



# Aviation Applications of Automated Aircraft Weather Data

---

**Examples from meteorologists in forecast offices**

Richard Mamrosh  
National Weather Service  
Green Bay, Wisconsin



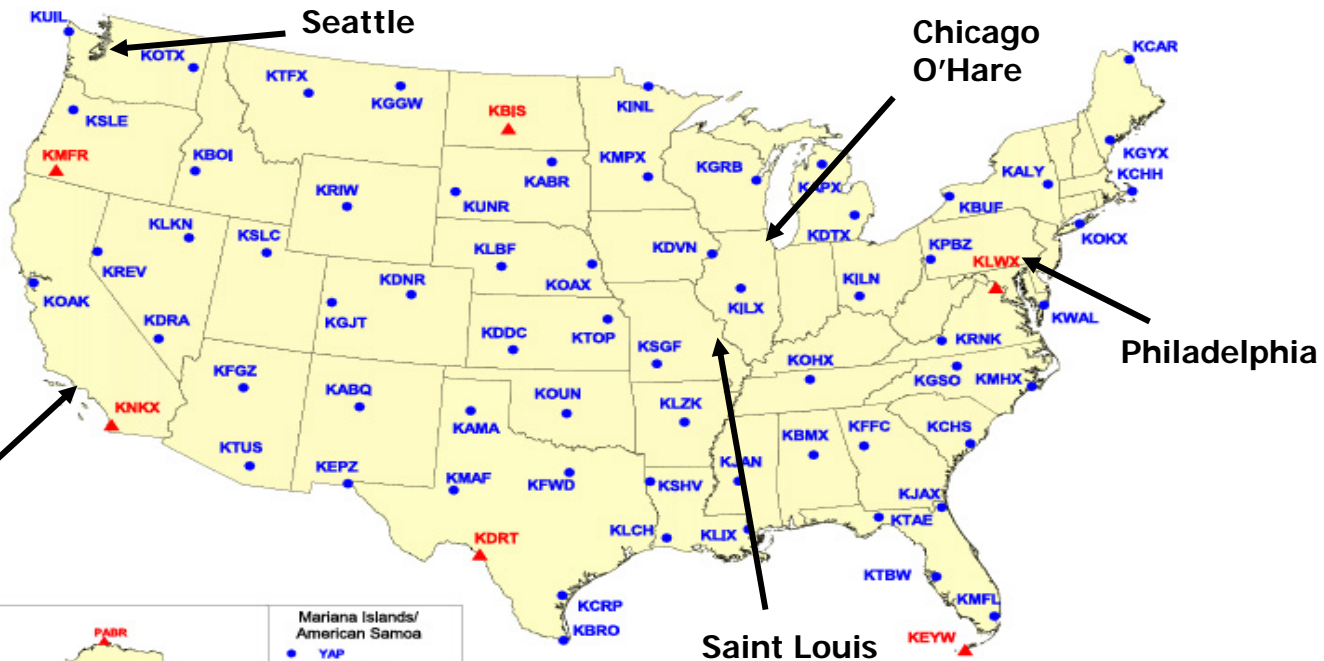
# Difficulties in Aviation Forecasting

---

- Accurate aviation forecasts require a frequent and dense network of both surface and upper air observations.
- Because this does not yet exist, meteorologists rely largely on model forecasts of atmospheric conditions.

# U.S. Radiosonde Network

Weather balloons with radiosondes are launched twice a day at these locations.



Notice that there are major airports with no radiosondes within 100 miles!



- Mariana Islands/  
American Samoa
- YAP
  - POHNPEI
  - ▲ CHULUK
  - ▲ KOROR, PALUA WCI
  - ▲ PAGO PAGO
  - ▲ MAJURO

**Legend**

- ▲ GCOS Sites
- U/A Sites

as of 1/4/02

# Other Upper Air Data Sources

In order to fill in some of the gaps in the weather balloon network, the NWS uses other useful sources of upper air data, such as

