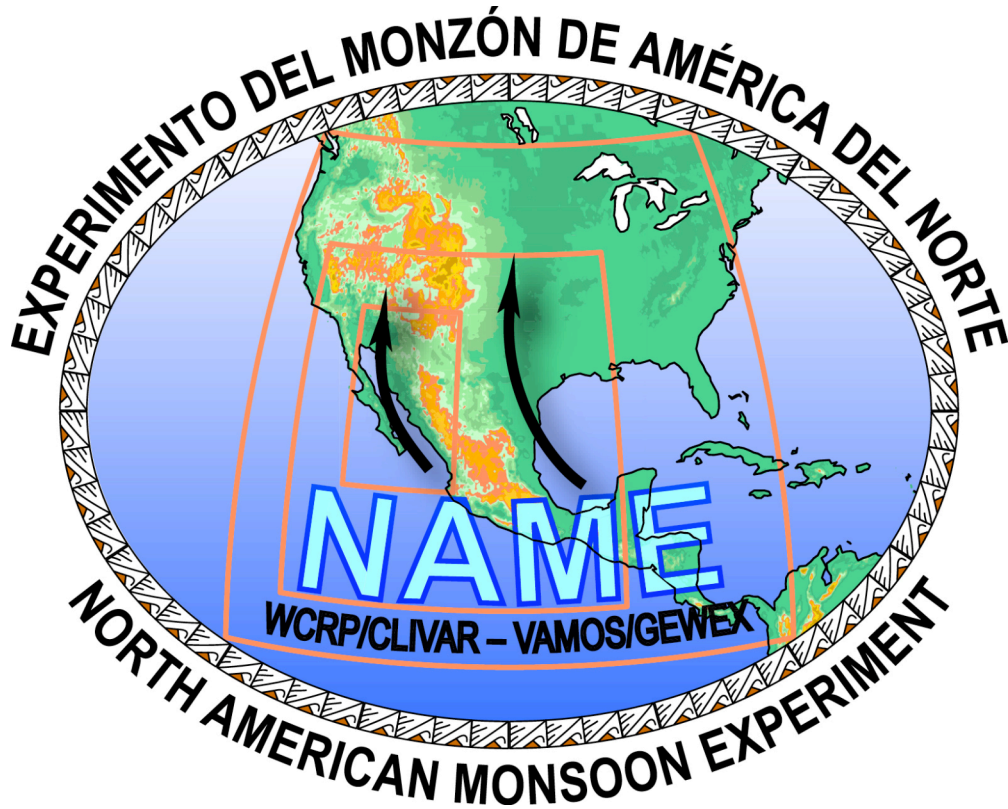


MEETING REPORT FROM THE 8TH MEETING OF THE NAME
SCIENCE WORKING GROUP



August 17-18, 2006

El Conquistador Resort and Hotel
Tucson, Arizona

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1. Executive Summary

The 8th meeting of the NAME Science Working Group (SWG-8) was held 17-18 August 2006 at the El Conquistador Resort, near Tucson, Arizona. The purpose of the meeting was to review emerging results from NAME research, document progress made on NAME research goals and programmatic milestones, and discuss future priorities for advancing understanding and prediction of the North American Monsoon System.

Several major accomplishments were reported on at the SWG-8 meeting which included:

- Submittal and archival of 97% of the NAME data sets collected during the 2004 Enhanced Observing Period (EOP) to the NCAR/EOL NAME data archive.
- Completion and impending publication of a special issue of the Journal of Climate on NAME. The special issue contains over 20 works on diagnostics and modeling research will be printed sometime in early spring 2007.
- Initiation of a North American Monsoon observing system design which will be a deliverable from the NAME research community to operational weather and climate forecasting agencies in both the U.S. and Mexico.
- Development of an additional working group within the NAME Climate Process Team that will focus on exploring land-atmosphere interactions during the monsoon.
- Progress on NAMAP-II which aims to assess the performance of several dynamical modeling systems on simulating the 2004 EOP and summer monsoon.

In addition to these accomplishments, several unresolved or emerging issues were identified which require address as NAME proceeds into the future. These issues are summarized as follows:

- Improved quantification of the impact of NAME special observations, particularly precipitation, and their associated uncertainties on monsoon predictions.
- Improved understanding of the multi-scale linkages between local, regional and large scale forcing mechanisms.
- Better documentation and tracking of operational forecast skill for a range of models, timescales and spatial scales.
- Expedited transfer of research into operations while improving the value of forecasts to regional stakeholders
- Resumption and continuation of operational soundings in northwest Mexico

This report discusses progress on these items in detail. The SWG-8 Meeting Agenda is given in Appendix A. NCAR/EOL has made all oral presentation as well as many poster presentations available online through the meeting website (www.eol.ucar.edu/projects/name/science_planning/SWG8/). Special thanks are extended to our sponsors [OGP / CPPA (Jin Huang and Ken Mooney), to Jill Reisdorf of UCAR/JOSS and to local host Erik Pytlak (NWS-Tucson).

