Approach for the long-term spatial and temporal evaluation of ocean color data products in the coastal environment

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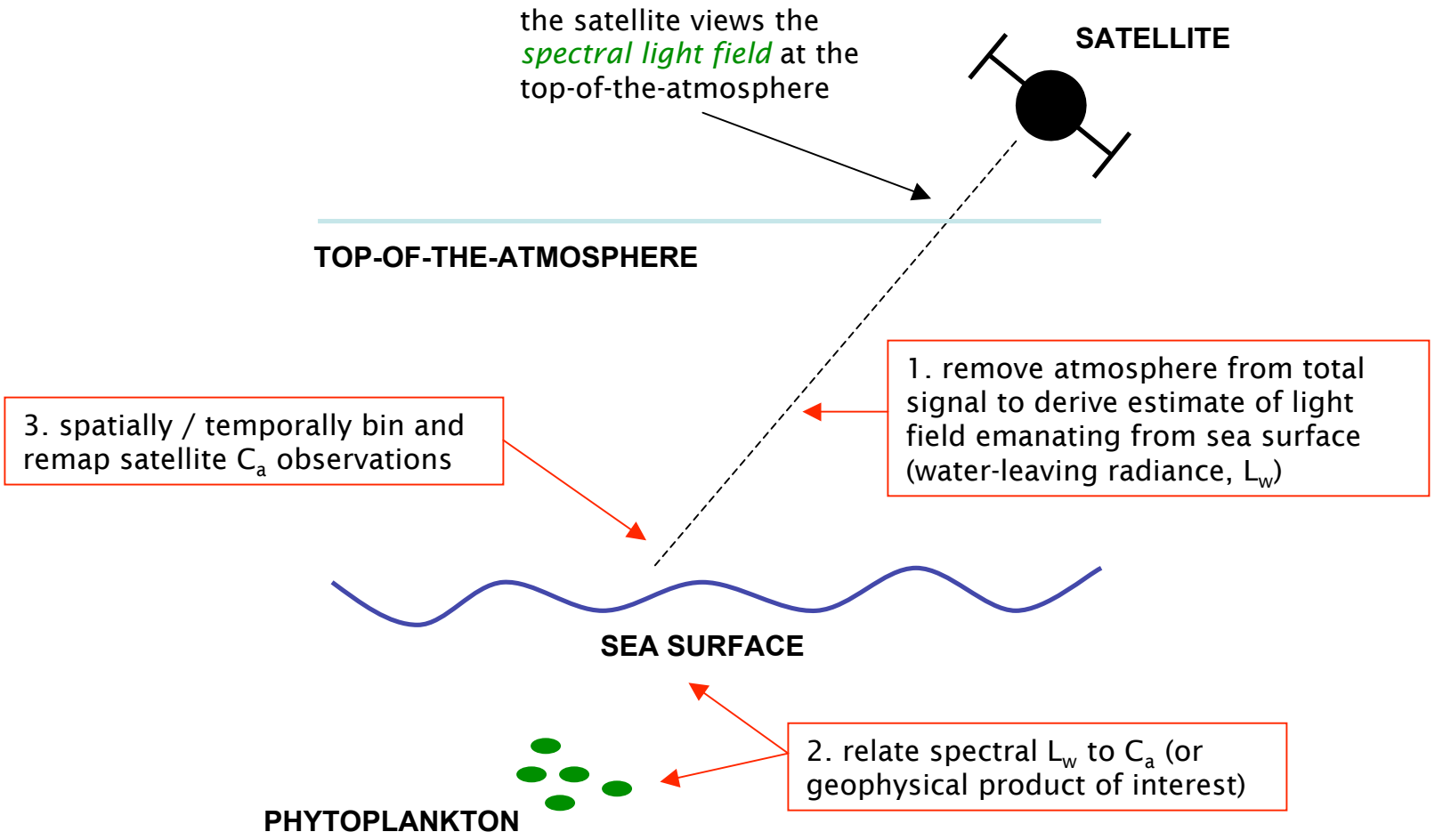
goal: develop an infrastructure for working with the community to rapidly evaluate long-term regional time-series of satellite ocean color data products

demonstrated via a Chesapeake Bay C_a algorithm round robin
initiated by the Chesapeake Bay Program, executed by the NASA OBPG, with
additional participation by NOAA, the U. of Maryland, and Old Dominion U.