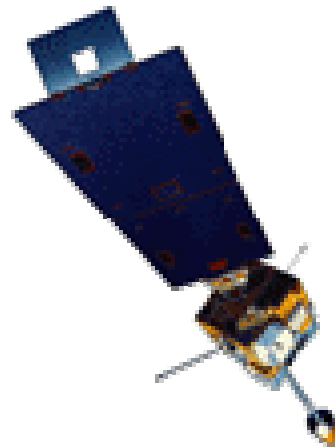


Wind Profilers

Wind Estimates  
from Doppler  
Radar



Commercial aircraft



GOES and  
POES Satellites



# Aircraft Weather Data

---

- The NWS, FAA and DOD use a variety of data from commercial aircraft (MDCRS, ACARS, AMDAR, TAMDAR) in the production of aviation forecasts.
- These data have been used since the late 1990s by meteorologists to improve forecasts of turbulence, icing, fog, low level wind shear, and other phenomena.
- A few examples from NWS WFOs, CWSUs, and AFWA are presented here.



# Low Level Wind Shear

---

- AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE DETROIT/PONTIAC MI  
748 AM EDT TUE SEP 13 2005

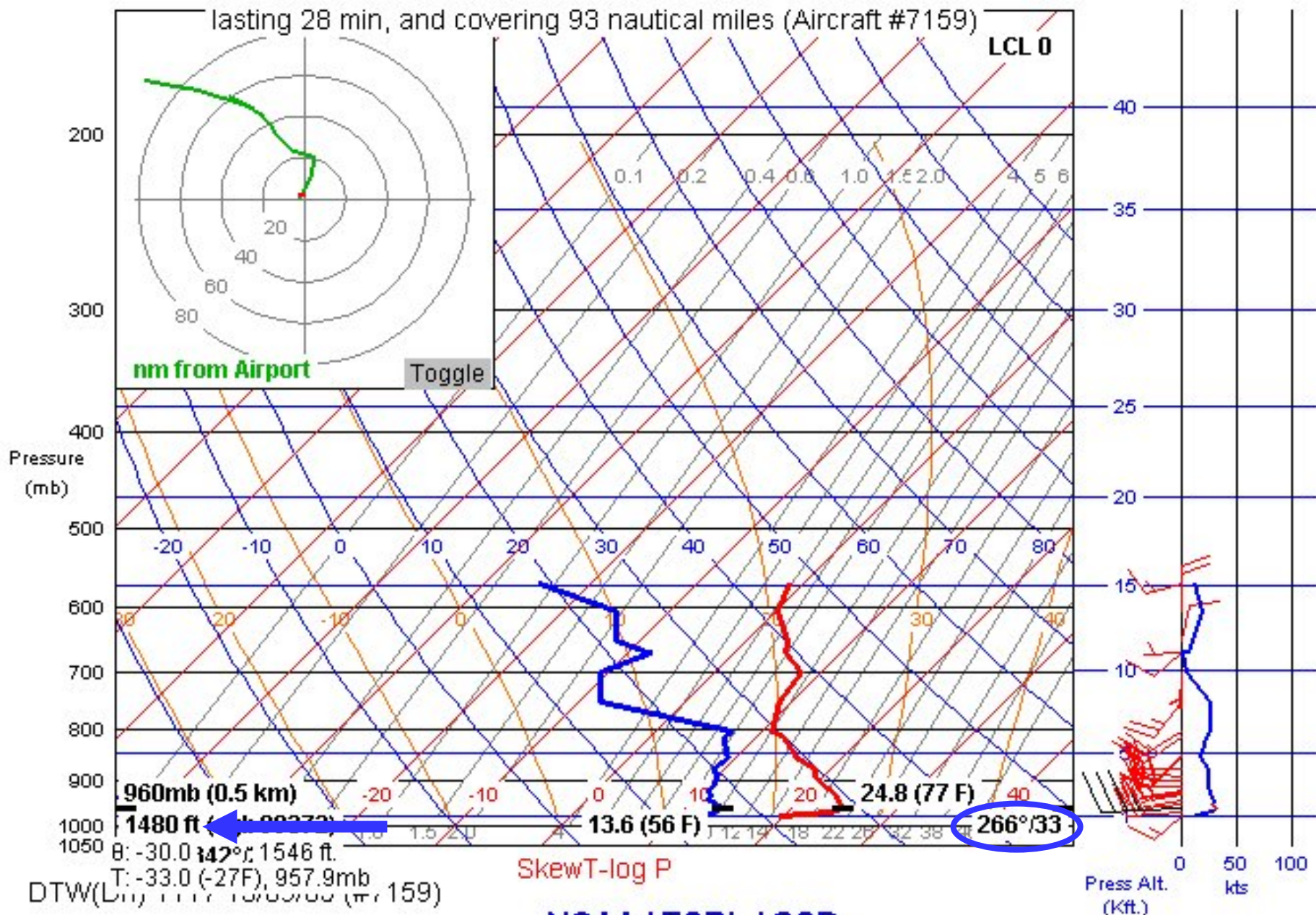
.AVIATION...

