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NCEP SREF Bundle

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where the nation's climate and weather services begin



Short Range Ensemble Forecast (SREF) System



Current Configuration

- **Current resolution: 48 km**
- **10 members: 5 Eta using BMJ plus 5 RSM using SAS**
 - **5 = 1 control + 2 breeding pairs (p1,n1,p2,n2)**
 - **Full North American Domain**
 - **Eta from June 2002, RSM from 2001**
- **09 and 21 Z runs to 63 hours**
 - **GFS Ensemble boundary conditions**
- **Products: AWIPS 212 CONUS grids available on NCEP ftp**
 - **Thinned Content for Each Member [standard GRIB]**
 - **Mean, spreads, probabilities [non-standard GRIB]**



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Proposed Upgrades

- **Late Summer: 48 km**
 - Go from 10 to 15 members:
 - **Add 5 Eta using Kain-Fritsch members**
 - 5 = 1 control + 2 breeding pairs (p1,n1,p2,n2)
 - NCO running in parallel since September 2002
- **Output format changes:**
 - **Use Ensemble GRIB Extension Standards** for mean, spread and probabilistic products on AWIPS CONUS grid #212
 - All probabilistic products in one file (rather than 5)



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Proposed Upgrades

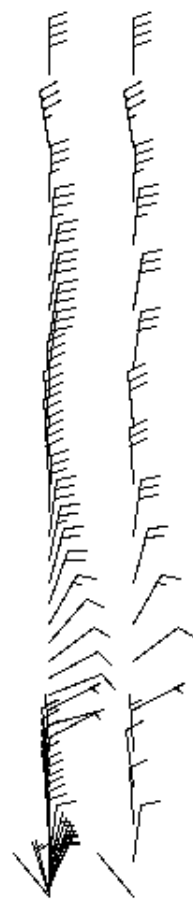
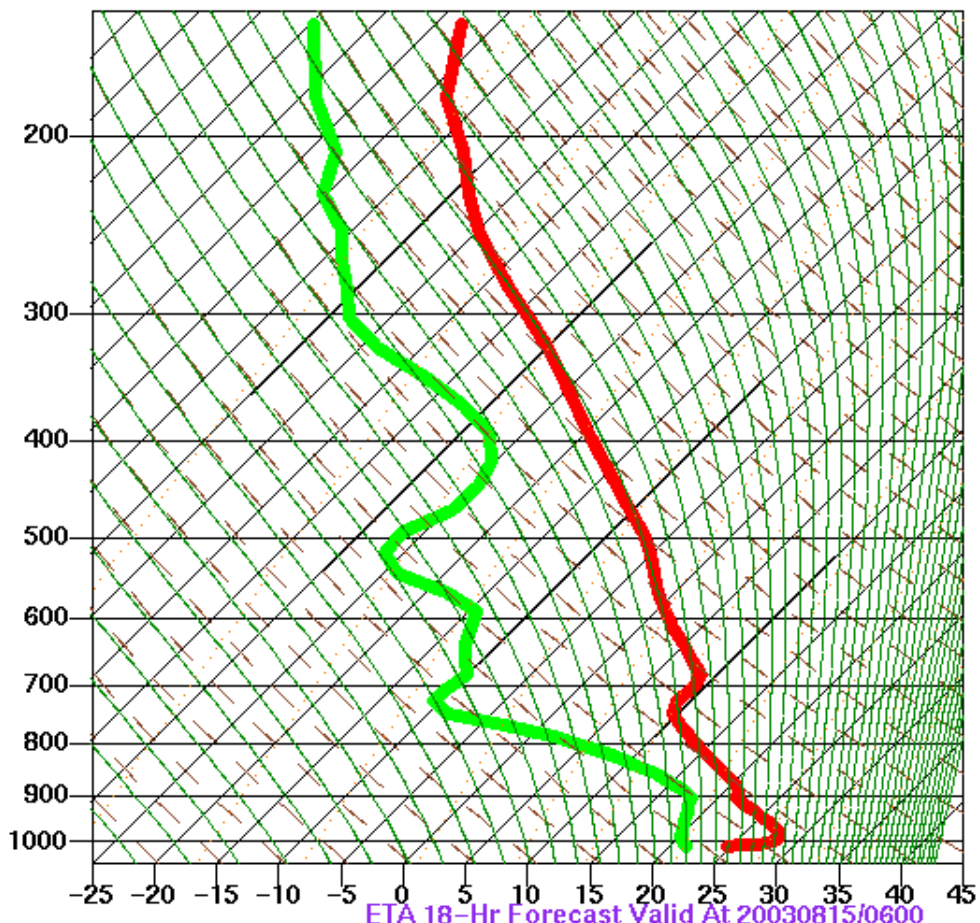
- **Additional GRIB output:**
 - Requested by Service Centers
 - Eta: Additional cloud and convective products (13)
 - RSM: Additional convective fields and vertical levels (40)
 - Additional fields can be used to generate future ensemble products
- **Create BUFR Sounding File**
 - BUFR Soundings for all 10 Eta ensemble members
 - Requested and used by SPC, HPC and AWC
 - Working on plans to ship to NCEP Service Centers



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Example of Eta BUFR Sounding

