**NAME Science Working Group Meeting (SWG-7.5)**


*NAME Science Working Group*

*Panel Report from the NAME Science Working Group Meeting (SWG-7.5)*

*October 28, 2005*
*State College, PA*

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November 2005

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**Executive Summary**

The NAME Science Working Group Meeting (SWG-7.5) was held on 28 October, 2005 in State College, Pennsylvania. The objectives of the workshop were to review emerging findings from the NAME 2004 Enhanced Observing Period (EOP), to update the status and quality of the NAME 2004 data sets, and to review progress on NAME modeling, diagnostic and applications studies. Additional tasks included updating the Action Items defined during the NAME SWG-7 meeting in Mexico City and updating the NAME Program Milestones and list of Value-added Data Products developed from EOP observations.

The expected outcome of the NAME SWG-7.5 meeting is a report that summarizes (i) the status of EOP datasets and their archival at NCAR/EOL; (ii) emerging scientific findings from EOP analyses; (iii) additional NAME-related diagnostic and modeling activities; and (iv) a review of how these emerging findings are addressing the NAME Science questions articulated in the NAME Science and Implementation Plan.

This report discusses progress on these items. It includes a list of ACTION items and summaries of the meeting sessions. The Meeting Agenda, which was organized into six sessions (NAME Data Management, Synthesis of findings from the 2004 NAME-EOP, NAME Diagnostic Studies, Coordination of NAMAP2, NAME Applications, and Synthesis of NAME Science Issues) is given in Appendix A.

Special Thanks are extended to our sponsors [OGP / CPPA (Jin Huang and Ken Mooney) and our local host, Paul Knight of the Pennsylvania State University.

**ACTION ITEMS:**

The following an updated list of Action Items which were originally developed from the NAME 2004 Data Analysis and Seventh NAME Science Working Group (SWG-7) Meeting. They are organized into several categories: Documentation; Datasets; Modeling and Applications; Publications; Education Module; Meetings; and SWG Rotation. NAME SWG members, and NAME PIs are expected to contribute to the completion of these Actions. Since a primary goal of the SWG7.5 was to update this list, the various Action Items are labeled as 'COMPLETED', 'IN PROGRESS', 'ALTERED' or 'NEW'.

**Documentation:**

**Action 1** **COMPLETED:** Prepare and distribute NAME Data Analysis and SWG-7 Meeting Report (Higgins and SWG). The SWG-7 Meeting report was completed and made publicly available during late-spring of 2005.

**Action 2** **ALTERED:** Update and disseminate NAME Science and Implementation Plan (Higgins and SWG). Instead, the SWG has updated the NAME Modeling and Data Assimilation Strategy document (see below) and will pursue these activities over the next several years.

**Action 3** **COMPLETED:** Develop a list of NAME "Synthesis Products" that are expected to emerge from NAME and the plans for achieving them (SWG). This list was developed and published within the SWG-7 Meeting Report.

**Action 4** **COMPLETED:** Revise NAME milestones to make NAME Tier 3 activities more visible and explicit. A list of NAME milestones was developed and published within the SWG-7 Meeting Report.

**Datasets**

**Action 5** **IN PROGRESS:** Evaluate progress on the development of the NAME post-field phase data set, including dates of deliverables (SWG). Prior to the SWG-7.5 meeting Steve Williams of the NCAR Earth Observing Laboratory (EOL-formerly UCAR JOSS) was appointed as the ex-officio NAME data supervisor and has taken on responsibility for coordinating NAME data submission and archiving.

**Action 6** **IN PROGRESS:** Evaluate progress on NAME 2004 value added products (SWG). This is an ongoing activity in conjunction with NAME research activities.

**Modeling and Applications**

**Action 7** **COMPLETED:** Update strategy in NAME Modeling and Data Assimilation "White Paper" (Mo, SWG). The updated document was finalized during the summer of 2005 and is now publicly available on the NAME project website.

**Action 8** **IN PROGRESS:** Establish protocols, expand participation and carry out NAMAP2 (Gutzler, Mo, Schemm, Shi, Higgins). As reported below is Section 1.4 logistical

planning for NAMAP2 is at a very mature stage and teams are beginning to prepare for their model runs.

**Publications**

**Action 9** **COMPLETED:** Publish an article entitled "The North American Monsoon Experiment (NAME) 2004 Field Campaign and Modeling Strategy" in the *Bulletin of the American Meteorological Society* (Higgins, SWG, NAME PIs). Article has been accepted for publication and is due in print in January 2006.

**Action 10** **IN PROGRESS:** Contribute to a Special Issue of the *Journal of Climate* on NAME (SWG, PIs). Submissions have been completed and are now in the review process. Issue is expected to be in print in late 2006.

**Education Module**

**Action 11** **COMPLETED:** Release "beta-version" of NAME "Reports to the Nation" monograph at the NOAA booth during the March 31-April 3 National Science Teachers Association (NSTA) Annual Conference in Dallas Texas. Distribute Questionaire for teachers to evaluate the document (OGP)

**Action 12** **ALTERED:** Hold focused workshop in Tucson, AZ during the summer of 2005 inviting teachers that responded to the questionnaire (Action 1.10) in order to solicit more specific input on the use of the NAM Monograph and the lesson plans being developed by Steve Uyeda (OGP). The focused workshop has been postponed.

**Action 13** **COMPLETED:** Post photos from NAME 2004 on the JOSS web site so that they can be incorporated into the NAME "Reports to the Nation" monograph.

**Action 14** **IN PROGRESS:** Work with Steve Uyeda to complete remaining 6 of 10 lesson plans for NAME curriculum unit.

**Action 15** **POSTPONED:** Hold NAME Session at March 2006 NSTA Annual Conference focused on the North American Monsoon Presentations by NAME scientists. Walk through the education materials.

