NAMAP2 (and the NAME Climate Process Team)

A multi-model assessment of North American Monsoon simulations

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Introduction

NAMAP2 is a coordinated exercise in global and regional atmospheric modeling of the North American Monsoon System (NAMS). The summer season of 2004, during which the NAME 2004 field campaign took place, is the simulation target. Simulation protocols were developed following discussion among participants, guided by the results of the first phase of NAMAP (Gutzler et al., 2005). The simulations have been completed. This poster presents the first set of preliminary analyses from the NAMAP2 simulations; analysis is ongoing and the initial results shown here will be expanded very considerably in the coming months.

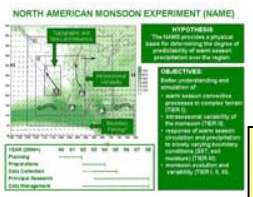
The first NAME Model Assessment Project (NAMAP) was an attempt to engage the modeling community in advance of the NAME 2004 field campaign. NAMAP provided an indication of the ability of numerical models to simulate atmospheric variability across southwestern North America during the summer season. For NAMAP, numerical simulations of atmospheric variability across southwestern North America during a single summer (1990) were carried out independently by six modeling groups. The NAMAP analysis focused on the ability of the models to simulate the observed seasonal and (where observations permitted) diurnal cycles. The results led to the formulation of metrics to quantify model simulation quality and improvement. Some of these metrics are listed below and additional discussion is contained in the NAMAP Atlas (CPC Atlas online 2004) and in Gutzler et al. (2005, *BAMS*).

NAMAP2 will re-examine the metrics proposed by NAMAP, extend the NAMAP analysis to transient variability, and exploit the extensive observational database provided by NAME 2004 to analyze simulation targets of special interest. A centralized comparative analysis of model output is being carried out at the NOAA Climate Prediction Center, and we hope that the simulations will be used by individual modeling groups as Control Runs for their own analysis purposes.

Oceanic temperature data and (for regional models) lateral boundary conditions were specified. A new SST analysis has been developed for NAMAP2 (by Xie and Wang at NOAA CPC) that makes extensive use of satellite data to improve the characterization of SST within NAME Tier III.

The results of NAMAP2 will be directly linked to operational model development efforts at NCEP through the NAME Climate Process Team, described in more detail in the poster by Jae Schemm et al. ("NAME CPT Project") .

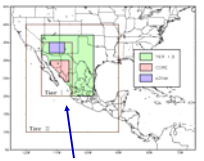
Observed 2004 Warm Season Rainfall Across the NAMAP2 Analysis Domain



The first phase of NAMAP (Gutzler et al. 2005) focused primarily on monthly and seasonal quantities in NAME Tier I. NAMAP2 analysis will:

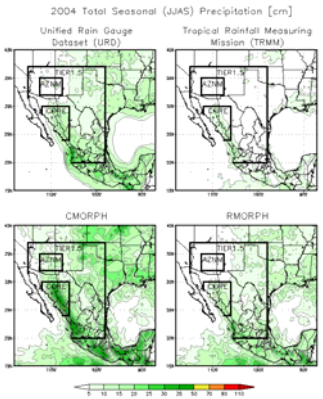
(a) Revisit Tier I calculations of NAMAP to examine targets identified in the earlier analysis (see box below)
(b) Expand the analysis into Tier II
(c) Examine transient variability

NAMAP-derived targets for model simulations include:
* Simulate observed monsoon onset within a week
* Simulate monthly mean precipitation to within 20%
* Simulate large scale surface fluxes to within 20%
* Correctly simulate the diurnal cycle of convective and nonconvective precipitation

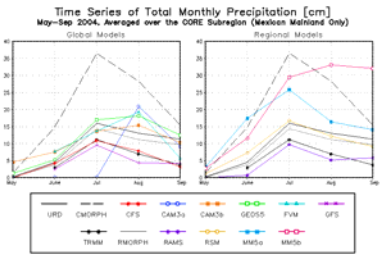


Tier II is the full analysis domain for NAMAP2. We have defined several additional subregions of interest for spatial averaging within Tier II, including:

* NAME Tier I
* AZNM (Higgins et al. 1998)
* CORE (Gutzler 2004)
* "Tier 1.5", encompassing all of northern MX, AZ, NM and west TX



Examination & diagnosis of hydroclimatological variables will be emphasized. Initial comparison of observed rainfall estimates for summer 2004 from four different analysis products indicates huge disparities, especially over mountainous terrain in the core of the monsoon region.



