SOCLIM BioArgo floats: first results around the Kerguelen Plateau

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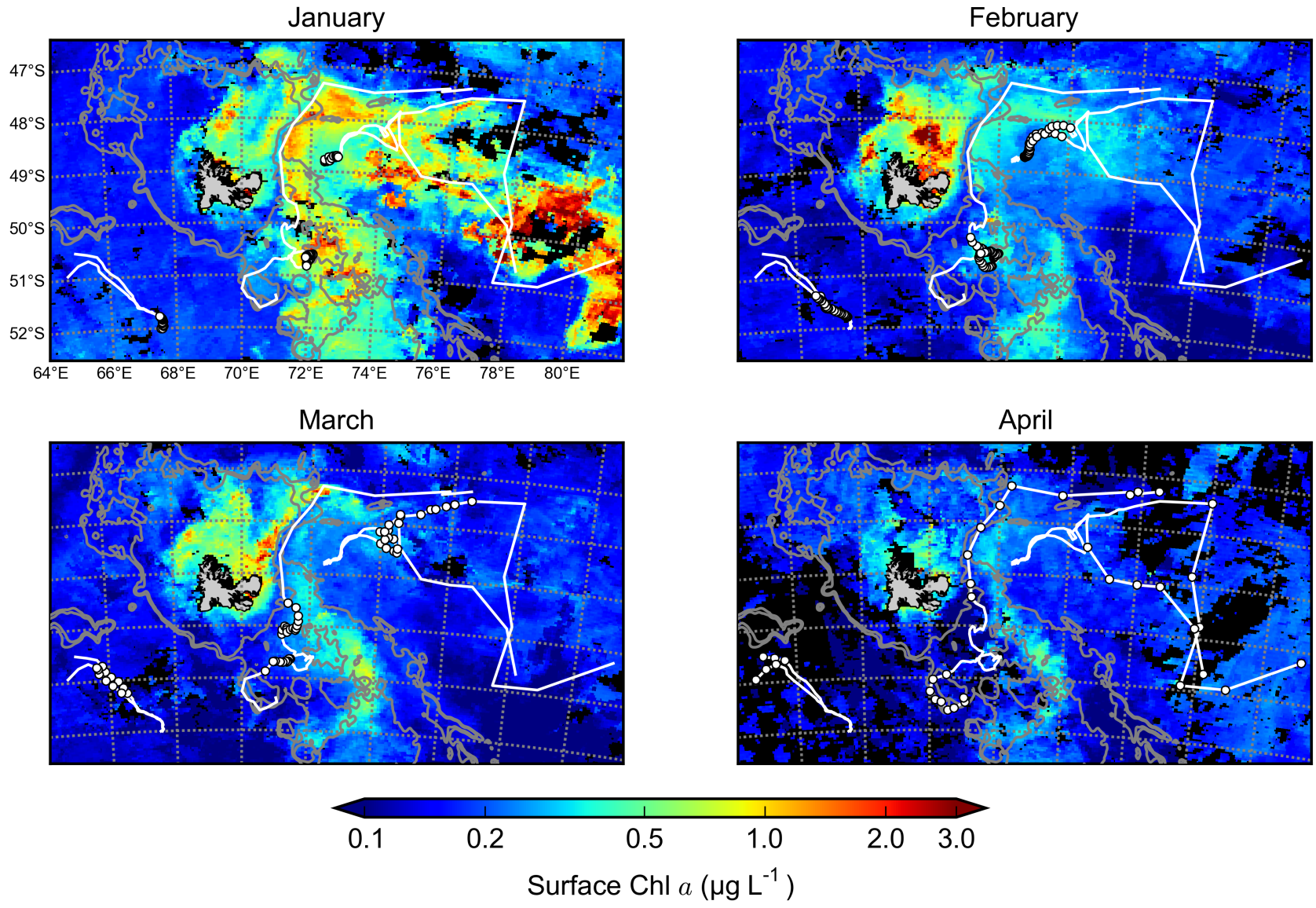
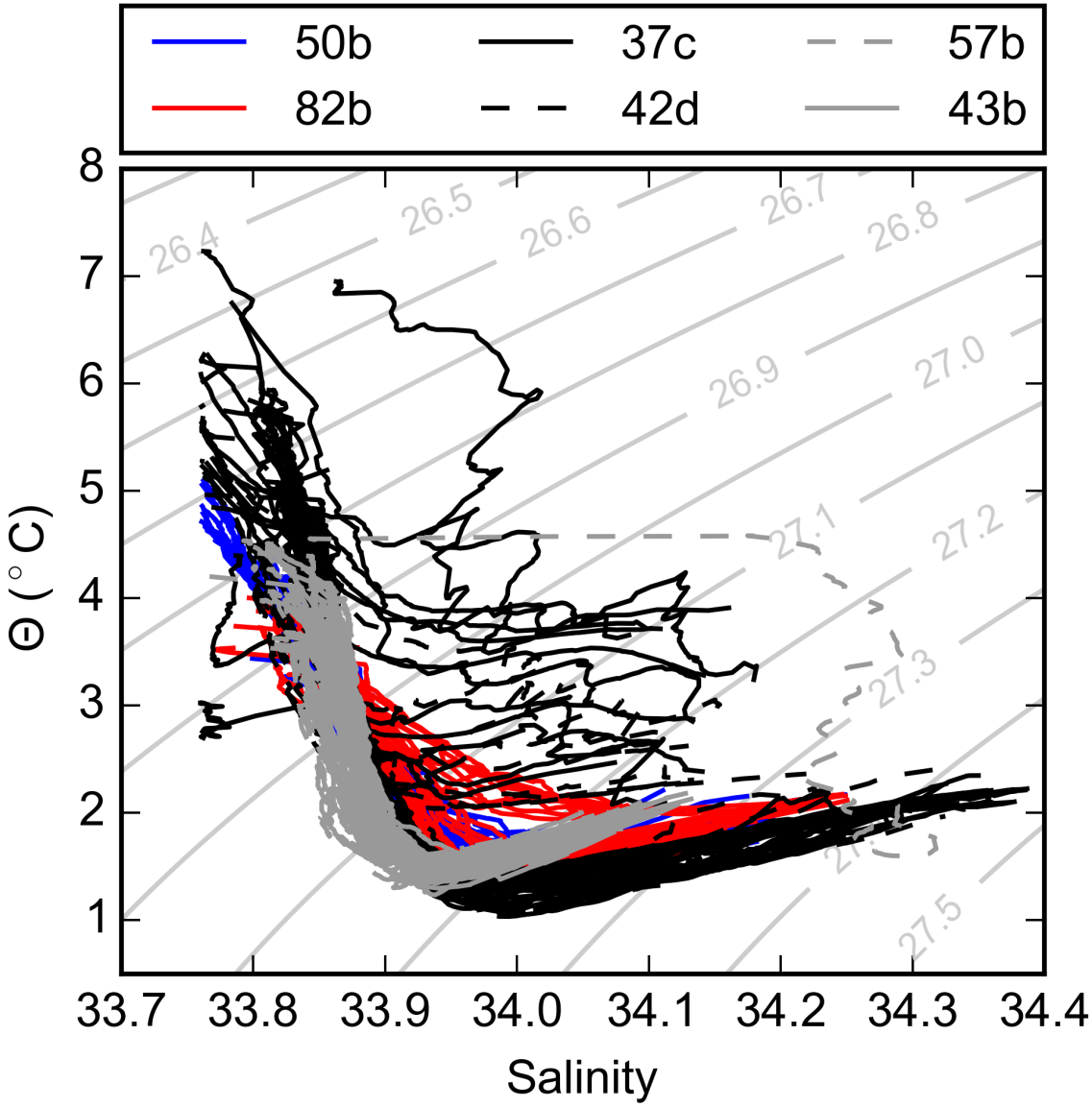
SOCLIM meeting