**Meetings**

**Action 16** **ALTERED:** Coordinate the 8$^{th}$ NAME Science Working Group Meeting with the 9$^{th}$ VAMOS Panel Meeting in Foz do Iguazu, Brazil (March 2006). Due to several conflicts it was not feasible to coordinate the 2006 meeting of the NAME SWG (SWG-8) with the 9$^{th}$ VAMOS Panel Meeting to be held at Foz do Iguaçu.Brazil. Instead, the SWG-8 meeting will be held in conjunction with the annual NOAA-CPPA Principal Investigators meeting in Flagstaff, Arizona during the week of 14 August 2006.

**Action 17** Coordinate future NAME SWG meetings with VAMOS Panel Meetings (Higgins, Gochis, SWG).

**Action 18** **COMPLETED:** Organize a Special Session on NAME 2004 and NAME Modeling Activities at 30th Climate Diagnostics and Prediction Workshop, State College PA (24-28 October, 2005). Results of this session are summarized in this report.

**SWG Rotation**

**Action 19** **COMPLETED:** Carry out the NAME SWG 2005 membership rotation (Higgins, SWG) During 2005, NAME SWG members Chidong Zhang, Mike Douglas and Siegfried Schubert completed their membership rotations. Elections were held and new members are Enrique Vivoni, Tereza Cavazos, Brian Mapes and Steve Williams (ex-officio).

**Action 20** **COMPLETED:** Modify ToR for rotation of the NAME SWG chair (SWG). CLIVAR VAMOS accepted the changes in ToR and the pending SWG Chair rotation. Following SWG-8, Dave Gochis will take over as chair of the SWG and Wayne Higgins will become a member of the SWG for one additional 3-year term. During the transition period prior to SWG-8, both Wayne and Dave will function as co-chairs.

**SWG-7.5 ACTION ITEMS:**

**Action 1** Develop a meeting report from the SWG-7.5 Meeting, focused on synthesizing key NAME findings to date

**Action 2** Continue planning for the SWG-8 meeting in Flagstaff, Arizona to be held in conjunction with the annual NOAA-CPPA investigator's meeting.

## 1. Session Summaries

The NAME SWG-7.5 meeting was held on Fri. October 28, 2005 immediately following the conclusion of the 30th Annual Climate Diagnostics and Prediction Workshop (CDPW) in State College, Pennsylvania. The purpose of the SWG-7.5 meeting was to summarize the status of data sets collected during the 2004 NAME Enhanced Observing Period (EOP-04), to review recent progress in NAME research, including emerging findings from the EOP-04, to discuss recent diagnostic and modeling advances related to North American Monsoon processes and to plan for future activities. The final session of the CDPW (Session 11), entitled, *Results from NAME 2004*, provided a convenient opportunity to review several of NAME related research projects.

At meeting onset, Dave Gochis presented an overview of the expected goals of the meeting. This talk included a brief review of the NAME science questions that are presented in the NAME Science and Implementation Plan, as well as a review of the NAME Program Milestones. The purpose of this review was to frame the discussions on NAME research which were put forth in the following 6 sessions:

1) NAME Data Management
2) Synthesis of findings from the 2004 NAME EOP
3) NAME Diagnostic Studies
4) Coordination of NAMAP2
5) Update on NAME Applications
6) Synthesis of NAME Science Issues

The meeting agenda (reprinted in its original form in Appendix A) was finalized through several iterations among various SWG members and OGP program managers prior to the meeting on Oct. 28th. Despite the brevity of time allocated for the meeting there was a good deal of discussion on many key issues and findings related to NAME research, which is detailed in the following Session Summaries.

### 1.1 Session 1: NAME Data Management (Steve Williams, UCAR/JOSS)

The NAME Data Management activities are being coordinated by the NCAR Earth Observing Laboratory (EOL) [formerly the Field Operations and Data Management Group of UCAR's Joint Office for Science Support]. Figure-1 illustrates the NAME distributed data flow and archive strategy. EOL has established and maintains the NAME Project web pages at (http://www.joss.ucar.edu/name ) including the data management pages and final project archive. These web pages provide: (1) access to the archive through a distributed "Master List" of all NAME datasets at: (http://www.joss.ucar.edu/name/dm/archive), (2) instructions and guidelines for submitting NAME datasets; (3) NAME program-relevant documents; and (4) links to other related project data. Presently, the project is in the final data submission stage.

The NAME Data archive status (as of *26 October*) is: (a) 239 of 266 datasets (90%) have been submitted or linked; (b) 11 datasets are in progress; and (c) the NAME Map Server Tool and the Field Catalog will continue to be available on-line. The Field Catalog (reports, maps, imagery and other "browse"-able products) currently consists of approximately 500,000 files totaling 26 MB. Ongoing support of the Field Catalog will greatly facilitate investigators conducting case studies from the NAME EOP.

