Meridional Heat Transport in North Atlantic Simulated with a High-Resolution Model

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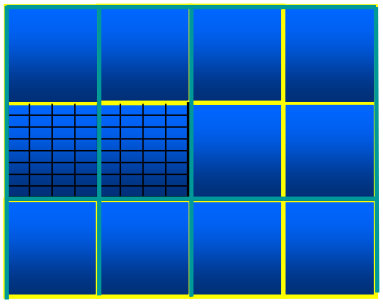
Motivation

- **MHT (Meridional Heat Transport) in ocean plays important role in climate**
- **Total MHT =** $\overline{vT} = \overline{v}\,\overline{T} + \overline{v'T'}$
  $\overline{v}\,\overline{T}$ **is related to MOC (Meridional Overturning Circulation)**
  $\overline{v'T'}$ **is related to meso-scale eddies**
- **Coarse-resolution climate models show variations in** $\overline{v}\,\overline{T}$ **and MOC are correlated;** $\overline{v'T'}$ **is parameterized**
- **Estimating** $\overline{v'T'}$ **and its variability requires high-resolution eddy-resolving models**

2-way nesting using AGRIF

A regional modelling strategy



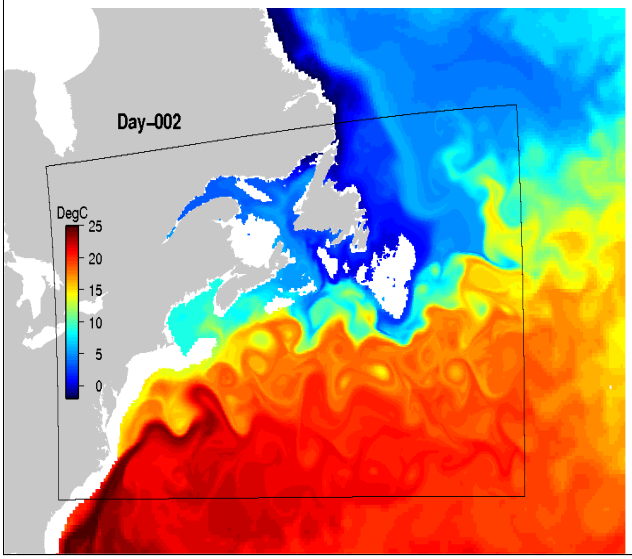
Coarse resolution large-scale model

Feedback

Interpolate to provide initial and boundary condition control

Finer resolution regional model

North Atlantic Model: 1/4° Full NA + 1/12° Embedding in Gulf Stream region



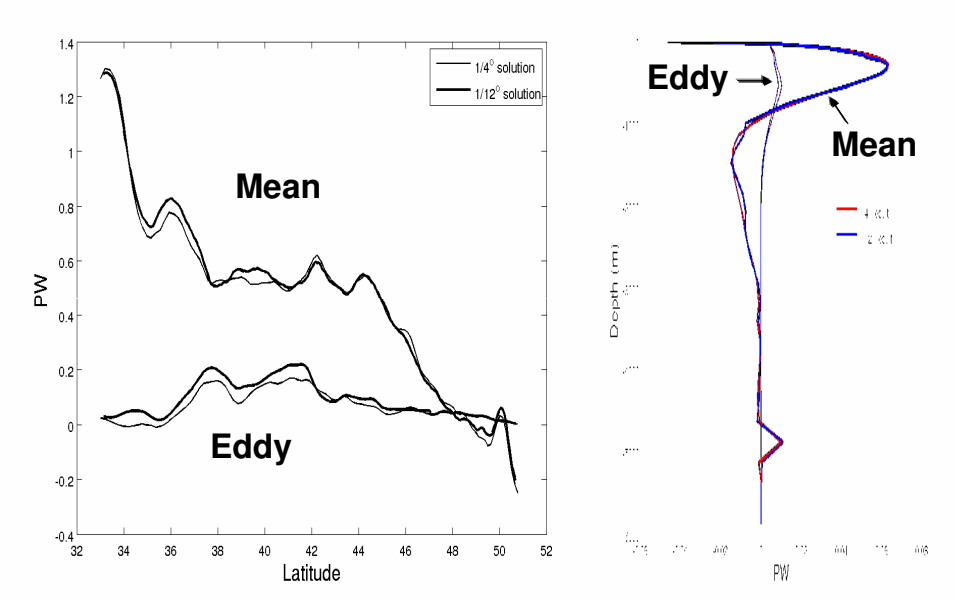
Temperature at 1000 m after 9 years of prognostic simulation with no nudging.

