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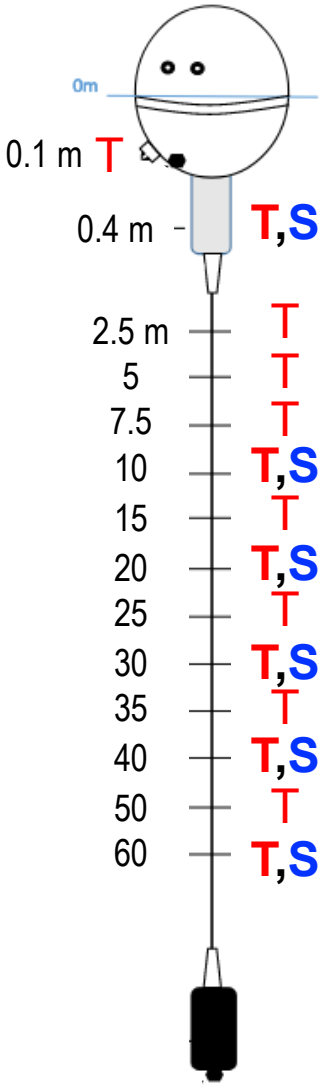
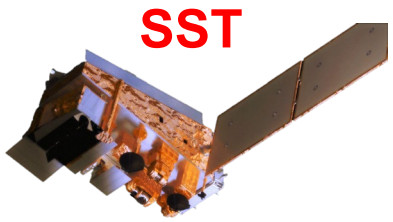
Mike's buoys in the Pacific Arctic



T,S

"hydrobuoys"

SSS



SST

2. SIZRS

3. Arctic Heat

1. SASSIE

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University of Washington

Remote sensing: next year!

(NASA) **SASSIE**: Salinity And Stratification at the Sea Ice Edge (*2021-2024*)

K. Drushka, F. Bingham, S. Brown, E. D'Asaro, A. deCharon, I. Fenty, S. Fournier, P. Gaube, T. Maksym, V. Menezes, S. Misra, J. Schanze, A. Shcherbina, M. Steele, J. Thomson, & S. Zippel. (*UW, JPL, WHOI, UNC, ODYSEA, ESR*)

kdrushka@apl.uw.edu

Google:
“nasa sassie”

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PAG Dec 2022
Victoria, Canada

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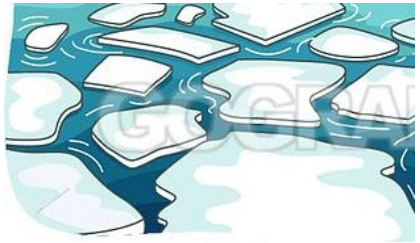
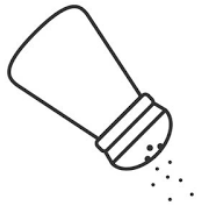
- SMAP **satellite validation**

- **How close to the ice** can satellite SSS go?



- How does salinity influence **ice advance**?



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☞ **Beaufort Sea**

Google:
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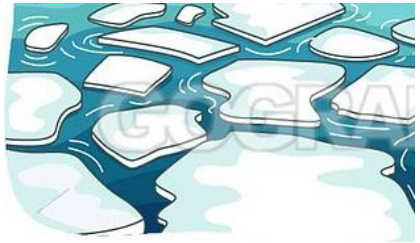

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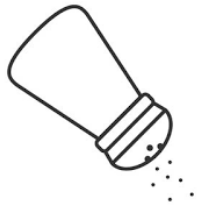

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NASA SASSIE: Salinity And Stratification at the Sea Ice Edge

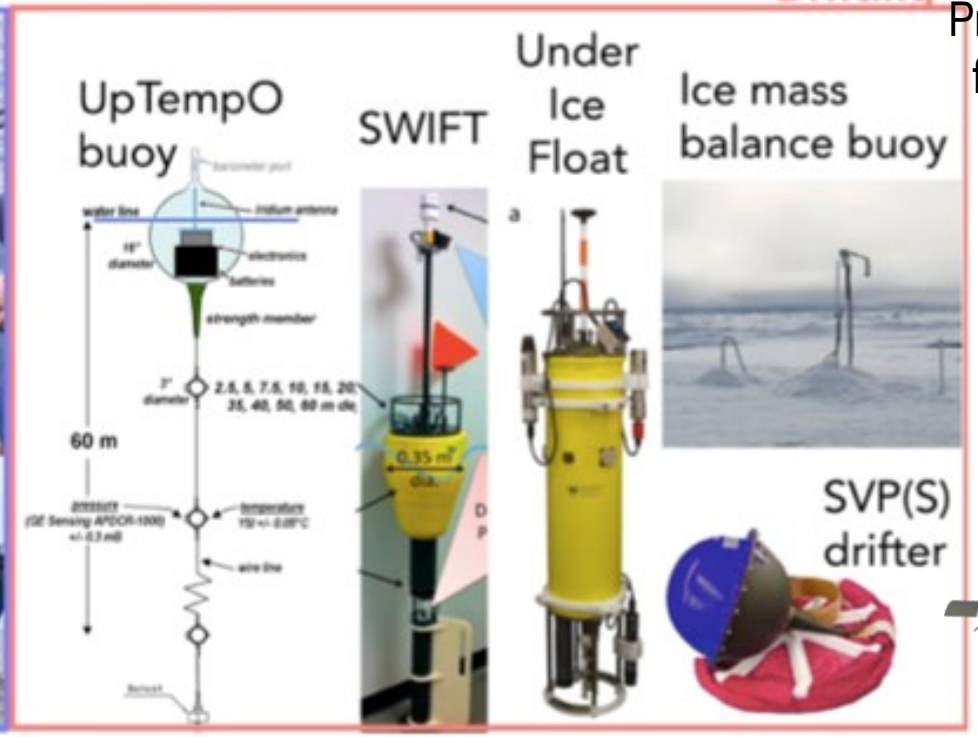
(*2021-2024*)

2022 field campaign

Remote sensing

Piloted

Ship-based



Drifting

Profiling floats

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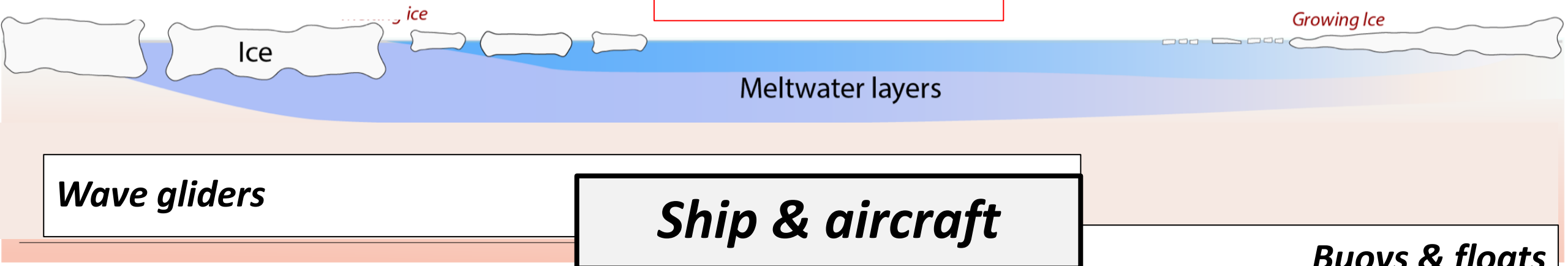
2022 field campaign: Three main phases

August: ***melt***

September: ***transition***

October: ***freeze-up***



Wave gliders

Ship & aircraft

Buoys & floats

Satellite, modeling

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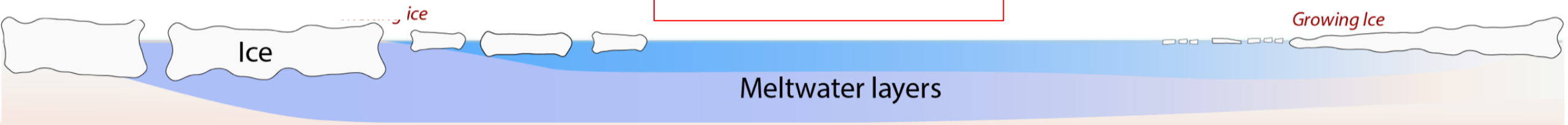

Wave gliders

Ship & aircraft

Buoys & floats

Satellite, modeling

Mike:
11 buoys
7 floats

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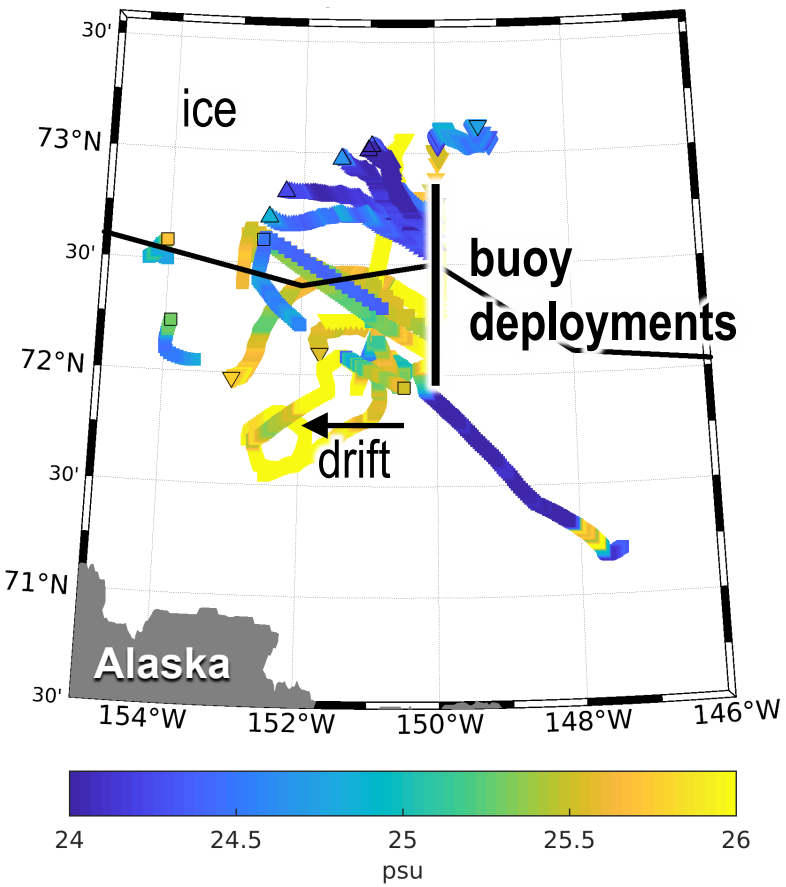
Open water - ice transition in early September 2022

~ 2-3 psu salinity gradient across the ice edge

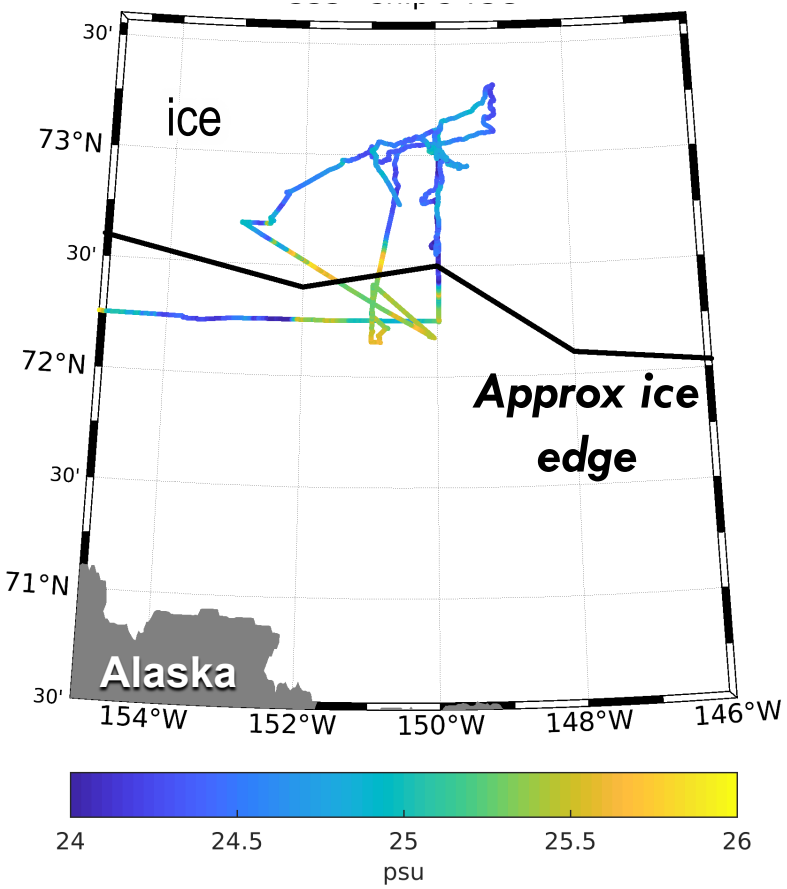
Salinity within the sea ice is more uniform

Strong spatial variability south of the ice edge

SSS from buoys & Wave Gliders



SSS from the ship



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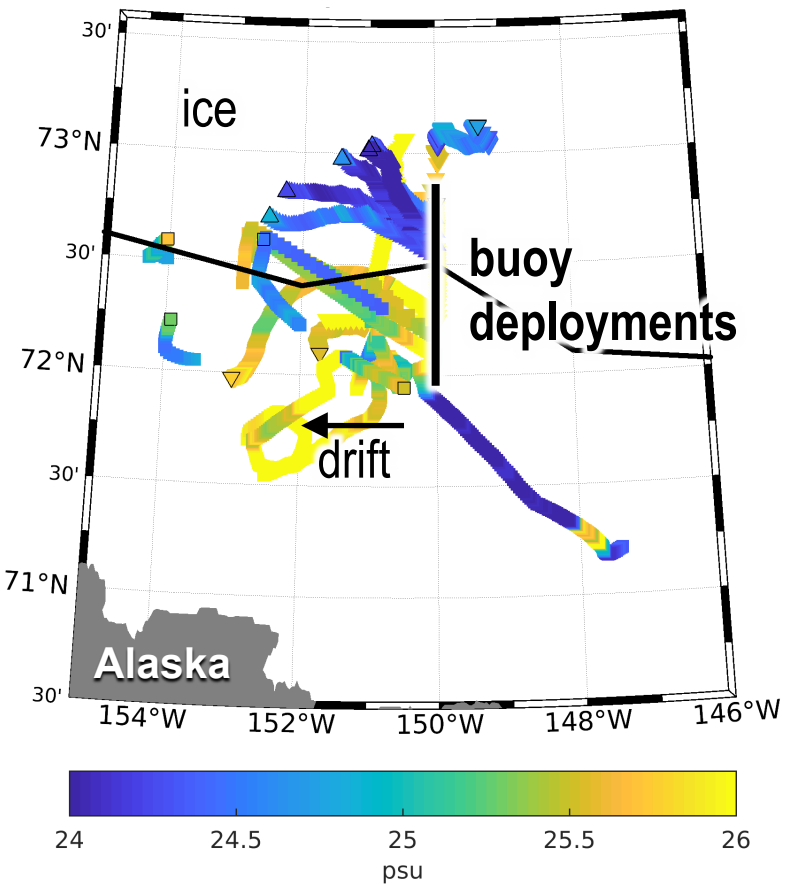
Data public at
JPL's PO.DAAC
by spring 2023

