Pathway of Greenland Meltwater Revealed by Passive Tracers in a NEMO Simulation

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3rd Annual VITALS Science Meeting, Halifax, NS, Oct 19-21, 2015

Outline

- **Model configuration and experiment setup**
- **Results**
  - evolution of passive tracer content
  - travel time to the Labrador Sea
  - vertical distribution of passive tracers
- **Summary and future work**

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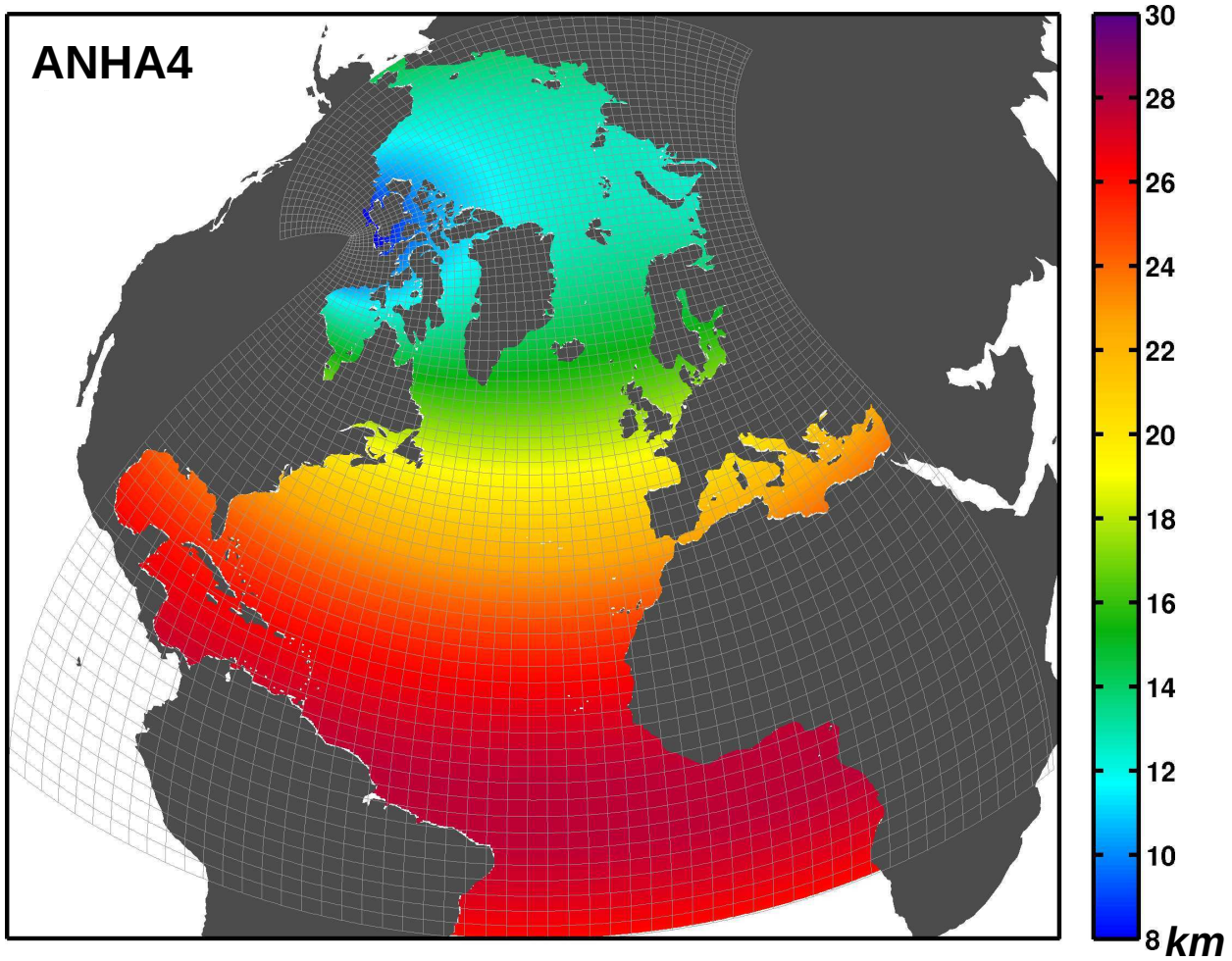
Model Configuration



