SPC/NSSL SPRING PROGRAM 2003

http://www.spc.noaa.gov/exper/Spring_2003
SPC/NSSL Science Support Area
14 April - 6 June 2003

Program Overview
and
Operations Plan

5/1/03

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I. Historical Perspective

Co-location of the Storm Prediction Center (SPC) with the National Severe Storms Laboratory (NSSL) and other agencies in the Norman, OK Weather Center has facilitated considerable interaction and collaboration on a variety of experimental forecast and other operationally relevant research programs. A wide cross section of local and visiting forecasters and researchers has participated in a number of programs over the past six years. These include forecasting support for field programs such as IHOP, establishing the SPC winter weather mesoscale discussion product, evaluating operational and experimental NWP models for application in convective forecasting, and integrating new observational data, objectives analyses and display tools into forecast operations. A key goal of these programs is to improve forecasts of meteorological phenomena by speeding up the transfer of new technology and research ideas into forecast operations at the SPC, and sharing new techniques, skills, and results of applied research more freely. Typical issues addressed in these activities include, but are not limited to: data overload concerns in operations, testing and evaluation of new analysis or predictive (NWP) models, better understanding of operational forecast problems, development and evaluation of diagnostic conceptual models, and new product development and display strategies.

During the Spring of 2000 and 2001, these collaborative programs focused on critical SPC operational products including the short term predictability of severe and non-severe thunderstorms and potential impact on operational convective watch lead time. During the Spring of 2002, the program focused on providing forecasting support for the IHOP field project, primarily addressing afternoon convective initiation and nocturnal MCS development.

Details about earlier Spring Programs are available at:
www.spc.noaa.gov/exper/Spring_2000
www.spc.noaa.gov/exper/Spring_2001
www.spc.noaa.gov/exper/Spring_2002

This document will provide an overview of logistical, personnel, planning and verification issues involved in the Spring Program for 2003.

II. Program Motivation, Goals and Objectives

The prediction of convective weather is important from both meteorological and public service/societal impact perspectives. Since a primary mission of the National Weather Service is the protection of life and property from hazardous weather phenomena, applied research aimed at improving the forecasting of severe thunderstorms and tornadoes is a critical responsibility at the Storm Prediction Center (SPC) and the National Severe Storms Laboratory (NSSL).

The SPC is responsible for the prediction of severe convective weather over the contiguous United States on time scales ranging from several hours to three days. To meet these responsibilities, the SPC issues Convective Outlooks for the Day 1, Day 2 and Day 3 periods to highlight regions with enhanced potential for severe thunderstorms (defined as thunderstorms producing hail $\geq$ 3/4 inch in diameter, wind gusts $\geq$ 50 kt or thunderstorm induced wind damage, or tornadoes). These outlooks are issued in both categorical (slight, moderate, or high risk) and probabilistic formats, and are issued with increasing frequency as the severe weather time frame draws nearer. In addition to the scheduled Outlooks, Severe Thunderstorm and Tornado Watches are issued on an as-needed basis to provide a higher level of alert over smaller regions in time and space when atmospheric conditions are favorable for severe thunderstorms and tornadoes to develop. The SPC also issues Mesoscale Discussion Products which emphasize hazardous weather on the mesoscale, and often serve to fill the gap between the larger scale Outlooks and near-term watches. These specialized forecast products depend on the ability of SPC forecasters to assess the current state and evolution of the environment over varied time frames, synthesizing a wide variety of observational and numerical model data sources. In general, observational data play a larger role in the shorter time frames for diagnostic purposes, however, the development of more accurate and higher resolution mesoscale models in recent years has allowed model information to play an increasing role in the short-term prediction of convection as well.

In addition to the formulation of mesoscale models with ever increasing grid resolution and more sophisticated data assimilation systems and physics packages, there is increased recognition that factors such as initial condition uncertainty and model physics errors play a substantial role in setting limits of model predictability, both on synoptic time/space scales and subsynoptic scales. In fact, the impact of these sources of error may be greatest on the mesoscale and stormscale, where limits in our knowledge of physical processes and our ability to sample the atmosphere have considerable impact in the formulation of high resolution models capable of accurate prediction of small scale phenomena such as thunderstorm systems. Thus, development of ensemble forecasting systems, first used in medium-range prediction, are now being explored to assess their in short-range prediction. It is important for the SPC and NSSL to investigate the usefulness of both high resolution mesoscale models and Short-Range Ensemble Forecasting (SREF) systems for predicting severe thunderstorms, and these different approaches will be the primary focus of the 2003 Spring Program.

The use of SREF systems in severe weather forecasting is very much in its infancy, with little if any previous work done to address their utility in severe convective forecasting. Thus, we will be exploring basic issues associated with the use of SREF systems, including development of appropriate meteorological fields and parameters, visualization and display techniques, and interpretation of the post-processed SREF output as it relates to the formulation of outlook scale products. A major goal is to "mine" key information that may be needed by SPC severe weather forecasters from the vast amounts of data generated by SREF systems, and determine what is most useful to operational forecasters. The statistical nature of SREF output may lend itself directly to the formulation of the probabilistic suite of operational outlook products currently issued by SPC, and this subject will be specifically addressed during the program.

Finally, there continues to be a large requirement to improve the day-to-day short term prediction of convective initiation, evolution, and intensity, which relates directly to the quality of the SPC severe thunderstorm and tornado watch program. An effective NWS severe weather forecast and warning program is dependent on providing the public with sufficient advance notice of impending hazardous weather. Human response studies have shown that when a warning is issued, people are more likely to seek shelter if they have been made aware of the severe weather threat prior to the issuance of the warning. However, if they have not been "pre-conditioned" to the threat prior to hearing a warning, their first response is often to seek confirmation of the threat, rather than to seek shelter. This can result in the loss of precious time when life and property are at immediate risk. Thus, there is a substantial need for SPC to issue severe weather watches prior to the issuance of warnings by local WFOs, but this is dependent on knowing ahead of time "where and when" severe thunderstorms will develop.

Beginning in the 1980s, SPC forecasters became more reliant on new sources of real-time observational data, particularly from satellite and radar, to monitor the life cycle of thunderstorms. Most notable was the discovery that forecasters could often wait until they saw signs of convective initiation before issuing a watch. This new operational methodology resulted in more accurate placement of watches in time and space, but it also changed the character of the convective watch from a pure forecast product to a hybrid nowcast/forecast product.

Over the last two decades, SPC has been a recognized leader in the use of interactive computer workstations for operational forecasting of short-term hazardous weather. Given our primary mission of mesoscale forecast responsibility, it is not only prudent but necessary to place a strong emphasis on diagnostic analysis using real-time observational data for short-term thunderstorm prediction. However, owing to insufficient sampling of the mesoscale environment (especially when the distribution of water vapor is considered) coupled with limited scientific knowledge of important mesoscale and storm- scale processes, considerable uncertainty still exists in the short-term prediction of convection. As a result, it is in our best interest to continue exploring the ability of new experimental mesoscale and near-stormscale models to predict convective development. This will allow us to see if there is information from these models that can help us more confidently predict when and where convection will develop a few hours in advance, which is directly related to potential improvements in watch lead time.

These two modeling approaches allow us to examine important issues related to use of new model-based SREF systems, information transfer from models to forecasters, and high resolution model performance that can be directly related to forecaster decision making and potential improvements in severe thunderstorm forecasting.