26 May 2015

SOUTHERN OCEAN AND CLIMATE
FIELD STUDIES WITH INNOVATIVE TOOLS


January
February
March
April
47°S
48°S
49°S
50°S
51°S
52°S
64°E
66°E
68°E
70°E
72°E
74°E
76°E
78°E
80°E
0.1
0.2
0.5
1.0
2.0
3.0
Surface Chl a (µg L^{-1})


50b
37c
57b
82b
42d
43b
26.4
26.5
26.6
26.7
26.8
26.9
27.0
27.1
27.2
27.3
27.5
8
7
6
5
4
3
2
1
Θ (°C)
33.7
33.8
33.9
34.0
34.1
34.2
34.3
34.4
Salinity

Outline

- Data processing
- Chlorophyll *a* retrieval
- Biomass attenuation
- Sections and optical signature
- Questions for the SOCLIM cruises

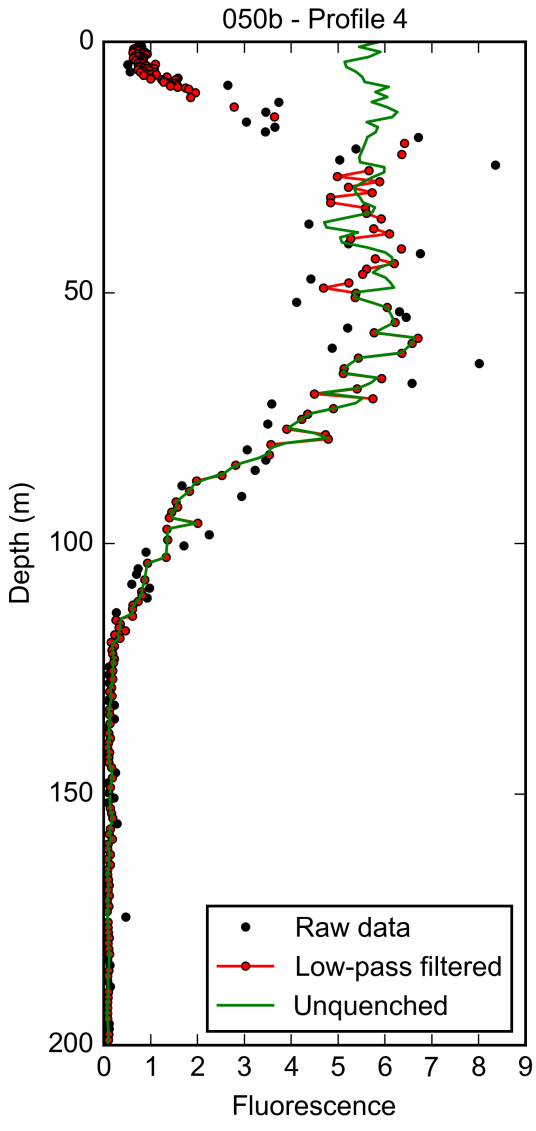
Data processing

(1) Low-pass filter on Fluo, cp, bbp

- Quadratic fit on 20 m intervals
- Discard data point away from the fit by $>$ 1 RMS
- Bin data at 1m intervals (linear interpolation if no data)

(2) Unquenching the fluorescence profile

- Fit $\text{Fluo}_{50-200} = \text{f}(\text{cp}_{50-200})$
- Correct Fluo_{0-50} with f and cp_{0-50}
- Use bbp if cp not available
- $R^2_{cp} = 0.96 \pm 0.03$
- $R^2_{bbp} = 0.89 \pm 0.09$



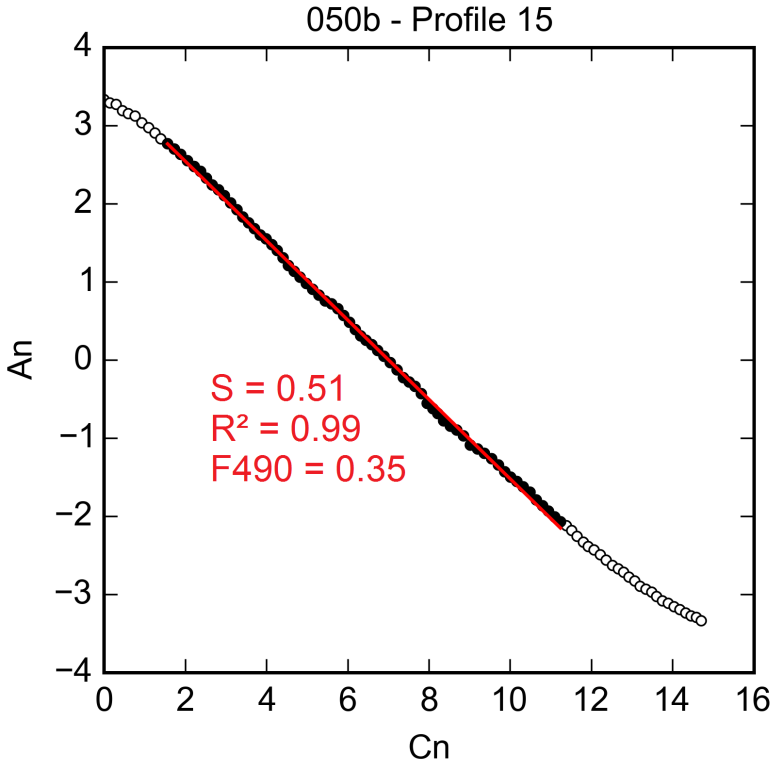
Method from *Xing et al.*, 2011

$$ln(Ed_{490(z)}) + \sum_{i=1}^{n} K_w \ \Delta z = ln(Ed_{490(0-)}) - F_{490}^{e(490)} \sum_{i=1}^{n} (\chi_{(490)} \ Fluo^{e(490)}) \quad (1)$$

