



AMDAR Forecast Applications

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AMDAR has many applications

- Aviation
 - Low level wind shear
 - Ceilings and visibilities
 - Icing and turbulence
- Winter Storms
 - Precipitation type
 - Lake effect snow
- Thunderstorms
 - Convective initiation
 - Calculation of stability indices
- Fire Weather
 - Mixing heights
 - Haines indices
 - Relative humidity forecasts
- Marine Forecasts
 - Small craft and Gale Warnings
- Hazardous Materials Support
 - AMDAR can be used to support HAZMAT teams
 - Can be input into local dispersion models

Aviation Applications

- AMDAR soundings in vicinity of airports allow meteorologists to get a real time view of the atmosphere
- This permits much more accurate forecasts of low clouds, fog, low level wind shear and more.
- AMDAR flight level data provide important data in flight corridors.
- Many aircraft report icing and turbulence data.

Low Level Wind Shear

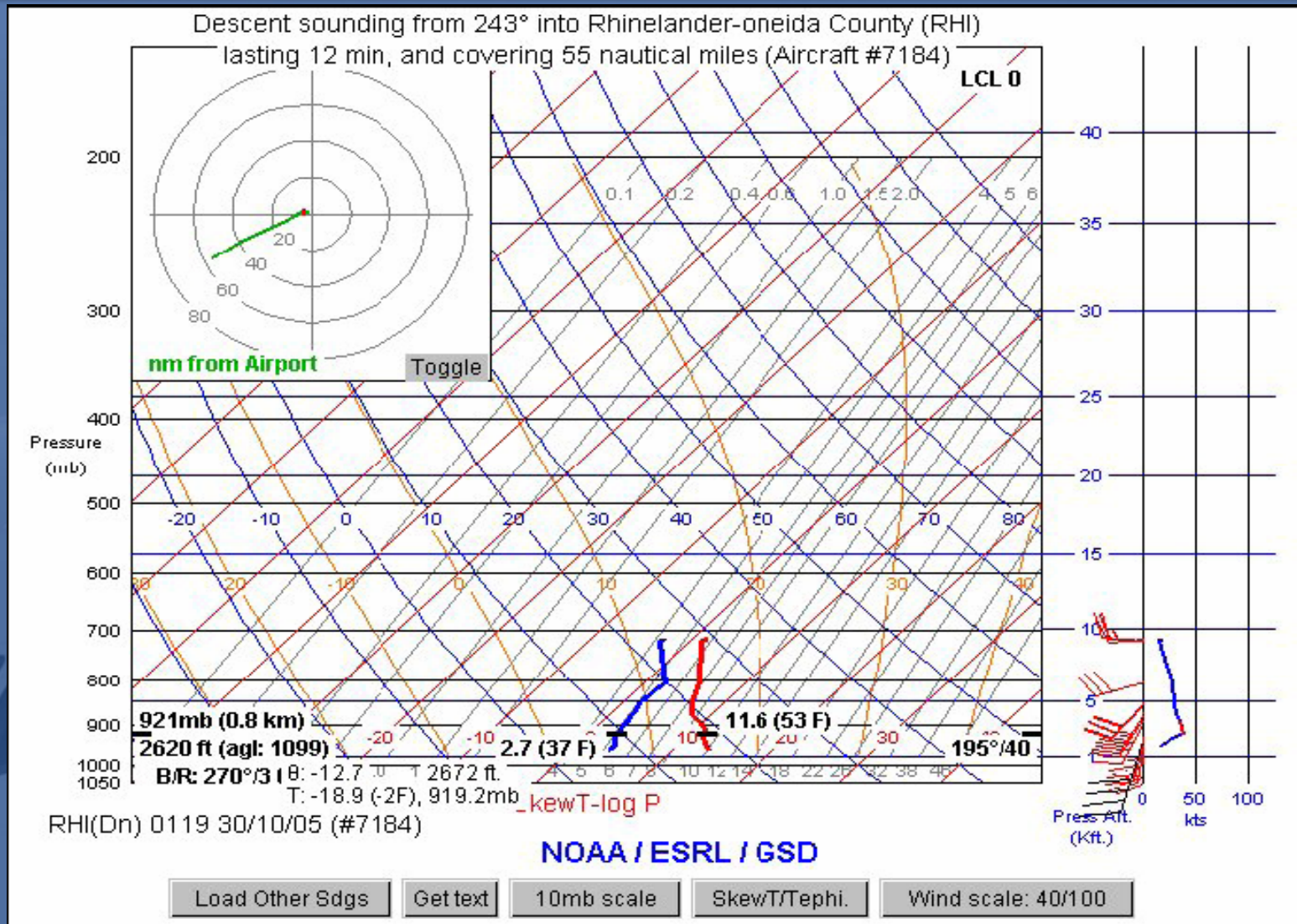
- AMDAR can be useful in determining the presence of low level wind shear (LLWS). Aircraft ascending or descending in the vicinity of an airport are in an ideal location for depicting low level wind shear.



Low Level Wind Shear

- An example of this was by the WFO in Green Bay, Wisconsin, on the evening of 29 October 2005.
- LLWS was forecast to begin after 0600 UTC in the TAF that night. TAMDAR soundings from around 0120 UTC showed that LLWS was already present.

Low Level Wind Shear



Low Level Wind Shear

- The meteorologist was able to update the TAF and begin the LLWS more than 3 hours earlier than the prior forecast.
- This was mentioned in the Area Forecast Discussion that was issued around 0245 UTC:

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE GREEN BAY WI
945 PM CDT SAT OCT 29 2005

TAMDAR SOUNDINGS AT RHI... SAW...EAU...LSE AND
CWA SHOW 35-40KTS OF WIND AT 1000' AGL...SO
WILL UPDATE TAFS IN OUR CWA TO START LLWS
QUICKER.

Ceilings and Visibilities

- AMDAR is very useful in forecasting low ceilings and fog that greatly impact airports.
- Water vapor data is very important, but soundings without it can still be useful.

