

# Ocean General Circulation Modelling Using NEMO and the ANHA Configuration

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## Why Numerical Ocean Modelling

- conduct experiments to study the physics and "what if" kind of questions
- prediction for "sudden" events associated to the ocean state, e.g., oil spill pathway
- fill the gap in observations (economically) to better understand the past and current ocean states

## What is NEMO and ANHA Configuration

NEMO stands for the Nucleus for European Modelling of the Ocean, which is a state-of-art modeling framework widely used for oceanographic research, operational oceanography, seasonal forecasting and climate studies. It includes five major components,

- the blue ocean (ocean dynamics)
- the white ocean (sea ice)
- the green ocean (biogeochemistry), more details about the ANHA and BLING marriage: poster #16
- the adaptive mesh refinement software (AGRIF, see poster #13)
- the assimilation component

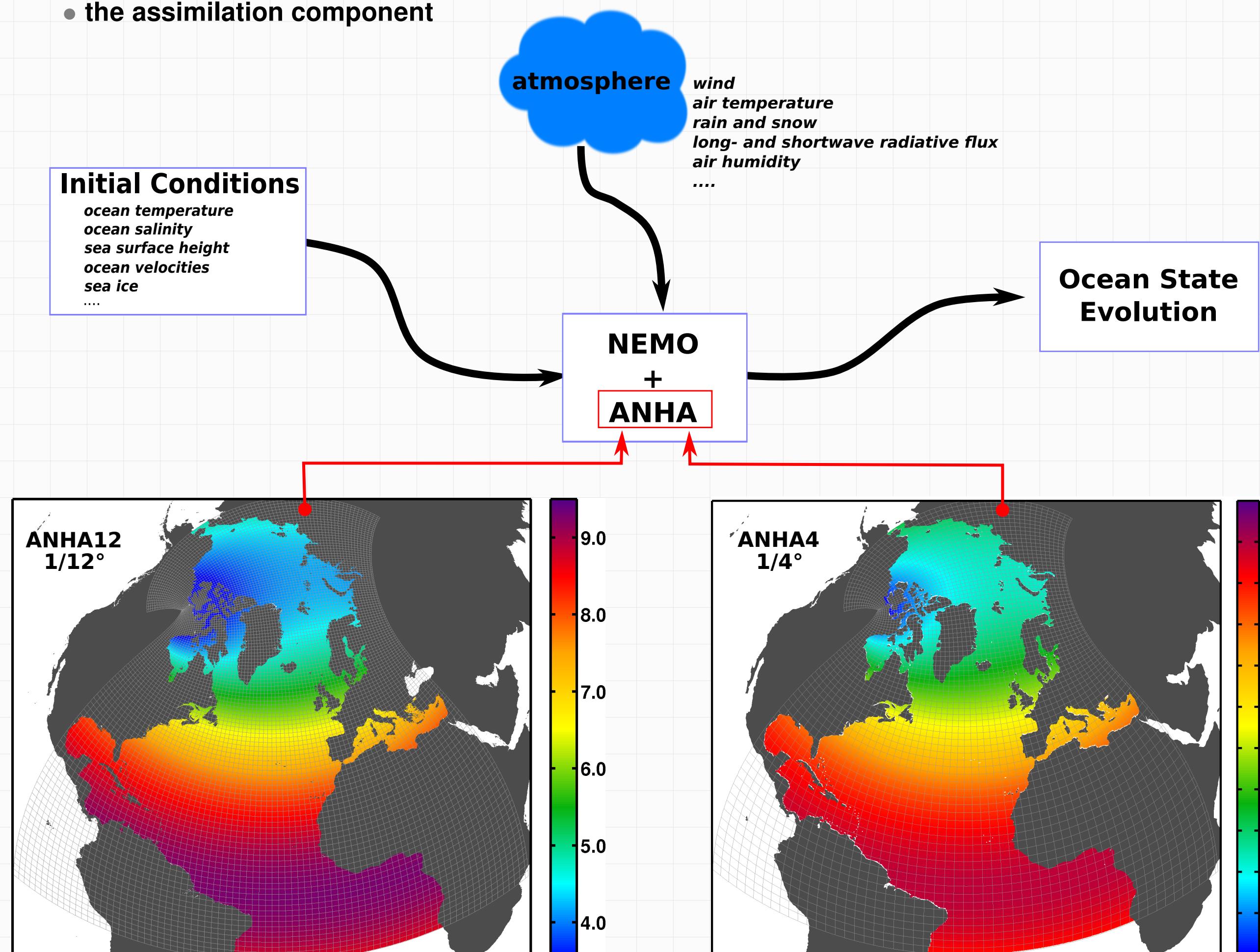
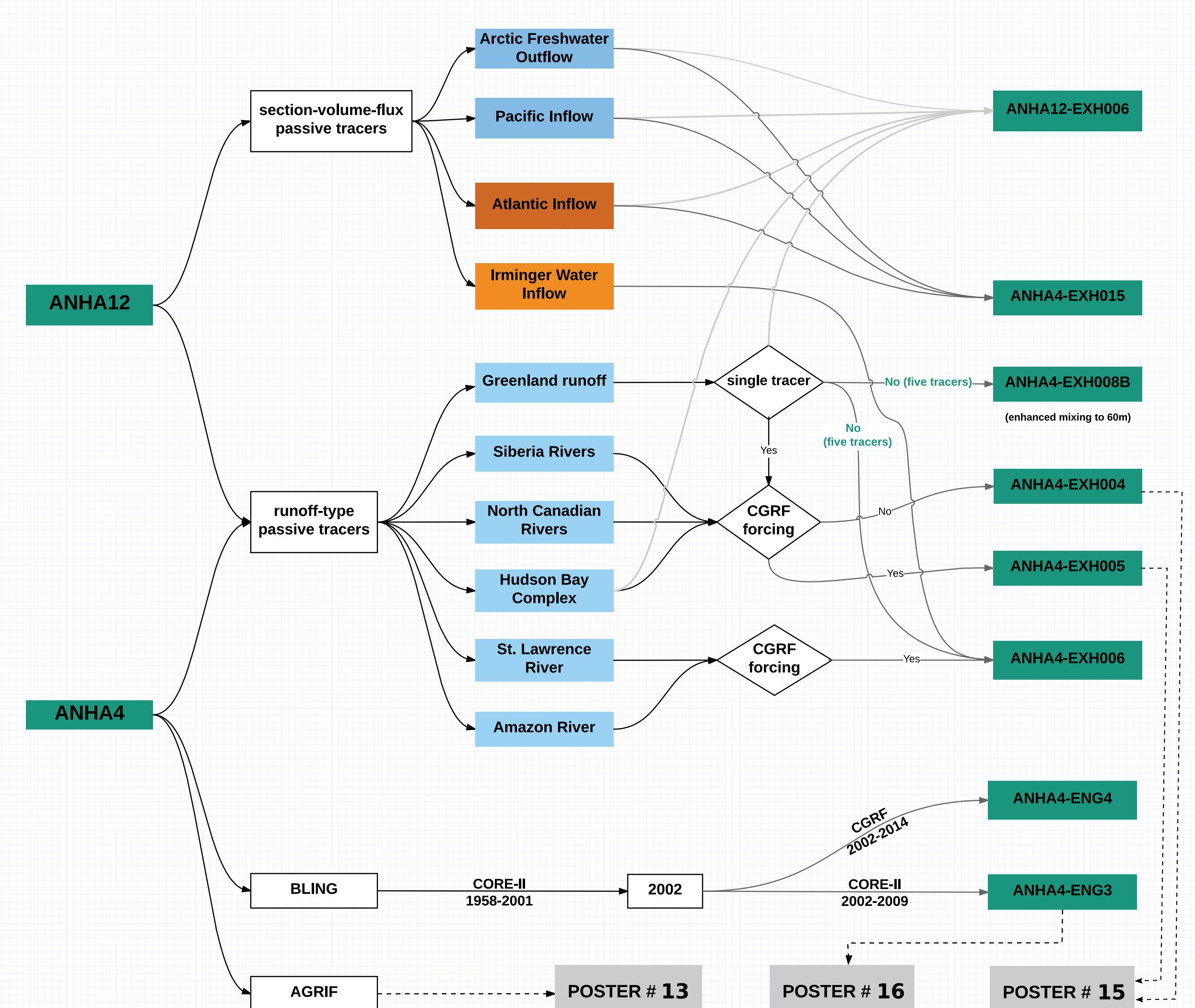


Figure 1 Arctic and Northern Hemisphere Atlantic (ANHA) NEMO configurations domain and horizontal resolution (colour, unit: km). Left is ANHA12 (1632 x 2400 x 50 grid points) and right is ANHA4 (544x800x50 grid points)

