Using AWIPS
for Transitioning from Research to Operations

Jordan Joel Gerth

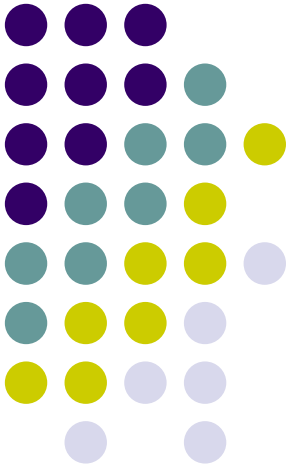
Student Hourly to assist Research and Development

Cooperative Institute for Meteorological Satellite Studies

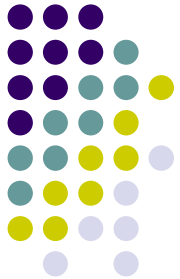
Space Science and Engineering Center

University of Wisconsin at Madison

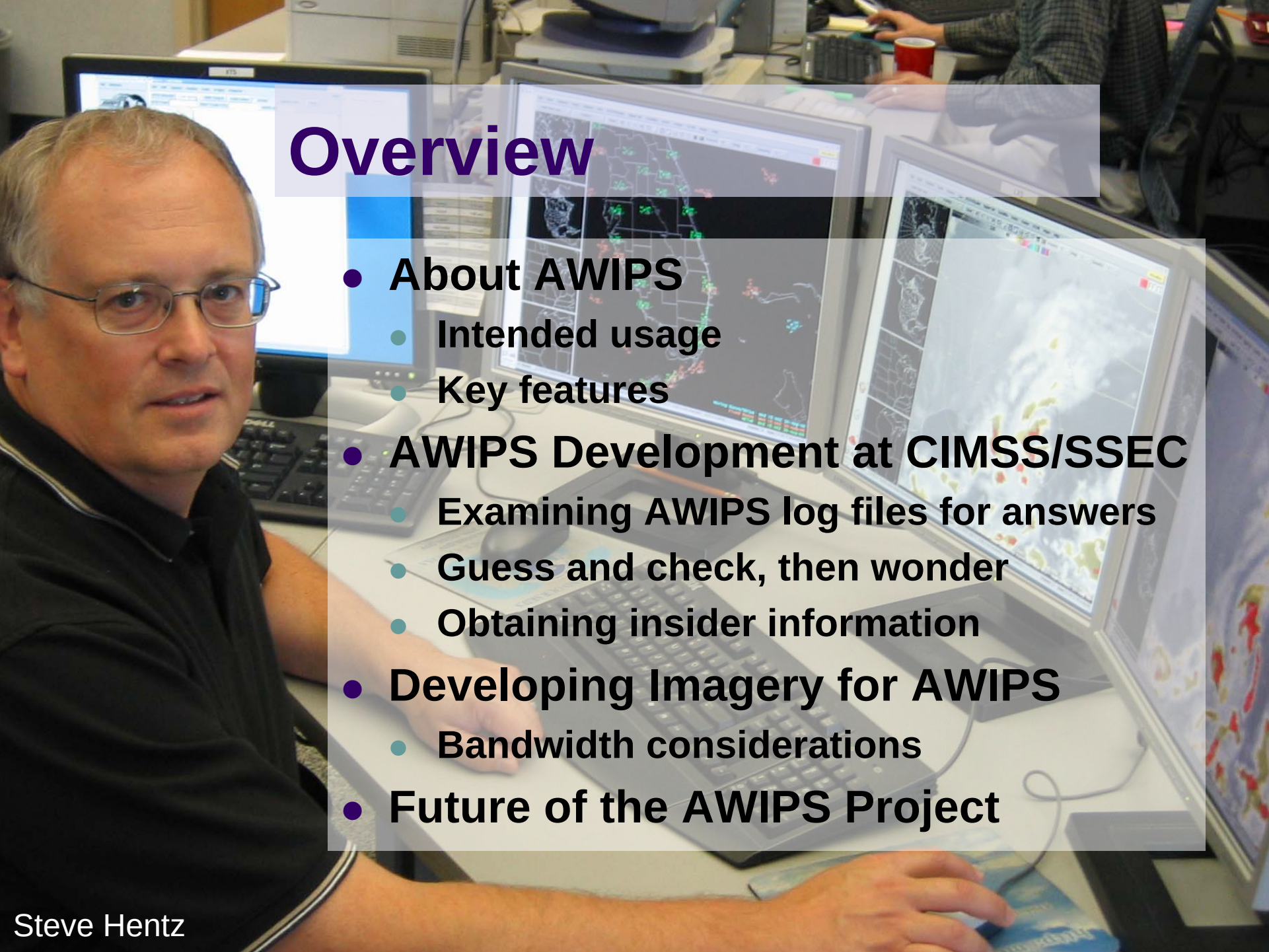
Thursday, July 12, 2007, 1 PM



Contributors to AWIPS Project



- Scott Bachmeier (SSEC)
- Kris Bedka (SSEC)
- Russ Dengel (SSEC)
- Wayne Feltz (SSEC)
- Jordan Gerth (SSEC)
- Scott Lindstrom (SSEC)
- Jerry Robaidek (SSEC)
- Kathy Strabala (SSEC)
- Steve Wanzong (SSEC)
- Technical Computing
- Robert Aune (NESDIS at SSEC)
- Dan Baumgardt (NWSFO ARX)
- Jason Burks (NWSFO HUN)
- Jeff Craven (NWSFO MKX)
- Matt Davis (NWSFO ARX)
- Xiangbao Jing (ESRL GSD)
- Kim Licitar (NWSFO MKX)
- Joe Wakefield (ESRL GSD)
- Gary Wade (NESDIS at SSEC)
- Zihou Wang (NWS OST)



Overview

- About AWIPS
  - Intended usage
  - Key features
- AWIPS Development at CIMSS/SSEC
  - Examining AWIPS log files for answers
  - Guess and check, then wonder
  - Obtaining insider information
- Developing Imagery for AWIPS
  - Bandwidth considerations
- Future of the AWIPS Project

Steve Hentz

About AWIPS

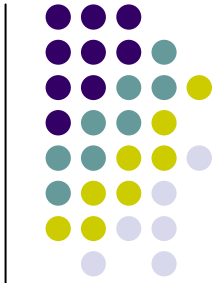
- **A**dvanced
- **W**eather
- **I**nteractive
- **P**rocessing
- **S**ystem

- **D**isplay
- 2 (Two)
- **D**imensions

About AWIPS

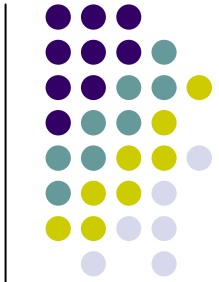
- Graphical user interface; no command line
- Powerful one-stop mechanism for gathering and viewing all weather information pertinent to operations at National Weather Service field offices, including model output, satellite data, surface and upper-air observations, lightning, local and regional radar imagery, and redbook graphics
- Also used for issuing and disseminating text products, such as warnings and statements

About AWIPS: Pros



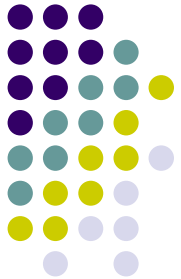
- Display Two Dimensions is menu-driven and intuitive, with simple controls for looping
- Large amount of operational datasets available in real-time or near real-time
- Overlay and sampling capabilities
- Four-panel displays
- Cross-section and point soundings available
- Configuration cemented with localization
- Screen captures are simple and attractive

About AWIPS: Cons



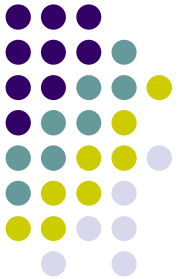
- Ability to process raw archived data quite difficult
- Decoder programming was not streamlined for consistency and uniformity
- For most datasets, reads AWIPS-formatted netCDF files only, which are difficult to create outside of the AWIPS environment
- Display Two Dimensions does not read mapping information in the header of satellite netCDF files
- Generally poor documentation, not easy to modify menu system and add products

About AWIPS: Cons



- Log files are generally not descriptive as to the actual problem when one arises
- Difficult to recover from sudden system halt
- Decoders sometimes check file name for accuracy
- Decoders must be running at all times, but some segmentation fault without notice
- Cron tasks must be set to assure purge processor runs, and that the data is ingesting
- Source code is not available
- Notification server and automatic update is finicky

Is AWIPS for you?



- Do you…
  - Have a need for current weather information?
  - Create imagery or products which could be beneficial in an operational environment?
  - Like to forecast the weather or predict where the next big snowstorm will strike?
  - Need high-quality plots in a short timeframe?
  - Wish to interact with meteorologists in the field?
  - Have an interest in other high power weather software packages like IDV and McIDAS?

