Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009

GFDL Core Physical Climate Model Development

Presented by

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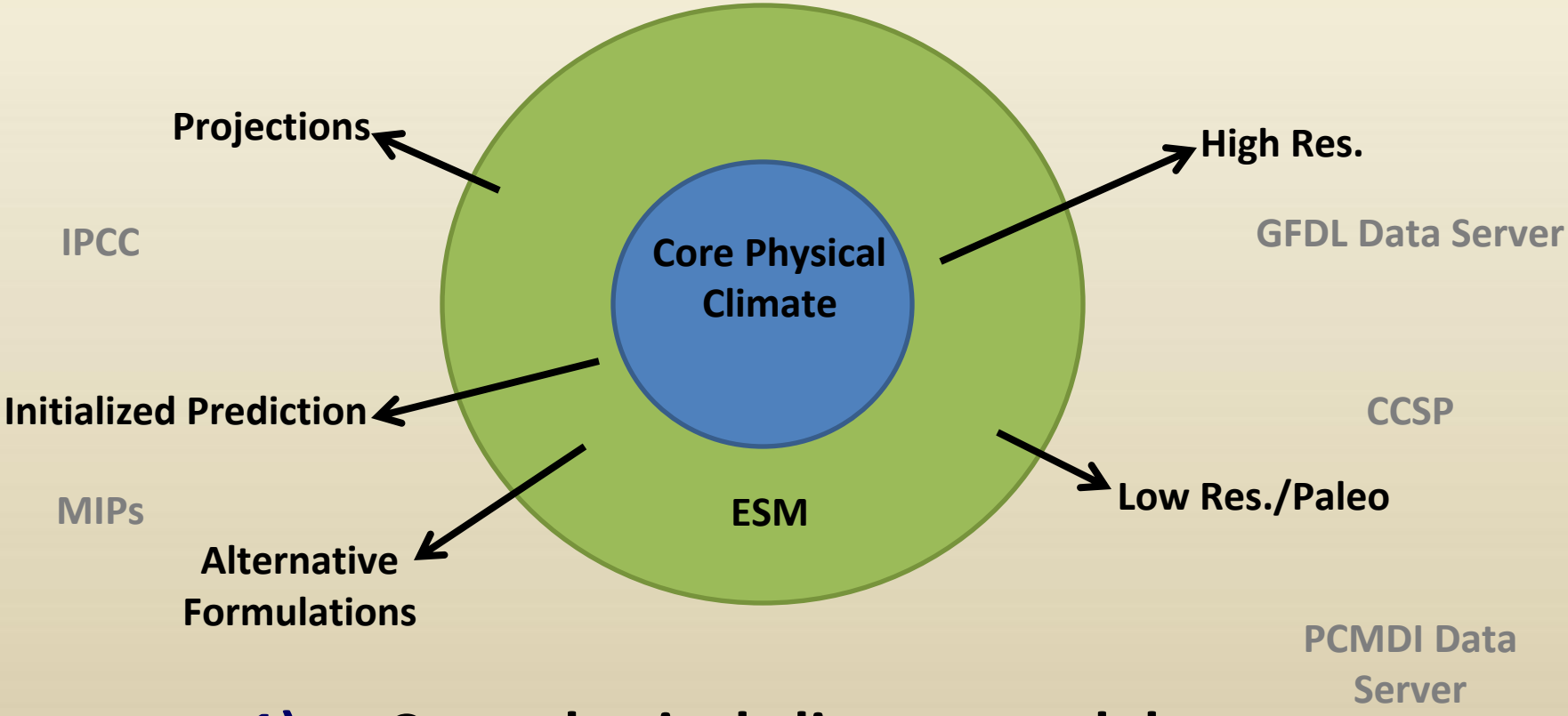