note ~ the approach is independent of the data product and region of interest


the satellite views the
spectral light field at the
top-of-the-atmosphere
SATELLITE
TOP-OF-THE-ATMOSPHERE
1. remove atmosphere from total signal to derive estimate of light field emanating from sea surface (water-leaving radiance, L_w)
3. spatially / temporally bin and remap satellite C_a observations
SEA SURFACE
2. relate spectral L_w to C_a (or geophysical product of interest)
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ALGORITHMS

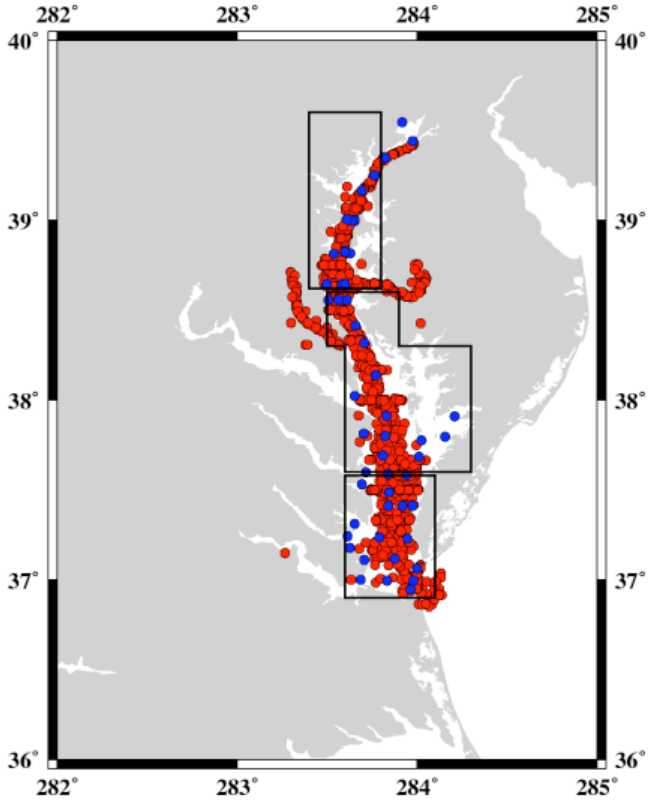
<u>empirical (statistical) approaches</u>

OC4	operational SeaWiFS
OC3	operational MODIS
OC2	
OC3-CB	tuned to Bay (ODU)
Clark	tuned to Bay (NOAA)
Carder	operational VIIRS

<u>semi-analytical approaches</u>

GSM01	
GSM01-CB	tuned to Bay (UMD)

GROUND TRUTH



SIMBIOS/Harding (3,000 stations)

CBP (15,000 stations)

stratification following Magnuson et al. 2004

PROCESSING

5,000 SeaWiFS MLAC files acquired
processed using MSL12 5.4.1 ~ 3 runs / file
statistical and visual QC applied
900 final files considered from 1998 to 2005

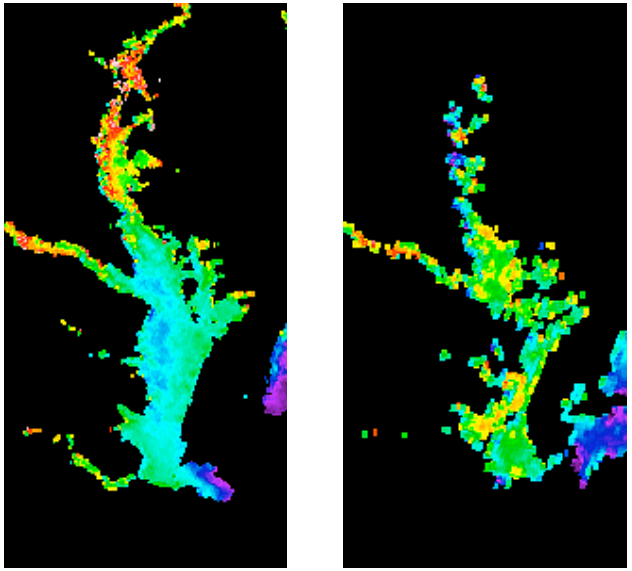
COMPARISON TO GROUND TRUTH

data distributions via histograms
time-series (monthly averages)
match-ups with Level-2 data

