The mean surface circulation of the North Atlantic subpolar gyre

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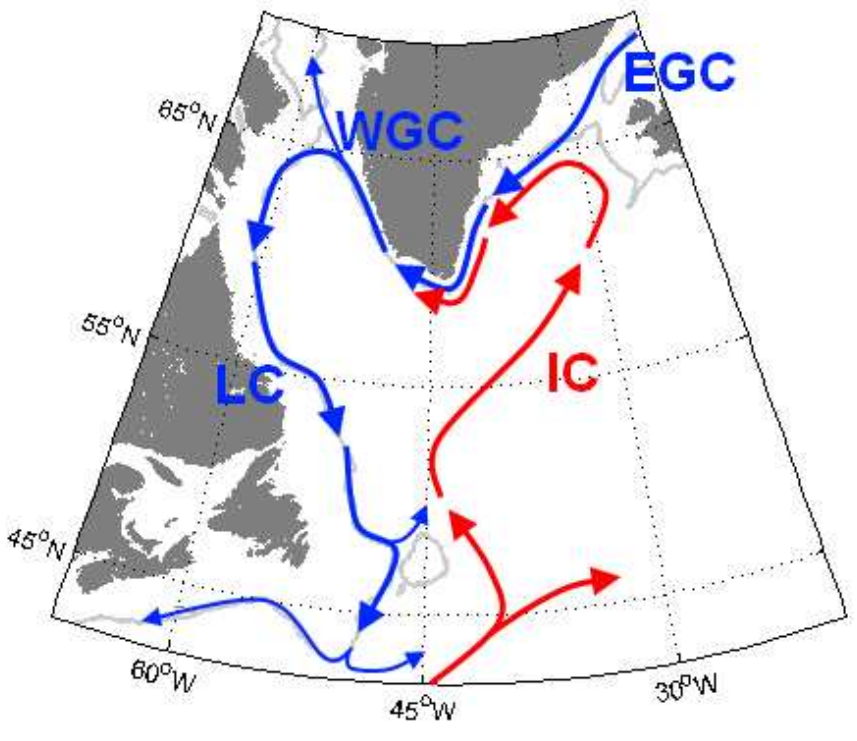
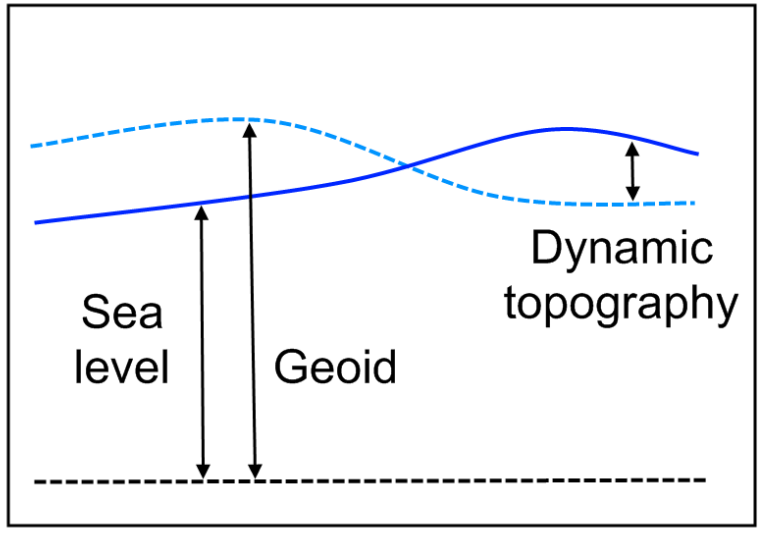
Motivation

- Area of deep water formation for the MOC
- Affected by freshwater input from Greenland
- Relatively poorly sampled
- What can remote sensing contribute to our understanding?



A geodetic MSST

- MSST is estimated using:
  - Mean sea surface
  - Geoid
- Both can be measured using remote sensing
- The mean surface velocity can be derived from MSST
- But, until recently, the geoid was not known to sufficient accuracy



