North Atlantic Simulations in Coordinated Ocean-ice Reference Experiments phase-II (CORE-II) (Mean States)

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CORE-II: An experimental protocol for ocean – ice coupled simulations forced with inter-annually varying atmospheric data sets for the 1948-2007 period (Large and Yeager 2009). This effort is coordinated by the CLIVAR Working Group on Ocean Model Development (WGOMD).

These hindcast simulations provide a framework for

•evaluation, understanding, and improvement of ocean models,

•investigation of mechanisms for seasonal, inter-annual, and decadal variability,

•evaluation of robustness of mechanisms across models,

•complementing data assimilation in bridging observations and modeling and in providing ocean initial conditions for climate prediction simulations.

The CORE datasets are collaboratively supported by NCAR and GFDL. They can be accessed via

-WGOMD CORE web pages

-http://data1.gfdl.noaa.gov/nomads/forms/core.html

Participating groups (18 models):

- Australia: CSIRO (ACCESS)

- France: CERFACS, CNRM

- Germany: AWI, IfM-GEOMAR (KIEL)

- Italy: CMCC, ICTP

- Japan: MRI (free, DA)

- Norway: U. Bergen

- Russia: RAS (INMOM)

- UK: NOCS

- USA: FSU, GFDL-GOLD, GFDL-MOM, MIT, NASA GISS, NCAR

Level, isopycnal, hybrid, mass, and sigma coordinates; free models; DA; mostly nominal 1° resolution

Hypothesis: Global ocean – sea-ice models integrated using the same inter-annually varying atmospheric forcing data sets produce qualitatively very similar mean and variability in their simulations.
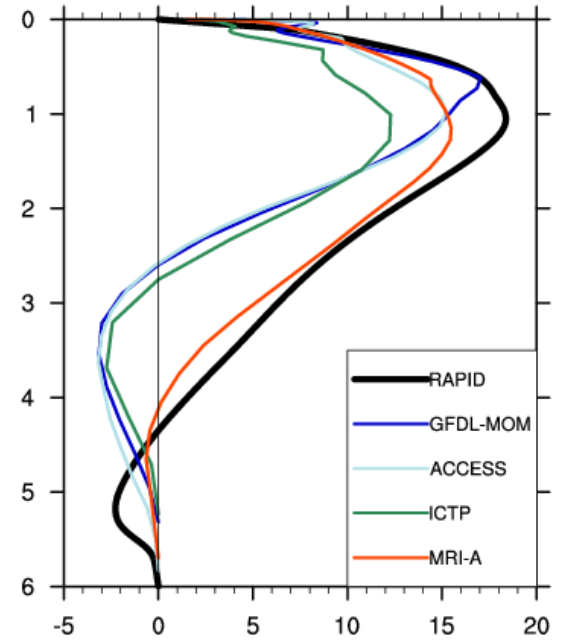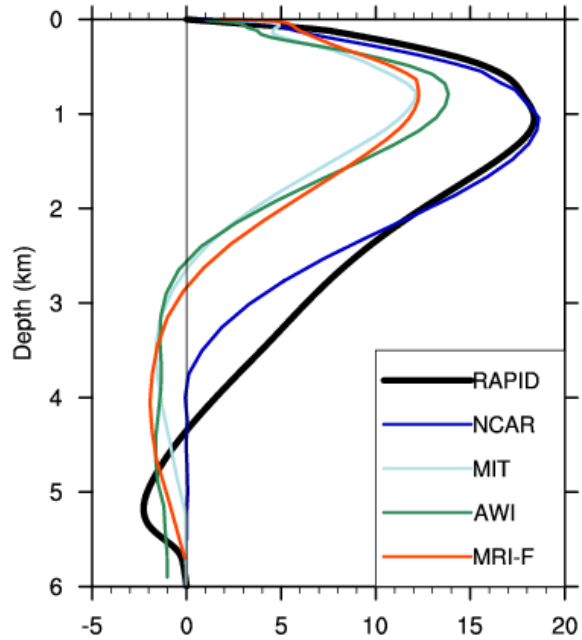
We test this hypothesis, considering the mean state in the North Atlantic with a focus on the Atlantic Meridional Overturning Circulation (AMOC).

