

Large particle distributions and processes across the P16N transect

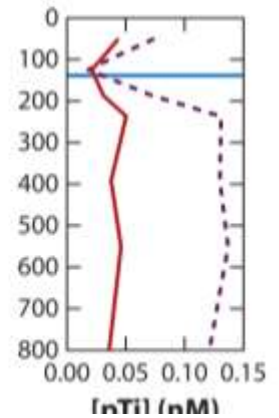
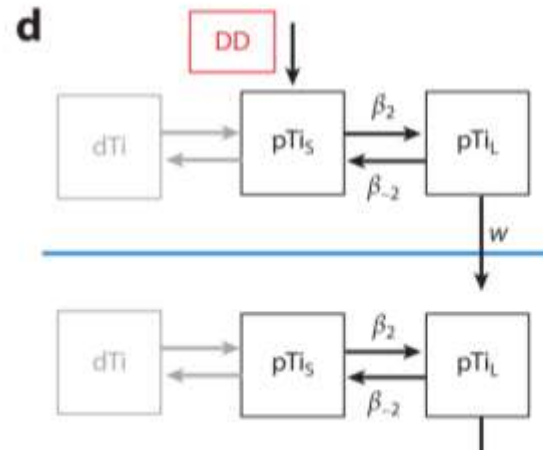
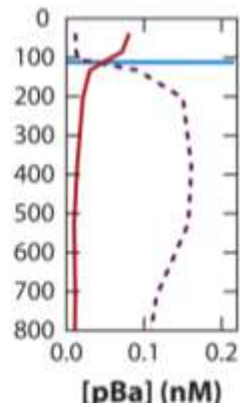
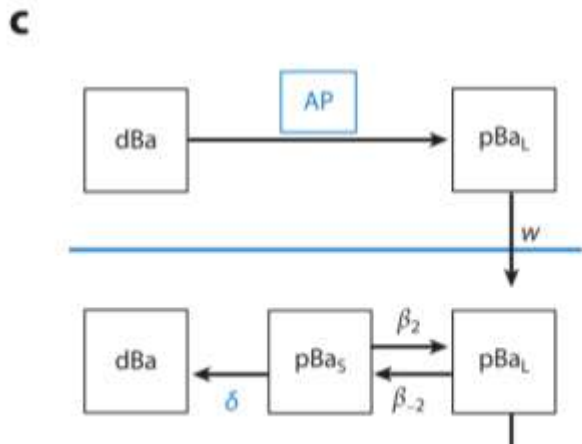
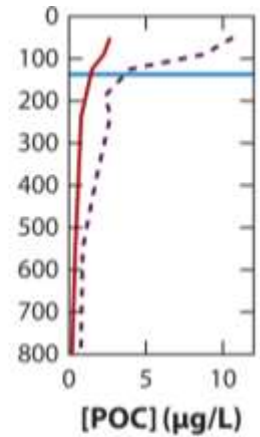
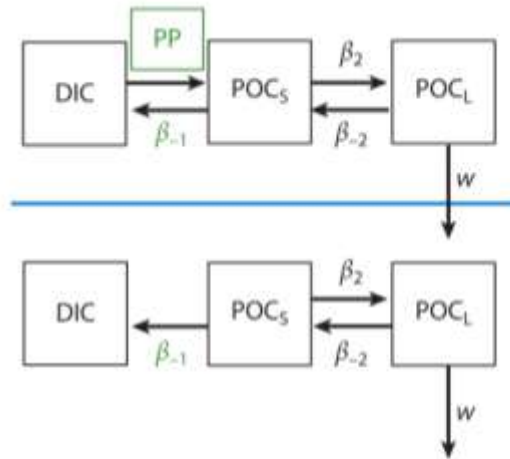
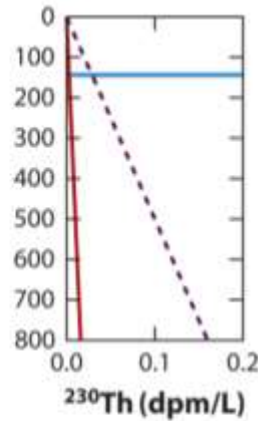
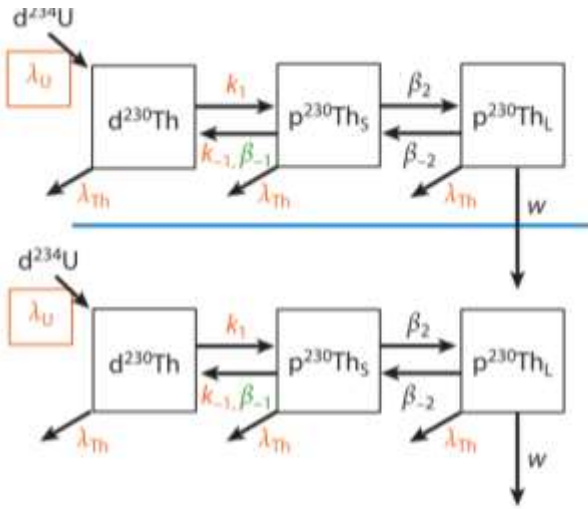
Andrew McDonnell
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With contributions from:
Jessica Turner & Jessica Pretty

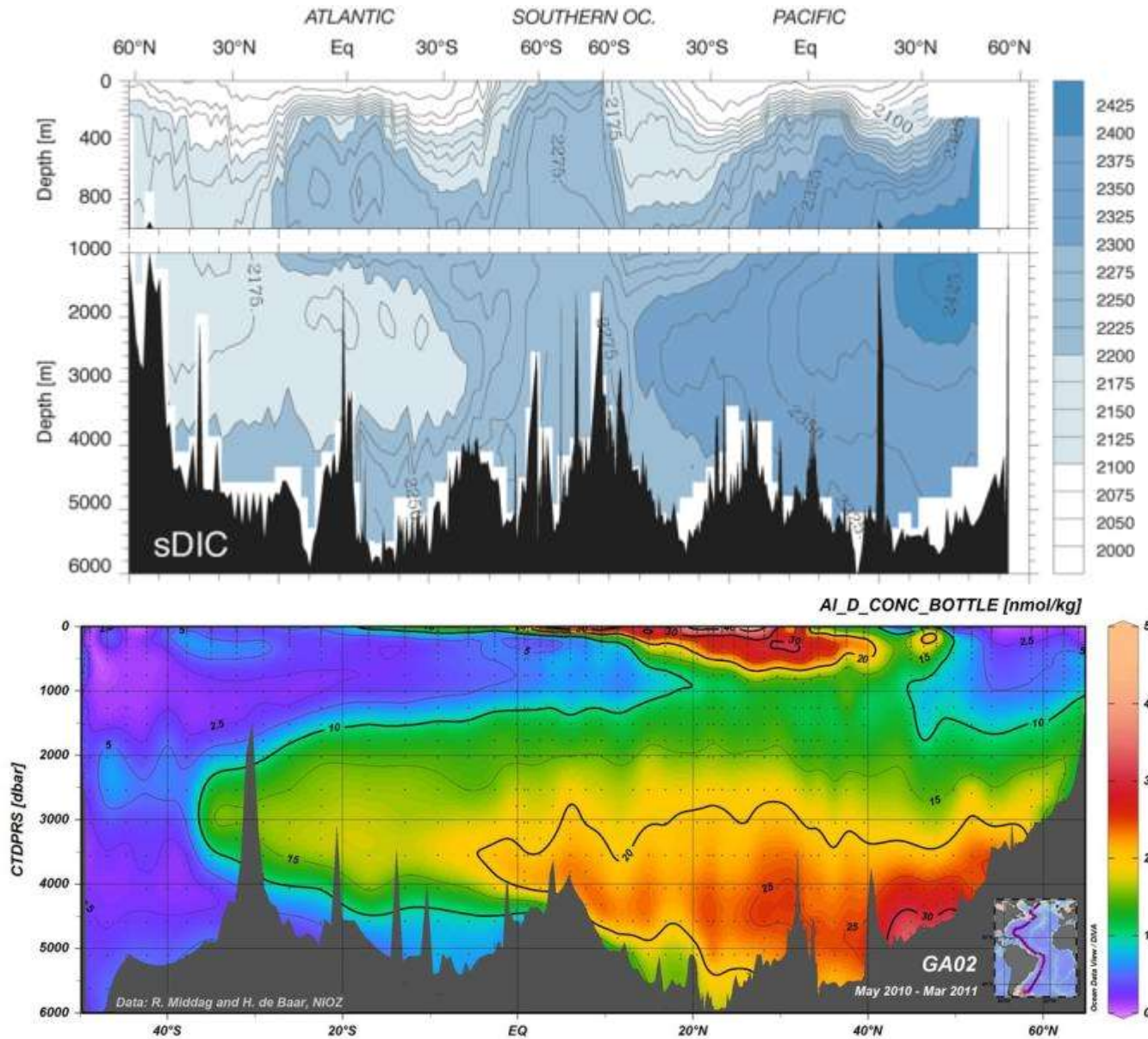


TEI's \leftrightarrow Particles



Background & Motivation

Large scale biogeochemical hydrography



Sarmiento and Gruber 2006

eGEOTRACES

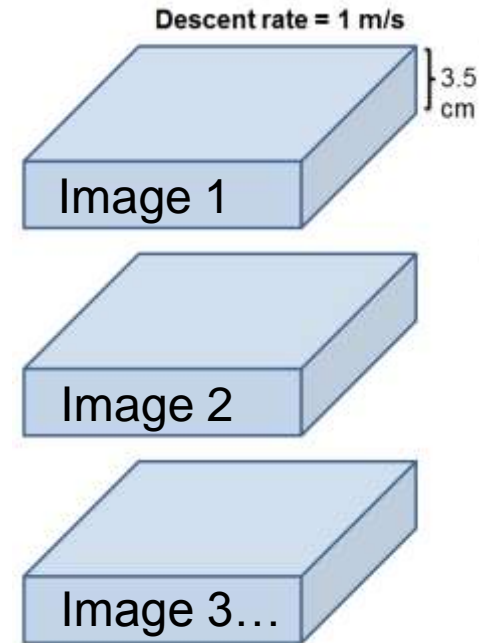
Goals

- Determine the large scale distributions and of marine particles
- Examine the patterns and mechanisms of the biological carbon pump

