Optics and biogeochemistry at Crater Lake, OR

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Optics and biogeochemistry of Crater Lake, OR

Why study lakes?

- If we cannot understand and model them, forget about the oceans.

Why study Crater Lake?

- History (Petit (30s), R. Smith (60s)).
- Provides a challenge to modern in-situ IOP instrumentation.

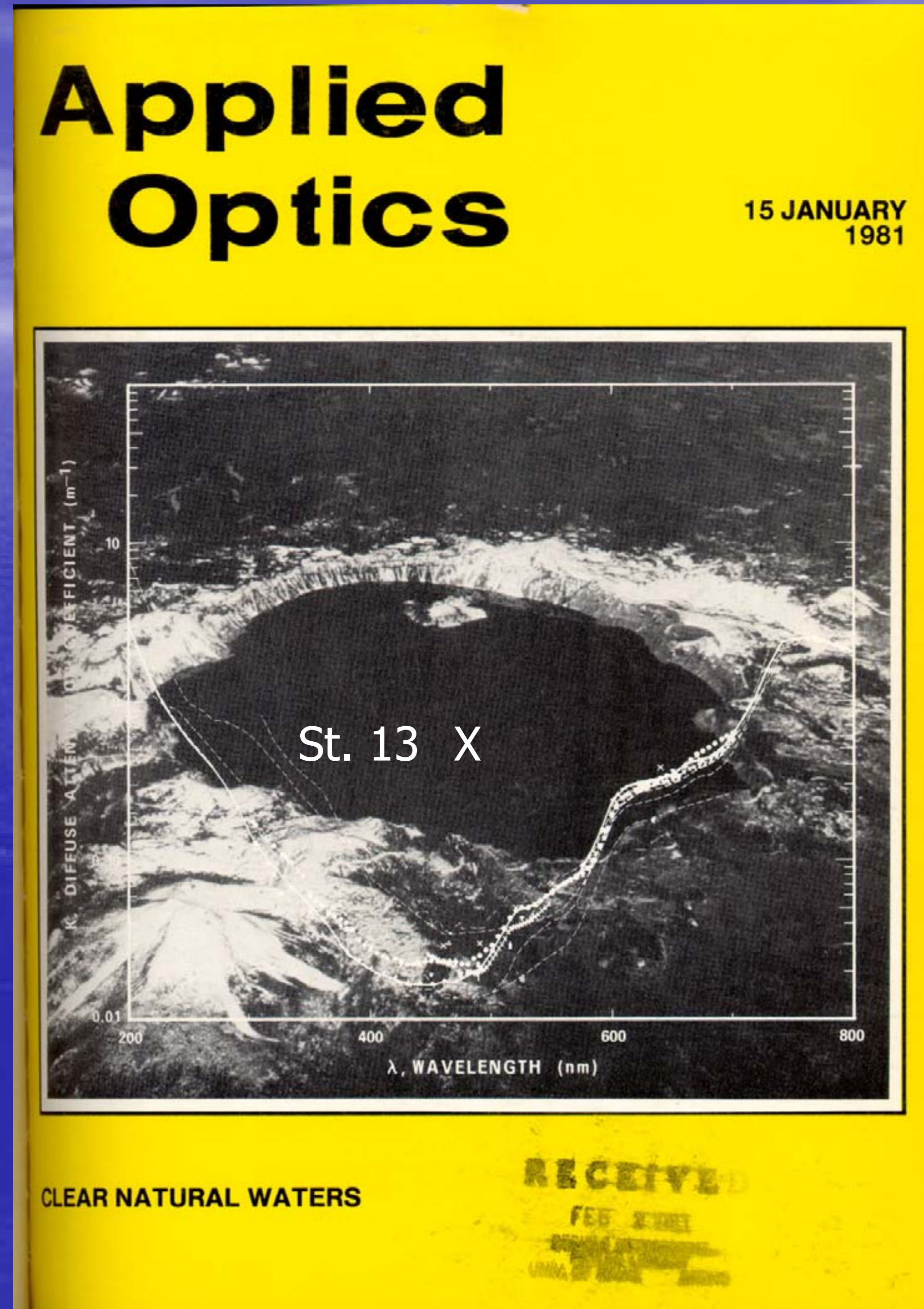
Why use optics to study lakes?

- High resolution (spatial, temporal) description of parameters that relate to the biogeochemistry of the lake.

