NAME Research Update and Legacy

NAME Science Working Group

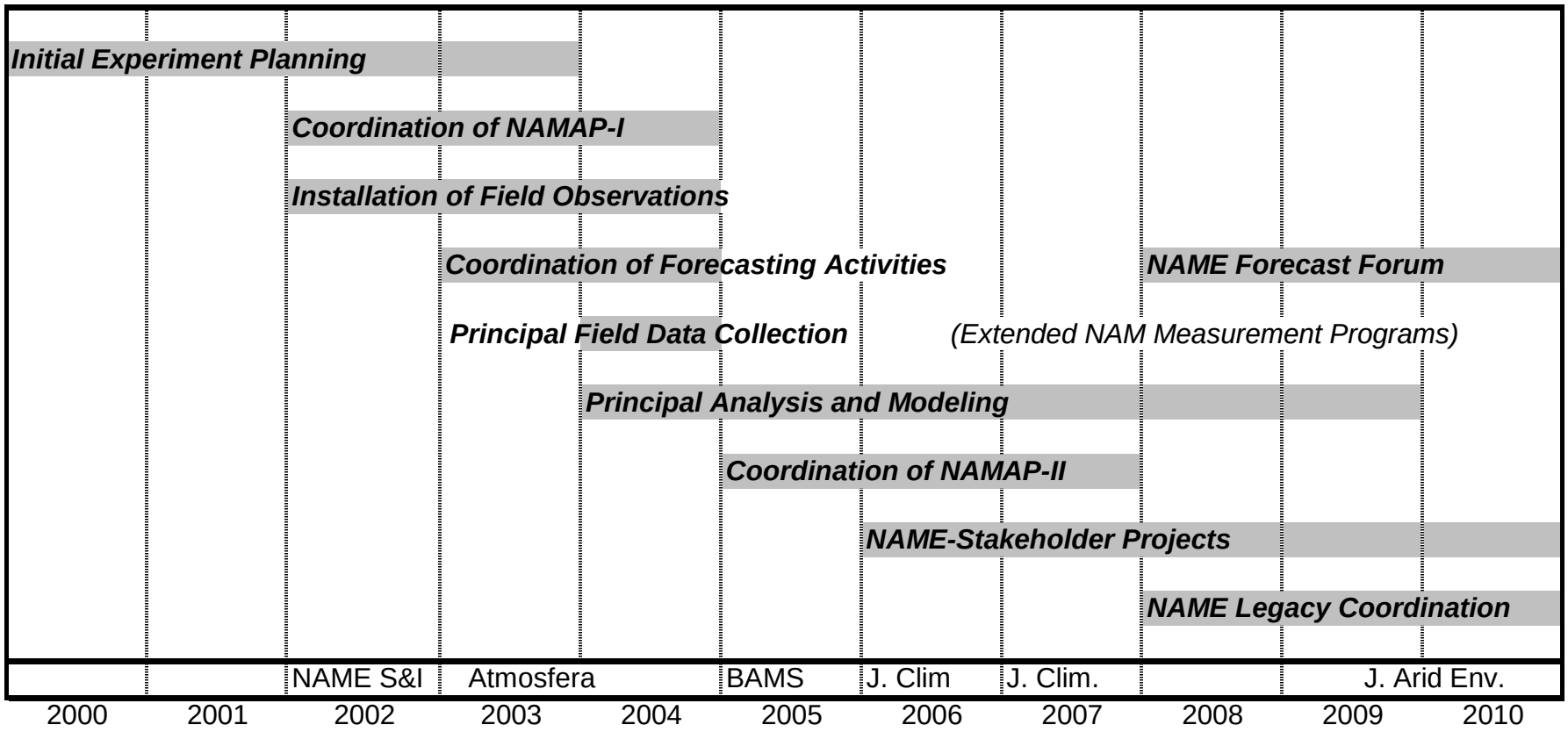
NAME Research Update and Legacy

- Programmatic and Research Update

- Advances in Science
- Contributions to Operations
  - Assessment of NAM observing system
  - Service collaborations
  - Improvements in modeling
- Capacity Building
  - Training
  - Monsoon research applications

