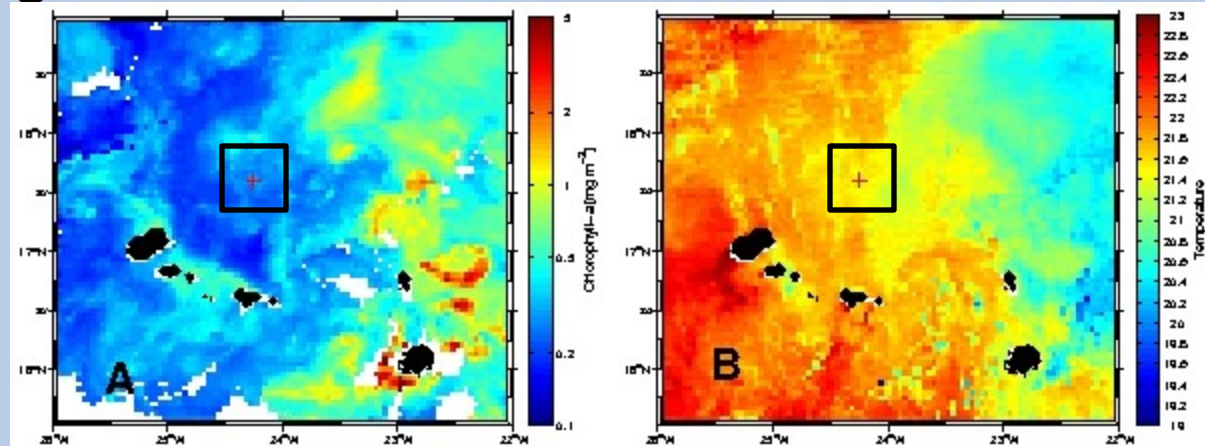


Results from a Glider Swarm Experiment near Cape Verde



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IFM-GEOMAR Kiel/Germany
in collaboration with colleagues from INDP / Cape Verde

- observe the meso- to submesoscale variability near the Tenatso mooring site
- connect glider biogeochemical observations to physical observations and to external forcing (e.g. dust input) to further our understanding of the coupling between the various processes
- make use of the mooring data for intercalibration
- collect experiences conducting an experiment with a group of gliders



'Boundary conditions':

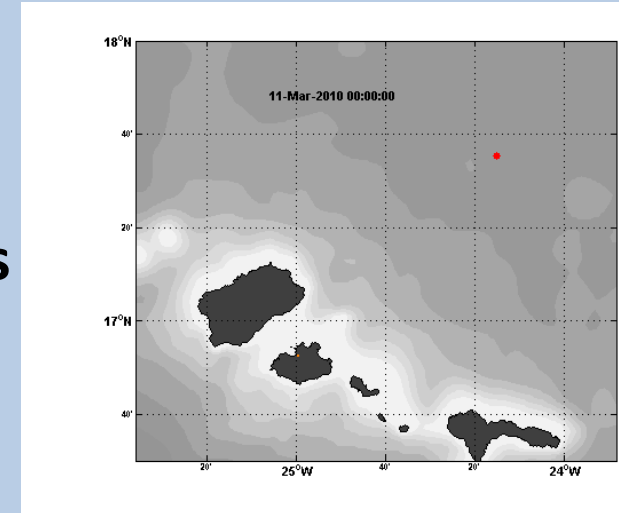
- 6 Slocum gliders using lithium batteries equipped with T, S, O₂, Chl-A, Turb sensors
- observe area 'around' Tenatso mooring

Target:

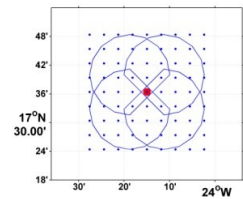
- cover the area as synoptically as possible
- be able to determine covariance length scales
- use regular sampling strategy (not adaptive)

Chosen setup:

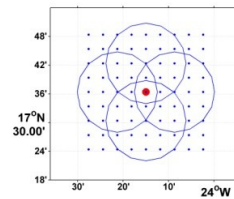
- area of 45 x 45 km for 7 weeks
- pattern optimized to cover area and space/time scales
- 500 m dive depth for deep gliders to increase repeat rate
- deployment location according to sea conditions



