High-frequency variability of dissolved oxygen in the subpolar North Pacific

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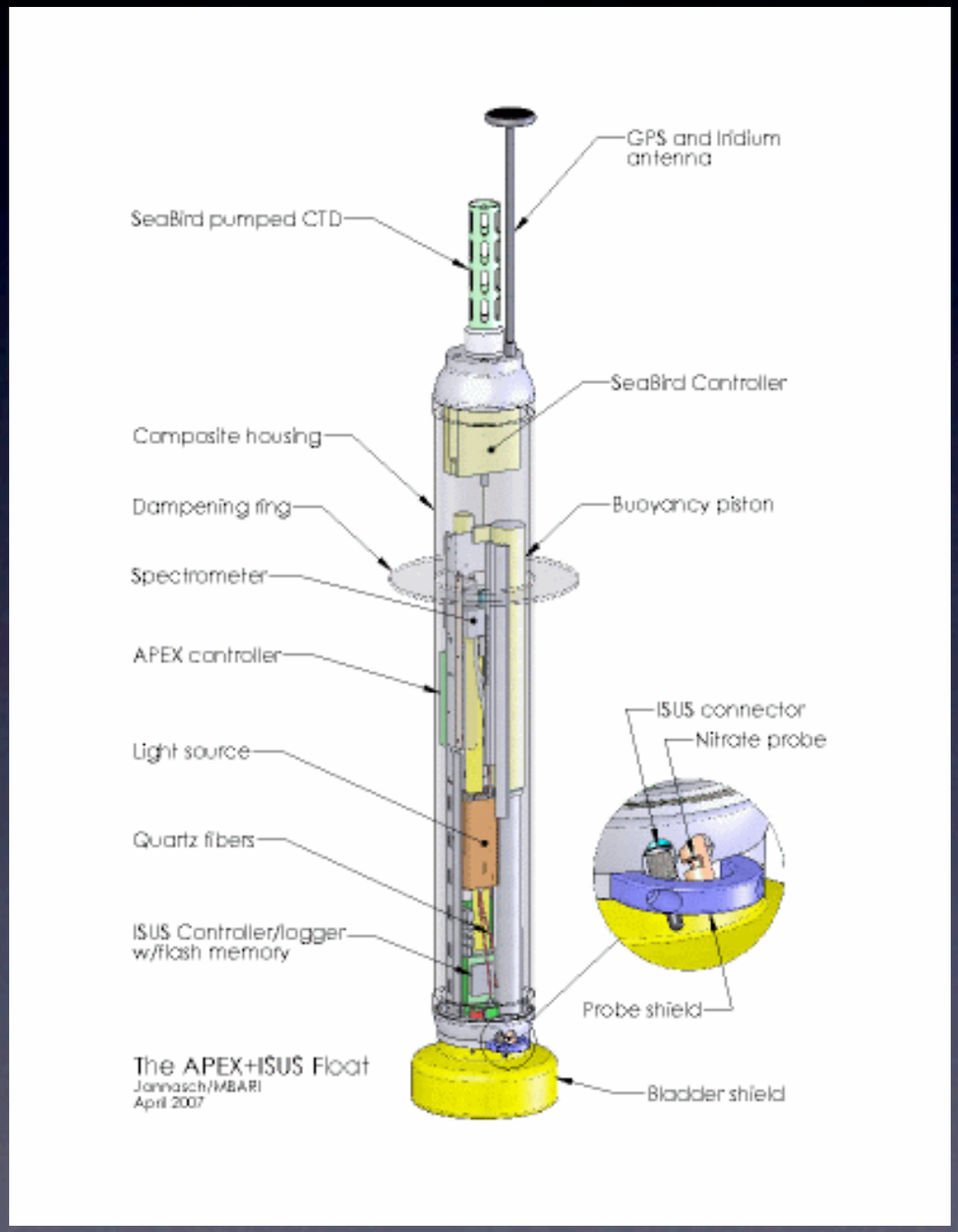
Background

- Dissolved Oxygen (DO) is a widely observed tracer
- It responds to both physical and biological change
- Existing DO observational studies are mainly focusing on seasonal and longer timescales