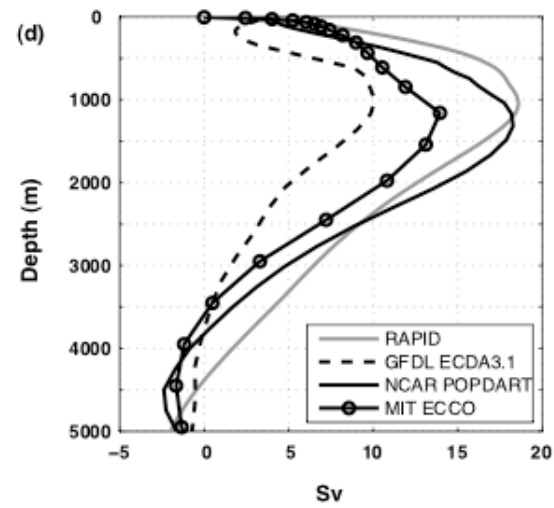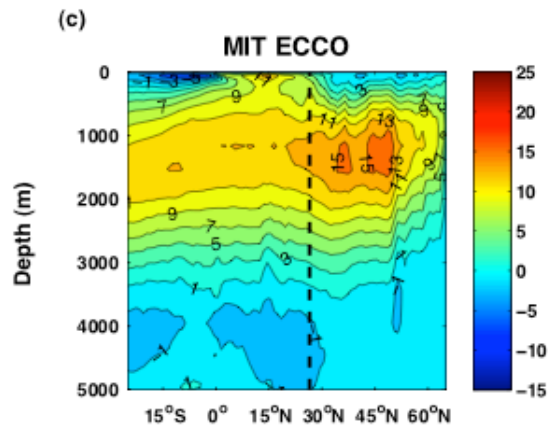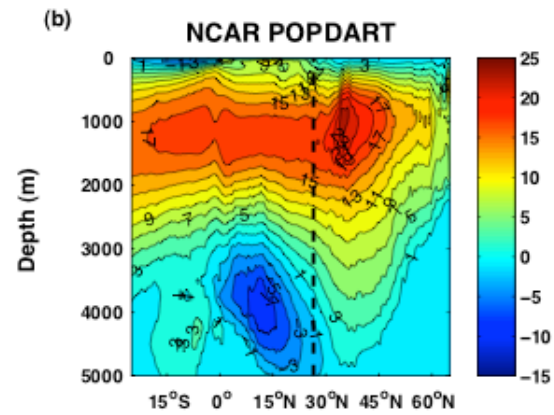Caveat… participants are free in their choices of surface freshwater / salt flux treatments and sea-ice models.
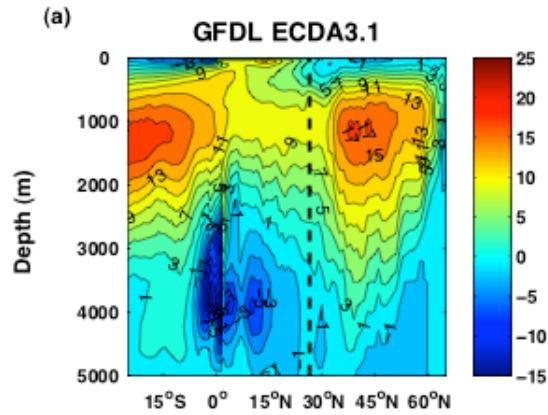
AMOC Mean (1988-2007)