STRATIFICATION

spatially: upper, middle and lower Bay
temporally: Winter, Spring, Summer, Fall

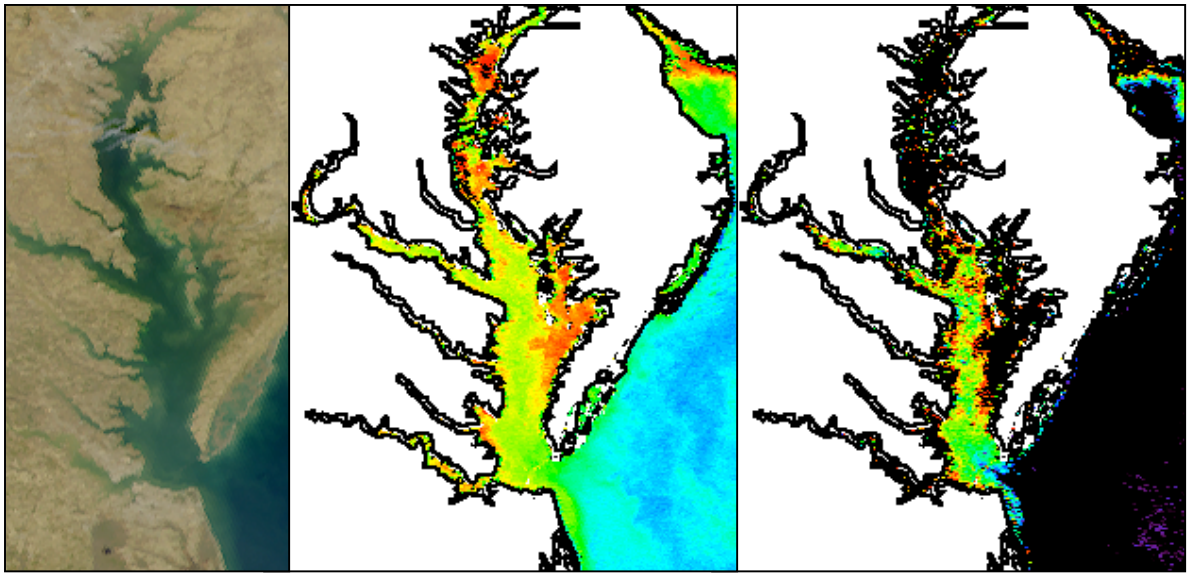
QUALITY CONTROL



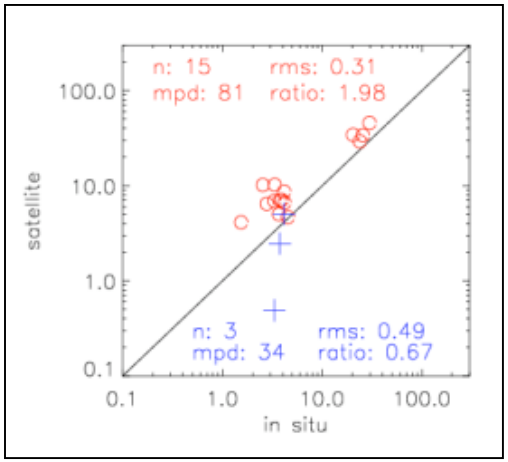
GOOD BAD

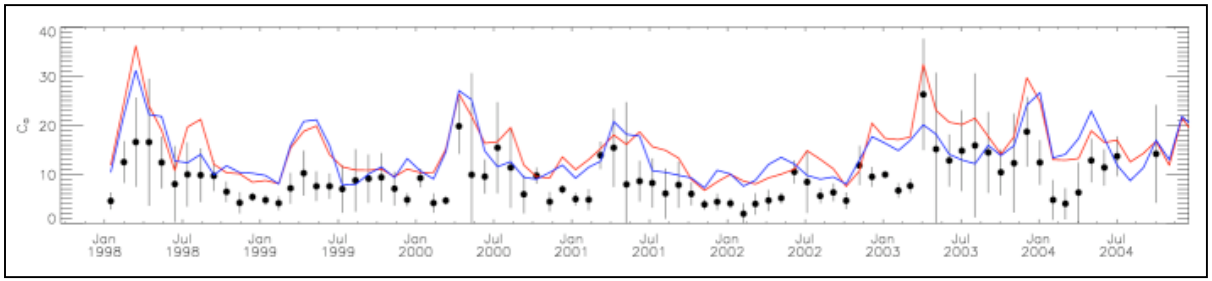
eliminate scenes with high sat zenith
require >25% of Bay ocean pixels to be cloud free
visual inspection
consider only $0.1 < C_a < 100$ mg m^{-3}
require >200 valid pixels per scene