**BASED ON 11Z TAMDAR SOUNDINGS VICINITY OF DTW...ADDED LOW-LEVEL WIND SHEAR TO ALL THE TAFS THIS MORNING. AIRCRAFT SOUNDINGS SHOW 1KFT WINDS OF 250/30KTS. THIS IS ALSO SIMILAR TO DTX VWPS OVER THE LAST 30 MINUTES...WHICH INDICATE 30KTS AT THE LOWEST CUT /2KFT/. 09Z RUC IS TOO WEAK WITH THE LOW-LEVEL JET COMPARED TO RECENT OBSERVATIONS. CONSEQUENTLY ADDED LLWS FOR THE FIRST COUPLE HOURS OF THE TAF...UNTIL WE START TO MIX THROUGH THE SURFACE-BASED INVERSION.**



# Descent sounding from 306° into Detroit Metro, MI (DTW)

lasting 28 min, and covering 93 nautical miles (Aircraft #7159)



NOAA / ESRL / GSD

Load Other Sdgs

Get text

10mb scale

SkewT/Tephi.

Wind scale: 40/100



# Freezing Level

---

AREA FORECAST DISCUSSION  
NWS SEATTLE WA  
AFDSEW 810 AM PST TUE NOV 1 2005

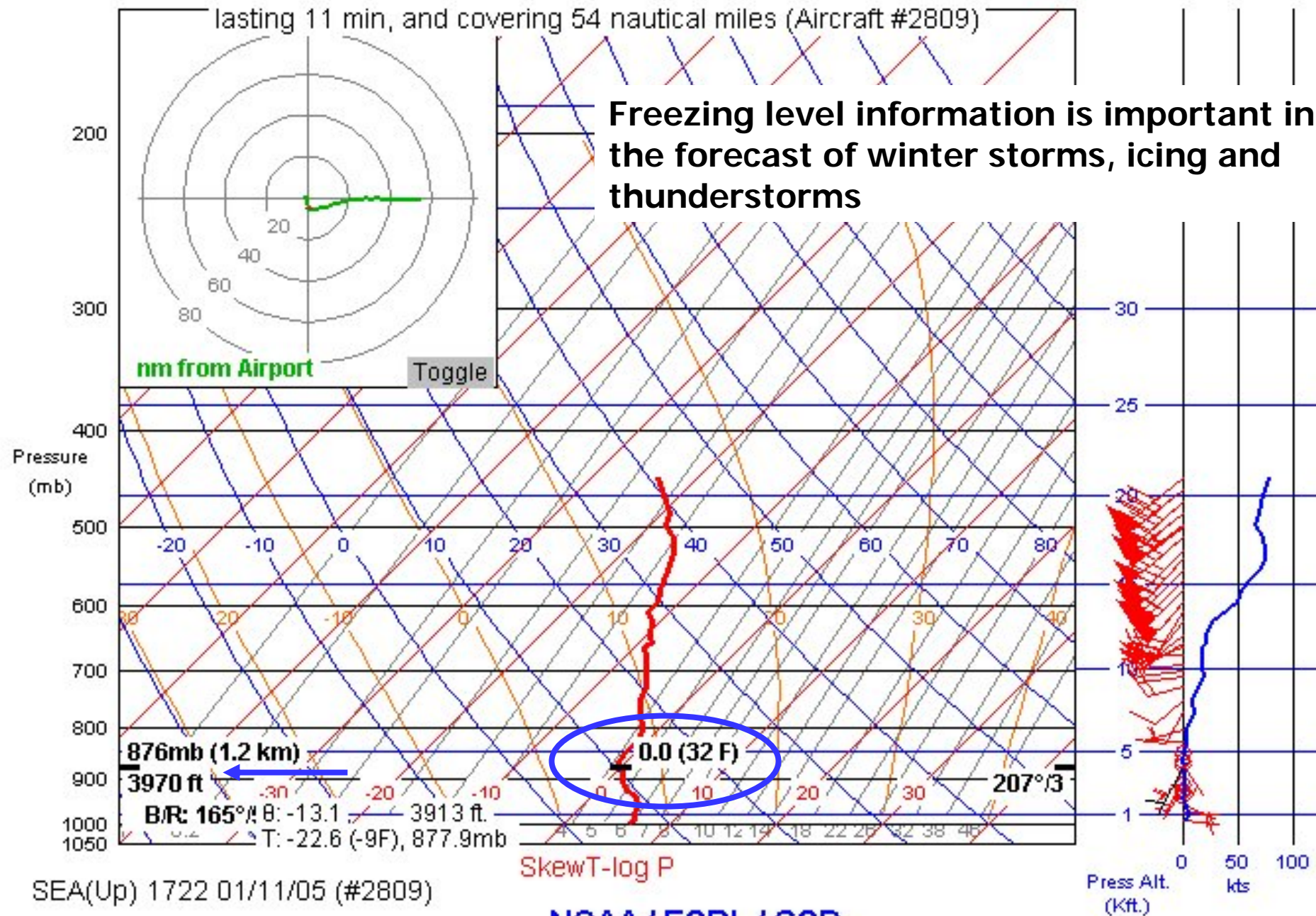
.SHORT TERM... **FREEZING LEVELS RATHER LOW THIS MORNING AND ACCORDING TO THE ACARS SOUNDINGS...CONTINUE TO LOWER. HAS DROPPED 600-800 FEET FROM 12Z-15Z AND NOW IS SITTING AT 4000 FEET.** LOOKING AT THE WEB CAMS IN THE MOUNTAINS...THIS EASILY CONFIRMED WITH ACCUMULATING SNOW IN ALL THE PASSES...EVEN SNOQUALMIE.



