WATER MASS TRANSFORMATION
DIAGNOSTICS IN MOM5
(Chapter 36 in MOM5 manual)

Stephanie Downes

Subduction versus Water Mass Transformation

Karstensen 2004
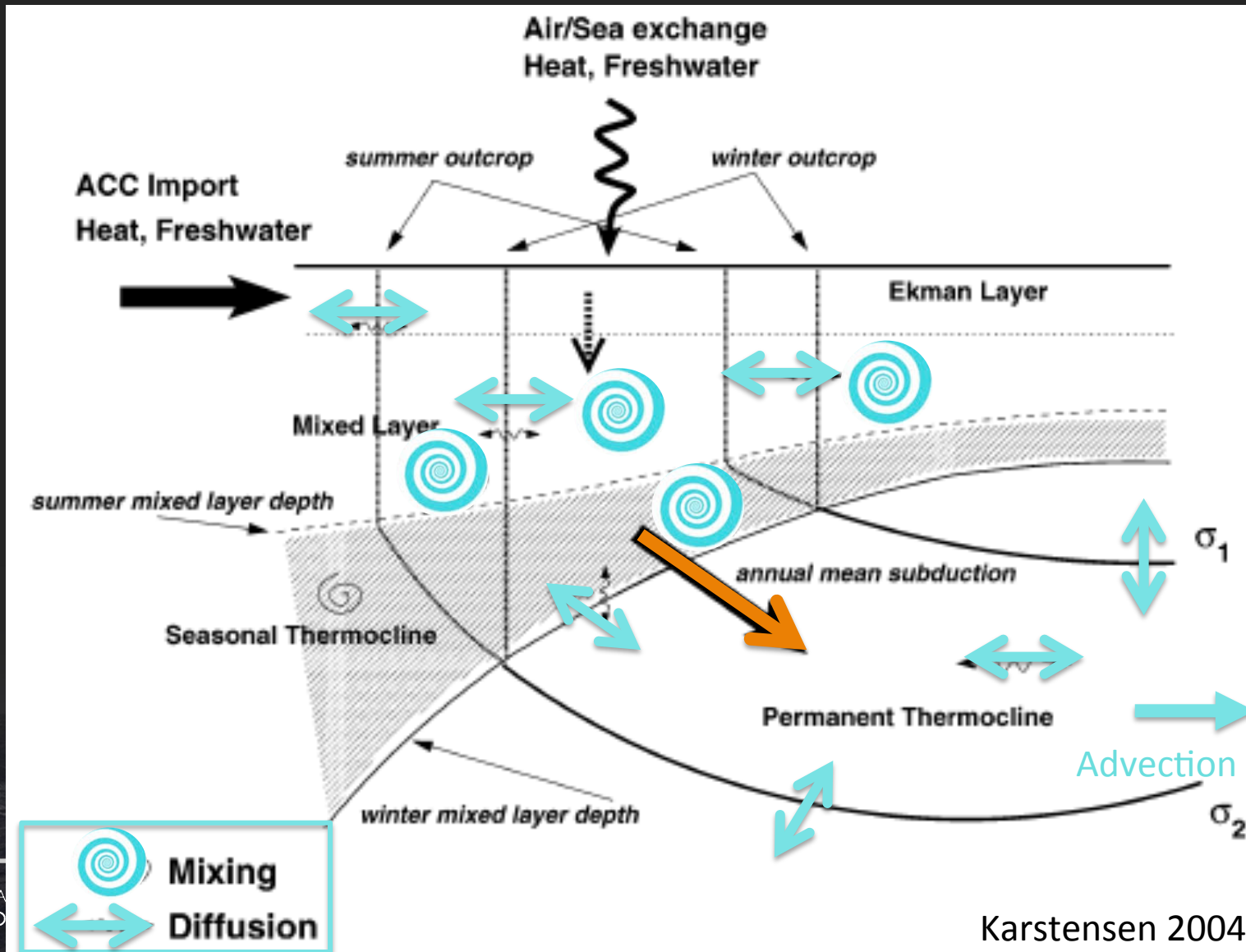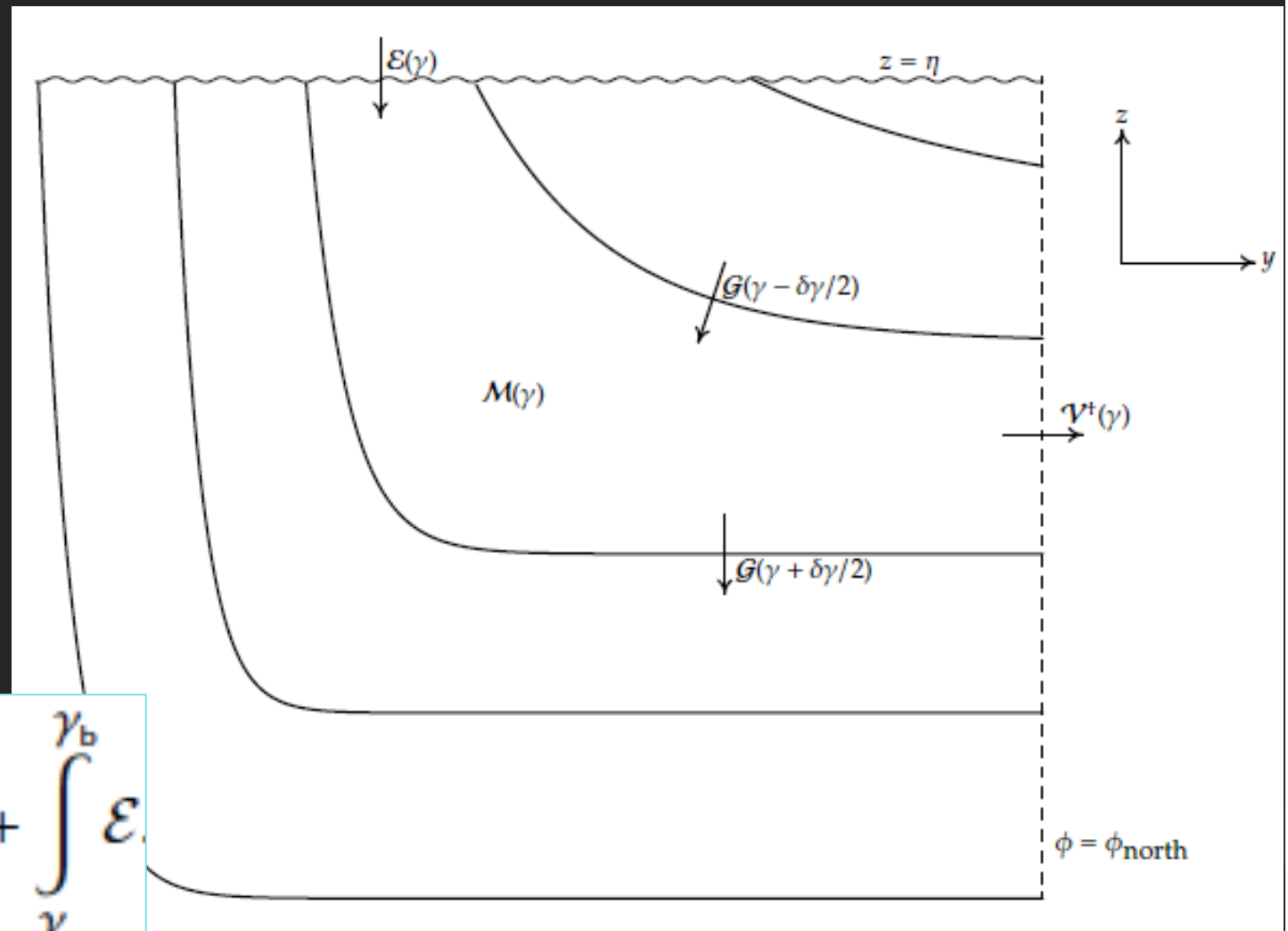
Water mass transformation in MOM5