Crater Lake, OR

Physical attributes:

1880m above sea level.
Locked in a volcano’s caldera.
Little source of organic matter.
Radius of O(3km).
589m deep (deepest in US).
Food-web spanning from
micro-organisms to fish.



Sampling: June 26-27 and September 19, 2001.

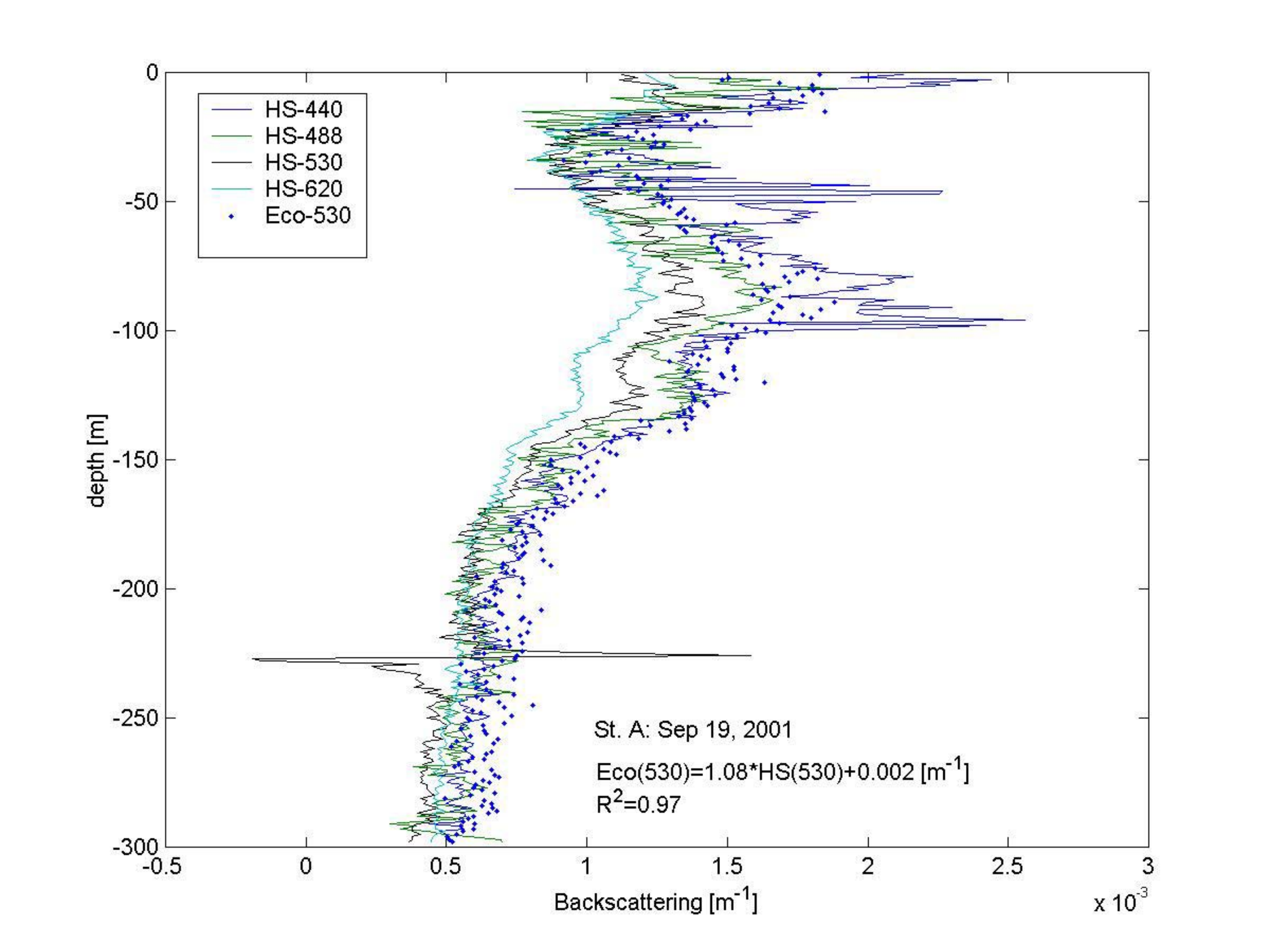
Novel optical instrumentation:

WetLabs *ac*-9: Attenuation and absorption at 9 wavelengths.