Ascent sounding toward 91 from Seattle, WA (SEA)

lasting 11 min, and covering 54 nautical miles (Aircraft #2809)

Freezing level information is important in the forecast of winter storms, icing and thunderstorms



SEA(Up) 1722 01/11/05 (#2809)

NOAA / ESRL / GSD



# CWSU Indianapolis uses TAMDAR to monitor freezing level

---

[ [Post Response](#) ] [ [Return to Index](#) ] [ [Read Prev Msg](#) ] [ [Read Next Msg](#) ]

## TAMDAR Discussion Board

### TAMDAR caught low level cold layer

Posted By: [Lyle Alexander](#) <[lyle.alexander@noaa.gov](mailto:lyle.alexander@noaa.gov)>

Date: 24-April-05 2222Z

On Friday, April 22nd, a strong low pressure system was over Indiana. Cold air was rushing southward over Illinois in the wake of the low. TAMDAR data over central IL showed temperatures approaching the freezing mark at around 3 to 5 thousand feet in the late afternoon, several hours earlier than the models had forecasted. RUC2 based on TAMDAR had some reflection of this colder layer. By 00Z, the sounding at ILX had a layer of below freezing temperatures from 3900 to 5100 feet.

Lyle

Delete This Message

Password:

[ [Post Response](#) ] [ [Return to Index](#) ] [ [Read Prev Msg](#) ] [ [Read Next Msg](#) ]



# Coastal Fog/Stratus

---

- EXTREME SOUTHWESTERN CALIFORNIA AREA
  - FORECAST DISCUSSION
  - NWS SAN DIEGO CA
  - 330 AM PST WED FEB 13 2002
- 
- **ACARS SOUNDINGS SHOWED THE BASE OF THE MARINE INVERSION NR THE SURFACE WITH THE TOP NR 1000 FT...FAVORABLE FOR DENSE FOG FM THE CST INLAND TO THE MESAS.**