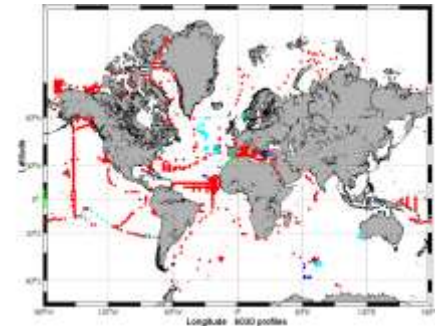
Underwater Vision Profiler 5 (UVP5)



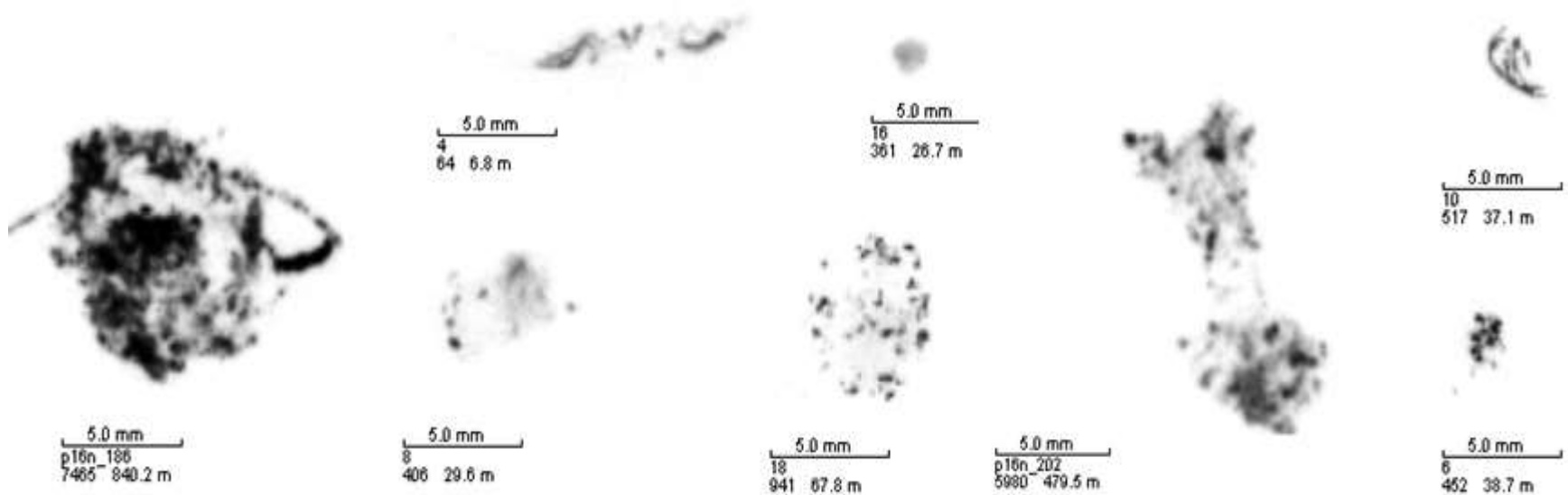
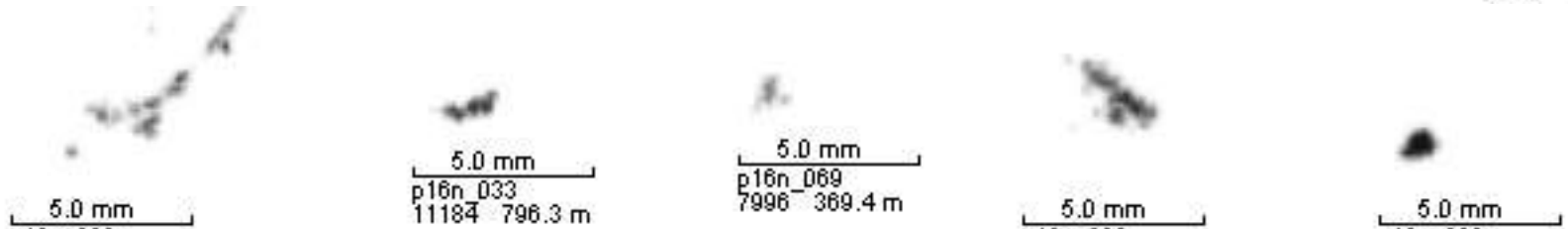
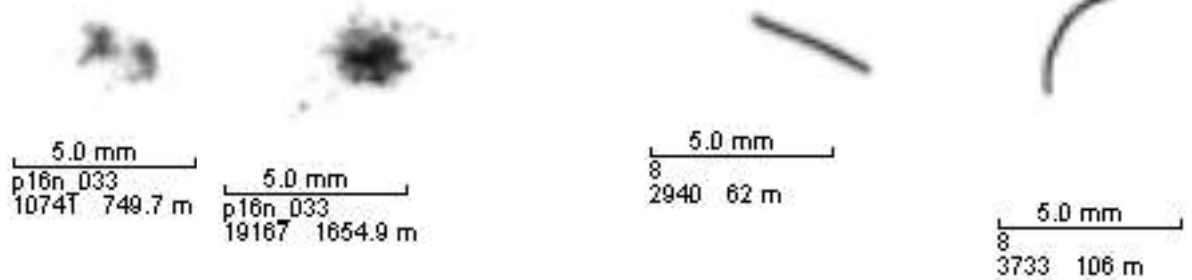
- Integrates with the CTD rosette
- 6000 m pressure rating
- Images 0.88L @ 6 Hz
- Images particles $>60 \mu\text{m}$
- Enables the assessment of the particle size distribution
- Stores images of large particles and zooplankton



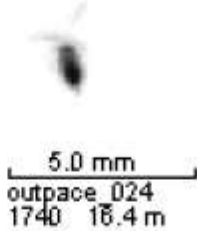
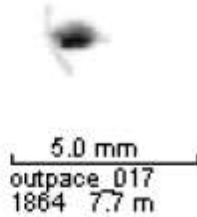
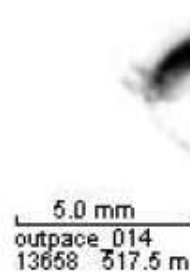
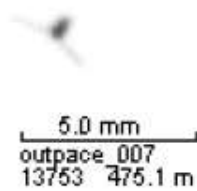
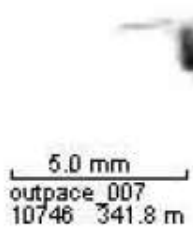
6000+
Global Profiles



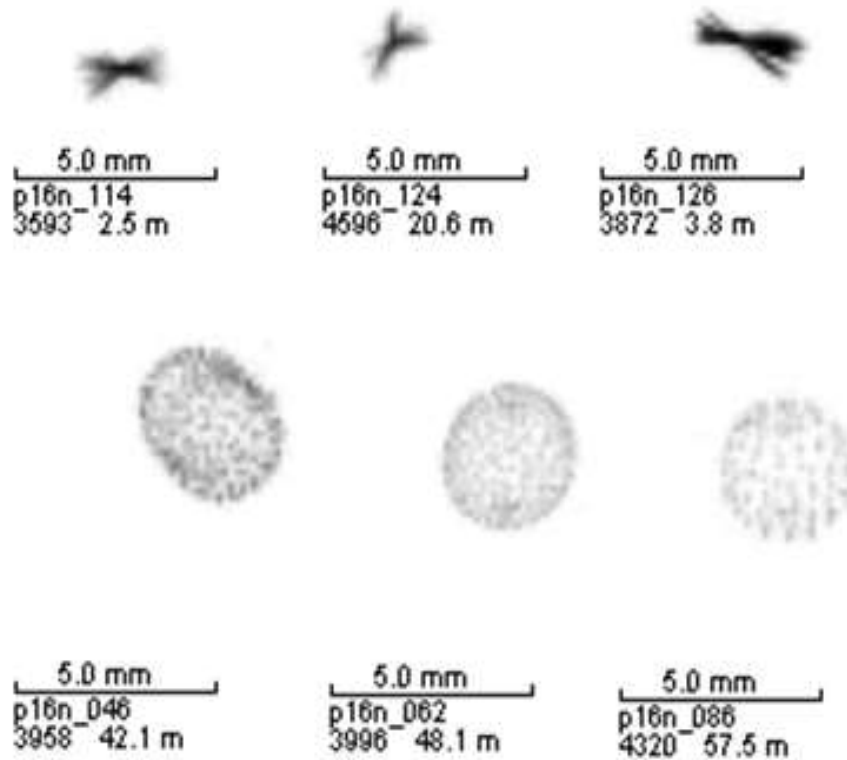
UVP5 Images: Detritus



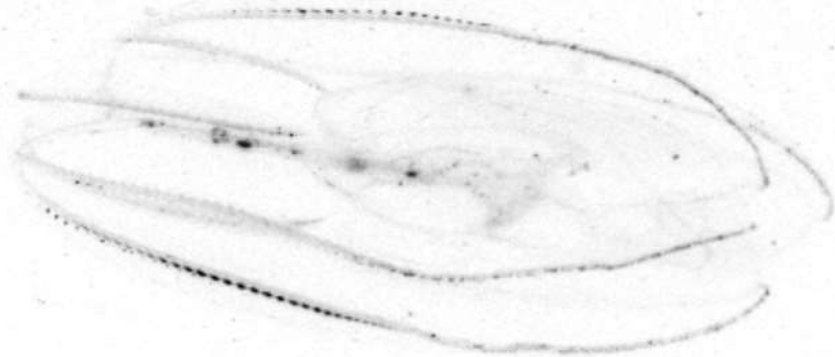
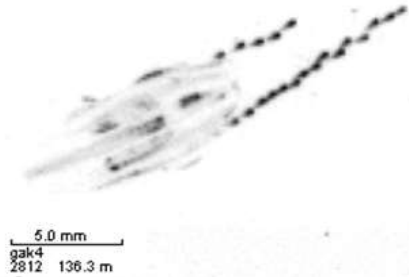
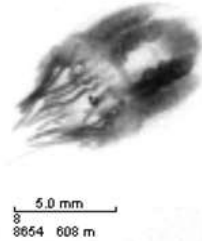
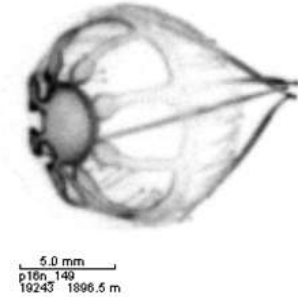
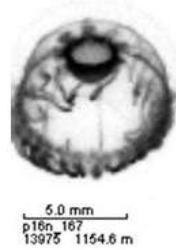
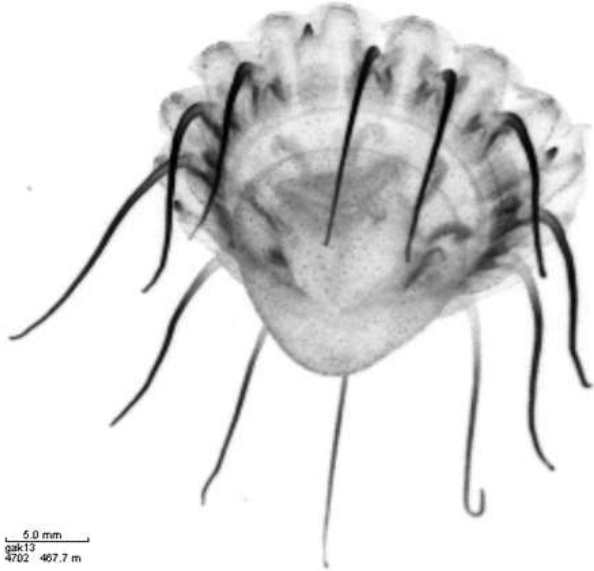
UVP5 Images: Copepods



UVP5 Images: Trichodesmium



UVP5 Images: Gelatinous Zooplankton



UVP5 Images: Other Rare Specimens



Particle and Zooplankton Identification



EcoTaxa is a web application dedicated to the visual exploration and the taxonomic annotation of images that illustrate the beauty of planktonic biodiversity.