030815/0600 724030 KIAD CAPE: 1170 LIFT: -3 SWET: 189
030815/0600 724030 KIAD SHOW: 1 CINS: -64 TOTL: 44

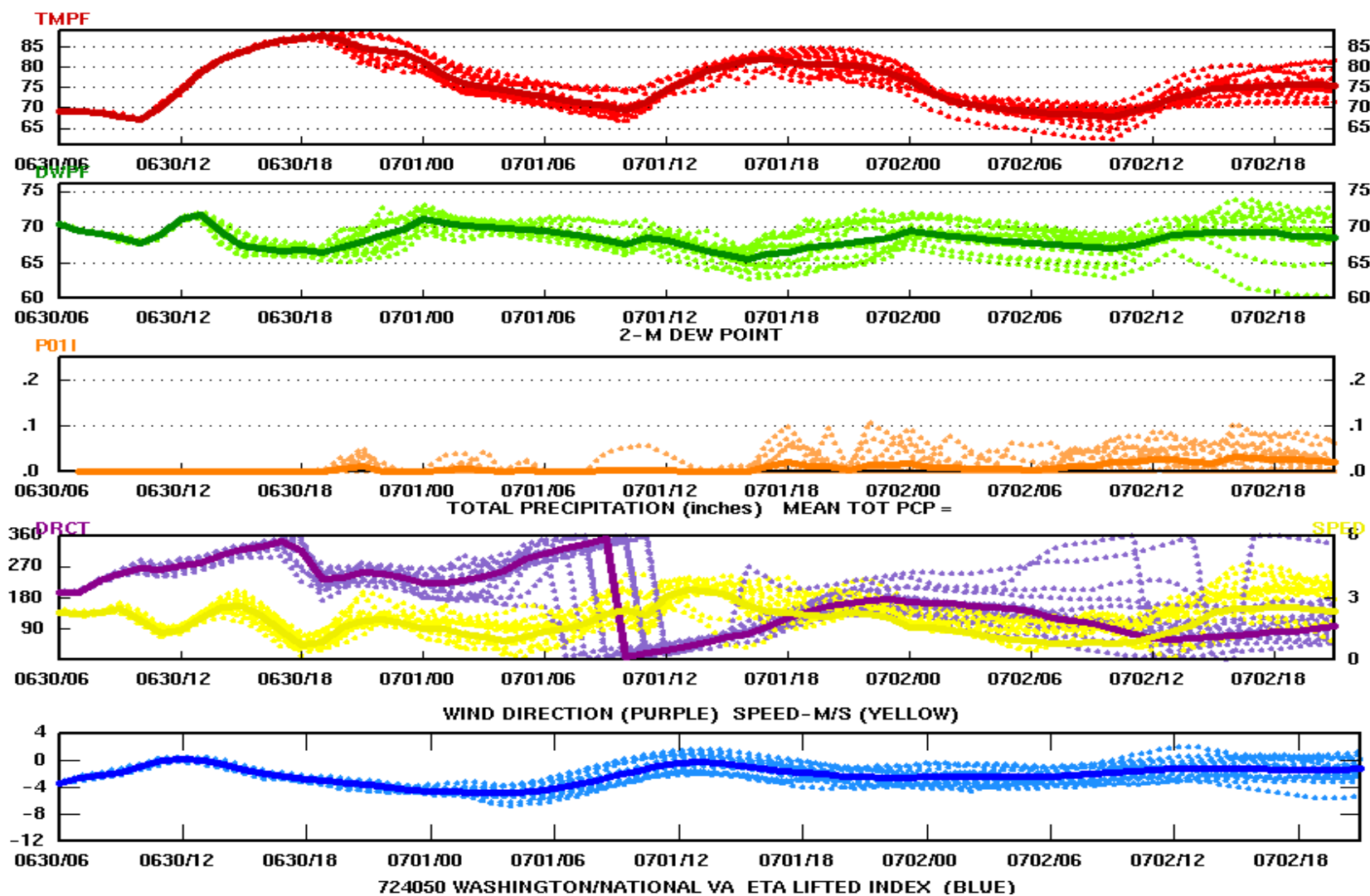




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Eta Members Ensemble Meteogram

724050 ETA 12 KM 60 LYR FCST 2-M TEMPERATURE





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GRIB formatting being fixed for these probabilistic products

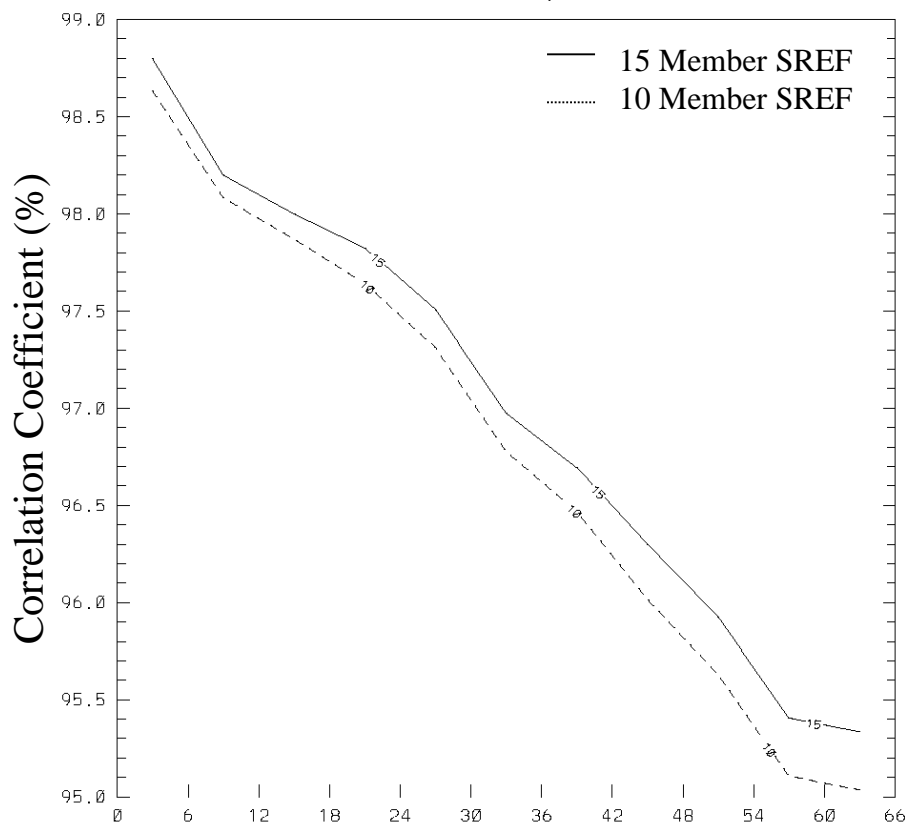
Grid #212: Lambert Conformal 40 km, 185x129

<i>Probabilistic Parameters</i>	<i>Units</i>	<i>Threshold</i>
Convective Avail. Pot. Energy	[J/kg]	≥ 500, 1000, 2000, 3000, 4000
Convective Inhibition (CIN)	[J/kg]	≤ -50, -100, -200, -300, -400
Storm Relative Helicity (SREH)	[m2/s2]	≥ 100, 150, 200, 250, 300
Lifted Index	[K]	≤ 0, -2, -4, -6, -8
Precipitation (3, 6, 12, 24 hr)	[Inches]	≥ 0.1, 0.25, 0.5, 1.0, 2.0
12hrly Accumulated Snow Fall	[Inches]	≥ 1, 2.5, 5, 10, 20
Prob precip type is rain	[%]	
Prob precip type is freezing rain	[%]	
Prob precip type is snow or sleet	[%]	

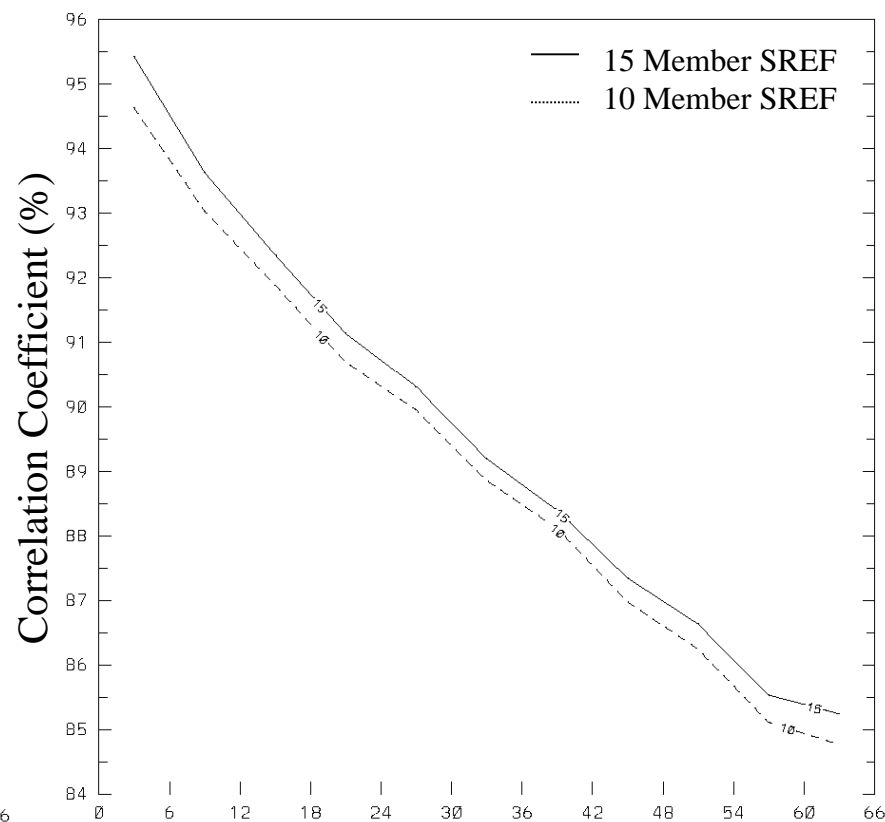


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July 2003 Correlation Coefficients



