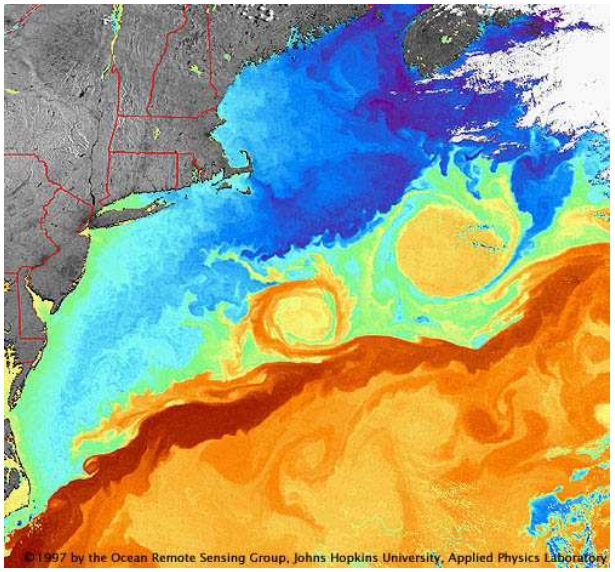
The interplay between eddies and biota in the oceaan



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CO_2 sinks (Gt C yr^{-1})

- Atmosphere $\pm$ 3
- Ocean $\pm$ 2
- Missing $\pm$ 1

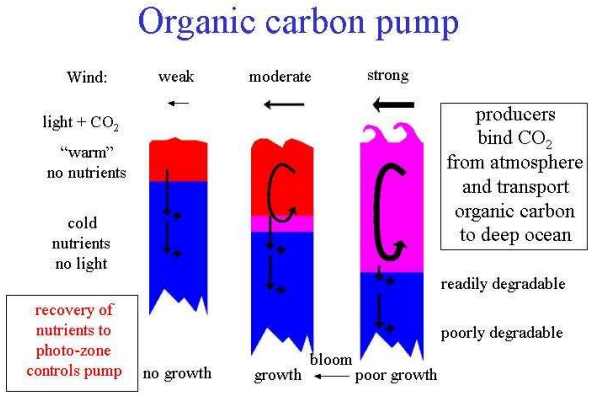
C_2-uptake by oceans

Transport:

1) atmosphere → ocean surface

2) surface → deep ocean via:

- ocean circulation
- sinking of organic material (biological pump)



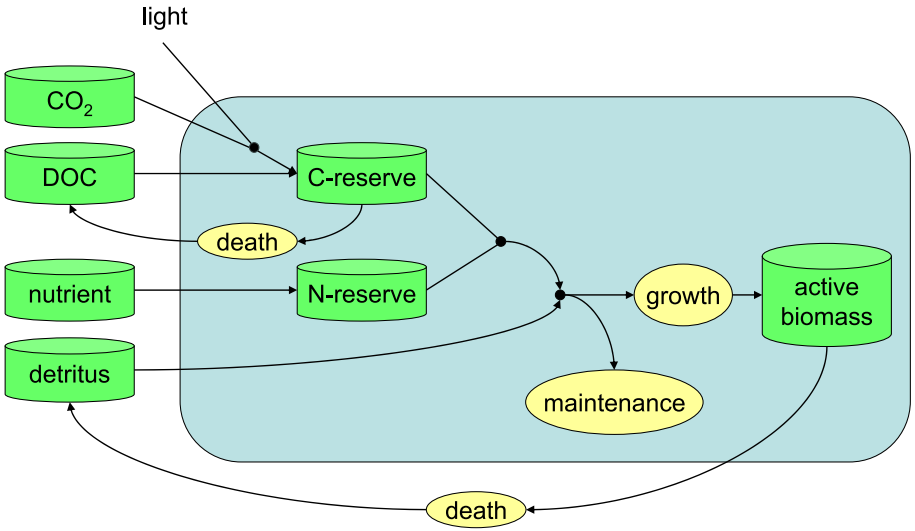
What is the influence of ocean currents on the 'biological pump'?

