WFO DTX Aviation Decision Support

Support for the Detroit Metro Airspace (D21)

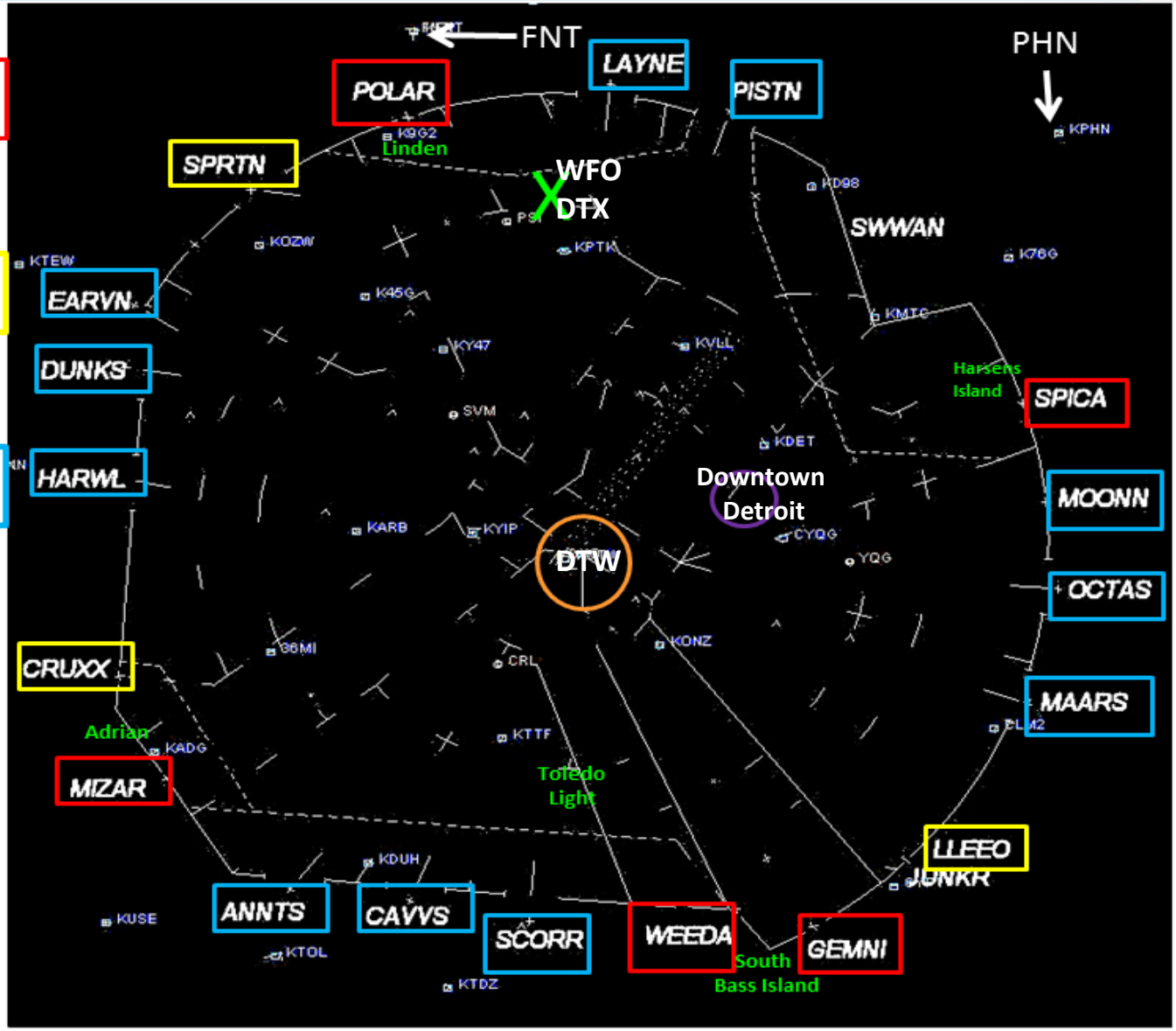
- For 2014 Detroit Metro Airport (DTW) ranked 17th in the US for total passenger traffic.
- Total annual airport operations for DTW (including passenger, cargo and military) generally range between 380,000 and 400,000.
- DTW is the second largest hub for Delta Airlines. It is a major gateway to Asia and Europe for Delta Airlines.
- Detroit Metro Airport not only services metro Detroit, Flint, Ann Arbor and Lansing (Southeast Michigan), but also Windsor, Ontario and Toledo, Ohio. [A population between 5 and 6 million].
- Long term plans for Detroit metro are the addition of a new runway and terminal expansions, expecting that air traffic will grow over the next 20 years.

- DTW is a Class B airport serviced by the Cleveland Air Route Traffic Control Center. They are the largest airport within the Cleveland ARTCC.
- Below is a diagram of the D21 airspace.