850 mb Temperature

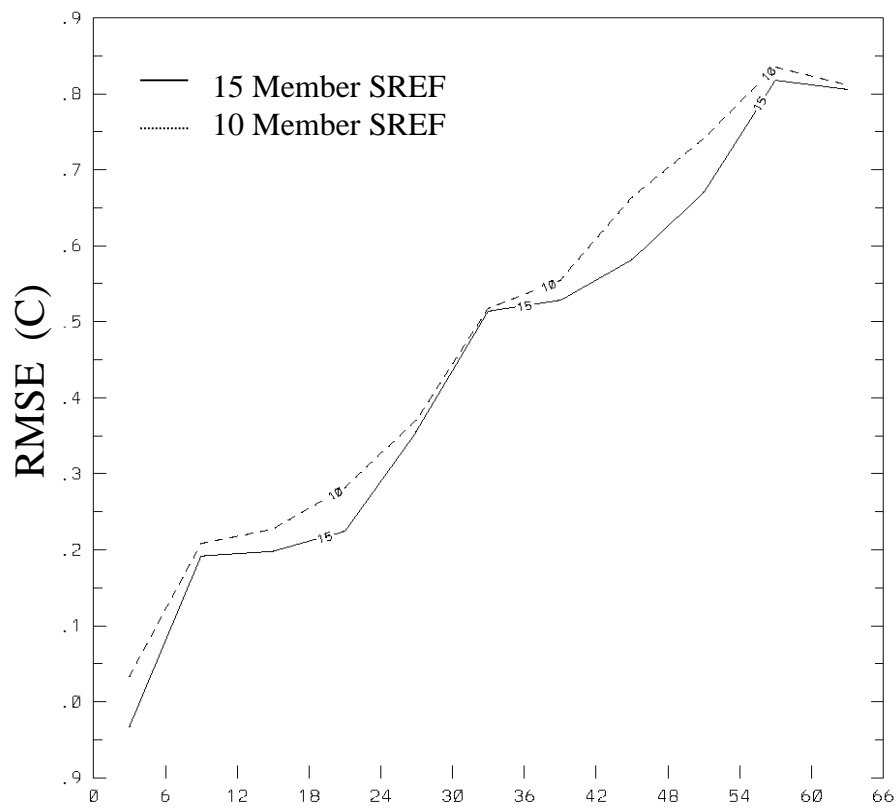


850 mb U-wind

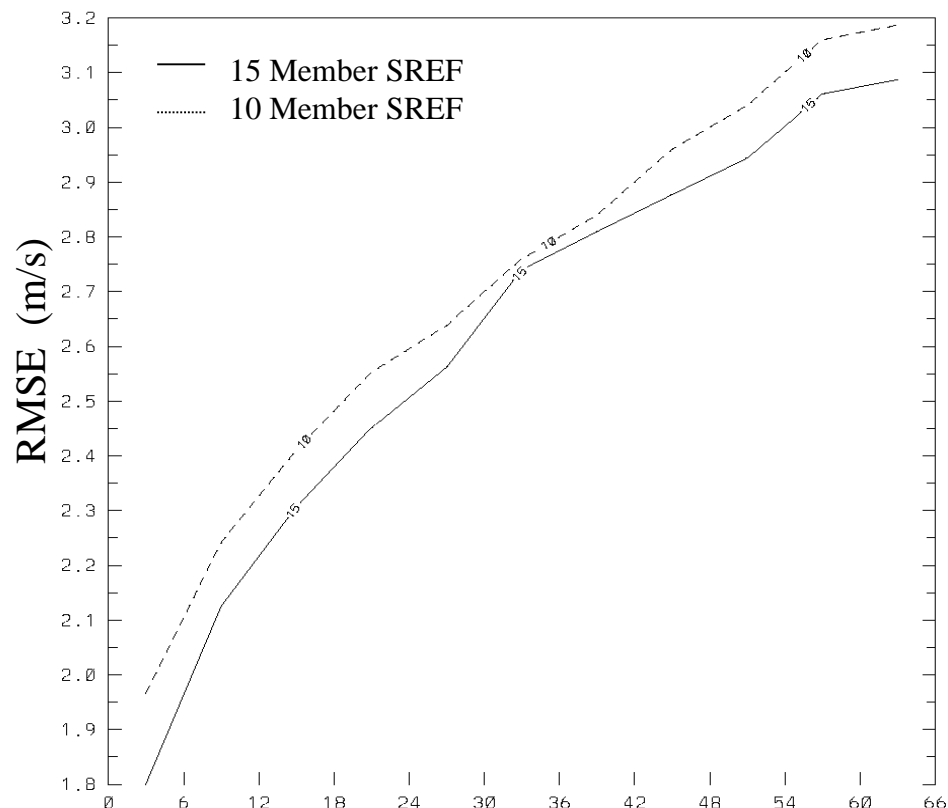


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July 2003 RMSE



850 mb Temperature

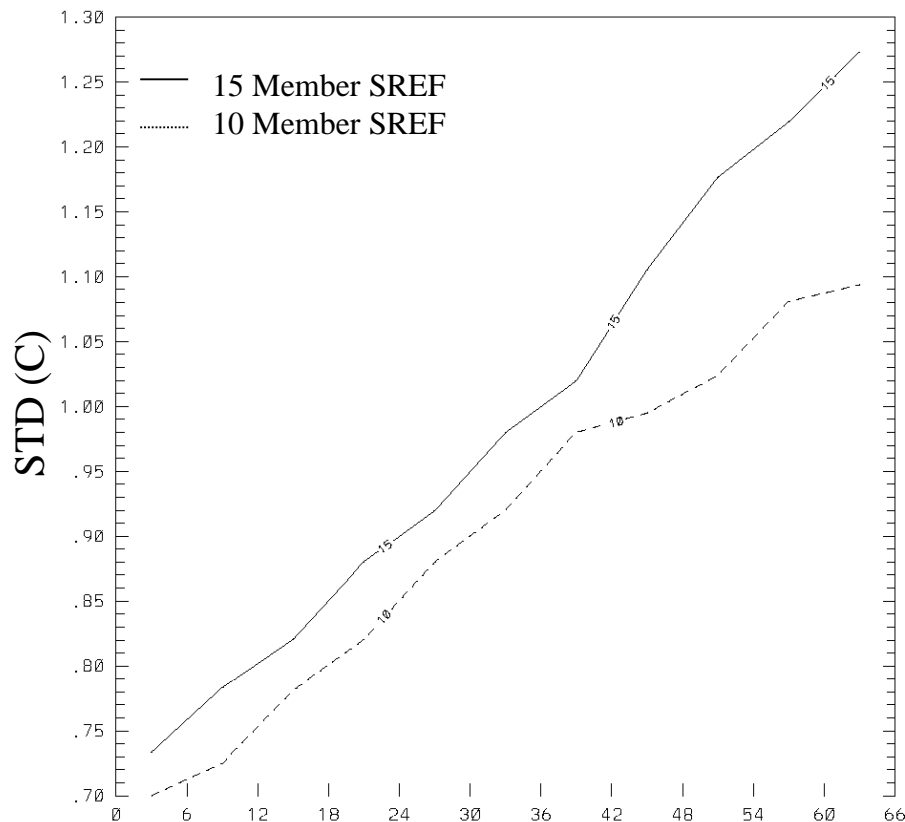


850 mb U-wind

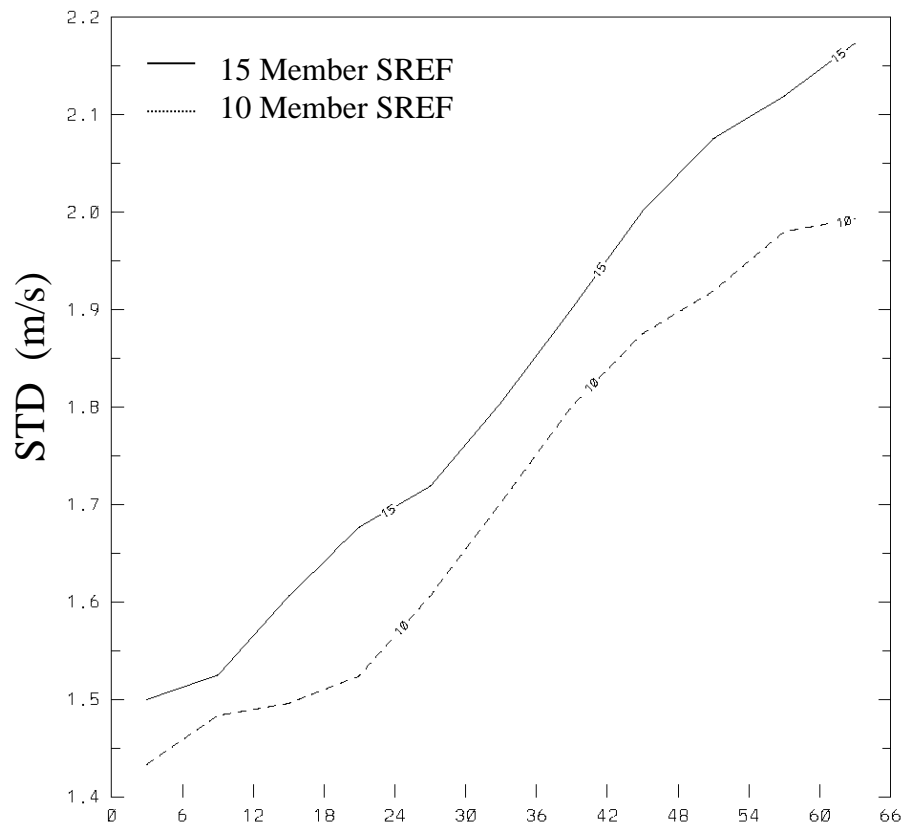


SREF Proposed Upgrades

July 2003 Spread (Std. Deviation)



850 mb Temperature



