Ocean Color Time Series

Goal:

Provide consistent time series of Level-3 ocean color data from 1979, with a 9-year gap (1987-1996)

Emphasize consistent algorithms and calibration methodologies

Produce Climate Data Records (CDR) of ocean color

Ocean Color Time Series

REASoN CAN Team:

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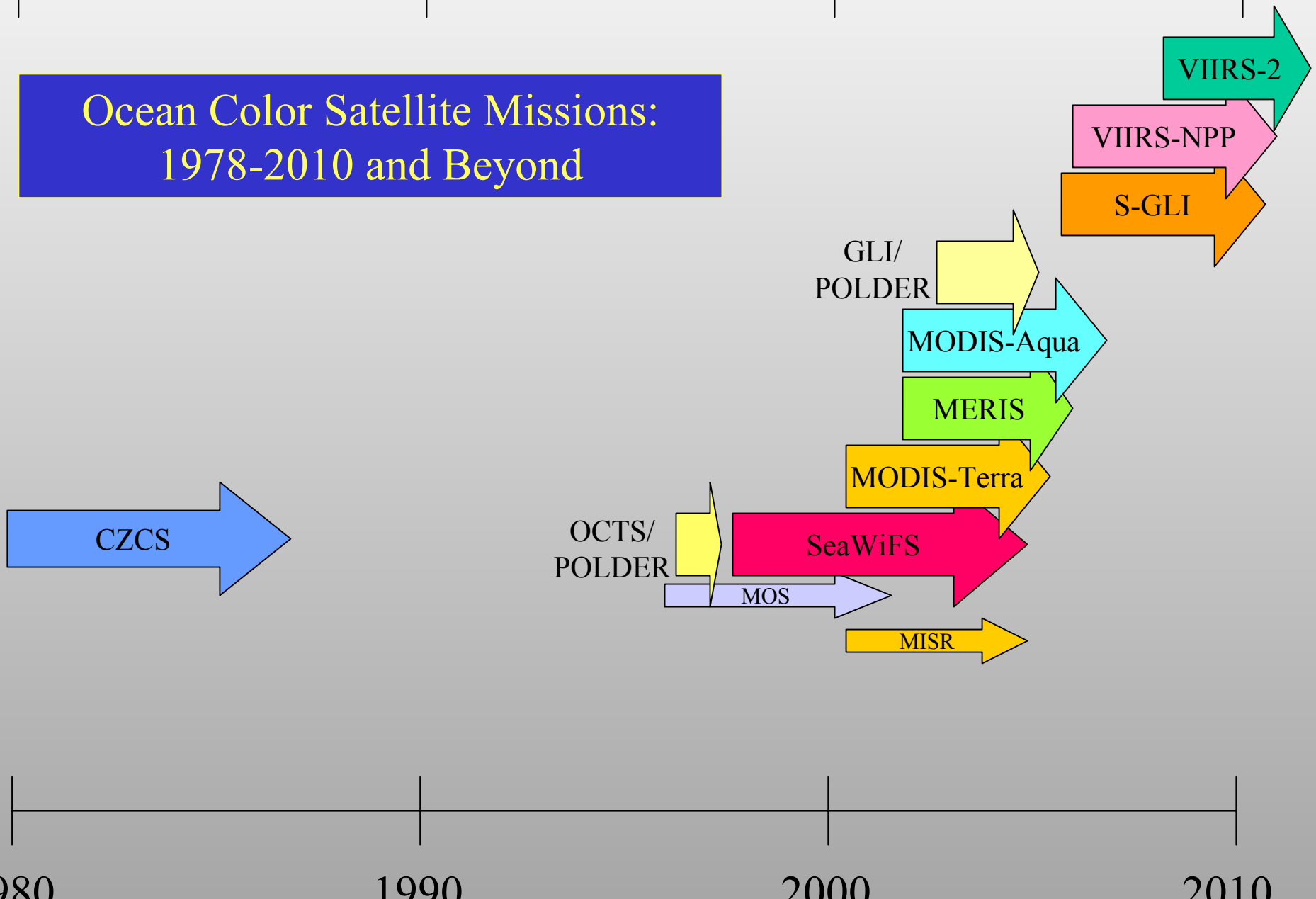
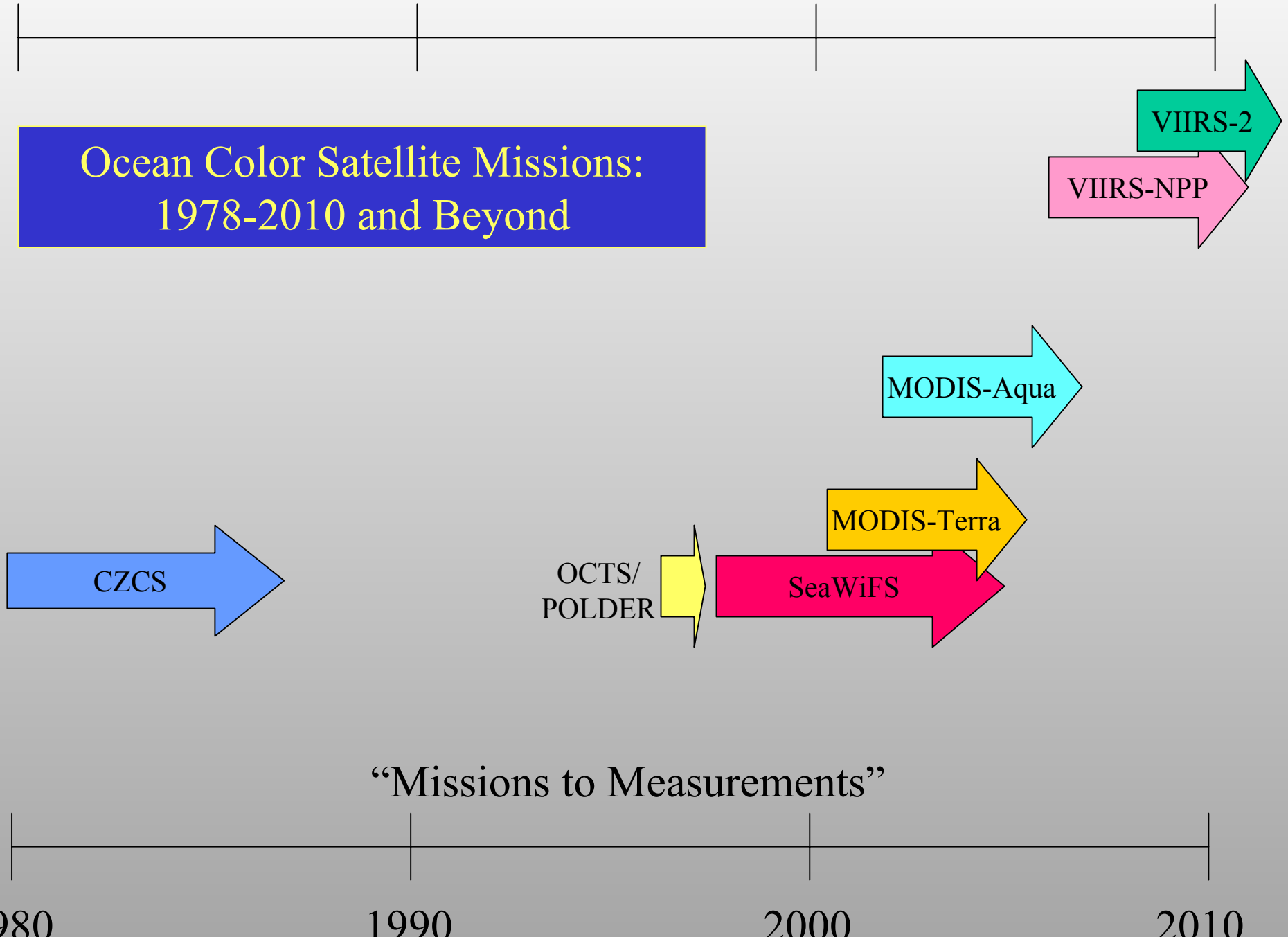
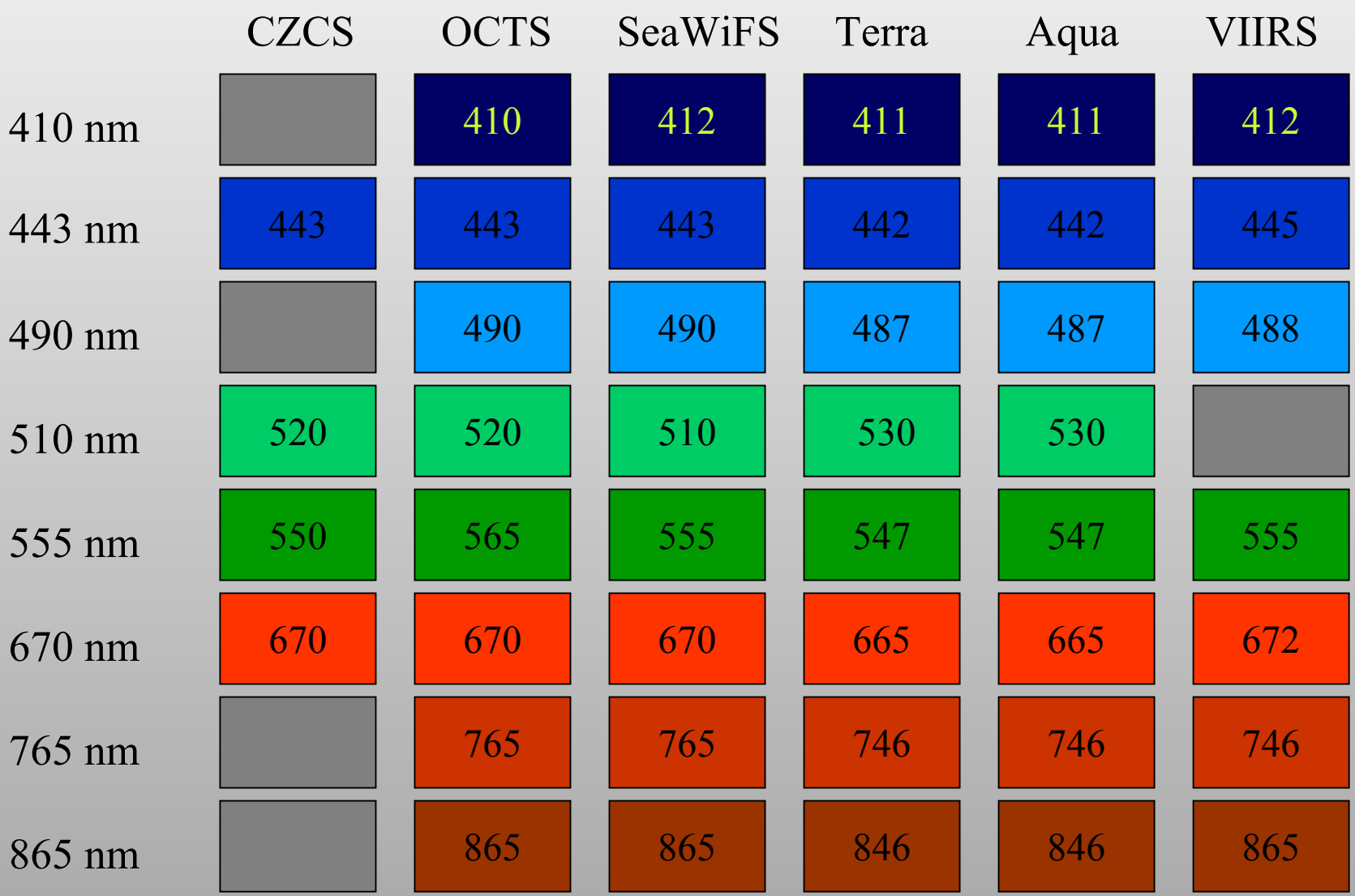
Ocean Color Satellite Missions: 1978-2010 and Beyond



