ARCTIC RESPONSE TECHNOLOGY
OIL SPILL PREPAREDNESS

JIP – FATE OF DISPERSED OIL UNDER ICE

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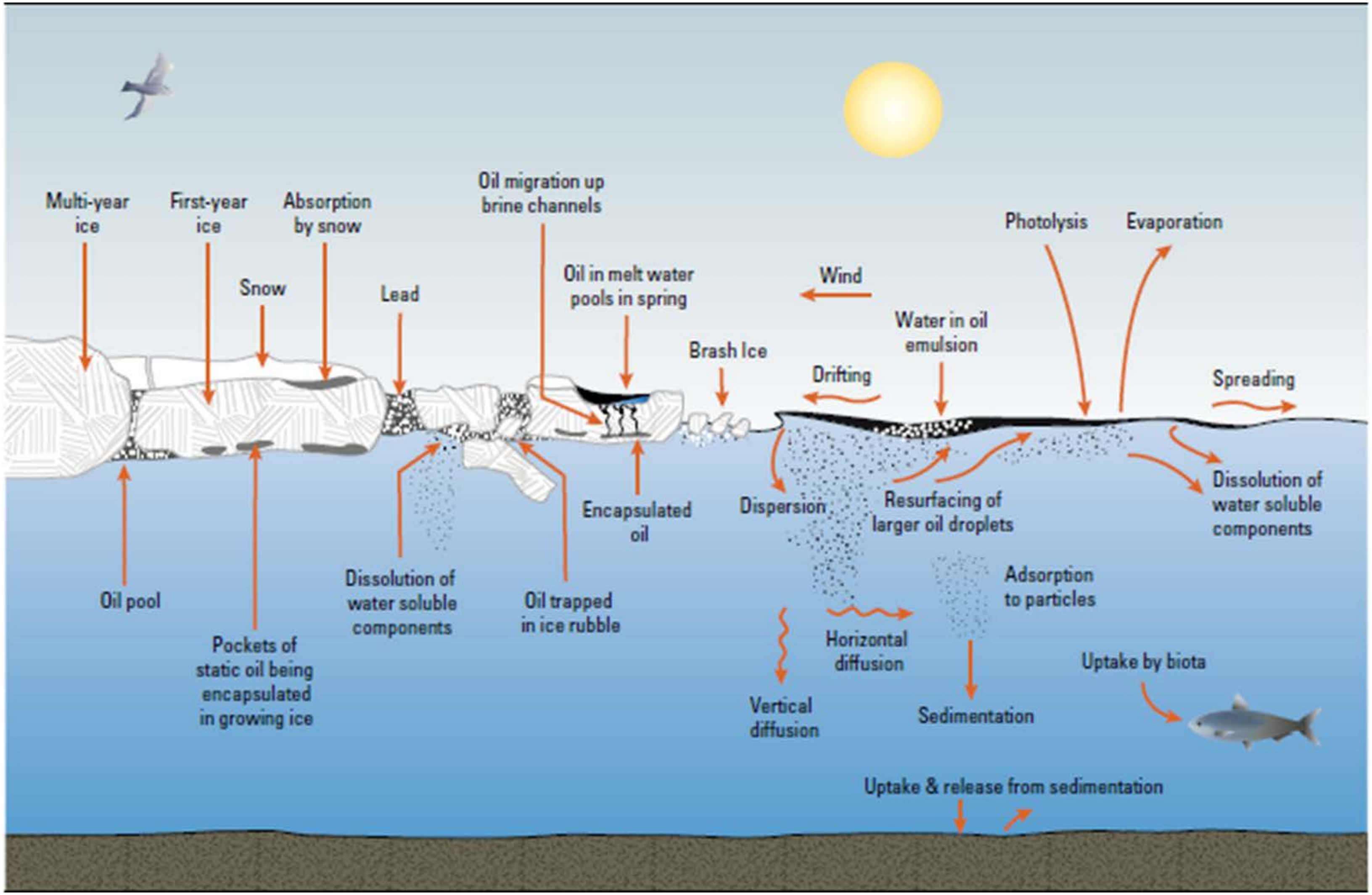
IOSC 2014, SAVANNAH, GEORGIA, USA

