Future Planning: Biogeochemical Sensors on Autonomous/Lagrangian Platforms

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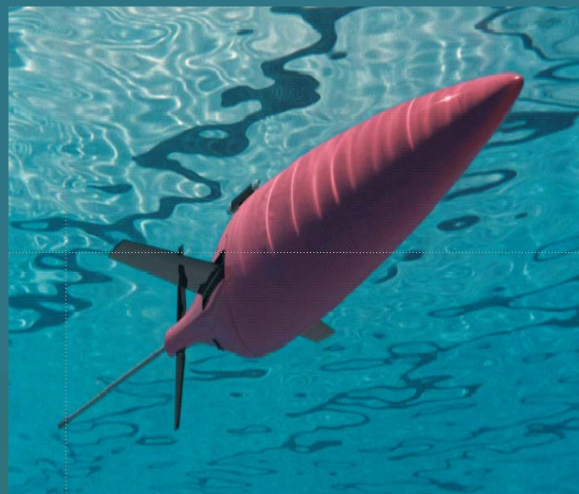
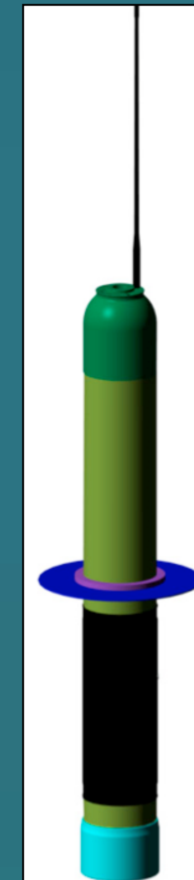
and representing the interests of many others in the community

NASA OCRT
14-16 April 2004

Autonomous / Lagrangian Platforms



underwater glider



profiling float

surface drifter

AUV

Sensors
on Autonomous / Lagrangian Platforms

Optical:

active and passive optical sensors (radiometers, fluorometers, beam c, backscattering, biolumінesence)

Chemical:

oxygen

nutrients on larger platforms

Other:

acoustics, turbulence, etc.

Satellites provide comprehensive spatial coverage
~ 1 km to entire globe

Satellites provide temporal coverage
~ day to years (and decades)

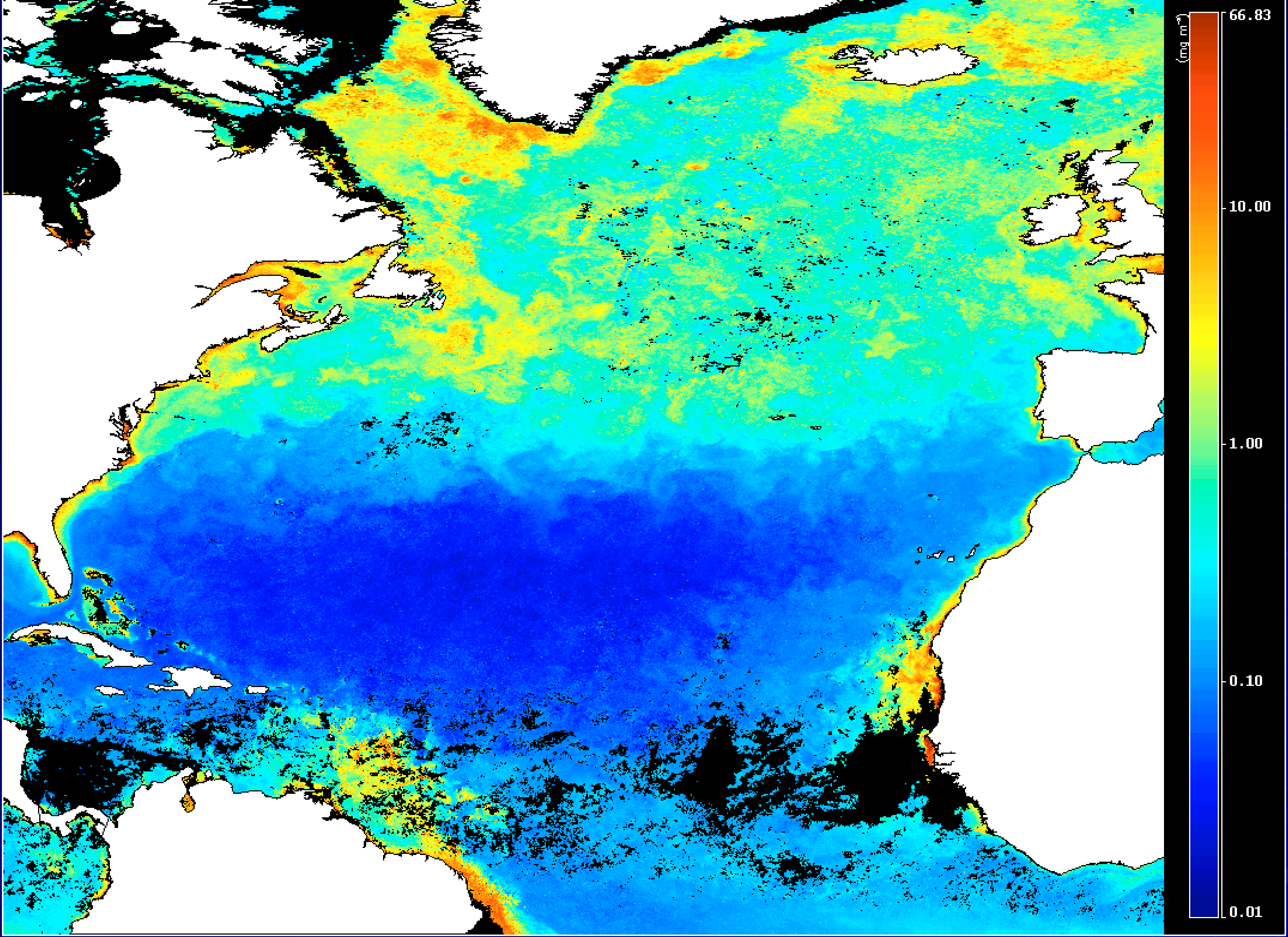
So why should NASA be interested in biogeochemical sensors on Autonomous / Lagrangian Platforms?

1. Ocean color satellites cannot see through clouds

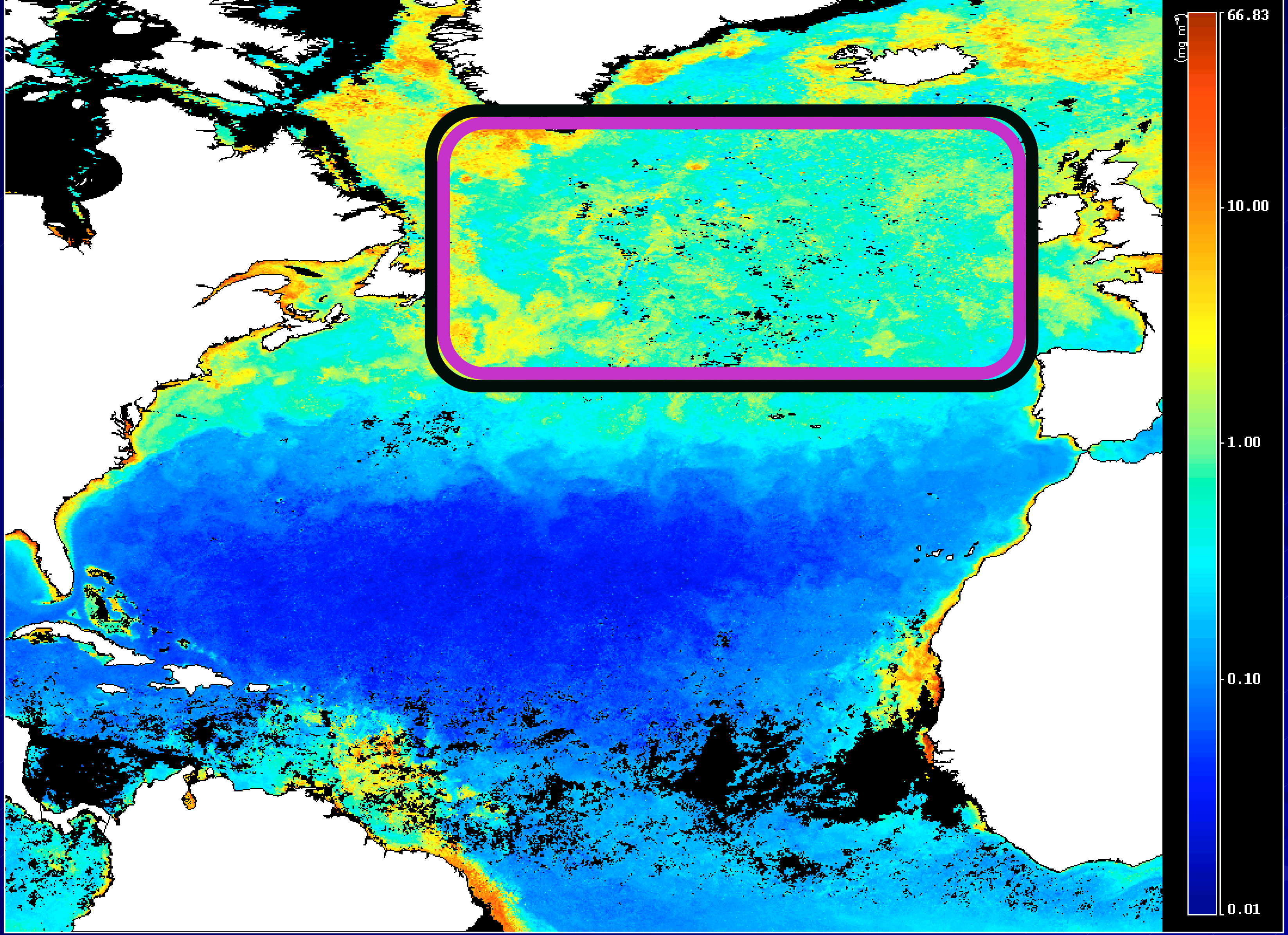
- problematic in persistently cloudy regions
- miss important dynamics of carbon cycle