SSS from buoys & Wave Gliders



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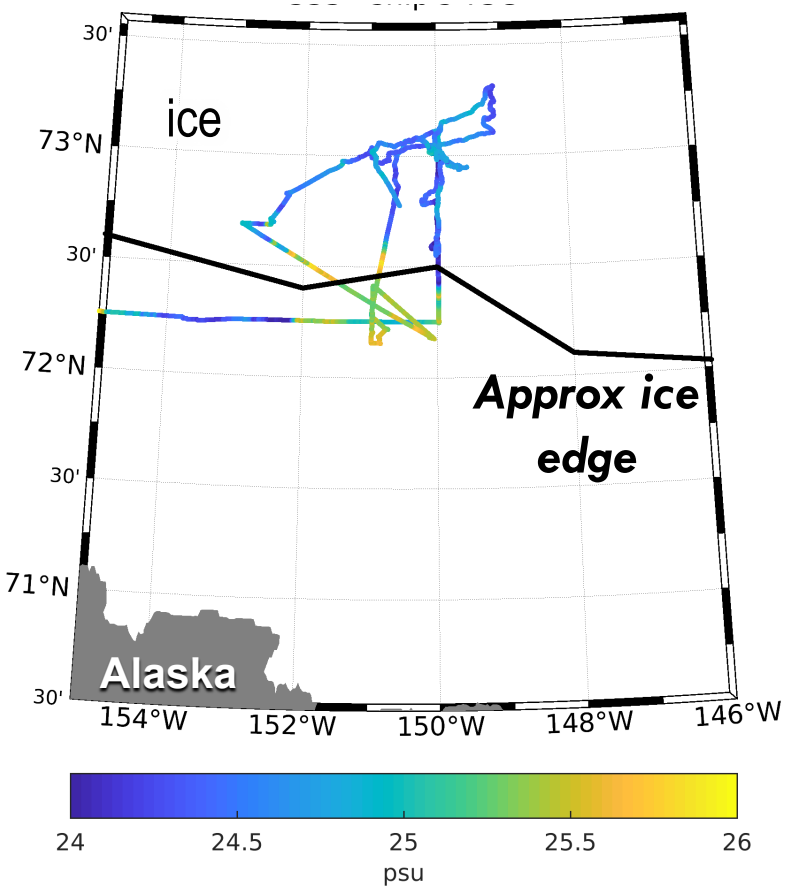

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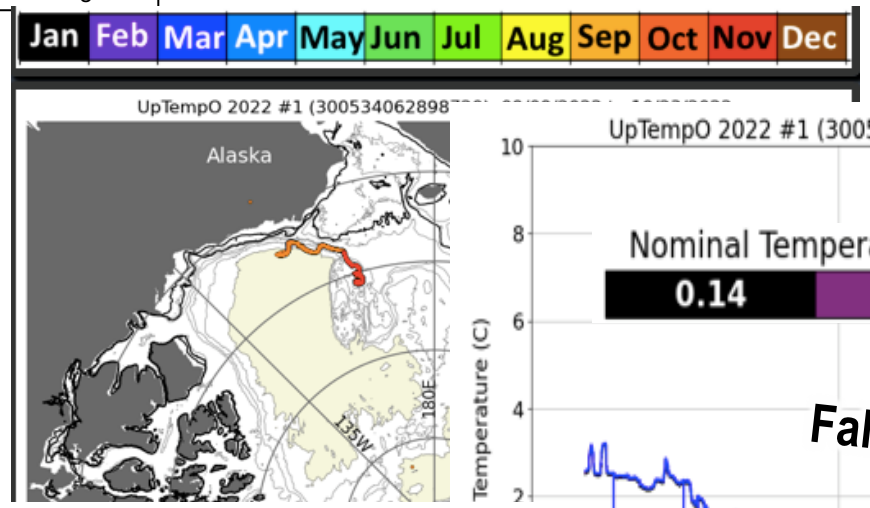
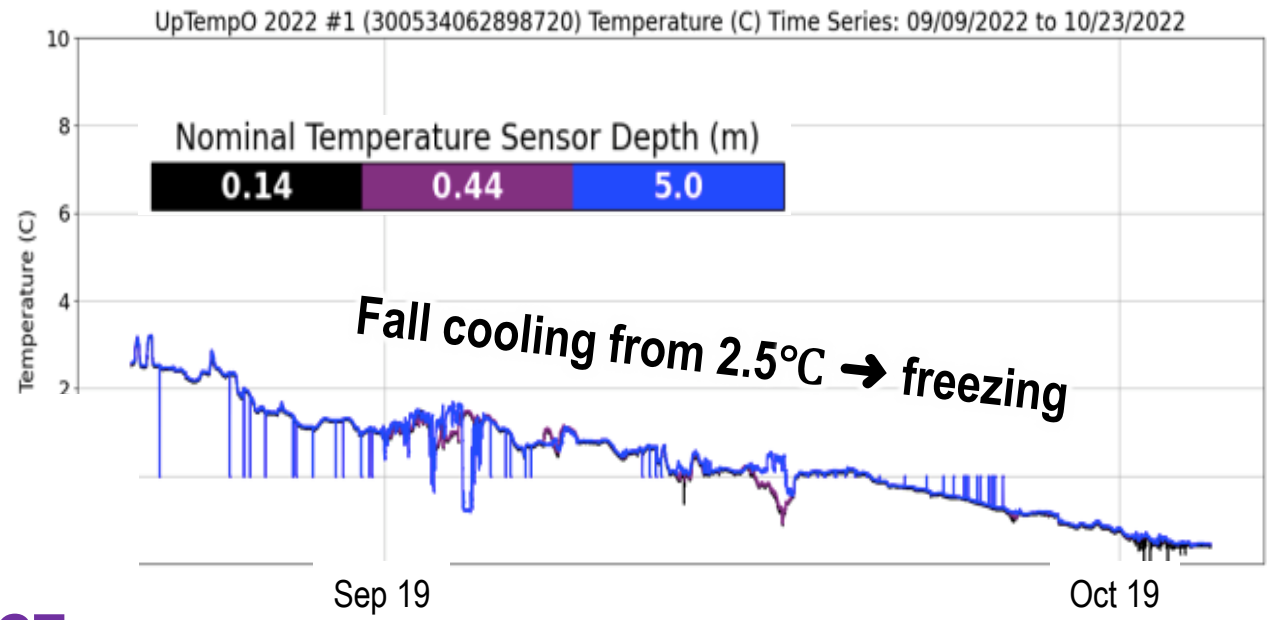
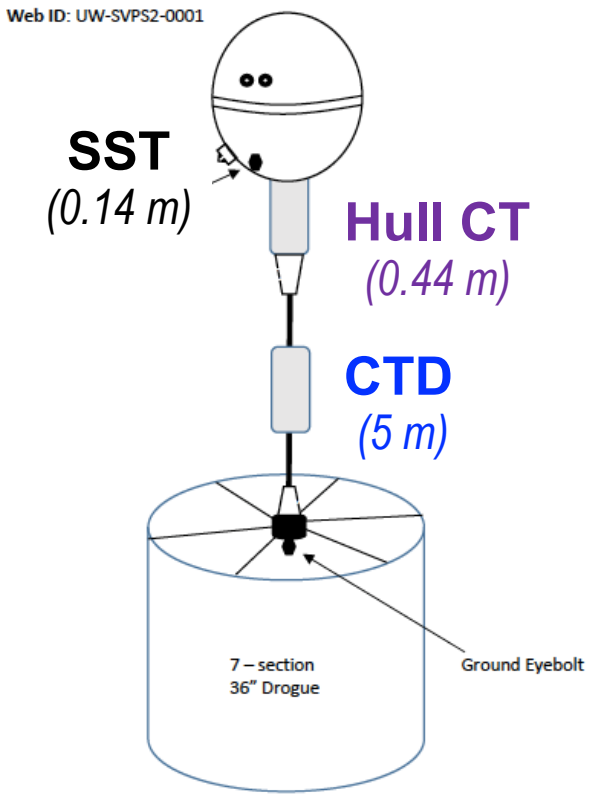
SASSIE 1st Buoy:
SVP-S2-SBE (*Sep 9 – Oct 23*)







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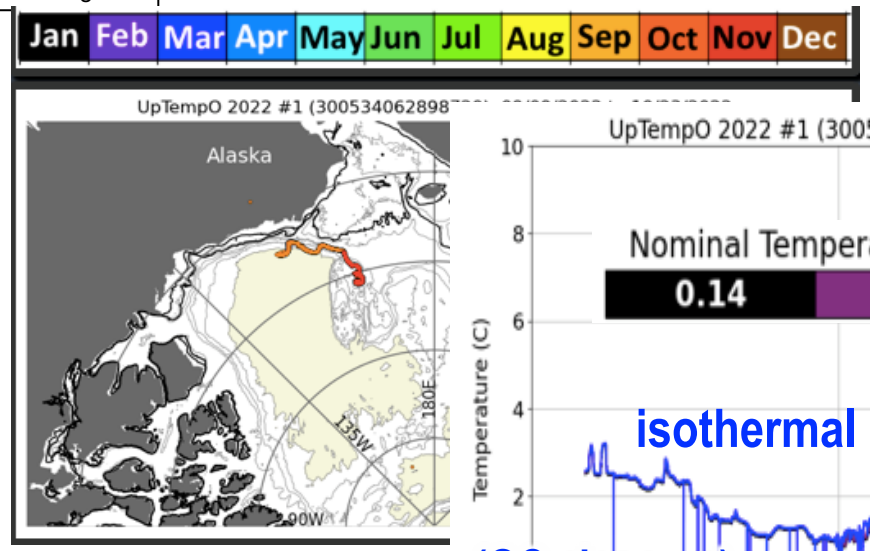
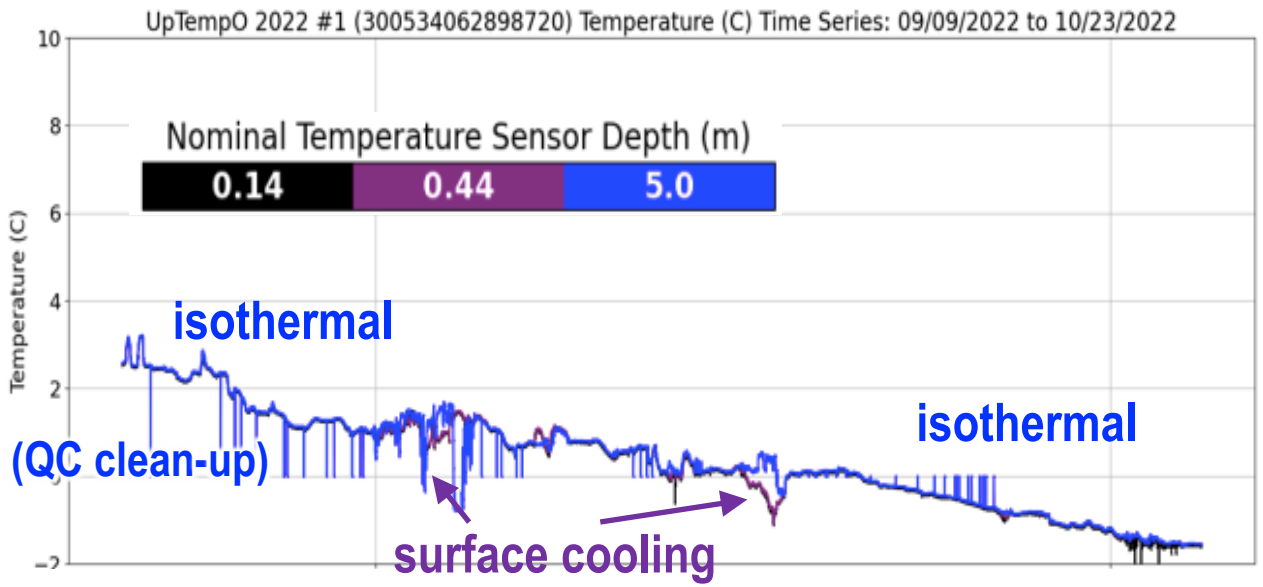
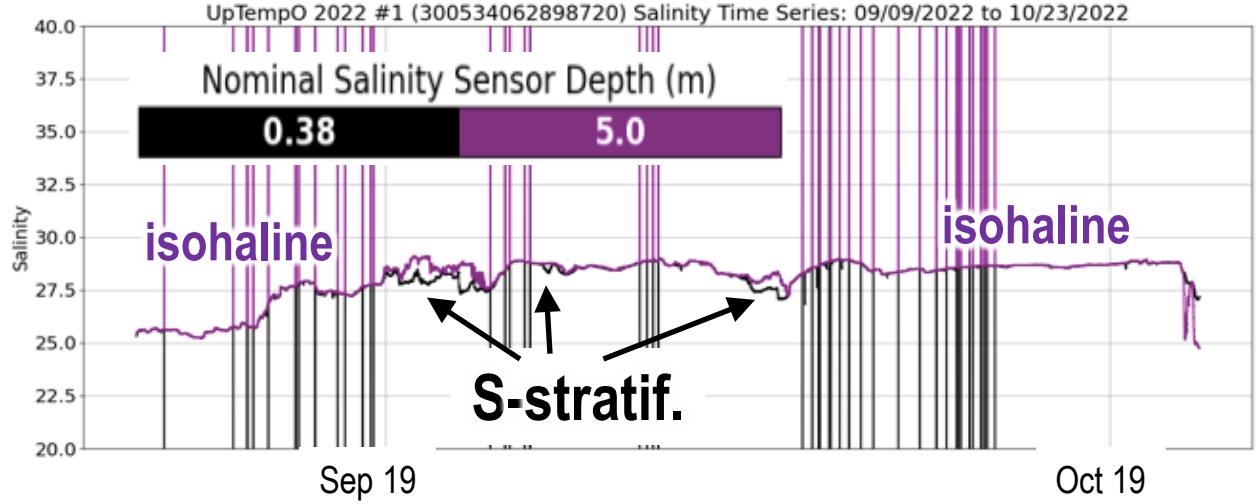
SASSIE 1st Buoy: **SVP-S2-SBE** (*Sep 9 – Oct 23*)







