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REPORT ON THE FIRST NWS SOUTHERN REGION SOO/COOPERATIVE INSTITUTE WORKSHOP JUNE 28 - JULY 1, 1994

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INTRODUCTION

Science and Operations Officers (SOOs) will play a major role in the modernization of the National Weather Service. They will help integrate new tools and technology into the operational warning and forecast programs of the office. To accomplish this, SOOs will be heavily involved in professional development activities of the entire staff. They also will need to maintain close ties with the research community in order to identify studies that have potential benefits to NWS operations, and to seek opportunities for collaboration with researchers in order to facilitate the transfer of research results.

NOAA Cooperative Institutes have been established in the NWS Southern Region at Texas A&M University (the Cooperative Institute for Applied Meteorological Studies) and at Florida State University (the Cooperative Institute for Tropical Meteorology). The NWS Southern Region sponsors these institutes with the NWS Headquarters Office of Meteorology (CIAMS), and the National Meteorological Center (CITM). Institute faculty and students investigate applied research topics with the goal of improving operational forecast procedures.

Each of the institutes also conducts training activities for NWS personnel. In June 1994, the first of what is planned to be a series of annual workshops was conducted in Tallahassee to convene Southern Region SOOs, institute faculty and students, and others involved in furthering the science of meteorology at NWS field offices. Goals were to familiarize the participants with each other and his or her interests; to review operational needs and research activities under way or planned at the institutes; and to strengthen the foundation for future collaboration.

What follows is a summary of the First SOO/Cooperative Institute Workshop. Participants in the workshop are listed in Appendix 1. The agenda is included as Appendix 2.

FIRST DAY

Welcome and Introductions

Prof. David Stuart (Chairman, FSU Meteorology Department) welcomed all the workshop participants on behalf of FSU and CITM. He noted the intent of the workshop was to bring university faculty together with the NWS meteorologists to work on forecasting problems of mutual interest.

Harry Hassel (Director, NWS Southern Region) pointed out the NWS modernization is filled with opportune moments and that this workshop was one of those moments. Harry commented briefly on the background of CIAMS at Texas A&M University and CITM at the Florida State University. He reiterated the intent of the workshop was to bring all the parties together to share experiences and promote interaction among the SOOs and among the faculty and students of the cooperative institutes and the SOOs. He also indicated that he expected the SOOs to demonstrate initiative and creativity in making connections with the cooperative institutes.

Dr. Ron McPherson (Director, National Meteorological Center), in his welcoming address, spoke about three specific turning points associated with modernization of the NWS. He defined these as important decisions that will influence the science of meteorology in the United States in the coming years. They are:

(1) Establishing the SOO program which will provide a new focus for science at individual NWS Weather Forecast Offices (WFOs).

(2) Collocating WFOs, where possible, with university meteorology departments, which will facilitate interactions and collaboration among academic and operational meteorologists.

(3) Forming additional NOAA/NWS Cooperative Institutes as partnerships between the NWS and the universities to ensure the ability to address critical applied meteorological issues, even in a time of limited federal resources.

Ron noted that the mission of the NWS included the protection of life and property through the issuance of forecasts, watches, and warnings, and the promotion of economic efficiency by tailoring weather information for specific sectors of the economy. Recognizing the value of the SOO program, he noted that a SOO position will be established at each of the new Centers for Environmental Prediction.

Prof. Richard Orville (Director, CIAMS) provided a brief overview of CIAMS activities. He mentioned the successful partnership that had been formed between CIAMS and the Houston Area NWS office and indicated that the success had been achieved in spite of the distance between the two offices because of the interest and initiative of the people who worked at both locations with strong support from their organizations.

Prof. T. N. Krishnamurti (Director, CITM) reviewed the primary research efforts of CITM, which are:

(1) Conducting tropical synoptic meteorological studies.

(2) Improving tropical data assimilation by numerical models.

(3) Improving weather forecasting in the tropics.

(4) Conducting numerical modeling studies.

(5) Studying the climatology of the tropics.

(6) Stimulating education in tropical meteorology.

Areas of potential interaction with SOOs include studies of regional forecast problems involving satellite and radar data and algorithms, mesoscale analysis and forecasting, interactive graphical display systems, and access to FSU computer resources.