Iteratevly downard, gives n equations for n depth intervals

$$An = B_0 - S \ Cn \quad (2)$$

Chlorophyll *a* retrieval

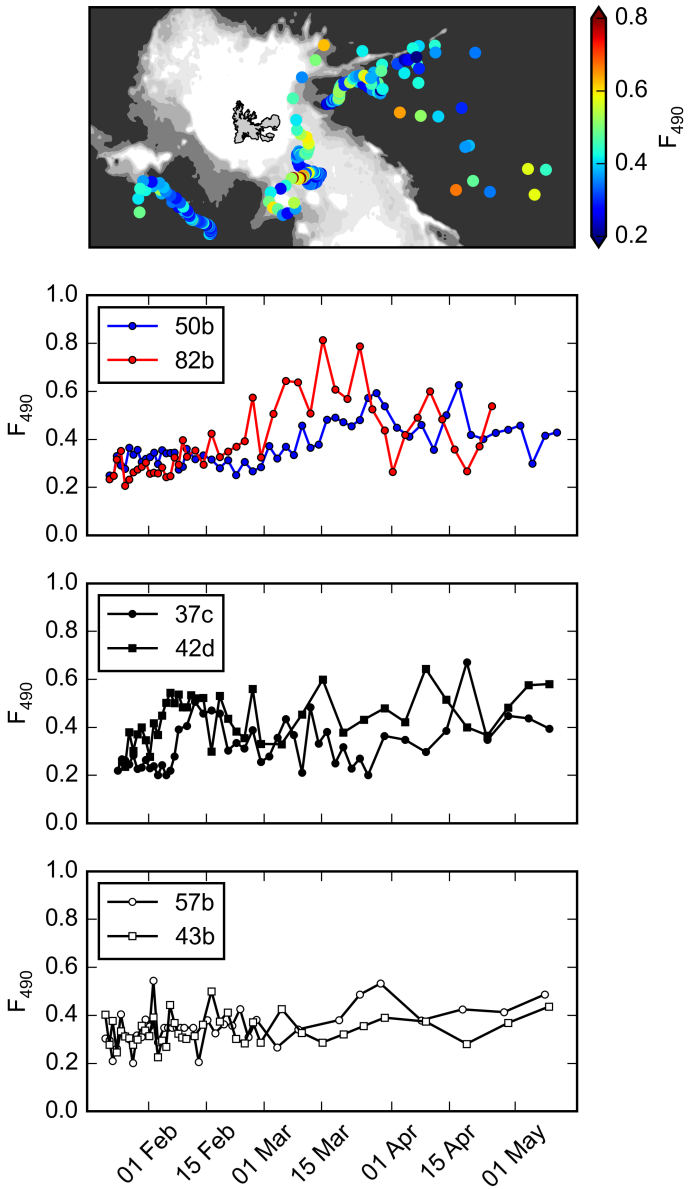


Discard data points away from the fit until $R^2 \geq 0.98$

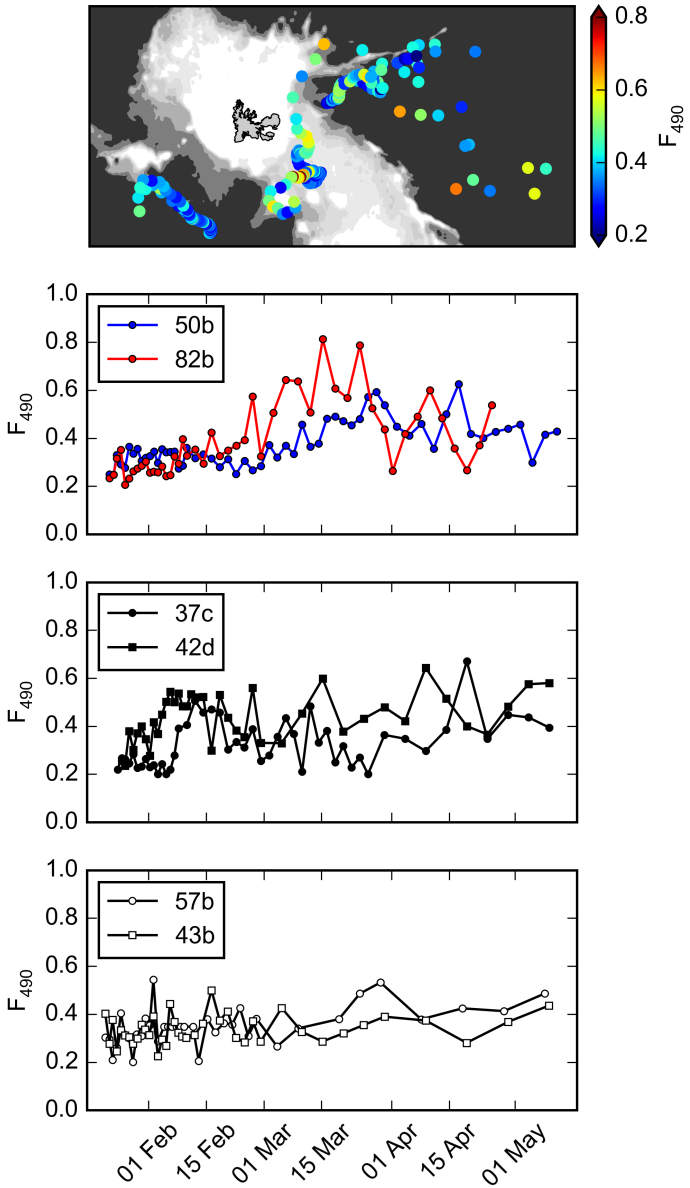
$$F_{490} = S^{1/e(490)} \qquad (3)$$

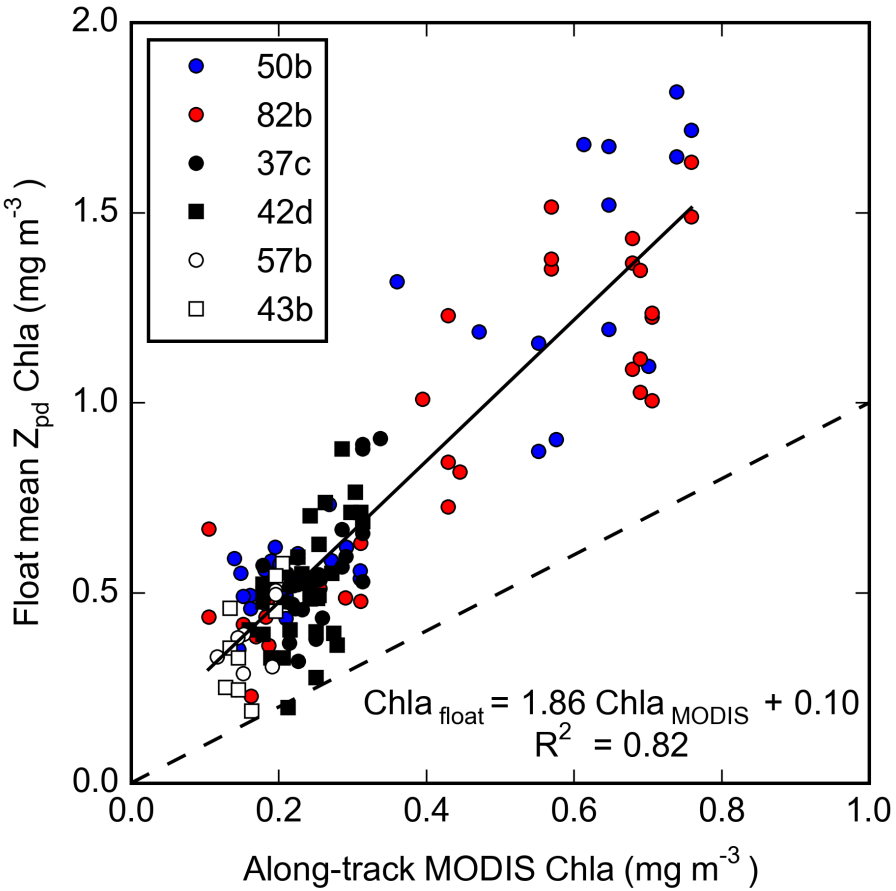
$$[Chla] = F_{490}\ Fluo \qquad (4)$$

Chlorophyll *a* retrieval



Chlorophyll *a* retrieval

