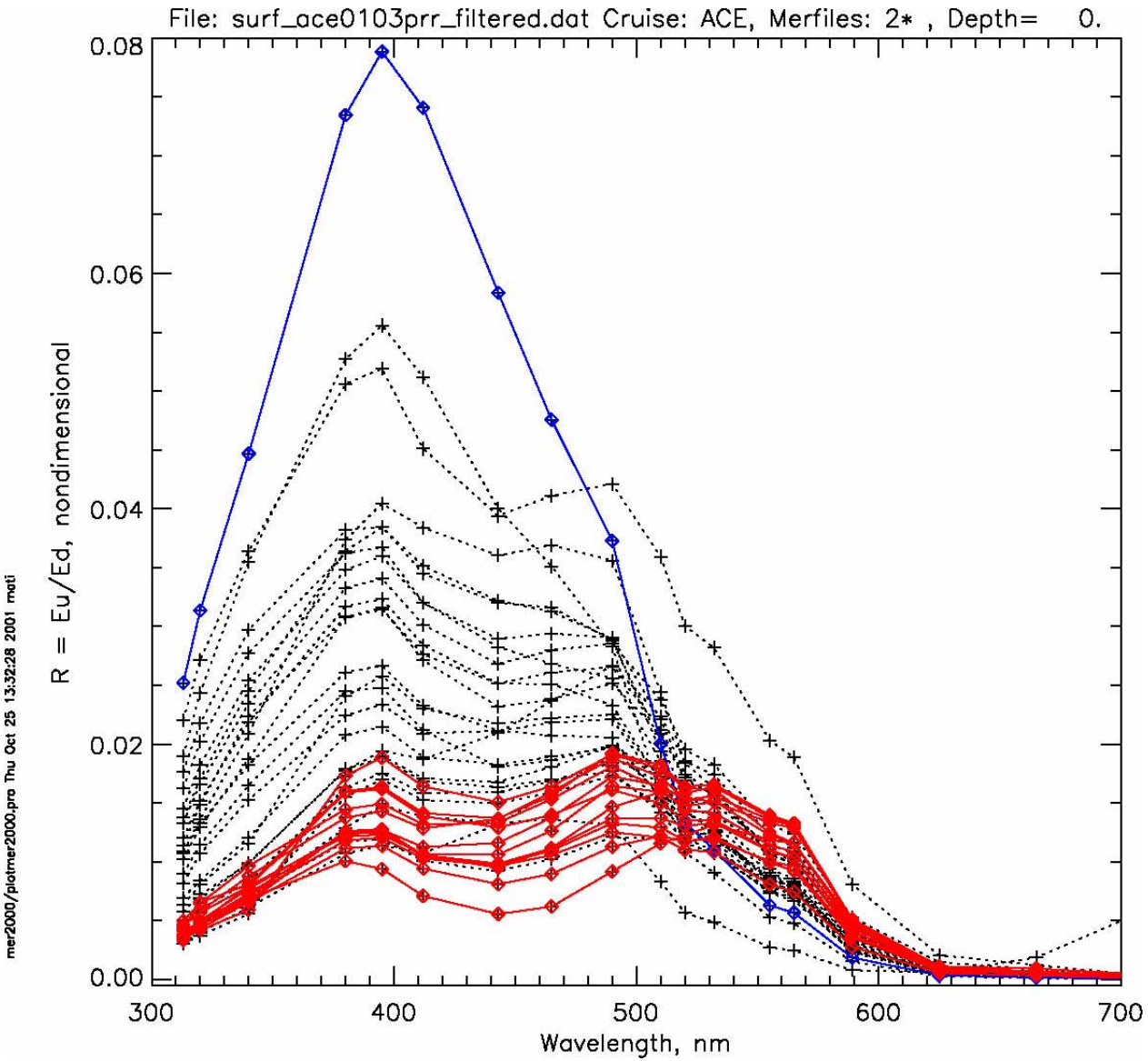
Comprehensive work on ocean and atmospheric optics and characterization of constituents in each

