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

- Initial Experiment Planning
- Coordination of NAMAP-I
- Installation of Field Observations
- Coordination of Forecasting Activities
- NAME Forecast Forum
- Principal Field Data Collection
- Principal Analysis and Modeling
- Coordination of NAMAP-II
- NAME-Stakeholder Projects
- NAME Legacy Coordination

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

- 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)
- 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.)
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)'
Results from NAMAP-II:

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

Gutzler et. al, JClim., submitted

D. Gochis, VPM12 June 2, 2009
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.

Vivoni et. al, GRL, 2008: Gochis et al., JAE, 2009

D. Gochis, VPM12 June 2, 2009
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
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
- 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)

D. Gochis, VPM12 June 2, 2009
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

D. Gochis, VPM12 June 2, 2009
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

D. Gochis, VPM12 June 2, 2009
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/ applications 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

D. Gochis, VPM12 June 2, 2009
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)

D. Gochis, VPM12 June 2, 2009
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

D. Gochis, VPM12 June 2, 2009
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.)
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
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.

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