Observatoire Océanologique de
Villefranche-sur-mer



Station Biologique de Roscoff



Oceanomics



Partner University Fund

As a visitor, you have free access to the specimens that have been already identified by taxonomist experts.

You can explore the database by navigating along the UniEuk taxonomic tree which aims at unifying taxonomic names and tree according to reliable and curated molecular phylogenies. It encompasses the whole Eukaryotic and Prokaryotic lineages (Viruses coming soon) that have been molecularly described. Then images can be filtered according to several sample criteria: geographic location, depth, date and time of sampling, and imaging instrument.

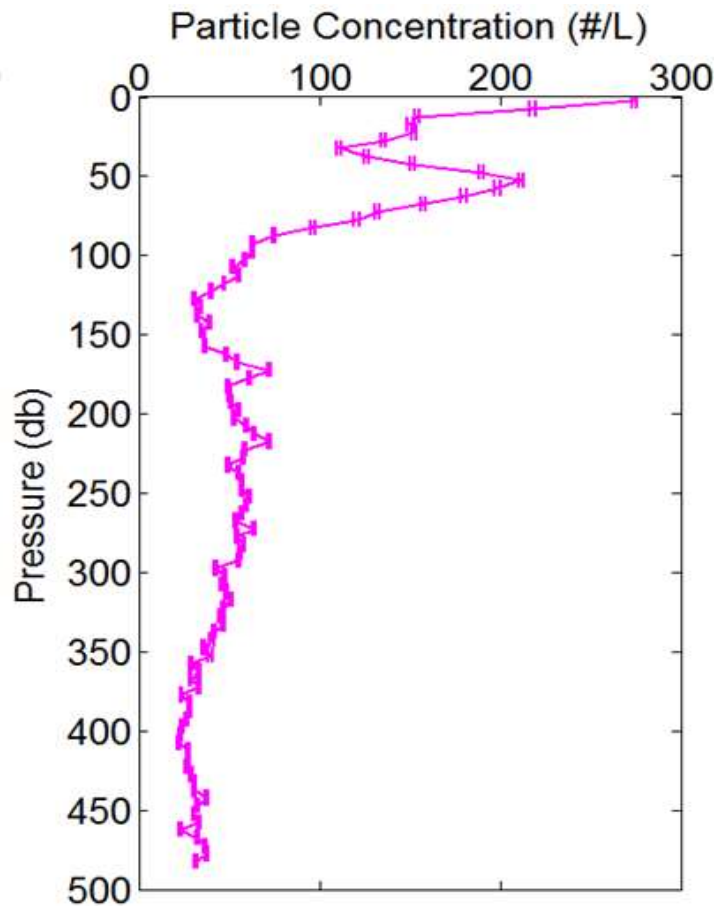
As a scientist, you can contribute to the richness of this image database and/or to the collaborative taxonomic annotation effort. Images are organised in projects which should be consistent in terms of sampling and imaging techniques. We provide tools to support the annotation of large image datasets by supervised machine learning prediction.

[Explore images](#)

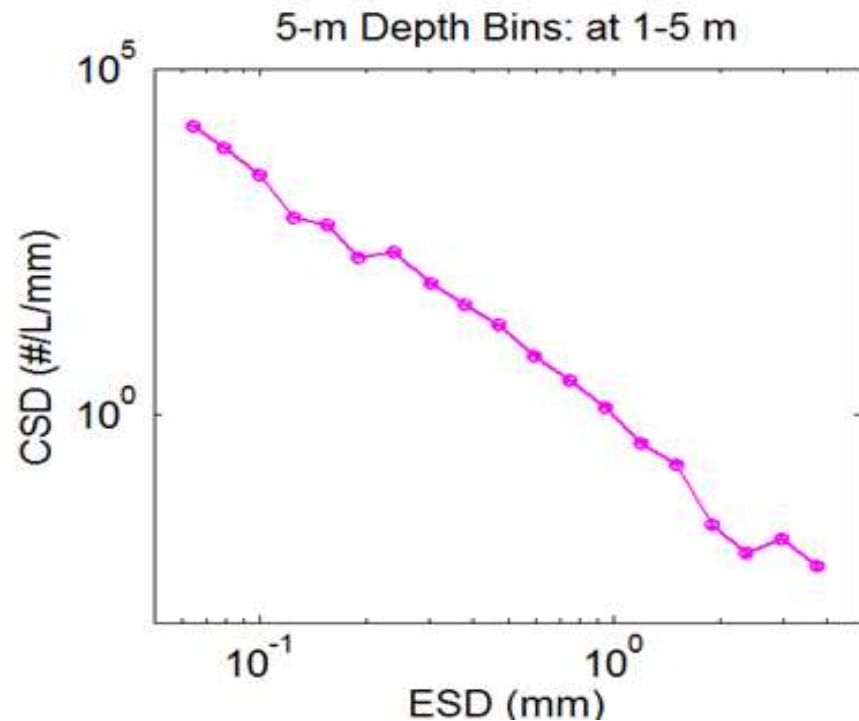
[Contribute to a project](#)

Determination of Particle Distributions

Vertical Profiles

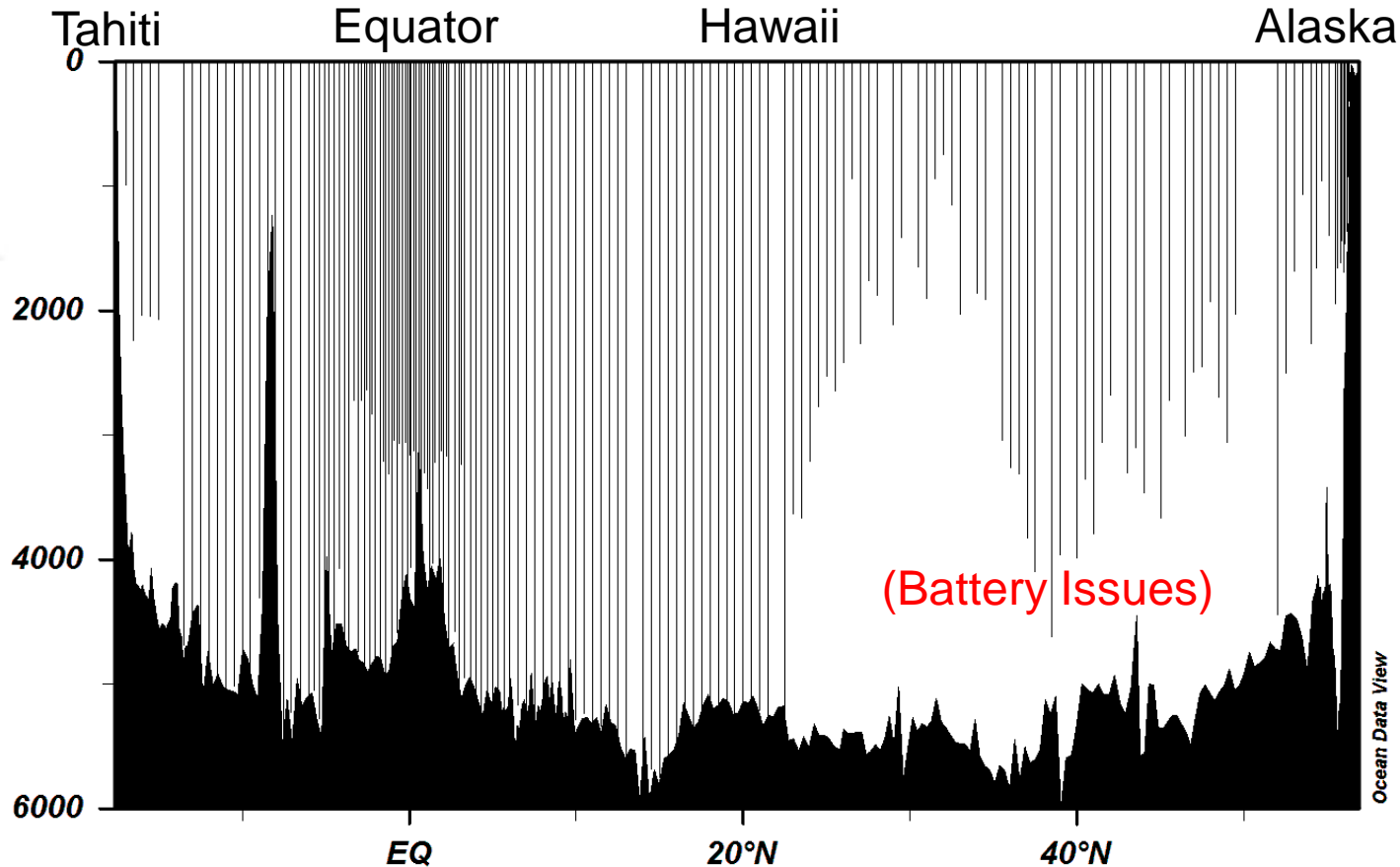
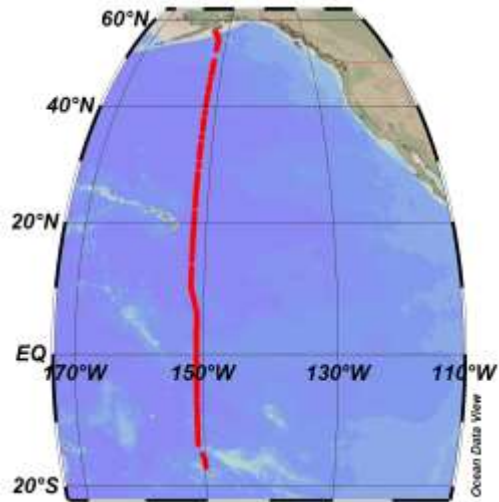


