

Measurement of acoustic backscatter and ocean velocity from an autonomous glider

Nick W. Woods¹ and David M. Fratantoni²

¹MIT/WHOI Joint Program in Physical Oceanography

²Woods Hole Oceanographic Institution



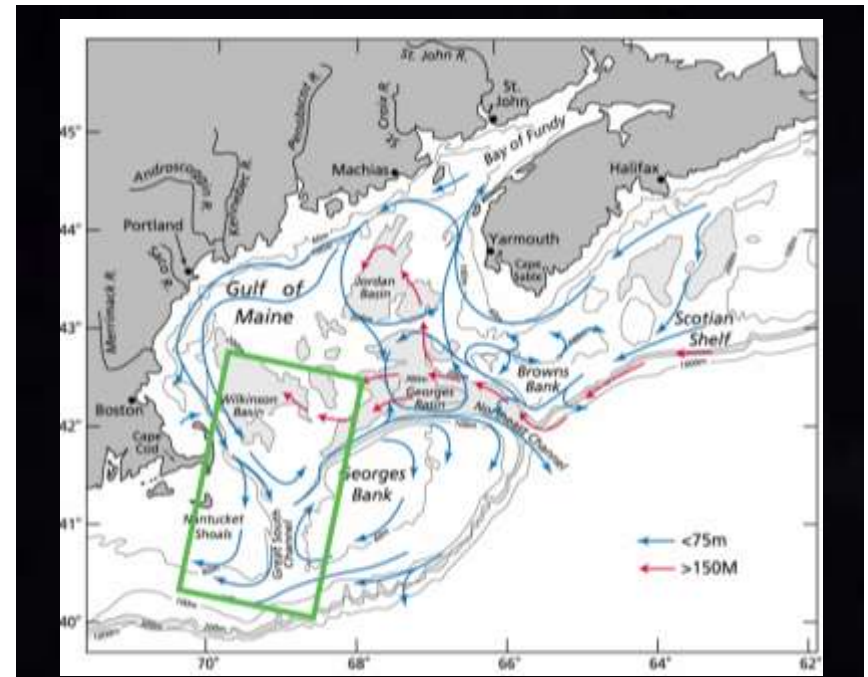
ASL Autonomous Systems Laboratory
Woods Hole Oceanographic Institution



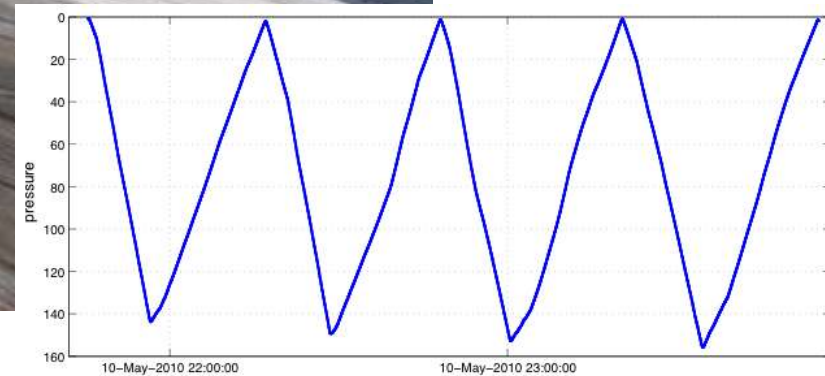
Introduction

Copepods (*Calanus finmarchicus*) are an economically and ecologically important zooplankton living in the Gulf of Maine (GOM) and Great South Channel (GSC)

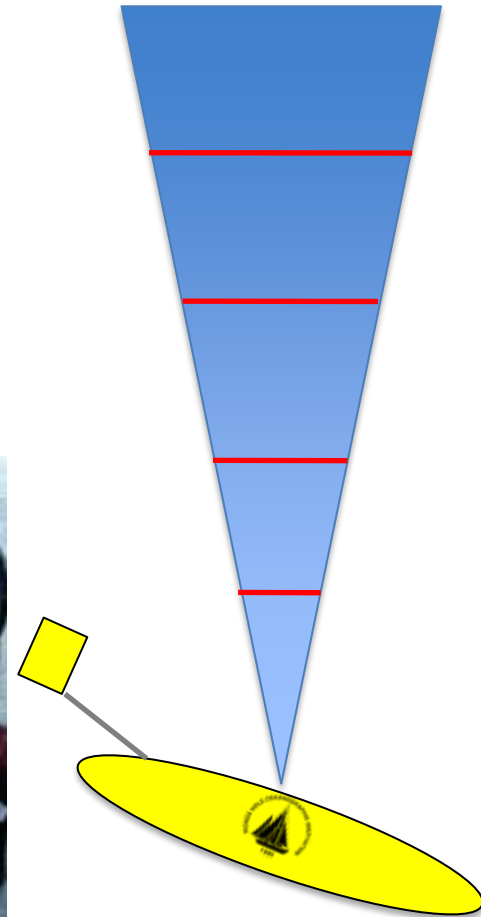
Our interest: how does physical oceanography influence distribution/patchiness of copepods in the GOM/GSC?



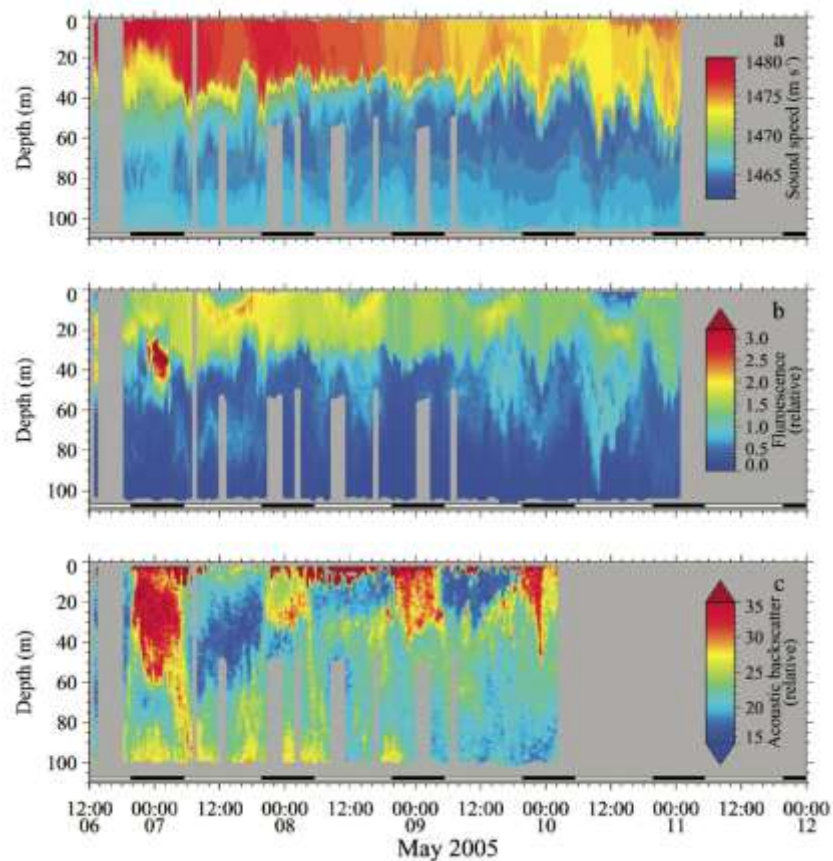
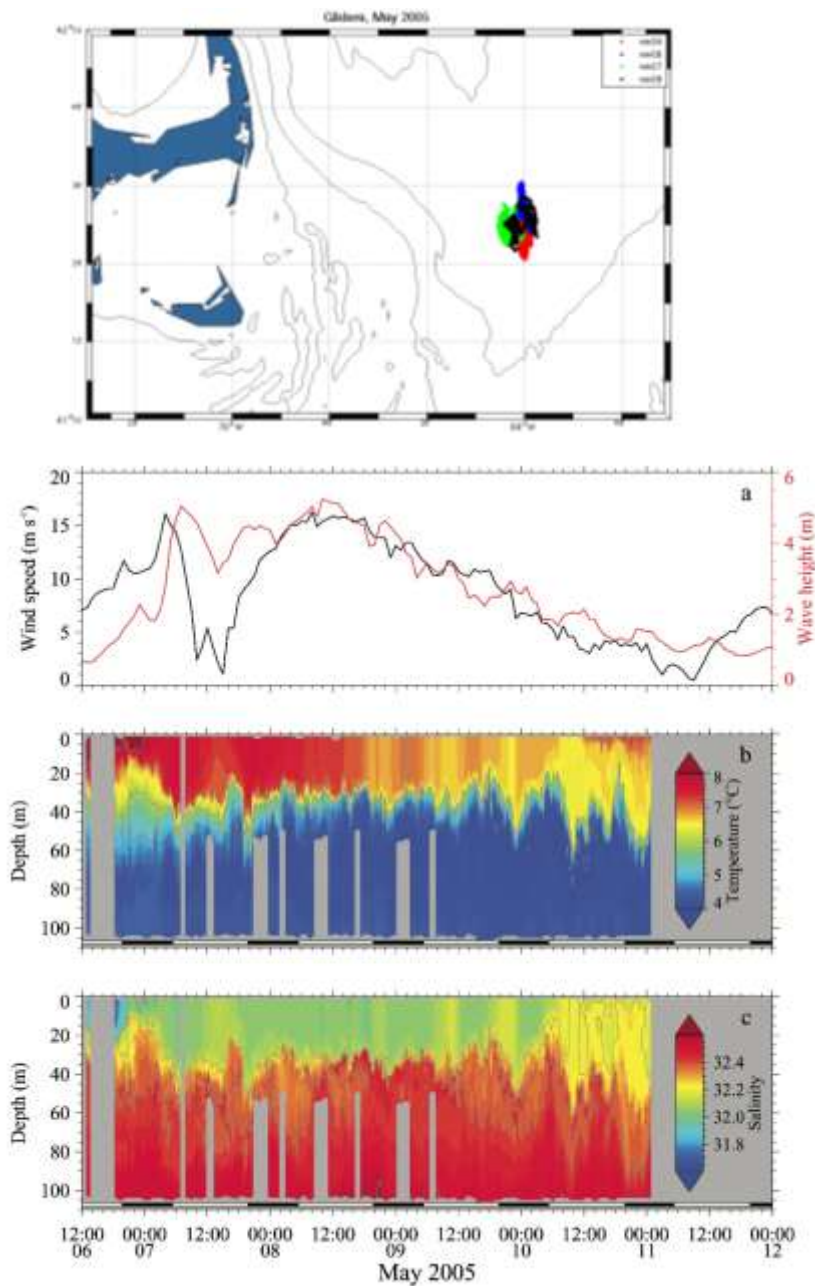
Autonomous underwater gliders