Data Ingest Flow Diagram

Local Data Manager Feeds:
DDPLUS, DDS, FSL2, HRS,
IDS, NIMAGE, NNEXRAD

Add Communications
Control Block (CCB) to
most Messages

Store raw METAR data in
/data/fxa/point/metar/Raw

Store raw model data in
/data/fxa/Grid/SBN/Raw

Store raw satellite data in
/data/fxa/sat/SBN/Raw

sendPing COMMS_ROUTER SAUS70

sendPing GRID_ROUTER LTBA98KWBE

sendPing COMMS_ROUTER TIGE01

MetarDecoder

GribDecoder

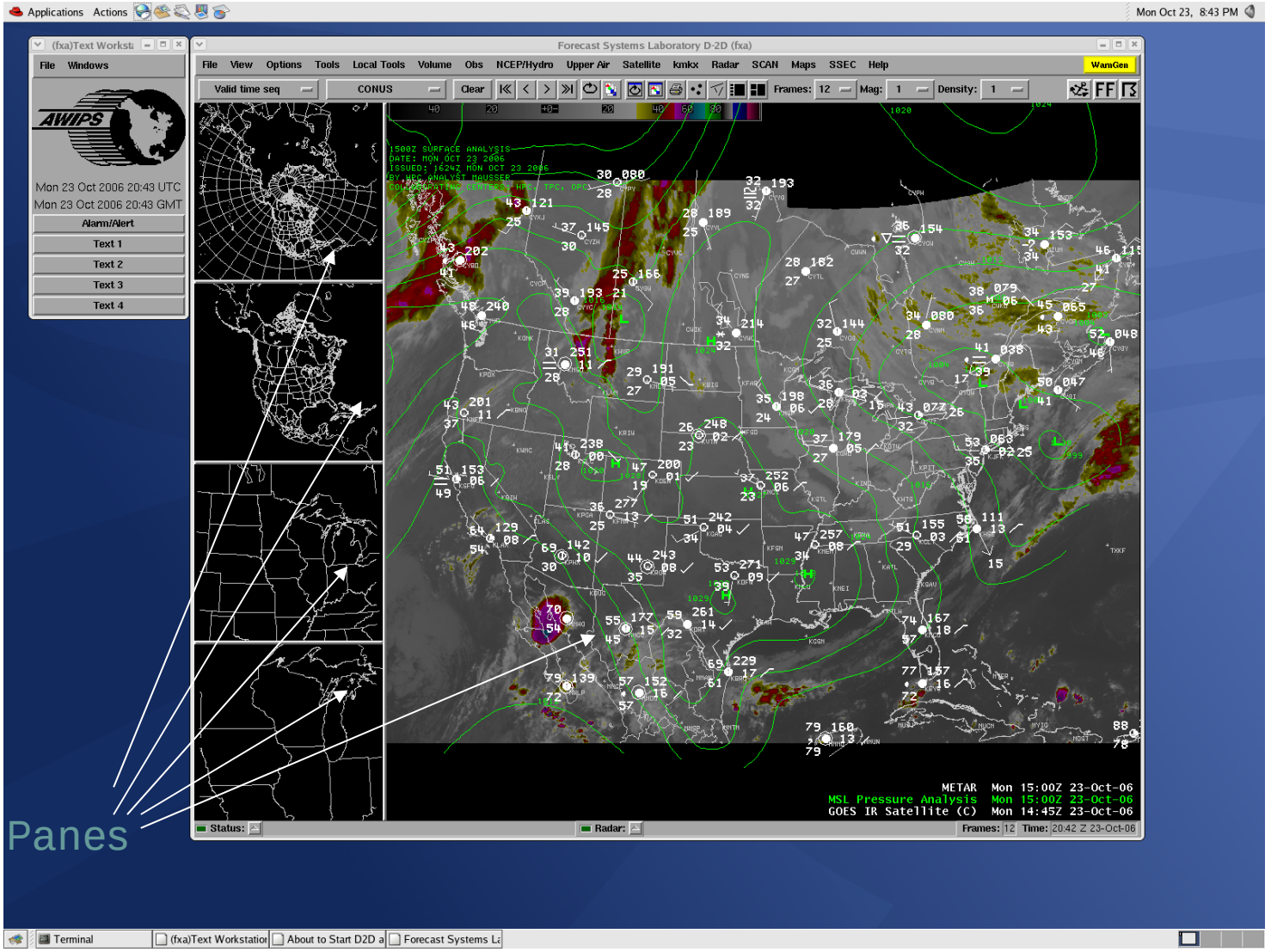
Satdecoder

Decoded METAR data stored in
/data/fxa/point/metar/netcdf
as netCDF

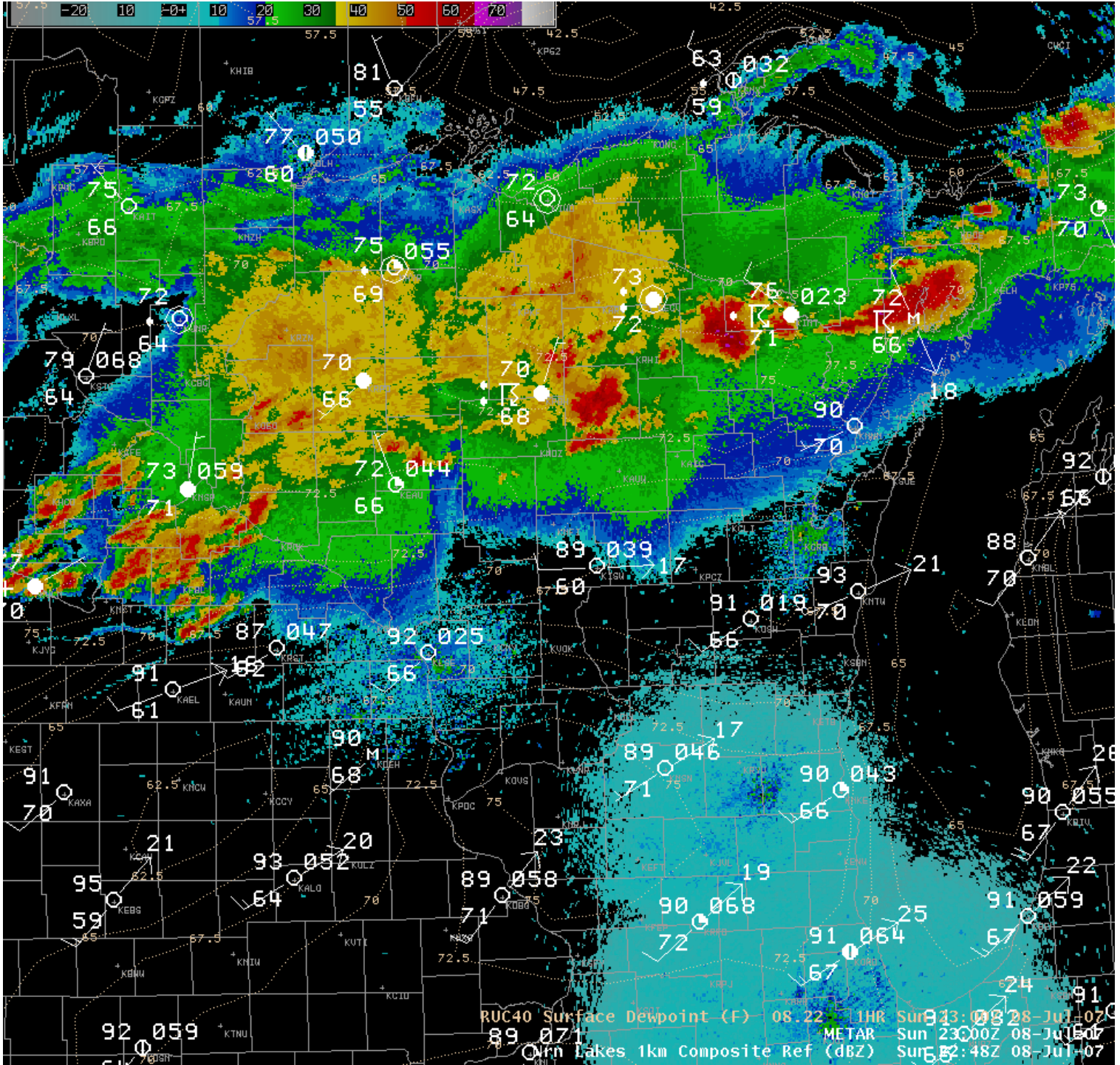
Decoded model data stored in
/data/fxa/Grid/SBN/netCDF
as netCDF

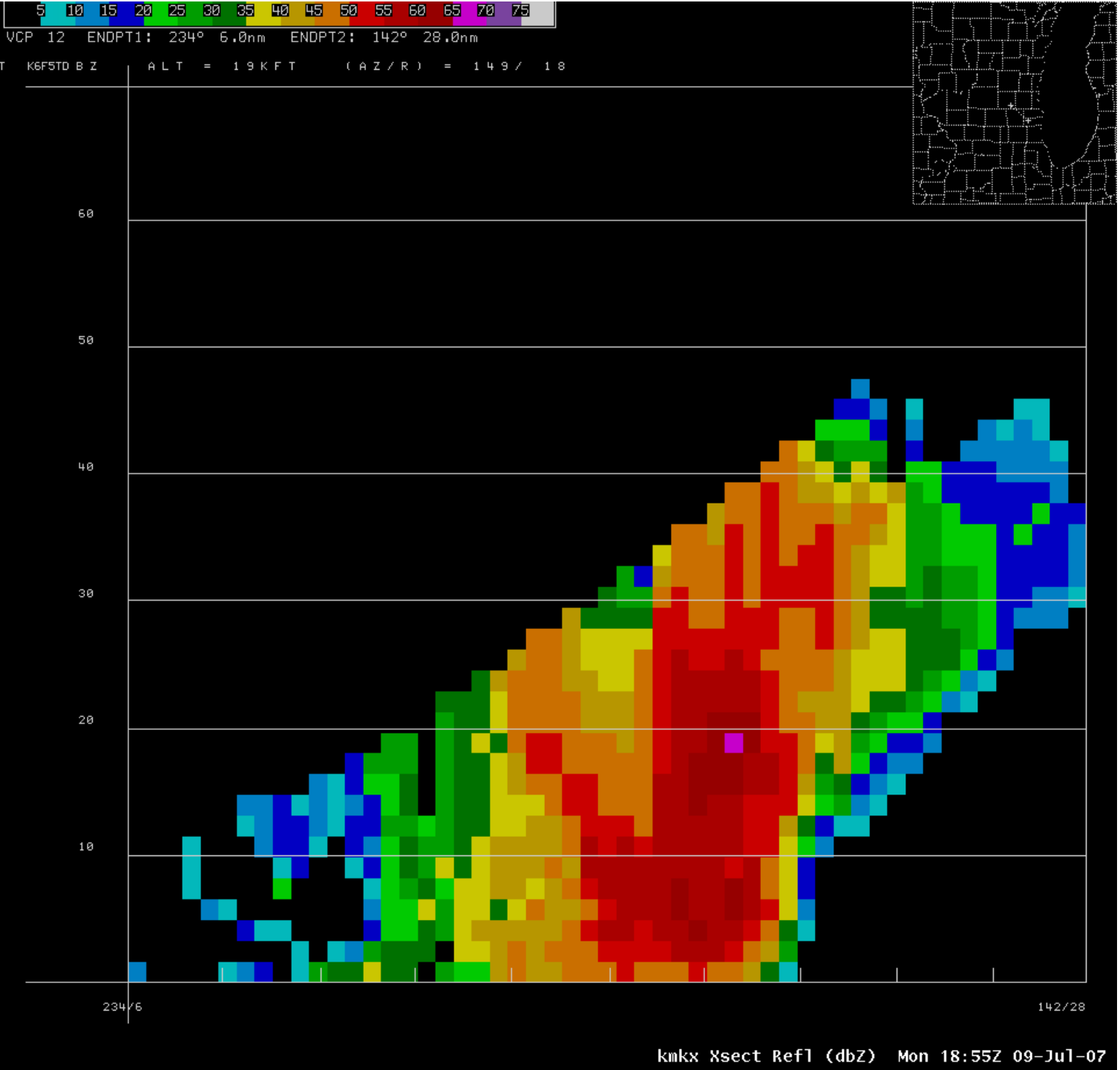
Decoded satellite data stored in
/data/fxa/sat/SBN/netCDF
as netCDF