2. Synthesis of 2004 EOP, Modeling and Diagnostic Studies

a. 2004 NAME EOP Data Status

At the time of the meeting 97% of the 2004 NAME data sets (276/284) have been submitted or linked to the NAME data archive hosted by NCAR/EOL (www.eol.ucar.edu/projects/name/dm/). These NAME datasets require over ½ terabyte of storage space. The 2004 NAME field data catalog (26 Gb) (<http://catalog.eol.ucar.edu/name/>) is also being maintained.

b. Journal of Climate Special Issue on NAME

At the time of the SWG-8 meeting, 20 full-length articles and one technical note had been approved for publication within the Journal of Climate special issue on NAME. A short overview article to the special issue was also prepared and accepted for publication. A majority of the articles present diagnostic findings from the 2004 Enhanced Observing Period. Additional articles not related specifically to the 2004 EOP present diagnostic and modeling studies on land atmosphere interactions, precipitation climatology, model sensitivity studies, and diagnostic studies on interannual variability of the monsoon. One article also focuses on human dimensions applications of monsoon climate research. The special issue is now in press and is due to be published sometime in the spring of 2007. Completion of the J. Climate special issue on NAME represents attainment of an important milestone to the NAME program as it contributes a significant body of findings on key monsoon processes and behavior.

c. Presentation of scientific findings at the SWG-8 Meeting

Sixteen oral presentations were made at the SWG-8 meeting which were organized according to the topical areas of Results from NAMAP-II, NAME Diagnostic, Modeling and Data Impact/Data Assimilation Studies, 2004 EOP Forecasting Recap and Monsoon Applications. Two plenary sessions focusing on Observing System Needs and Advancing Predictions of the NAM were also held. All of the oral presentations are publicly available through the meeting agenda which is posted on the NAME website (www.eol.ucar.edu/projects/name/science_planning/SWG8) hosted by NCAR/EOL. Detailed reports from the two plenary sessions are provided in the sections below. Given the limited time for oral presentations, significant emphasis was placed on poster presentations. Over 30 posters on a variety of topics were presented during the Thursday evening poster session. The complete listing of posters presented at the SWG-8 meeting is linked through the online meeting agenda. Several authors have also made their posters available through the poster session listing.

d. Synthesis of findings presented at the SWG-8:

The online presentations, the book of abstracts and the forthcoming papers will serve as the official records of the research presented during the workshop. Hence, a complete review of all presentations will not be provided in this report. However, several key findings and unresolved issues surfaced throughout the workshop,

which warrant more detailed discussion. These topics, with associated reference to relevant presentations are given below.

- i. Precipitation products: Precipitation is obviously a key component of the NAM and numerous techniques have been developed to estimate its timing, intensity and spatial extent. Many of the basic features of the monsoon precipitation climatology, its diurnal cycle and its association to topography have been documented and confirmed (Xie-poster, Nesbitt-poster, Lang-poster, Ahijevych-poster, Carbone-oral, Vivoni-poster, Gochis-poster, Lobato-poster). Significant uncertainty still exists as to what the dynamical and thermodynamical factors are contributing to the organization, upscale growth and propagation of convective events in the NAM region (Carbone-oral, Nesbitt-poster, Lang-poster). Additionally, large discrepancies between operational products pose present significant challenges to model verification efforts, as well as basic diagnostic analyses (Schemm-oral presentation). Notably, data assimilation experiments using the 2004 EOP data showed that some models are as sensitive to the assimilation of precipitation as are atmospheric sounding measurements (Mo-oral). Posterior correction of operational monitoring and forecast products with additional gauge data appears to provide significant benefit in removing biases in the operational products (Shi-poster, Maitaria-poster, Gochis-oral).
- ii. Circulation structures: Characterization of the atmospheric circulation in the Gulf of California region has been greatly improved as a result of the 2004 NAME EOP. Comparison between NAME EOP objective analyses and the North American Regional Reanalyses reveal marked differences with respect to land sea breeze and terrain circulations, vertical motion and convective heating (Ciesielski-oral). Numerous investigators have explored the transient structures associated with gulf surge events (c.f. Zuidema-oral, Johnson-poster Rogers-poster, Mejia-poster). The surge event during July 9-12 associated with passing of tropical storm Blas to the south of the Gulf of California is being examined in detail using enhanced soundings (Rogers-poster), PIBAL, and aircraft data (Mejia-poster). Examination of westward and eastward propagating transients and their relationship to precipitation continues to show that synoptic scale transient structures act as significant modulators of the time-mean circulation and are often responsible for episodic pulses of moisture to regions peripheral to the primary monsoon region of western Mexico (Johnson-oral, Maddox-poster, Becker-poster, Dominguez poster). Renewed interest in the role of the Intra-America-Seas (IAS-Gulf of Mexico, Caribbean and tropical North Atlantic) has arisen. Studies presented by Enfield (at the CPPA portion of the meeting on Weds. Aug. 16 and by Wang (poster) documented the influence of variability in the IAS region on the structure and bifurcation of the Caribbean low-level jet into its northward (Great Plains) and westward (Central American) components. However, improved understanding of the role of these moisture flux patterns and the mechanistic modulation of the large-scale subtropical circulation connecting the Atlantic and Pacific Oceans remain as key research needs (Saleeby-poster).