coincident
cooling
+
stratification

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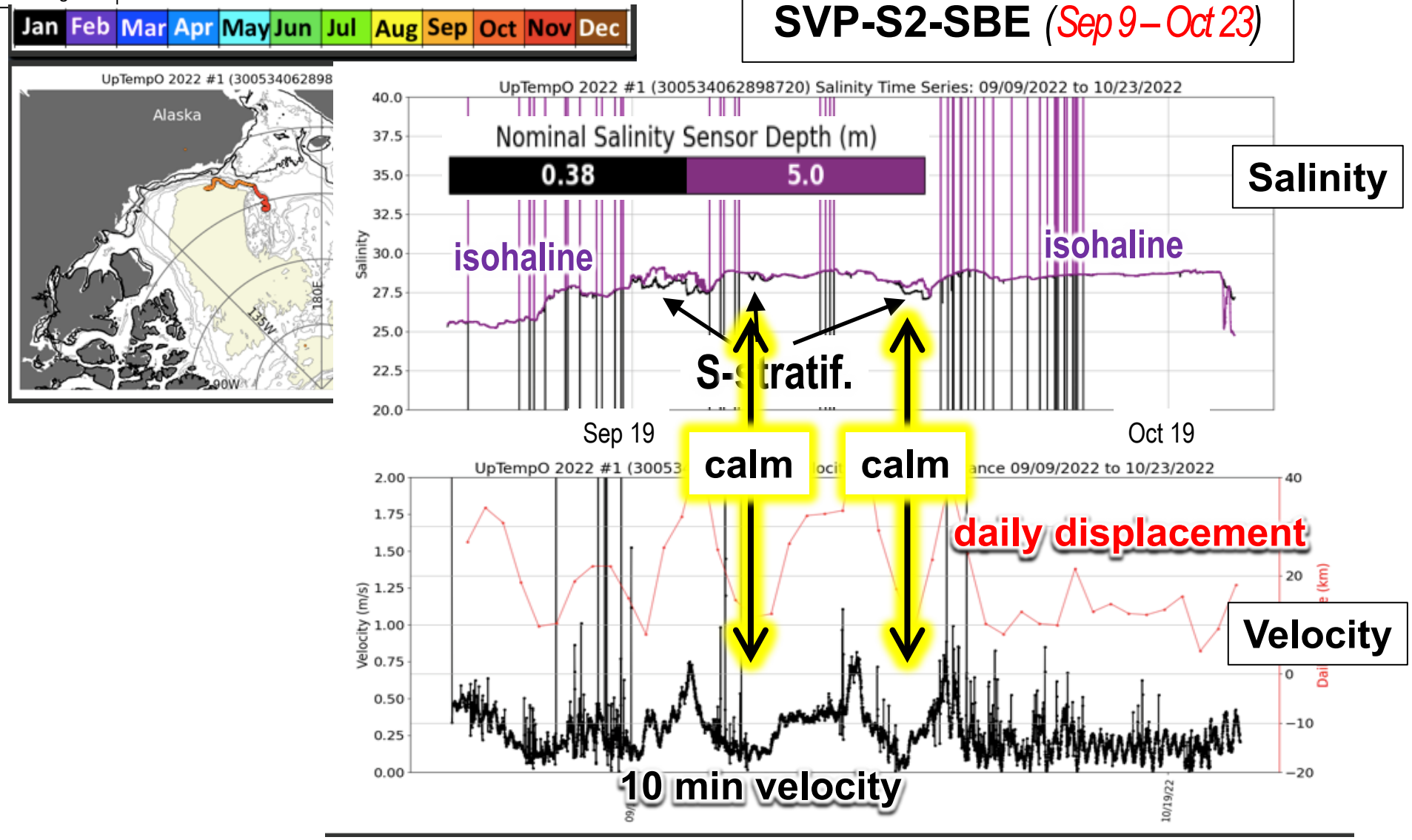

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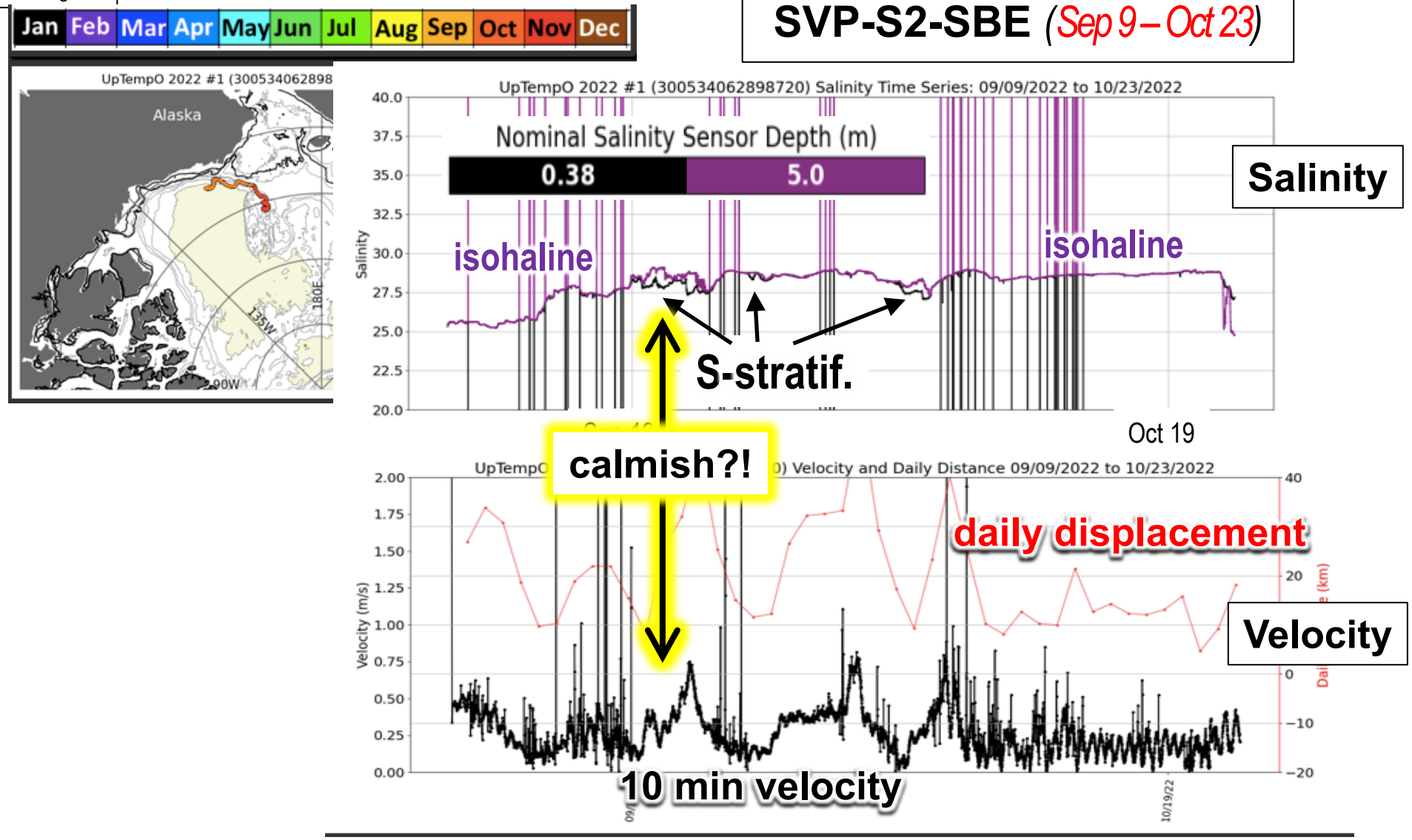

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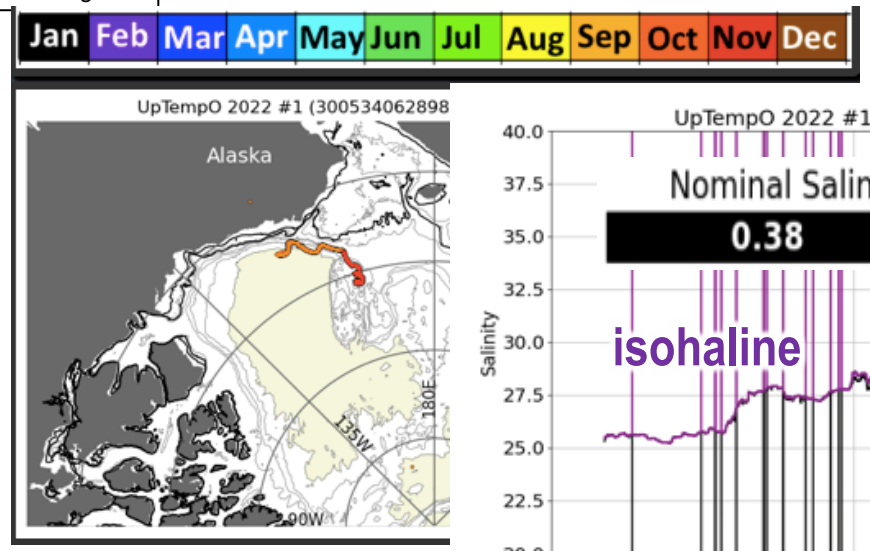
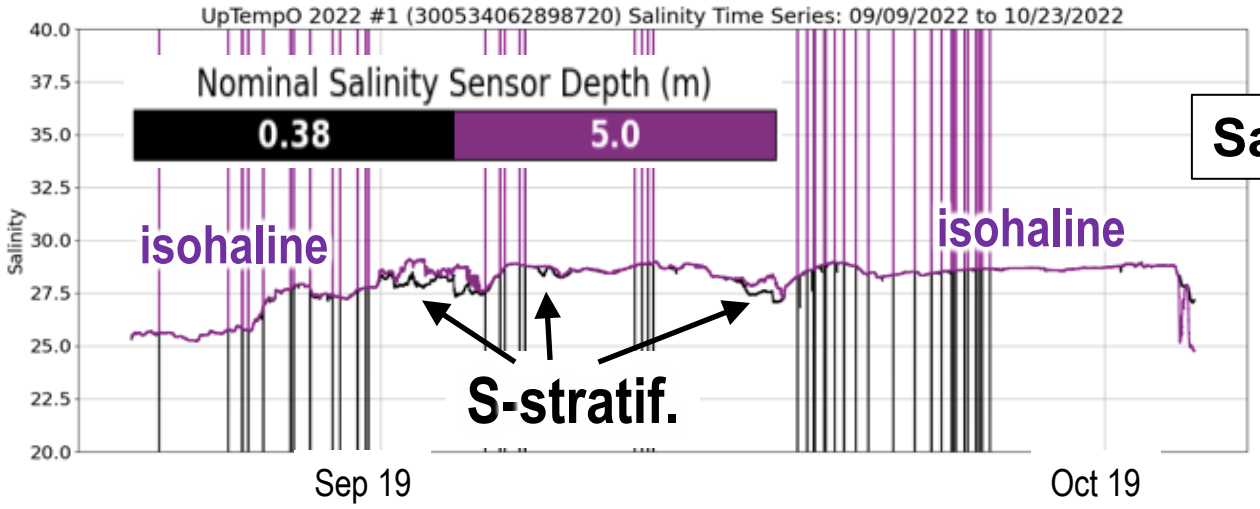
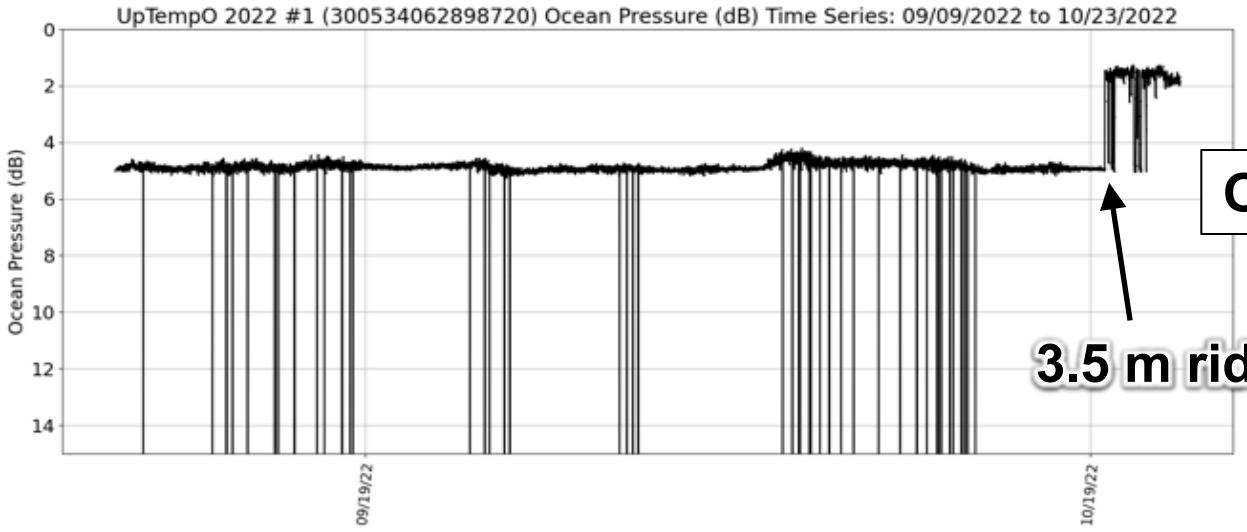




