The ice edge signal in temperature is clearer than it is in salinity, and there may be various salinity signals superposed. Variance in temperature is substantially greater to the south of the ice edge, as insolation heats open water, whereas salinity variance remains relatively consistent throughout the section.

Is there a large-scale, coherent relationship of surface ocean properties to the ice edge?

How can we separate this relationship from other signals?

What modeled processes can account for this relationship?

What are the larger implications for the seasonal ice zone as it grows and persists?

We use a month-to-month 1-D PWP model (Price, Weller, Pinkel, 1986) to determine whether observed upper ocean freshwater content change is due to ice melt. The PWP is forced with output from the Marginal Ice Zone Modeling and Assessment System (MIZMAS) to account for the influence of sea ice on atmosphere-ocean fluxes. The model is initialized with one month’s SIZRS profiles, then stepped forward and compared with the following months.

We use three proxies for the gyre to eliminate its signal through regression on meridional salinity gradients: monthly Arctic Oscillation index, isopycnal tilt, and bottom pressure. In the right panel are salinity residuals from detrending plotted with ice edge. When the gyresal signal is removed, residual values correlate significantly with distance from the ice edge. The blue circles show residuals from all SIZRS months in 2012-14; the red line is a linear fit to the data, and the purple lines are extrema for such a fit, generated in a 1000 iteration bootstrap simulation.

Comparison of freshwater content change relative to 34.8 in PWP simulations and SIZRS observations. Change in meters is shown against a 1:1 line, indicating that the PWP is able accurately to represent upper-ocean freshwater content change and that observed freshwater content changes are occurring primarily due to ice melt.

Mean differences between PWP and observations over all depths and all runs. The top 40 meters are shown in the red boxes. Mean errors in temperature and salinity (blue lines; standard deviations delineated in gray) are less than half a degree Celsius and half a psu, respectively.