Ocean Color Satellite Missions: 1978-2010 and Beyond



Ocean Color Missions: Bands



Ocean Color Missions: Sensor and Orbit

	CZCS	**OCTS**	**SeaWiFS**	**Terra**	**Aqua**	**VIIRS-NPP**
Altitude (km)	955	797	705	705	705	833
Period (min.)	104.0	100.8	98.9	98.9	98.9	
Inclination	90.28^o	98.63^o	98.25^o	98.20^o	98.20^o	98.74^o
Equator Cross Time (local)	Noon	10:41 AM	Noon	10:30 AM	1:30 PM	10:30 AM
Node	Asc.	Desc.	Desc.	Desc.	Asc.	Desc.
Half Scan Width	39.34^o	40.00^o	58.3^o	55^o	55^o	56^o
IFOV	0.05^o	0.05^o	0.09^o	0.08^o	0.08^o	0.05^o
Ground IFOV at nadir (km)	0.825	0.700	1.12	1.0	1.0	0.75
Pixels along scan	1968	2222	1285	1354	1354	
Scan period (s)	0.134	1.0	0.667	1.5	1.5	1.786
Tilt	$\pm$ 20^o	$\pm$ 20^o	$\pm$ 20^o	None	None	None
Scan ground coverage (km)	1500	1400	2800	2330	2330	3040
Digitization (bits)	8	10	10	12	12	12

Consistent Ocean Color Time Series Requires Similar

1) Calibration

2) Algorithms

3) Spatial and Temporal Resolution (Level-3)

4) Data Format

5) Access

6) Analysis Tools

	CZCS	OCTS	SeaWiFS	Terra	Aqua	VIIRS
Calibration	No	Yes	Yes	Yes	Yes	?
Atmospheric Correction	No	No	Yes	No	Yes	No
Bio-Optics	No	Yes	Yes	Yes	Yes	No
Resolution	No	Yes	Yes	No	Yes	?
Format	No	Yes	Yes	No	Yes	?
Access	Yes	Yes	Yes	Yes	No	?
Analysis	Yes	Yes	Yes	No	No	No