Without embedding, Gulf Stream "overshooting" commonly occurs within the first 5 years.

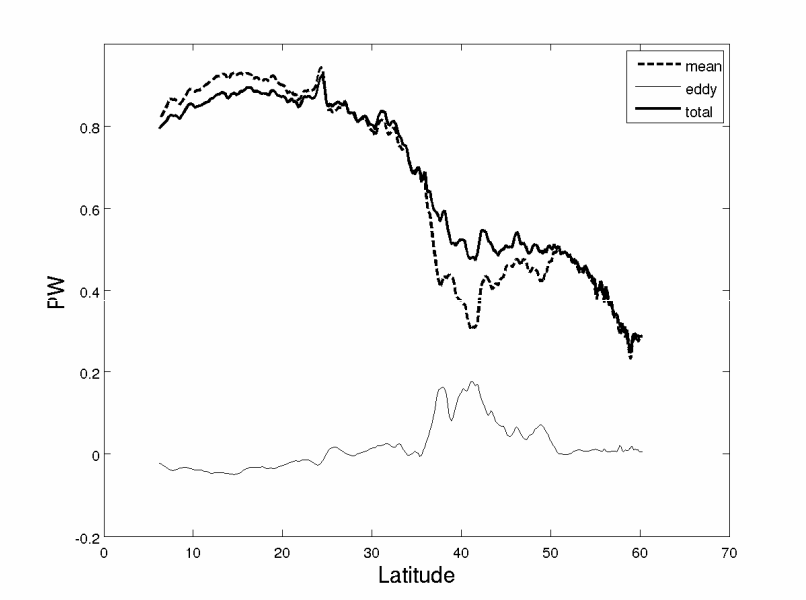
Analyses

- Three years of results (yr 6-9) are saved as 3-day averages
- $\overline{v}$, $\overline{T}$ defined as 3-year means; hence v' , T' contain seasonal and inter-annual variations (assumed to be small)
- First compare MHT from 1/4° and 1/12° solutions in over-lapping area
- Then more detailed analysis of 1/4° solutions for the whole NA

