Hanna Shoal Year-Round: Emerging Results from the CEO

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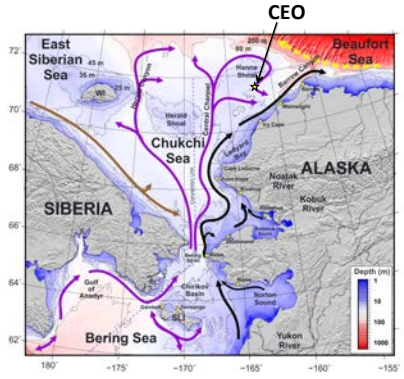
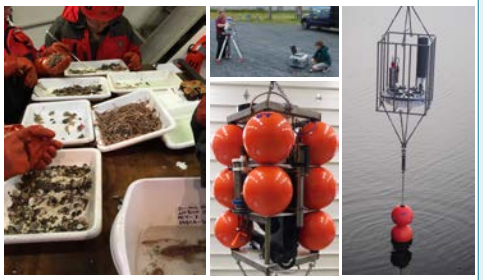
Chukchi Ecosystem Observatory: Overview



The **Chukchi Ecosystem Observatory** (CEO) moorings were recovered and redeployed for a third consecutive year of observations in August 2016.

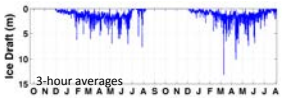


The CEO is designed to autonomously record year-round high-resolution data representing multiple disciplines and trophic levels in the NE Chukchi Sea so that we may:

- ✓ Quantify variations in nutrient and carbonate chemistry, particle, plankton, fish and marine mammal observations and relate to fluctuations in currents, waves, winds, light, & ice.
- ✓ Collect reference observations that can be applied to evaluating and improving biogeochemical, ice-ocean circulation, ecosystem, and fisheries models.
- ✓ Provide core observations to form a leverage point for additional research activities
- ✓ Provide rapid data access to stakeholders

CEO data are revealing consequences of wind and wave activity on ocean currents and water column hydrography, the annual cycle of nutrient draw-down and replenishment, the timing and composition of particulate matter settling and marine mammal activity, the distribution of ice keels, and the timing and location of sound scatterers in the water column.

What goes on under the ice does not stay under the ice



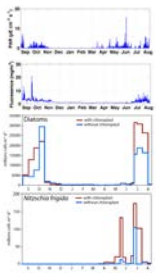
September 2014 to August 2016

- CEO moorings are underneath ice for two-thirds of the year
- 3-hour averages of ice draft shows ice of up to 13 m thick
- Deepest observed keel depth = 26 m

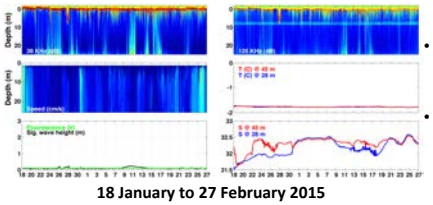
Scan the QR codes to hear CEO recordings of bearded seals & walrus.

Bearded Seal **Walrus**

- Lots of sunlight under thick ice in May/June 2016
- Very little chlorophyll fluorescence at 33 m depth in May 2016; increases through June and July
- Very large diatom export in June and July
- Light and appearance of ice algae *Nitzschia frigida* in May & June indicates ice release due to snow and ice melt.

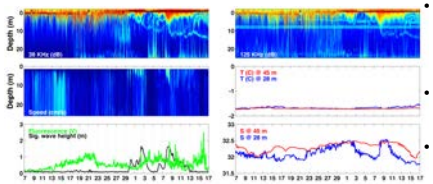


August 2015 to August 2016



18 January to 27 February 2015

- Mid-winter acoustic scattering signals exhibit appreciable variability
- Alternating episodes of water column stratification and re-homogenization
- Strength of acoustic scattering may be related to stratification, current speed, and ice compactness.

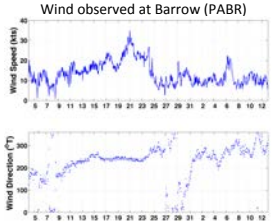


7 June to 17 July 2015

- Early summer return of surface mixed layer and associated scattering layer coincident with retreat of ice
- Fluorescence in water column weeks before ice retreat
- Mid-depth instruments see temperatures rise and salinities decrease before and after transition to open water

Fall Storm Consequences

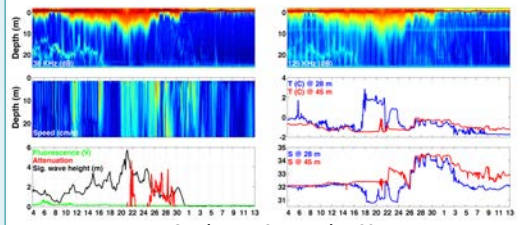
Strong fall winds with extremely persistent direction led to a major shift in abiotic and biotic water column characteristics.



4 October to 13 November 2014

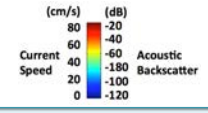
The moorings recorded:

- Significant wave heights of nearly 6 m
- Increase of water column turbidity
- Water column destratification followed by restratification
- Reduction in amplitude of diurnal fluctuations of scattering layers
- Deepening of persistent scattering layer (at pycnocline?)
- Appearance and then slow decay of Atlantic Water



4 October to 13 November 2014

Color scheme for all acoustic backscatter and current speed panels on this poster



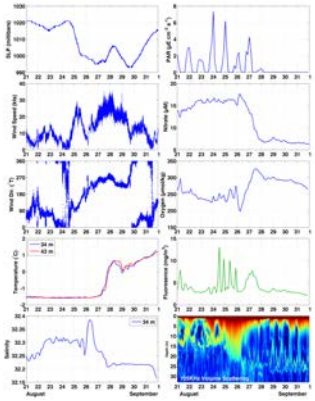
Summer Storm Consequences

The moorings recorded:

- A deepening mixed layer that was accompanied by deepening of an associated mid-depth acoustic scattering layer
- Freshening and warming below the surface mixed layer
- Decrease of sunlight
- Decrease of nitrate
- Pulsed increases of fluorescence
- Increase then slow decay of dissolved oxygen
- Changes in character of the diurnal acoustic scattering signal

Not shown here:

- CTD samples from before and after storm confirm the MLD deepening along with incomplete water column mixing
- Bottle samples suggest modest post-storm increase of nutrients above the MLD.



21 August to 1 September 2015

Acknowledgements

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