

Eddy surface-mixed layer interactions

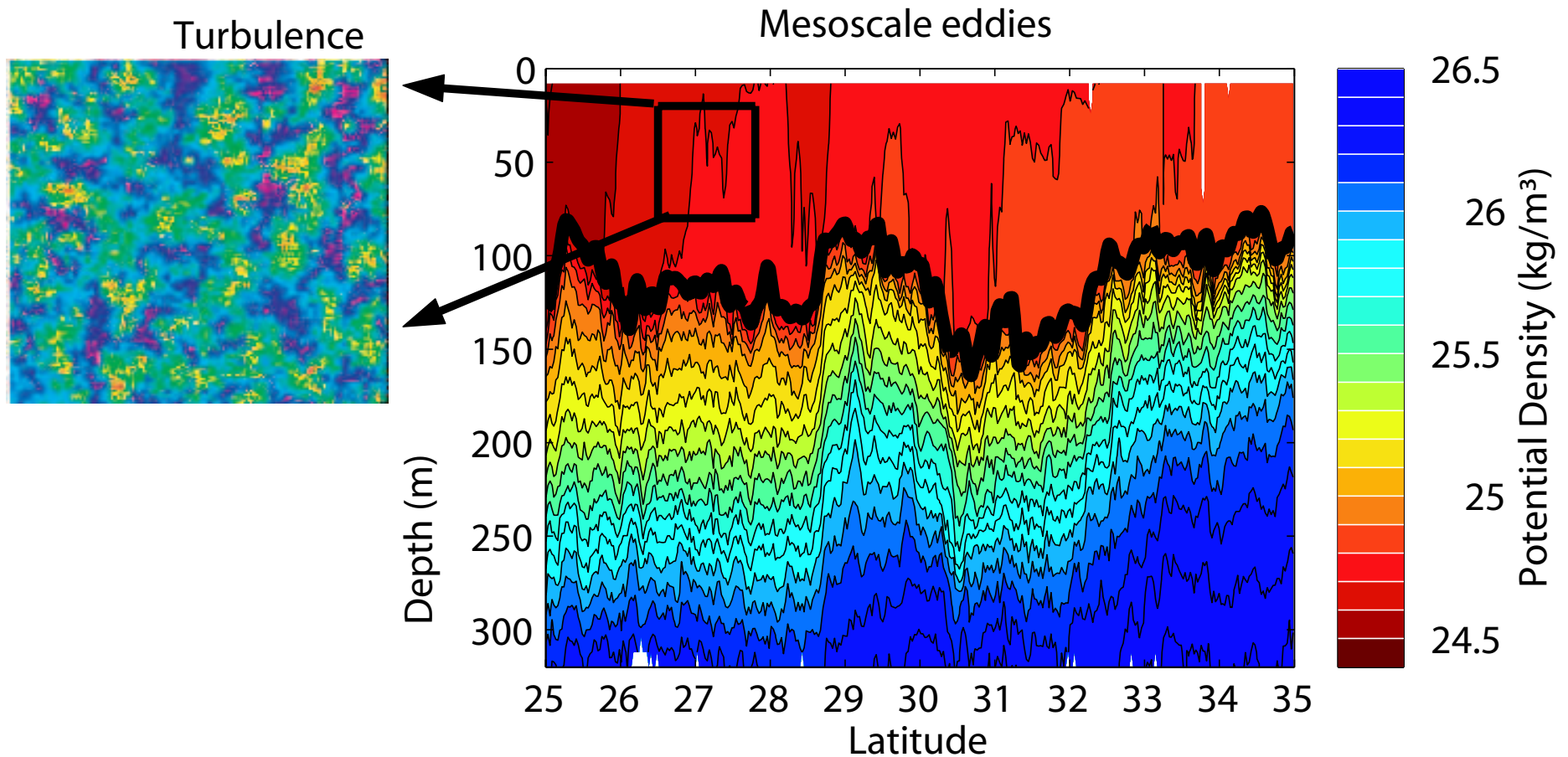
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1 – Parameterization of subgridscale eddy fluxes in IPCC-class ocean models