Nortek Aquadopp profiler



Gliders in the GSC in 2005



From Baumgartner & Fratantoni, 2008

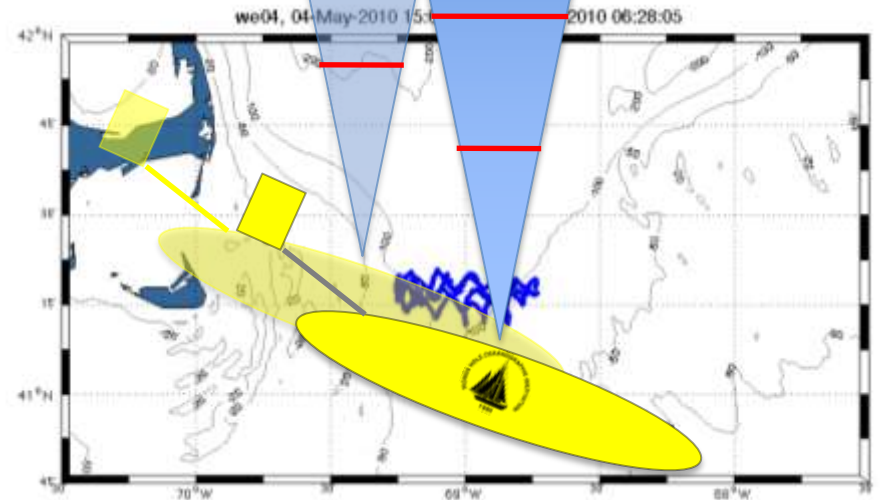
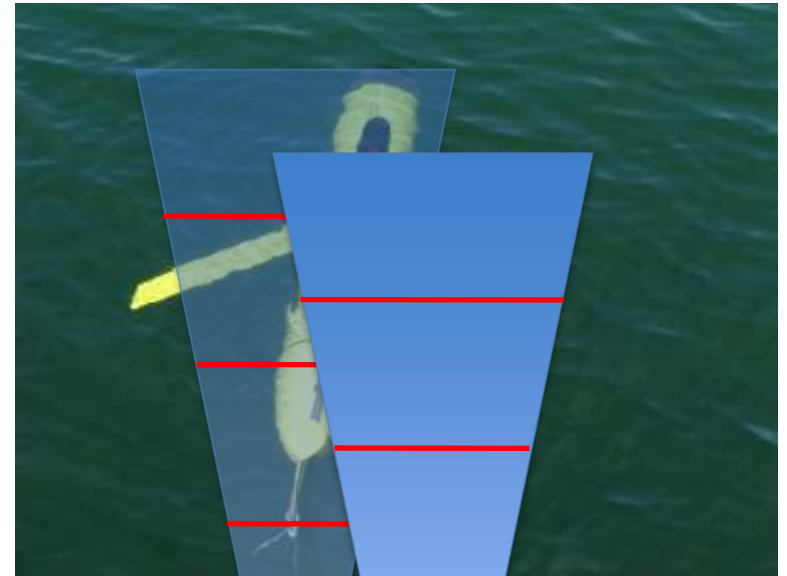
Gliders in the GSC in 2010

we04, deployed for 11 days, equipped with 1MHz Aquadopp

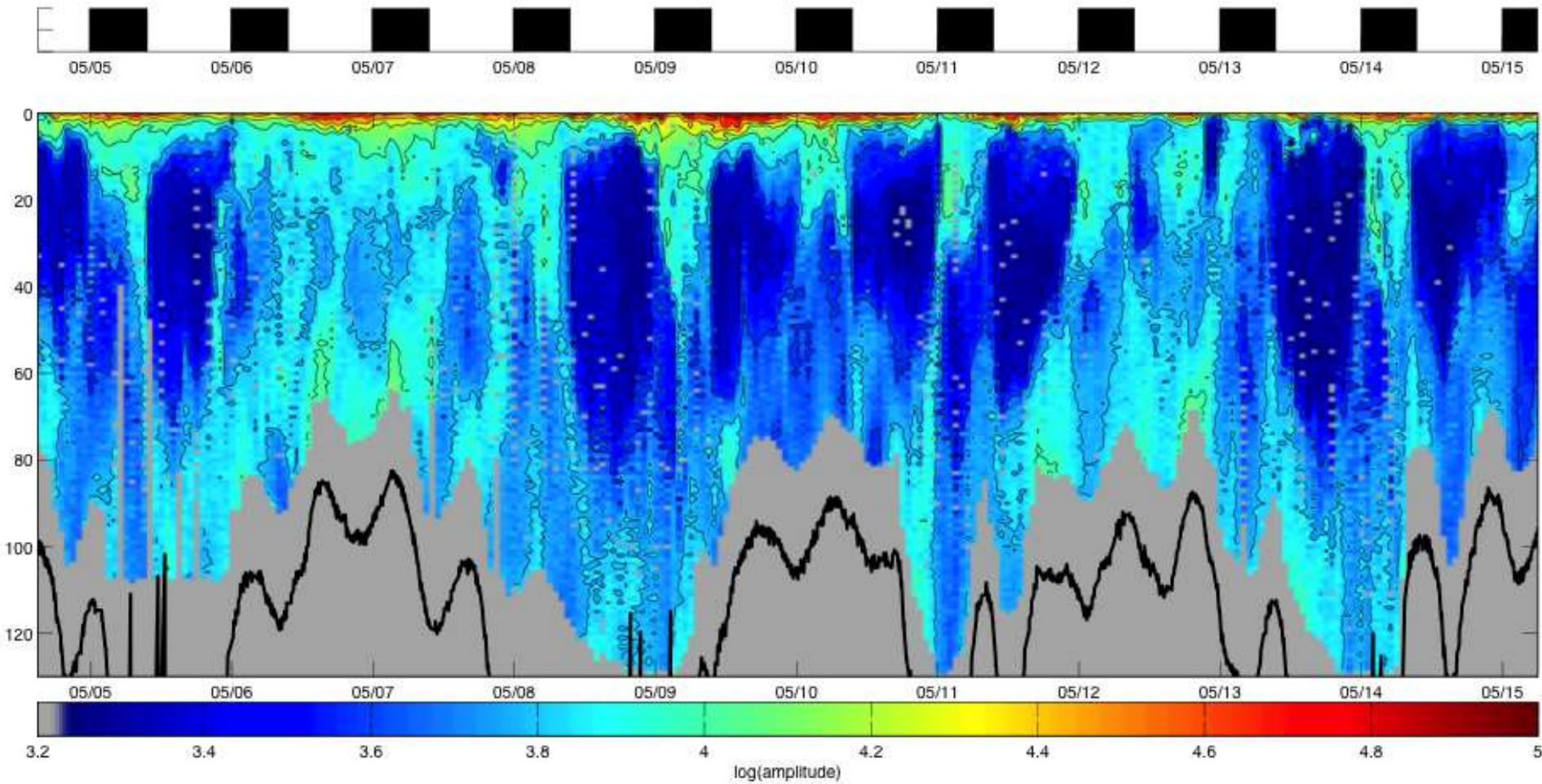
4 complete zonal sections

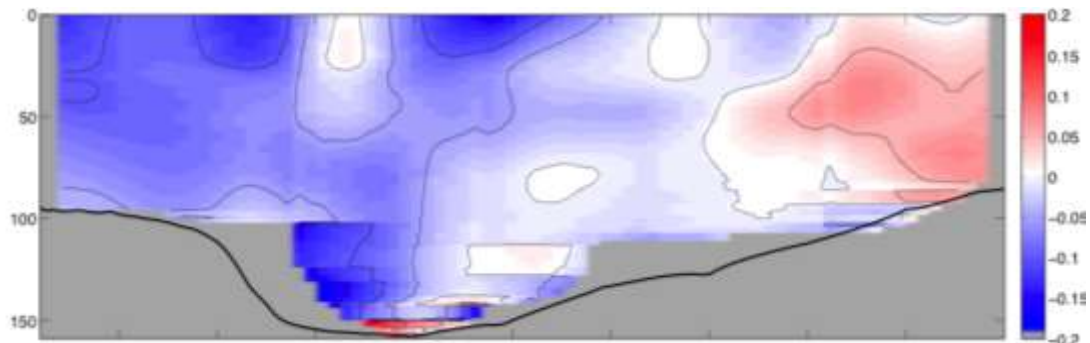
5x 1m bins, 2s avg. interval, 1 profile every 10s

