Non-invasive, highly vertical resolved observations of sea-ice biomass

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Dilemma of time series:

Sampling of many ice cores impacts processes in question

Increasing the sample area increases spatial variability

To improve in-situ process studies and test heterogeneity as an independent variable one needs to separate temporal and spatial variability
Separation of temporal and spatial variability

- Difference in carrying capacity: Growth rate identical
- Difference in growth rate: Carrying capacity identical
- Disturbances and resiliency

Biomass vs. Time

Site A, Site B, Site C

Single sample
The importance of resolving vertical gradients and disturbances

- Congelation events
- Bottom ablation events
- U.I. boundary layer effect

- Ice
- Water
- Steep biomass gradient
- Shallow biomass gradient
- Algal nutrient stress
- Biomass gradients and interface dynamic
- Grazing impediment
- Lateral advection
Advantages:

Flexible operation: Stationary and profiling mode

Unified anti-fouling and anti-freeze system

Modular sensor system (no pressure housings)

Non-destructive, high temporal, and vertical sampling of vertical gradients

Instantaneous in situ data for strategic support

Disadvantage:

Little horizontal scale resolution
Data examples Barrow 2003

January 27

March 4

April 9

April 30

Fluorometer raw data

Depth from the ice surface (cm)

Depth horizon (cm)

Bulk Chl a conc. (µg/l)

Fluorometer raw data

Depth from the ice surface (cm)

Depth horizon (cm)

Bulk Chl a conc. (µg/l)
Planned coastal expansion

- **Internet**
- **BASC**
- **hydrological connectivity from shore**
- **surface meltwater**
- **ice cracks**
- **ice algae**
- **terrestrial meltwater**
- **vertial migration**
- **fetal particle export**
- **aggregate export**
- **aggregates on pycnocline**
- **seal**
- **advected marine water**
- **benthos**
Conclusion

System is well suited to be integrated into ice tethered buoy nodes

...to study basin-wide

• timing and geographic extent of physical forcing events and the resulting dynamic of sea-ice biomass

• change in accessibility of sea-ice biomass to grazers

• and timing of release of organic material to the water column