A new geoid

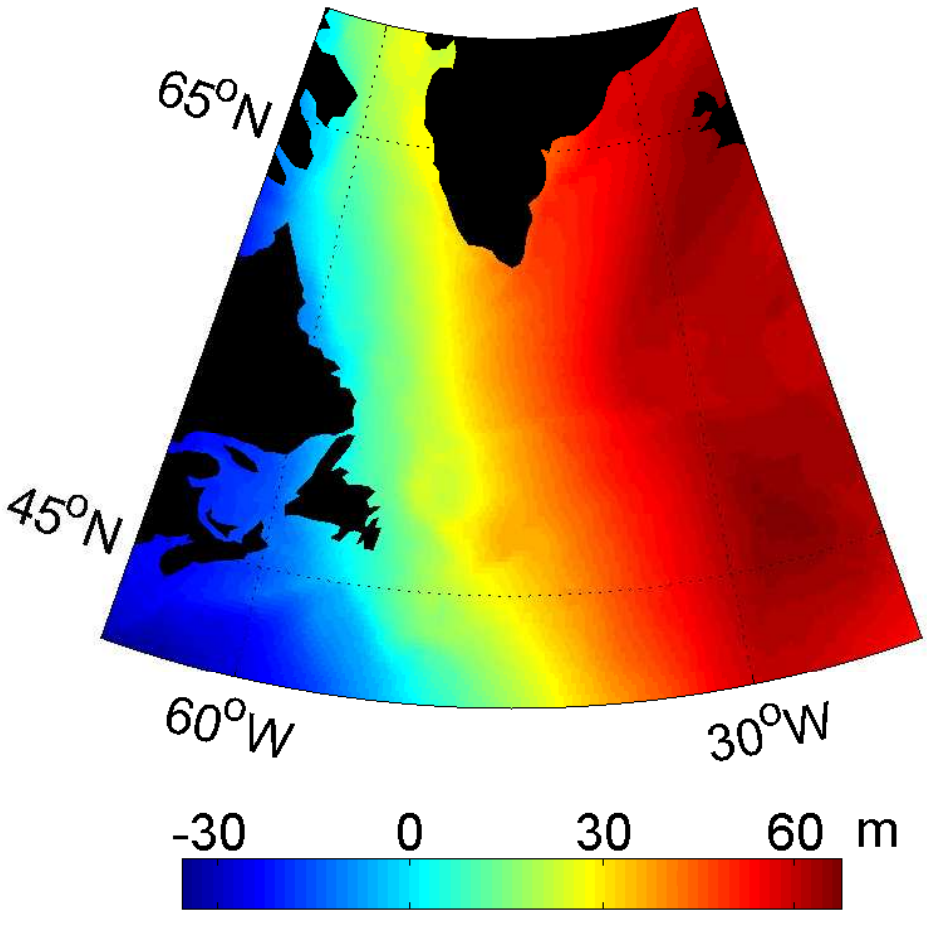
The PCG08 geoid

Incorporates gravity data from:

- GRACE satellite
- Satellite altimetry
- Terrestrial measurements

Produced by:

- Marc Véronneau
- Jianliang Huang

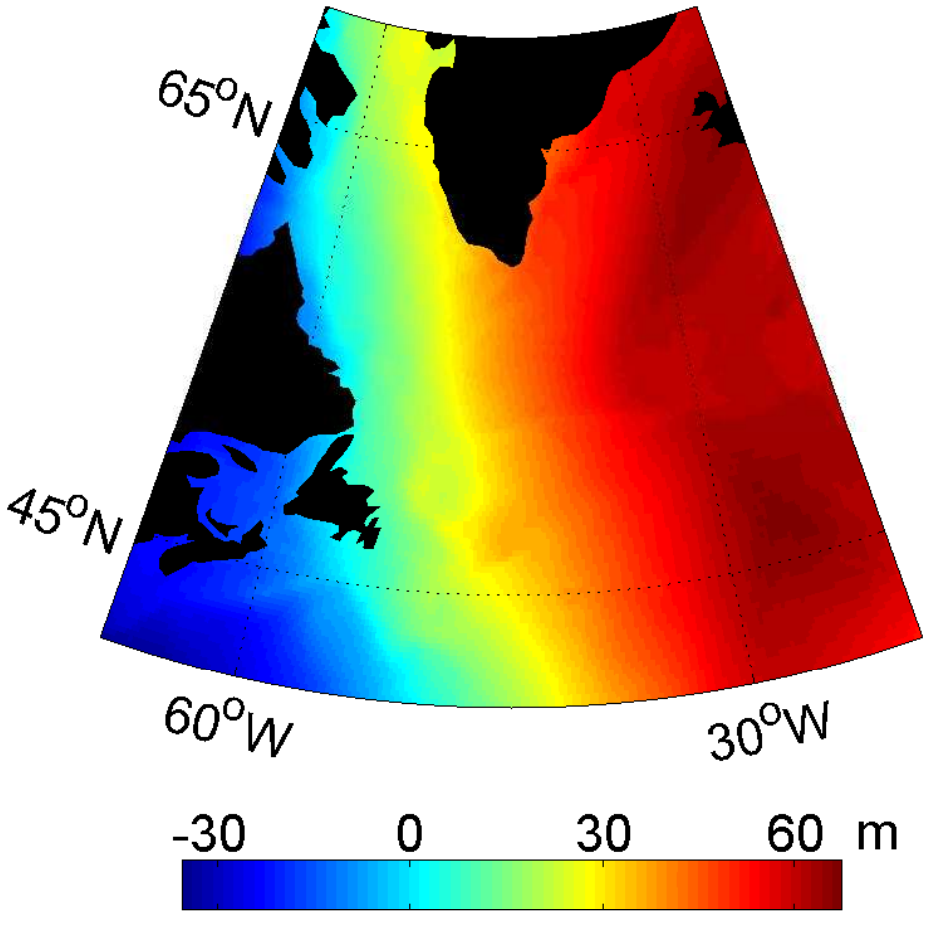


The mean sea surface

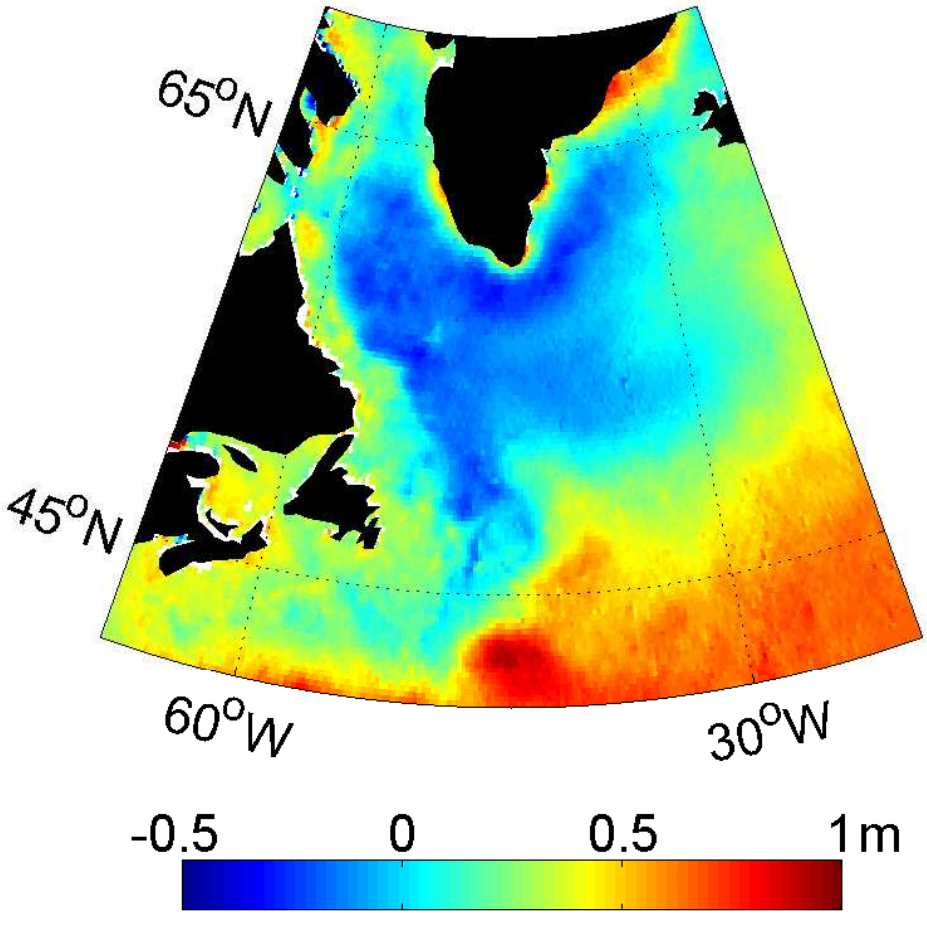
The DNSC08 mss

- 12 years of altimeter measurements
- 1 minute resolution
- Global coverage
- Adjusted to Argo time period

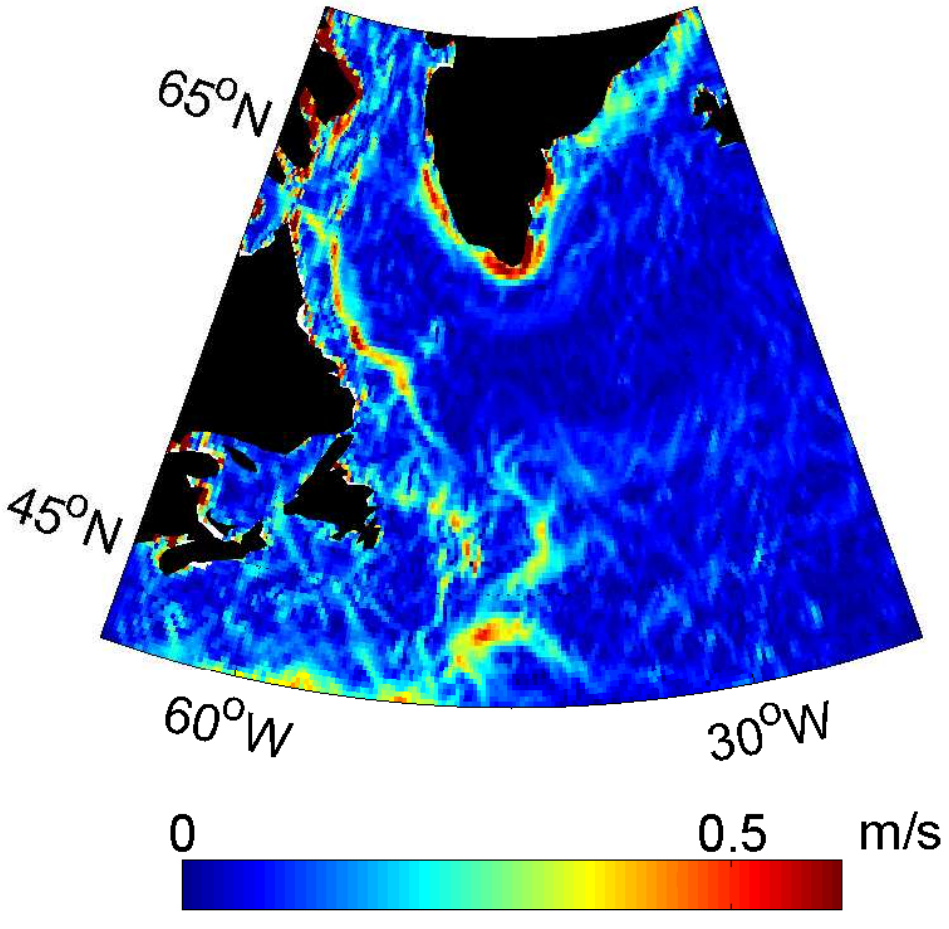
Produced by the Danish National Space Institute