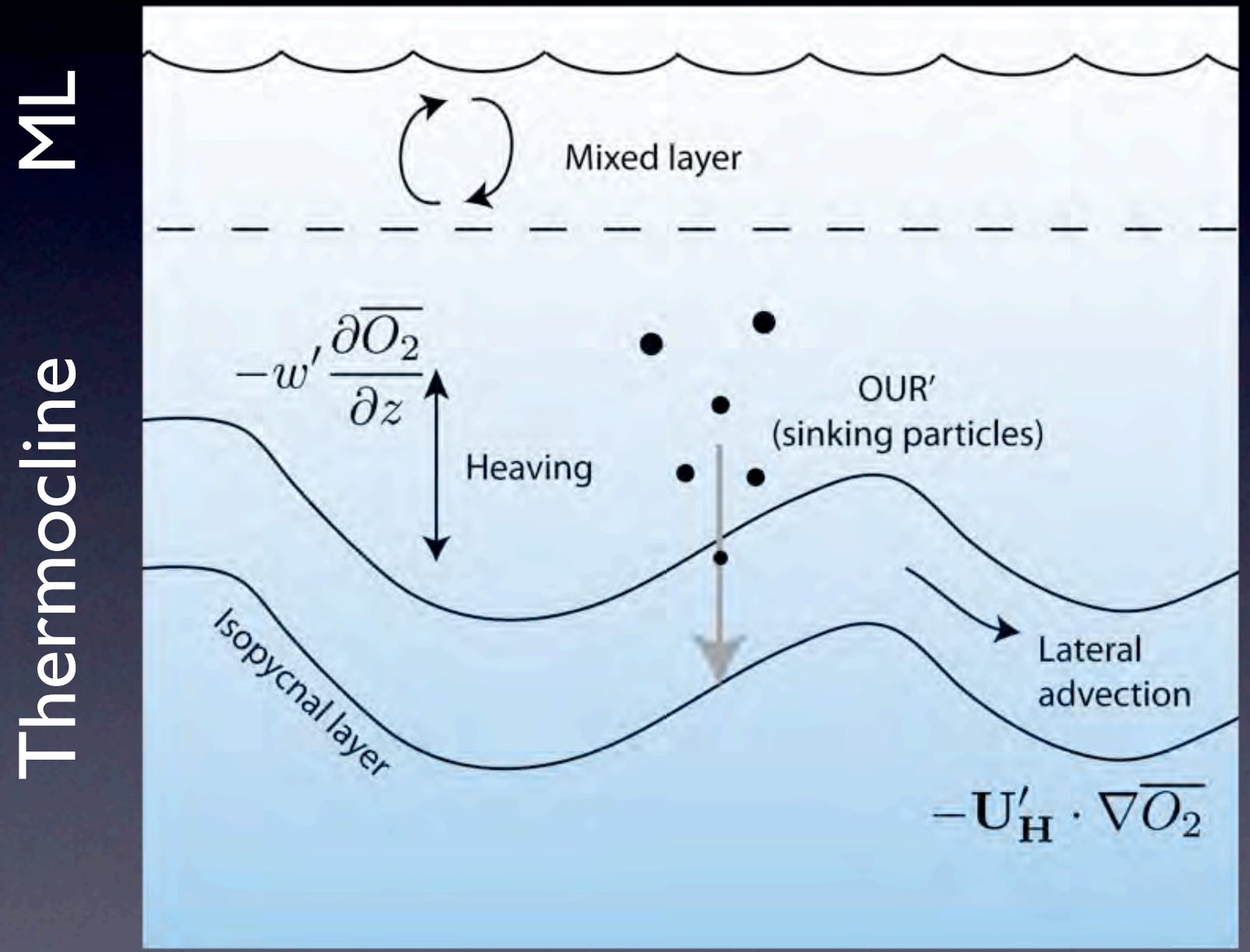
New opportunity for monitoring high-frequency variability

- DO and NO_3 sensors on profiling floats(Apex/ISUS)
- Increased measurement frequency (~70 times/year)
- Short-timescale analysis