Salinity

Death of a buoy



Ocean pressure

3.5 m ridging

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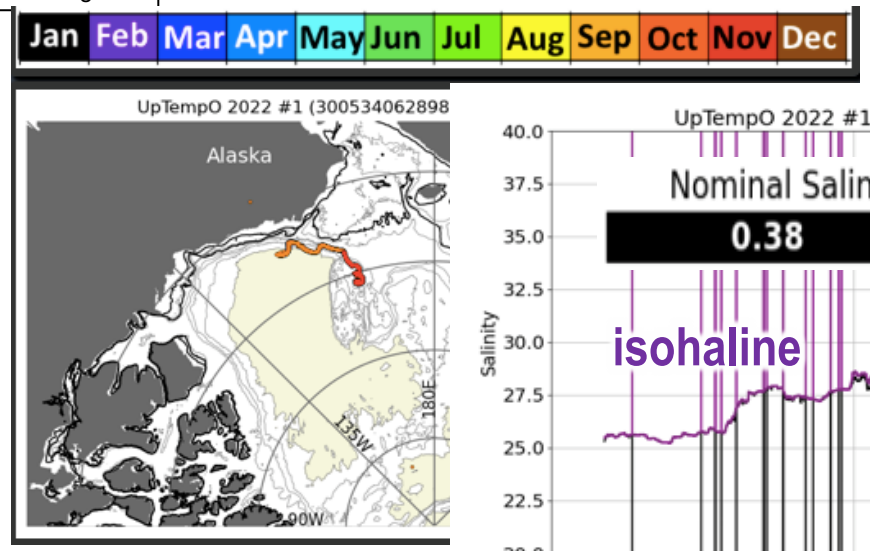

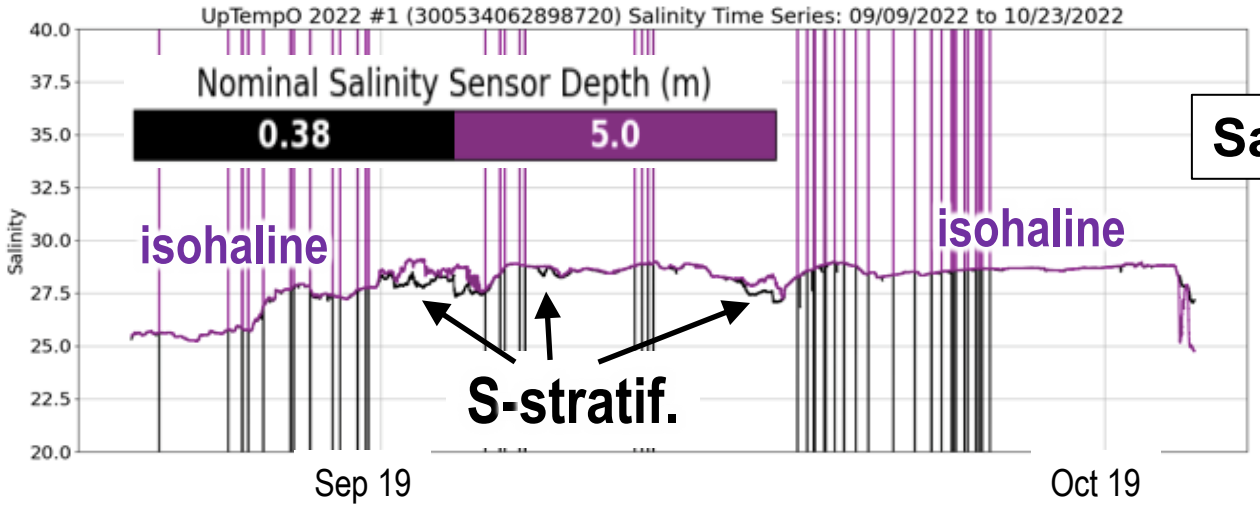

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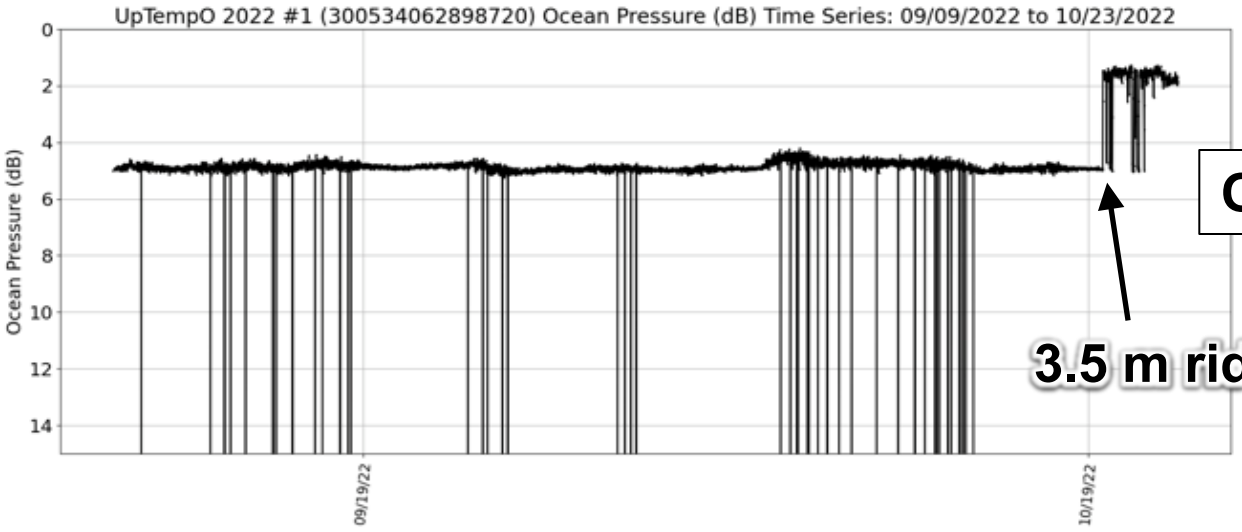

Ocean pressure

3.5 m ridging

Death of a buoy

- **all buoys in ice now**
- **some still reporting**

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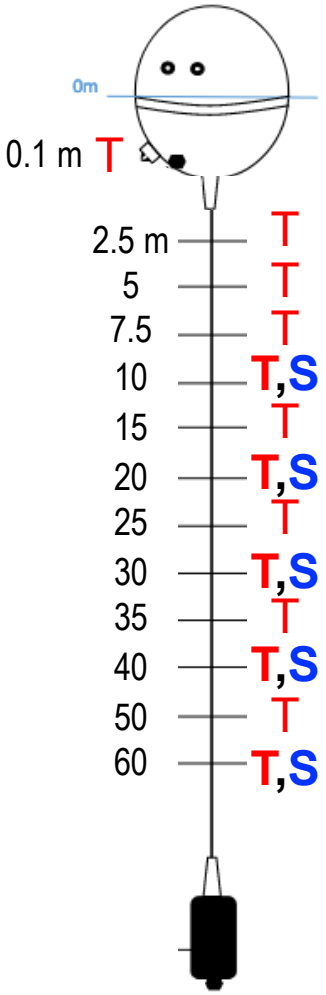
3rd buoy deployed: UpTempO-S9 (*Sep 10– Oct 25*)



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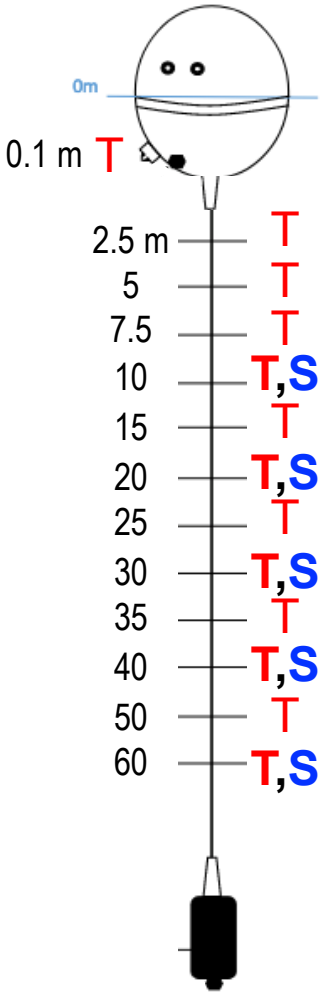

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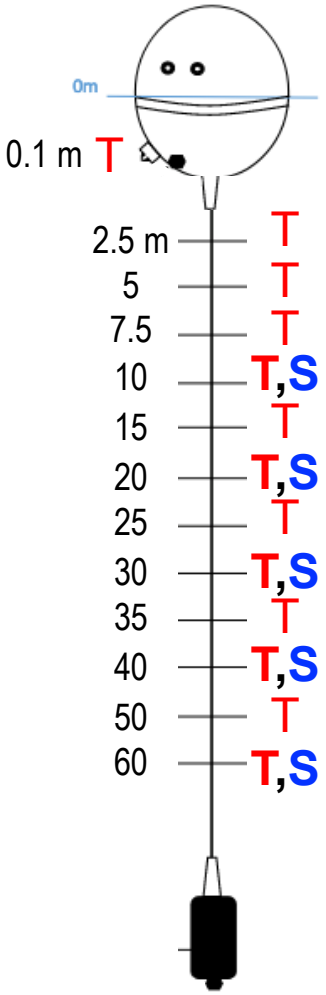

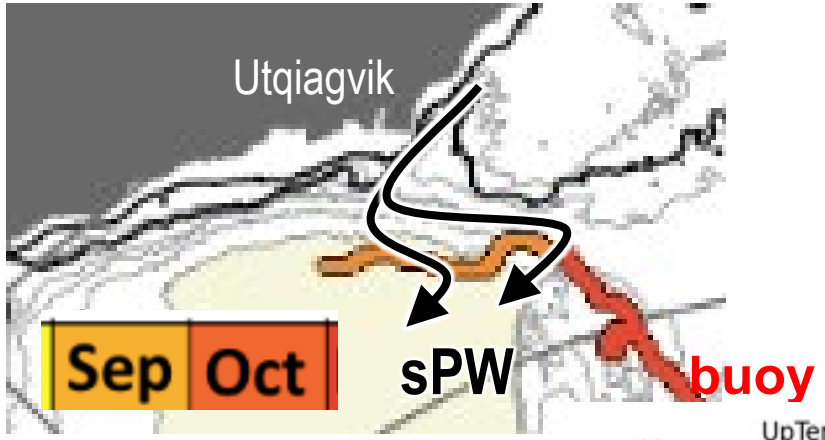

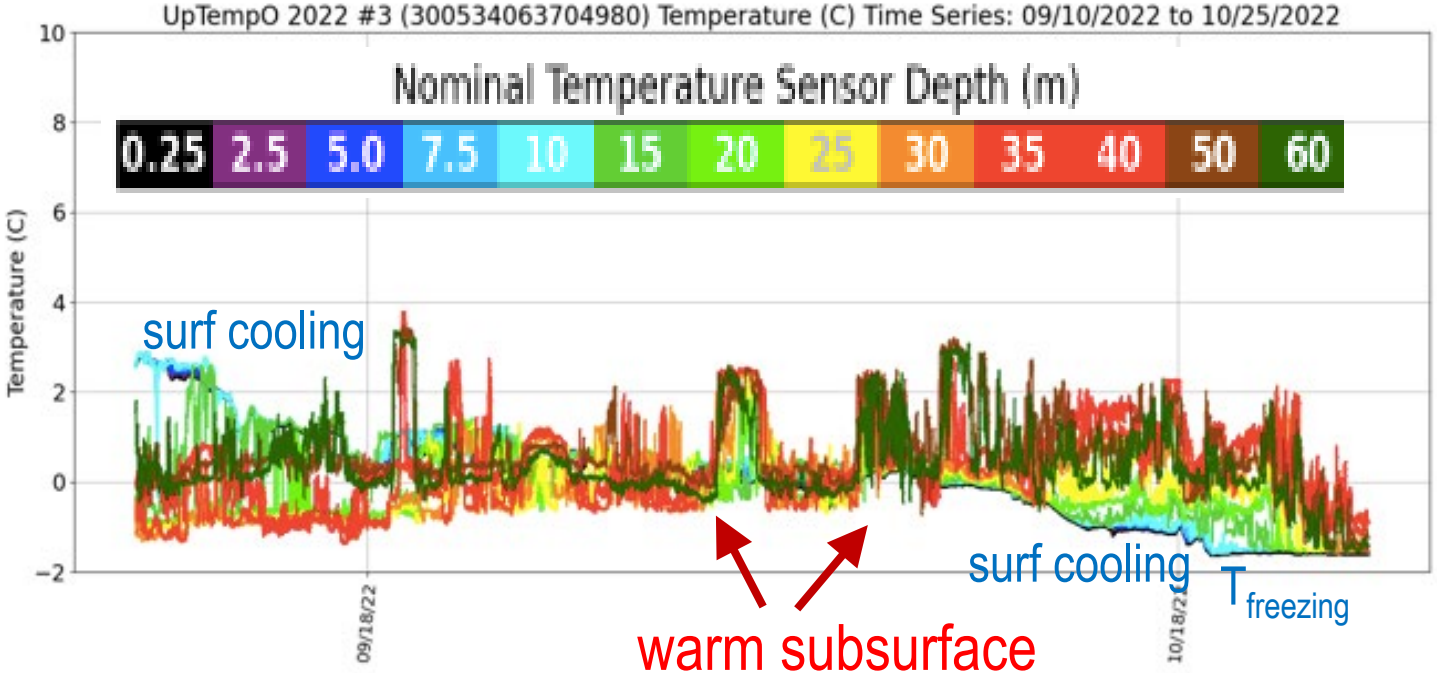

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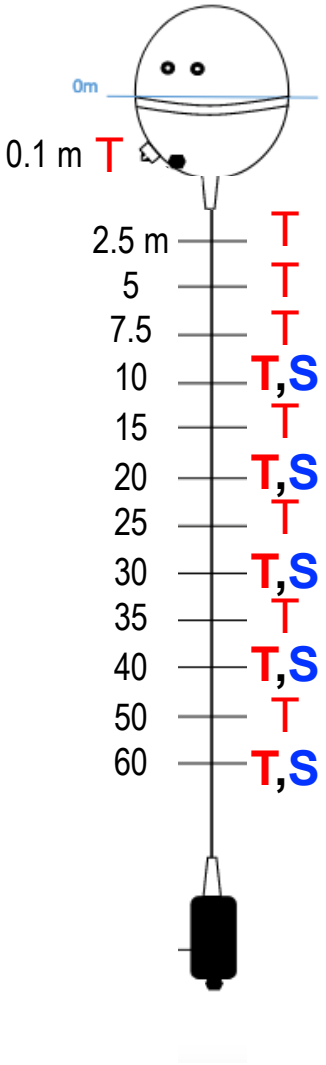