Balancing mass in a density layer

$$\int_{\gamma}^{\gamma_b} \left(\mathcal{V}^{\dagger} + \frac{\partial \mathcal{M}}{\partial t} \right)$$

$$= \mathcal{G}(\gamma) - \mathcal{G}(\gamma_b) + \int_{\gamma}^{\gamma_b} \mathcal{E}$$

$\mathcal{E}(\gamma)$

$z = \eta$

$\mathcal{G}(\gamma - \delta\gamma/2)$

$\mathcal{M}(\gamma)$

$\mathcal{V}^{\dagger}(\gamma)$

$\mathcal{G}(\gamma + \delta\gamma/2)$

$\phi = \phi_{\text{north}}$

Outputted tendency terms (T and S)

| G (diapycnal)	E (surface)	V (transport)
• Eulerian time tendency (all processes impacting T and S) • Submesoscale transport • Advection • Mesoscale transport • Geothermal heat • Calving • **Diffusion** (vertical and lateral): from static background diffusivity, internal tide mixing, coastal tidal mixing, leewave mixing, isopycnal & diapycnal mixing, KPP, neutral diffusion (cabelling & thermobaricity)	• Precipitation • Evaporation • River runoff • Melt & sea ice formation • Shortwave heating	Volume transport terms (TX_TRANS_RHO & TY_TRANS_RHO with mesoscale and submesoscale components