# Dense Fog Forecast

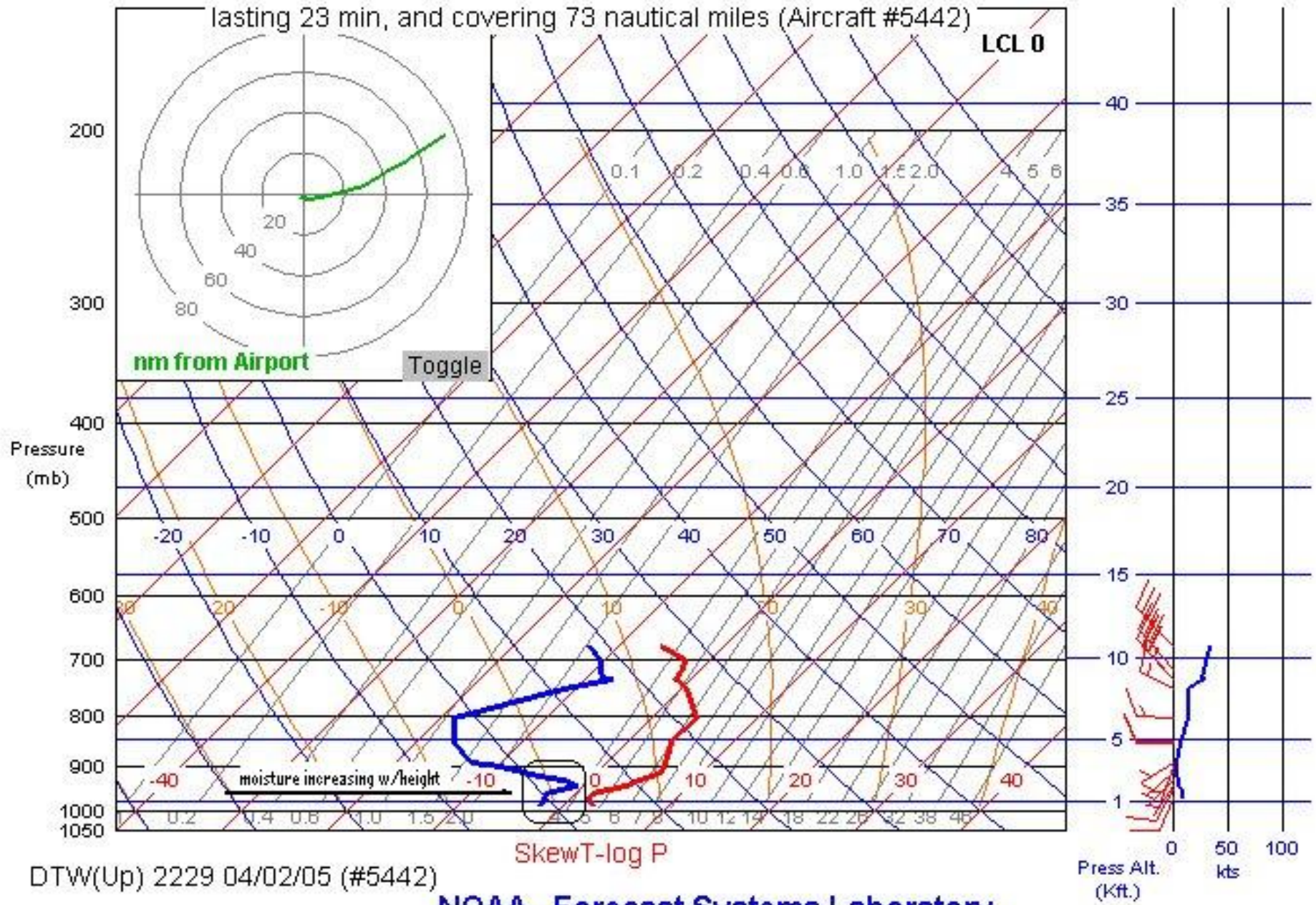
---

- The WFO 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)



DTW(Up) 2229 04/02/05 (#5442)