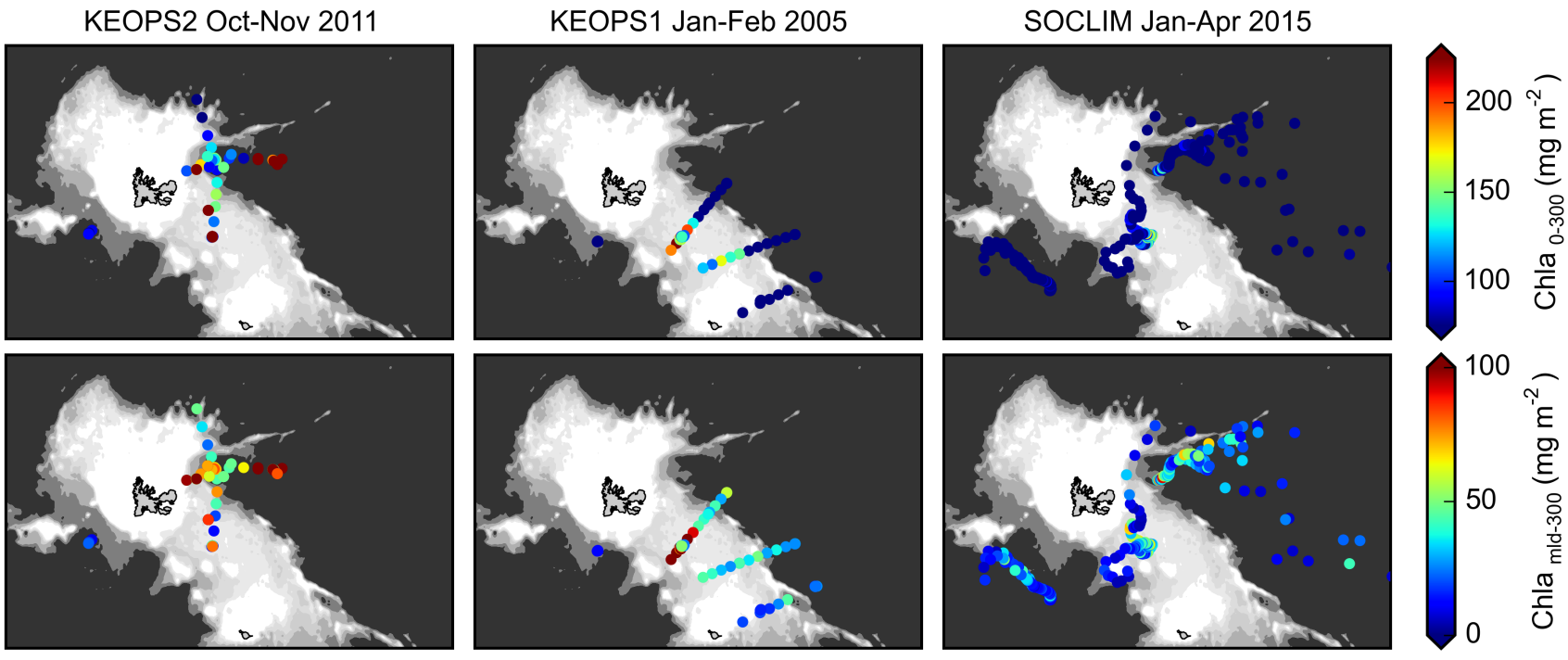




Linear fit $R^2 = 0.82$

Power fit $R^2 = 0.73$

Chlorophyll *a* retrieval



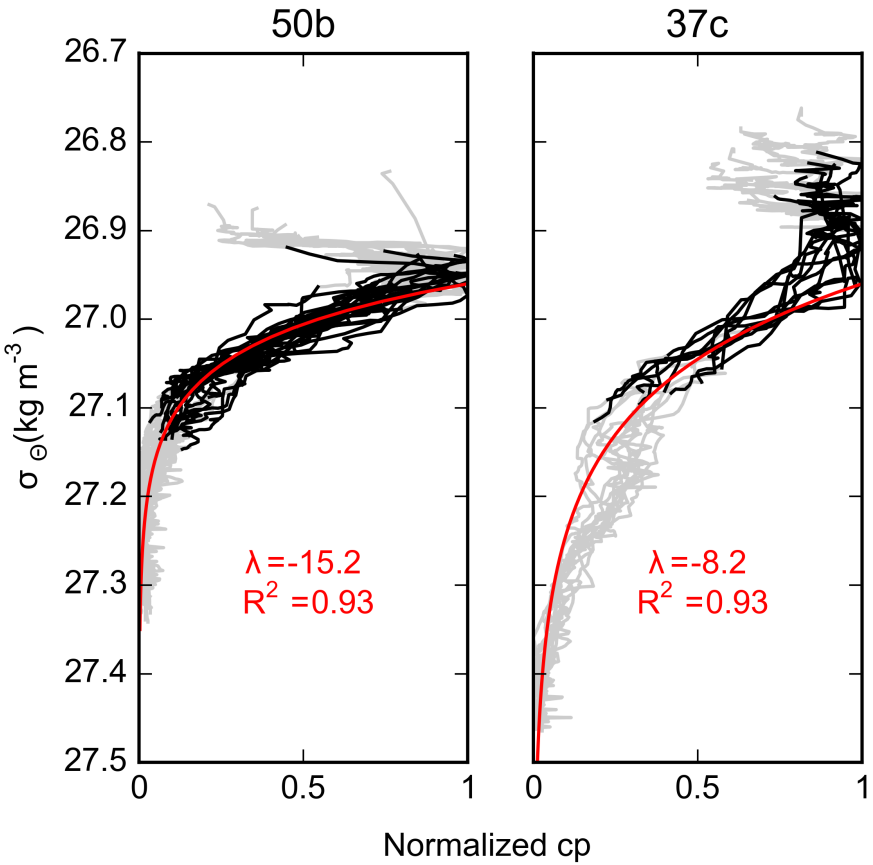
KEOPS1 and KEOPS2 fluorometer calibrated with HPLC measurements

Biomass attenuation

$$|c_p| = \frac{c_p - min(c_p)}{max(c_p) - min(c_p)}$$

Estimate the exponential attenuation from $|c_p| = 1$, downward

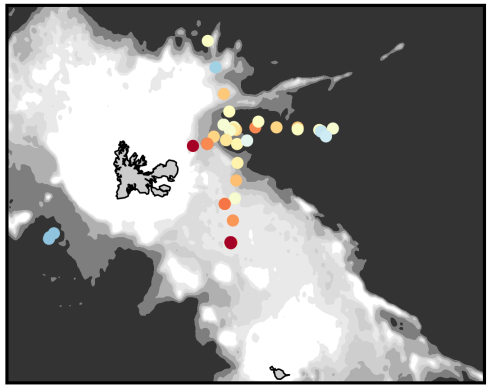
$$|c_p| = e^{-\lambda\ \sigma_\Theta - min(\sigma_\Theta)}$$