1) Core physical climate model
2) CM3/CM2.1 simulation comparison

Past GFDL climate model IPCC contributions

Halloween Report
Oct 2000

Valentine Memo
Feb 2006

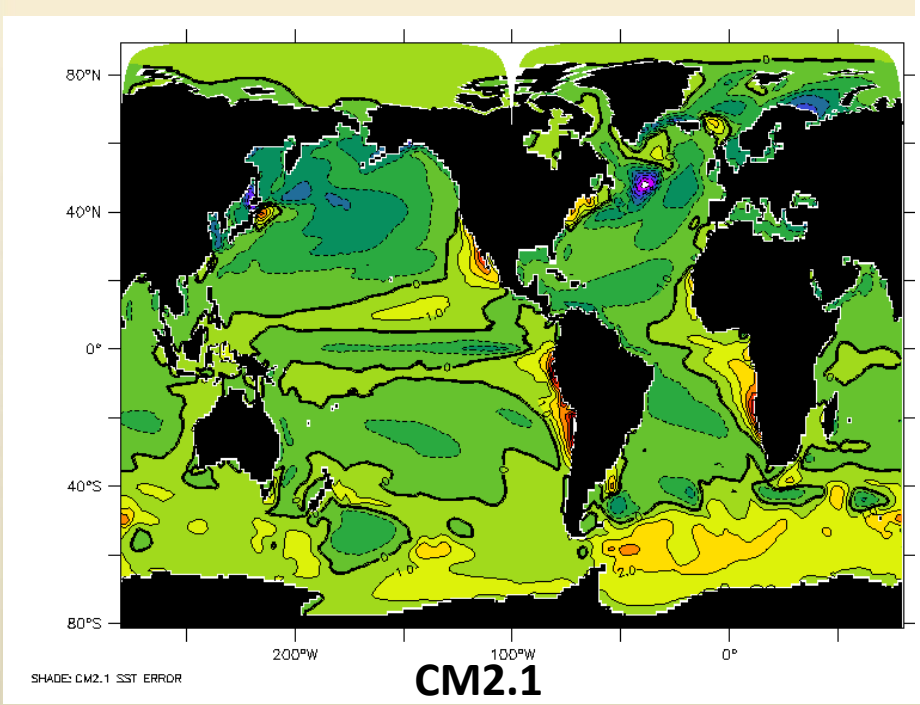
- 1990 “FAR”
  - Future projections based largely on GFDL model
- 1995 “SAR”
  - GFDL model one of ~6 models used for future projections
- 2001 “TAR”
  - GFDL model is “2nd tier” out of ~12 models
- 2007 “AR4”
  - GFDL CM models are two of the best out of ~24 models
- 2013 “AR5”
  - GFDL CM2.1 based ESMs and decadal prediction, new “core” model CM3

AR5 Coupled Model Formulations

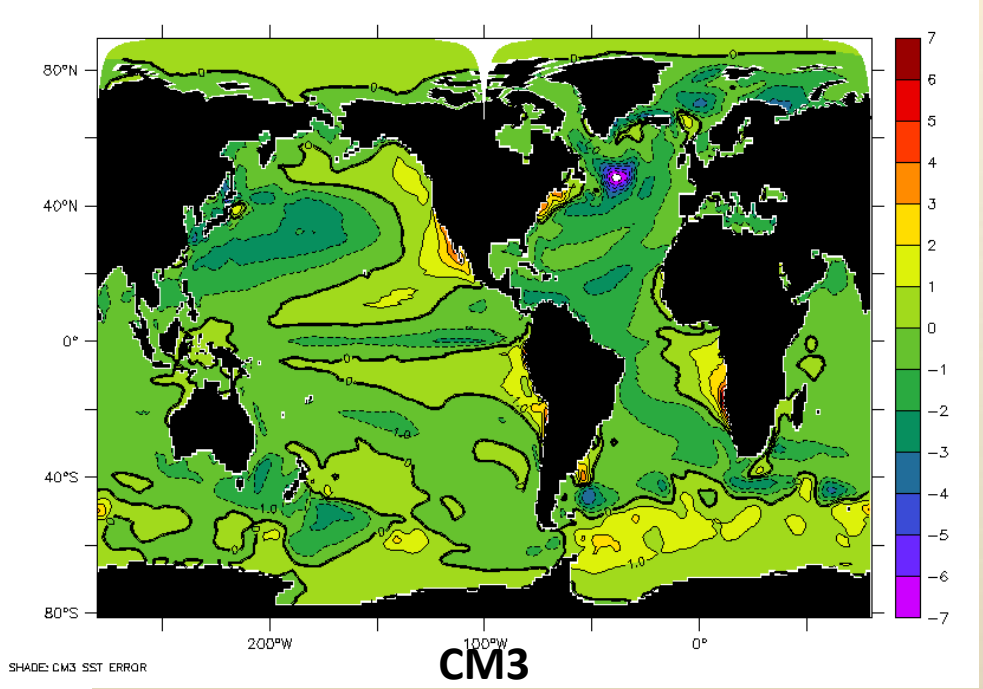
	CM2G	CM2M	CM2.1	CM3
Atmosphere	AM2.1 (L24)	AM2.1 (L24)	AM2.1 (L24)	AM3 (L48)
Land	LM3	LM3	LM2	LM3
Sea ice	SIS	SIS	SIS	SIS
Ocean	GOLD	MOM4p1 “M configuration”	MOM4	MOM4p1 “CM2.1-like”

