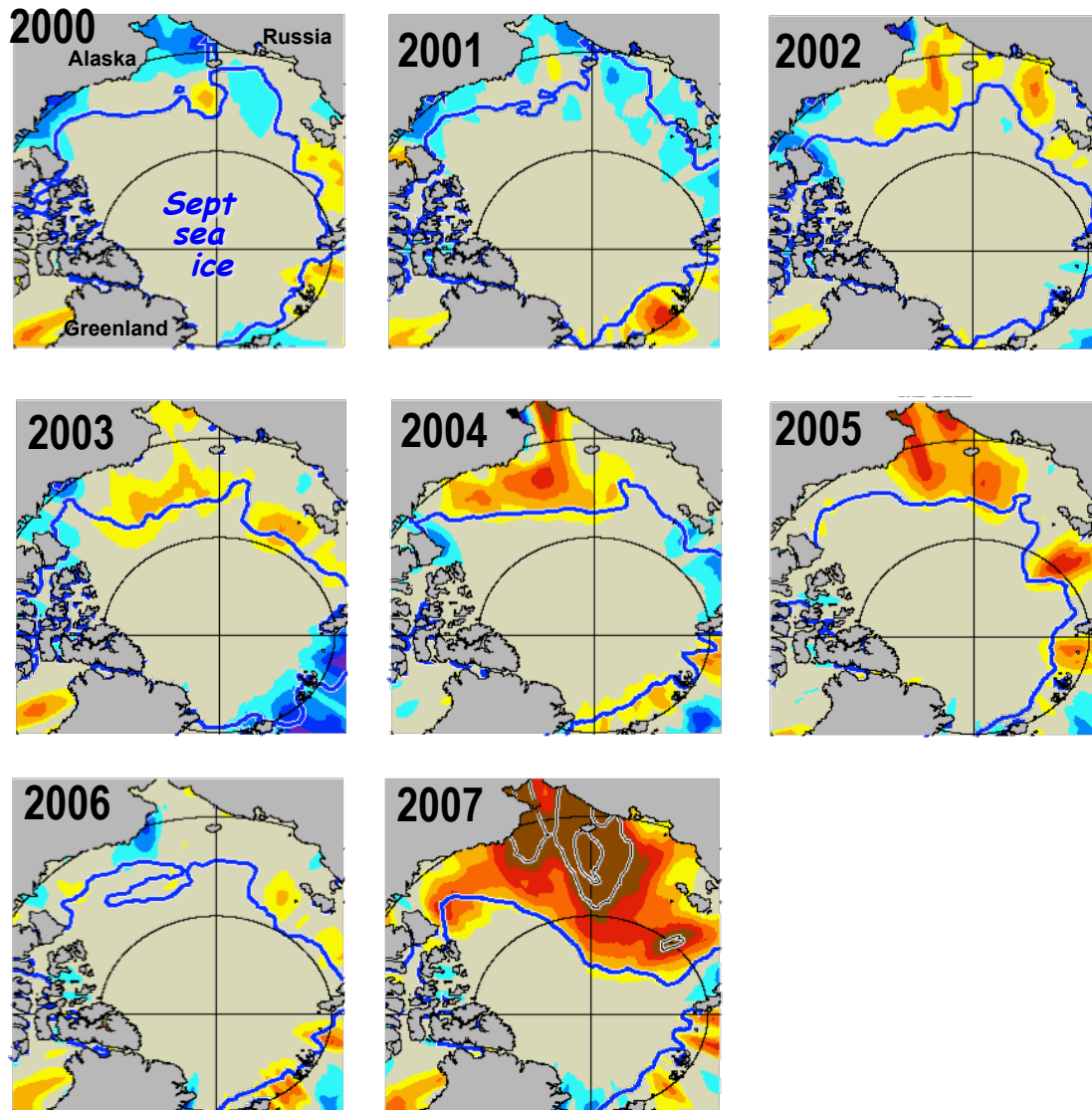
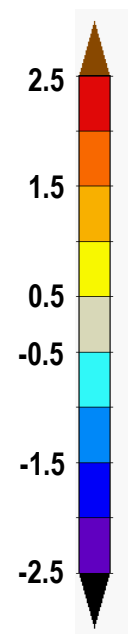


Ice Retreat → Ocean Warming



from Steele et al., GRL 2008



Sea Surface Temperature (°C)

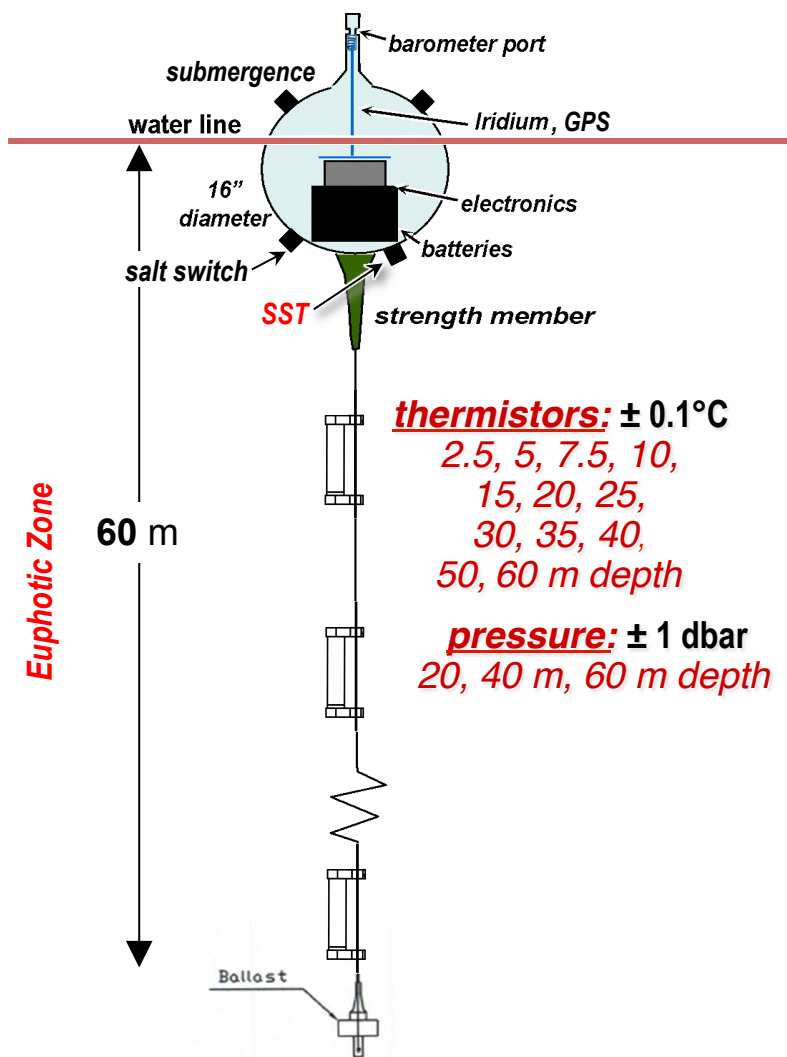
Anomalies of summer (JAS),
relative to 1982-2007 mean
daily NOAA OI.v2