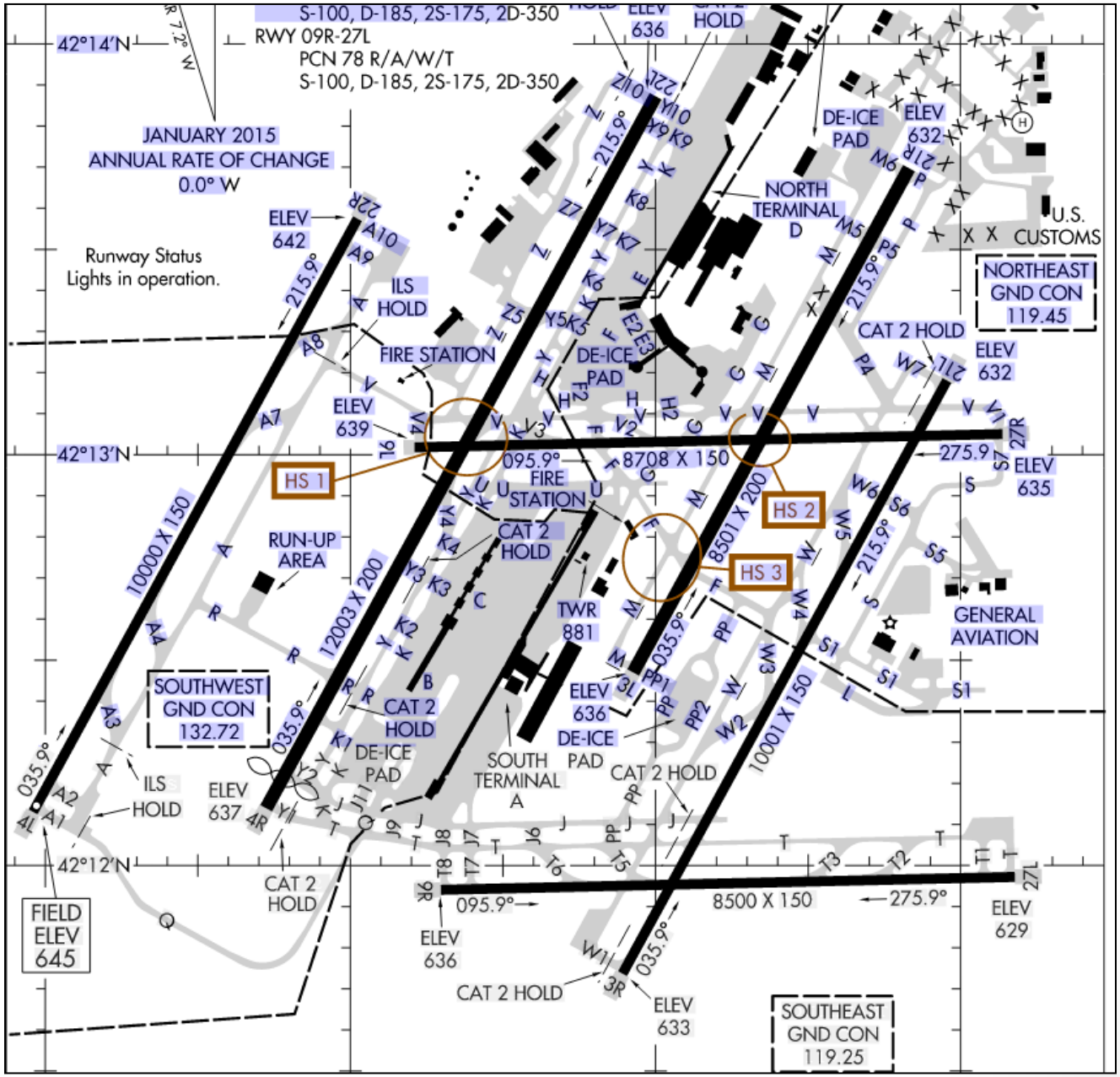
Standard Terminal Arrival Fixes (STARs)

Satellite Airport Arrival Procedures (STARs)

Departure Procedures (DPs)



- Below is a diagram of Detroit Metro Airport. Note the runway configuration 4 SW-NE oriented runways and 2 E-W oriented runways.



Main Users of DTW TAF

- Traffic Management Unit (TMU) and other controllers at CLE ARTCC.
- DTW air traffic control tower and TRACON.
- Airline dispatchers, especially Delta Airlines and their meteorologist staff.
- Forecasters at the CLE CWSU.
  - They use the DTW TAF extensively for their twice (at a minimum) daily briefings to the TMU and Detroit Metro TRACON.

Weather Conditions Which Have Large Impacts on DTW Operations

- **Winds**
  - Sustained or frequent gusts exceeding crosswind thresholds on the 4 SW-NE oriented runways. This forces operations to use the two W-E oriented runways, which greatly reduces the capacity of the airport. If southwest flow operations are underway and a sudden and unexpected increase in the cross winds occur, the TRACON must then reconfigure the flow in and out of the airport, causing a ripple effect in the National Airspace and causing some aircraft to be placed in a holding pattern.
  - Winds at or above 7 knots from 340 to 90 degrees. These may force take offs to the northeast as opposed to the southwest. DTW must follow a court ordered noise abatement program which limits the amount of time per year that they can use northeast flow operations (it is densely populated northeast of the airport). So they prefer to stick to southwest flow operations.
- **Ceilings**
  - 5000 ft, [CAT F] Ceilings at or below this critical threshold will restrict visual approach to the airport. This means that aircraft must be spaced farther apart, which in turn greatly reduces the arrival rates. The last two warm seasons, one of the SW-NE runways have been closed due to construction, which has caused a hyper-sensitivity to this threshold.
  - 200 ft, [CAT A] Cigs below 200 ft fall below airport minimums.
- **Dense Fog** – Visibilities below ½ mile fall below airport minimums.
- **Thunderstorms** – As with all major hubs, convection not only at the airport but anywhere within the airspace (especially at the arrival and departure fixes) greatly impact traffic flow in and out of the airspace.
- **Winter Weather** – Intense snowfall rates, sleet and freezing rain/drizzle slow arrival rates due to the time it takes to clear runways and deicing operations.

WFO DTX Aviation Support

- Shift duties have been adjusted to include a decision support services desk twice a day (day shift and night shift). Short term and long term grids are now done on the grid desk. The DSS desk focusses on near-term high impact weather, scheduled and unscheduled DSS services to local, state, federal partners, and aviation support.

- Aviation Support consists of the following:
  - The standard 30-hour TAF for DTW and 24-hour TAFs for YIP, DET, PTK, FNT, MBS.
  - Enhancement to the aviation discussion for Detroit Metro specific thresholds.
  - Direct support to the CLE CWSU, which indirectly supports the TMU at the Cleveland ARTCC and the DTW TRACON.

DTW Specific Aviation Discussion

- **AFD FORMAT:** One paragraph will give a general overview of the forecast for SE MI TAF sites, with emphasis on the first 6 to 8 hours. The second paragraph will discuss concerns for DTW specifically. The focus being mainly on timing of high impact events forecast to hit DTW and specifics with respect to DTW thresholds. The last section will be a list of potential threshold criteria (which have at least of low probability of occurrence) and their probability of impacting DTW (low, medium or high).

- **DTW THRESHOLD PROBABILITIES:**
  - Crosswinds with high wind speeds
  - Thunderstorm potential
  - Precip type for winter weather (when temps are in a range of 25-45 deg and/or when precip type is a concern).
  - Potential for ceilings to be at or below 5000 ft
  - Potential for cigs/vsby to fall below 200ft and/or 1/2SM

Aviation AFD – Examples

//DISCUSSION…

A COLD FRONT WILL TRACK ACROSS SE MI BETWEEN 18Z AND 22Z THIS AFTERNOON. DEEP MIXING HEIGHTS WILL PROMOTE INCREASING WESTERLY WINDS IN ADVANCE OF THIS FRONT…WITH GUSTS EXPECTED TO APPROACH 30 KNOTS. AMPLE DAYTIME INSTABILITY IS EXPECTED TO LEAD TO A SOLID LINE OF THUNDERSTORMS AHEAD OF THE FRONT…SOME OF WHICH MAY PRODUCE VERY STRONG WINDS. WINDS WILL VEER SHARPLY FOLLOWING FRONTAL PASSAGE. RESIDUAL LOW LEVEL MOISTURE MAY LEAD TO SOME MVFR OR IFR FOG AND STRATUS TONIGHT.