ESM2G and ESM2M

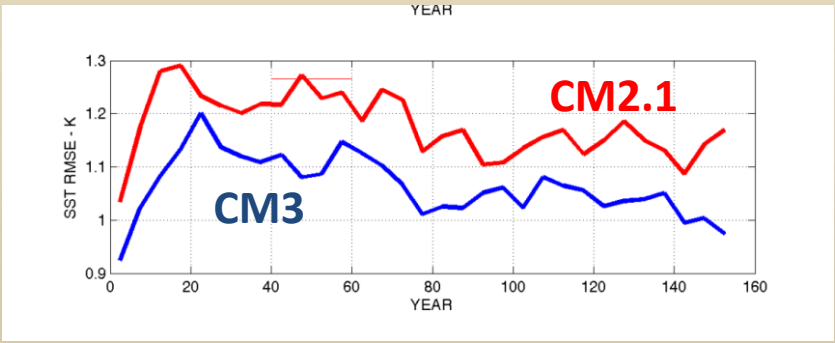
CM3 has reduced SST errors relative to CM2.1



CM2.1

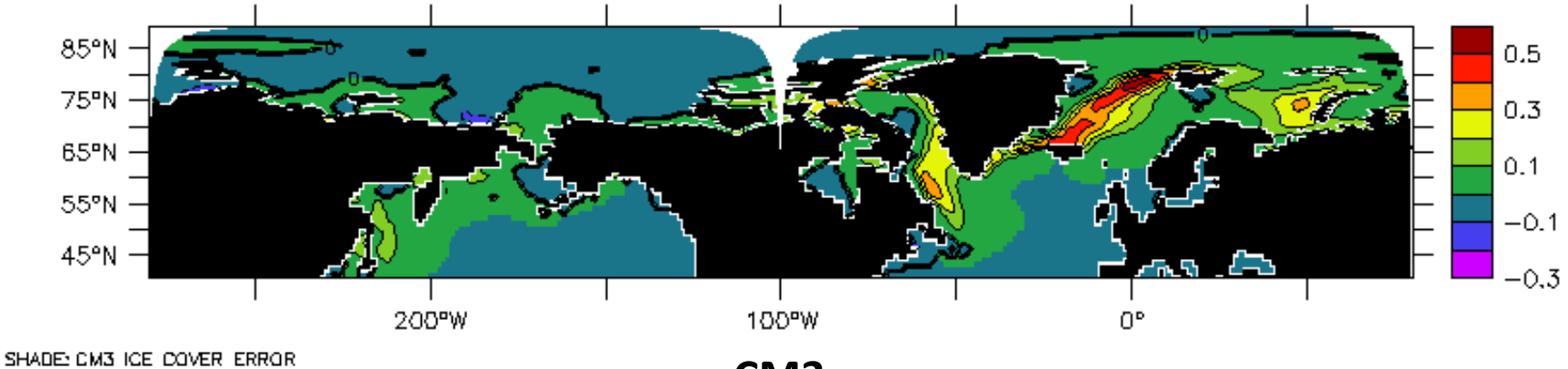


CM3

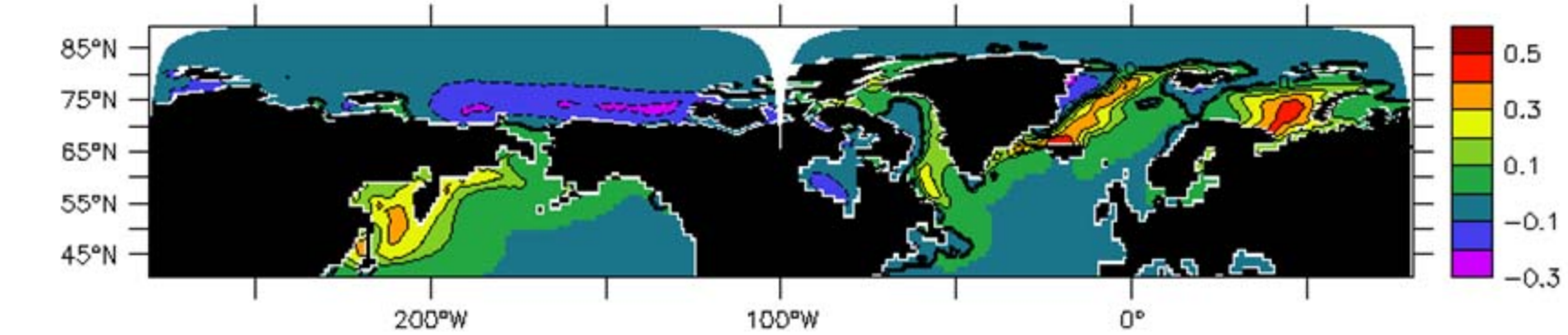


CM3 improvement
- Southern ocean
- Eastern tropical Pacific
- North Pacific

CM3 has reduced NH sea ice cover error relative to CM2.1

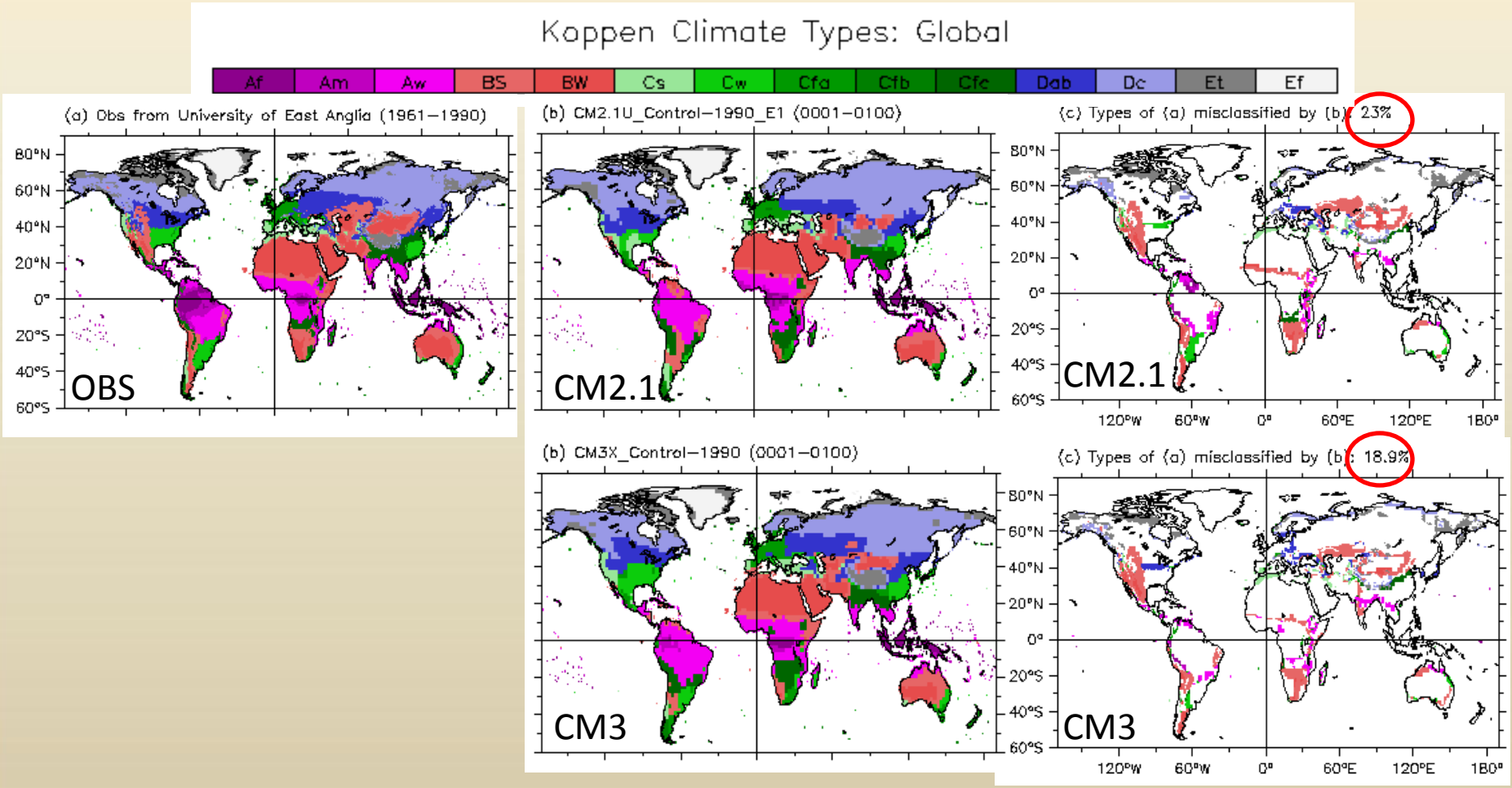