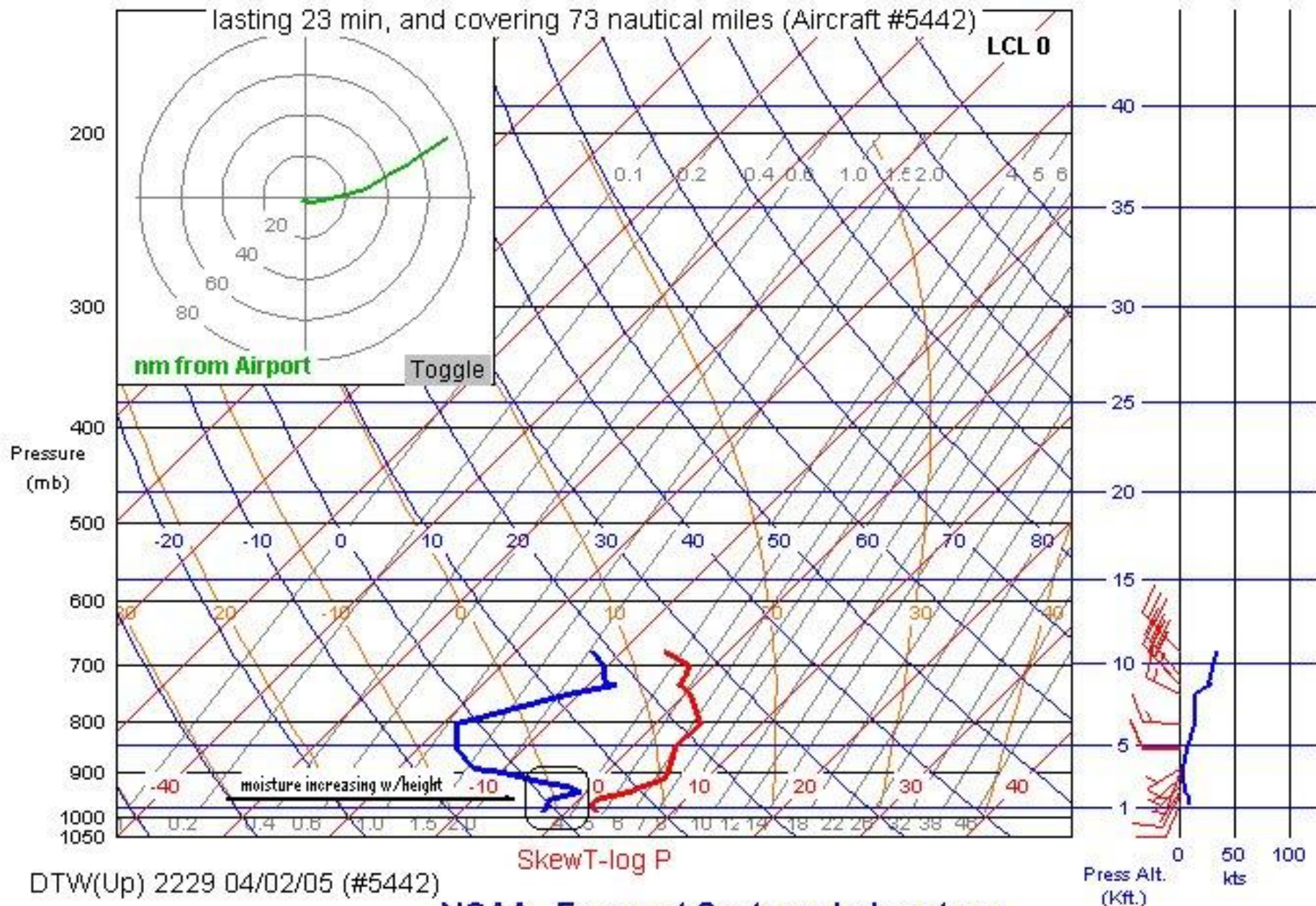


Ceilings and Visibilities

- The NWS in Detroit found TAMDAR to be useful in forecasting a dense fog event on the evening of February 4th, 2005.
- Soundings showed that there were light winds in the boundary layer, moisture near the surface and dry air above.
- These are normally suitable conditions for the formation of low clouds or fog.

Ascent sounding toward 68° from Detroit Metro, MI (DTW)

lasting 23 min, and covering 73 nautical miles (Aircraft #5442)



Load Other Sdgs

Get text

10mb scale

SkewT/Tephi.

Wind scale: 40/100

Ceilings and Visibilities

Forecasters at DTX amended their TAF for the 09 to 12 UTC period, reducing visibilities to ½ mile. The METARS below show that it became even foggier than that.