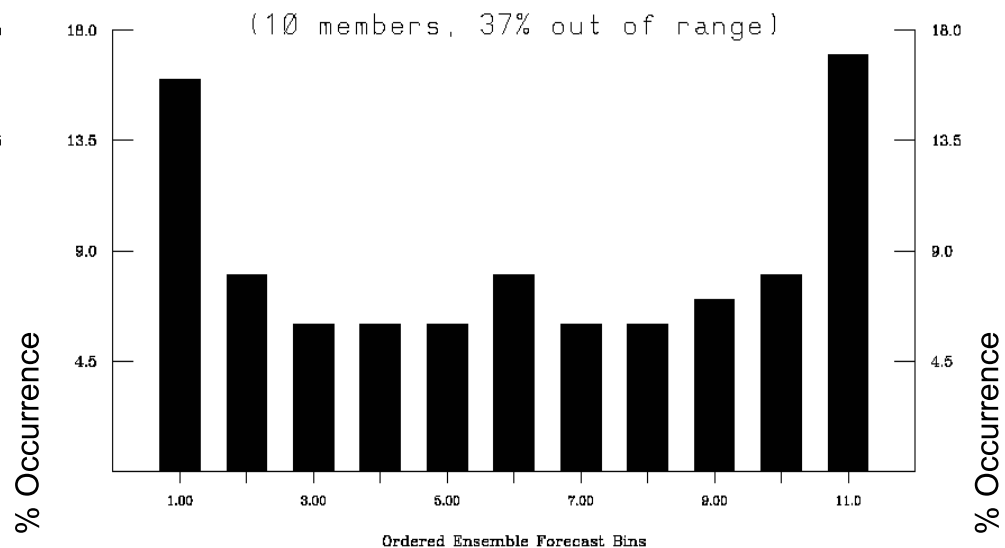
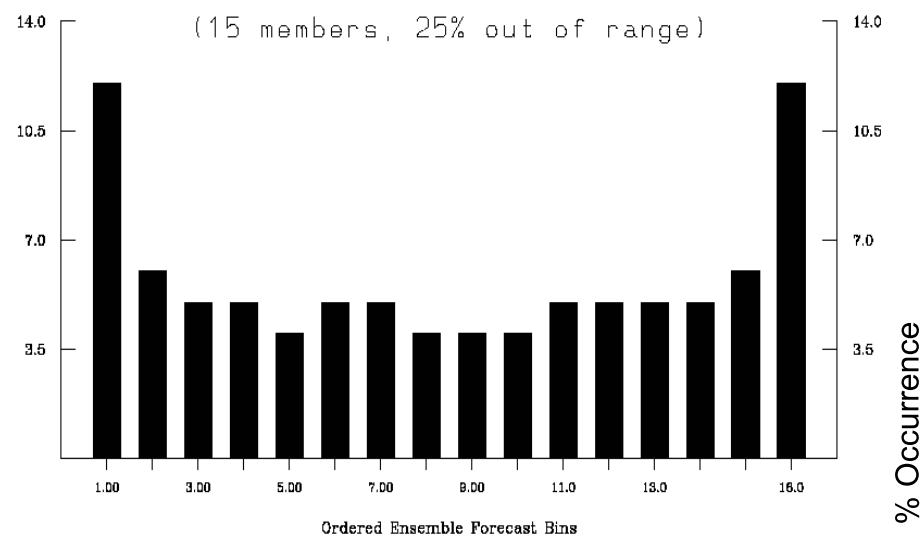
850 mb U-wind



SREF Proposed Upgrades

Ensemble Forecasts vs Analysis

Chance Ens Encompass Anl for 850mb-U at 63h (July 03)

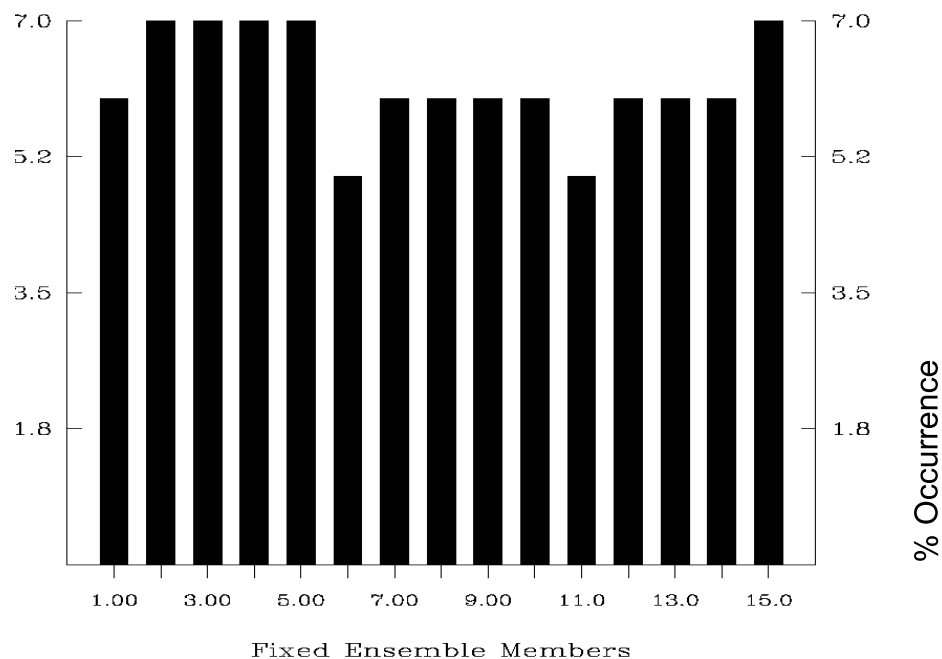




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Ensemble Members vs Analysis

Chances Nearest To Anl - 850mb-U at 63h (July 2003)