Autonomous and Langrangian Platforms and Sensors can

potential to “fill in the gaps” in persistently cloudy regions, particularly for critical events (i.e., North Atlantic spring bloom)



SeaWiFS chlorophyll, NA spring bloom, May 2003



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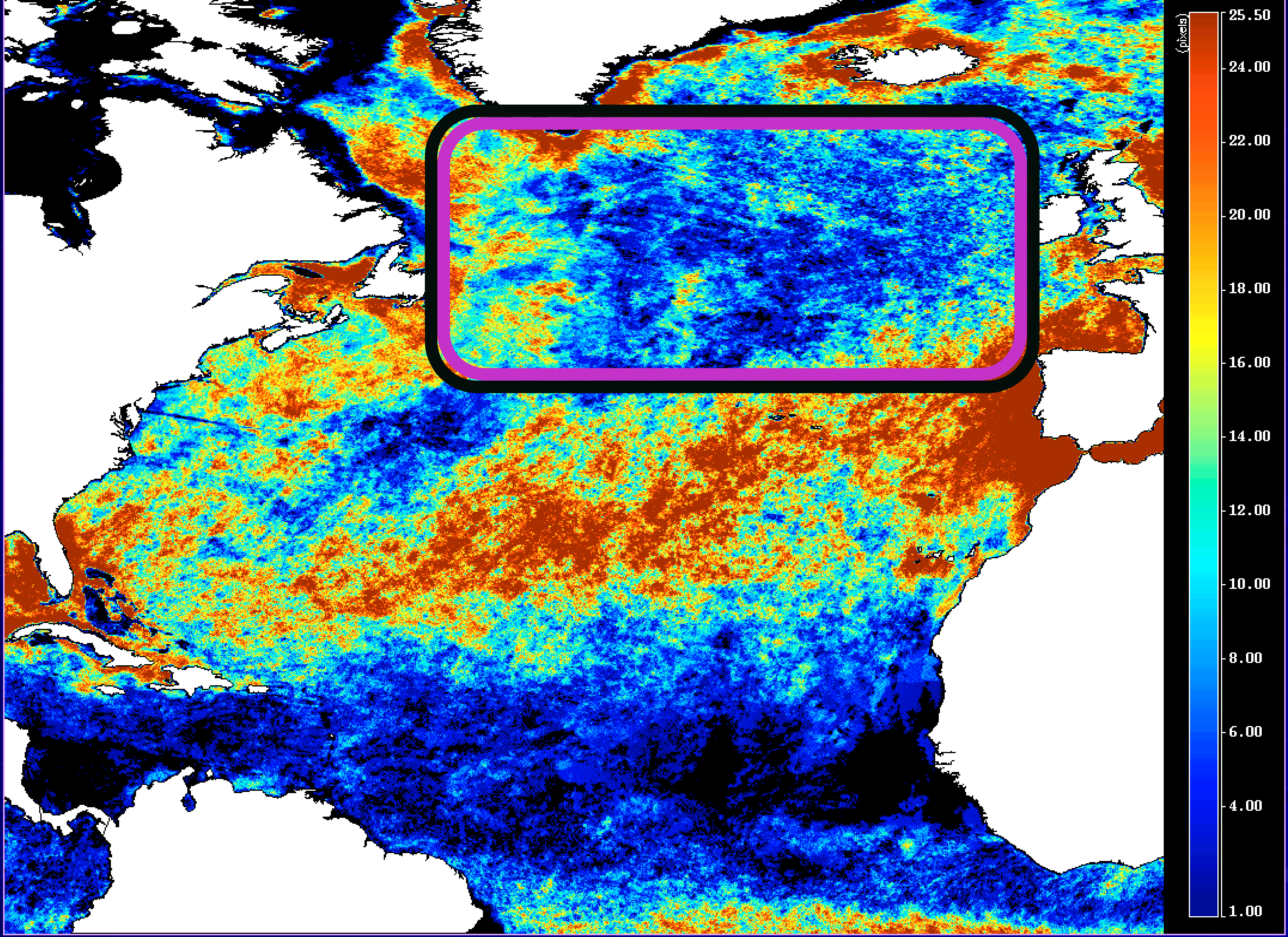
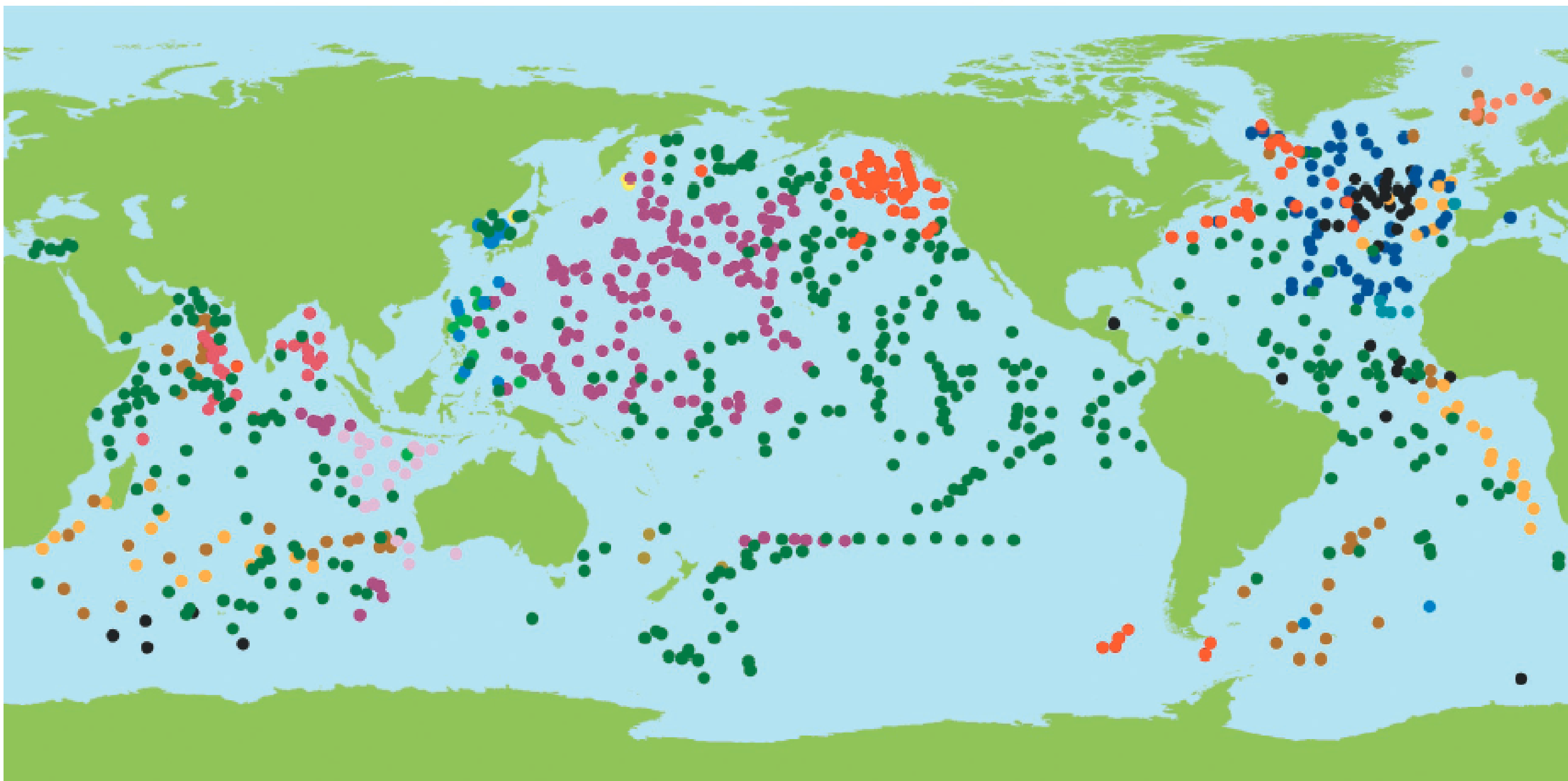