Special Topic No. 1 - NMC Overview

Dr. Ron McPherson discussed the planned restructuring of the National Meteorological Center. Ron noted that the original plan to restructure the NWS as part of its modernization included only the field offices, not the national centers. Subsequently, a plan was developed to create, under the collective name of the National Centers for Environmental Prediction, the following specific centers:

Hydrometeorological Prediction Center
Storm Prediction Center
Aviation Weather Center
Tropical Prediction Center (and National Hurricane Center)
Marine Prediction Center
Climate Prediction Center
Environmental Modelling Center

Development groups in each of the first six centers will link to the Environmental Modelling Center, which will in turn support each of the other centers through operational prediction models and modelling research. The planned restructuring addresses:

A desire to satisfy the growing need for centralized environmental predictions for the nation.

The need to capitalize on other investments in the modernization of the NWS.

A requirement to facilitate the transfer of new scientific advances into operational environmental prediction.

The desire to make the most cost-effective use of the available resources.

CITM Overview

Prof. T. N. Krishnamurti and **Russ Treadon** (CITM) next discussed their research on the use of satellite-derived precipitation estimates in the initialization of numerical weather models in the tropics. Since observational data are sparse in much of the tropics, the analysis fields often do not accurately represent the true fields of divergence, vorticity, moisture flux, etc. By using a reverse algorithm, the model fields are adjusted until the precipitation they produce closely matches that estimated from the satellite data. Forecasts made from the adjusted fields are more accurate than those made without benefit of the satellite data. Forecast skill drops sharply after Day 1, however.

Eric Williford (CITM) presented preliminary results from his analysis of the mesoscale features associated with the cyclogenesis of the "Storm of the Century" in March 1993. He plans to adapt a very high resolution adaptive grid model to work with FSU's Scientific Animation software to study the generation, conversion, transfer, and dissipation of energy of the storm while it was forming over the Gulf of Mexico.

Ricardo Correa-Torres (CITM) discussed his work related to the Mississippi floods of the summer of 1993. He noted that although the floods came during an El Niño event in the Pacific, other historic floods were not associated with El Niños.

Prof. John Elsner (CITM) showed results of his study on the prediction of the number of hurricanes in the Atlantic Ocean Basin. John's studies are an extension of the work of Dr. William Gray at Colorado State University. By separating storms into two groups, John showed that the number of storms with true tropical origins could be skillfully forecast, while the number of storms that formed or intensified as a result of interactions with baroclinic (higher latitude) disturbances could not be predicted with any skill. His research indicates it may not be possible to predict accurately the number of storms that would make landfall along the U.S. coast during any given hurricane season. John also presented some initial work on the development of statistical predictions for the Caribbean Basin. It is expected that further work in this area will link closely with WSFO San Juan and the Techniques Development Laboratory at NWS Headquarters.

Special Topic No. 2 - PC-GRIDDS Workshop

Dr. Ralph Petersen (NWS Office of Meteorology) led a presentation on the use of the PC-GRIDDS applications program for analysis of NMC model gridded data with **Paul Janish** (NSSL/Experimental Forecast Facility, Norman), **Don Baker** (SOO, WSFO Lubbock), and others. Ralph first explained how the reverse Polish notation used in PC-GRIDDS related to the stack manipulations performed in the computer's memory. He then showed how PC-GRIDDS could be used to diagnose the effects of improperly specified moisture flux on numerical predictions. The case he presented was one in which significant rains had fallen over Texas. A model using only climatology and vegetation type (such as the NGM or Eta model) could not accurately predict the location or intensity of subsequent convection, compared with a model (AVN) that had more accurately analyzed surface moisture fields.

Ralph also described a new PC program in development that would allow third world countries to manipulate gridded numerical model output for international aviation forecasts. The system will have a graphical user interface, and the data structure will be changed to accommodate the larger, global data sets. The staff at WSO Tallahassee and the Agricultural Weather Service Unit at Auburn are assisting the NWS Office of Meteorology in this effort.

SECOND DAY

Introduction to Tropical Meteorology

Dr. Steven Lyons (NHC) gave a brief introductory lecture on the meteorology of the tropics, reminding participants from offices north of the "tropical zone" why tropical weather systems are important for their areas. Steve noted that tropical systems or regimes have a direct impact on many locations and that interactions of the tropics with the middle latitudes can (and frequently do) impact numerical model forecasts in extratropical areas. He stressed the need for kinematic analysis in the tropics and the importance of understanding the vertical structure of tropical weather systems. Tropical systems that are not vertically coupled, either in a numerical model or the real atmosphere, rapidly dissipate. Steve noted that because many tropical weather systems are thermally direct circulations, they can persist for long periods even when their intensity is weak.