Mean sea surface topography

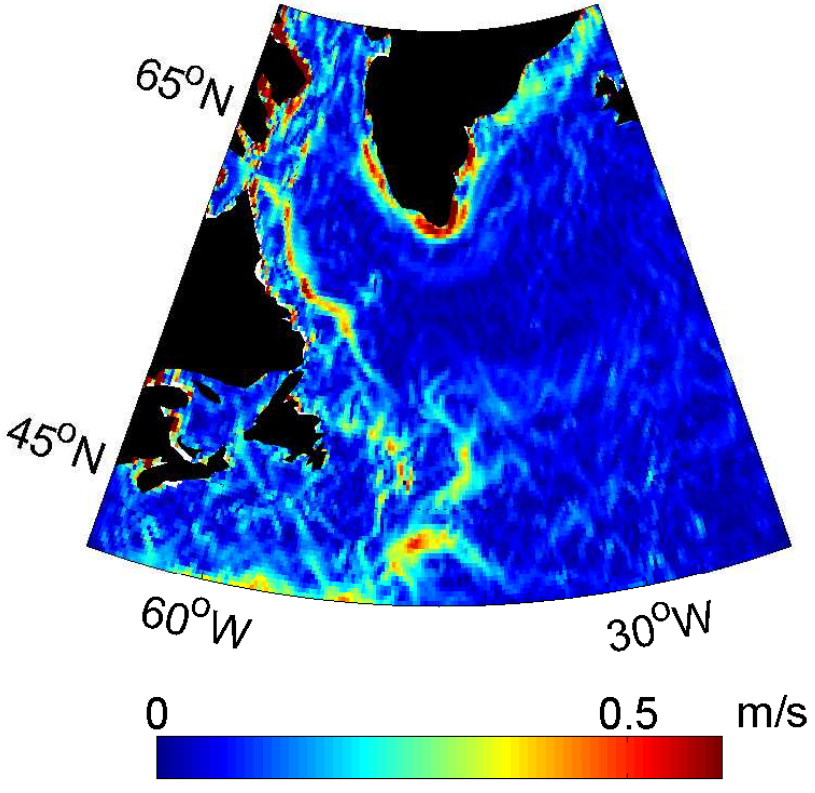


Geostrophic velocity

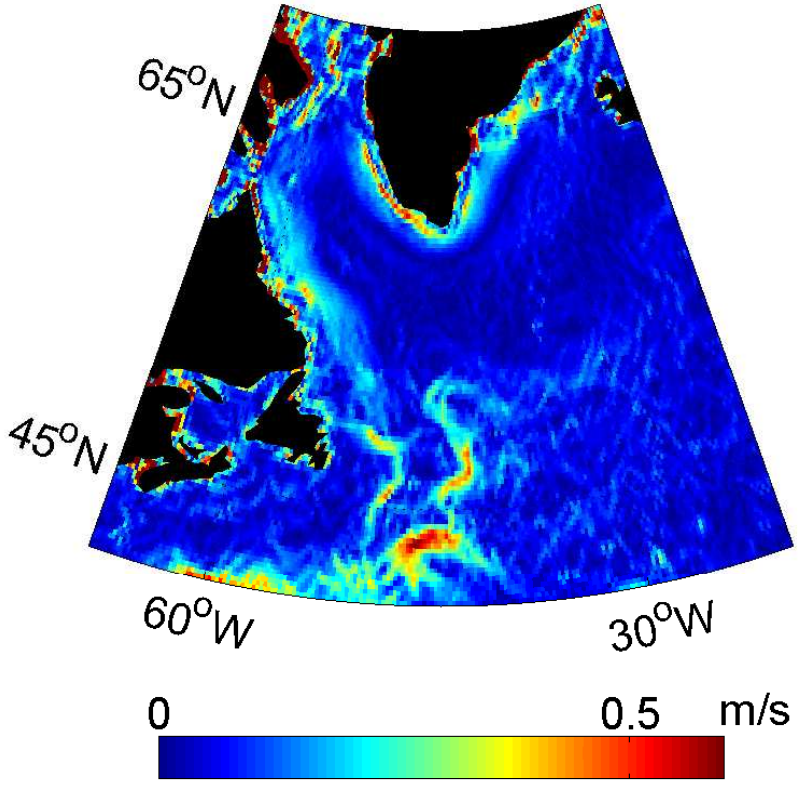


Previous geodetic estimates

New geodetic estimate:

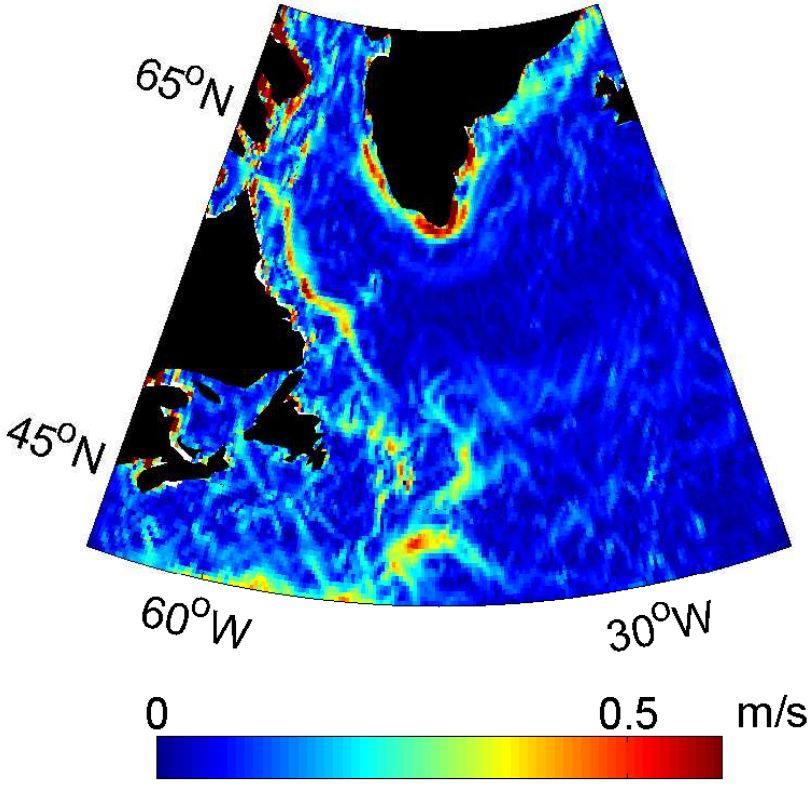


DNSC08 geodetic estimate:

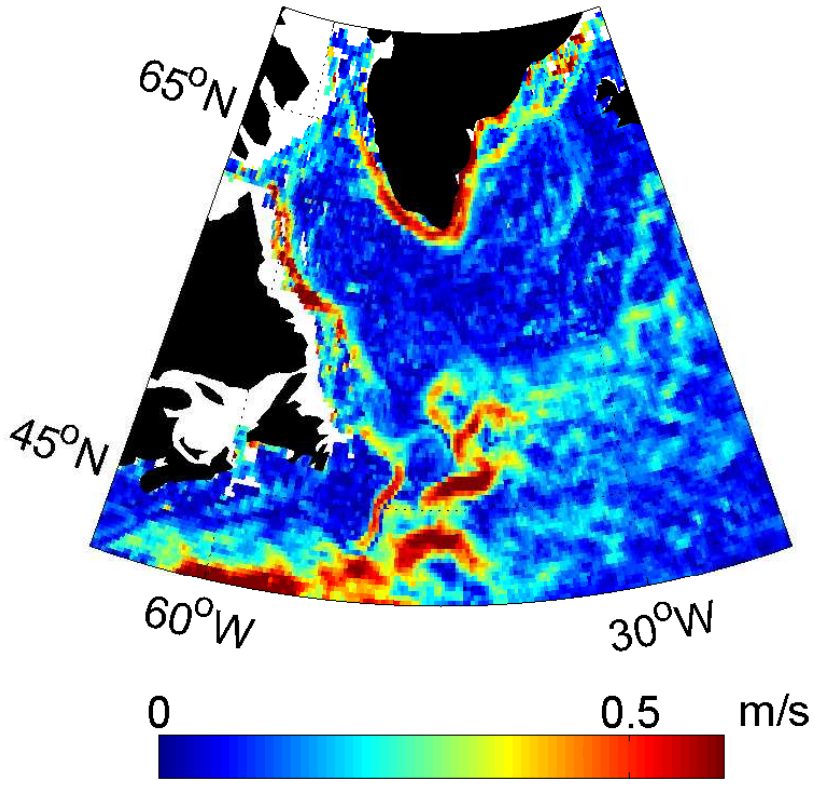


Other velocity measurements

New geodetic estimate:



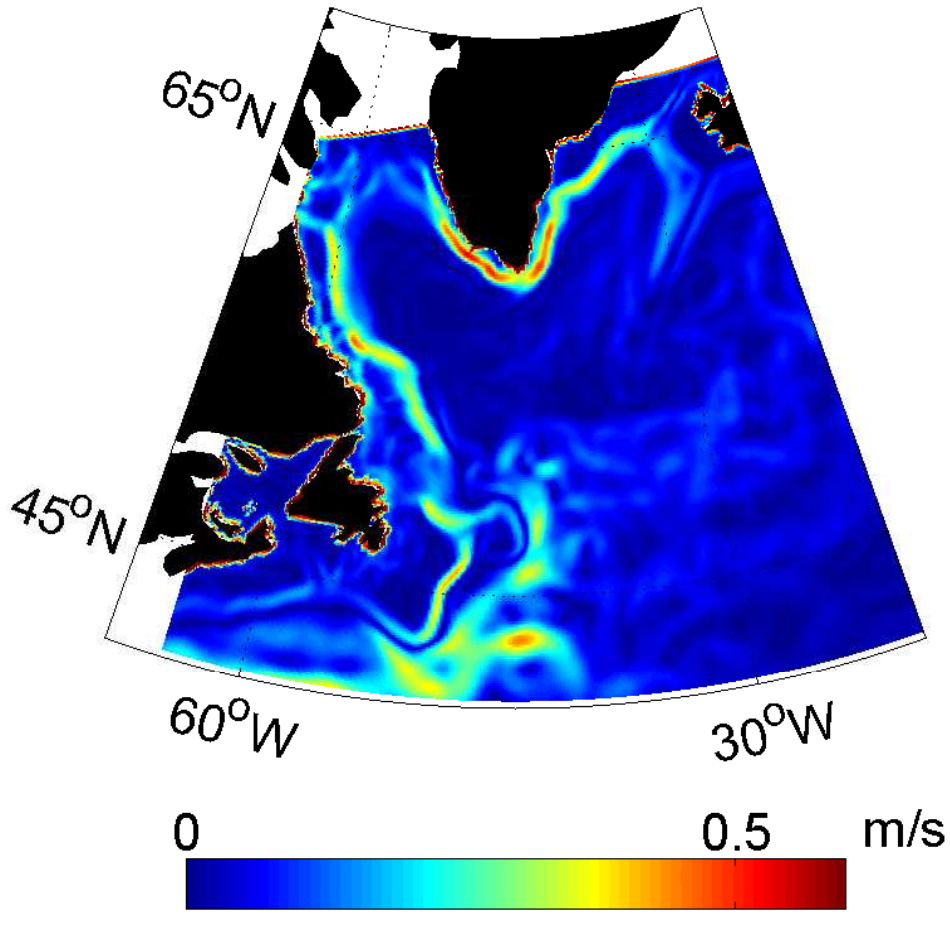
Surface drifter velocity:



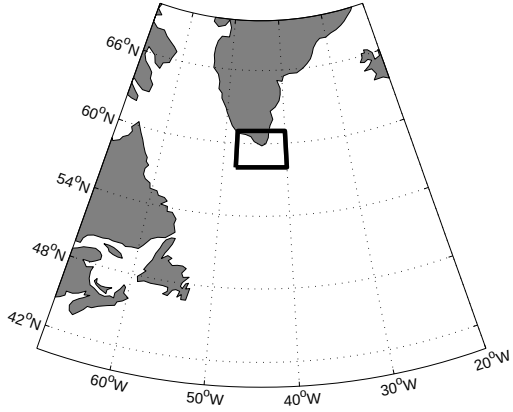
Ocean model

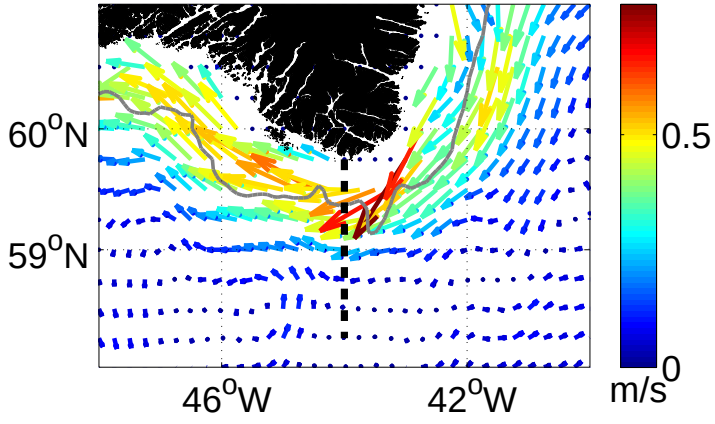
- Nemo
- Spectral nudging
- Uses a new climatology
  - Based on Argo data
  - De-eddied using the technique of Higginson et al. (2009)