FOR DTW…THE FRONT WILL MOVE THROUGH AROUND 21Z…WITH THUNDERSTORMS EXPECTED A GOOD 2 TO 3 HOURS IN ADVANCE OF THE FRONT.

//DTW THRESHOLD PROBABILITIES…

- HIGH FOR WIND GUSTS TO REACH 30 KNOTS FROM 260-270 DEG THIS AFTERNOON.
- HIGH THAT THUNDERSTORMS WILL OCCUR THIS AFTERNOON.
- MEDIUM THAT CEILINGS WILL FALL BELOW 5000 FT AFTER 22Z.

//DISCUSSION…

DEEPENING LOW PRESSURE WILL MOVE FROM OHIO INTO SOUTHERN ONTARIO TODAY. THIS SYSTEM WILL PRODUCE A WIDE SWATH OF PRECIPITATION ACROSS THE SE MI TERMINALS. A RAIN SNOW MIX WILL DEVELOP OVER THE REGION BETWEEN 14Z AND 16Z AND CHANGE OVER TO ALL SNOW BY MID AFTERNOON BEFORE ENDING AROUND 02Z THIS EVENING. THE PERIOD OF HIGHEST INTENSITY SNOWFALL WILL BE BETWEEN 20Z AND 00Z.

FOR DTW…A LITTLE WARMER AIR IN METRO DETROIT WILL CAUSE THE PRECIPITATION TO BEGIN AS ALL RAIN BEFORE EVENTUALLY CHANGING OVER TO SNOW. THIS CHANCE OVER SHOULD OCCUR BETWEEN 18Z AND 20Z. AN ACCUMULATIONS OF 3 TO 6 INCHES OF HEAVY WET SNOW IS EXPECTED BY 02Z AS SNOWFALL RATES MAY EXCEED AN INCH PER HOUR AT TIMES.

//DTW THRESHOLD PROBABILITIES…

- LOW FOR PRECIP TYPE TO BE SNOW PRIOR TO 18Z. HIGH AFTER 18Z.
- HIGH THAT CEILINGS WILL REMAIN BELOW 5000 FT TODAY AND TONIGHT
- MEDIUM THAT VISIBILITIES WILL FALL BELOW ½ MILE IN HEAVY SNOW LATE THIS AFTERNOON AND EVENING.

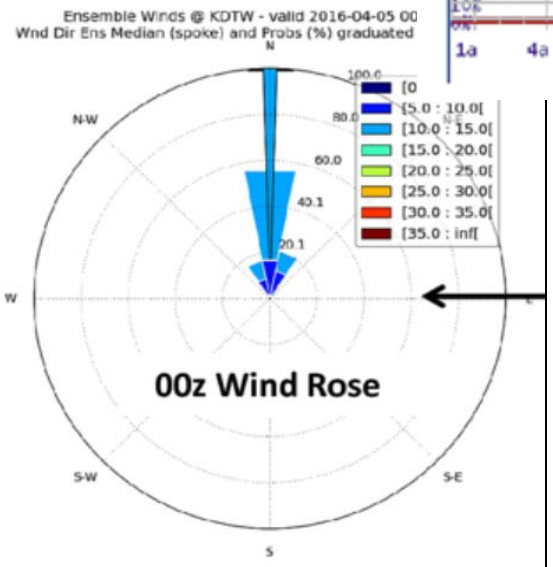
Direct Support to CLE CWSU

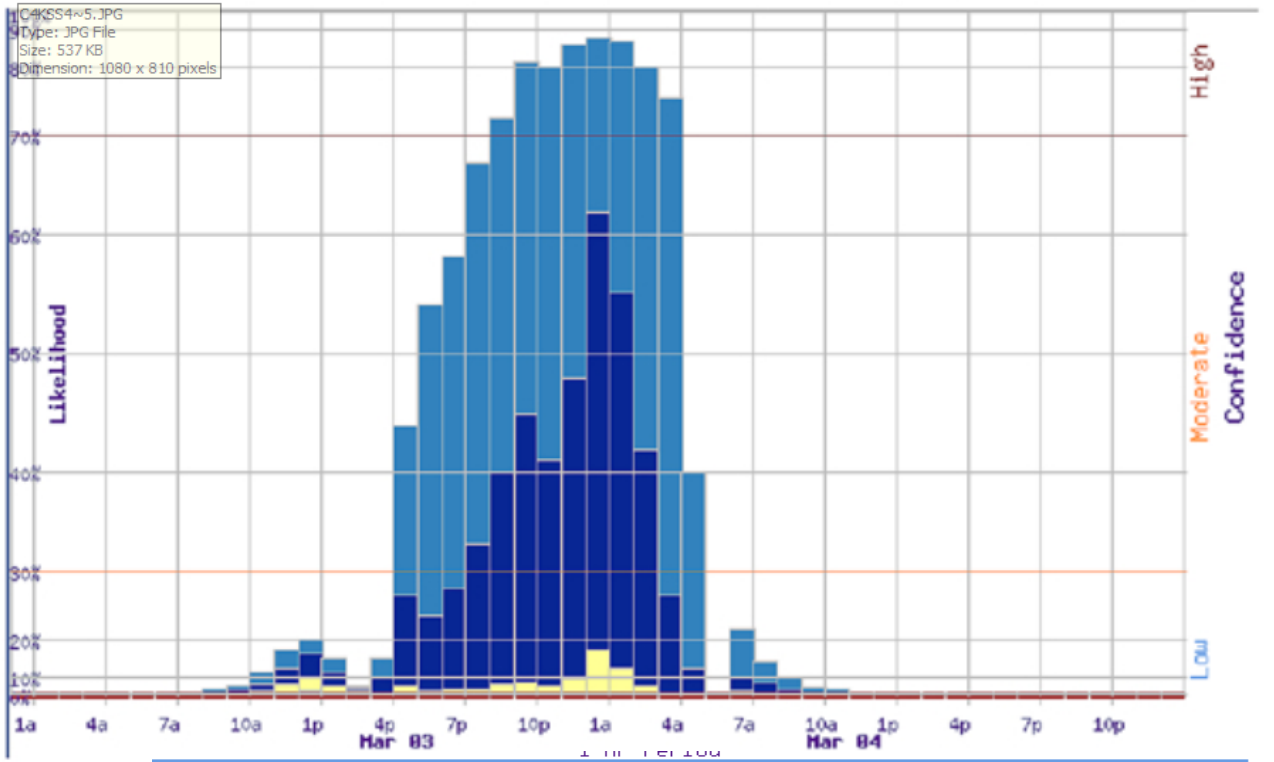
D21 Dashboard – This is a one stop shop web page with tabs to give useful forecast data to the CLE CWSU forecasters to help them gather information for their briefings to the TMU and DTW TRACON.

