The integrated Beaufort Observatory (iBO)

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US-Canada Northern Oil and Gas Research Forum 2017
Biological Observatories and Monitoring Technical Talks
Anchorage, Alaska
12 October 2017, 13:40

Canada ArcticNet ᐅᑭᐅᖅᑕᖅᑐᑦ ᑐᑭᓯᓂᐊᖅᑎᑦᑕ AMUNDSEN SCIENCE Golder Associates Imperial

Management & Decision Making System

Prediction, forecasting, engineering, impact assessment,oil spill detection, impact and mitigation in the Arctic

Policies and regulations that frame Arctic oil and gas development

Information System

Knowledge on ecosystem structure, diversity, geochemistry and change

Understanding of the sea ice and ocean physical environment

iBO Mooring Program

Long-term observations of the ice-ocean system

- Insights on environmental processes & variability
- Value-added as time series get longer
- Basis for tool development & validation
- Decision and management strategies by providing high-quality information

iBO 2015-2018

Rationale

- iBO developed to maintain key time series, combine data, data collection strategies and knowledge from long term moored Beaufort Sea observatories:
  - Impetus for integration stems from offshore oil & gas industry's desire for better regional understanding of the Beaufort ice-ocean system
  - Environmental Studies Research Fund and additional support from Imperial Oil provide iBO opportunity as a regionally-integrated program
- Data available to regulatory agencies, offshore O&G industry, agencies responsible for ocean forecasting, academic scientific research

iBO maintains the following moored observatories

- 4 iBO moorings on the slope

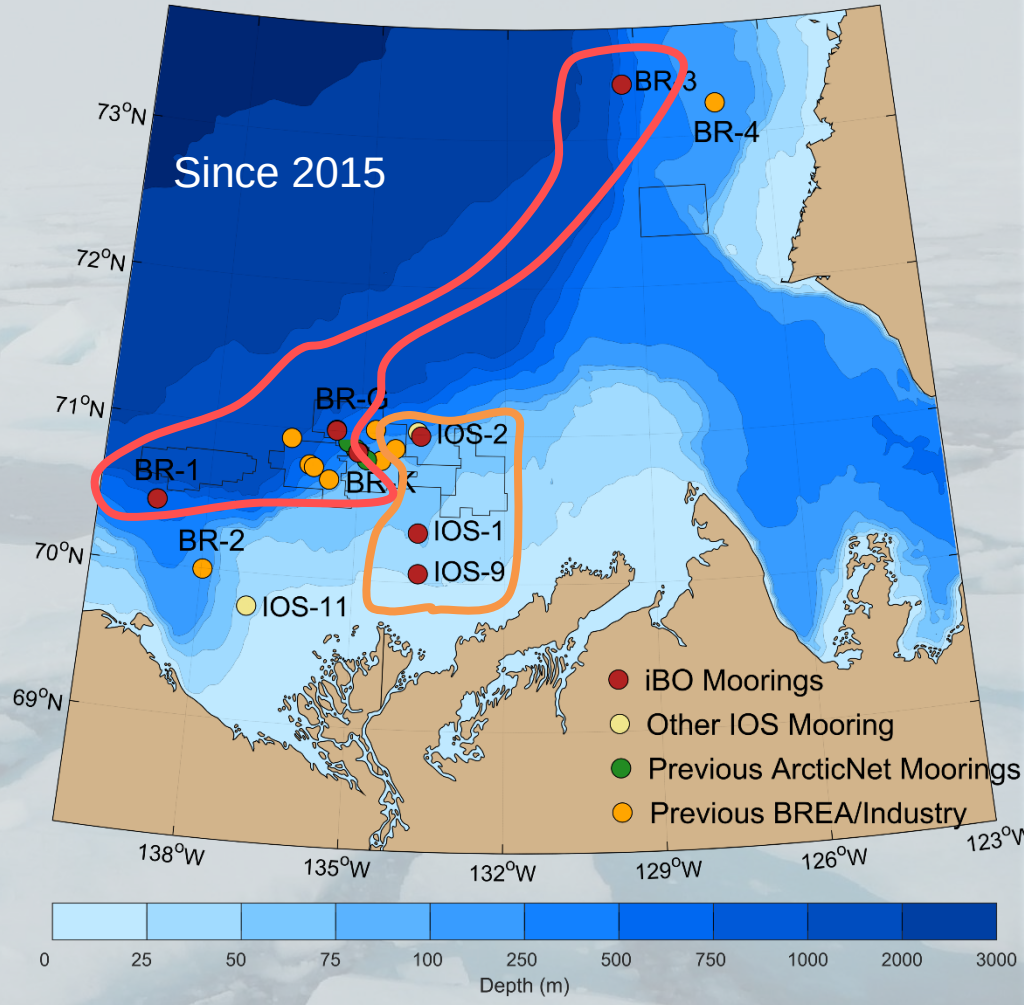
  → Former ArcticNet-Industry & BREA moorings 2009-2015

- 3 iBO moorings on the shelf

  → DFO ice profiling sonar time series established in 1990

In addition:

- 6 other DFO and ArcticNet moorings supplement iBO since 2015
- 5 other MARES moorings since 2016 (US-BOEM program)



iBO moorings

Acoustic Doppler current profilers (ADCPs)

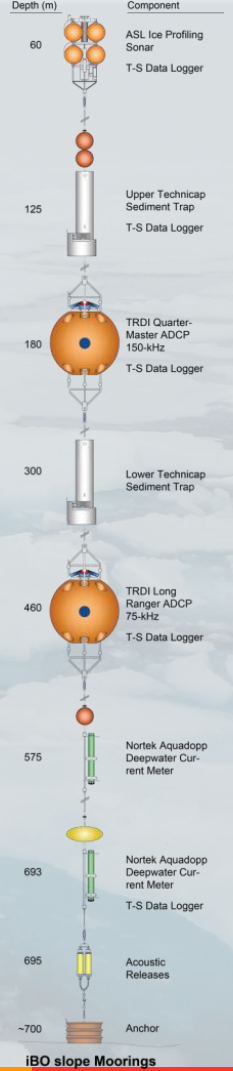
Deep current-meters

Sediment traps

Ice profiling sonars

Laser Particle-size analyzer

Salinity, temperature, fluorimeter/turbidity loggers



iBO aims also to **integrate regional understanding** of the shelf-slope environment through mooring-based data acquired by:

- DFO since 1974
- ArcticNet and related projects (CASES, Industry, BREA) since 2002

Both organizations were able to maintain observatories through distinct multi-stakeholder initiatives