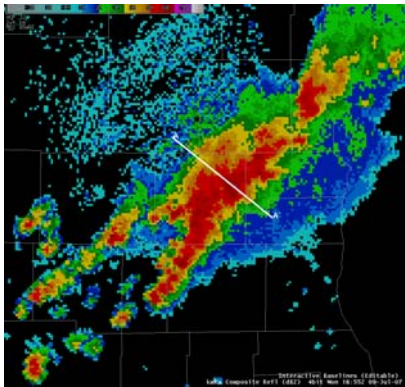
AWIPS D2D

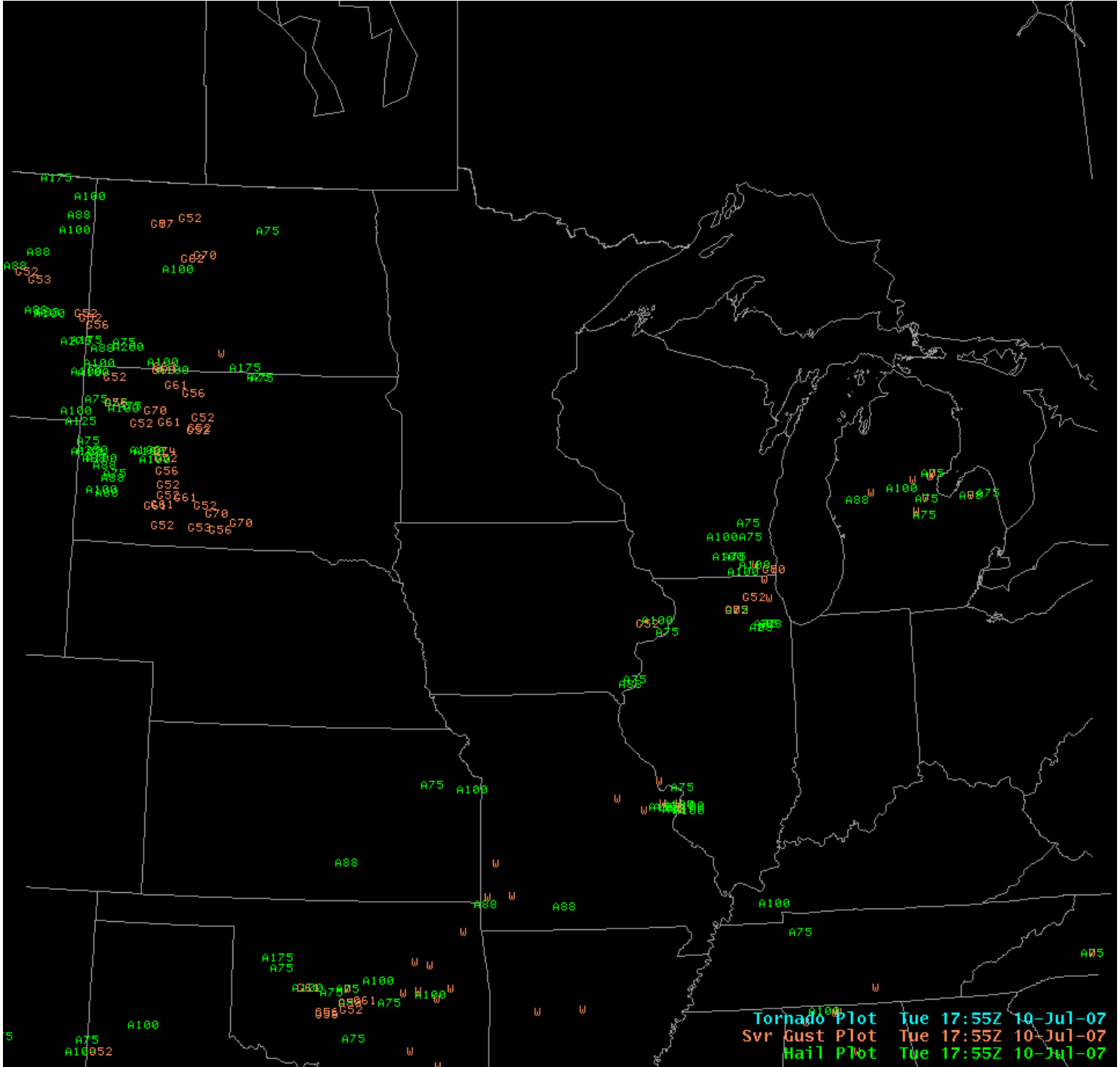


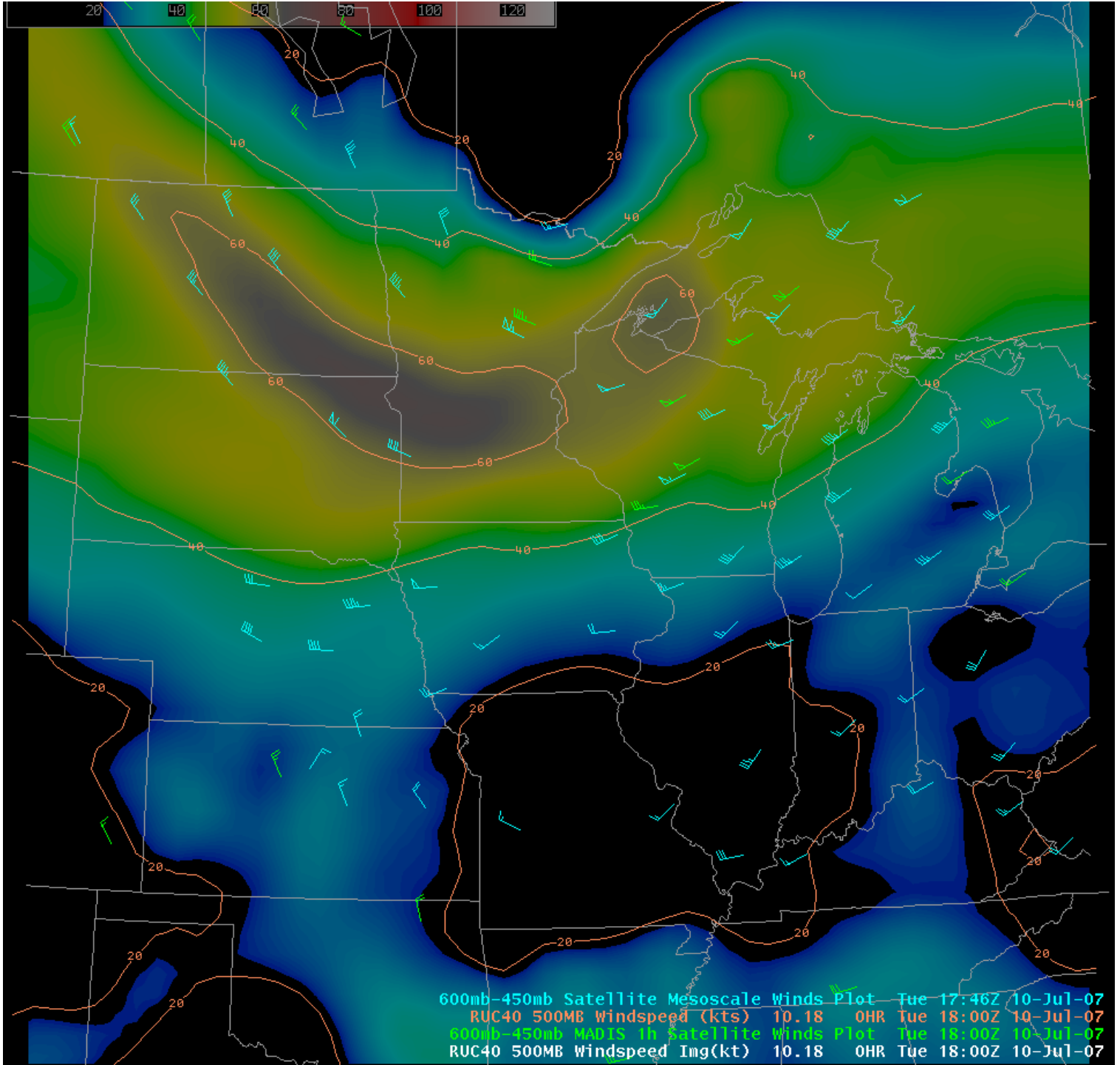
Panes

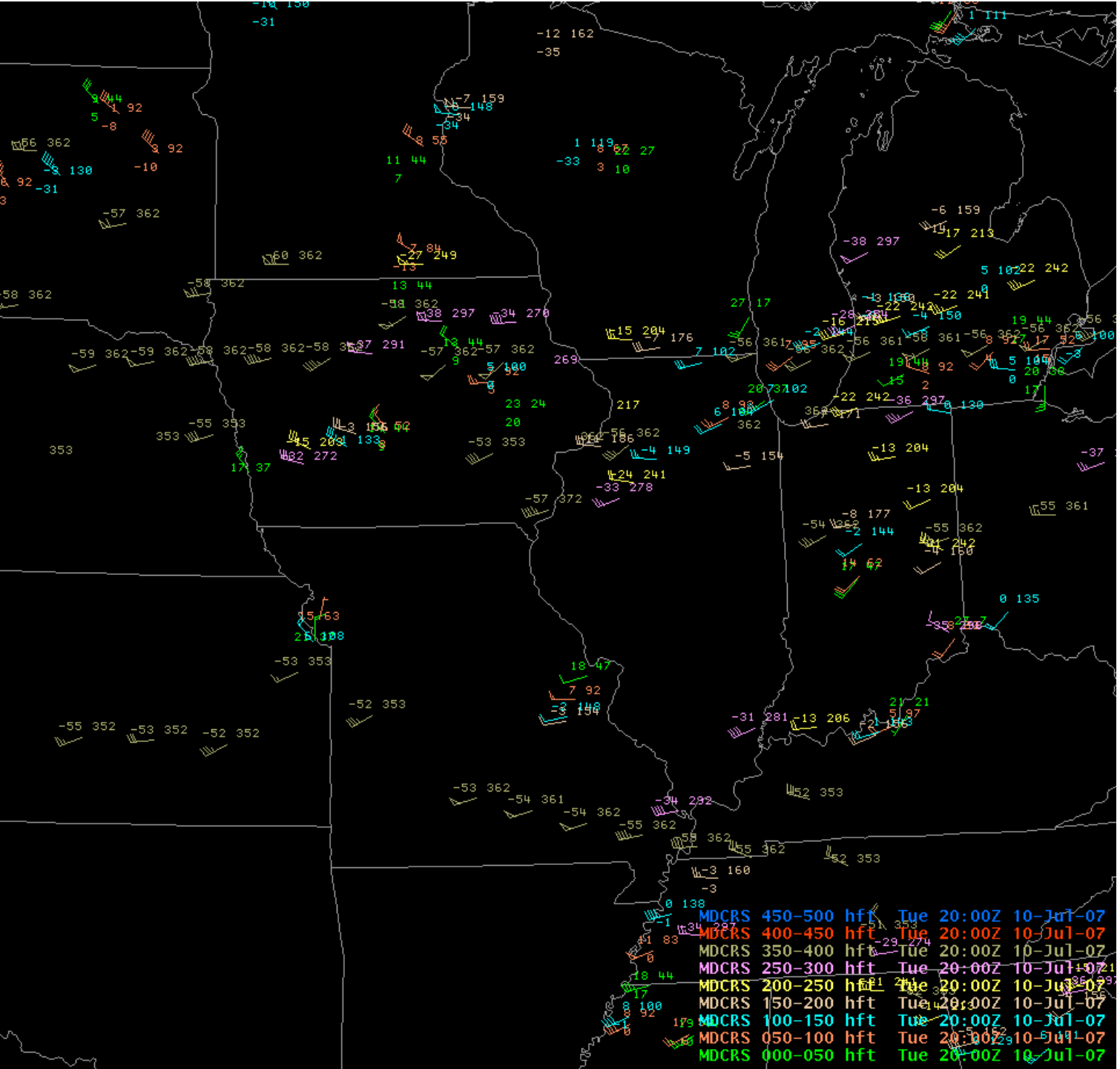

RUC40 Surface Dewpoint (F) 08.22 1HR Sun 23:00Z 08-Jul-07
METAR Sun 23:00Z 08-Jul-07
Nrn Lakes 1km Composite Ref (dBZ) Sun 22:48Z 08-Jul-07

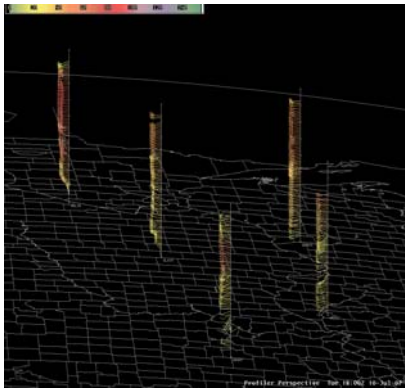

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
VCP 12 ENDPT1: 234° 6.0nm ENDPT2: 142° 28.0nm
T K6F5TD B Z ALT = 19KFT (AZ/R) = 149/ 18
60
50
40
30
20
10
234/6
142/28
kmkx Xsect Refl (dbZ) Mon 18:55Z 09-Jul-07