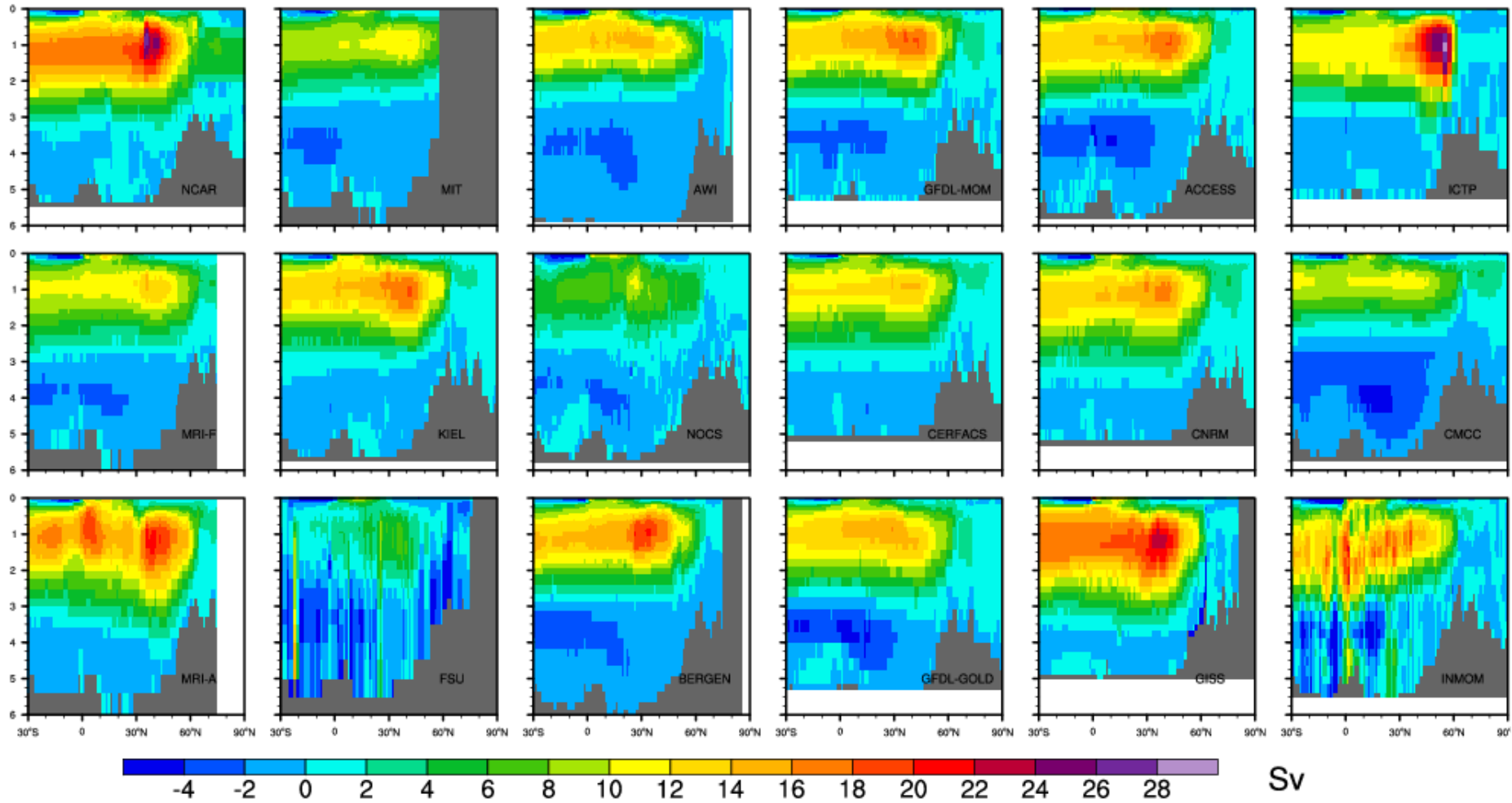
AMOC at 26.5ºN (2004-2007)
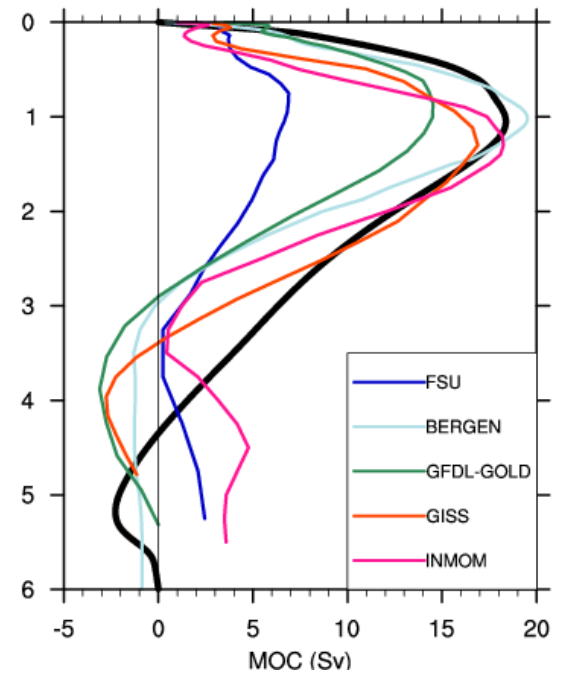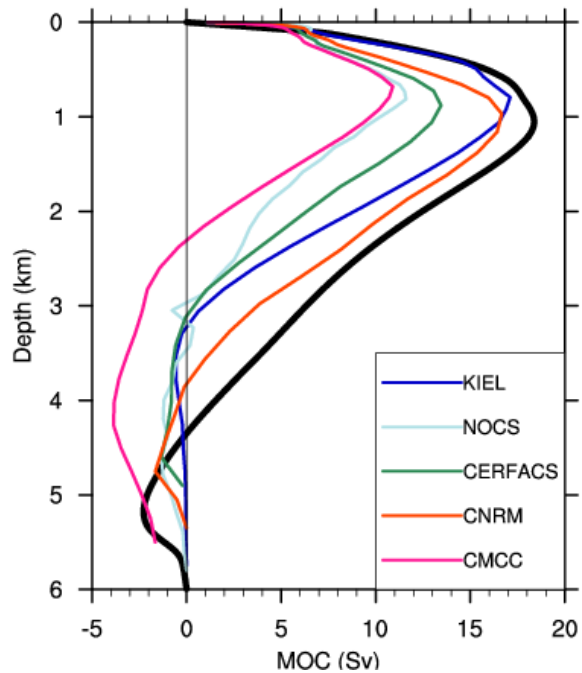
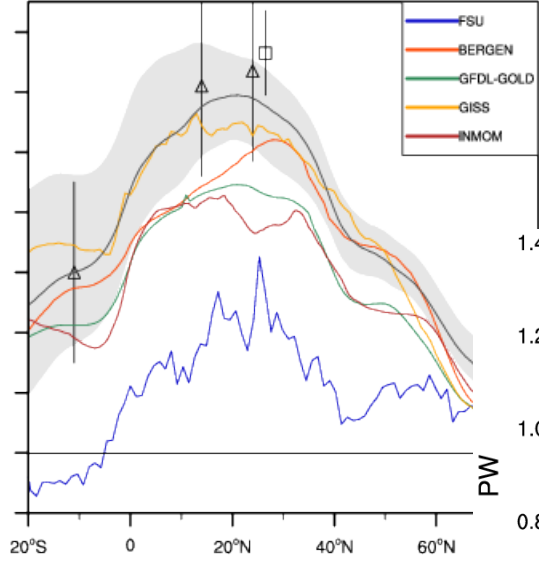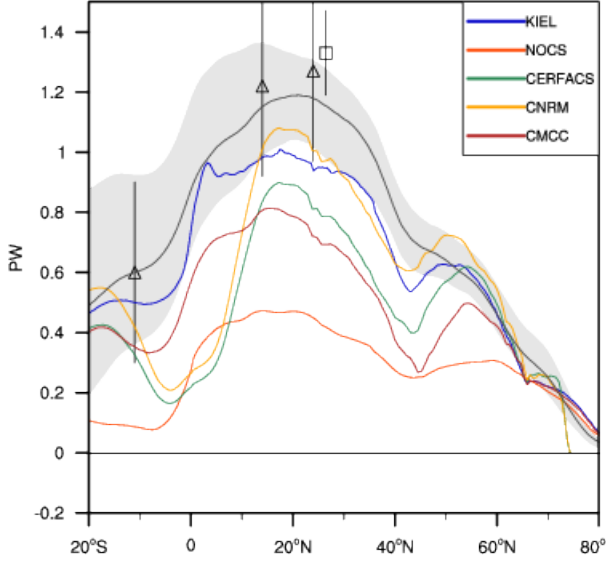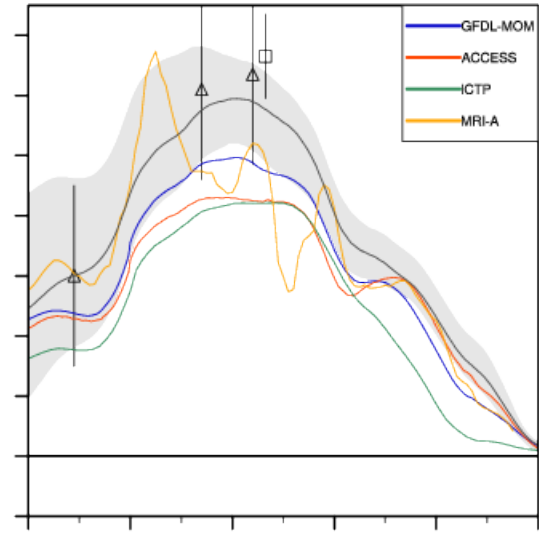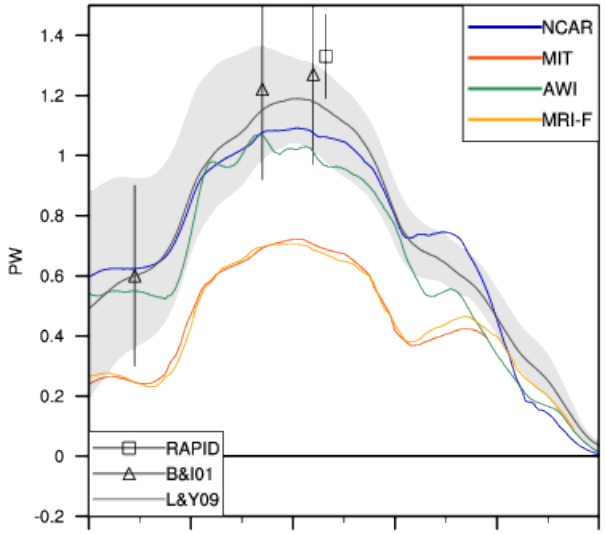# AMOC (2000-2005)

