Development of an autonomous profiling Carbon Glider

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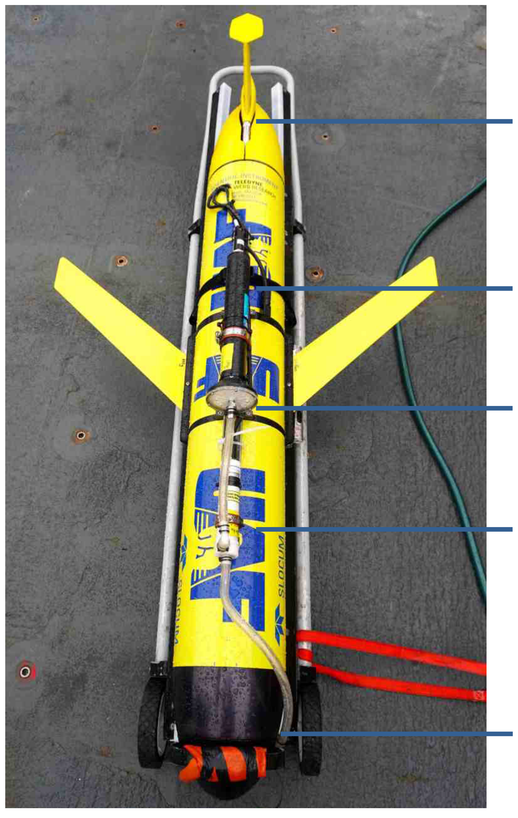
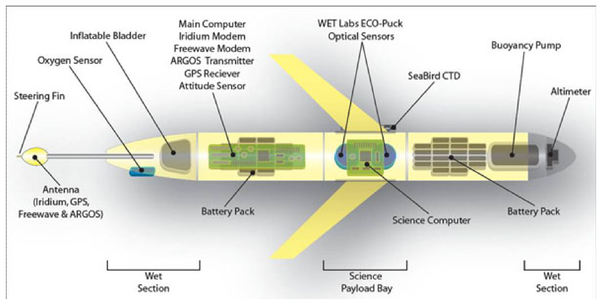
Motivation

New autonomous observational capabilities are needed because traditional ship based observations are operationally expensive and unable to provide the type of spatial and temporal coverage of seawater CO_2 measurements required for an improved conceptual understanding and quantitative assessment of the carbon cycle in the rapidly changing Arctic Ocean.