http://www.mbari.org/chemsensor/APEXISUS.htm

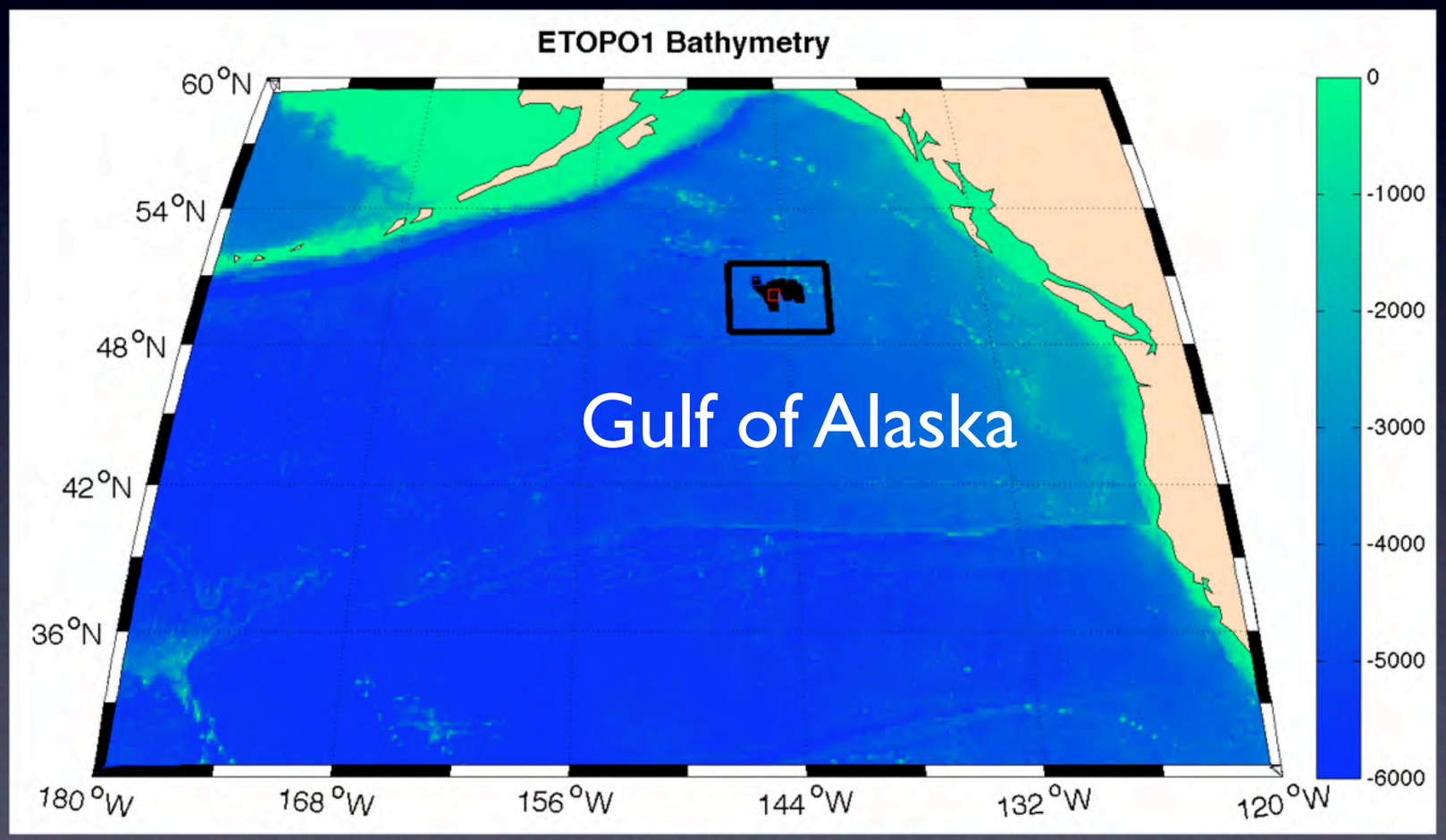
Main causes of DO variability



Objective

- Determine and understand high-frequency variability of the DO and NO_3 in Gulf of Alaska