HOBI Labs Hydroscat-6: backscattering estimated from $<\beta(140)>$ at 6 wavelengths.

WetLabs Eco-VSF: backscattering estimated from $<\beta(100)>$, $<\beta(125)>$ & $<\beta(150)>$ at 530nm.

Backscattering closure (Sep. 19 2001):



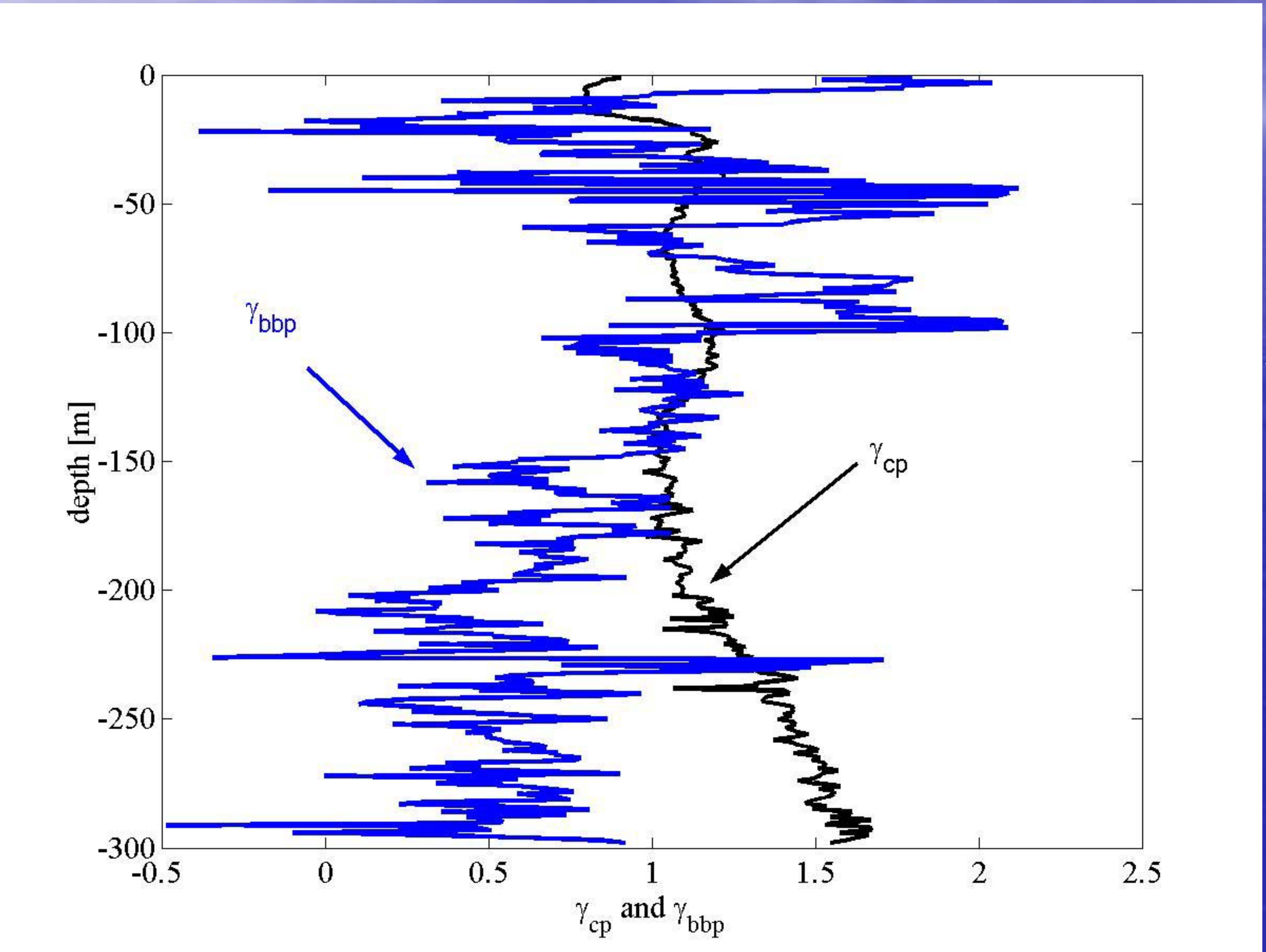
Good signal despite clarity!