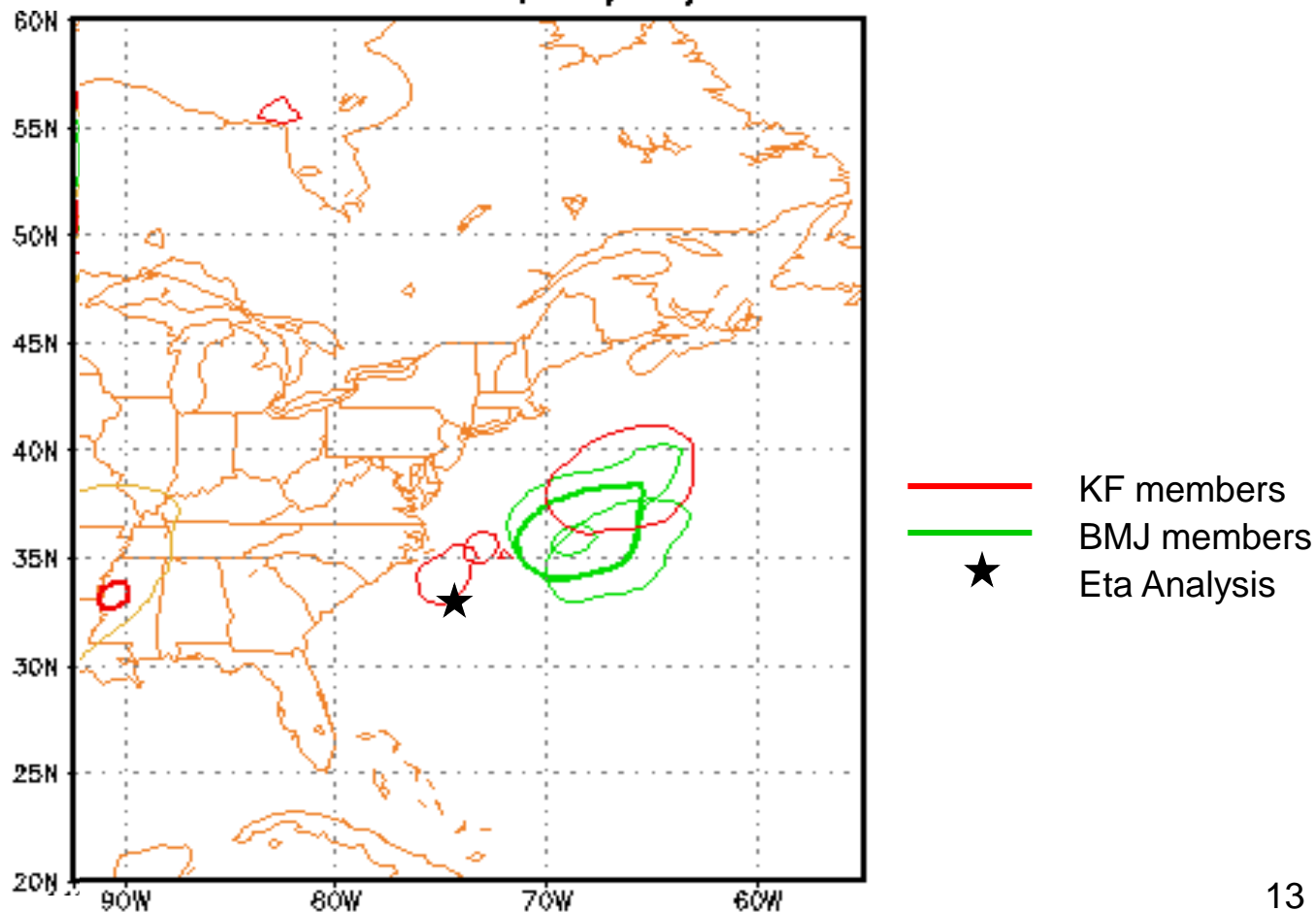




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Individual Member SLP Contours

COM SLP(MB) 1008mb Spgt 63H fcst from 09Z 23 OCT 2002
verified time: 00z, 10/26/2002

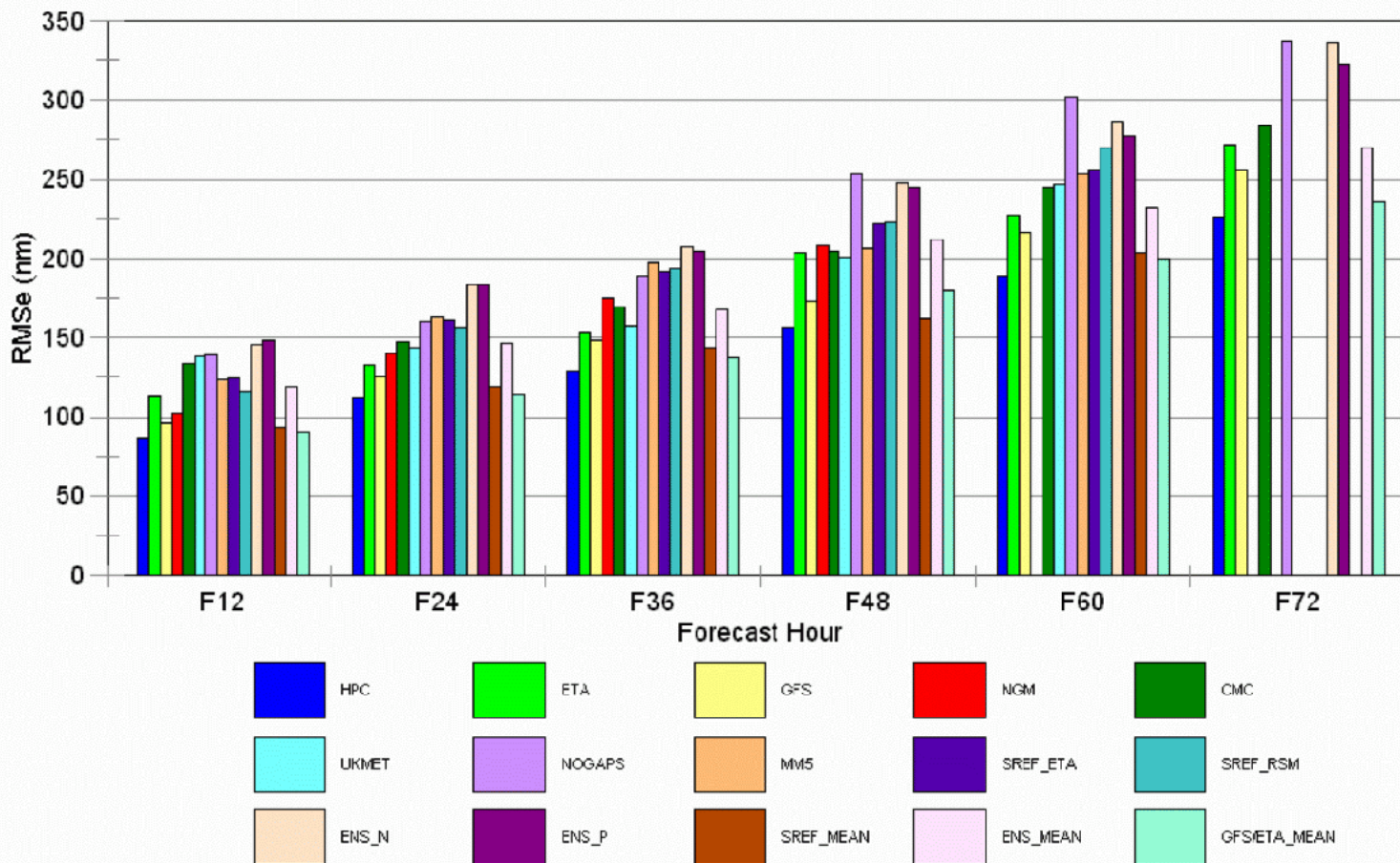




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Cold Season Application and Evaluation

Forecast Low Track vs Actual Low Track



On average 250 cases per forecast hour (drops to about 175 after forecast hour 48)