Ocean Color Time Series: Challenges

CZCS

Data merging algorithm selection

How to determine precision, especially between/among sensors

Atmospheric algorithm selection

Bio-optical algorithm selection

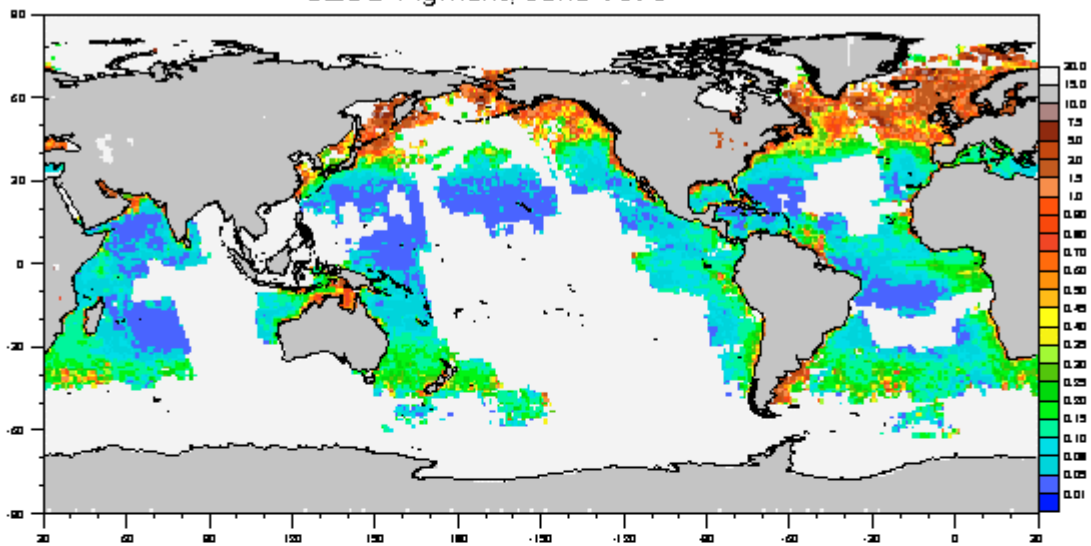
The CZCS flaws fall into 3 categories:

science algorithms

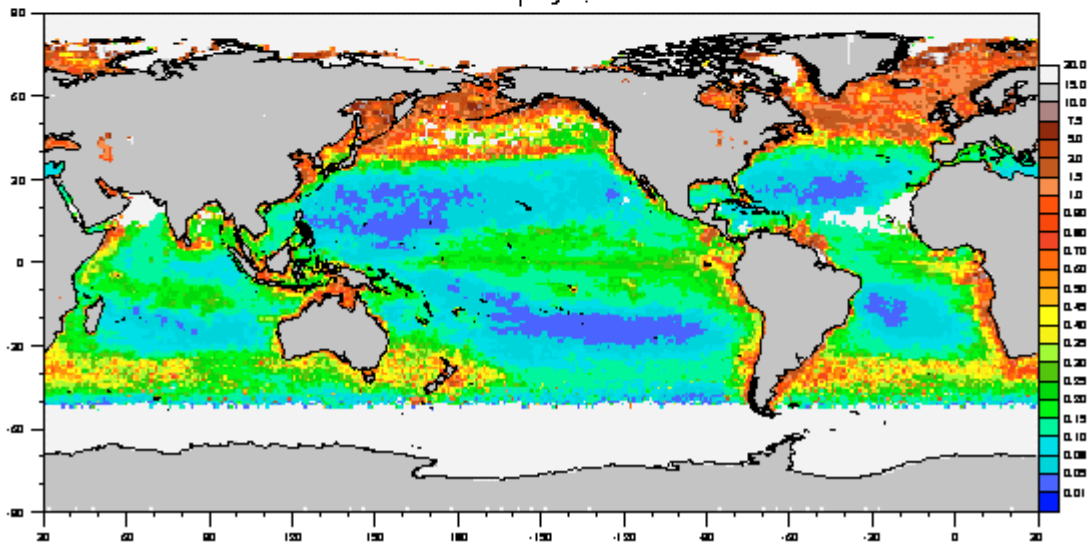
sensor design (signal-to-noise; inadequate bands)
CZCS: 443 nm 520 nm 550 nm 670 nm 750 nm