NOAA - Forecast Systems Laboratory

- Load Other Sdgs
- Get text
- 10mb scale
- SkewT/Tephi.
- Wind scale: 40/100



# TAF and METARS

---

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

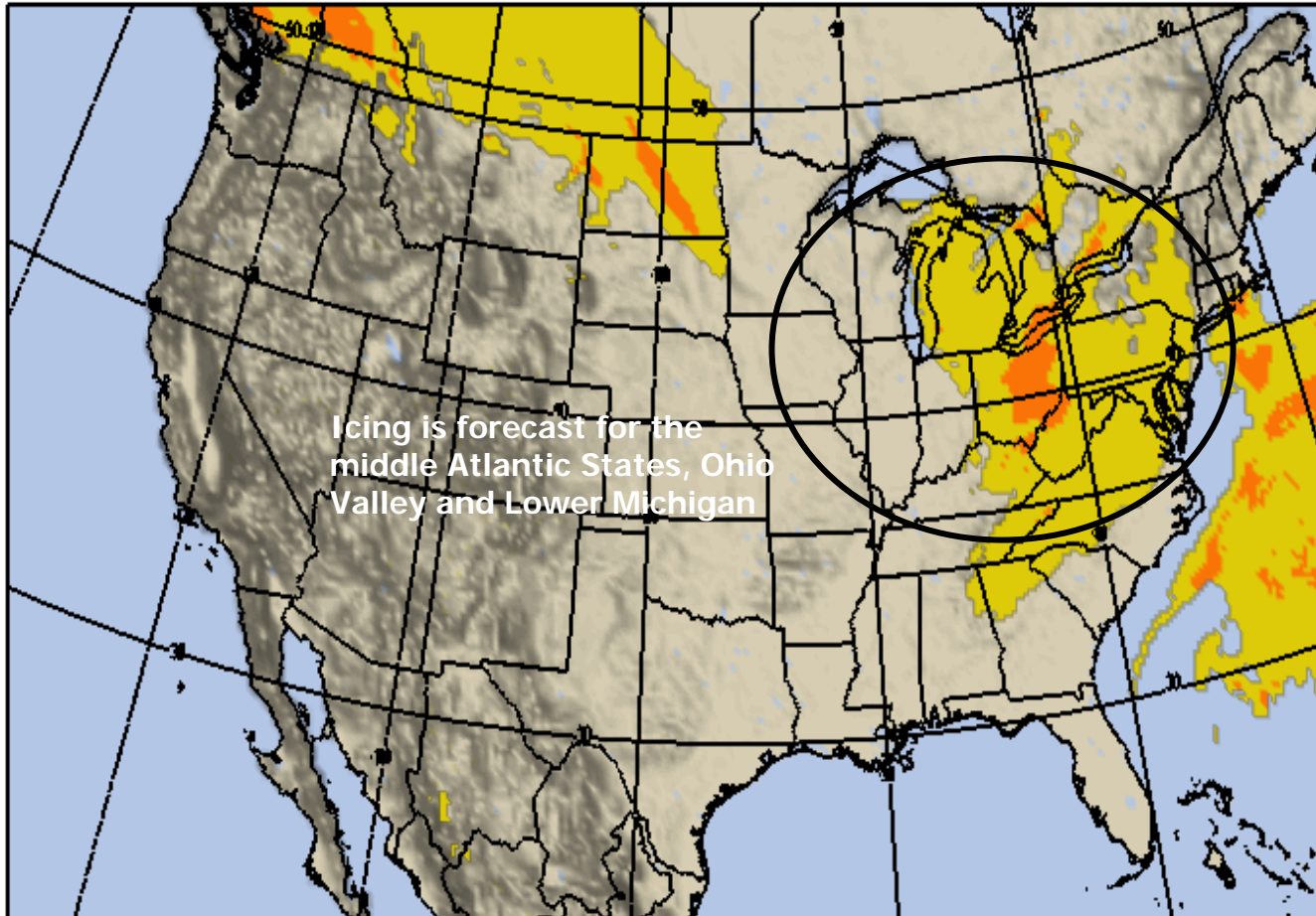
Kdtw 0936z 17004kt **1/4sm fg** r04/0500v0600