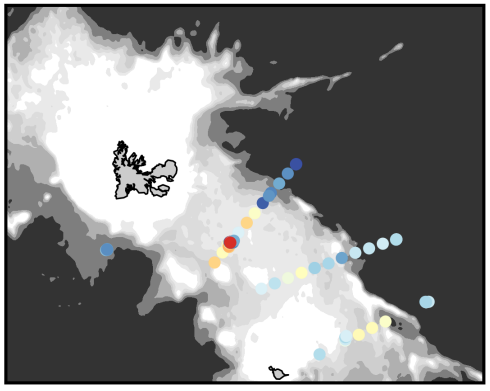
Example for few profiles

Biomass attenuation

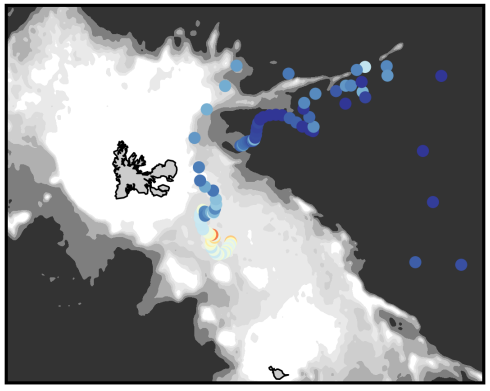
KEOPS2 Oct-Nov 2011

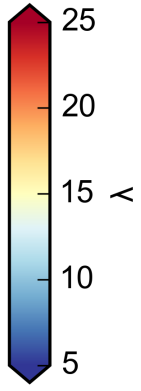


KEOPS1 Jan-Feb 2005

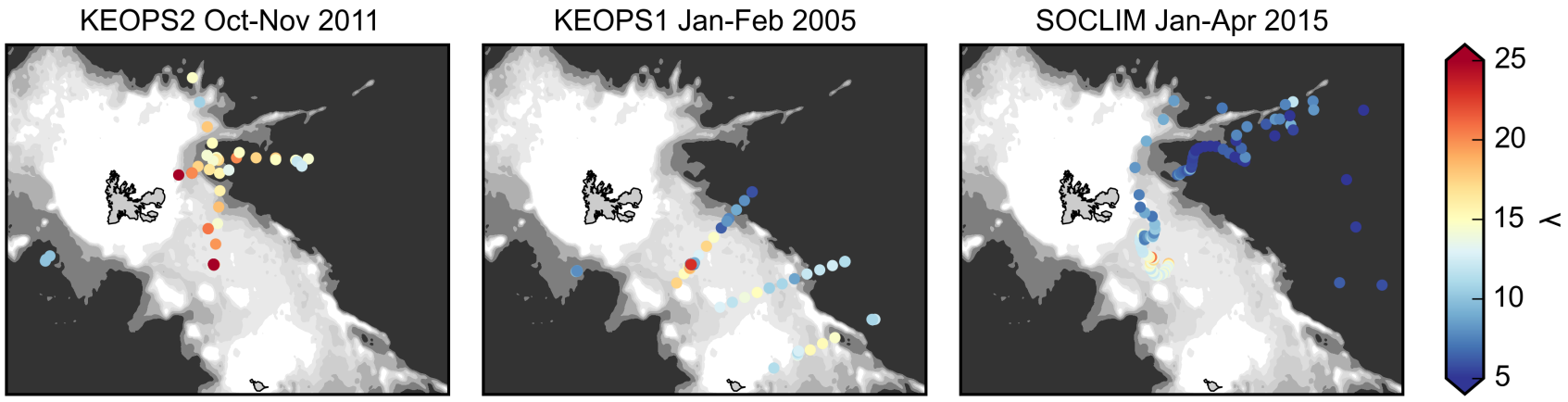


SOCLIM Jan-Apr 2015





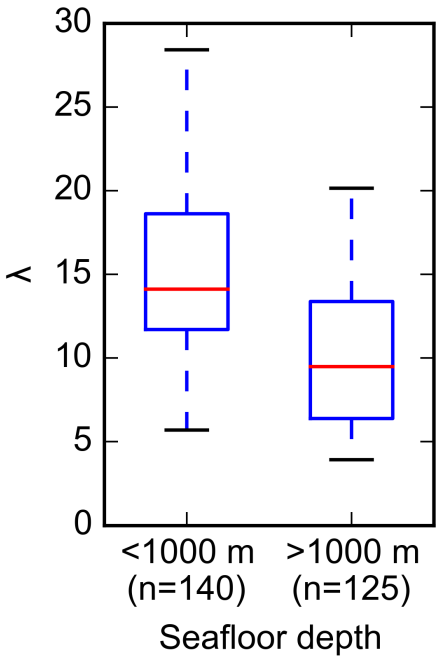
Biomass attenuation



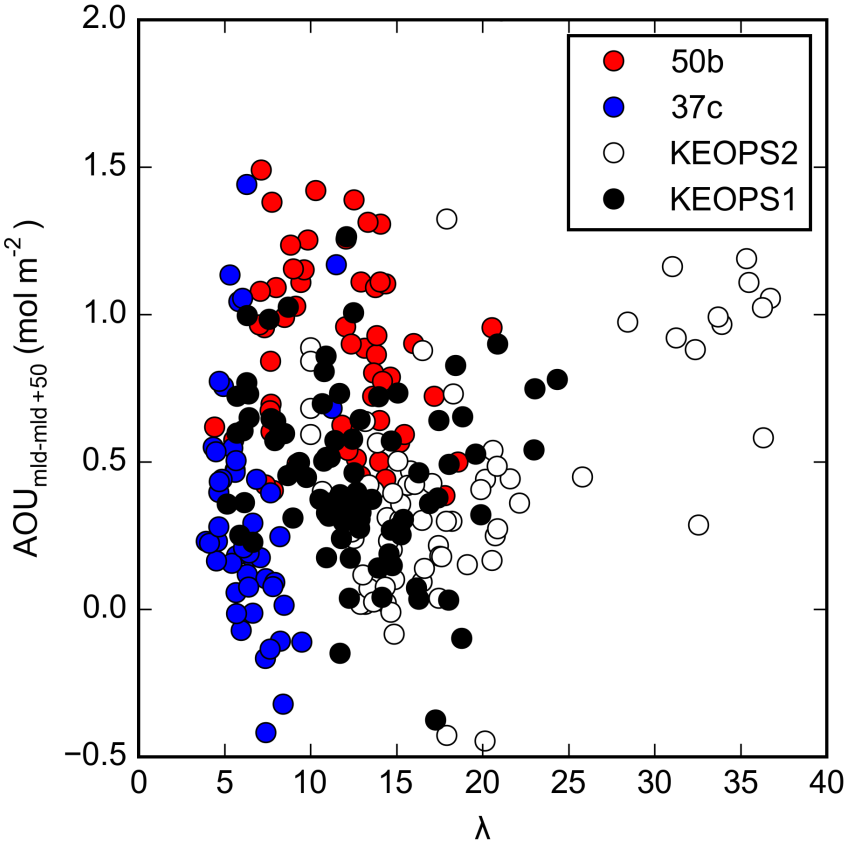
Higher attenuation over the plateau (Kolmogorov-Smirnov $p < 0.01$)

Higher heterotrophic microbial respiration?

Higher transfer to mesozooplankton?