- iii. Land-atmosphere interactions: Seasonal precursory signals show strong linkage to monsoon onset and total monsoon wetness but mechanisms for long term variability in the signal remain unclear (Cavazos-oral). The land surface generally exhibits a vigorous response to monsoon rainfall following onset (Vivoni-poster and Watts-poster). Intervening dry periods, however, cause different behavioral responses in different vegetation communities (Watts-poster). Since relatively few PBL observations were collected during NAME it is unclear how the land surface fluxes interact with regional scale features such as the land-sea and mountain-plain circulations to initiate convection. Recycling of moisture appears to be particularly important after onset in drier regions along the U.S.-Mex. border and into AZ/NM (Dominquez-poster). In these regions episodic moisture flux inputs are also critical in replenishing moisture for evaporation and thermodynamic instability (Becker-poster). Evaporated moisture is hypothesized to be particularly important during relatively dry periods where, presumably, atmospheric moisture flux convergence is decreased.
- iv. Tropical storm impacts: Following an earlier study by Englehart and Douglas (2001, Int. J. Climat.) several recent studies have focused on characterization and modeling of the impact of tropical storms on various parts to the NAM precipitation regime. The direct effect of tropical storms on monsoon precipitation is most pronounced over southern Baja California (Farfan-poster) as well as west-central and southwest Mexico. In these regions mature tropical storms may drop in excess tens of inches (250 mm) of rainfall over a few days and cause widespread flooding. The remnants of these systems can also bring heavy rainfall to the border regions of Arizona, Sonora, New Mexico and Chihuahua (Ritchie-poster). However, there is significant interannual variability within the eastern tropical Pacific in the number of storms produced as well as the respective tracks of these storms. Improved understanding and operational monitoring of the factors related to the northward recurvature of these systems is critical to improving forecasts of tropical storm impacts on the NAM region.
- v. EOP Data Issues: The 2004 NAM was characterized as a moderate monsoon year experiencing, slightly above normal precipitation in western Mexico but below normal precipitation in AZ and NM. Intensive sampling of precipitation during 2004 provides limited insight into processes related to interannual variability. It was reiterated that an enhanced precipitation observing network across the monsoon region needs to be maintained in order to obtain better understanding of climatological features contributing to the interannual variability of warm-season precipitation (Carbone-oral, Gochis-oral, Mo-oral) as well as the for the development and training of satellite retrieval methodologies. Given the strong dependence of precipitation on abundant atmospheric moisture, there is a pressing need for cost effective, continuous-sampling, real-time observations of atmospheric moisture. Global Positioning System (GPS) column-integrated precipitable water (PW) retrievals showed significant sensitivity to the arrival of moist airmasses within their effective sampling domains (Kursinski-oral, Maddox-poster, Minarez-Sosa-poster). A

network of real-time reporting GPS PW observing sites would provide significant value in the characterization of atmospheric moisture fields in both cloud-free and cloudy environments which are currently hypothesized to have a positive impact on quantitative precipitation forecasts of the NAM.

The 2004 EOP was witness to an unprecedented number and diversity of atmospheric, land surface and oceanic observations. This enhanced observing system has already proven critical in understanding the circulation structure in the Gulf of California region (Rogers-poster, Ciesielski-poster and oral, Johnson-oral, Maddox-poster, Zuidema-poster, Mejia-poster, M. Douglas-poster). Unfortunately, there has been a critical loss or intermittency to the pre-existing sounding network in western Mexico since the field campaign. It is strongly suspected, that the attrition of the regional sounding network has degraded the skill of forecasts during the subsequent 2005 and 2006 monsoon seasons (as well as intervening cold seasons) and that this loss will significantly hinder improvements in operational warm season precipitation predictions. During the SWG-8 conference there was a strong call for the resumption and continuation of operational soundings in NW Mexico.