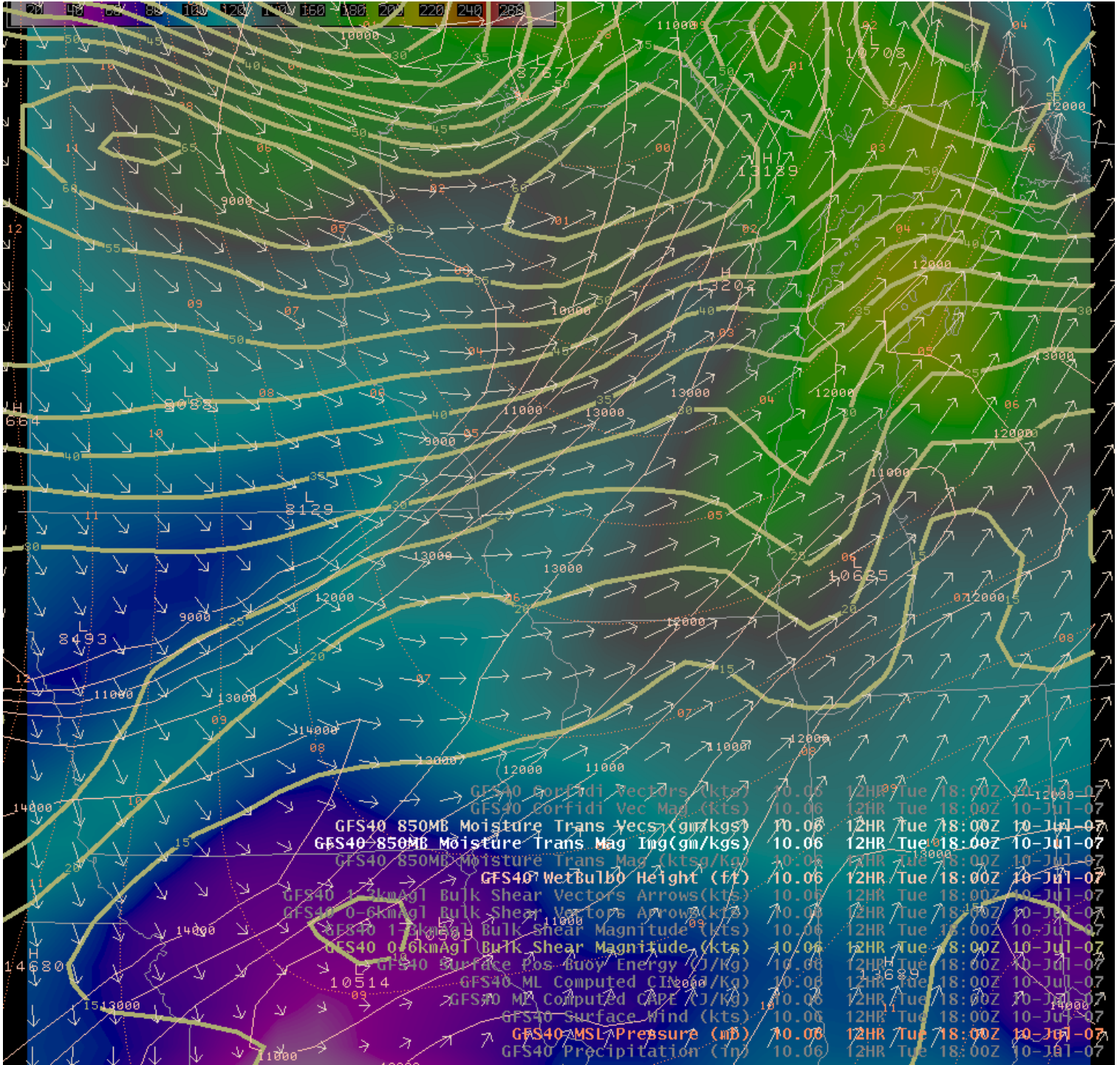


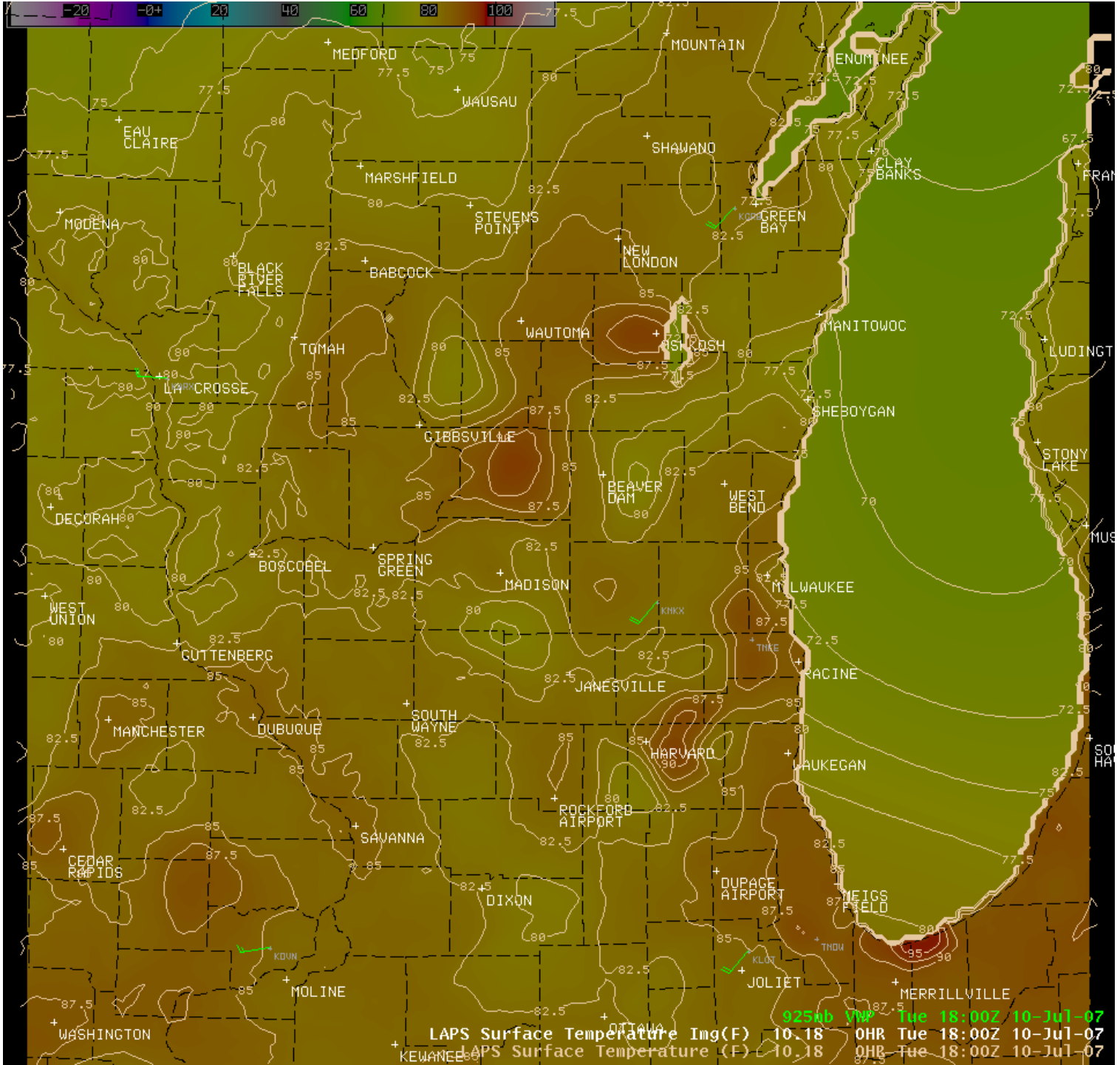

Tornado Plot Tue 17:55Z 10-Jul-07
Svr Gust Plot Tue 17:55Z 10-Jul-07
Hail Plot Tue 17:55Z 10-Jul-07

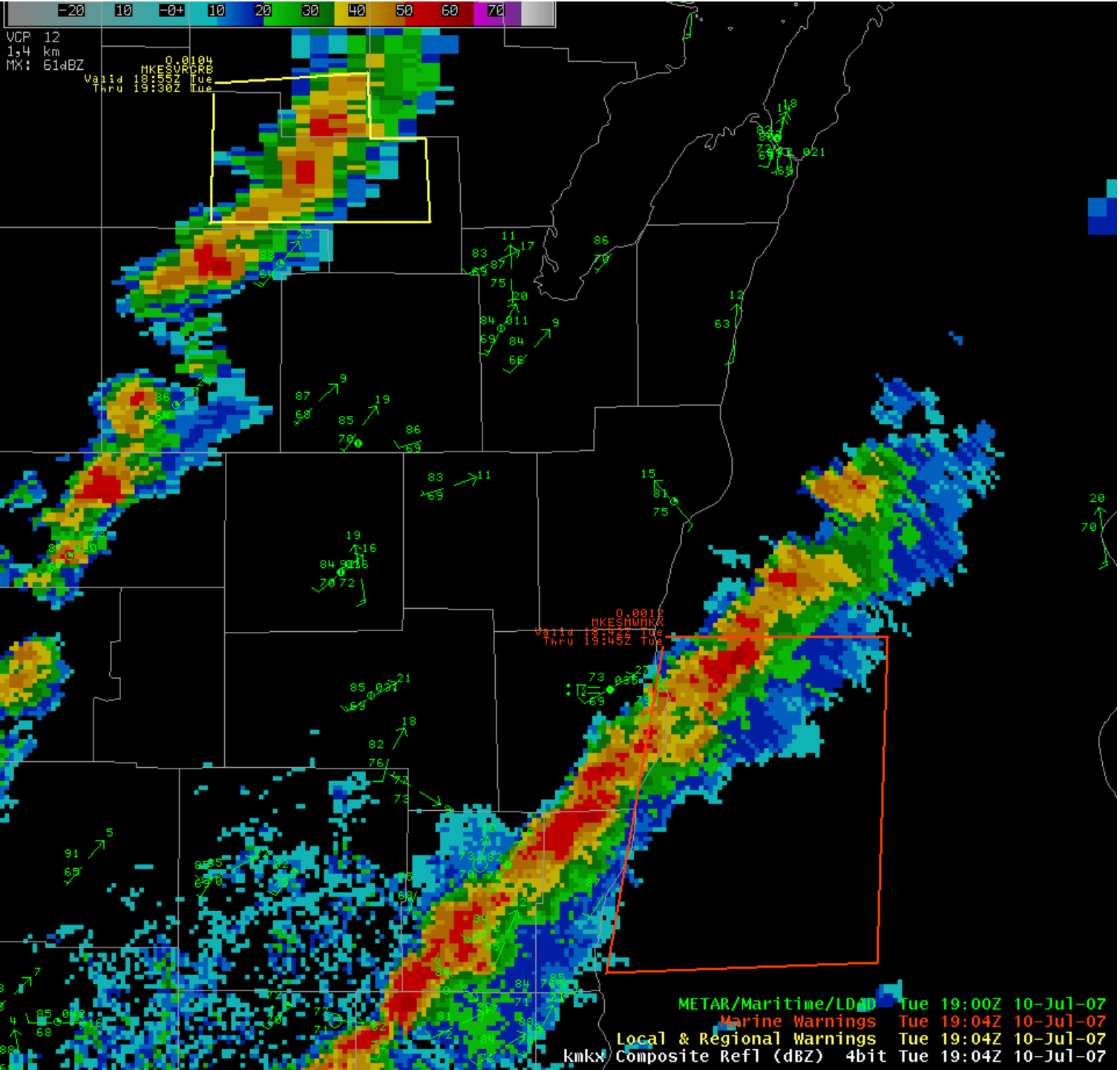

20
40
80
60
100
120
600mb-450mb Satellite Mesoscale Winds Plot Tue 17:46Z 10-Jul-07
RUC40 500MB Windspeed (kts) 10.18 0HR Tue 18:00Z 10-Jul-07
600mb-450mb MADIS 1h Satellite Winds Plot Tue 18:00Z 10-Jul-07
RUC40 500MB Windspeed Img(kt) 10.18 0HR Tue 18:00Z 10-Jul-07

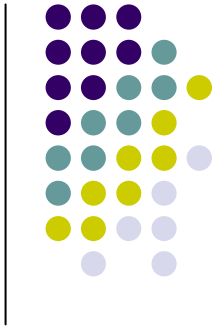

MDCRS 450-500 hft Tue 20:00Z 10-Jul-07
MDCRS 400-450 hft Tue 20:00Z 10-Jul-07
MDCRS 350-400 hft Tue 20:00Z 10-Jul-07
MDCRS 250-300 hft Tue 20:00Z 10-Jul-07
MDCRS 200-250 hft Tue 20:00Z 10-Jul-07
MDCRS 150-200 hft Tue 20:00Z 10-Jul-07
MDCRS 100-150 hft Tue 20:00Z 10-Jul-07
MDCRS 050-100 hft Tue 20:00Z 10-Jul-07
MDCRS 000-050 hft Tue 20:00Z 10-Jul-07




GFS40 Corfidi Vectors (kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 Corfidi Vec Mag (kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 850MB Moisture Trans Vecs (gm/kgs) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 850MB Moisture Trans Mag Img(gm/kgs) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 850MB Moisture Trans Mag (ktsg/kg) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 WetBulb0 Height (ft) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 1-3kmAgl Bulk Shear Vectors Arrows(kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 0-6kmAgl Bulk Shear Vectors Arrows(kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 1-3kmAgl Bulk Shear Magnitude (kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 0-6kmAgl Bulk Shear Magnitude (kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 Surface Pos Buoy Energy (J/Kg) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 ML Computed CIN (J/Kg) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 ML Computed CAPE (J/Kg) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 Surface Wind (kts) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 MSL Pressure (mb) 10.06 12HR Tue 18:00Z 10-Jul-07
GFS40 Precipitation (in) 10.06 12HR Tue 18:00Z 10-Jul-07


-20
-0+
20
40
60
80
100
MEDFORD
MOUNTAIN
MARINETTE
WAUSAU
EAU CLAIRE
SHAWANO
MARSHFIELD
CLAY BANKS
MODENA
STEVENS POINT
GREEN BAY
NEW LONDON
BLACK RIVER FALLS
BABCOCK
MANITOWOC
WAUTOMA
OSHKOSH
TOMAH
LA CROSSE
SHEBOYGAN
GIBBSVILLE
STONY LAKE
BEAVER DAM
WEST BEND
DECORAH
SPRING GREEN
BOSCOBEL
MADISON
MILWAUKEE
WEST UNION
GUTTENBERG
RACINE
JANESVILLE
MANCHESTER
DUBUQUE
SOUTH WAYNE
HARVARD
WAUKEGAN
ROCKFORD AIRPORT
SAVANNA
CEDAR RAPIDS
DUPAGE AIRPORT
DIXON
MEIGS FIELD
JOLIET
MOLINE
MERRILLVILLE
WASHINGTON
OTTAWA
KEWANEE
925mb VWP Tue 18:00Z 10-Jul-07
LAPS Surface Temperature Img(F) 10.18 OHR Tue 18:00Z 10-Jul-07
LAPS Surface Temperature (F) 10.18 OHR Tue 18:00Z 10-Jul-07

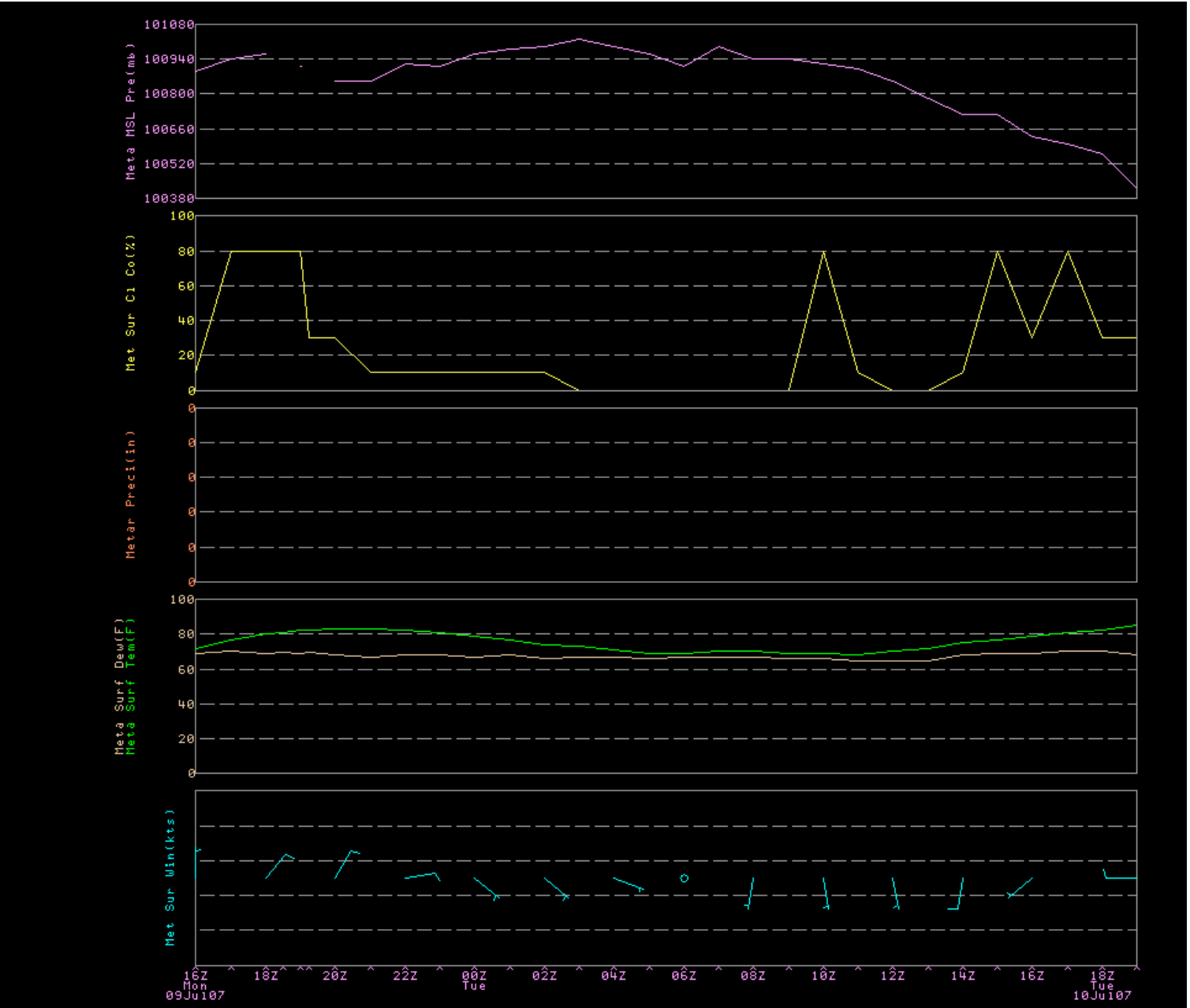




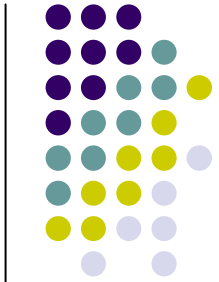
BOU Full: FSL

Edit
- Box
- Track
- Box and Track

- Severe Weather Statement
- Flash Flood Statement
- Flash Flood with Svr Tstm
- non-convective FFW (Dam Break)
- non-convective Flash Flood Statement
- ----------
- Marine Wx Statement - NO SMW issued
- Blizzard Warning
- Blowing Dust Advisory
- Blowing Snow Advisory
- Coastal Flood Statement
- Coastal Flood Warning
- Coastal Flood Watch
- Dense Fog Advisory
- Excessive Heat Warning
- Flash Flood Watch
- Flood Warning
- Flood Watch
- Freeze Warning
- Freezing Drizzle Advisory
- Freezing Rain Advisory
- Frost Advisory
- Generate WRKSLS
- Heavy Snow Warning
- High Wind Warning
- High Wind Watch
- Hurricane Local Statement
- Hvy/Hi Surf Advisory
- Lakeshore Flood Statement
- Lakeshore Flood Warning
- Lakeshore Flood Watch
- Severe High Wind Warning
- Short Term Forecast
- Snow Advisory
- Snow/Blowing Snow Advisory
- Special Weather Statement (zones)
- Urban/Small Stream Advisory