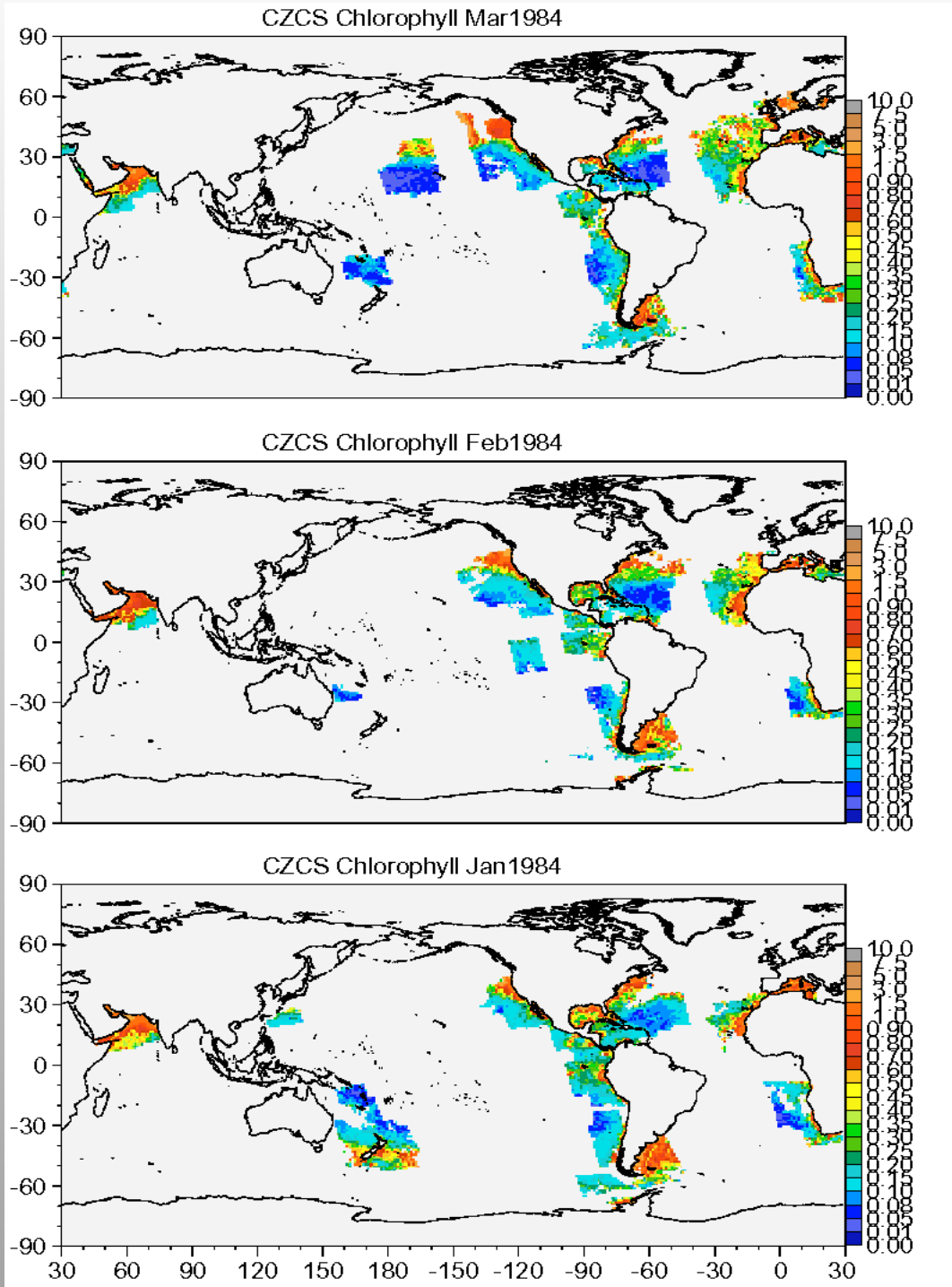
mission operation (sampling)