Size Distributions



2015 P16N Repeat Hydrography Cruise April/May 2015

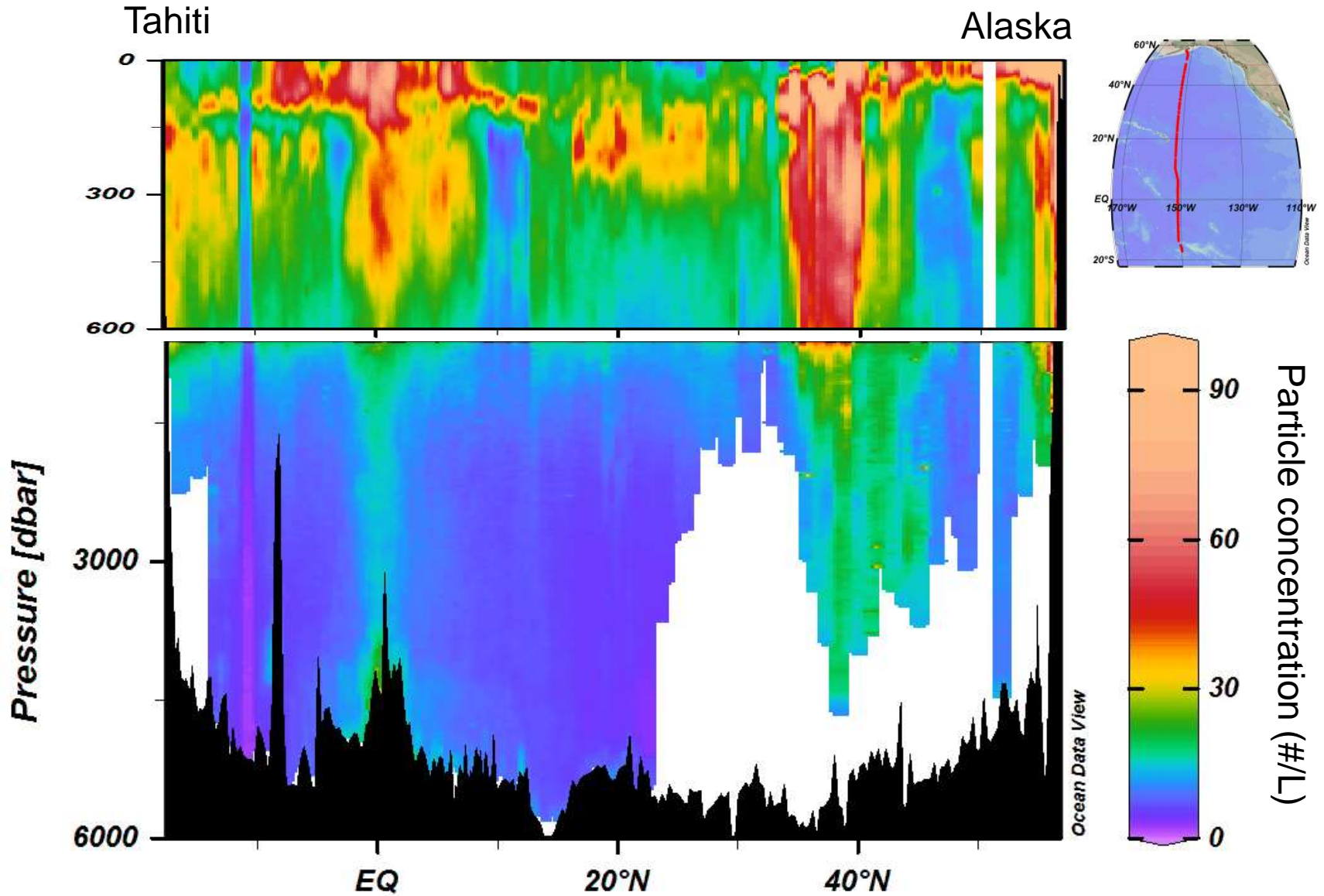
Distribution of UVP5 Data



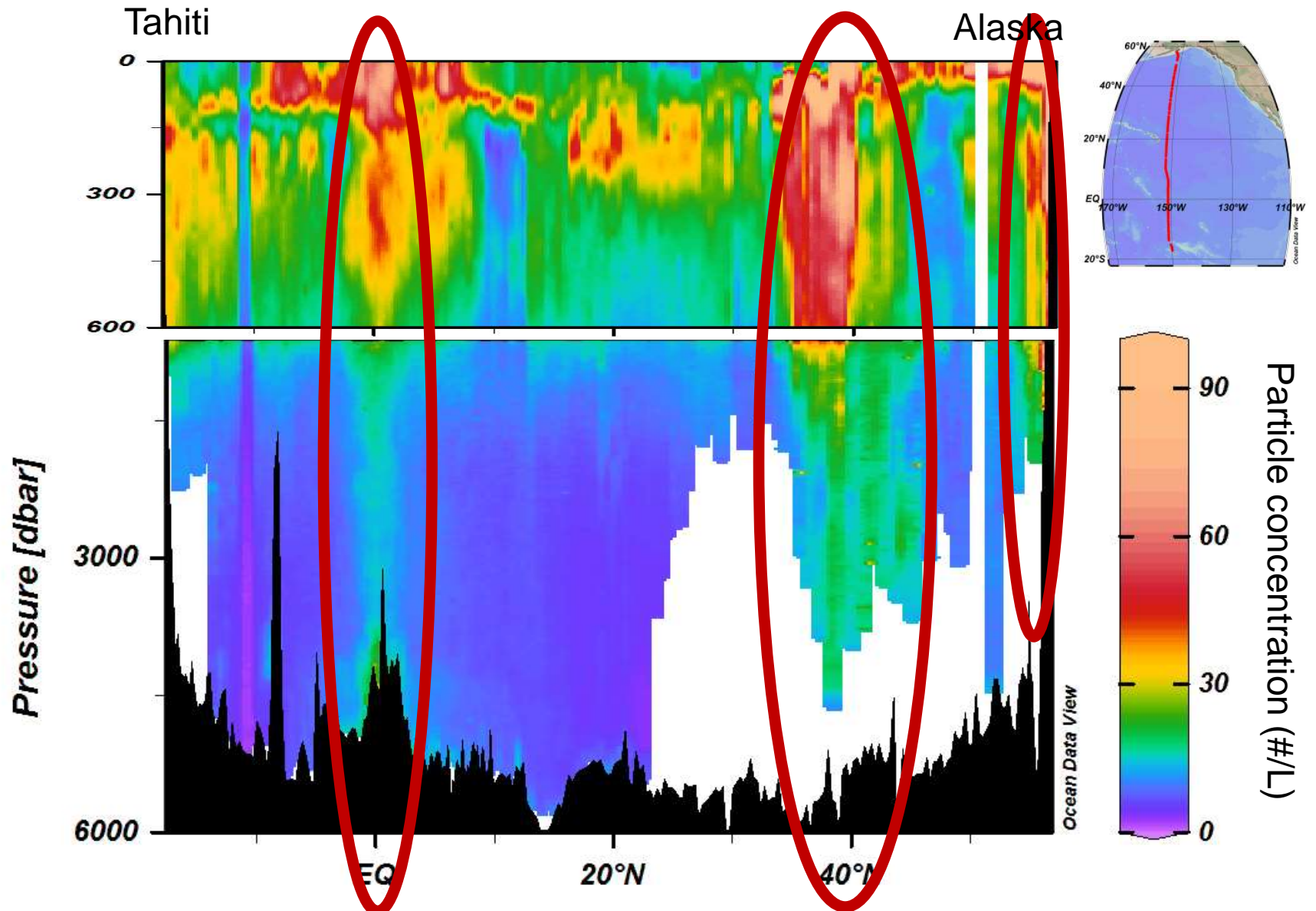
171 vertical profiles



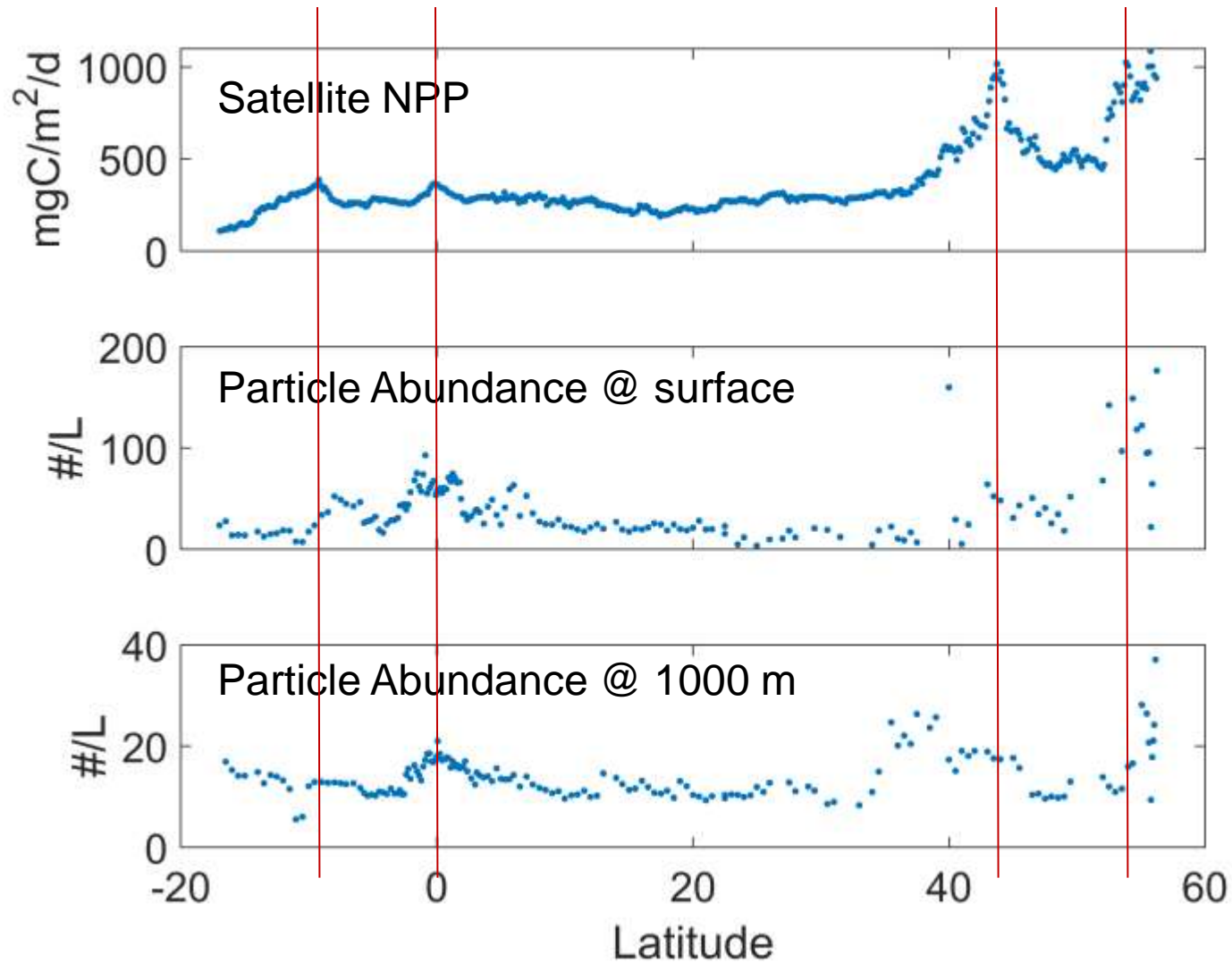
Total Particle Concentrations (#/L)