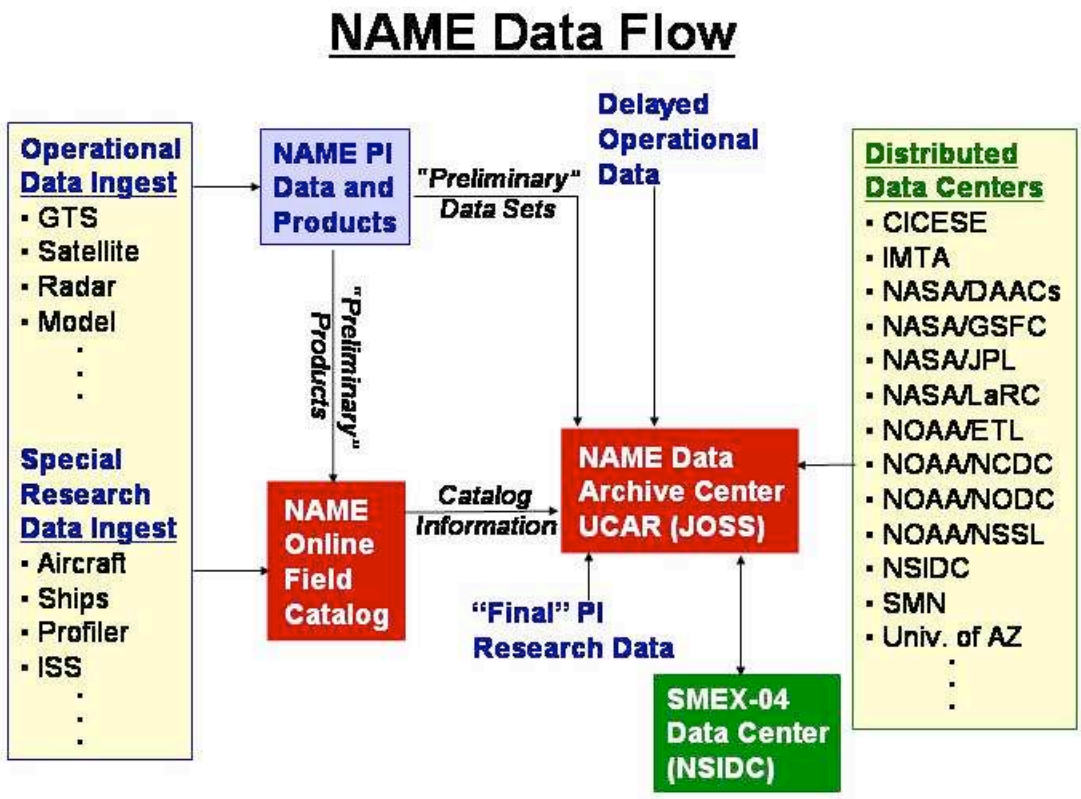


**Fig 1**. – NAME Data Flow and Archive Strategy

The formation of surface precipitation and upper air "composite" datasets will begin shortly. The surface precipitation "composite" data sets (hourly and daily) involves the collection of all operational/research surface network precipitation data from available sources, geographical and time subsetting, integration of data to a common time scale, resolution of duplicate data conflicts, conversion of all data to a common format, compilation of metadata with station data, provision of uniform quality control, and generation of final "composite" data sets at respective time resolutions. Precipitation composites will be created for Tiers I, II and III. Following a similar process, two upper air composites will be generated from operational and research rawinsonde data. These include: (1) All soundings in highest vertical resolution; and (2) All soundings interpolated to 5-mb levels (important for use in model ingest and initialization). The major advantage of creating these surface and upper air "composite" data sets is cost efficiency by eliminating the requirement of each investigator to individually re-process separate network data sets. The NAME SWG agreed on an early December 2005 deadline for all datasets to be included in the "composites to be submitted to EOL. Other potential "composites" to be considered include streamflow and surface flux datasets.

The NAMAP-2 Project (http://www.joss.ucar.edu/name/namap2/ has recently been initiated to bring together a variety of modeling comparisons and evaluation efforts. Designated modeling group participants are being identified as are experimental details such as standard protocols, formats, and model validation datasets. This project will take advantage of the large amount of special research and verification datasets collected during the 2004 NAME EOP to improve model development. The NAME data group in EOL will facilitate archiving and coordination of NAMAP-2 model and validation datasets.

A new sea surface temperature (SST) product has been developed by Ping-Ping Xie and Wanqui Wang at NOAA/CPC. This dataset will be utilized as the common SST field for NAMAP-2 model runs. These data have been submitted to the NAME data archive and are available for NAMAP2.

The NAME Data Management team is willing to support a unified land surface data set for the 2004 EOP. This composite dataset would potentially include; a) surface meteorological forcing data required for running land surface parameterizations, b) surface validation data, such as surface flux and SMEX-04 soil moisture, and c) a merged U.S.-Mexico streamflow dataset from 2004. These datasets were viewed as key elements in validating NAMAP-2 model runs and for monsoon applications studies.

NAME has established a close coordination with the 2004 Soil Moisture Experiment (SMEX-04) conducted by NASA and the USDA in Arizona and Northern Mexico. The SMEX-04 archive has been established at the National Snow and Ice Data Center (NSIDC) in Boulder, CO, and collaborative data sets have begun to be shared between projects. This process will continue as final datasets become available for both projects.

Full details and documentation of the NAME data management strategy and data sets collected for NAME are provided in the NAME Data Management Plan at: http://www.joss.ucar.edu/name/dm/Name_dmdoc.html.

**1.2 Session 2: Synthesis of findings from the 2004 NAME EOP (D. Johnson, CSU)**

The NAME 2004 EOP provided an unprecedented dataset for studying the structure and evolution of the North American monsoon. Significant findings are emerging from analysis of this dataset and related modeling studies, some of which are new results and some of which are confirmatory of past studies. The full impact of the NAME 2004 EOP will not be realized until a thorough integration of analysis and modeling studies, a process which will take a number of years.

Preliminary findings from the field phase are summarized in the following areas: precipitation characteristics, marine boundary layer/ocean characteristics, monsoon onset and advance, Gulf of California surges, mesoscale circulations, the diurnal cycle, and synoptic circulations.

*Precipitation characteristics*
Analysis of S-Pol radar data reveals two prominent regimes: an "undisturbed" regime where convection forms over high terrain and moves westward, generally dissipating before reaching the coastline; and a "disturbed" regime where convection is longer-lived, more organized, and moves from south to north along the SMO. Mesoscale convective systems are a dominant mode of convection with respect to rainfall production, and are favored in the northerly phase of easterly waves. Gulf surges do not appear to significantly modulate convection in the S-Pol radar domain (at least for NAME 2004), but this result is viewed as a likely consequence of the limited-domain analysis.