Programmatic Review

NAME Program Timeline



- **NAME Data Archive (www.eol.ucar.edu/projects/name)**
- **Numerous 'synthesis' datasets have been generated to date**

The North American Monsoon Experiment: Update on 2008-2009 Activities:

- Development of a bias-corrected dataset for NAME-2004 sounding data (P. Ciesielski and D. Johnson)
- Establishment and launch of the NAME Forecast Forum as a means of tracking climate model forecasts of NAM rainfall. Publication accepted by Eos. (D. Gochis, J. Schemm, W. Shi, A. Douglas)
- Completion of NAMAP-II (model assessment) effort and submission of manuscript to J. Climate (D. Gutzler et al.)
- WMO/WWRP book chapter on progress in NAM research and predictions (D. Gochis and H. Berbery)
- Continued field research into land-atmosphere coupling in NW Mexico (E. Vivoni and C. Watts)
- Continued development of a regional observing system design for the NAM (NAME SWG)
- JAE Special Issue and establishment of a 'Boarder Climate Summary' as a stakeholder climate information publication (G. Garfin et al.)

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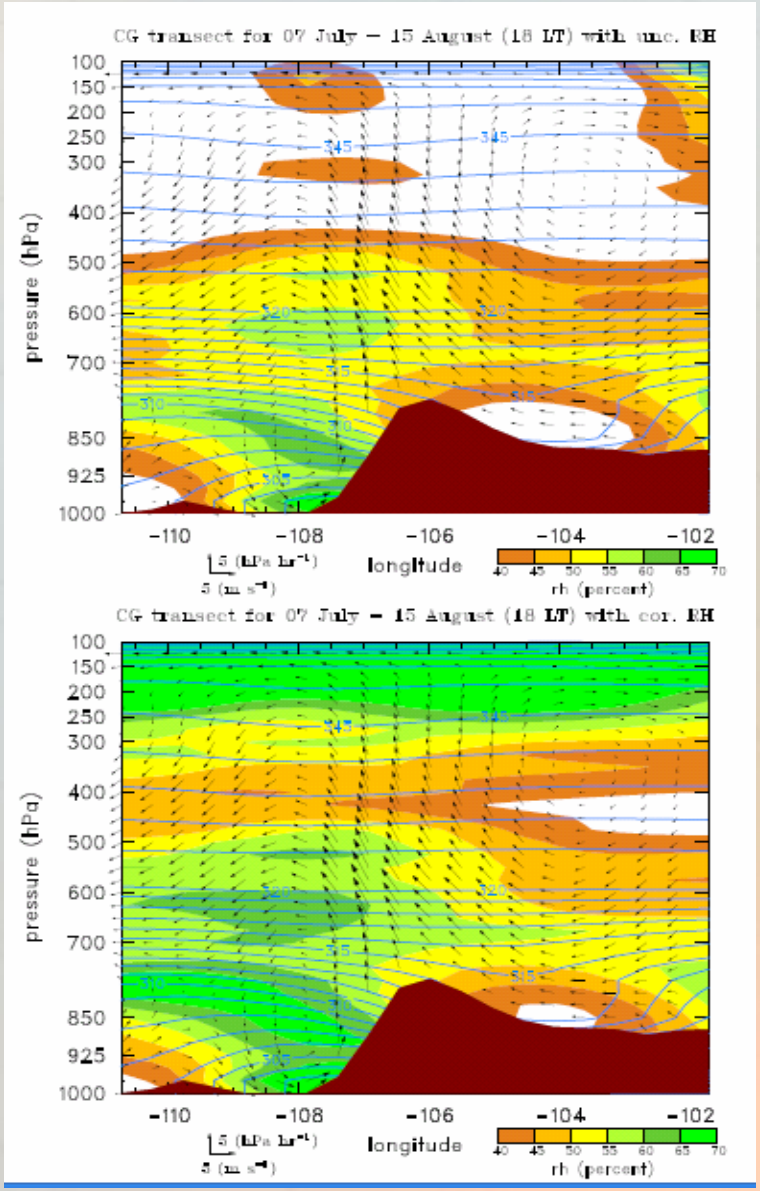
Humidity Bias Correction in NAME-EOP/NAM Sounding Network:

- SMN sonde humidity ‘corrections led to significant improvement in the description of the humidity field, and in several convective parameters such as precipitable water (PW), CAPE (<450 K/kg), CIN (<75J/kg) and in the diurnal cycle of apparent drying (Q2)’



Uncorr.