3. Transferring Research to Operations: Advancing Predictions of the NAM

a. Issues related to assessing predictability:

Results of a recent study attempting to diagnose “random” versus “potentially-predictable” components of monsoon rainfall from long-term SW U.S. climate stations were presented (Anderson-oral presentation). The technique used daily Markov Chain models and empirical intensity distributions to quantify and compare the fraction of interannual rainfall variance that arises from the random evolution of daily rainfall within the Markov chain models versus the fraction that is *not* captured by stochastic models with climatological (i.e. non-varying) precipitation characteristics. The fraction of variance not captured by the stochastic model was defined as the “potentially-predictable” component. Specific results for the SW U.S. region indicated that only about 15-20% of the interannual variance in total precipitation was considered potentially-predictable. In addition, this potentially predictable variability appears to be associated with only a small fraction of the years at a given station (<20%) in which there are systematic changes in the frequency/intensity characteristics. More generally, however, the research suggests that potential predictability studies using stochastic modeling methodologies can be used to identify particular regions or events that lend themselves to successful forecasting, thereby making them a potentially useful model metric.

b. Improving Linkages to the NOAA Climate Test Bed (*R. W. Higgins*):

The National Oceanic and Atmospheric Administration (NOAA) has formed the Climate Test Bed (CTB) to accelerate the transfer of research and development into improved NOAA operational climate forecasts, products, and applications.

The CTB will routinely serve as a conduit between the operational, academic and research communities. This facility is located at the National Centers for Environmental Prediction in Camp Springs, MD. CTB personnel include scientists from NCEP and from other NOAA and non-NOAA organizations participating in the CTB.

The CTB recognizes that enhancing the working relationship with the broader climate community is central to its mission. The CTB is taking aggressive steps to engage and leverage activities funded by other agencies and programs, in order to ensure that research breakthroughs are transferred to NOAA climate forecast operations. In this regard, it is strongly recommended that CTB enhance collaboration with CPPA / NAME in several specific areas:

Predictability of the North American monsoon system

- the relative influence of land and ocean on the American monsoons;
- the challenge of predicting rainfall on intraseasonal and seasonal time scales;
- relationships between the North and South American monsoons.

Western hemisphere warm pool and warm season prediction

- relationships to the large scale circulation;
- relationships between the warm pool and summer rainfall in the Caribbean and central US.

Droughts

- the role of the oceans and land (surface and subsurface) on droughts in the monsoon region;
- the challenge of drought monitoring, diagnosis, and prediction (e.g., predictability, observational network, coupled modeling) in the monsoon region.

Extreme events

- the role of atmosphere-ocean interactions (e.g., MJO, TEW, hurricane) and land-atmosphere interactions (soil moisture, vegetation) on intraseasonal variability and extreme events;
- the challenge of predicting extreme events (e.g., quantify the role of land vs ocean, land/ocean initial conditions, model resolution).

ENSO and warm season prediction

- relationships between ENSO and warm season precipitation in the monsoon region;
- model bias in the SE Pacific and implications to ENSO prediction.

c. Seasonal Analog Forecasts at SMN:

The methodology for creating the official SMN seasonal forecasts for Mexico was presented (A. Douglas-oral presentation). The technique seeks to maximize

the predictive power of quasi-stationary, large-scale forcing mechanisms that have either direct regional or teleconnective influence on the warm season precipitation regime. Unique combinations of climate indices and their associated forcing are utilized. The technique involves performing cluster analyses on a selection of variables or indices and selecting analog years from the historical archive. Combinations of analog years are then used to create probabilistic and/or categorical forecasts of precipitation (or other atmospheric variables) on monthly and seasonal timescales. Results for the 2006 monsoon were shown to be reasonable with respect to observations to date. It was recommended that the technique be extended for the CONUS as an additional experimental forecast.

d. Regional Modeling and Predictability of the NAM:

Several regional and global models were compared with respect to diagnosing the processes related to precipitation character in selected regions of central and southern North America (Berbery-oral presentation). The examination of model results, with emphasis on the diurnal cycle of precipitation, from a variety of scales provides insight into how process representation at different scales affects model precipitation behavior. The main results indicate significantly varying influences of thermodynamic forcing, attributed to surface processes and, presumably, access to low level moisture, and dynamical forcing, largely attributed to moisture flux convergence. The diurnal cycle of moisture flux convergence was found to be particularly critical to Great Plains precipitation behavior. In contrast, the monsoon region of NW Mexico showed comparatively more dependence on thermodynamic modulation, presumably by the land surface. However, the problem of convective initiation is common to both regions, particularly in coarse resolution models. These model errors were attributed to deficiencies in how “local” processes such as land/atmosphere interactions, complex terrain, coastal regions, etc. modulate deep convection.

e. Expanding the mission and scope of the NAME Climate Process Team (*E. Vivoni*)