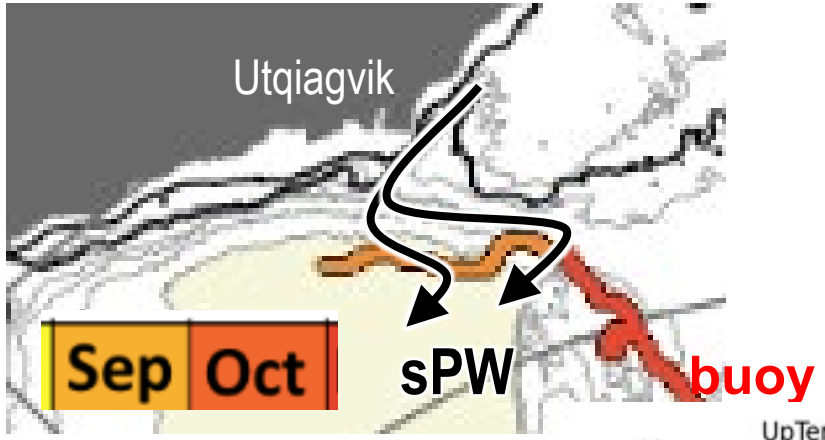

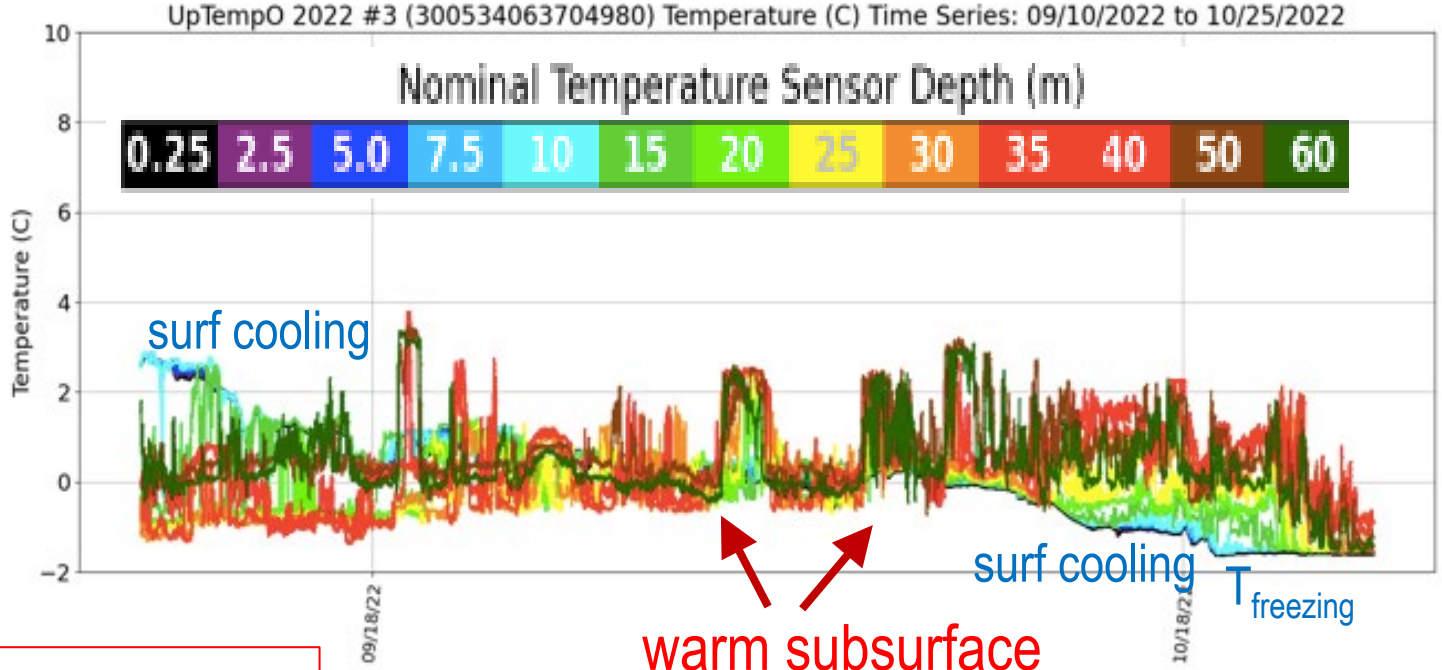

http://psc.apl.washington.edu/UpTempO/Data.php

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University of Washing

(ONR) SIZRS: Seasonal Ice Zone Reconnaissance Surveys

(SIZ: winter: icy; summer: ice-free)

☞ ***2012-2024***

Synoptic ***monthly*** *surveys (June-Oct)*

across frontal boundaries to study:

- ***ice/ocean*** *circulation*
- ***air-sea*** *exchange*

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(ONR) SIZRS: Seasonal Ice Zone Reconnaissance Surveys

(SIZ: winter: icy; summer: ice-free) *2012-2024*

AxCTD & AxCP
- James **Morison**
- John **Guthrie**

IR & Lidar remote sensing

Atmos. sondes
- Zheng **Liu**
- Axel **Schweiger**

Buoys
- Michael **Steele**
- Ignatius **Rigor**

Synoptic ***monthly*** *surveys (June-Oct)*

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psc.apl.uw.edu/research/projects/sizrs/

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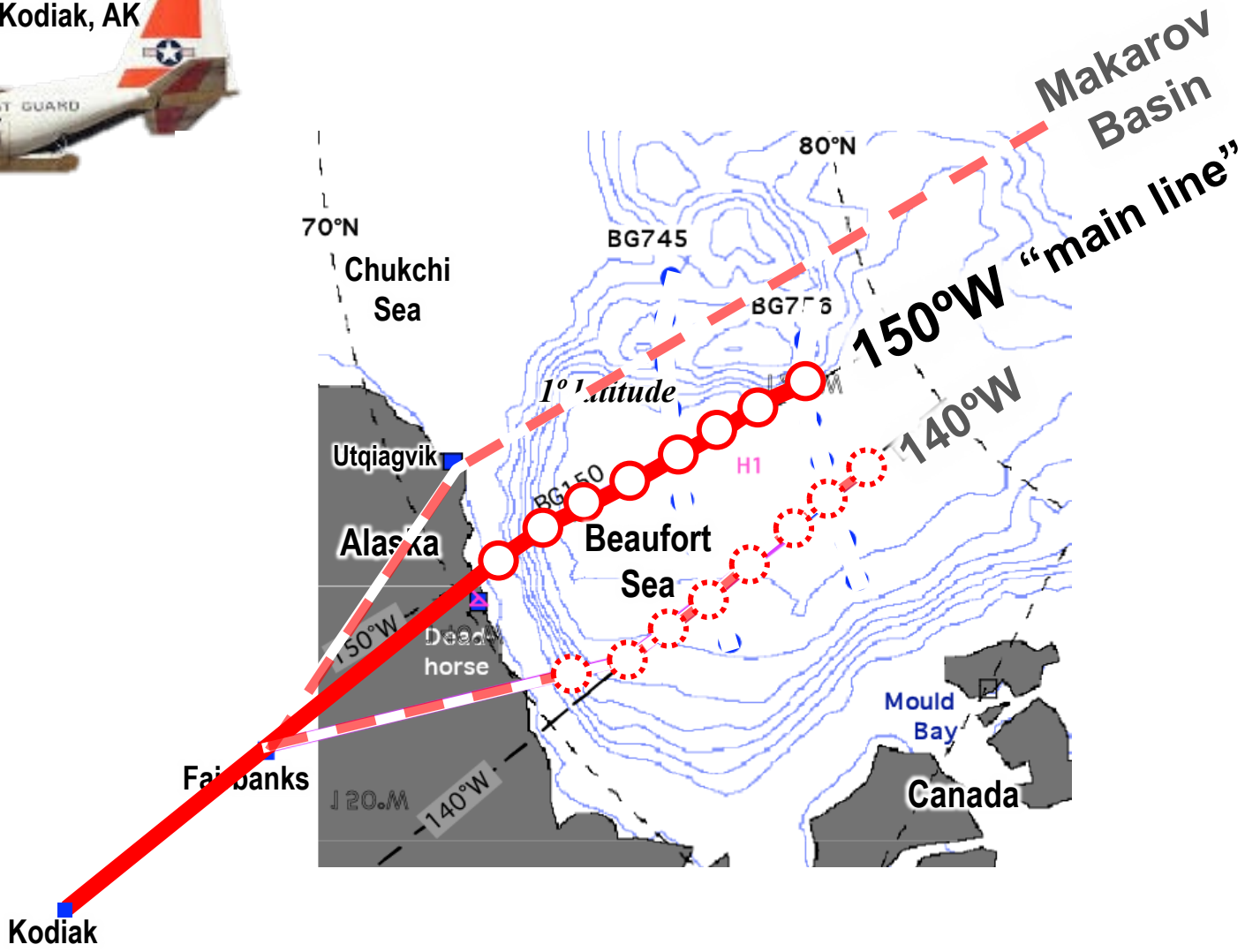

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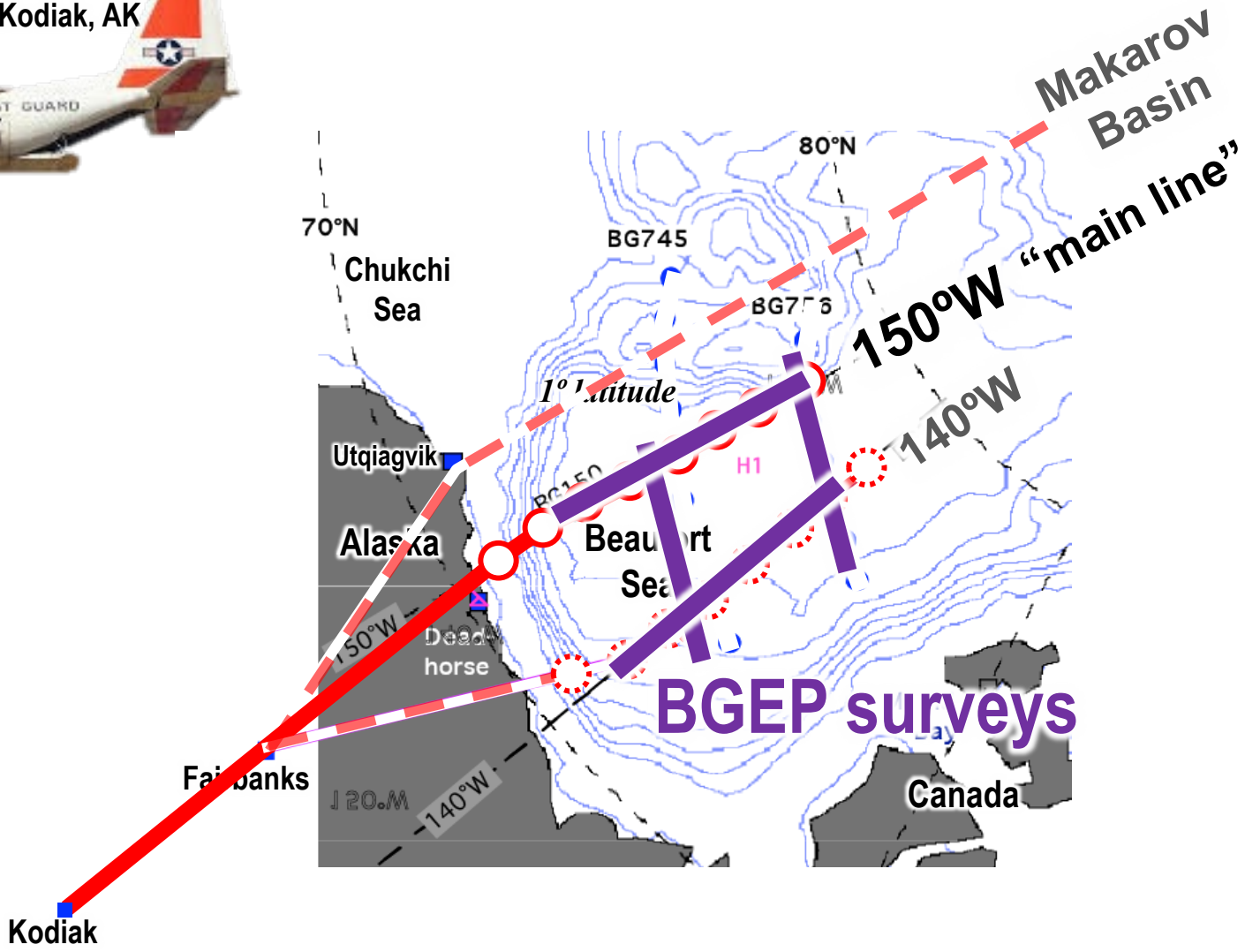