## What Simulations We Do



## What Is the Cost

CONFIG	simulation	cores	one model year simulation (core year)	storage (GB/year)
ANHA4	basic	48	0.13	11
	basic + 5 passive TRC	72	0.26	22
	basic + BLING	60	0.25~0.29	45
ANHA12	basic + 5 passive TRC	300	12~12.9	130+
AGRIF			POSTER # 13	

## What Simulations Tell Us

### Pathway of the Greenland meltwater in the ocean

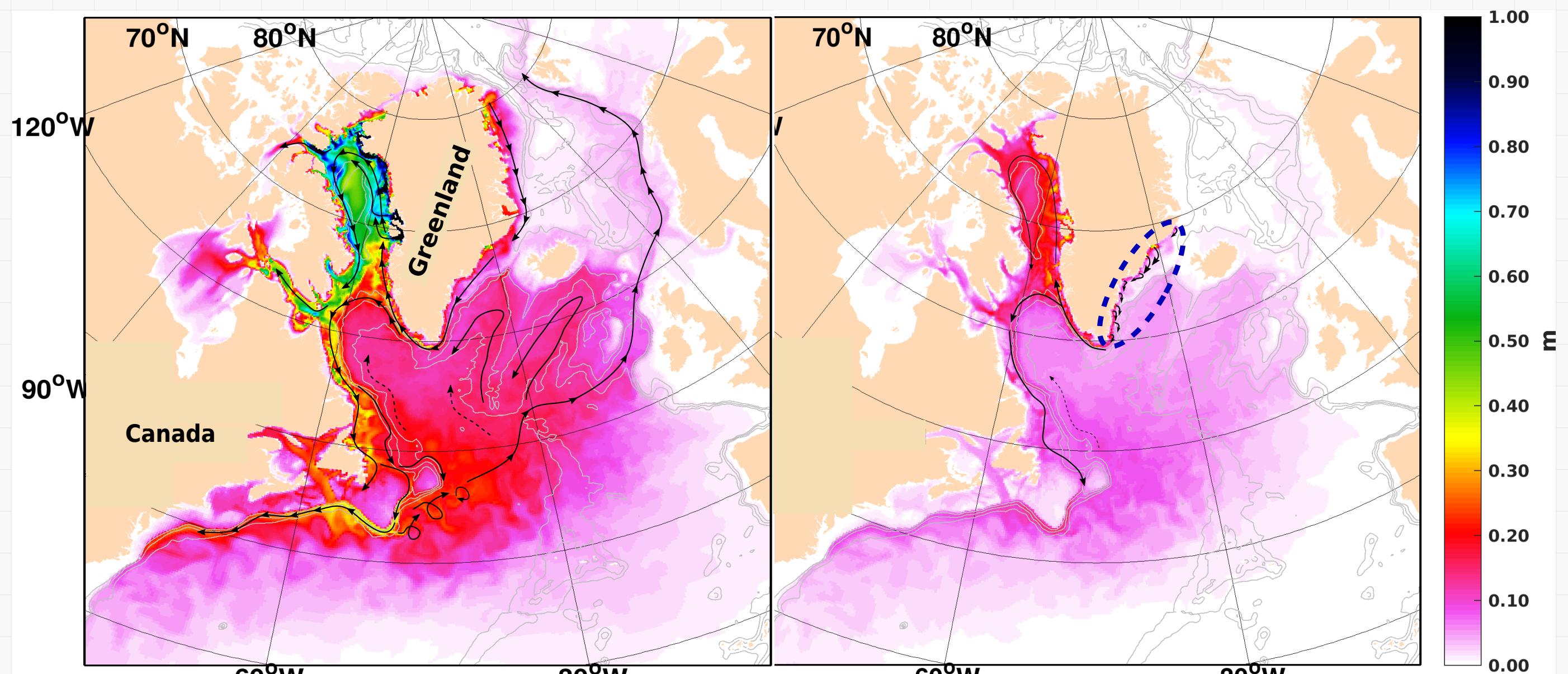


Figure 2 The horizontal distribution of vertical integrated Greenland meltwater passive tracer (left: meltwater from all around Greenland coast; right: meltwater only from southeast Greenland coast). Black arrows show the propagation pathway of the Greenland meltwater.