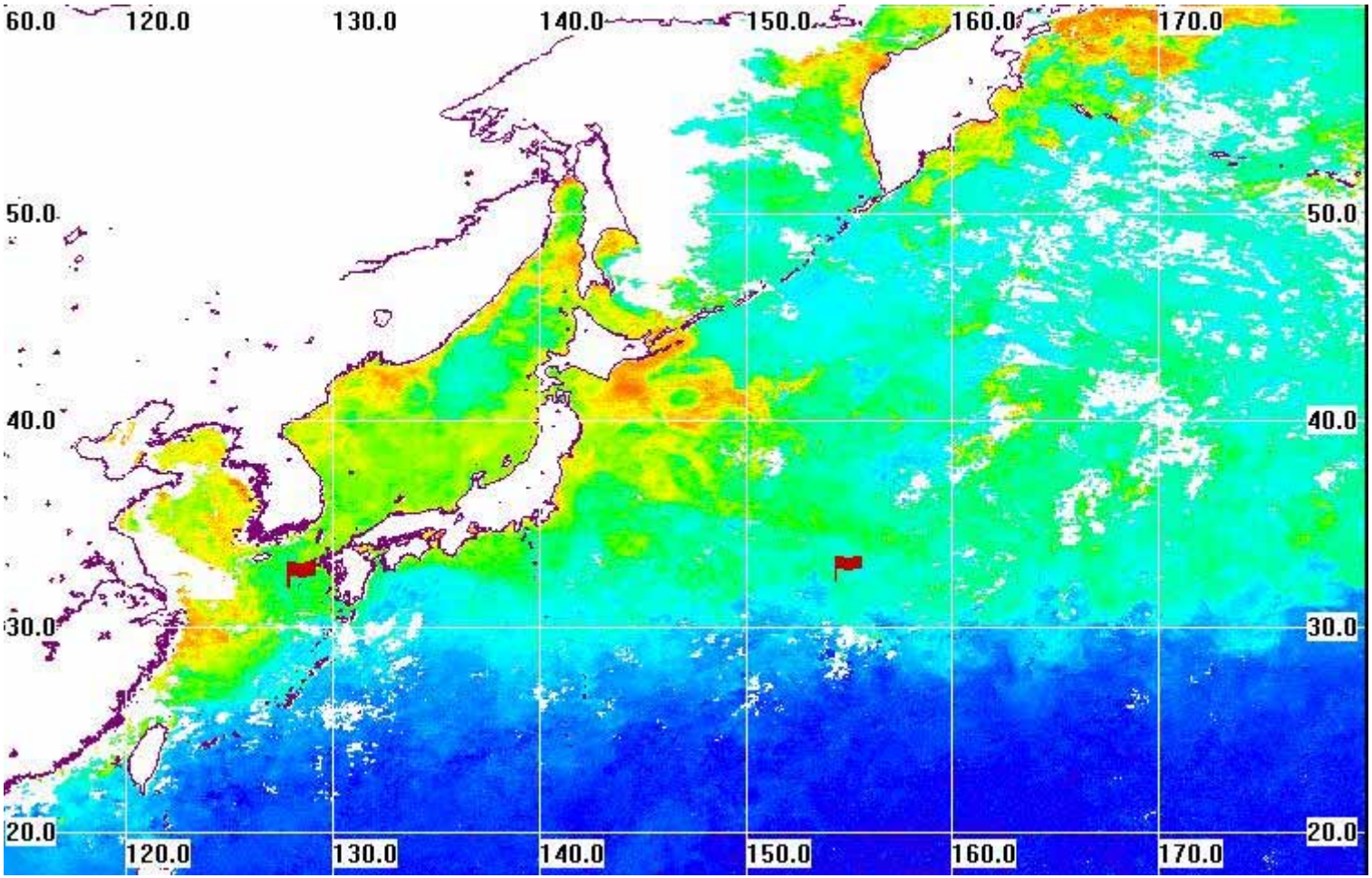
40 bio-optical stations

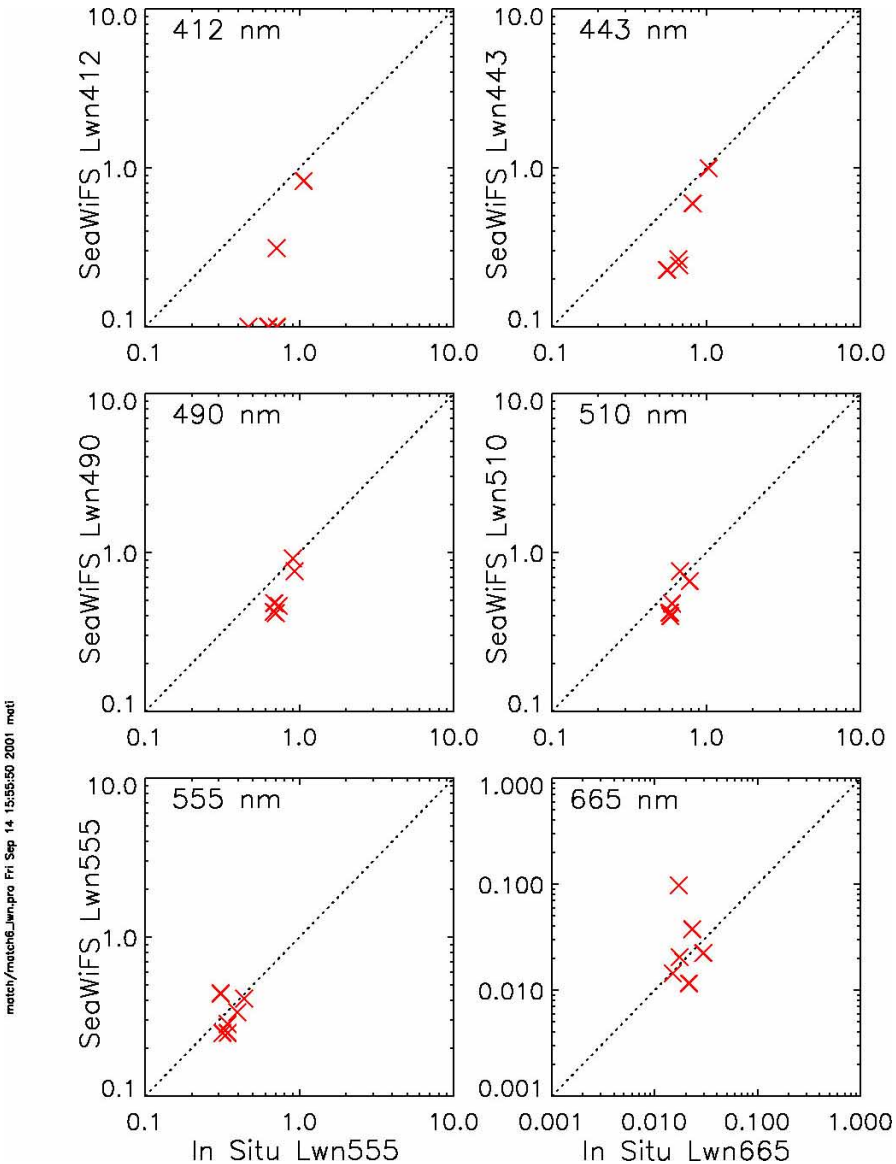
Only 3 very good matchups with standard SeaWiFS processing

More matchups may be possible with new atmospheric corrections


First Mate With Autopilot ... by the Capn
Charts Navigation Routes/Marks Options Window Help
Show Info
Hide Menu
Chart 52 Scale = 1 : 10,000,000 Depth in Meters
North Pacific Ocean - Southwestern Part
Split View
Show Buttons
52 (Zoom = 3x)
120°
125°
130°
135°
140°
NORTH KOREA
SOUTH KOREA
JAPAN
CHINA
YELLOW SEA
EASTERN CHINA SEA
SEA OF JAPAN
SIKOKU BASIN
OMEGA JAPAN STATION
445 nm
Start
First Mate With Autop...
dailylogACE-Asia-TB.doc - ...
RH_OH_030501.doc - Mic...
cruisetrack1.doc - Microso...
3:17 AM