(As if to drive home the point, two days after the workshop, Tropical Storm Alberto made landfall along the Florida Panhandle, only 100 miles west of Tallahassee. The storm was responsible for over 20 inches of rain and record flooding in Georgia.)

Glenn White (NMC) complemented Steve's introduction by reviewing tropical modelling at NMC. His subjective impression was that the skill of the NMC global model in the tropics may be roughly comparable to that of North American models 20 years ago. Skill is greater in the subtropics than the deep tropics and greater in the upper troposphere than in the lower troposphere. Steve Lyons has found considerable skill in the global model's forecasts of the positions of tropical systems at upper levels, although the model unrealistically weakens the intensity of the systems.

Glenn presented a case in which the global model provided useful indications four to five days in advance of the strength and position of a frontal zone associated with significant flooding in Puerto Rico; however, the forecasts never placed heavy rainfalls over the island. The NMC global model analyses are capable of realistically depicting most features of the five-day mean time-averaged divergent flow at upper levels. Short-range forecasts of precipitation have some skill in predicting the movement of strong westward propagating precipitation features near 15 and 20 N. Glenn advised forecasters always to check the accuracy of the model's analysis in the tropics against observations and satellite images. Model forecasts of tropical precipitation do contain many realistic features, but at this stage of model development should be regarded with caution and used as only one input to the tropical forecaster's rainfall predictions.

Glenn reported that a hurricane forecast model developed at the Geophysical Fluid Dynamics Laboratory (GFDL) at Princeton, New Jersey, will be run in parallel with the operational Quasi-Lagranian Model (QLM) during the 1994 hurricane season. A decision on whether to implement the GFDL model will be based on its performance. Glenn also reported that the Rapid Update Cycle (RUC), which produces frequent and timely mesoscale analyses and short-range forecasts, is being evaluated by the Spaceflight Meteorology Group (SMG) in Houston, Texas, (among other field offices) and should be fully operational by the end of the summer. Output from the RUC will be available to offices like the other gridded data currently used with the PC-GRIDDS program, as well as via the Internet.

CIAMS, CITM, and SOO Presentations

Prof. Richard Orville (CIAMS) described the proper use and interpretation of lightning data in the southern United States. He noted that the NWS Southern Region has the greatest incidence of thunder-days in the country and the most lightning deaths. He estimates that the current National Lightning Detection Network has a detection efficiency around 70%, with an average location error of 5 to 10 km. More accurate locations may be possible soon because of a combination of detection technologies, thanks to a merger of the companies that have developed competing technologies—magnetic detection and time-of-arrival.

Dr. Orville indicated that lightning aloft (IC/CC) may occur as much as 15 minutes before the first cloud-to-ground (CG) strike. This is significant, since studies have shown that lightning-related deaths are frequently the result of the first CG strike. Knowledge of precursor lightning aloft might allow time for warnings to save lives. Discussion ensued among workshop participants concerning the most effective way to convey the threat due to lightning in special weather statements or warnings.

Antony Perez (CIAMS) discussed his research on the relationships, if any, between CG lightning and violent tornadoes. Using data from 42 storms that produced strong tornadoes, he found that some changes in the rate of lightning flashes do correspond to changes in storm intensities. For example, he noted higher rates of positive strokes (lightning which lowers positive charge to the ground) occurred before tornado occurrence than afterward. Additional work is needed in this and other areas related to applications of lightning data, and some ideas for future studies were discussed among the SOOs and institute researchers.

Following the lunch break, participants viewed a 35-minute videotape showing VIS-5D analysis of a Gulf of Mexico return flow case. The tape was prepared by **Dr. John Nielsen-Gammon** (CIAMS) using the institute's Silicon Graphics computers. Animation and the ability to change display parameters provide additional dimensions to this powerful visualization tool. SOOs will receive first-hand experience with this system at next year's workshop.