Biomass attenuation

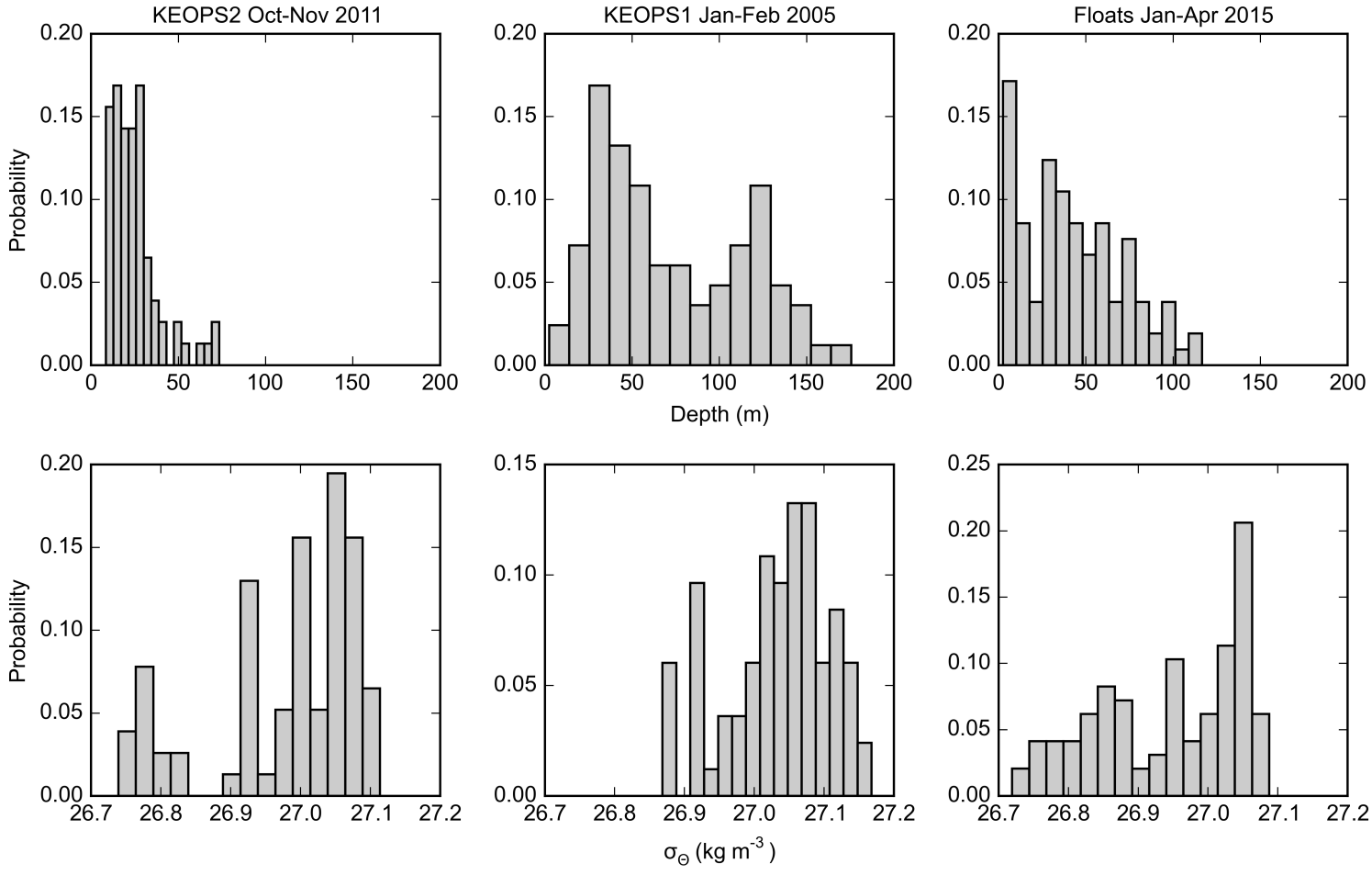


No relationship $\lambda \sim$ AOU

Heterotrophic microbial activity not the major process involved in biomass attenuation?

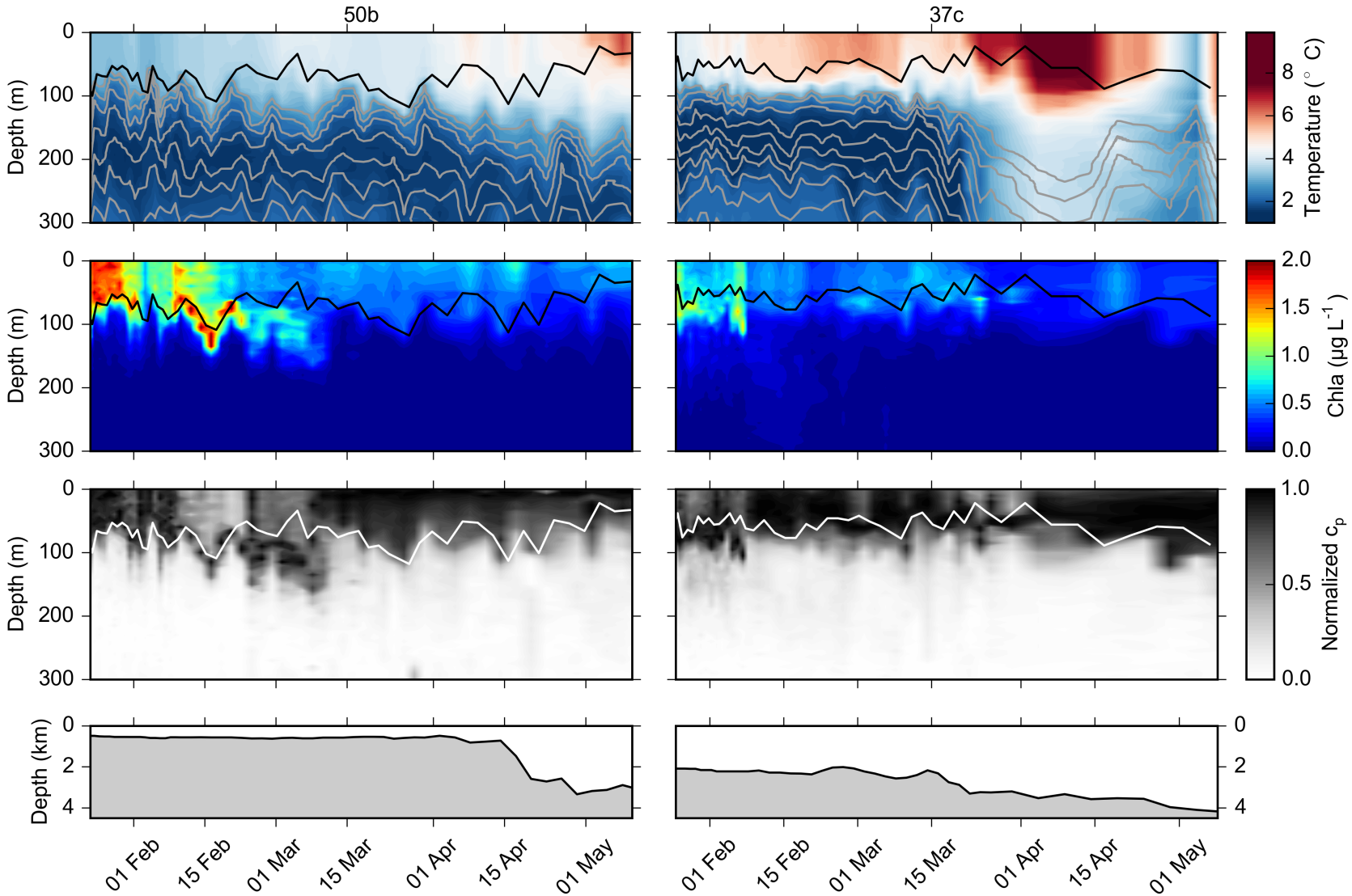
Biomass attenuation

Where is the $|c_p| = 1$ located?