Local solar + advection

Steele et al. JGR (2010)

The UpTempO buoy

Upper Temperature of the polar Oceans



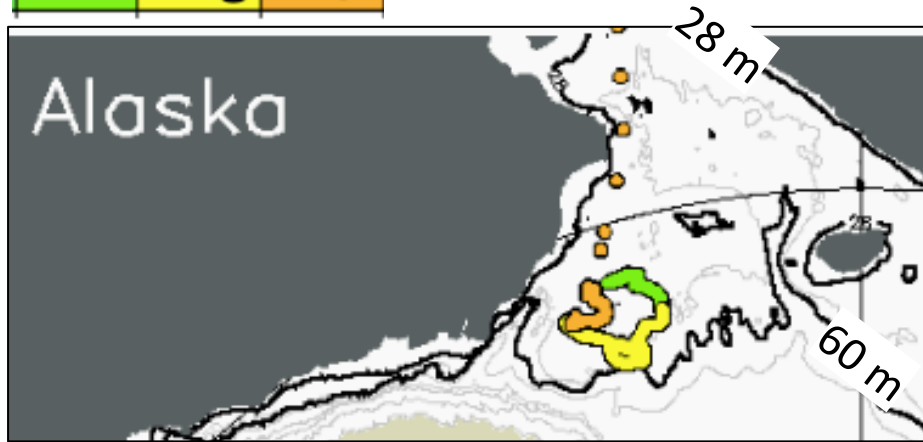
Deploy:

In ice or water by ship, ice camp, air

Chukchi UpTempO

Jul Aug Sep

2015

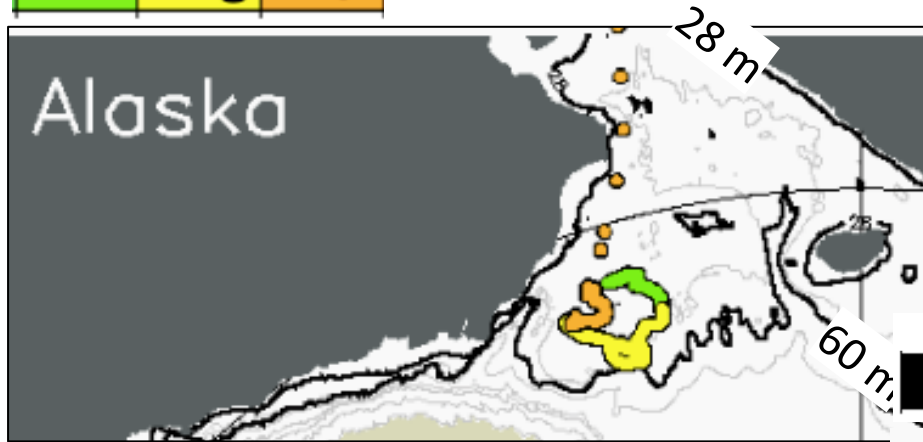


New: 25 m for shelves

Chukchi UpTempO

Jul Aug Sep

2015



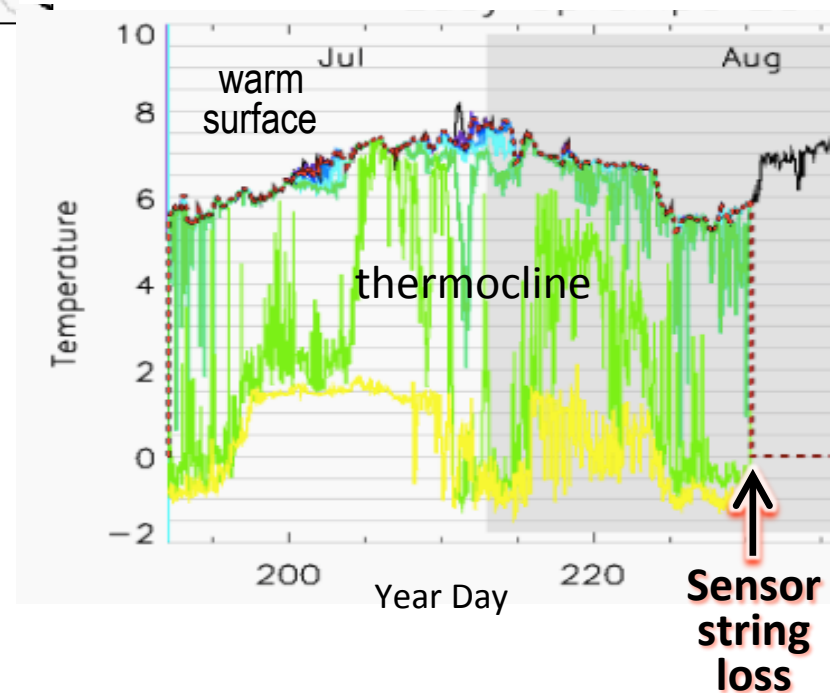
New: 25 m for shelves

Nominal Temperature Sensor Depths (m)



Also:

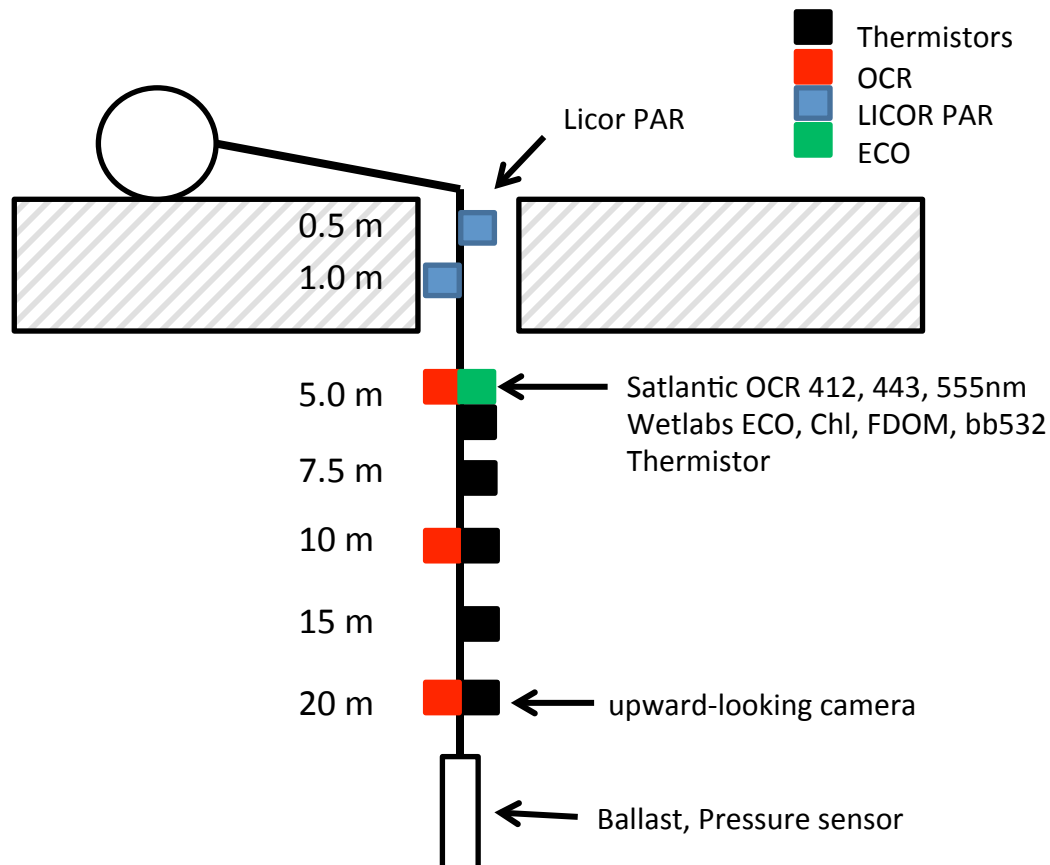
- 4 m **salinity** ~ 31.5
- Surface **winds**



UpTempO + bioOptics: The "WARM" buoy

WArming &
irRadiance Measurements

V. Hill, B. Light, M. Steele



Also:

- 50 m string for basins

Future:

- 3 x CT → S for stratification
- Incoming PAR sensor

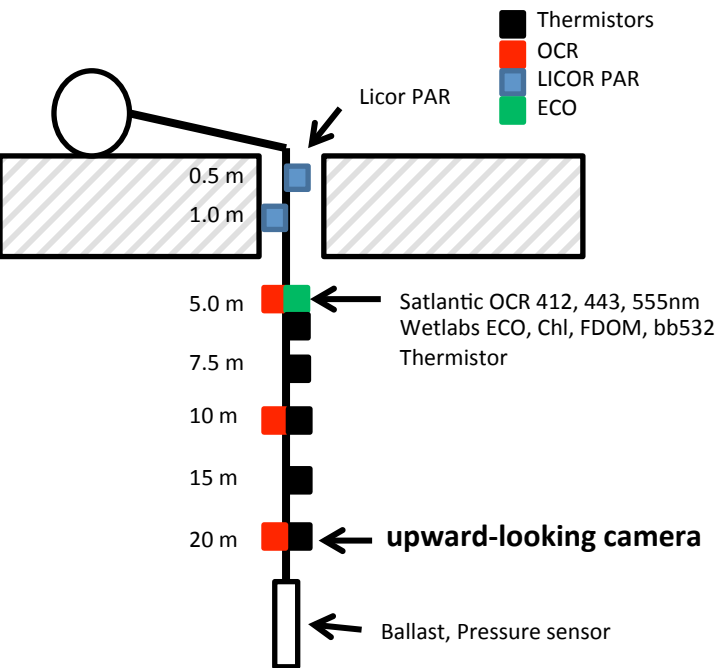
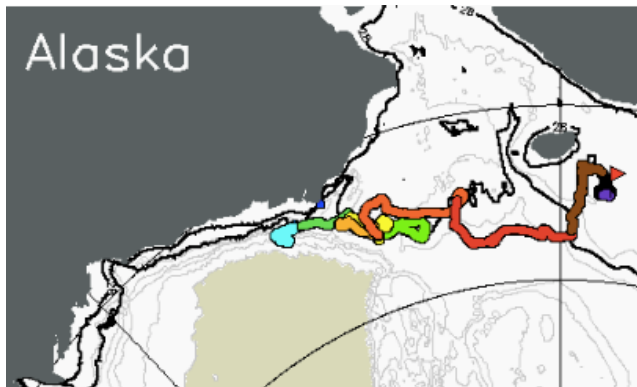
The "WARM" buoy