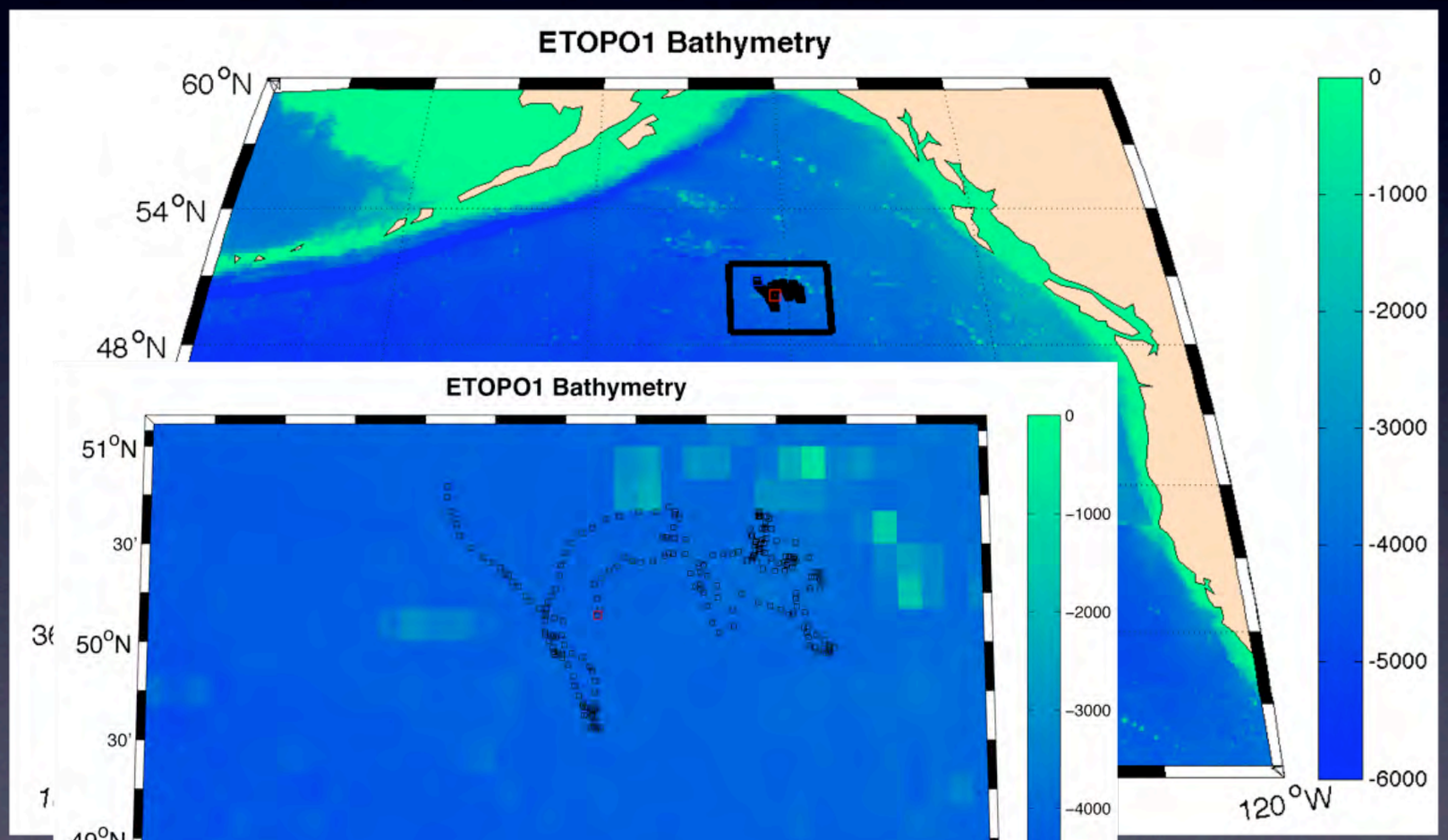
Apex/ISUS Float Data



- Location
(OSP, 50°N, 145°W)
- Time period
9/2008 - 8/2011
every 5 days
- Vertical coverage
surface - 1000m
T,S,DO,NO_3

Data provided by Ken Johnson, Johnson et al., 2012, submitted

Apex/ISUS Float Data



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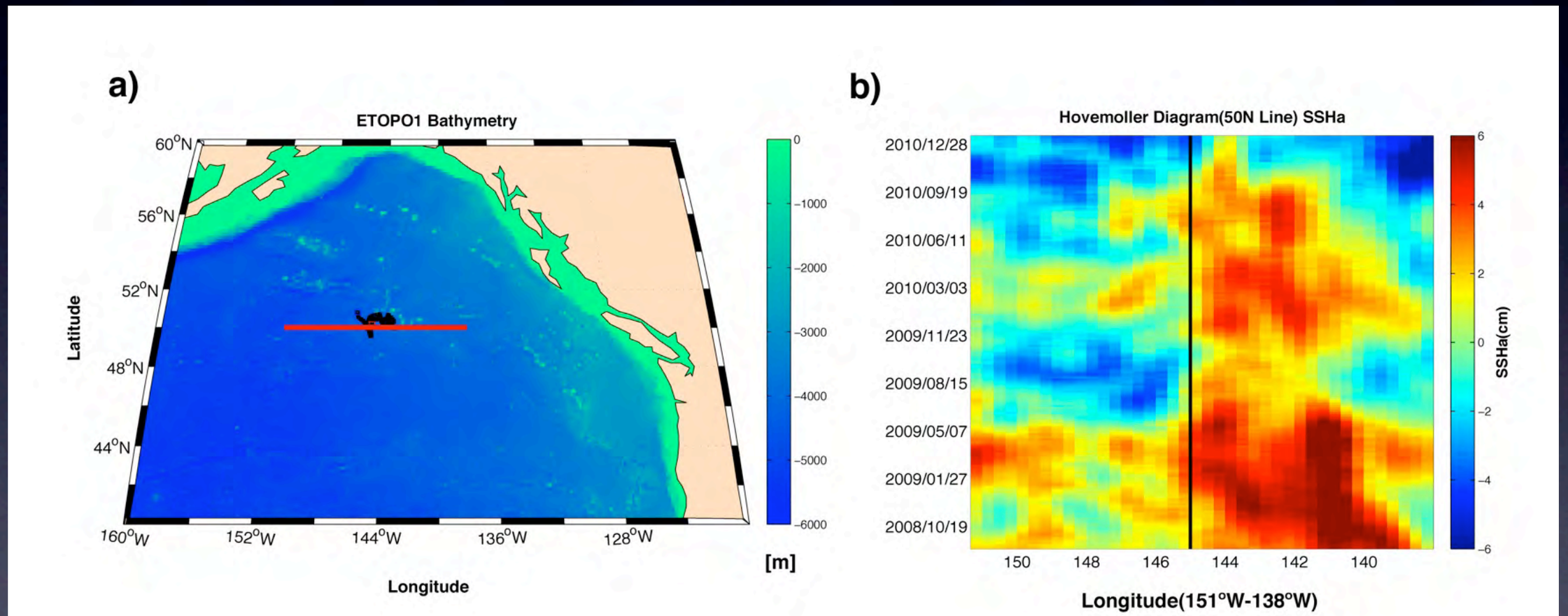
Background Sea Level Anomaly (SLA)