Kdtw 0532z 00000kt **2sm br clr**

Kdtw 0739z 17003kt **1 3/4sm br** r04/1000v3500

Kdtw 0936z 17004kt **1/4sm fg** r04/0500v0600

Kdtw 1154z 16004kt **1/4sm fg** r04/2800v0600

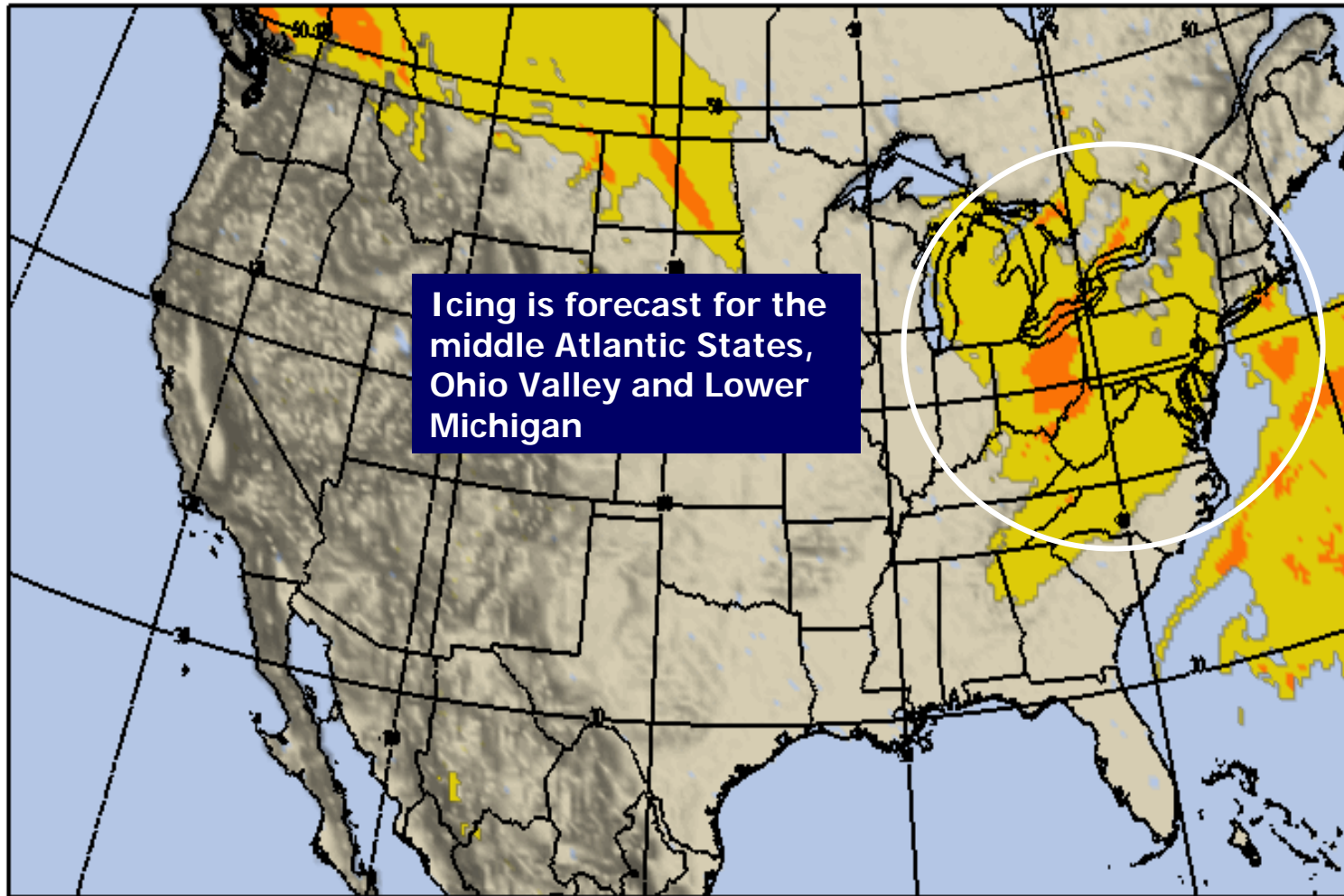
Aircraft observations are increasingly being used to forecast the development of low clouds and fog.

Icing and Turbulence

- The U.S. Air Force Weather Agency used TAMDAR to verify an icing forecast from their MM5 model.