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ArcticNet
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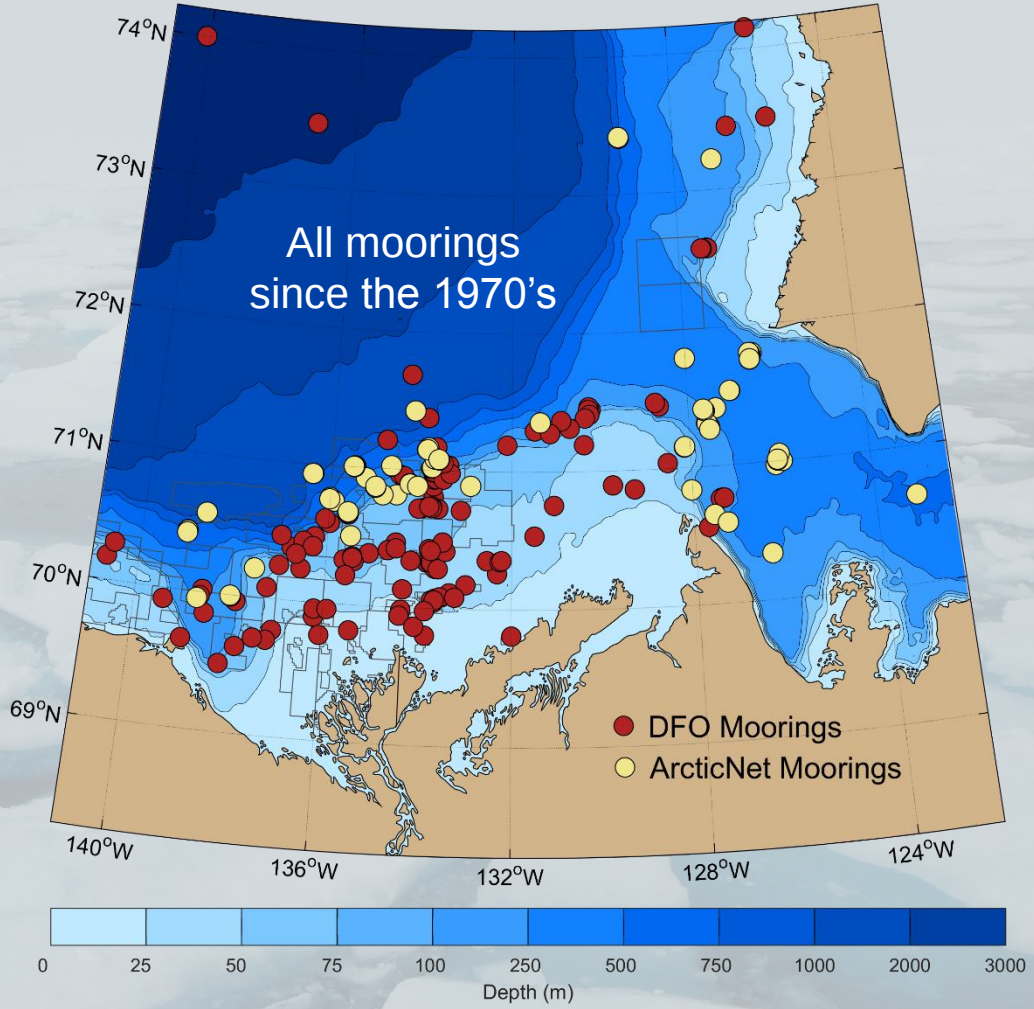
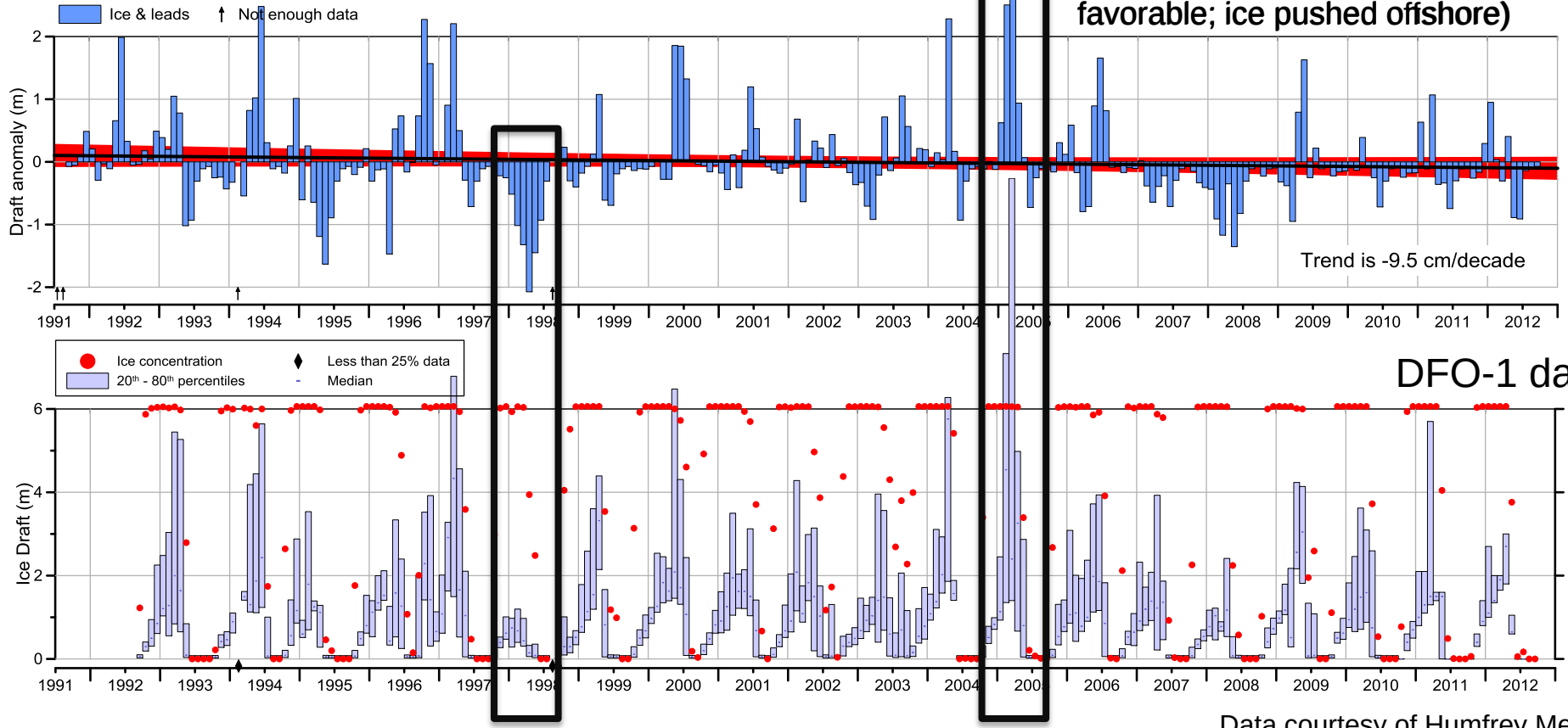