Corr.

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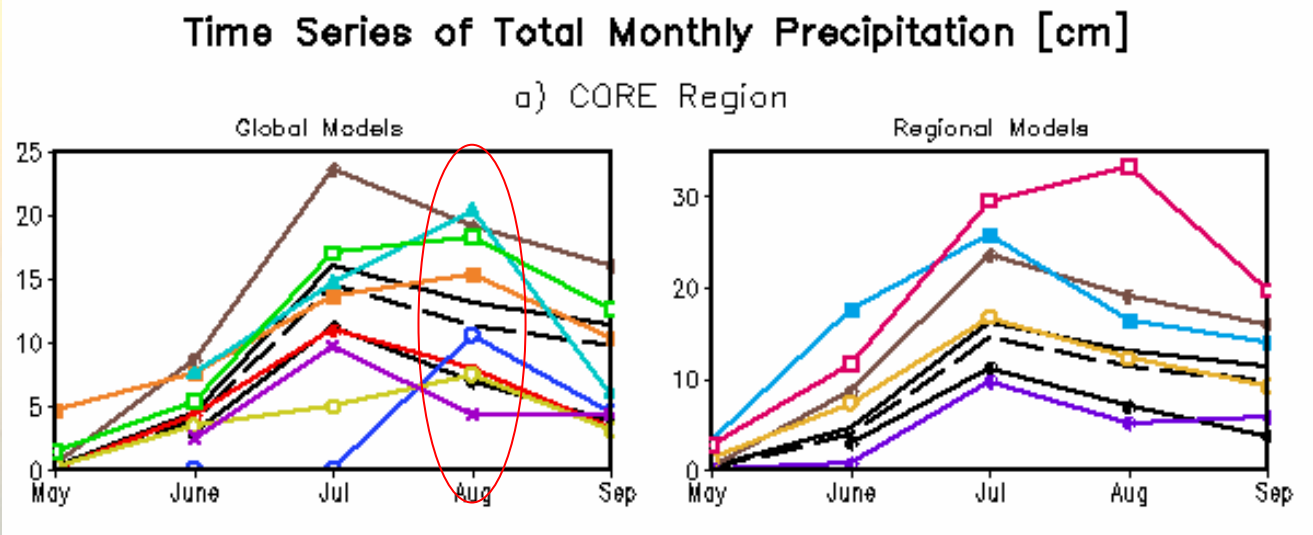
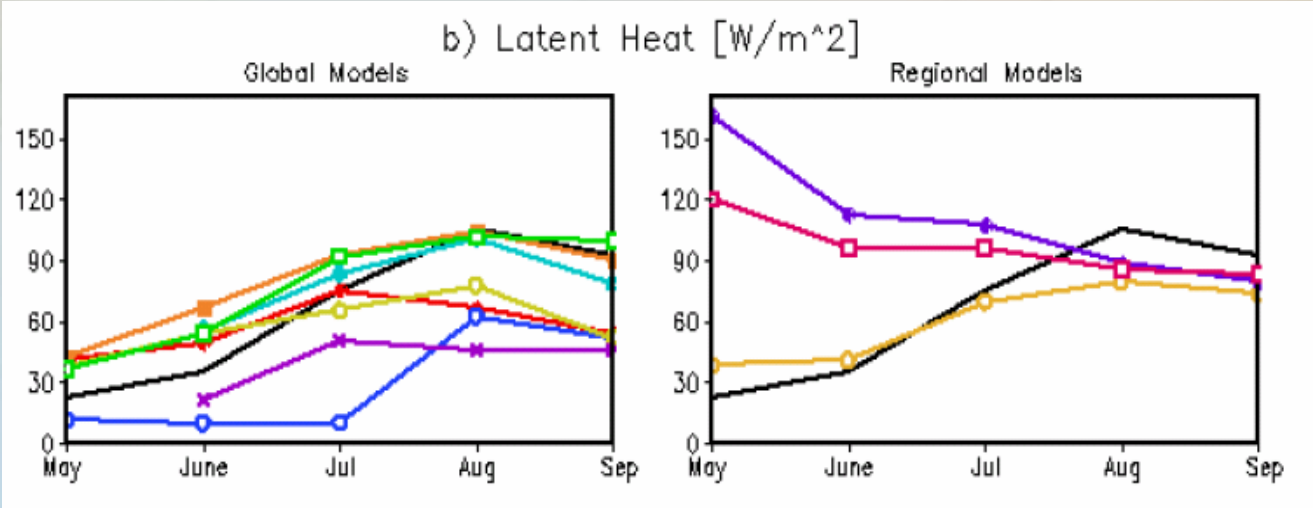
Results from NAMAP-II:





- GCMs show late (Aug.) peak in pcp.
- Both regional and GCM modeled land surface fluxes poorly constrained

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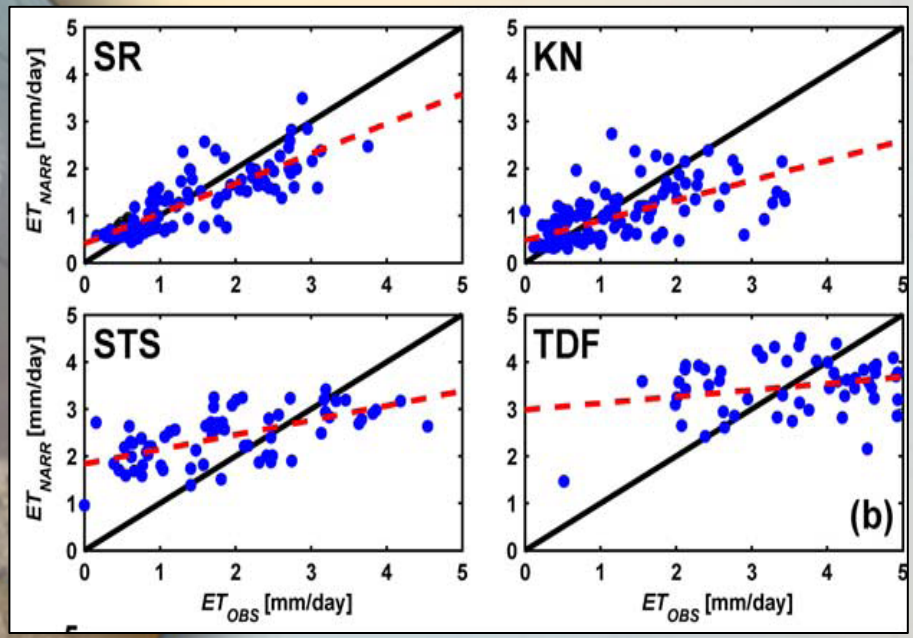
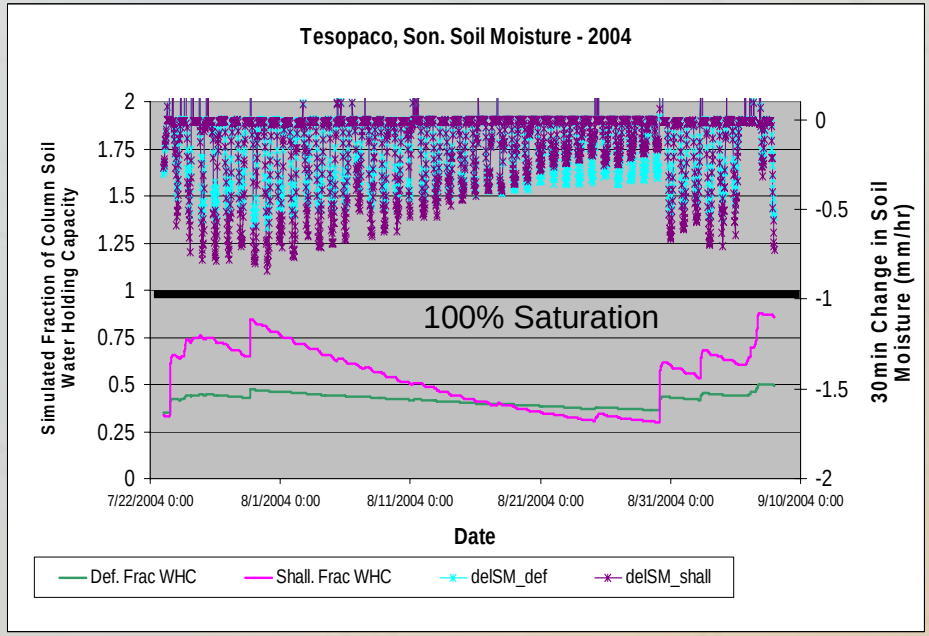
Assessing land surface model deficiencies in the NAM region:





- NARR (Noah) ET shows poor agreement with obs in the tropical deciduous forests of western Mx.
- Improper dynamic range of Noah fluxes linked to excessive soil water holding capacity in complex terrain

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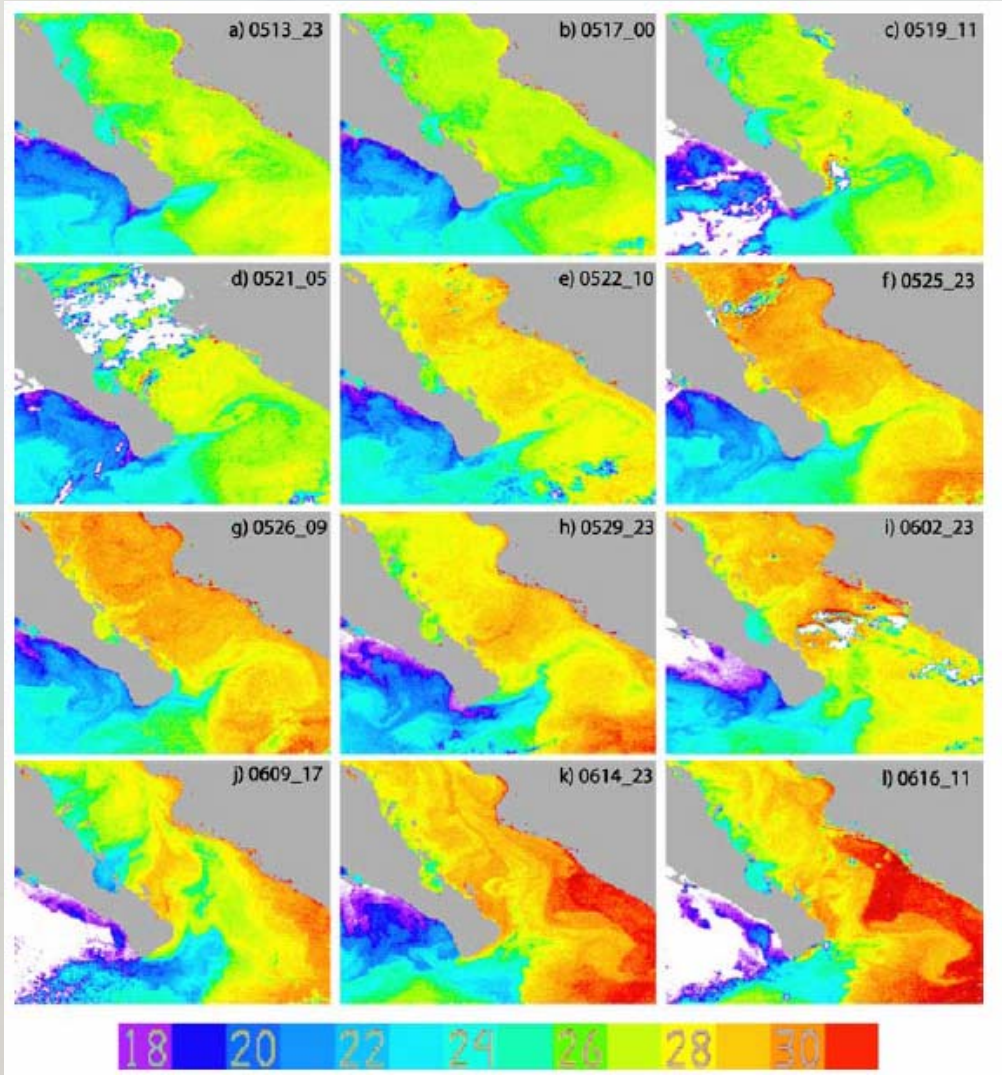
Legacy: Advances in science