Atlantic Meridional Heat Transport (1988-2007)
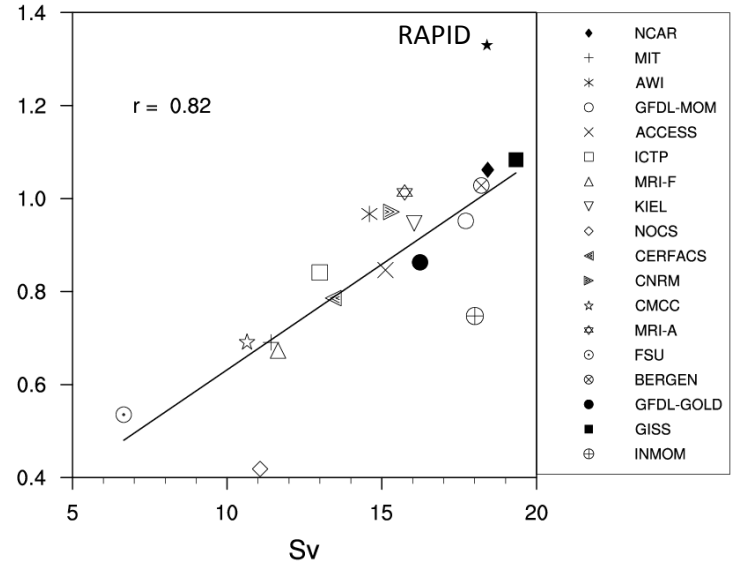
MHT vs. AMOC maximum at 26.5°N