OIL IN ICE – AFTER DALING 1990, MODIFIED IN NRC REPORT



COLLABORATION AMONG TEN COMPANIES

- **International research programme**
- **Builds upon decades of R&D** in arctic oil spill response
- Brings together **experts across industry, academia and independent research centres**
- Research integrity through **technical review and public dissemination** of results

Six areas of research:

Dispersants

Environmental Effects

In Situ Burning (ISB)

Mechanical Recovery

Trajectory Modelling

Remote Sensing

www.arcticresponsetechnology.org

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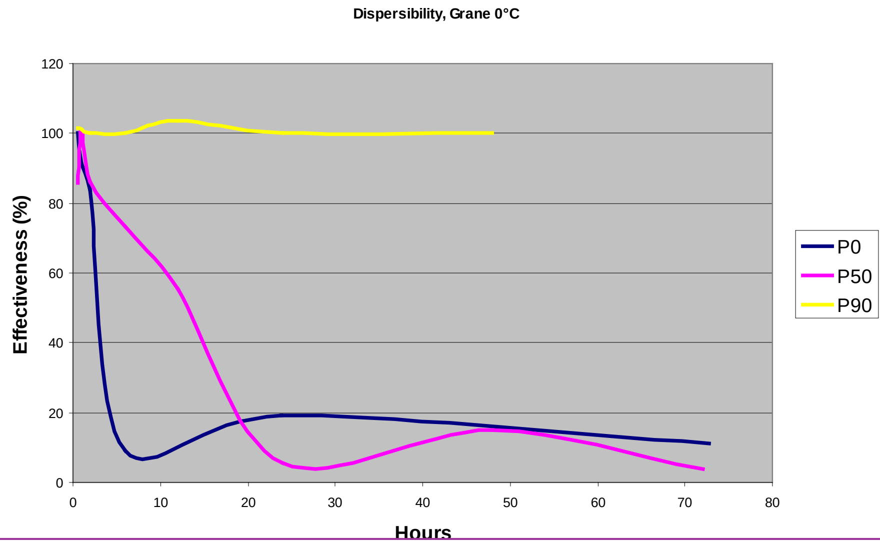
JIP 2009 ARCTIC RESPONSE TECHNOLOGES, USE OF DISPERSANTS

Weathering vs dispersibility

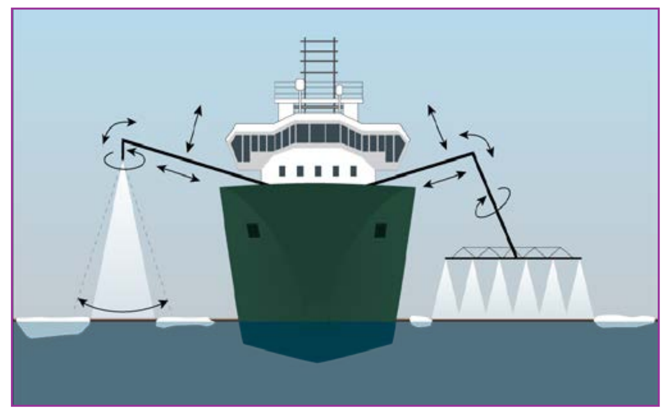


Will the oil be dispersible given enough energy?

A number of experiments show that the presence of ice will reduce the speed of the weathering process,

Presence of ice will also reduce the energy level from waves.

Application technology designed for open water is probably not the best for use in ice covered areas



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ARCTIC RESPONSE TECHNOLOGY JOINT INDUSTRY PROGRAM (OGP) 2012-2015

Dispersants Working Group	Environmental Effects Working Group	Trajectory Modeling Working Group	Remote Sensing Working Group	Mechanical Recovery Working Group	In-Situ Burning Working Group	Experimental Field Releases
Project 1: Fate of dispersed oil under dynamic drift ice pack	Project 3: Environmental impacts of Arctic spills and their response	Project 4: Trajectory modeling in ice	Project 5: Oil spill detection and monitoring in low visibility & ice	Project 6: Mechanical recovery in ice infested waters	Project 7: State of knowledge ISB Arctic / ice	Project 10: Counter-measure verification through controlled field releases and exercises
Project 2: Dispersant testing under realistic field conditions					Project 8: Aerial ignition capability	
					Project 9: Herders to expand ISB window	

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ARCTIC RESPONSE TECHNOLOGY JIP: PROJECT 1

Fate of Dispersed Oil Under Ice

"The primary objective is to develop a detailed numerical model that predicts the potential for a dispersed oil plume to resurface and re-form a new slick under the ice. Ideally, dispersed oil plumes will remain in the water column indefinitely while biodegradation proceeds."

