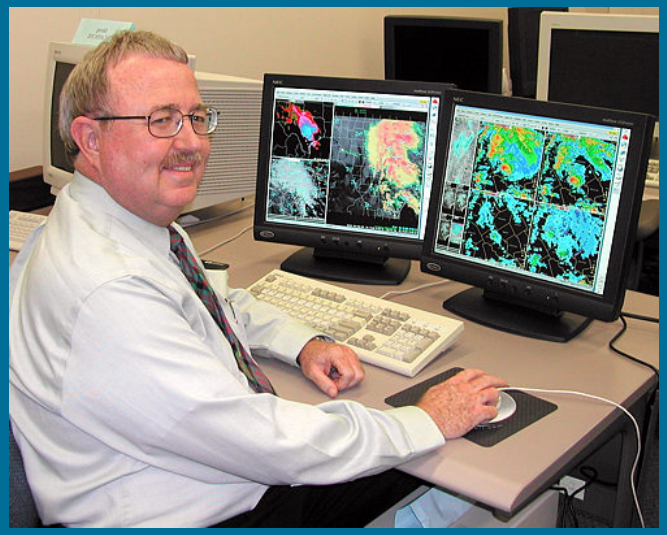
Review of NCEP's Model Suite 2005



Bernard N. Meisner
Scientific Services Division
NWS Southern Region
Fort Worth, Texas

Where America's Weather Occurs!

The views expressed herein are those of the author and do not necessarily reflect the position of the National Weather Service.

Thanks!

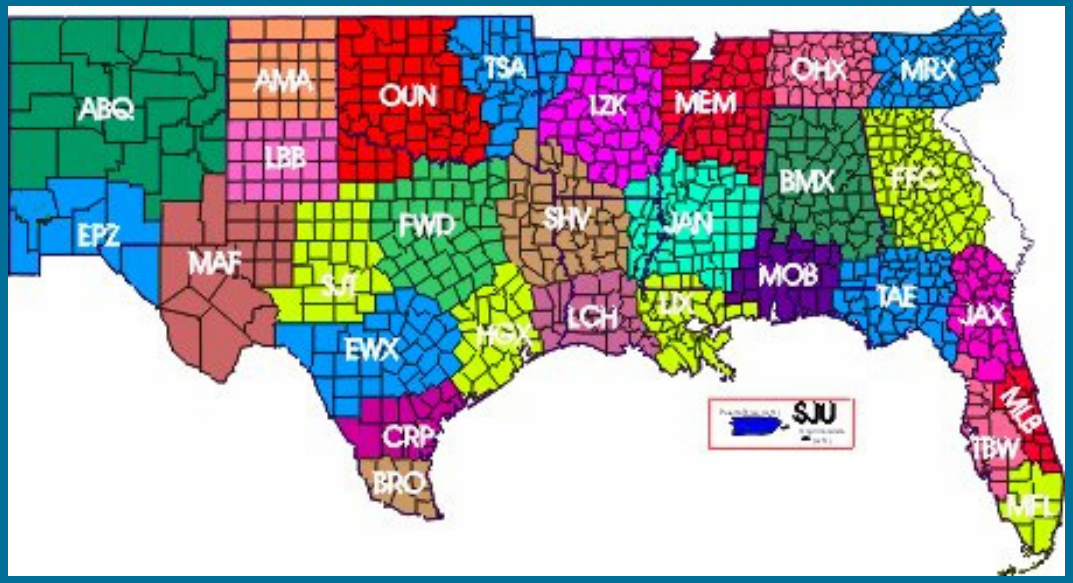
Thanks to the EMC for continuing to sponsor these annual reviews!

Someone should give Steve Lord an award.

Wait a minute, they just did!

The Southern Region

We are CONUS



and we are OCONUS!

32 WFOs

7 CWSUs

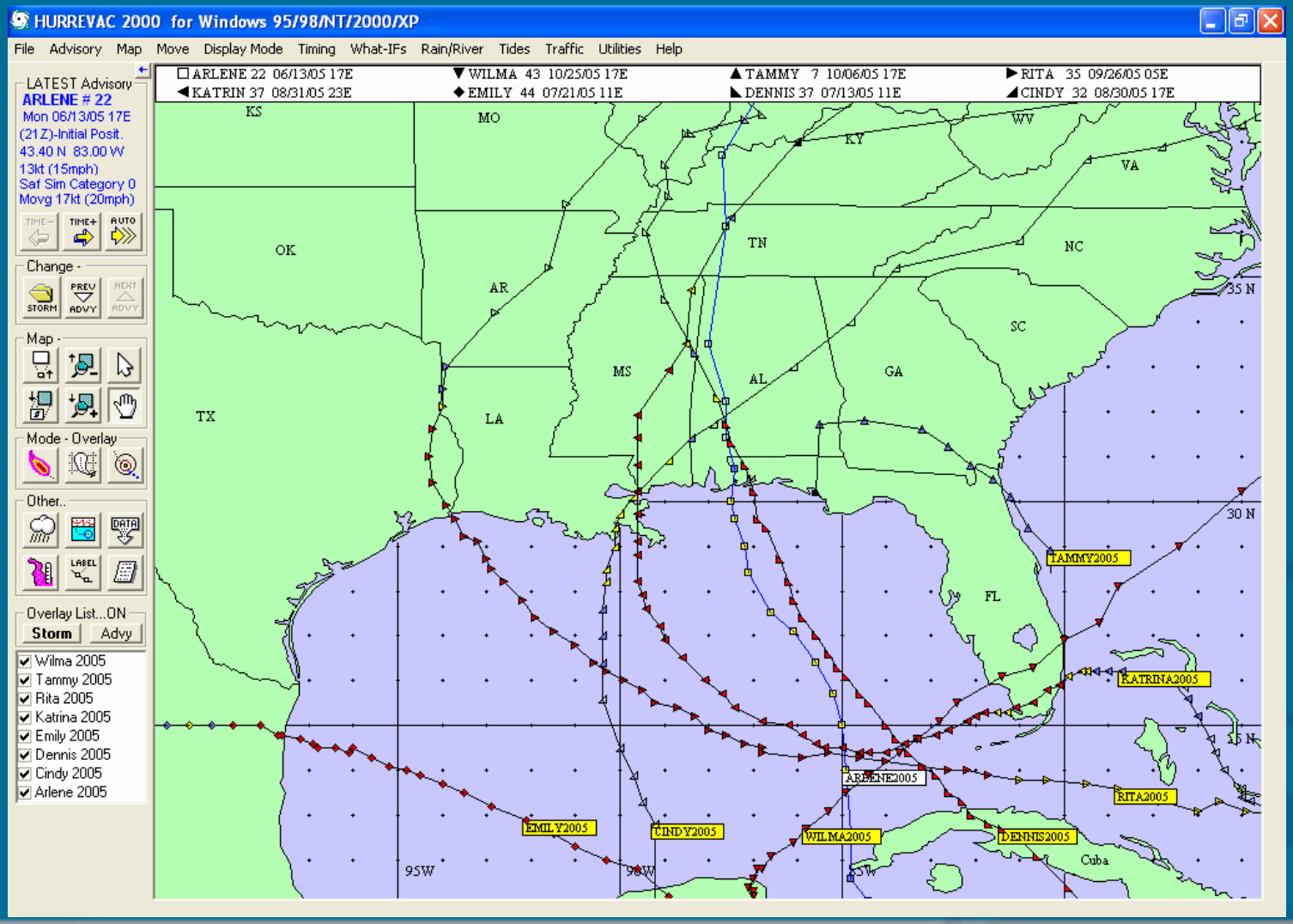
4 RFCs

Spaceflight Meteorology Group, Houston

FAA Training Academy, Oklahoma City

Corps of Engineers River & Reservoir Control Center, Vicksburg, MS

Southern Region Storms



Review of NCEP's Model Suite 2005

Outline

- Preparing for the Operational WRF
  - DTC Winter Forecast Experiment
  - Hi-Res WRF Output
  - Workstation WRF
- Ongoing Requests
- Guidance Needs For A New Paradigm
  - Impact Weather Events
  - Forecast Opportunities

Review of NCEP's Model Suite 2005

Preparing for the Transition to Operational WRF Guidance

Winter Forecast Experiment

- A project of the Developmental Testbed Center
- Time period: January 15 – March 31, 2005.
- High resolution CONUS WRF models.
- Real time model runs.
- Output provide to NWS field offices for evaluation.

http://www.dtcenter.org/projects/dwfe/index.php

SRH Homepage
Scientific Services
SOO Program
Training and Professional Development
Publications
University Collaboration
University Assignment Program
Teletraining Seminars
Weather Event Simulator
The AWOC
Contact Us
bernard.meisner@noaa.gov

You are at: SR Intranet » SSD » DWFE

WRF Development Testbed Center's Winter Forecast Experiment (DWFE)

Background | What's New | Training Materials
DWFE Model Output Web Site | FX-Net Software | Procedures & Enhancement Curves

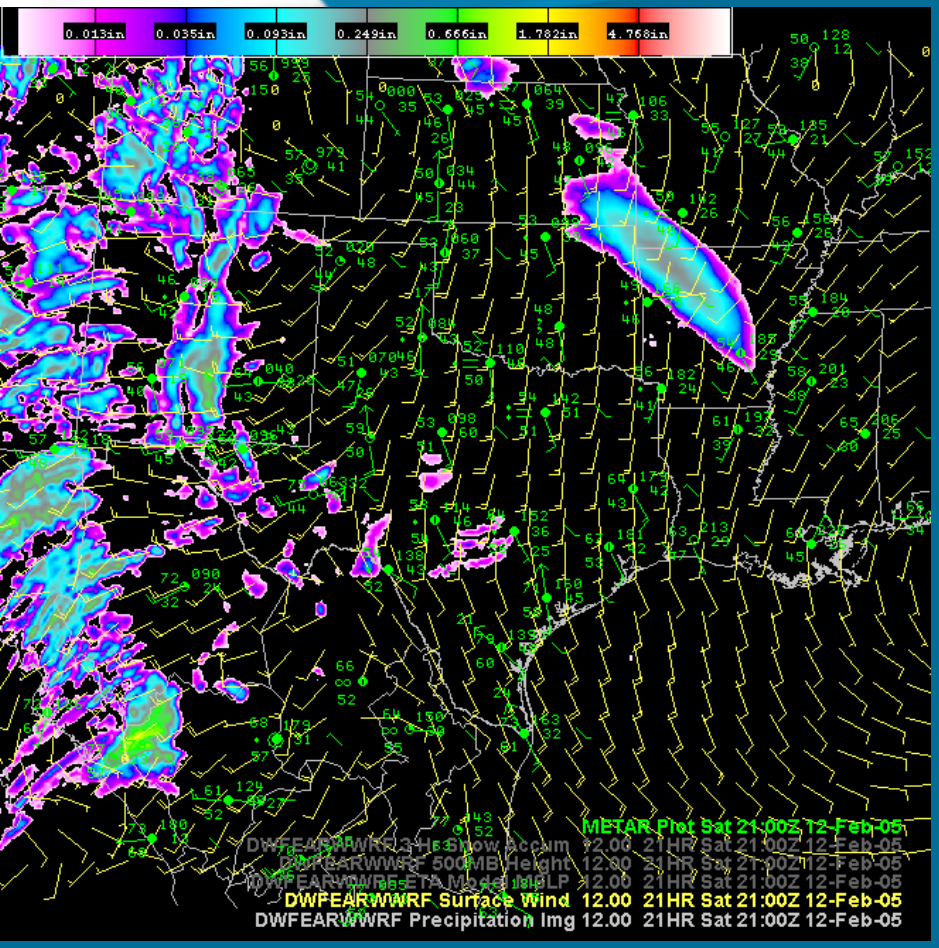
What's New?