$b_{bp}(530)<b_{bw}(530)$

Correlation similar to that at LEO XV.

Only 4 usable λ

Particulate b_{bp} vs. c_p spectral slope



$$b_{bp}, c_p = A\lambda^{-\gamma}$$

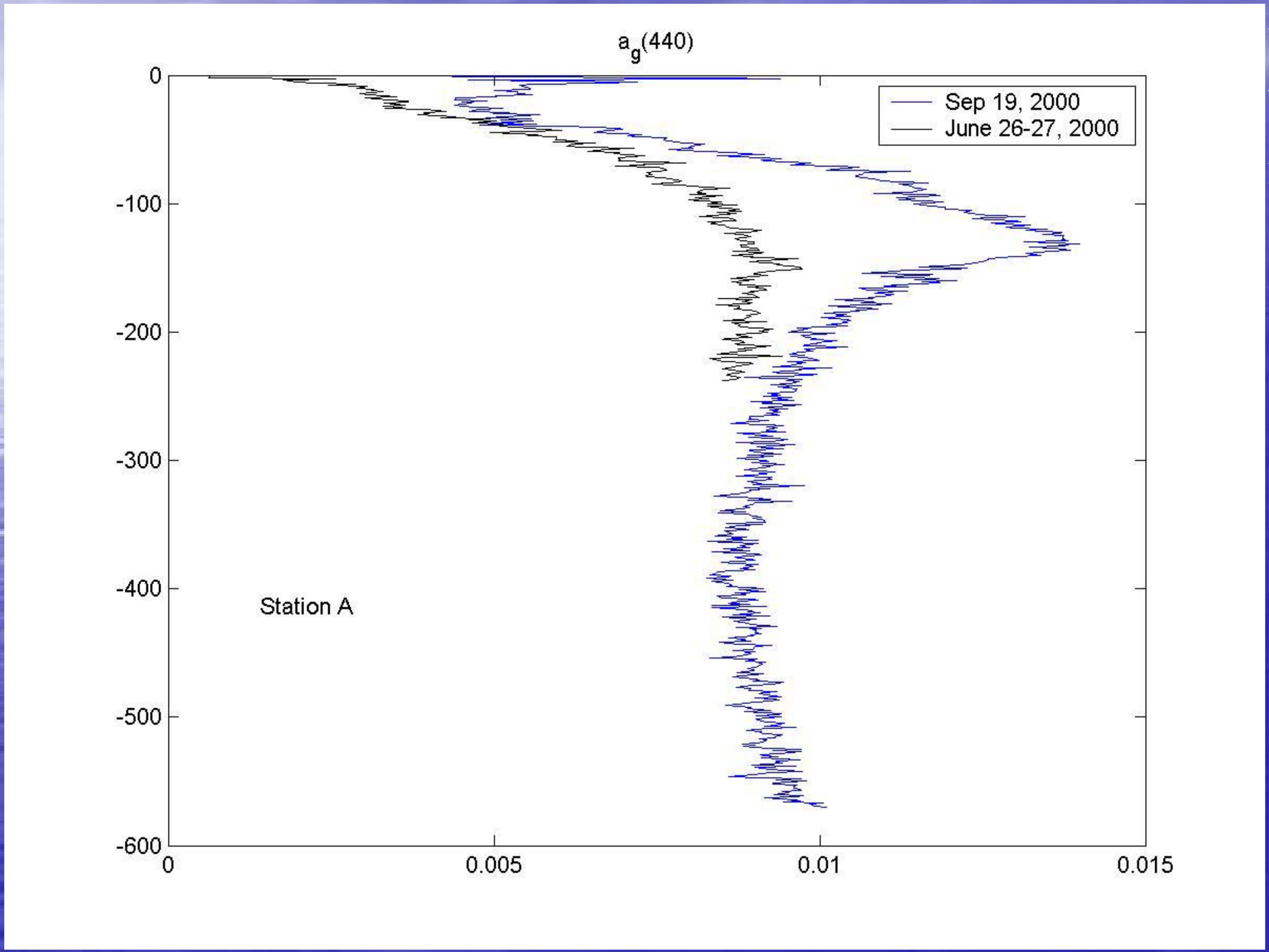
Provides estimate of tendencies of PSD.

Not correlated!

Caution:
slope is influenced by small possible offsets and noise in data.