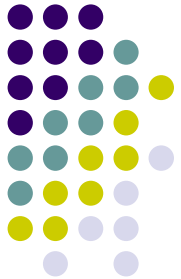

Meta MSL Pre(mb)
101080
100940
100800
100660
100520
100380
Met Sur Cl Co(%)
100
80
60
40
20
0
Metar Preci(in)
0
Meta Surf Dew(F)
Meta Surf Tem(F)
100
80
60
40
20
0
Met Sur Win(kts)
16Z Mon 09Jul07
18Z
20Z
22Z
00Z Tue
02Z
04Z
06Z
08Z
10Z
12Z
14Z
16Z
18Z Tue 10Jul07
Metar ptA KMSN MSL Pressure TSer(mb)
Metar ptA KMSN Surface Cloud Cover TSer(%)
Metar ptA KMSN Surface Dewpoint TSer(F)
Metar ptA KMSN Surface Wind TSer(kts)
Metar ptA KMSN Precipitation TSer(in)
Metar ptA KMSN Surface Temperature TSer(F)

AWIPS Development



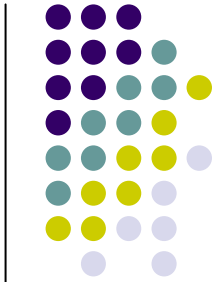
- My primary tasks at CIMSS/SSEC from the fall of 2005 through the present time are:
  - Developing and maintaining a standalone AWIPS system while providing in-house user assistance
  - Optimizing the CIMSS/SSEC AWIPS experience
  - Serving as the technical focal point for NWS offices who are interested in enhancing their AWIPS satellite imagery
  - Monitoring imagery distributed to NWSFOs
  - Creating AWIPS accessories, such as Tcl GUIs

AWIPS Development



- We have different needs than NWSFOs
  - We do not issue text products, but AWIPS lets us know if a new storm cell has developed nearby
- NWSFOs ingest data from NOAAPORT into AWIPS using the acquisition server, whereas we ingest data with the Unidata Local Data Manager
  - However, we both use sendPing as the signal to the numerous decoders to check the raw data directories
- NWSFOs have a uniform naming convention for all of their machines, and some source code has these machine names compiled in
  - Standard NWS machine names are: dx, lx, na, px
  - Our names are: awipsds, galileo, kalmia, sturm, moss

AWIPS Development

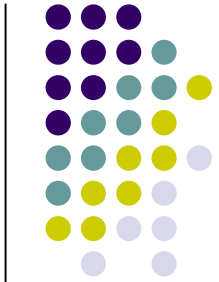


- There were four key procedures that worked to get AWIPS running at CIMSS/SSEC:
  - To append the CCB header or not
    - The Communications Control Block is stripped off of products sent over the LDM, so it needs to be appended upon arrival.
    - Most CCB headers were generic, but the redbook graphics and aviation reports needed some intricate work.
  - Examining AWIPS log files for answers
    - Systems manager documentation can get you halfway for the main datasets. If lucky, your AWIPS log file may inform you of the error at that juncture. Better yet, log files from NWSFOs work wonders.

AWIPS Development

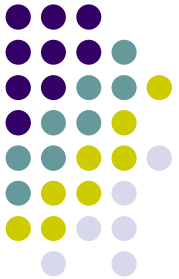
- Guess and check, guess again, then wonder
  - It is possible to navigate through the dark if you walk slowly and keep your hands in front of you.
  - Do not assume identical things at face act alike.
  - The sendPing executable signals the decoder with “magic strings” that are tricky to develop.
    - Last and final “magic string” was uncovered June 2007 to process the scatterometer winds. It consists of nearly 100 spaces.
- Obtaining insider information
  - Hot tips from AWIPS software developers, support staff, and Information Technology Officers save the day, but finding out who knows what is a problem.

AWIPS Development

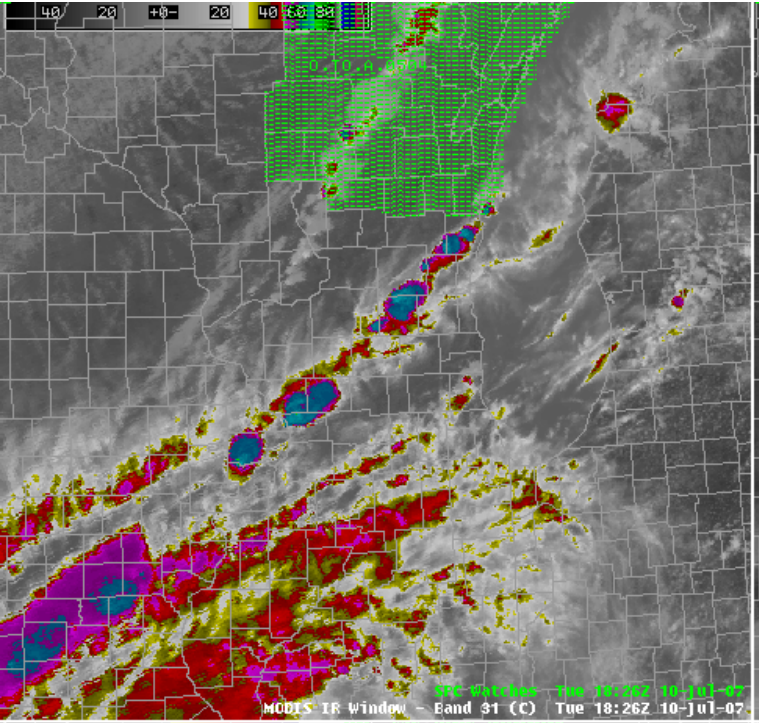


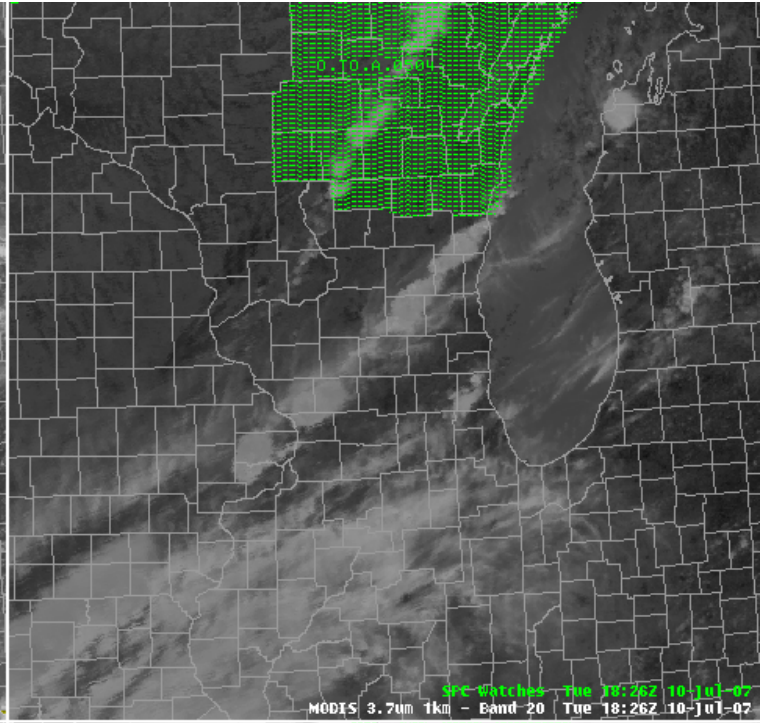
- The machine used for AWIPS development crashed in September 2005, shortly after I arrived. The only option was to start from the beginning.
- OB5 – First functioning AWIPS workstation running
- OB6 – Added SSM/I data and CIMSS color tables
- OB7.1 – Added POES imagery to satellite menu
- OB7.2 – Required work to alter GUARDIAN function
- OB8.1 – Expected to be released after July 30, 2007
- OB8.2 – Will contain new radar viewing capabilities
- OB8.3 – Likely my last AWIPS upgrade at CIMSS
- AWIPS II – The next generation of AWIPS, in Java

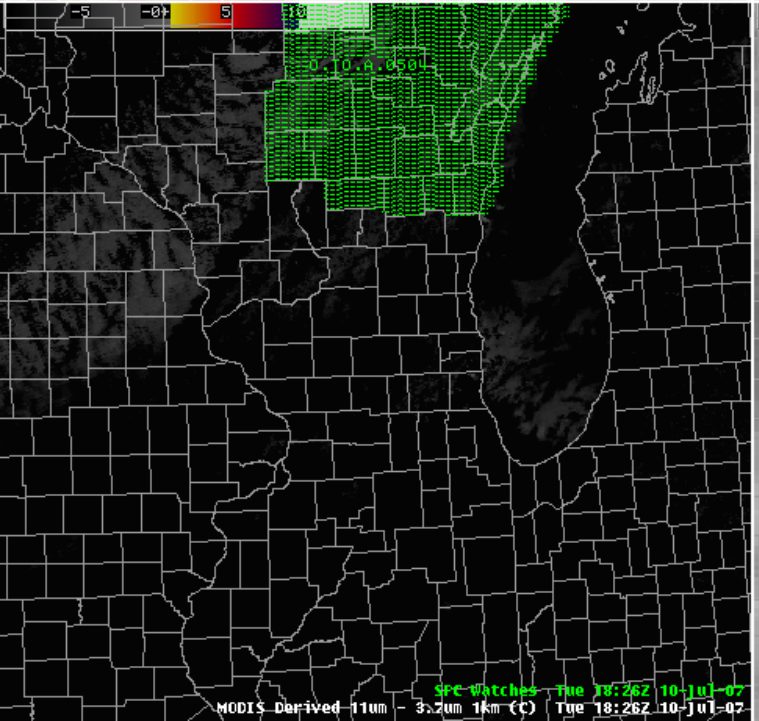
AWIPS Development

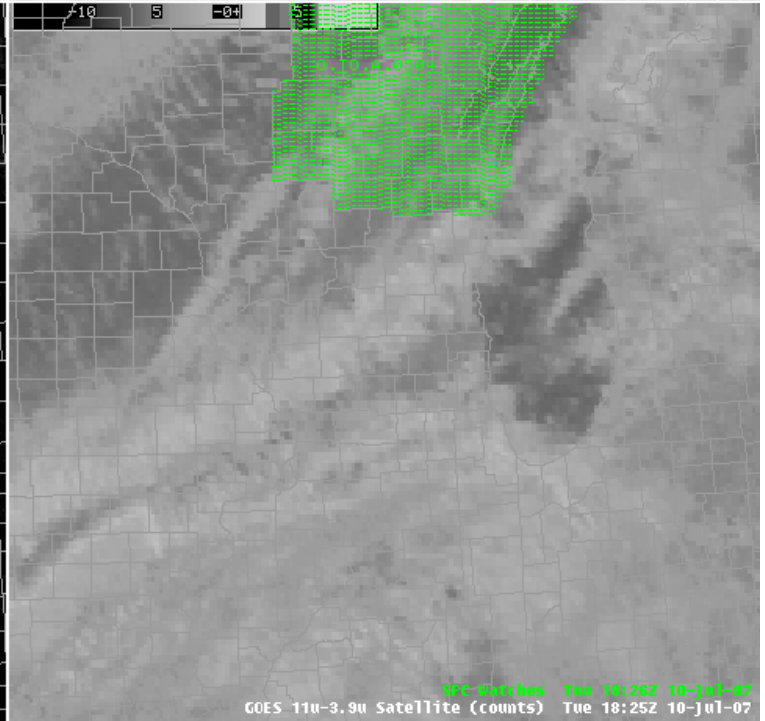


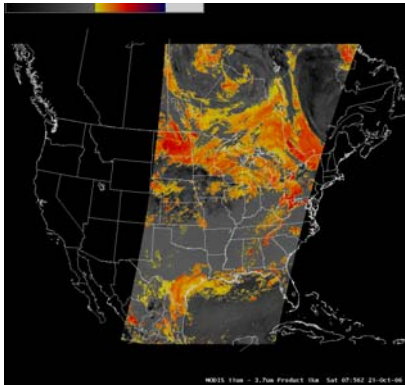
- The following SSEC AWIPS-compatible files are currently being provided to NWSFOs:
  - MODIS Imagery
    - Visible, Snow/Ice, Cirrus, Water Vapor, IR, Fog
  - MODIS Products
    - TPW, Cloud Phase, Cloud Top Temperature
  - MODIS Sea Surface Temperature
  - CRAS Forecast IR Window and Water Vapor
  - GOES Sounder CAPE and Ozone
  - GOES Mesoscale Winds

