Decadal Predictability of the N. Atlantic MOC in GFDL’s CM2.1 Coupled Climate Model

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• The GFDL CM2.1 model came online in the fall of 2004.

• Here we discuss an ongoing line of inquiry into the predictability of the North Atlantic meridional overturning strength based upon sets of simulations built around a long running pre-industrial control simulation & some climate of the 21st Century runs.
N. Atlantic MOC in GFDL CM2.1 Control

* Negligible climate drift. * Character of internal variability varies
The N. Atl. MOC in the 1860 Control

CM2.1 1860 CONTROL

N ATL MOC MAX [SV]

900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
20 21 22 23 24 25 26 27 28 29

N ATL MOC MAX [SV]

1275 1300 1325 1350 1375 1400 1425 1450 1475 1500 1525 1550 1575
19 20 21 22 23 24 25 26 27 28 29
The set starting at Jan 1001
The set starting at Jan 1101
• Some times there appears to be more multi-year to decadal predictability than at other times.
• Can one predict when there’s likely to be more predictability?
• What is the difference between statistical skill vs. practical skill?
• Skill relative to what? Climatology, persistence, a statistical model based upon previous years?
Natural modulation of ENSO in a 2000yr coupled GCM run

CM2.1 1860 NINO3 SST spectra

Annual Cycle

ENSO (somewhat irregular period)

400yr means (67%) 2000yr mean

 Courtesy Andrew Wittenberg, NOAA/GFDL
Natural modulation of ENSO in a 2000yr coupled GCM run.
Natural modulation of ENSO in a 2000yr coupled GCM run

2000 yr & 400 yr means

100 yr means

25 yr means

~ length of satellite record

(C$^\circ$)² / octave

period (YR)

Courtesy Andrew Wittenberg, NOAA/GFDL
Looking at 21st Century Simulations
Projected Atlantic SST Change (relative to 1991-2004 mean)

From Tom Delworth

Areal average
70°W-0°W
0°N-60°N

Results from GFDL CM2.1 Global Climate Model (SRES A1B)

Observed Trend from 1950-2004
Regarding the communication of info to interested non-specialists...

Projected Atlantic Avg SST

(GFDL CM2.1 model, SRESA1B scenario, 10 member ensemble)
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If this is “news” to environmental reporters, science & technology museum conference attendees, and nation weather service forecasters then what does it say about our communities communication effectiveness?
Projected Atlantic Avg SST

(GFDL CM2.1 model, SRESA1B scenario, 10 member ensemble)
The set starting at Jan 1201
The set starting at Jan 1301
The set starting at Jan 1401
The set starting at Jan 1501
Variability and Change...