WArming &
irRadiance MMeasurements

V. Hill, B. Light, M. Steele

2014

May Jun Jul Aug Sep Oct Nov Dec



Heat budget:

warming ~ solar + advection

$T \sim PAR + residual$

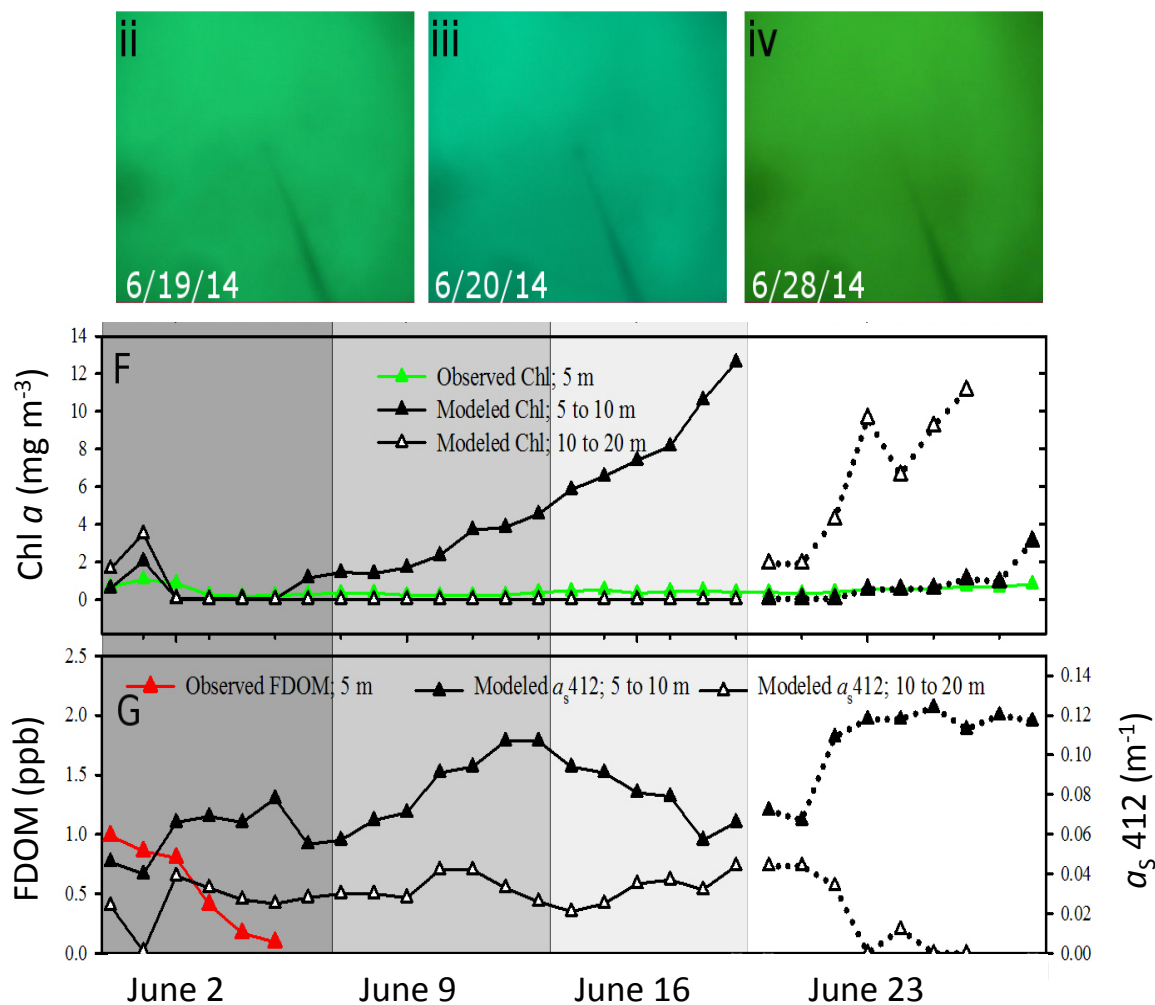
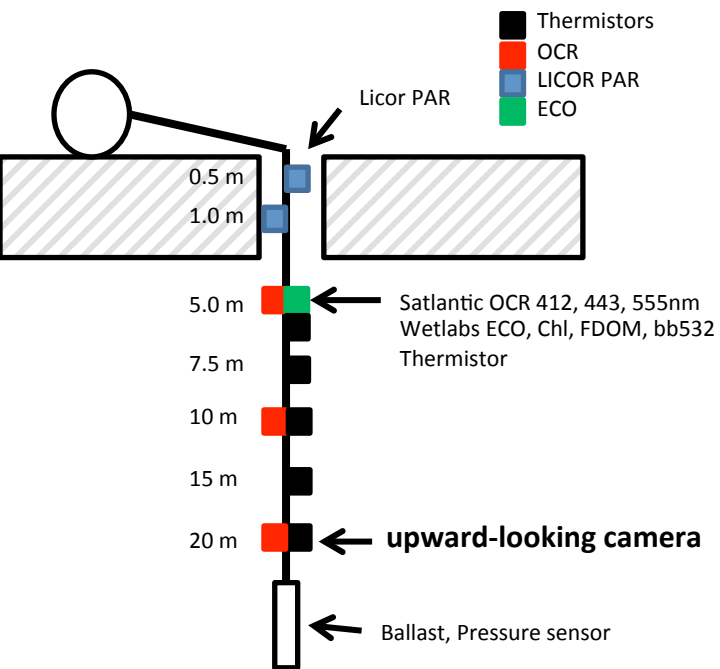
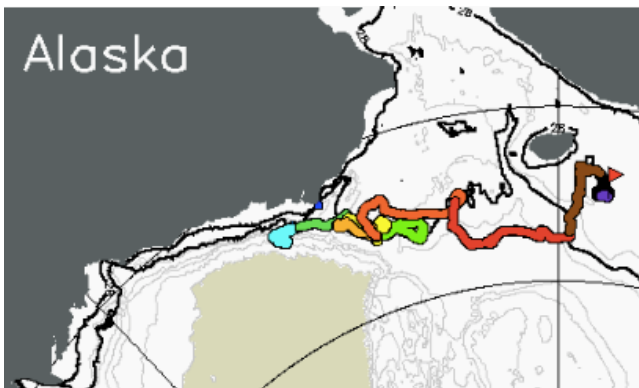
The "WARM" buoy