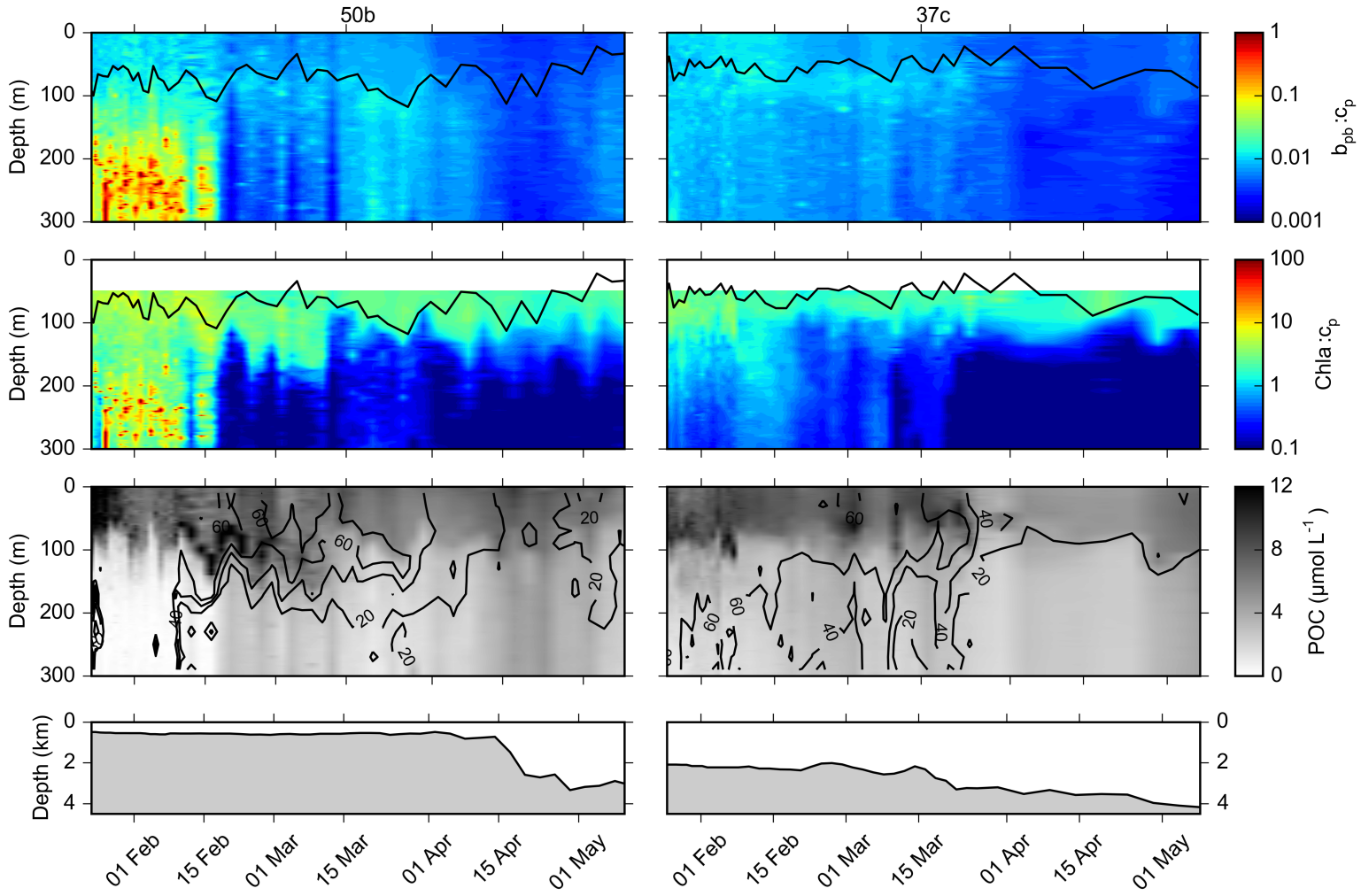


Biomass follows the production isopycnal

Sections and optical signature



Sections and optical signature

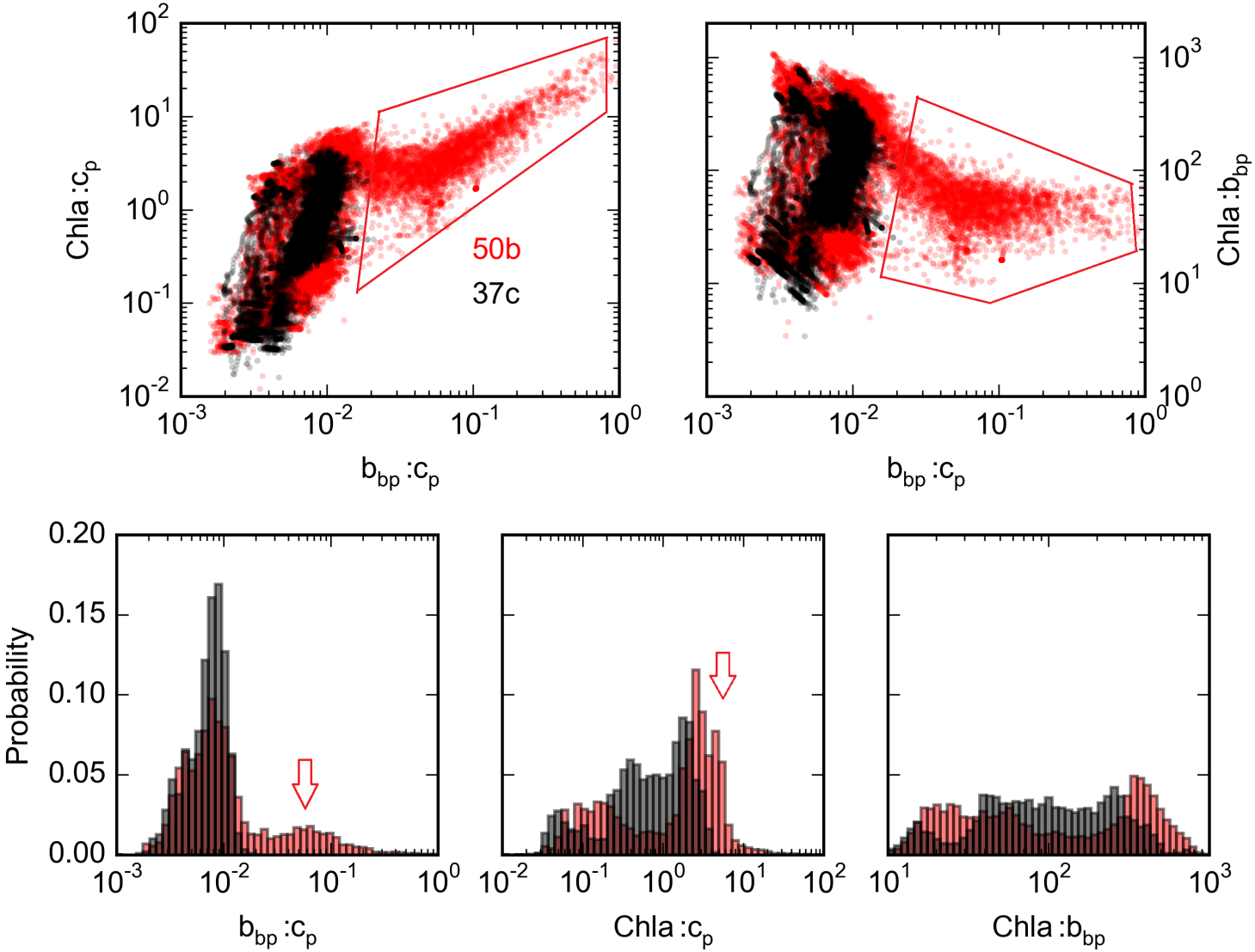


c_p and b_{bp} converted to POC using *Cetinic et al.*, 2012 ratios

POC colorscale $= POC_{cp}$

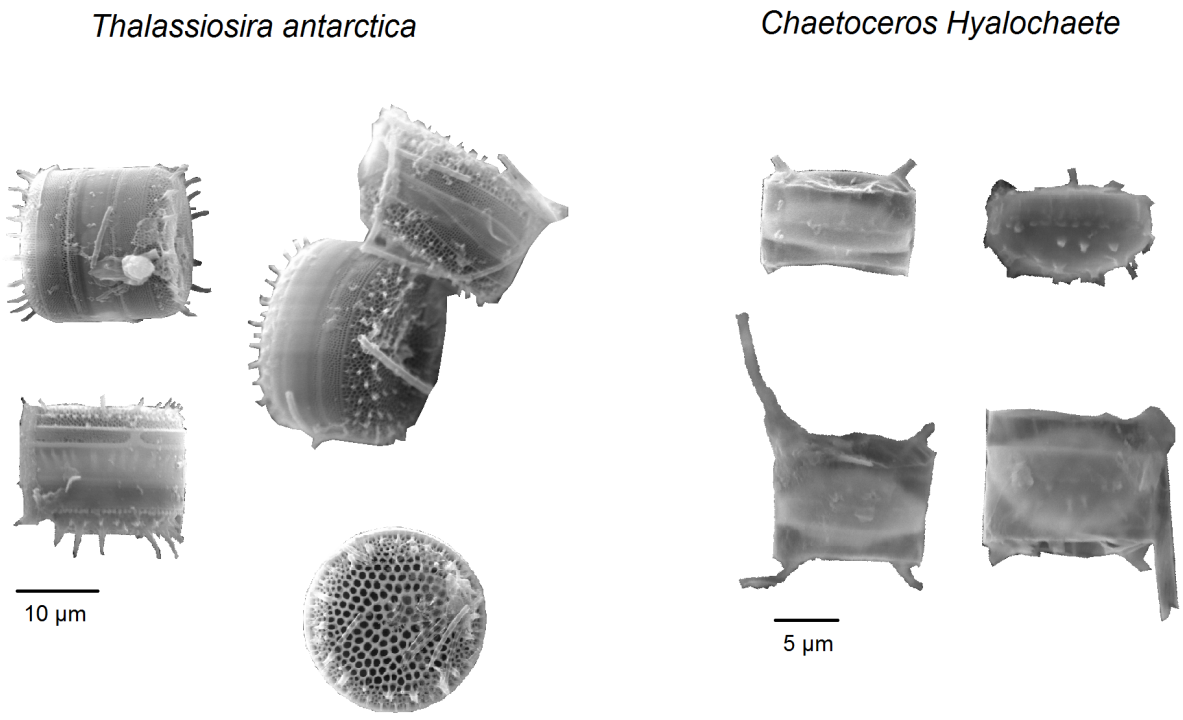
isolines $= POC_{bbp}/POC_{cp} \times 100$

Sections and optical signature



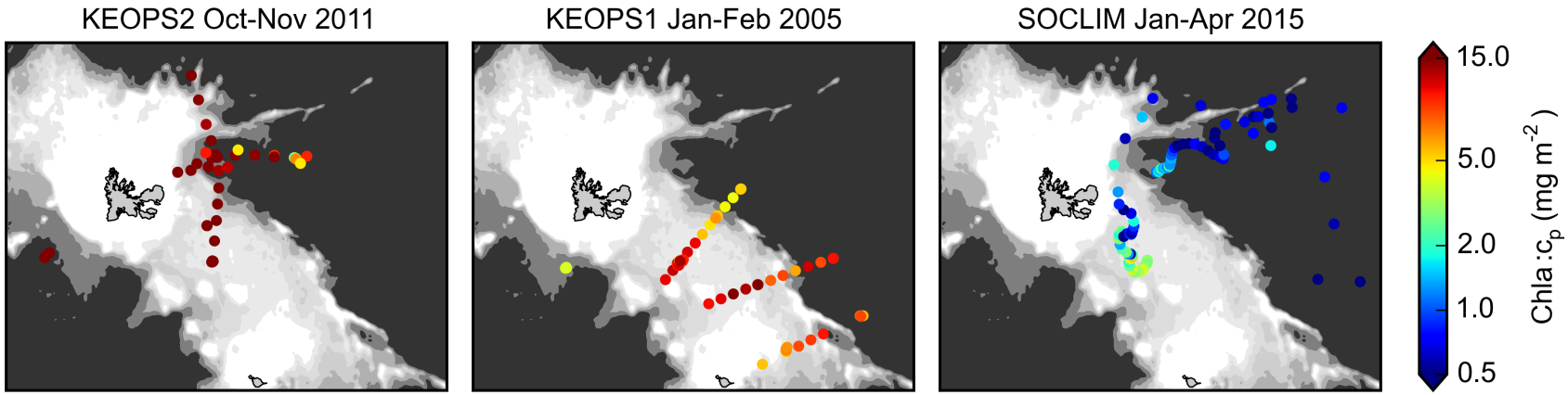
Sections and optical signature

High $b_{bp} : c_p$ and $Chla : c_p$ between 200-300m observed by 50b.
Spores ?

