Microstructure and Mixing Measurements during SPURS

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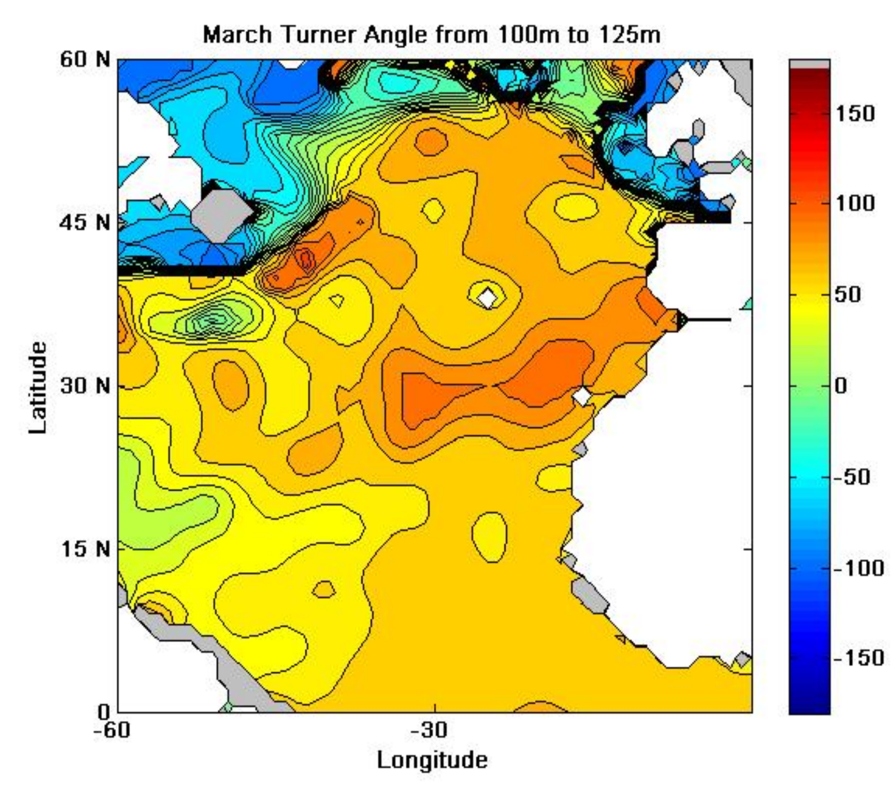
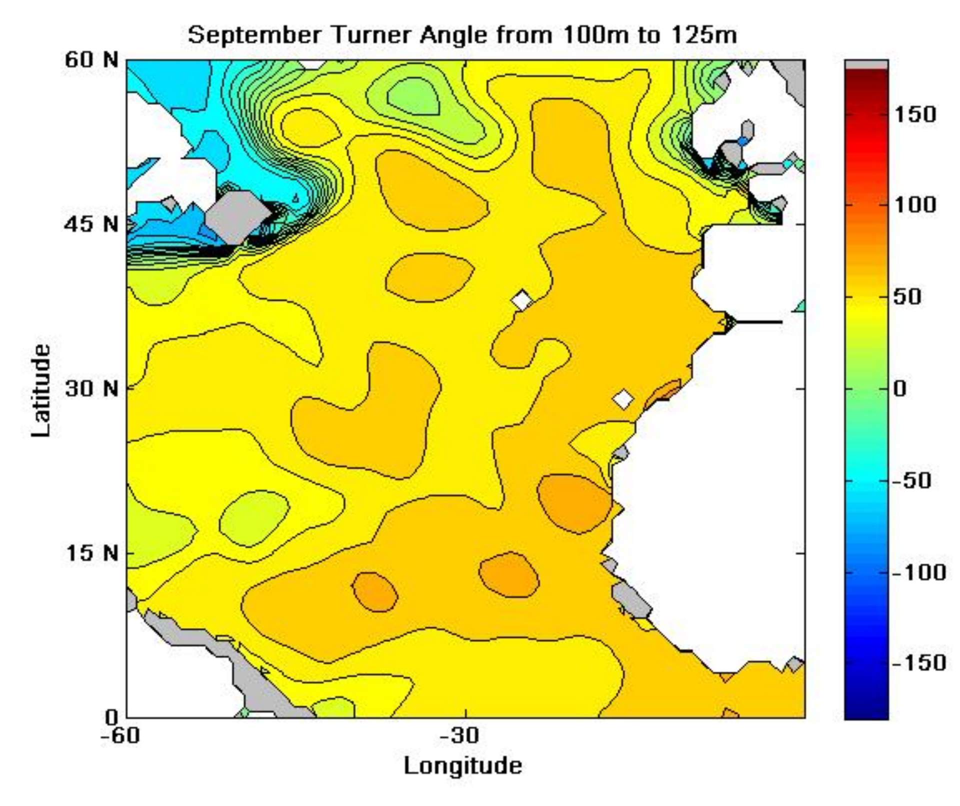
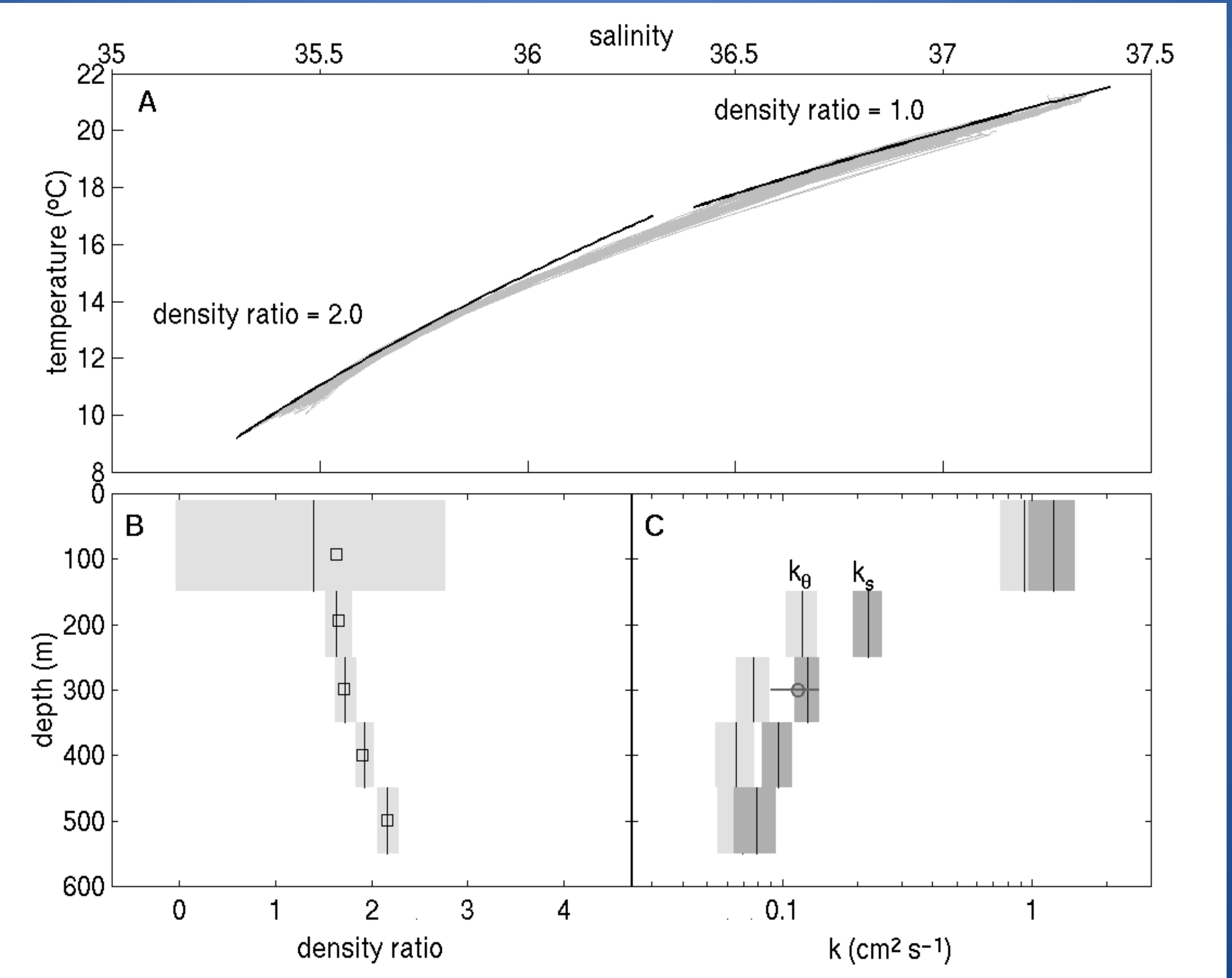
Resubmitted to NSF