Colored dissolved material:

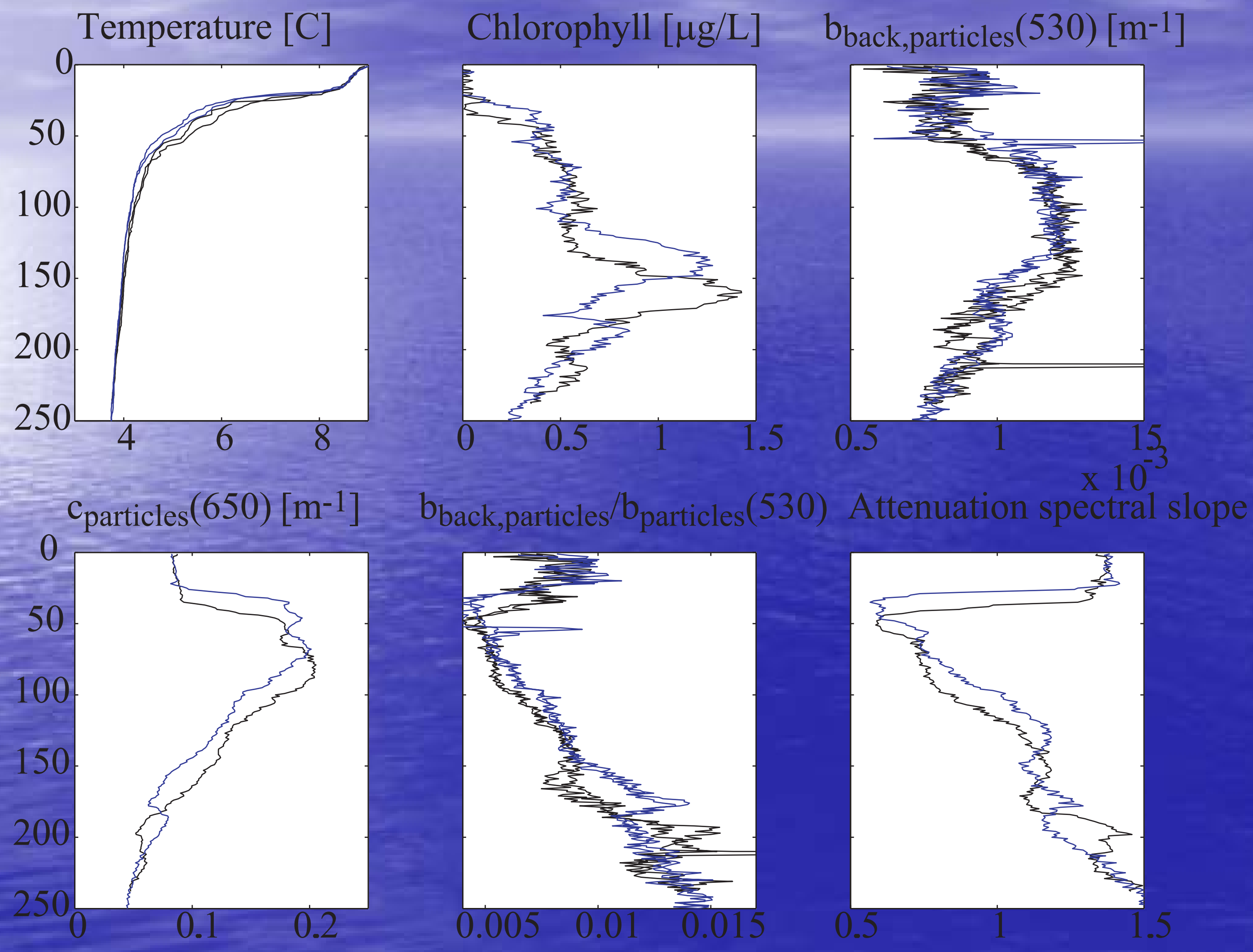
Uncertainty: ±0.005.



Uncertainty reduced by independently measuring it with *a* and c side.