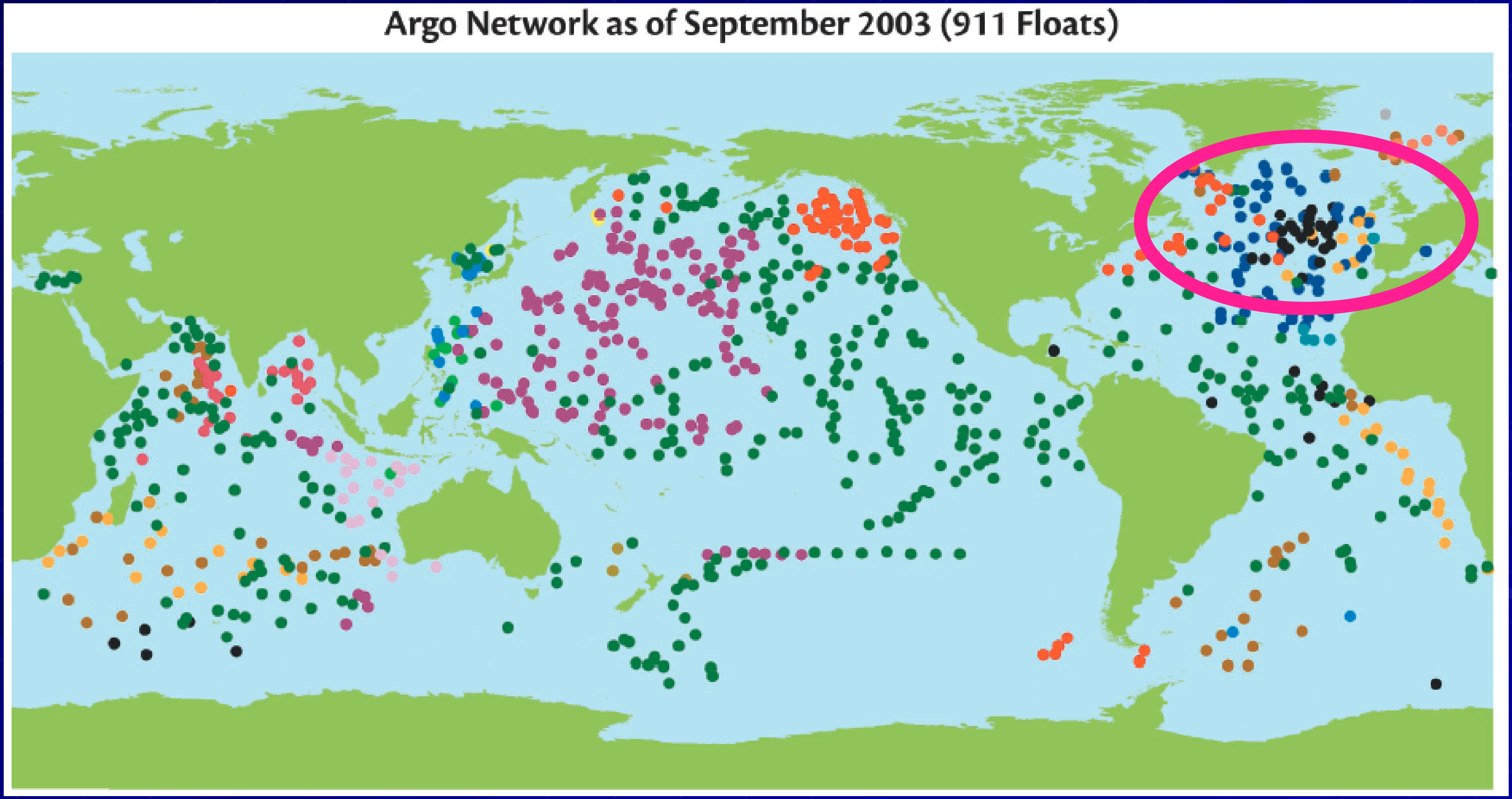
SeaWiFS pixel density, NA spring bloom, May 2003

ARGO network of profiling T, S floats; similar network for the Surface Velocity Drifter program

Argo Network as of September 2003 (911 Floats)



Visualize a network of biogeochemical floats or drifters that “fill in gaps” in satellite coverage of NA bloom and reduce uncertainty in carbon models