During the Executive Session of the SWG-8 a brief discussion was held on the current activities of the NAME Climate Process Team (CPT). The NAME-CPT is currently engaged in the NAMAP-II effort as well as in the exploration of the representation of convection in large scale models. However, there was general consensus that the CPT should be expanded to foster interaction and involvement of those working in land-atmosphere interactions. In particular, an opportunity was identified to capitalize on the NAMAP-II intercomparison project, by focusing on the diagnosis of the simulated land-atmosphere interactions. This new effort stems from recent field observations and modeling studies suggesting the potential for land surface effects on the monsoon system through variables such as soil moisture and surface turbulent fluxes. As each modeling effort utilizes a potentially different land surface model (LSM), the details on the land surface schemes, initialization and parameterization need to be fully documented. Intercomparison of the results pertaining to the land-atmosphere interface can be performed from the current model simulations with

respect to a limited set of available field observations. Furthermore, diagnosis of the effects of the land surface conditions (soil moisture, evapotranspiration, etc.) and their spatial patterns on the lower atmospheric processes (convective initiation, rainfall, etc.) can be investigated. This activity will provide insight into the *need for* and *approach to* improved representation of land surface conditions in coupled models of the monsoon system.

f. Recommendations on seasonal forecasting and transferring research to operations:

To facilitate improved understanding, assessment and use of the seasonal forecasts the following recommendations were put forward:

1. Collect and display latest statistical and dynamical seasonal forecasts of the monsoon on the NAME webpage (as during NAME 2004).
2. Extend A. Douglas' analogue forecasts to include both the US and Mexico
3. Focus the CPC hazards / benefits assessment for the global tropics on a hazards / benefits assessment for the Americas. In particular, week 1 and week 2 forecasts of (i) hazards / benefits related to precipitation, tropical cyclones and (ii) monsoon onset, advance and precipitation totals. See: <http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml>. Click on "MJO Weekly Update"
4. Generate seasonal precipitation forecasts and Monsoon bulletin issued at a minimum of once per year.

4. Update on NAMAP-II (J. Schemm and D. Gutzler)

- a. Summary of Progress: During the past year NAMAP-II has proceeded into its analysis phase. In late 2005 the new NAME 2004 sea surface temperature analysis was completed and made available to participating modelers. Output protocols were developed, including two separate data sets: (a) a many-variable time series of output maps, resolving the diurnal cycle, for spatial analysis as was done in NAMAP-I (analysis to be carried out at UNM and NCEP); (b) a set of "MOLTS"-style time series with much higher temporal resolution for more detailed thermodynamic and hydrologic analysis (analysis to be carried out at U Miami). A NAMAP-II web page and email listserv are supported by EOL. Simulations of the 2004 warm season have been completed, and output has been received at NCEP, from 6 global models and 4 regional models. Additional regional modelers expressed interest at this meeting and may submit several simulations. Analysis of the output has begun; very preliminary results were presented at this meeting and a more expansive presentation of results will be prepared for the Climate Diagnostics and Prediction Workshop in October.

- b. Unresolved issues and expanded analyses: NAMAP-II validation data have to date included only operational precipitation and circulation analyses. One of the motivations for NAMAP-II has always been to utilize enhanced observations from the 2004 field campaign. As NAME 2004 data become publicly available the NAMAP-II analysis team will become one of the first users of some of these data sets. The NAMAP-II PIs will need to collaborate closely with NAME 2004 data producers to ensure that NAME data are properly used, and that model-data comparisons are carried out in an optimal way.

Recommendations for NAMAP-II data access:

The NAME SWG now recommends that NAMAP-II output be made available to the community, as was the case for the first round of NAMAP-I simulations. An independent analysis of moisture transports based on NAMAP-I output was presented at this meeting and it is hoped that the new NAMAP-II runs might be used to similar advantage. In response to this recommendation discussions have been initiated between NCEP, where the NAMAP-II archive is now stored, and EOL, which maintains the principal NAME data archive and has a better infrastructure for public dissemination of large data sets.

5. NAME Forecasting Experience (*E. Pytlak*)

NAME forecasters from 2003 and the 2004 field campaign continue to work on monitoring, classifying, and researching key synoptic and mesoscale features which affect the NAME Tier I and II domains. The main efforts since 2004 have also shifted toward educating operational forecasters and key users like the military and media. There are also many research avenues still available for further study by research institutions, not only at the climate scale, but also at the synoptic and mesoscale.

Based on tracking data from 2003 through 2006, it is now apparent that 2004 was an unusually weak year for upper level inverted troughs. It is clear these upper level features strongly modulate convective outbreaks throughout Tier-I. However, because of their limited number in 2004, they were not sampled particularly well by the NAME dataset. The initial hypothesis on how these features are structured still needs to be tested and refined. It is also possible that forecasting the number and track of these systems in any given boreal summer could yield some benefit to interannual monsoon predictability.