Trajectory(ETOPO1) AVISO SLA Hovmöller

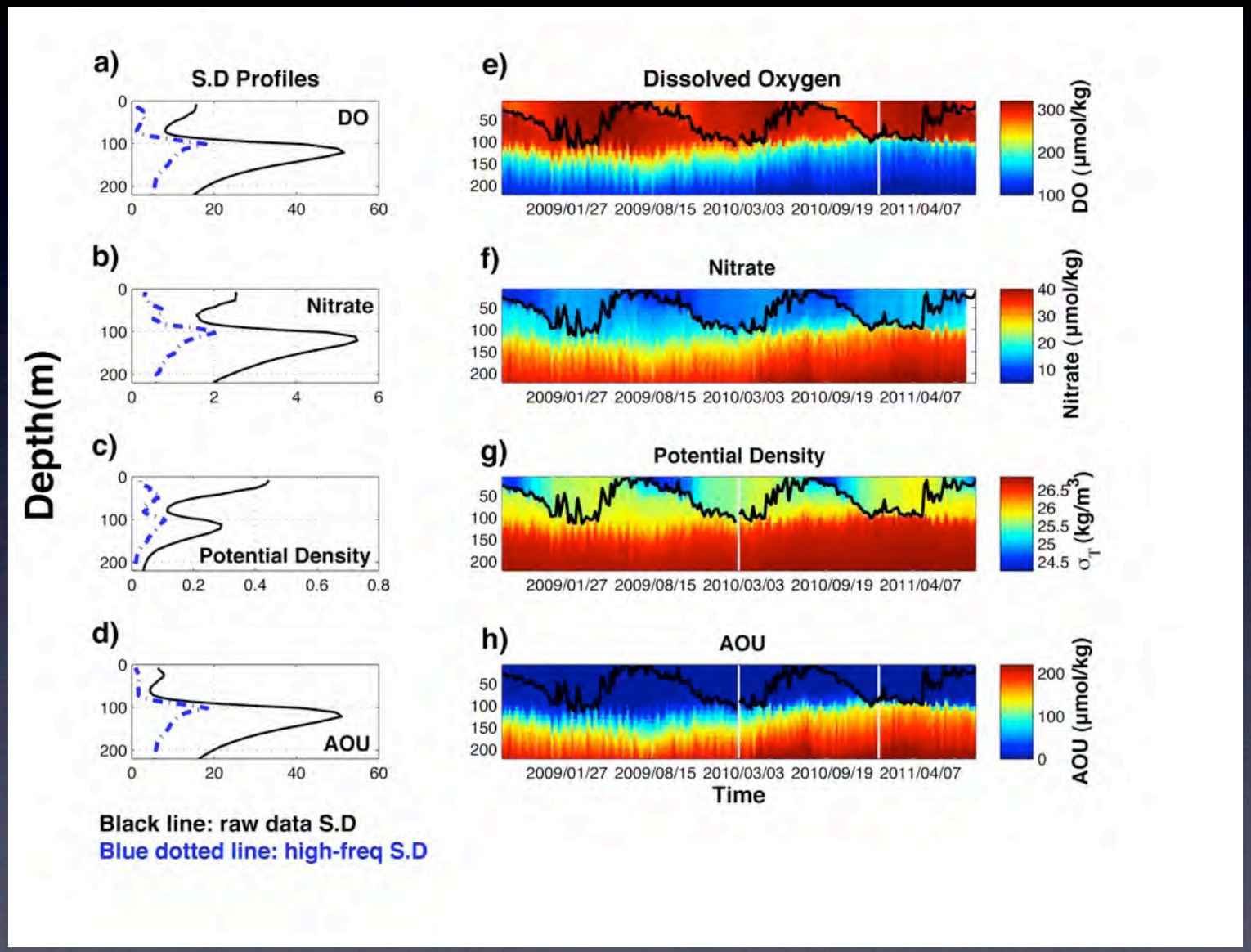


- No wave propagation signal in SLA at 145°W

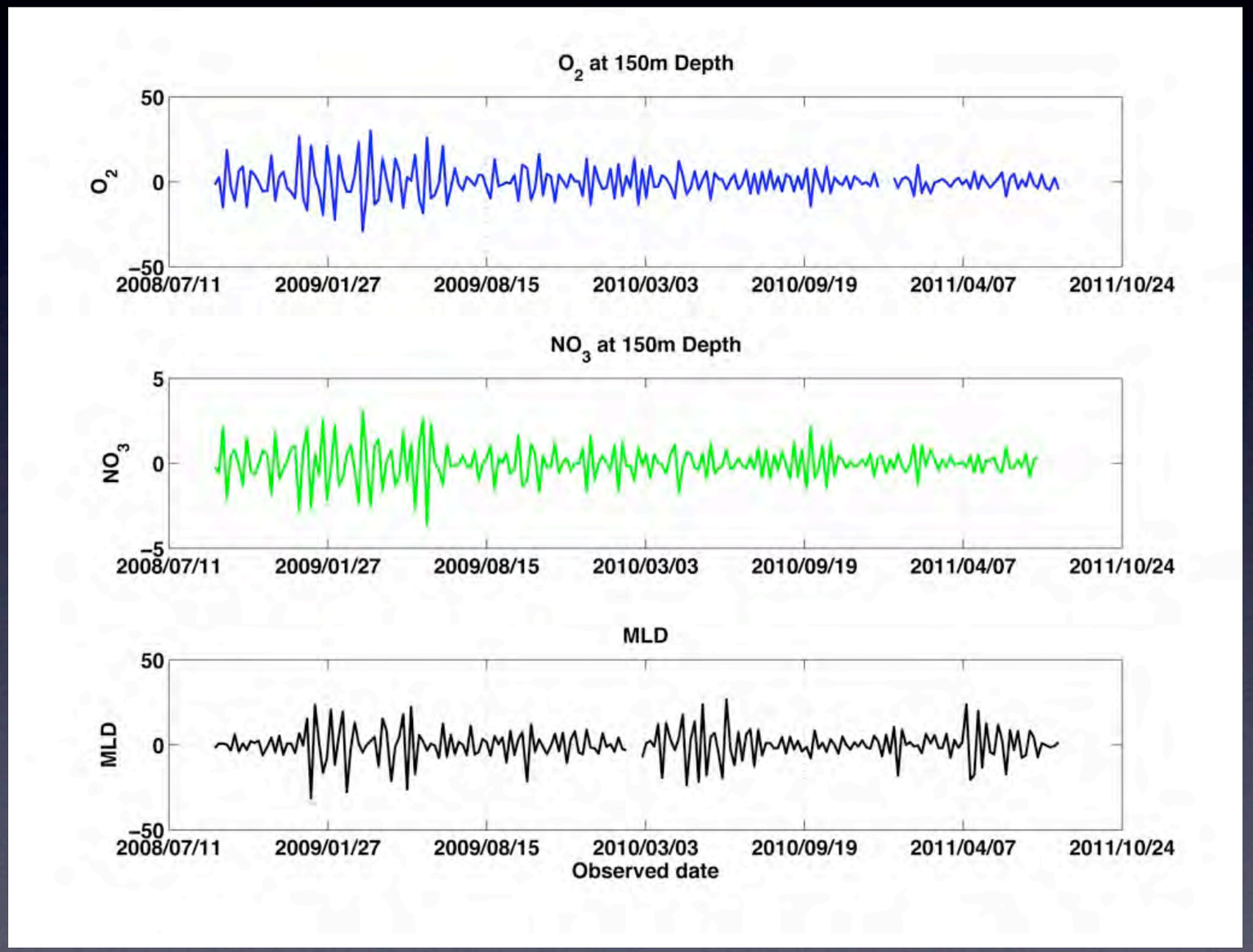
SLA from http://www.aviso.oceanobs.com/en/