WArming &
irRadiance Measurements

V. Hill, B. Light, M. Steele

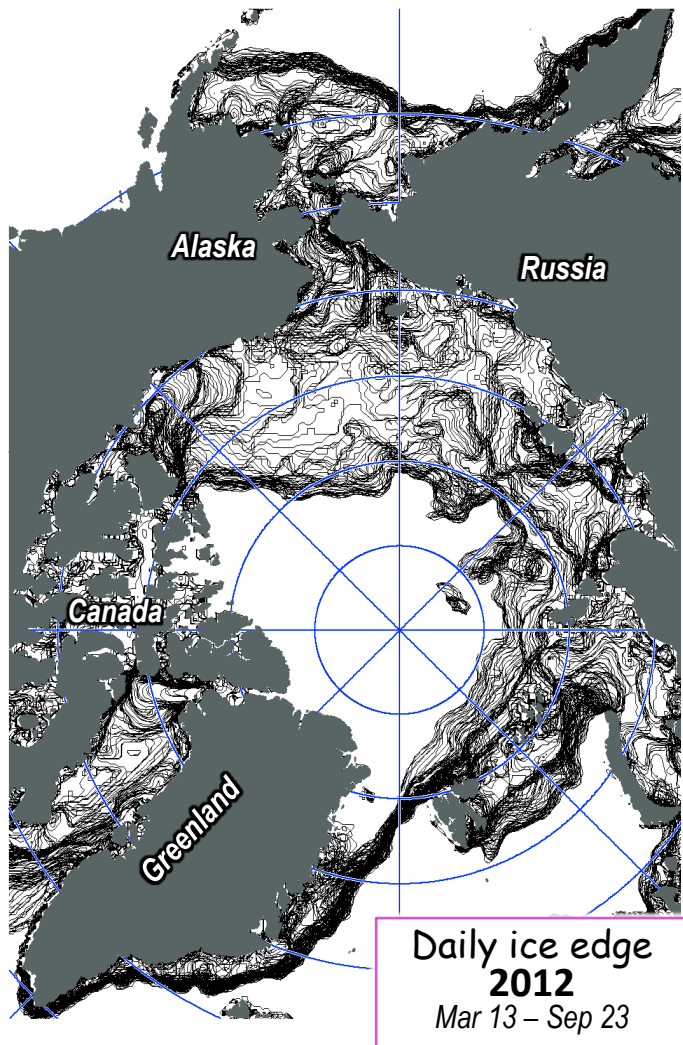
2014

May Jun Jul Aug Sep Oct Nov Dec



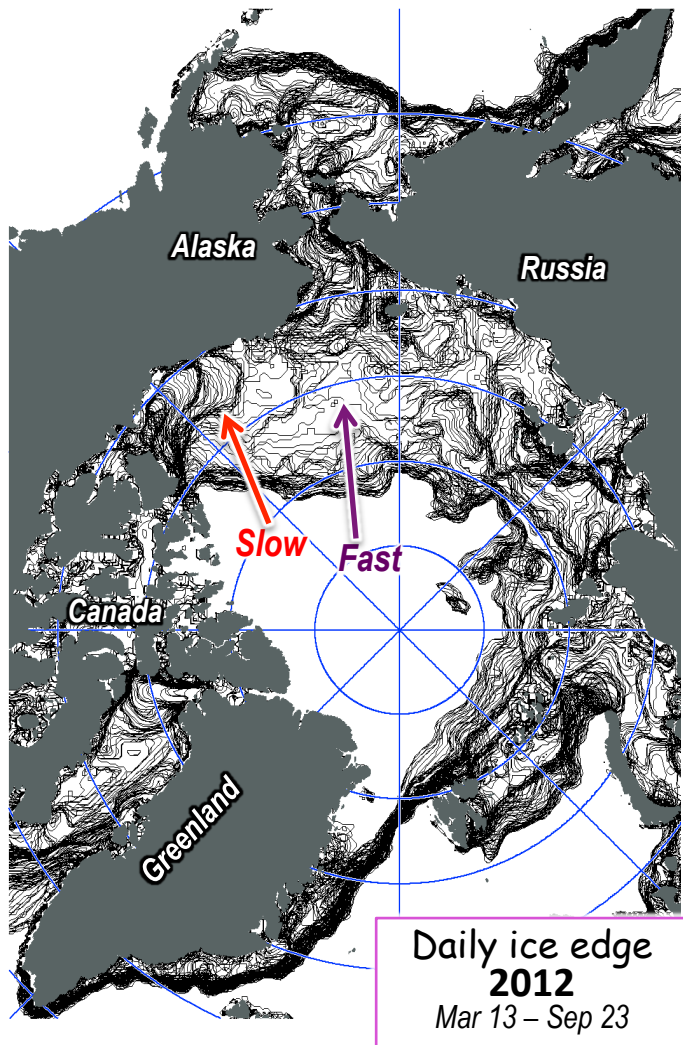
Ice Retreat ← Ocean Warming

DBO mtg
Mar 9, 2016



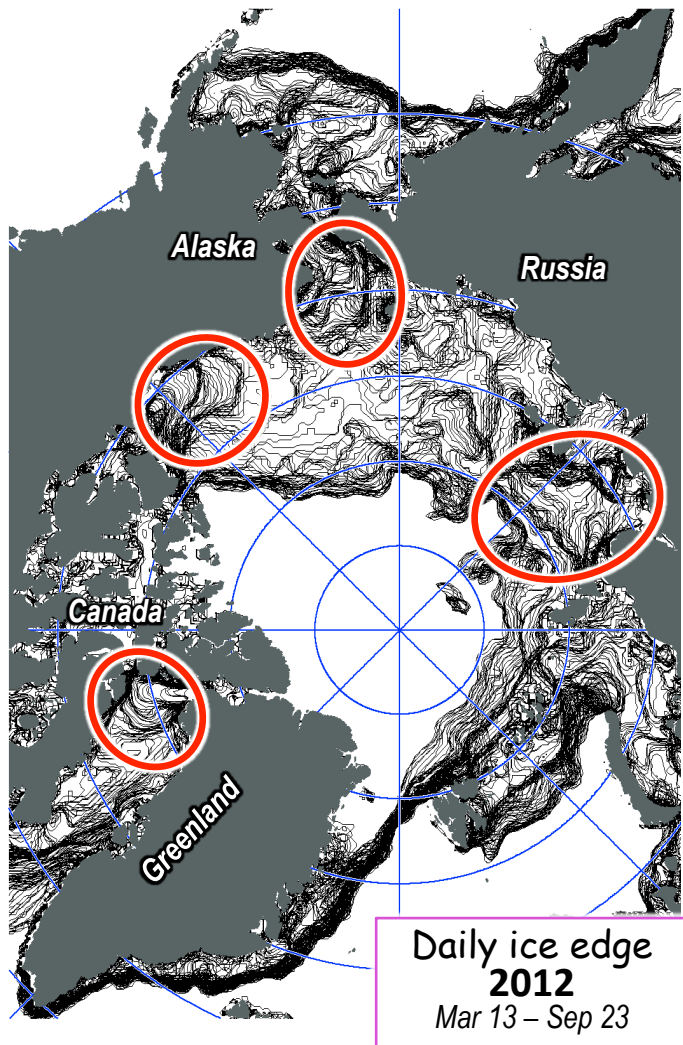