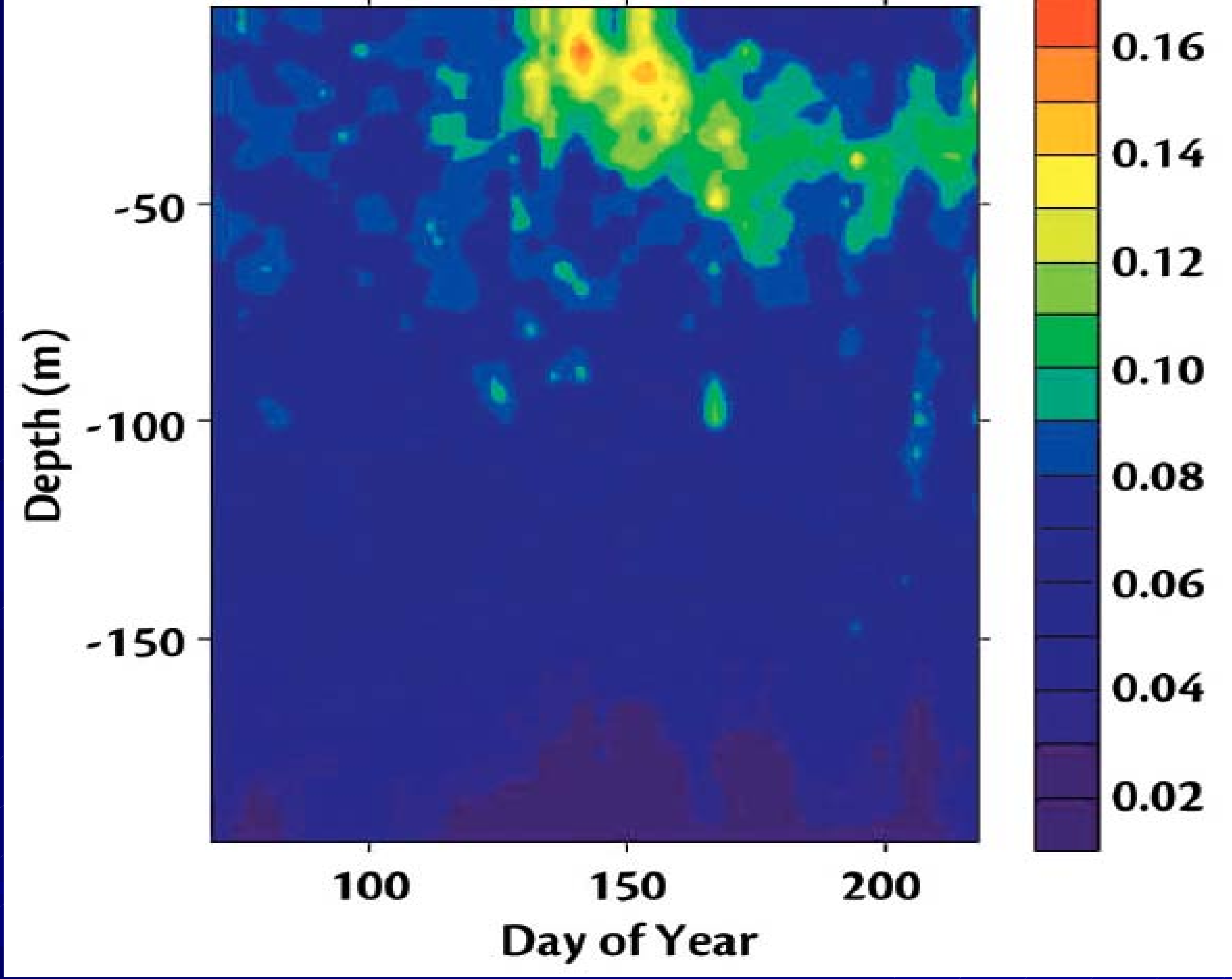


2. Ocean color satellites are limited to a surface-biased view

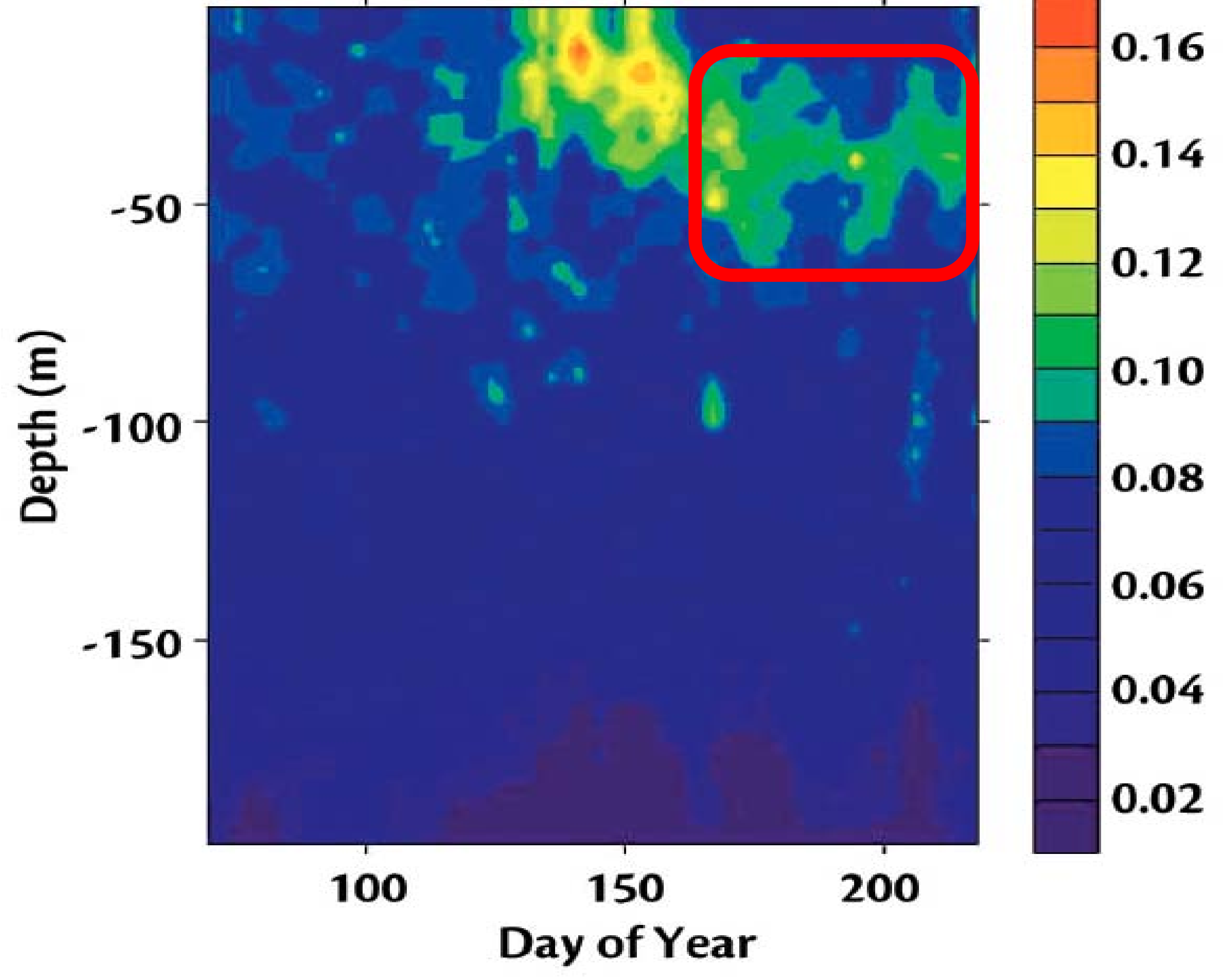
of biogeochemical properties, and by inference, processes

Profiling platforms can

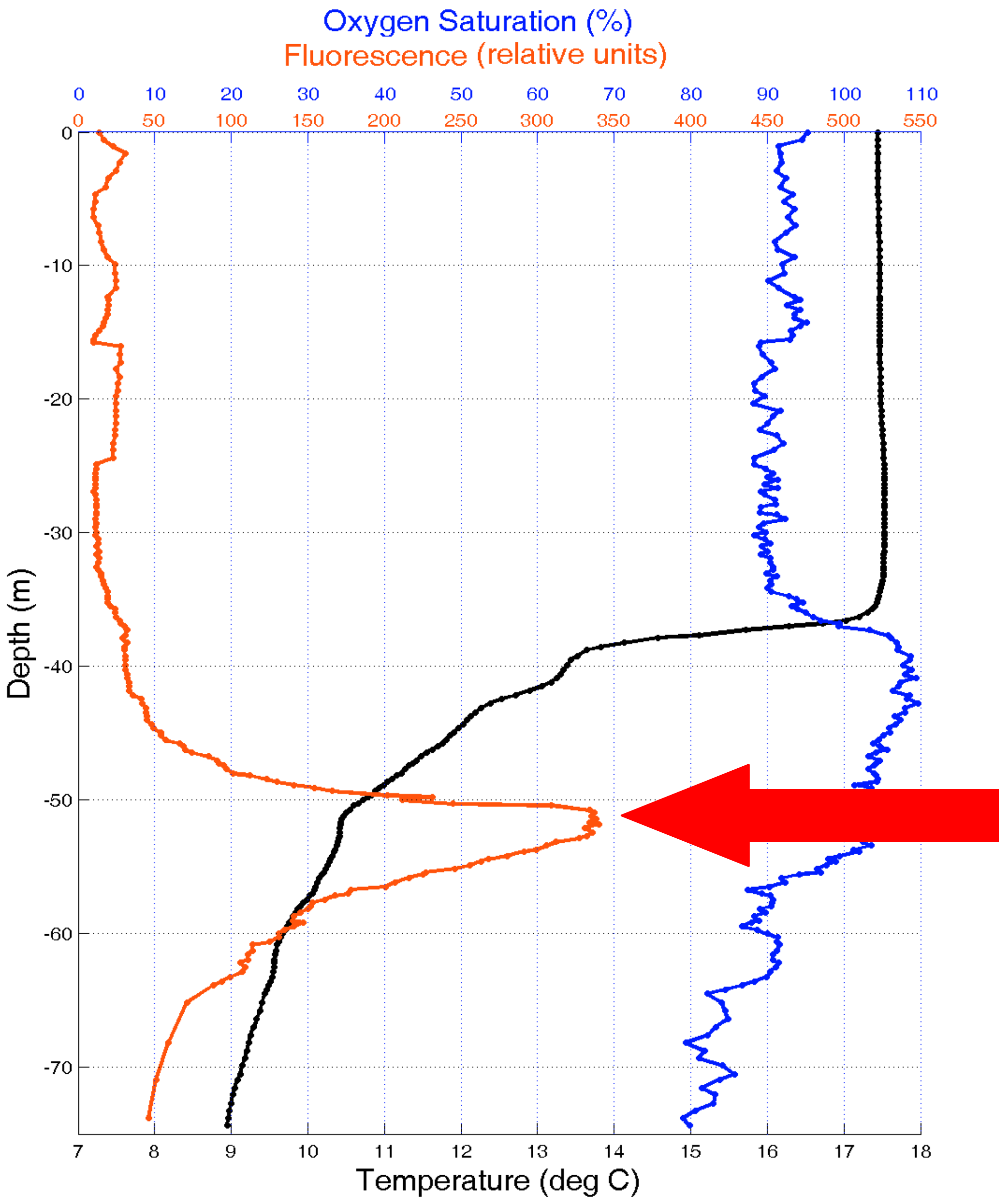
provide information on the vertical distribution of particles, carbon, and other properties



Evolution of spring bloom in the Sea of Japan/East China Sea.
SOLO float with 3-channel radiometer (Mitchell et al.)