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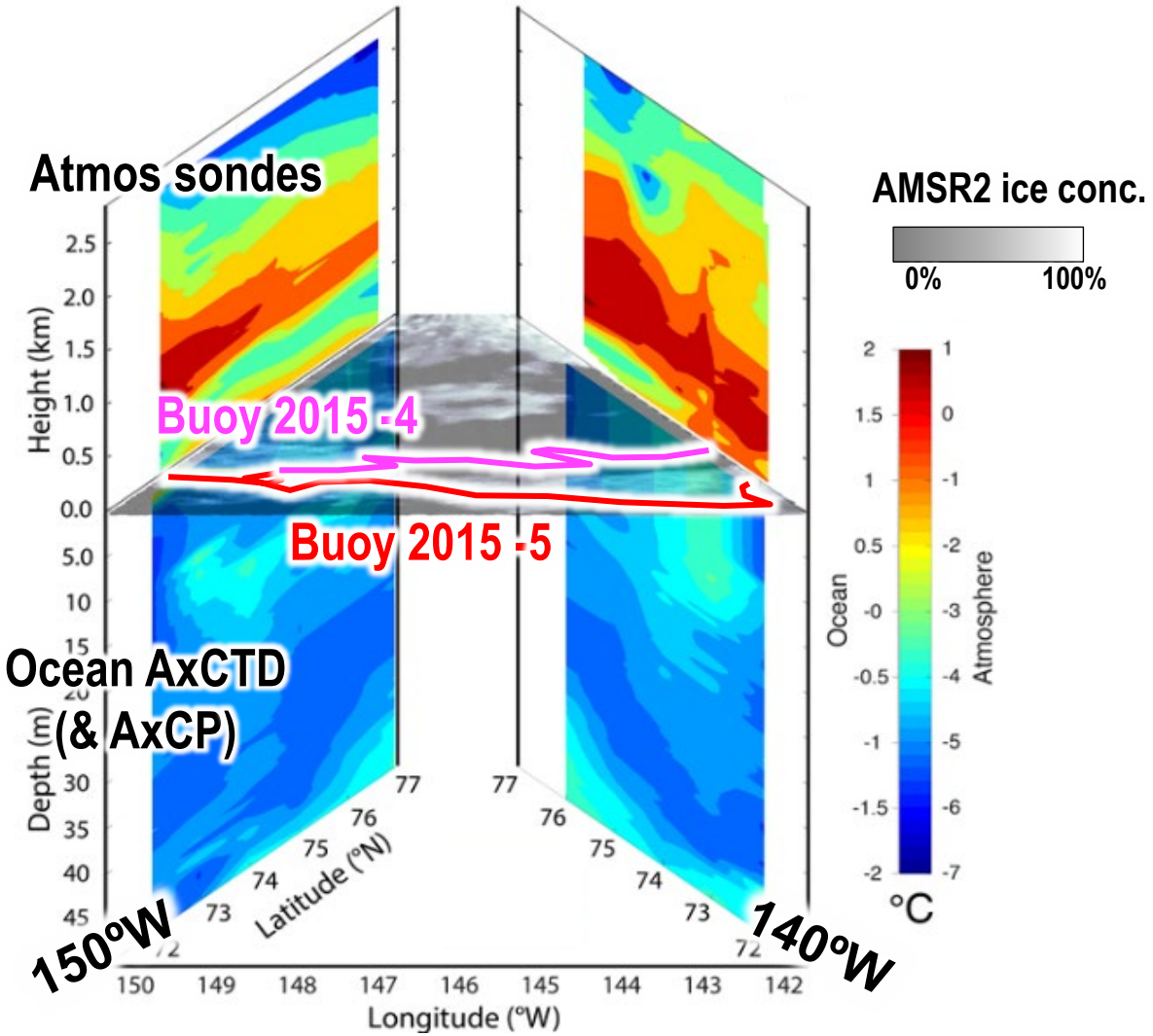
(SIZ: winter: icy; summer: ice-free) *2012-2024*

- **monthly**
- **synoptic**
- **air-ice-ocean**



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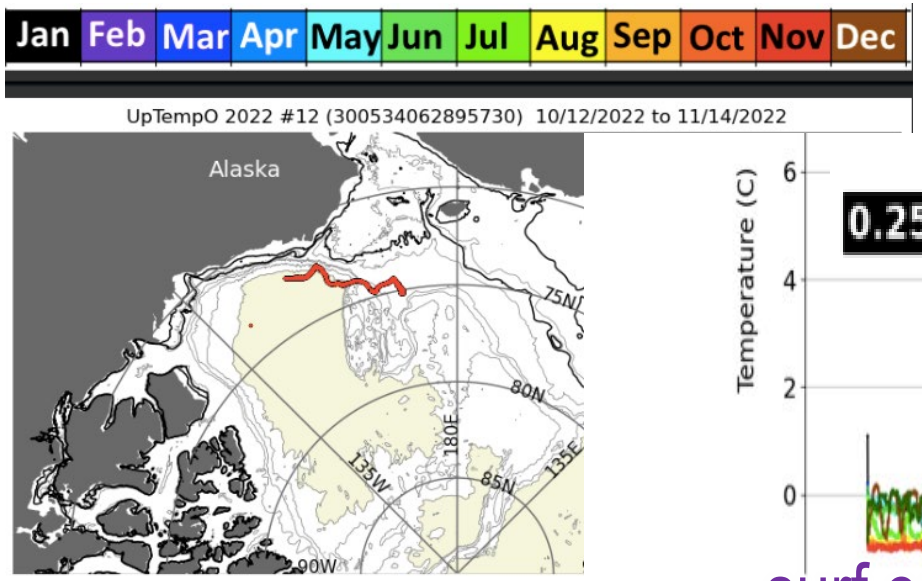
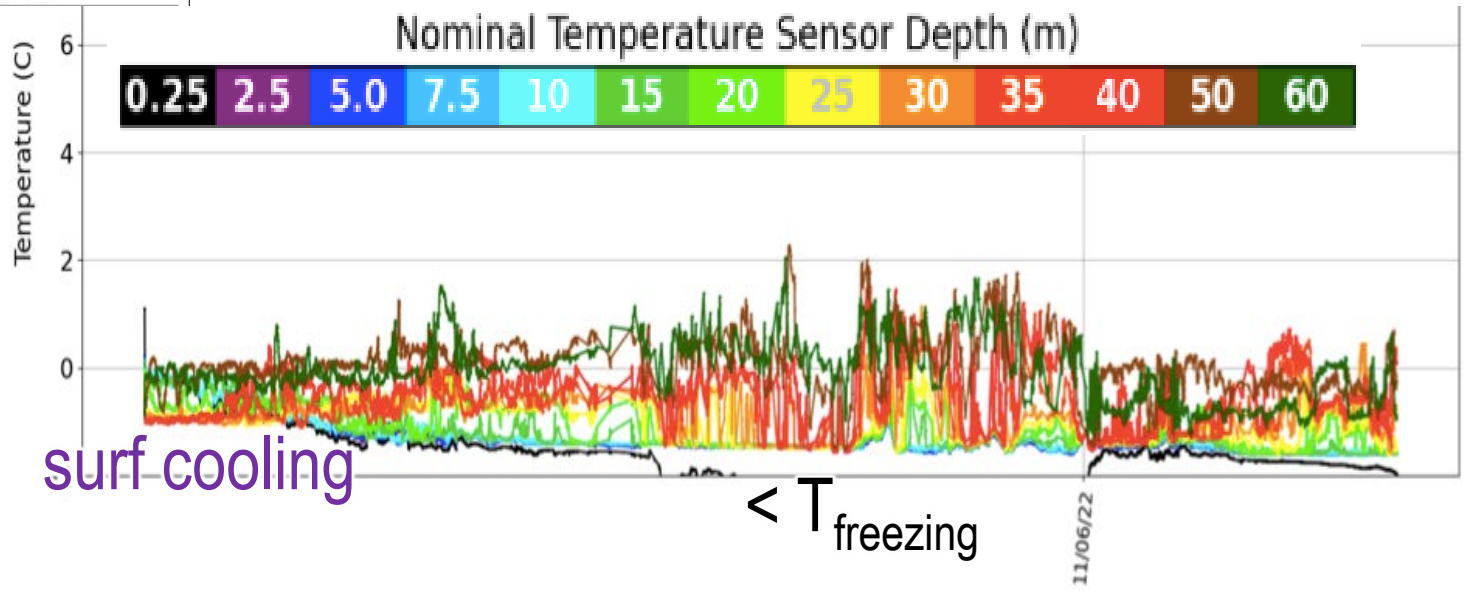
2022 SIZRS UpTempO T-string *(Oct 12 – Nov 14)*





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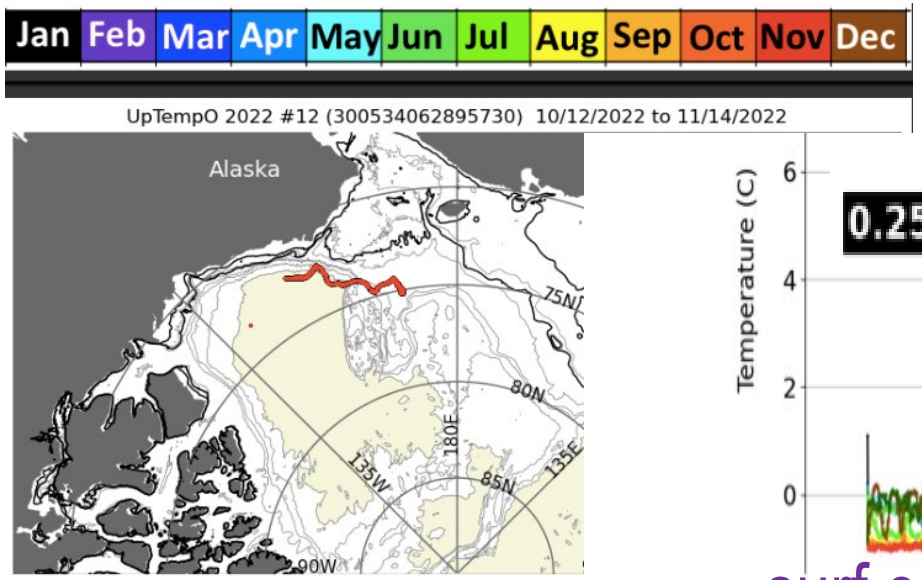
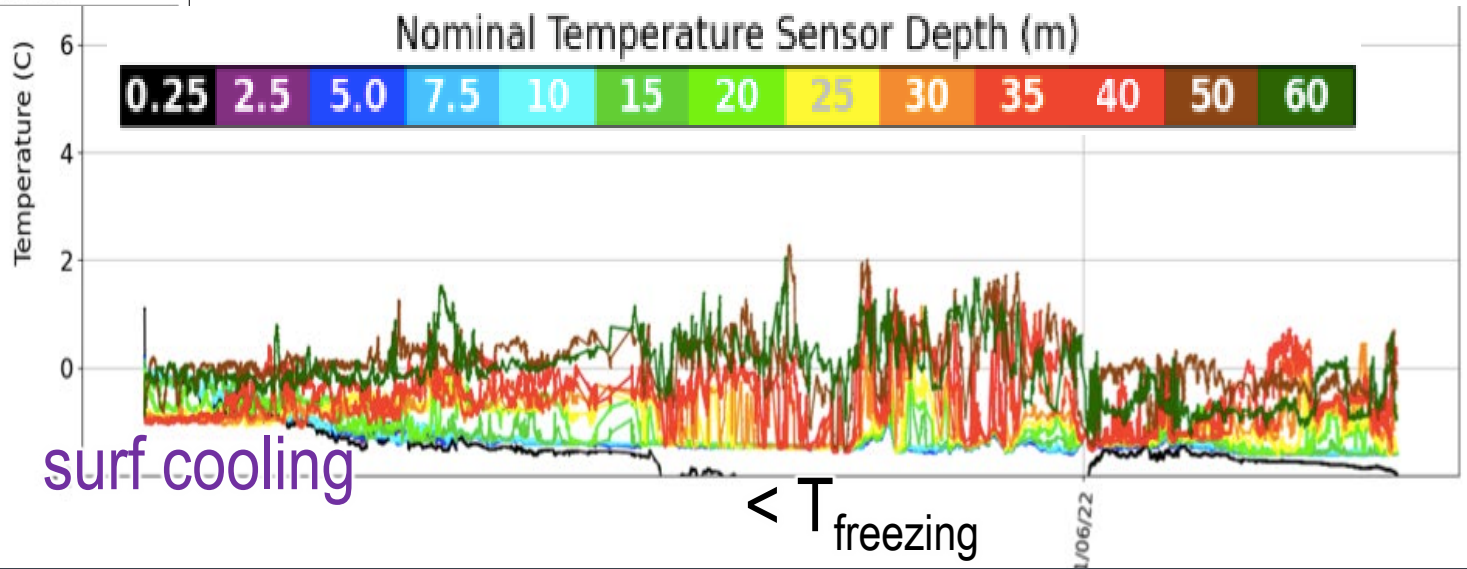
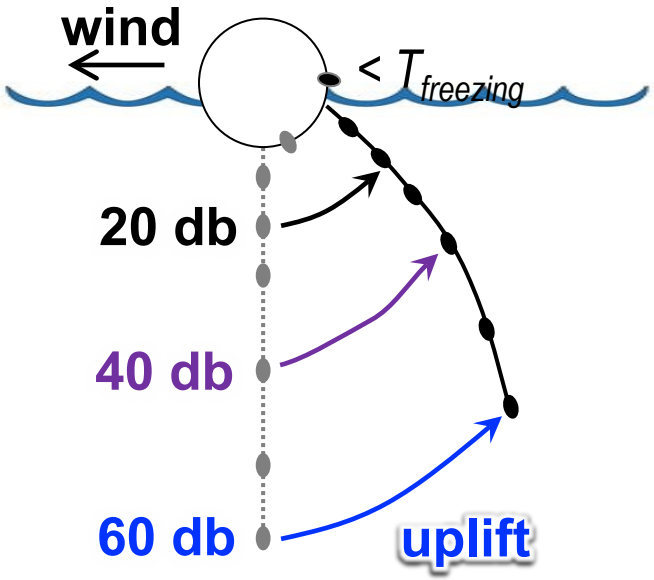
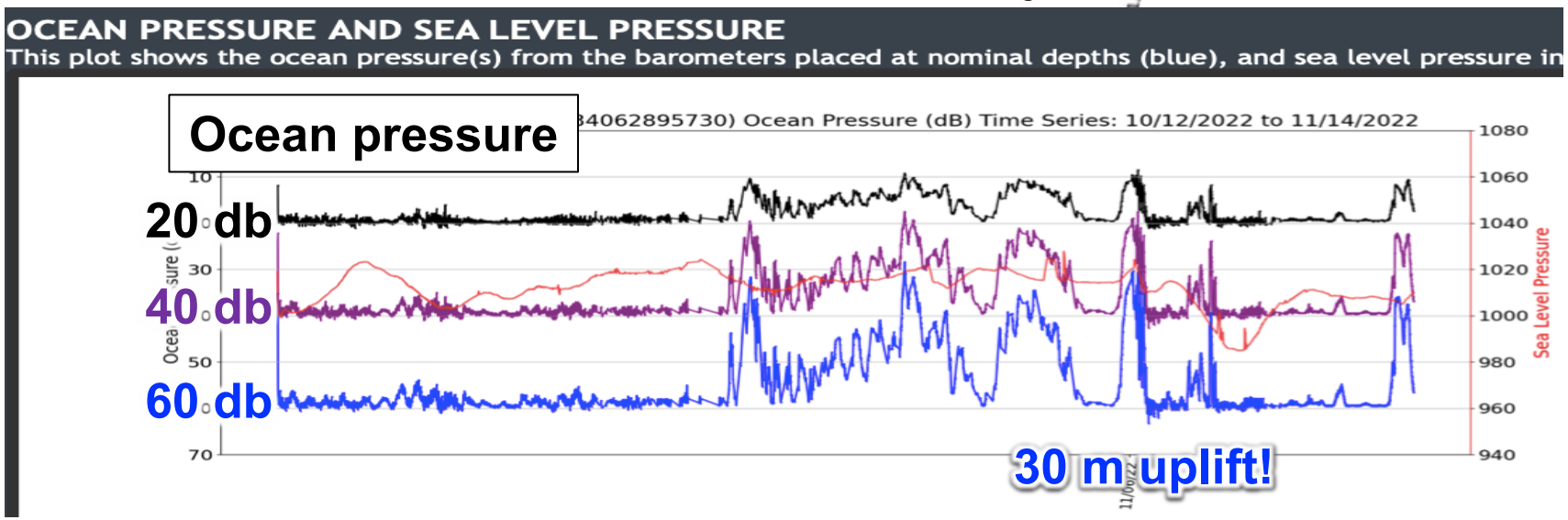
2022 SIZRS UpTempO T-string *(Oct 12 – Nov 14)*