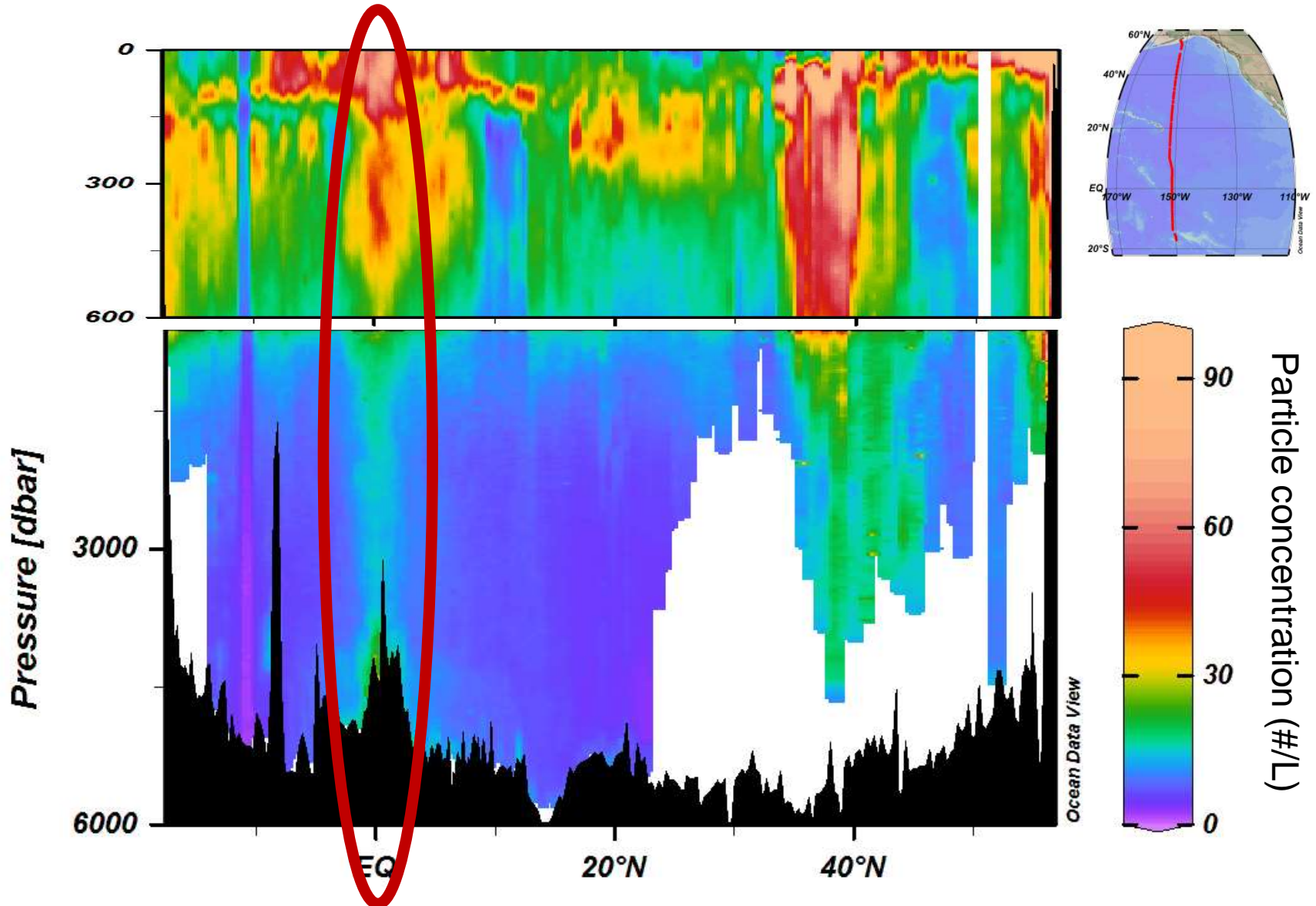
Zones of Deep Particle Penetration



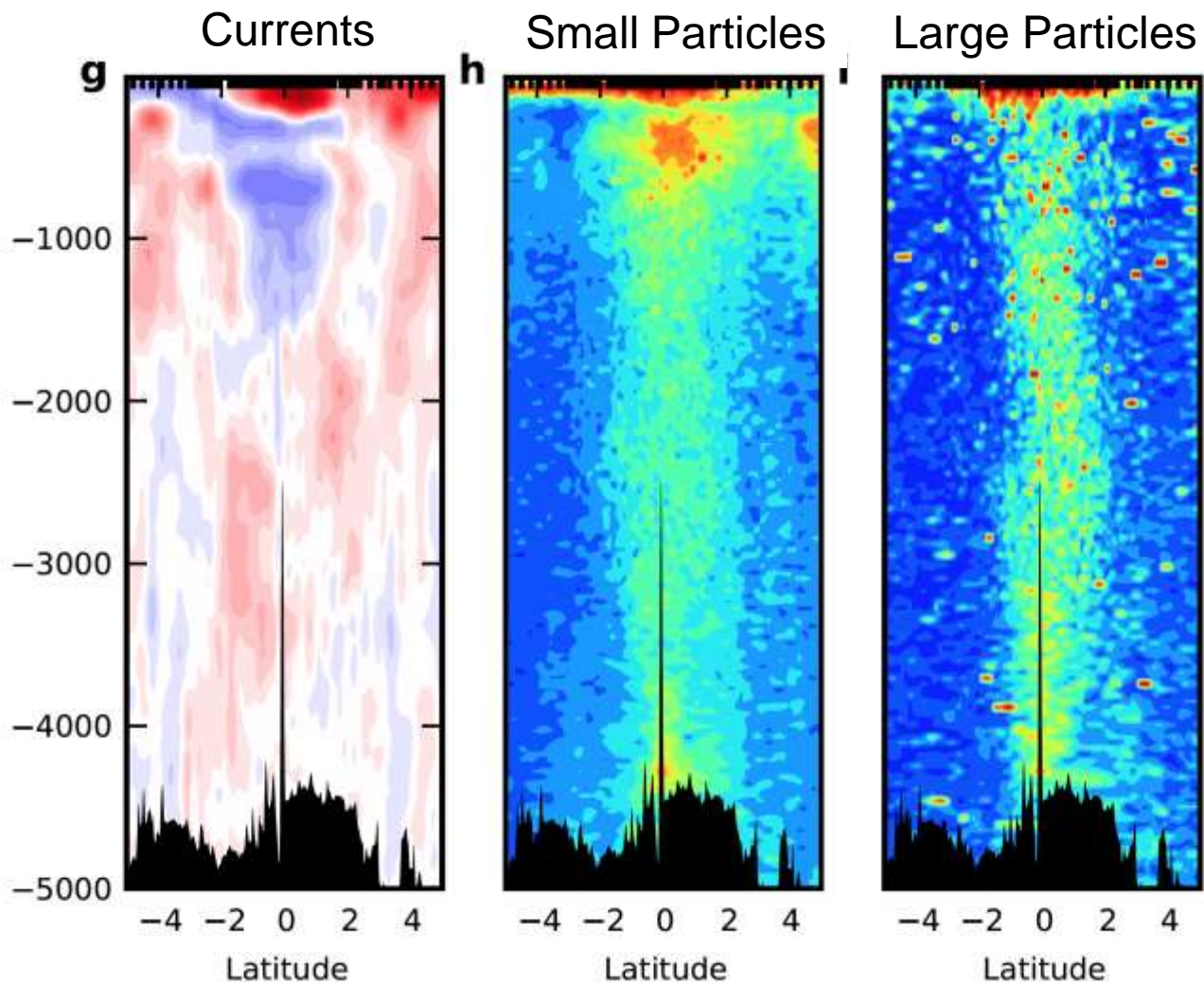
Relationship between Particles and NPP



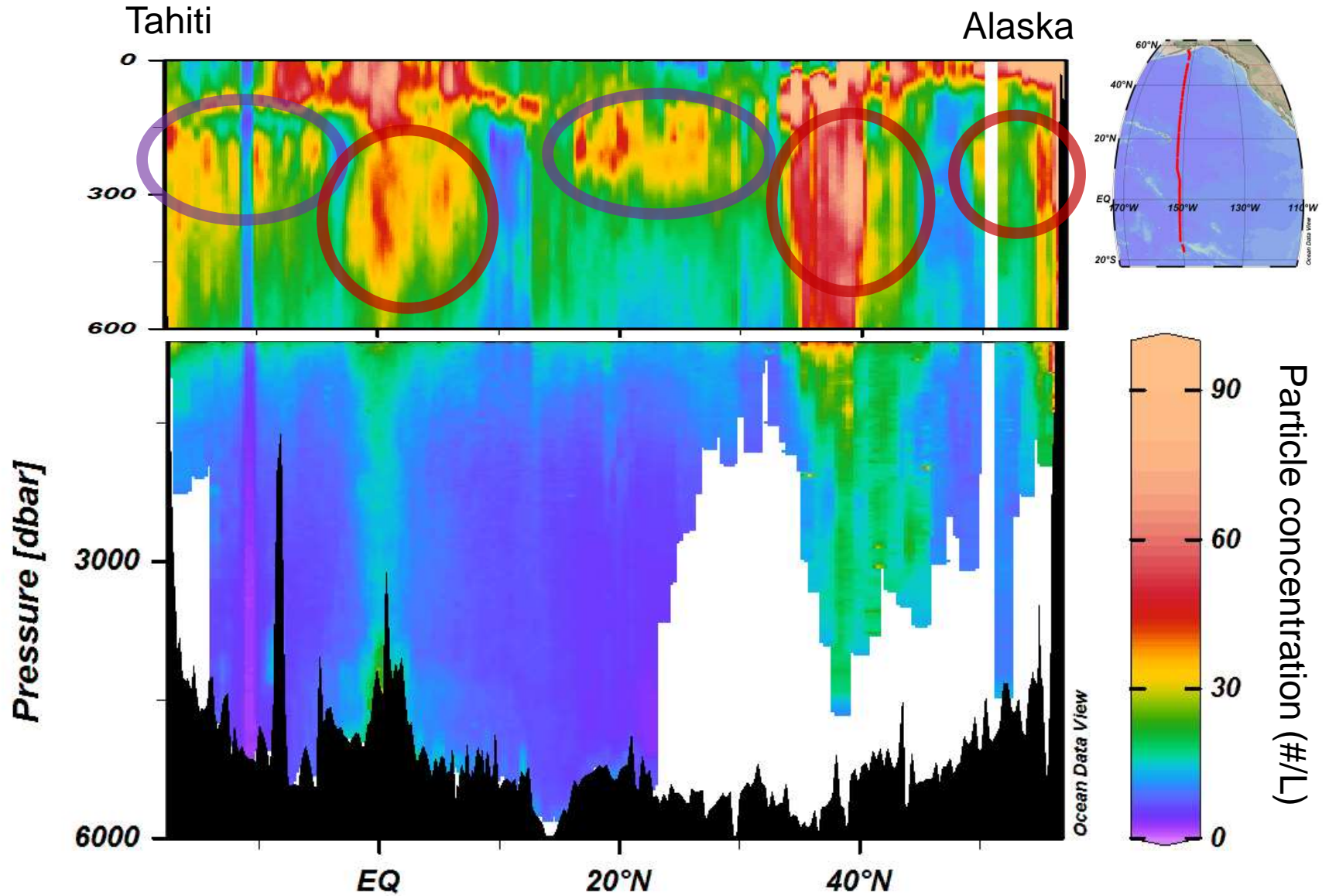