Phase I

- Literature Review

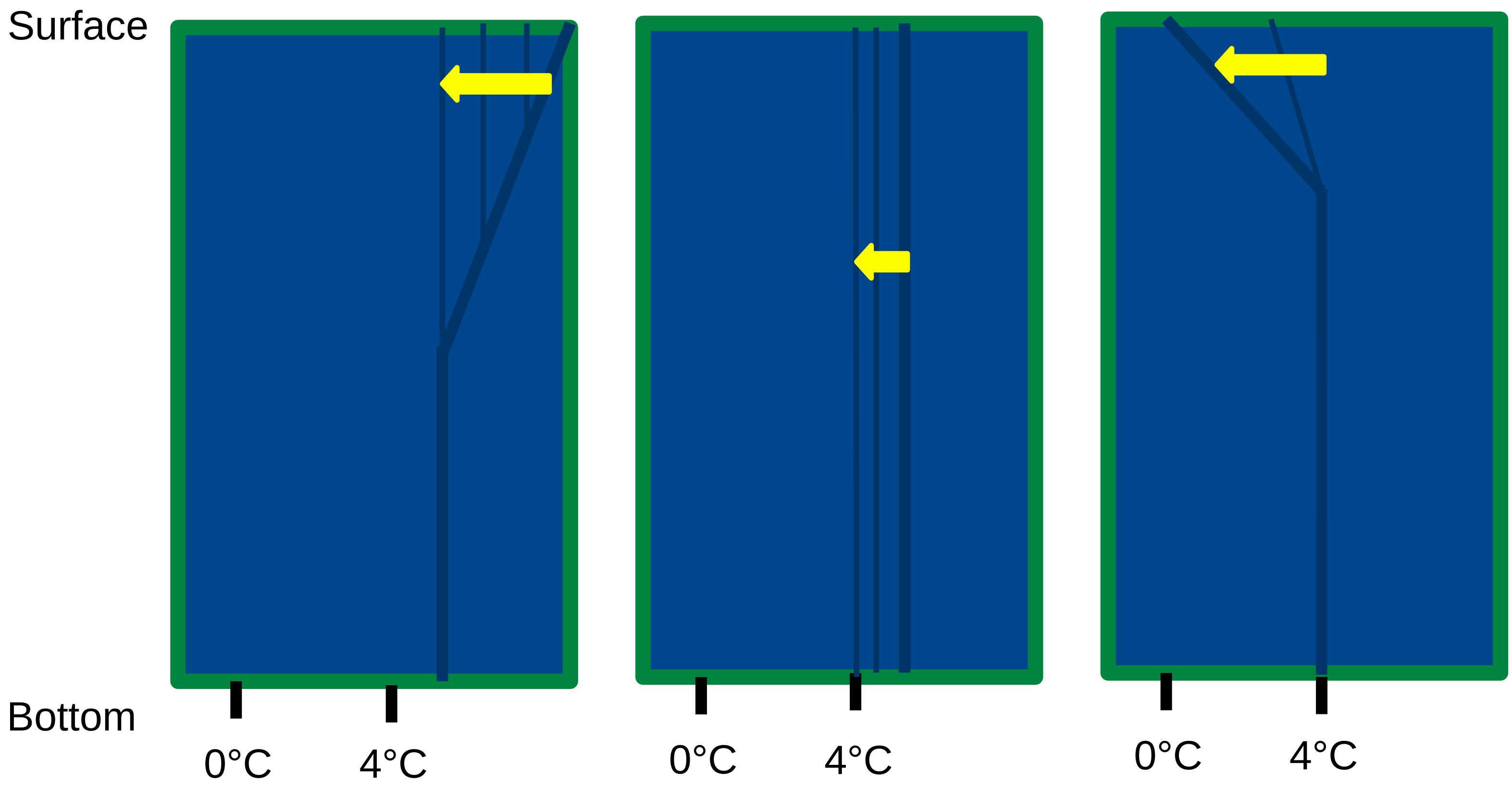
Phase II

- Designing and conducting a program to collect data on under-ice turbulence and currents in a low-energy, land-fast ice environment. First case will be quite water under land-fast ice as a minimum energy environment.
- Designing and conducting a program to conduct dye tracer studies in parallel with the data collection efforts defined above,
- Running the plume model using defined oil droplet sizes and oil densities and the turbulence/current data to predict the behavior of dispersed oil;
- Preparing a detailed report describing the findings of tasks in Phase 2.

