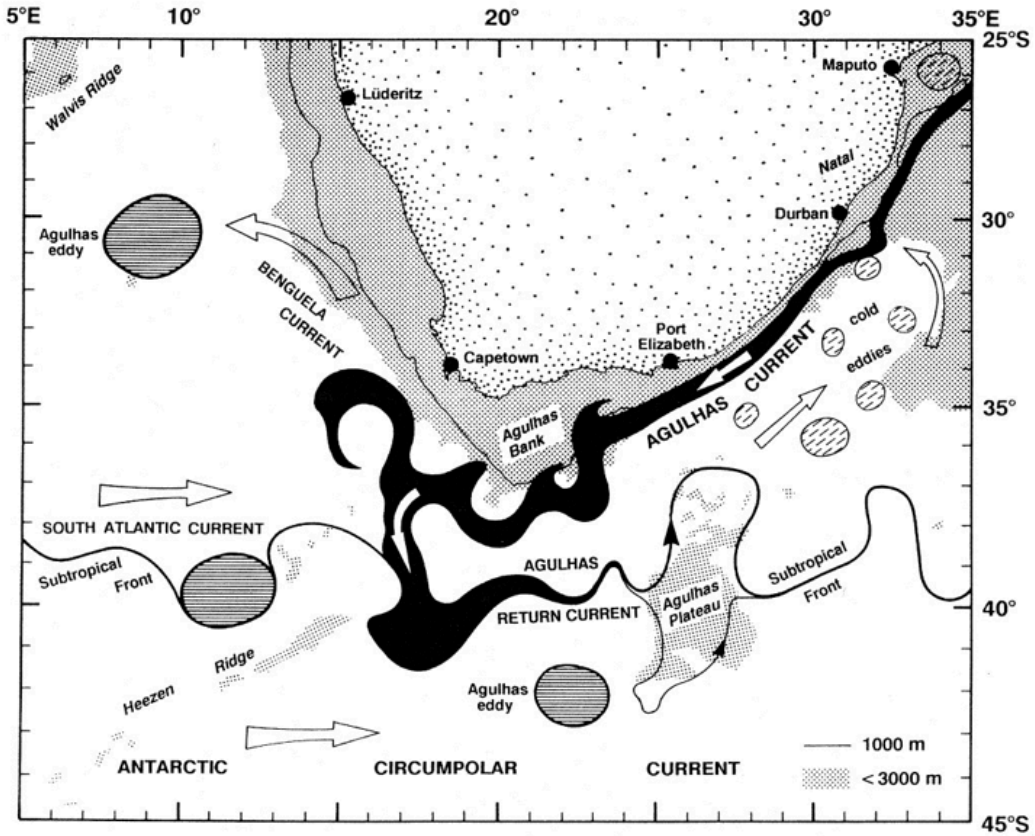
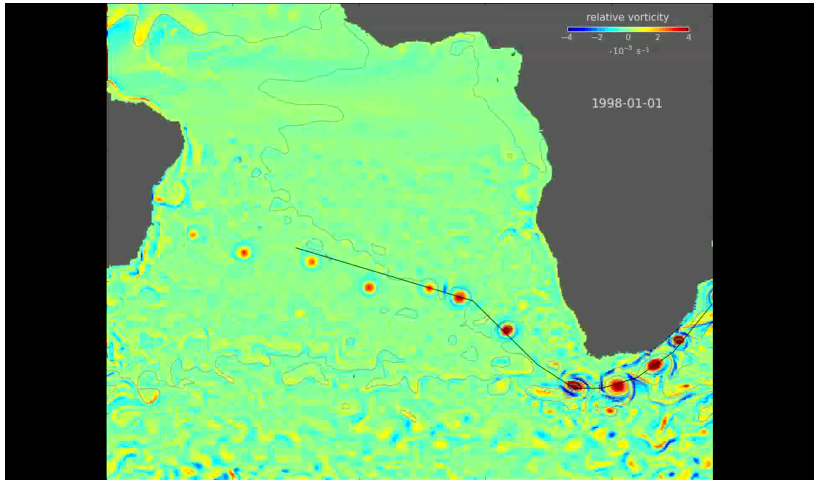
ECCO2 Agulhas – Bio (in eddies), nesting (resolution) + some physics (retroflection) along the way.

Chris, Oliver, Sheekela



Peterson and Stramma, 1991



Relative vorticity in cube84, c510 solution. Agulhas rings very pronounced and resilient.