The coastal 0-500 m elevation band has the greatest precipitation intensities as systems propagate westward from the SMO. Lower elevations have greater amplitude in the rainfall intensity over the diurnal cycle than high elevations. There is a similar diurnal cycle of precipitation frequency east and west of the SMO, although the afternoon maximum in the east is slightly less in frequency and significantly less in intensity. The heaviest rainfall at longer (e.g. hourly and daily) time scales is concentrated near Gulf of California coastline; the frequency of light-rain days is clearly highest over high terrain of the SMO. The impact of the NERN on the operational 0.25º CPC gridded analysis has been found to be substantial and, at the seasonal timescale, produces precipitation estimate differences on the order of the interannual variability of precipitation in some regions.

*Marine boundary layer/ocean characteristics*
At the R/V *Altair*, the top of the MBL grew in the afternoon (to ~500 to 800 m); there was a diurnal cycle of 2-cm ocean temperature of ~2-3ºC; and multiple inversion layers occurred above the MBL. The maximum precipitation typically occurred at ~07-08 L; cloud fraction was greatest at night. There was detectable SST cooling after TS Blas. Ocean salinity levels near the surface are comparatively higher than below due to minimal precipitation and significant evaporation. Results from R/V *Ulloa* cruises shows that much of the heating of the Gulf of California occurs via advection of warmer water from the south. During the 5-21 June cruise, the MBL was very shallow (~300 m), with multiple inversions above; the MBL was deeper during the 2nd cruise (August).

*Monsoon onset and advance*
The 2004 monsoon onset (7-10 July, IOP1) over northern Tier I was associated with a weak upper-level vortex (best seen in water vapor imagery) passing across region and to the west of Baja; a minor surge also developed in the northern Gulf of California. The primary monsoon onset in the SW US was associated with the passage of Tropical Storm Blas to south of Tier I; a strong surge developed over the northern Gulf of California on 13 July. There were dramatic surface dew point rises over Sonora accompanying the onset. Surface fluxes associated with vegetation "green-up" accompanying onset were documented at 8 flux sites.

*Gulf of California surges*
Two strong gulf surges occurred during the early period of the monsoon (12-13, 22-23 July). They were nocturnal in character (i.e. amplified by the nocturnal LLJ), triggered by convective outflows from MCSs, associated with tropical cyclone and/or upper-level trough passage, and characterized by a rapidly moving leading edge having greatest amplitude and strongest southerly winds in the northern GoC. P-3 observations of surges indicate maximum winds and moisture transport over gulf waters with peak winds near 925 hPa. Additional weaker surges occurred, typically over the northern gulf in association with convective outflows. Precipitation over the Arizona region is strongly correlated with surges in 2004 based on CMORPH and the Eta model. The effect of surges on total precipitation is greater in AZ than in core NAME region over Mexico.

*Mesoscale circulations and the diurnal cycle*
The land/sea breeze circulation was documented by 915-MHz wind profiler at Estacion Obispo, Sinaloa (25 km inland). The sea breeze had onshore flow to about 1 km depth while winds aloft were more southerly. The land breeze had comparatively weak flow at low levels, while upper levels showed more transience. The depth of the coastal sea breeze return flow aloft to the west of the SMO is deeper than the normal sea breeze return flow over flat terrain. A prominent nocturnal low-level jet occurred over the northern GoC; this jet weakened toward the south and was virtually absent at Los Mochis. LLJ winds appear to be strongest over the center of the GoC away from topography indicating that the jet does not appear to be generated by classical 'terrain slope-jet' dynamics. QuikSCAT winds show a bifurcation of northwesterly flow around southern Baja, with frequent pattern of cold advection at mouth of GoC.

*Synoptic circulations*
Synoptic circulations (easterly waves, upper-level inverted troughs, midlatitude troughs, cut-off lows, tropical cyclones, etc.) were all found to affect rainfall in the NAME region in 2004. During 2004, cold fronts affecting the region were well above normal (twice as frequent as the 35-year mean). These systems principally affected the northeastern region of Tier I in New Mexico. Inverted trough occurrence was below normal. Cut-off lows in 2004 were near the long-term mean while open, westerly troughs were above normal.

### 1.3 Session 3: NAME Diagnostic Studies (A. Douglas, Creighton U. and K. Mo, NOAA/CPC)

Diagnostic studies of the NAM form the backbone of the NAME research program as these studies improve our scientific understanding of the physical and biological processes controlling the monsoon. The 2004 NAME EOP generated copious amounts of data from which diagnostic studies are now being conducted. Gridded analyses of the NAME upper air sounding data have been completed. Data sets are available from the Colorado State website (http://tornado.atmos.colostate.edu/name/). The data impact studies based on the global CDAS2, regional RCDAS data assimilation system have also been completed and these data were posted on NCEP's anonymous ftp site for distribution during Oct. 2005 (ftp site: nomad7.ncep.noaa.gov, directory:/pub/raid1/narr/reanalysis/analyses/NAMEwt). A revised set of data impact studies with improved SST estimates, precipitation composite products and all available NAME special soundings will be completed by Feb. 2006. A concerted effort needs to be made that quantifies uncertainties in the various analysis products so modelers can use them to verify their simulations or forecasts intelligently.