Zones of Deep Particle Penetration



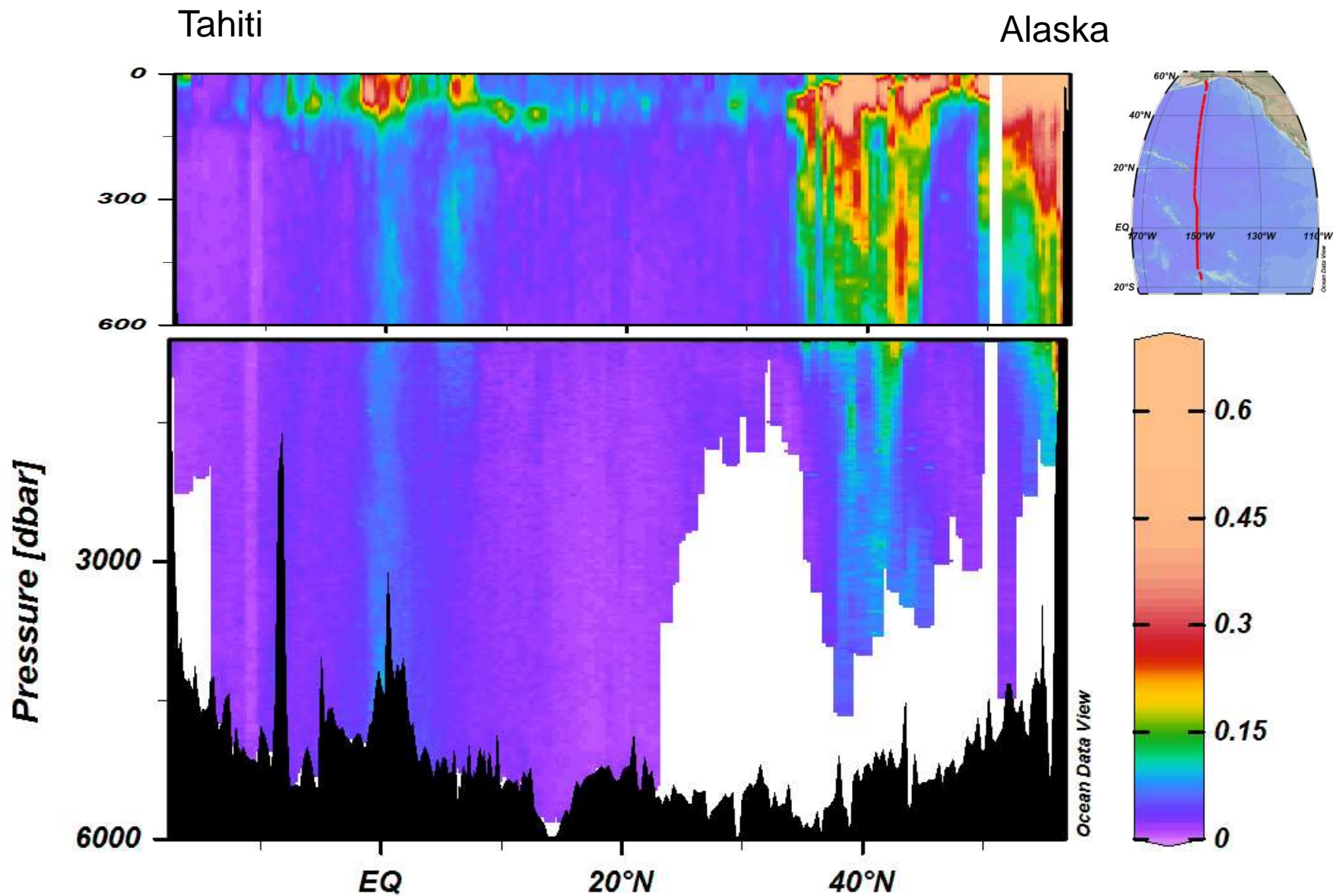
Deep Equatorial Snowfall



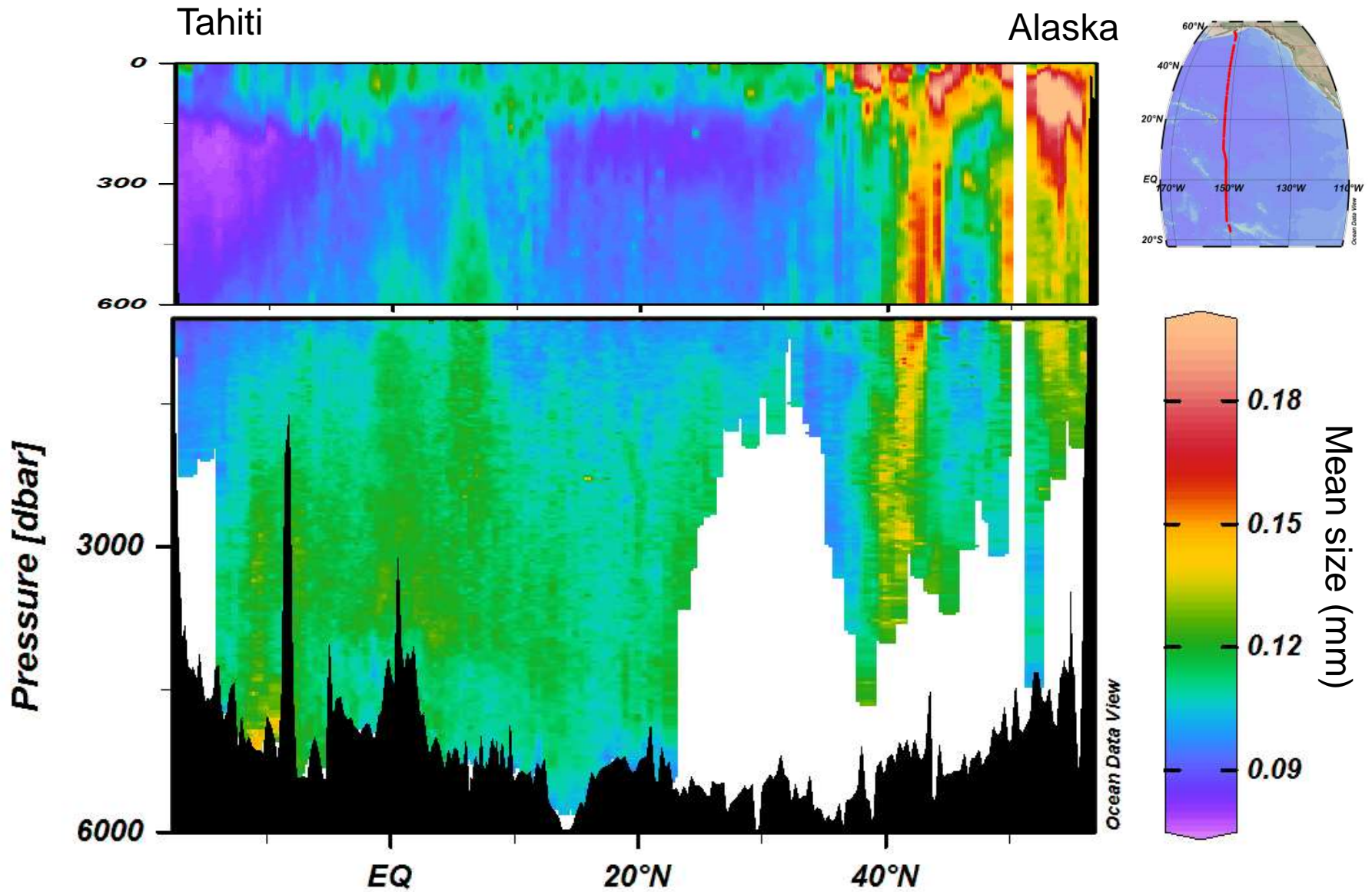
Upper Mesopelagic Particle Maxima



Particle volume concentration (ppmv)