- Overview Page: one or two page graphic summarizing the main weather concerns for the D21 airspace. Created by the DTX DSS forecaster on duty. [More on this later]
- Discussion: Latest aviation discussion from DTX AFD.
- Wind and Gust: Probability graphs for sustained winds and wind gusts generated off NDFD and ensemble guidance. Also wind rose data for sustained and gusts based off ensemble guidance.
- Convection: Latest CCFP's and probability graphs for convection at DTW and at the arrival fixes.
- Snow: 1 and 6 hour probability graphs for snow, expressed as time periods of highest snowfall rates .
- HRRR Cigs and Vis: Hourly forecast ceiling and visibility graphics for the Great Lakes region based off the most recent HRRR.
- Satellite: Recent satellite data focused over metro Detroit.
- Radar: Recent regional radar mosaic and HRRRx 1km hourly forecast reflectivity images.
- DTW Flow and DTW Flow (Gust): Metro flow probabilities based on ensemble winds, updated hourly (hourly forecasts to 18 hours, every three hours to 36 hours). Uses ensemble winds and critical wind thresholds at DTW to determine the most likely runway configuration used for take offs and landings.
- LAMP: Forecast time series based on LAMP guidance for DTW and PTK (northern sections of D21 airspace).
- TAFs: Latest TAFs within and near the D21 airspace.