Ice Retreat ← Ocean Warming

DBO mtg
Mar 9, 2016



Ice Retreat ← Ocean Warming

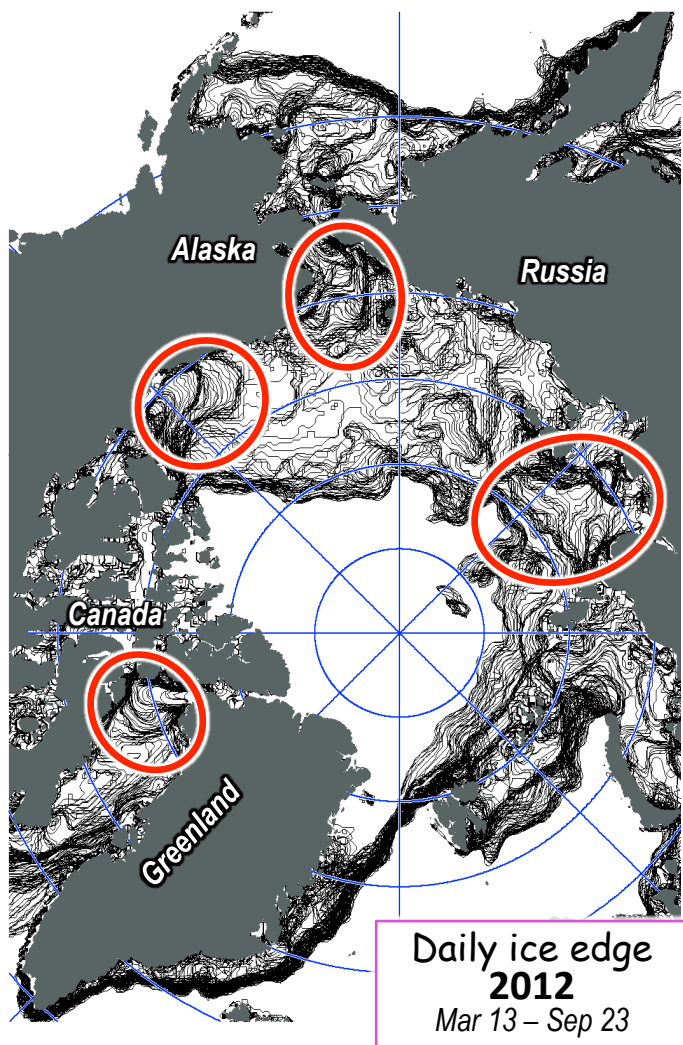
DBO mtg
Mar 9, 2016



"Ice edge loitering"

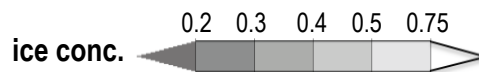
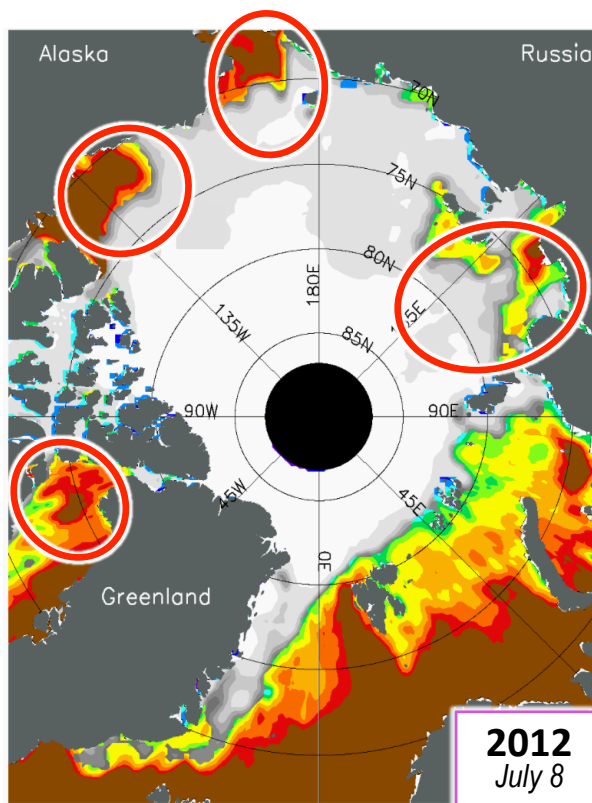
Steele & Ermold, JGR (December, 2015)