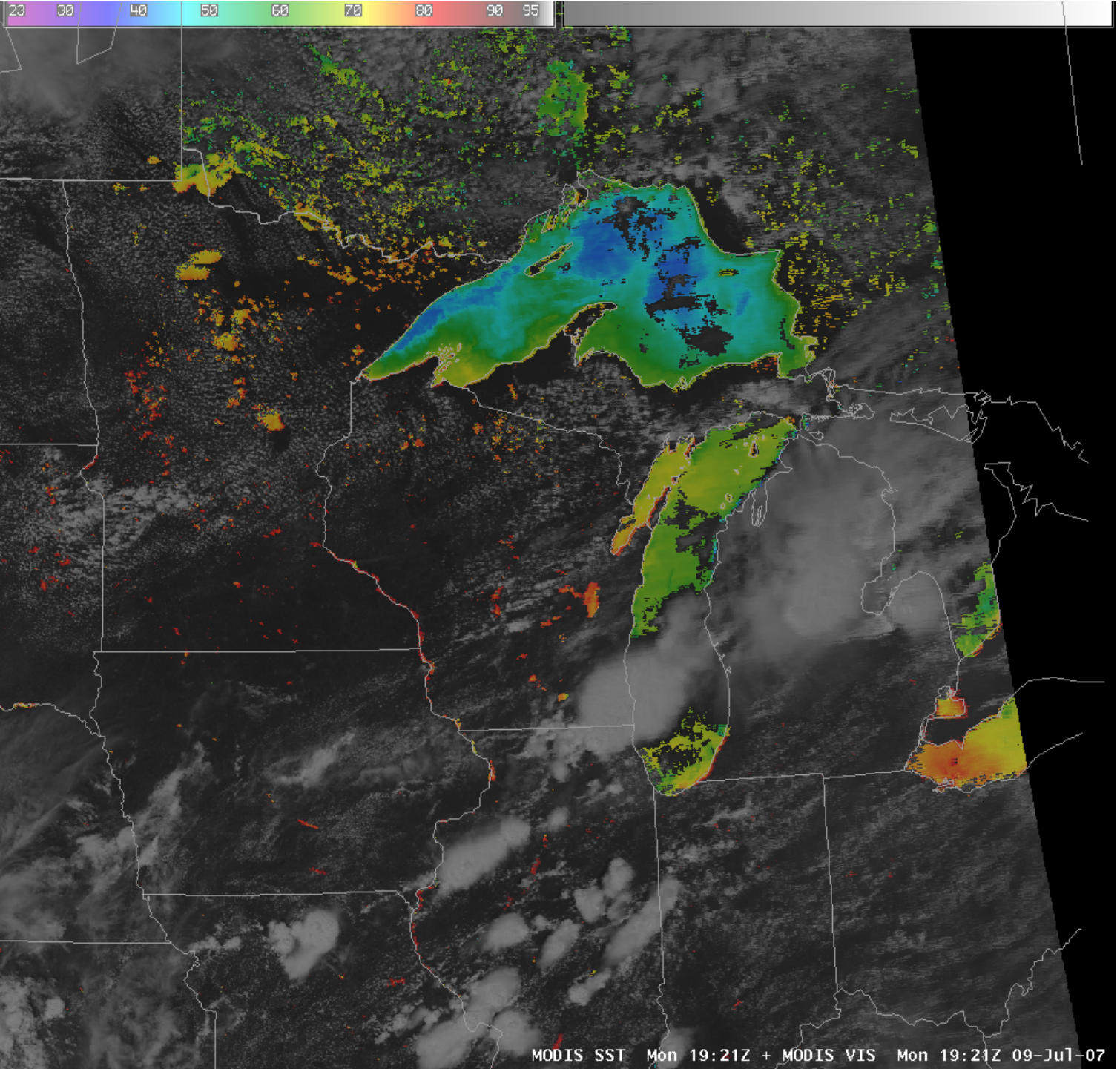

SPC Watches Tue 18:26Z 10-Jul-07
MODIS IR Window - Band 31 (C) Tue 18:26Z 10-Jul-07

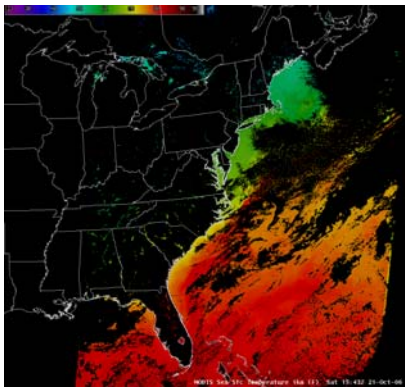

SPC Watches Tue 18:26Z 10-Jul-07
MODIS 3.7um 1km - Band 20 Tue 18:26Z 10-Jul-07

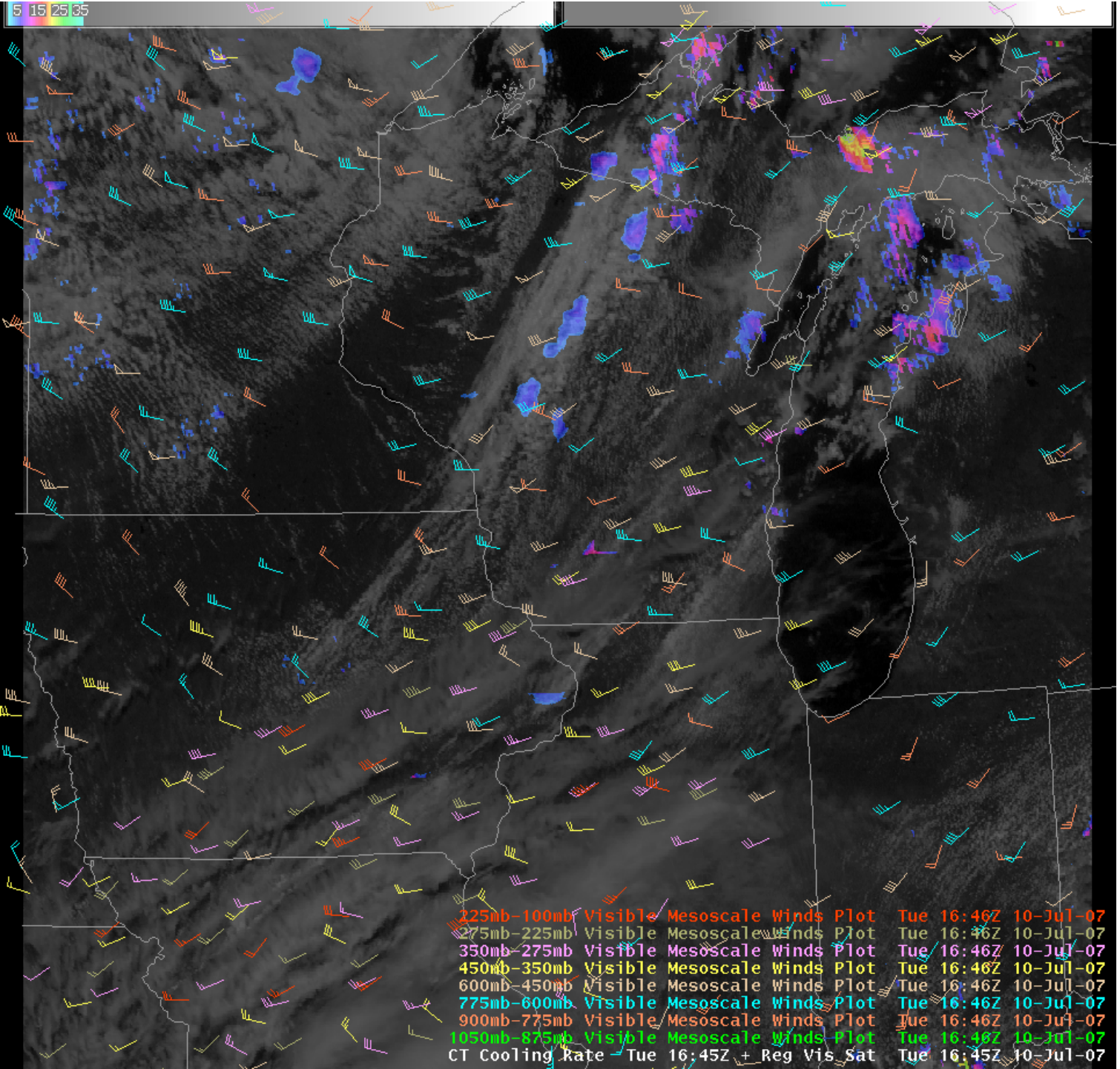

SPC Watches Tue 18:26Z 10-Jul-07
MODIS Derived 11um - 3.7um 1km (C) Tue 18:26Z 10-Jul-07

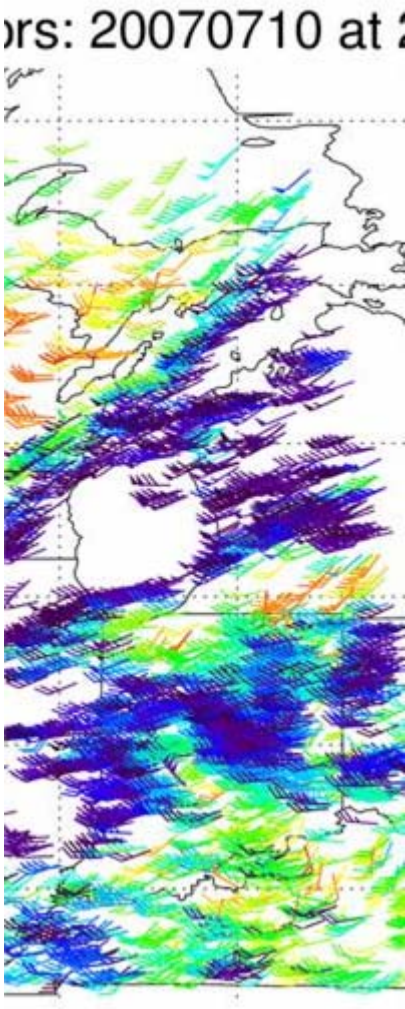

SPC Watches Tue 18:26Z 10-Jul-07
GOES 11u-3.9u Satellite (counts) Tue 18:25Z 10-Jul-07