The overall goal of the Spring Program is to facilitate collaboration and interaction between SPC forecasters, NSSL scientists, and other researchers and forecasters to advance operationally relevant research and improve severe weather forecasts. **During Spring Program 2003, the primary objectives are to: 1) explore the utility of SREF systems to provide unique and meaningful guidance in operational severe weather forecasting, and 2) examine the ability of new high resolution models to predict convective initiation and evolution, as it relates to improving watch lead time.**

III. Program Focus Areas

Spring Program 2003 will have seven (7) research thrust areas:

1. Explore the utility of SREF systems to complement existing deterministic model output in the probabilistic convective outlook formulation process.

2. Identify ways to extract meaningful information from SREF systems for use by operational severe weather forecasters.

3. Incorporate operational forecaster insights to develop effective visualization of SREF output fields that facilitate forecast decision-making within operational time constraints.

4. Test the concept of forecaster determined "feature-based" model sensitivity areas used in the generation of initial SREF perturbations.

5. Compare forecasts from a multi-model SREF system utilizing traditional objective techniques to generate initial perturbations with an experimental SREF system utilizing an adjoint model that incorporates subjective forecaster input to generate initial perturbations.

6. Examine the ability of new high resolution models to predict afternoon convective initiation and evolution.

7. Compare output from a 12 km version of the WRF model with convective parameterization and a 3 km WRF with explicit precipitation physics as it relates to forecasts of convective initiation, evolution, and mode.

IV. Spring Program Web Site

A full description of all program objectives, types of model output, forecast products, evaluation and verification forms, daily weather summary, and other related links are available at the Spring Program web site:

http://www.spc.noaa.gov/exper/Spring_2003

This web site will be fully operational by 1 May 2003. The site is intended to support real time activities as well as additional research and reference after the conclusion of the program.

V. Dates and Participants

Spring Program 2003 will run Mon-Fri from 14 April through 6 June 2003. Full time participants will work shifts of one week, with part-time visiting scientists participating on a 2-3 day basis (schedule permitting). Program operations will be conducted in the Science Support Area (SSA) located adjacent to the SPC Operations area. The full time forecast team will consist of four forecasters and/or scientists to complete daily forecasts and participate in evaluation/ verification activities. Staffing typically will include one SPC forecaster, one NSSL scientist and two visiting scientists and forecasters from NCEP/EMC, WFO/OUN and other NWS facilities, University of Oklahoma, Iowa State University, University of Arizona, MIT, and the University of Washington. Other visitors include staff from the Meteorological Services of Canada, the UK Met Office, USWRP, COMET, and NIFC.. ***Visiting participants are invited to present a seminar to the Norman Weather Center. Interested visitors should contact Steven Weiss (weiss@spc.noaa.gov).*** A brief training session will be provided to all participants on the morning of their first scheduled shift. A schedule of participants is provided in **Attachment A.**

VI. Daily Operations Schedule

SPC, NSSL, and visiting staff will create forecast products, conduct evaluation activities and participate in a daily map discussion in the Science Support Area from 8 am - 4 pm on Mon-Thu. Operations on Friday will run from 8 am - 1:30 pm and will serve to evaluate the experimental severe weather outlook valid on the previous day, verify deterministic model forecasts valid the previous afternoon, conduct the daily SPC/NSSL map discussion, and document interesting findings by the forecast team during the week. On Friday afternoon visiting forecasters and scientists will have the opportunity to present a seminar. No experimental severe weather outlooks will be created on Friday (see daily schedule below).

Participants are expected to perform evaluation activities in a collaborative manner, such that results reflect a consensus decision. Participants may eat lunch while conducting program activities or at their discretion any time during the day. Here is an outline of the daily schedule for activities during the Spring Program:

Monday:

8:00 am - 8:30 am:	- Orientation
8:30 am - 9:45 am:	- Complete online forms for subjective verification of deterministic model forecasts valid for previous day
9:45 am - noon:	- Traditional analysis and assessment of 12z deterministic models - Submit online input for MM5 SREF perturbations by 11:20 am - Produce Initial Day 2 severe weather outlook (graphic/text due by noon)
Noon - 1:30 pm:	- Lunch and daily SPC/NSSL Map Discussion
1:30 pm - 4:00 pm:	- Assess EMC and MM5 SREF output - Produce Final Day 2 severe weather outlook and complete SREF evaluation forms - Summarize activities, archive data, and wrap-up

Tuesday-Thursday:

8:00 am -9:45 am:	- Complete online forms for subjective verification of experimental outlooks and deterministic model forecasts valid for previous day
9:45 am - noon:	- Traditional analysis and assessment of 12z deterministic models - Submit online input for MM5 SREF perturbations by 11:20 am - Produce Initial Day 2 severe weather outlook (graphic/text due by noon)
Noon - 1:30 pm:	- Lunch and daily SPC/NSSL Map Discussion
1:30 pm - 4:00 pm:	- Assess EMC and MM5 SREF output - Produce Final Day 2 severe weather outlook and complete SREF evaluation forms - Summarize activities, archive data, and wrap-up

Friday:

8:00 am -9:45 am:	- Complete online forms for subjective verification of experimental outlooks and deterministic model forecasts valid for previous day
9:45 am - 11:20 am	- Standard analysis and assessment of 12z deterministic models - Submit online input for MM5 SREF perturbations by 11:20 am
11:20 am - noon:	- Summarize weekly summary of events, issues, comments, etc.
Noon - 1:30 pm:	- Lunch and daily SPC/NSSL Map Discussion
1:30 pm - 2:00 pm:	- Complete any remaining archive of data, and wrap-up
2:00 or 3:00 pm	- Visitor seminar time (1 hour)

VII. Forecast Products

A forecast component will be included in the program that consists of formulating Day 2 probabilistic severe weather outlooks valid for the 24 hour period beginning 12z the next day. The Day 2 time period was chosen because: 1) the forecaster decision-making process for the 24-48 hr time period depends almost entirely on model output, which simplifies the assessment of the role played by various data sources (as opposed to short-term forecasts, which are influenced by both observational data and model output), and 2) the coarser resolution SREF systems lend themselves more directly to forecasting in outlook time/space scales. A key component will be to determine the value-added impact of SREF output used by forecasters to adjust earlier forecasts based entirely on deterministic model guidance.

Two severe weather outlooks will be issued. The first will be a preliminary outlook issued by Noon CDT based on deterministic model output, typically the 12z Eta model (perhaps supplemented by other models such as the EtaKF and GFS). The second outlook will be issued by 4 pm CDT, and will incorporate EMC and MM5 SREF output to modify, if needed, the forecast probabilities issued in the preliminary outlook. In this way, we can compare the two outlooks and assess the impact of using new SREF output in the forecast process.

Each severe weather outlook will consist of a graphical product and a short written discussion explaining the rationale of the forecast, emphasizing the role of the model guidance in the decision-making process and focusing on key uncertainties in the forecast. The severe weather outlooks will be identical to the SPC operational Day 2 probabilistic severe outlooks, which forecast the probability of all severe weather types combined (hail, wind, tornado). They cover the CONUS domain and include possible contours of 5,15, 25, 35, and 45%. When a 10% or greater probability of significant severe events (F2 or greater tornado, hail ≥ 2 inches, or wind gusts ≥ 65 kt), a "hatched area" will also be delineated. These probability values represent the expected areal coverage of severe weather across the region evaluated on an 80 km grid. This is equivalent to the probability of severe weather occurring within ~25 miles of any point. These forecasts will be verified by severe storm reports collected by the SPC from local storm report (LSR) products issued by NWS WFOs across the country.

Experimental severe weather outlooks will be issued twice daily and are valid for the same time periods.