No nutrients in euphotic zone, below no light $\rightarrow$ vertical transports can save the day

Methodology

- Flow model
- Mixotroph model (DEB)

The mixotroph model



Flow models: F=m*a

F=m*a $\rightarrow$ Navier–Stokes equations:

$$\frac{dv}{dt} = -\omega \times v - \frac{\nabla p}{\rho} + \nabla^*(\kappa \nabla v) \text{ - } g e_3$$

Coriolis pressure friction gravity

Further model features: mass conservation and heat diffusion

Parameter	Interpretation
v	velocity
ω	Earth rotation
p	pressure
κ	diffusion constant
g	gravity acceleration
e_3	unit vector in vertical direction

How to simulate an eddy?

- Initial condition: a Gaussian temperature distribution
- Time integration of the Navier–Stokes equations

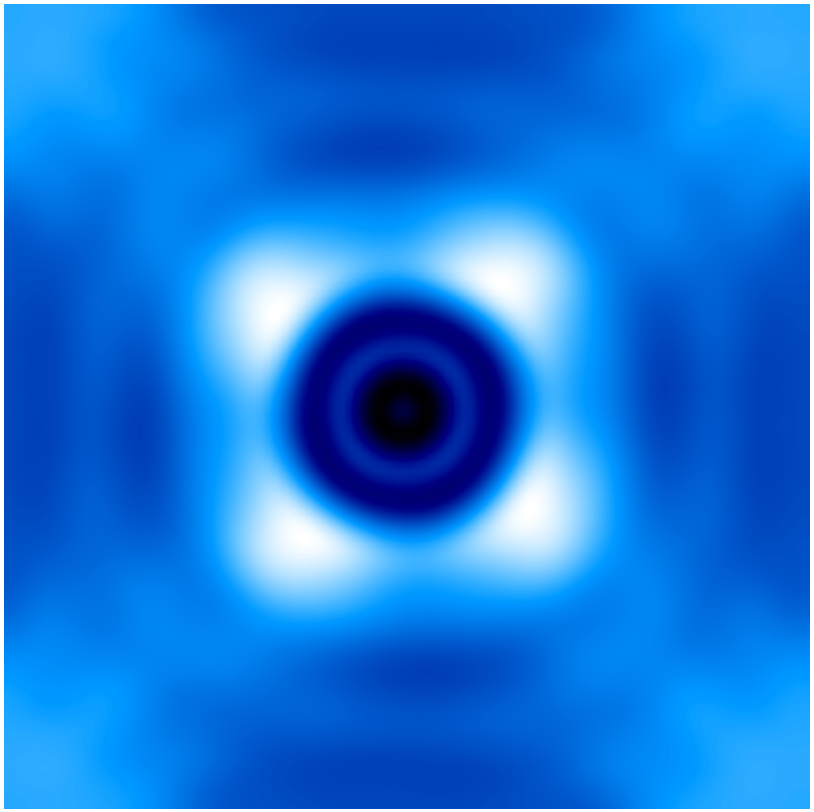
he influence of mesoscale eddies

Why study the influence of mesoscale eddies (i.e. eddies with a diameter around 100 km)?

- Resolution current climate models too low to resolve eddies
- Eddies probably important for carbon pump because of vertical transports