Prof. Peter Ray (CITM) showed recent results from a non-hydrostatic cloud model that had been initialized using radar data as a futuristic look at what might be possible for forecast applications. Currently, the model can accurately simulate storm development for only a few hours into the future. The goal of this research is a better understanding of how storms grow,

thrive, and propagate in a marine tropical environment. Peter then showed some results of predicting the future track of a landfalling hurricane using Doppler radar reflectivity and velocity data. He also indicated that CITM has obtained from NSSL and the WSR-88D OSF several radar algorithms for testing and verification.

A discussion followed concerning the importance of establishing an event directory for WSR-88D data that are being archived at the National Climatic Data Center. Without such a directory, as the volume of data grows with the installation of Level-2 (base data) recorders at more WSR-88D sites, it will be increasingly difficult for researchers to identify the locations and times of significant weather events or events that initially appeared threatening but were not associated with severe weather. These are the data and events that must be studied in detail to carry out effective research into validating and improving WSR-88D algorithms. A standardized logging procedure would be a logical solution to this problem, and SOOs might play a major role in developing such a procedure.

Don Baker (Lubbock SOO) showed some sample cases from the recently accepted Lubbock WSR-88D. One was a significant rain event due to a dry line that included tornado formation with a 40 F surface temperature. Another was a supercell that formed near Reese AFB on May 26, 1994, in which a mid-level circulation persisted for three hours with much hail but no reported tornado. Don also described his collaborative efforts with the meteorology faculty and students at Texas Tech University. These include a proposed COMET Partners project to evaluate the radar rainfall algorithm using a dense network of rain gauges deployed to support a cloud seeding experiment in West Texas, a planned line-of-sight data link between the WSFO and the University, and a local severe weather conference being planned for the fall of 1994.

David Sharp (Melbourne SOO) described WSR-88D operations at Melbourne, Florida. Dave's background includes an assignment as an instructor at the WSR-88D OSF Operations Training Branch, so he is very familiar with the WSR-88D system. He noted that the quality and utility of products displayed at the radar's Principal User Processor (PUP) and included in the Level II archive are often the direct result of efforts taken (or not taken) at the Unit Control Position (UCP). He emphasized the need to update the clutter suppression regularly to ensure that false echoes will not be erroneously accumulated as rainfall, or that actual rainfall will be suppressed. David also described some collaborative research that has been under way between staff at NASA's Kennedy Space Center and the Melbourne WSO.

Charles Paxton (Tampa Bay Area SOO) described the development of a strategy for predicting waterspouts. A relationship between shower growth rate as detected by the WSR-88D and the occurrence of waterspouts has been observed.

Larry Ruthi (Norman SOO) listed some points for consideration when using the WSR-88D in severe weather analysis and prediction. He noted the mid-levels of storms must be monitored to provide significant lead time for low level mesocyclone intensification and tornado genesis and that the storm environment must always be considered when making warning decisions. Larry observed that mid-level winds, measured relative to storm motion, are extremely important in tornado genesis, while low-level winds are more directly related to mid-level cyclone

formation and persistence. Some mesocyclonic storms may persist for hours without producing tornadoes, while large hail and damaging winds usually accompany storms with strong and persistent mesocyclones. Larry also reported that the tornado vortex signature (TVS) often does not form until just before tornado touchdown. As a result, warnings based on TVS may be issued too late for effective action to be taken by individuals near the point of touchdown. He has found that the Oklahoma Mesonet (a network of automated surface observing sites, including one site per county) and the wind profilers have been extremely valuable tools for predicting severe weather.

Special Topic No. 3 - Palm Sunday Outbreak

The Palm Sunday, 1994 Tornado Outbreak in northern Alabama and Georgia was reviewed in detail by **Josh Korotky** (Tallahassee SOO) and **Kevin Pence** (Birmingham SOO). Josh presented the synoptic overview of the event noting that it was not a classic situation. He demonstrated that isentropic diagnostics are very useful in predicting severe weather in the Southeast and emphasized the importance of looking at a layer rather than a single level. Significant vertical wind shear in the warm sector was important in this outbreak.

Kevin reviewed operations of the Birmingham office on Palm Sunday morning. He noted that the forecaster on duty, using data from the Maxwell AFB WSR-88D, correctly kept the tornado warning in effect throughout the morning, despite a lack of severe weather reports. (Subsequent investigation revealed that over 50 calls were made by citizens in the affected areas to local 911 numbers concerning the severe weather, but no reports were forwarded to the Forecast Office.) Kevin also stressed the need to monitor other storms in the forecast area during a severe weather event.