➔Interesting for looking at bio in rings/eddies.

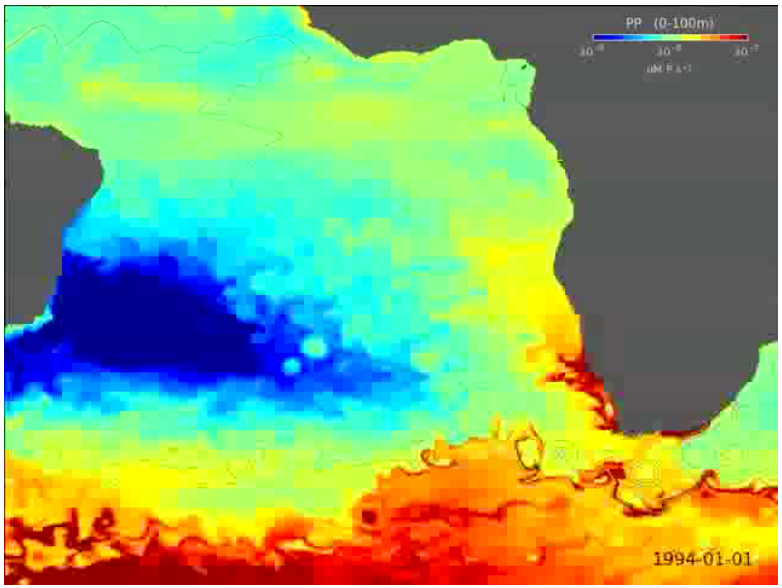
➔A little bit unphysical in vigor and stability?

ECCO2 Agulhas – biology

Embedded eco-system model with 78 virtual species concentrations (each with a different physiology) that compete for shared nutrients and are advected by flow.

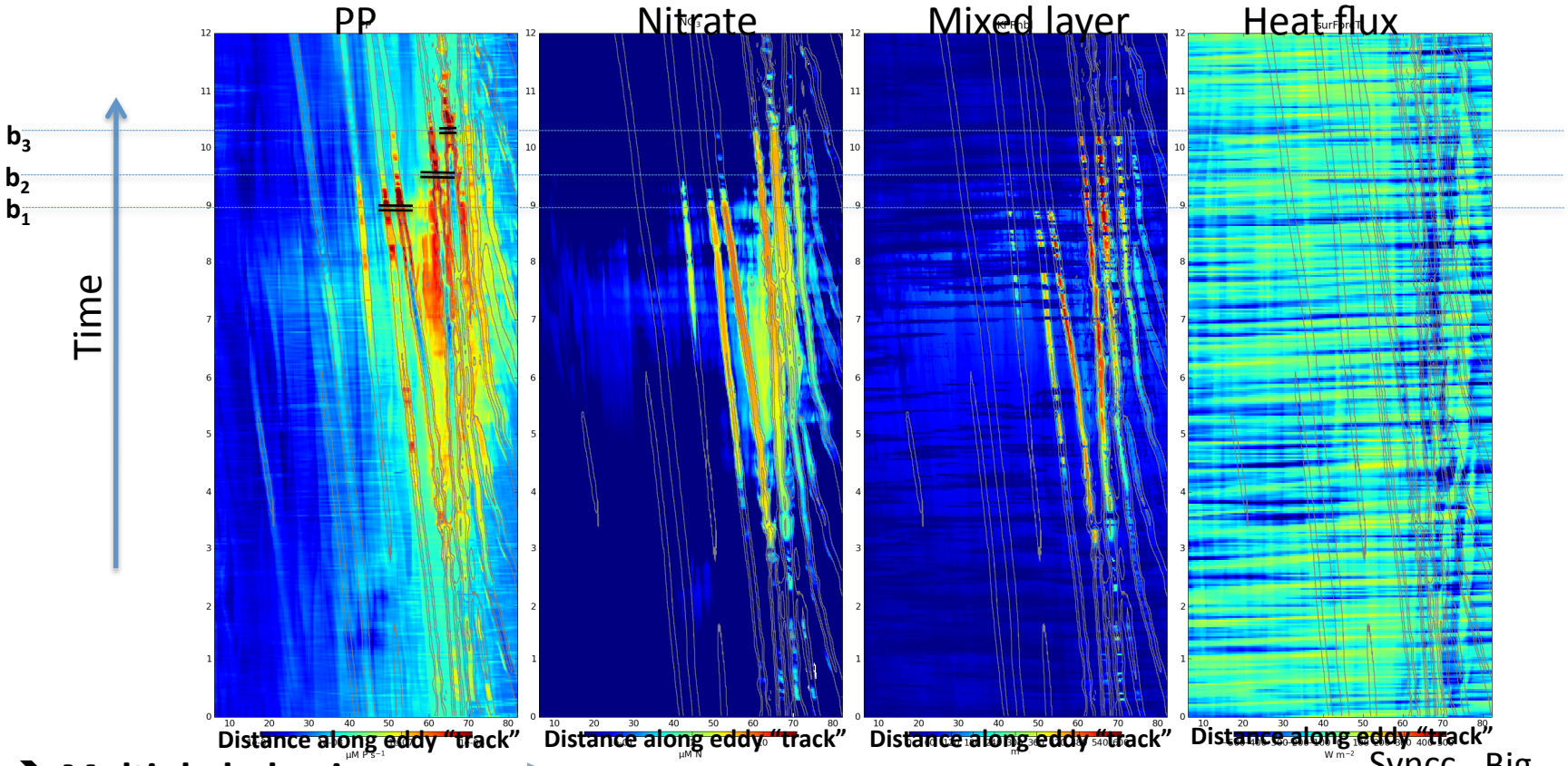
Eddies induce both high and low productivity in their core. Within eddy alternation between nucleus of high productivity (lots of stuff growing) and low productivity (low growth) relative to surroundings.