Examples of usage

South Atlantic
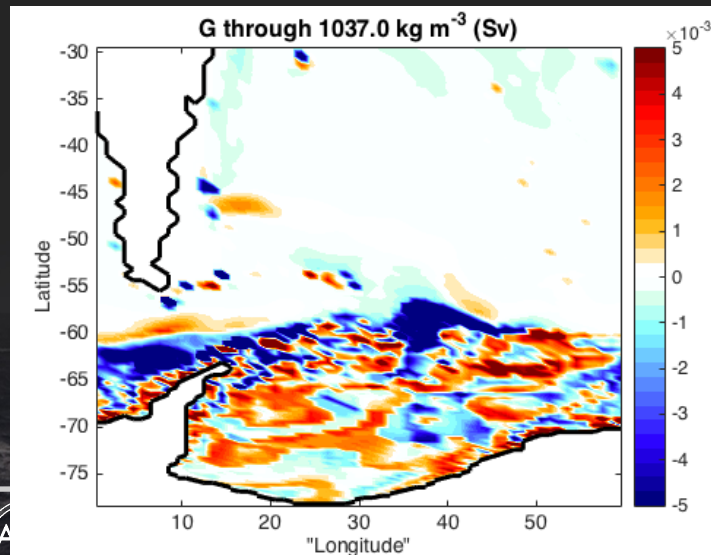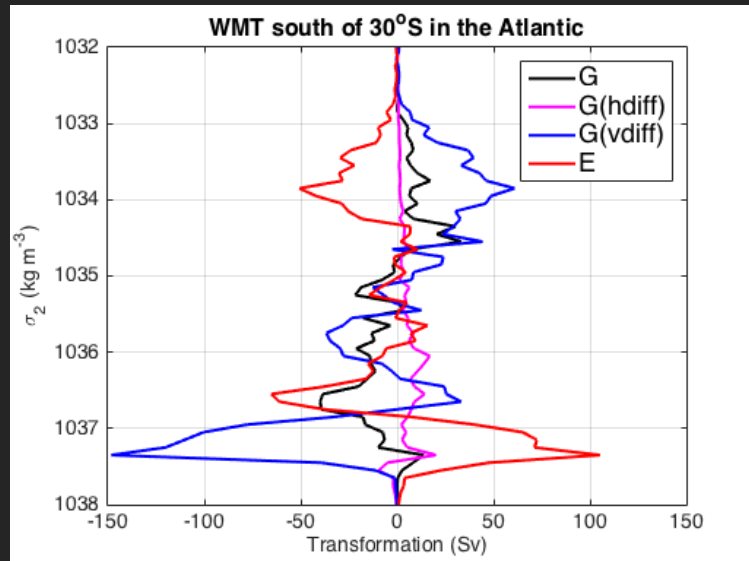
Equatorial Pacific

Zhai et al. (2017)