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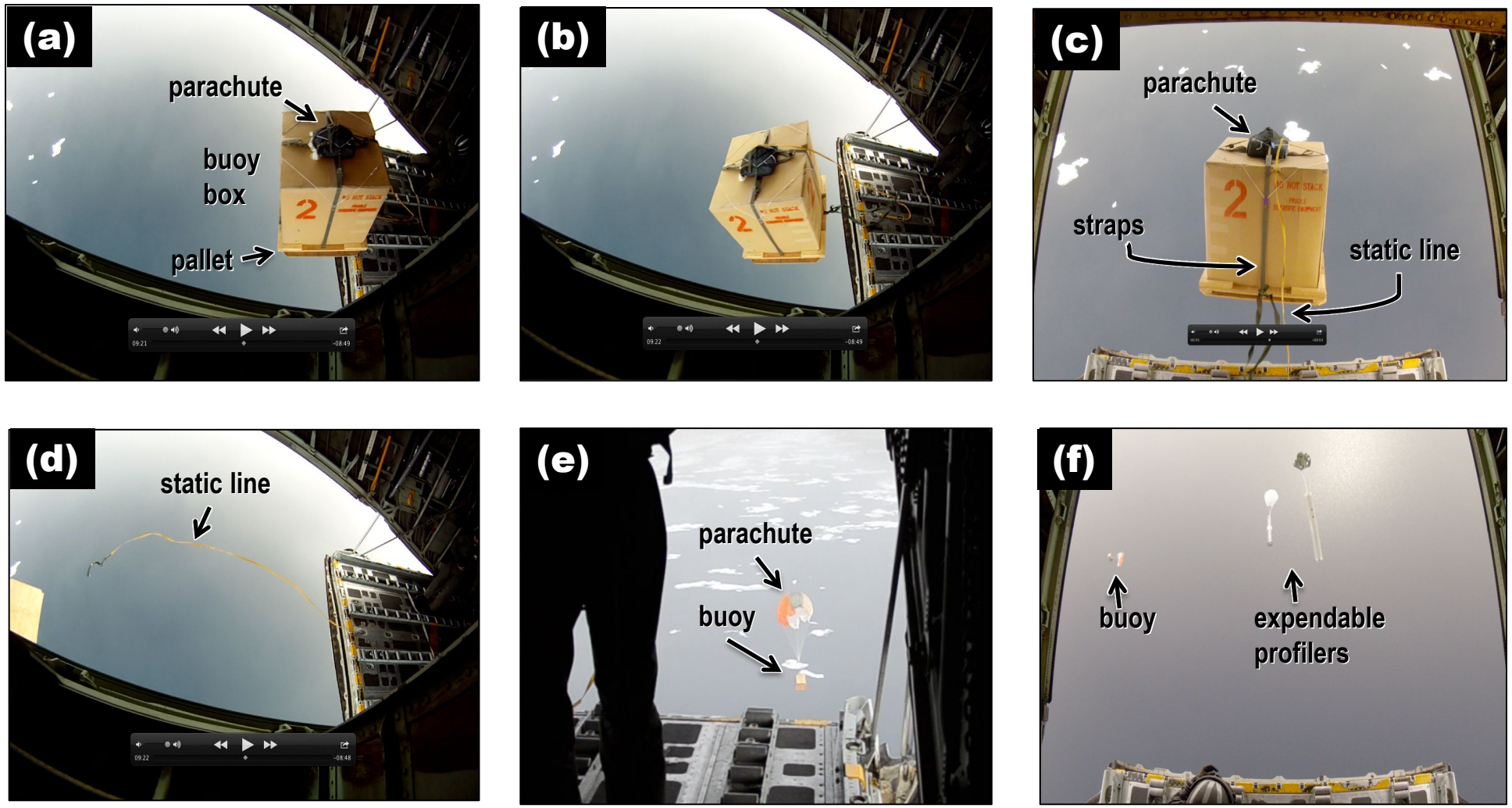
1st SIZRS UpTempO buoy deployment

August, 2013



…reporting in 4-48 hours

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SIZRS buoy deployment via C130 aircraft

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SIZRS buoy deployment October, 2022

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Mike's hydrobuoys in the literature

- ***Li, Ding, Steele, Schweiger*** *(Nat Commun., 2022)*
- ***Banzon, Smith, Steele, Huang, Zhang*** *(J. Tech., 2020)*
- ***Minnett et al. incl. Steele*** *(Rem. Sens. Environ., 2019)*
- ***Fournier, Lee, Tang, Steele, Olmedo*** *(Rem Sens., 2019)*
- ***Moore, Schweiger, Zhang, Steele*** *(GRL, 2018)*
- ***Castro, Wick, Steele*** *(Rem. Sens. Environ., 2016)*

- **Validation/improvement of:**
  - *satellite SST*
  - *satellite SSS*
  - *models*
- **Upper ocean warming/freshening**

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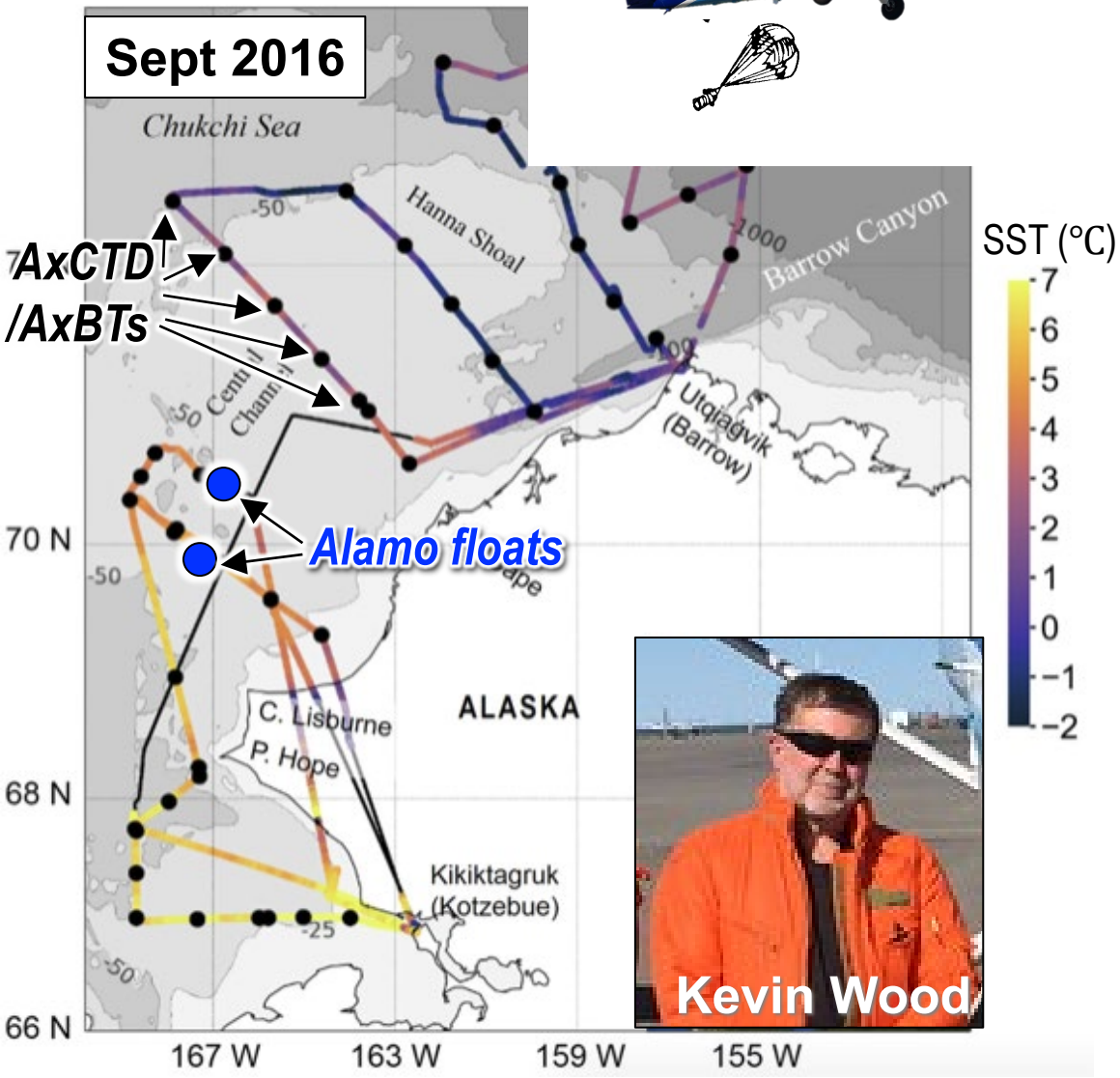
Twin Otter

(NOAA) Arctic Heat II

Calvin Mordy & Jiaxu Zhang (*PMEL / CICOES*)



2016-2021:

- *usually ~ 3 flight periods/summer*

☞ **Expendables & floats**
☞ Summer **heat** predicts fall ice **advance**

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Twin Otter

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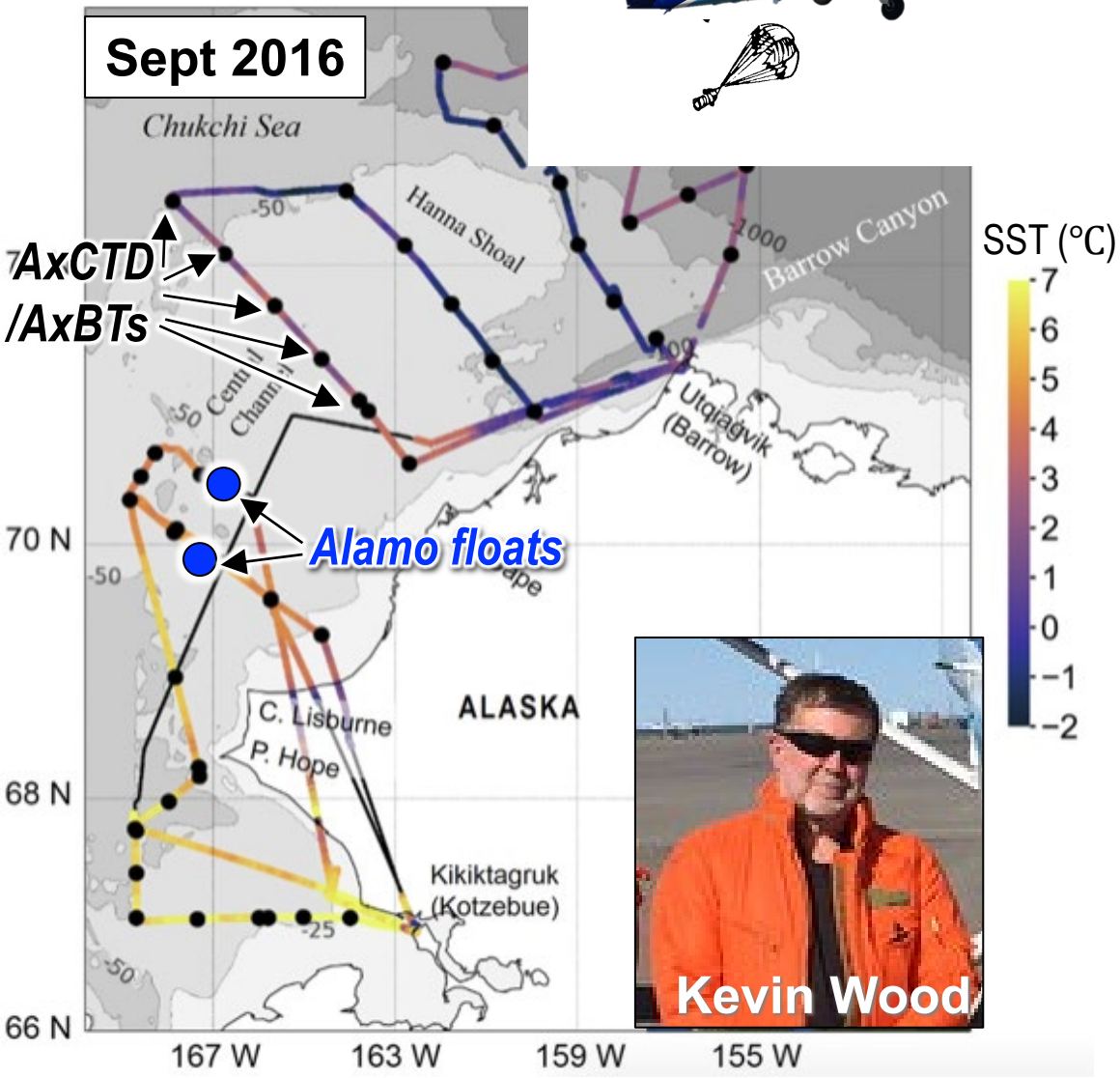

