Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009
Rainfall projections remain very uncertain in much of tropical Africa

Percentage change in precipitation by end of 21st century:
AR4-SPM based on PCMDI-CMIP3 archive

White areas => less than two thirds of the models agree on the sign of change
AM2.1 with prescribed SSTs generates remarkably good fit to observed Sahel rainfall variations

Observations = CRU Summertime precipitation in Sahel

(Delworth, Lu, Zhang, Findell, Knutson)
CM2.1 20\textsuperscript{th} century simulations also very realistic

Mean of 8-member ensemble


Sahel Drought: Past and Future

Single realization of CM2
Sahel Drought: Past and Future

CM2.1 future projections are for catastrophic drought in Sahel

Range of SRES scenarios
Sahel Drought: Past and Future

Sahel drying in CM2 is outlier among world climate models

QUMP: 129 different mixed layer models
% Sahel precip response to 2xCO2

(courtesy of Matthew Collins, Hadley Center)

Precipitation projections for late 21st century in several CMIP3-AR4 models

CM2

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AM2/CM2 distinctive in that it dries the Sahel in response to uniform component of ocean warming

+2K uniform SST perturbation: annual mean precip
What is responsible for the distinctive aspects of CM2?
Not likely the land model (based on preliminary AM2/LM3 exps),
Likely the convection/cloud parameterizations
(can modify result by manipulating this part of model).

Can we predict which models have drier/wetter Sahel
from some features of control simulations?
Not yet - ongoing collaborative analysis of AR4 models with
Columbia/Lamont (Sobel, Giannini, Biasutti, Kang).

AM3 should provide valuable new material for comparative analysis
Despite its outlier status, we continue to take CM2’s projection for extreme drought in the Sahel very seriously, due to the quality of the overall CM2 simulation and especially the quality of its simulation of the 20th century African climate.

For a more extensive discussion, visit: www.gfdl.noaa.gov/sahel-drought