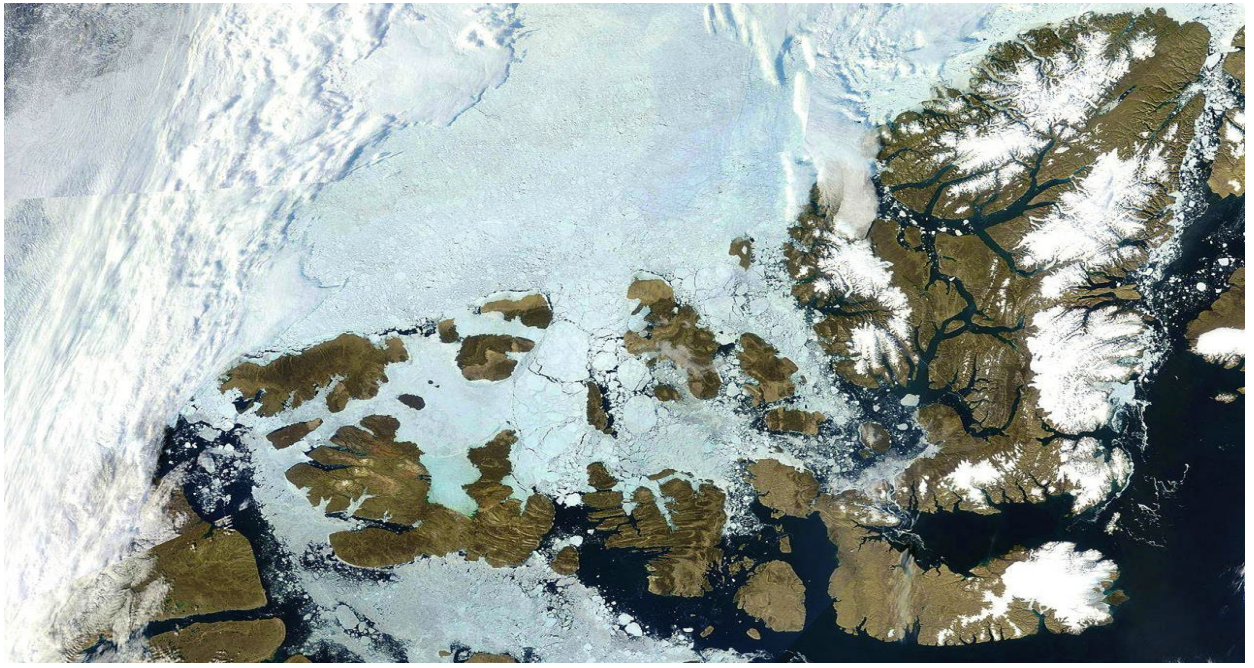
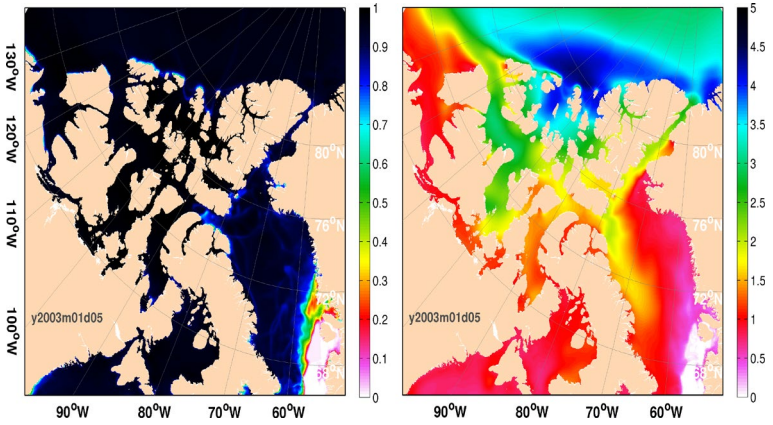
High resolution NEMO modelling for the North with the ANHA configuration



http://ns.umich.edu/Releases/2011/Apr11/Arctic14.jpg

Paul G. Myers, Xianmin Hu, Laura Castro de la Guardia, Nathan Grivault, Juliana Marson, Clark Pennelly, Natasha Ridenour, Laura Gillard,
Department of Earth and Atmospheric Sciences
University of Alberta