Salt fingers are favored in the upper thermocline in the spurs region, especially in the spring. (Turner angles near 90º at base of ML)

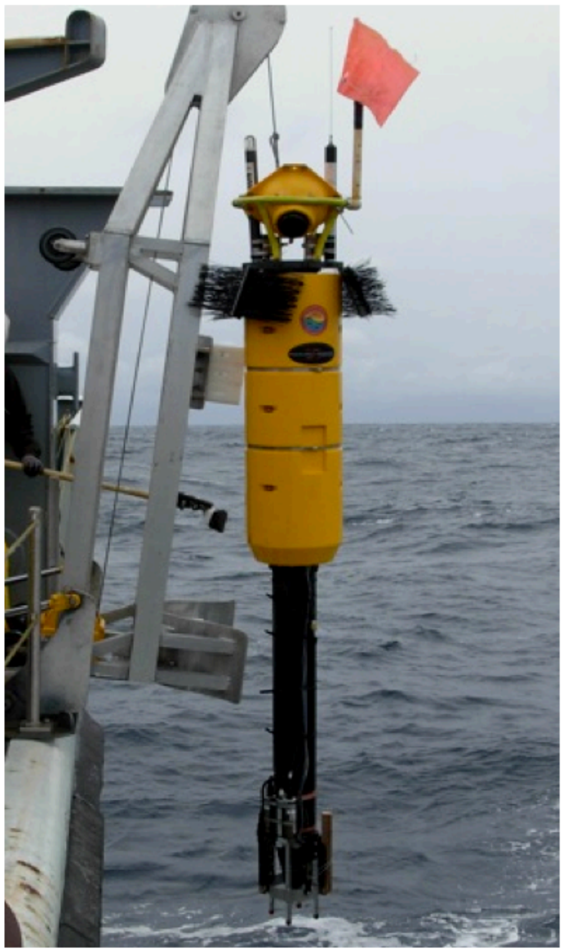




