**Environmental Studies Program: Ongoing Studies**

**Study Area(s):** Chukchi Sea

**Administered By:** Alaska OCS Region

**Title:** Development of an Autonomous Carbon Glider to Monitor Sea-Air $CO_2$ Fluxes in the Chukchi Sea (AK-13-03-12)

**BOEM Information Need(s) to be Addressed:** The Chukchi Sea is thought to be an important sink for excess atmospheric carbon dioxide ($CO_2$). A more accurate assessment of $CO_2$ flux within this region could improve future projections of $CO_2$ concentrations. Results from this study will facilitate a better understanding of oceanic uptake of $CO_2$ in the Arctic and potential effects related to offshore oil and gas activities and will inform NEPA analyses for potential future lease sales, EPs, and DPPs in the Chukchi Sea.

**Total BOEM Cost:** $160,317
plus Joint Funding ($160,317)

**Period of Performance:** FY 2015-2018

**Conducting Organization:** CMI, UAF

**Principal Investigator(s):** Dr. Claudine Hauri

**BOEM Contact:** Warren Horowitz

**Description:**
Background: One of the concerns relating to human activities is the effects on the carbon-dioxide exchange and relationship to climate change within the Arctic Ocean. Since the Chukchi Sea is thought to be a very important carbon sink, and acts as a biogeochemical pathway to the Arctic Ocean, it is very important to better understand how to most efficiently measure carbon fluxes within the water column, and between the atmosphere and the ocean. Our present understanding of the carbon cycling within the Chukchi Sea is based upon sparse data obtained from fixed moorings and ship based measurements. Therefore it is important to develop a platform that can provide continuous measurements of $CO_2$ within the water column.

The integration of a carbon sensor into a Slocum glider may provide more accurate measurements of the spatial and temporal variability of sea-air $CO_2$ fluxes within the Chukchi Sea. Measurements from such autonomous platforms could provide future times series of the physical and biogeochemical observations within the Arctic at unparalleled spatial and temporal scales. The “Carbon Glider” could provide insights in the physical mechanisms that drive the changes in $CO_2$ throughout the water column and obtain a better understanding of the physical processes that lead to a buildup of $CO_2$ in subsurface waters associated with benthic and water column remineralization.

Objectives:

- Develop a carbon glider that will measure $pCO_2$, temperature, and salinity at very high spatial and temporal scales within the water column.
- Evaluate the glider's ability to autonomously map the vertical and horizontal variability in oceanic $pCO_2$

Methods: This study will integrate a custom made-MiniPro $CO_2$ sensor with a Slocum glider. Laboratory testing will be conducted to optimize the new sensor's performance and initial field tests will be conducted in from UAF's Seward Marine Center. Once the carbon glider operation and performance is shown to be robust during test deployments in Seward, a week-long demonstration mission to assess carbon distributions will be conducted in Resurrection Bay during the spring of 2016. If successful and additional funding is obtained, a second trial may occur in the Arctic.

The calibration samples taken during the glider deployment and retrieval will be used to evaluate the accuracy and precision of the sensor. Glider-measured $pCO_2$ will be calibrated directly with respect to water column measurements of total alkalinity and dissolved inorganic carbon from bottle samples. These data will be used to create a calibration curve for the measured values, as well as to assess the uncertainties in the sensor data. Fieldwork was completed in the spring of 2017.

**Current Status:** Completed

**Final Report Due:** February 2018

**Publications Completed:** None

**Affiliated WWW Sites:** http://www.boem.gov/akstudies/
http://www.cfos.uaf.edu/cmi/
https://marinecadastre.gov/espis/#/search/study/100128

**Revised Date:** January 30, 2018