Potential Temperature Bias from WOA09
(0-700 m, 1988-2007)
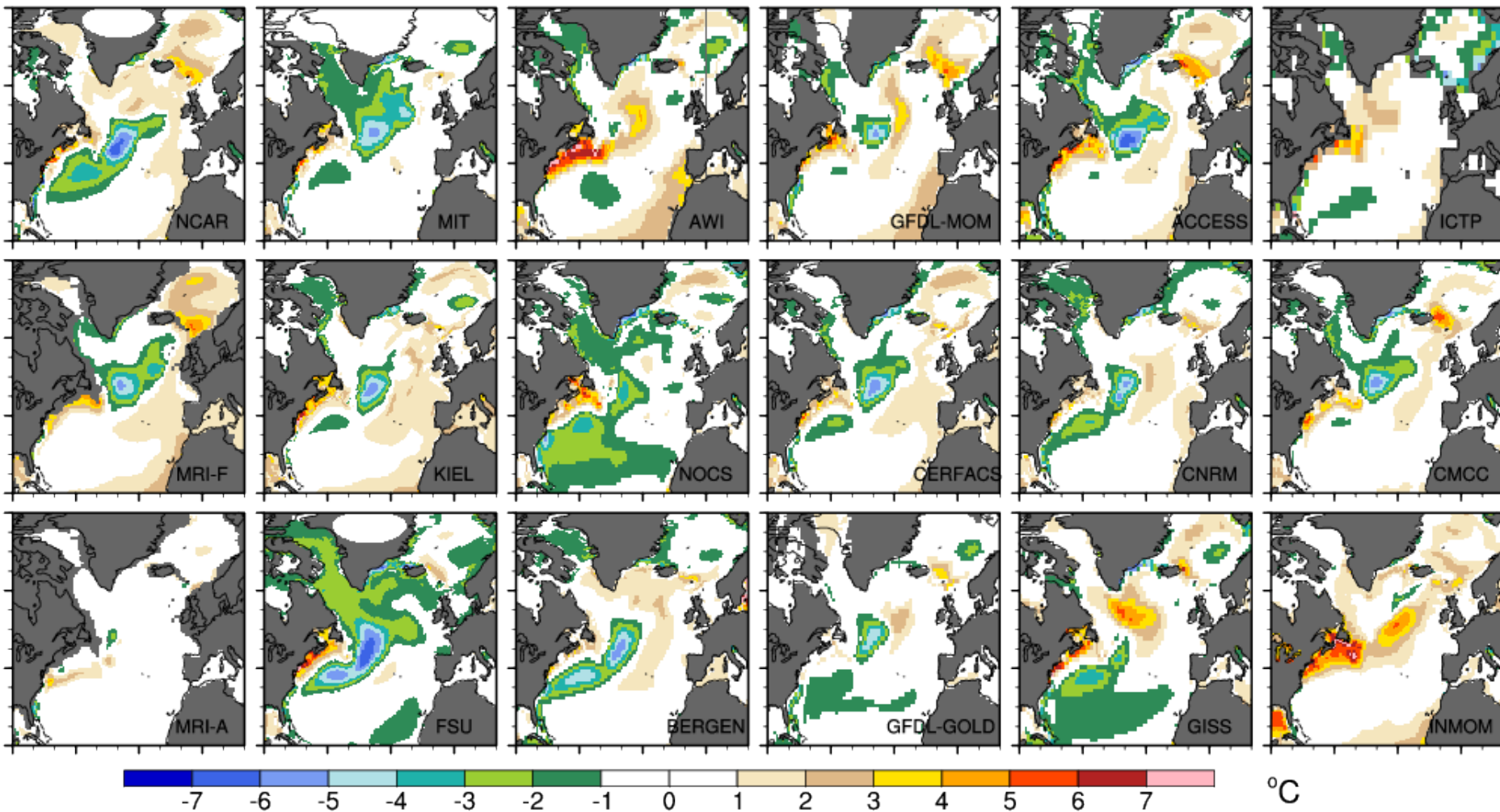
AMOC Maximum Transports vs. Labrador Sea Upper-Ocean Potential Temperature and Salinity Biases
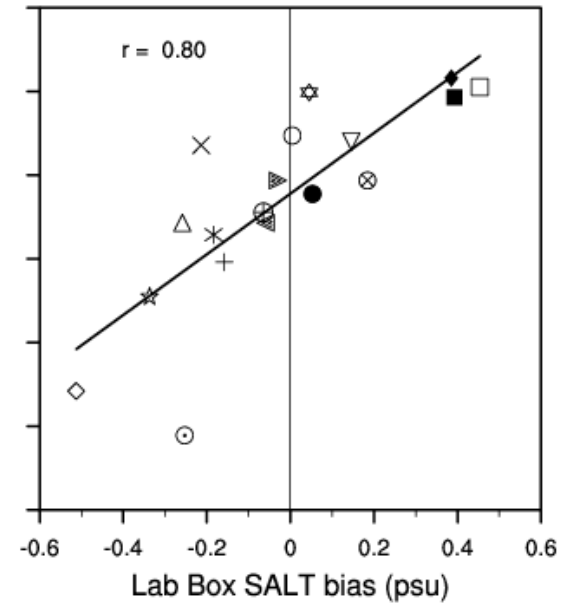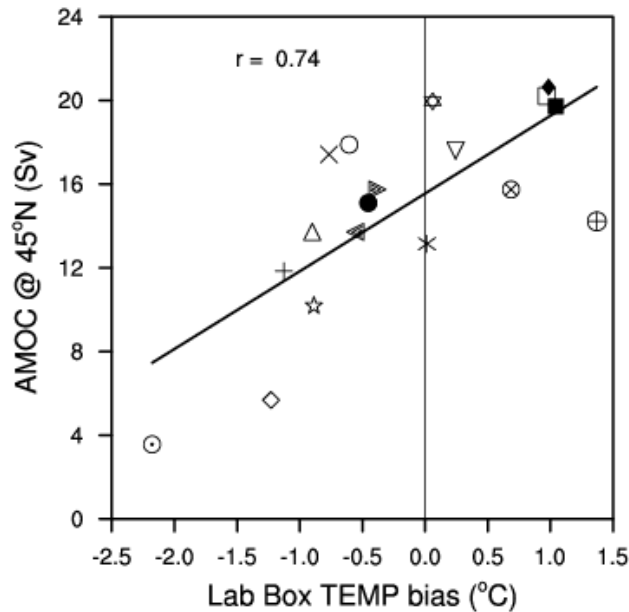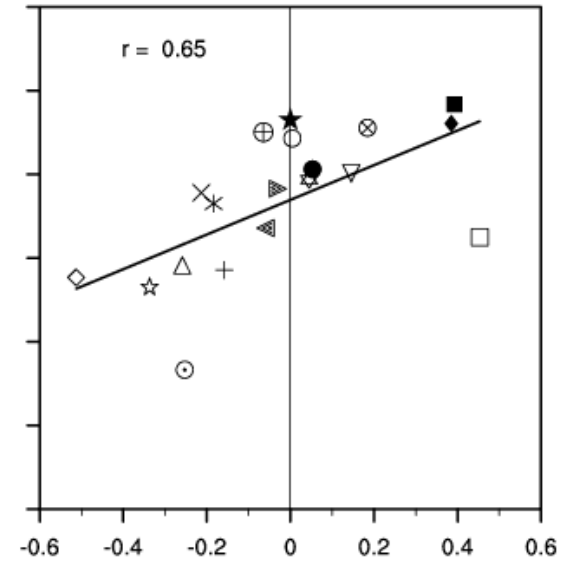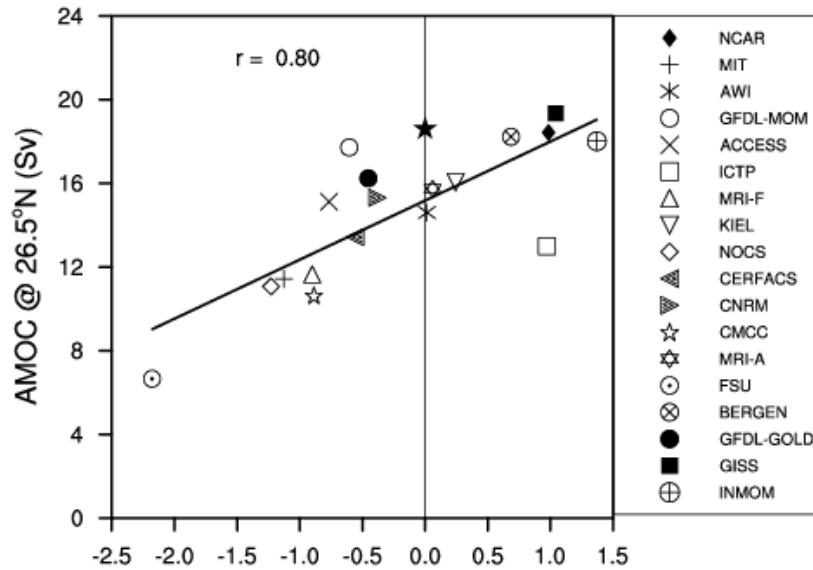
March-Mean Mixed Layer Depth (1988-2007)