s.downes@utas.edu.au   @OceanStephD
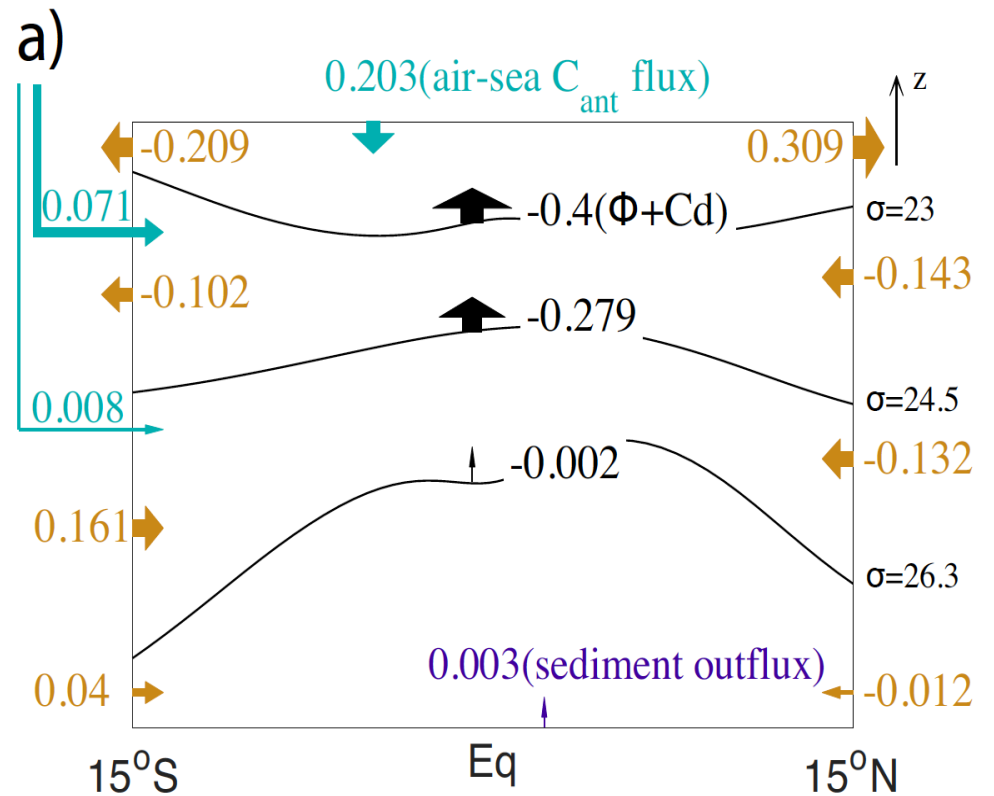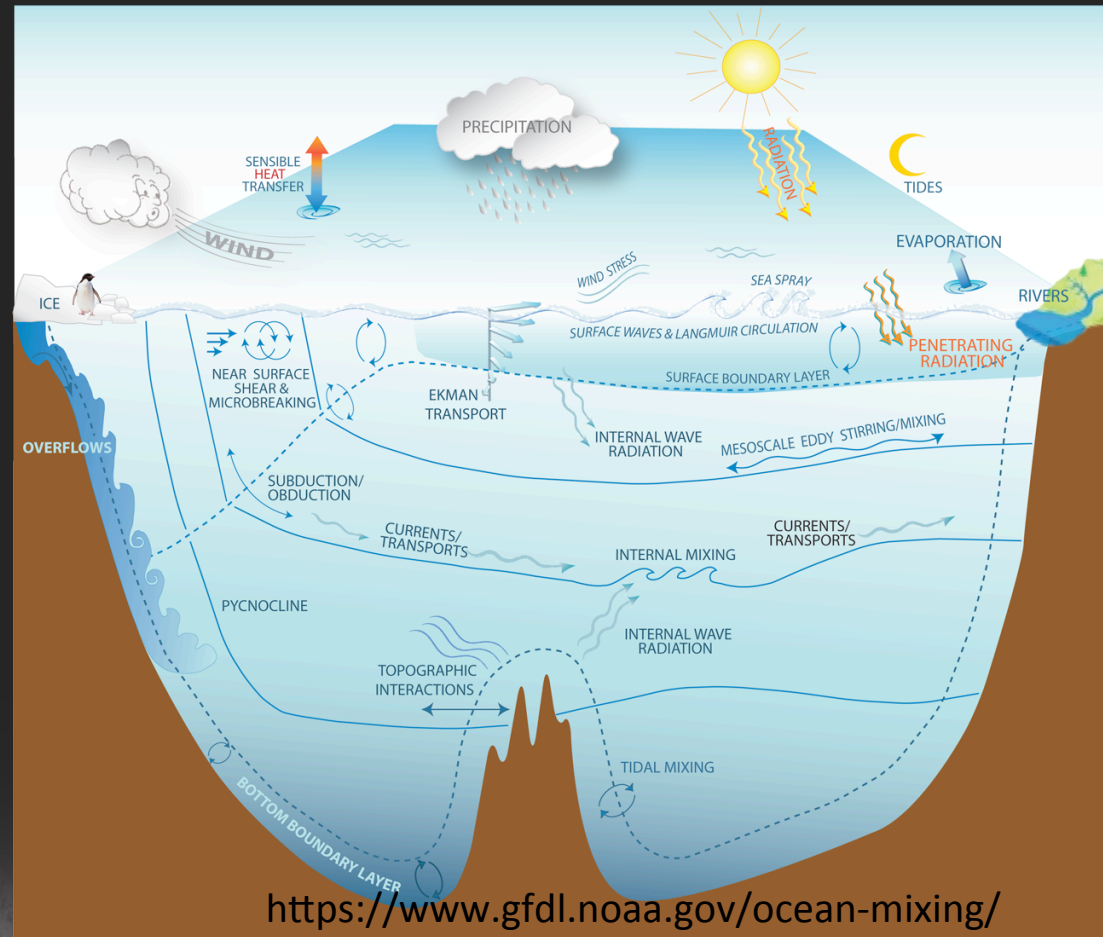
How is it done? (*can be time consuming)

ONLINE

SALT tendency terms:
$kg\ m^{-2}\ s^{-1}$

TEMP tendency terms:
$W\ m^{-2}$

OFFLINE
Use the specific heat capacity, local salinity, grid area, surface fluxes to convert to the same units before binning into required density classes.

https://www.gfdl.noaa.gov/ocean-mixing/

ANTARCTIC CLIMATE & ECOSYSTEMS
COOPERATIVE RESEARCH CENTRE

s.downes@utas.edu.au   @OceanStephD