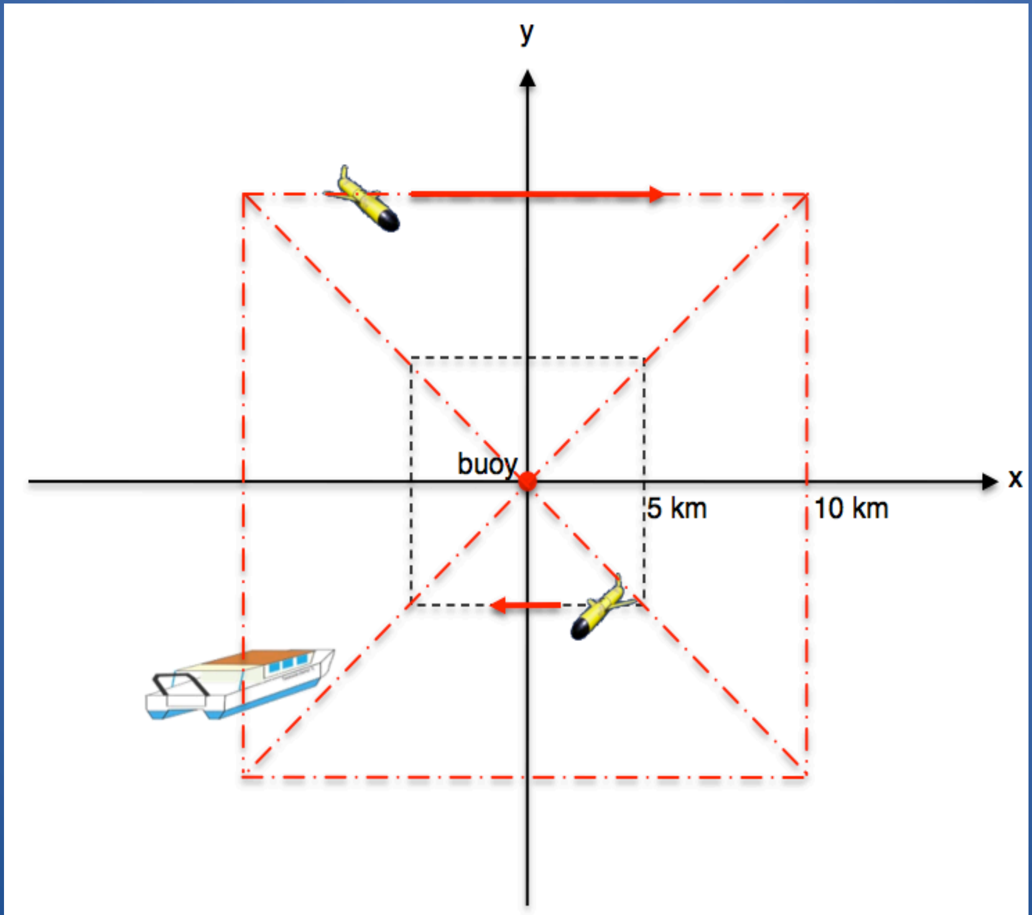
Fingers adjust low density ratio fluid from the ML to density ratio ~2 in the thermocline (Schmitt, 1999; St Laurent and Schmitt, 1999; Johnson, 2006; Johnson and Kearney, 2009)