MHT from 1/4° and 1/12° Solutions

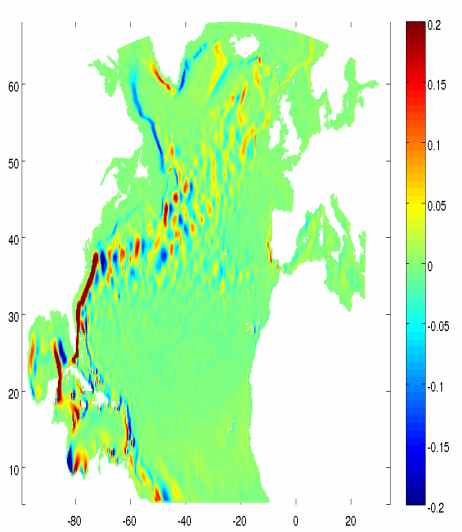


MHT from 1/4° Solution: Latitude Distribution

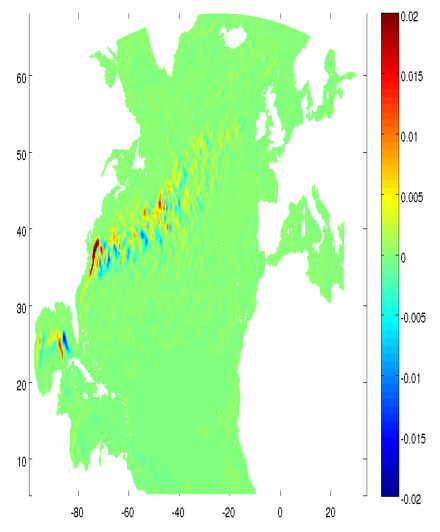


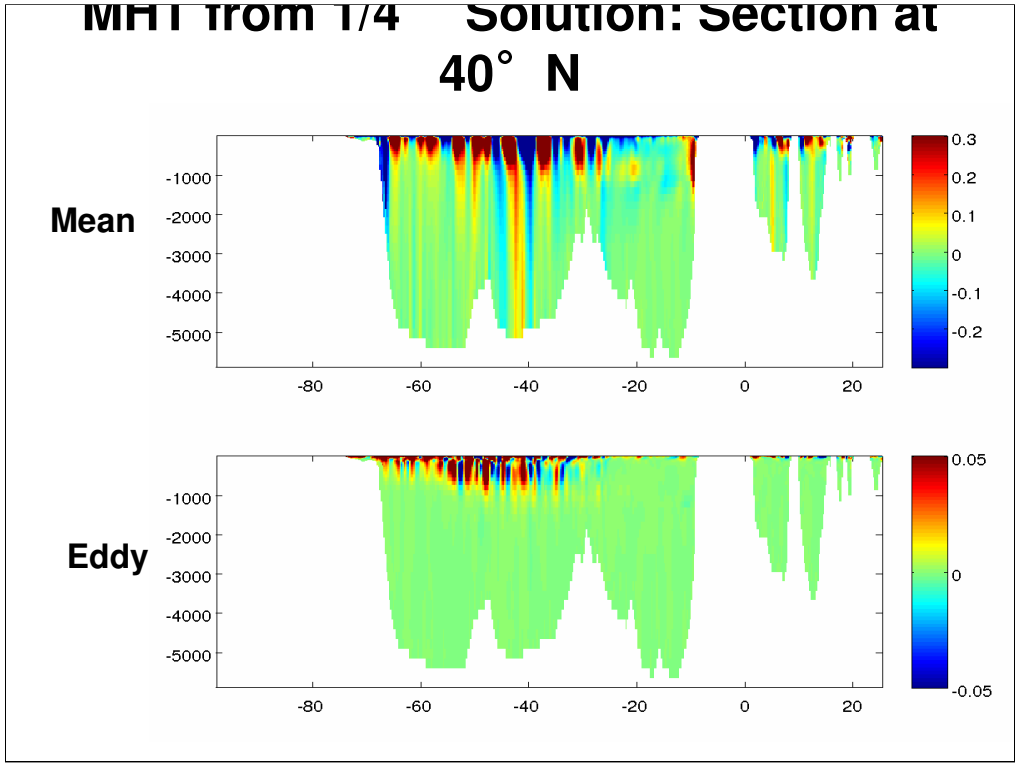
MHT from 1/4° Solution: Horizontal Distribution

Mean



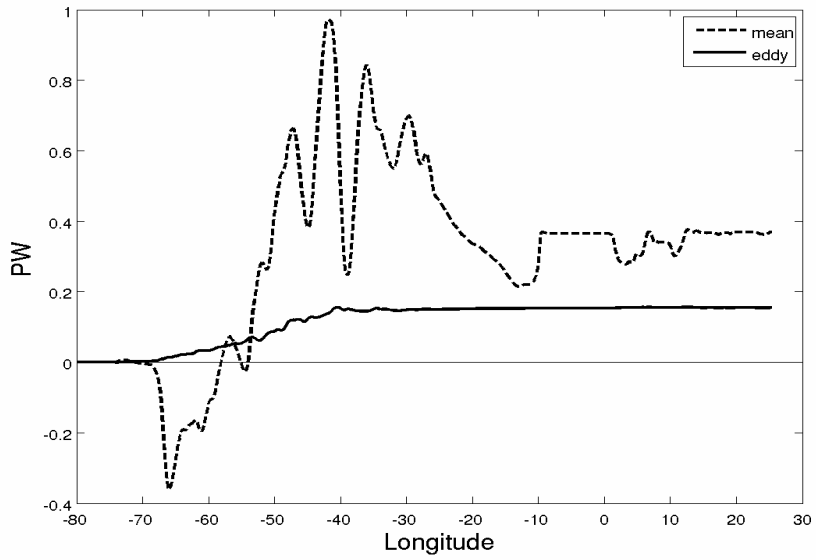
Eddy




MHT from 1/4° Solution: Section at 40° N
Mean
-1000
-2000
-3000
-4000
-5000
-80
-60
-40
-20
0
20
0.3
0.2
0.1
0
-0.1
-0.2
Eddy
-1000
-2000
-3000
-4000
-5000
-80
-60
-40
-20
0
20
0.05
0
-0.05

MHT from 1/4° Solution:

Integration with Longitude at 40° N



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