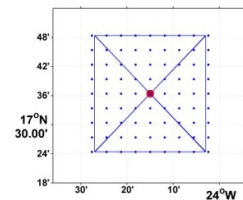
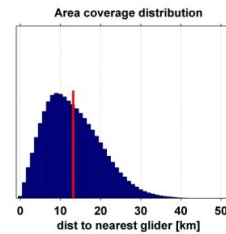
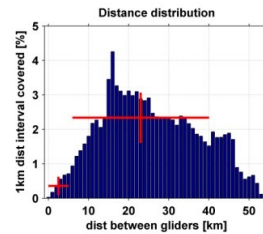
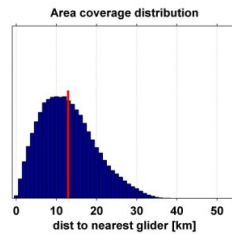
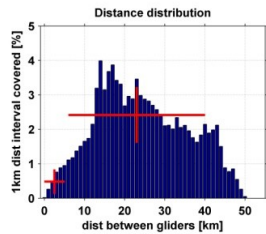
Optimizing the glider tracks



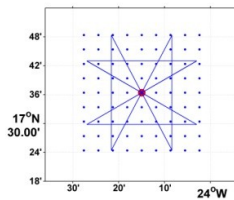
Repeat length : 95.0 km / 1
Repeat duration : 3.8 days / 1
Mean dist to any loc : 12.9 km
6-40km glider distance : 2.4 ± 0.8 %
0-5km glider distance : 0.5 ± 0.4 %



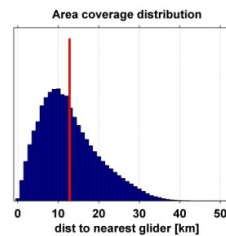
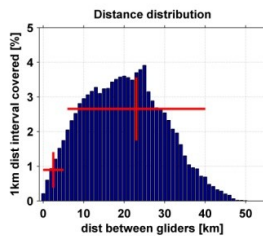
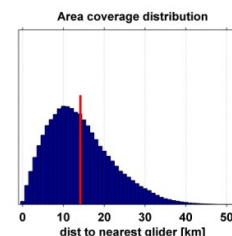
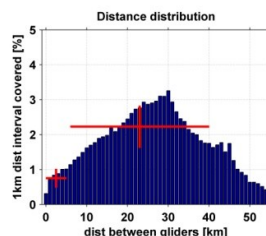
Repeat length : 97.2 km / 1
Repeat duration : 3.9 days / 1
Mean dist to any loc : 13.2 km
6-40km glider distance : 2.3 ± 0.7 %
0-5km glider distance : 0.4 ± 0.3 %



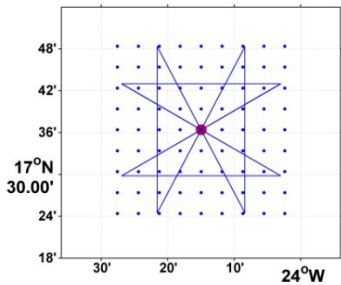
Repeat length : 211.5 km / 2
Repeat duration : 8.5 days / 2
Mean dist to any loc : 14.2 km
6-40km glider distance : 2.2 ± 0.6 %
0-5km glider distance : 0.8 ± 0.3 %



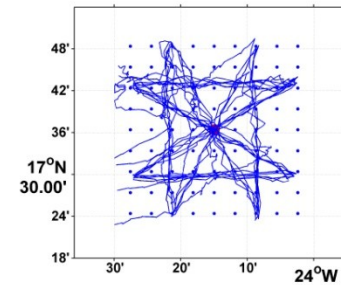
Repeat length : 189.0 km / 2
Repeat duration : 7.6 days / 2
Mean dist to any loc : 12.8 km
6-40km glider distance : 2.7 ± 0.9 %
0-5km glider distance : 0.9 ± 0.5 %



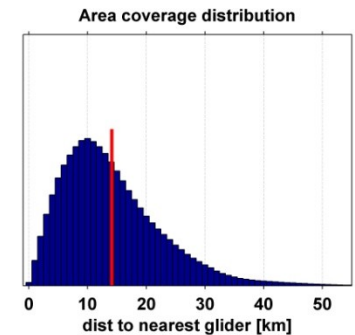
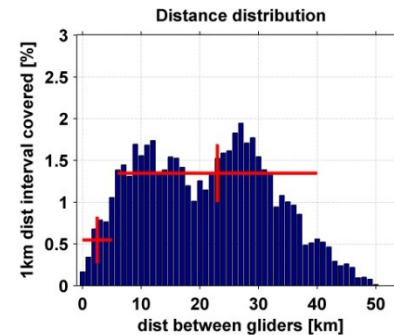
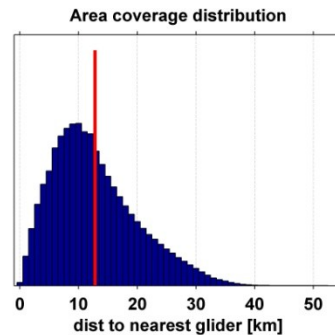
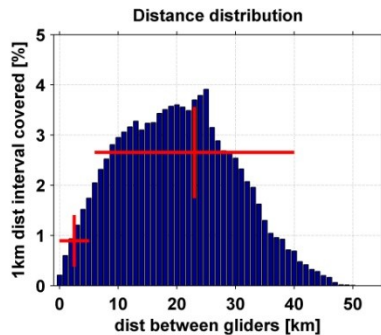
- short repeat time
- even area coverage
- even glider distance distribution
- many mooring passings
- easy steering