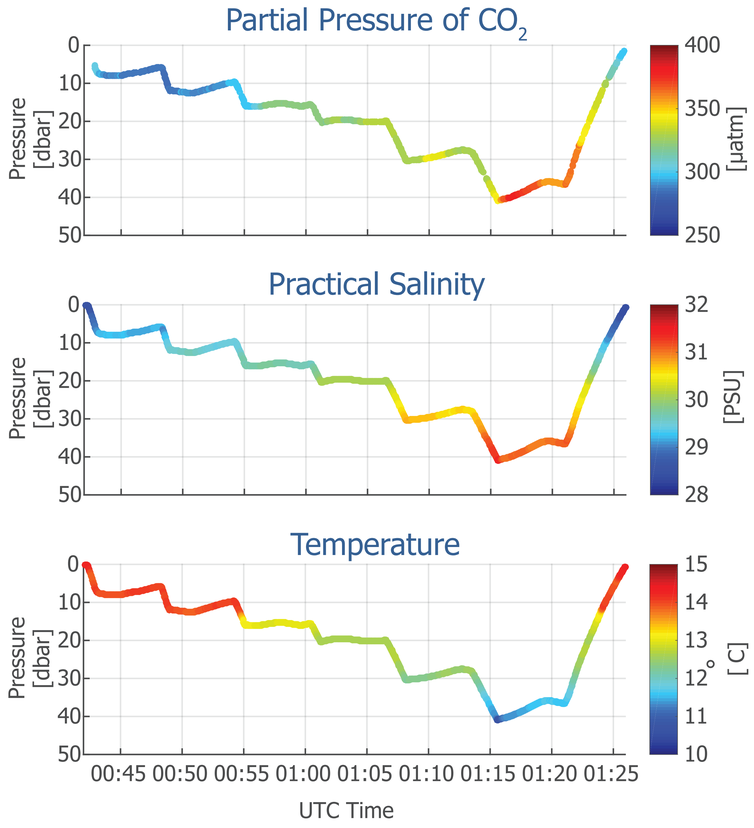
Carbon Glider Configuration



Teledyne Webb Slocum Glider

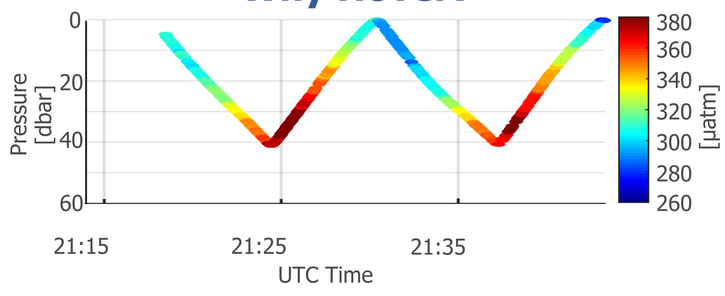


Carbon Glider Profiles from a Hover Mission in Resurrection Bay in August



The vertical gradient in pCO_2 is established primarily by the photosynthetic drawdown of carbon dioxide and the dilution through freshwater at the surface.

Why Hover?

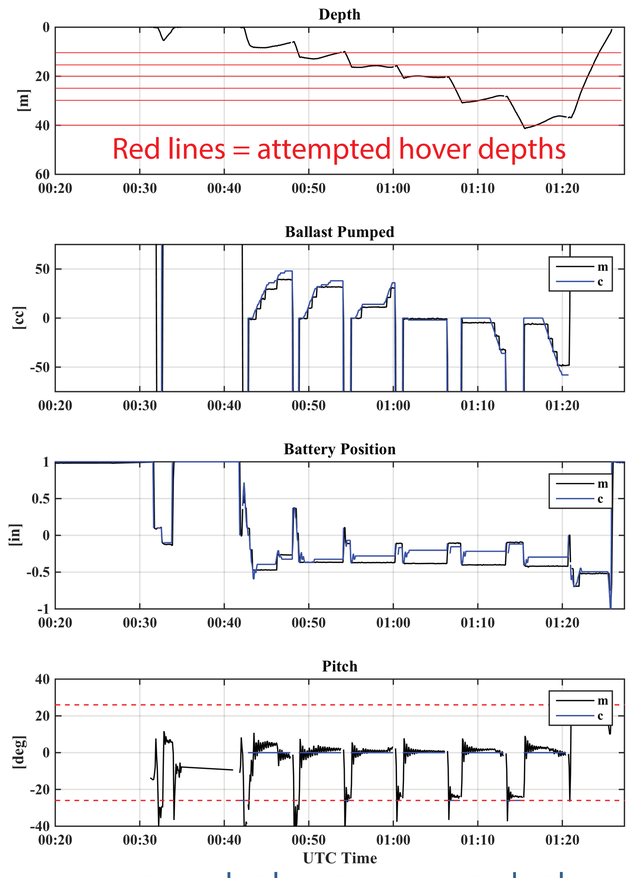


- Hover capability needed for sensor equilibration
- Response time of sensor introduces 67 second hysteresis when operated in continuous mode

Technicalities of a Hover Mission

- Dynamical adjustment of battery position is used to maintain a level pitch
- Dynamical buoancy adjustments bring the glider to the desired depth

At the 15 and 20 m hover depths, the glider was essentially neutrally buoyant and required very little buoyancy adjustments. At other depths, significant buoyancy adjustments were required to reach the desired depths.



m = measured value, c = command value

First Autonomous glider based profiles of pCO_2

Key to success:

- Integrated custom pCO_2 sensor: fast response time, small in size, low power demand
- Hover mission capability