ETOPO1 from http://www.ngdc.noaa.gov/mgg/global/global.html

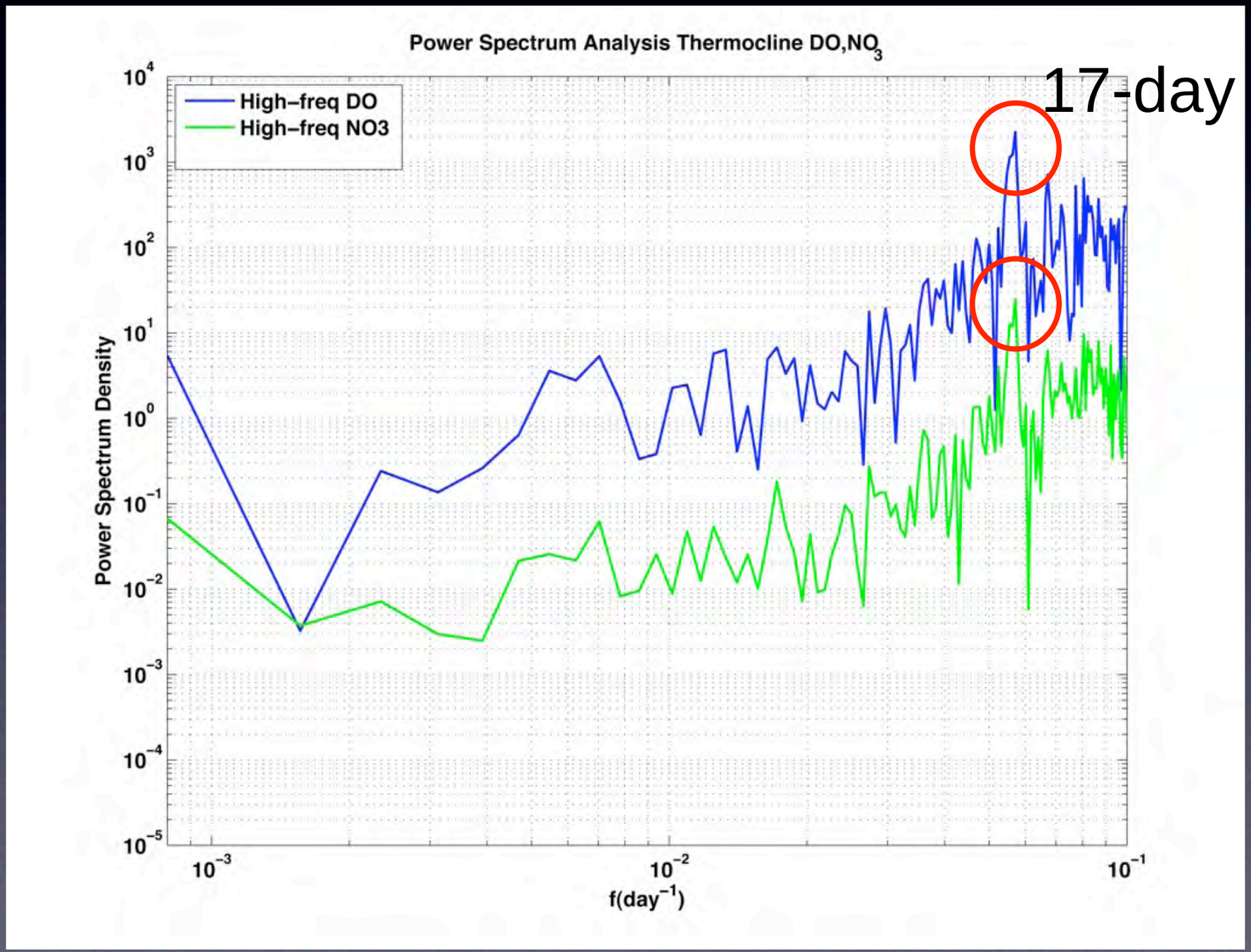
Observed Tracers