Repeat length : 189.0 km / 2
Repeat duration : 7.6 days / 2
Mean dist to any loc : 12.8 km
6-40km glider distance : 2.7 ± 0.9 %
0-5km glider distance : 0.9 ± 0.5 %

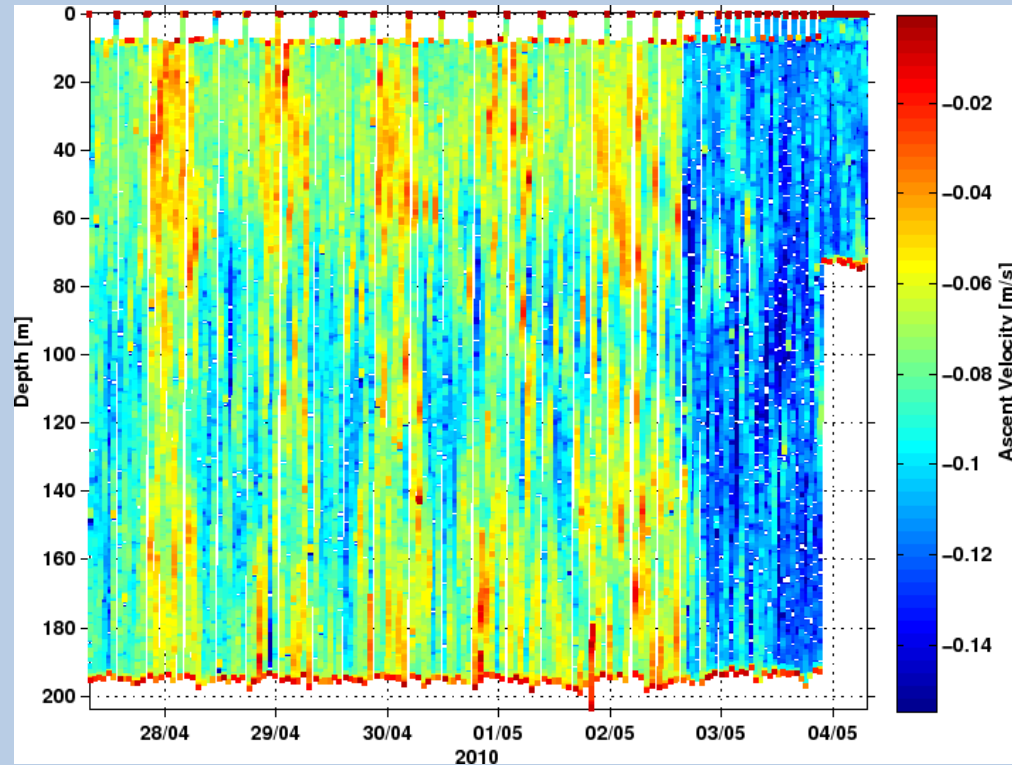


Mean dist to any loc : 14.1 km
6-40km glider distance : 1.3 ± 0.3 %
0-5km glider distance : 0.5 ± 0.3 %