Some Examples From the D21 Dashboard

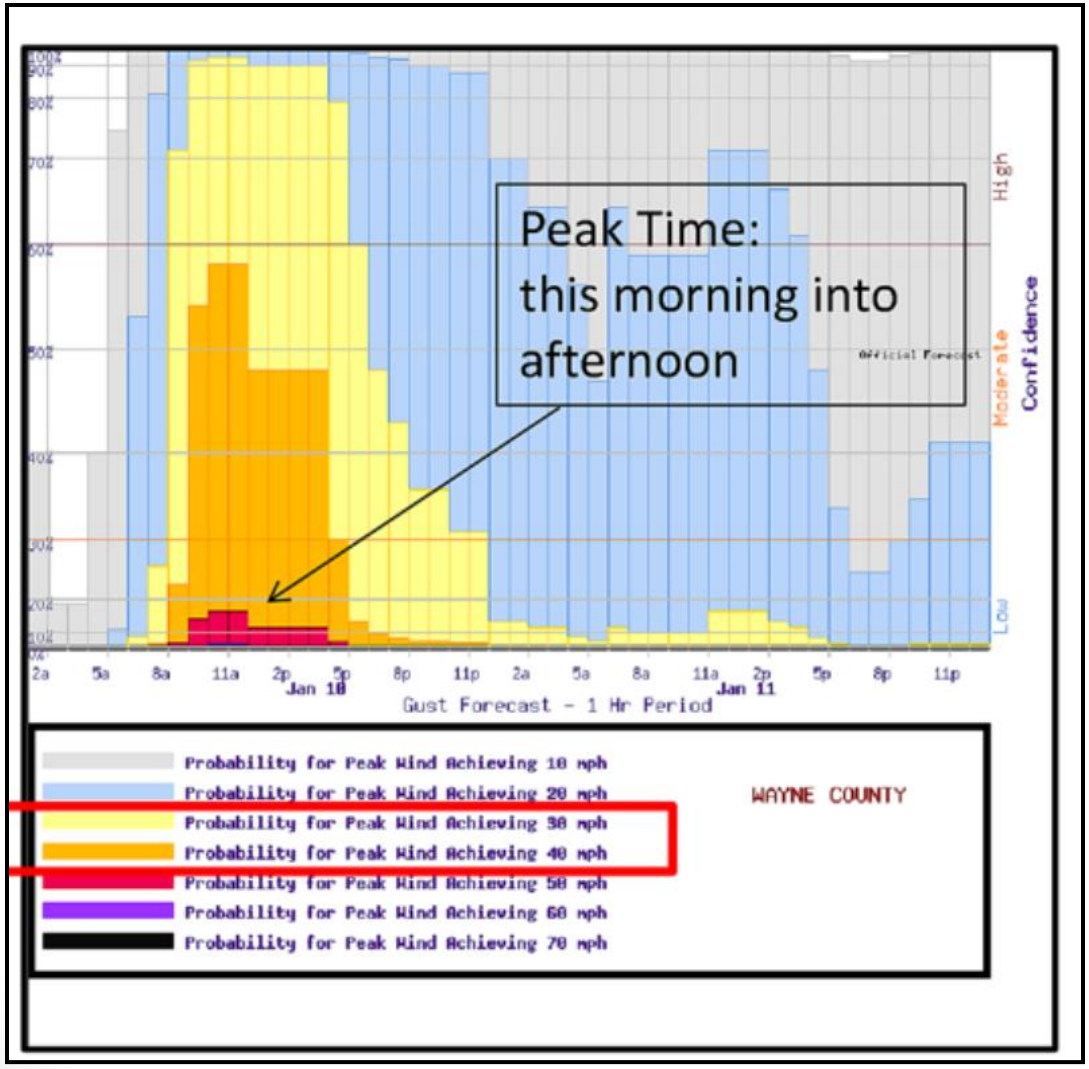
Ensemble Wind Rose





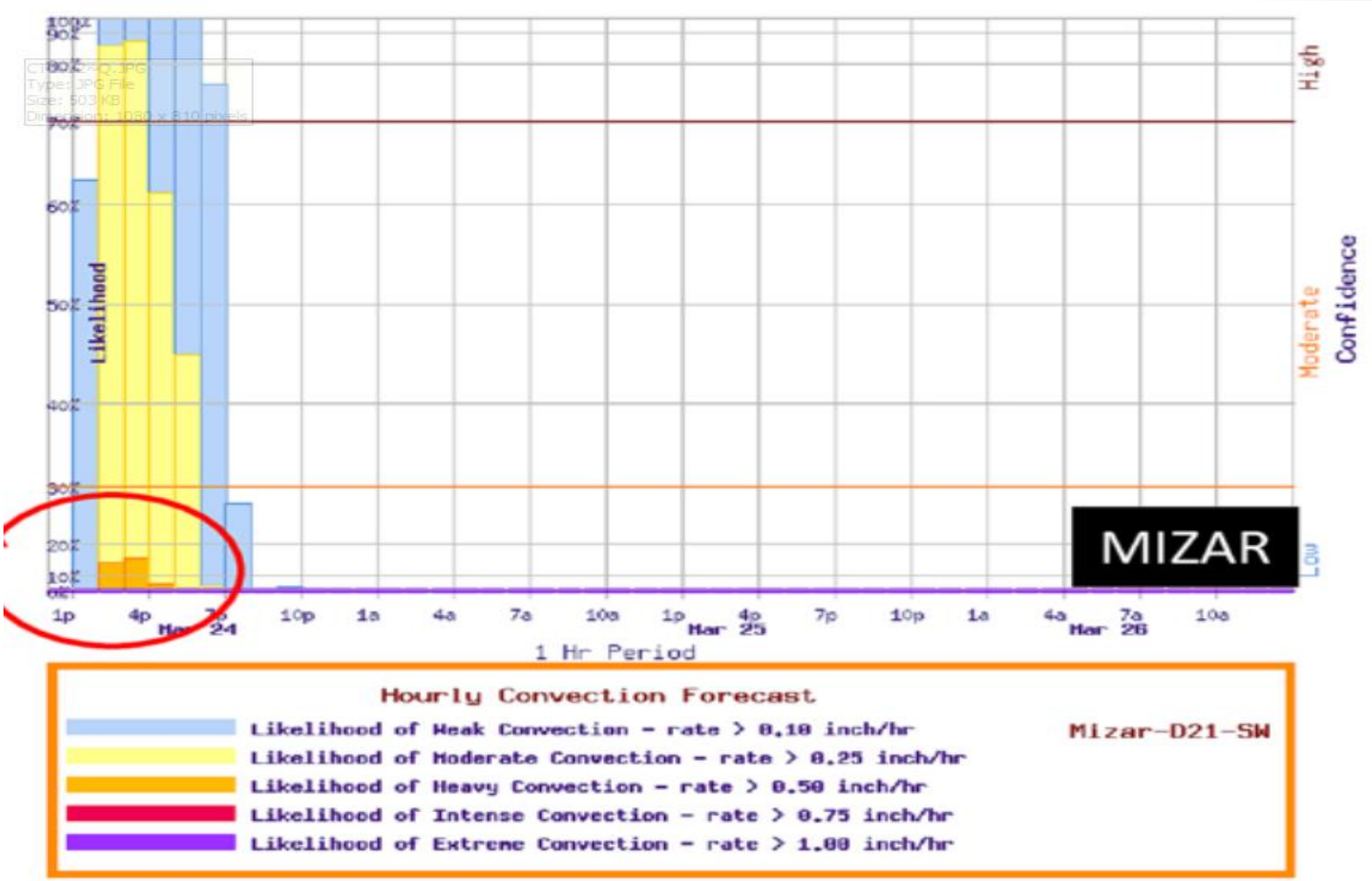
Probability of Snow Graph

More Examples From the D21 Dashboard



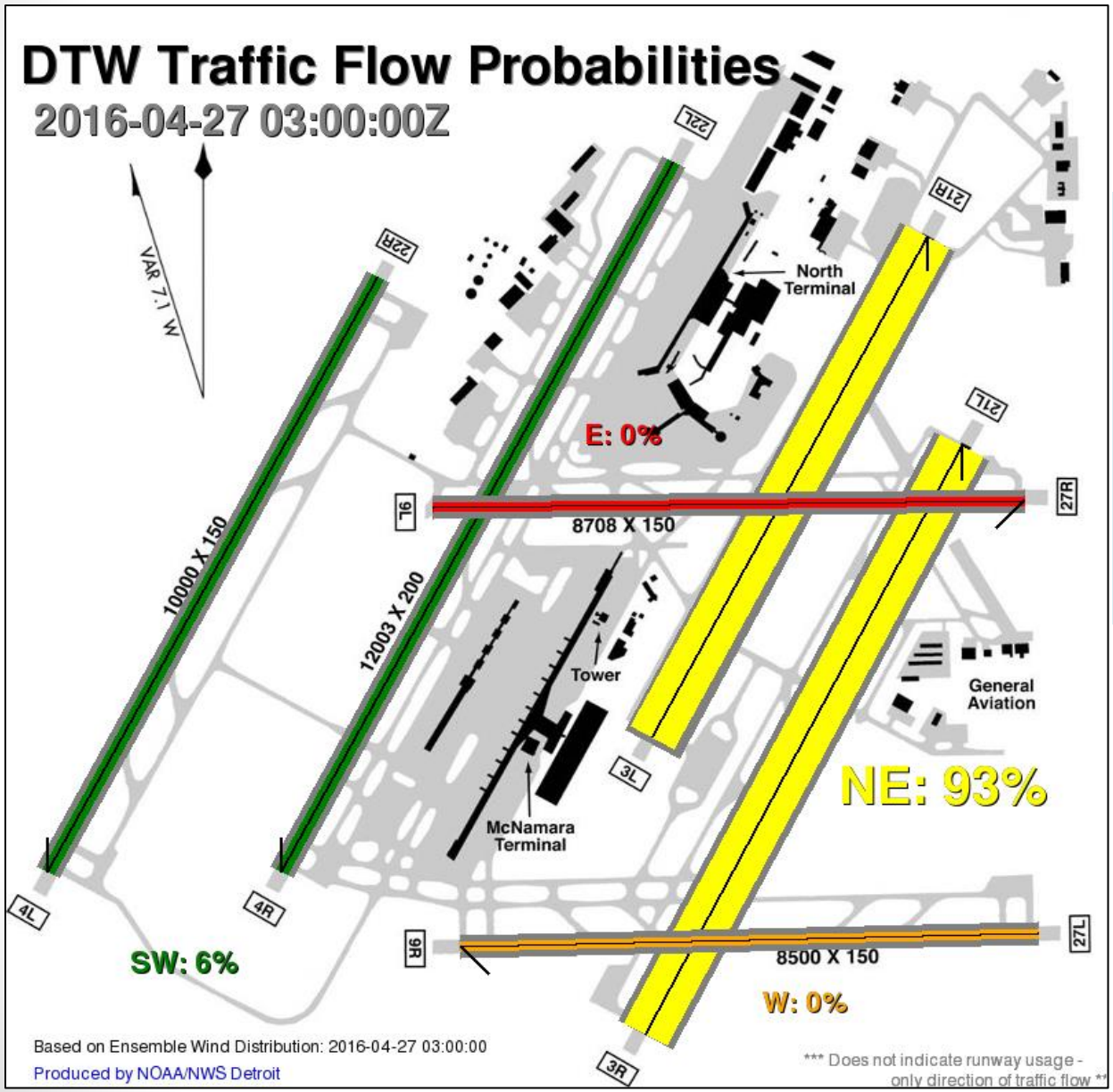
Probability of Wind Gusts Graphs

More Examples From the D21 Dashboard



Probability of convection graph for MIZAR (standard arrival fix)

More Examples From the D21 Dashboard



Flow probabilities based on ensemble winds and DTW wind thresholds.

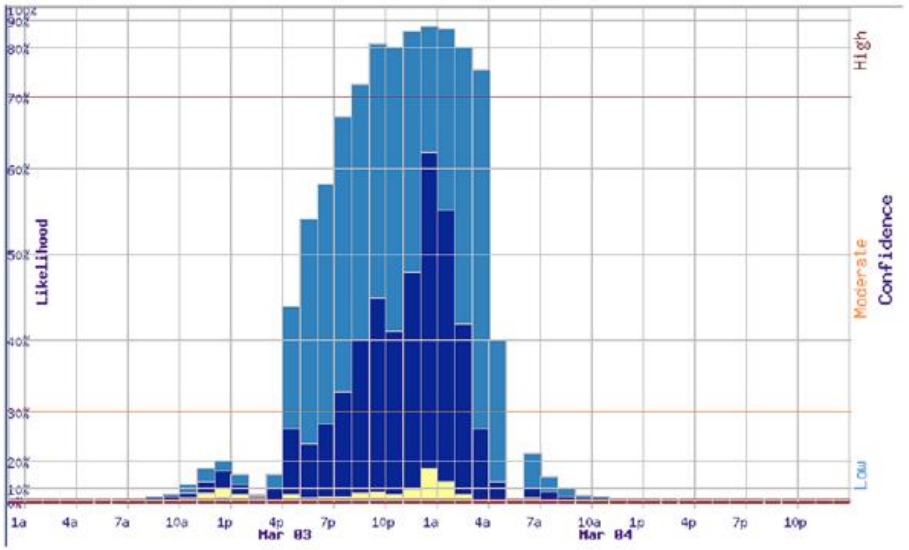
In this case, light NE winds are favoring taking off to the northeast. (Again SW is the favored flow for metro airport).

D21 Support Overview Page

- Created by DTX DSS forecaster twice a day and posted to the web page by 2 PM and 6 AM local time, one hour prior to their scheduled briefing to the controllers at the Cleveland Center.