CZCS Pigment; June 1979



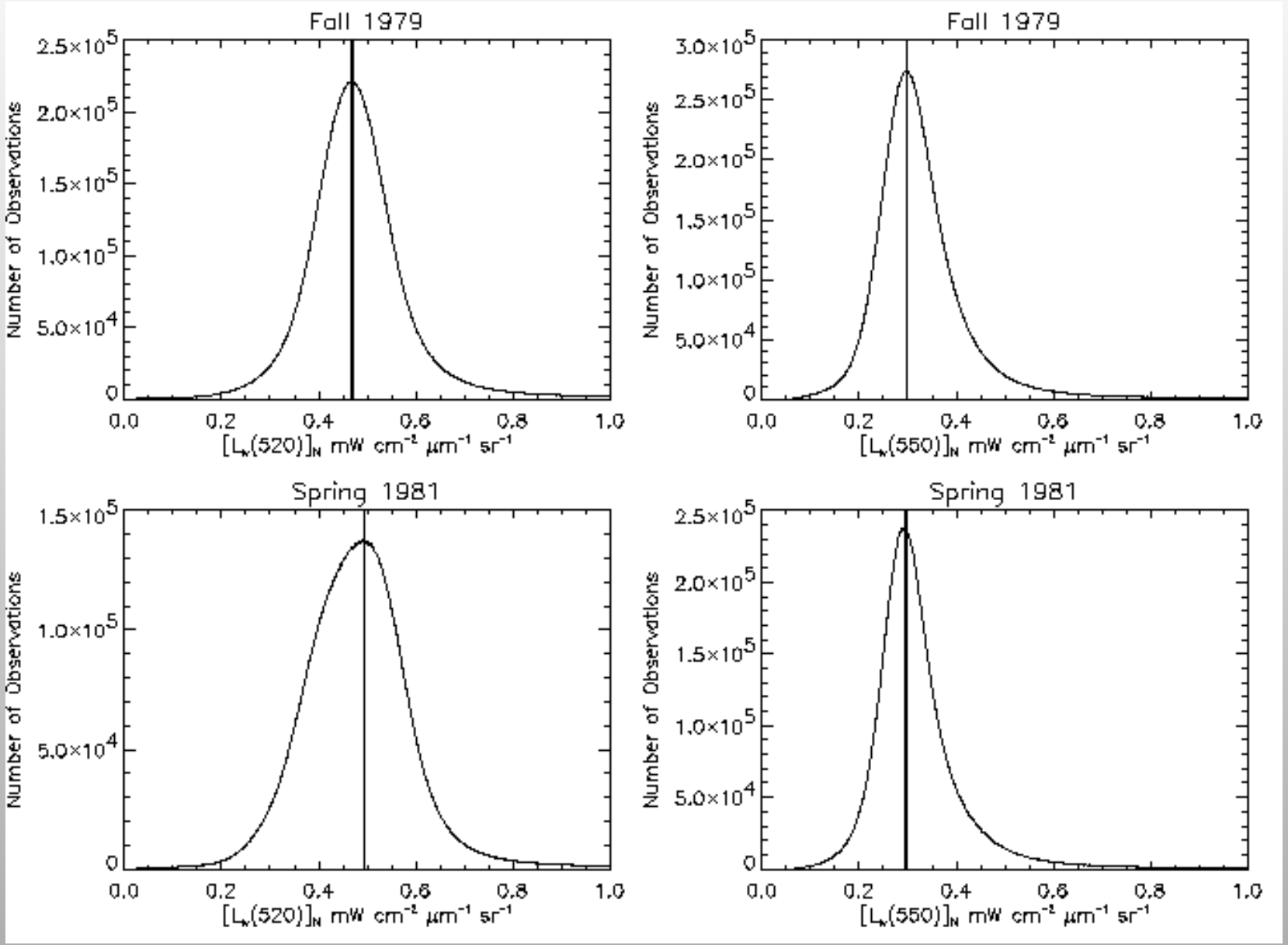
SeaWiFS Chlorophyll; June 1999




CZCS Chlorophyll Mar1984
CZCS Chlorophyll Feb1984
CZCS Chlorophyll Jan1984
90
60
30
0
-30
-60
-90
30 60 90 120 150 180 -150 -120 -90 -60 -30 0 30
10.0
7.5
5.0
3.0
1.5
1.0
0.90
0.80
0.70
0.60
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.08
0.05
0.01
0.00

CZCS Science Algorithm Deficiencies

1) calibration
2) navigation
3) constant aerosol type
4) single-scattering approximation for aerosols and no Rayleigh-aerosol interaction
5) production of pigment rather than chlorophyll
6) lack of whitecap/foam reflectance
7) lack of accounting for pressure variability in Rayleigh scattering
8) lack of accounting for increased water-leaving radiance at 670 nm at high chlorophyll



Global

Expected = 0.498
Observed = 0.498

Expected = 0.300
Observed = 0.294

Data Merging Algorithms

1) Binning
2) Averaging
3) Subjective Analysis
4) Blended Analysis
5) Optimal Interpolation
6) Objective Analysis
7) Wavelet Analysis
8) Neural Network Analysis
9) Spectral Bio-Optical Modeling
10) Data Assimilation into a Numerical Model

Data Merging Algorithms

Workshop planned for Summer/Fall 2004, sponsored by IOCCG and NASA

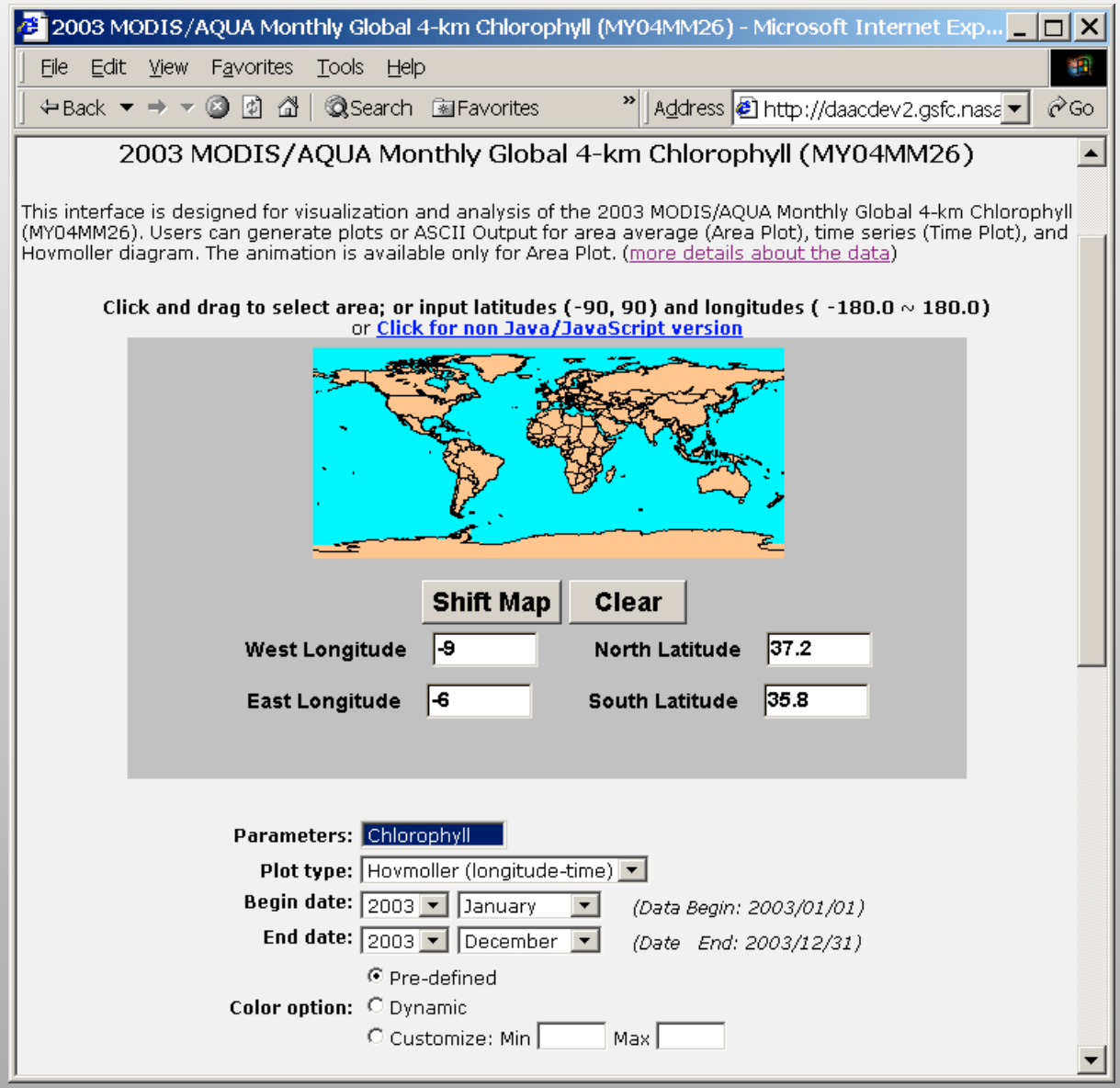
Watson Gregg and Paula Bontempi, Co-Chairs