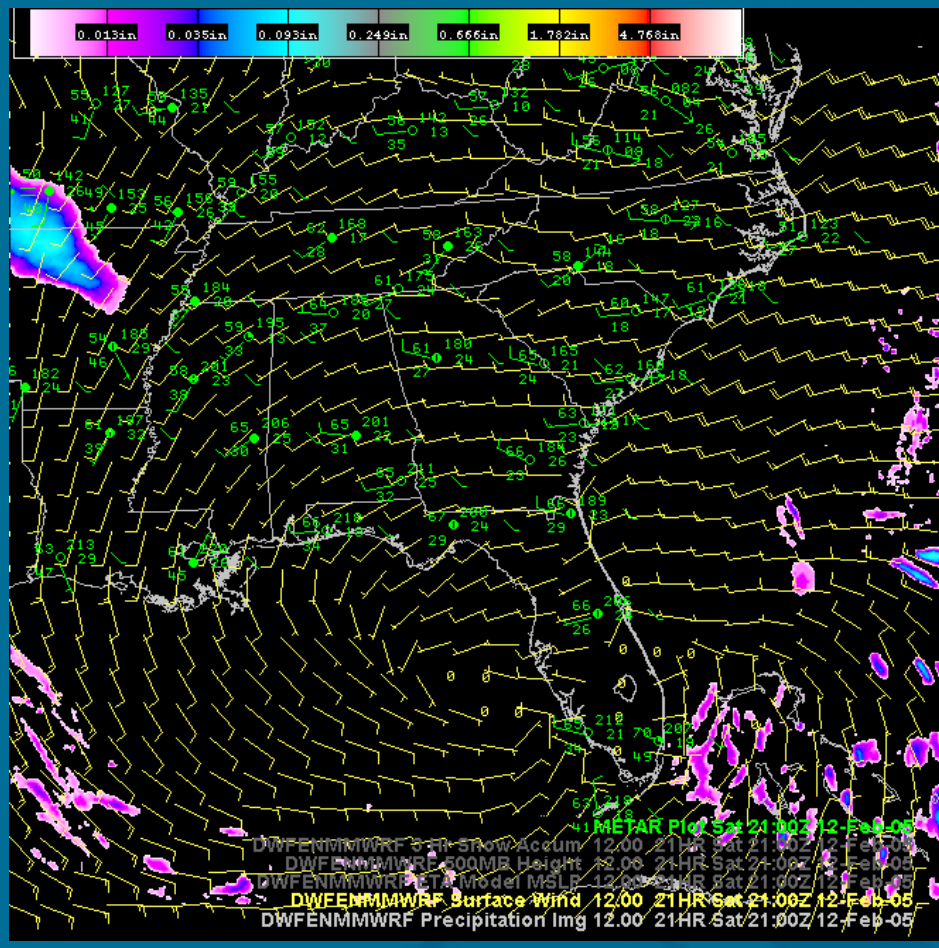
22 February 2005: Computation of Surface Winds and Temperatures at Time T00
The following is a description for the NMM provided by Matt Pyle: The NMM computations at f00 for the 2 m / 10 m fields are not consistent with how they are computed during the integration. At the 0 h time, the 2 m temperature is a weighted average of the skin temperature and the lowest atmospheric level and the 10 m winds are simply the winds at the lowest atmospheric level. During the integration, these quantities are diagnosed within the model surface layer (subroutine SFCDIF) based on fluxes of heat and momentum between the lowest model level and the values at z0. Dramatic changes in these quantities between the 0 h and 3 h forecast times are to be expected. Hopefully forecasters aren't reading too much into the overly warm (or overly cold) 0 h shelter temperatures in the NMM, or the howling 0 h winds - they are space holders more than meaningful diagnostic fields.

For the ARW - the 2 m / 10 m fields for f00 are simply the fields from the lowest model level, whereas these quantities are diagnosed for all other forecast times. As Matt stated above for the NMM, the f00 fields for the ARW should also be viewed as place holders.

22 February 2005: ARW WRF Output Unavailable February 25-27
There will be a shutdown of the NCAR Mesa Lab computing facility beginning 2/24/2005 at 0600 hrs to 2/27/2005 at 1730 hrs. This shutdown will affect supercomputing and mass storage services. The timing of this shutdown is such that the ARW real-time forecast for the 00 UTC 24 Feb '05 cycle should be able to run to completion, including all post-processing and file transfers. On the other hand, any significant delays in the arrival of the Eta data for initializing this forecast cycle could interfer with the end-to-end process completing before the shutdown begins. We will be unable to generate real-time forecasts for 25-27 Feb '05. We are working with NCAR's Supercomputing folks on a strategy for backfilling the forecasts for this time period. Assuming the supercomputers come back online as planned, real-time forecasts for ARW should be available once again starting with the 00 UTC 28 Feb '05 cycle. The

Two Southern Region Domains

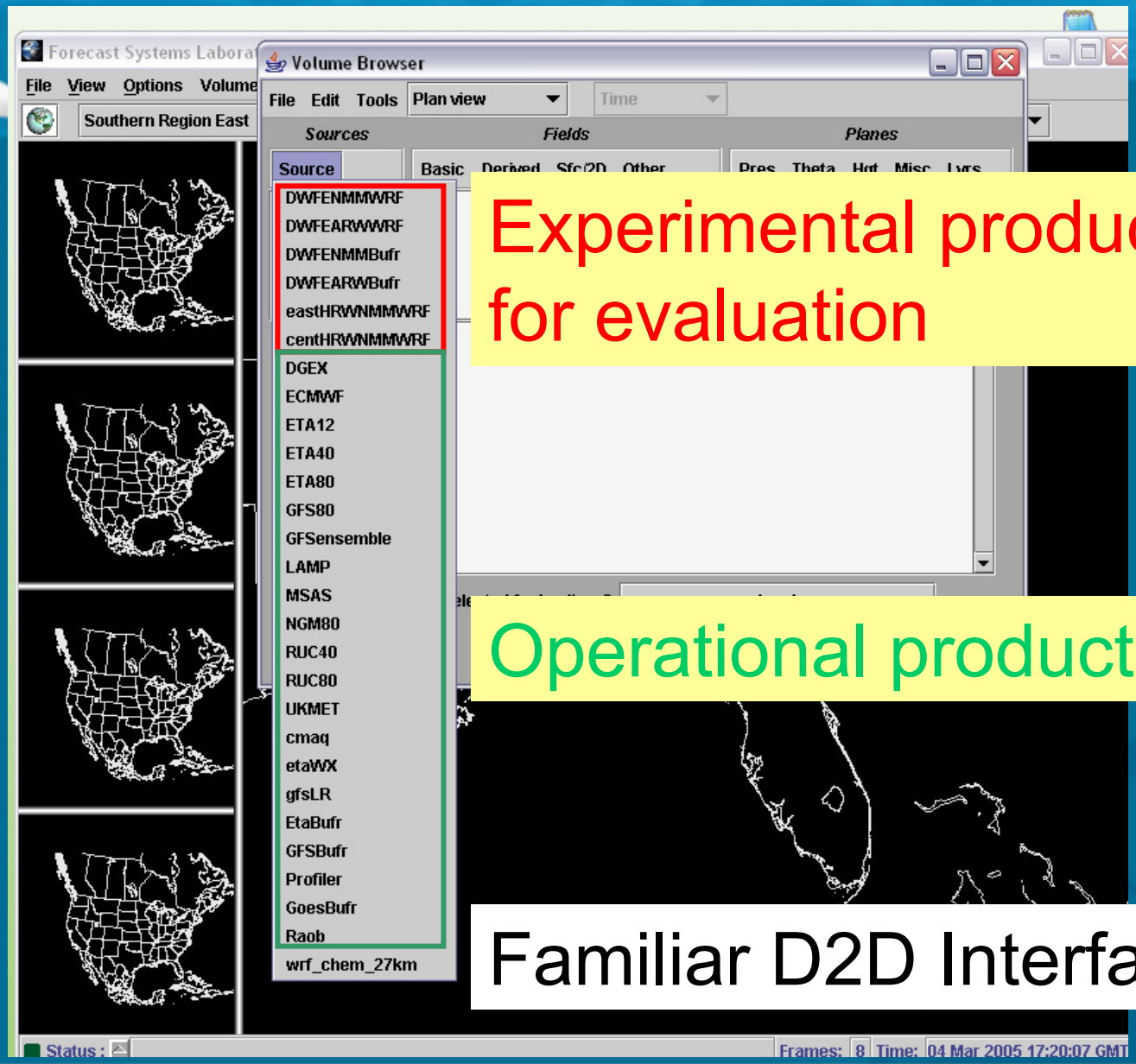




All products available at full resolution on these domains

All Available Model Guidance

F x - N e t



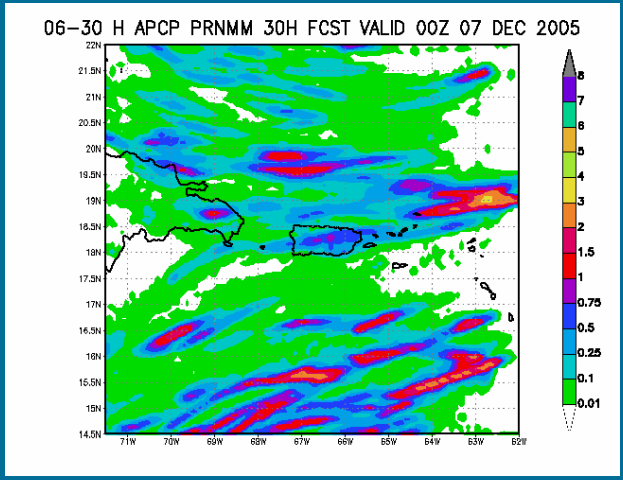
Experimental products for evaluation

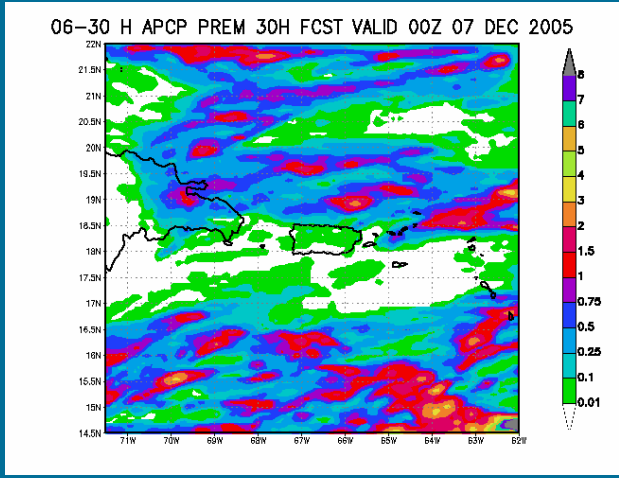
Operational products

Familiar D2D Interface

Hi-Res WRF Guidance

WFO San Juan





Ingesting Hi-Res Window ensemble WRF model output into AWIPS.