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2022:

- *June + July/Aug with APL/SIZRS team collaboration*

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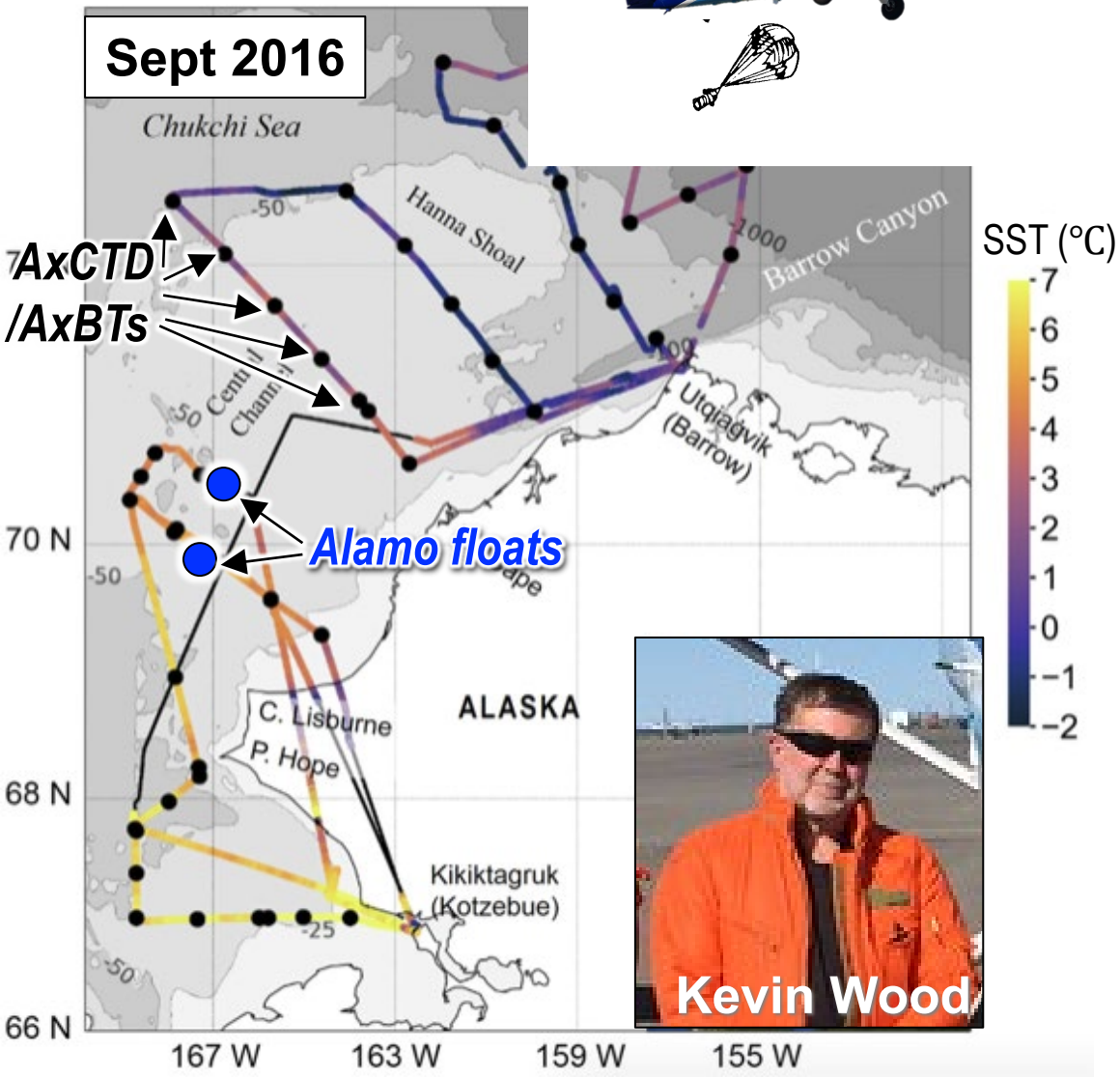

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2022:

- *June + July/Aug with APL/SIZRS team collaboration*

2023 ➔:

- *Seeking funding*
- *Likely focused on Pacific Water circulation*

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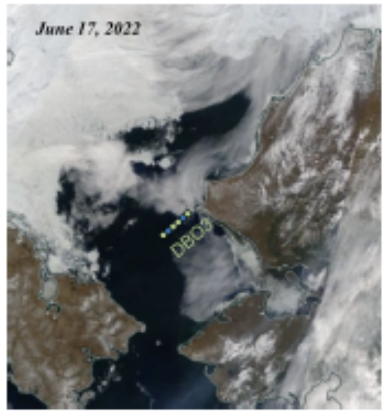
2022 Accomplishments

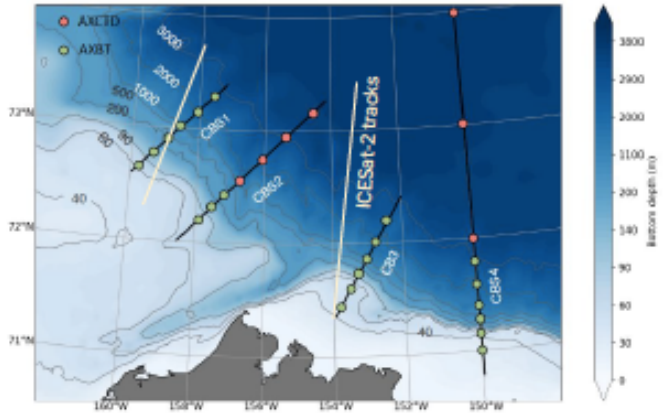
- June Flights
  - Deployed 8 AXBTs along DBO3 shortly after ice retreat.
  - Deployed 3 microSWIFT wave buoys off Prudhoe Bay in collaboration with Maddie Smith (APL)
- July-August Flights
  - Deployed 24 AXBTs (AOC) and 7 AXCTDs (APL) across the shelf break.
  - Deployed ~30 dropsondes in collaboration with Zheng Liu (APL).
  - Test run of the Lidar observational system LATIS in collaboration with John Gutherie (APL).

June flights crew members

DBO3 section (June)



Shelf break section (July-Aug)



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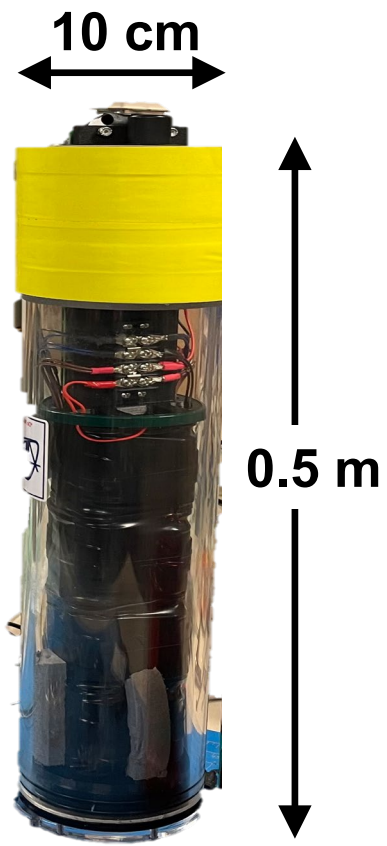
APL's microSwift



- **Iridium**
- **GPS**
- **Alkaline C-cells**
- **Surface waves**

- Jim **Thomson** *(surface waves)*
- Alex **deKlerk** *(engineer)*

- Deployed off ships, docks, **Arctic Heat II** (2022)
  - Lifetime: several days

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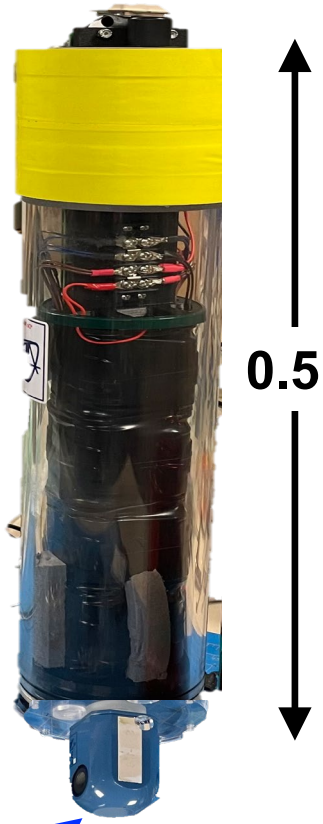
APL's microSwift-TS



CT cell:
Aanderaa 4319

- **Iridium**
- **GPS**
- **Alkaline C-cells**
- **Surface waves**
- **SST**
- **SSS**

- Jim **Thomson** *(surface waves)*
- Alex **deKlerk** *(engineer)*
- Mike **Steele** *(SST/SSS)*
- *+ APL engineering support*

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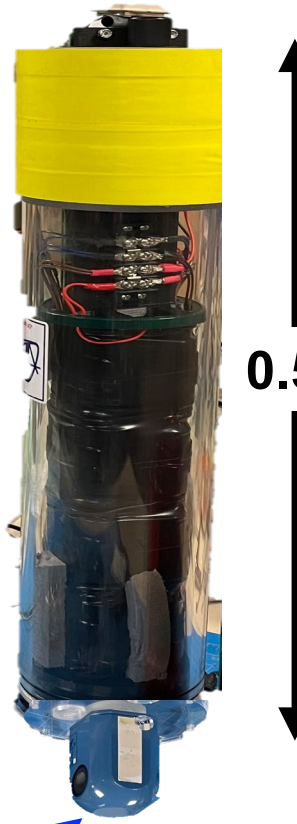
APL's microSwift-TS



CT cell:
Aanderaa 4319

- **Iridium**
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- Jim **Thomson** *(surface waves)*
- Alex **deKlerk** *(engineer)*
- Mike **Steele** *(SST/SSS)*
- *+ APL engineering support*

2023:

- Deploy via **Arctic Heat II**
- Lifetime: 1-3 months *(hopefully!)*

Summary

- **Hydrobuoys for SST, SSS, upper ocean**
- **Ship or air-deploy**
- **Lots of form factors!**

Thank you

EXTRA

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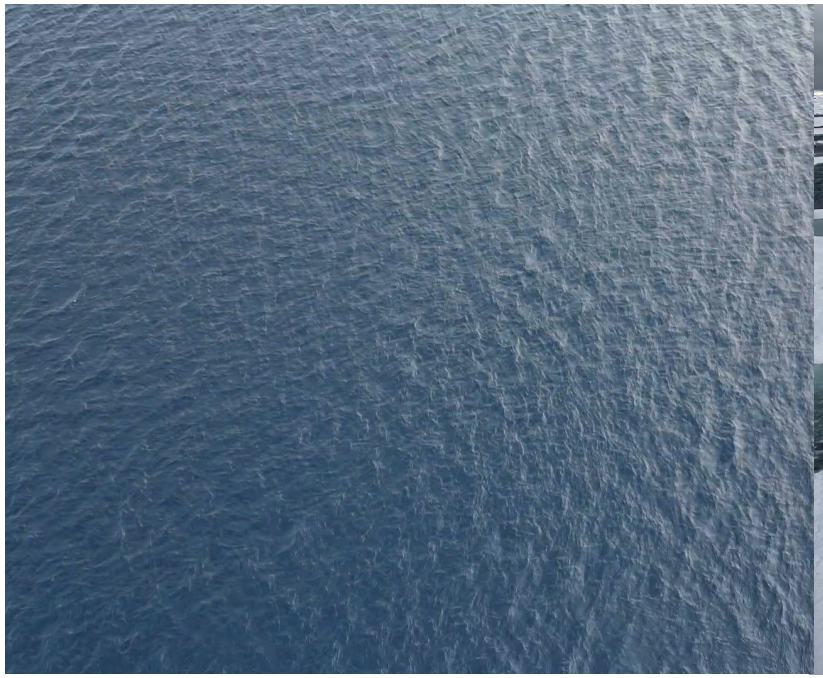
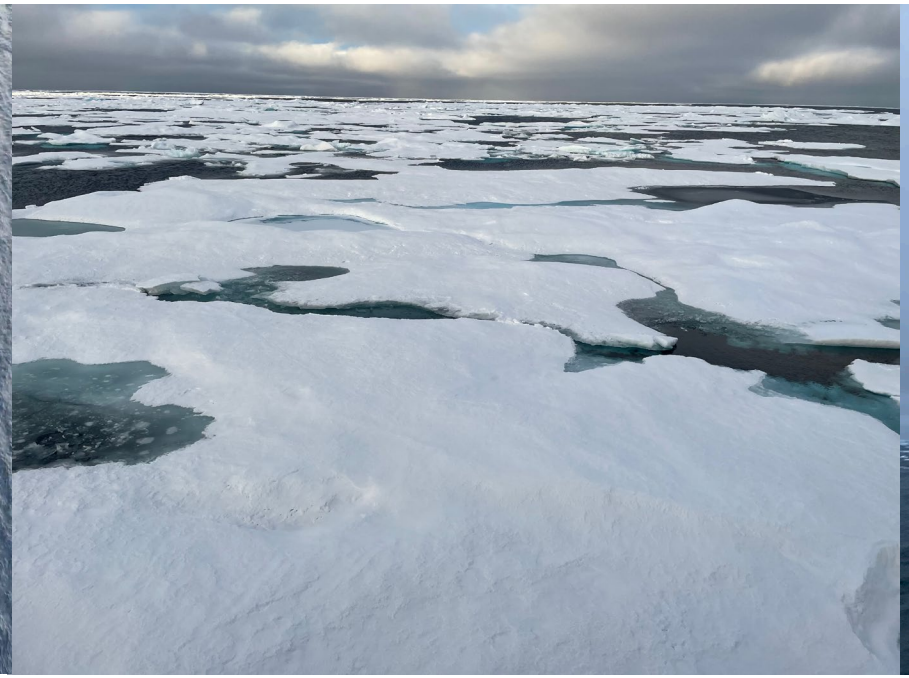
September cruise: **Five major "plays"**

Open water
(two plays)



Heavy ice cover
(one play)



Open water/ice transition
(two plays)