Nortek vel. precision estimate: 7.9 cm/s

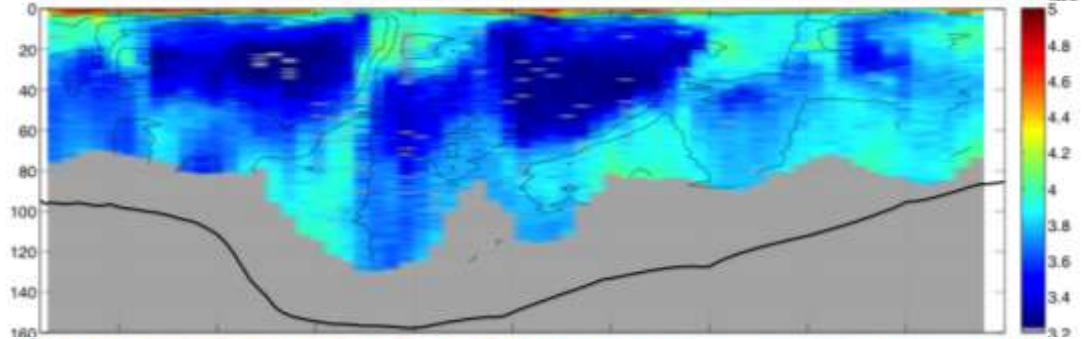


Acoustic backscatter

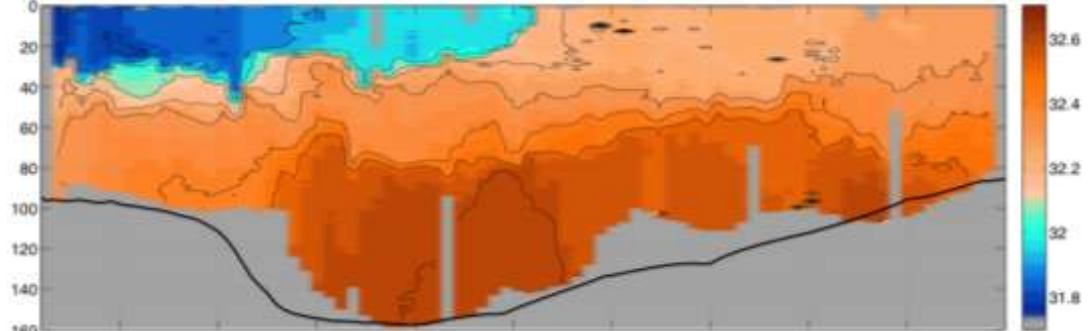




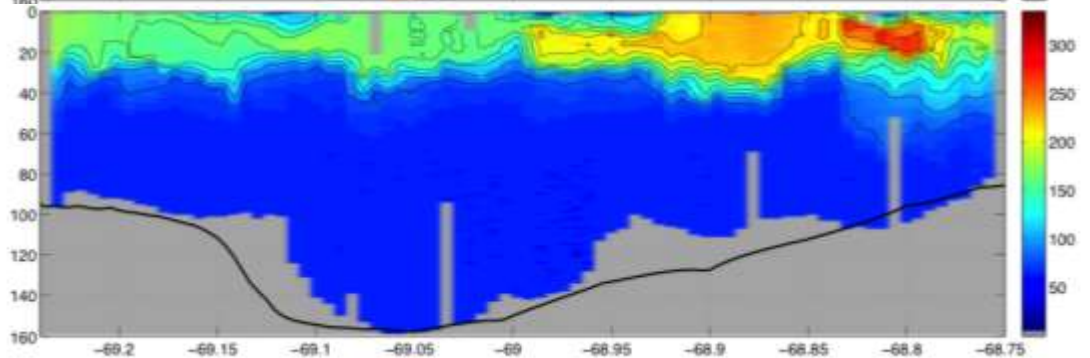
Geostrophic
velocity



Acoustic
backscatter



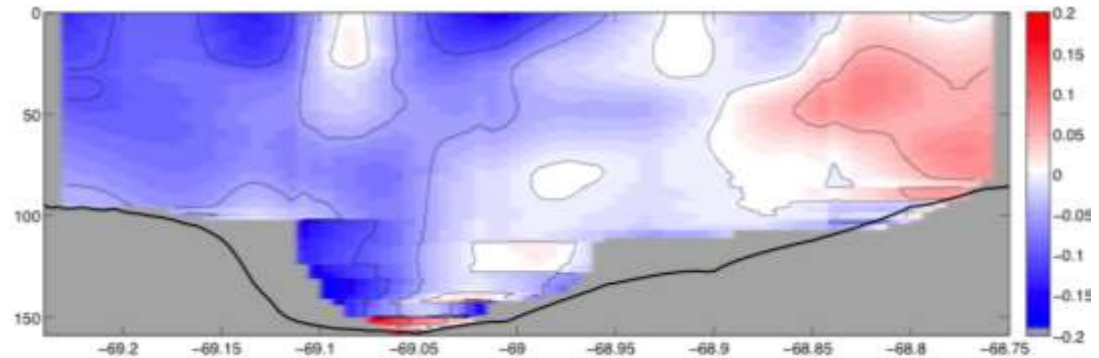
Salinity



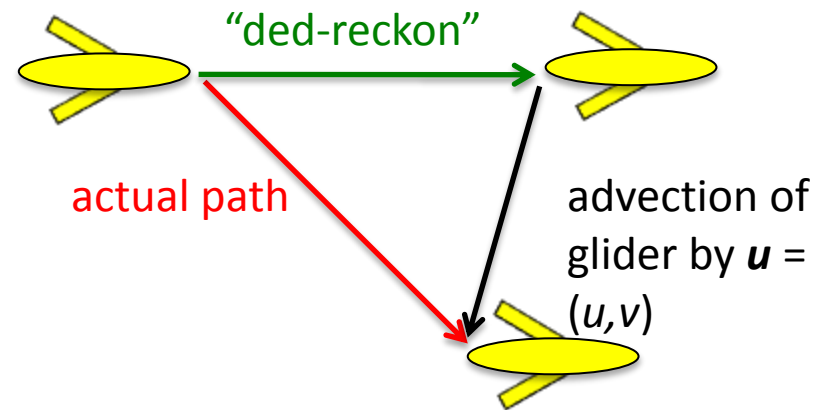
Chlorophyll
fluorescence

Water velocity estimates from gliders

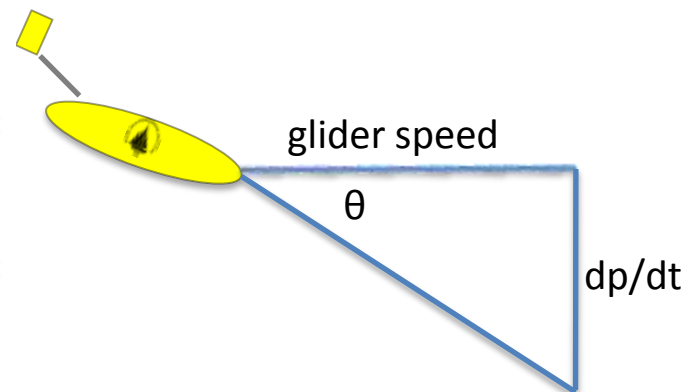
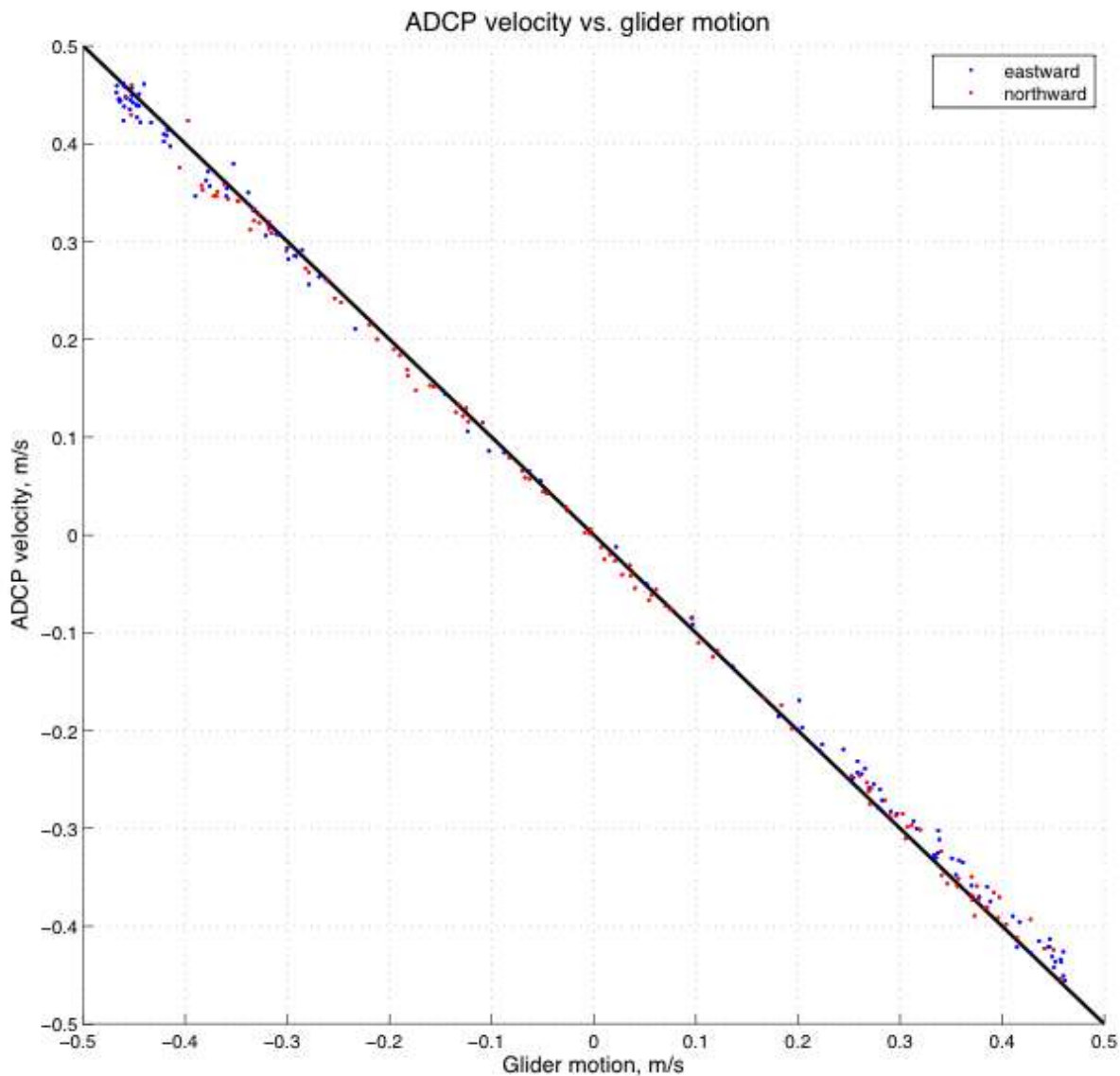
Geostrophic velocity



Gliders “ded-reckon” while underwater, difference between “ded-reckoned” and GPS location provides estimate of time- and depth-average water velocity



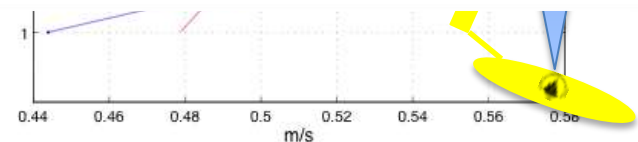
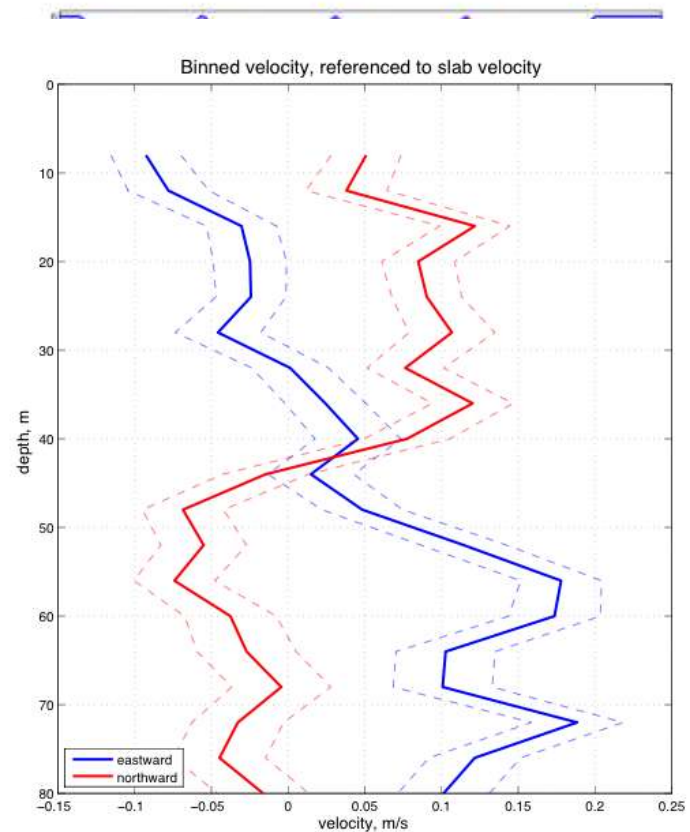
ADCP vs. glider motion



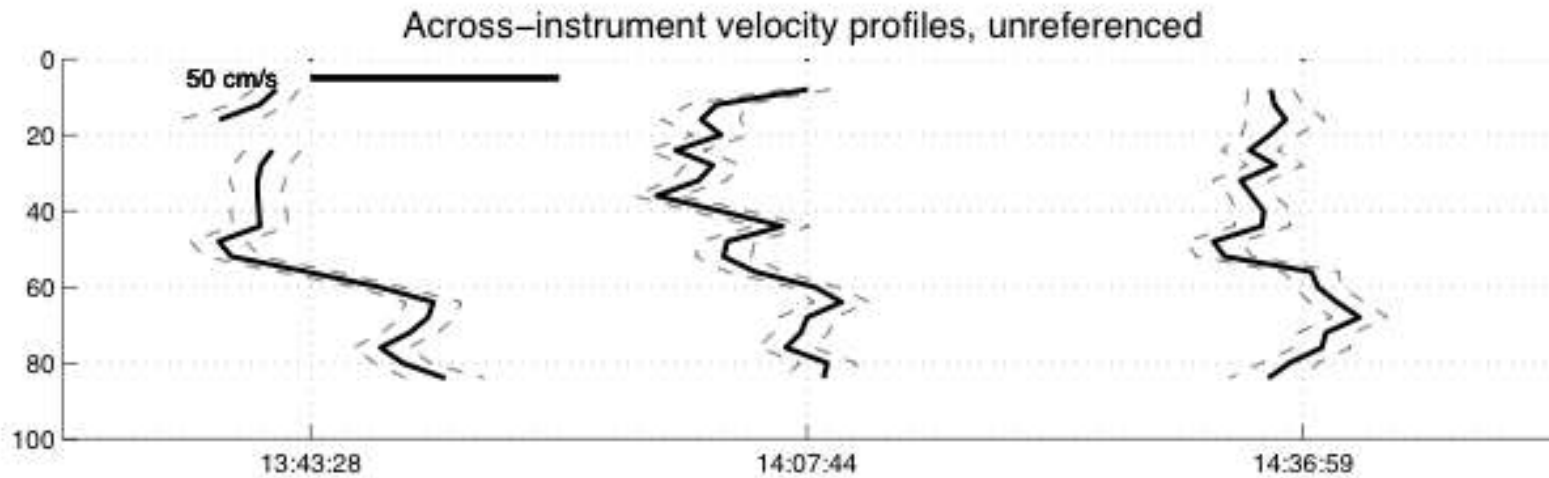
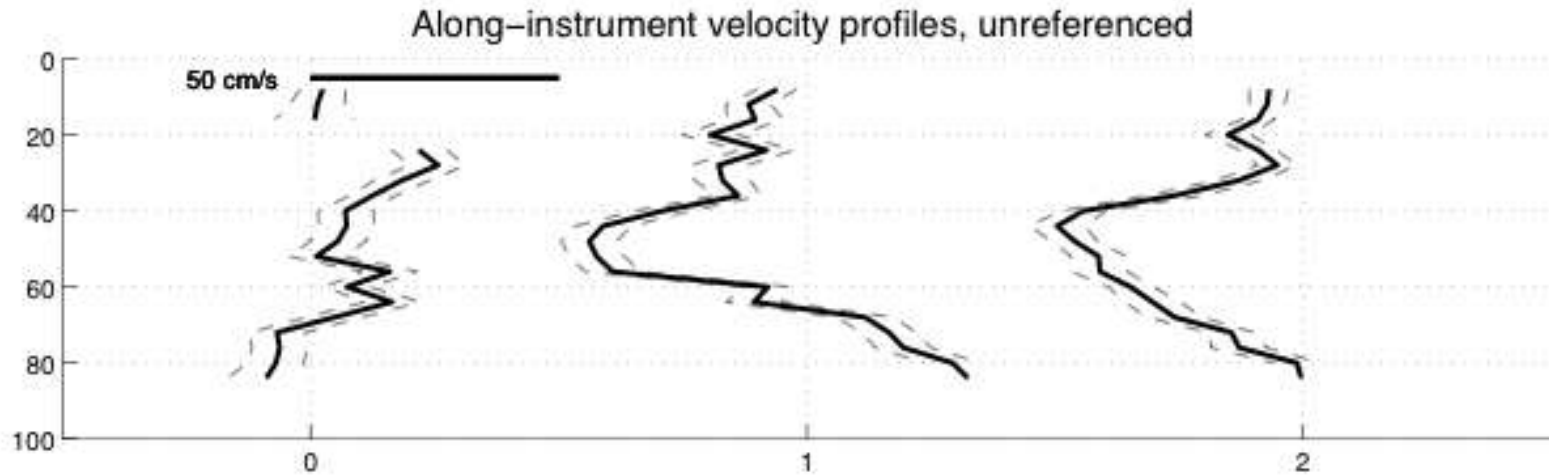
Direct velocity measurement from glider's ADCP