CM3



CM2.1

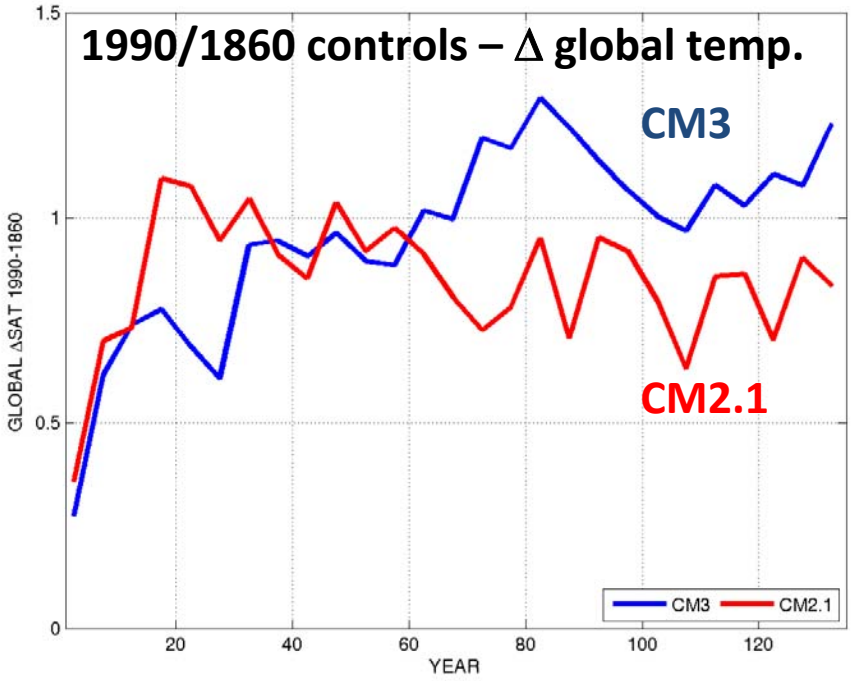
CM3 has reduced Köppen climate errors relative to CM2.1

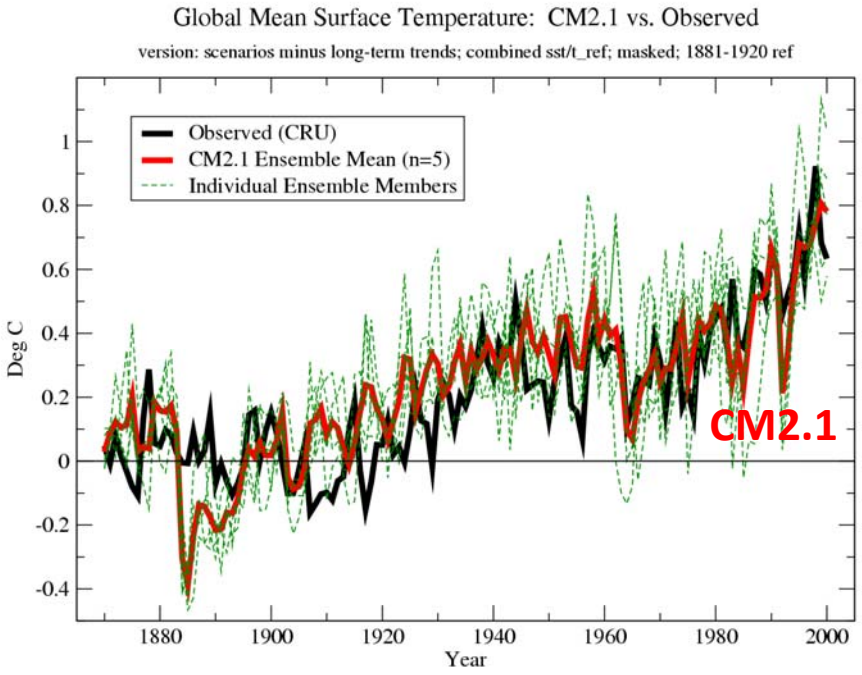


(Gnanadesikan and Stouffer 2006)

CM3 appears on target for the 20th century warming simulation

	$F_{1980\text{-}1999}$	TCR	F*TCR
CM2.1	1.3 W/m^2	1.5^{o}C	1.95
CM3	~1 W/m^2	2.1^{o}C	2.1





(Knutson et al 2006)

CM3 vs. CM2.1 Simulation Summary

- **Improved surface climate simulation:**
  - SST's, sea ice, Köppen climates, SAT variability (NH land)
- **Degraded ocean simulation:**
  - SSS, ocean subsurface T & S
- **Interesting difference:**
  - 20th century forcing/climate sensitivity combination

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