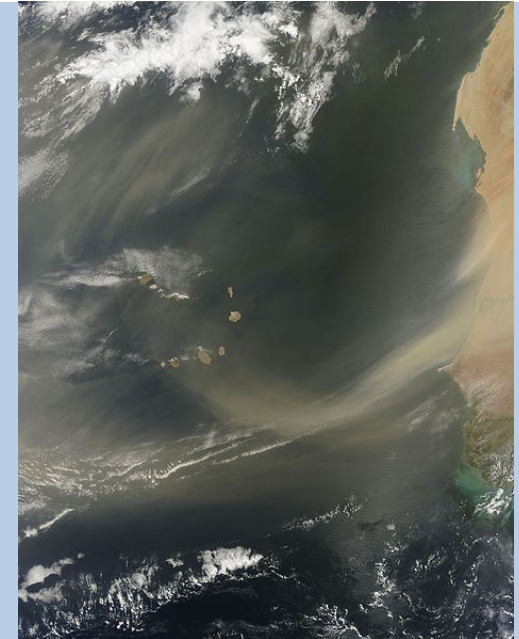
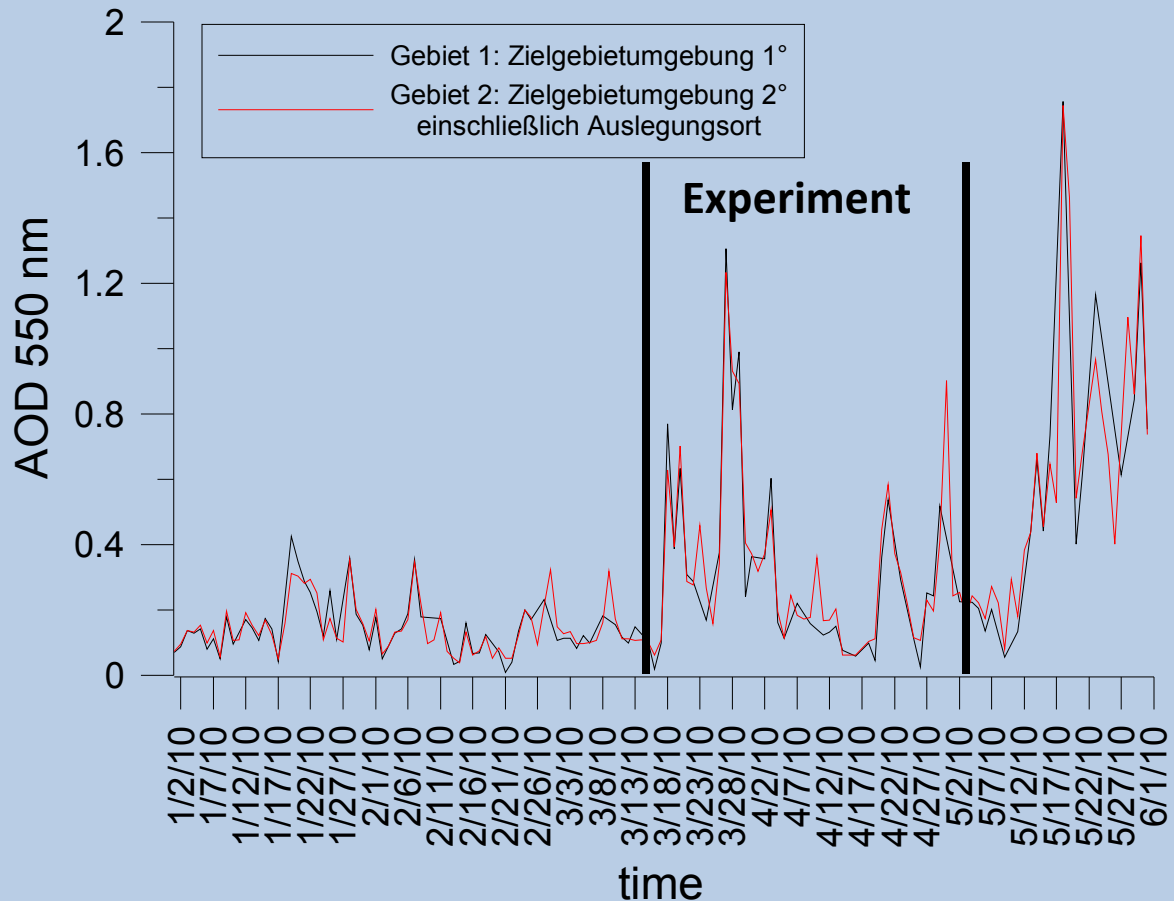


- designed tracks were largely followed
- biofouling led to significant drop in speed in second half leading to a near-loss of steerability
- some sensors were also adversely affected by biofouling

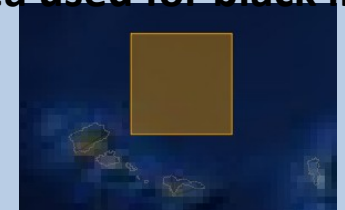
unexpected effects of biofouling: a diurnal cycle in the glider's vertical velocities