### Pathway of the Pacific and Atlantic water in the Arctic Ocean

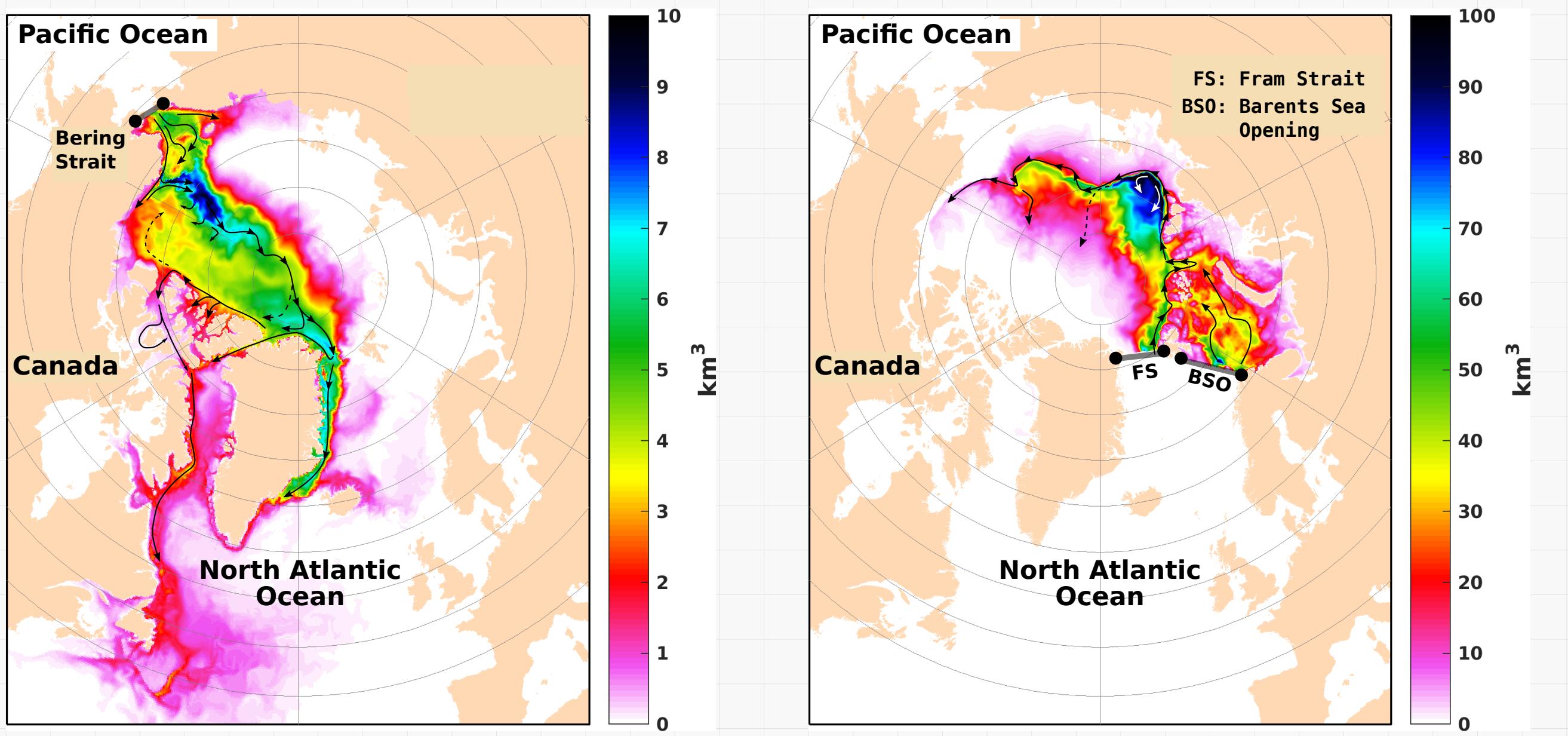


Figure 3 The horizontal distribution of vertical integrated Pacific Inflow (left) and Atlantic Inflow (right) passive tracer (volume accumulated since January 2002). Black arrows show the propagation pathway of the inflows.