We are examining when and why eddy productivity is high/low. To do this we have been following eddies along a track and looking at covariance of physics and biology over time. This has also led us to look at eddies in the Agulhas region.



Primary productivity from Darwin (Follows et. al) ecosystem model embedded in cube84 (94-99).

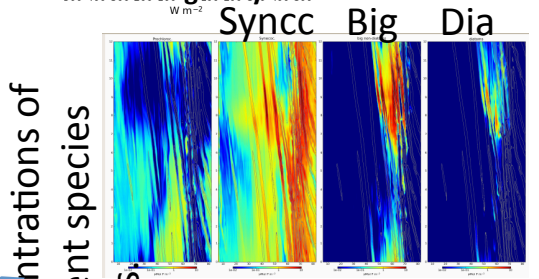
ECCO2 Agulhas – biology interaction with eddies and forcing – along AG eddy "track" Hofmullers.



➔ **<u>Multiple behaviors:</u>**

e.g. b1, b3 eddy blooms have low nitrate, shallow mixed layer; but, b2 has high nitrate, deeper mixed layer.

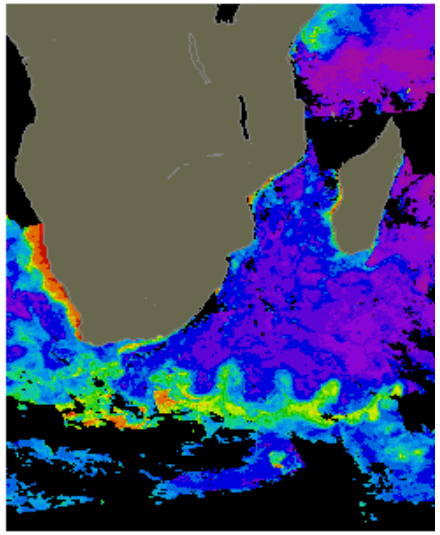
Storms bring up nutrients in eddy core, but also transport biology away from optimum photosynthetic zone ➔ growth at eddy rim. Can examine this balance for PP and species.



Can we relate ocean color plus eddy field to some aspects of species mix?

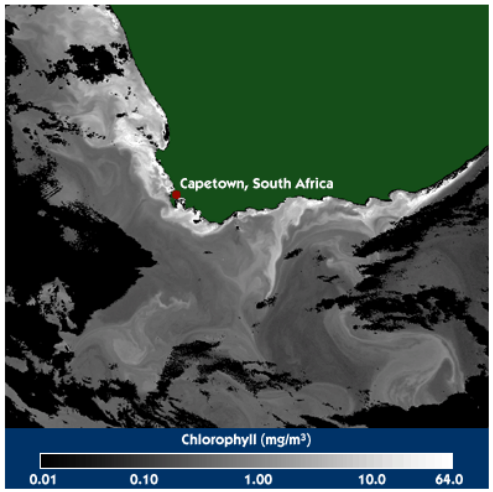
Physical - The Agulhas region from obs

- Southern hemisphere, Indian Ocean “gulf stream”.
- Sheds warm salty eddies into North Atlantic
  - possible impacts on meridional overturning e.g. Biastoch - model, 2008 (and also Bugnion - model et. al [uncoupled only], Gordon and colleagues - obs).
- Current **retroflects** (turns around toward Australia) so that eddies don’t all enter North Atlantic (in the real ocean).
- Different water masses, jets, coherent rings, coastal dynamics in the Agulhas region create host of “micro-climates” for biology.