Aerosol optical thickness at 550 nm



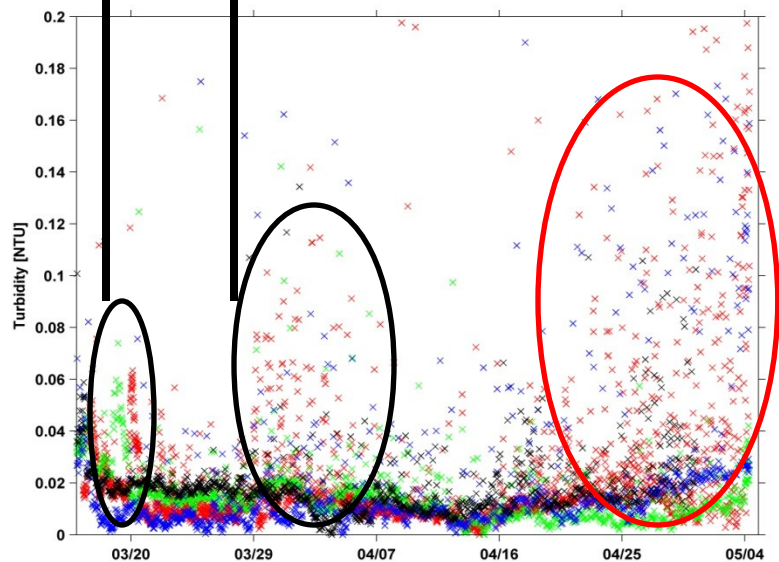
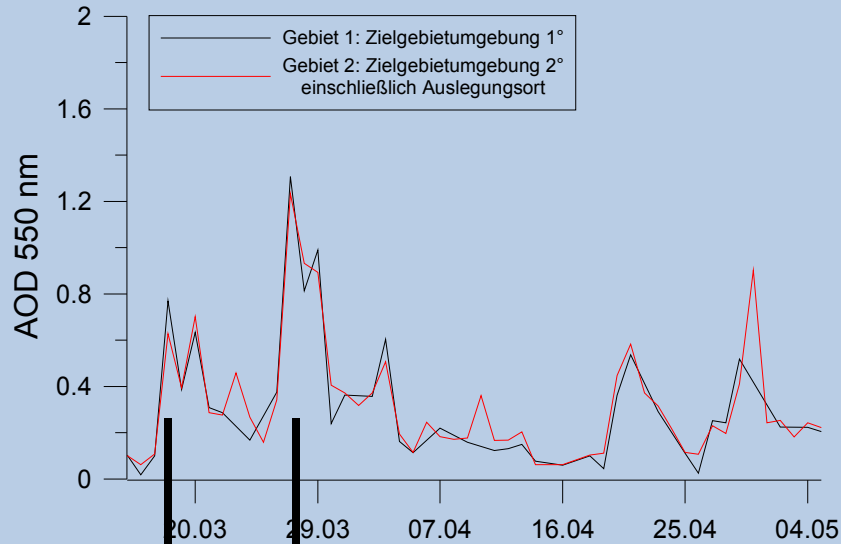
Area used for black line



Area used for red line



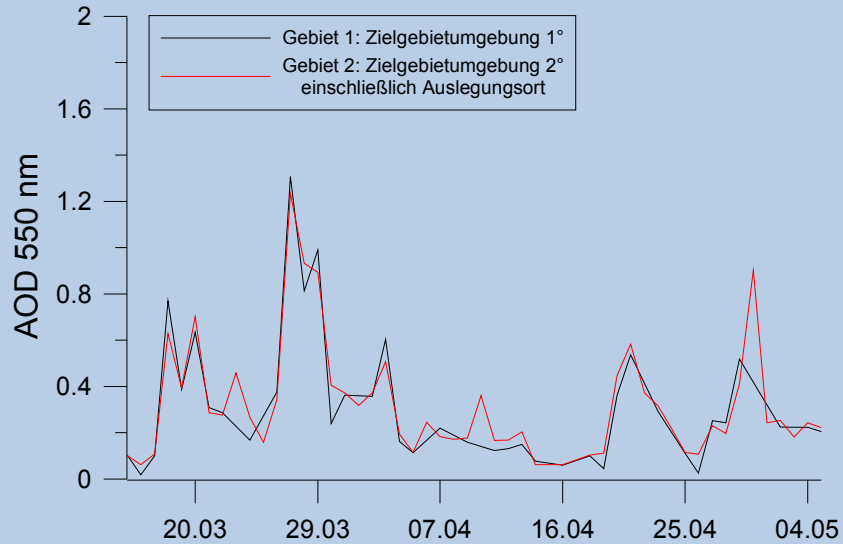
Dust from Aqua Modis and turbidity from gliders