Thank You Mesoscale Modeling Branch!

“Workstation WRF”

SOO/STRC
Science & Training Resource Center

Search

Home | Search | System Admin. | Modeling | Data | WES | Software | SOO TRC | Additional Resources | Case Study Library

STRC · WRF EMS

WRF

- WRF EMS Introduction
- WRF EMS Users Guide
- WRF EMS Benchmarks
- Installation
- Computer Requirements
- FAQ
- Acknowledgements
- STRC Presentations
- LAM Studies

SOO/STRC WRF Environmental Modeling System

New: Beta-testing is currently underway! As of 15 October 2005, 51 NWS offices and Government agencies have participated in the beta testing effort. The anticipated official release date of the EMS package in 30 November 2005.

WRF EMS: What is it?

The National Weather Service's (NWS) SOO Science and Training Resource Center (STRC) Weather Research and Forecasting (WRF) Environmental Modeling System (EMS) is a complete, full-physics, numerical weather prediction (NWP) package, that incorporates dynamical cores from both the National Center for Atmospheric Research (NCAR) Advanced Research WRF (ARW) and the National Center for Environmental Predictions' (NCEP) Non-hydrostatic Mesoscale Model (NMM-WRF) packages into a single end-to-end forecasting system. Nearly all the capability of the individual NCEP and NCAR releases has been retained within the STRC EMS; however, installation, configuration, and running of the NCEP and NCAR versions has been greatly simplified to encourage its use by NWS forecast offices and the university community. *No compilers are necessary as statically-linked x32 and x64 binaries are provided for both distributed and shared memory Linux systems.* The SOO/STRC WRF EMS is easy to run on most linux workstations; it should possible for those with limited modeling experience to have the package installed and running in less than 1 hour. In addition, the NCEP NMM core is very efficient, which should be an advantage for real-time forecasting purposes.

Review of NCEP's Model Suite 2005

Ongoing Requests

Ongoing Requests

- Analysis of Record. Analysis of Record. Analysis of Record. Analysis of Record.
- Model guidance in the form of NDFD sensible weather grids, with verification of that guidance.
- A schedule of expected scientific review opportunities, and output in an AWIPS ready format (or on an Fx-Net server).
  - "We'd appreciate your evaluation of the new 1/12 degree SSTs. They're available as a GRIB2 file on our server!"
- Continue quarterly conferences calls as supplements to this meeting.

We Are In the IFPS Era

Isn't on AWIPS?

Few forecasters will use it.

Put it on AWIPS

Soon all will use it!

Bernard's Annual Auto Analogy
with a twist this year!

Impact Weather & Forecast Opportunities

My new car has:

- Automatic transmission
- Cruise control
- Climate control
- Automatic door locks
- Passenger air bag sensor
- Headlight darkness sensor

While I use those features every day…
I can override any of them when necessary!

Evolving Role for Forecasters

The accuracy of numerical model output and the related statistical guidance is approaching the point at which it is becoming difficult for forecasters to improve upon that guidance during relatively benign weather conditions.*

The role of the field forecaster is evolving into one of interpreting forecasts of *Impact Weather Events* for our customers, and adding value to the guidance when the model solutions are in error (*Forecast Opportunities*) -- such as anticipating model "flips" -- typically in the medium range.

New guidance products will be required to support the field forecasters in their new roles.

**This does not imply the number of field forecasters can be reduced!*

When Do WFOs Add Value?

Relative to GFS MOS Guidance

Temperature Forecasts All Model Runs - WFO vs. GFS Guidance (% Improvement)

January 2005 - August 2005

Office	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	9.0	5.2	4.3	3.3	-0.9	-1.0	-2.8	-3.2	-3.7	-3.6	-3.8	-1.2	-1.7	1.3
	5.0	2.0	-4.0	-4.7	-14.0	-6.2	-7.7	-7.5	-8.2	-6.7	-8.0	-5.7	-4.4	-0.5
	5.8	4.2	2.7	2.1	0.1	0.6	0.9	-1.7	-1.5	-0.2	-2.0	-0.5	2.0	0.4
	1.7	-3.9	-4.8	-1.4	-9.7	-13.4	-10.9	-9.6	-12.0	-11.8	-13.0	-9.1	-11.4	-6.1
	16.3	11.9	12.5	7.2	5.7	2.8	1.9	2.6	-1.2	-0.4	-2.0	0.1	-1.5	1.0
	-13.9	-17.9	-13.7	-16.2	-14.1	-13.7	-12.3	-11.1	-10.4	-9.2	-9.1	-5.7	-6.4	0.8
	7.6	5.5	6.4	5.7	2.3	3.3	-1.7	1.7	-0.9	0.5	-2.4	-0.8	-2.0	1.4
	6.9	4.7	0.1	0.8	-2.9	0.0	-2.5	-1.4	-0.7	-0.3	1.7	1.0	-1.5	-2.9
	4.0	1.8	0.1	-3.4	-7.8	-2.3	-3.8	-5.5	-5.1	-4.3	-3.2	-2.6	-1.4	-0.5
	2.6	3.0	-1.2	-2.5	-6.0	-4.4	-2.3	-2.1	-2.4	-3.6	-2.7	-2.7	-1.9	0.0
	5.2	4.6	7.7	3.2	-0.6	-1.5	1.4	0.8	1.8	-2.4	-0.4	1.5	2.8	3.9
	13.1	9.7	8.5	6.5	1.4	2.1	-0.4	-0.3	0.3	-1.9	-2.1	1.2	1.7	3.6
	1.0	1.1	1.2	1.8	-0.3	-0.1	2.3	3.7	4.4	-0.4	1.4	3.1	4.9	2.9
	8.2	5.3	5.3	4.8	0.5	-1.1	-1.7	-0.3	0.2	-1.5	-2.6	-4.8	0.9	4.7
	-2.3	-0.7	-5.5	-0.6	-5.9	-1.1	-1.4	0.1	1.9	-1.9	1.6	-0.6	0.9	3.1
	2.6	-2.0	-0.3	-0.6	-2.6	-7.6	-3.4	-1.0	1.3	-3.3	-3.9	-3.1	0.5	1.8
	7.9	7.9	1.5	2.7	-3.6	-0.7	-5.4	0.0	-1.9	-2.5	-2.8	-2.1	-2.7	0.3
	1.4	-1.1	-1.5	-3.1	-6.7	-3.3	-0.5	1.7	1.3	-1.2	-1.3	1.1	0.7	2.5
	11.0	6.8	8.4	6.5	3.7	-2.1	-4.8	-3.6	-5.1	-1.6	-6.0	-2.5	-2.8	-6.3
	9.6	7.2	6.9	3.6	-2.7	-4.7	-4.4	-3.3	-1.4	-1.5	-1.9	-0.7	-1.1	3.3
	3.5	4.0	0.4	-0.5	-1.5	-9.8	-6.2	-6.7	-8.1	-6.9	-7.3	-8.0	-19.2	-3.8
	2.7	-2.4	-4.3	-6.0	-7.6	-9.5	-7.2	-5.5	-4.0	-1.3	-1.0	-1.6	-3.0	0.4
	1.9	-0.8	-1.5	0.9	-1.3	-1.3	-0.5	-1.2	-2.3	-0.1	-1.3	-0.1	-0.5	1.0
	7.1	7.4	2.9	1.7	-2.5	-2.1	-1.5	-2.5	-4.5	-2.1	-3.2	-3.5	0.8	2.7
	6.5	5.1	2.5	3.6	0.5	-2.8	-4.2	-3.3	-2.6	-2.9	-1.4	-1.2	-2.6	3.0
	16.9	14.1	13.1	10.1	4.1	1.8	-0.9	3.8	3.2	2.3	1.1	-2.2	-2.2	-1.5
	9.9	7.9	4.6	0.9	-3.0	-1.3	-2.5	-0.8	0.2	1.7	0.8	0.7	2.2	0.4
	10.7	7.3	6.0	4.9	1.6	1.9	-0.3	0.7	1.2	0.8	0.1	0.2	-1.1	0.4
	4.4	2.8	4.3	1.1	-1.1	-8.3	-5.3	-5.5	-3.7	-3.6	-4.6	-5.6	-1.8	0.6
	7.4	2.4	0.9	-1.1	-4.0	-8.6	-6.6	-3.7	-1.4	-2.3	-3.2	-7.5	-2.9	5.0
	14.2	11.8	9.3	5.3	-0.8	-2.2	1.4	3.0	0.2	-0.3	-0.1	-0.8	0.2	0.8
	6.5	4.1	3.1	1.5	-2.3	-2.7	-2.9	-1.5	-1.8	-2.0	-2.6	-2.1	-1.5	0.3

Evolving Role for Forecasters

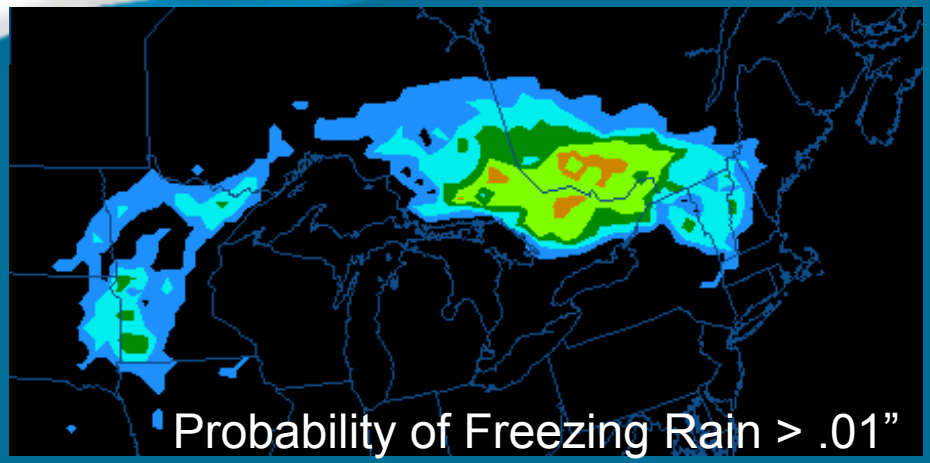
Impact Weather Events

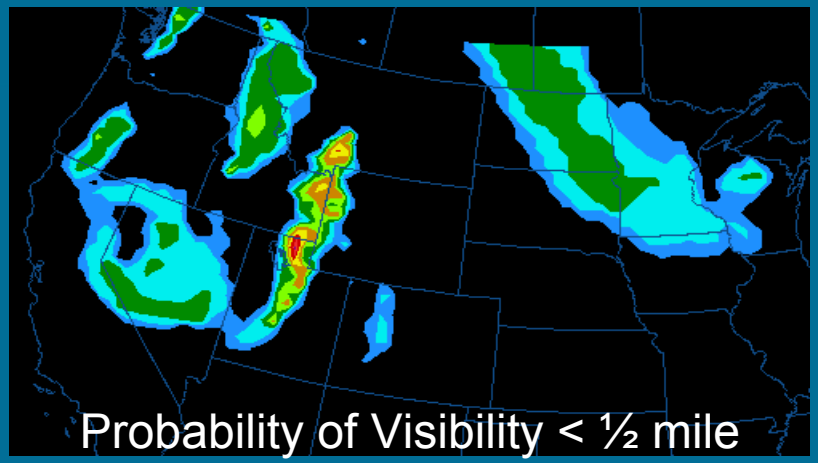
Field forecasters will interpret the forecasts in terms of the impact on our customers. (*e.g.*, Dec. 5, 2005 snowfall event in Washington, DC metro area)