Model : NEMO 3.4
LIM2 + EVP

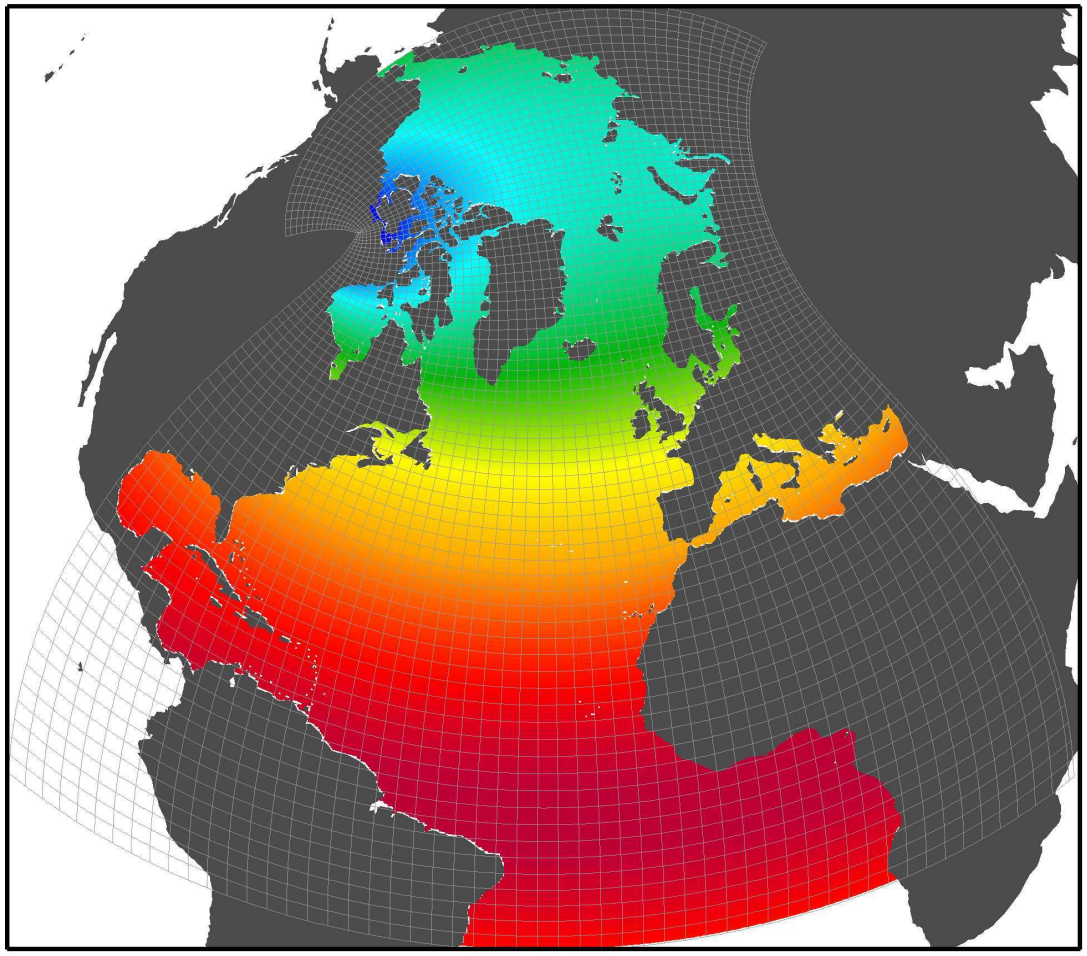
Resolution : 1/4 degree

Mesh : 544 x 800

50 levels

ANHA: Arctic and Northern Hemisphere Atlantic

Experiment Setup



Initialization:

3D T, S, U and V (GLORYS2v3, Jan02)
SSH and Sea Ice

Atmospheric forcing (CGRF, hourly):

T2, Q2, U10, V10
Precipitation ***~ 33km***
Radiation (SW & LW)

Runoff:

Inter-annual Dai and Trenberth's runoff
+ Jonathan Bamber's Greenland melt

OBC:

U, V, T and S (GLORYS2v3)