Salient results on physical processes of interest

25+ years ice draft time series by DFO are maintained and expanded through iBO

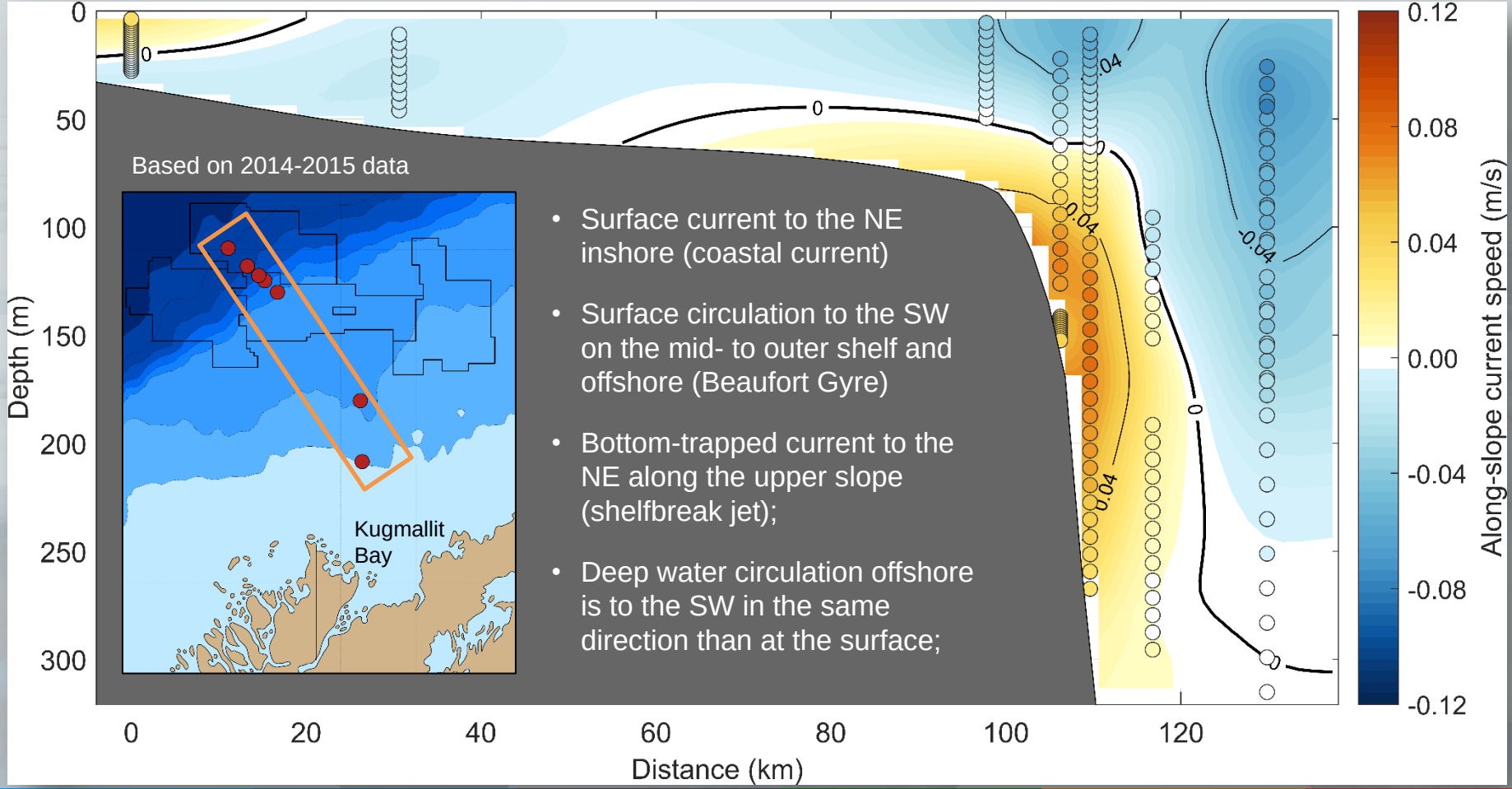
Record negative ice draft anomaly: winter 1995 during persistent easterly wind period (downwelling-favorable; ice pushed offshore)