- Tier I: Clear documentation of the diurnal cycle of clouds and precipitation as functions of regional physiography (over terrain, land-sea interface, open water, etc)
- Tier I: *Baseline* characterization of many land-ocean-atmosphere exchanges
- Tier I: Improved characterization of the seasonal evolution of GoC oceanic circulation and heat transport

Characterization of the seasonal evolution of the Gulf of California:

- Thermohaline depiction during NAM-04 onset cruises
- Heat budget of GoC dominated by advective flow from SE (~20-30 TW vs. ~1-2 TW from sfc heating)
- Complex flow structure around the mouth of the GoC
- Challenging for coupled modeling of NAM land-air-sea interactions



1 km AVHRR SST 13 May - 16 Jun, 2004

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Legacy: Advances in science

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- Tier I: Improved characterization of the seasonal evolution of GoC oceanic circulation and heat transport
- Tier II: Improved characterization of the regional circulation and moisture transport mechanisms within the core monsoon region…dual source regime
- Tiers II&III: Recognition of the NAM as a weakly-forced system and we now have a much improved depiction of numerous intra-seasonal modes of variability (TEW, surges, inverted troughs, mid-latitude fronts, MJO, tropical storms)

Legacy: Advances in science

- Tier III: Improved characterization of the large scale drivers (Pac. and Atl. SST modes)
- Tier III: Identification of problems in modeling land surface modulation of the regional climate…unresolved

- NAME has been an important motivator for new scientific programs (e.g. IASCLIP)

Legacy: Contributions to operations

- Comprehensive assessment of operational data assimilation and dynamical models (NAMAP-I, II, many papers, NFF)
- Elucidation of additional drivers of NAM variability (N. Pacific, MJO, inverted troughs)
- Improved communication and data sharing (NWS/SMN)
- Assessment and improvement of many remotely sensed products (e.g. SSTs, satellite QPE, GPS-water vapor, land cover, soil moisture) over the NAM region