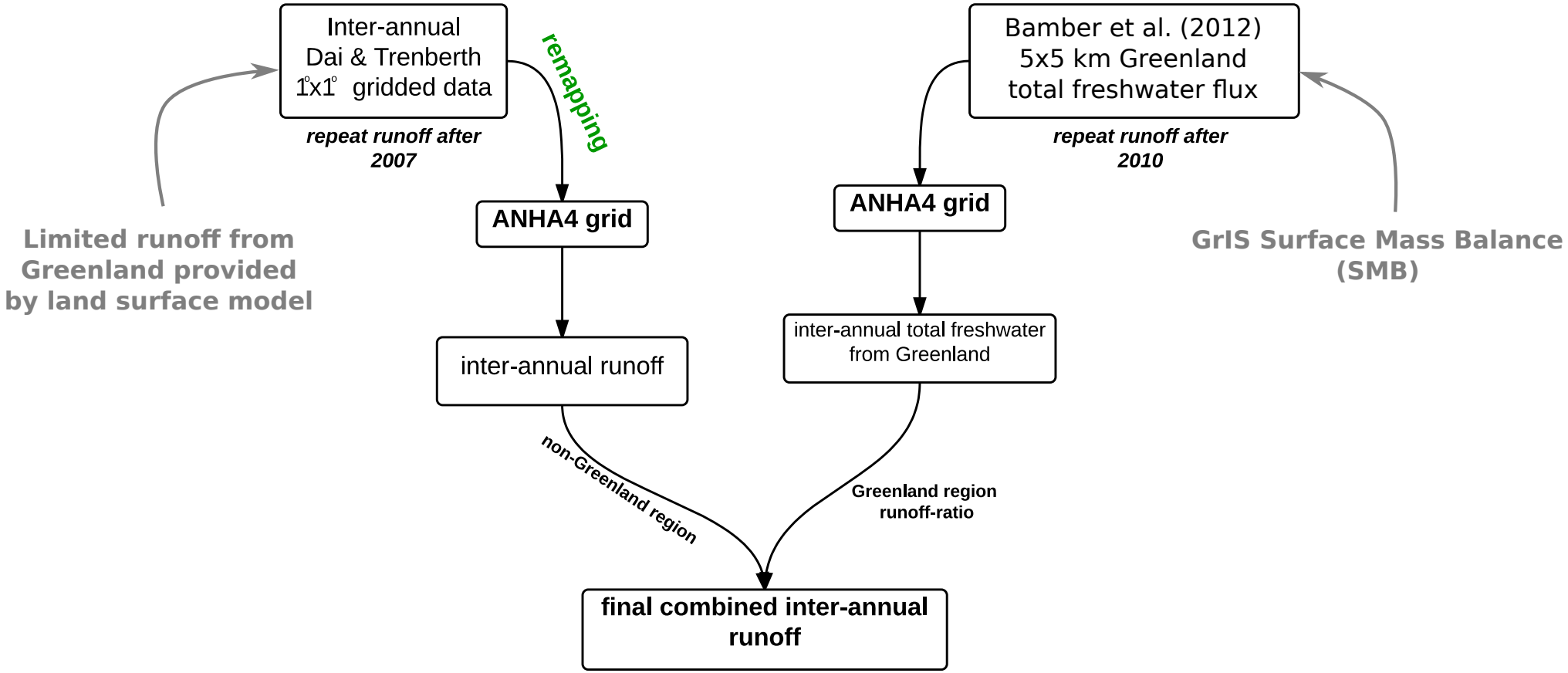
NO temperature & salinity restoring

Jan 2002 – Dec 2013

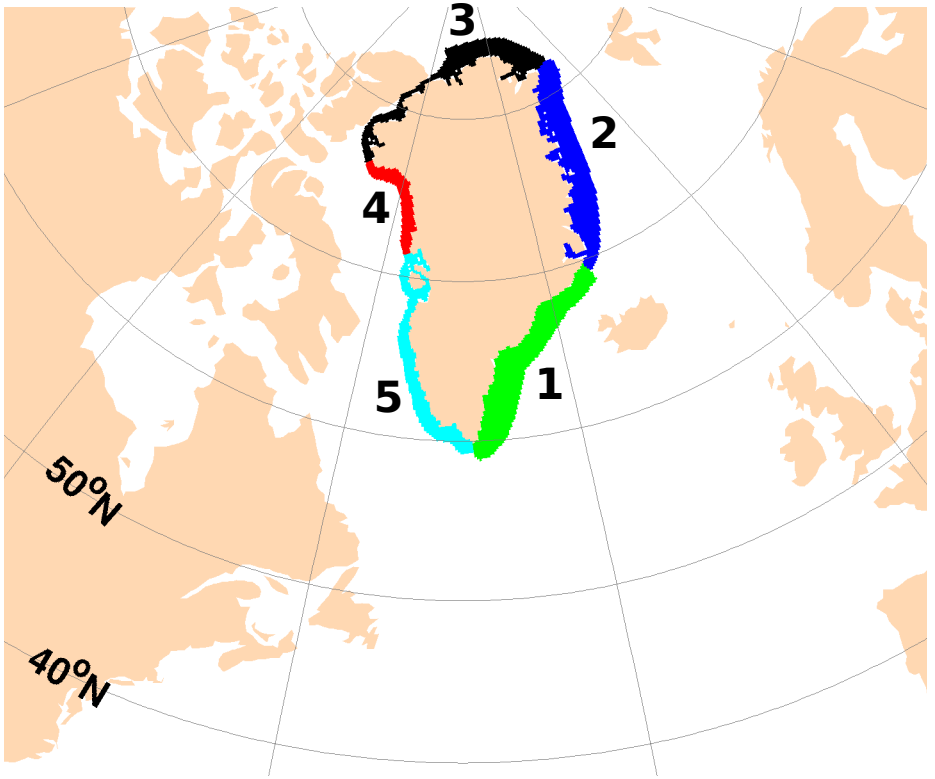
CGRF: CMC GDPS reforecasts
GDPS: Global Deterministic Prediction System

CMC: Canadian Meteorological Centre
GLORYS: GLobal Ocean ReanalYses and Simulations

How to Create the Runoff Data



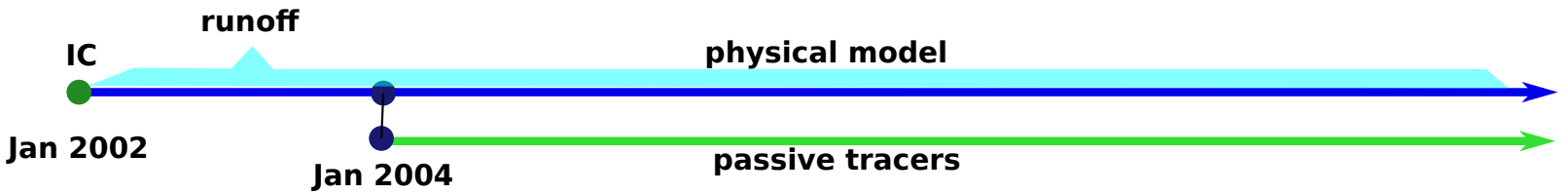
How to Add the Passive Tracers



- five passive tracers
- proportional to the amount of runoff
- start adding tracers from Jan 2004

