Review of "Dissipation ratio and eddy diffusivity of turbulent and salt finger mixing derived from microstructure measurements" by Li, Yang & Sun

This manuscript takes microstructure measurements from a variety of different ocean basins with different propensities for salt finger double diffusive convection, and discusses the dissipation ratio (mixing efficiency Γ) and the turbulent diffusivities of heat, salt and buoyancy. However, I do not think that the salt-finger cases are treated properly, and so I recommend against this manuscript being published in *Ocean Science*.

This paper divides the observations into different sets based on the propensity to exhibit salt-fingering behaviour, as measured by the Turner angle. So far so good. But then the mixing efficiency, Γ, is estimated differently depending on which class of observations the measured data falls into. If the data comes from a doubly-stable regime, then the Oakey formula (which appears in between equations (2) and (3) of the manuscript)

$$\frac{\frac{1}{2}\chi_\theta N^2}{\epsilon\,\theta_z^2}$$

is used, whereas if the data is from a water column that has warm salty seawater overlying cooler fresher seawater, then a different formula is used, namely, from their Equations (4) and (5),

$$\Gamma_\theta^F = \left(\frac{R_\rho-1}{R_\rho}\right)\left(\frac{r^F}{1-r^F}\right) \qquad \text{and} \qquad \Gamma_S^F = \left(\frac{R_\rho-1}{1-r^F}\right).$$

We know from the careful study of St. Laurent and Schmitt (1999) that in the North Atlantic Central Water where R_ρ is about 2 and so is susceptible to salt-fingering, the detection of salt fingers is very difficult. Their conclusion is that most of the time the observed microstructure is due to ordinary turbulent mixing which has the same turbulent diffusivity for all conserved scalar quantities. Hence, in such locations, it is not appropriate to assume that salt fingers account for all the observed microstructure, as the present manuscript assumes. This is the reason I recommend that the present manuscript should not be published in *Ocean Science*.

There is a way of using the microstructure observations while recognizing that they are the sum of contributions from both (1) isotropic turbulence and (2) salt fingering. This method appeared in section 3 of McDougall and Ruddick (1992), and it is quite different to what is used in the present manuscript.

Reference:

McDougall, T. J. and B. R. Ruddick, 1992: The use of ocean microstructure to quantify both turbulent mixing and salt-fingering. *Deep-Sea Research*, **39**, 1931-1952.