- Gives the CWSU a quick overview of the most important weather concerns to the D21 airspace. The 6 AM page is especially useful to the CWSU forecaster, who has only one hour between arriving in the morning and briefing the ARTCC controllers and TMU.
- Utilizes various graphics from the D21 dashboard and other images to highlight the main weather concerns, like graphical model output.

D21 Snowfall Event Example

Discussion Date: 1100z – March 3, 2016
Next Discussion: 1900z – March 3, 2016

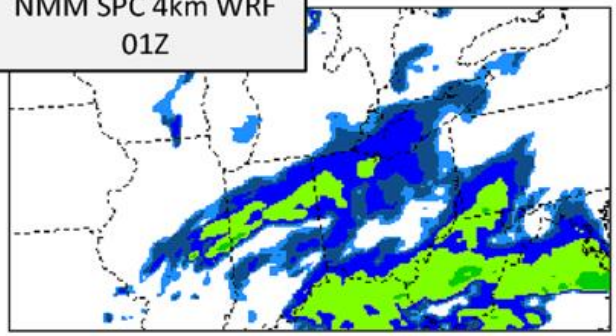


1 Hr Snow Prob Guidance

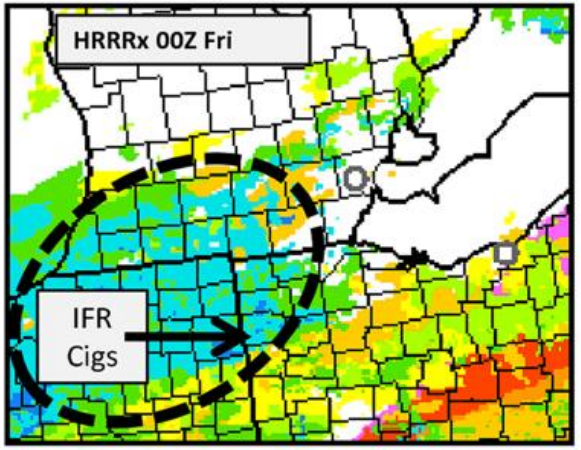
A high confidence exists that 1 hr snowfall rates will remain at .1 inch or less throughout much of the event. A moderate conditional probability exists that hourly snowfall rates could reach the .1 to .3 inch range between 02-08Z 3-4-2016 time window.

Total snowfall for the event is expected to be around 1 inch at DTW

Simulated Reflectivity
NMM SPC 4km WRF
01Z



Best potential for precipitation, and potential IFR cigs will be this evening as best focus of warm advection will arc against the MI/OH state line.