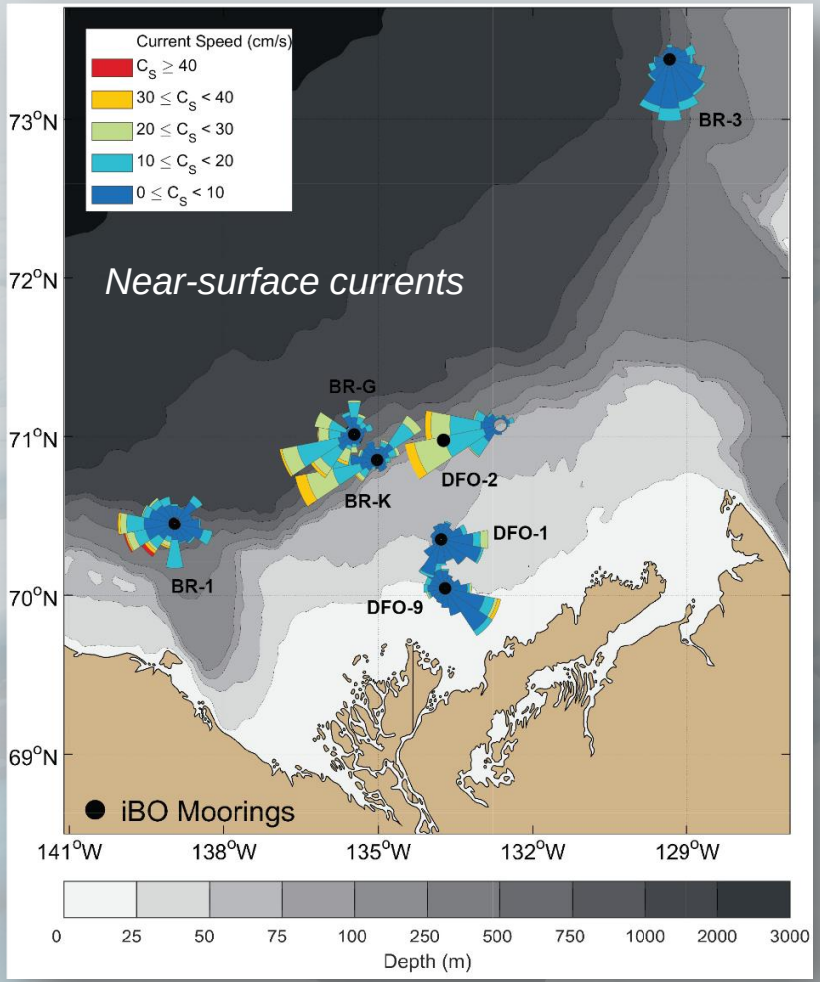
DFO-1 data

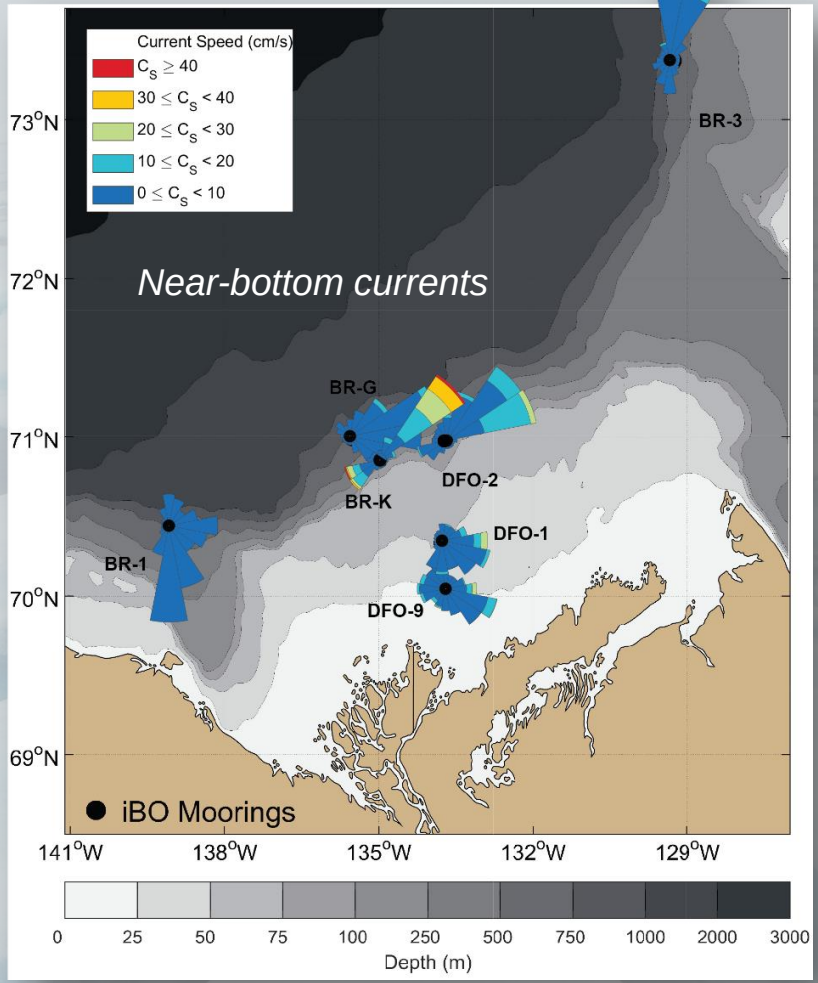
Data courtesy of Humfrey Melling

Mean along-slope current in offshore leases (blue = to SW, red = to NE)



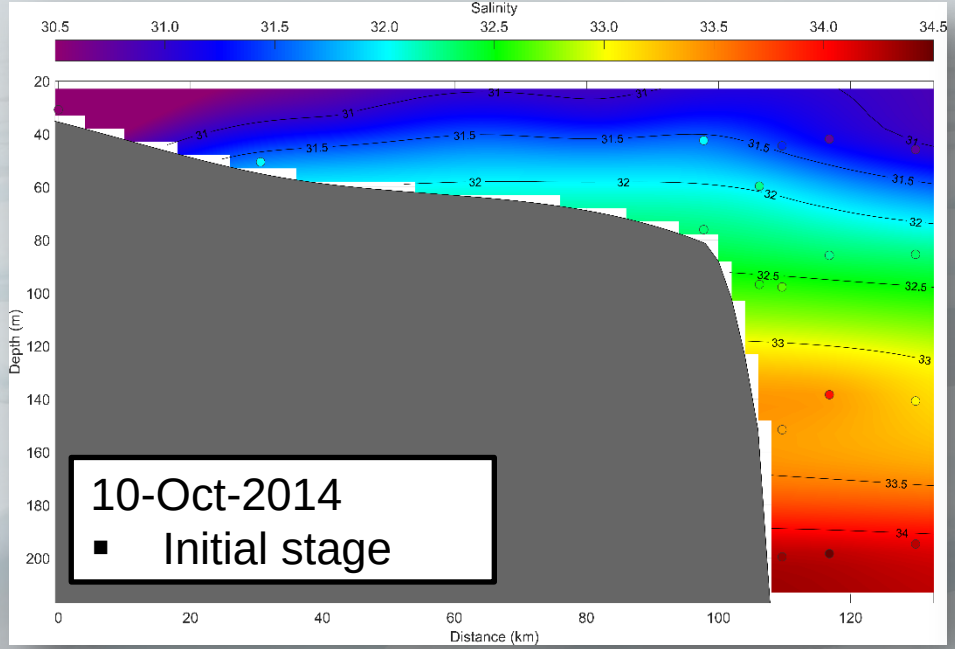
Ocean currents during the operational season based on 2014-2015 dataset