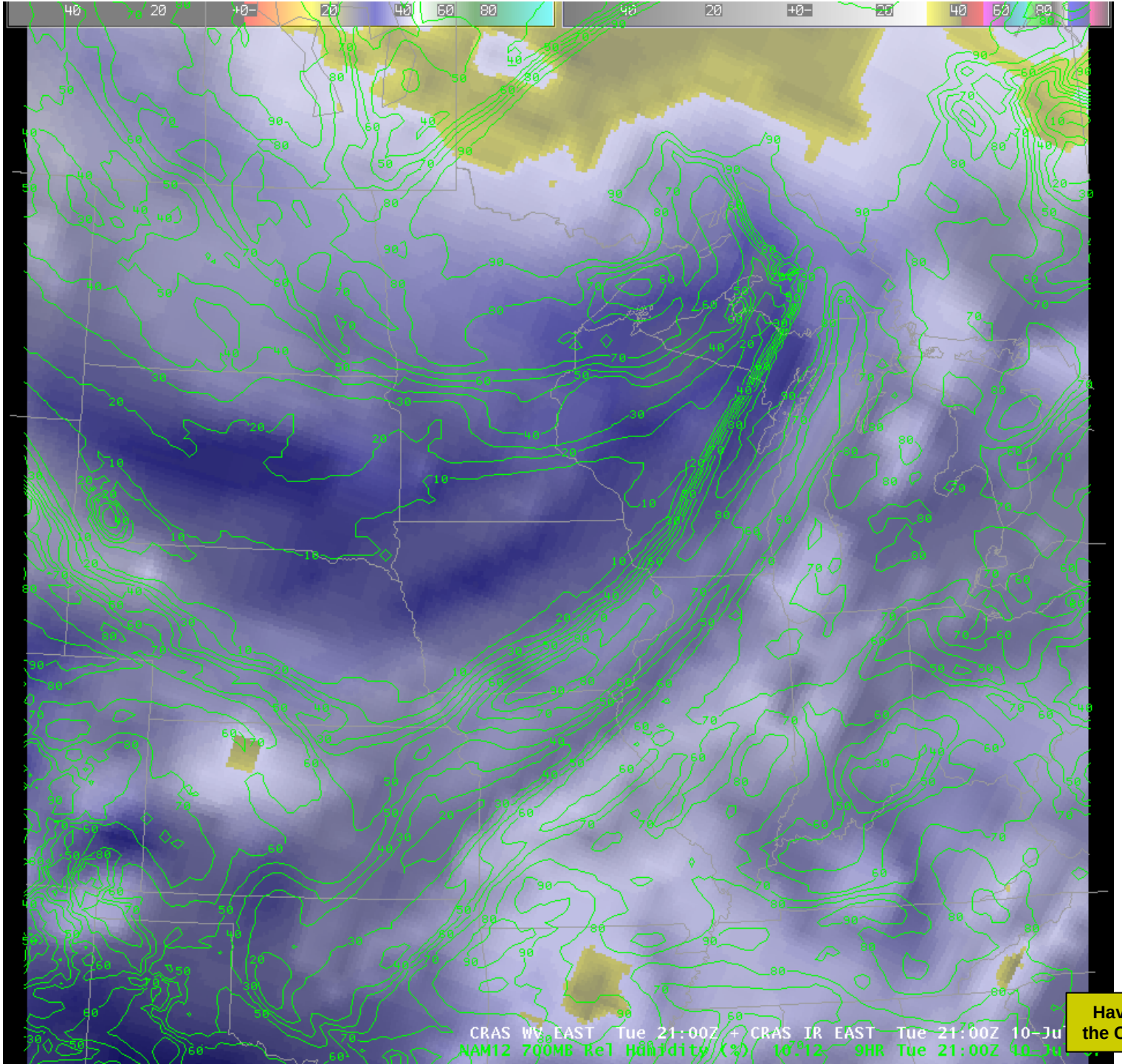



23 30 40 50 60 70 80 90 95
MODIS SST Mon 19:21Z + MODIS VIS Mon 19:21Z 09-Jul-07




5 15 25 35
225mb-100mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
275mb-225mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
350mb-275mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
450mb-350mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
600mb-450mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
775mb-600mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
900mb-775mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
1050mb-875mb Visible Mesoscale Winds Plot Tue 16:46Z 10-Jul-07
CT Cooling Rate Tue 16:45Z + Reg Vis Sat Tue 16:45Z 10-Jul-07

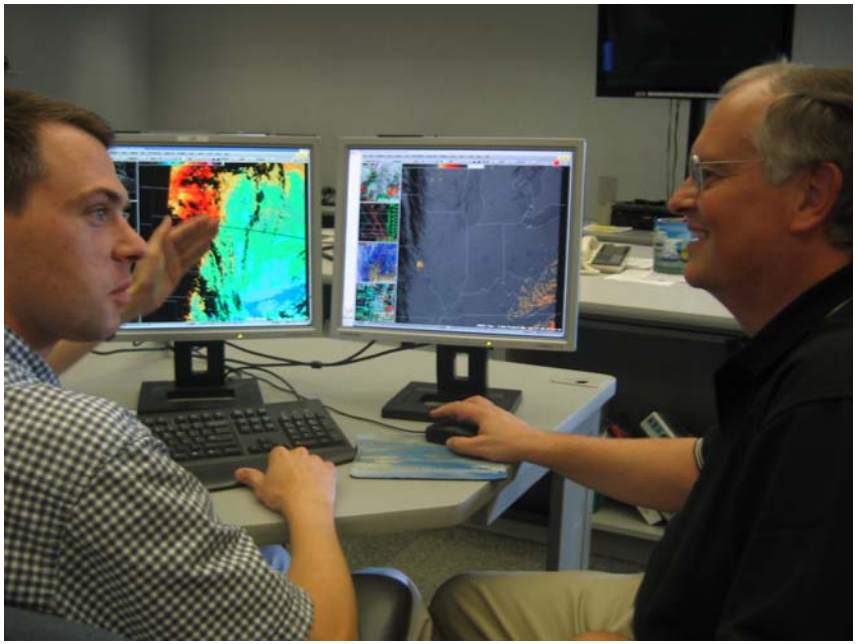

ors: 20070710 at


CRAS WV EAST Tue 21:00Z + CRAS IR EAST Tue 21:00Z 10-Ju
NAM12 700MB Rel Humidity (%) 10-12 9HR Tue 21:00Z 10-Ju

Have you seen the CRAS today?

Developing Imagery for AWIPS

- AWIPS has benefits for CIMSS/SSEC:
  - Allowing us to work with the primary utility used by NWS forecasters to provide better training modules and exercises
  - Allowing forecasters to evaluate cutting-edge research and provide us with valuable feedback
  - Maximize use of NASA and NOAA resources

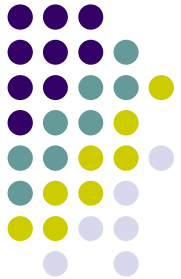


Mark Gehring and Steve Hentz, above

One Year Anniversary

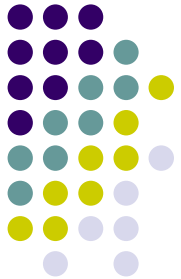
- CIMSS/SSEC started providing MODIS imagery to the National Weather Service in Milwaukee/Sullivan, WI, on July 5, 2006

An Experimental Product



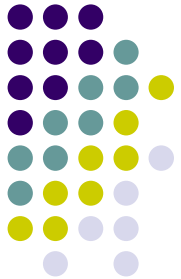
- First impressions are important.
  - Do not expect a second chance. Make sure training is available and questions are resolved in due time.
- Forecasters talk.
  - A good tip from a fellow forecaster is one way to guarantee the use of the experimental product will expand to other forecasters and offices.
- “Consistency. Reliability.”
  Ken Rizzo, Meteorologist-In-Charge, MKX
  - It must be there at the same time, every day, with as little disruption as possible.

An Experimental Product

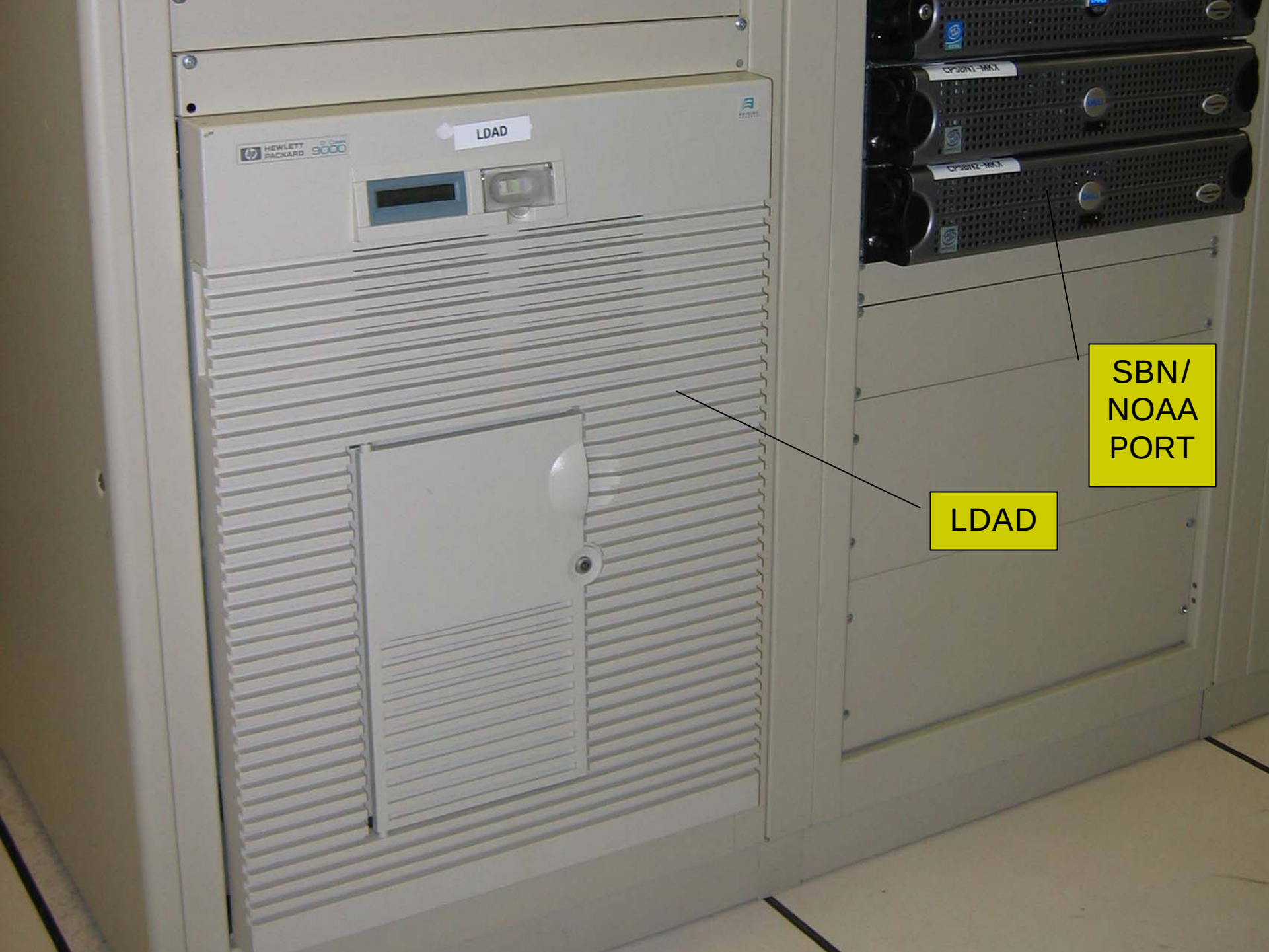


- Some forecasters will not care.
  - “I have been using the [Nested Grid Model] for the past 15 years with no problems.”
- Stuff happens. Handle it.
  - “Where did these lines come from?”
- Check back later.
  - Keep a continuing dialogue with the forecasters. If they see and talk to you frequently, they are likely to at least give your products a chance. Offices sometimes do not report outages unless you call them.
  - Create quick surveys, but nothing that takes a lot of time.
- Do lunch with the forecasters.
  - Break down the stereotypes.

Bandwidth Considerations



- Until recently, the Internet connection speed at all offices in the National Weather Service Central Region was only 96 kbps
- As a result:
  - All images have to be compressed prior to being sent over the Local Data Manager
  - File arrival has to be segmented so that the connection is not overwhelmed
  - Due to old hardware, files cannot be processed on LDAD machines at Weather Service offices