### Pathway of the riverine water in the ocean

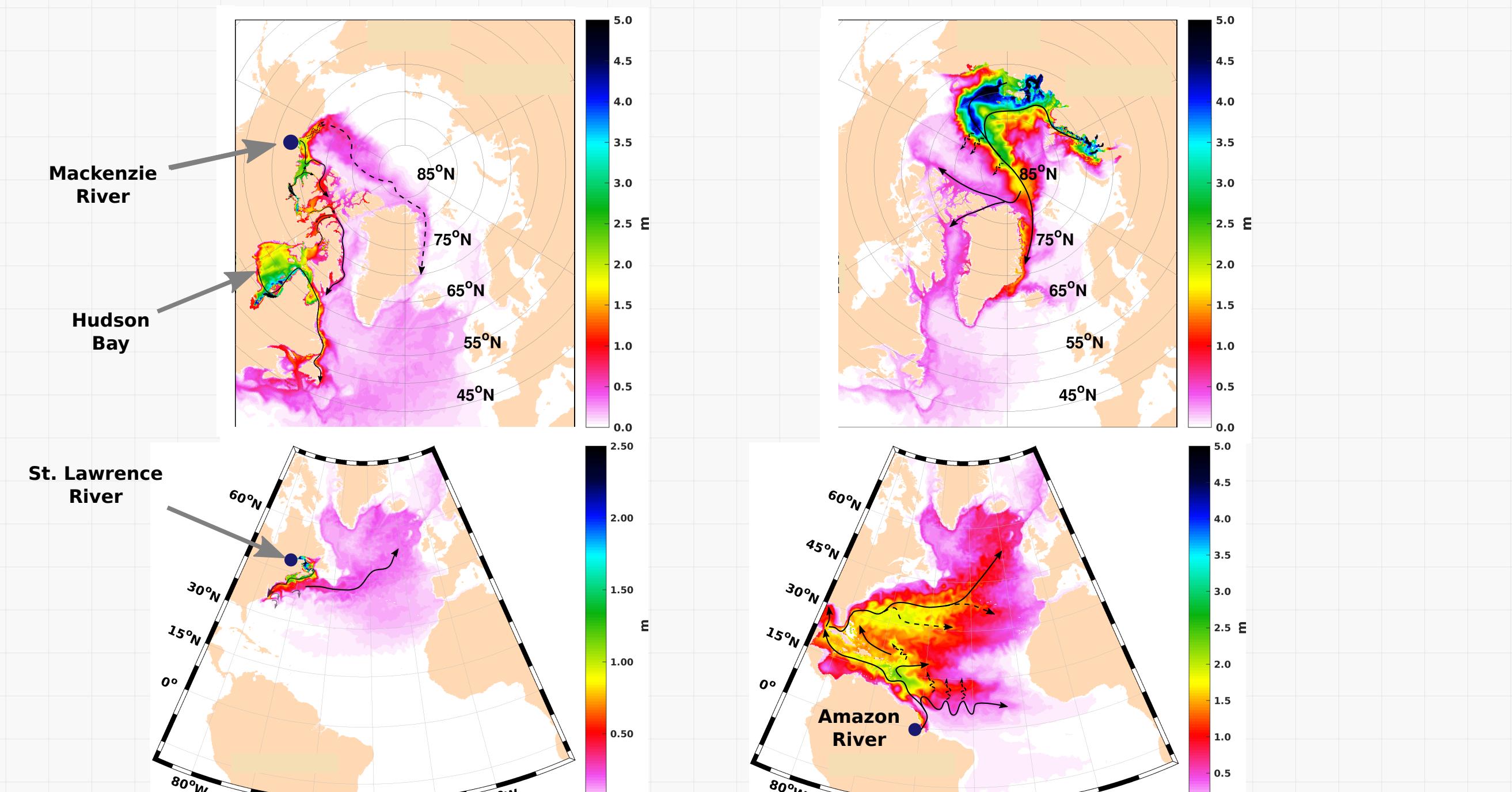


Figure 4 The horizontal distribution of riverine origin water in the Arctic and Atlantic Ocean (accumulated over the period of 2002 -- 2010). Top left panel for rivers from northern Canada (including Mackenzie River and rivers flowing into Hudson Bay). Top right panel for rivers from the Siberian coast. Bottom left is for St. Lawrence River and bottom right is for Amazon River.