COVERAGE

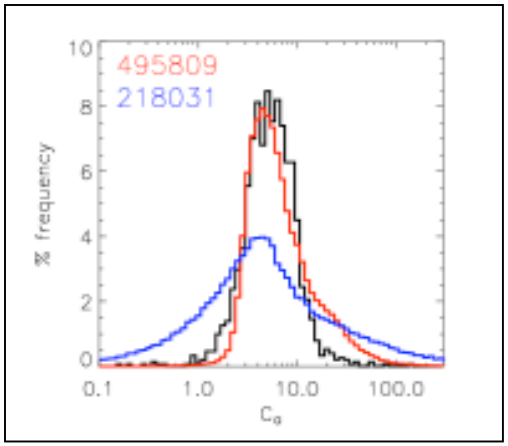


L2 MATCH-UPS





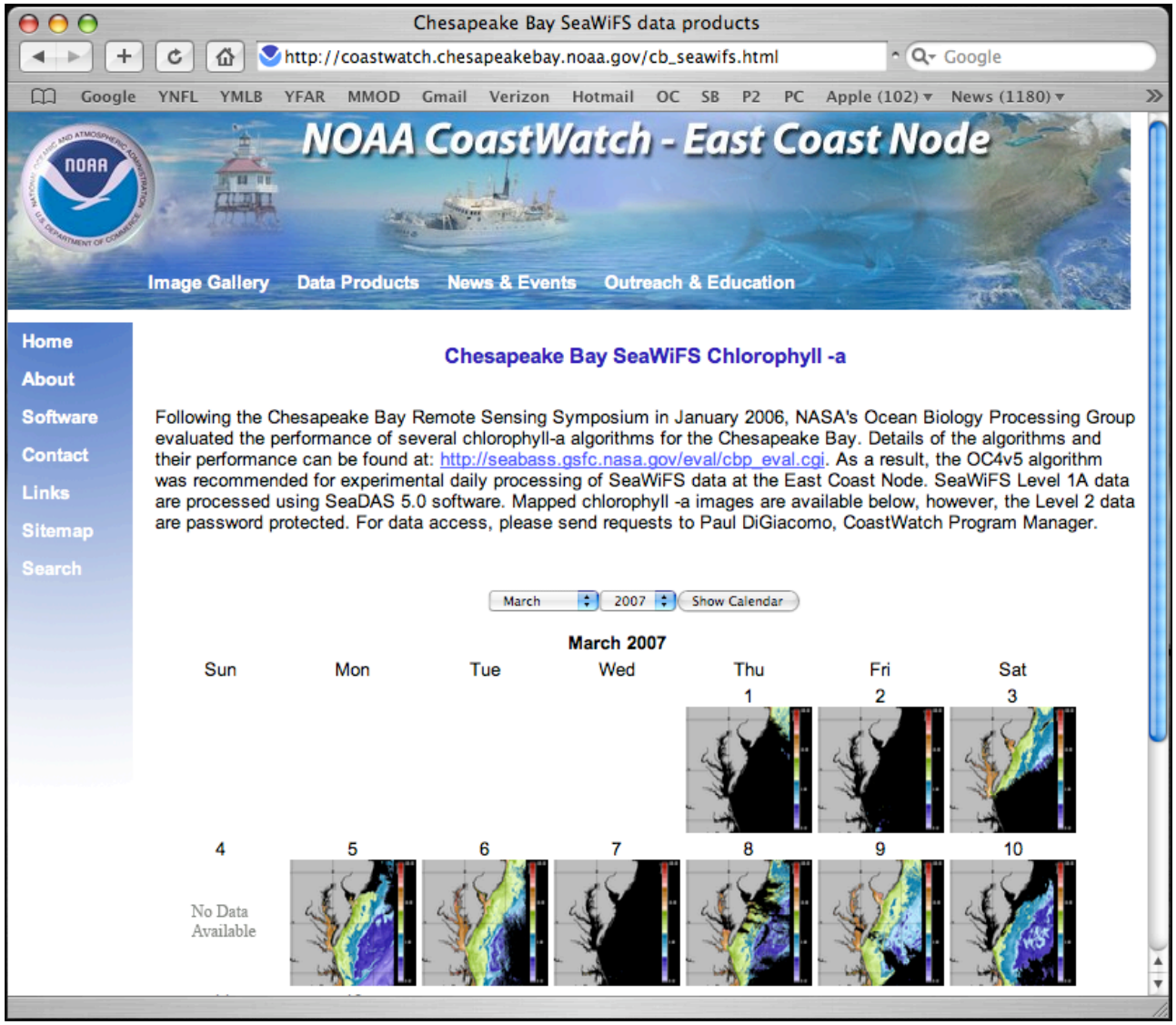
TIME-SERIES



DISTRIBUTIONS

the histograms, time-series, scatter plots, and maps
convey comparative information in rather different ways

trade-offs in specific coverage needs and accuracy requirements drive the
selection of the best algorithm(s) and processing approach(es)


Chesapeake Bay SeaWiFS data products
http://coastwatch.chesapeakebay.noaa.gov/cb_seawifs.html
Google
Google YNFL YMLB YFAR MMOD Gmail Verizon Hotmail OC SB P2 PC Apple (102) News (1180)