Processing similar to lowered ADCP

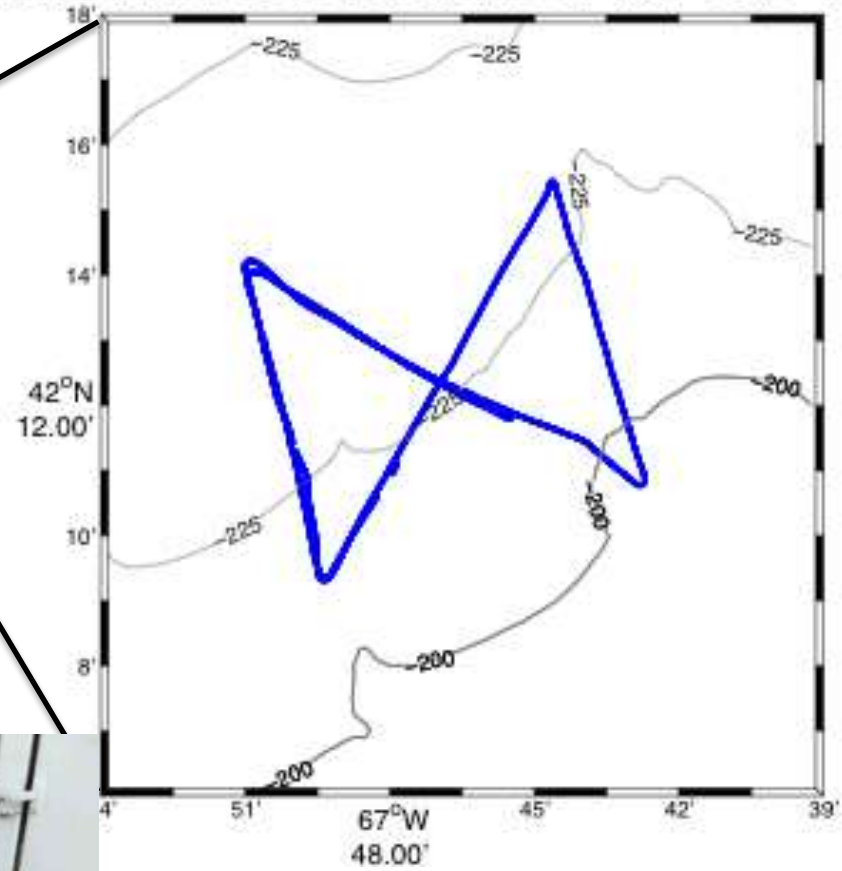
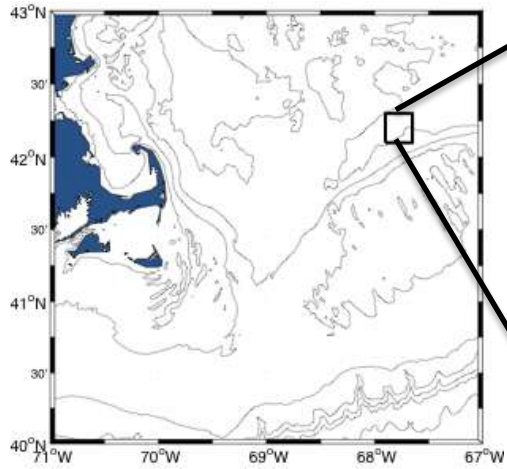
- Raw profiles eliminated based on several criteria
- Shear from linear fit to velocity profile
- Shears binned in vertical
- Integrate to get velocity
- Referenced to glider slab velocity, rotated to earth coordinates



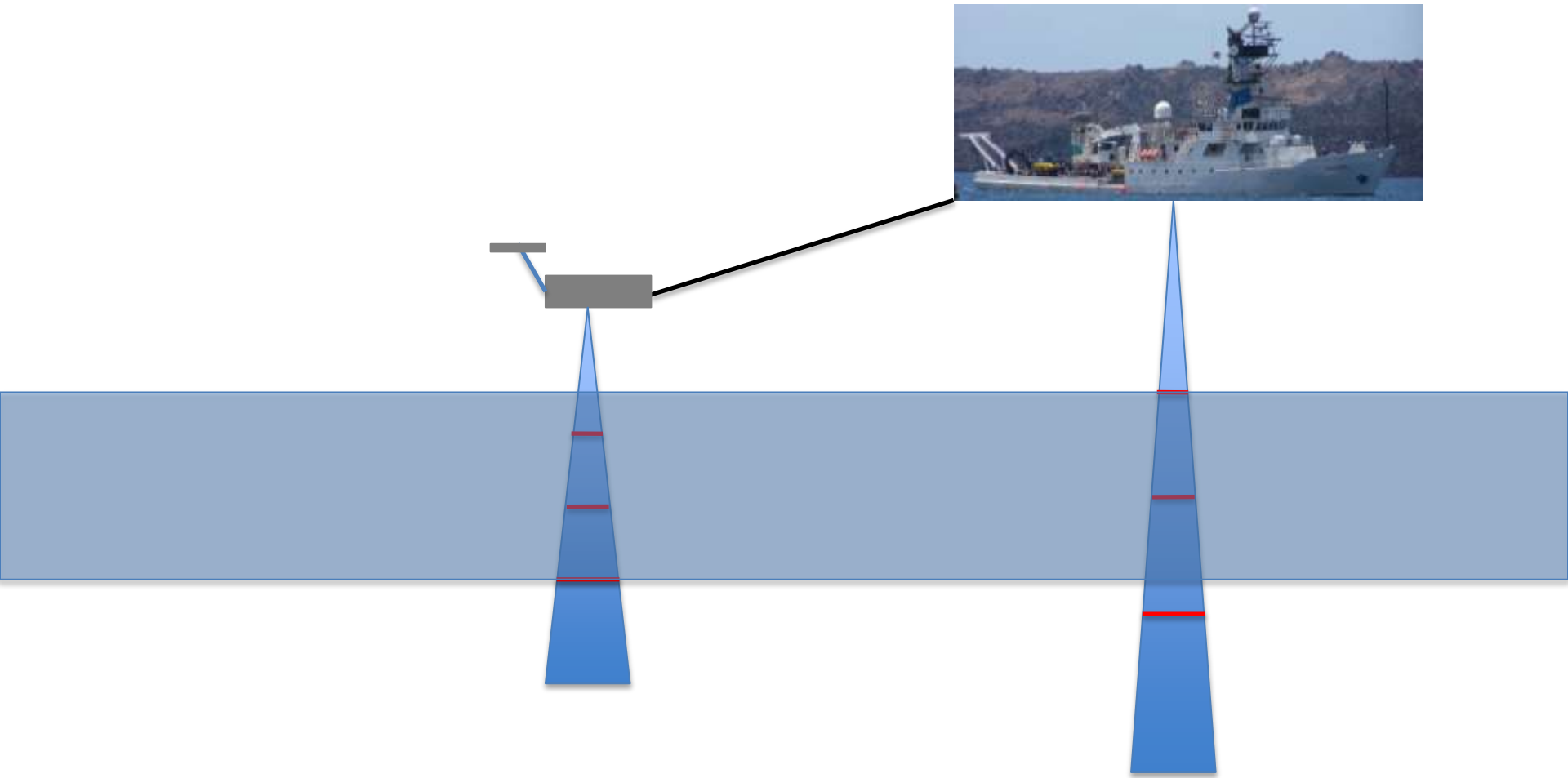
Unreferenced velocity profiles



EN487, 04-Nov-2010 00:49:37 to 04-Nov-2010 10:38:59

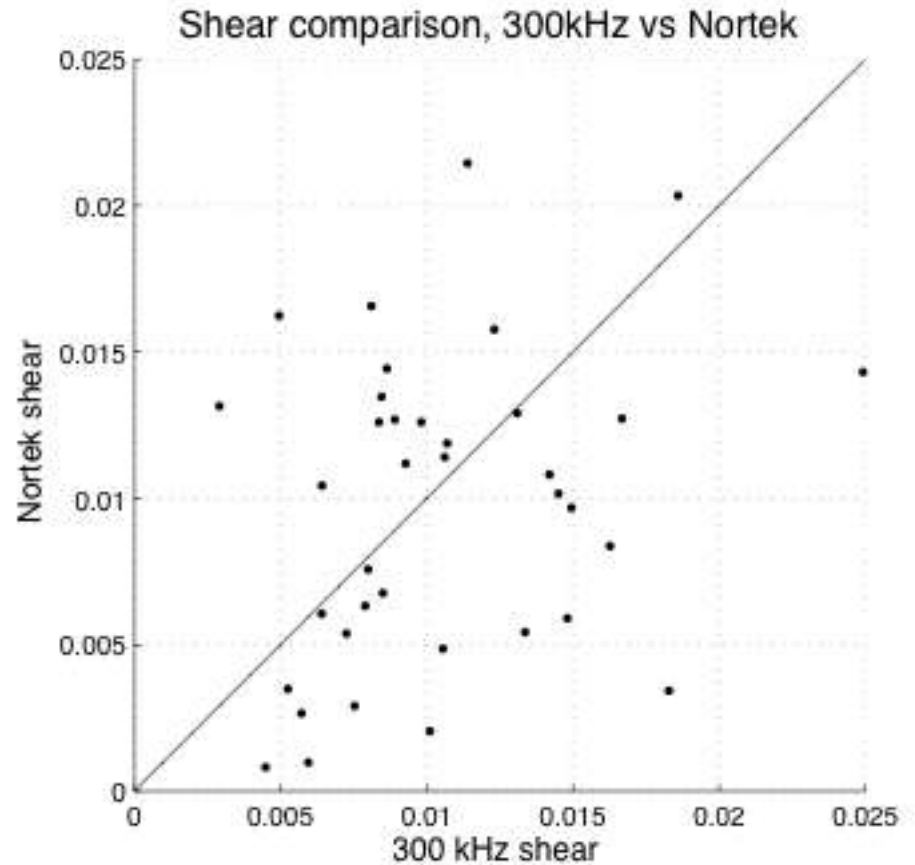


Do 300 kHz shipboard ADCP and 1 MHz Nortek shears agree?