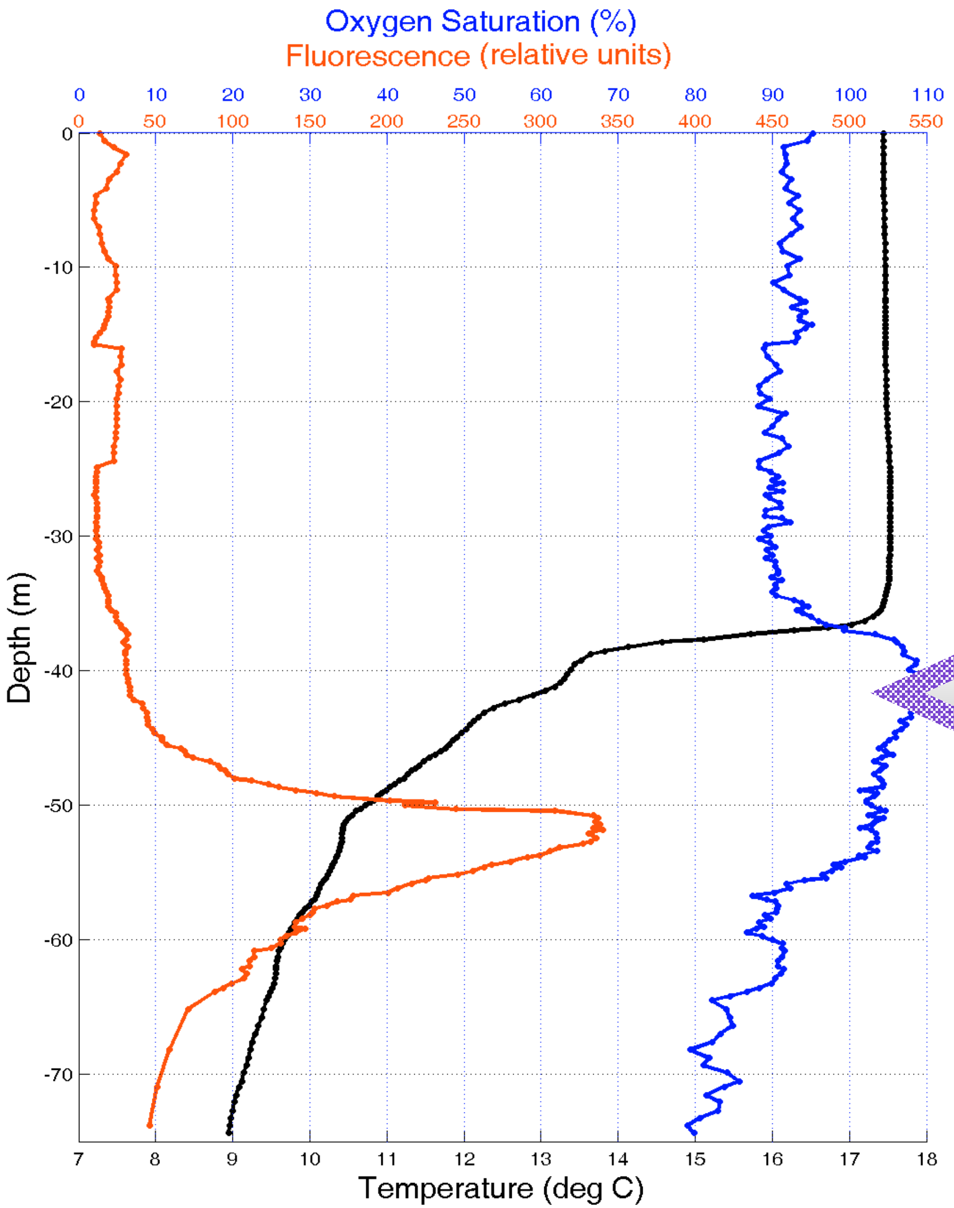


satellite observations miss the subsurface maximum



Seaglider data, Perry and Eriksen, Washington Coast

deep chlorophyll maximum



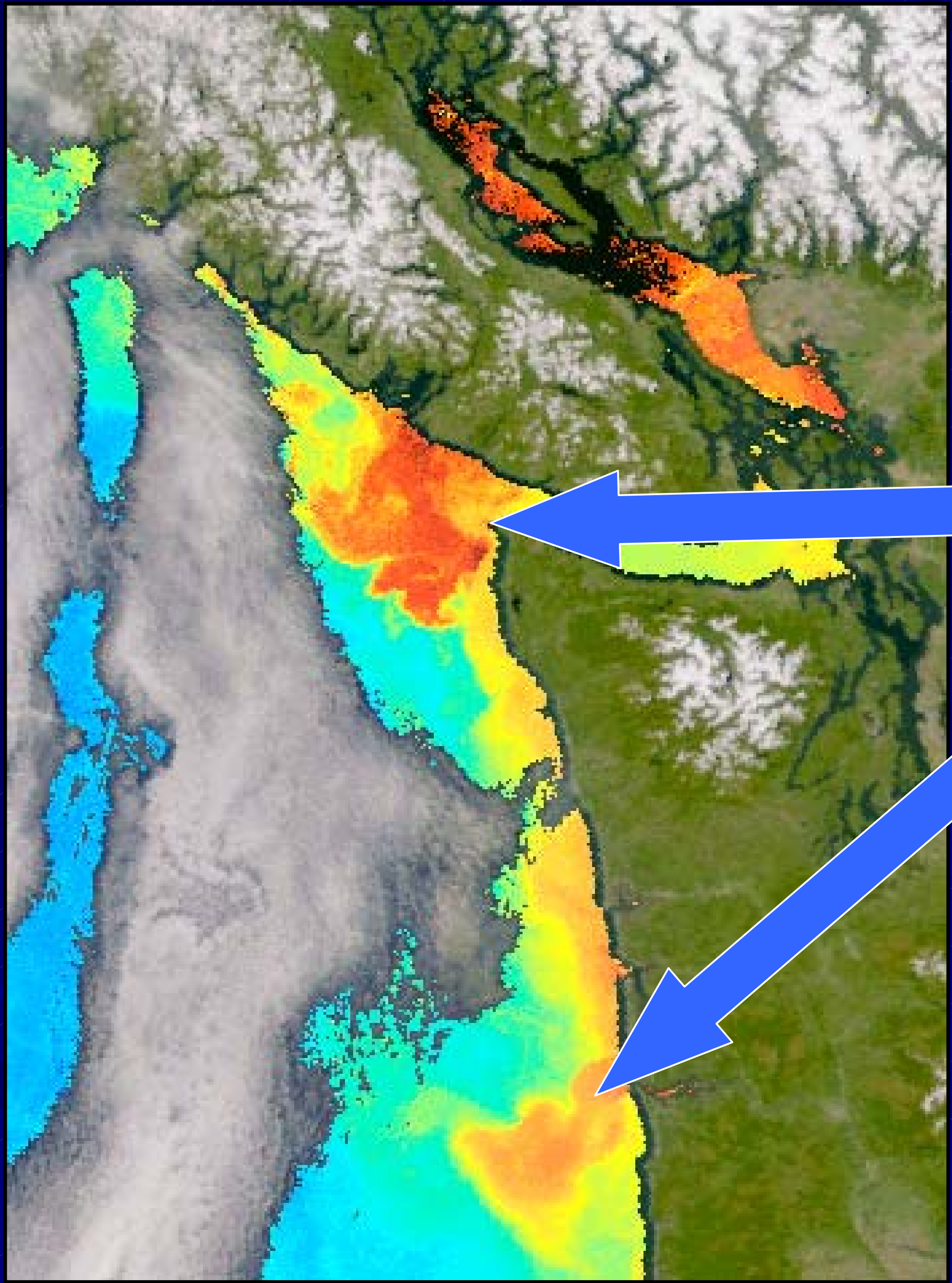
Seaglider data, Perry and Eriksen, Washington Coast

deep chlorophyll layer is responsible for community net production (O_2 super saturation)

3. Ocean color Lw conversion to products sometimes ambiguous
(an under-constrained problem)

- chlorophyll or sediment?
- chlorophyll or CDOM?
- early cocco bloom or some other type of particle ?