The better understanding of Gulf Surges resulting from the field campaign is already yielding some improvements in not only short term quantitative precipitation forecasts, but also dewpoint, temperature, wind and relative humidity forecasts. It appears that outflow-dominated surge events, which can be as much as 2km deep, are mainly associated with MCS outflows, and can lead to upswings in

convection over Arizona and northern Sonora. However they tend to be brief and detrain quickly. Stronger, full Gulf Surges, which are a fast-moving gravity bore or gravity bore/Kelvin wave are much longer lasting and have much greater impact in northern Tier-I compared to weaker outflow surges. The best news is that these stronger surges are being detected and modeled by our higher resolution operational NWP models, provided there is adequate data over the southern Gulf of California.

Due to the high incidence of backdoor cold fronts in 2004, there is a rich dataset to study these features. This is critical to New Mexico, eastern Arizona, and northern Chihuahua since these fronts are key flash flood triggering mechanisms in northeast Tier-I. Initial hypotheses on these fronts have to be refined in light of the NAME dataset.

Hurricane Javier (IOP-10) was a golden opportunity to monitor recurvature and extratropical (ET) transition in Tier-I and northeast Tier-II. Javier and his mid level remains produced the heaviest rain of any large scale feature during the 2004 monsoon. The data suggests that conceptual models on oceanic ET transitions also apply to ET transition in complex terrain, which theoretically will increase the predictability of heavy precipitation distribution, precipitation duration, and even tropical cyclone-related wind evolution. However, research since 2004 indicates that the interaction between a tropical cyclone, incoming upper level westerly troughs, and mountainous terrain is exceedingly complex, and subtle changes in the synoptic environment lead to significant changes in the ET transition.

The main finding from NAME forecasting is that more real-time data, particularly from the Gulf of California and the enhanced upper level sounding network, generally leads to better short and medium-term weather forecasts. Missing Mexican upper air data, like what was observed in 2005 and during the latter half of 2006, can at times significantly degrade model performance throughout Tier-I, and hamper the ability of operational forecasters to adequately gauge the strength and potential impact of larger-scale triggering features.

6. NAM Forecaster Training Module (E. Pytlak)

Now that the research findings are being published and presented, there is a critical mass of information to share with operational field forecasters. The COMET module proposal submitted through the NWS NSTEP process did not survive for FY07. However, NWS Tucson and NWS Western Region Headquarters have enough graphics and software capability to produce a video training module on their own. The initial “strawman” outline includes:

- An overview of the North American Monsoon system, including the large-scale driving mechanisms and moisture origins;
- Description of the large-scale monsoon flow regime, especially with respect to convective initiation and organization;

- Identifies key triggering and convective organizing mechanisms embedded within the flow regime (i.e.: IVs, backdoor cold fronts, tropical cyclone interactions)
- Identifies key mesoscale features, including Gulf of California surges, moisture flux and transport from subtropical rain forests, and orographic precip focusing;
- Expands on severe thunderstorm and flash flood forecasting implications, including influences of pre-monsoon burn areas on flash flood and debris flows;
- Explains medium-range influences on the monsoon system, including ENSO, MJO, and tropical cyclone activity in both the Atlantic and Pacific basins;
- Discusses precipitation climatology in both deterministic and probabilistic frames; and
- And finally offers an overview of societal impacts, including public safety information unique to the monsoon region.

7. Recommendations on NAME Hydrometeorological and Societal Applications Research (*D. Gochis and A. Ray*)

- a. Hydrological issues: The NAME Hydrometeorological Working Group (NHWG) continues to operate as a loosely affiliated assemblage of researchers pursuing various topics of hydrological research related to the NAM. Publications from several members are beginning to populate the literature and several of these findings were presented at the SWG-8 (Cavazos-oral presentation, Zhu-poster, Toll-poster, Vivoni-poster, Gochis-poster). Despite some early progress on improving understanding of hydrological processes in the NAM region significant issues remain with respect to improving operational monitoring and prediction of NAM streamflow, soil moisture and evapotranspiration. The following recommendations were put forth as opportunities for further integrating research in NAM process hydrology, broader NAME research and operational forecasting agencies (Gochis-oral presentation):
 - i. Increase collaboration between NAME hydrometeorology working group and NWS Office of Hydrology, including Hydrometeorology Test Bed and operational forecasters at the SMN and CNA.
 - ii. Maximize utilization of the current generation of satellite quantitative precipitation estimation (QPE) and model quantitative precipitation forecast (QPF) products. Focus on analyzing and correcting for bias structures in operational QPE and QPF products.
 - iii. Continue basic research on improving understanding of land-atmosphere exchange processes in the semi-arid southwest using a combination of targeted field studies and physically-based modeling studies.
 - iv. Quantify the influence of strong gradients in terrain, vegetation and hydrometeorological/hydroclimatological forcing from NW Mexico to the

central Rocky Mountain region on the evolution of the warm season circulation. Extend existing statistical studies on the affect of antecedent hydroclimatic conditions (e.g. snowpack, soil moisture) to include model simulations using physically-based hydrological models.