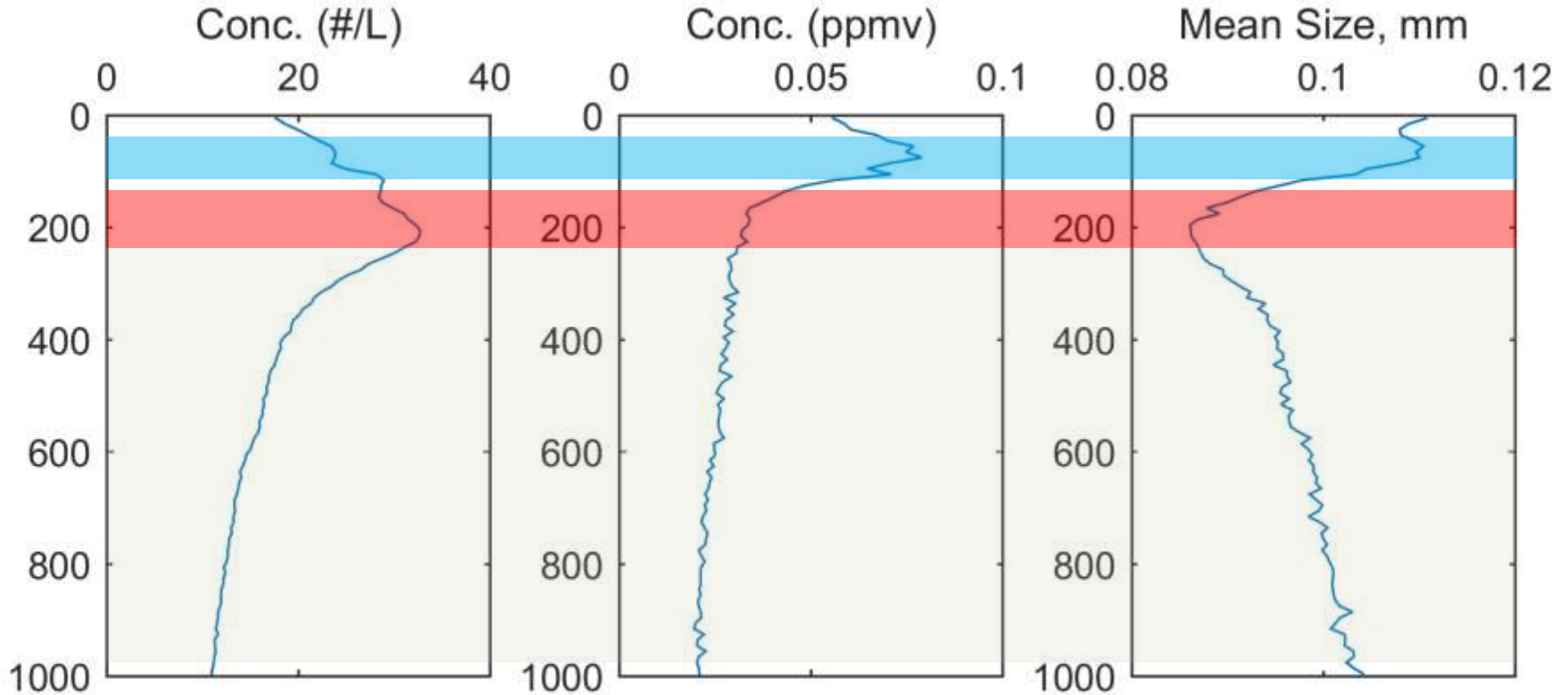
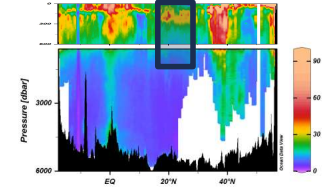


Mean Particle Size



Subtropical particle distribution

Average across 15-32° N



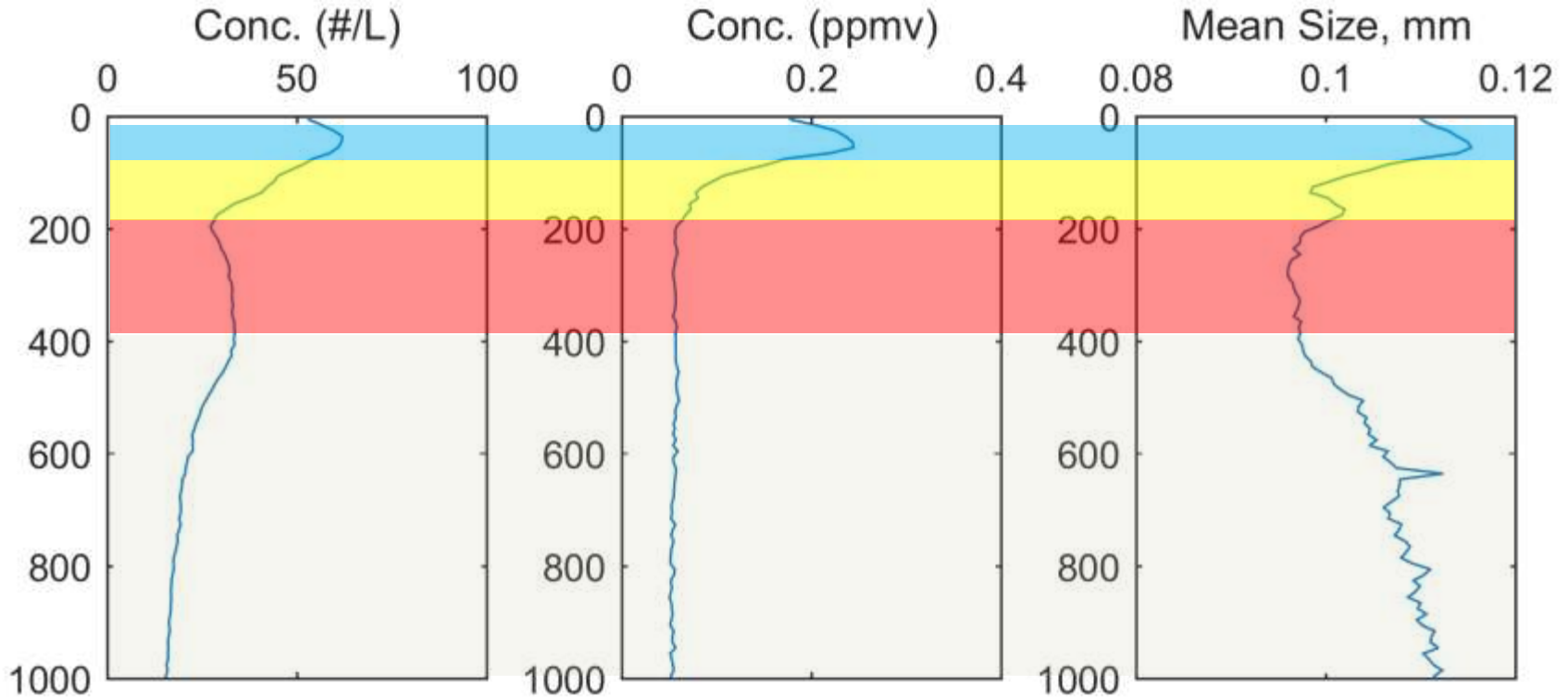
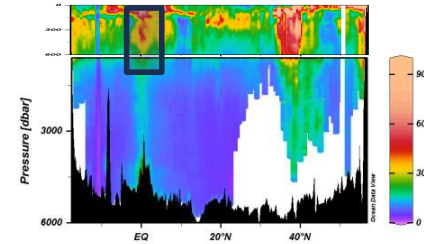
Large particle
production & aggregation

Disaggregation/fragmentation
large → small

Small particles attenuate w.r.t. depth
Large particles penetrate deeply

Equatorial particle distributions

Average across 3.7 ° S – 3.7° N



Large particle
production & aggregation

Rapid destruction of all particles,
especially large ones

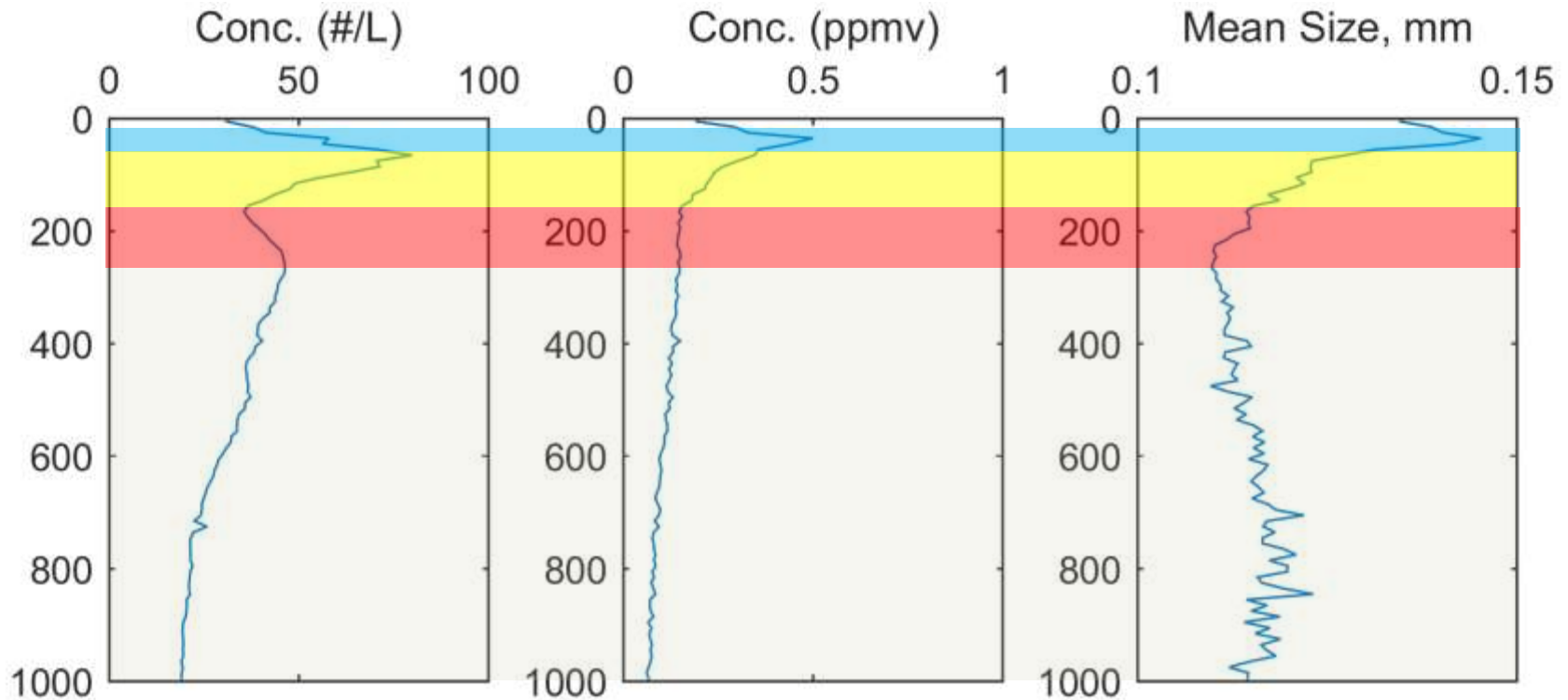
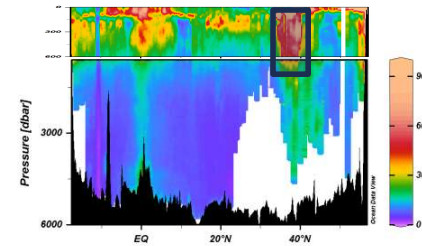
Disaggregation/fragmentation
large → small