- ◇ Ocean interior: mesoscale eddy fluxes
- ◇ Boundary layers: small-scale turbulent mixing



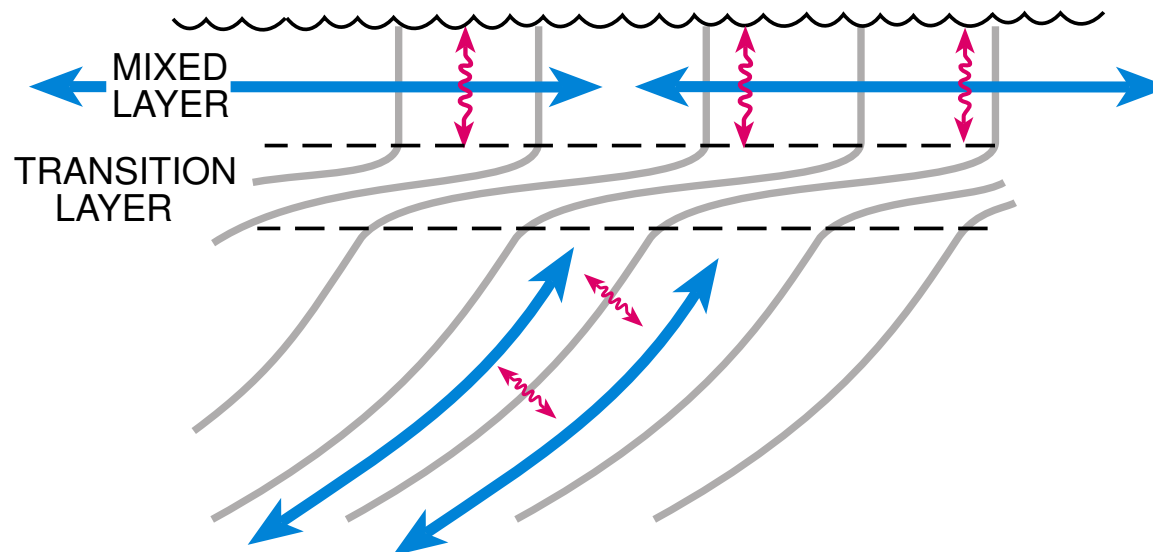
2 – Parameterizations at the ocean surface

◇ Closure schemes for mesoscale eddy fluxes

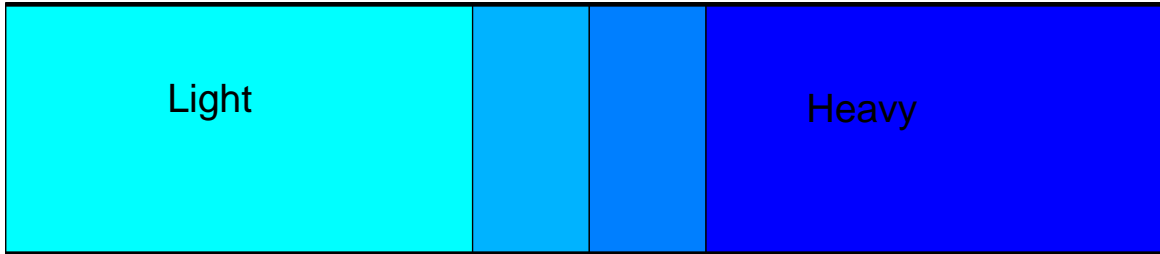
- Parameterizations are tapered to zero at boundaries
- Parameterizations ignore the diabatic eddy fluxes at the boundaries

◇ Closure schemes for turbulent mixing

- Parameterizations ignore interactions between turbulent mixing and mesoscale eddy fluxes
- Poor understanding of the transition from interior to surface parameterizations