DESCRIPTION OF ICE GROWTH PROCESS

Stage	**Pancake cycle**	**Congelation Growth cycle**
Young ice	Frazil ice Pancake ice rafting	Frazil ice Grease ice Nilas Finger rafting
First-year ice	Cementing and consolidation (ice floes and sheet ice) Rafting and ridging	Congelation ice (sheet ice) Rafting and ridging
Multi-year ice	Weathered from melt Ridging	Weathered from melt Ridging

FORMATION OF SEA ICE IN A FRESHWATER LAKE



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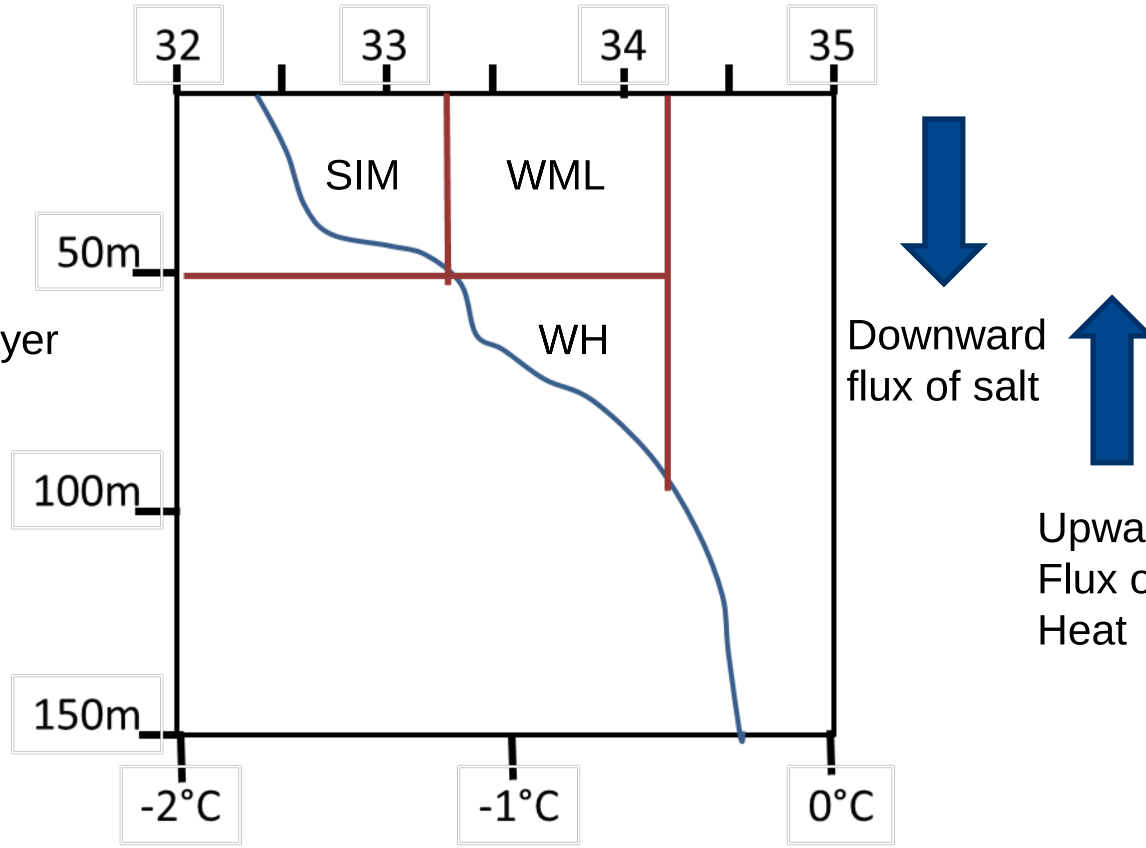
CHANGES IN ARCTIC SURFACE SALINITY DUE TO SEASONAL ICE FORMATION AND WIND MIXING