THIRD DAY

Cooperative Institute Topics

Prof. Kevin Kloesel (CITM) presented a climatological review of winter cyclones in the Gulf of Mexico. The goal of his research is to relate cycles of Gulf cyclogenesis to precipitation over Florida. He noted that the baroclinic zone associated with the continental shelf is a preferred breeding area for the cyclones. Kevin found that all storms, regardless of strength, produce about the same amount of rain as they pass over the Florida Panhandle. The stronger storms also produce heavy rains in peninsular Florida. Future work will look for possible relationships between storm track and intensity.

Prof. Henry Fuelberg (CITM) described his research on sea breeze thunderstorms aimed at producing better forecasts of summer convection over the Florida Panhandle when the sea breeze is the dominant forcing mechanism. After stratifying the days into those with no convection, those with weak convection, and those with strong convection, he found that convection was most strongly correlated with wind direction and deep layer moisture. He noted that a surface-based lifted index computed using the 9:00 a.m. EDT surface and dew point temperatures was the best discriminator for predicting strong convection, while the K-Index was the best

discriminator for distinguishing between days with weak convection and days with no convection.

Henry next discussed a local study that revealed that the minimum temperature measured at the official (airport) station in Tallahassee was significantly lower than any location in the vicinity. The temperature difference appears to be real rather than due to any differences in instrumentation. Long thought to be associated with cool air drainage, recent investigations indicate some other undetermined cause. (At least one participant at the workshop noted this problem is an old one and was first investigated by FSU students decades ago.)

Prof. Michael Biggerstaff (CIAMS) reviewed the scales of damaging straight-line winds ranging from derechoes to microbursts. A conducive synoptic environment for a windstorm includes high Convectively Available Potential Energy (CAPE), low Convective Inhibition (CIN), dry mid-level air, and a neutrally stable boundary layer. Damaging winds often occur after the peak in storm intensity is reached (as indicated, for instance, by highest echo tops), with the strongest gusts often ahead of the surface precipitation in the region of the bow echo. Mike noted that microbursts are very short-lived and that it is nearly impossible to detect them in time to issue an effective warning. He noted there is a need for a WSR-88D algorithm for detecting the potential for severe straight-line winds.

Svetla Veleva (CIAMS) presented a revised conceptual model of asymmetric squall lines. In her model a mid-level mesoscale vortex affects the convective structure along the squall line by altering the mesoscale low-level flow. The mesoscale outflow, in turn, affects the depth and direction of convective outflow propagation. Cells north of the meso-low are generally weak because the outflow is nearly parallel to the environmental flow, while cells south of the meso-low are the strongest because of the convergence of the outflow with the environmental flow.

Prof. Paul Ruscher (CITM) described a coordinated field experiment and numerical modeling effort to improve aviation forecasts, in particular, in the coastal zone of Florida. His group is using a one dimensional planetary boundary layer that is coupled with a thermodynamic model and a soil hydrology model. The system works very well under cases of weak synoptic forcing. To be effective, the model needs good predictions of 2 m temperatures and 10 m winds.

Chris Herbster (CITM) described plans for two dimensional modeling of the sea breeze. A high resolution mesoscale model will be run on historic data with a grid spacing of between 7 to 50 km, with lateral boundary conditions provided by the ECMWF one-degree analysis and forecast fields. A field experiment (which was conducted in the weeks following the workshop) included plans to use a line of observing stations from Tallahassee to the Gulf Coast. Surface and upper air (pibal) data will be collected, with supplemental data provided by the cooperative observing network and special raobs from WSO Tallahassee. The focus of the experiment is on the structure, evolution, and propagation of the sea breeze front. Support for this project has been arranged from students, WSO Tallahassee staff, and NWS Southern Region Headquarters (supplies).

Prof. John Ahlquist (CITM) reviewed ensemble forecasting and described two numerical techniques used to generate the initial perturbed conditions. He indicated that random errors are not physically consistent. John noted that not all errors grow at the same rate. Although some errors grow rapidly, their maximum amplitude is small, so they may not be operationally significant. Other errors may grow slowly, but continuously, throughout the forecast cycle, and their final amplitude may be large.