Based on a density change of 0.125 kg m^{-3} from the surface
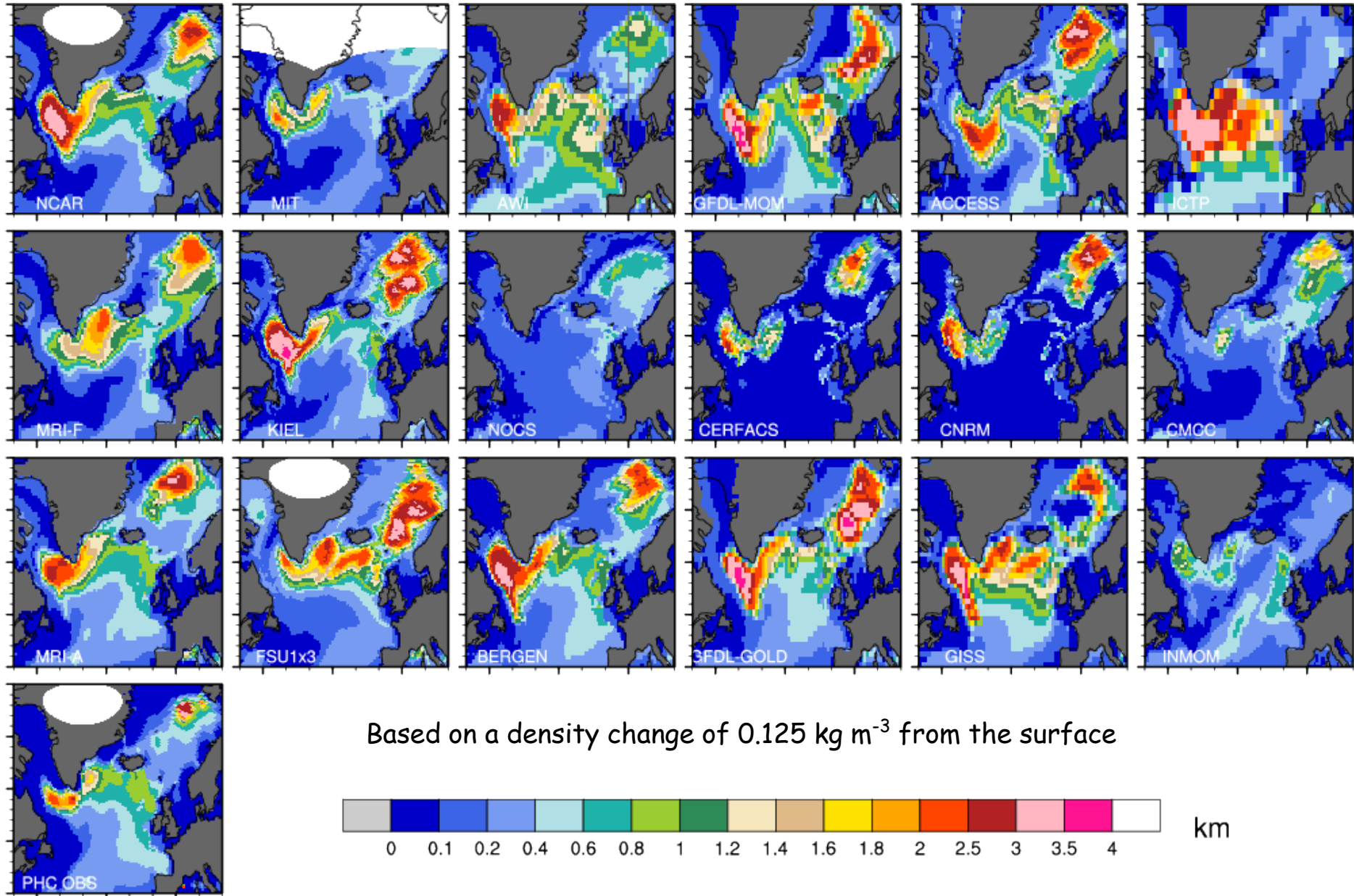
AMOC Maximum Transports, Labrador Sea Potential Temperature and Salinity Biases vs. Labrador Sea March-Mean Mixed Layer Depth