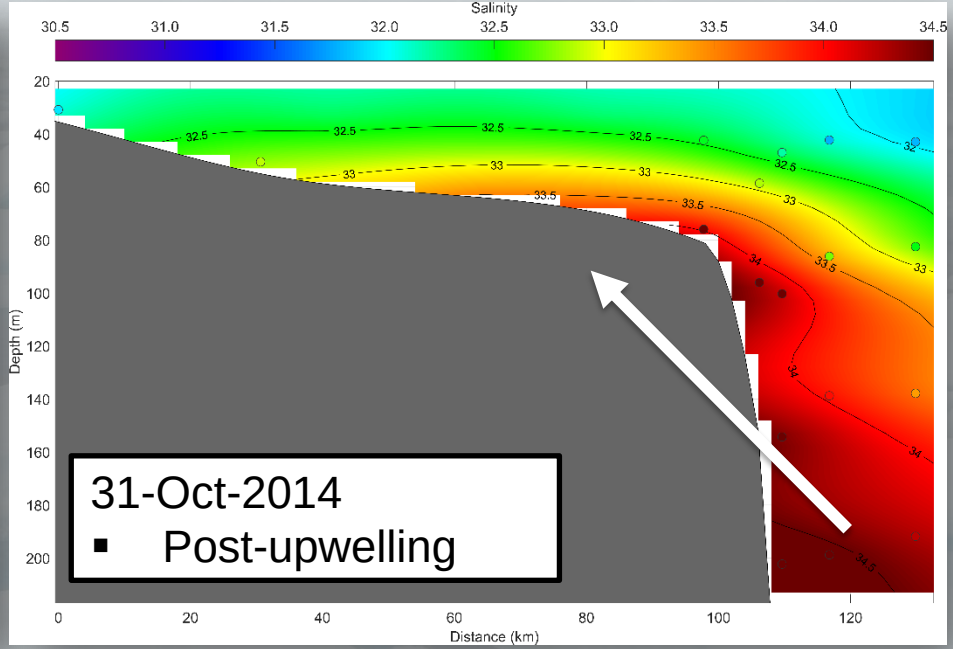




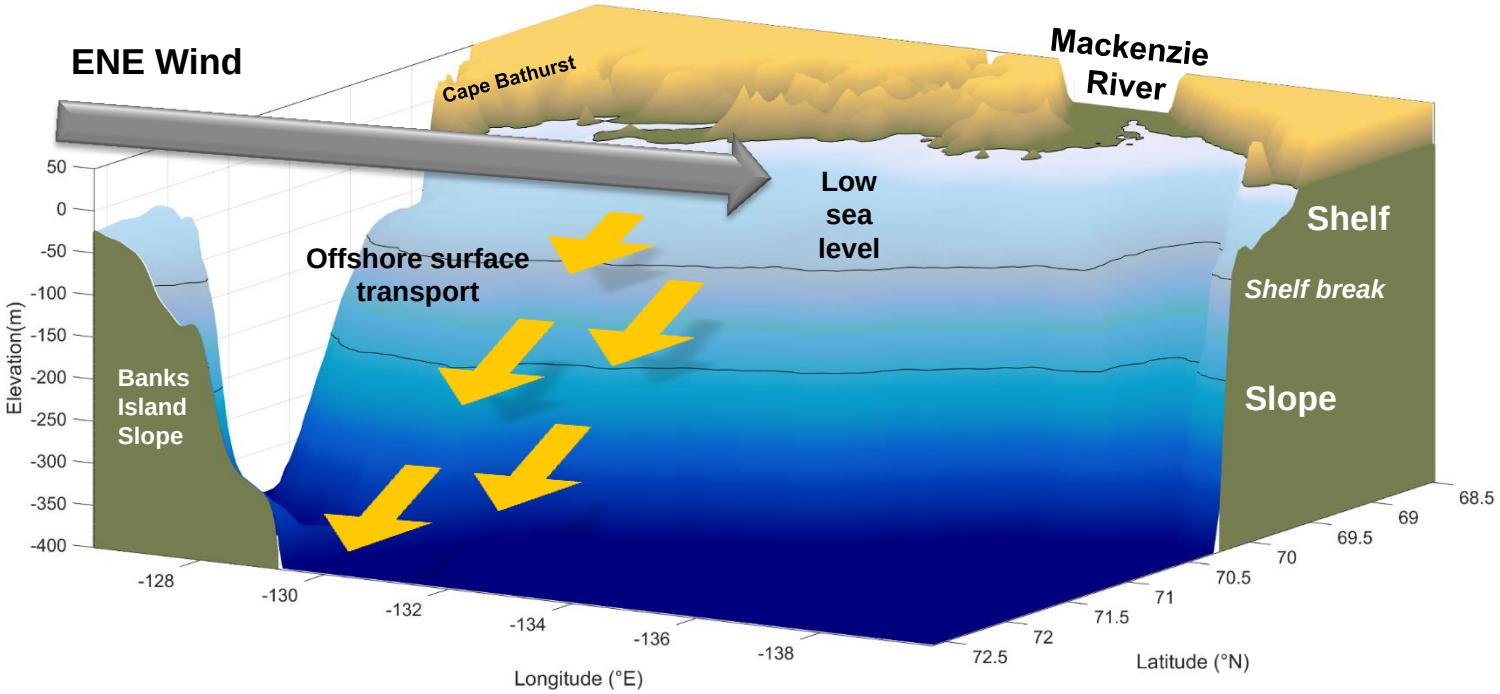
Shelf-break upwelling in the fall of 2014

- Intrusion of deep salty water over the shelf





Coastal Upwelling in the Canadian Beaufort Sea



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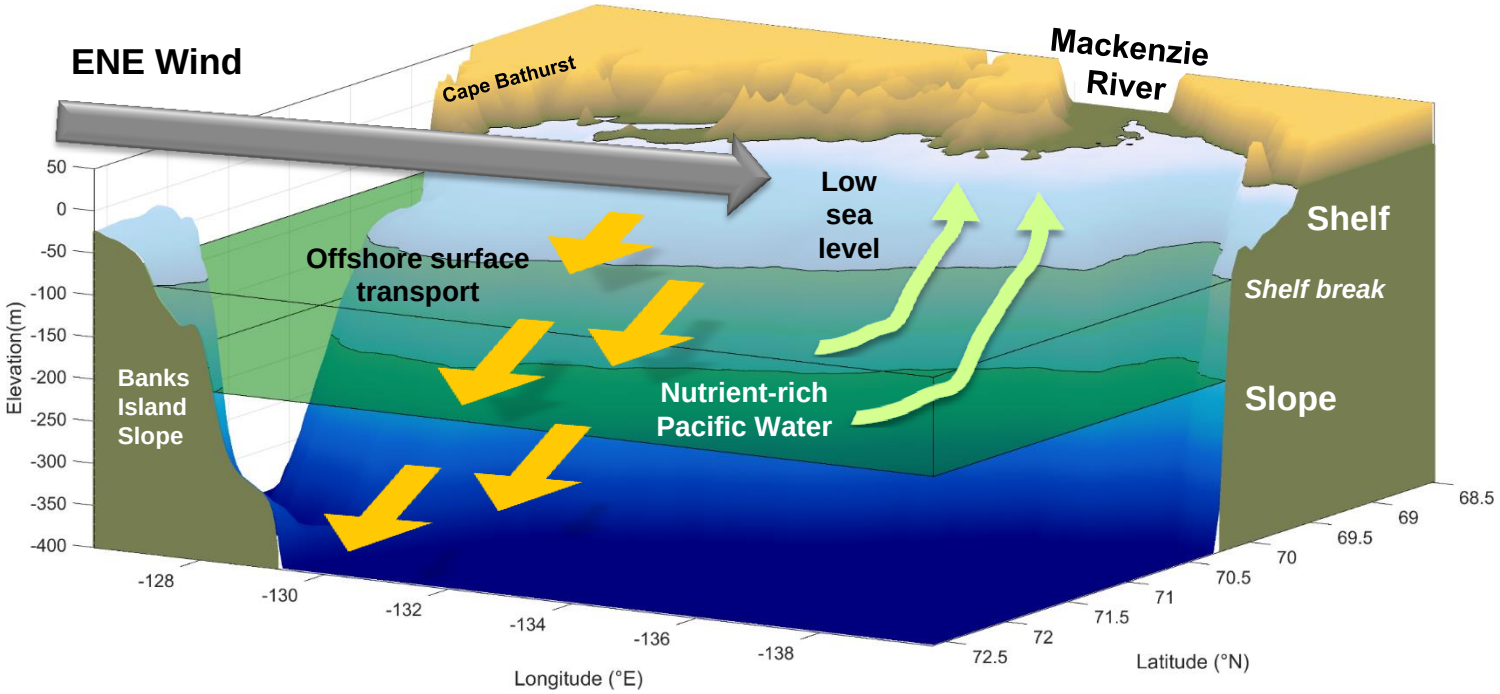