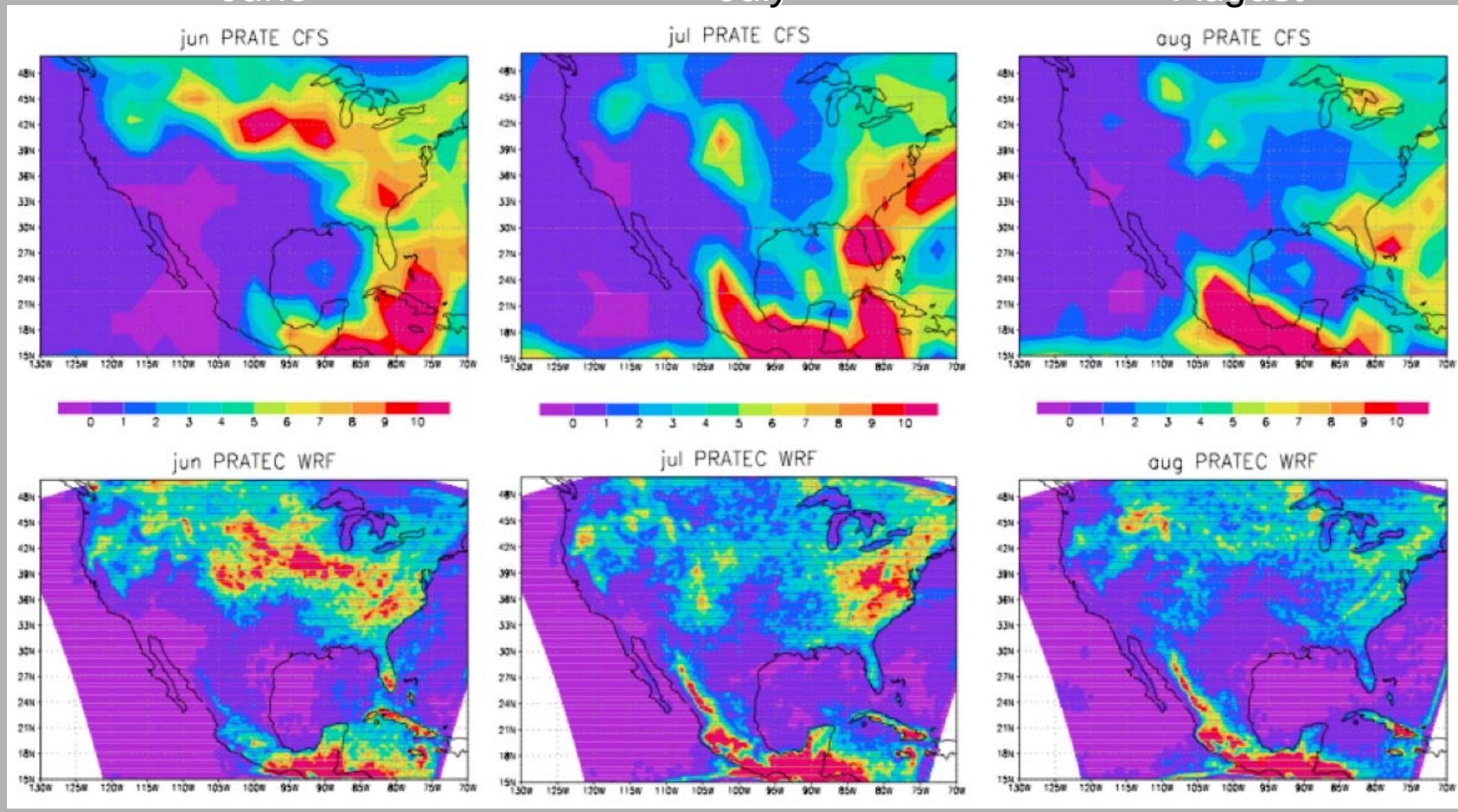
Legacy: NAME Modeling Activities

- NAMAP-II Manuscript submitted (Gutzler et al)
  - Global and regional model assessment from seasonal simulations of 2004 NAM
  - Some improvements over NAMAP-I vintage in seasonal cycle and magnitude of rainfall
- Data impact study from the 2004 EOP observations (K. Mo):
  - Identified critical role of operational sounding network and land data assimilation of realistic precipitation product in analyses and simulations of NAM
  - **Provided justification for sustained funding of Mx. sounding network**
- NAME Forecast Forum (2008-present, CPC, NCAR, U. Arizona, NWS)
  - Synthesis of several dynamical model forecast products
  - Regional products over NAME Tier II
  - Regional forecast performance tracking yr-over-yr
  - Eos brief report in press, Border Climate Summary 2x/yr

Legacy: NAME Modeling Activities

- NAM Climate Model Downscaling (Castro, Dominguez, U. Arizona, Schemm, CPC)
  - Dynamical downscaling of CPC seasonal forecast/hindcast ensembles and AR4 scenarios
  - Employment of spectral nudging at wavelengths >4dx (~400km)
  - Suggested improvement in the spatial patterns of rainfall over western Mx.
- Seasonal forecast downscaling for hydrological applications (Muñoz and Lettenmaier):
  - Statistical downscaling of CFS ensembles
  - VIC hydrological modeling

Dynamical Downscaling of Summer Precipitation (mm day^{-1}) Original CFS vs. WRF Downscaled w/ applicatins to Climate Change Studies