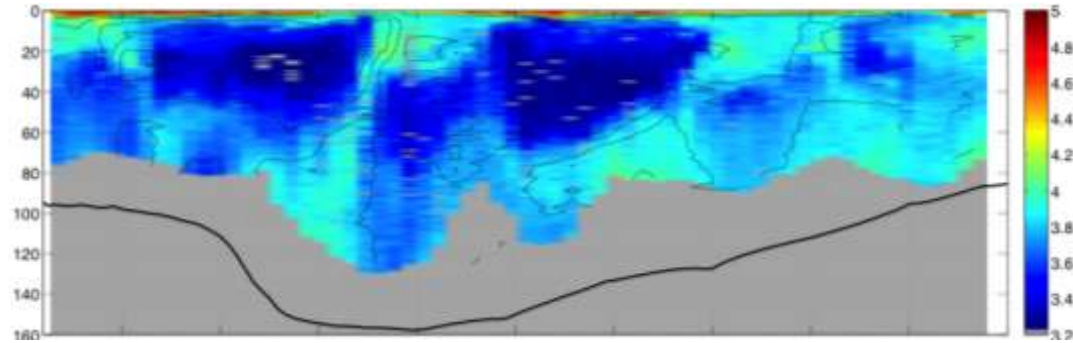
Do 300 kHz shipboard ADCP and 1 MHz Nortek shears agree?

300 kHz and nortek shears
are of same magnitude

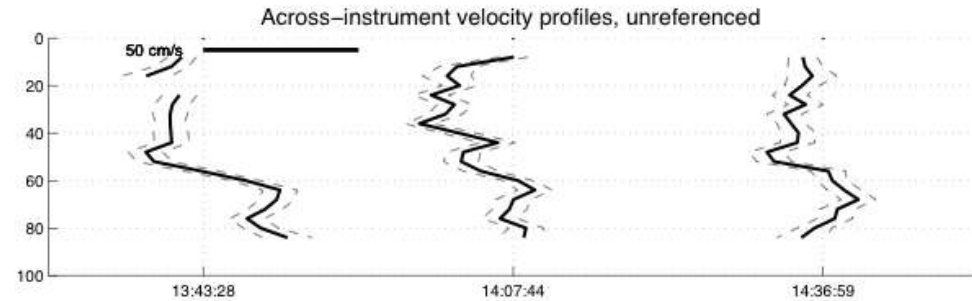


Conclusion/what's next?

Geographic patterns in acoustic backscatter suggest different behaviors/populations



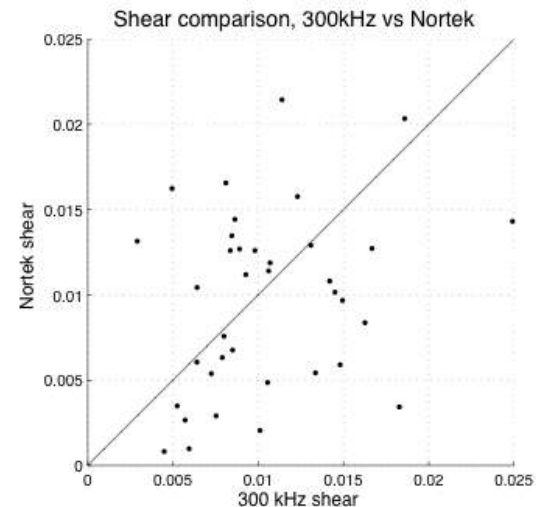
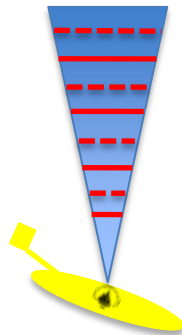
Direct velocity measurement from gliders in Great South Channel not ideal, but perhaps elsewhere?



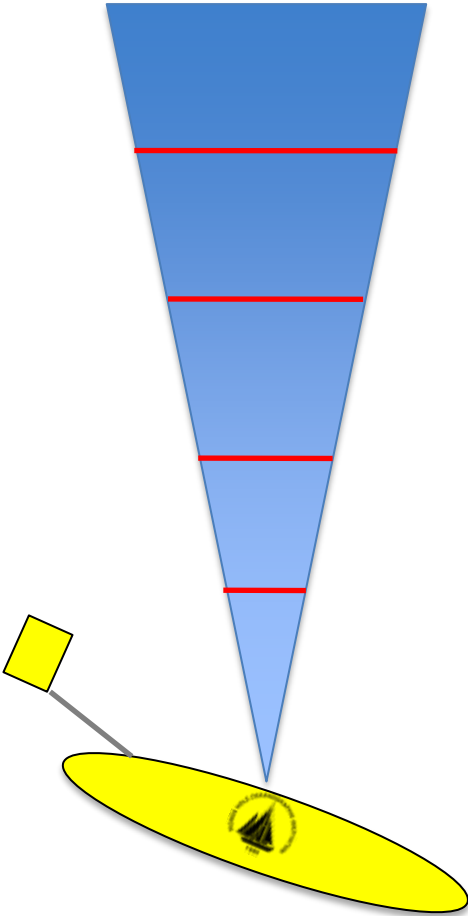
Comparison between shipboard and glider ADCP estimates of shear

New HR firmware?

More tests on towed and fixed platforms



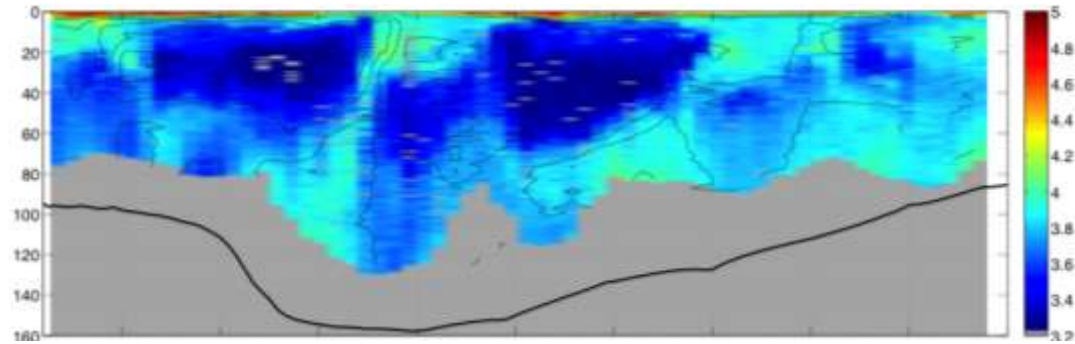
The end!



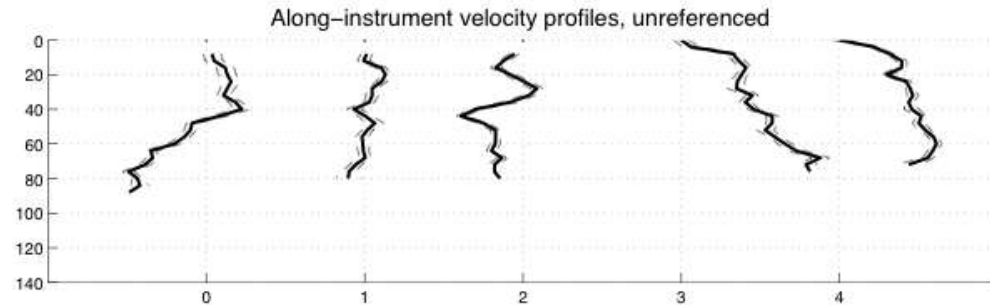
Extra slides to follow

Conclusion/what's next?

Geographic patterns in acoustic backscatter suggest different behaviors/populations