Icing and Turbulence

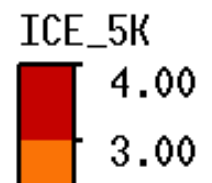


19 Jan 05
Wednesday
1800Z
12hr FCST

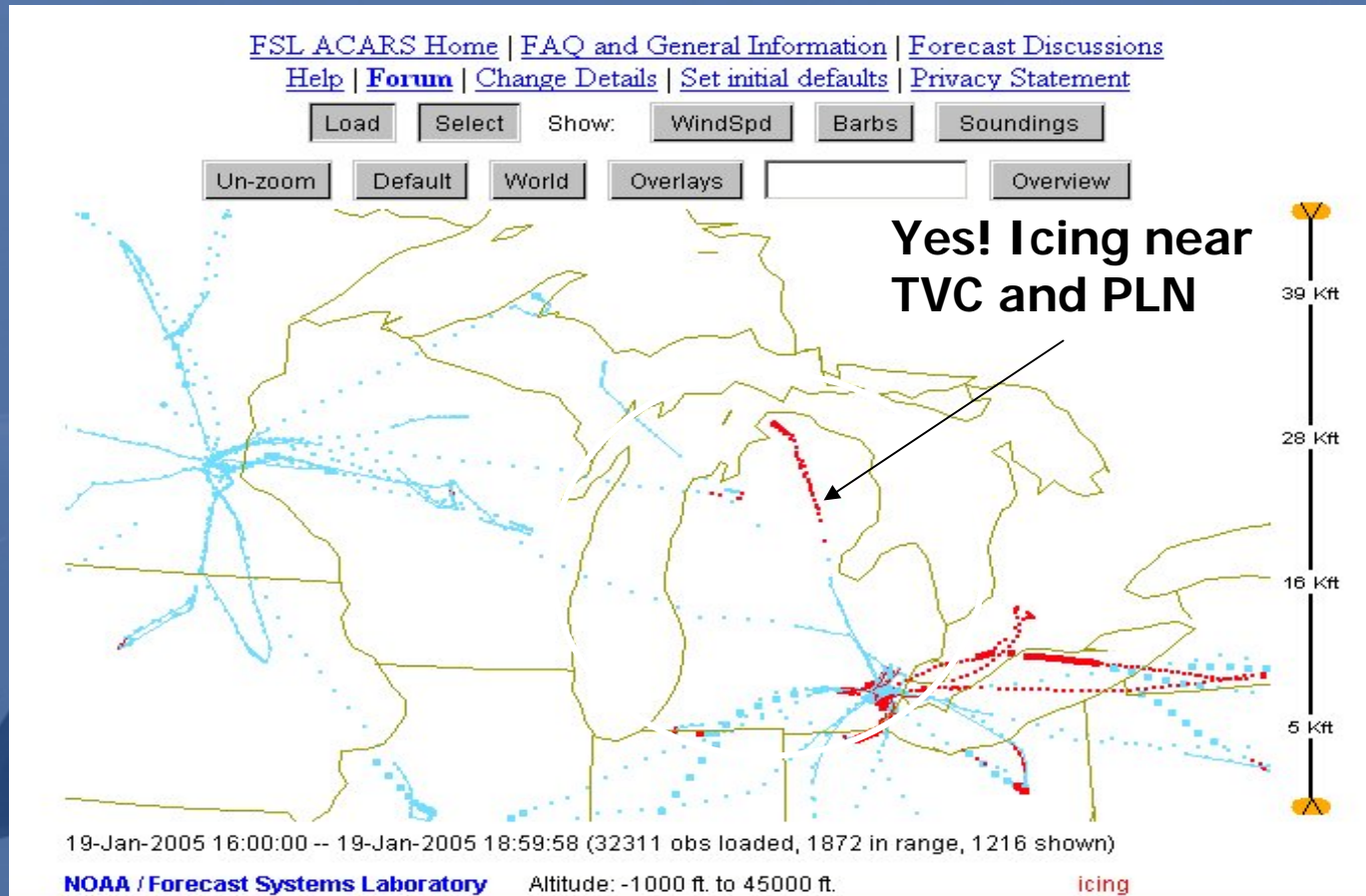
Vis5D

Air Force
Weather
Agency

MM5 15.0Km
Model Time
05011906Z



Icing and Turbulence



Automated aircraft reports of icing and turbulence will help AFWA
And the AWC in the forecast and verification of these aviation hazards.

Winter Storms

- Precipitation type forecasts can be made with greater accuracy with AMDAR.
- Frequent soundings show the height of the freezing level, and the presence of elevated warm layers, both of which are necessary for accurate precipitation type forecasts.

Precipitation Type Forecasts

- The Storm Prediction Center used ACARS data for a freezing rain event across eastern New York and southern New England on December 8, 1998.
- Their discussion issued in the early afternoon mentioned ACARS soundings from the vicinity of Boston that showed an elevated warm layer.

SPC MESOSCALE DISCUSSION #1100 FOR FREEZING RAIN...

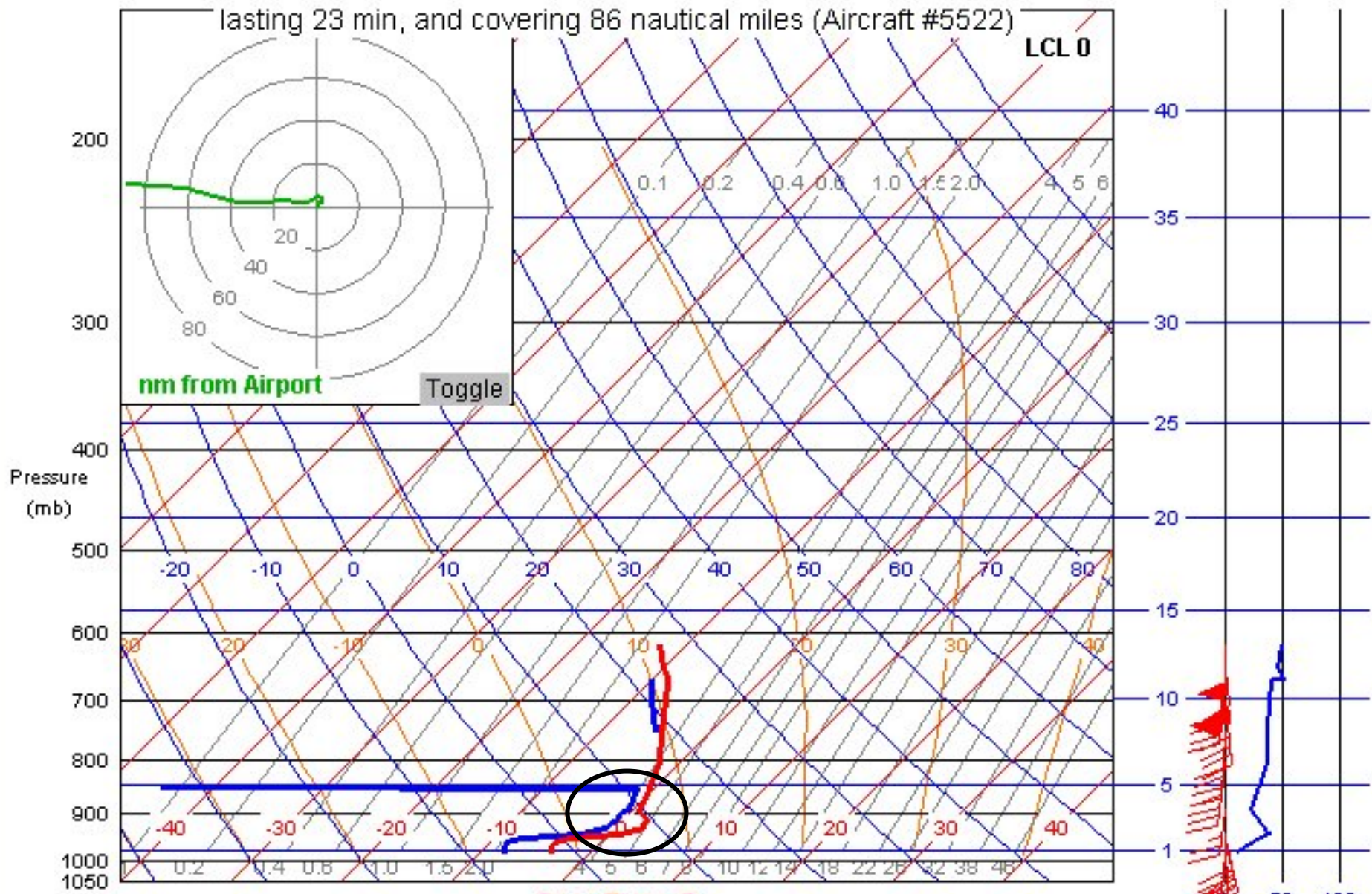
AREAS OF FREEZING RAIN ARE LIKELY ACROSS PARTS OF EAST CENTRAL NEW YORK...SRN NH AND SRN VT. FREEZING RAIN IS EXPECTED TO ACCUMULATE ON EXPOSED SURFACES THROUGH 08/23Z.