### Deep convection in the Labrador Sea and Atlantic Meridional Overturning Circulation

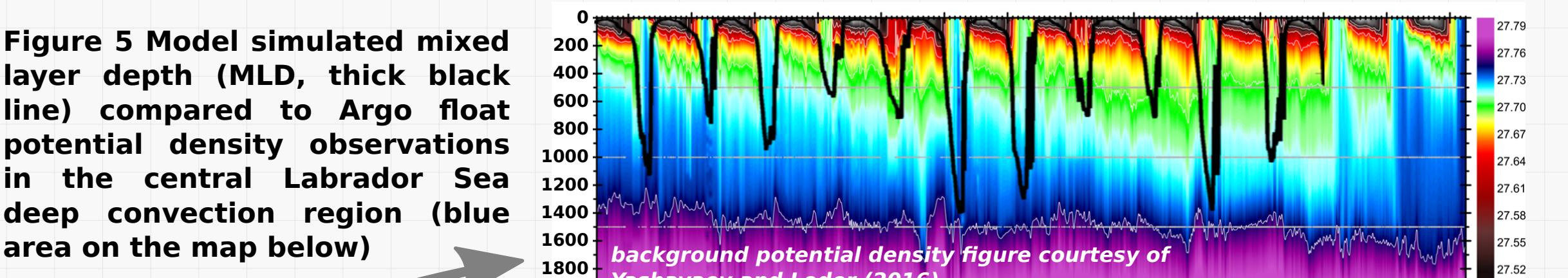


Figure 5 Model simulated mixed layer depth (MLD, thick black line) compared to Argo float potential density observations in the central Labrador Sea deep convection region (blue area on the map below)

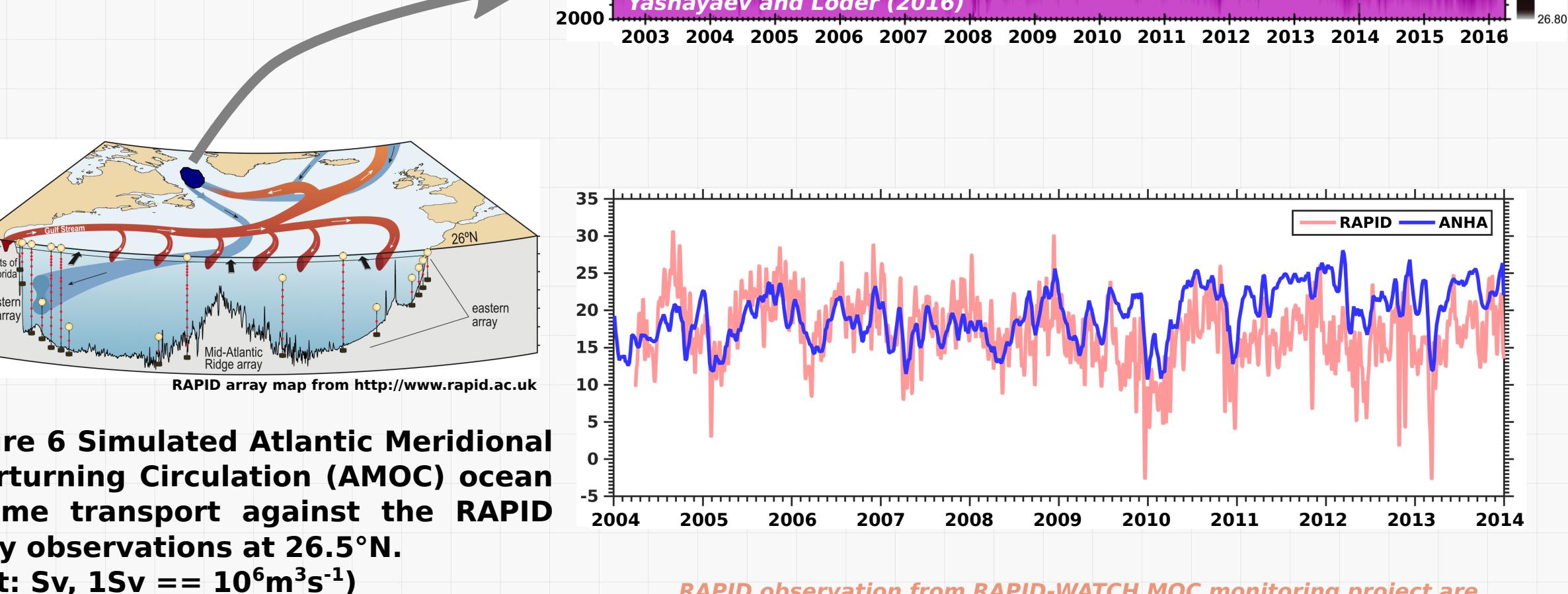


Figure 6 Simulated Atlantic Meridional Overturning Circulation (AMOC) ocean volume transport against the RAPID array observations at 26.5°N. (unit: Sv, 1Sv == 10⁶m³s⁻¹)

### Acronyms:

- AGRIF: Adaptive Grid Refinement In Fortran
- BLING: Biogeochemical with Light, Iron, Nutrient and Gasses
- CGRF: Canadian Meteorological Centre Global Deterministic Prediction System reforecasts
- CORE-II: Coordinate Ocean-ice Reference Experiment version 2
- GLORYS2v3: Global Ocean Physics Reanalysis II version 3