SREF Applications

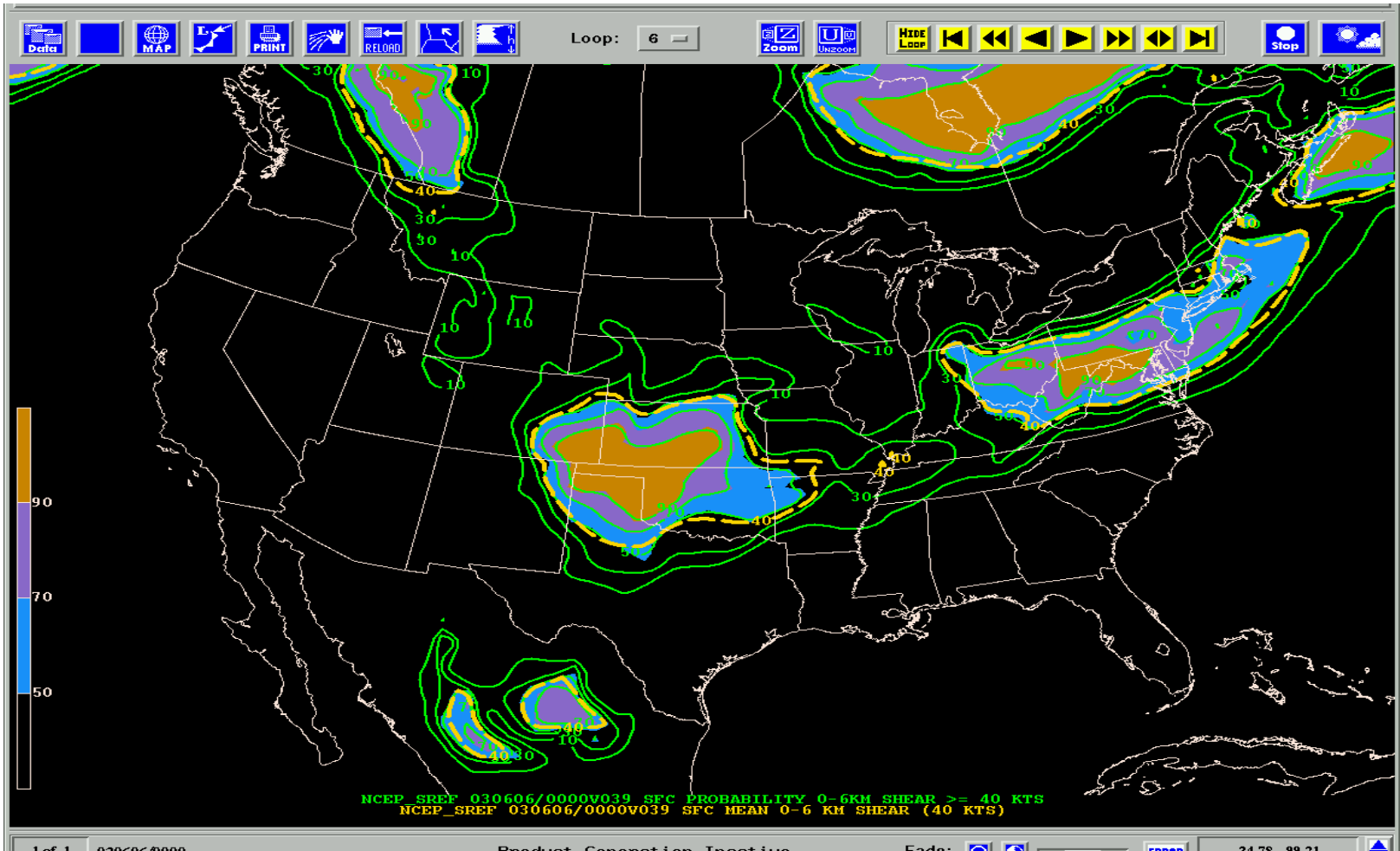
Spring Season Applications (SPC)

- **Advanced SREF Products w/ proposed 15 member upgrades**
 - **SPC probability of occurrence calculations for key Severe Wx parameters:**
 - **Wind Shear > 40 kts in column**
 - **CAPE > 1000 Joules/kg**
 - **Convective rain > 0.01 inch**
 - **Multiply probabilities to form a Joint Probability Product**
 - **Bias corrected gridded outputs**