Ventilation Interactions and Transports Across the Labrador Sea

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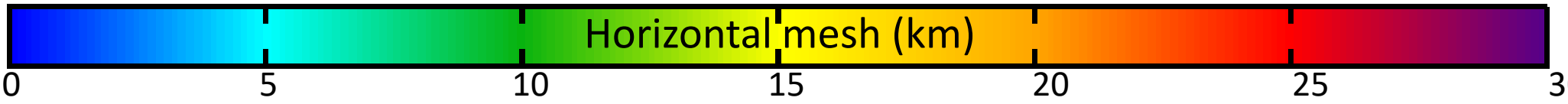
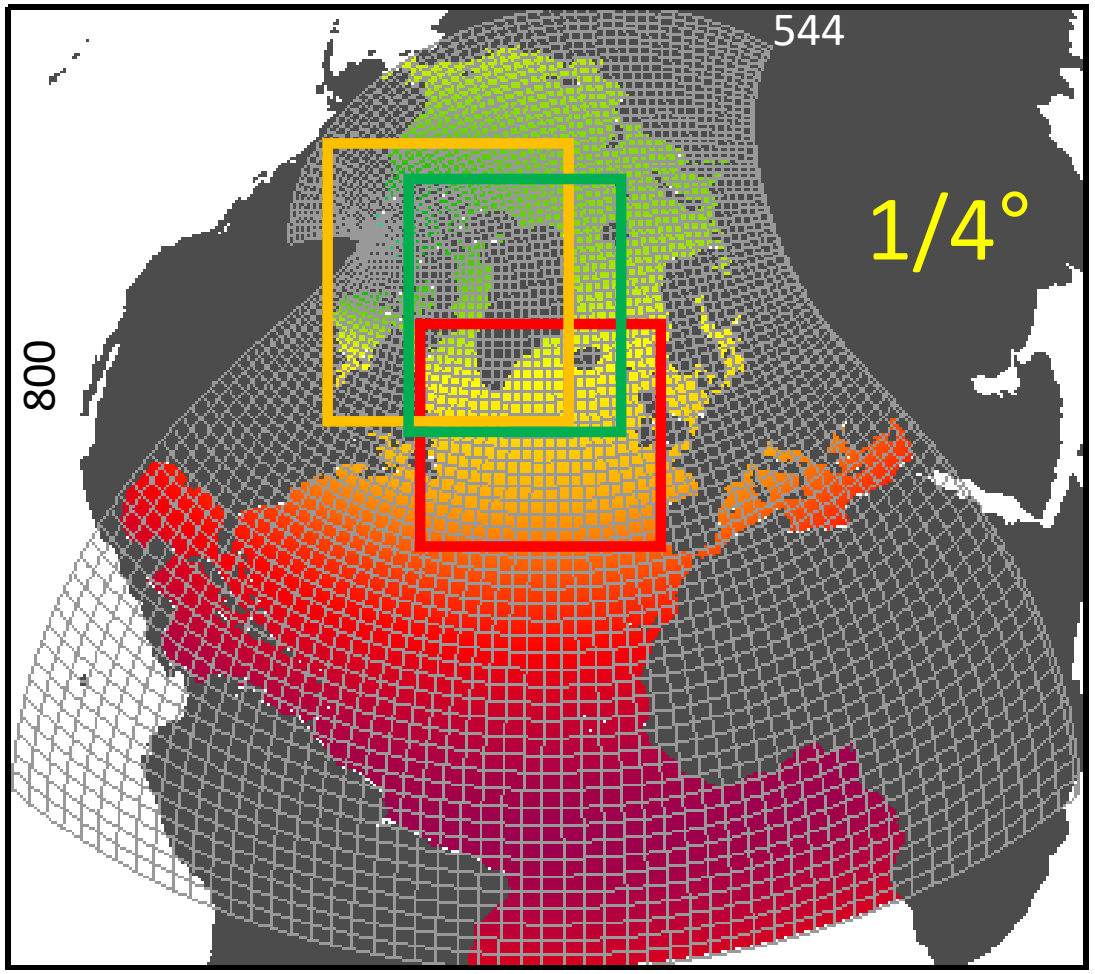
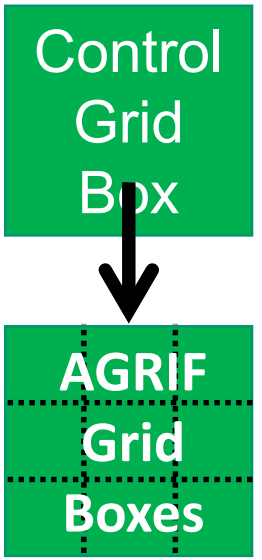
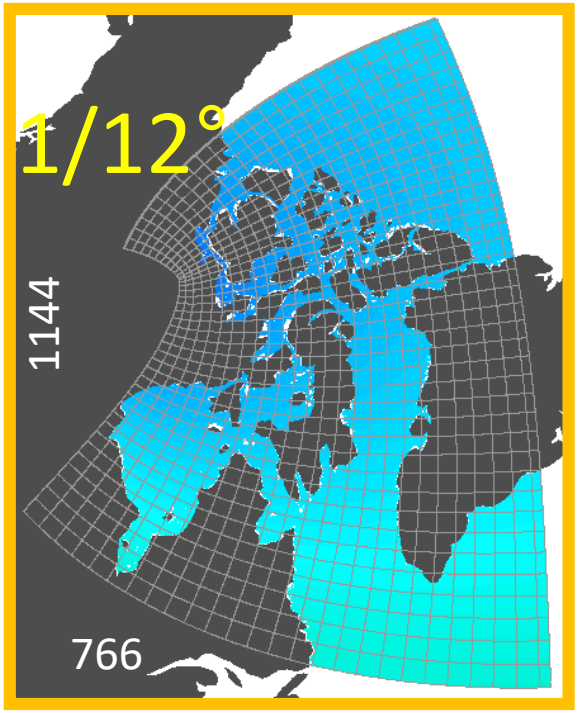