One principal task of understanding the NAM and its variability will be to develop improved estimates of the water and energy budgets from the monsoon and surrounding regions. Recent data analysis and modeling studies by NAME investigators are contributing to the goal of reducing uncertainty in these budget estimates. Several of these works are in progress and have been submitted to the Journal of Climate special issue on NAME, which is now in the review process. Key findings noted at the SWG7.5 meeting included:

- Greatly improved understanding of the diurnal cycle of precipitation from surface rain gauge and radar and satellite based observing platforms. These studies consistently highlight the role of orography in modulating spatial distribution, frequency and intensity of diurnally forced convection. While much progress has been made in documenting and understanding the general monsoon precipitation regime, key aspects of this regime that still must be addressed include:

    - The structure and evolution of tropospheric heating due to deep convection
    - Spatial distribution and evolution of 'typical' single cell vs. organized convective events;
    - Interaction of the terrain circulations with the sea breeze circulation along the coastal plain of the western Mexican mainland;
    - Dependence of precipitation structures on synoptic scale transient mechanisms;
    - Integration of land surface fluxes and boundary layer growth over complex terrain in the initiation of convection (i.e. the role of 'local' forcing);
    - Improved understanding of the covariance of precipitation between the NAME Tier I regions and Tiers II and III

  NAMAP-1 highlighted the fact that most modeling systems, especially coarse-resolution global models, have significant difficulty in accurately simulating key characteristics of the monsoon precipitation regime. Therefore one of the key components of NAMAP-2 will be to rigorously assess the simulated precipitation regimes. The precipitation composite products, described in the data management section above, will greatly facilitate this effort. To a similar end, it was felt that improved methods for temporally-disaggregating daily precipitation into hourly estimates, using either statistical techniques or ancillary data sources, such as remotely sensed fields, could be beneficial in augmenting the relatively sparse network of sub-daily observing sites in the NAM.

- Sources of moisture feeding monsoon precipitation are becoming much better understood. Diagnostic analyses of transient features are beginning to suggest that up to 50% of the rainfall in the NAM can be tied to rain bearing transient systems. Sounding data, collected during the NAME EOP and prior, coupled with emerging geochemical measurements are enabling improved documentation of these moisture sources. It is clear now that core regions (roughly the NAME Tier I region) of the NAM receive moisture from the Gulf of California, the eastern tropical Pacific and the Gulf of Mexico at different times and in widely varying amounts. Large scale, diurnally modulated, moisture convergence over the cordillera region is persistently documented in state-of-the-art re-analyses. Some 'free-running' modeling systems are also capable of capturing this behavior though results vary widely as functions of model resolution, domain size for limited area models, and selection of model physical parameterizations. Data and preliminary modeling results from the 2004 EOP support the hypothesis that synoptic scale transients exert significant influence on the transport of moisture from these source regions into the core monsoon regions of southwestern North America and further northward into the continental U.S. Modulation of the moisture transport by synoptic transients, subsequently, affects the spatial distribution of precipitation patterns. This influence was particularly notable during the 2004 field campaign where several mid-latitude disturbances helped advect moisture into New Mexico which brought higher than normal rainfall. Accurate depiction of these transients, via either direct numerical prediction or statistical prediction methods, was viewed as critical to improving monsoon forecasts and will be a key component of NAMAP-2. [Special Note: Following the 2004 EOP the Mexican government dramatically reduced its atmospheric sounding operations in both time and location. The loss of these observations was viewed as a critical blow to the North American climate observing network and, likely, limit diagnostic and data assimilation activities in the future.]

- On the interannual timescale it has been shown that Pacific SST conditions exert teleconnective influence on the NAM. Comparatively less is understood on the role of Atlantic and Caribbean SSTs in modulating the NAM climate. While these linkages have been documented in correlation studies, the mechanisms contributing the variance in the continental-scale warm season circulation and the resulting moisture convergence in the NAM is less understood. A key challenge identified at the SWG7.5 meeting was to develop an improved mechanistic understanding of how large-scale variability in SST conditions and continental scale hydrologic conditions (e.g. soil moisture and snowpack) alter the regional and continental scale circulation. Improved identification of the influence of 'local' vs. 'remote' forcing mechanisms is needed to address this issue. Uncertainty also exists in the relationship between conditions in the Gulf of California and key monsoon processes such as monsoon onset and intensification of the land-sea breeze.

- Gulf of California moisture surge events are a key component of the NAM climate system. These transient features serve as a principal, though intermittent, source of moisture for the regions of northern Sonora, Arizona and the rest of the southwest U.S. A couple of good indices with 30-50 year record lengths are now being produced by NAME researchers, but mechanisms for the genesis and propagation of surge events are still highly uncertain. These mechanisms likely depend on a number of external and internal forcing mechanisms. Several studies have now drawn connections between Gulf surges and tropical easterly waves and inverted troughs. However, it is clear that other

mechanisms, such as large outflows from organized convection also contribute. Identification of the principal conditions under which surges are generated and propagated was identified as an area of continued research.

- The NAM hydrological regime is also being investigated by several NOAA and NASA funded investigators. Basic hydroclimatological analyses reveal a handful of streamflow regimes which are strongly reflective of precipitation forcing. In general, there are three dominant streamflow regimes in western Mexico: a northern regime whose basin responses are similar to those in the southwestern U.S. and where precipitation events are comparatively infrequent but of high intensity, a southern regime where precipitation is quite frequent and basin runoff coefficients (ratio of streamflow to precipitation) become quite high, and an eastern regime where precipitation is quite isolated, infrequent and of limited intensity. Understanding the character of precipitation and runoff responses in these regions is critical for developing comprehensive flood risk and water resources management strategies and it is essential that weather and climate prediction models accurately depict these regimes in order to be useful for stakeholders. NAME hydrological investigations are being loosely coordinated under the NAME Hydrometeorology Working Group (NHWG) who are proposing a special session at the next NOAA-GAPP PI meeting in conjunction with the NAME SWG-8 meeting.