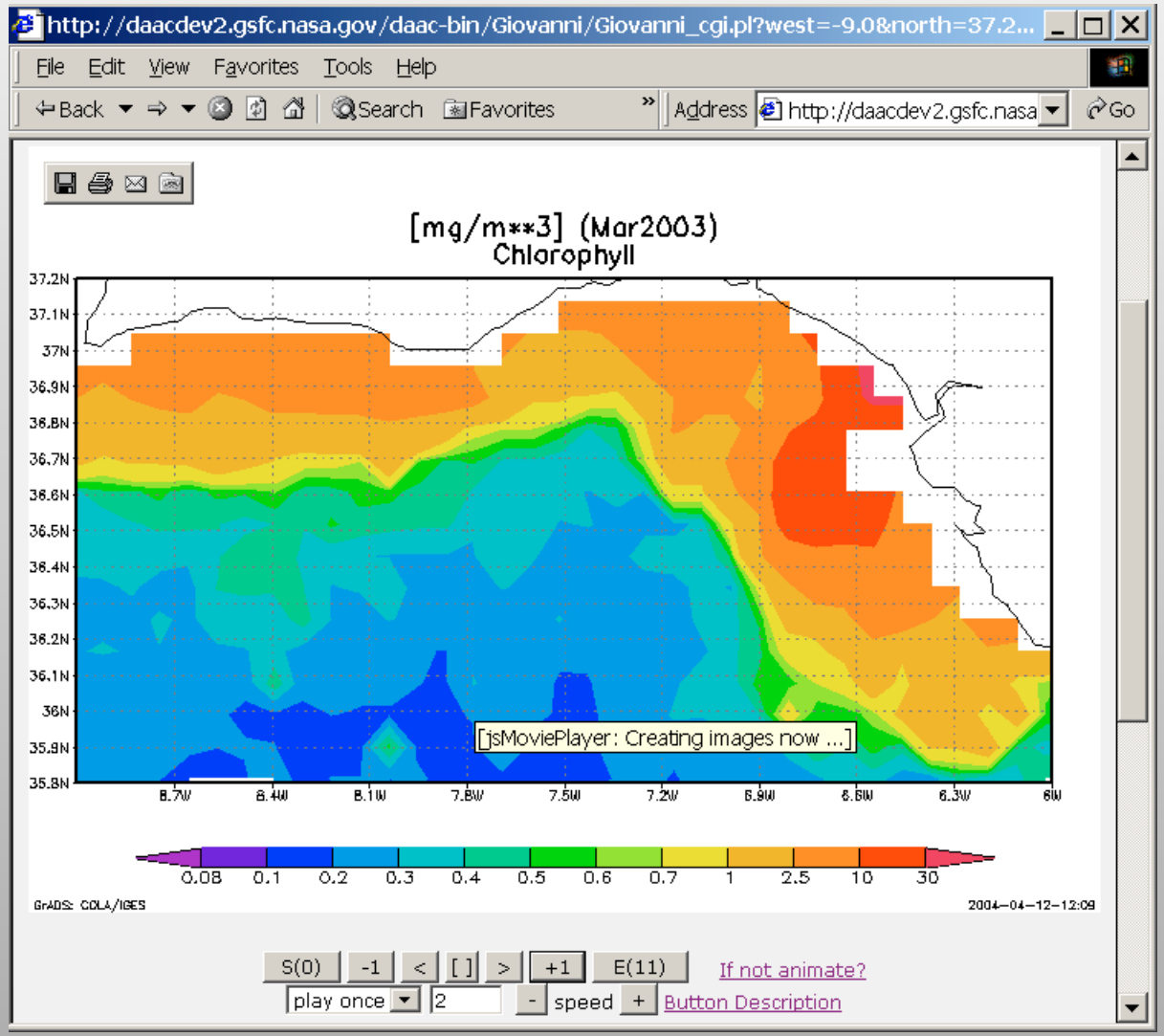
Objectives: To define

1) data and knowledge requirements
2) assessment methodology
3) possible approaches, with strengths and weaknesses