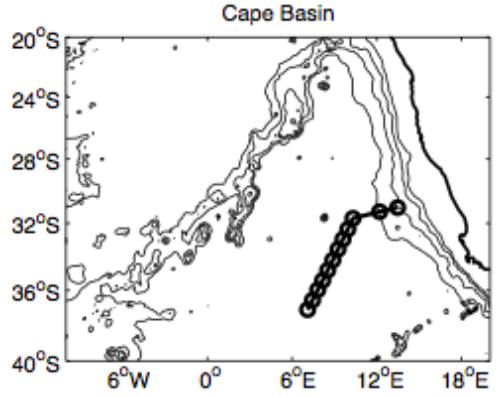
CZCS color

Seawifs chlorophyll

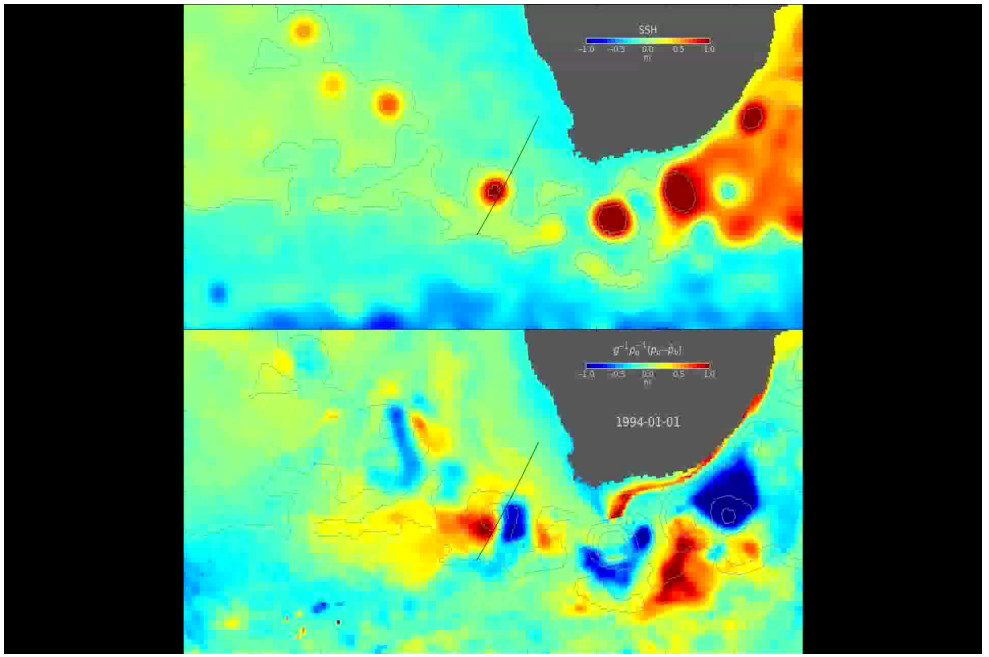


+altimetry

ASSTEX PIES mooring observations in addition to remote sensing.



CS510 cube84 Agulhas physical

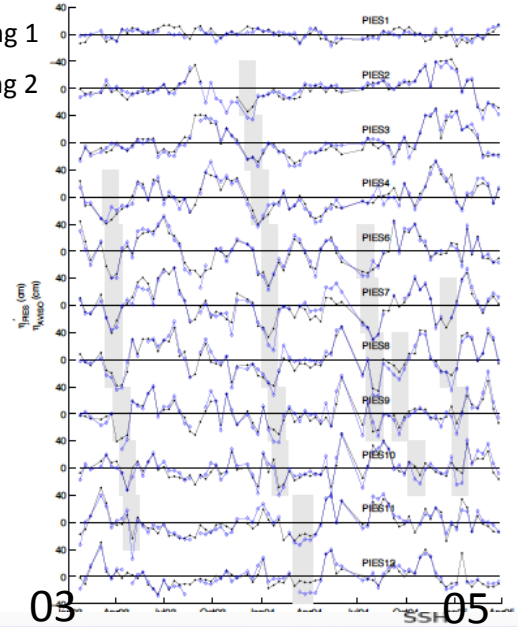


Mooring 1

Mooring 2

etc….