**1.4 Session 4: Coordination of NAMAP2 (D. Gutzler, UNM)**

David Gutzler discussed the status and planning issues for the second phase of the NAME Model Assessment Project (NAMAP2). The purpose of NAMAP2 is to coordinate a set of simulations of the 2004 warm season, using the enhanced data sets from the NAME 2004 field season as validation. The NAMAP2 effort follows the first phase of NAMAP, which yielded baseline simulations (from the 1990 warm season) and motivated a set of metrics for model improvement of North American monsoon precipitation and circulation (summarized in a short paper in the Bulletin of the American Meteorological Society that appeared in October 2005). NAMAP2 has been under discussion for nearly a year but is still completely open to new participants. It will be part of a broader NAME Climate Process Team project that involves operational model development at NCEP.

A web page for NAMAP2 has been maintained by staff at NCAR EOL (formerly JOSS), as was the case for the first phase of NAMAP. The web page currently contains the NAMAP2 protocols that have been developed over the spring and summer, plus links to the data sets needed for model boundary values.

Recent NAMAP2-related developments include the development of a new NAME SST data product that can be used as the lower boundary condition for atmospheric models. Shortcomings of the NCEP operational SST product in the vicinity of the Gulf of California were noted during the first phase of NAMAP. The desire for an improved SST product was publicized by Gutzler at the March 2005 VAMOS meeting in Mexico City. In response, P. Xie and W. Wang of NCEP generated a new product incorporating additional satellite and in situ data to obtain higher resolution in both space and time. They will submit a short paper to the J. Climate special issue on NAME describing this analysis.

With the new SST product now available, NAMAP2 simulations will be carried out during the upcoming winter. The timeline calls for simulations to be completed by the end of February 2006. Analysis of the model output will be carried out at NCEP. The next report to the SWG on NAMAP2 should take place at the VAMOS meeting in April, and we hope that considerable analysis will be completed before the next full NAME SWG meeting during August 2006.

Several issues were raised during the presentation for consideration by the SWG members in attendance, and by the NAMAP2 team. These include:

* Validation data: NAMAP2 seeks gridded values of (among other quantities) precipitation and surface fluxes for the 2004 warm season suitable for comparing to high resolution (20 km or so) model output. NCEP is producing 1/8 degree gridded precipitation data. It was suggested that Mexican LDAS, being run by D. Lettenmaier's group at the U. of Washington may provide the most reasonable fields of soil moisture and fluxes.

* Implementation issues: A few details of NAMAP2 implementation have not yet been finalized, including disk space at NCEP and an ftp portal at NCEP for delivery of model output. Questions were raised concerning disk space at NCAR/EOL for final archiving of the output. Storage costs have been estimated at EOL but we do not yet know what the volume of submitted output will be.

**1.5 Session 5: Update on NAME Applications (A. Ray, NOAA/CDC)**

A bi-national U.S.-Mexico workshop on Applications in the Monsoon Region is planned for early May 2006 with joint funding from the NOAA CPPA and SARP programs. This workshop will build on the progress of several NOAA-funded efforts in the region in order to (1) develop links between the monsoon and climate science efforts in the region and key research groups (funded by NOAA and others) that are studying climate and society interactions and that are engaged in activities to narrow the communication gap between climate experts and information users and (2) integrate climate science with public policy in the region. The monsoon region, for the purposes of this workshop, includes northwestern Mexico, the U.S.-Mexico border region as a distinct cultural and socio-economic area, and monsoon-influenced areas in the western U.S. The workshop will help NAME to engage potential users of monsoon science and to develop plans for meeting "outyear" milestones related to development of forecasts and other products focused on monsoon and drought. This workshop will connect these efforts with research groups with ongoing studies seeking to understand sensitivities of users and needs for forecasts.

This workshop will focus on applications in the "monsoon region," per se, rather than applications of monsoon information in particular to reflect the reality that the needs of potential users relate not just to the monsoon but a broader set of climate and contextual issues. The workshop will be designed to connect a suite of climate knowledge to climate-sensitive societal problems in the region, including but not limited to the monsoon.

The two-and-a-half day workshop will be held in the San Carlos/Guaymas area in the first or second week of May 2006, and would include about 40-50 participants. Invitees will include representatives from the NAME community and also from other climate science programs that may contribute to development of climate information products useful for applications in the region. On the user side, our goal is to connect the groups who study user sensitivities and needs and those who have ongoing interactions with users with the producers of relevant science. Thus we will emphasize participation of individuals representing such organizations rather than individual users.

Expected workshop outcomes and/or products include: 1) Strengthening of the network of applications and HD researchers and activities in the NAME region. Issue a directory of researchers, decisionmakers, relevant institutions, and other stakeholders; 2) A list of other initiatives with which this effort should be

networked; 3) A list of achievable collaborative efforts (including but not limited to basin studies), names of collaborators on each project, and tasks for the collaborators for the next 1-2 years; 4) Specific input to planning efforts for a Regional Climate Center for Northwest Mexico; 5) Plan for and commission a survey and a consequent state-of-the-border paper that summarizes conditions, opportunities, and challenges for enhancing the adoption of climate diagnostic techniques and products.; 6) Formulate initial plans for seeking funding from various sources; 7) Issue a workshop report, within six months of the workshop, and a short summary in Spanish and English.

### 1.6 Session 6: Synthesis of NAME Science Issues (D. Gochis, NCAR)

The main goal of the SWG 7.5 was to synthesize recent findings in NAM research and use these findings as the basis for updating the NAME science questions and program milestones as articulated in the NAME Science and Implementation Plan (listed in Appendix C below) and earlier SWG meeting reports. In this section progress on the research questions is synthesized and, where relevant, emerging questions, brought up at the SWG 7.5 meeting are posed. While the responses below are not meant to be exhaustive they are intended to document progress in NAME research and identify critical new areas of inquiry for NAME to accomplish its programmatic goals.