LATEST SATELLITE PICTURES INDICATE CLOUD TOPS HAVE COOLED OVER ERN NY...SRN NH...AND SRN VT IN THE PAST HOUR. ACARS SOUNDINGS FROM BOS SHOW 850MB TEMPERATURE OF 4C WHILE SURFACE TEMPERATURES REMAIN NEAR FREEZING...

Precipitation Type Forecasts

- On December 15, 2005 meteorologists at the NWS office in Buffalo, N.Y. used AMDAR soundings to determine that there was a substantial warm layer between 2,000 and 5,000 feet above the ground.
- Because there was such a deep layer of warm air, the forecast was updated to reduce snow accumulations and increase the amount of sleet and freezing rain.

Descent sounding from 277° into Erie Intl/Tom Ridge Field (ERI)
lasting 23 min, and covering 86 nautical miles (Aircraft #5522)



ERI(Dn) 1536 15/12/05 (#5522)

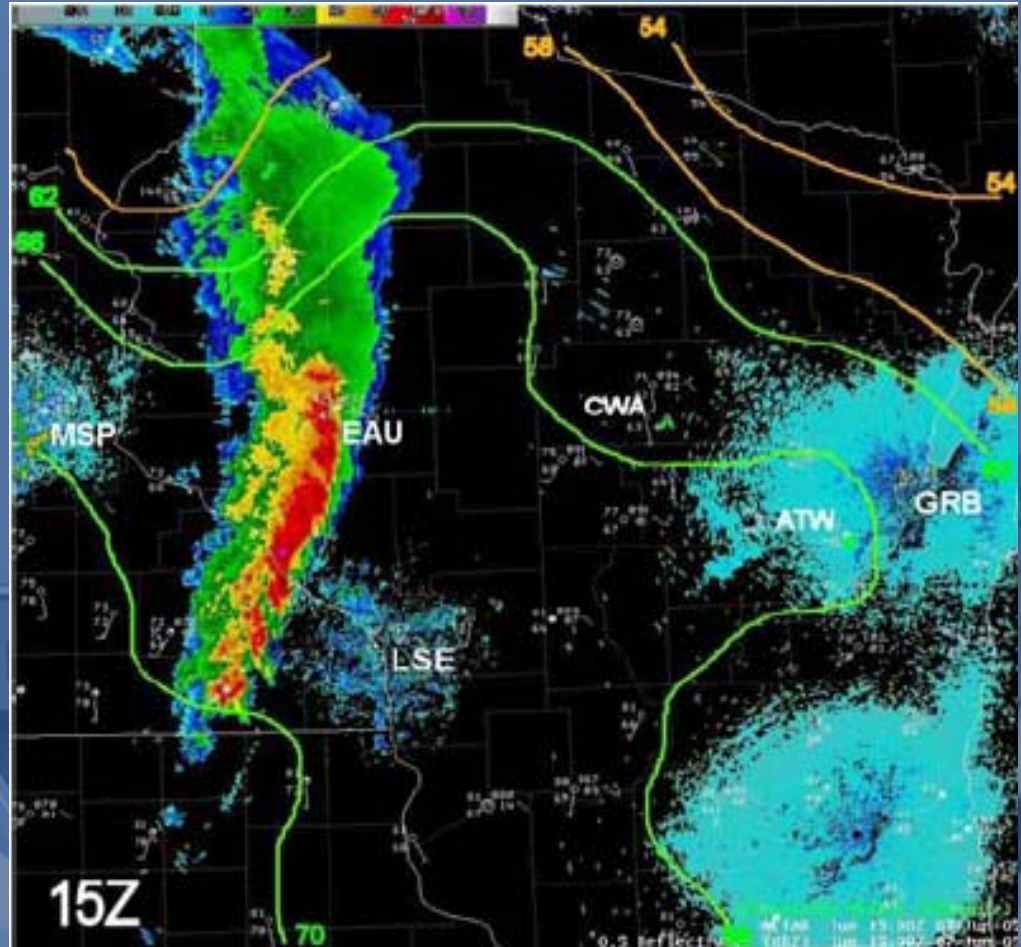
Press Alt. (Kft.)
50 100
kts

Convective Forecasts

- AMDAR data have been used extensively in support of convective forecasts.
- Temperature and moisture data provide the needed information to determine the stability of the atmosphere.
- Wind data can be used to construct hodographs.