- b. Societal Applications: Plans for improving the linkages between NAME climate research and societal applications were presented (Ray-oral presentation). These plans included several recent activities including, a report from a binational workshop on Monsoon Region Applications held in Guaymas, Son. in early May, 2006, a forthcoming paper in the J. Climate special issue on NAME, and several proposals submitted to NOAA CPPA, SARP and RISA programs as well as non-NOAA funding sources. In addition to several recommendations for improving coordination between the NAME physical science and societal applications communities, three key recommendations for synthesis products were put forward:
 - i. Conduct a regional integrated assessment focused on the border region to identify transboundary challenges arising from managing commonly shared resources, both natural and human, and identify highly interconnected social and economic activities that are influenced by climate.
 - ii. Establish a virtual regional climate center for northwest Mexico and the U.S.-Mexico border region. The objectives of the center would include the integration of groups at different educational and governmental entities, production of useful products and information on climate and hydrometeorology for different sectors of society.
 - iii. Development and publication of a bilingual, annual or semi-annual Monsoon Outlook whose purpose would be to distill and synthesize current research and forecasts of the monsoon into an accessible language for lay users and stakeholders throughout the monsoon region. Publication of the Monsoon Outlook would be a collaborative effort between NAME physical scientists, operational agencies producing seasonal forecasts of the monsoon (e.g. NCEP and SMN) as well as human dimension scientists in the Mexico and the U.S.

8. Progress towards an Observing System Design (*R. Johnson*)

This session opened with a series of presentations on NAME observing systems. Paul Ciesielski reported on the overall success of the NAME sounding network, but pointed out that several important issues remain with respect to data quality. Most importantly, a dry bias appears in the SMN sondes, ranging from 10% in the lower troposphere to 30-40% near the tropopause. This bias is likely related to contamination of the Vaisala humidity sensor by aging packaging material, a problem also identified in previous field programs. Plans are underway to work with NCAR/EOL to develop a correction algorithm for this humidity bias and apply it to the NAME sounding data set. P. Ciesielski also reported on discrepancies between NARR surface fluxes and those observed at the few NAME flux sites. Rob Kursinski reported on the deployment the GPS PW network during NAME and

explained how it helped to delineate the temporal and spatial variability of the PW field during the experiment. Two deployments in close proximity near Hermosillo indicate substantial variability in PW on small scales during the convective season, but reduced variability during the post-monsoon season. Plans were presented for a future network of PW sensors across the crest of the SMO from north to south collocated with the rain gauge network. Dave Gochis reported on results from the deployment of the NAME Event Rain Gauge Network (NERN), which has yielded a wealth of information about the diurnal cycle and westward evolution of precipitation from the SMO. Another important source of precipitation data is from the simple rain gauge (daily) network supported by IMTA. There are both daily and hourly merged gauge precipitation data sets available from the 2004 EOP from these networks at NCAR/EOL. Finally, Pingping Xie discussed the Multi-Platform-Merged (MPM) SST analysis over the NAME domain. This product (0.25°, 3-h) is based on the GOES, TMI, AMSR, and NOAA 16/17 satellite data sets. It will be used as the common SST field for the NAMAP-II model runs.

Recommendations on an Observing System Design:

Following the presentations, there was a discussion of recommendations regarding future observing system needs for the North American Monsoon. First, it was recommended that the work on NAME humidity sensor biases be continued and brought to completion with the release of a corrected sounding data set. Also, the need to re-establish a strong operational sounding network over Mexico was emphasized, in light of the recent cutbacks in SMN operational sites and consequent negative impact on prediction. These stations are important for monsoon prediction on multiple time scales, and efforts should be undertaken to quantify their forecasting impact. Given limited resources, studies should be conducted to determine which sites/locations are most important for monsoon prediction. Further improvements to prediction could also be realized through a GPS WV network over Mexico, with GTS real-time capability so the data can be used in model initialization. It is also important to establish and maintain a quality rain gauge network, whose data can be merged with remotely sensed observations from radar and satellite, for improved atmospheric and hydrologic predictions and applications. It is also recommended that the SMN radar network be re-enabled to improve both short-term warnings and forecasts, as well as establish precipitation climatologies in the region. Finally, there is a need for NAME to coordinate with existing flux-monitoring programs in Mexico as well as establish enhanced oceanographic measurements in the central and southern GoC (e.g., SST measurements) via buoys or ship cruises. Along these lines it was suggested that NAME improve and/or strengthen linkages of the long-term observing system (as a post field phase deliverable) to GEOSS (Global Earth Observation System of Systems).