SIM – Seasonal Ice Melt

WML – Winter Surface Mixed Layer

WH – Winter Halocline



Rudels et al (1996)

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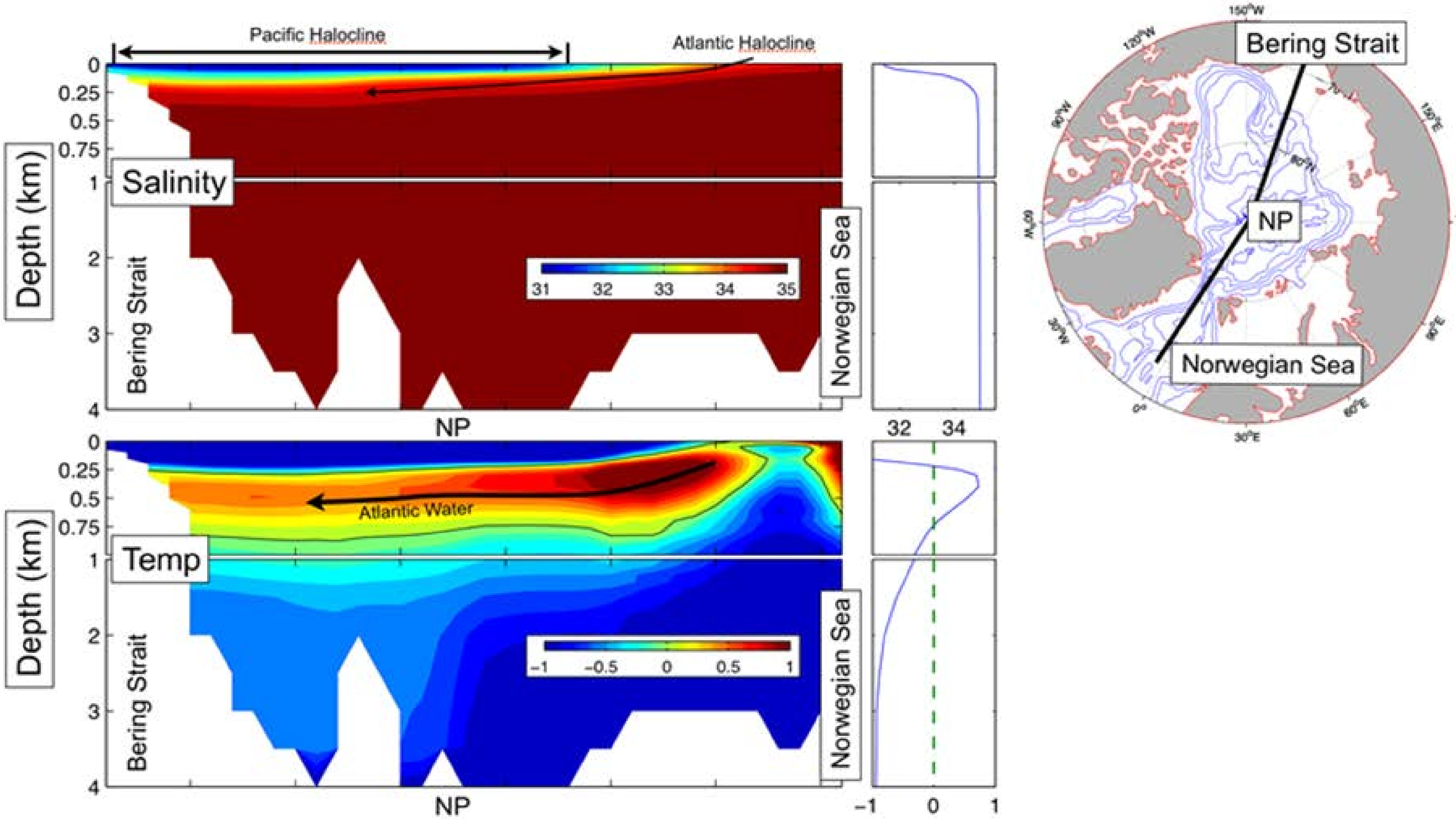
WATER COLUMN STRUCTURE BETWEEN BERING STRAIT AND NORWEGIAN SEA



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THANK YOU

QUESTIONS?