The National Meteorological Center uses a combination of lagged-average forecasts and the breeding of growing modes (BGM) technique to produce its ensemble. For the BGM part, random errors are introduced to the initial conditions. After six hours of integration, difference fields are computed between forecasts made from the perturbed and unperturbed initial conditions. The difference fields are re-scaled to the same amplitude as the initial perturbation and are added to and subtracted from the unperturbed forecast fields to produce two members of the ensemble. Forecasts made from previous days that verify at the same time complete the ensemble.

The European Center for Medium-range Weather Prediction uses the "linearized operator" technique of Lorenz. This computationally intensive technique requires running a separate linear model to combine the most troublesome errors with the current analysis. John noted that both methods have their strong points and their drawbacks.

Stephen Allen, a forecaster from WSO Houston, substituted for the SOO from his office who was unable to attend the workshop. Steve reviewed current projects between the Houston office and CIAMS personnel. He noted there were frequent visits between the two sites, and there would soon be a high-speed (T1) data link between the WSO and Texas A&M to facilitate the rapid transfer of radar and lightning data. Hiring student aides for the summer has stimulated student interest in working for the NWS. Stephen then presented some WSR-88D cases. He noted that tornado-producing mesocyclones in the marine environment are shallower and much weaker than those of the Central Plains. He presented a case, often seen in the warm season, in which the WSR-88D VAD winds showed a northeast bias when environmental winds were obviously from the northwest. The error appears shortly after sunset and ends shortly before sunrise, suggesting that the presence of insects may play a role in the anomaly. Discussion among the participants (and the NSSL and OSF attendees) indicated there are many "unknowns" associated with radar-derived winds.

Special Topic No. 4 - GOES 8 Satellite Workshop

Dr. James Purdom (National Environmental Satellite Data and Information Service) presented and discussed early results from the recently launched GOES-8 satellite. He reviewed the differences between the latest and previous GOES satellites and noted that the improved, multi-spectral digital imagery initially would be distributed over dedicated 56k-bit connections to the Internet. To help provide an early operational assessment of the new data, NWS Headquarters and NESDIS have arranged to provide several Regional and Mesoscale Meteorology Advanced Meteorological Satellite Development Interpretation System (RAMSDIS) field test sites with a PC and appropriate software to acquire, manipulate, and display the imagery. Jim noted there

will be a period during which operational forecasters and research scientists will learn together how to make the most effective use of the new and improved features of the redesigned and enhanced GOES (I-M) satellites. Participants shared Jim's enthusiasm as he demonstrated GOES-8 capabilities with slides and videotape.

FOURTH DAY

SOO Topics

Steve Amburn (Tulsa SOO) presented a methodology for making Quantitative Precipitation Forecasts (QPFs). Forecasters at WSO Tulsa are participating in an experimental program to provide QPFs to the adjacent River Forecast Center. The RFC uses area-averaged rainfall as input to its river forecast program. Experience has shown, however, that forecasters (who are generally not used to thinking in terms of area-averages) often tend to overpredict area-average rains. As part of the training program for local forecasters, Steve separated the prediction of area-average precipitation into predictions of the average areal coverage, the average rainfall rate, and the duration of the precipitation. Average areal coverage can be deduced from the probability of precipitation forecast. Preliminary studies have indicated that typical rainfall rates average from 0.25 to 0.70 in/hr for convective storms and are about 0.15 in/hr for stratiform rains. Storm duration can be forecast by considering factors such as overall stability of the air mass, strength of any caps, and the timing of the onset of vertical motion and the progression of boundaries over the area.

Steve's suggestions of areas for further study included improvements in the estimates of average areal coverage, development of regional climatologies to relate rainfall rates to critical meteorological parameters, and refinements in the ability to determine the duration of events.

Michael Eilts (NSSL) described the work of the Experimental Forecast Facility (EFF) to diagnose storm structure and evolution and to provide short term predictions of severe weather as guidance to operational forecasters. He showed examples of severe weather detection algorithms and interactive displays that are being developed by his group at NSSL. Regional representatives (SOOs) from each region have been invited by NSSL to participate in a working group to help assess the science and direction of development work. Some SOOs also should be able to assist in the field evaluation of new NSSL algorithms for the WSR-88D. Mike also briefly described NSSL's Phoenix Southwest Area Monsoon Project (SWAMP) experiment and plans for testing of new algorithms there during the summer of 1994. It is expected this field work will move to the Northern Plains in the spring and summer of 1995 and to Atlanta in support of the 1996 summer Olympic Games.