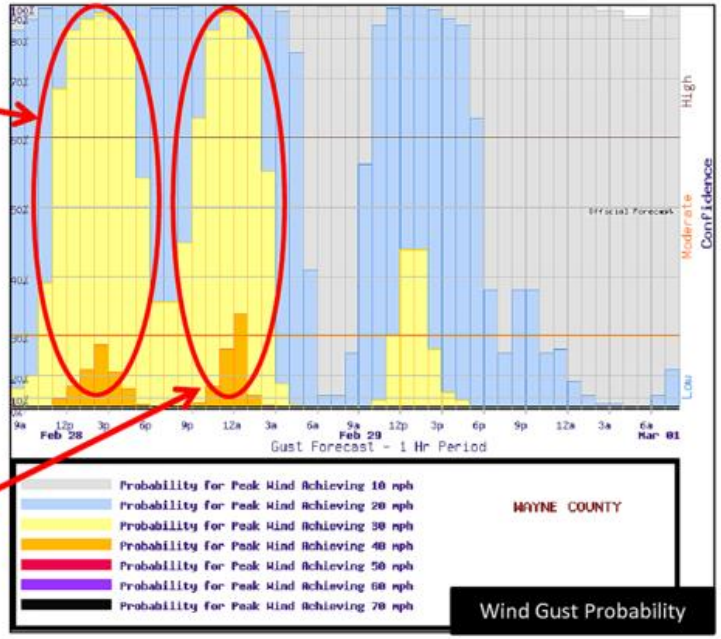
D21 High Wind Event Example

Discussion Date: 1100z – Feb. 28, 2016
Next Discussion: 1900z – Feb. 29, 2016

Winds the main concern through tonight.
MVFR conditions this evening in rain.

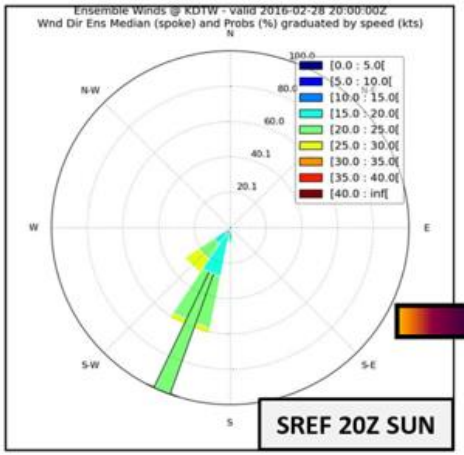
Wind gusts near 30 knots continue into early evening (direction 220).

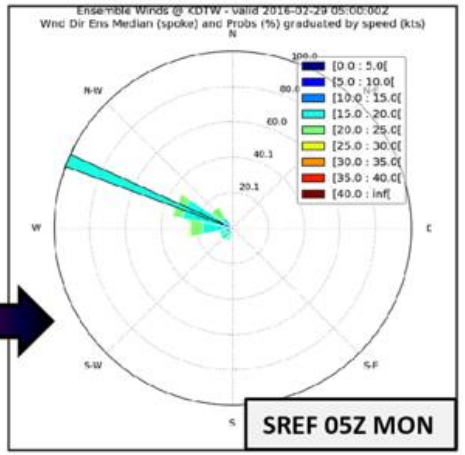
Secondary surge of gusty winds expected along a cold front tonight. Front should push across around 04Z (11PM) with winds remaining gusty for several hours afterward (direction 270-280).



Southwest winds (220 degrees) this afternoon will most likely range between 20-25 knots with gusts in the 30-35 knot range.

Cold front will shift winds to the northwest tonight (280 degrees). More uncertainty with speeds, but highest probability is between 15 and 20 knots with gusts again around 30 knots.



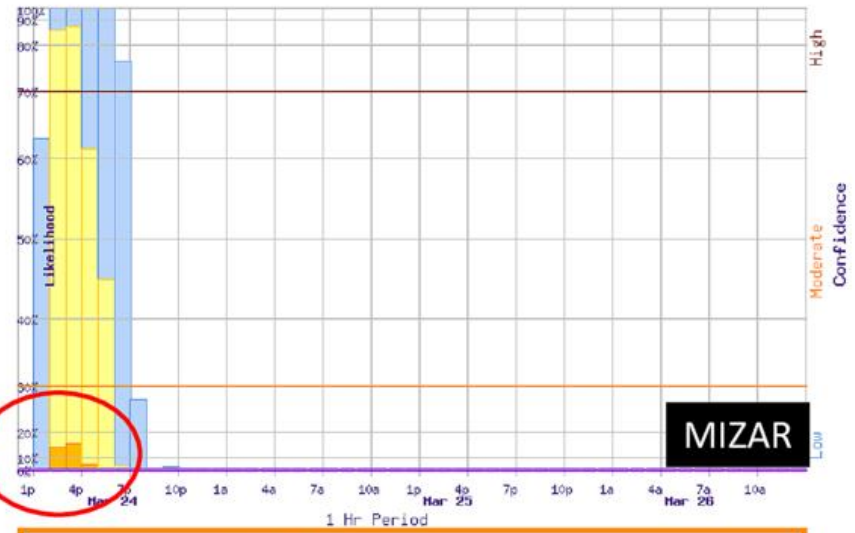


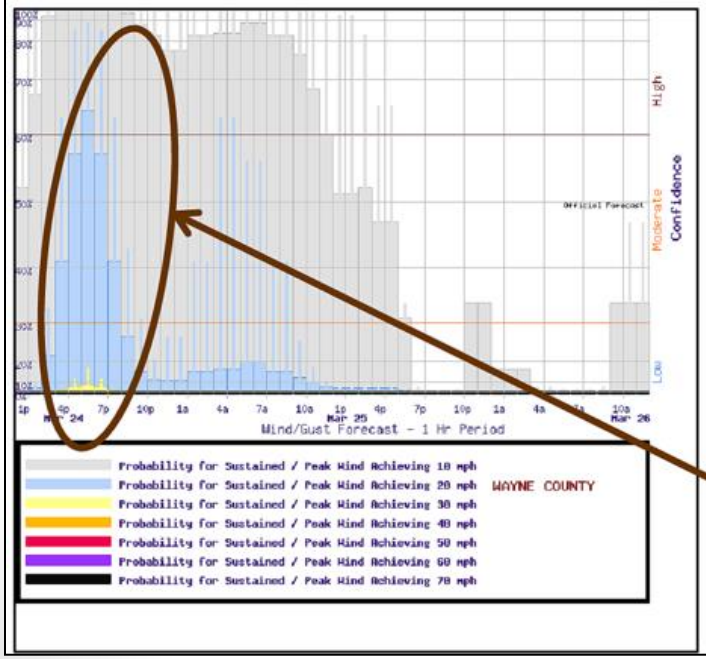
D21 Chance of Thunderstorms Example

Discussion Date: 1800 UTC – Mar. 24, 2016
Next Discussion: 1000 UTC – Mar. 25, 2016

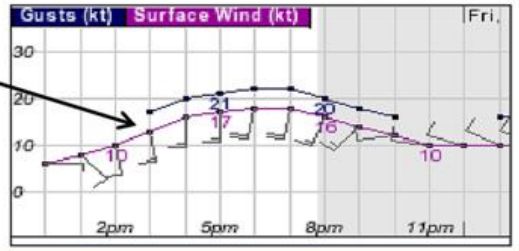
Late afternoon thunderstorm chances are highest across the southern portions of the D21 Airspace.