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Wind Shear Prob > 40 kt

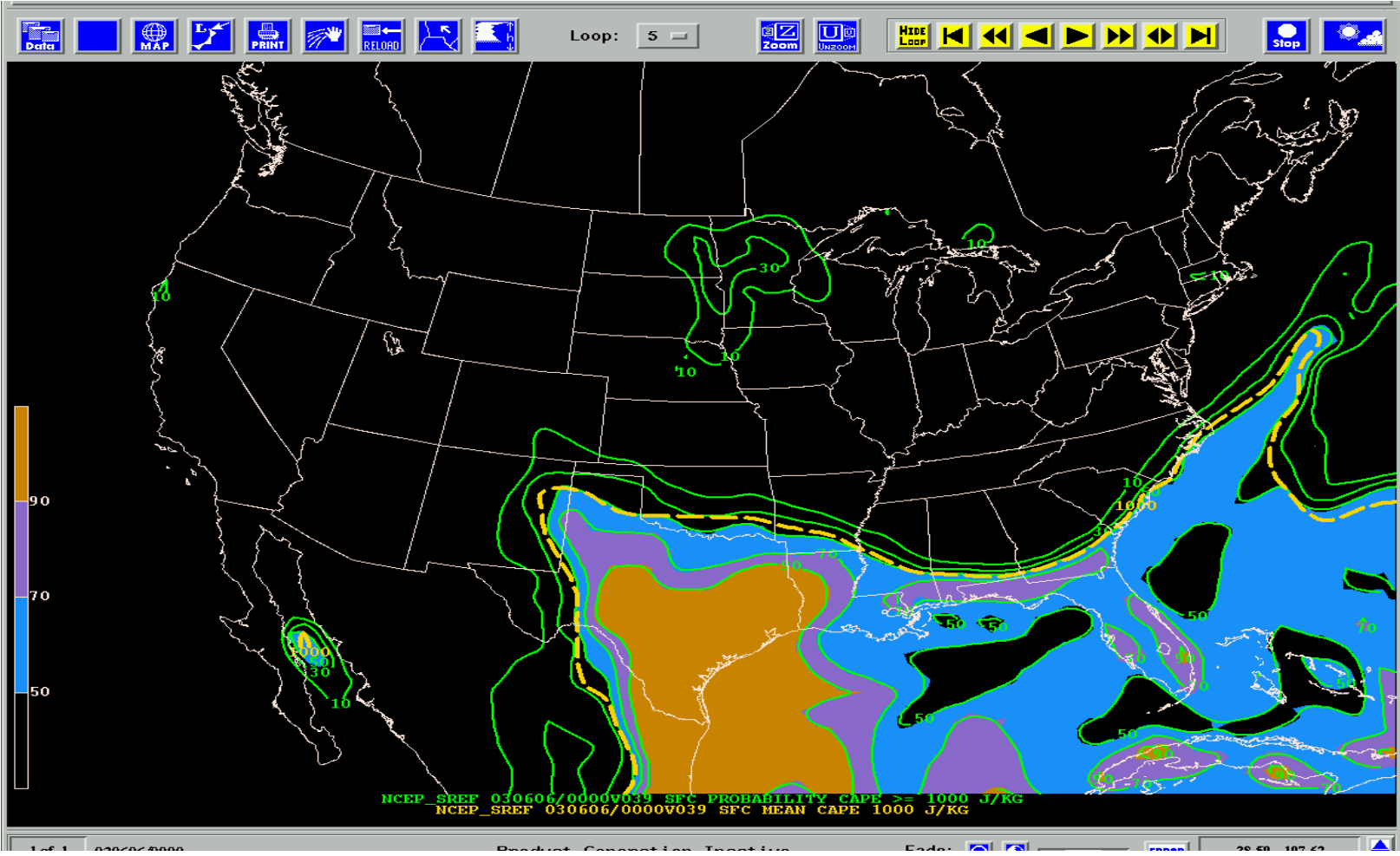


June 06 2003



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CAPE > 1000

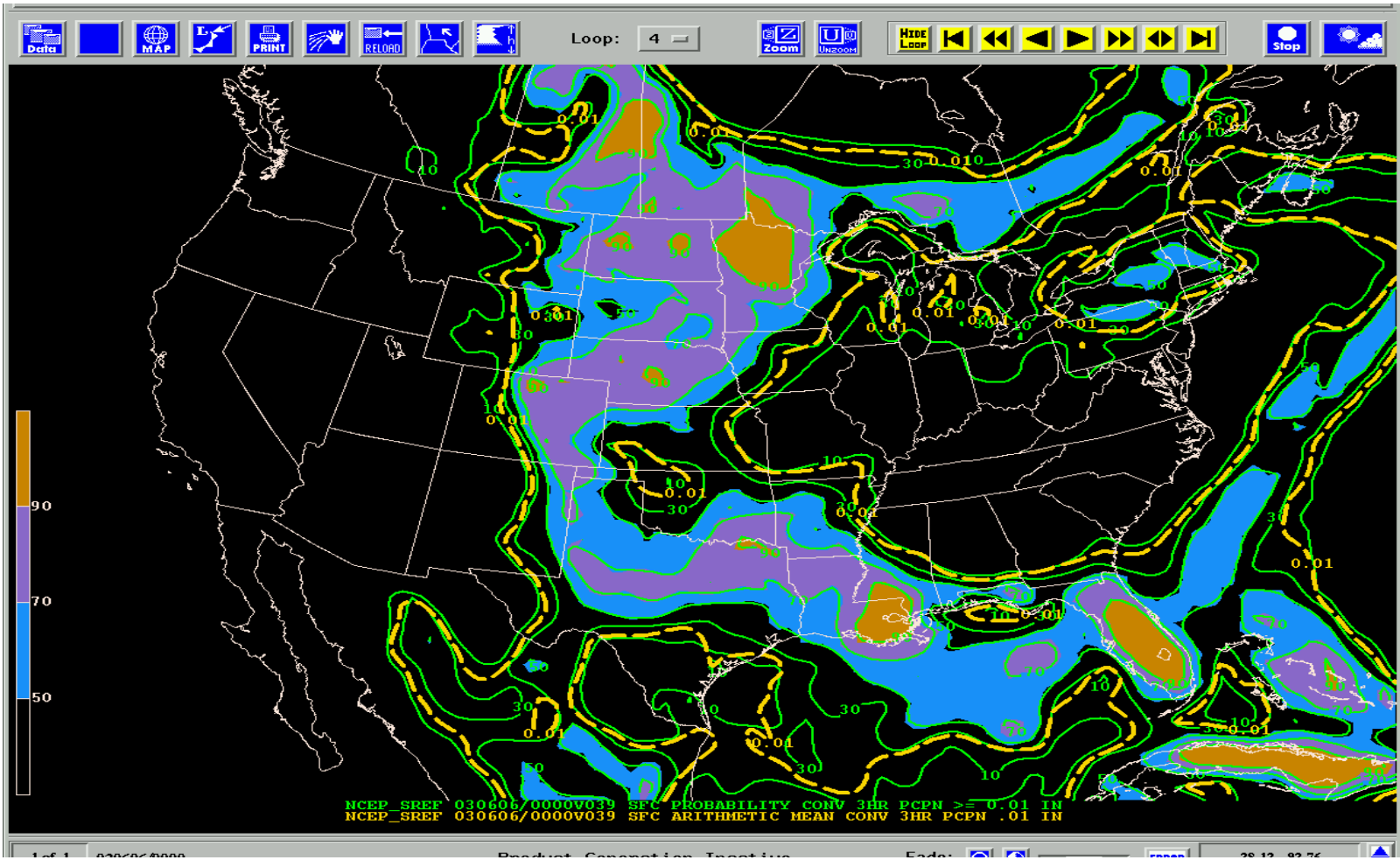


June 06 2003



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Convective Precip Probability



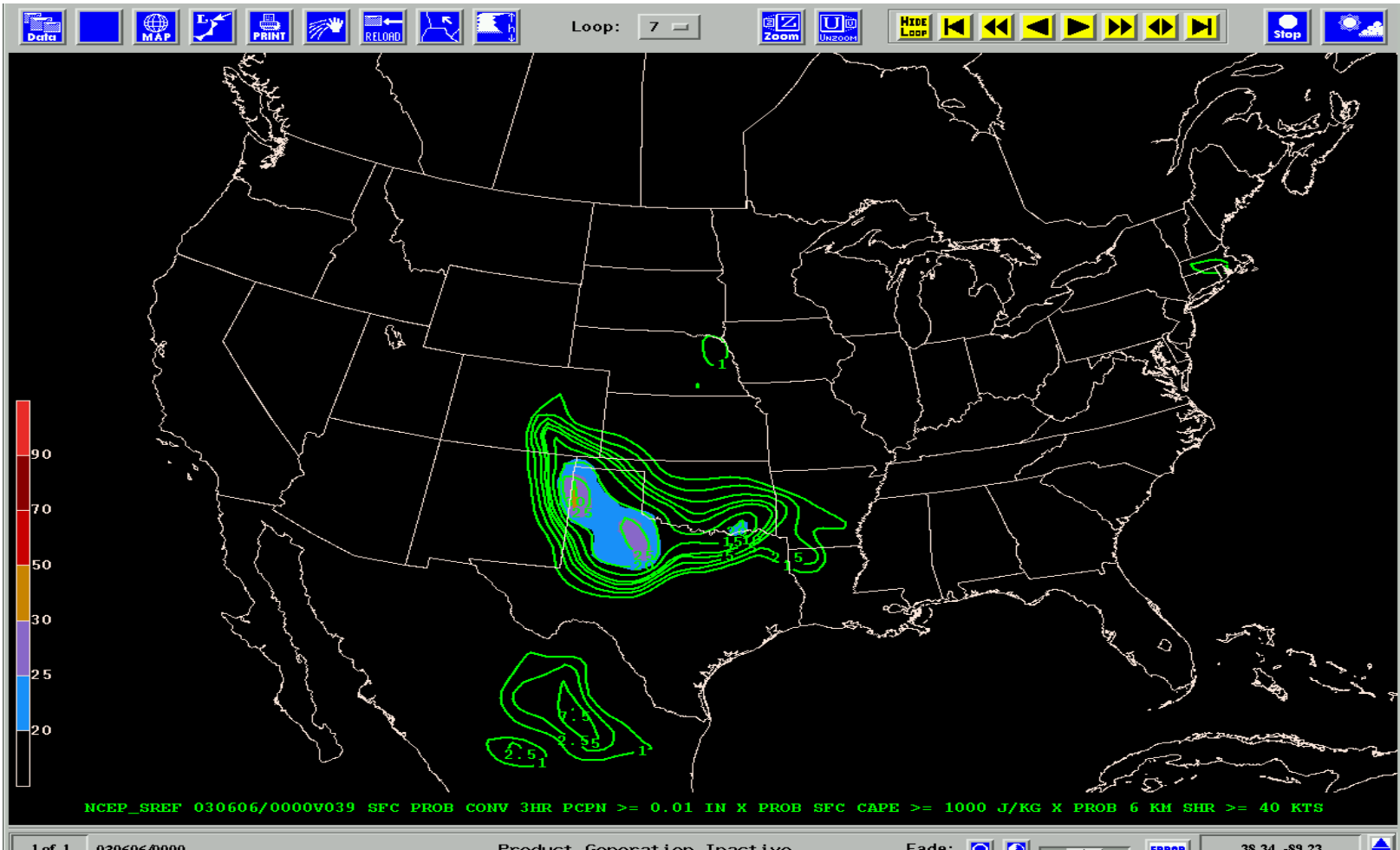
June 06 2003



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Combined Severe Weather Probability



June 06 2003



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All Centers Give Thumbs Up plus Comments

- **AWC:** *Wants the KF members for convective forecasts
NGM's Kuo convective parameterization should be added to the ensemble for forecasting afternoon convection*
- **SPC:** *Found SREF very useful during Spring Program
Probabilistic products helped quantify factors influencing severe weather occurrences*
- **TPC:** *Will begin looking at 10 m Gale wind and precip threshold probability*
- **HPC:** *Will use BUFR sounding output from SREF members to develop guidance for forecasting precip type during Winter Weather Experiment*
- **OPC:** *Interested in displays of convective precip probability and 10 m Gale wind probability*