$$\Delta C = \frac{\Delta t}{\rho_o \cdot e3t_1} \cdot rnf$$

$$\frac{s}{\frac{kg}{m^3} \cdot m} \cdot \frac{kg}{m^2 \cdot s} = unitless$$



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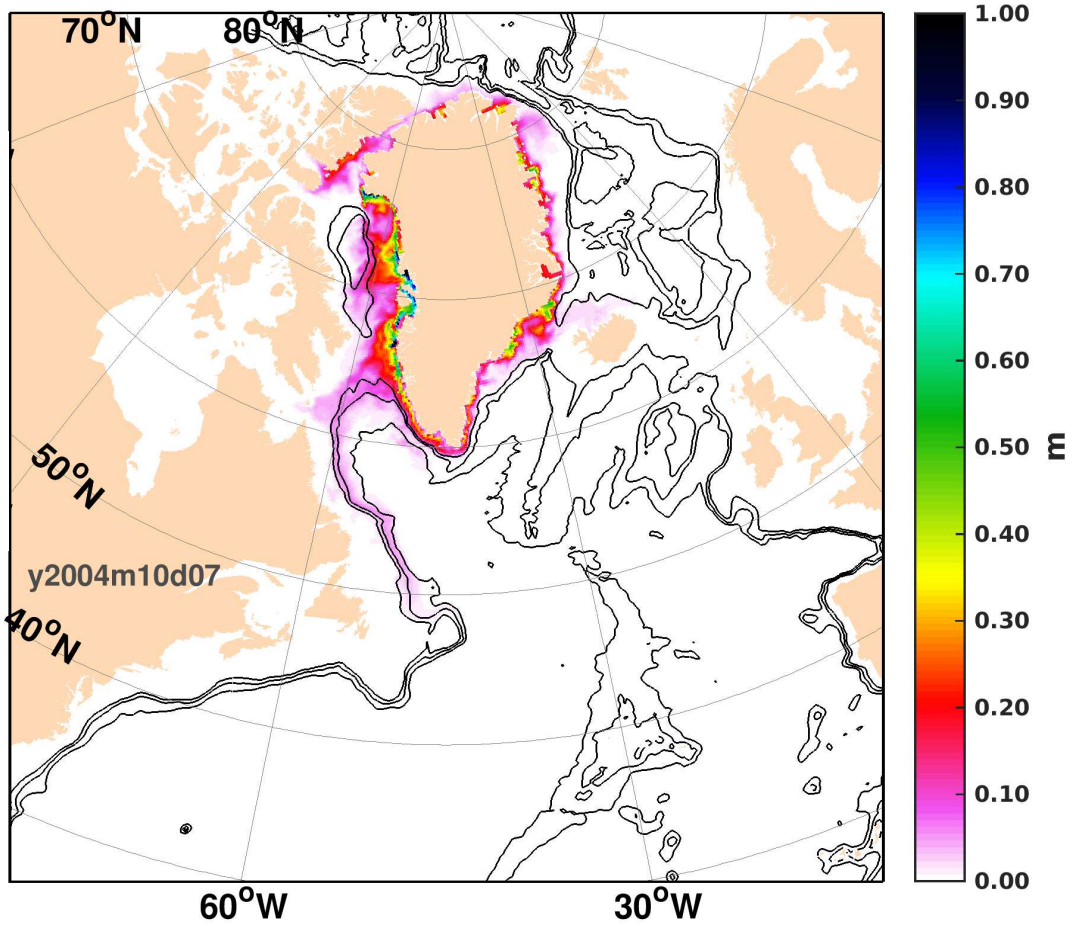
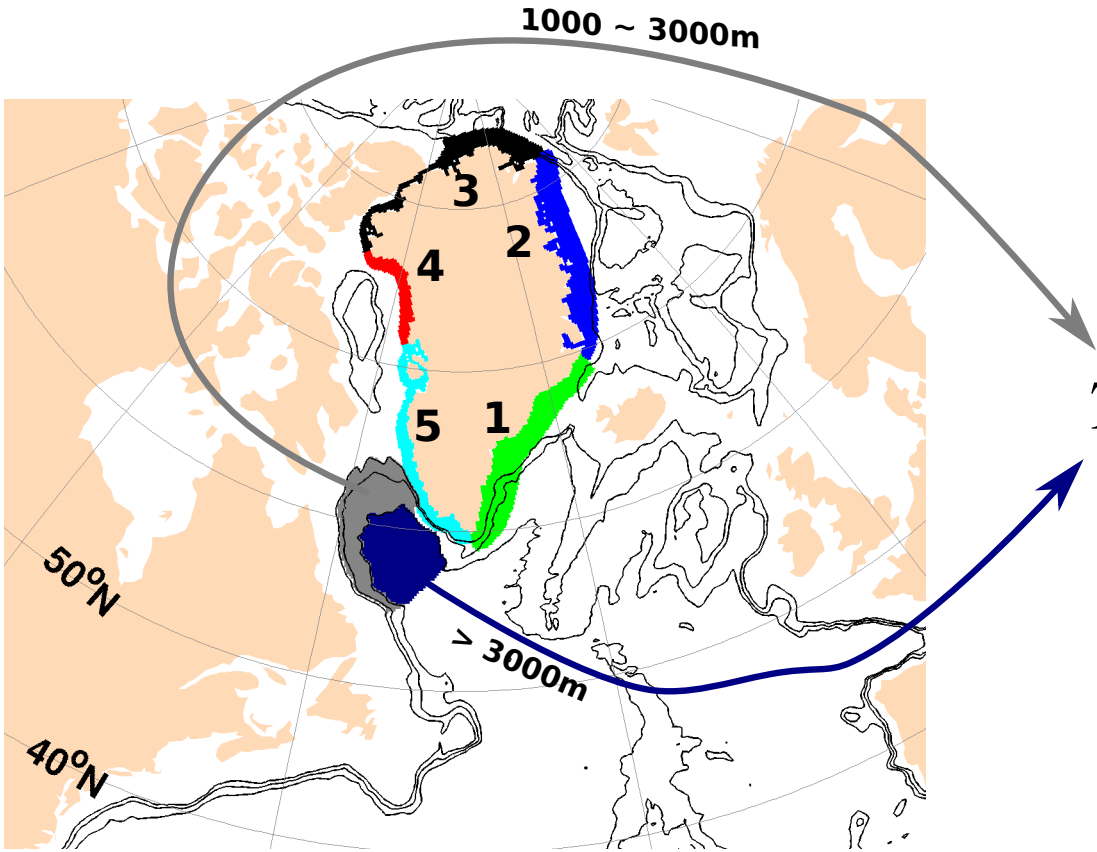
Evolution of Total Passive Tracer Content