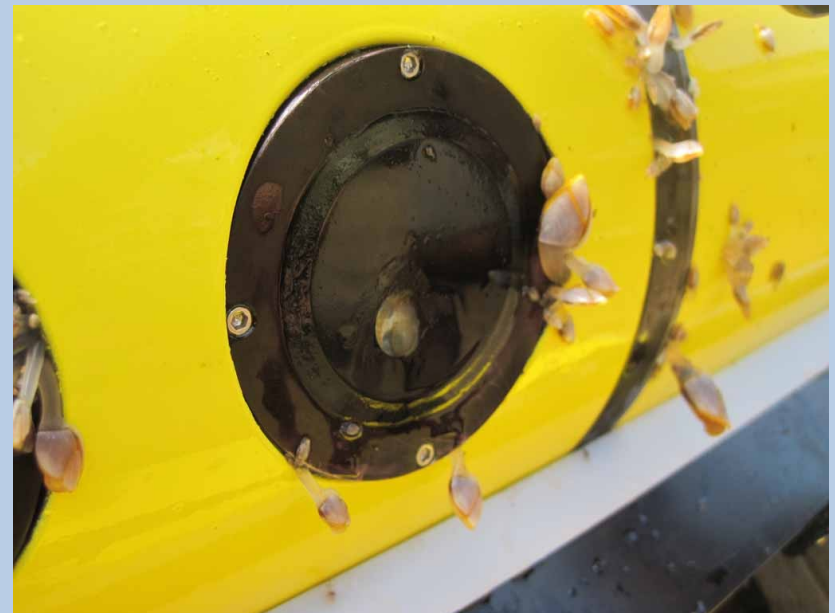
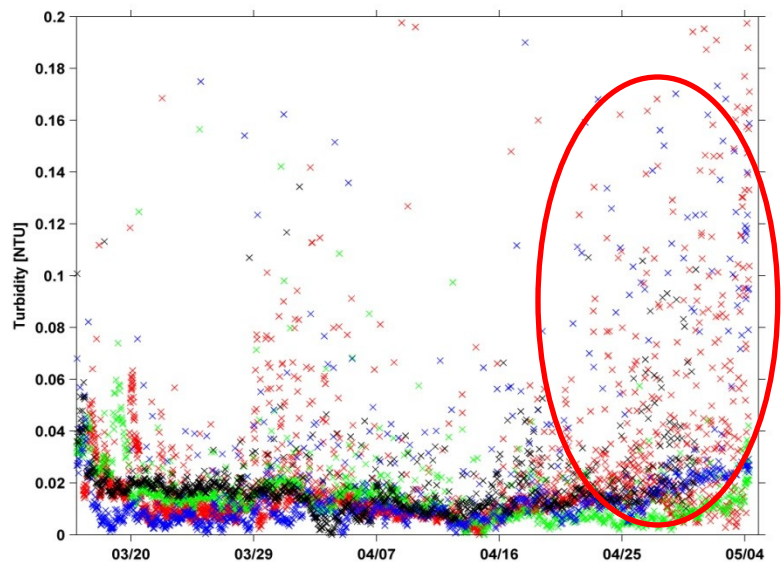
- Several dust events were observed during the experiment.
- The first two events appear to correlate to some (?) of the (nearly) unprocessed glider turbidity data.
- During the last third of the experiment the data gets noisy again because of biofouling.

upper 50 m average turbidity

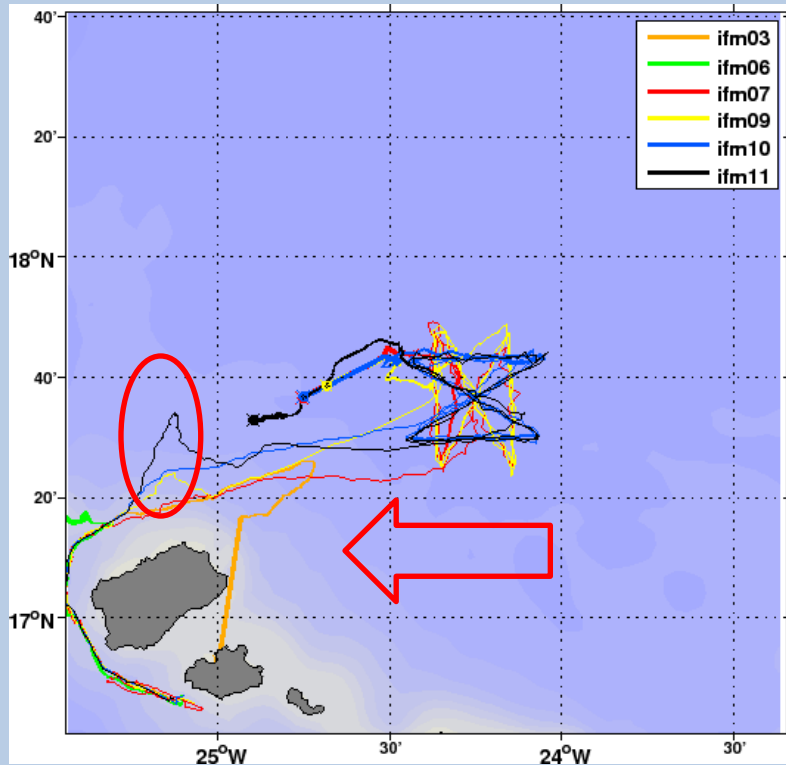
Dust from Aqua Modis and turbidity from gliders