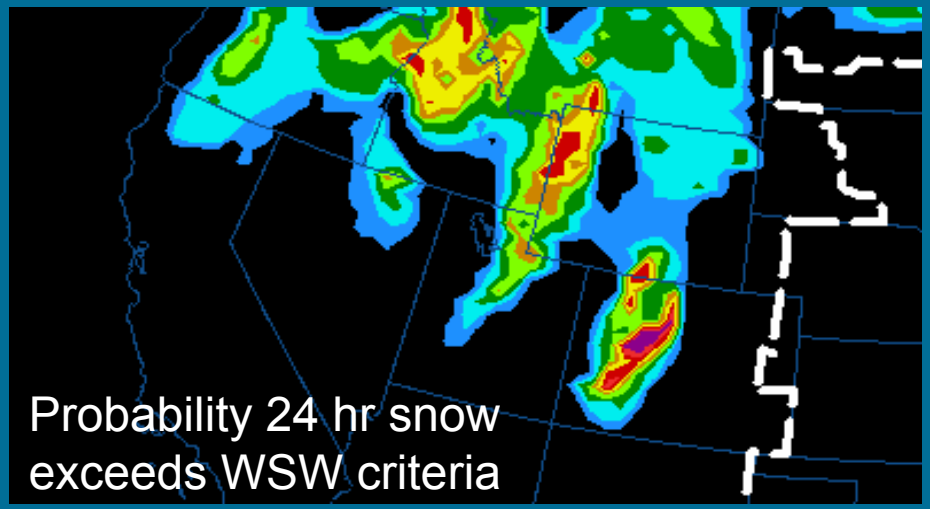
- When will the event begin?
- How long will it last?
- How intense will the weather be?
- How large an area will be affected?

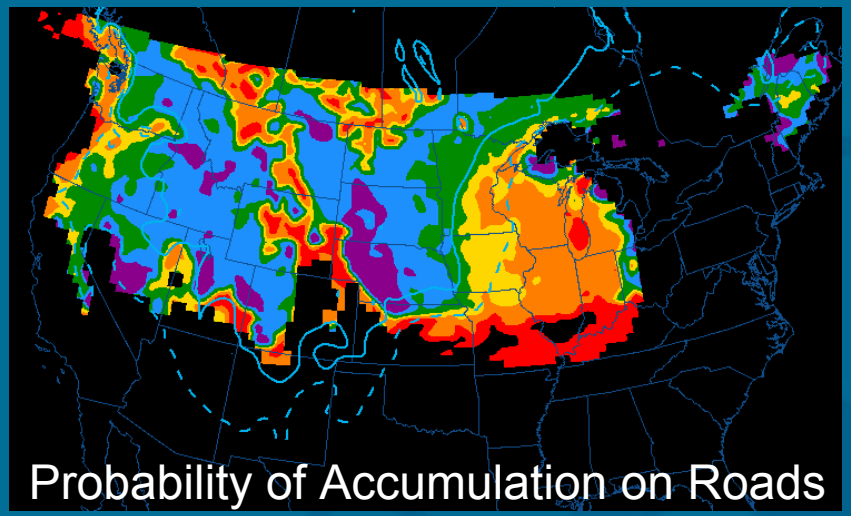
There is a need for probabilistic grids (ensemble based) to provide this information.

Impact Weather Guidance



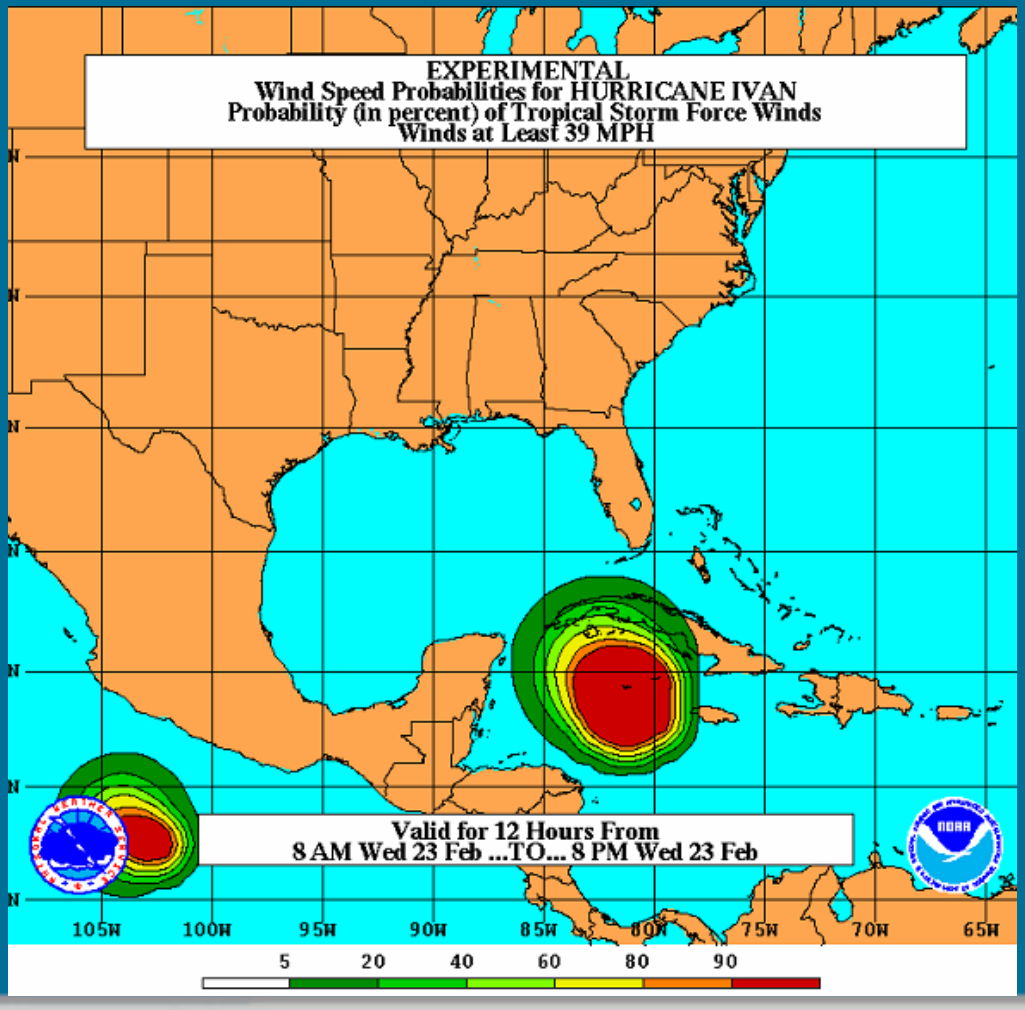






Impact Weather Guidance

Supporting Products




```
ZCZC MIAWSPAT4 ALL
TTAA00 KNHC DDHHMM
TROPICAL STORM NONAME PROBABILITIES NUMBER   1
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL
2100Z FRI FEB 11 2005

AT 2100Z THE CENTER OF TROPICAL STORM
NONAME WAS LOCATED NEAR LATITUDE 23.3 NORTH...
LONGITUDE  75.5 WEST WITH
MAXIMUM SUSTAINED WINDS NEAR  35 KTS... 40 MPH... 65 KM/HR.

CHANCES OF EXPERIENCING WIND SPEEDS OF AT LEAST
   ...34 KT (40 MPH... 65 KPH)...
   ...50 KT (60 MPH... 95 KPH)...
   ...64 KT (75 MPH...120 KPH)...
FOR LOCATIONS AND TIME PERIODS DURING THE NEXT 5 DAYS

                FROM    FROM    FROM    FROM    FROM    FROM    FROM
  TIME        18Z FRI 06Z SAT 18Z SAT 06Z SUN 18Z SUN 18Z MON 18Z TUE
PERIODS          TO      TO      TO      TO      TO      TO      TO
             06Z SAT 18Z SAT 06Z SUN 18Z SUN 18Z MON 18Z TUE 18Z WED

FORECAST HOUR    (12)    (24)    (36)    (48)    (72)    (96)   (120)
- - - - - - - - -
LOCATION        KT

BAR HARBOR ME   34  X   X( X)   X( X)   X( X)   X( X)   X( X)   3( 3)

AUGUSTA ME      34  X   X( X)   X( X)   X( X)   X( X)   X( X)   4( 4)

PORTLAND ME     34  X   X( X)   X( X)   X( X)   X( X)   X( X)   4( 4)

CONCORD NH      34  X   X( X)   X( X)   X( X)   X( X)   1( 1)   5( 6)

BOSTON MA       34  X   X( X)   X( X)   X( X)   X( X)   1( 1)   4( 5)

HYANNIS MA      34  X   X( X)   X( X)   X( X)   X( X)   X( X)   4( 4)

NANTUCKET MA    34  X   X( X)   X( X)   X( X)   X( X)   X( X)   4( 4)

PROVIDENCE RI   34  X   X( X)   X( X)   X( X)   X( X)   1( 1)   5( 6)

HARTFORD CO     34  X   X( X)   X( X)   X( X)   X( X)   1( 1)   7( 8)

MONTAUK POINT   34  X   X( X)   X( X)   X( X)   X( X)   1( 1)   5( 6)

NEW YORK CITY   34  X   X( X)   X( X)   X( X)   X( X)   2( 2)   9(11)
NEW YORK CITY   50  X   X( X)   X( X)   X( X)   X( X)   X( X)   3( 3)
```

Impact Weather Guidance

Who should provide this guidance?

- The Environmental Modeling Center?
- The NCEP Service Centers?
- The Meteorological Development Laboratory?

Obviously, this project will require post-processing of the numerical model output, and adequate training on the proper interpretation of the products by the field forecasters.