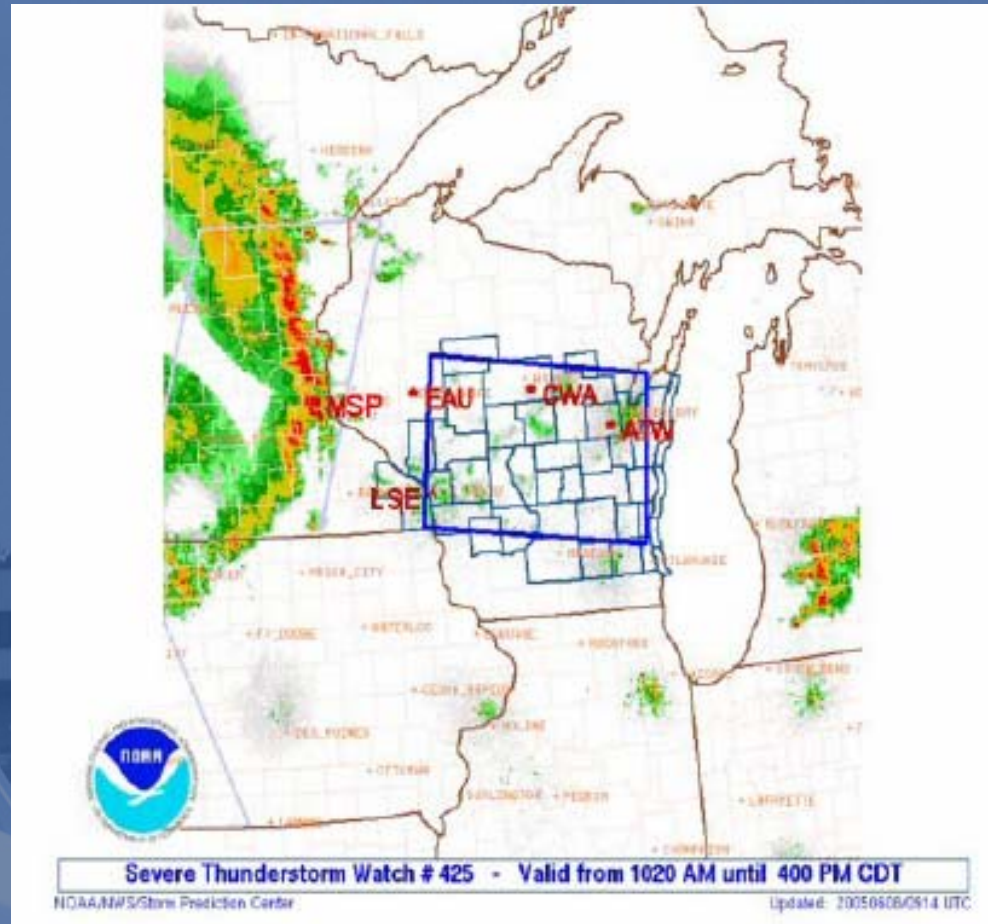
A Convective non-event

- A linear mesoscale convective system was over eastern Minnesota and western Wisconsin at 1500 UTC on June 7, 2005.



A Convective non-event

- It was thought initially that this elevated convection would become surface based as the system moved east during the day.
- A Severe Thunderstorm Watch was issued for much of Wisconsin at 1530 UTC.



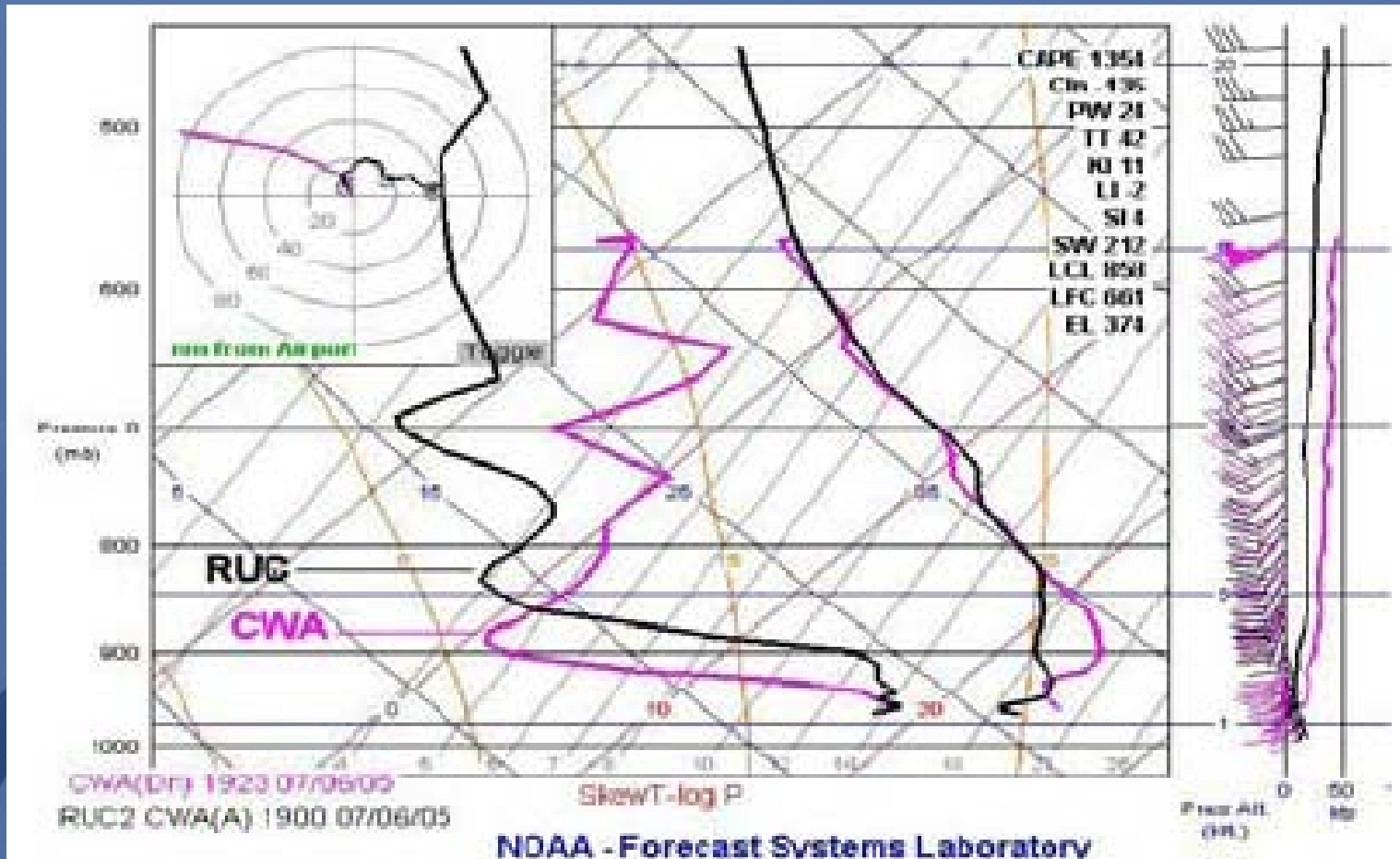
A Convective non-event

- Shortly after the issuance of the watch, forecasters at the Green Bay NWS noticed that TAMDAR soundings from the watch area appeared much too stable for surface based convection.
- A sounding from the Central Wisconsin airport at 1512 UTC showed a strong capping inversion, that was unlikely to break.
- Another sounding at 1923 UTC showed the atmosphere was still much too stable for convection. Forecasters then lowered the chance for thunderstorms, and the watch was later dropped.