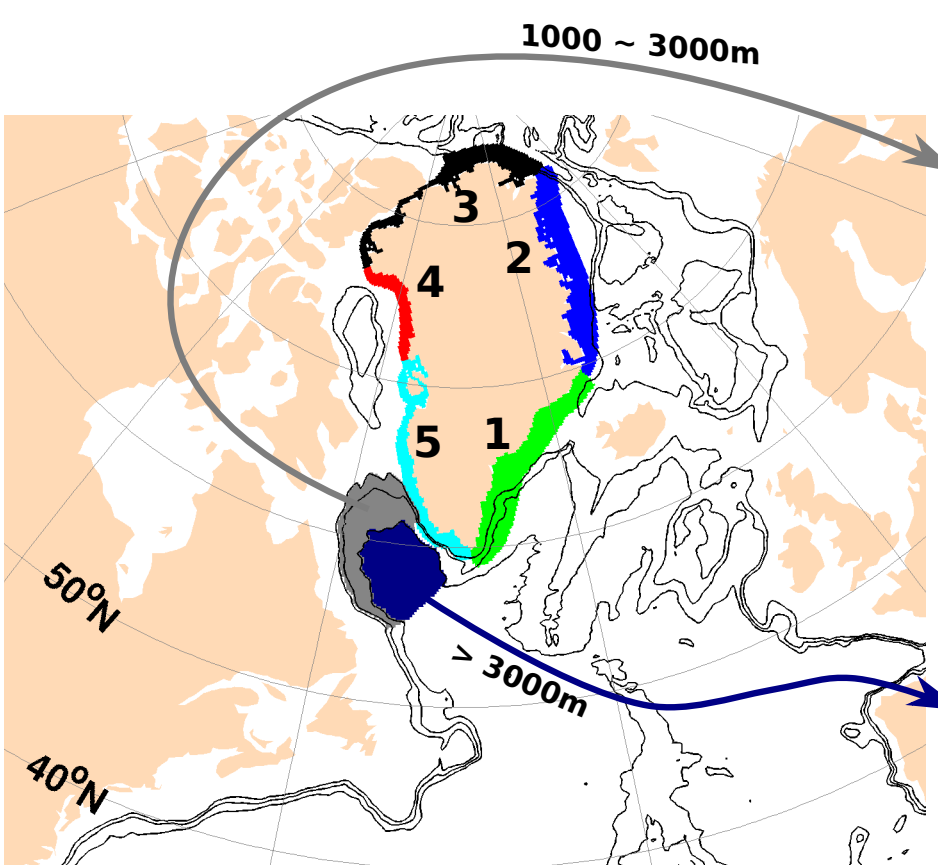
$$TC(x,y,t) = \int c(x,y,z,t)\,dz$$

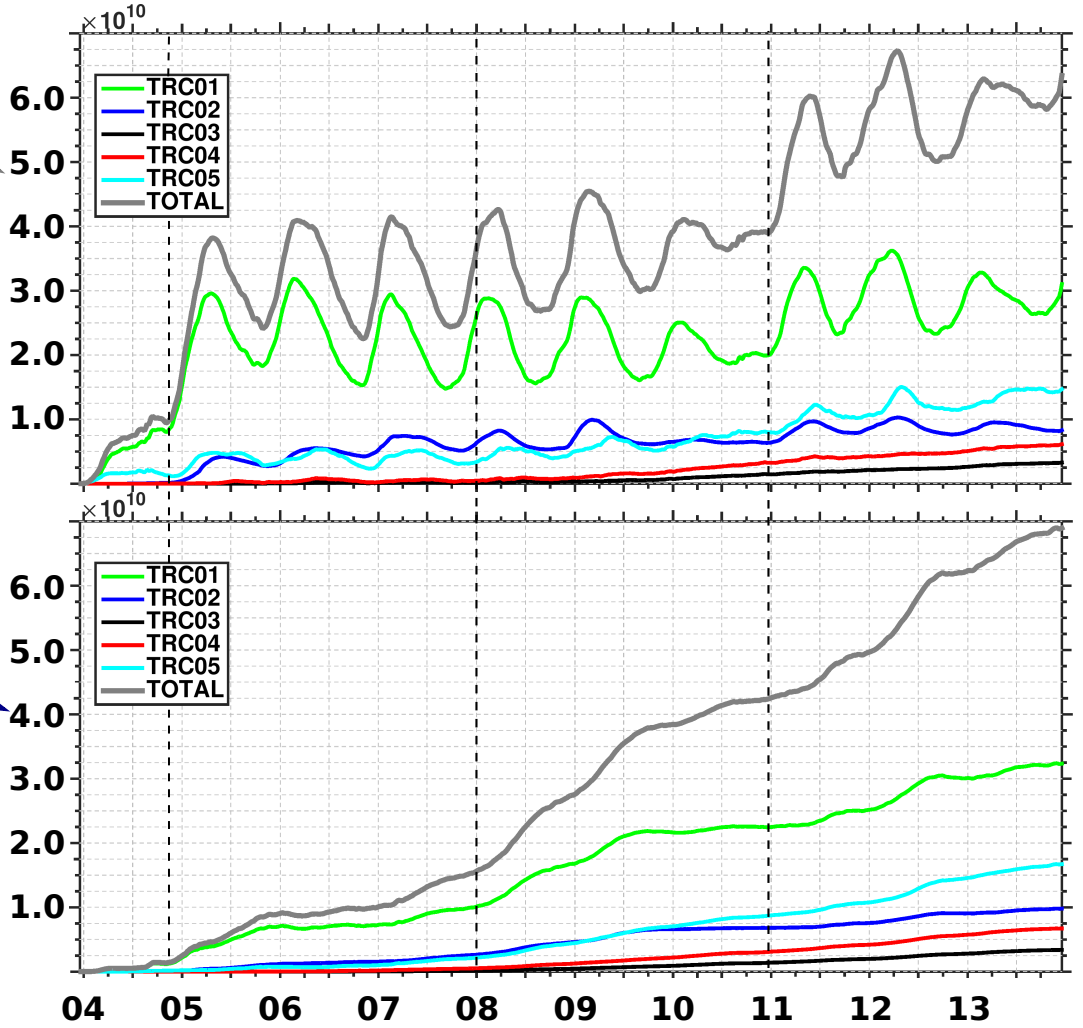