LDAD
SBN/
NOAA
PORT
LDAD

Delivery Process

LDM
Space Science and Engineering Center
Madison, WI

EXP feed

Quality control machine:
Local AWIPS workstation

LDM
Central Region Headquarters
Kansas City, MO

96 kbps connection

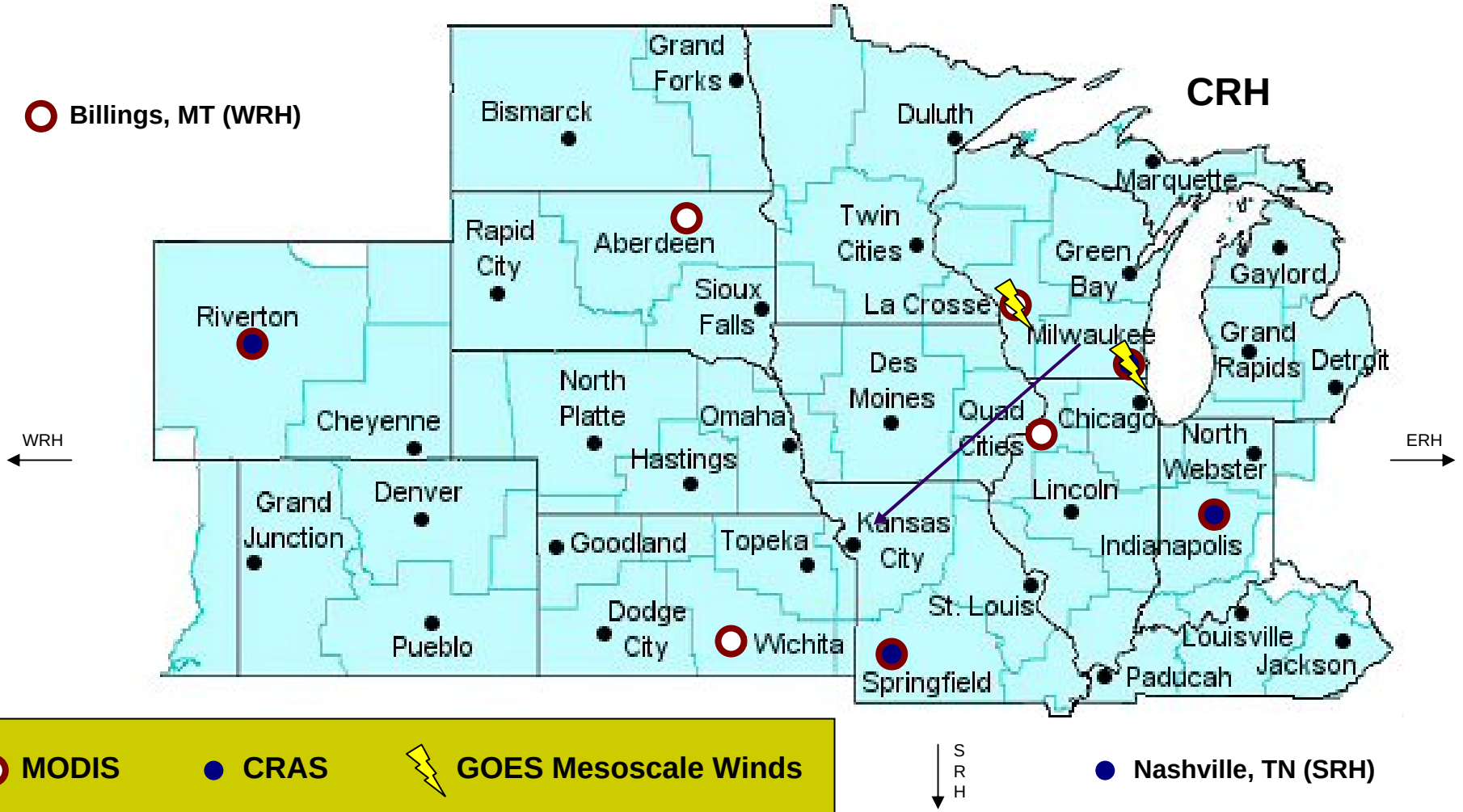
LDM on LDAD
NWSFO
Milwaukee, WI

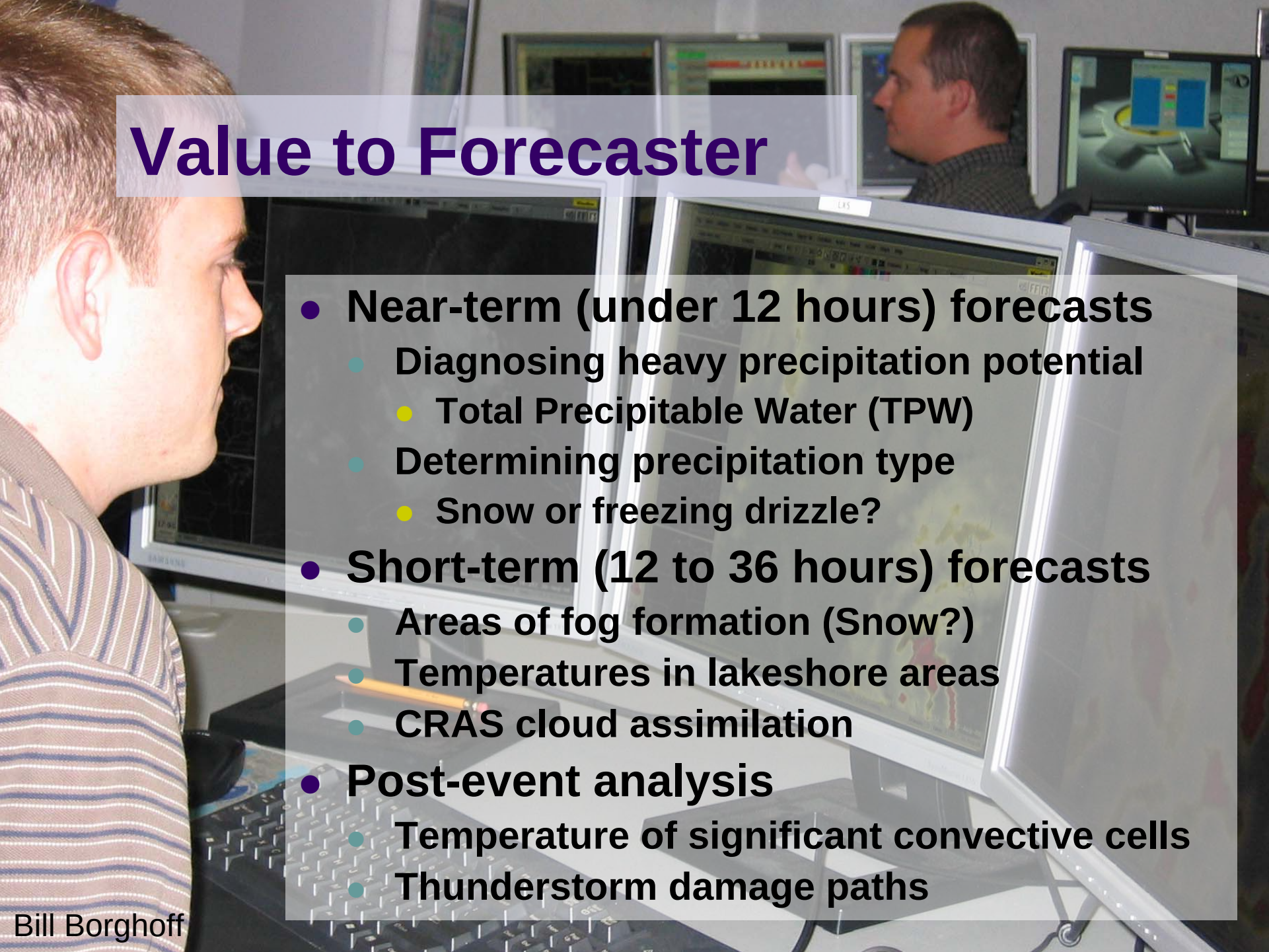
LDM on LDAD
NWSFO
La Crosse, WI

LDM on LDAD
NWSFO
Riverton, WY

LDM on LDAD
NWSFO
Davenport, IA

CIMSS/SSEC Imagery Distribution Network





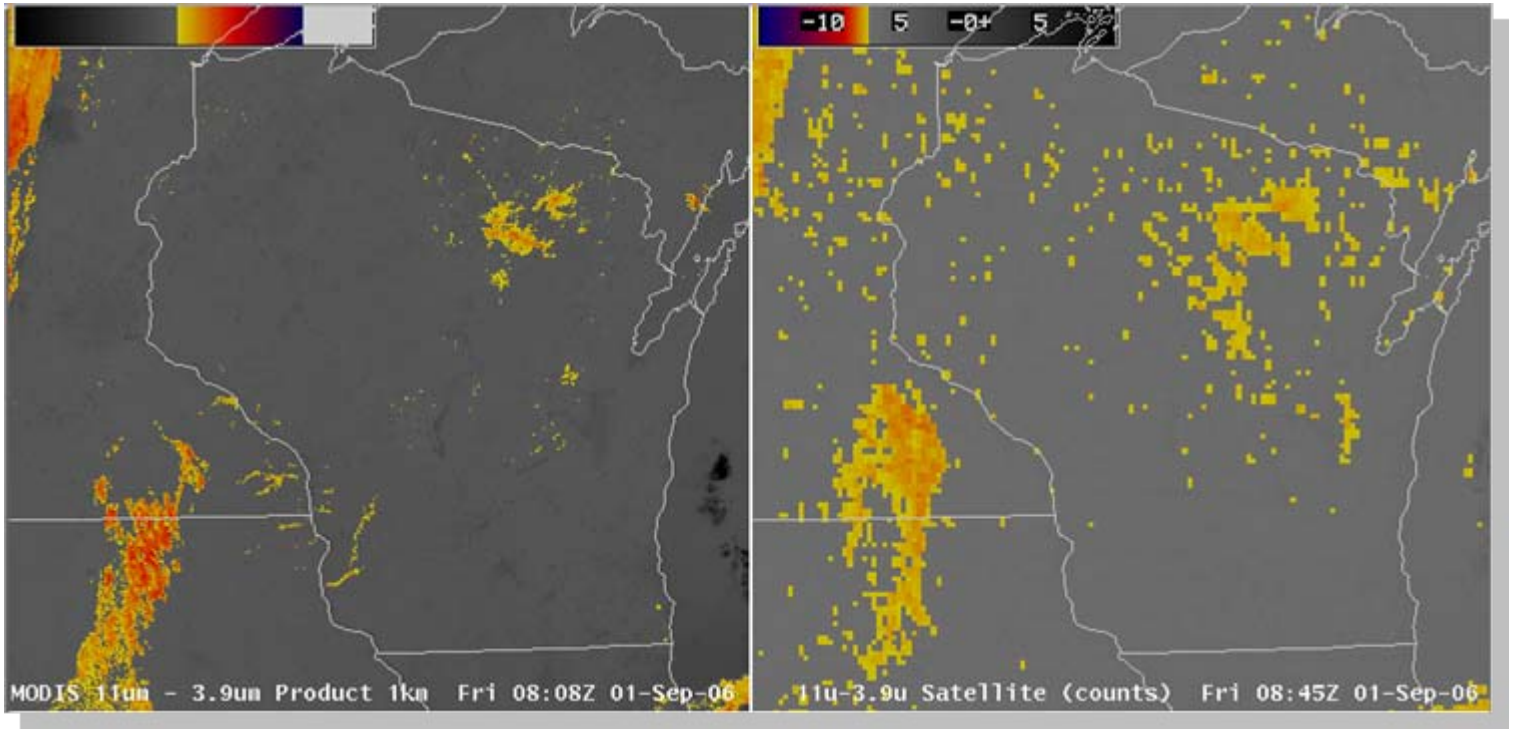
Value to Forecaster

- Near-term (under 12 hours) forecasts
  - Diagnosing heavy precipitation potential
    - Total Precipitable Water (TPW)
  - Determining precipitation type
    - Snow or freezing drizzle?
- Short-term (12 to 36 hours) forecasts
  - Areas of fog formation (Snow?)
  - Temperatures in lakeshore areas
  - CRAS cloud assimilation
- Post-event analysis
  - Temperature of significant convective cells
  - Thunderstorm damage paths

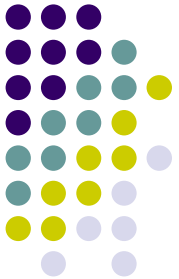
Bill Borghoff

Area Forecast Discussion

MAIN SHORT TERM FORECAST PROBLEM IS EAST FLOW AND MARINE LAYER INFLUENCE OVER EASTERN WISCONSIN...AND DENSE FOG POTENTIAL IN THE WEST. THINK MOST OF THE DENSE FOG WOULD BE IN THE RIVER VALLEYS...WITH A TENDENCY FOR PATCHY FOG AND SOME STRATUS AGAIN IN THE EAST WITH MORE OF A GRADIENT. MODIS 1 KM IMAGERY LAST NIGHT SHOWED THE DENSE FOG IN LONE ROCK AND BOSCOBEL WAS CONFINED TO THE IMMEDIATE WISCONSIN RIVER VALLEY...IMPORTANT INFORMATION. THE LOCAL RIVER VALLEY DENSE FOG IS NOT SEEN IN THE NORMAL 2 KM GOES. (HENTZ/MKX)



Other Forecast Discussions



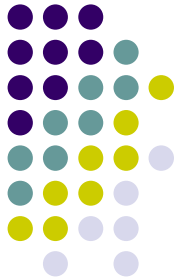
- **CIRRUS PREVENTING DEPICTION OF GOES SATELLITE DERIVED LI-S IN UNSTABLE AREA NEAR BOUNDARY. LI`S NEAR PLUS 10 OVER THE FAR NORTHEAST PORTION OF THE FORECAST AREA NORTH OF THE CIRRUS. SOUTHEAST. 17Z MODIS SEA SURFACE TEMPS SHOW WATERS ALONG THE WESTERN SHORE OF LAKE MI HAVE WARMED FROM YESTERDAY...NOW IN THE MID 50S TO NEAR 60 AS UPWELLING HAS ENDED WITH PERSISTENT EAST FLOW. (HENTZ/MKX)**

- **22 DISCUSSIONS** have mentioned MODIS

- **IN ADDITION CRAS IR HAS VERY GOOD INITIAL DEPICTION OF BAROCLINIC LEAF SIGNATURE DEVELOPING OVER KANSAS AND PROGS SOUTHERN EDGE OF THIS SIGNATURE OVER WARNING AREA BETWEEN 12Z AND 15Z FRIDAY...THE BEST TIME WITH EXPECTED GFS PLACEMENT OF SURFACE LOW OVER NORTHWEST INDIANA. AT THIS TIME AMOUNTS AND TIMING OF SNOWFALL EVENT LOOK TO BE ON THE MONEY. (ZAJDEL/MKX)**

- **28 DISCUSSIONS** have mentioned CRAS

Future of the AWIPS Project



- CIMSS/SSEC AWIPS team participation in:
  - September 2007 Great Lakes Operational Meteorology Workshop in Milwaukee, Wisconsin
  - January 2008 American Meteorological Society Meeting
- Delivery of 250m MODIS True Color imagery to select NWSFOs starting late in the summer
- Distribution of CRAS numerical fields to CONUS and Alaska NWSFOs in GRIB2 format this fall
- Production of a MODIS-influenced sea surface temperature analysis by spring of 2008

Potential for AWIPS

- AWIPS D2D is a valuable learning tool for college students studying atmospheric science, since the federal government is the primary employer of meteorologists in the United States.
  - Integrated Data Viewer (IDV) is the only other tool available to forecasters at NWSFOs; a few have GEMPAK (mainly national centers), but AWIPS usage surpasses both of those by far.
- If designed correctly, AWIPS II may allow for a streamlined system of introducing new products to forecasters, as long as bandwidth to forecast offices is improved further.

Conclusion

- AWIPS is an excellent tool for:
  - Obtaining current weather information quickly
  - Interacting and building a relationship with the operational forecasting community
- Comments? Questions?
- If you are interested in gaining access and giving AWIPS a try, please contact me.
- There will likely be an AWIPS primer session during lunch sometime in the coming weeks.