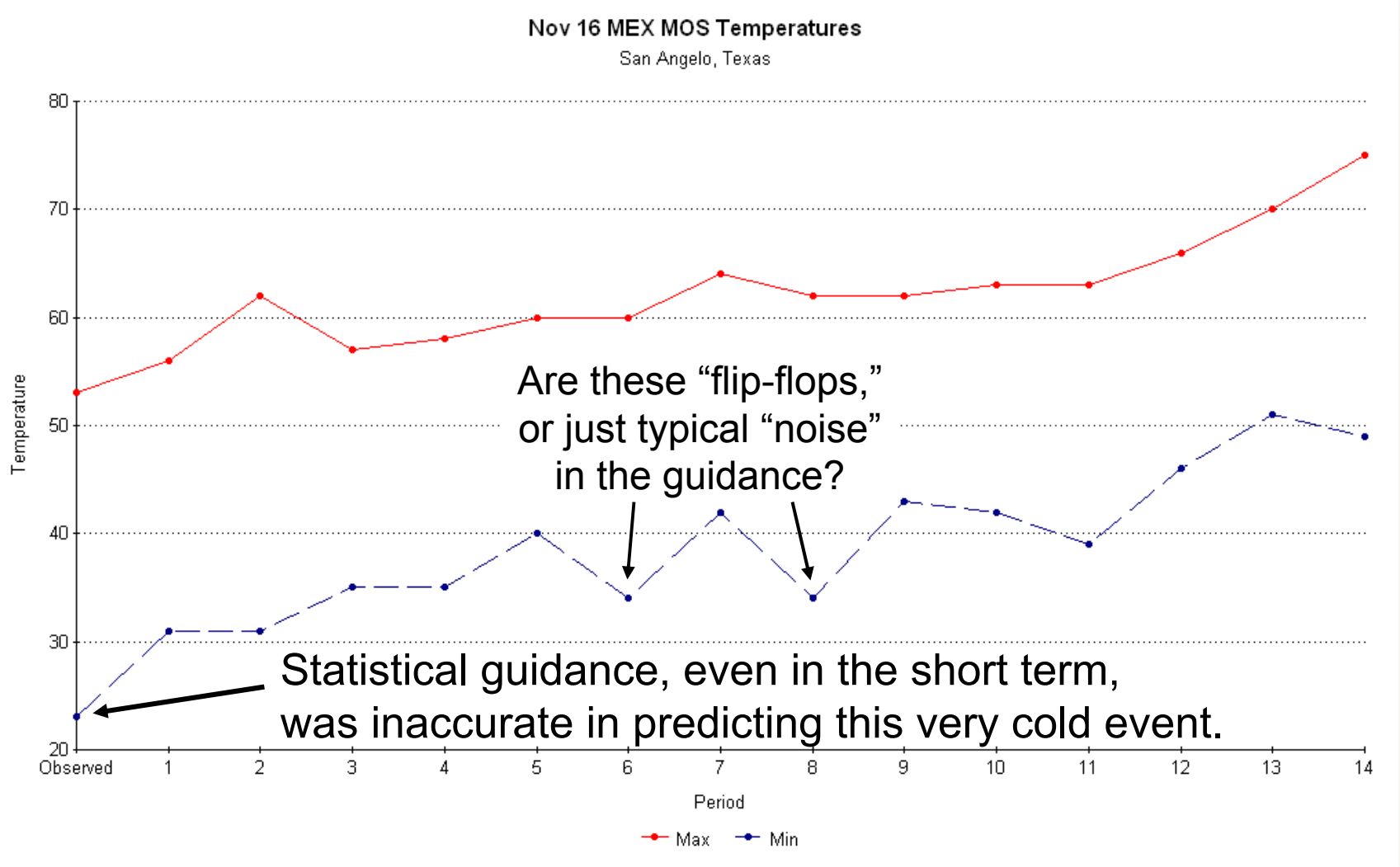
Review of NCEP's Model Suite 2005

Forecast Opportunities

and Model Flips and Flops

Forecast Opportunities

Field forecasters easily beat the guidance for this event and added value to the forecast.



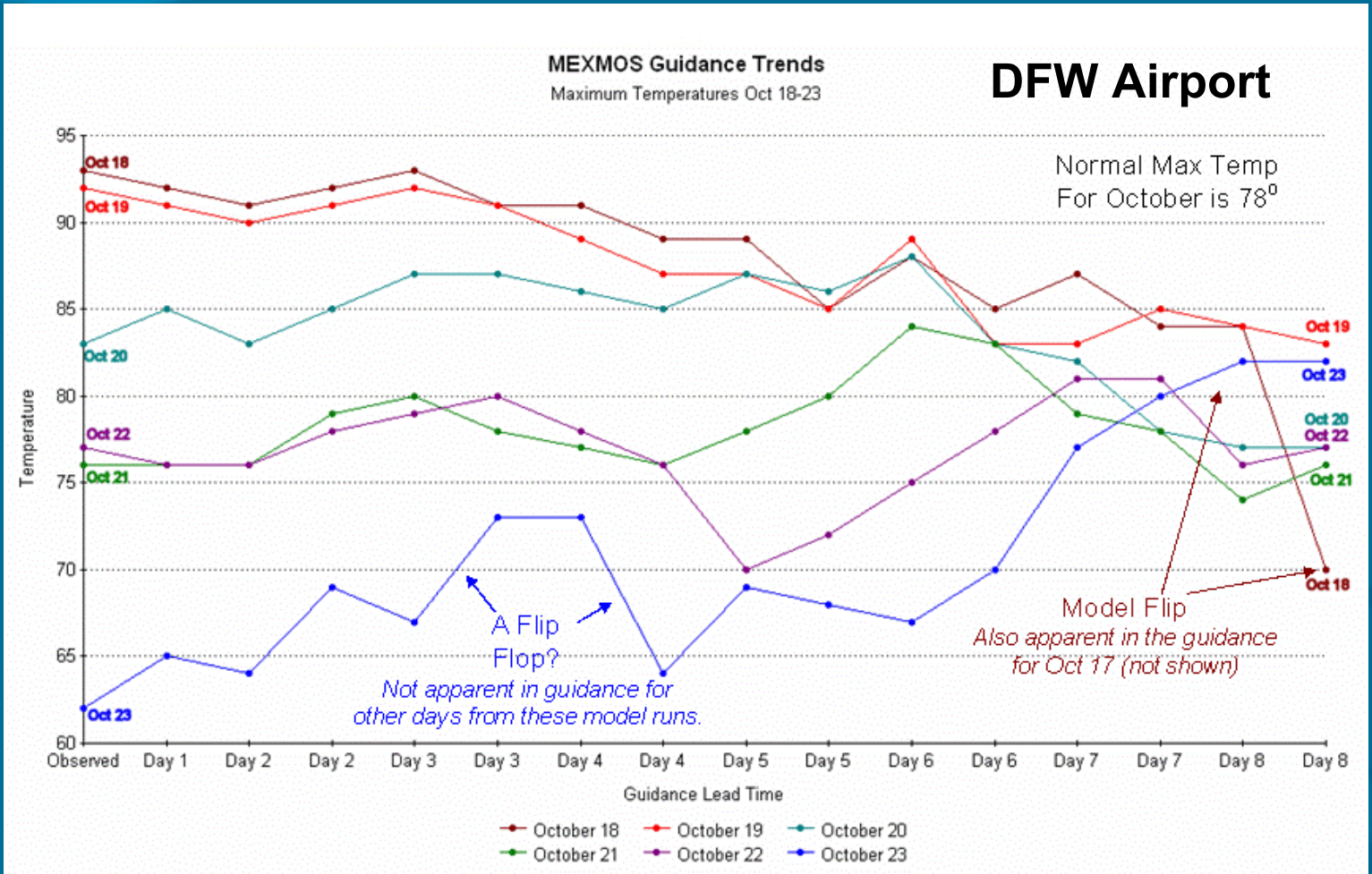
Forecast Opportunities

October 16-22, 2005

	Sunday 16	Monday 17	Tuesday 18	Wednesday 19	Thursday 20	Friday 21	Saturday 22
OBSERVED	58 86	59 91	64 93	65 92	61 83	56 76	51 77
Oct 8 1200 UTC	61						
Oct 9 0000 UTC	60 82						
Oct 9 1200 UTC	61 83	57					
Oct 10 0000 UTC	62 81	62 75 Forecast Opportunity					
Oct 10 1200 UTC	60 80	62 77 Forecast Opportunity	55				
Oct 11 0000 UTC	64 82	60 69 Forecast Opportunity	52 70 Forecast Opportunity				
Oct 11 1200 UTC	63 82	62 83 Model Flip	64 84 Model Flip	63			
Oct 12 0000 UTC	62 85	62 83	61 84	61 83			
Oct 12 1200 UTC	68 90	64 85	63 87	65 84	62		
Oct 13 0000 UTC	63 85	63 86	62 85	64 85	65 77		
Oct 13 1200 UTC	62 85	67 89	67 88	64 83	63 77	55	
Oct 14 0000 UTC	64 85	62 85	63 85	63 83	65 78	60 76	
Oct 14	64 85	63 88	68 80	68 80	66 82	60 74	54