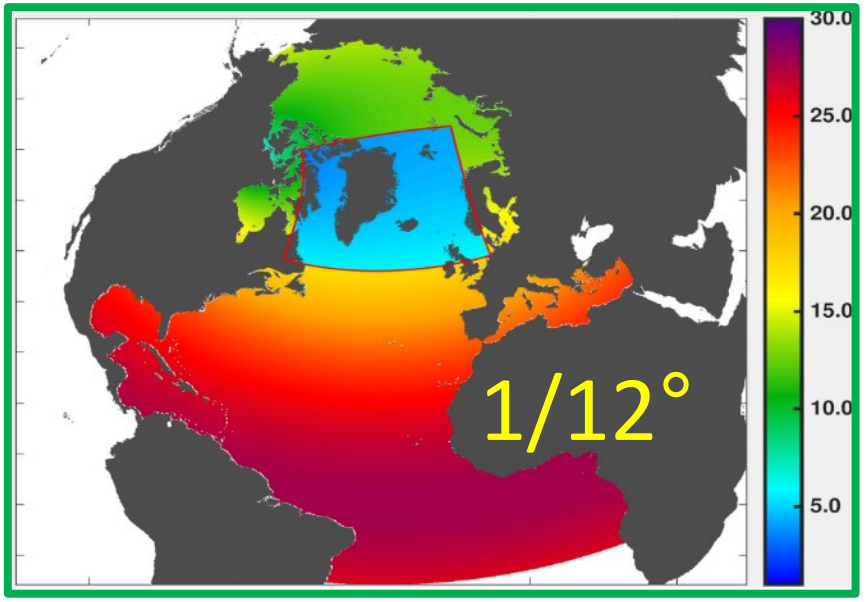


AGRIF: **A**daptive **G**rid **R**efinement **I**n **F**ortran





Simulation	ANHA4	ANHA12	AGRIF [CAA]	AGRIF [SPG]
Horz. Resolution	1/4°	1/12°	1/12°	1/12°
Core years	0.7	37.8	5.3	3.7



ANHA: Arctic and Northern Hemisphere Atlantic

ANHA12 & ANHA4

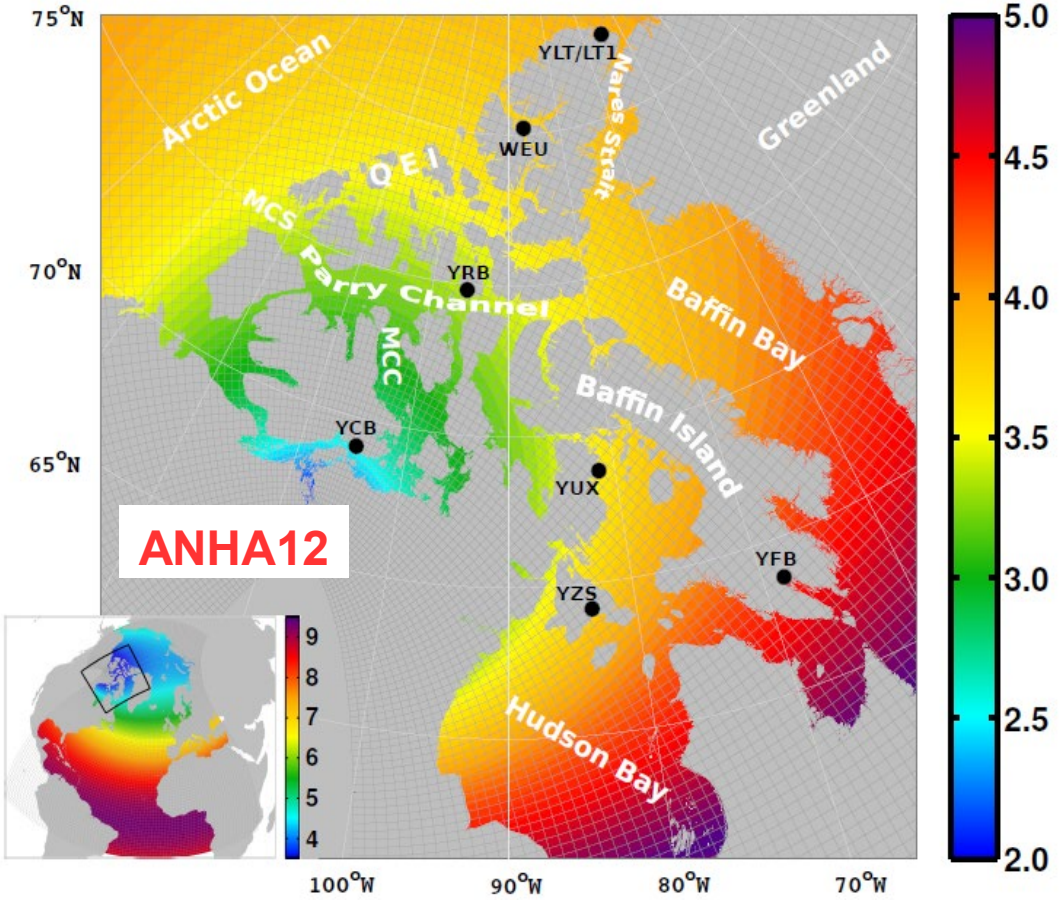
Model : NEMO 3.4
LIM2 + EVP

Resolution : 1/12 degree
¼ degree

Mesh : 1632 x 2400
544 x 800
50 levels

LS : ~ 5 km
~ 15 km

CAA : ~ 4 km
~10 km



Initialization:

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

Atmospheric forcing:

T2, Q2, U10, V10
Precipitation
Radiation (SW & LW)

CGRF hourly 33km

Snow: Calculated from precipitation

Runoff: Dai and Trenberth inter-annual
Greenland Mass Loss (Bamber)
+ Iceberg Module

OBC: U, V, T and S (GLORYS2v3)

NO temperature & salinity restoring

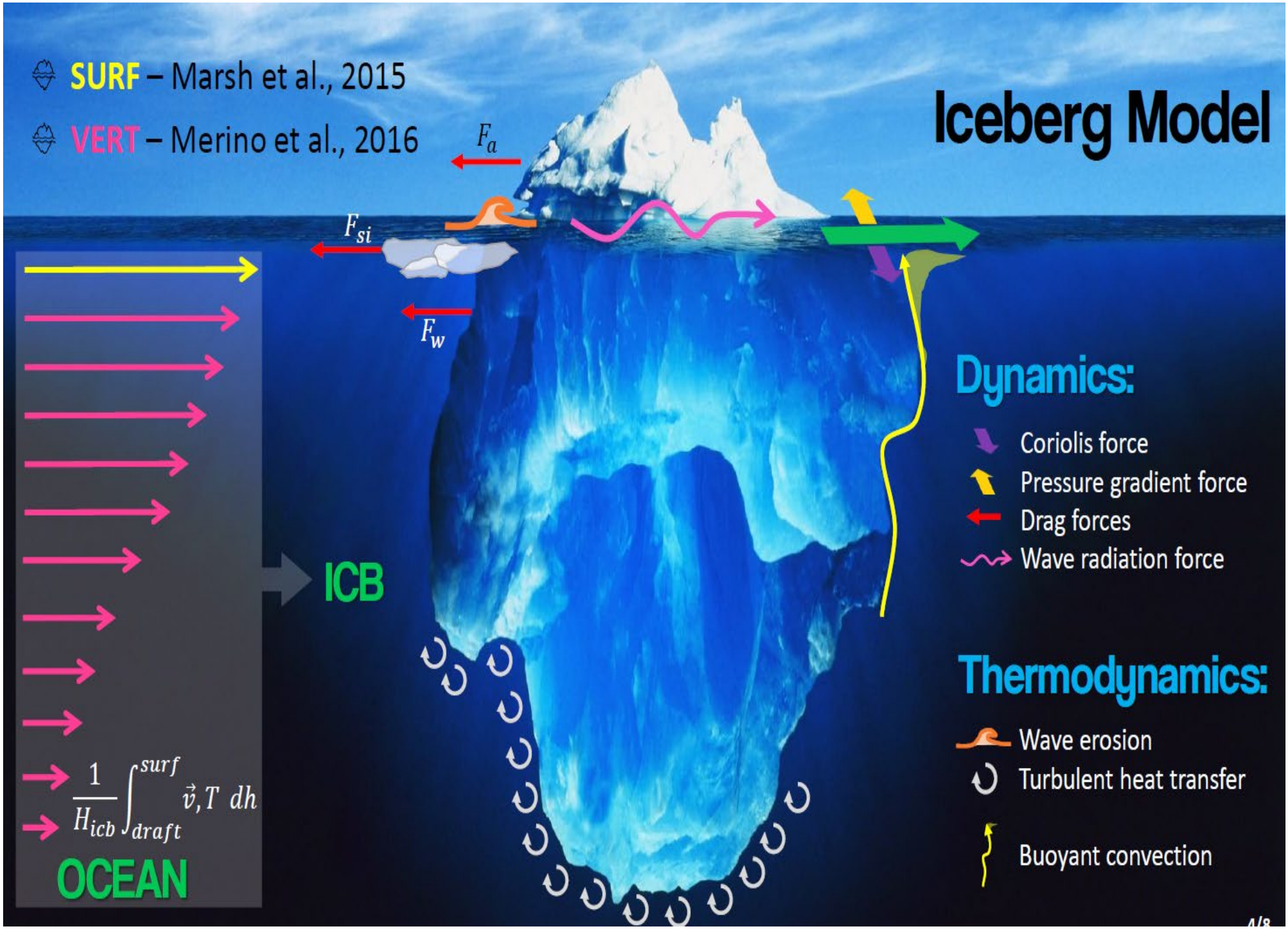
Jan 2002 – 2018

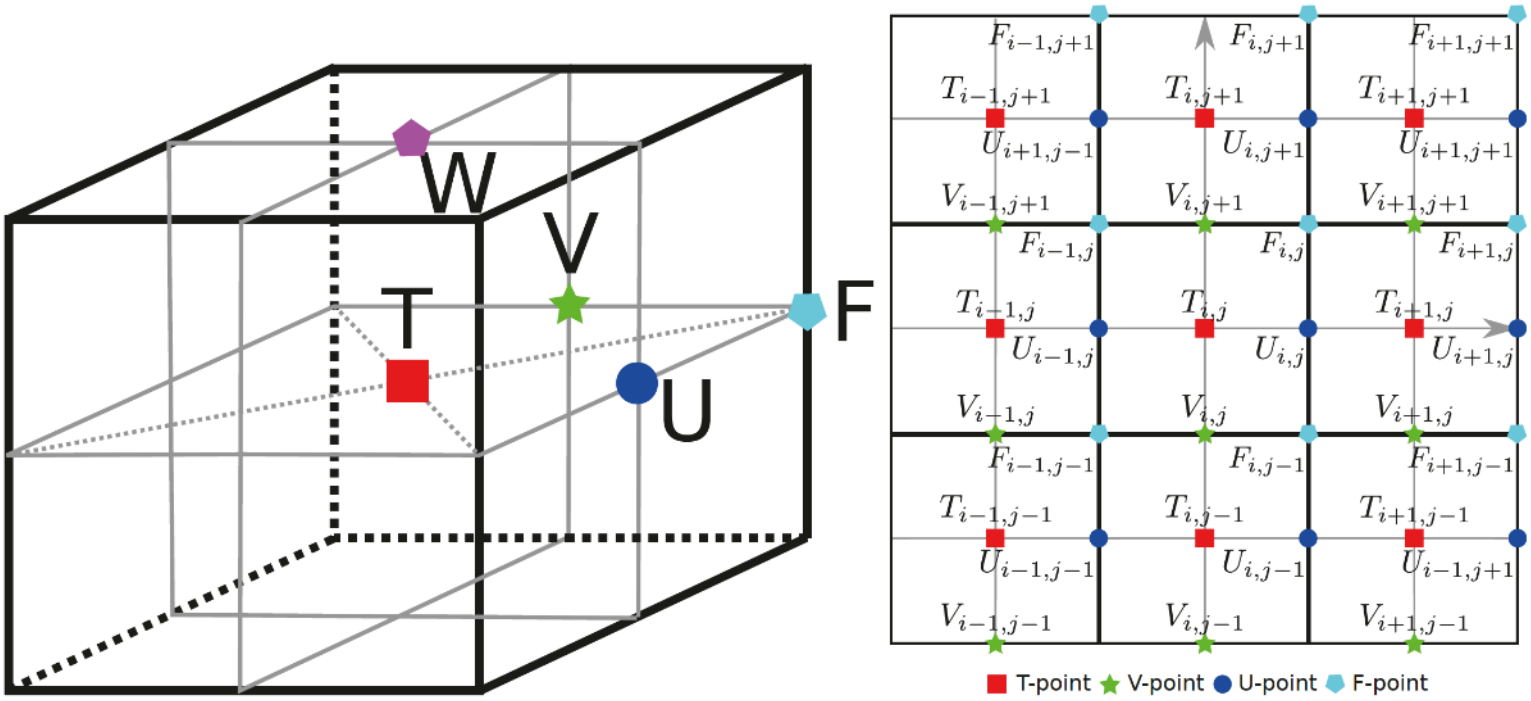
CGRF: CMC GDPS reforecasts

GDPS: Global Deterministic Prediction System

CMC: Canadian Meteorological Centre

GLORYS: GLobal Ocean ReanalYses and Simulations


SURF – Marsh et al., 2015
VERT – Merino et al., 2016
Iceberg Model
F_a
F_{si}
F_w
ICB
$\frac{1}{H_{icb}} \int_{draft}^{surf} \vec{v}, T \; dh$
OCEAN
Dynamics:
Coriolis force
Pressure gradient force
Drag forces
Wave radiation force
Thermodynamics:
Wave erosion
Turbulent heat transfer
Buoyant convection