Outlook	**Issue Time**	**Valid Period**
Preliminary	17z (Noon CDT)	Day 2 (12-12z)
Final	21z (3 pm CDT)	Day 2 (12-12z)

During the preparation of the final outlook, the forecast team will be assessing various types of SREF output and utilizing this information to update the preliminary outlook. During this time, they will complete an evaluation form that will be used to document the usefulness of the two SREF systems in the forecast decision-making process. In order to complete evaluation forms in a timely manner, part of the forecast team should begin completing it while the forecast graphic and text discussion are being produced. Information about the Day 2 outlook product is provided in **Attachment B**; the SREF assessment forms are in **Attachment C.**

VIII. Morning Verification Activities

From ~8:00 am - 9:45 am daily, the forecast team will conduct subjective evaluations related to the SREF and deterministic model components of the program. Web-based forms are provided for these tasks, which are expected to be done in a collaborative manner with all team members contributing to the assessments.

A. On Tuesday-Friday during this time period, subjective evaluation of the experimental Day 2 severe weather outlooks valid for the previous day will also be performed. (On Tuesday morning, the Day 2 experimental outlooks valid for Friday will be evaluated). The evaluation of these outlooks will utilize plots of severe storm reports overlayed on the forecast probabilities to assess the accuracy and usefulness of the forecasts. It is important to make sure the team members assess the two outlooks (Preliminary and Final) using the following criteria: how well they delineated regions where severe reports occurred (spatial accuracy), how well they exhibited a sense of reliability (more reports occurred in regions with higher probabilities), and comparing the two outlooks in a relative sense, e.g., did the update provide better, worse, or the same level of accuracy. The verification will include numerical ratings from 0-10 and an opportunity for a brief written discussion explaining the decision. More information about the Day 2 Outlook verification forms is found in **Attachment D.** Objective verification of the Day 2 outlooks will also be conducted, and we view these two methods as being complementary.

B. Every day, 12z deterministic model forecasts of precipitation areas valid the previous afternoon will be assessed. Subjective evaluation of the deterministic model precipitation forecasts will focus on the regional domain used by the 3 km WRF model. This domain is adjusted daily to focus on the area having the greatest severe potential based on the 13z SPC Day 1 severe outlook. Verification will be made by comparing 3-hourly accumulated precipitation produced by four high resolution models (Eta12, EtaKF20, NMM8, WRF12, and WRF3) with hourly mosaic images of radar base reflectivity. The intent ***is not*** to perform a QPF verification, because storm severity is not necessarily correlated with precipitation amounts. What we are most interested in is the ability of the model precipitation forecasts to provide useful guidance to severe weather forecasters interested in predicting the “where”, the “when”, and the spatial pattern of thunderstorm development. Our working concept is this: if we have a good idea how the timing, location, and evolution of afternoon convection will unfold, our ability to issue high quality severe weather watches will increase in some situations. In addition, we will examine more closely comparisons between the WRF12 that incorporates the K-F convective parameterization scheme and the WRF3 with explicit precipitation physics. Our goal here is twofold: 1) to assess the impact of substantially increased resolution and explicit physics in the WRF, and 2) to determine if providing higher temporal resolution output (accumulated model precipitation at 1-hourly time frames compared to the standard 3-hourly time frames) assists forecasters in identifying detailed precipitation structures and aspects of convective mode in the model precipitation fields. It has been shown that subjective verification of mesoscale model precipitation fields provides important information about human perception of model performance, since traditional measures such as Equitable Threat Score can provide misleading information when small scale features are considered. See **Attachment E** for more information about the model precipitation forecast evaluation forms.

IX. Daily Map Discussion

A daily map discussion is held from 1:00-1:30 pm in the SSA to bring together SPC forecasters and

NSSL scientists for an informal discussion of interesting and/or unusual weather around the country, focusing primarily on severe storms during the spring season. During the Spring Program time period, it is appropriate to focus discussion on aspects of the program activities, including performance of yesterday's high resolution models, and SREF findings that are new and thought provoking. We would like two members of the forecast team to lead each discussion; usually the SPC forecaster will manage the NAWIPS displays and lead the discussion about application of daily findings to operational forecasting, and one researcher will facilitate discussion about scientific issues related to SREF concepts and/or deterministic models. However, all participants are encouraged to contribute to the discussion. This is an excellent forum to generate discussion on a wide range of topics related to the Spring Program, and we should make sure that we are successful in raising issues of scientific and operational importance.

The forecast team will have completed during the morning web based verification/evaluation forms intended to solicit specific information regarding the quality of the Day 2 Outlooks and deterministic model performance. Findings during the verification exercises will be presented in the first 5-15 minutes of the daily map discussion at 1:00 pm CDT. The remaining time will be allocated to an open discussion related to short-range forecast issues, the preliminary Day 2 Outlook, and a look at SREF activties. The map discussion is scheduled to end promptly at 1:30 pm, so team members will have sufficient time to prepare for the final Day 2 Outlook later in the afternoon. The forecast team is asked to document important comments, ideas, and findings made in map discussion pertaining to convective forecast issues for later review.

IX. Forecaster/Participant Duties and Responsibilities

All new participants will participate in an orientation session on the morning of their first scheduled shift. However, to become familiar with program goals and objectives, all participants are asked to read the operations plan prior to their first day in the SSA.

The forecast team will be made up of four members on most days, with shorter-term visitors present on some of the days (see schedule, **Attachment A**). <u>**There are two critical tasks that must be achieved.**</u>

> 1). First, input for the generation of the MM5 SREF perturbations must be submitted by 11:20 am. There is a fixed time to run the MM5 SREF system, with no flexibility for delays. (See **attachment G** for information about forecaster input to the MM5 SREF.)
>
> 2). The Day 2 outlooks should be created and issued in a timely manner, because this helps simulate a real-world forecasting environment where time deadlines must be met.

Completion of evaluation forms and documentation of key scientific findings are also important, but should not delay creation or issuance of the forecast products.

Participants in the Spring Program are responsible for the following activities while on shift:

- ✔ **Complete Verification and Evaluation forms for the high resolution model forecasts and experimental Day 2 severe weather outlooks valid the previous day.**
- ✔ **Submit all input for MM5 SREF perturbations by 11:20 am.**

- ✔ **Complete experimental Day 2 outlooks by Noon and 4 pm.**

- ✔ **Set up and facilitate daily Map Discussion (including review of previous day forecasts and other relevant verification issues)**

The order and responsibilities for completing scheduled activities should depend on individual skills and areas of interest. Since the SPC forecaster has the most familiarity with equipment and data flow, they will be assigned "lead" of the forecast team.

While it is recommended the entire forecast team work together and interact on forecast issuance and evaluation activities, it is most feasible to work in groups of two on specific tasks, with interaction as needed. A suggested breakout of specific duties is as follows:

Team Member A - SPC Representative who should lead the forecast team during daily operations. They are responsible for facilitating the outlook process and discussion, creating forecast graphics, and writing the outlook discussions. This forecaster's primary work area will be the Linux NAWIPS workstation in the northwest corner of the SSA. Forecaster A should lead map discussion on the first day of operations, but that responsibility should be shared among other participants as they become more familiar with systems/displays later in the week.

Team Member B - NSSL Representative who is primarily responsible for providing insight into the performance of specific models, adding insight to the forecast process via use of model output, and providing assistance in completing the Final Outlook evaluation forms (with Member D) during the time the outlook discussion is being written. This member is also responsible for documenting important discussion topics during map discussion. Their primary work area will be the Linux NAWIPS workstation located in the southeast corner of the SSA.