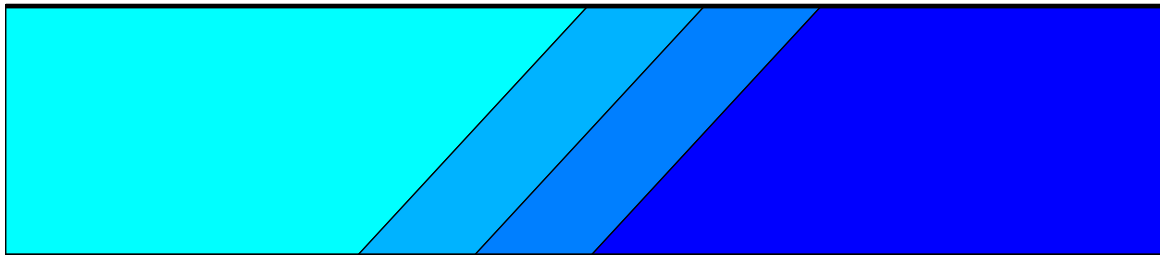


3 – Interaction of frontal instabilities and mixing: compensation



Front in a vertically mixed layer

↓ Slumping



Front slumps (restratification)

↓ Vertical mixing



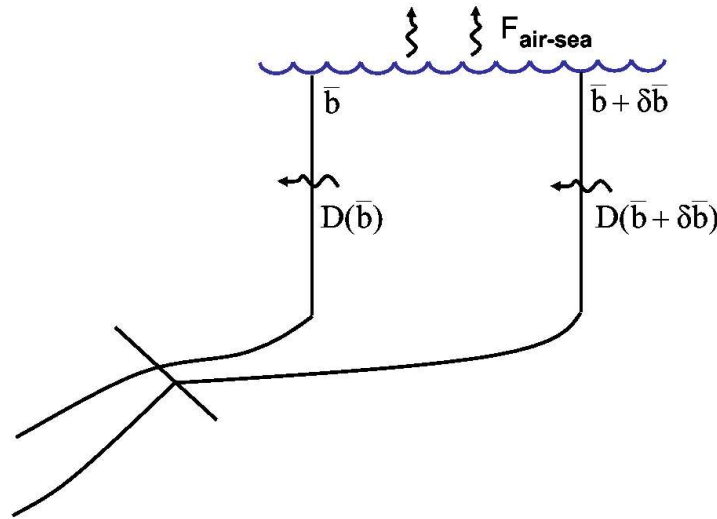
Interaction of slumping and mixing results in horizontal diffusion

4 – Eddy-driven water-mass transformation

◇ The Walin balance in an eddying mixed layer is,

$$\bar{b}_t + \bar{\mathbf{u}} \cdot \nabla \bar{b} = -\nabla \cdot \overline{\mathbf{u}'b'} - \frac{\partial F_{air-sea}}{\partial z},$$

$$\underbrace{A_{mean}(\bar{b}) + A_{eddy}(\bar{b})}_{A_{res}(\bar{b})} = F_{air-sea} - \underbrace{\frac{\partial(D_{ent} + D_{lat})}{\partial \bar{b}}}_{\partial_{\bar{b}} D_{res}},$$



5 – Projects

- ◇ High resolution numerical simulations (Boccaletti, Ferrari, Fox-Kemper, Marshall, McWilliams)
- ◇ Computation of all the metrics chosen by the CPT from SeaSoar profiles and moored data (Johnston, Rudnick, Weller)
- ◇ Coupling of a quasi-geostrophic ocean interior with a sub-inertial mixed-layer (Boccaletti, Ferrari, and Flierl)
- ◇ Extension of the omega-equation to study the ageostrophic circulation of a density front outcropping in a turbulent mixed layer (Tandon)
- ◇ Develop and test parameterization for IPCC-class ocean models (team members and modeling centers)