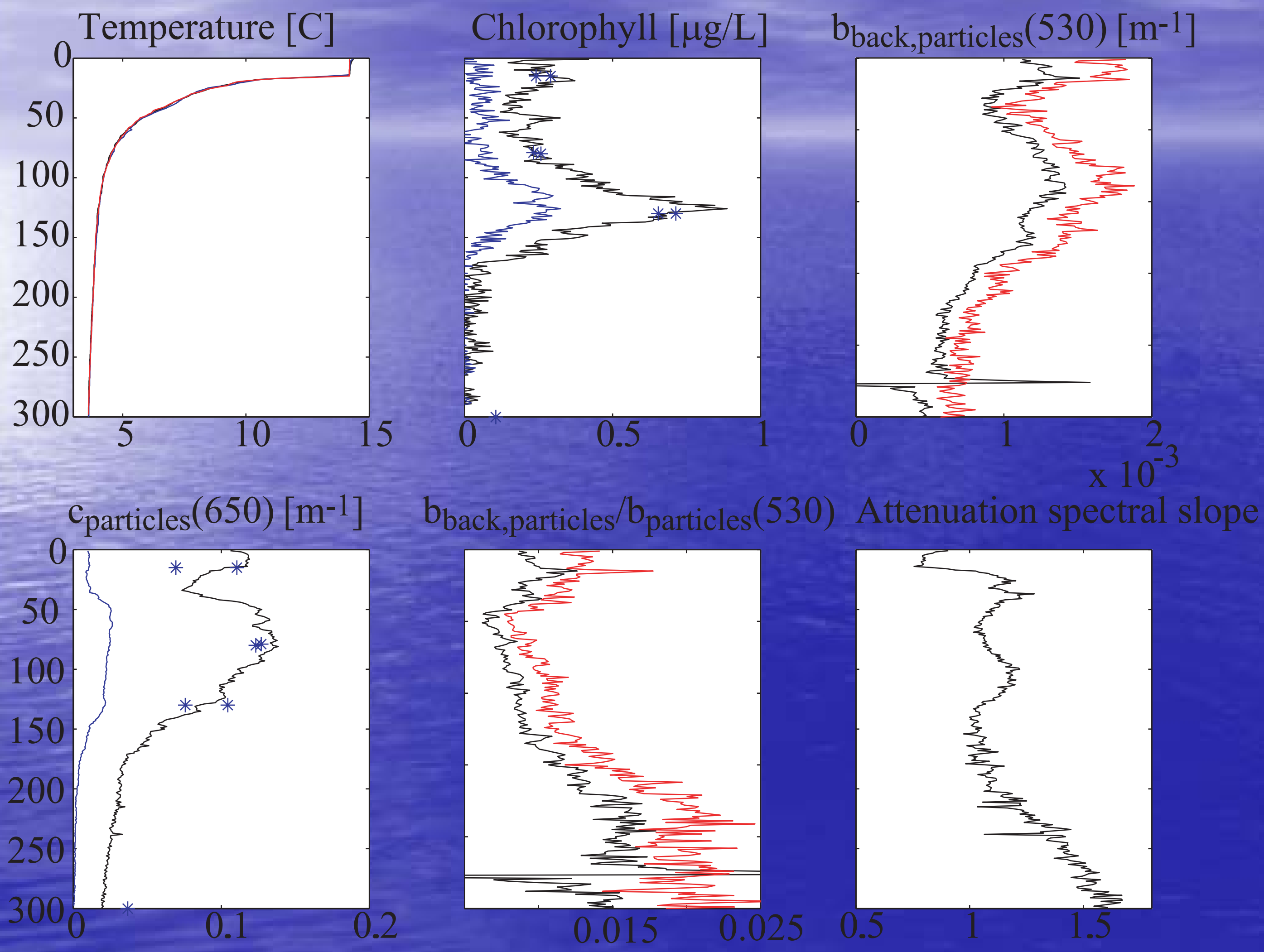
CDM accumulates through the summer with a maxima at 130m.

Particulate material (June 26-27, 2001):



- T-cline at 20m
- Chl-max @ 150m
- 50m internal waves (storm)
- b_b and c_p not well correlated.
- c_p-max @ 80m
- b_{bp}/b_p similar to c_p and γ

Particulate material (Sep 19, 2001):



T-cline at 20m

Chl-max @ 130m

b_b and c_p well correlated.

c_p-max @ 80m

b_{bp}/b_p less similar to γ

c_p* and chl* similar to Aloha.

Blue: <1μm Red: EcoVSF *-chl_a and POC

Summary

•Novel IOP instrumentation perform well in one of the clearest natural waters.

•Backscattering and its spectrum do not necessarily correlate with the beam attenuation.