Team Member C - Visiting Scientists should provide insight into that part of the forecast process with which they are most familiar. Those with some background or interest in operational forecasting will work more closely with the SPC forecaster and assist in the outlook process. These participants should focus on their areas of expertise as it pertains to issuance of the outlook product, evaluation activities, or model/SREF system development and concepts. Their primary work area will be the Linux/Windows PC and HP NAWIPS workstation located on the north part of the SSA. This member will document the fields identified for input to generate perturbations for the MM5 SREF system. This person will work with Member B to complete SREF evaluation forms while the final outlook discussion is being written.

Team Member D - This visiting scientist or forecaster will work most closely with the NSSL scientist to interpret model systems and output. They will provide perspective from the operational forecasting or research community to identify issues related to model strengths/weaknesses, and/or ways to make model output more useful to forecasters. Their primary work area will be the Linux/Windows PC and HP NAWIPS workstation on the south side of the SSA.

Visitor(s) - These visiting scientists or forecasters are invited to participate in the forecast discussion and provide insight as applicable. They are encouraged to help in the analysis of model output and work with the forecast team as applicable. Although they do not have specific responsibilities, they can contribute to the activities as their time and interests permit.

X. Experimental Displays and Model Data

In order to incorporate new analysis displays and NWP model data into the forecast process, several non-operational data sets will be available for use during the Spring Program. It is hoped that through a proof-of-concept methodology data sets and analysis tools which provide useful information during the Spring Program will be more efficiently integrated into SPC operational data flow and workstations.

Model data which will be available to forecasters participating in the Spring Program includes the following (model run resolution / model display grid):

12km/80km Operational Eta Model (12, 18, 00, 06z)
12km/40km Operational Eta Model (12, 18, 00, 06z)
12km/12km Operational Eta Model (12, 18, 00, 06z)
22km/40km Experimental EtaKF Model (00, 12z)
22km/20km Experimental EtaKF Model (00, 12z)
48km/40km EMC SREF (Eta/RSM/EtaKF) (09, 21z)
30km/30 km NSSL/MM5 SREF (12z)
8km/8km Experimental Nested Non-hydrostatic Mesoscale Model (NMM) (12z - central U.S)
12km/12km NSSL WRF (12z)
3km/3km NSSL WRF (12z)

**** Italicized fields are experimental data not typically available to SPC forecasters ****
*** All model data will be available via NAWIPS workstations or Internet ***

In addition to standard NWP data, new displays for viewing SREF output are being developed within NAWIPS, including spaghetti, mean/spread, probability, median/max-min, probability matched mean, and operational Eta rank/departure from SREF mean charts of parameters used in severe weather forecasting. Also, the forecast teams will have ability to generate one time requests of numerous statistical quantities from the SREF grids.

XI. Operations Center Hardware and Software

Spring Program forecast and evaluation exercises will take place in the Science Support Area (SSA), immediately adjacent to SPC operational forecast area. Equipment available to spring program participants includes:

1. Dual monitor HP and Linux Workstations running NAWIPS with Netscape available for Internet access
2. Single monitor PCs with Windows XP applications (Internet, e-mail, etc.)
3. Automated Report Logging System (ARLS) for real time visual and audible alerts of any convective watches or warnings (or issuance of SPC operational products).
4. Four raised monitors to display U.S. loops and/or facilitate displays for map discussion.
5. National Lightning Data Network display (for CG lightning info)
6. Two laser printers for color and b/w hard copy output.

XII. Data Archive

The following Spring Program data are being archived on tape for post-analysis research:

Gridded Model Data:	12km Eta (12z run) 3hrly accum. precipitation 22km EtaKF (12z run) 3hrly accum precipitation 12km NSSL WRF (12z) 3hrly and 1 hrly accum. precipitation 3km NSSL WRF (12z) 3hrly and 1 hrly accum precipitation EMC SREF (09z run - 27-51 hrs/Day 2 output) NSSL MM5 SREF (12z)
All Point Forecast Data:	Eta, EtaKF
Objective Analyses:	SFCOA, sfcwxdataloop (metafiles)
Observational Data:	Surface Obs
Radar Data:	U.S. Mosaic Radar (Base Reflectivity)
Satellite Data:	1-SPC / 1km Visible (GOES-E)
VGF Files:	Lightning, Severe Reports, Day 2 Experimental Outlooks

XIII. Acknowledgments

Special thanks and appreciation is extended to all participants and staff for assisting in Spring Program preparations/planning, programming and data flow issues. Without the combined efforts of many SPC and NSSL staff, the Spring Program could not be conducted. In particular, special thanks to Andy Just (SPC) for developing the web page and online data archive; Phillip Bothwell (SPC) and Mike Baldwin (CIMMS/OU) for providing access to radar and severe storm report verification data; Gregg Grosshans (SPC) for establishing model data flow and configuring the experimental outlooks for transmission and archival; Jeff Cupo for developing and organizing model display files, and Jay Liang (SPC) and Doug Rhue (SPC) for assistance in configuring hardware/software in the Science Support Area. We further wish to recognize the full support of SPC and NSSL management and enthusiasm by participants from the Environmental Modeling Center (NCEP/EMC), Hydrological Prediction Center (NCEP/HPC); National Weather Service Forecast Offices, Norman, OK and White Lake, MI; University of Oklahoma, Iowa State University, University of Arizona, MIT, University of Washington, Meteorological Services of Canada (Toronto, Montreal, and Winnipeg), the UK Met Office in Bracknell, England, and the COMET program for funding assistance for visiting faculty, who provided assistance and motivation for making such an undertaking a positive experience for everyone.

Attachment A

Spring Program 2003 Participant Schedule

OPERATIONS SCHEDULE FOR SPC/NSSL SPRING PROGRAM 2003
14 APRIL – 6 JUNE 2003

ALL SHIFTS MON–FRI WILL BE FROM 8AM–4PM. FRI OPERATIONS WILL CONCLUDE AFTER MAP DISCUSSION AT 1:30 PM, ALTHOUGH VISITING SCIENTIST SEMINARS MAY BE PRESENTED AFTER FRIDAY MAP DISCUSSION. SCHEDULES MAY BE CHANGED OR TRADED THROUGH INDIVIDUAL AGREEMENT **AND** COORDINATION WITH STEVEN WEISS (x705) OR DAVID BRIGHT (x719).

New Participants in the experiment are strongly encouraged to read the Operations Plan prior to working their first shift. A list of all participants by affiliation is provided at the end of this document.

Updates to this document are available at:
http://www.spc.noaa.gov/exper/Spring_2003/

(#) – Visiting Scientist
(*) – Initial spin-up week

MON*	**TUE***	**WED***	**THU***	**FRI***
4/14	**4/15**	**4/16**	**4/17**	**4/18**
Weiss	Weiss	Weiss	Edwards	Edwards
Bright	Bright	Bright	Levit	Weiss
Levit	Levit	Levit		
	Edwards	Edwards		

MON	**TUE**	**WED**	**THU**	**FRI**
4/21	**4/22**	**4/23**	**4/24**	**4/25**
Weiss	Weiss	Kain	Kain	Weiss
Kain	Kain	Dial	Dial	Dial
Dial	Dial	Bright	Bright	Kain
Bright	Bright			Bright

MON	**TUE**	**WED**	**THU**	**FRI**
4/28	**4/29**	**4/30**	**5/1**	**5/2**
Gallus	Gallus	Gallus	Gallus	Gallus
Janish	Janish	Janish	Janish	Janish
Darrow	Darrow	Darrow	Darrow	Darrow
Nutter	Nutter	Nutter	Nutter	Nutter
Ferrier#	Ferrier#	Ferrier#	Anderson#	
	Anderson#	Anderson#		