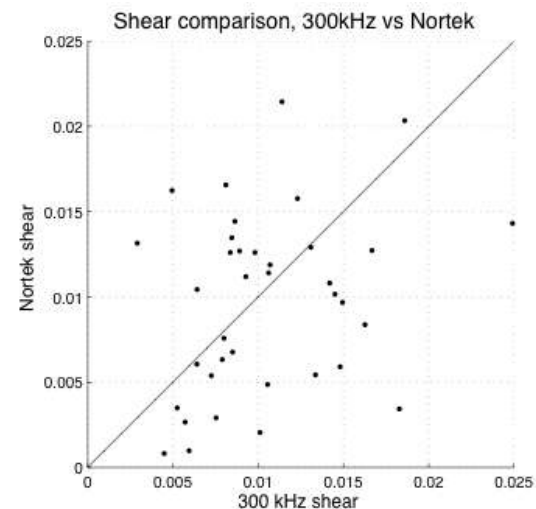
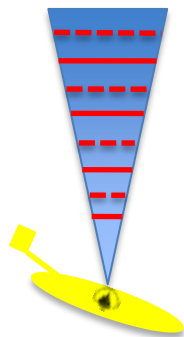
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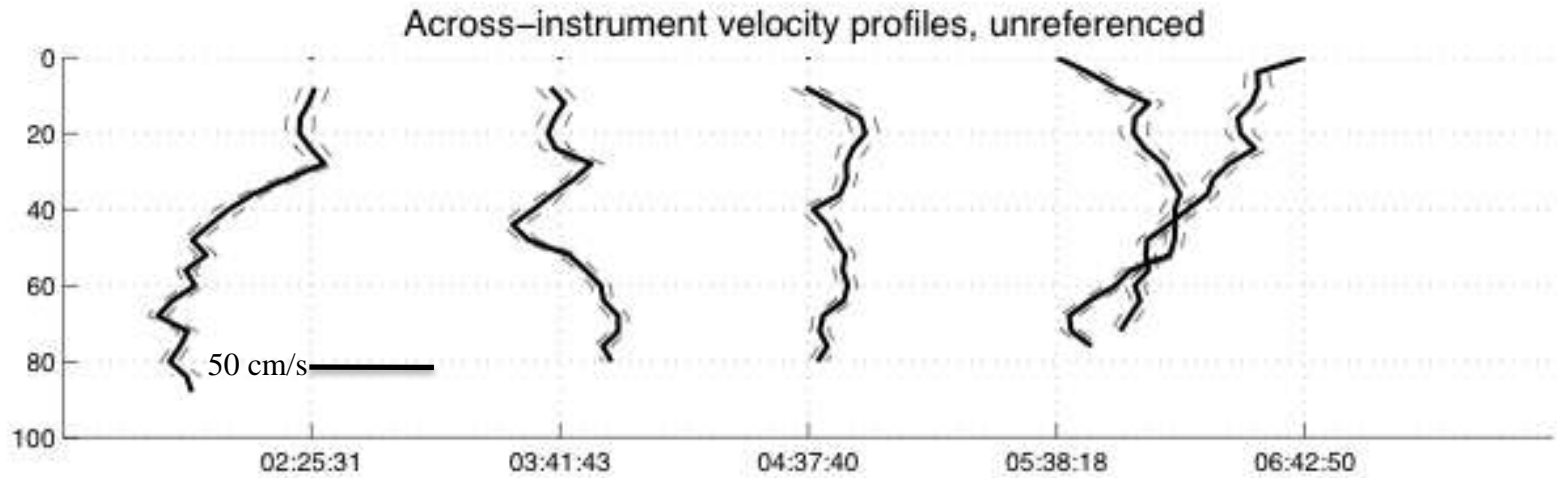
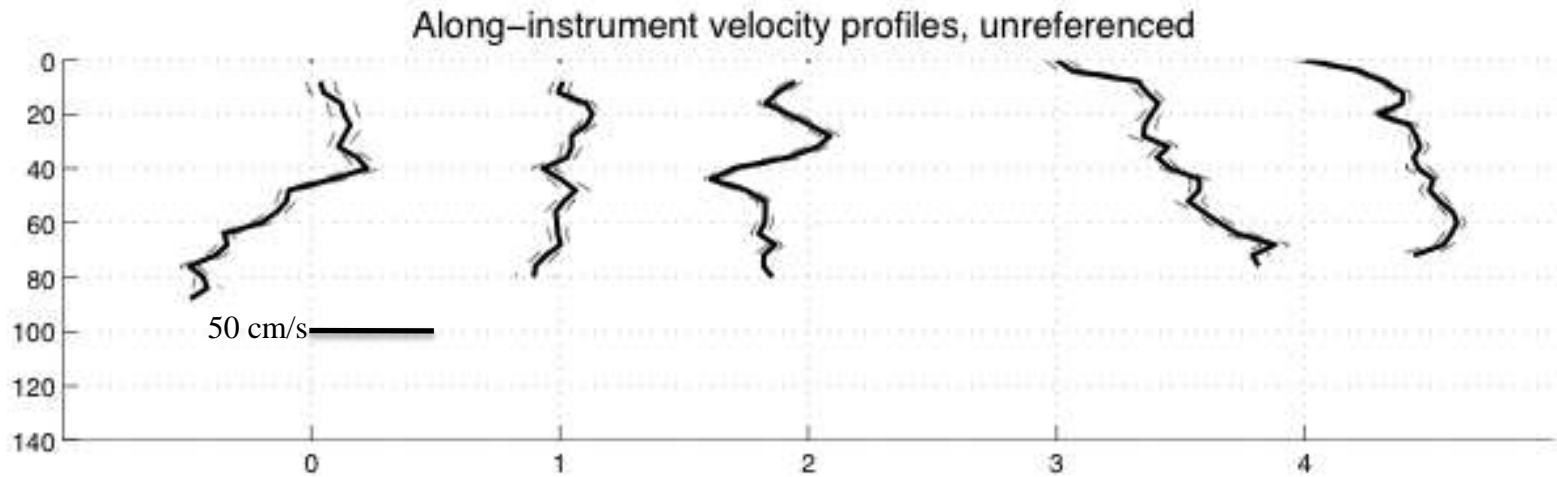
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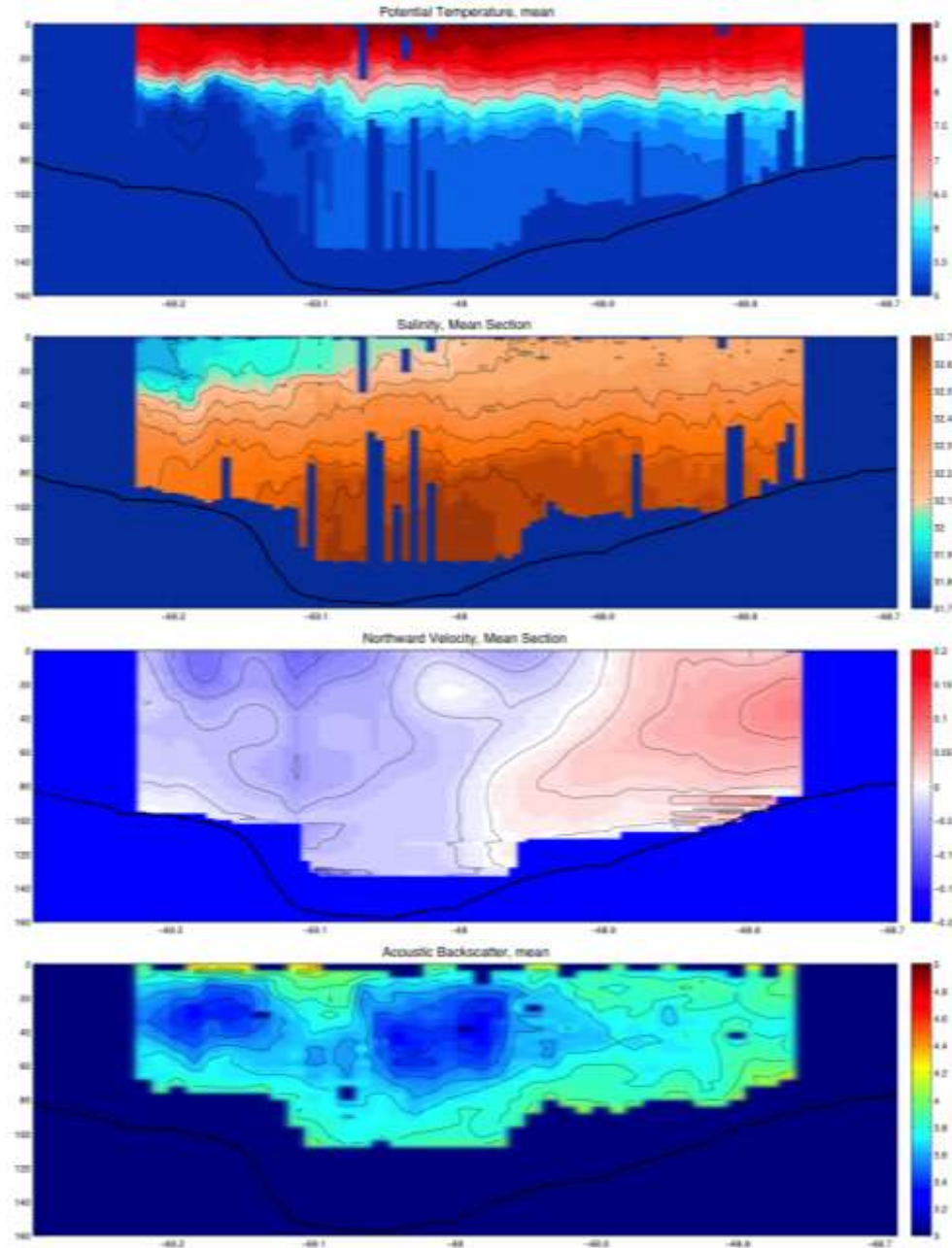
More tests on towed and fixed platforms