Forecast Opportunities

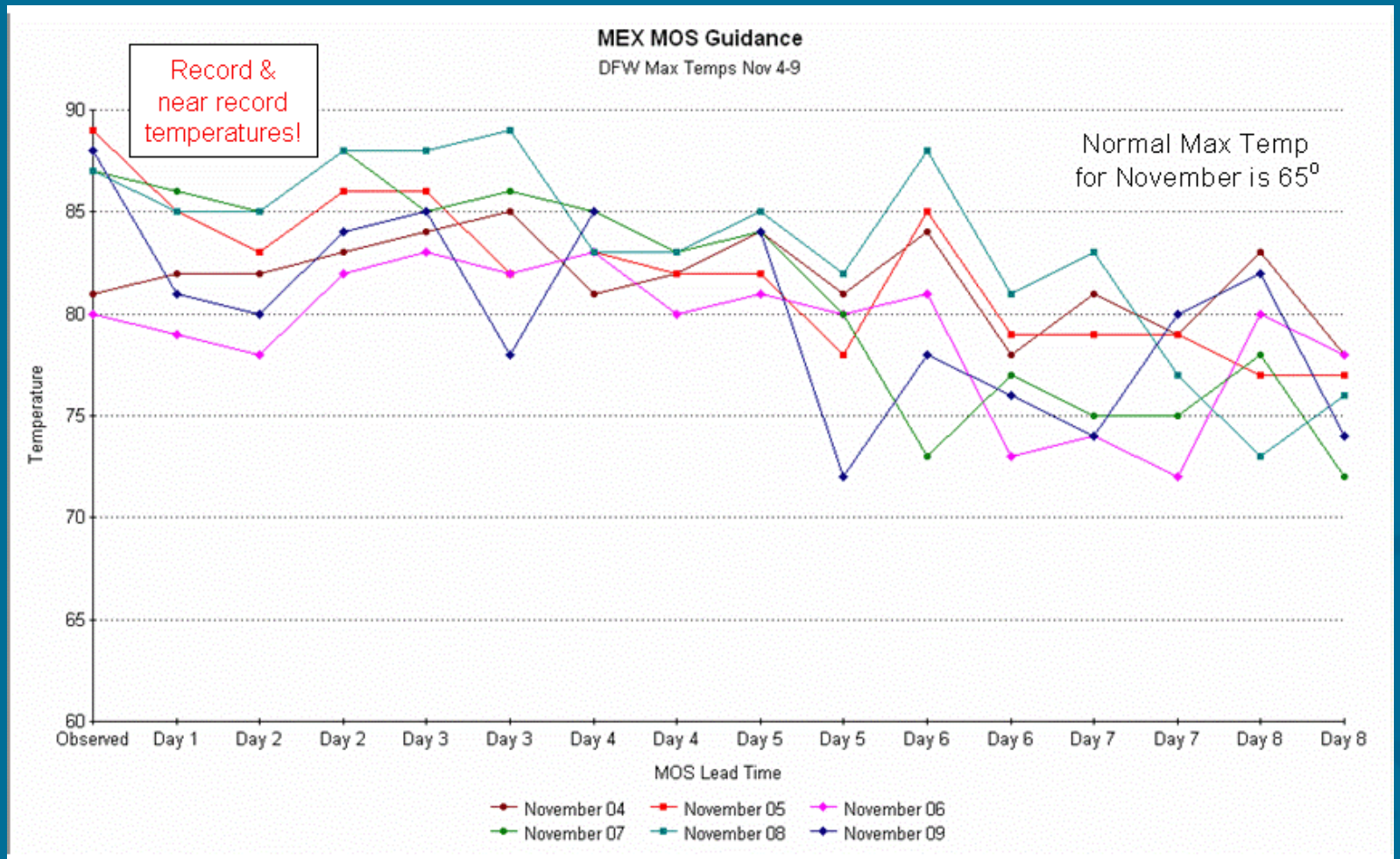
DFW Max Temps Oct. 18-23, 2005



No obvious bias between 0000 and 1200 UTC runs

Forecast Opportunities

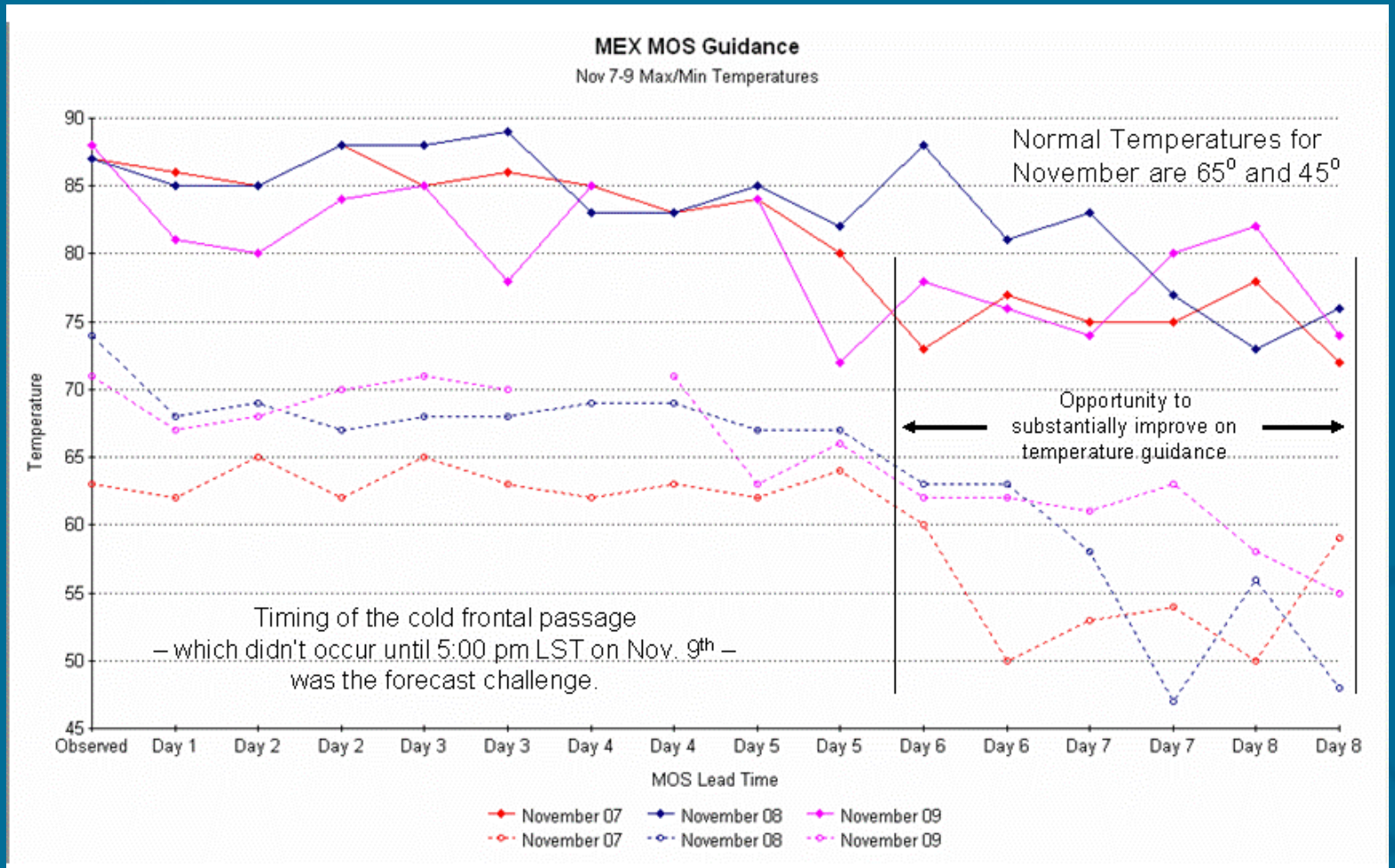
DFW Max Temps Nov. 4-9, 2005



No obvious bias between 0000 and 1200 UTC runs

Forecast Opportunities

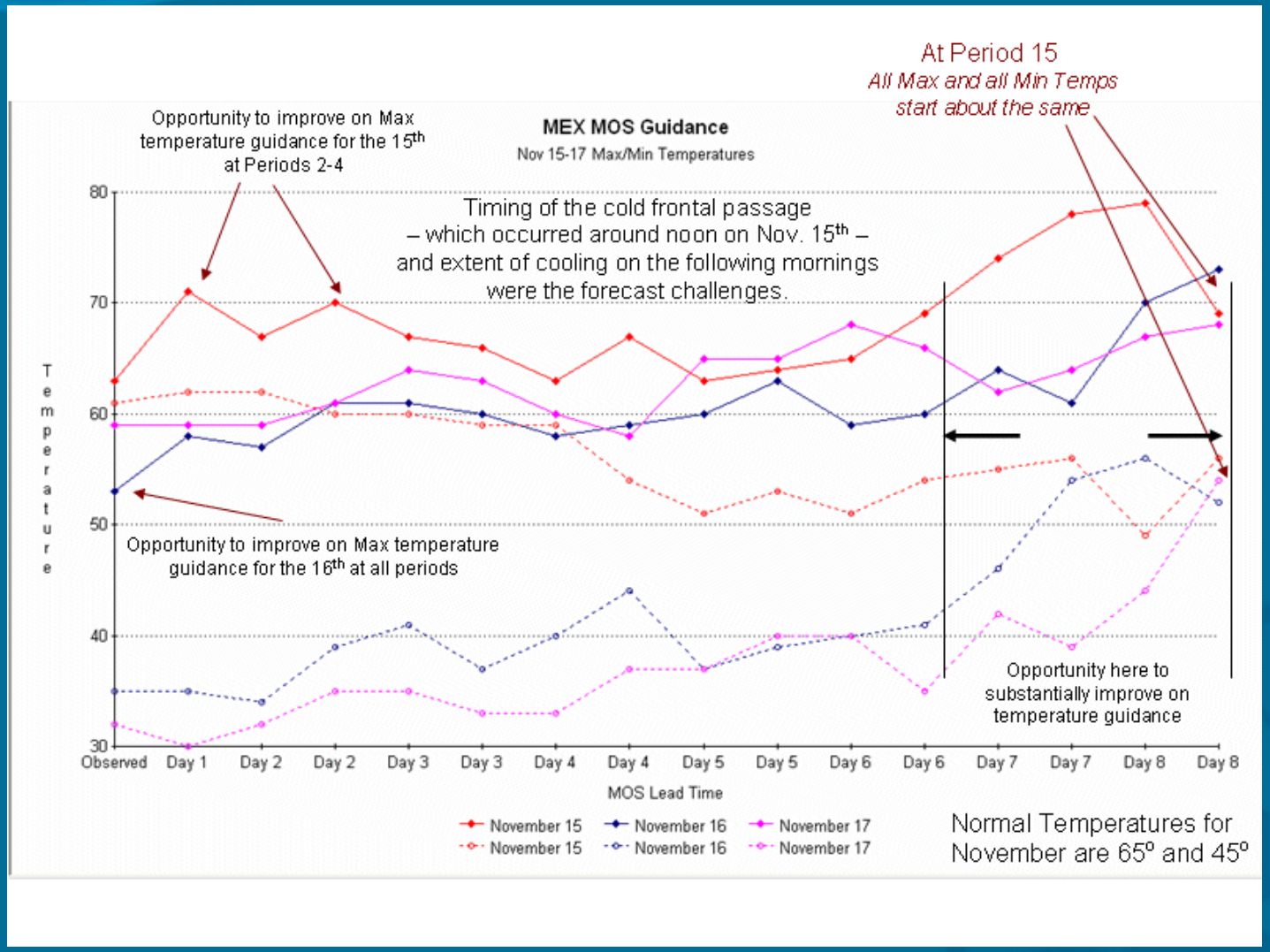
DFW Max/Min Temps Nov 7-9, 2005



No obvious bias between 0000 and 1200 UTC runs

Forecast Opportunities

DFW Max/Min Temps Nov 15-17, 2005



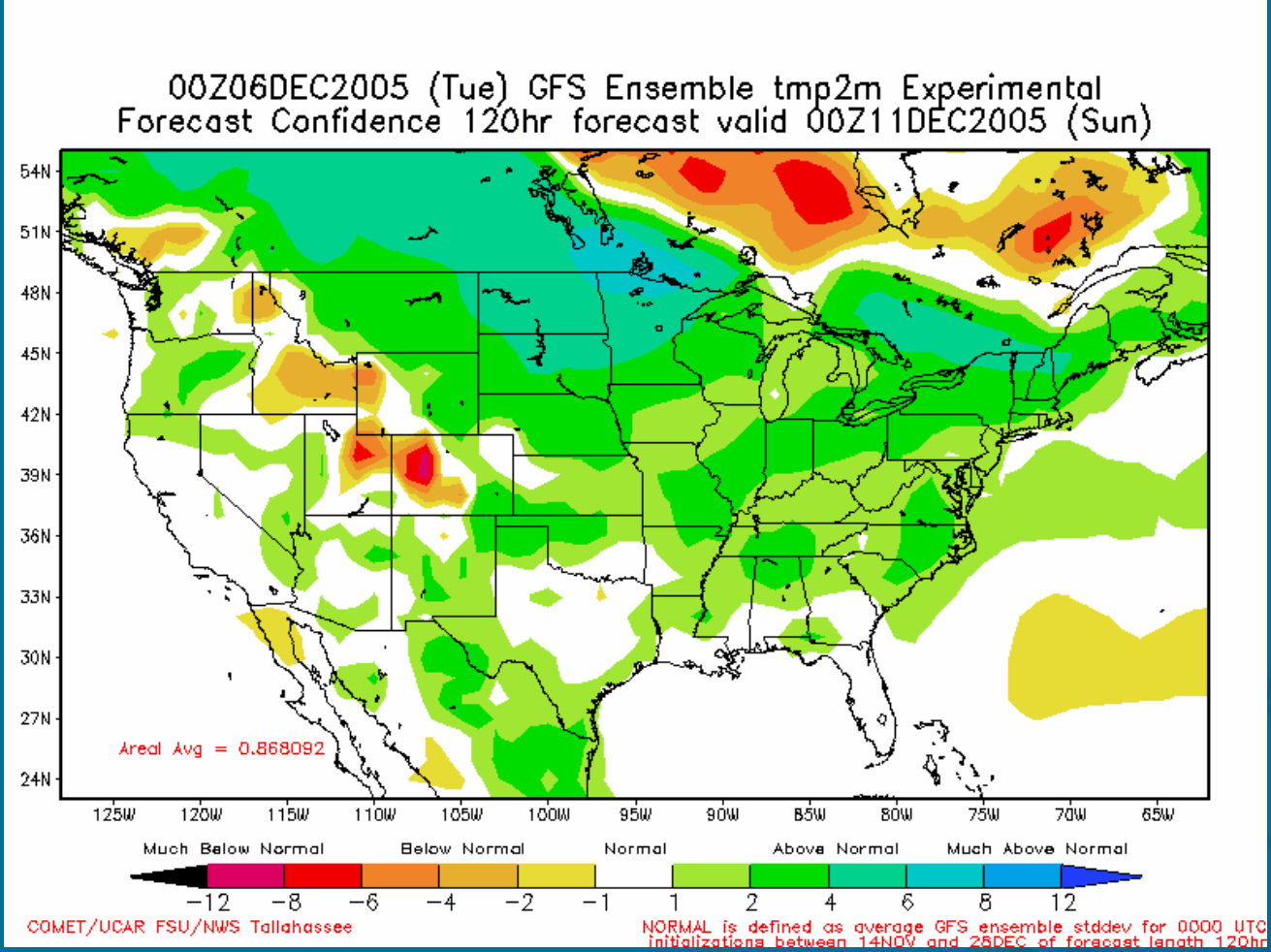
Forecast Opportunities

DFW November, 2005

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Date	Max/Min	Observed	Day 1	Day 2	Day 2	Day 3	Day 3	Day 4	Day 4	Day 5	Day 5	Day 6	Day 6	Day 7	Day 7	Day 8	Day 8	Day 9
2	November 2005			0000 UTC	1200 UTC	0000 UTC	1200 UTC	0000 UTC	1200 UTC	0000 UTC	1200 UTC	0000 UTC	1200 UTC	0000 UTC	1200 UTC	0000 UTC	1200 UTC	1200 UTC	0000 UTC
3	November 01	Max	72	72	72	76	78	78	72	72	75	69	77	71	73	68	70	72	
4		Min	45		47	48	50	52	52	54	52	56	50	49	48	48	54	50	54
5	November 02	Max	80	76	77	78	80	78	78	76	74	76	77	76	82	73	73	73	
6		Min	45		47	48	49	50	49	47	51	47	54	53	52	49	50	46	49
7	November 03	Max	82	78	79	81	82	83	79	77	78	78	82	78	75	85	82	74	
8		Min	53		52	53	54	55	53	51	55	52	53	51	52	57	56	52	53
9	November 04	Max	81	82	82	83	84	85	81	82	84	81	84	78	81	79	83	78	
10		Min	61		61	61	61	62	65	63	62	59	58	56	56	54	60	54	58
11	November 05	Max	89	85	83	86	86	82	83	82	82	78	85	79	79	79	77	77	
12		Min	63		66	65	64	64	65	65	64	59	59	58	55	56	55	56	59
13	November 06	Max	80	79	78	82	83	82	83	80	81	80	81	73	74	72	80	78	
14		Min	57		58	59	60	59	60	59	62	63	63	52	52	54	55	58	58
15	November 07	Max	87	86	85	88	85	86	85	83	84	80	73	77	75	75	78	72	
16		Min	63		62	65	62	65	63	62	63	62	64	60	50	53	54	50	59
17	November 08	Max	87	85	85	88	88	89	83	83	85	82	88	81	83	77	73	76	
18		Min	70		68	69	67	68	68	69	69	67	67	63	63	58	47	56	48
19	November 09	Max	88	81	80	84	85	78	85	x	84	72	78	76	74	80	82	74	
20		Min	71		67	68	70	71	70	x	71	63	66	62	62	61	63	58	55
21	November 10	Max	72	70	69	72	73	69	69	70	66	75	72	72	72	69	70	73	
22		Min	53		51	52	55	54	50	48	61	x	66	47	51	52	53	59	59
23	November 11	Max	77	75	76	77	74	72	73	72	70	73	68	74	68	68	75	71	
24		Min	51		52	54	53	52	51	47	49	46	48	58	56	47	53	51	57
25	November 12	Max	83	81	80	78	78	79	76	75	78	74	77	73	70	71	67	70	