MON	**TUE**	**WED**	**THU**	**FRI**
5/5	**5/6**	**5/7**	**5/8**	**5/9**
Homar	Homar	Homar	Homar	Homar
Wandishin	Wandishin	Wandishin	Wandishin	Wandishi
Kain	Kain	Kain	Kain	Kain

Carbin	Carbin	Carbin	Carbin	Carbin
	Billingsley#	Billingsley#	Uccellini#	
			Ashton#	

MON	**TUE**	**WED**	**THU**	**FRI**
5/12	**5/13**	**5/14**	**5/15**	**5/16**
Manikin	Manikin	Manikin	Manikin	Manikin
Stensrud	Stensrud	Stensrud	Stensrud	Stensrud
Bukovsky	Bukovsky	Bukovsky	Bukovsky	Bukovsky
Corfidi	Carbin	Carbin	Carbin	McQueen#
			Alarie#	
			McQueen#	

MON	**TUE**	**WED**	**THU**	**FRI**
5/19	**5/20**	**5/21**	**5/22**	**5/23**
Hansen	Hansen	Hansen	Hansen	Hansen
Brooks	Brooks	Brooks	Brooks	Brooks
Weiss	Weiss	Weiss	Weiss	Weiss
Mann	Mann	Mann	Mann	Mann
Mylne#	Mylne#	Mylne#	Mylne#	Mylne#
Sills#	Sills#	Sills#	Sills#	Sills#
	Gaynor#	Gaynor#	Gaynor#	
	Du#	Du#	Du#	
			Ball#	

MON	**TUE**	**WED**	**THU**	**FRI**
5/26	**5/27**	**5/28**	**5/29**	**5/30**
Bright	Burgess	Burgess	Burgess	Burgess
Grimit	Bright	Bright	Bright	Bright
Weiss	Grimit	Grimit	Grimit	Grimit
	Kain	Kain	Kain	Kain
		Michaud#	Michaud#	

MON	**TUE**	**WED**	**THU**	**FRI**
6/2	**6/3**	**6/4**	**6/5**	**6/6**
Brown	Brown	Brown	Brown	Brown
Peters	Peters	Peters	Peters	Peters
Baldwin	Baldwin	Baldwin	Baldwin	Baldwin
Seaman#	Seaman#	Seaman#	Bua#	Bua#

Full-Time Participating Scientists and Forecasters

SPC: S. Weiss, D. Bright, R. Edwards, G. Dial, M. Darrow, G. Carbin, S. Corfidi, J. Peters
NSSL: J. Kain, M. Wandishin, D. Stensrud, M. Baldwin, D. Burgess, H. Brooks, V. Homar
NCEP/EMC: G. Manikin
NWS/OUN: K. Brown
NWS/DTX: G. Mann
University of Oklahoma: P. Nutter, M. Bukovsky
MIT: J. Hansen
University of Washington: E. Grimit
Iowa State University: B. Gallus
Koch/Entergy Corp: P. Janish

Part-Time Scientists and Forecasters

NCEP/EMC: B. Ferrier, J. Du, J. McQueen
NWS/NIFC: R. Billingsley
NWS/USWRP: J. Gaynor
UK Met Office: K. Mylne
Met. Services of Canada: A. Ashton, M. Alarie, D. Ball, D. Sills, R. Michaud
COMET: B. Bua
NSSL: L. Wicker, D. Schultz
NWS/OUN: M. Foster
SPC: R. Schneider, J. Schaefer
Iowa State University: C. Anderson
Forecast Systems Lab.: S. Benjamin
Pennsylvannia State University: N. Seaman

Attachment B

Day 2 Experimental Severe Weather Outlook Instructions

Day 2 Experimental Severe Weather Outlook Instructions Spring Program 2003

Experimental severe weather outlooks for the Day 2 period will be issued twice daily Monday-Thursday. These outlooks will be very similar to the operational day 2 outlooks, except only severe storm probability contours will be formulated (no categorical outlook, and no general thunderstorms will be forecast). The same probability contours used in the operational day 2 outlooks will be used (5, 15, 25, 35, and 45 %), along with a probability of significant severe storms when appropriate. **All probability lines should be CLOSED, including those along U.S. coastlines and borders.** The Preliminary Outlook is issued by Noon CDT, and forecasters will utilize traditional forecasting methods based on 12z deterministic model output from the Eta, EtaKF, and GFS. During the afternoon, a Final Outlook will be issued by 4 pm CDT based on additional information received from the EMC SREF and MM5 SREF. The goal is to explore the utility of ensemble based guidance in severe weather forecasting, and to determine if it provides value-added information over and above that provided by traditional deterministic models. The statistical nature of ensemble prediction systems suggests particular application to probabilistic severe weather outlooks, where the assessment of uncertainty (or forecaster confidence) is especially important.

For the Preliminary Day 2 Outlook, the forecaster will draw/save probability contours in NMAP2, and save the outlook in the same manner as for operational outlooks. **After saving the outlook, enter the command: sp_day2 in an xterm window.** This is necessary to archive the outlook, attach a date/time to the graphics file corresponding to the preliminary outlook date/time, and send the graphics to the web page. Next, a discussion will be written in a text box on the web page that is similar to operational discussions, except a prime emphasis will be on aspects of uncertainty that impacts the development of severe weather on Day 2. For example, if models diverge on the placement of primary synoptic features (e.g, upper trough, surface low/boundaries), or if there is concern about the moisture return, or the breaking of a cap (will convection develop?), then these factors will be explicitly discussed in the discussion box below the outlook graphic on the web page. The text box is preformatted to provide a section to discuss forecast uncertainties.

For the Final Day 2 Outlook, the forecast team will assess the EMC SREF and MM5 SREF during the afternoon, and determine if any output provides improved understanding of the severe weather threat for tomorrow. After examining SREF output in NMAP2SP (see below), the team should decide if their assessment of Day 2 severe potential has changed. If forecaster confidence is increased (decreased) in certain parameters that might make severe weather more (less) likely in an area tomorrow, then the forecast team might consider having higher (lower) probability values compared to the preliminary outlook. The preliminary outlook should serve as the "first guess" for the final outlook, with adjustments (if any) based on information from the two SREF systems. After the final outlook probability contours are completed, the outlook is saved following the same procedures used for the preliminary outlook. (Remember to enter the **sp_day2** command after saving the outlook.) Once the outlook is available on the Final Outlook web page, a second discussion is written that documents the influence of both SREF systems in assessing the day 2 severe weather threat.

The SREF output can only be displayed in experimental NMAP2SP windows. To bring up a NMAP2SP display, go to an xterm and type: nmapsp <enter>

In NMAP2SP, a number of restore files and sfp files have been created to view a variety of SREF output in spaghetti, mean/spread, probability, etc. formats. There also is capability to generate one time requests (OTR) using a special GUI that automatically builds a wide variety of SREF output restore files.

Attachment C

Final Day 2 Outlook
SREF Output Assessment
(Web Based Forms)

Final Day 2 Outlook Preparation Form
Assessment of SREF Output
Spring Program 2003

TODAY'S DATE:
FORECAST TEAM:
VISITING SCIENTISTS:

I. General Assessment of SREF Output in Formulation of Final Day 2 Outlook

Please refer to the scale below in completing your subjective evaluation:

0	5	10
Not Useful	**Moderately Useful**	**Extremely Useful**

Not Useful: Provided no new information beyond what was available from deterministic models, or we did not know how to interpret and/or apply the information to severe weather.

Moderately useful: Provided some new information not available from deterministic models, and appeared to provide some helpful guidance for severe weather forecasting.