March-Mean Sea Ice Area vs. Potential Temperature Bias, Salinity Bias, and March-Mean Mixed Layer Depth for the Labrador Sea

TEMP BIAS   SALT BIAS   MARCH MLD
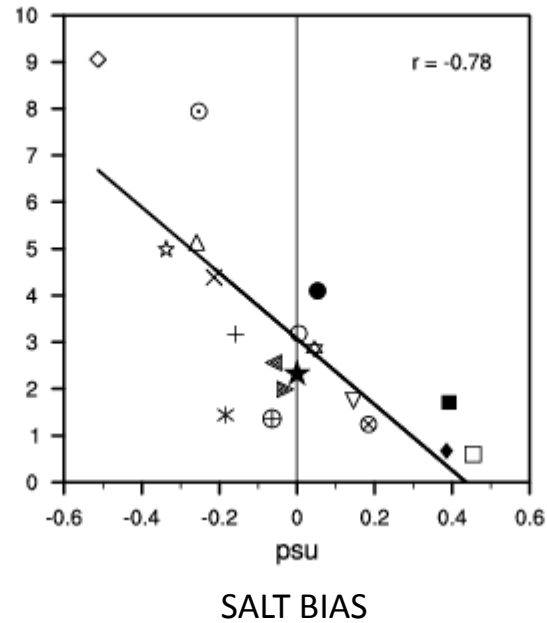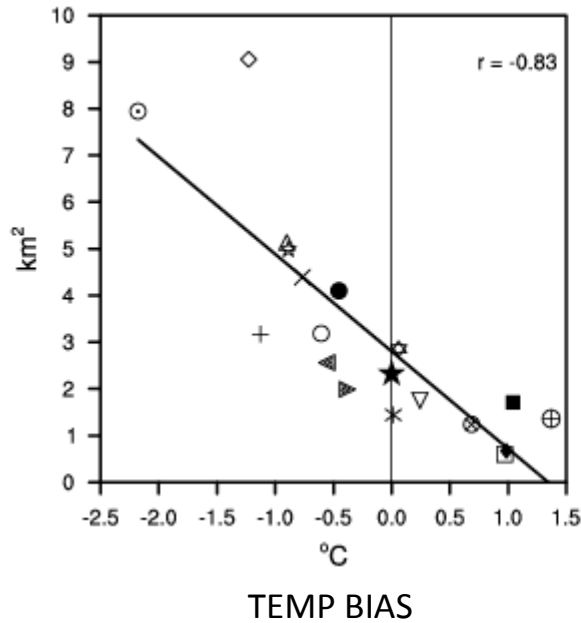
CONCLUSIONS

- Models forced with the same CORE-II data will produce not so similar solutions.

- No grouping of model solutions based on model family or vertical coordinate representation is obvious.

- Inter-model differences appear to be due to differences in sea-ice models and snow and ice albedo treatments and in ocean model parameterizations and parameter choices.
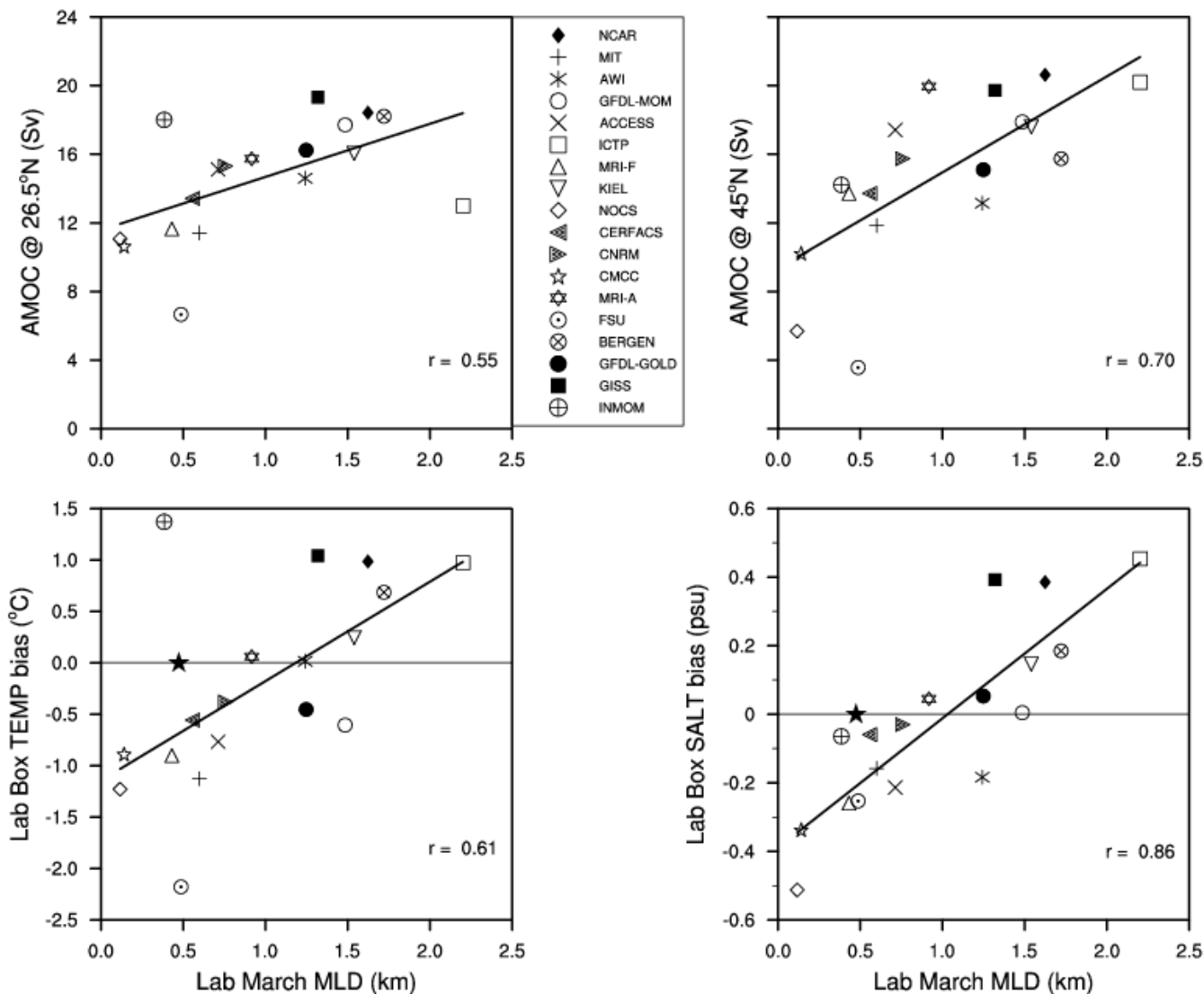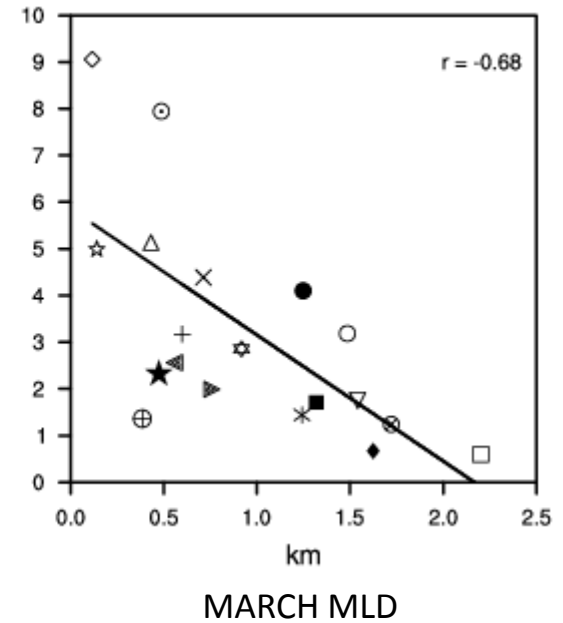
- The majority of the models appear suitable for use in North Atlantic studies. Although all models will benefit from further improvements, some may require more focused attention.