- **Likely culprits for the noisy data towards the end of the experiment are biofouling on the sensor or fish near the sensor.**

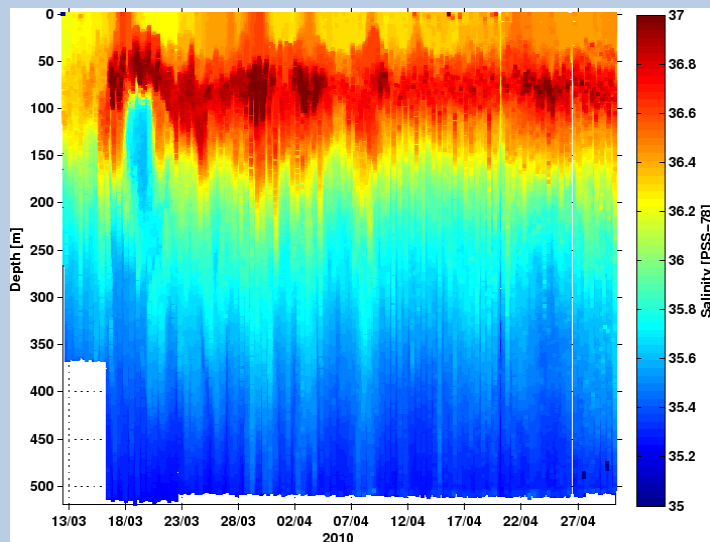
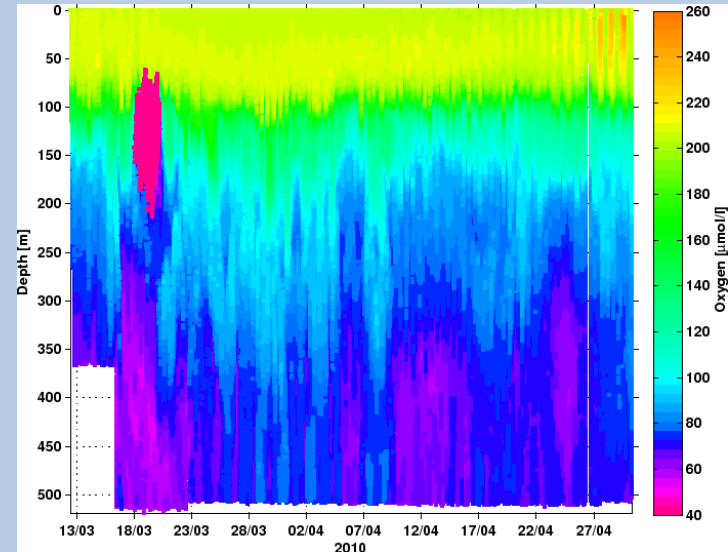
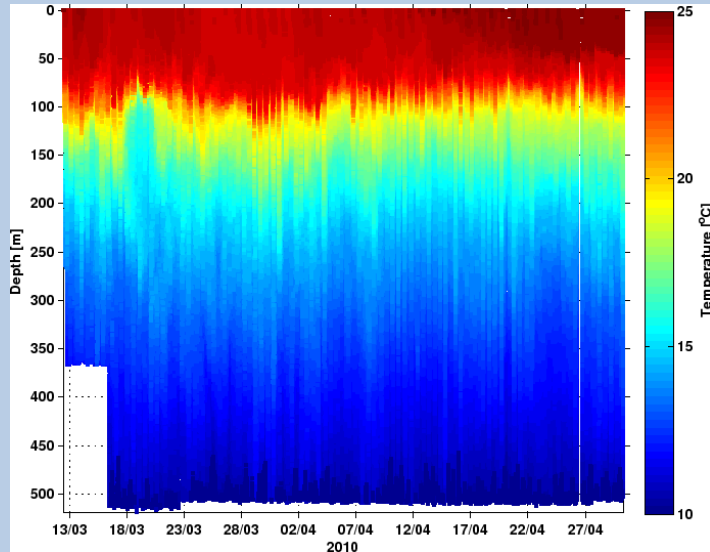