*Progress and Unresolved Issues on Tier I Research:*
The 2004 NAME EOP provided a much improved observational dataset from which the lower atmospheric circulations along the Gulf of California coastline can be studied. Atmospheric sounding, pilot balloon, profiler and surface meteorological station measurements are all contributing to improved understanding of the diurnal cycle of lower atmospheric winds and, hence, vapor transport. NOAA-P3 aircraft flights over the Gulf of California have improved depiction of the wind field over the Gulf of California, across the Baja Peninsula and along the Pacific coastline of Baja California. Analysis of these measurements is underway by various NAME PIs and many results are discussed in the sections above or should be forthcoming over the next several months. It is increasingly evident that the atmospheric flow structure around the Gulf of California is principally modulated by a diurnal cycle circulation and the passing of synoptic scale transients. Improved understanding of this modulating behavior should remain a priority of NAME research.

Comparatively less understanding has been gained regarding the daytime evolution of the atmospheric boundary layer and moisture fluxes over the foothill region and high terrain of the Sierra Madre Occidental. The nature of the interaction between the land and marine boundary layer regimes also remains unclear. Most of the atmospheric observing systems deployed during the 2004 EOP were deployed within 50 km of the coastline of the Gulf of California and, therefore, only sampled the low elevation topographic regime of the NAM. To this end Dick Johnson posed the following as a new NAME research question, “What is the structure and diurnal variation of the atmospheric boundary layer over land and ocean?” Improved understanding of these processes was viewed as critical to improving understanding of convective initiation and organization mechanisms.

Several groups collected surface flux data during the 2004 EOP. While analysis of this work is still in progress, these measurements should improve understanding in the nature of land-atmosphere coupling in the core monsoon region. In particular, improved understanding of vegetation response to and control of soil moisture is needed in order to better constrain estimates of moisture recycling to the atmosphere. A key challenge will be to develop appropriate methods to scale local measurements across large eco-regions. It was noted that the influence of assimilated precipitation observations into re-analysis models is spatially consistent with some forecast model biases. Improved or sustained precipitation observations and soil moisture observations should help address these uncertainties.

Progress on the diurnal cycle of convection, its preferred locus of initiation and the dominant moisture sources for the monsoon is discussed in Sections 1.2 and 1.3 above. While significant progress has been made on improving understanding in the mean character of these processes, significant uncertainty still exists in how they are modulated by propagating transients. Improvement in the understanding of how and when convection organizes into long-duration, propagating, mesoscale convective systems is also required.

*Progress and Unresolved Issues on Tiers II and III Research:*
In general, it was widely acknowledged that comparatively less progress has been made in addressing research questions from Tiers II and III compared to Tier I. While this was understandable considering the effort focused on Tier I as part of the 2004 EOP, it was felt that the research issues of Tiers II and III need to remain equal in priority. Due to the large number of findings emerging from Tier I as a result of the 2004 EOP, discussions of research issues more relevant to Tiers II and III were lacking at the SWG7.5. Nevertheless, the 2004 monsoon highlighted the significant dependence of monsoon precipitation, in many regions, on transient features. This acknowledgement prompted the SWG to suggest a rewording of one of the NAME Science Questions from, "How important are interactions between Tropical Easterly Waves (and cold fronts, deep lows) and Gulf of California moisture surges in the prediction of monsoon precipitation?" to, "How important are interactions between tropical easterly waves, upper-level inverted troughs, cold fronts, cut-off lows, open troughs, and Gulf of California moisture surges in the prediction of monsoon precipitation?". While a thorough climatological analysis of the dependence of regional and local precipitation to various transient mechanisms is warranted it was felt that intra-seasonal to seasonal prediction tools must be able to account for transient activity in order to generate reliable forecasts of monsoon precipitation.

There was some discussion, albeit limited, on recent work describing the role of SST's and continental scale hydrological anomalies in modulating the NAM circulation. Recent work, has shown that regions encompassed by NAME Tiers II and III have been diagnosed as 'hot spots' for warm season land-atmosphere coupling (e.g. the southern Great Plains). Therefore, it was suggested that the NAME community develop improved diagnostics for evaluating this complex feedback process and to contribute to the elucidation of this interaction as it relates to regional climate anomalies. Similarly, it was suggested that comparatively little is understood about the coupling mechanisms between the ocean and atmosphere. This uncertainty is impeding our understanding of key coupled processes such as ENSO on interannual time-scales and the evolution of the Madden Julian Oscillation (MJO) on intra-seasonal timescales. Therefore, in order to improve predictions on intra-seasonal to inter-annual timescales, emphasis needs to be placed on improving the representation of ocean-atmosphere interactions in coupled prediction models.

*Update of NAME Program Milestones:*
During the SWG7.5 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 (NAMAP2) **(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)

- FY07 – Quantify the relative influence of oceanic and land surface boundary conditions on simulations of the NAME 2004 monsoon
- 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
- The NAME milestones have been updated starting in FY07 to emphasize NAME Tier 3 activities.