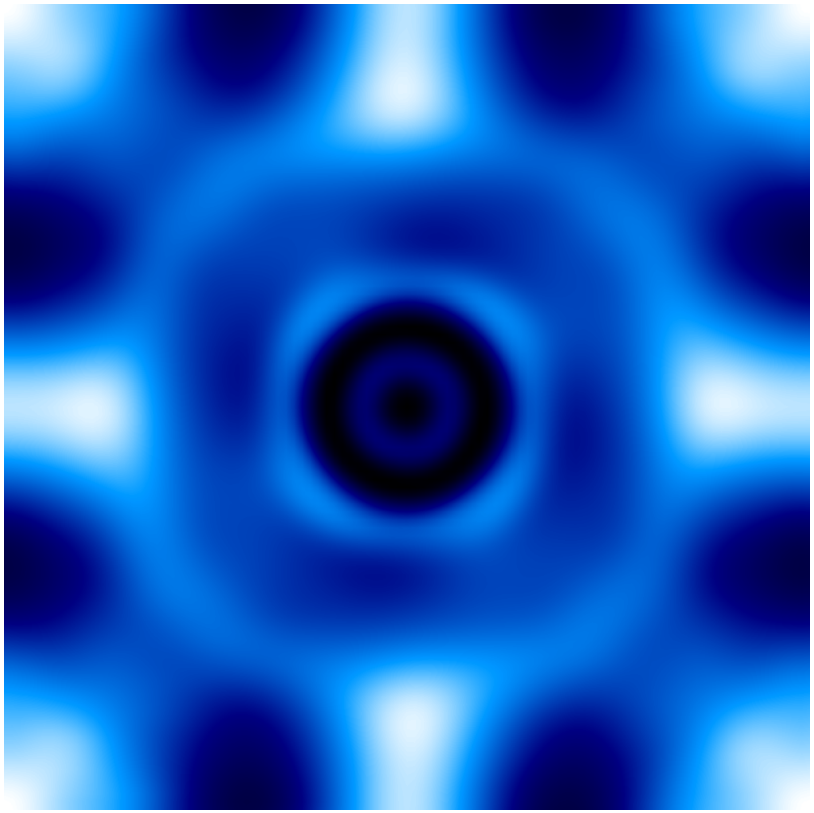
Vertical transports are crucial
$\rightarrow$ can be caused by instability of the eddy

he simplest case: a marginally instable eddy

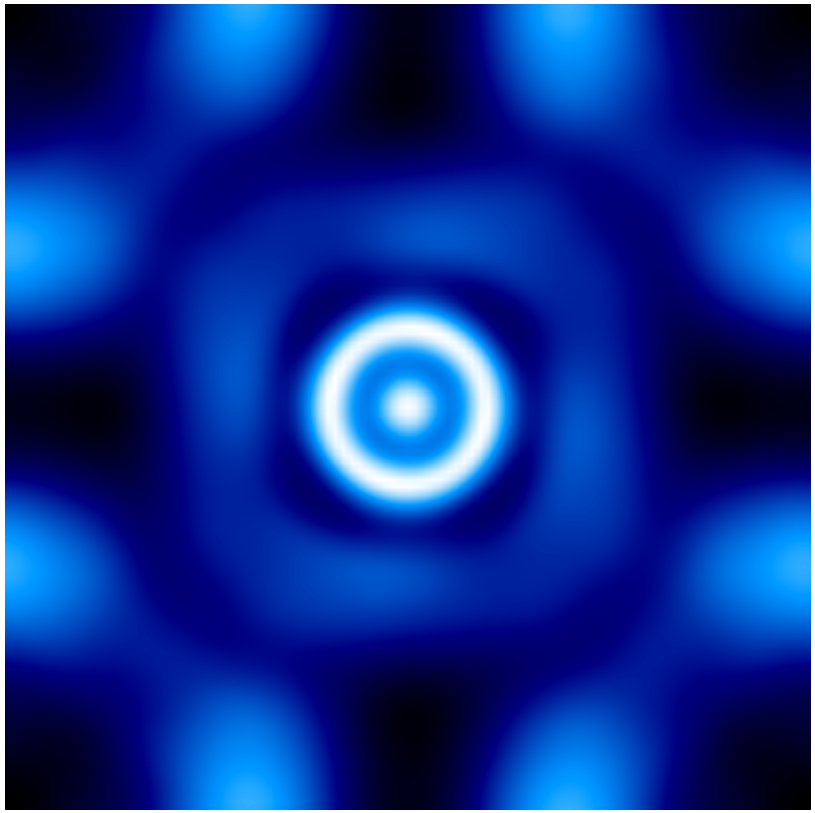


Influence of a marginally instable mesoscale eddy on biota

Nutrients



Biomass



Further research

- More realistic eddies
- Entire ocean basin
- Carbon pump in geological past
- ??