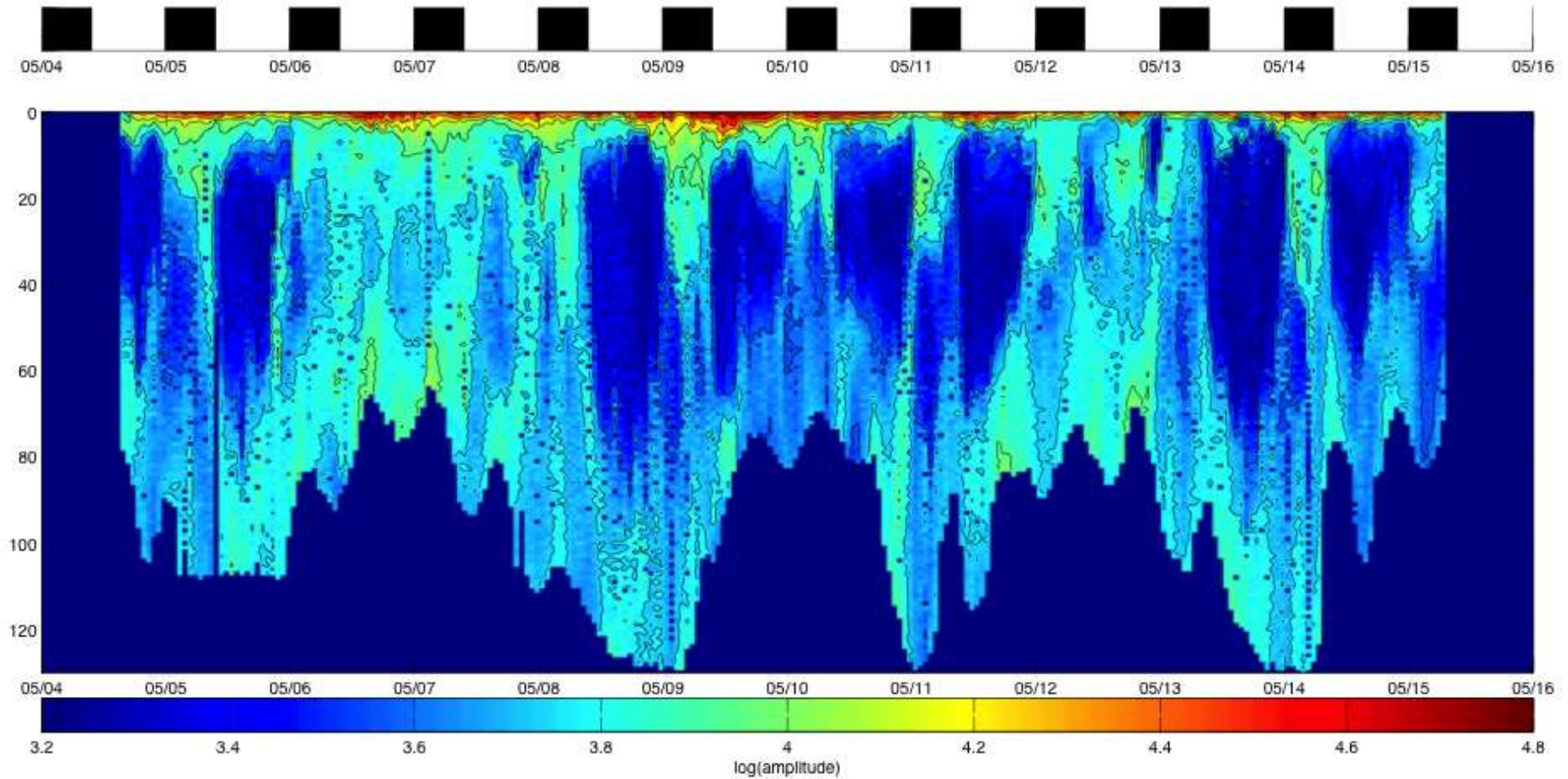
Unreferenced velocity profiles



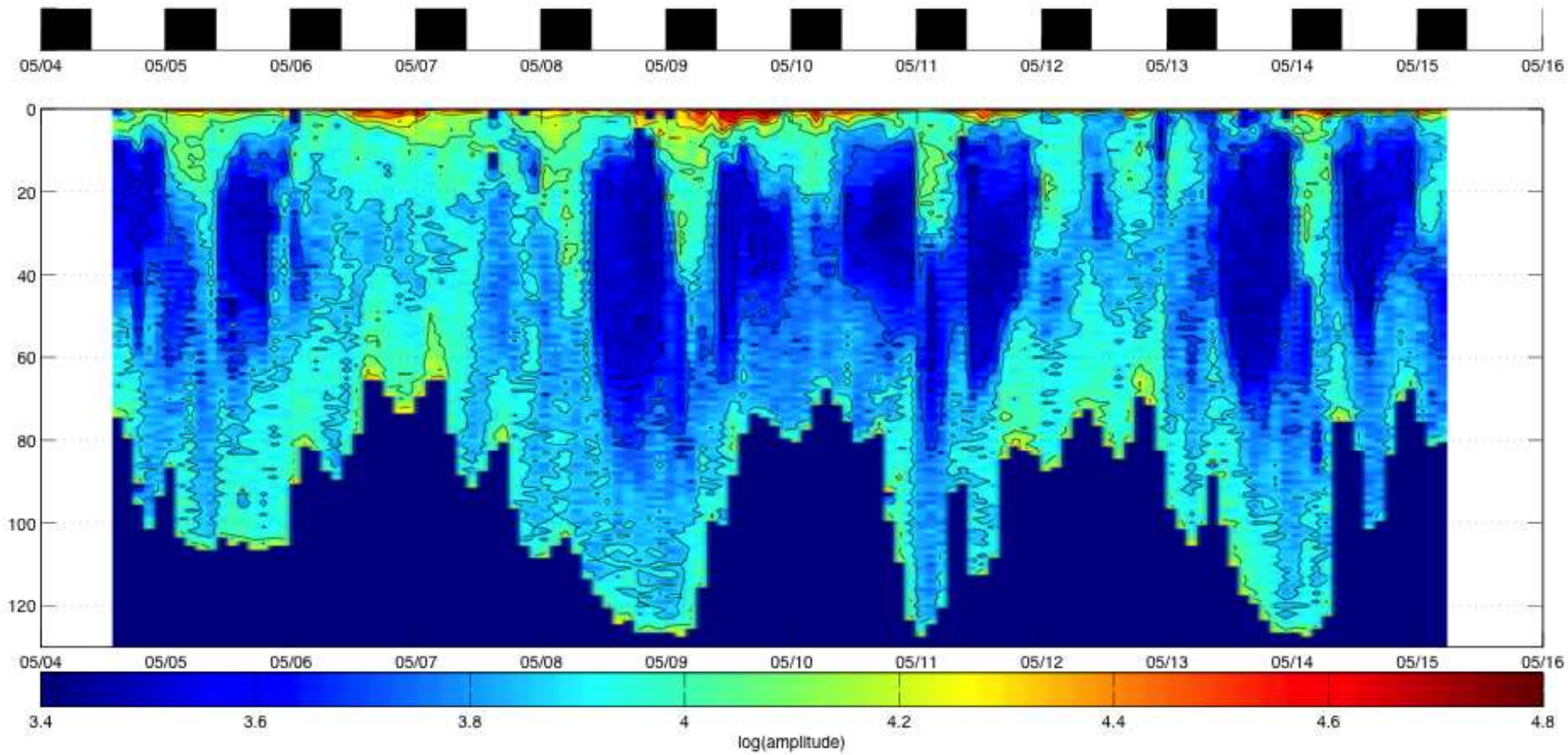
Mean zonal sections



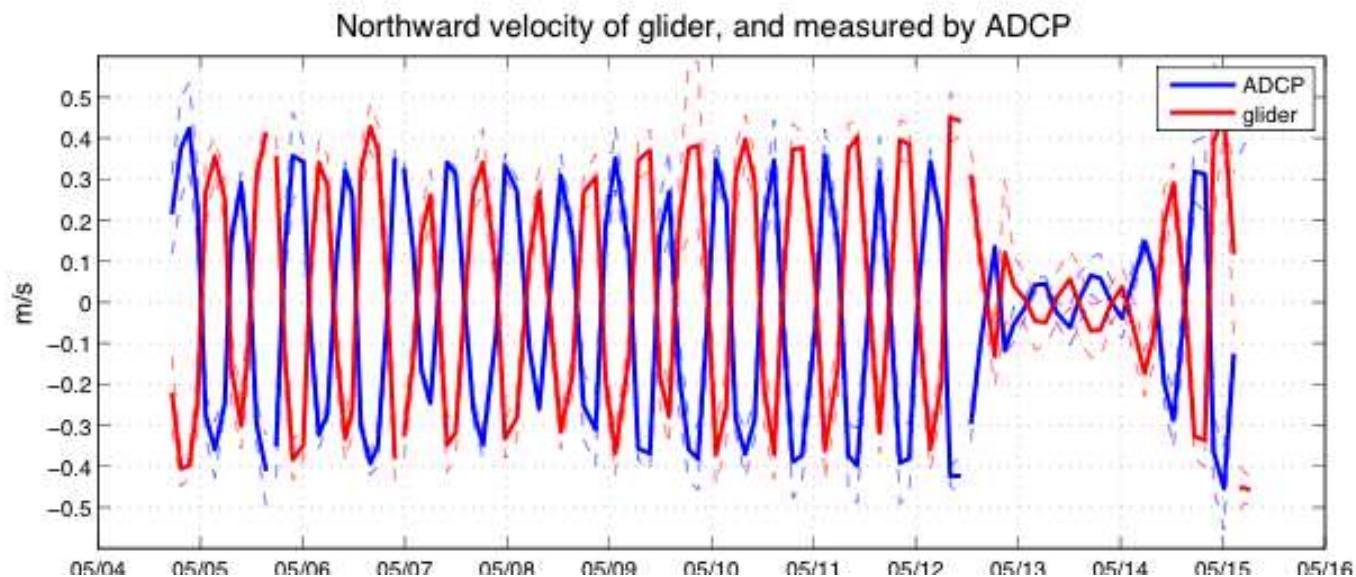
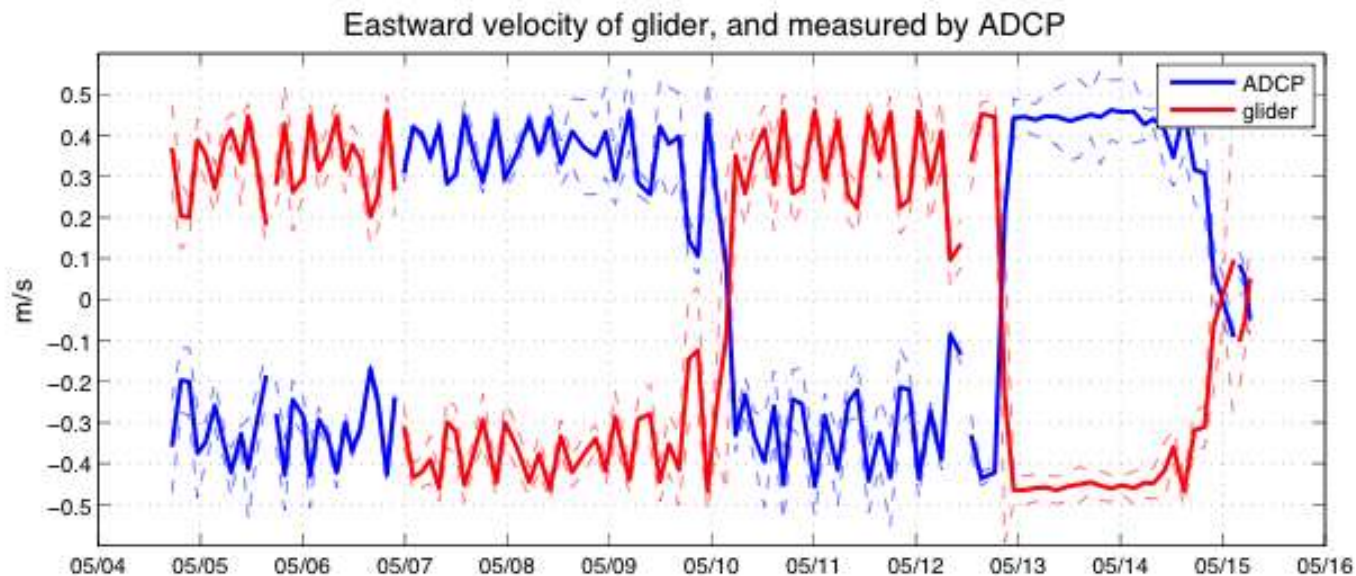
Acoustic Backscatter



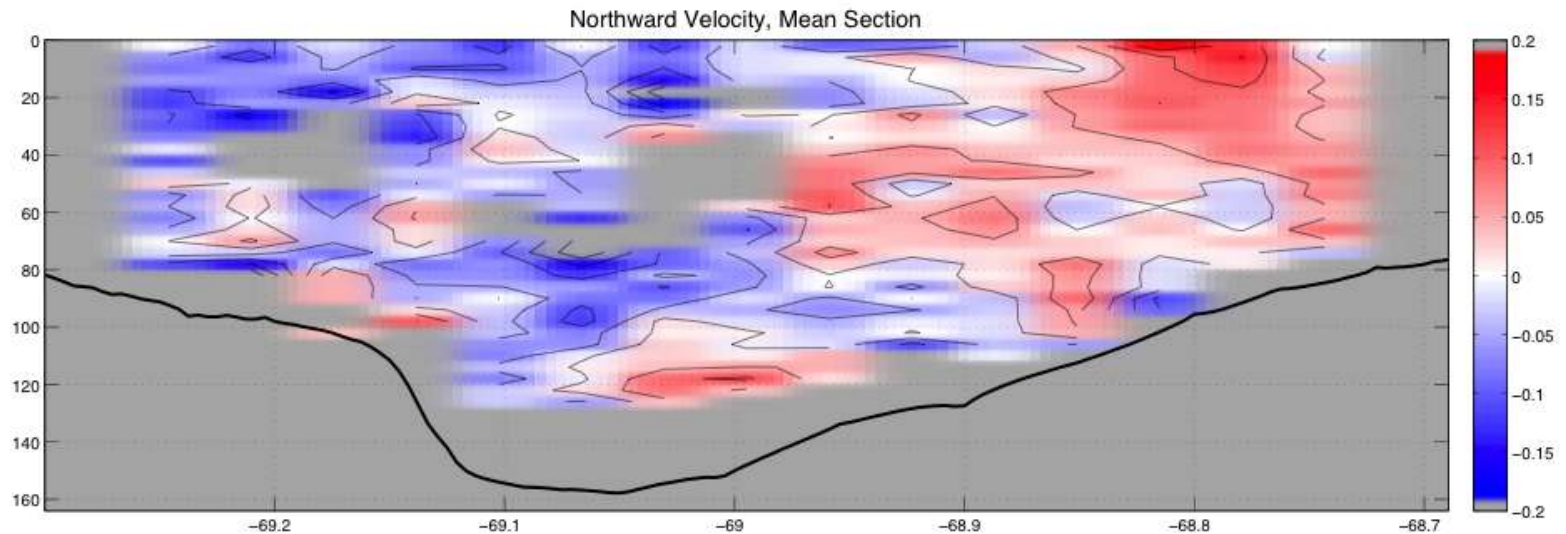
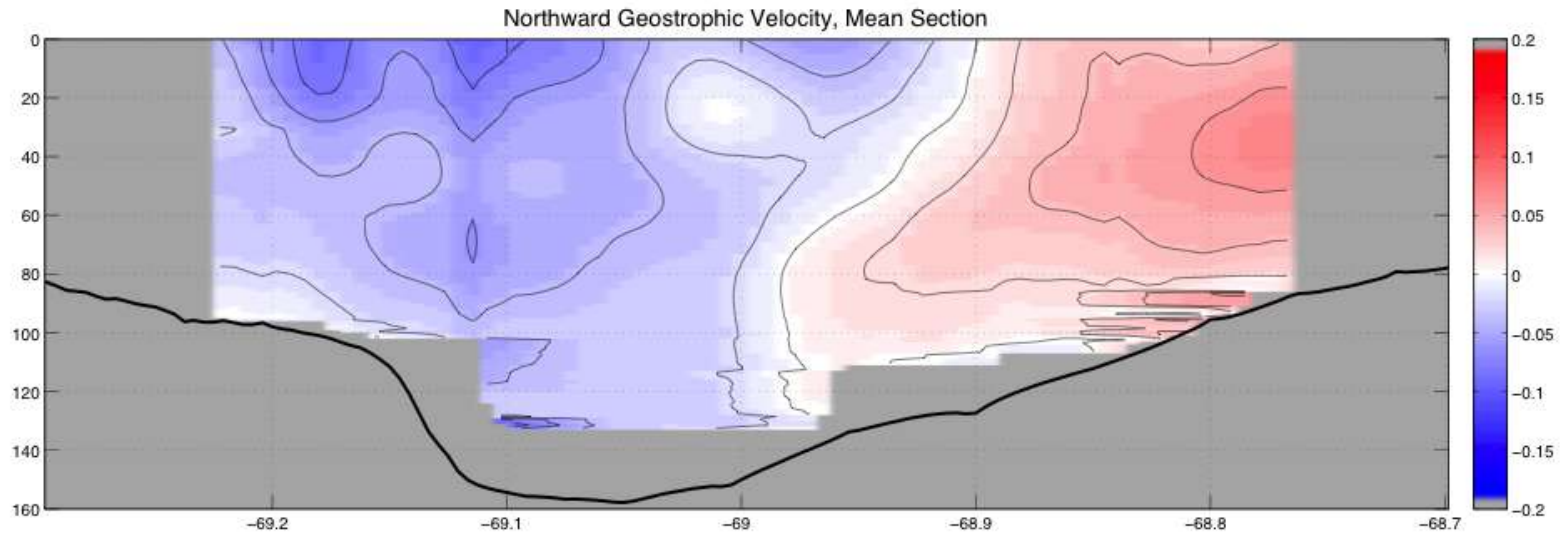
Acoustic Backscatter