A chance discovery during a detour

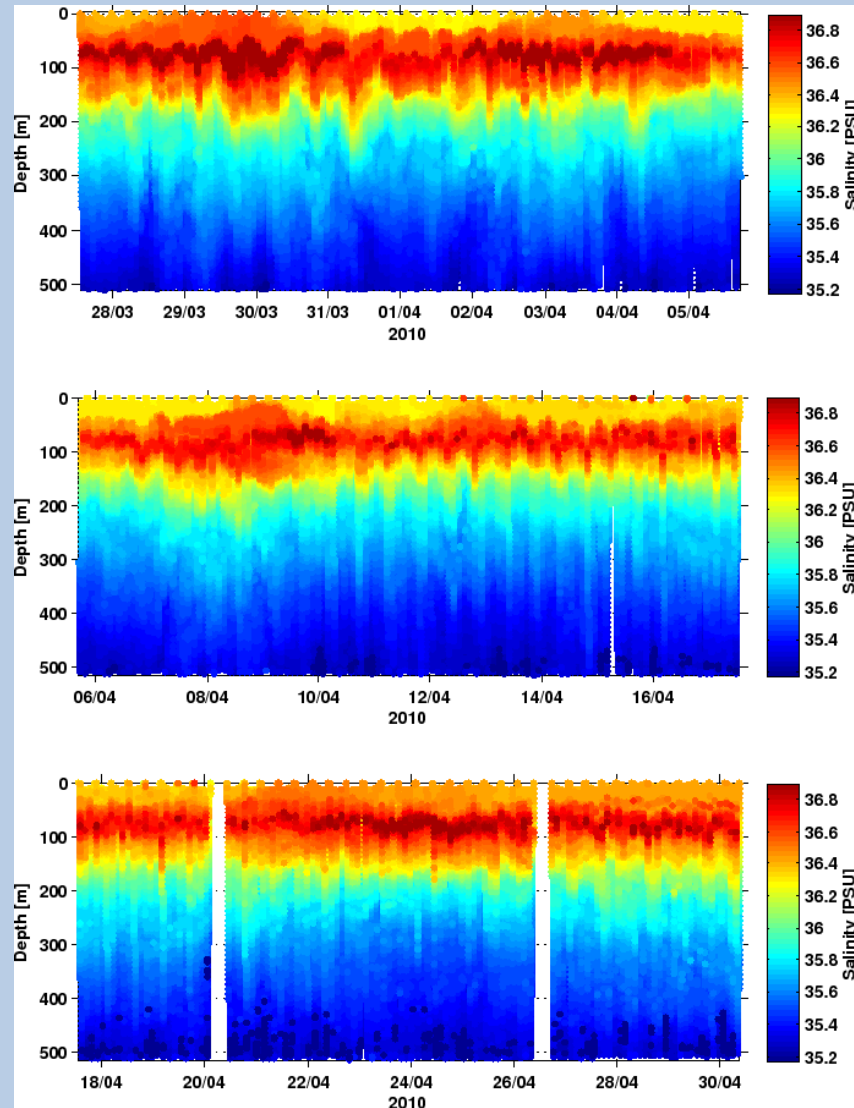


- Background current in the area is generally westward with a slight intensification near the islands
- To evade this current we steered ifm11 on a more northerly course towards the experiment area
- The new course led us directly into a subsurface eddy

A chance discovery during a detour



- The (uncalibrated) oxygen concentrations in this eddy are extremely low for this region.
- It is unclear where this watermass comes from.



- Shown are 3 repeat cycles of the track pattern by glider ifm11.
- Variability is found on various temporal and spatial scales.
- Phases with strong internal wave activity alternate with more quiet times.
- Mesoscale changes appear to drift by with the background current.

- In spring 2010 we conducted a 7 week long experiment north of Cape Verde employing 6 Slocum gliders.
- The experiment was designed to observe the submeso- and mesoscale variability near the Tenatso mooring site.
- The experiment plan was executed successfully with some setbacks mainly stemming from very strong biofouling.
- Nevertheless the collected data (3000 profiles, 3800km) exhibit a wealth of variability on various temporal and spatial scales.
- **Could we collect 'promising' practice against biofouling ?**

Results from a Glider Swarm Experiment near Cape Verde



All photographs courtesy of M. Müller