Travel Time to Reach the Labrador Sea



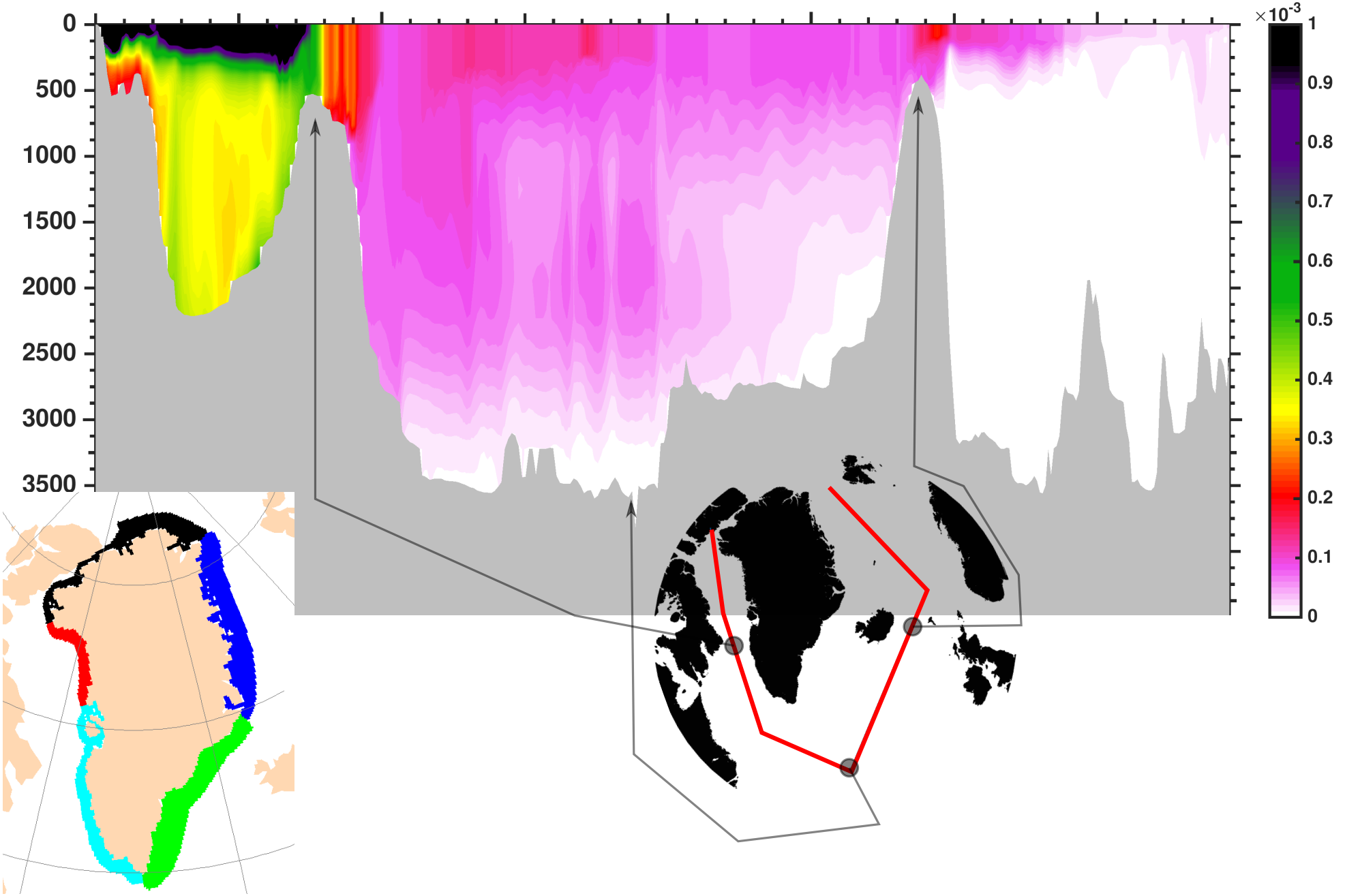
$$TS(t) = \iiint c(x, y, z, t)\, dz\, dy\, dx$$