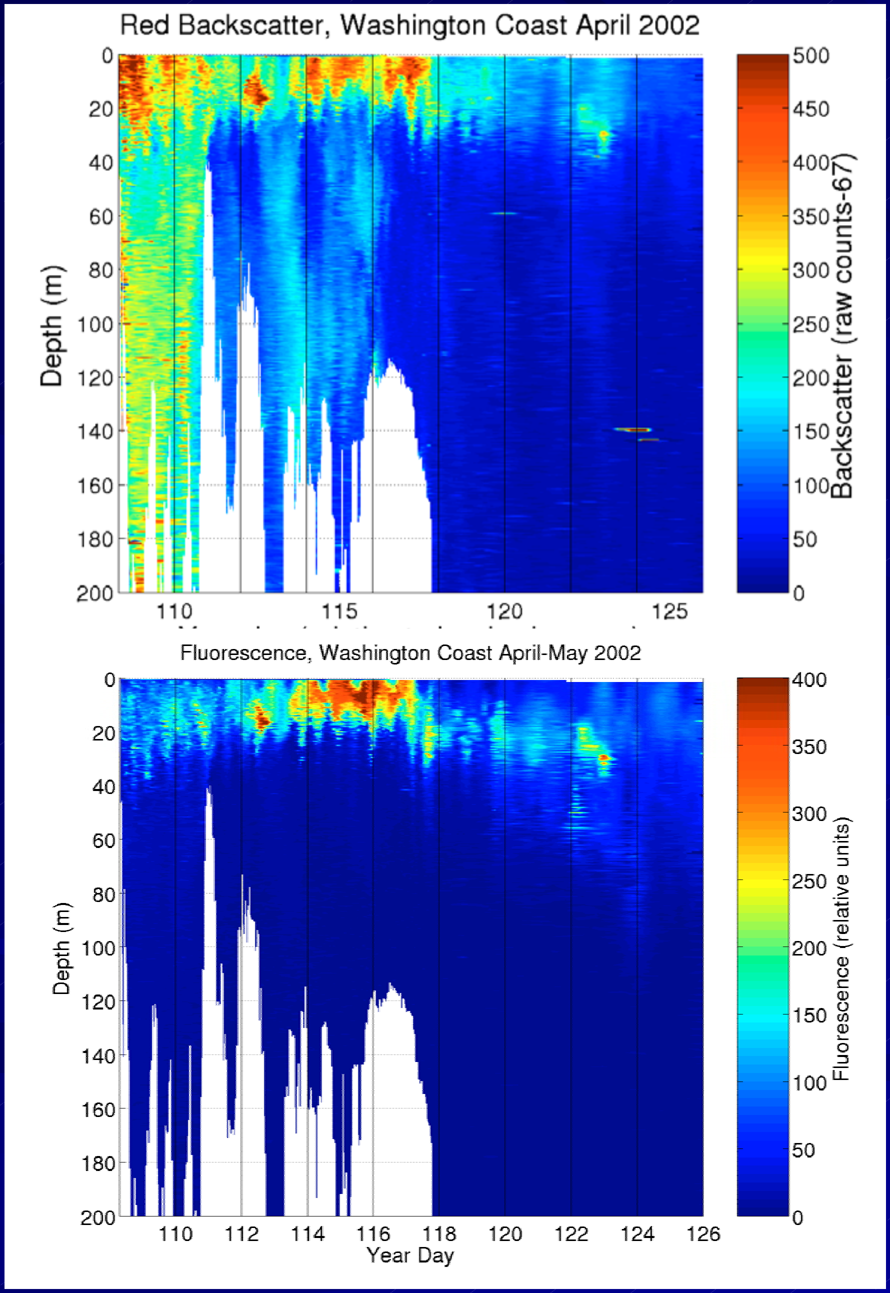
Sensors on in-water platforms can provide additional information to better constrain products and reduce uncertainty



Pacific Northwest sediment or chlorophyll?

SeaWiFS
May 22, 1999

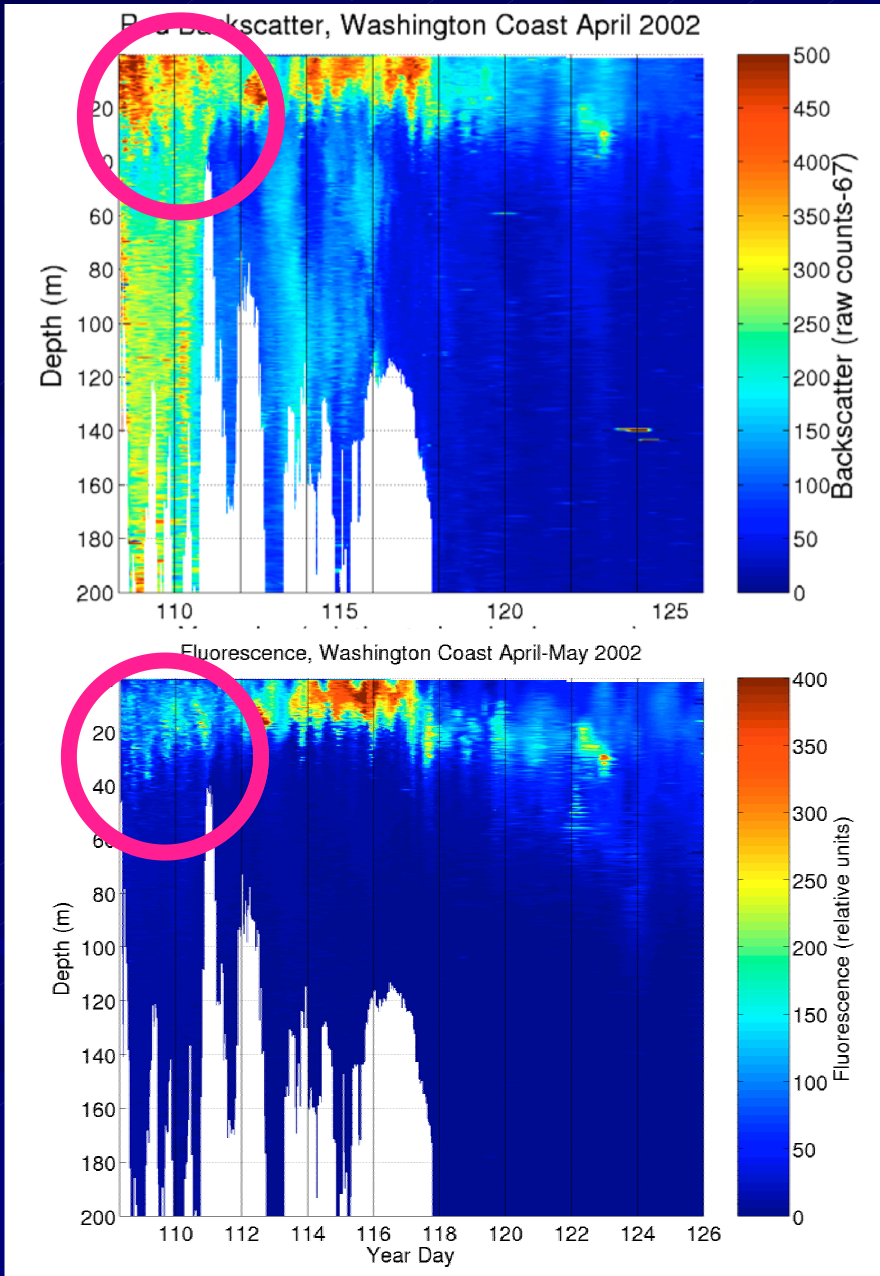
Seaglider transect Strait of Juan de Fuca



