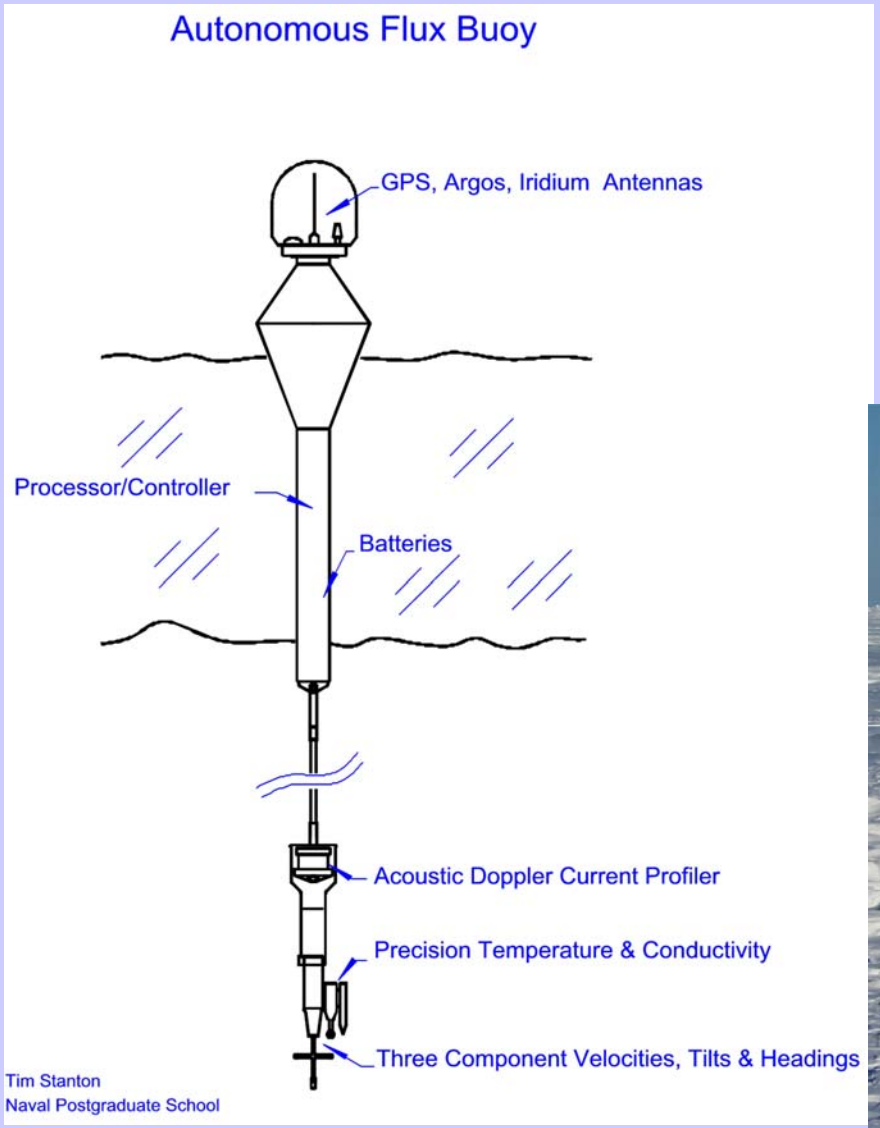
An Autonomous Ocean Flux Buoy

T. Stanton, Naval Postgraduate School

http://www.oc.nps.navy.mil/~stanton/fluxbuoy/



Measure mixed layer heat, salt and momentum fluxes and upper ocean velocity structure with an Iridium connected, 2 year endurance autonomous buoy

Long Timeseries Multiple Methods for Flux Determination

- Direct eddy correlation flux estimates at 6m depth
  - <u'w'>, <v,w'>, <w'T'>, <w'S'>

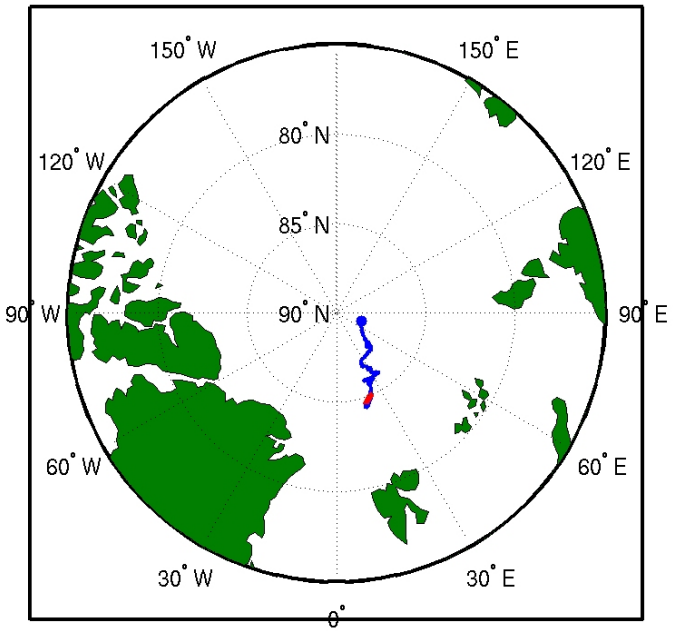
- Reference points to compare with departure from freezing based estimates:

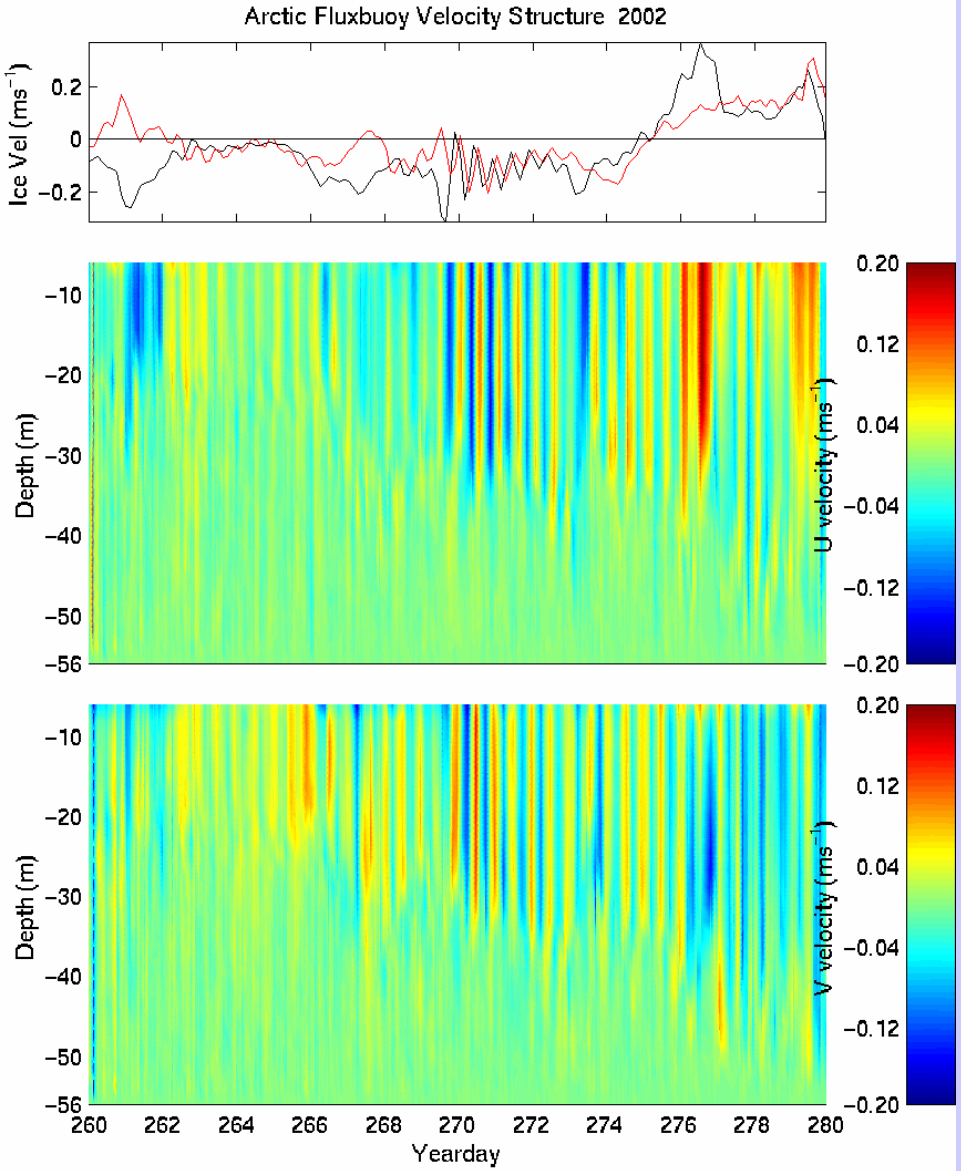
$$H_w = \rho c_p \left\langle w'T' \right\rangle_0 = \rho c_p c_w u_{*0} \delta T$$

- Resolve convective events and still unresolved processes, for example during freeze-down

Measure ocean velocity structure into the pycnocline, GPS-based ice velocity, and infer mixed layer depths

Start (04/29/02 05:21:17 UTC) Lat: 88.5143 Lon: 71.6049
End (10/10/02 15:40:37 UTC) Lat: 85.0092 Lon: 23.6207





CONCLUSIONS so far

- 3 successive flux buoys have been deployed at the North Pole NPEO station, with each one reaching the Atlantic Ocean

- Buoy objectives have been met using modified ultra low power 3 component velocity sensors, a modified inductive conductivity sensor and high resolution T sensor, and a 8 channel power / processor /communications controller. Sensor stability / accuracy still a challenge for > 1 year unattended deployments (better each time)

- Iridium data transfer protocols successfully allow 20 – 200 Kbyte / day data transfers including spectral covariances, raw timeseries segments and processed fluxes

- 2 way Iridium communications provide remotely selected sampling schemes and diagnostic capabilities

- These buoys provide “event resolving” direct ocean fluxes, and now have the capability of making ice-thickness / ice conductive flux measurement to resolve coupled ocean / ice fluxes. They are now routinely deployed by two people within 12 hours in 9’ thick ice.