Ice Retreat ← Ocean Warming

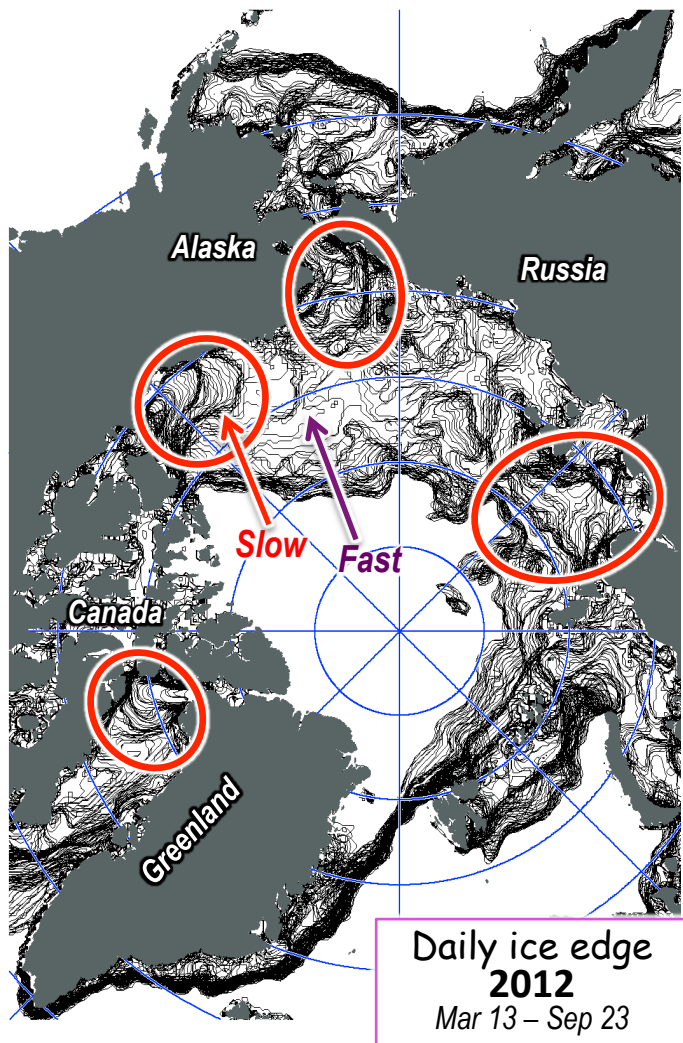


"Ice edge loitering"

Steele & Ermold, JGR (December, 2015)

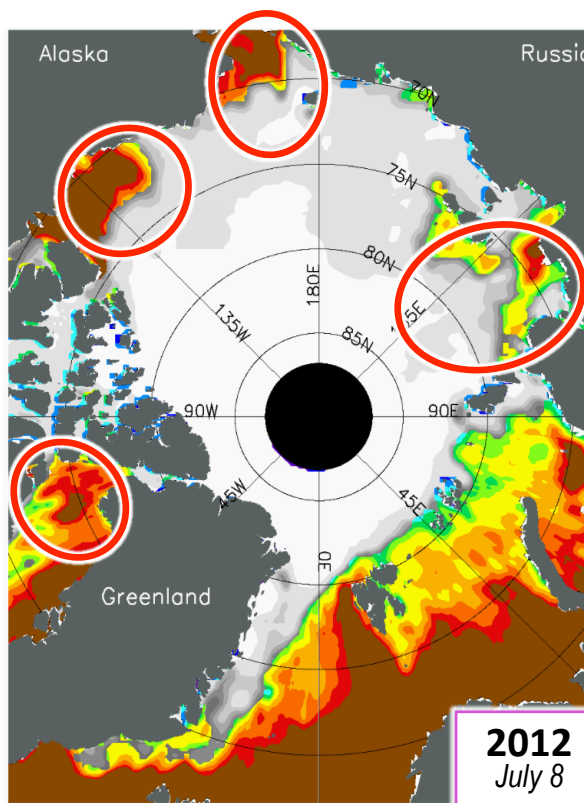


Ice Retreat ← Ocean Warming



"Ice edge loitering"

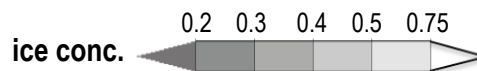
Steele & Ermold, JGR (December, 2015)



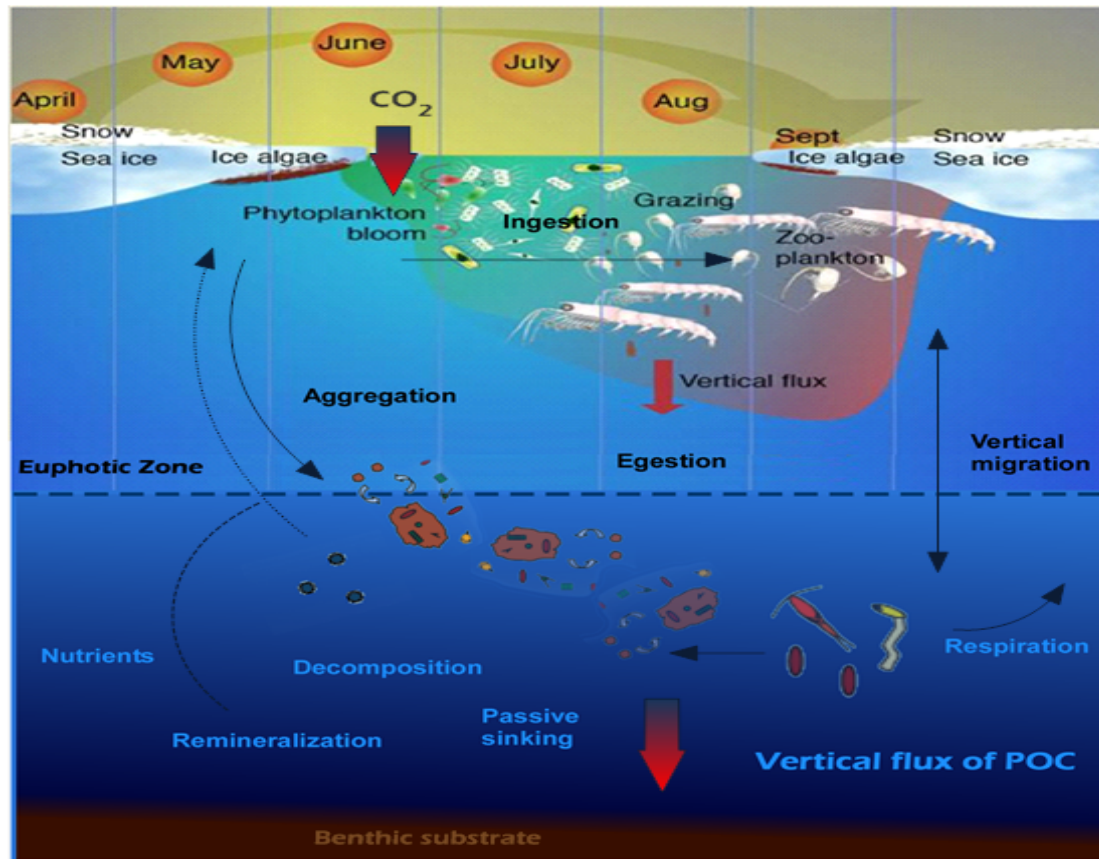
Explanation?