26		Min	67		66	67	68	68	65	63	62	58	56	53	47	58	54	48	59
27	November 13	Max	76	80	78	80	80	77	76	77	70	71	73	72	74	74	67	73	
28		Min	58		62	61	62	63	61	65	61	60	60	59	59	58	53	56	53
29	November 14	Max	80	75	75	79	82	84	79	75	80	74	72	73	74	69	66	72	
30		Min	54		55	58	58	59	56	57	60	58	46	51	49	51	55	56	57
31	November 15	Max	63	71	67	70	67	66	63	67	63	64	65	69	74	78	79	69	
32		Min	61		62	62	60	60	59	59	54	51	53	51	54	55	56	49	56
33	November 16	Max	53	58	57	61	61	60	58	59	60	63	59	60	64	61	70	73	
34		Min	35		35	34	39	41	37	40	44	37	39	40	41	46	54	56	52
35	November 17	Max	59	59	59	61	64	63	60	58	65	65	68	66	62	64	67	68	
36		Min	32		30	32	35	35	33	33	37	37	40	40	35	42	39	44	54
37	November 18	Max	60	63	61	61	63	62	63	65	65	66	62	64	67	66	64	69	
38		Min	34		37	37	38	38	39	42	44	41	45	43	42	46	41	45	46
39	November 19	Max	66	66	65	67	68	67	70	67	70	68	64	66	65	66	59	65	

FSU/NWS TLH COMET

Experimental Forecast Confidence Graphics



http://moe.met.fsu.edu/confidence/

FSU/NWS TLH COMET

Experimental Forecast Confidence Discussion

Mozilla Firefox

File Edit View Go Bookmarks Tools Help

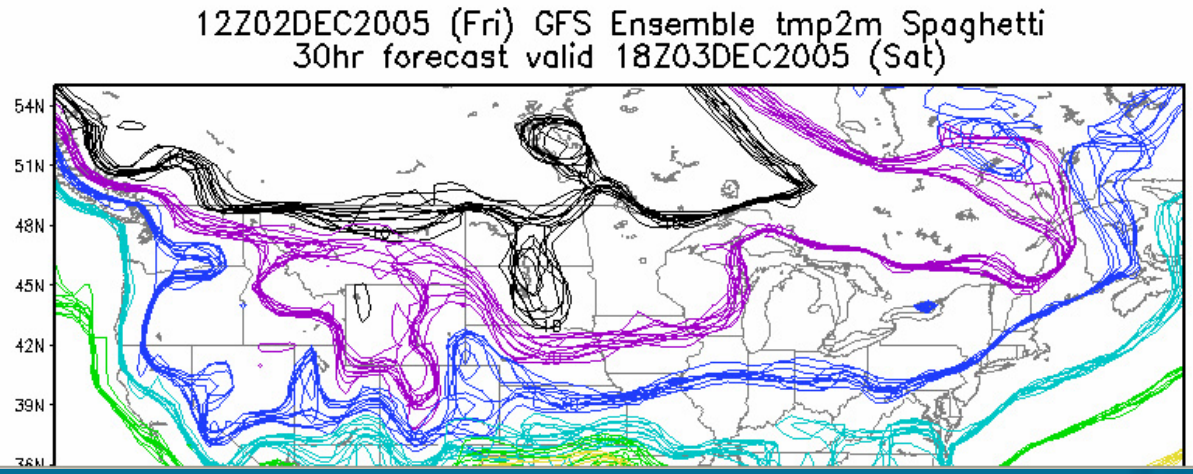
http://moe.met.fsu.edu/confidence/disco.html

The main purpose of these discussions is see how the confidence is behaving and what synoptic features are causing the low or high confidence. FEEDBACK of any kind (good, bad, terrible) is certainly welcome and should be directed to adurante@met.fsu.edu.

Confidence Discussion- 12/02/2005 (15:50 EST)

The two areas of low confidence that will be looked at today will be the area associated with the developing coastal low for early next week and the absolutely intense area of low confidence in the northern Rockies. We will first examine the area associated with the forecast coastal low.

In the interest of length, we will only look at the behavior of today's 12Z run. The confidence associated with the developing low starts to tank at the 30 hour forecast over western OK and northern TX. Low confidence really increases from the 24 to 30 hour forecast probably due to diurnal effects as temperatures are supposed to rise into the 70s just south of the developing cold front that is forecast to drape along the Red River Valley. Spaghetti values show a huge variation among the ensemble members with some members forecasting 50s and 70s over the same region.