WGOMD members and CORE participants are actively analyzing these simulations, and there are 7 planned papers focusing on North Atlantic (mean and variability), SSH, Southern Ocean and ventilation, Arctic Ocean, South Atlantic, overturning in T and S space …

We welcome participation from interested people….

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March Ice Thickness (m) 2001-2005
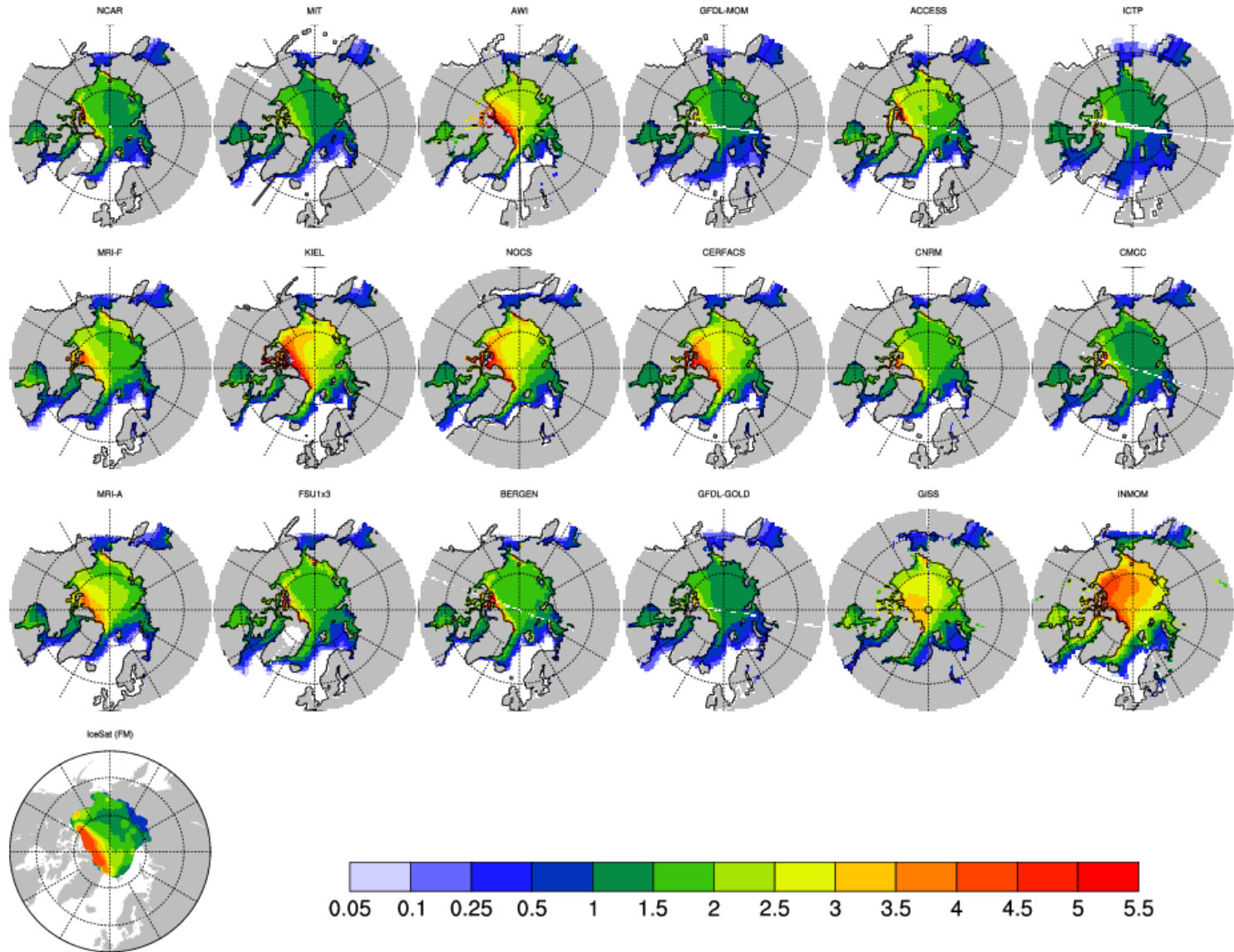
Time Series of AMOC Maximum Transport at 26.5°N