optical backscatter

chlorophyll fluorescence

Seaglider transect Strait of Juan de Fuca

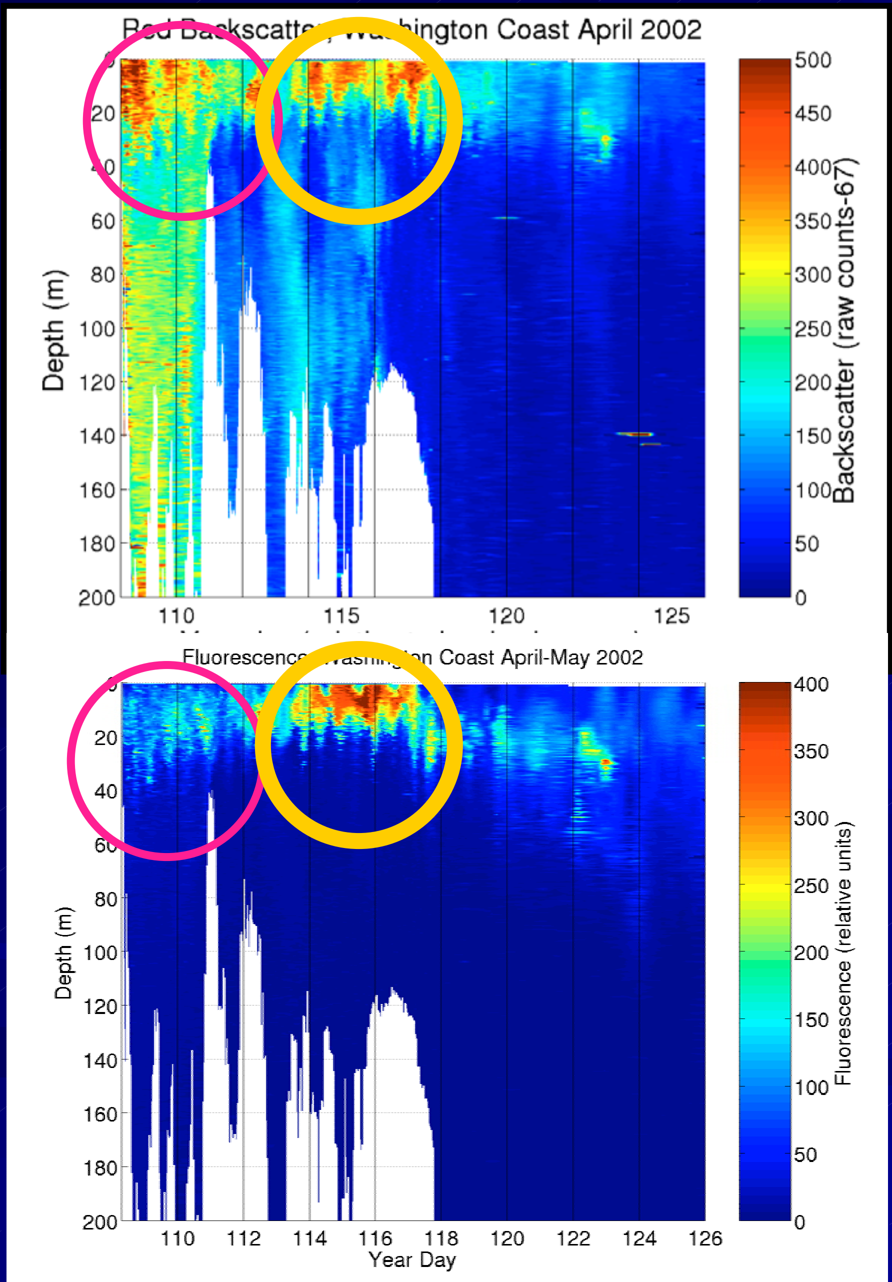


optical backscatter

sediments

chlorophyll fluorescence

Seaglider transect Strait of Juan de Fuca



optical backscatter

phytoplankton

chlorophyll fluorescence

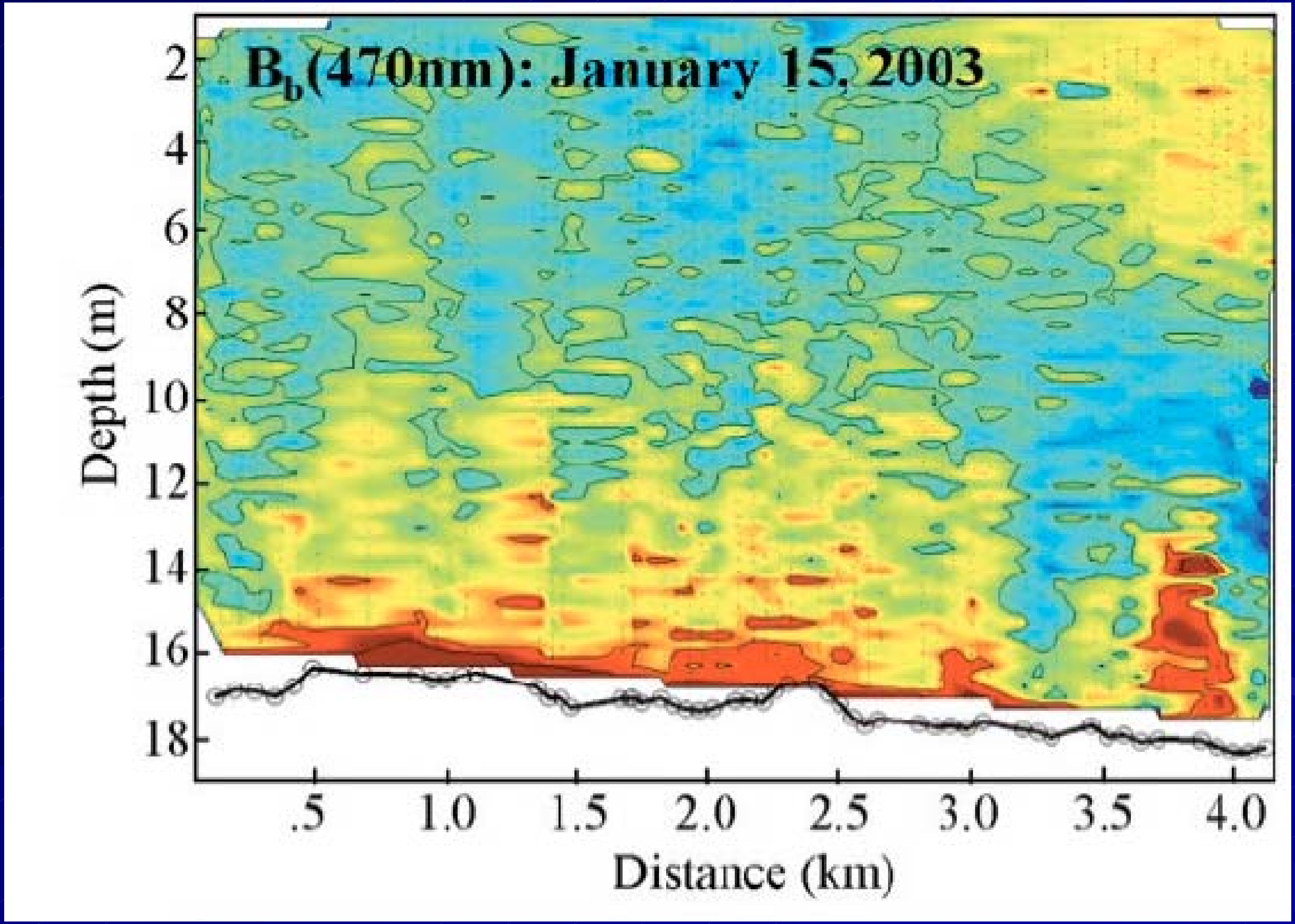
4. Cal / Val challenge --- in spatially heterogeneous coastal zone

how does a point measurement from optical mooring relate to a spatially averaged pixel ?