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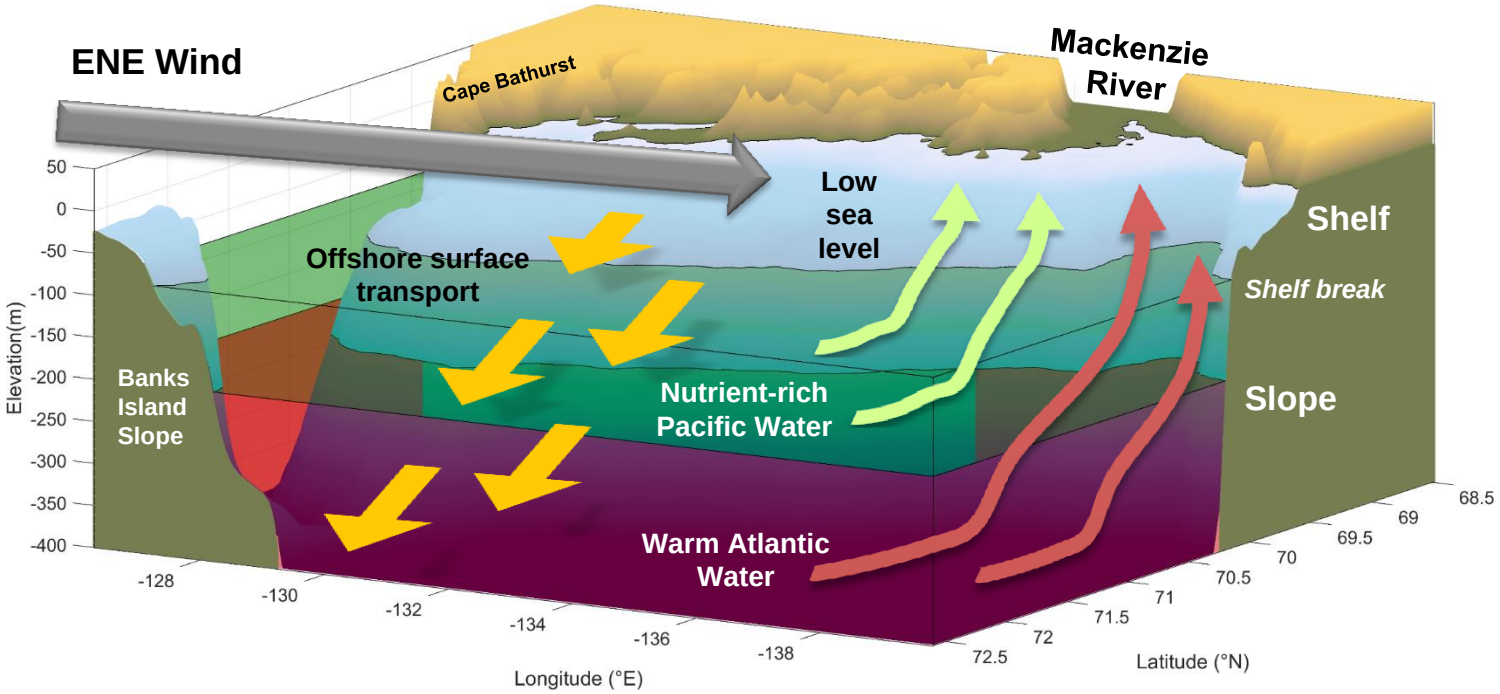

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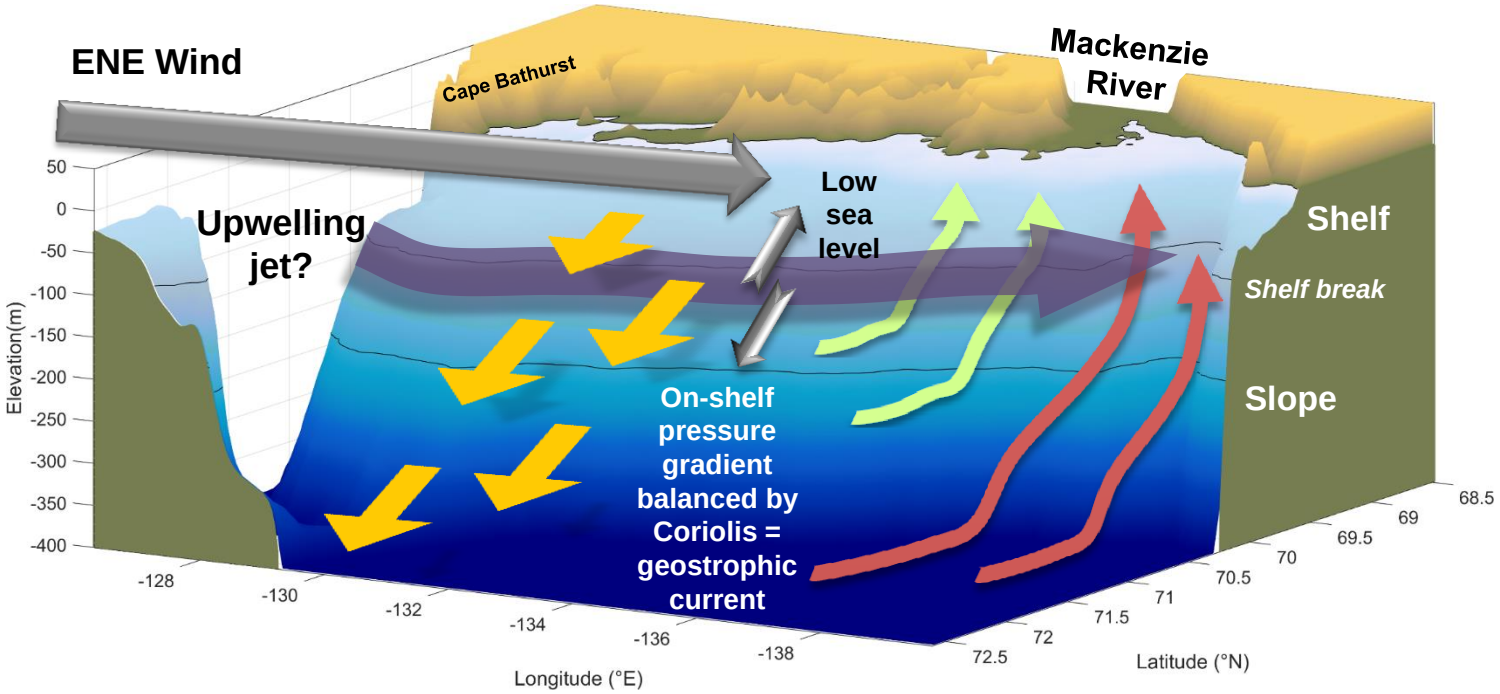