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Chesapeake Bay SeaWiFS Chlorophyll -a
Following the Chesapeake Bay Remote Sensing Symposium in January 2006, NASA's Ocean Biology Processing Group evaluated the performance of several chlorophyll-a algorithms for the Chesapeake Bay. Details of the algorithms and their performance can be found at: http://seabass.gsfc.nasa.gov/eval/cbp_eval.cgi. As a result, the OC4v5 algorithm was recommended for experimental daily processing of SeaWiFS data at the East Coast Node. SeaWiFS Level 1A data are processed using SeaDAS 5.0 software. Mapped chlorophyll -a images are available below, however, the Level 2 data are password protected. For data access, please send requests to Paul DiGiacomo, CoastWatch Program Manager.
March
2007
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March 2007
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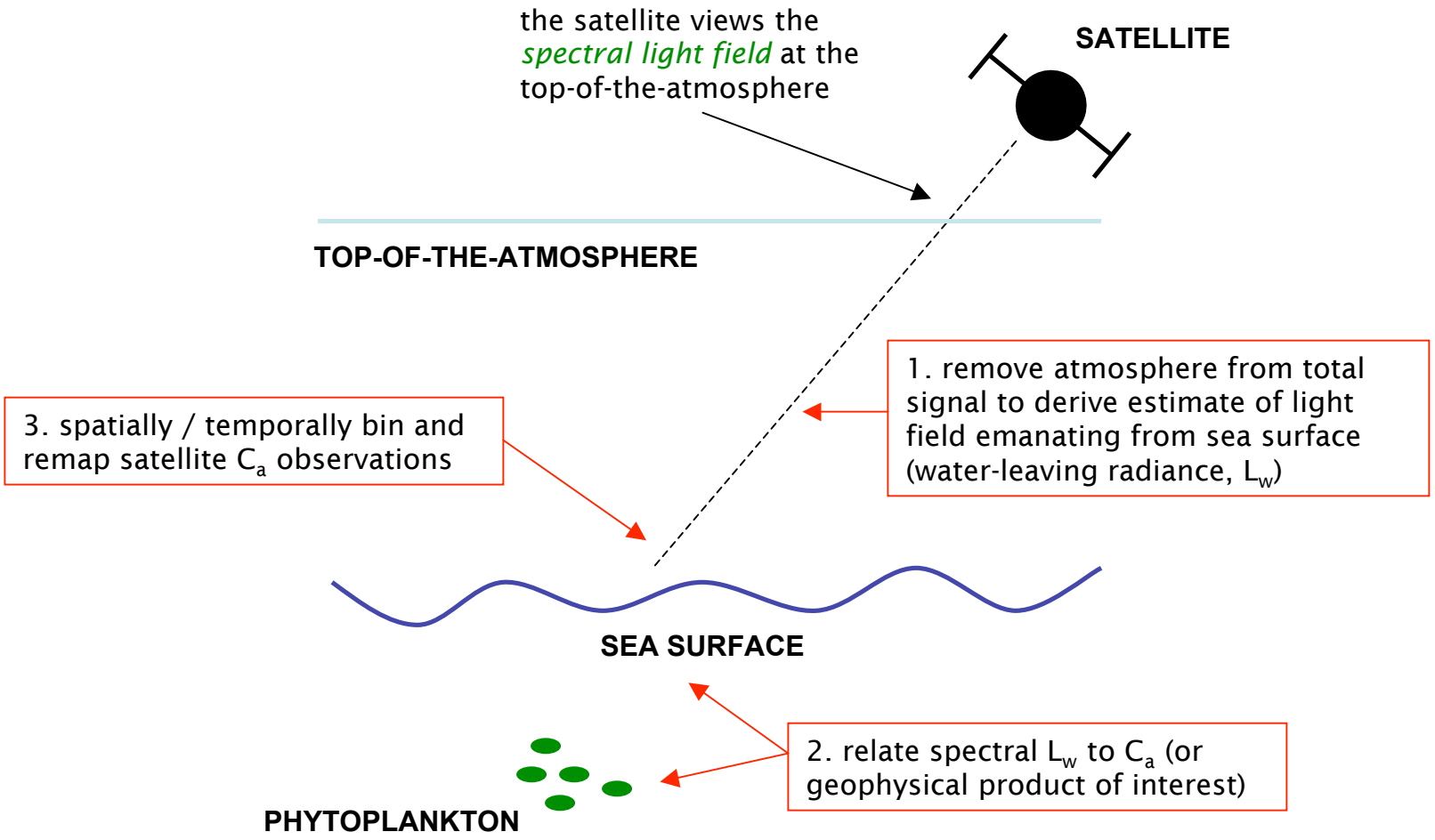
1 2 3
4 5 6 7 8 9 10
No Data Available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some challenges to remote sensing of coastal and inland waters:

temporal and spatial variability
- limitations of satellite sensor resolution and repeat frequency
- validity of ancillary data (reference SST, wind)
- varied resolution requirements and binning options

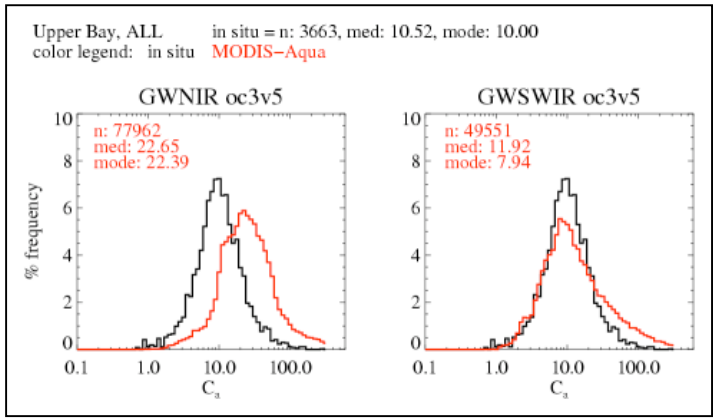
straylight contamination from land

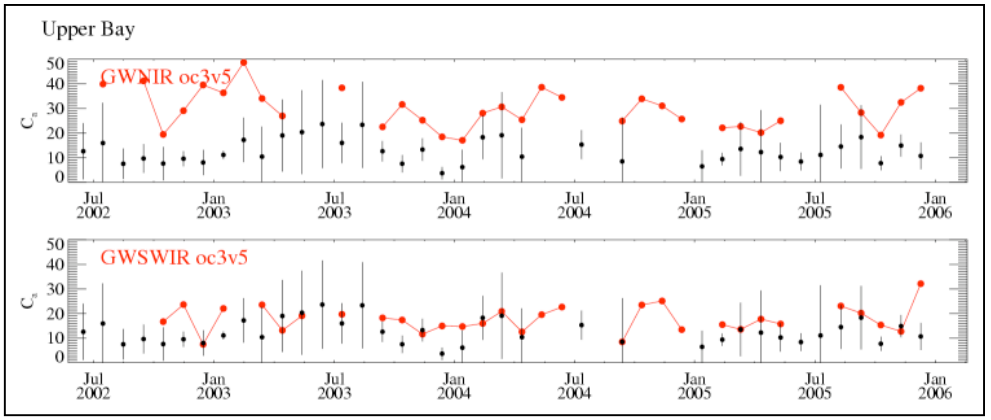
non-maritime aerosols (dust, pollution)
- region-specific models required
- absorbing aerosols

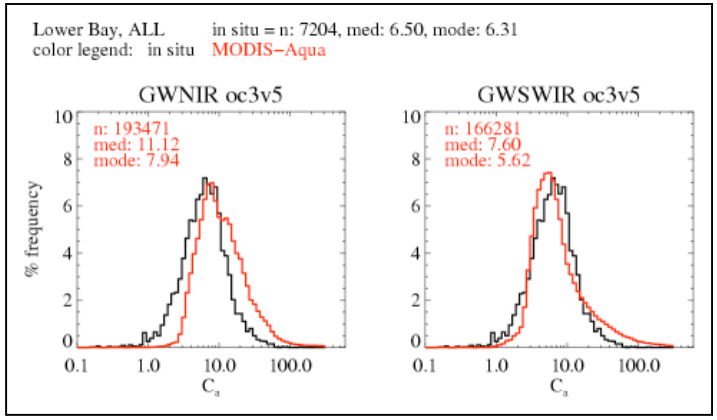
suspended sediments and CDOM
- complicates estimation of L_w(NIR), model not a function of C_a
- complicates correction for non-uniform subsurface light field (f/Q)
- saturation of observed radiances

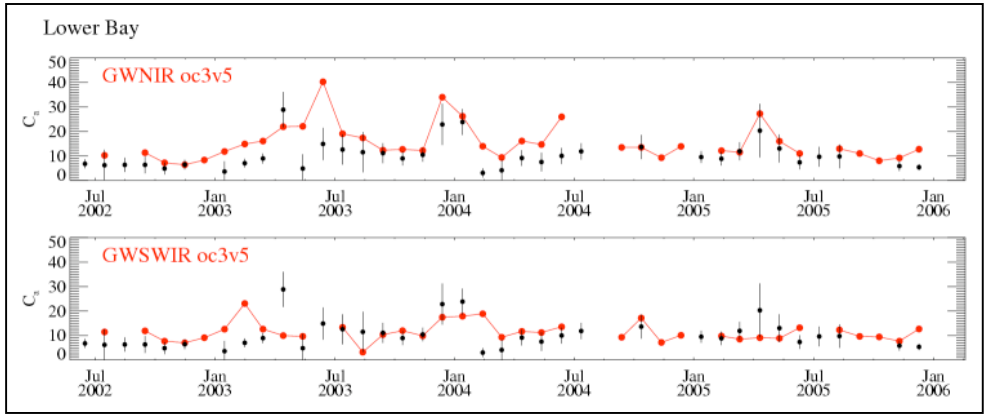
anthropogenic emissions (NO_2 absorption)

the MODIS-Aqua SWIR (250-m) atmospheric correction was evaluated (preliminary results):









please visit two OCRT posters that discuss the application of an NO_2 correction and regionally derived aerosol models:

W. Robinson, Z. Ahmad, B.A. Franz, S.W. Bailey, and C.R. McClain,
"NO_2 data use for ocean color processing"

Z. Ahmad, E. Kwiatkowska, B.A. Franz, and C.R. McClain,
"Aerosol optical thickness from the SeaWiFS and MODIS sensors over the Chesapeake Bay"

NASA Ocean Biology Processing Group ~ PJW, SSAI, 11 Apr 2007