(black lines are observations; output from a few models is still being processed)

References and additional information:

Gutzler, D.S. et al., 2005: The North American Monsoon Model Assessment Project. *BAMS*, **86**, 1423-1429.
NAMAP CPC Atlas: http://www.cpc.ncep.noaa.gov/research_papers/ncep_cpc_atlas/11/index.html
NAMAP2 web page: http://www.joss.ucar.edu/name/namap2

NAMAP2 Models and Simulation Protocols

Participating Modelers

Global Models

Model Name	Affiliation / Contact
CFS (Operational)	NOAA CPC / J Schemm
CAM3	UCSD SIO / C Collier & G J Zhang
CAM3	NCAR / D Lawrence
GFS	NOAA CPC / K Mo & H Wei
Finite Volume	NASA GSFC / M Bosilovich
GEOS5	NASA GSFC / M I Lee & S Schubert

Regional Models

Model Name	Affiliation / Contact
RAMS	Duke U / S Roy (now at UIUC)
RSM	UCSD SIO / A Nunes & J Roads
MM5	IMTA / R Lobato
MM5	UNM / E Ritchie (now at U AZ)

Simulation Protocols

Simulation Period	15 May–30 September 2004
Domain of Interest	15°N–45°N 125°W–75°W
Lateral Boundary Conditions (for regional models)	NOAA CDAS2
Surface Boundary Conditions/ oceanic	Multiple-Platform-Merged Analysis (from Xie & Wang, NOAA NCEP)
Surface Boundary Conditions/ continental	Chosen by each modeling group

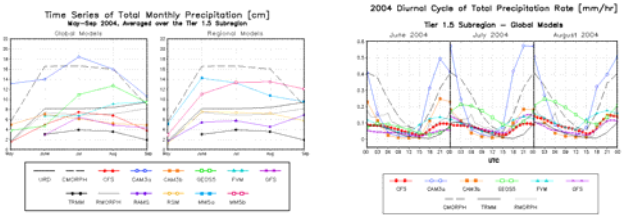
Output files have been archived in two formats.

a) Spatial analysis: The maps and time series shown here are derived from archived lat-lon fields of model output, saved every 3 hr (8/day) covering the NAMAP2 domain during the model simulation period (the 2004 warm season). These fields are being used to analyze the means and diurnal cycle across the domain, including time series averaged over the spatial subregions shown immediately to the left.

b) High-resolution temporal analysis: Modelers also archived "MOLTS"-style time series (at least hourly in time and full vertical resolution) at model grid points corresponding to NAME sounding sites. These data, emphasizing surface fluxes and profiles of humidity, T, u, v, w, p, resolved and convective precipitation, cloud fraction, radiation, and turbulence, will be used to examine cloud and convection processes in more detail. This component of the NAMAP2 analysis is being carried out by Prof. Brian Mapes and colleagues at the University of Miami, and will be reported on later.

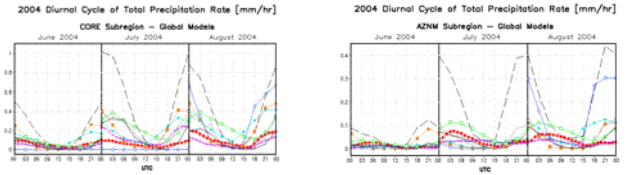
Selected Initial Results (emphasizing the global models)

Total Precipitation
Tier 1.5
Monthly/Diurnal Variability



In NAMAP we found that several models (both global and regional) systematically produced rainfall too far eastward, so NAMAP2 will include an additional averaging box (Tier 1.5) that extends across northern MX to the Gulf of Mexico. As the monthly precipitation time series plot shows, the seasonal cycle is not very pronounced over Tier 1.5 and models tend to sort themselves into a consistent hierarchy of wetter/dryer relative to each other. The diurnal cycles tend to have approximately the right phase, and the RMORPH observed estimate is close to the model average – but the spread among models is large.

Total Precipitation
CORE and AZNM
Diurnal Variability



In NAMAP most global models simulated monsoon onset that was significantly delayed relative to observations. Nearly all of these simulations show much better agreement with the observed jump in precipitation from June to July in the CORE and AZNM subregions. Monsoon onset is now being analyzed in detail using daily time series. As in NAMAP, there is considerable spread in the amount of nocturnal precipitation in these simulations. This feature will also be assessed, with much better observations to use following the NAME field campaign.

Some initial impressions: The proposed metric for simulating observed precipitation to within 20% (averaged over a significantly large spatial domain) may be impossible to verify due to uncertainties in the observations! We will share these results with operational data producers to help motivate improvements in these obs. A more detailed analysis of precipitation in Tier 1 and the CORE subdomain, comparing against NAME field data, will be carried out. We will face similar uncertainties comparing against surface moisture and flux fields, which are now being processed.