A Convective non-event

- The thunderstorms that prompted the severe thunderstorm watch never became surface based as they moved east.
- Meteorologists had been “tricked” by forecast soundings that predicted the cap to erode sufficiently for surface based storms to form.
- This problem became less frequent as more forecasters used AMDAR data.

A Convective non-event



RUC Forecast (black) was much less stable than TAMDAR sounding

Fire Weather

- Accurate fire weather forecasts require knowledge of stability, wind and moisture availability above the ground.
- The large spatial and temporal gaps in radiosonde data make this difficult. Places distant from radiosondes are at an even large disadvantage.
- AMDAR data can fill many of these gaps, and is now used increasingly in fire weather forecasts.

Fire Weather

- Forecasters found AMDAR data useful in deciding to expand a *Red Flag Warning in effect for Northern and Central Wisconsin on the afternoon of July 15, 2006.
- Very dry air could be seen on TAMDAR soundings earlier in the day when the Red Flag Warning was issued. Later soundings showed there was sufficient dry air in other parts of the forecast area to expand the warning.
- * Temperature $>75\text{F}$, RH $<25\%$, winds of 25 mph

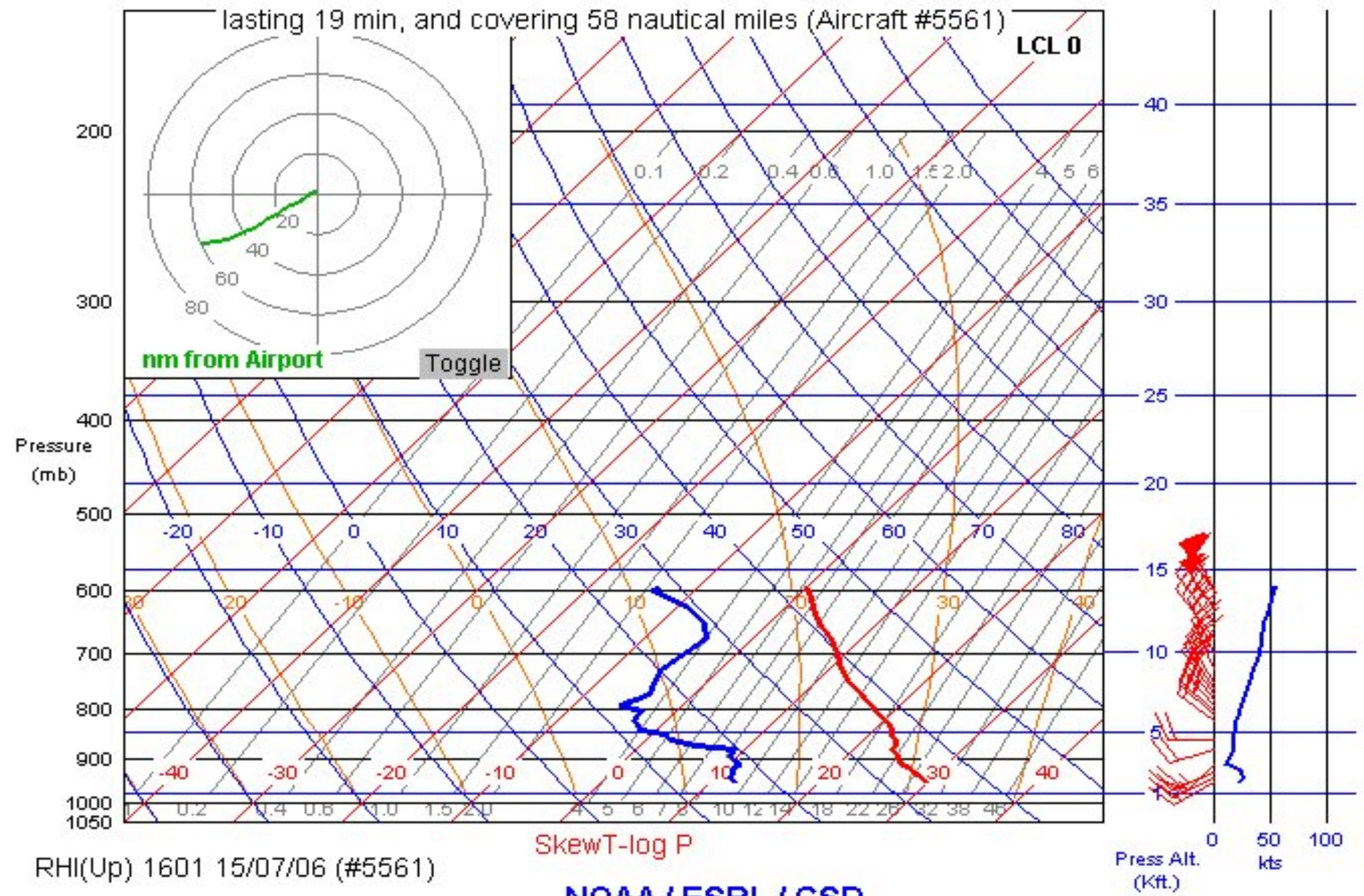
Fire Weather

AREA FORECAST DISCUSSION...UPDATED
NWS GREEN BAY WI
200 PM CDT SAT JUL 15 2006

.UPDATED...ADDED AREAL COVERAGE FOR THE RED FLAG HEADLINES.
RH/S ALREADY IN THE 20 PCTS EARLY THIS AFTERNOON AND WINDS
NEAR CRITERIA OVER NW WI. **TAMDAR** SOUNDING THIS AM FROM RHI
SHOWS A VERY DRY AIR MASS TO MIX DOWN WITH NEAR CRITERIA
WINDS.