Small particles attenuate w.r.t. depth
Large particles penetrate deeply

Results

Subtropical/Subpolar boundary particle distributions

Average across 32° N – 43° N



Large particle production & aggregation

Rapid destruction of all particles, especially large ones

Disaggregation/fragmentation large → small

Small particles attenuate w.r.t. depth
Large particles penetrate deeply

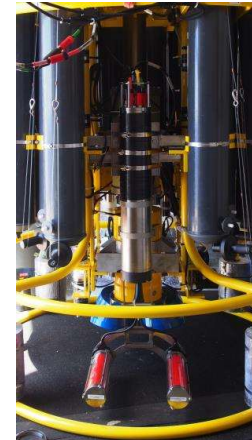
Take Home Messages

- **High-resolution hydrographic mapping of particle abundance and size distribution**
- **Distinct zones of deep particle penetration**
 - Equatorial Pacific
 - Subtropical/Subpolar Transition
 - Northern Gulf of Alaska
- **Maxima in particle abundance (#/L) coincident with minima in particle size**
 - Aggregation and particle production in euphotic zone
 - Disaggregation and particle destruction in upper mesopelagic

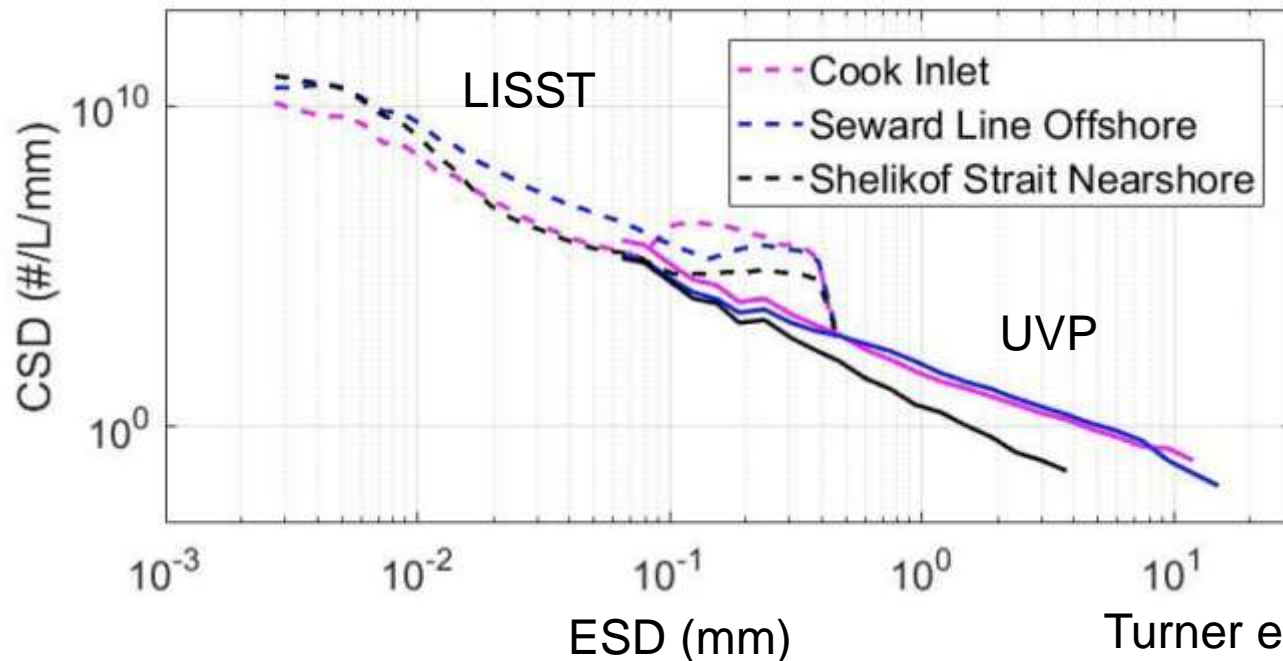
Pushing the Particle Envelope on the GEOTRACES Pacific Meridional Transect



LISST: 2.5 μm – 500 μm

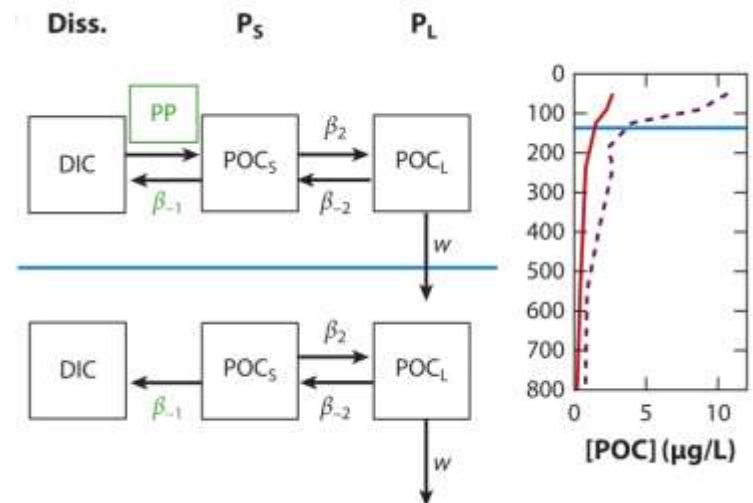
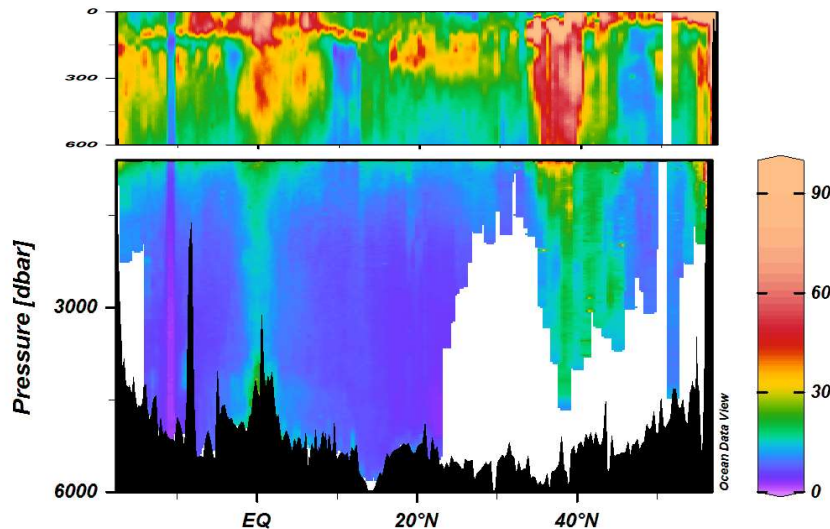


UVP:
100 μm – 1 cm

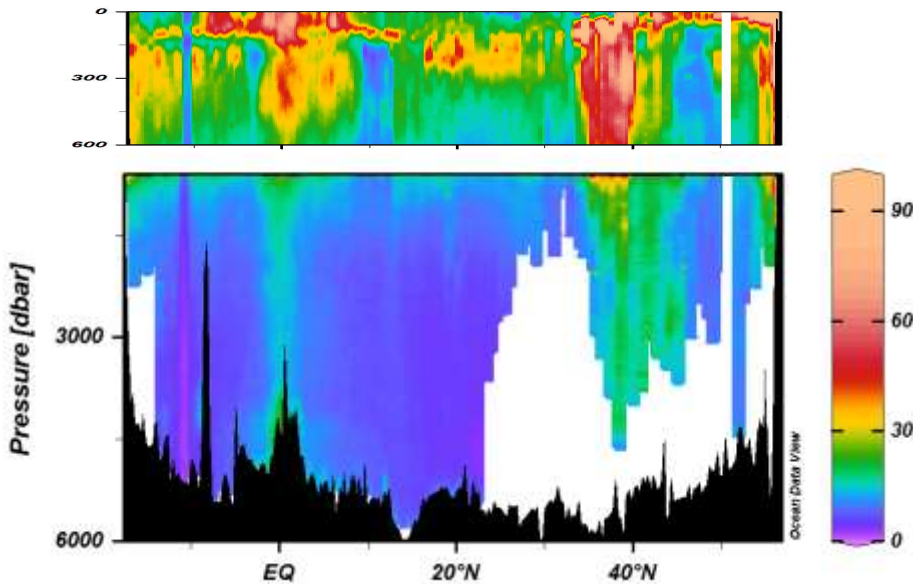


Pushing the Particle Envelope on the GEOTRACES Pacific Meridional Transect

- Assess the abundance and size distribution of marine particles
 - High resolution size distribution: 1.25 μm - 1 cm
 - High spatial and depth resolution
- Pair with TEI tracer observations @ the core of GEOTRACES
- Use these datasets to constrain, test, and improve models of TEI processes and particle dynamics



Lam & Marchal 2015



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With contributions from:

Jessica Turner & Jessica Pretty

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- Miguel Jimenez Urias
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