File: surf_ace0103prr_filtered.dat Cruise: ACE, Merfiles: 2* , Depth= 0.
R = Eu/Ed, nondimensional
Wavelength, nm
0.00
0.02
0.04
0.06
0.08
300
400
500
600
700
mer2000/plotmer2000.pro Thu Oct 25 13:32:28 2001 mati


60.0
120.0
130.0
140.0
150.0
160.0
170.0
50.0
40.0
30.0
20.0


412 nm
443 nm
490 nm
510 nm
555 nm
665 nm
SeaWiFS Lwn412
SeaWiFS Lwn443
SeaWiFS Lwn490
SeaWiFS Lwn510
SeaWiFS Lwn555
In Situ Lwn555
In Situ Lwn665
10.0
1.0
0.1
1.000
0.100
0.010
0.001
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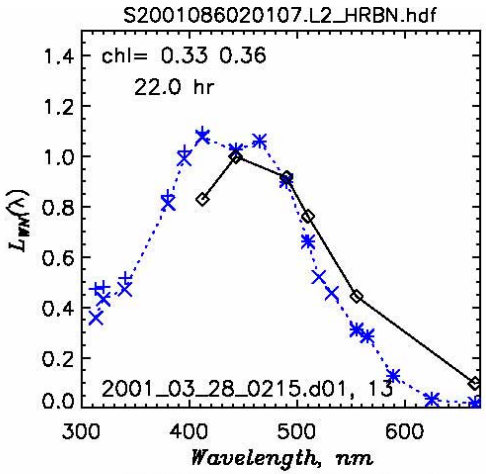

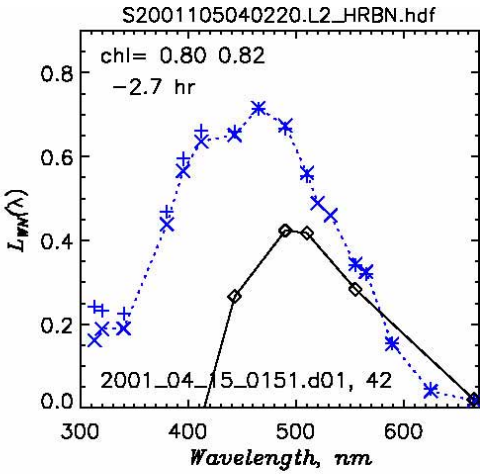

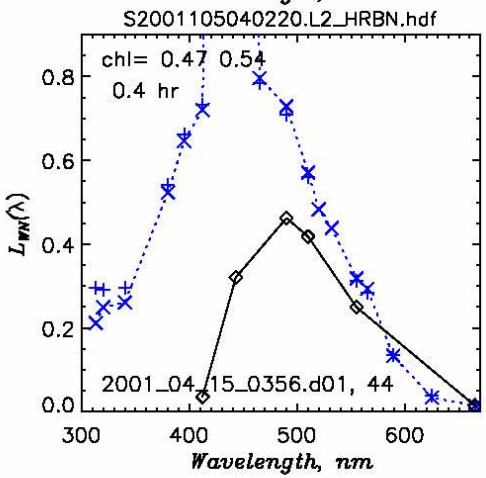

Comprehensive observations needed to extend understanding

Reflectance

Pigments, organic sediments, mineral sediments

Absorption

Scattering (total, backscatter)

Must make new observations in areas with different properties

Southern Ocean

CDOM-dominated

Suspended sediment dominated (organic and mineral)

Cocolothophore

Diazotrophs (Trichodesmium, Nodularia,Diatom symbionts)

Calibrabration and Validation at sea requires signficant number of ship days

Since SeaWiFS launch we have >400 days and > 600 statinons

but only 70 high resolution matchups

Good cal/val for GLI will require a good coordinated effort and data sharing