*Update of NAME Value-added data products*
The SWG7 Meeting report provided comprehensive lists of NAME 'Value-added' data products. During the SWG7.5 meeting these lists were briefly reviewed. From this discussion the following products have been designated as 'delivered', while new products are designated as 'forthcoming':

**List of recently 'delivered' value added data products:**
NAME Radar composites; jointly developed by Col. State U. and NCAR
NAME atmospheric analyses; developed by Col. State U.
NAME data impact on RCDAS; performed by NCEP/CPC

**List of 'forthcoming' value-added data products:**
Merged rain gauge data set (hourly and daily) for 2004; developed by NCAR/EOL and the NAME Precip. Analysis Group
Merged atmospheric sounding composite; NCAR/EOL and NAME sounding teams
Land surface dataset; NCAR/EOL, U. Washington, NCEP

**Appendix A: Agenda from the SWG-7.5 Meeting (updated Oct. 18, 2005)**

**Friday, October 28th 2004**
**State College, Pennsylvania**

**Purpose:** The purpose of the NAME SWG7.5 is to review the science findings from the 2004 EOP and from recent modeling and diagnostic studies, and to use these discussions as the basis for updating the NAME 'strategic plan'. [The 'strategic plan' is currently defined as the body of documents including the NAME Modeling and Data Assimilation White Paper, the NAMAP2 program, the lists of NAME data products, the annual NAME milestones, and the NHWG Research Strategy.]

**12:00** (Lunch Served)

**12:30** (Dave Gochis) Welcome, overview of agenda, goals of meeting.

**1:00** (Steve Williams) Overview and management of 2004 NAME-EOP Data

**1:30** (Dick Johnson) Review and development of a list of key scientific findings from the 2004 EOP, update the lists of *value-added*, and *synthesis data products* from the SWG-7 report. Use these findings as basis for updating NAME Science Questions.

**2:15** (Art Douglas and Kingtse Mo) Review and refine the science issues related to seasonal to interannual variability of the monsoon and its predictability, develop a list of key recent diagnostic and modeling results that significantly advance our understanding of S/I variability. Use these findings as basis for updating NAME Science Questions.

**3:00** Short Coffee Break

**3: 20** (Dave Gutzler) Discuss the integration of the observations, data products and modeling results within NAMAP2. Determine optimum metric for model performance based on findings from observation-based diagnostic studies. Finalize timeline of NAMAP2.

**4:20** Wrap-up. Refine NAME science questions and (as necessary) update annual milestones for FY05-FY09, including products from SWG7.5 meeting (i.e. strategic documents listed above). CTB linkages/pathways of interaction time permitting.

**5:00** Firm End

**Appendix B: Agenda from the 2004 30th Annual CDPW, Session 11**

**Friday, October 28, 2005**

**SESSION 11: RESULTS FROM NAME 2004**
**Chairperson: David Gochis**

8:00-8:30 Radar Observations During NAME 2004 – Data Products and Initial Results
*Timothy Lang, David Ahijevich, Rit Carbone, Rob Cifelli, Stephen Nesbitt, Gustavo Pereira and Steven Rutledge*

8:30-9:00 Main Results and Future Plans for the NAME Enhanced Rain Gauge Network (NERN)
*Christopher Watts, David Gochis, Julio Rodriguez and Jaime Garatuza - Payan*

**9:00-9:30 Break**

9:30-10:00 A 50 Year Analysis of Rain Bearing Synoptic Features in Northern Mexico: Placing the NAME 2004 Summer Experiments in an Historical Context
*Arthur Douglas and Phillp Englehart*

10:00-10:30 NAME CPT Project – Issues for Warm Season Prediction
*Jae Schemm and David Gutzler*

10:30-11:00 The Impact of the NAME 2004 Special Soundings on the NCEP Analyses and Forecasts
*Kingtse Mo, Eric Rogers, Wesley Ebisuzaki and Wayne Higgins*

11:00-11:30 Model Simulation of the Diurnal Cycle and Moisture Surges Along the Gulf of California During NAME
*E. Berbery and E. Becker*

11:30 – 12:00 Assessment and Verification of North American Monsoon Quantitative Precipitation Forecasts from the Weather Research and Forecasting Model using 2004 NAME EOP Data
*David Gochis*

**Appendix C: NAME Science Questions**

Tier I Research Questions:

- How are low-level circulations along the Gulf of California / west slopes of the Sierra Madre Occidental related to the diurnal cycle of moisture and convection?

- What is the relationship between moisture transport and rainfall variability (e.g. forcing of surge events; onset of monsoon details)? Is there a "meangingful time mean state" vs "distrubed states"?

- What is the typical life cycle of diurnal convective rainfall? Where along the western slope of the Sierra Madre Occidental is convective development preferred?

- What are the dominant sources of precipitable moisture for monsoon precipitation over southwestern North America?

- What are the fluxes of energy and water from the land surface to the atmosphere across the core monsoon region, and how do these fluxes evolve in time during the warm season?

Tier II Research Questions:

- How important are interactions between Tropical Easterly Waves (and cold fronts, deep lows) and Gulf of California moisture surges in the prediction of monsoon precipitation?

- What is the nature of the relationship between the MJO, tropical cyclone activity and monsoon precipitation?

- What portion of the skill of summer precipitation forecasts, in addition to that already harvested from ENSO, will arise from an ability to forecast MJO activity over a season?

- What is the physical setting for the bimodal distribution (i.e. wet-dry-wet) in warm season precipitation over Mexico and Central America and what factors influence its interannual variability?

- How does the phase of the MJO relate to the frequency and intensity of hurricanes and tropical storms in the eastern Pacific and Atlantic basins? How does this tropical variability influence NAMS?

Tier III Research Questions:

- How is the evolution of the warm season precipitation regime over North America related to the seasonal evolution of the boundary conditions?

- What are the interrelationships between year-to-year variations in the boundary conditions (both land surface and adjacent sea surface), the atmospheric circulation and the continental hydrologic regime?

- What are the links, if any, between the strength of the summer monsoon in southwestern North America and summertime precipitation over the central United States?

- Can numerical models reproduce the observed summer precipitation in average years and years with ENSO/PDO influence?

- How much of the seasonal predictability of large-scale warm season precipitation anomalies can be downscaled to local precipitation variability?

- What are the relationships between extreme weather events (e.g. floods, droughts, heat waves, hurricanes), climate variability and long-term trends?