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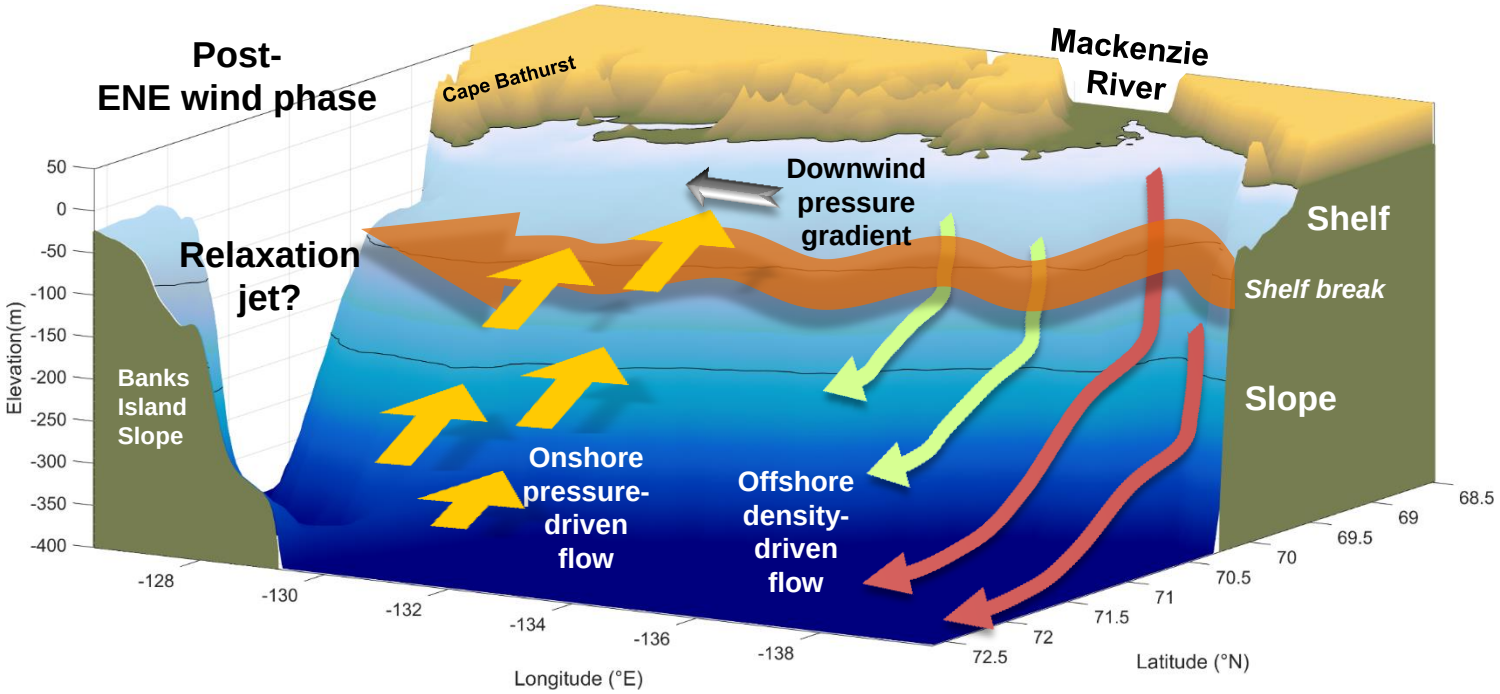
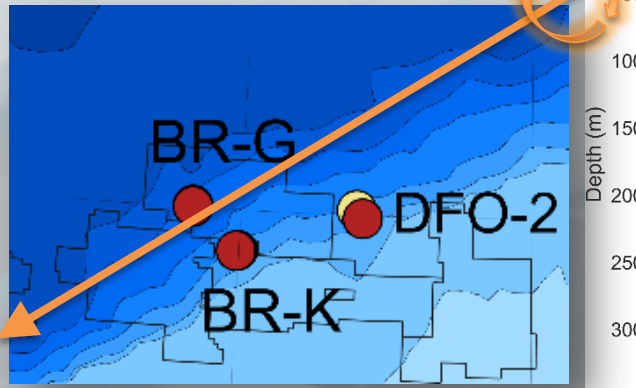
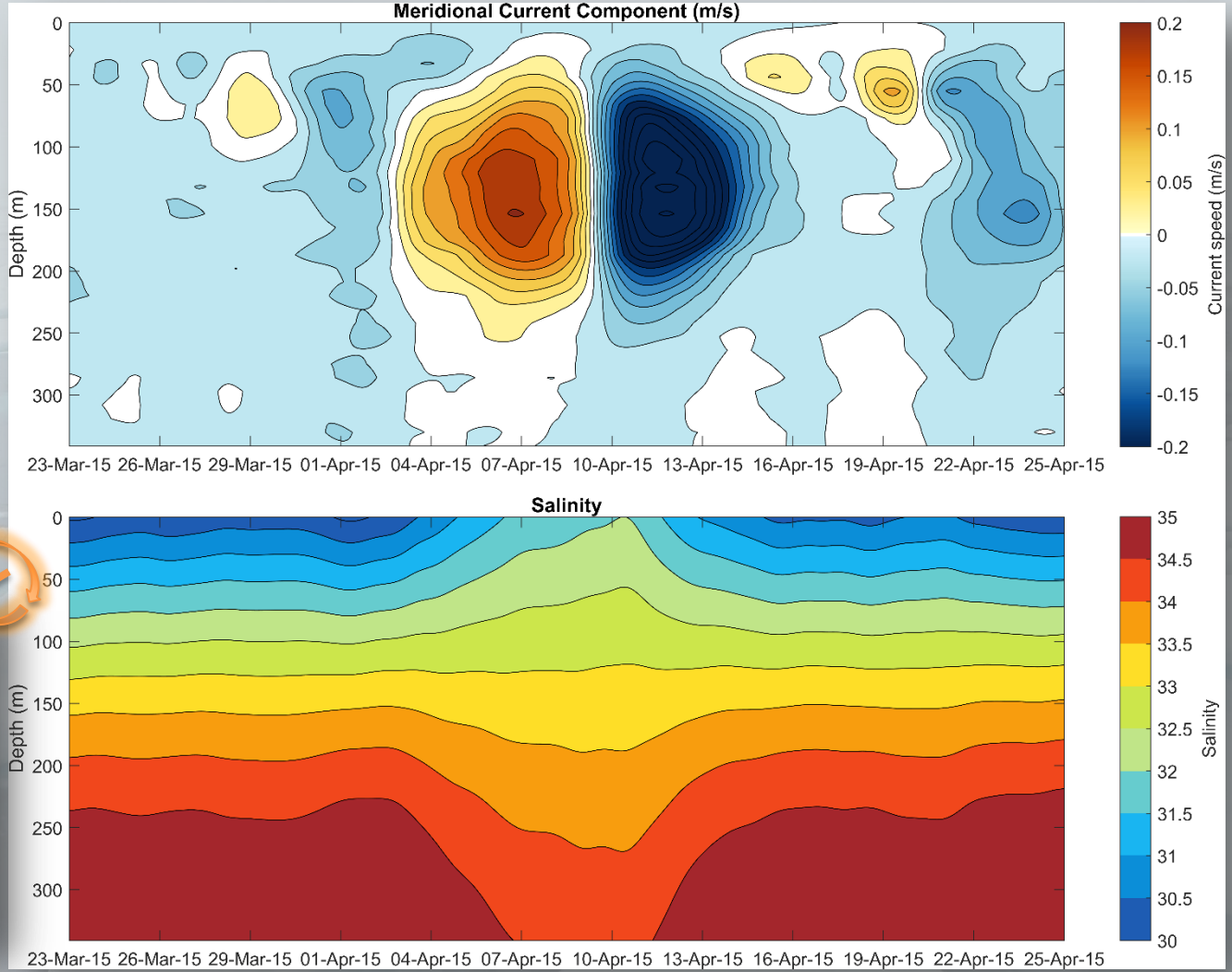