~1m

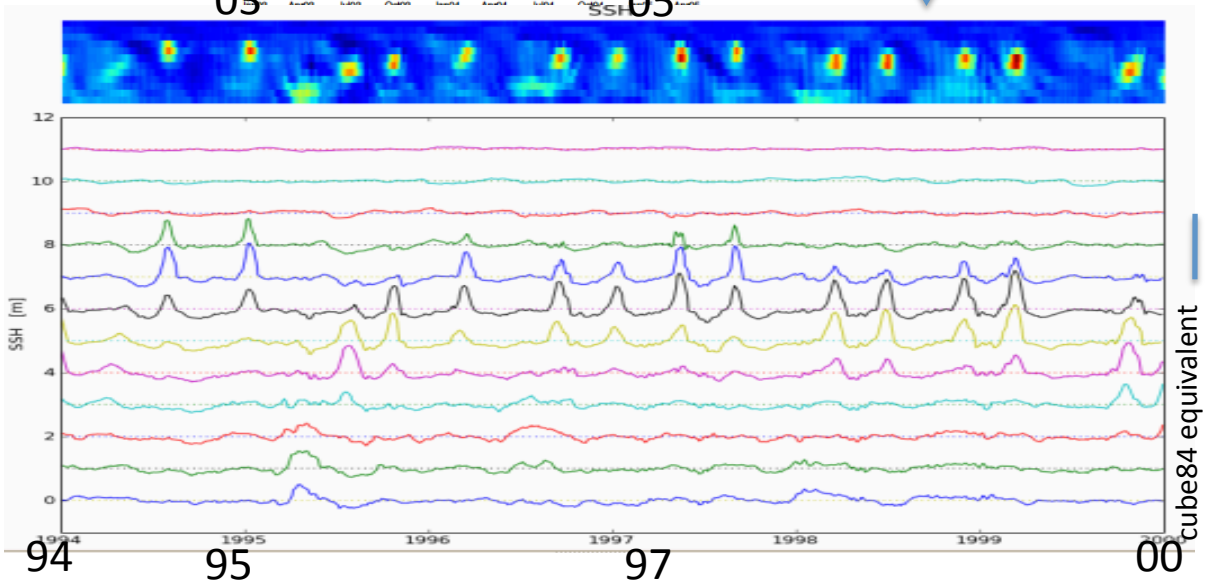


Baker-Yeboah, S., 2008: PhD Thesis

obs ssh(t), different t!

cube84

03 05



~2m

cube84 equivalent locations.

94 95 97 00

Sea-surface height (top) and bottom pressure anomaly bottom. ASTTEX array line shown. Animation and ASTTEX deployment period do not overlap!

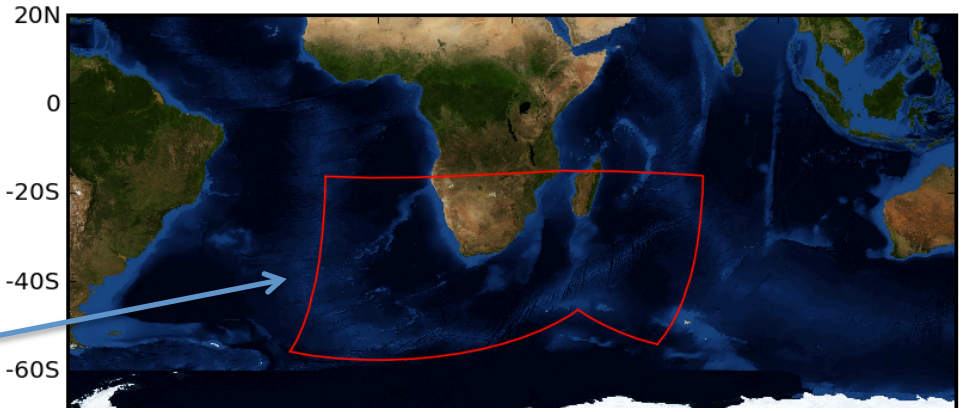
- Amplitude, similar
- Higher-temp and spatial freq in ASTTEX (duh!).
- Similar vertical slope – i.e. Pb leads slightly.