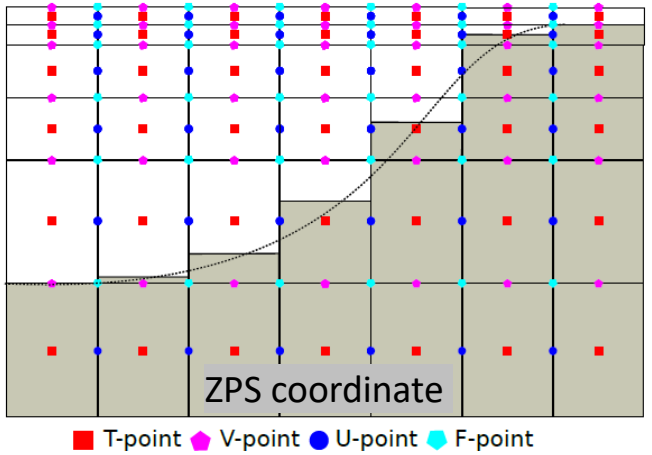


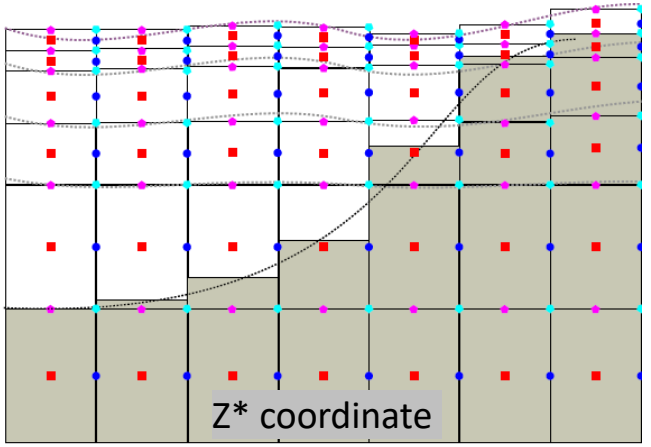
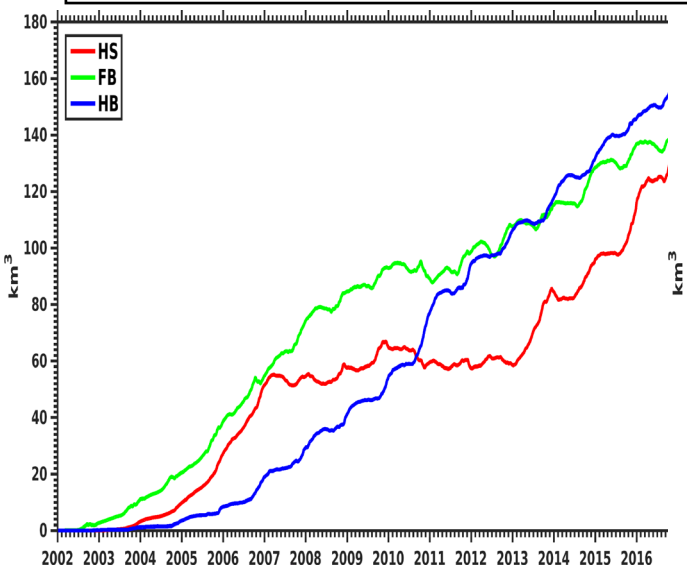
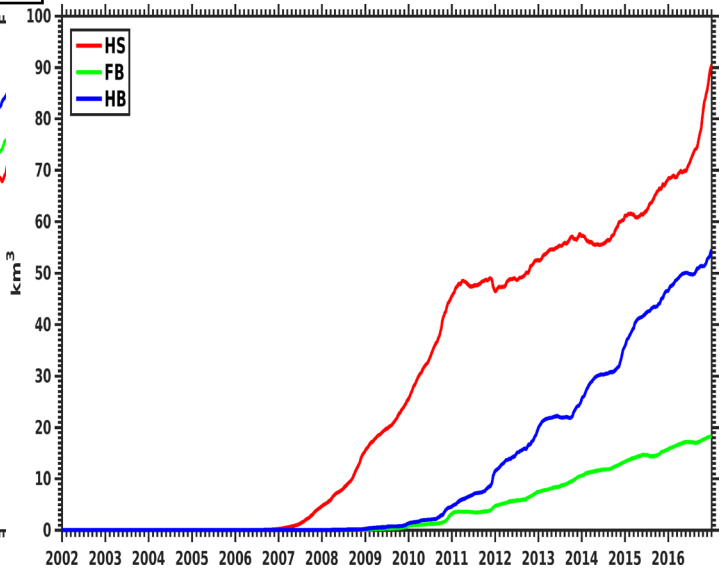
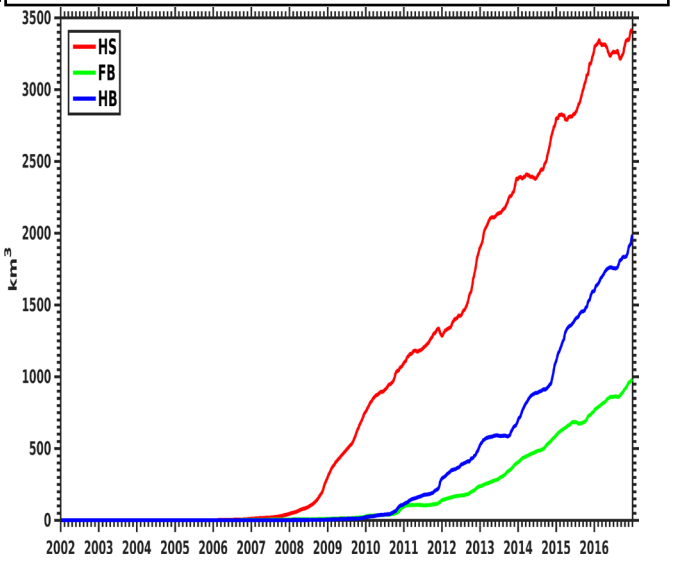
3D (left) and 2D over the horizontal plane (right) representation of a C-grid cell in the NEMO with every computed variable. Note that $\mathbf{T} = (T, S, p, \rho)$ is a vector containing scalar variables, and $\mathbf{U} = (U, V, W)$ is the vector of velocity.

Grid Type	Variables
gridT	temperature (votemper), salinity (vosaline), sea surface height (sossheig), mixed layer depth (somxl010), turbocline depth (sohmld)

Numerical Improvement: Tides

- Technical changes:
  - New coordinate system: z*
    - Variable dz
  - New time split scheme
    - Barotropic ts: 6 seconds
    - Baroclinic ts: 1080 seconds
- Physical changes expected:
  - Better mixing at the surface
  - Better mixing at the bottom
  - Addition of the tidal currents





High Latitude Waters Reaching the HBC