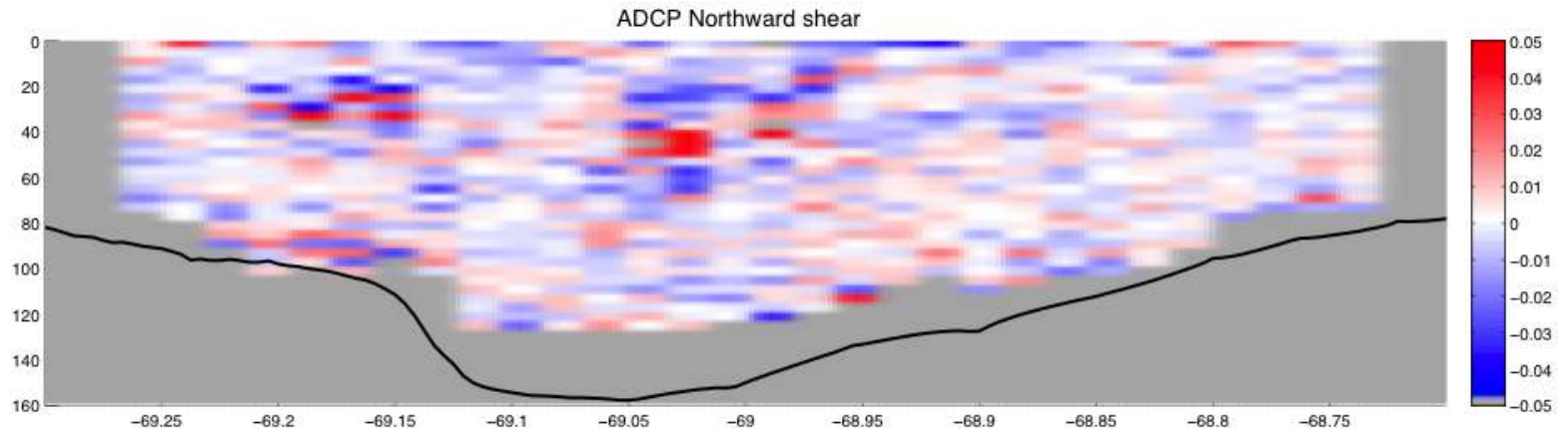
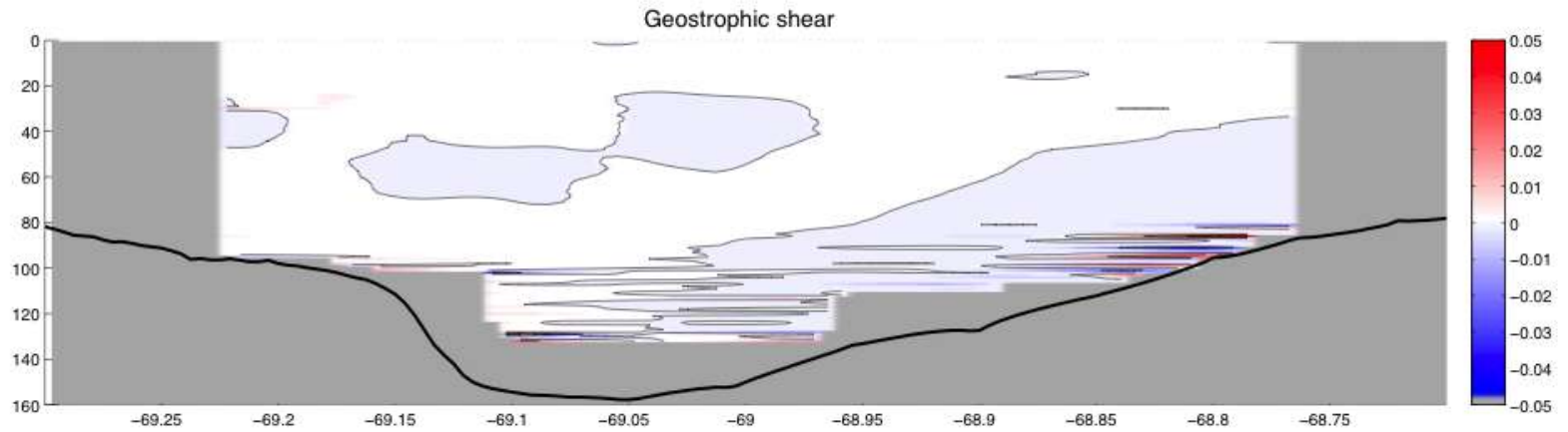
ADCP vs. glider motion



Geostrophic vs. ADCP velocity

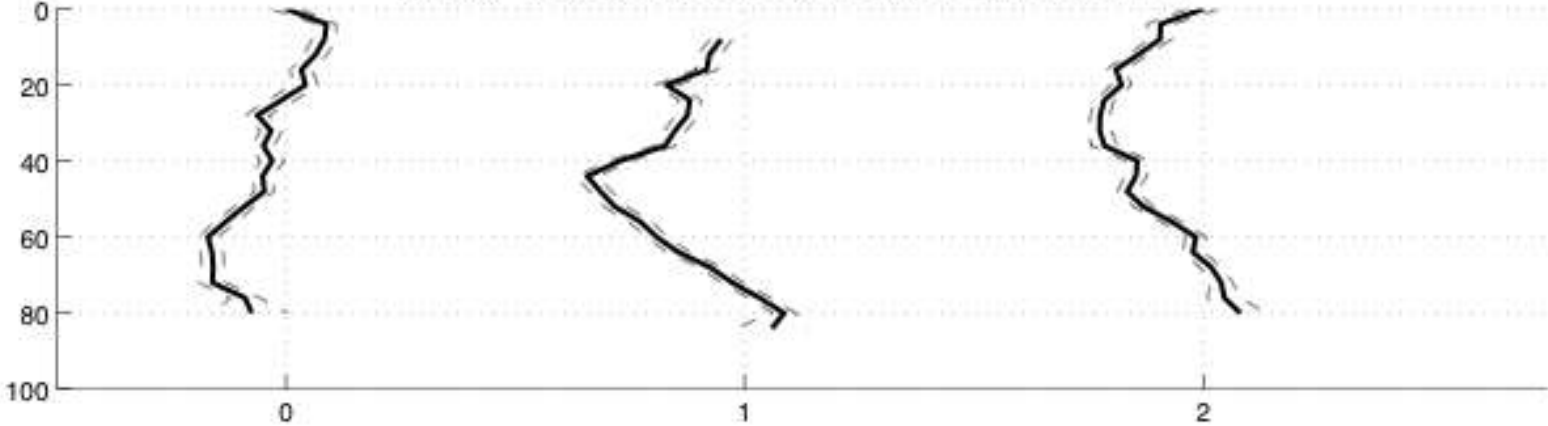


Geostrophic vs ADCP shear

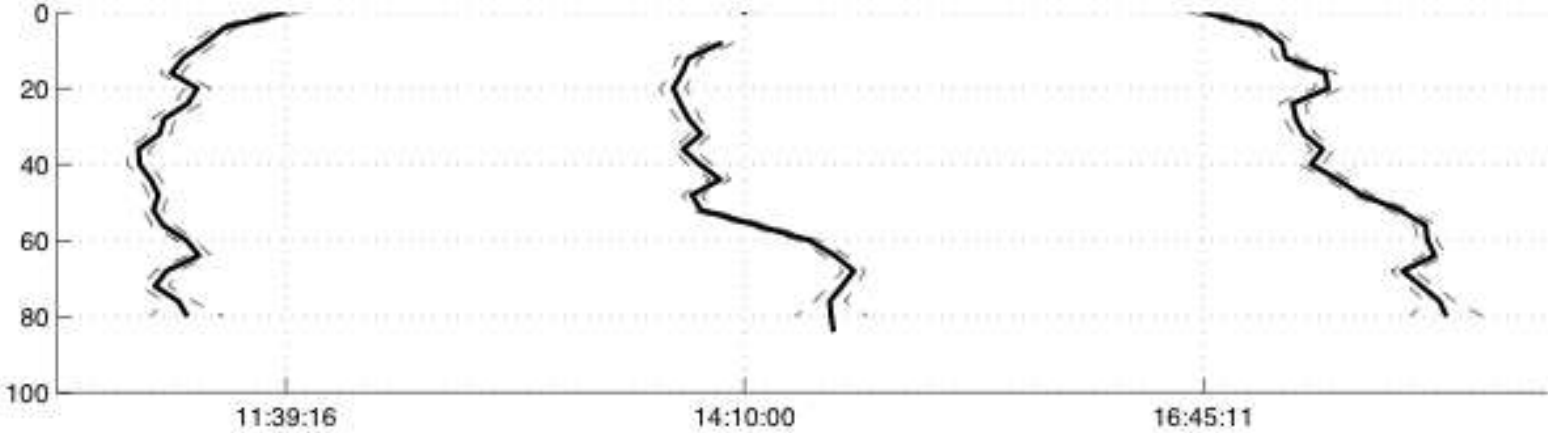


Unreferenced velocity profiles

Along-instrument velocity profiles, unreferenced

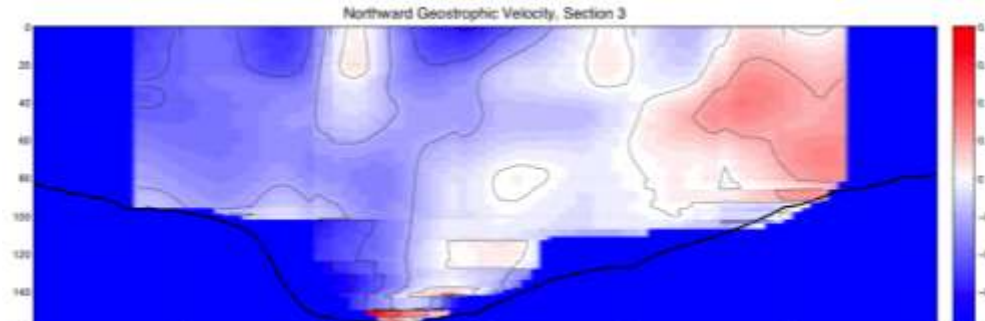


Across-instrument velocity profiles, unreferenced

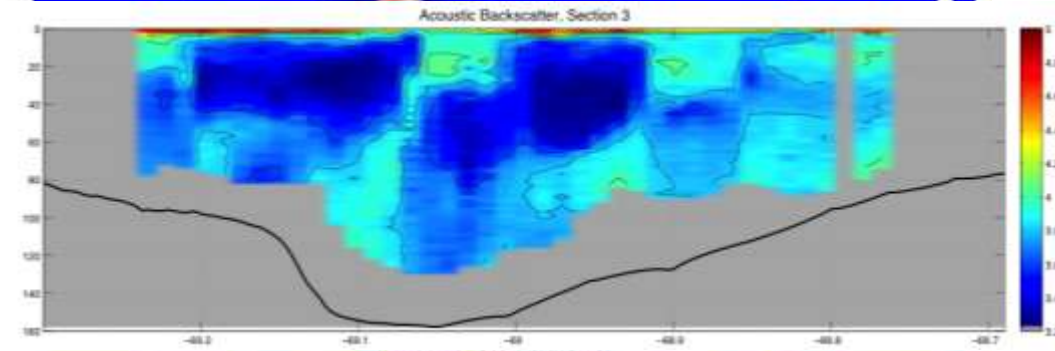


Zonal sections

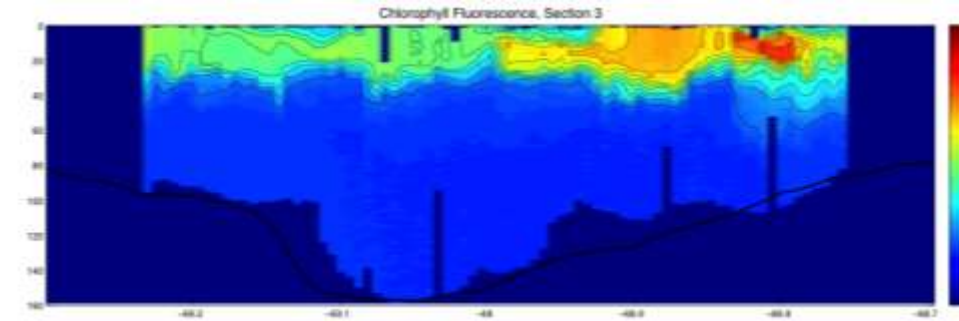
Geostrophic velocity



Acoustic backscatter



Chlorophyll fluorescence



Salinity