Travel Time to Reach the Labrador Sea





Vertical Distribution of Passive Tracer



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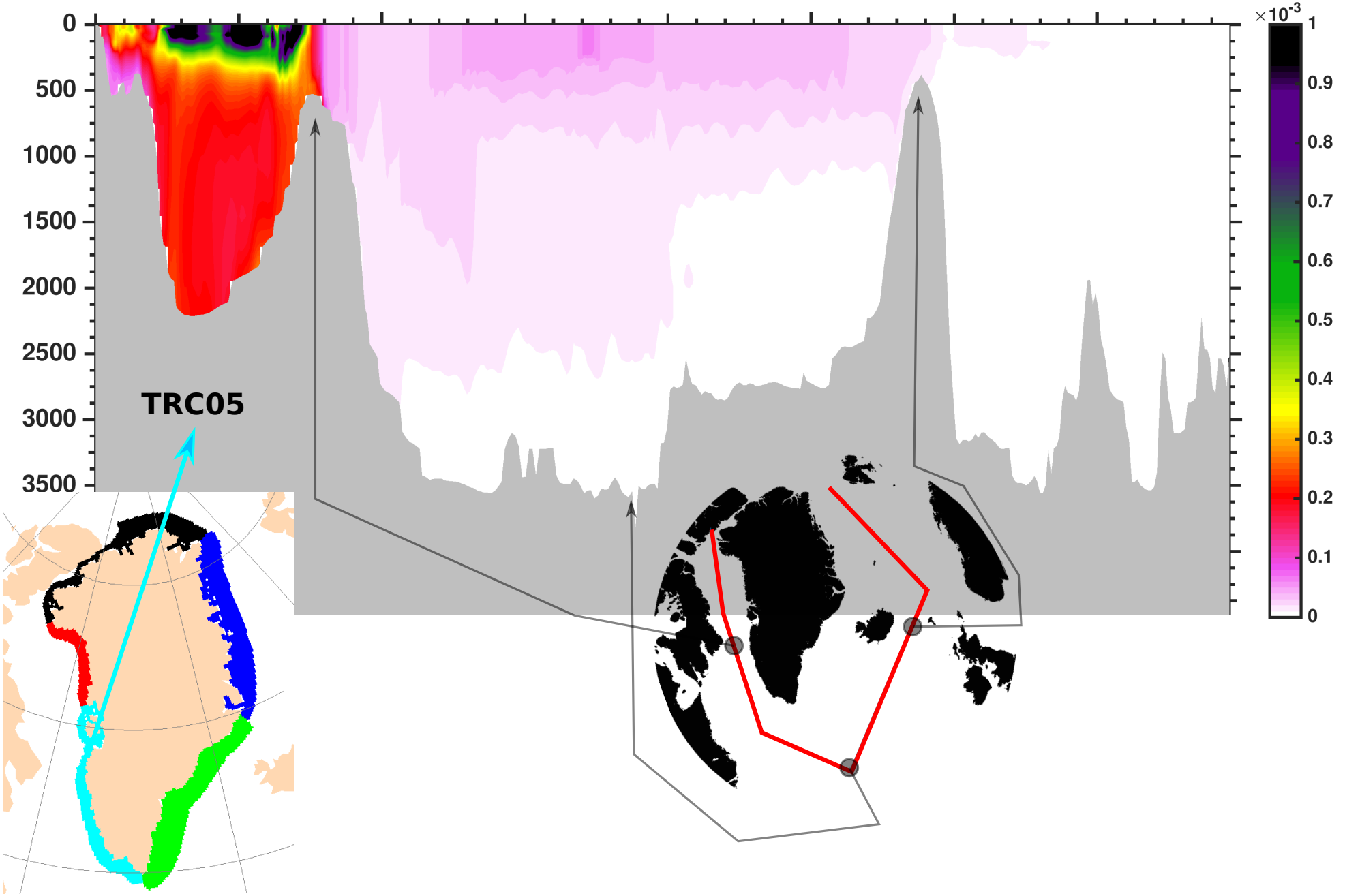

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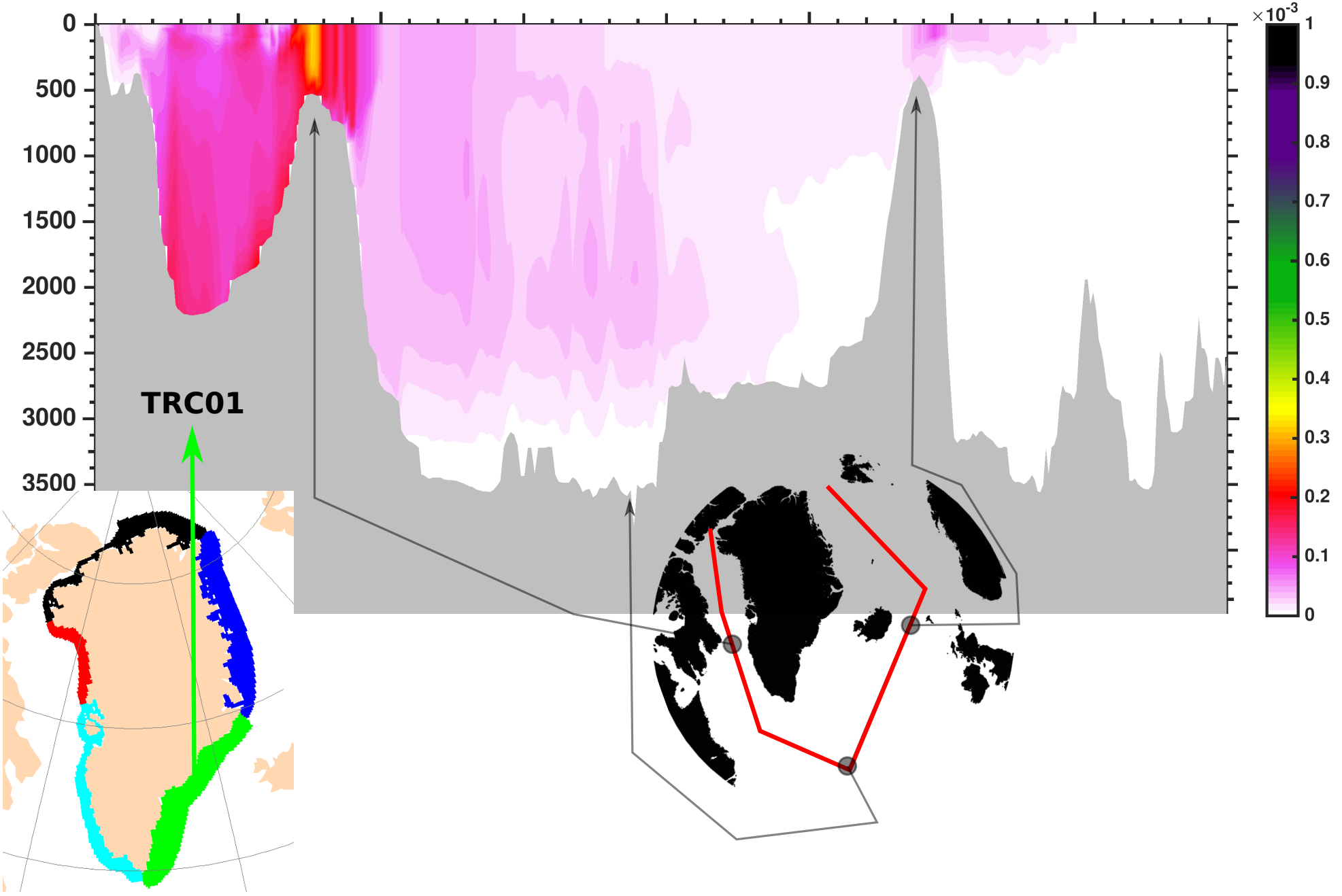