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Other Comments

- Western Region:

K-F tends to do quite a bit better here in the Southwest where our summer boundary layer is much deeper and drier

Should examine SREF performance in forecasts of the upper low (off the Pacific NW coast during August)

- Eastern Region:

WFO Tauton Eta10 with K-F will often more correctly initiate convection earlier than ops runs: K-F SREF will benefit field

Concerns about how to display member soundings on BUFKIT and AWIPS

K-F ensemble will improve QPF predictions over the Northeast in concert with other operational ensembles such as MM5



SREF Proposed Upgrade

Summary



- **All upgrade package components have been JIFed and are being tested on production machine**
- **Improvements seen in accuracy and spread**
- **15-member ensemble and products actively used and desired by AWC, HPC and SPC**



BACKUP SLIDES



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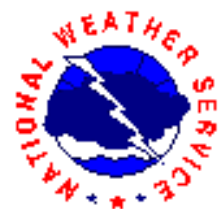
Grib Mean/Spread Products

Grid 212: Lambert Conformal 40 km, 185x129

<u>Mean and spread Parameters</u>	<u>Units</u>	<u>Level</u>	(* = not in Spread files)
2m Temperature	[K]	Sfc	
10m U, Vwind	[m/s]	10 m	
Total precipitation(3,6,12,24hr)	[kg/m2]	Sfc	
Convective Avail. Pot. Energy	[J/kg]		
Convective inhibition (CIN)	[J/kg]		
Storm RElative Helicity (SREH)	[m2/s2]	0-3000 m	
Lifted Index	[K]	0-30 mb abv grnd	
Sea Level Pressure	[Pa]	Sfc	
Pressure	[Pa]	1000-50 mb (every 50 mb) ?	
<i>Categorical rain *</i>	[y/n]	Sfc	
<i>Dominant precip type (over 3hr)*</i>	[1-7]	Sfc	
<i>12hrly Large scale Snow Fall*</i>	[kg/m2]	Sfc	
<i>12hrly Snow Depth*</i>	[kg/m2]	Sfc	
12hrly Accumulated Snow Fall	[kg/m2]	Sfc	
<i>Absolute vorticity*</i>	[/s]	1000-50 mb (every 50 mb)?	
Geopotential height	[gpm]	1000-50 mb (every 50 mb)?	
Relative humidity	[%]	1000-50 mb (every 50mb)?	
U, V- wind	[m/s]	1000-50 mb (every 50 mb)	
Temperature	[K]	1000-50 mb (every 50 mb)?	
Thickness	[gpm]	1000-850, 1000-500, 850-700mb	



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Additional Fields in Post

Eta Fields

- best CAPE
- convective cloud cover
- non-convective cloud
- cloud bottom height (ceiling)
- cloud bottom pressure (ceiling)
- cloud top height
- cloud top pressure
- cloud top temperature
- maximum wind level height
- maximum wind level pressure
- maximum wind level U component
- maximum wind level V component
- tropopause height

RSM Fields

- best CAPE
- 20 new pressure levels (40 total)
- dewpoint temperature all pressure levels
- 2m dewpoint temperature
- storm relative helicity
- storm motion
- storm motion U component
- storm motion V component



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Recent Changes

<u>Date</u>	<u>Change (Jif #)</u>
01/22/02	Eta Members: Implement new Ferrier Cloud physics (33)
08/06/02	Eta Members: Update land-sfc model heat flux routines to prevent negative fluxes (651)
04/14/03	RSM Members: Modify Grib post to produce extra output levels (40)
07/08/03	Eta members: Corrected truncation program to read from new format Eta restart files (264)

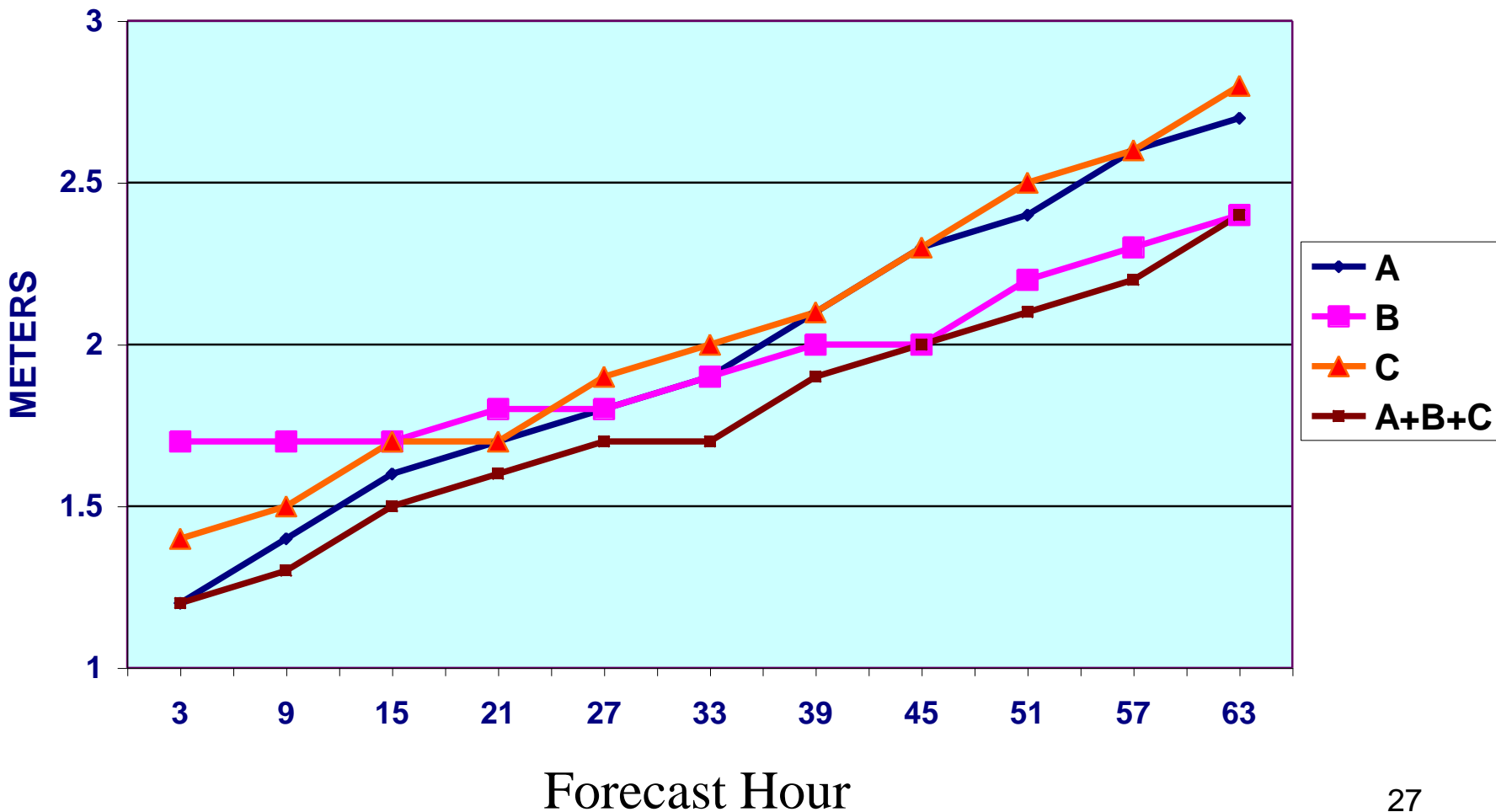


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Late Summer Impact Results



SLP RMSE (July 2003)





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Probabilistic Cloud Cover

ETA model: Prob of Total Cloudness between 80-100%

At 24H, FCST from 09z Jul 15 2003. Verified Time: 09z 07/16/2003