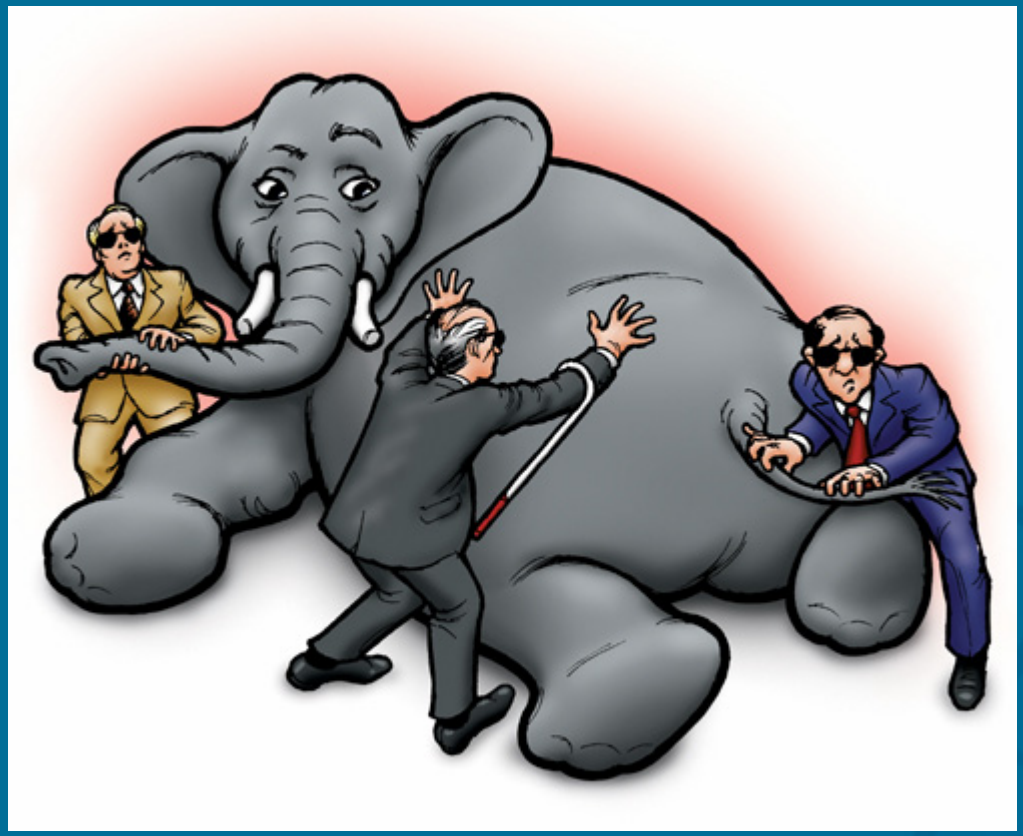


Model Flips and Flops

How to define them?

Run-to-run change in MOS max/min temperatures exceeds monthly MAE.

Run-to-run change in MOS max/min temperatures >10°F.



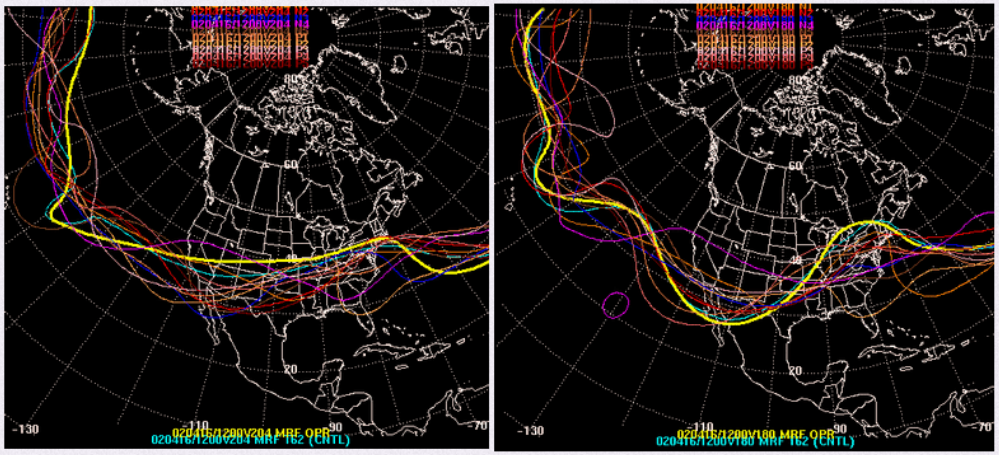
Current model run lies outside envelop of previous ensemble.

MetEd Tutorial

Applications of NWP Concepts

http://meted.ucar.edu/nwp/pcu3/cases/ens08apr02/titlpage.htm

Interpretation of Global Forecast Model "Flipflops"



Two (00 UTC 8 and 9 April 2002) ensemble forecasts separated by 24 hours, valid 12 UTC 16 April 2002, for 5700-m(?) 500-hPa height contour. The operational MRF T170 forecast is in bold yellow. Graphic courtesy of Stephen Jascourt, UCAR/COMET

Abstract

All forecasters are familiar with the radical changes from run to run that seem to occur with medium-range (and sometimes even short-range) forecasts in the Global Forecast Model. Do such 'flipflops' mean that there has been a fundamental change in the model forecasts?

In these cases, we will describe two recent model "flipflops" in a pair of time-adjacent MRF runs, and show how ensemble forecasts shed light on what is actually occurring in the MRF.

Learning objectives

In this case study, the main lessons are:

1. Model flipflops **usually** result from forecast uncertainty, rather than radical changes in the initial data, because the data assimilation system gives high weight to the first guess (i.e. the short-term forecast at analysis time).

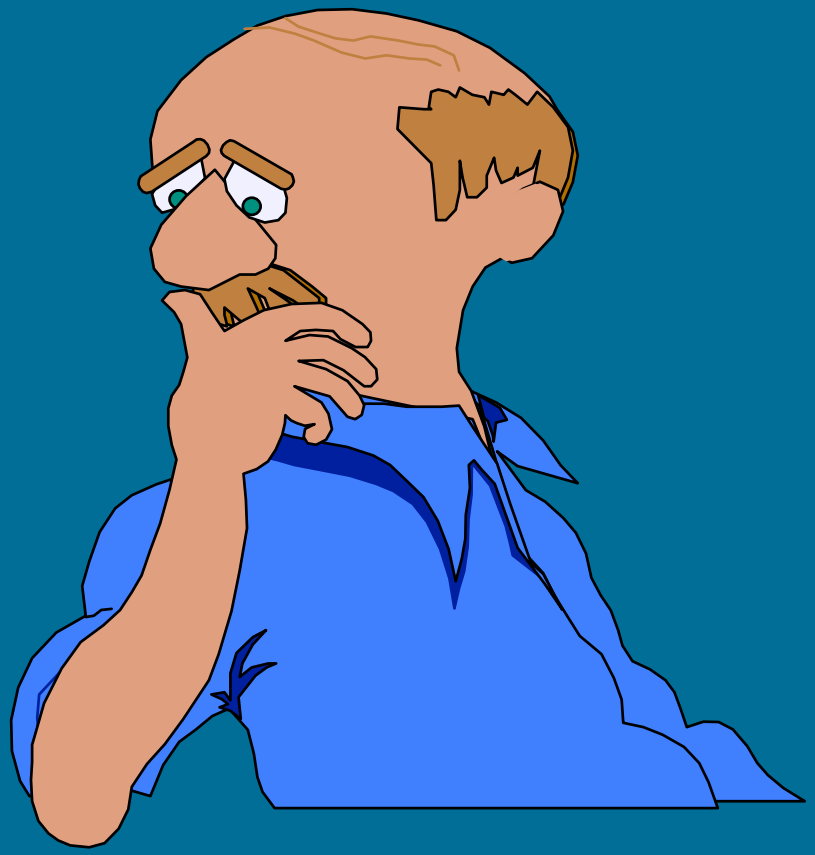
http://meted.ucar.edu/nwp/pcu3/cases/ens08apr02/frameset.htm

Model Flips

DFW November, 2005

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Date	Max/Min	Observed	Day 1	Day 2	Day 2	Day 3	Day 3	Day 4	Day 4	Day 5	Day 5	Day 6	Day 6	Day 7	Day 7	Day 8	Day 8	Day 9
2	November 2005			0000 U	1200 U	0000 U	1200 U	0000 U	1200 U	0000 U	1200 U	0000 U	1200 U	0000 U	1200 U	0000 U	1200 U	1200 U	0000 UTC
3	November 01	Max	72	72	72	76	78	78	72	72	75	69	77	71	73	68	70	72	
4		Min	45		47	48	50	52	52	54	52	56	50	49	48	48	54	50	54
5	November 02	Max	80	76	77	78	80	78	78	76	74	76	77	76	82	73	73	73	
6		Min	45		47	48	49	50	49	47	51	47	54	53	52	49	50	46	49
7	November 03	Max	82	78	79	81	82	83	79	77	78	78	82	78	75	85	82	74	
8		Min	53		52	53	54	55	53	51	55	52	53	51	52	57	56	52	53
9	November 04	Max	81	82	82	83	84	85	81	82	84	81	84	78	81	79	83	78	
10		Min	61		61	61	61	62	65	63	62	59	58	56	56	54	60	54	58
11	November 05	Max	89	85	83	86	86	82	83	82	82	78	85	79	79	79	77	77	
12		Min	63		66	65	64	64	65	65	64	59	59	58	55	56	55	56	59
13	November 06	Max	80	79	78	82	83	82	83	80	81	80	81	73	74	72	80	78	
14		Min	57		58	59	60	59	60	59	62	63	63	52	52	54	55	58	58
15	November 07	Max	87	86	85	88	85	86	85	83	84	80	73	77	75	75	78	72	
16		Min	63		62	65	62	65	63	62	63	62	64	60	50	53	54	50	59
17	November 08	Max	87	85	85	88	88	89	83	83	85	82	88	81	83	77	73	76	
18		Min	70		68	69	67	68	68	69	69	67	67	63	63	58	47	56	48
19	November 09	Max	88	81	80	84	85	78	85	x	84	72	78	76	74	80	82	74	
20		Min	71		67	68	70	71	70	x	71	63	66	62	62	61	63	58	55
21	November 10	Max	72	70	69	72	73	69	69	70	66	75	72	72	72	69	70	73	
22		Min	53		51	52	55	54	50	48	61	x	66	47	51	52	53	59	59
23	November 11	Max	77	75	76	77	74	72	73	72	70	73	68	74	68	68	75	71	
24		Min	51		52	54	53	52	51	47	49	46	48	58	56	47	53	51	57
25	November 12	Max	83	81	80	78	78	79	76	75	78	74	77	73	70	71	67	70	
26		Min	67		66	67	68	68	65	63	62	58	56	53	47	58	54	48	59
27	November 13	Max	76	80	78	80	80	77	76	77	70	71	73	72	74	74	67	73	
28		Min	58		62	61	62	63	61	65	61	60	60	59	59	58	53	56	53
29	November 14	Max	80	75	75	79	82	84	79	75	80	74	72	73	74	69	66	72	
30		Min	54		55	58	58	59	56	57	60	58	46	51	49	51	55	56	57
31	November 15	Max	63	71	67	70	67	66	63	67	63	64	65	69	74	78	79	69	
32		Min	61		62	62	60	60	59	59	54	51	53	51	54	55	56	49	56
33	November 16	Max	53	58	57	61	61	60	58	59	60	63	59	60	64	61	70	73	
34		Min	35		35	34	39	41	37	40	44	37	39	40	41	46	54	56	52
35	November 17	Max	59	59	59	61	64	63	60	58	65	65	68	66	62	64	67	68	
36		Min	32		30	32	35	35	33	33	37	37	40	40	35	42	39	44	54
37	November 18	Max	60	63	61	61	63	62	63	65	65	66	62	64	67	66	64	69	
38		Min	34		37	37	38	38	39	42	44	41	45	43	42	46	41	45	46
39	November 19	Max	66	66	65	67	68	67	70	67	70	68	64	66	65	66	59	65	

Questions?



mailto: bernard.meisner@noaa.gov