Larry Ruthi (Norman SOO) and **Paul Janish** (NSSL/EFF) reviewed the first phase of the Verification of the Origins of Rotation in Tornadoes Experiment (VORTEX) that was conducted in Kansas, Oklahoma, and Texas from April 1 to June 10, 1994. Larry reviewed some VORTEX forecast issues. He noted that it took longer than expected to acclimate the staff to the experimental forecast procedures. He also noted that surface data from the Oklahoma Mesonet were very valuable to the forecasters. Paul reiterated the value of the composite chart,

the importance of mid-level flow in tornado genesis, and the need to understand the interactions between synoptic and storm-scale environments.

George Wilken (Little Rock SOO) gave the final presentation of the workshop. He discussed professional development issues for SOOs. George prepared a draft of a SOO handbook and distributed it to participants for comments and suggestions. (Although the workshop dealt primarily with the science of meteorology, the site of the workshop was intentionally chosen to reflect the importance of education as part of the SOOs' responsibilities.) George emphasized that point and reminded SOOs they are trainers and coaches for the office staff. He showed examples of how he acknowledges and rewards efforts of the staff at his office. He also noted that the SOO is also the focus for research conducted by the staff.

Wrap-Up

Dan Smith (Scientific Services Division, NWS Southern Region) concluded the workshop by leading a discussion that recapped highlights of the meeting and summarized the action items brought out during the four days. This led to additional discussion of the WSR-88D event inventory; CITM will develop the concept for testing and evaluation by the SOOs. Dan also thanked all who participated in the workshop, including those from both FSU and Texas A&M. Comments and suggestions for next year's workshop to be hosted by CIAMS were solicited. Discussion indicated that all participants would appreciate greater emphasis on forecast operations, organization of sessions by theme, and ample time for discussion each day. An evaluation form was distributed to each participant, and a summary of comments has been prepared.

The participants indicated that the goals of the workshop were achieved. The SOOs liked having the opportunity to meet and interact with each other and to learn more about ongoing research. The faculty and students of the institutes, in turn, appreciated their interactions with the SOOs. There was general agreement that more time for discussion should be scheduled at future workshops.

Several publications and handouts were provided by the participants. Many are listed below to provide suggestions for further reading regarding topics covered in workshop presentations.

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The August 1994 issue of *Monthly Weather Review* will contain 20 papers on the special topic of "Thunderstorm Electrification and Lightning." Dr. Richard Orville (Director of CIAMS) is the Editor for this issue.

APPENDIX 1

SOO/COOPERATIVE INSTITUTE WORKSHOP

June 27 - July 1, 1994
Florida State University
Tallahassee, Florida

AGENDA

Monday, June 27

Day for travel - maps will be available at Collegiate Village Inn when you arrive

Tuesday, June 28

(all AM Sessions are in the Keen Building - Physics Conference room, 7th floor)

8:30 - 8:45	Drs. P. Ruscher/D. Stuart (FSU/CITM)	Welcome/introductions
8:45 - 9:15	Dr. R. McPherson (NMC)/ H. Hassel (NWS/SRH)	NWS perspectives on the CIAMS/CITM, SOO program and related issues
9:15 - 9:45	Dr. R. Orville (Texas A&M/CIAMS)	CIAMS overview and interests
9:45 - 10:15	Dr. T. N. Krishnamurti (CITM)	CITM overview and interests
10:15 - 10:40	EXTENDED BREAK	
10:40 - 11:45	Dr. R. McPherson (NMC)	SPECIAL TOPIC #1: NMC restructuring; plans, discussion, Q&A
11:45 - 1:15	LUNCH (On your own)	

(continued - All PM Sessions are in 307 Love - Meteorology/Math Building)

1:15 - 1:40	Dr. T. N. Krishnamurti (CITM)	Current skills in nowcasting of mesoscale rainfall from very high resolution models
1:45 - 2:00	R. Treadon (CITM)	Initialization of rainfall in the NMC MRF model
2:00 - 2:15	E. Williford (CITM)	A video presentation of the Storm of the Century