High-frequency Variability in the Main Thermocline



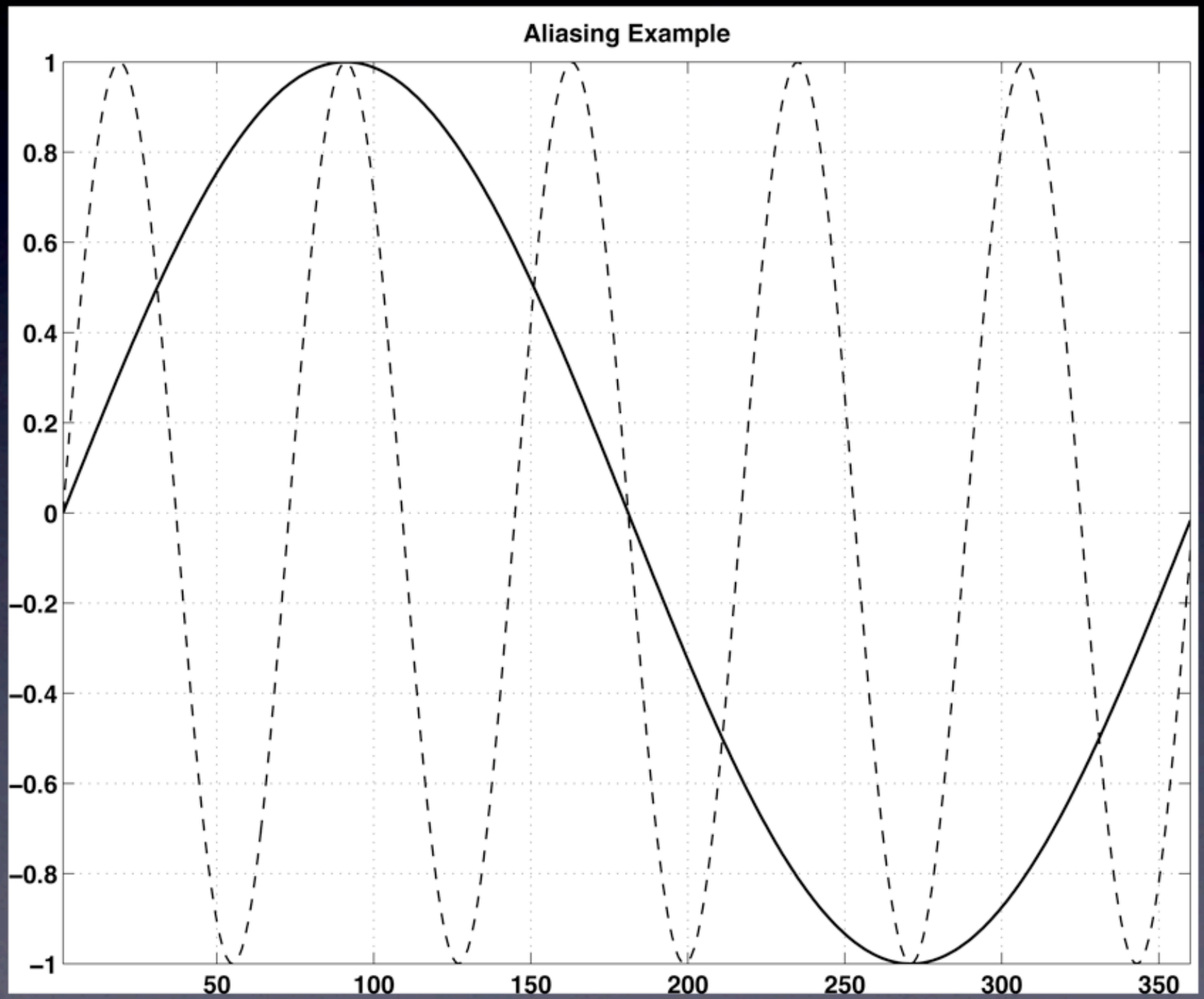
Power Spectrum of the Thermocline DO and NO_3