Extremely useful: Provided much useful information not available from deterministic models, and was directly applicable to assessing uncertainty in severe weather forecasting.

1. Overall, how useful did you find the SREF output in assessing severe weather potential?

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

2. How useful did you find the EMC SREF output?

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

3. How useful did you find the MM5 SREF output?

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

4. Text Box for general comments about SREF output
(FREE TEXT BX: Add general comments)

5. How useful were the following SREF display output techniques?

a. Spaghetti Charts

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

b. Mean/Spread Charts
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

c. Probability Charts
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

6. If you looked at spaghetti charts, which meteorological fields were best displayed in this chart format? (Check all that apply)

(CHECKBOXES:
250 mb: height isotachs
500 mb: height vorticity temperature isotachs
700 mb: height temperature dew point isotachs vert vel
850 mb: height temperature dew point isolatchs
Surface: PMSL temperature dew point isotachs
Pcpn: 3hr 6hr 12hr 24hr
Instby: CAPE CIN
Shear: SRH 0-6km Shear
Comp: SCP STP
Other
(FREE TEXT BX: Add additional comments)

7. If you looked at mean/spread charts, which meteorological fields were best displayed in this chart format? (Check all that apply)

(CHECKBOXES:
250 mb: height isotachs
500 mb: height vorticity temperature isotachs
700 mb: height temperature dew point isotachs vert vel
850 mb: height temperature dew point isolatchs
Surface: PMSL temperature dew point isotachs
Pcpn: 3hr 6hr 12hr 24hr
Instby: CAPE CIN
Shear: SRH 0-6km Shear
Comp: SCP STP
Other
(FREE TEXT BX: Add additional comments)

8. If you looked at probability charts, which meteorological fields were best displayed in this chart format? (Check all that apply)

(CHECKBOXES:
250 mb: height isotachs
500 mb: height vorticity temperature isotachs
700 mb: height temperature dew point isotachs vert vel
850 mb: height temperature dew point isolatchs
Surface: PMSL temperature dew point isotachs
Pcpn: 3hr 6hr 12hr 24hr
Instby: CAPE CIN
Shear: SRH 0-6km Shear
Comp: SCP STP
Other
(FREE TEXT BX: Add additional comments)

9. Did you use find other SREF data displays useful?

(CHECKBOXES: YES NO)

10. If "yes", please describe:
(FREE TEXT BX: Add general comments)

11. Please provide other comments and suggestions about SREF output:
(FREE TEXT BX: Add general comments)

Attachment D

Spring Program 2003
Day 2 Outlook Subjective Evaluation
(Web Based Forms)

Day 2 Outlook Subjective Verification Form
Spring Program 2003

TODAY'S DATE:
FCST. VALID PERIOD: ________________________
FORECAST TEAM:
VISITING SCIENTISTS:

I. Day 2 Preliminary Severe Weather Outlook Subjective Verification:

Overall Rating of Preliminary Severe Thunderstorm Outlook

In NMAP2 window 1 overlay the preliminary Day 2 outlook with the vgf file of severe reports for the 24 hour period. Rate the accuracy of the outlook on a scale from 0-10, with 0 being a very poor forecast, and 10 being a nearly perfect forecast. Since the outlook covers a national domain, some forecast regions may be more accurate than others - formulate an overall rating by averaging the accuracy of different forecast areas when necessary. Regions with greater severe storm occurrence or higher forecast probabilities should be given more weight in the rating process.

If the outlook was not available, **click on the checkbox labeled "NA".**

Day 2 Severe Thunderstorm Outlook Rating
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - e.g, regions where the outlook was good, and where it was not. Include aspects of predicted and observed coverage, and any displacement errors that were factors in your rating, e.g., the primary axis of severe weather was east of the forecast location.)

II. Day 2 Final Severe Weather Outlook Subjective Verification:

Overall Rating of Final Severe Thunderstorm Outlook

In NMAP2 window 2 overlay the final Day 2 outlook with the same vgf file of severe reports for the 24 hour valid. Rate the accuracy of the outlook on a scale from 0-10, with 0 being an extremely poor forecast, and 10 being a nearly perfect forecast. Pay close attention to the accuracy of this outlook compared to the preliminary outlook. If the final outlook was different from the preliminary outlook, determine if the changes resulted in a better outlook, worse outlook, or no change in perceived accuracy/usefulness to the product user. Make sure your rating reflects this relative comparison - for example, if the final outlook improved the preliminary outlook, the final outlook rating should be higher than the preliminary outlook rating.

If the outlook was not available, **click on the checkbox labeled "NA".**

Day 2 Severe Thunderstorm Outlook Rating
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - be sure to consider the rating of the final outlook relative to the preliminary outlook. If the final outlook showed changes from the preliminary outlook, discuss the relative impact of the changes on forecast accuracy (e.g, did the changes help or hurt the forecast.)

Attachment E

Spring Program 2003
Deterministic Model Precipitation Subjective Evaluation Forms
(Web Based Forms)

Deterministic Model Day 1 Precipitation Verification Form Spring Program 2003

GEOGRAPHIC REGION: ________________________

(***Defined by WRF3 domain)***

I. Data and Evaluation Instructions

For each of the following 12z models provide a subjective evaluations of the model forecast accuracy for total precipitation during the 18-21z and 21-0z periods.

1. From the NSSL WRF3 web page, estimate the 3-letter station ID near the center point of the WRF3 domain.
2. In window 1, load the sfp file SPRING_PGM_radar~BREF03 found in the local group
   a. set the time window from 18-03z;
   b. click on MAP, CUSTOM, and enter the 3-letter ID in GAREA , and accept.
3. In window 2 load the Eta12 **3-hrly precipitation fcst** for the 18-03z time period
   a. Click on MAP, CUSTOM, and enter the same 3-letter ID in GAREA, accept.
   b. Click on apply settings, loops 3-8.
   c. Load the Eta12
4. Load EtaKF, NMM, WRF12, and WRF3 **3-hrly total precipitation fcsts** for the 18-03z period in windows 3, 4, 5, and 6.
5. Load WRF12 and WRF3 **1-hrly total precipitation fcsts** for the 18-03z period in windows 7 and 8.

6. **In the other monitor** in window 1, load the spf file SPRING_PGM~visible~radar3~radar1 found in the local group.
   a. Click on MAP, CUSTOM, enter the same 3-letter ID in GAREA, apply to all loops, and accept.
   b. For each loop in windows 1-3, set the time frame from 18-03z
   c. Click on load

This will result in the following NAWIPS graphic displays:

	Left Monitor	**Right Monitor**
Window 1	visible satellite	3-hrly radar
Window 2	3-hrly radar	Eta12 3-hrly tot pcpn
Window 3	1-hrly radar	EtaKF 3-hrly tot pcpn
Window 4		NMM 3-hrly tot pcpn
Window 5		WRF12 3-hrly tot pcpn
Window 6		WRF3 3-hrly tot pcpn
Window 7		WRF12 **1-hrly** tot pcpn
Window 8		WRF3 **1-hrly** tot pcpn

This display arrangement facilitates visual comparison by forecast period between different model forecasts, and between model forecasts and radar by toggling between different frames on the same monitor. In addition, “side-by-side” comparison can also be conducted. Now compare the model precipitation forecasts with one-hourly radar reflectivity images valid during each model forecast period.

Please refer to the scale below in completing your subjective evaluation:

0	5	10
Poor Forecast	**Good Forecast**	**Excellent Forecast**

Poor Forecast:	Model missed primary features and would have provided bad guidance to a severe weather forecaster.
Good Forecast:	Model captured some primary features and would have provided some useful guidance to a severe weather forecaster.
Excellent Forecast:	Model captured all important features, and would have provided excellent guidance to a severe weather forecaster.