- Use of spectral nudging for mid-upper levels at 4dx (30km)

Legacy: NAME Modeling Activities

- Statistical downscaling of ensemble medium range forecasts (Maitaria et al)
  - Knn analog-based, non-parametric technique
  - Reliable probabilistic skill out to days 6-7 for daily precipitation
- Land surface model assessment and improvement in the NAM region (multiple groups):
  - Analysis of Noah/NARR land surface fluxes against NAM tower data (Vivoni et al)
  - Assessment of land surface schemes in AR4 vintage GCMs over the NAM region (Kelly and Mapes, NAMAP-II)
  - Assessment of land surface flux sensitivity to variable soil structures (Gochis et al)
  - Special issue of J. of Arid Environments on land surface process and ecohydrology in the NAM region

Legacy: NAME Modeling Activities

- NAME paired modelers and observationalists to focus on key problems with warm season precipitation simulations and forecasts in dynamical models (including the NCEP model production suite). One step closer to a "climate process team" approach, which is routinely used now (e.g. VOCALS, IASCLIP)

Legacy: Capacity building in NAME

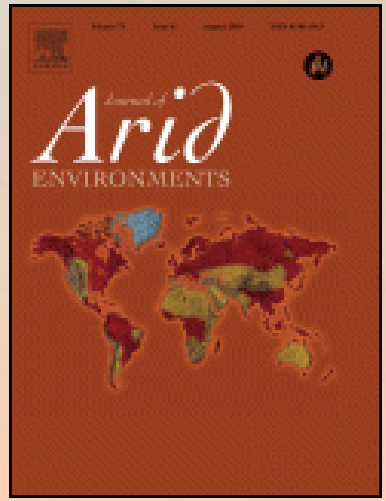
- Training (EOP field campaign measurements)
- Radar upgrades in W. Mex.
- Long-term U.S.-Mex. investigator linkages
  - Students in the field
- Some networks
  - Simple rain gauge network
  - Ongoing flux sites in Mx.
  - Augmented automated SMN and NWS/ALERT stations
- Seasonal Forecast Fora and Pubs.
  - Border Climate Summary
  - NFF

The North American Monsoon Experiment: Legacy Items:

- **Synthesis Datasets, Publications & Journal Special Issues:**
  - NAME04 rain gauge composite (Gochis et al., 2009)
  - Multisensor SST product (Wang and Xie, 2007)
  - NAME sounding composite (Johnson and Ciesielski 07, 08, 09)
  - VIC land surface retrospective (Zhu et al, 07)
  - RCDAS w/ and w/out NAME EOP obs. (Mo et al.)
  - NAMAP-I and II model archives (Gutzler et al.)

NAME-04 J. Climate-07

SMEX-04 JRSE-07



Ecohydro. J Arid Env.-09

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The North American Monsoon Experiment: Legacy Items:

Outstanding Questions and Remaining Challenges:

- Diagnostics:
  - *Coupling between seasonal (IAV) and intra-seasonal modes of variability*
  - Significant uncertainty in the distribution and scale-aggregation impacts of land-surface fluxes (incl. antecedent conditions, moisture recycling) on NAM rainfall
  - Long term trend analysis of many key hydroclimatic variables
- Predictions:
  - Lack of predictability of many large-scale modes for long-lead pred.
  - *Need for improved downscaling methods for improved short-lead seasonal and medium range predictions*
  - Resolve the failure of free running coupled OAGCMs to realistically represent key features of the NAM hydroclimate
  - Develop a process-based consensus on climate change impacts on NAM

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Remaining NAME Programmatic Activities:

- Expand NAME Forecast Forum activities
  - New regional products added for ’09
  - Expanded links to SMN, NADM and IRI
- Finalize Reg. Climate Obs. System Design
- NAM Special Session proposed at Fall ‘09 AGU Meeting
- Proposed NAM review article to ‘Reviews in Geophysics’

End

Many thanks to NAM researchers whose work was reported upon here

Thanks to CPPA for continued support of NAME