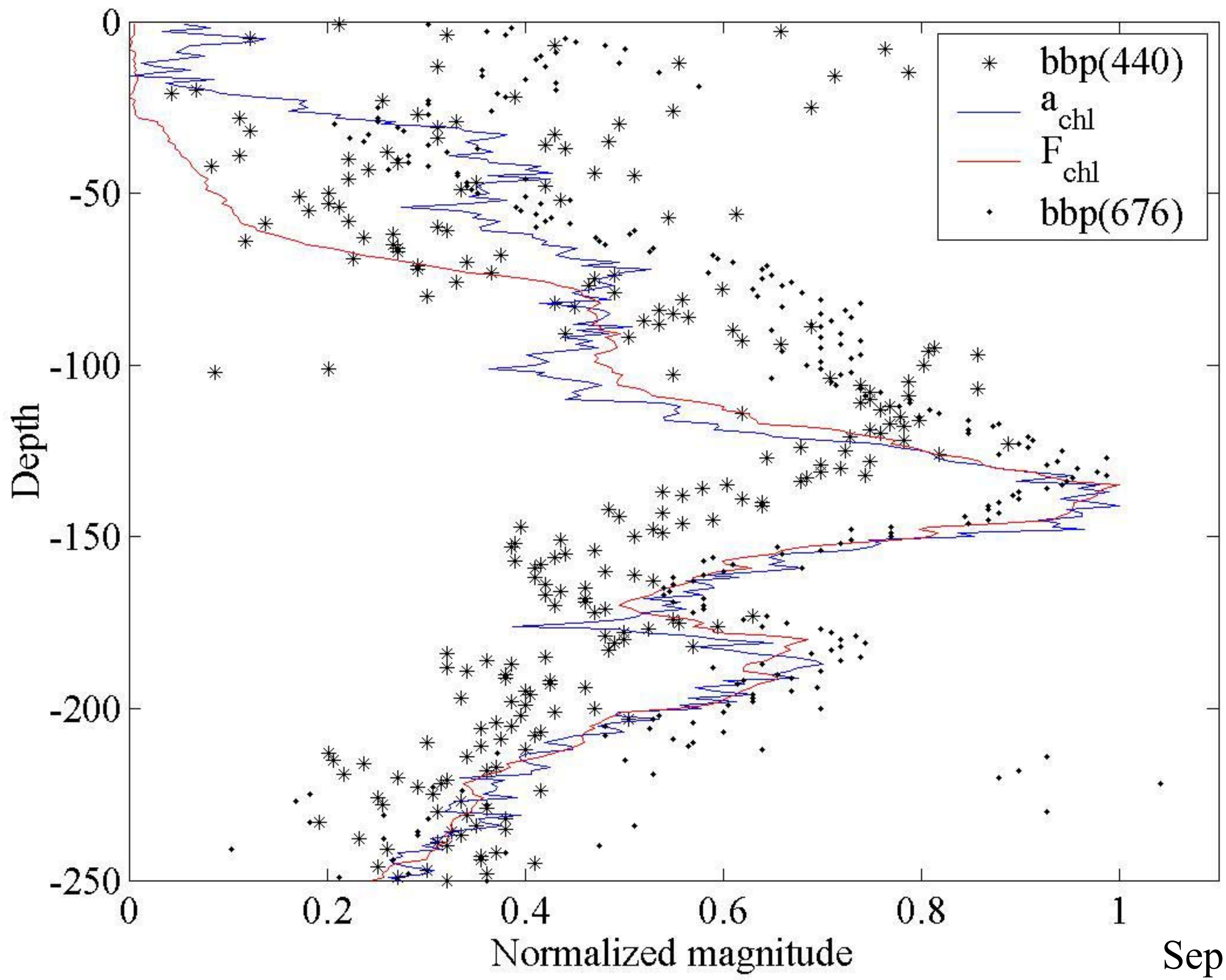
•c_p/POC and *a*/[chl] similar to oceanic values.

•CDM accumulation is observed.

•Use of Filters provides calibration independent measurements and provides information on relative contribution of different size classes (method pioneered by C. Roesler).

$b_{bp}(676)$-Chl comparison

$b_{bp,HS6}(676)=b_{bp}(676)+C\cdot F\_chl$
$b_{bp}(676) > b_{bp,HS6}(440)$



Sep, 2001