Note: we are not verifying QPF per se, but trying to determine the usefulness of the model precipitation forecast to a severe weather forecaster concerned with convective initiation and evolution. The timing, location, pattern (and possible information about convective mode), and movement of precipitation areas are factors to be equally considered, without strong emphasis on precipitation amounts. We use model QPF as a surrogate for model development of convective systems, because mesoscale NWP models do not explicitly predict severe thunderstorms.

Make sure that subjective numerical ratings are consistent in a relative sense. For example, if you believe that model A provided more accurate and useful guidance than model B, make sure that model A has a higher rating than model B.

II. Model 3 hrly Accumulated Precipitation Evaluation

If a model was not available, **click on the checkbox labeled "NA".**

A. First Period Model Evaluations - 18-21z Period

12z 12km Operational Eta - 18-21z period

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 20km EtaKF - 18-21z period

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 8km NMM - 18-21z period

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 12km WRF - 18-21z period

(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 3km WRF - 18-21z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

B. Second Period Model Evaluations - 21-00z Period

12z 12km Operational Eta - 21-00z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 20km EtaKF - 18-21z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 8km NMM - 21-00z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 12km WRF - 21-00z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

12z 3km WRF - 21-00z period
(CHECKBOXES: NA 0 1 2 3 4 5 6 7 8 9 10)

(FREE TEXT BX: Add additional comments related to reasons for your rating - identify strengths and weaknesses of the forecast relative to timing, location, and pattern)

III. WRF3 and WRF12 Comparison for 18-00z Period

Compare the 3-hourly and 1-hourly accumulated precipitation from the WRF3 and WRF12 models, and assess the usefulness of their forecasts in terms of timing, location, pattern, and movement of precipitation areas when compared to the radar mosaic images. Focus on the entire 6 hour period from 18-00z, paying closest attention to areas where the greatest severe threat occurred. For the 1-hourly model precipitation output, we are particularly interested in whether the higher temporal resolution allows better determination of timing, location, and convective structure/mode (e.g., linear, isolated cells, multicell clusters).

Refer to this scale in completing your subjective evaluation of the **WRF3 compared to the WRF12**:

-5	0	+5
WRF 3 Much Worse	**WRF3 The Same**	**WRF3 Much Better**

How did the WRF3 predict timing of precipitation compared to the WRF12?

(CHECKBOXES: -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5)

(FREE TEXT BX: Add additional comments related to timing fcst.)

How did the WRF3 predict precipitation location compared to the WRF12?

(CHECKBOXES: -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5)

(FREE TEXT BX: Add additional comments related to location fcst.)

How did the WRF3 predict precipitation movement compared to the WRF12?

(CHECKBOXES: -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5)

(FREE TEXT BX: Add additional comments related to movement fcst.)

How did the WRF3 predict precipitation structure / convective mode compared to the WRF12?

(CHECKBOXES: -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5)

(FREE TEXT BX: Add additional comments related to structure/mode fcst.)

Refer to this scale in completing your subjective evaluation of the **1-Hrly compared to the 3-Hrly pcpn**:

-5	0	+5
1-Hrly Much Worse	**1-Hrly The Same**	**1-Hrly Much Better**

How did 1-Hrly precipitation compare to 3-Hrly precipitation in providing information about timing, location, movement, and mode?

(CHECKBOXES: -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5)

(FREE TEXT BX: Add additional comments related to time resolution fcst.)

IV. General Comments:

Please provide any additional comments, especially in regard to the usefulness of the precipitation forecasts of the various models to provide useful short-term precipitation guidance for severe weather forecasters..

(FREE TEXT BX: Add additional comments)

Attachment G

Spring Program 2003
Generation of MM5 SREF Perturbations

Generation of MM5 SREF Perturbations

The MM5 SREF system generates perturbations using input by the forecast team that identifies environmental features and parameters considered to be important in the severe weather forecast. For example, the placement and depth of synoptic features such as 500 mb troughs, upper jet streaks, surface lows and boundaries such as fronts and dry lines, as well as thermodynamic variables such as low level moisture and instability, can all be an important part of the decision making process on given days. The MM5 SREF system uses the adjoint of the MM5 to incorporate forecaster identified "feature-based" regions of sensitivity (typically during the 24-48 hour Day 2 outlook period) into the generation of initial condition perturbations in a dynamically consistent manner. A special web-based GUI allows the forecast team to identify basic fields of interest (see below) and outline key areas on the forecast map that will be used to generate scaled perturbations (plus and minus) in the initial conditions.

To bring up the MM5 SREF GUI, you must be on netscape from a Linux NAWIPS. Click on the "netscape" box on the left side of the screen, and click on "spring program" when the entry window comes up. When netscape comes up, go to bookmarks and click on:

http://webtest.protect.nssl:1024/~fwang/

A total of 16 fields must be entered by the forecast team, resulting in 32 perturbations (or ensemble members) in the MM5 SREF system. Unlike ensemble systems that objectively generate initial condition perturbations, the MM5 perturbations reflect subjective forecaster input about what fields and locations are important on particular days.

The input must be entered and completed by 11:20 am in order to meet fixed run times of the SREF system. Thus, it is important for the forecast team to begin the "perturbation generation" process no later than 11 am. This should be an extension of the morning deterministic model analysis process associated with the preparation of the Preliminary Day 2 Outlook. During this process, the forecaster will be assessing his/her levels of confidence or uncertainty with regard to "ingredients" needed to generate severe thunderstorms, and this assessment will be the basis for identifying parameters considered important to the severe weather threat. If feasible, these parameters can be identified as the morning outlook process unfolds, prior to actual entry of data using the web-based GUI.

It works best if one team member (usually the forecaster preparing the Preliminary Day 2 Outlook) draws the sensitivity areas on the screen, and another team member writes down the list of parameters chosen on a paper form kept in a black notebook in the SSA. Parameters chosen come from a drop-down window list of basic mandatory level fields at the surface, 850, 700, 500, and 250 mb. Parameters include: t, q, u, v, vorticity, omega, geopotential height (or sea-level pressure), and CAPE. Simply draw a four-sided parallelogram around the desired area on the parameter map - click the mouse at each corner, and the program will automatically close the area after the fourth point. Click "continue" at the bottom of the page to enter this field. Once you have clicked "continue" you cannot change that field. (Click "cancel" if you do not like your area or parameter.) A counter at the top left of the display shows the number of entries you have to complete before you are finished, and it decreases by one as each field is entered.

Attachment H

Spring Program 2003
Weekly Participant Evaluation Form

Spring Program 2003
Weekly Participant Evaluation Form

NAME:

AFFILIATION:

LEVEL OF PARTICIPATION:
- ❑ **Part-time Visitor**
- ❑ **Full-Week Participant**

PRIMARY JOB RESPONSIBILITY:
- ❑ **Operational Forecaster**
- ❑ **Operational NWP Development**
- ❑ **Research Scientist**
- ❑ **Administrator**
- ❑ **Other: ______________**

DATES YOU WERE IN THE PROGRAM:

The primary goal of SPC-NSSL Spring Program is to improve forecasts of meteorological phenomena by speeding up the transfer of new technology and research ideas into forecast operations at the SPC, and sharing new techniques, skills, and results of applied research more freely. Below are specific goals of the Spring Program related to the NWS Strategic Plan and SPC 2003 goals. Your responses will allow us to evaluate the design and implementation of this year's Spring Program, determine our level of success in achieving those goals, and help to better define and design future Spring Program activities.