Mesoscale anticyclonic eddy during April 2015 at BR-G (subsurface)

- Entrapment of Pacific Halocline water
- Large vertical mixing
- Possibly travelling south-westward along the slope





iBO
2015-2018

Conclusions

- Key prerequisite for effective management of Arctic oil and gas development is availability of high-quality ice and ocean datasets to characterize variability of physical environment;
- Mooring data provide "*depth and breadth of understanding*" by capturing seasonality, inter-annual changes, and spatial variability of the physical system, which is a critical element to further understand the biology and biogeochemistry;
- In addition to making available observational data to the larger community, iBO aims at integrating historical datasets and developing a iBO Synthesis Report;

Next Steps

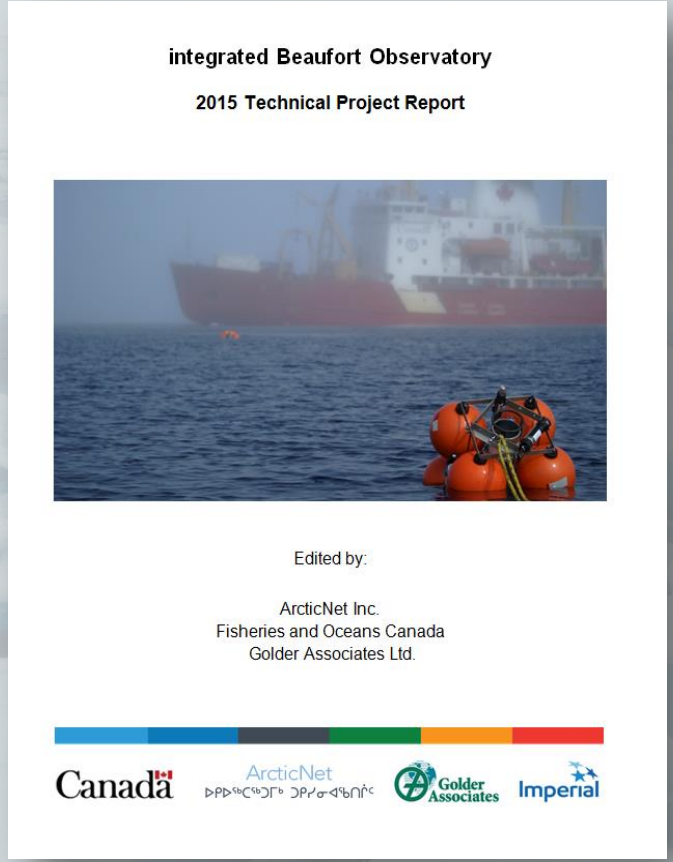
Proposal (2017-2020): **Variability in the Beaufort Ice-Ocean Environment: A Synthesis Report**

- Process recovered data from 2016-2017 deployment
- Plan for 2018 recovery mission
- Incorporation of Traditional Knowledge
- Characterize sea-ice drift/draft and ocean current over depth, space and time - emphasis on average conditions, seasonal and year-to-year variation and extremes in speed and persistence
- Document marine and atmospheric circumstances of potentially hazardous high energy and/or prolonged ocean events
- Use long term ocean data - select events & evaluate simulations of high-resolution operational ocean forecast model (ECCC/DFO's RIOPS, http://navigator.oceansdata.ca : Regional Ice-Ocean Prediction System)

Data publicly available in Polar Data Catalogue (Jan-2017)

https://www.polardata.ca/

Technical report reviewing the available 2014-2016 data can be transmitted to potential users


integrated Beaufort Observatory

2015 Technical Project Report

Edited by:

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Thank you! Questions?
Special thanks to the Canadian Coast Guard and DFO/ArcticNet mooring teams