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

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



# AFWA MM5 Icing Forecast



19 Jan 05  
Wednesday  
1800Z  
12hr FCST

Vis5D

Air Force  
Weather  
Agency

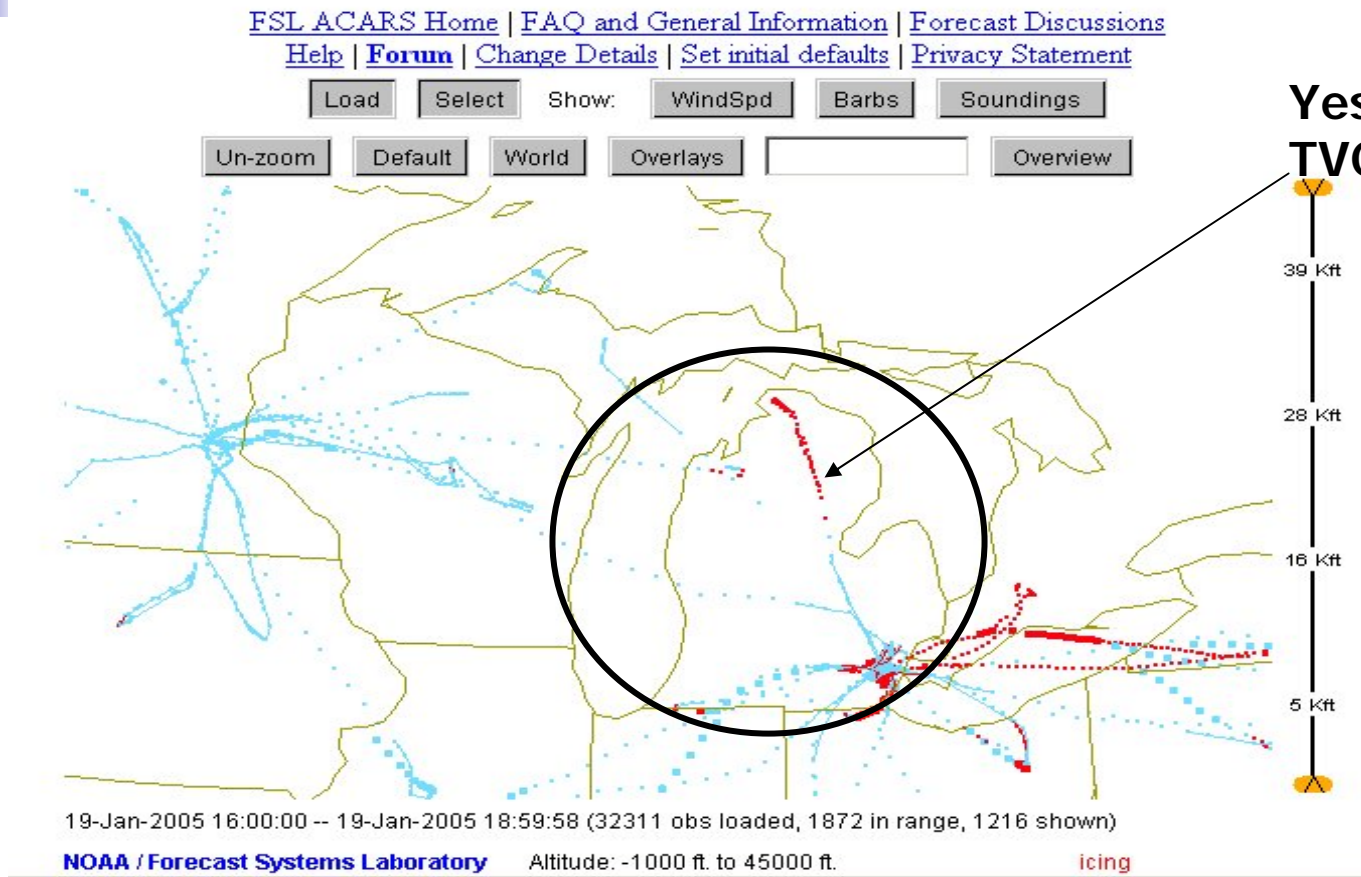
MM5 15.0Km  
Model Time  
05011906Z

ICE\_5K





# TAMDAR Icing Reports



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



# Summary

---

- Aircraft weather observations are increasingly used for both public and aviation forecasts.
- Aircraft data is still sparse in parts of the United States. Need more coverage in the High Plains and Western United States.
- Moisture data, whether from WVSS or TAMDAR is crucial for the accurate prediction of fog and low clouds.