for merging coincident ocean color data from multiple sensors.

Data Access -- GES-DAAC

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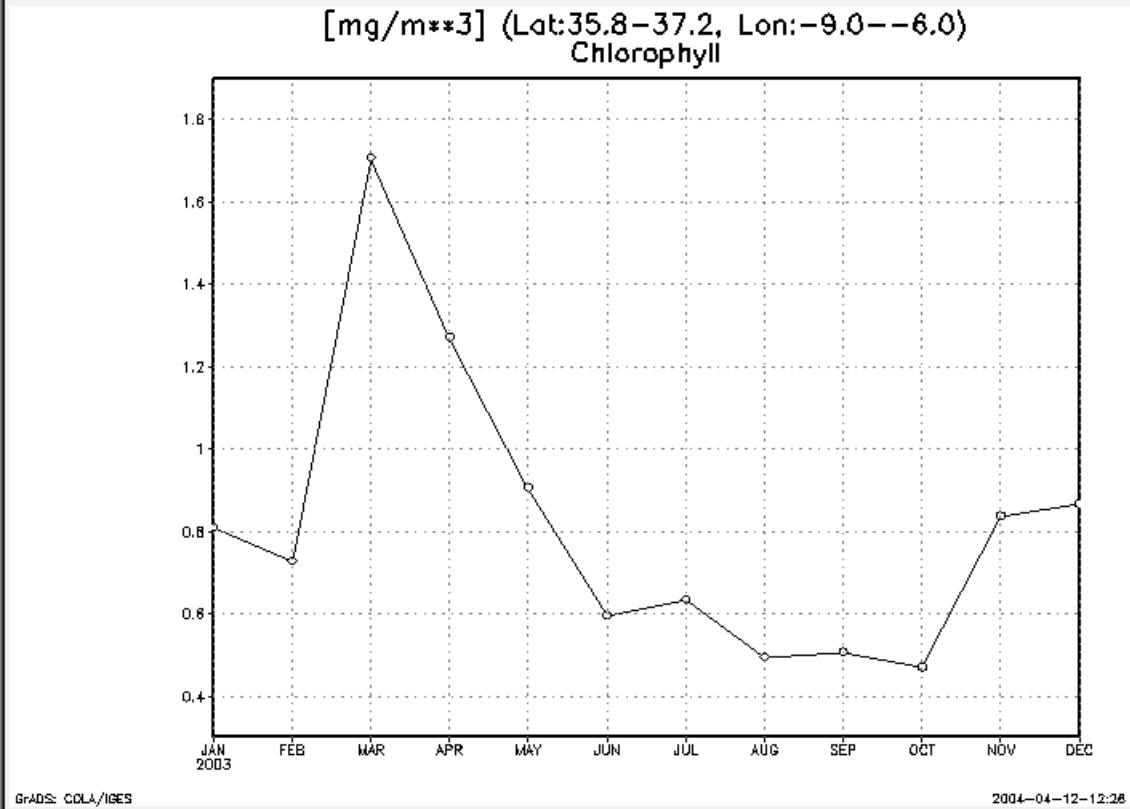
File Edit View Favorites Tools Help
Back Search Favorites Address http://daacdev2.gsfc.nasa Go
[mg/m**3] (Mar2003)
Chlorophyll
37.2N
37.1N
37N
36.9N
36.8N
36.7N
36.6N
36.5N
36.4N
36.3N
36.2N
36.1N
36N
35.9N
35.8N
8.7W
8.4W
8.1W
7.8W
7.5W
7.2W
6.9W
6.6W
6.3W
6W
[jsMoviePlayer: Creating images now ...]
0.08 0.1 0.2 0.3 0.4 0.5 0.6 0.7 1 2.5 10 30
GrADS: COLA/IGES
2004-04-12-12:09
S(0) -1 < [ ] > +1 E(11) If not animate?
play once 2 - speed + Button Description

Ocean Color MODIS/TERRA Chlorophyll Monthly Global 4-km Product (MO04MM26) - Micro...

File Edit View Favorites Tools Help

Back Search Favorites Address http://daacdev2.gsfc.nasa Go

Ocean Color MODIS/TERRA Chlorophyll Monthly Global 4-km Product (MO04MM26)



MODIS Aqua, Terra and SeaWiFS "comparison" using ASCII output