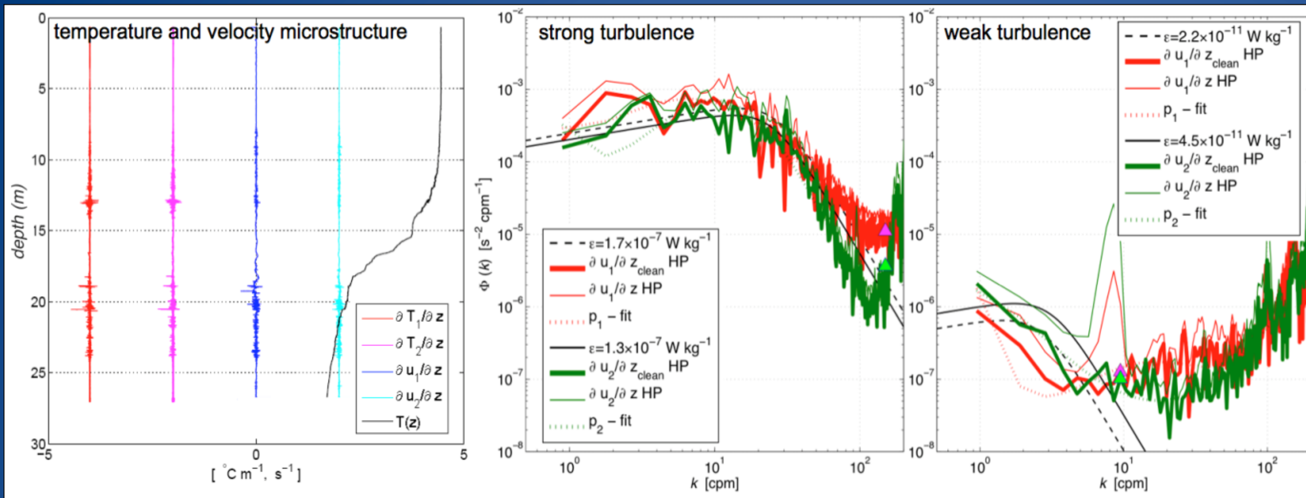


T-Glider, ASIP, Rockland Microstructure Profiler



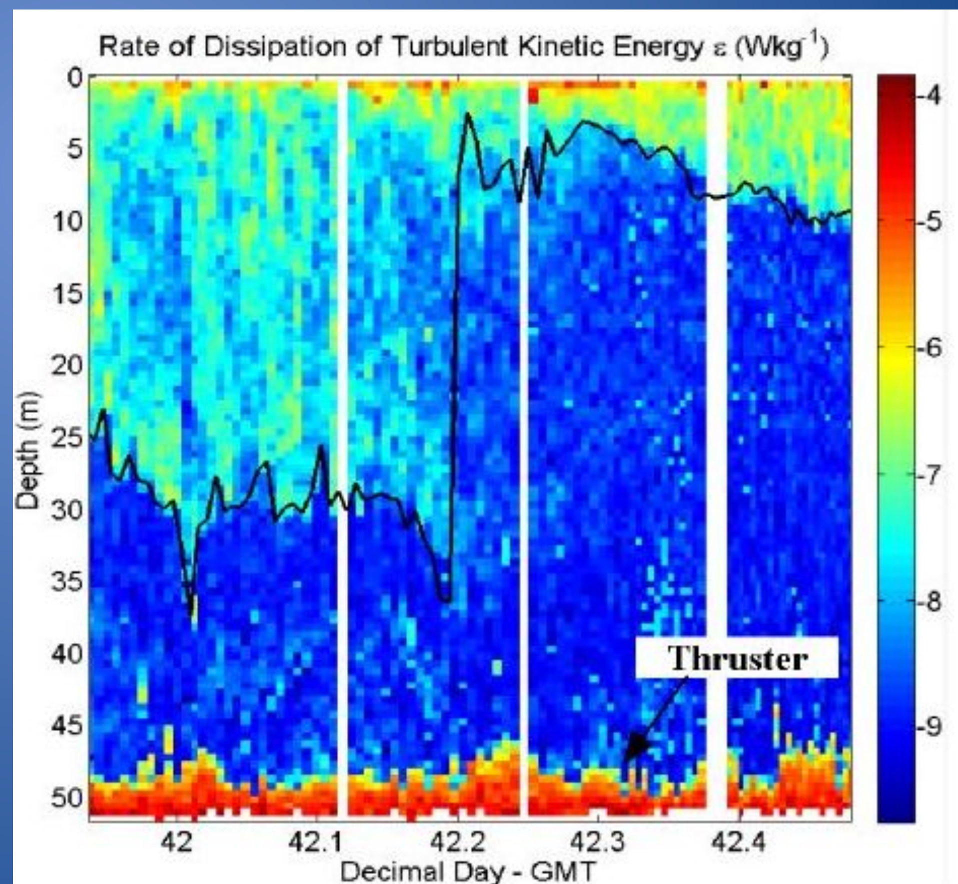
T-Glider and Ship survey of mixing around central mooring (and/or surface drifter?)