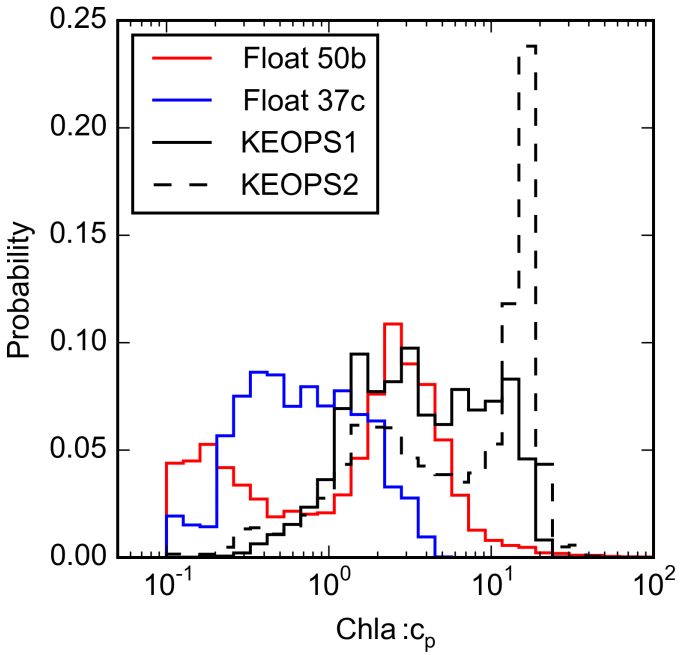


Diatom resting spores from A3 sediment trap (SEM)
64% annual POC flux

Sections and optical signature



50-100 m averaged *Chla* : c_p



Decreasing *Chla* : c_p from spring to summer

Coastal stations of KEOPS2: highest *Chla* : c_p

Questions for the SOCLIM cruises

- Backscattering available on CTD ?
- Calibration of $POC : c_p$ and $POC : b_{bp}$
- Calibration of optical signature with detailed microplankton taxonomy + cytometry
- Float deployment (locations)
- Same analysis with other floats with c_p, b_{bp} in the SO