Ascent sounding toward 245° from Rhinelander-oneida County (RHI)
lasting 19 min, and covering 58 nautical miles (Aircraft #5561)



RHI(Up) 1601 15/07/06 (#5561)

NOAA / ESRL / GSD

Marine Applications

- Surface wind and resulting waves are influenced greatly by both winds aloft and stability.
- Unstable air helps mix down strong winds above the boundary layer, while stable conditions hinder mixing.
- AMDAR are ideal for determining both winds aloft and atmospheric stability.

Marine Applications

- AMDAR has been used in the Great Lakes region and along the shorelines of the United States in marine forecasts.
- The following is an example from October 3, 2004. The NWS in Chicago used AMDAR data to determine that the atmosphere was sufficiently unstable to mix down 35 knot winds to the surface.
- Based on this information, they wisely decided to continue the Gale Warning that had been issued earlier in the day.

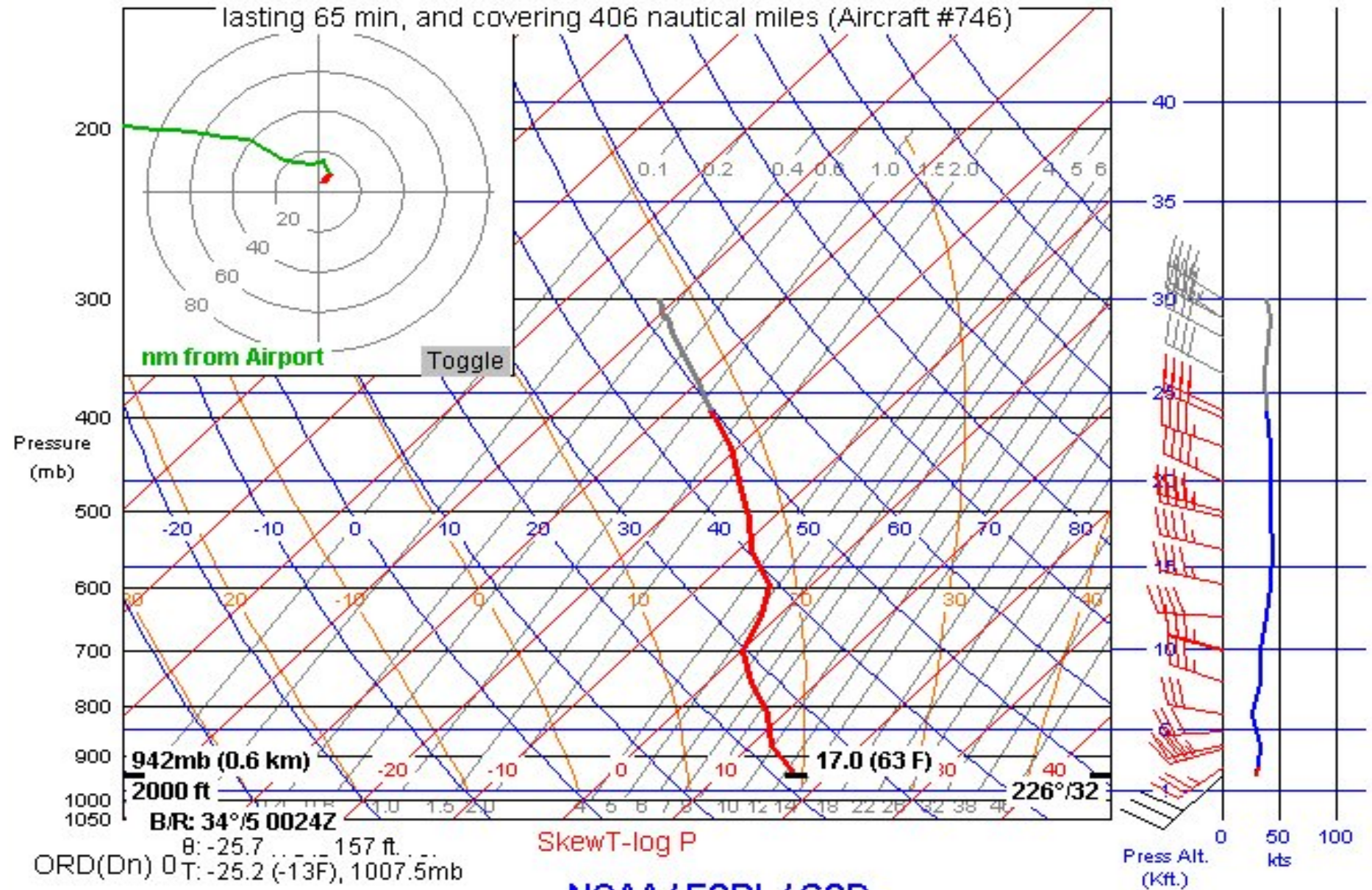
Marine Applications

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE CHICAGO IL
715 PM CDT SUN OCT 3 2004

.MARINE...SHIP REPORTS OF GALES THIS EVENING FROM THE
SOUTHWEST. SURFACE ANALYSIS AND USING THE ACARS SOUNDING
FROM ORD AT 2230 UTC SHOW STRONG WINDS ALOFT AND BEHIND
THE FRONT. WILL KEEP THE GALE WARNING FOR OVERNIGHT.
WHW



Descent sounding from 275° into Chicago/Ohare, IL (ORD)
lasting 65 min, and covering 406 nautical miles (Aircraft #746)



942mb (0.6 km)

2000 ft

B/R: 34°/5 0024Z

8: -25.7 ... 157 ft.

ORD(Dn) 0 T: -25.2 (-13F), 1007.5mb

SkewT-log P

NOAA / ESRL / GSD

Hazardous Materials Support

- AMDAR is used frequently by the National Transportation Safety Board in the investigation of aviation and marine accidents.
- AMDAR data was used in support of the September 11th disaster.
- AMDAR can be input into local models to predict the drift of hazardous materials.

Questions?

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