Off-ice winds +
warm SSTs

~ 4-10 day time scale



Ice edge ecosystem time scales: A proposal



← A slow **seasonal** progression

+

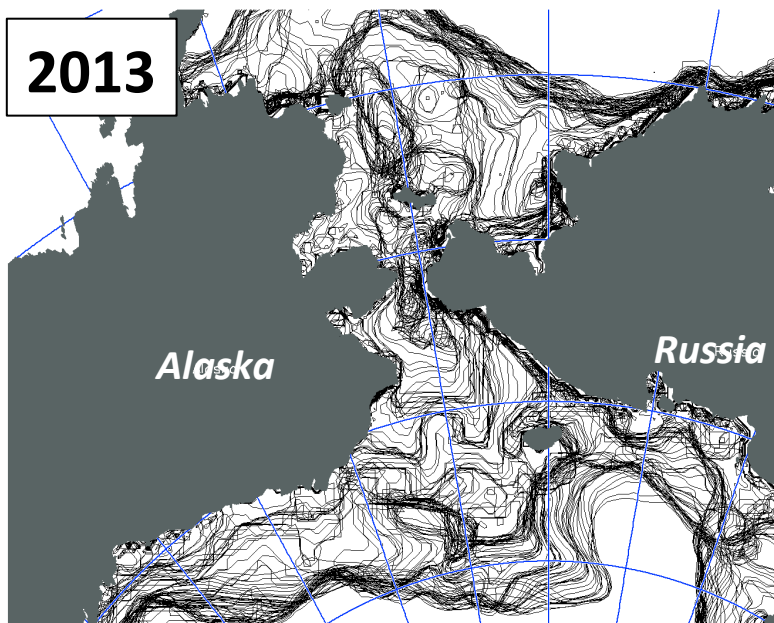
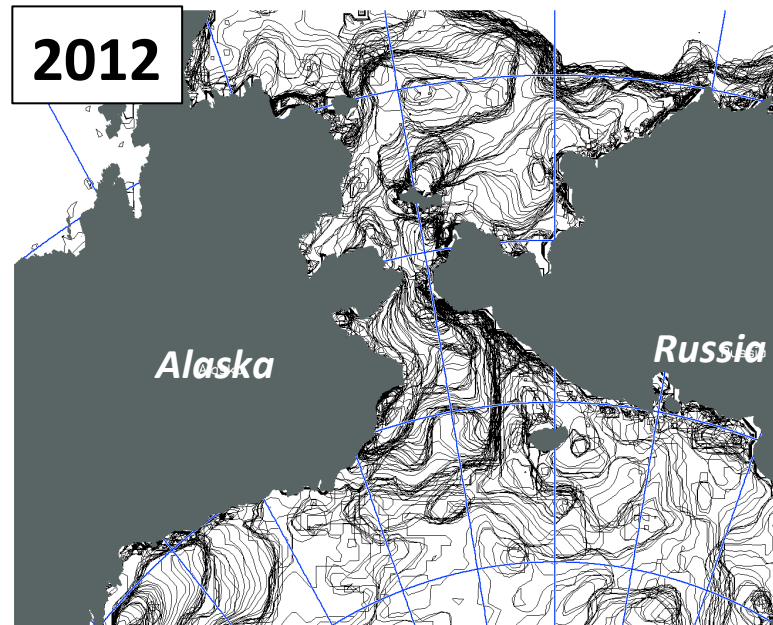
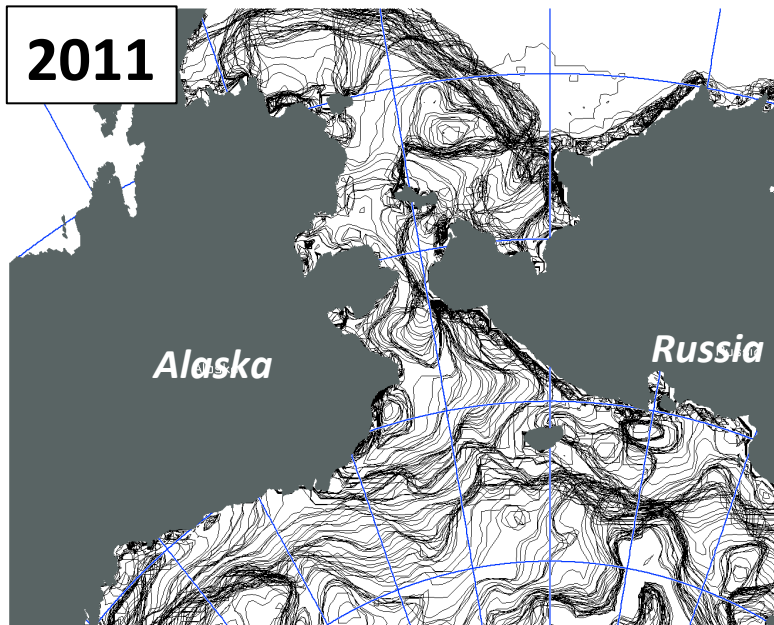
~ **Weekly** “reset” from:

(i) Highly stratified loitering MIZ

to:

*(ii) Less stratified, mixed MIZ
retreating rapidly northward*

Keck, Wassmann, Strand, Forest
(1993, 2003)



DBO Loitering

Loitering Frequency (1989-2013)