9. Update on NAME Milestones:

During the SWG-8 the NAME Program Milestones were briefly discussed and updated, where relevant, as 'COMPLETED' or 'IN PROGRESS':

- FY04 - Implement NAME 2004 Field Experiment (**COMPLETED**)
- FY05 - Evaluate impact of data from NAME 2004 on operational analyses (**IN PROGRESS**)
- FY06 - Assess global and regional model simulations of the 2004 North American monsoon (NAMAP-II) (**IN PROGRESS**)
 - Deliver quality controlled name data sets and synthesis products to NAME data archive
- FY07 - Evaluate impact of changes in model parameterization schemes (NAME CPT) (**IN PROGRESS**)
- FY07 – Quantify the relative influence of oceanic and land surface boundary conditions on simulations of the NAME 2004 monsoon (**IN PROGRESS**)
- FY08 - Measure improvements in model simulations of monsoon onset and variability (includes NOAA operational GFS/CFS)
- FY09 - Implement recommended changes to operational climate forecast systems to improve skill of warm season precipitation forecasts

10. New Business

- a. NAME SWG Member Rotation: Three existing members of the NAME SWG are scheduled to rotate off during Oct. 2006. These members are Jorge Amador, Richard Johnson and Robert Maddox. Nominations for new members are currently being solicited and elections within the NAME SWG will proceed during November, 2006. At the SWG-8 meeting in Tucson the chairpersonship of the SWG was transferred from Wayne Higgins to David Gochis. Wayne Higgins has requested and been granted permission to remain on the NAME SWG for an additional three year rotation. Following the NAME SWG it was determined that Miguel Cortez (SMN) was scheduled to rotate off of the SWG during 2006. However, it has been acknowledged that for NAME to fulfill its purpose of transferring research to operations it is critical to have active participation from an official representative from each national operational forecasting agency in the U.S. and Mexico. Therefore a request has been forwarded to the NAME SWG to establish two permanent positions within the SWG dedicated to a member from each the U.S. National Weather Service and the Mexican Servicio Meteorológico Nacional. Presently, Wayne Higgins and Miguel Cortez are expected to serve as these official representatives from their respective agencies. Replacement of these appointments will occur at such time as the individual representatives choose to step down, the NAME SWG decides to replace them or dissolves the positions altogether.
- b. The NAME SWG-9 meeting will be held in conjunction with the AGU/UGM Joint meeting in Acapulco, MX, May 21-25, 2007.
- c. Development of NAME list of citations: The NAME-SWG and broader NAME community have been encouraged to submit their citations and papers to NCAR/EOL for online posting through the NAME website.
- d. Development of list of NAME-relevant sessions at conferences:
 - i. There will be no NAME specific session at the 30th Annual NOAA Climate Diagnostics and Prediction Workshop (CDPW) this year. However, it was

recommended that future NAME sessions at the CDPW focus on multi-scale interactions

- ii. AGU/UGM 2007 NAME Sessions: A Union session on NAME has now been proposed and will provide an overview of the NAME program and NAME-related activities. Discipline-specific sessions on land/atmosphere interactions and NAM modeling and diagnostics studies are also being coordinated in conjunction with the Union session.

Appendix A. Meeting Agenda

Meeting Agenda for NAME SWG-8

Aug. 17-18, 2005

Tucson, AZ

Thurs. Aug. 17

9:00 Opening remarks (Gochis)

9:05-9:50 Results, lessons and discussions from NAMAP-II (Jae Schemm)

9:50-10:00 BREAK (coffee, fruit)

10:00-12:00 NAME Diagnostics, Modeling Data Impact/Data Assimilation Studies (Mo, Mapes)

12:00-1:00 LUNCH (provided)

1:00-2:00 NAME Forecasting Session (Erik Pytlak)

- Recap of 2004 EOP forecasting activities
- Forecasting problems for further investigation
- Comments on monsoon observations
- NAME COMET/Training Module

2:00-3:00 Reports from the Monsoon Region Applications Workshop and NHWG (A. Ray/D. Gochis)

3:00-3:30 BREAK

3:30-3:45 NAME Plenary Overview (Gochis/Higgins)

3:45-5:00 NAME Plenary Discussion I: Observing system needs (Johnson)

Paul Ciesielski (Sounding data quality issues)

Rob Kursinski (GPS water vapor measurements)

Dave Gochis (Rain gauge networks)

Ping-ping Xie (SST Datasets)

5:00-6:30 NAME Poster session / happy hour

Fri. Aug 18

8:00-9:30 NAME Plenary Discussion II: Advancing Predictions of the NAM (Higgins/A. Douglas)

Bruce Anderson (Potential predictability of monsoon precipitation)
Art Douglas (Creating seasonal forecasts at SMN)
Hugo Berbery (Regional modeling and predictability of the NAM)

9:30-9:45 BREAK (coffee, fruit)

9:45-12:30 NAME SWG Executive Meeting

- Outline meeting report
- Update on the pathways transferring research to operations...
- NAME milestones/roadmap/timeline
- NAMS Education module Report to the Nation/COMET/lesson plans
- NAME SWG Membership Rotation (FY07)
- New Business

12:30 ADJOURN