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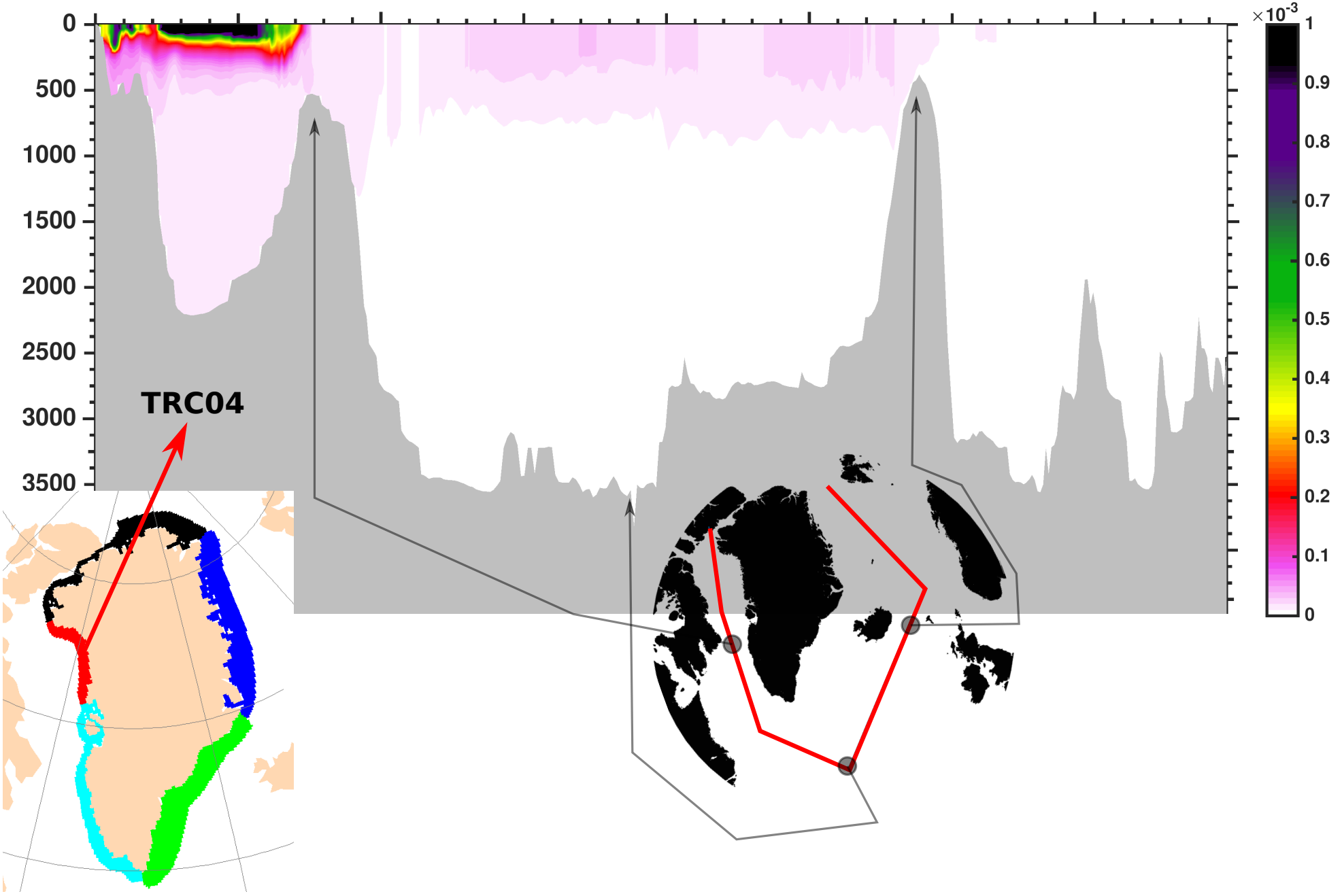

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Summary and Future Work

- **passive tracers nicely show the pathway of Greenland meltwater**
- **Greenland meltwater, particularly from the southeast, can reach Labrador Sea continent shore and slope region within one year, then spread in the subpolar gyre.**
- **Labrador Sea interior is accumulating over the whole simulation period**
- **large amount of passive tracers accumulated within Baffin Bay, even the deep basin, why?**
- **how does the Greenland meltwater impact coastal currents**