In the following questions, place an X above the appropriate rating.

Goal 1: Facilitate collaboration between operations and research, in an effort to advance severe weather forecast techniques and provide improved customer service.

G1.1. How well did the facilities and computer workstations support Spring Program activities?

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Not Well Reasonably Well Very Well

Comments:

G1.2. Were activities conducted during daily operations (model evaluations, issuance of forecast products, seminars, etc.) effective in helping to facilitate this collaboration?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective | Moderately Effective | Very Effective

Suggestions/Ideas:

G1.3. Was the Spring Program WEB page effectively structured to record evaluation information during subjective assessments and forecast product formulation?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective | Moderately Effective | Very Effective

Suggestions for improvement:

G1.4. How ***useful*** was the Spring Program in contributing to unique/new perspectives and/or partnerships applicable to your current work and professional development?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Marginally | Somewhat | Very | Extremely

What knowledge or ideas did you as a researcher or forecaster acquire that you will use in operations or future research?

G1.5. Assess the workload required during Spring Program. If you feel that the workload was too little or too much, please provide comments and/or recommendations regarding ways to improve daily operational tasks or justifying your assessment.

-5........-4........-3........-2........-1........0........+1........+2........+3........+4........+5
Too Little | A Good Mix | Too Much

Suggestions/Ideas:

G1.6. How would you rate your overall impression of the 2003 Spring Program relative to other operationally relevant, real-time exercises you've participated in? *If you have not participated in exercises of this type in the past, please do not answer, but provide comments as applicable.*

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Much Worse Average Much Better

Suggestions/Ideas:

<u>Goal 2</u>: Explore the utility of SREF systems in complementing existing deterministic model output in the probabilistic convective outlook formulation process.

G2.1. Were activities conducted during daily operations (model evaluations, issuance of forecast products, etc.) effective in exploring the utility of SREF systems?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective Moderately Effective Very Effective

Suggestions/Ideas:

G2.2. Evaluate how well the process of post-analysis subjective verification of the Preliminary and Final Day 2 Outlooks led to a fair and accurate assessment of the forecast skill of the Outlooks.

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Poor Adequate Good Excellent

Suggestions/Ideas:

<u>Goal 3</u>: Identify ways to extract meaningful information from SREF systems for use by

operational severe weather forecasters.

G3.1. Were activities conducted during daily operations (model evaluations, issuance of forecast products, etc.) effective in determining products that may or may not be useful to SPC forecasters?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective Moderately Effective Very Effective

What products are particularly useful to operations?

What products are NOT particularly useful to operations?

G3.2. Based on your experience in this Spring Program, rate on a scale of 1 to 10 the (potential) usefulness of short-range ensembles (NCEP, MM5, and/or others) to SPC operations.

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Useful Some Utility Extremely Useful

Comments:

Goal 4: Incorporate operational forecaster insights to develop effective visualization of SREF output fields that facilitate forecast decision-making within operational time constraints.

G4.1. Were NAWIPS display products effective in providing meaningful visualization of SREF output?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective Moderately Effective Very Effective

What other products/ideas should we pursue?

G4.2. Evaluate how well the process of utilizing SREF output and display products for the Final

Day 2 Severe Weather Outlook contributed to a useful assessment of the utility of SREF concepts and prediction systems in operational severe weather forecasting.

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Poor Adequate Good Excellent

Suggestions/Ideas:

<u>Goal 5</u>: Test the concept of forecaster determined "feature-based" model sensitivity areas used in the generation of initial SREF perturbations.

G5.1. Did our daily operations test the usefulness of this approach to SREF systems?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective Moderately Effective Very Effective

Suggestions/Ideas:

<u>Goal 6</u>: Compare forecasts from the NCEP SREF system (utilizing traditional objective techniques to generate initial perturbations) with an experimental MM5 SREF system (utilizing an adjoint model that incorporates subjective forecaster input to generate initial perturbations).

G6.1. Do you feel the Day 2 Outlook exercise provided an adequate opportunity to assess the operational utility of the two SREF systems? (Note: Quantitative evaluation between the two systems will occur after the program.)

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Not Effective Moderately Effective Very Effective

Comments about the operational utility of both SREF systems:

G6.2. Do you feel you have a better understanding of SREF concepts and/or utility in forecasting severe convection as a result of your participation in Spring Program 2003?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
No Impact   Some Impact   Considerable Impact

Where should the SPC go from here concerning utilization of SREF systems?

G6.3. Will your participation in Spring Program 2003 encourage you to use, examine, and analyze **SREF** data in real time forecast operations? (Answer if applicable.)

N/A 0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Marginal Impact   Some Impact   Considerable Impact

Briefly explain your rating:

G6.4. Did your participation in Spring Program 2003 have an impact on your understanding of SREF concepts and their potential utility in your research activities? (Answer if applicable.)

N/A 0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Marginal Impact   Some Impact   Considerable Impact

Any future research ideas you can attribute to your participation in the Spring Program?

Goal 7a: Examine the ability of high resolution models (Eta12, EtaKF, NMM) to predict

afternoon convective initiation and evolution.

<u>Goal 7b</u>: Compare output from a 12 km version of the WRF model with convective parameterization and a 3 km WRF with explicit precipitation physics as it relates to forecasts of convective initiation, evolution, and mode.

G7.1. Did the Spring Program evaluation help assess the ability of the Eta12, EtaKF, NMM, WRF12, and WRF3 to predict the initiation and evolution of convection?

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Not Effective Moderately Effective Very Effective

General comments, or comments about specific models:

G7.2. Evaluate how well the process of subjective verification in post-analysis lead to a fair and accurate assessment of model forecasts of precipitation fields relevant to convective initiation, evolution, and mode.

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Poor Adequate Good Excellent

Comments/Recommendations:

G7.3. How effective was the comparison of the 12 km WRF (parameterized convection) and 3 km WRF (explicit convection) in introducing you to the relative strengths and limitations of using high resolution model output for forecasts of convective initiation, mode, and evolution?

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Not Effective Moderately Effective Very Effective

Comments related to your rating:

G7.4. How useful were the displays of WRF 1-hourly model precipitation (compared to 3-hourly) in determining aspects of timing, movement, pattern, and mode of model generated convection?

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Not Useful Moderately Useful Very Useful

Describe ways in which this 1-hourly output was or was not helpful.

G7.5. Do you feel you have a better understanding of deterministic model performance and utility in forecasting convective initiation, evolution, and mode as a result of your participation in Spring Program 2003?

0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
No Impact Some Impact Considerable Impact

What are your most important impressions concerning model performance noted during your week in the program?

G7.6. Will your participation in Spring Program 2003 encourage you to use, examine, and analyze **deterministic model** data differently in real time forecast operations than prior to your participation? (If applicable)

N/A 0..........1..........2..........3..........4..........5..........6..........7..........8..........9..........10
Marginal Impact Some Impact Considerable Impact

Briefly explain your rating:

Goal 9: Design the Spring Program to foster better collaboration between research and

operations, and to improve mission critical elements for both the SPC and our collaborative partners within the meteorological community.

G9.1. How well did the Spring Program activities enhance interactions between operational and research groups by focusing on topics important to both segments?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Poor Adequate Good Excellent

Comments/Recommendations:

G9.2. Would you be interested in participating in any follow-up collaborative activities resulting from this Spring Program?

0.........1.........2.........3.........4.........5.........6.........7.........8.........9.........10
Are you crazy? Let me think about this I'd love to!

What specific areas of interest do you have?

Please offer any additional comments concerning the Spring Program on the remainder of this page.