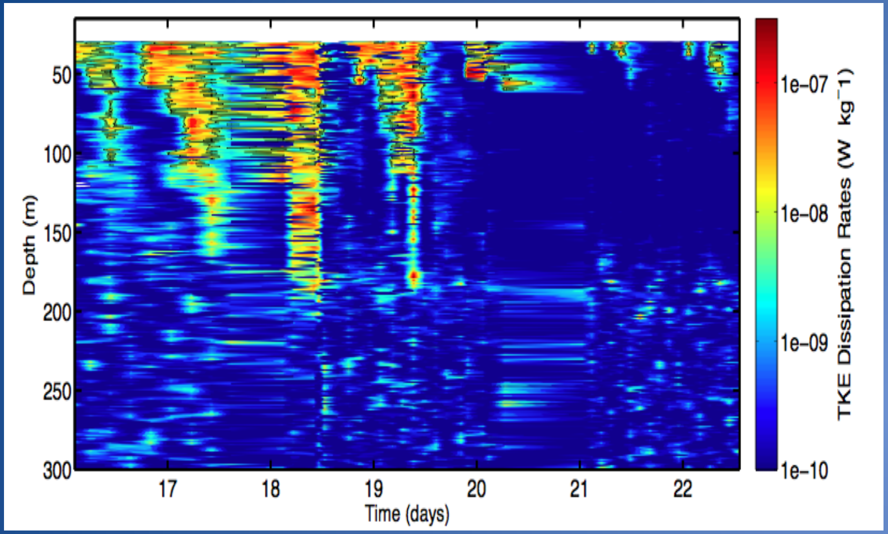


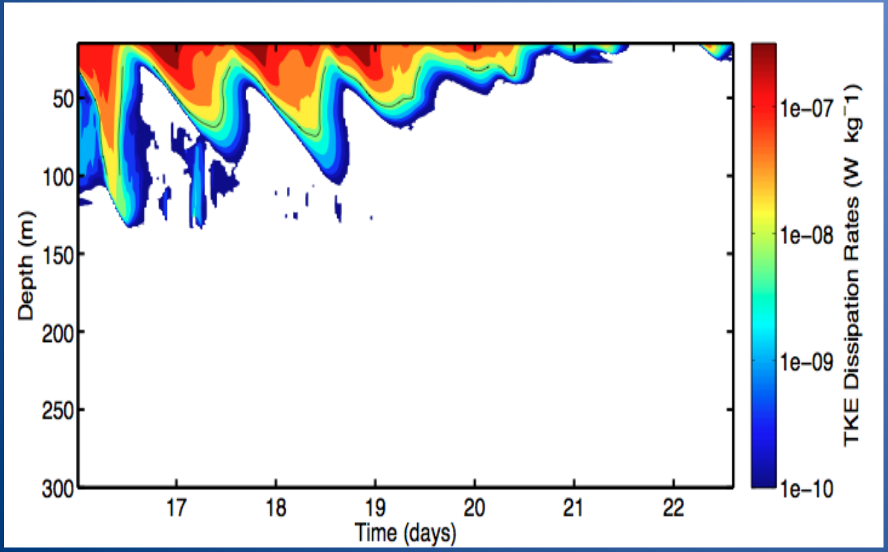
← T-glider data

ASIP data →



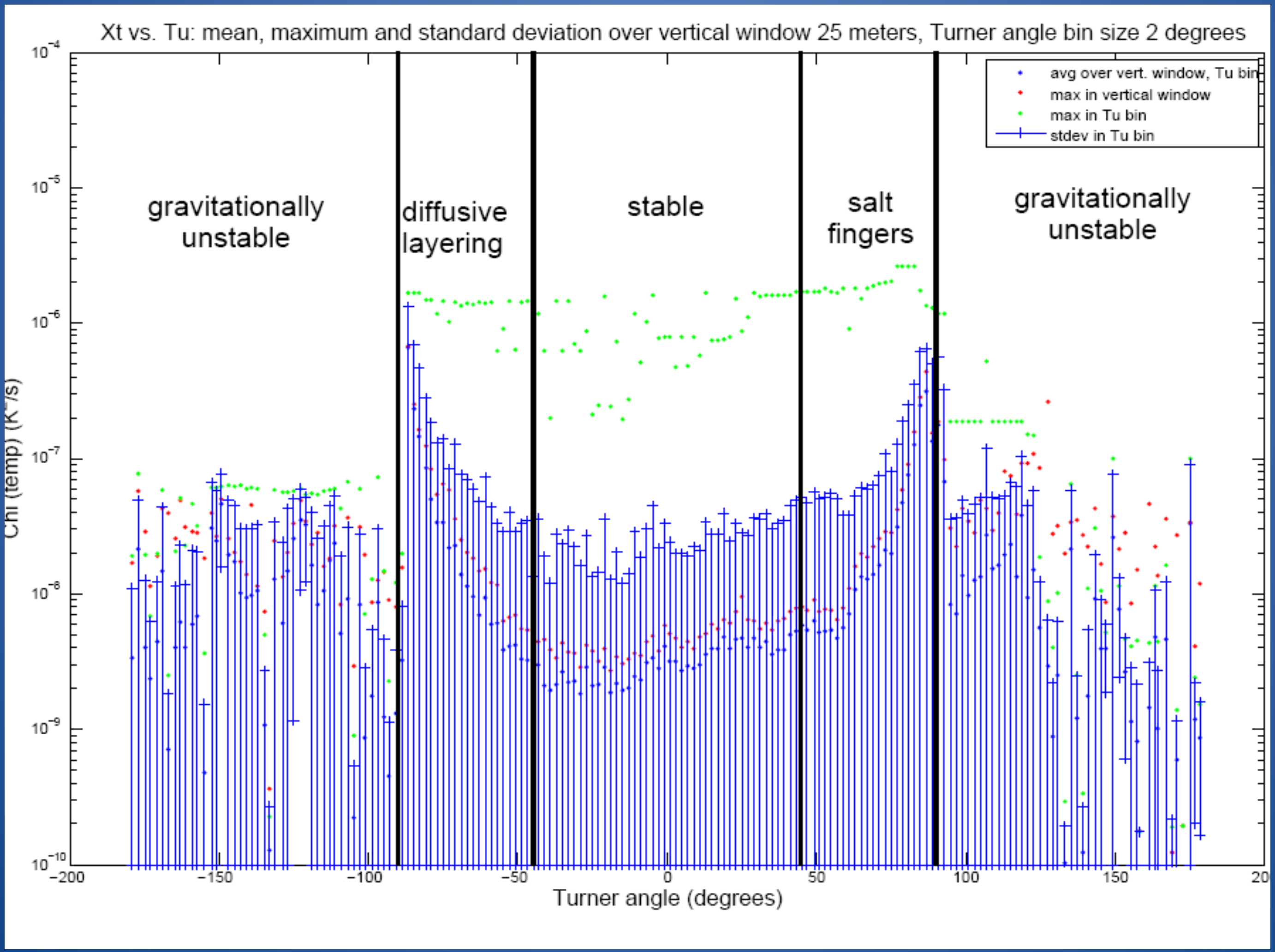
Modeling of mixing





Top: Kinetic energy dissipation levels observed by HRP at the NATRE site documenting changing diurnal convection events over a 1-week period in April of 1992. **Bottom**: The diurnal convection for the same surface forcing as simulated by the Kantha-Clayson model. Notable differences in the convective penetration are likely due to three-dimensional processes occurring in the mixed layer/thermocline transition layer not represented in the model. From Rahter, Clayson and St. Laurent (2010).

Toward a parameterization of salt fingers: binning in Turner angle
(good predictor of Chi, less so of Epsilon)



Analysis Goals:

- Through use of the microstructure, quantification of the diabatic flux terms relevant to the T and S budgets being constrained by the overall SPURS study. Particular focus will be on the temporal (assessed from the model simulations) and spatial (assessed from the data grid) scale-dependent aspects of the budgets.
- An assessment of the role of surface convection, internal wave processes, and double diffusive mixing on these fluxes. Model simulations, fed by the air-sea interaction buoy data, will be used to determine if observed T, S and signals are the result of mixed-layer response to surface forcing. Such simulations will help identify the source of the turbulence as either surface convection, inertial shear-driven instability, or if other processes not represented in the model must be invoked (advection effects, non-local internal waves, double diffusion).
- An assessment of mixing parameterizations, through alteration of the KC-model implementation to utilize independent diffusivities for S and T, as taken from the microstructure-based estimates. This simulation will be contrast to simulations using parameterized forms of the diffusivities, dependent on (e. g.: Zhang et al. 1998, Inoue et al. 2008).