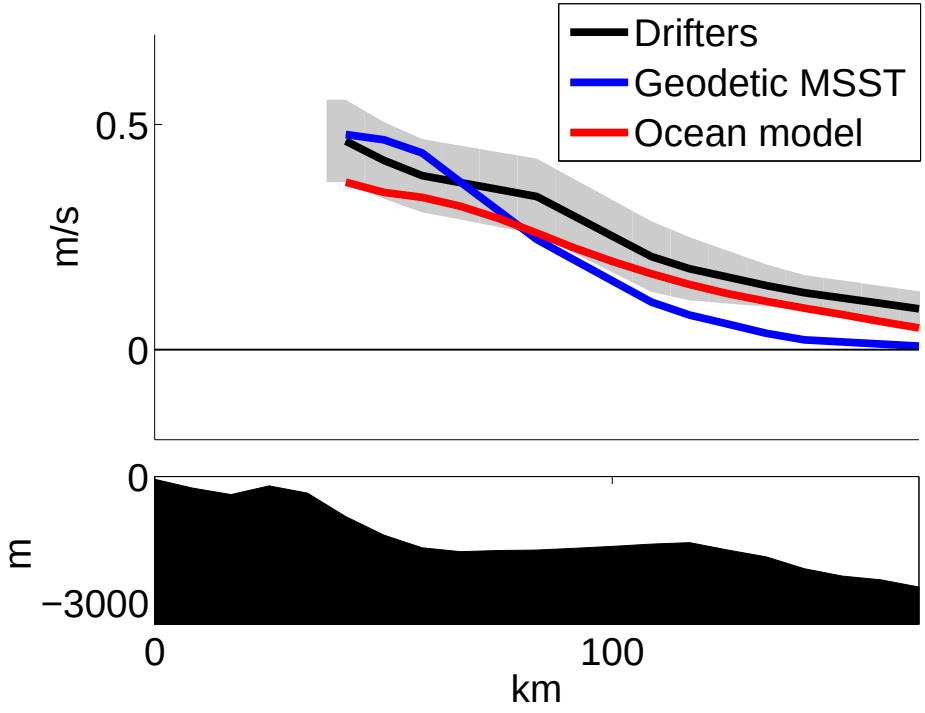
Model run by Dan Wright



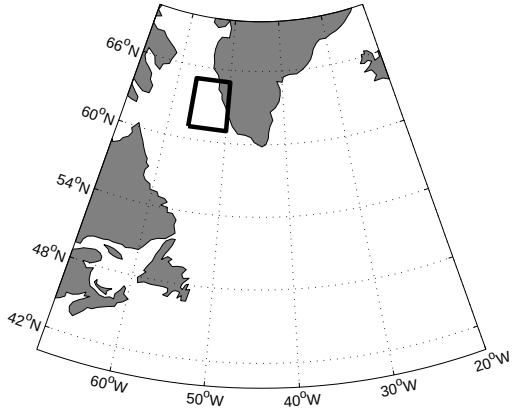
Cape Farewell

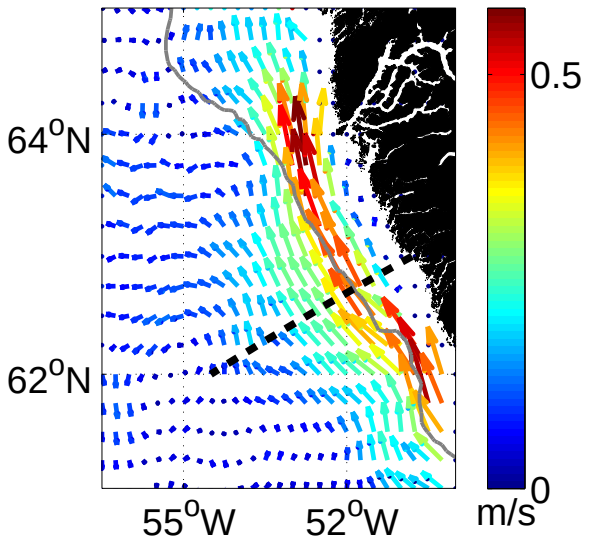


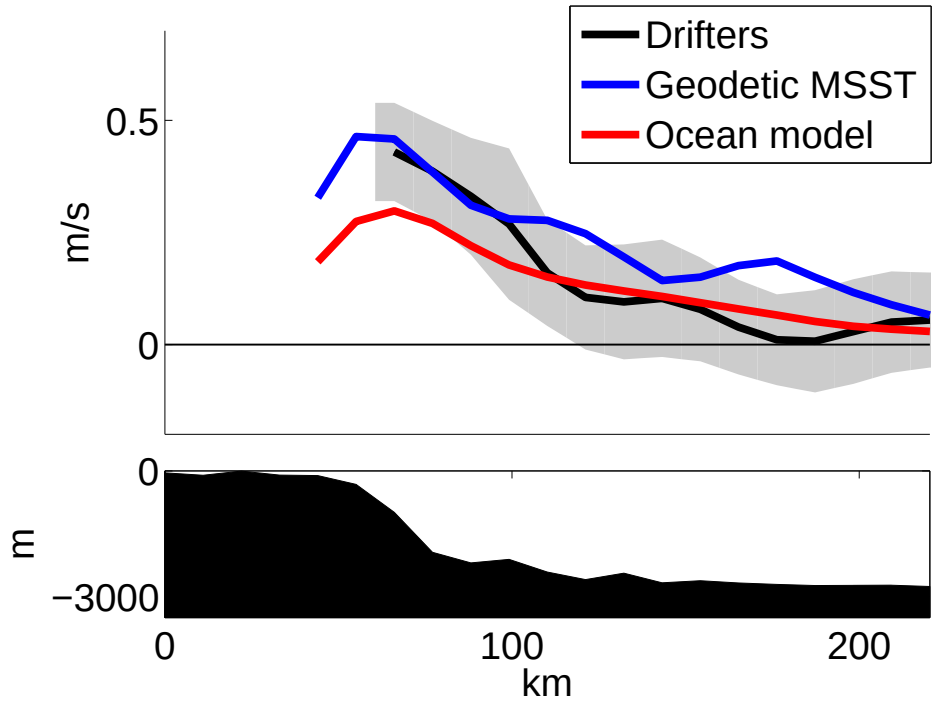




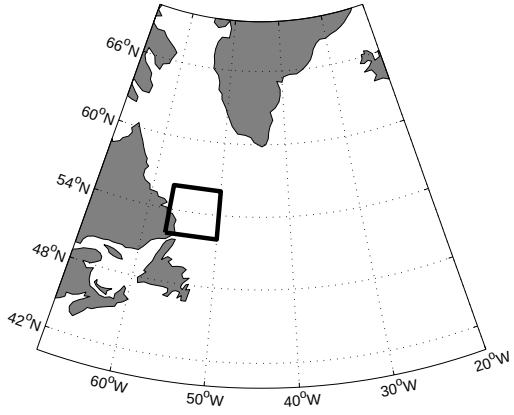
West Greenland Current

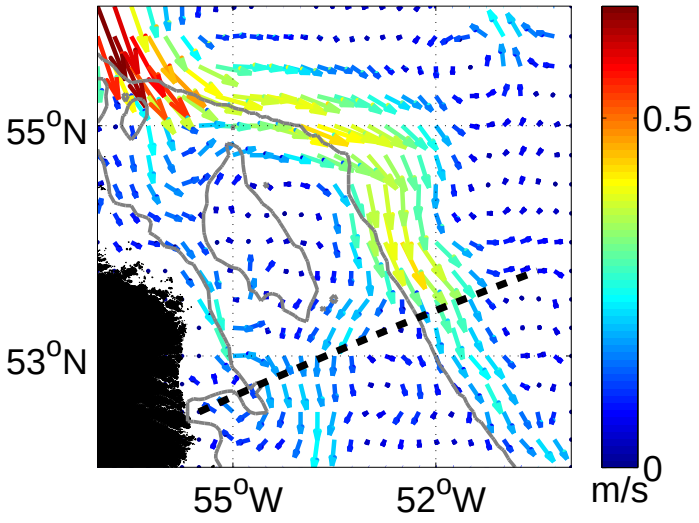


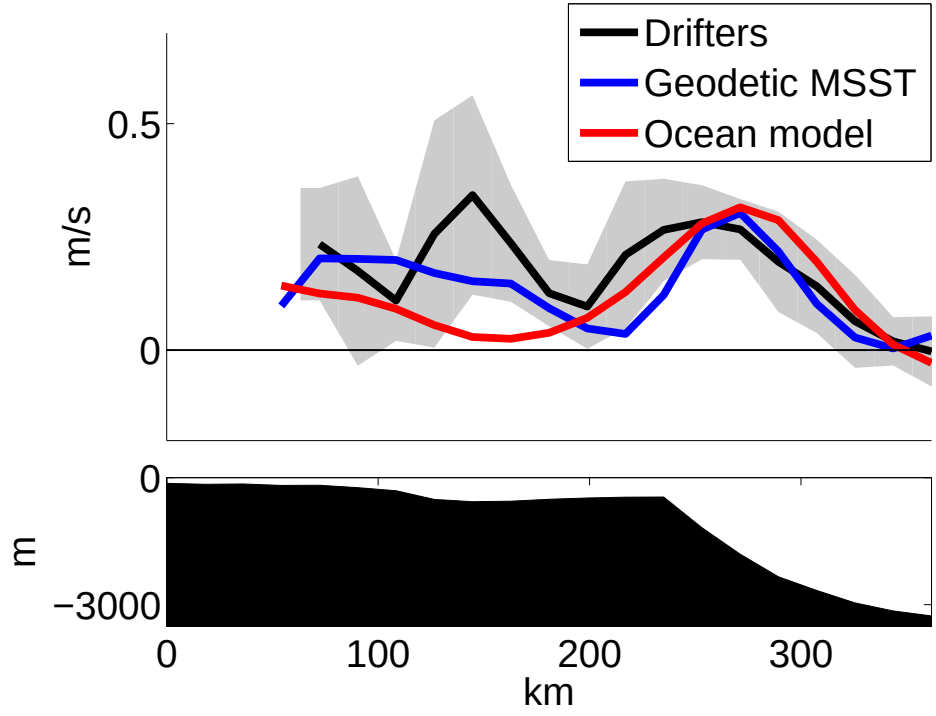




Labrador Current







Future work

- This new geodetically-determined MSST provides a valuable independent data source for mapping the surface circulation.
- The current analysis is the mean for a 9-year period. Ice may produce biases and I am looking to produce a seasonal analysis.
- Data exists to extend this analysis to other regions.
- Gravity data will soon be available from the GOCE satellite mission. This will increase the accuracy of the geoid model and will assist studies in regions where terrestral gravity data is more sparse.