Tuesday, June 28

2:15 - 2:30	R. Correa-Torres (CITM)	The Mississippi floods (summer 1993)
2:30 - 2:50	Dr. J. Elsner (CITM)	Seasonal hurricane predictions for the Atlantic Ocean basin
2:50 - 3:10	Dr. J. Elsner (CITM)	Analysis of San Juan hourly surface and 12-hourly upper air data
3:10 - 3:30	BREAK	
3:30 - 5:30	Dr. R. Petersen (NWS)/ P. Janish (NSSL)/ D. Baker (LBB) other participants	SPECIAL TOPIC #2: PC-GRIDDS workshop; applications, update, case studies and other related modelling discussion topics
5:30	Adjourn for the day	
6:00 - end	Picnic dinner at FSU Reservation on Lake Bradford (transportation ride-shared)	

Wednesday, June 29

(AM sessions in Physics Conference Room)

8:30 - 9:15	Dr. S. Lyons (NHC)	Introduction to tropical meteorology
9:15 - 10:00	G. White (NMC)	Tropical modelling at NMC
10:00 - 10:15	BREAK	
10:15 - 11:00	Dr. R. Orville (CIAMS)	Using and interpreting lightning data in the southern United States
11:00 - 11:30	A. Perez (CIAMS)	The relationship between tornadoes and lightning
11:30 - 12:45	LUNCH (box lunches on site)	

(PM Sessions in 307 Love - Meteorology)

1:00 - 1:30	Dr. P. Ray (CITM)	WSR-88D algorithm development
1:30 - 2:15	D. Baker (LBB)	WSR-88D studies
2:15 - 3:00	D. Sharp (MLB)/ C. Paxton (TBW)	WSR-88D studies
3:00 - 3:15	BREAK	

3:15 - 4:00	L. Ruthi (OUN)	WSR-88D studies
4:00 - 6:00	J. Korotky (TLH)/ K. Pence (BHM)	SPECIAL TOPIC #3: Analysis and discussion of the Palm Sunday (1994) tornado outbreak
6:00	Adjourn for the day (Dinner on your own)	
7:30 - end	(All invited) (Room 307 LOV)	Organizational meeting of the North Florida AMS Chapter: Demonstration of weather applications software (Mosaic, GEMPAK, (McIDAS-X, etc.)

Thursday, June 30

(AM Sessions in Physics Conference Room)

8:30 - 9:15	Dr. K. Kloesel (CITM)	Gulf cyclogenesis studies
9:15 - 9:45	Dr. H. Fuelberg (CITM)	COMET studies on thunderstorm forecasting as related to the sea breeze
9:45 - 10:00	Dr. H. Fuelberg / Dr. Ruscher (CITM)	Tallahassee's minimum temperature forecast problem
10:00 - 10:15	BREAK	
10:15 - 11:00	Dr. M. Biggerstaff (CIAMS)	Derechoes and WSR-88D applications
11:00 - 11:45	S. Veleva (CIAMS)	Revised conceptual model of asymmetric squall lines
11:45 - 1:15	LUNCH (On your own)	

(PM Sessions in 307 Love)

1:15 - 1:45	Dr. P. Ruscher (CITM)	Florida sea breeze studies with the WSR-88D
1:45 - 2:00	C. Herbster (CITM)	Sea breeze modelling and observational studies
2:00 - 2:45	Dr. J. Ahlquist (CITM)	Initial conditions for ensemble forecasting
2:45 - 3:15	S. Allen (HGX)	South Texas WSR 88D studies and collaborative activities with CIAMS
3:15 - 3:30	BREAK	

3:30 - 5:30	Dr. J. Purdom (NESDIS)	SPECIAL TOPIC #4: GOES 8 workshop, RAMSDIS
5:30	Adjourn for the day	
6:30 - end	Dinner on the coast at Angelo's (transportation ride-shared)	

Friday, July 1

(Sessions in Physics Conference Room)

8:30 - 9:00	S. Amburn (TUL)	QPF issues and discussion
9:00 - 10:00	L. Ruthi (OUN)/ P. Janish/M. Eilts (NSSL)	Report on VORTEX, early results, EFF operations and discussion
10:00 - 10:30	G. Wilken (LIT)/ other participants	SOO professional development topics
10:30 - 10:45	BREAK	
10:45 - 12:00	Participants	Summarize action topics; planning for collaborative research and training; planning for 1995 workshop
12:00	Adjourn workshop	

Please be sure to register at the workshop and fill in the form including your full work address, telephone number, fax number, and electronic mail address, if available, in both cc:mail and Internet. This information will be shared with all workshop participants.

APPENDIX 2

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