➔ How much are diffs affected by resolution

Agulhas 4km horiz-res cut-out – can we make eddy stats *even* (☺) more like altimeter and array obs.

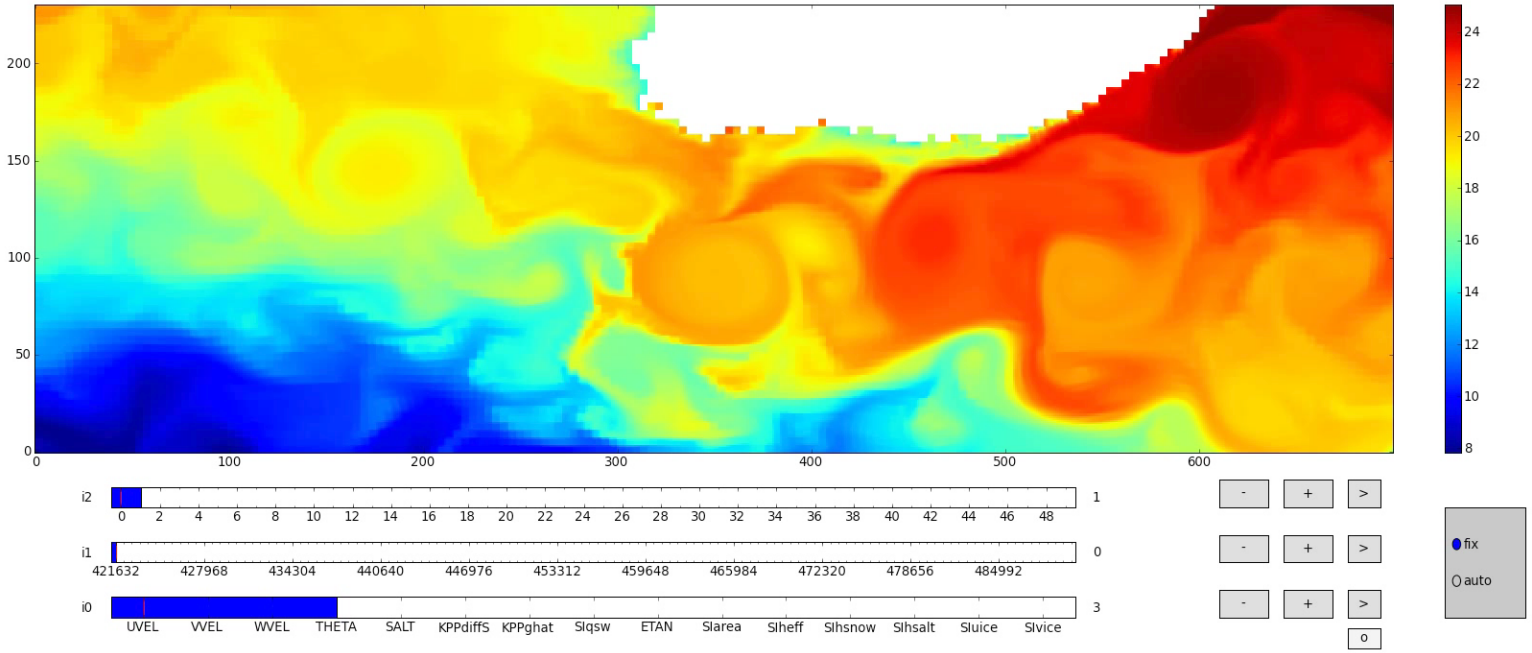
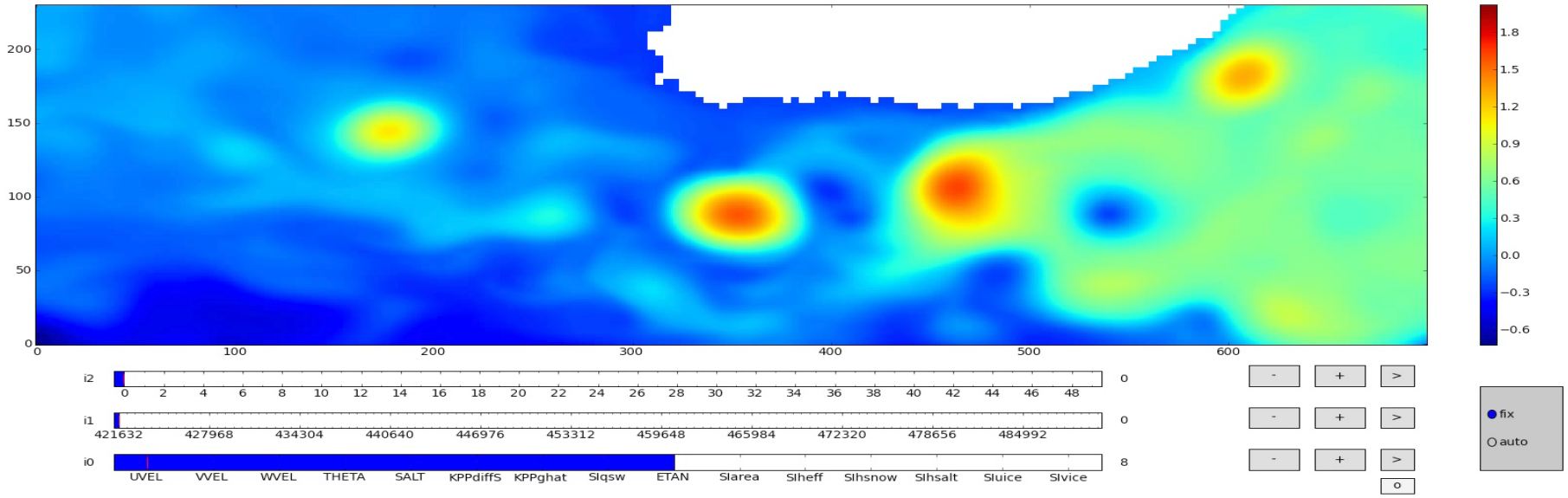
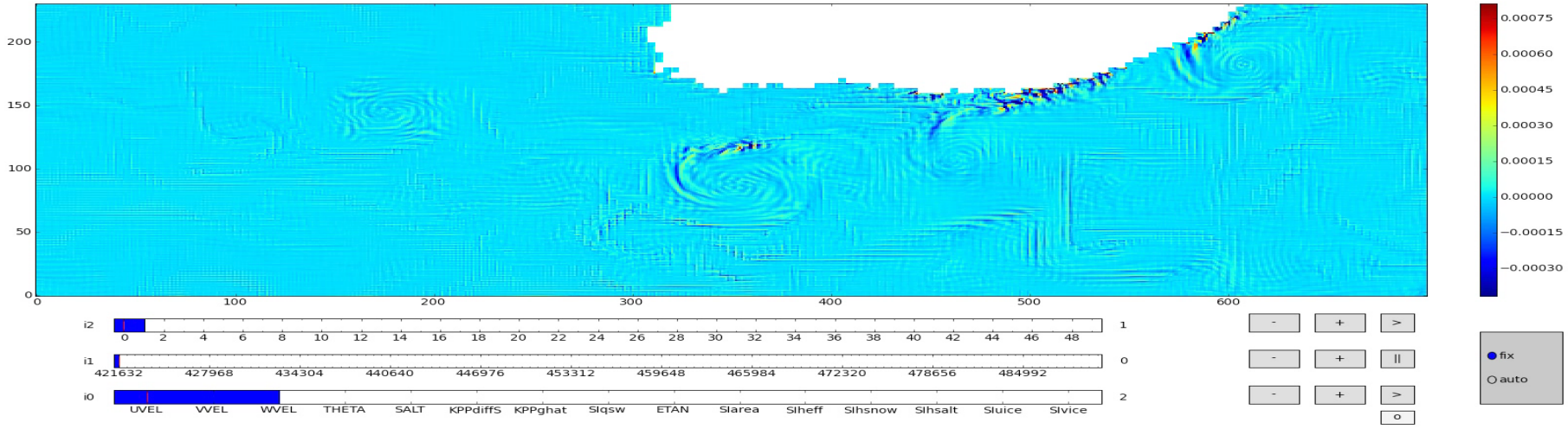
- Altimeter - enhanced retroflection, reduced strength of vortices shed into Atlantic
- ASTTEX - higher temporal frequencies in eddy stats over mooring.
- What impact on biogeography and productivity "dynamics".

➔ Higher res limited area driven from cube84 bcs.



Cape region SST in 4km res cutout run. 0-120 days (more on the way), nice overshoot of AC..

Can imagine more tendency to retroflect – maybe.



Output from 4km two year period should be available shortly (meantime can look at SSH and W.