Autonomous platforms

extend the spatial reach of mooring

Oscar Schofield, West Florida Shelf, optical backscatter from glider



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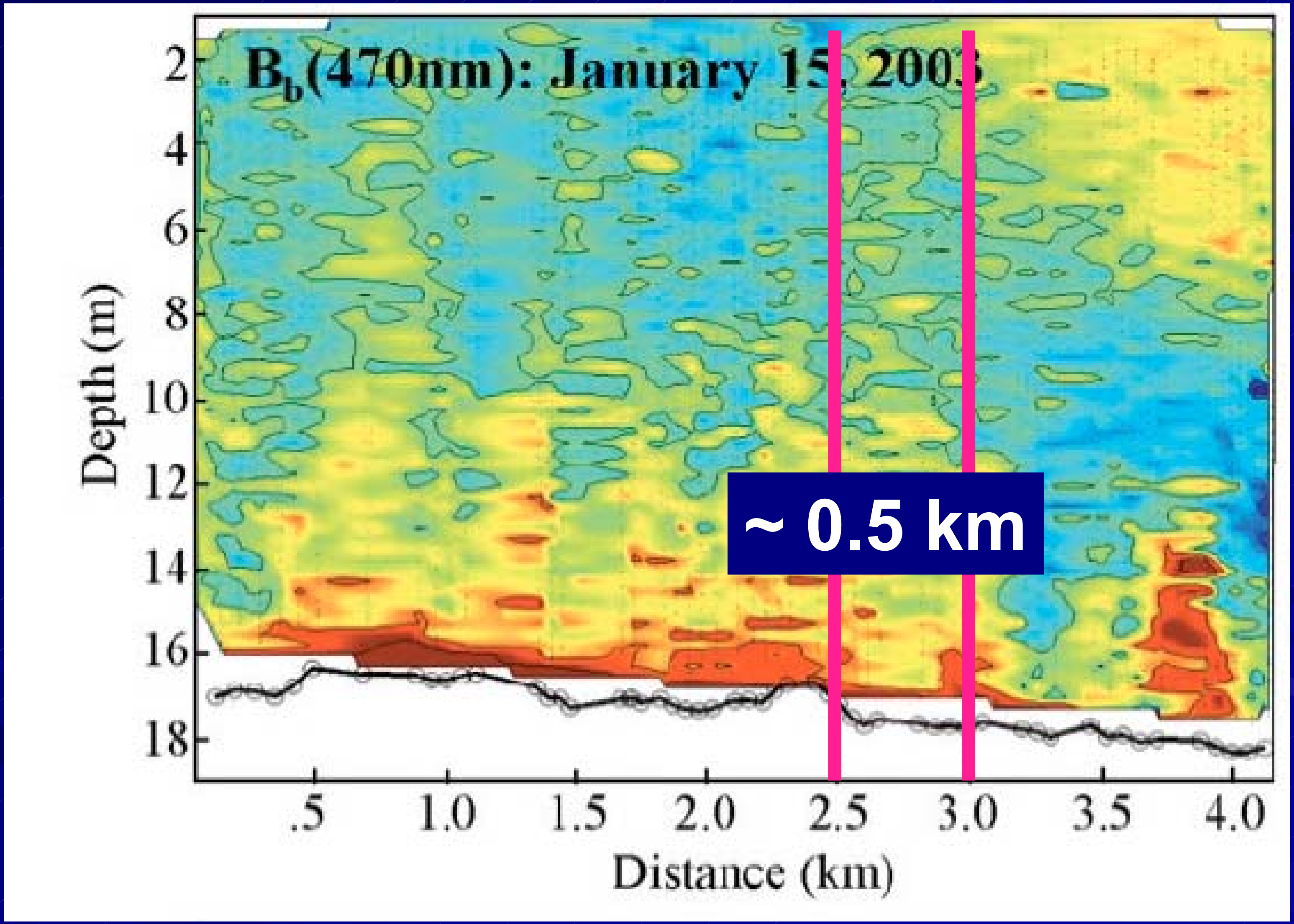

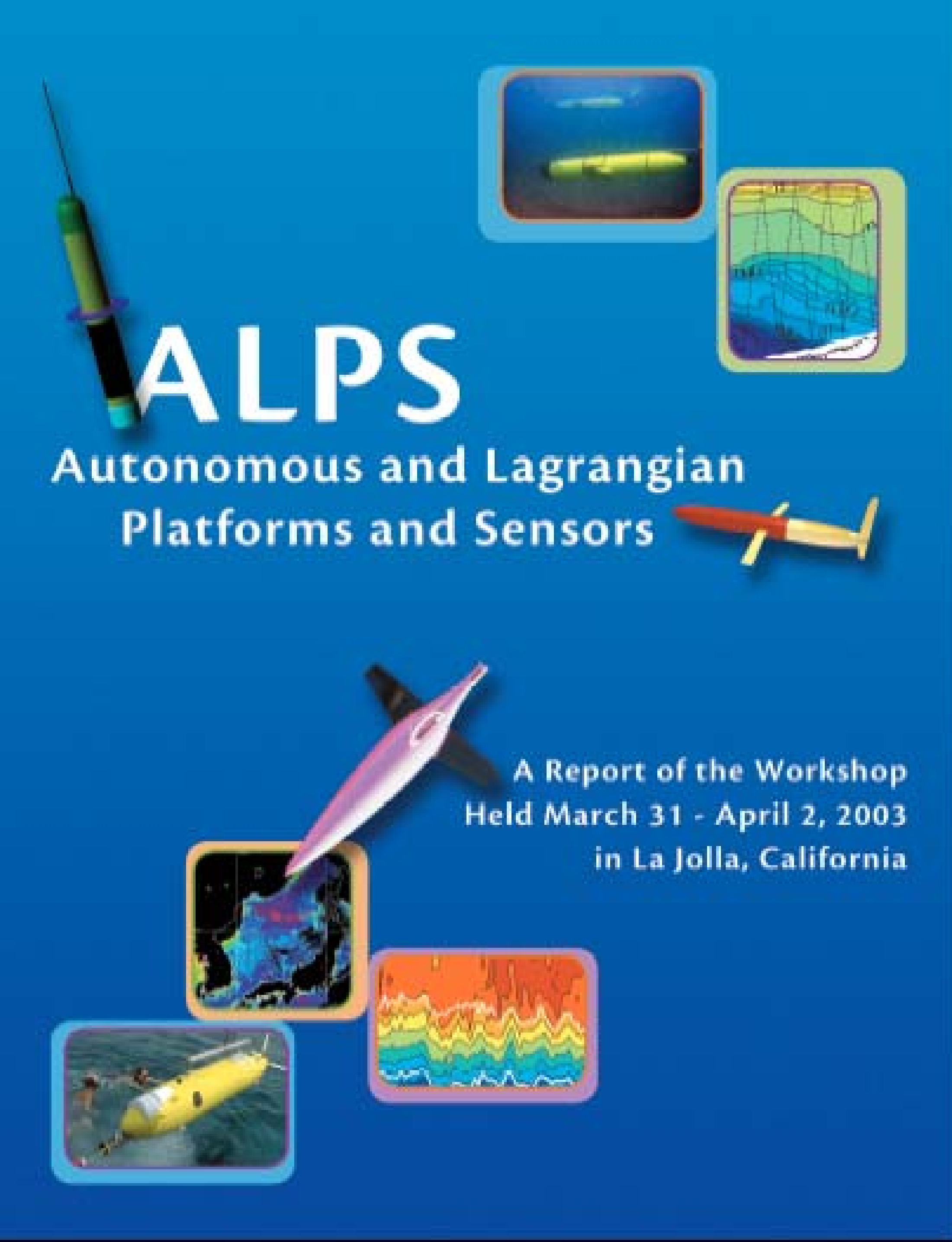

ALPS report

recommendations for next steps:

- * sensors
  - smaller
  - data interpretation
- * platforms
- * new combinations of existing systems (biogeochem floats)
- * pilots

www.geo-prose.com/ALPS

(Rudnick and Perry, 2003)

Biogeochemical Sensors on **Networks of** Autonomous/Lagrangian Platforms

1. "fill in the gaps" under clouds in high priority areas
2. provide z dimension to complement satellite x, y, t
3. reduce uncertainty in conversion of Lw to products
4. extend "spatial reach" of calibration moorings (Lw) in regions of high spatial variance (i.e., coastal zone)