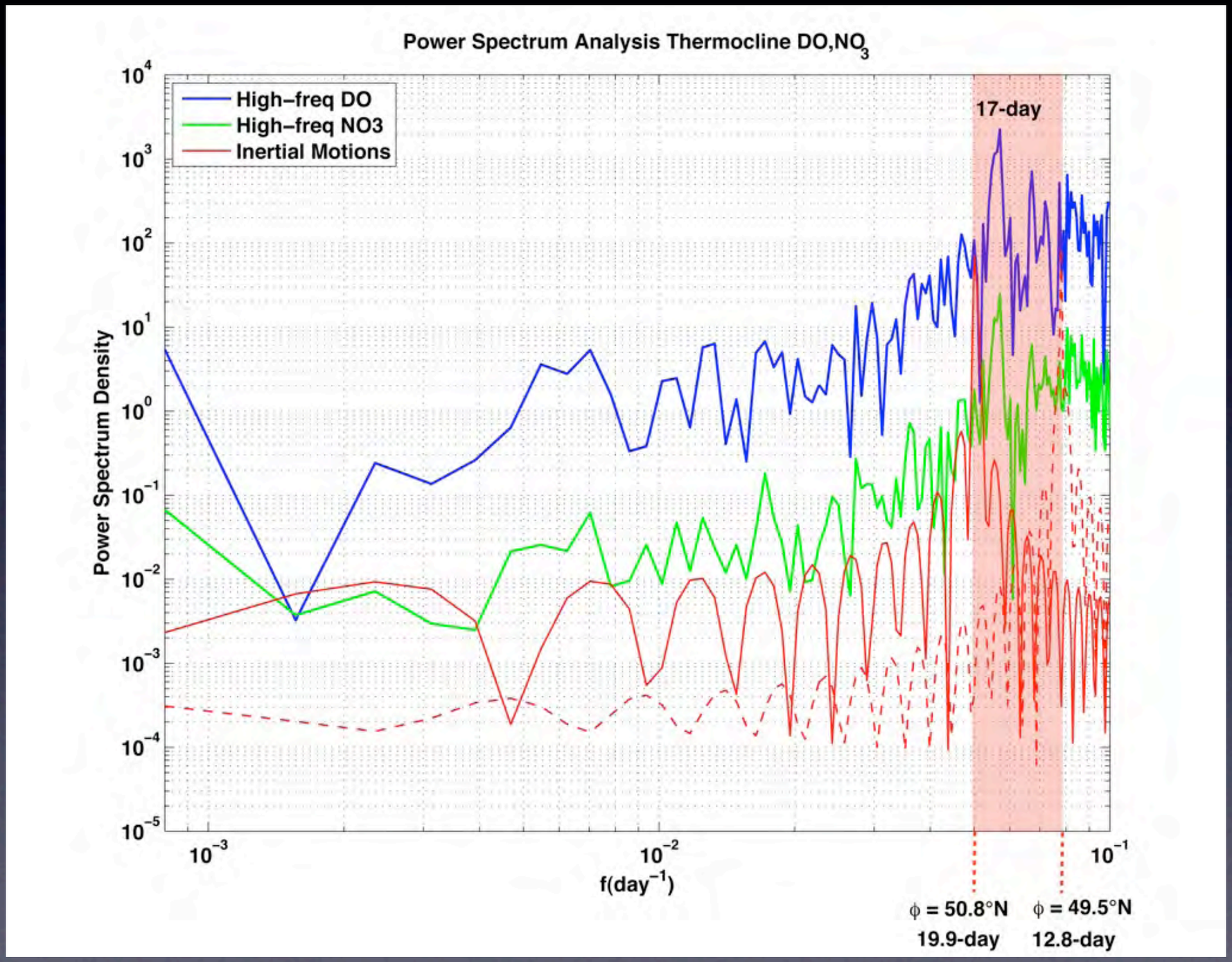
Indications from the Power Spectrum

- Mesoscale and sub-mesoscale eddies, inertial motion or tides
- Aliased tides or inertia oscillation

Aliased Spectral Peak



Aliased Power Spectrum



Aliased Internal Processes

- Inertial motion (simply sine wave) based on latitude in Gulf of Alaska can generate similar spectral peak (shown in the previous slide) as an aliased signals
- Internal wave (e.g. M_2 tide generated) has similar frequency which could also result in aliased signals

Correlation between Thermocline DO and Surface Properties

Table 1: OUR Relationship(Lag-linear Correlation Coefficient)

Variables	5-day	10-day	15-day	20-day	25-day
MLD	-0.07	-0.08	0.12	0.06	-0.18
SST	-0.08	0.02	0.00	-0.04	0.07
Surface O_2	-0.16	0.12	0.03	0.05	-0.13
Surface NO_3	0.00	0.01	0.04	-0.03	-0.10
SLA	-0.08	0.06	0.05	-0.08	0.04
NPP(8-day)	-0.04	-0.08	0.08	0.04	-0.01

- No evidence of biologically or eddy driven DO variability

* SLA and NPP are downloaded from AVISO and OSU, respectively.
http://www.aviso.oceanobs.com/en/
http://www.science.oregonstate.edu/ocean.productivity/index.php

Conclusions

- High-frequency variability is observed in DO with a 17-day spectral peak
- No correlation with surface physical and biological processes
- Spectral peak may come from aliased internal processes