Most probable time period of thunder at MIZAR is between 2 PM and 7 PM. WEEDA and GEMNI have slightly lower probabilities with about an hour or two later in timing.





The warm front should lift north of metro this a afternoon, causing winds to turn to the south.



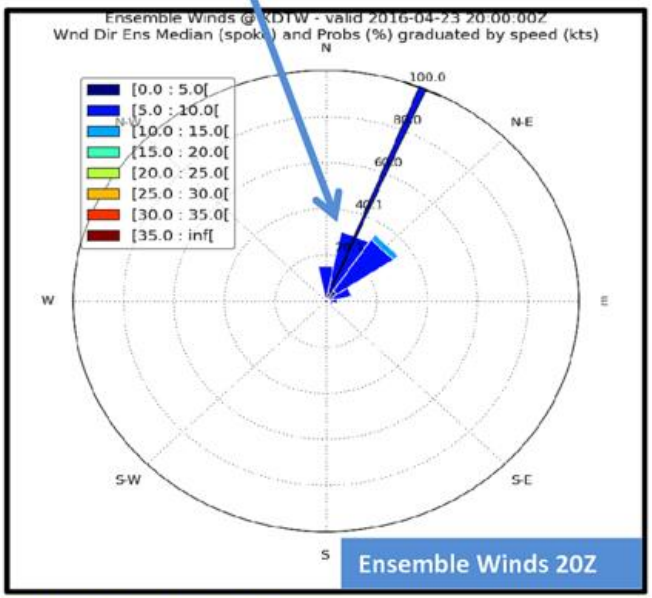
Recent observation trends suggest the sfc low will track a little farther south. So the warm sector should just barely pass north of metro. As a result, note the low probability for winds to exceed 30 MPH. Wind gusts in the 20s are most probable.

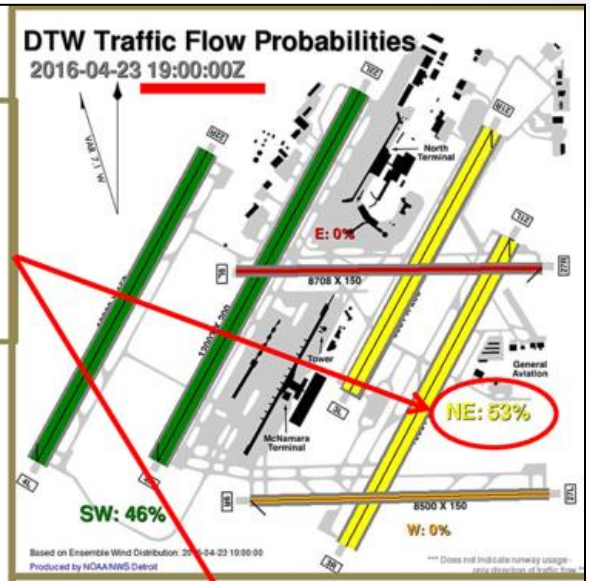
D21 Northeast Wind Example

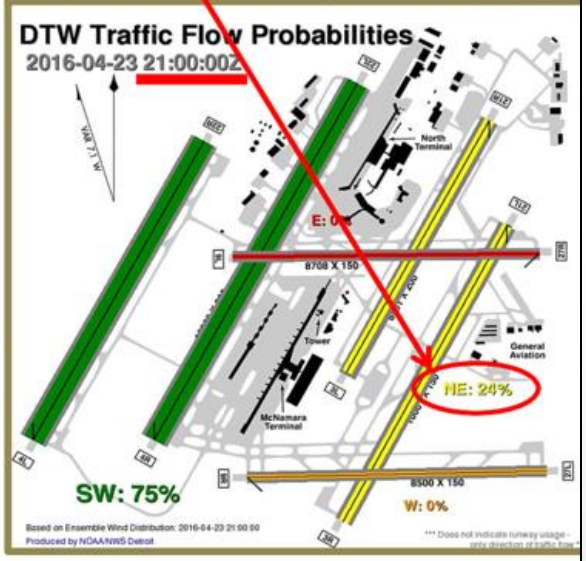
Discussion Date: 1800 UTC – Apr. 23, 2016
Next Discussion: 1000 UTC – Apr. 24, 2016

NNE Winds will persist through the afternoon. Some variation between NNE and NE is possible.

Several HiRes solutions suggest a gradual drop in wind speeds between 19Z and 23Z, supporting decreasing NE flow probabilities.







Little to no chance of even few or sct clouds below 5k ft, let alone a ceiling.

Example – Full D21 Support Web Page

D21 Tracon Decision Support

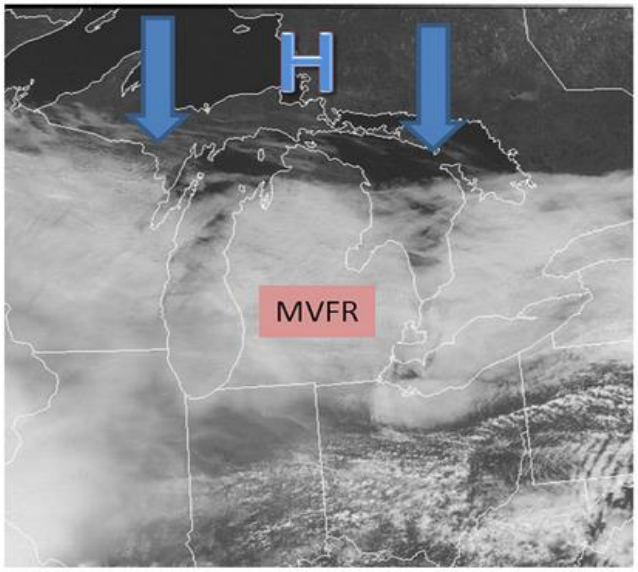
Weather.gov > Detroit/Pontiac, MI > D21 Tracon Decision Support

Detroit/Pontiac, MI
Weather Forecast Office

Recent Changes: Added TAFJXN and TAFTOL to TAFs page

Overview | Discussion | Wind | Gust | Convection | Snow | HRRR Cigs | HRRR Vis
Satellite | Radar | DTW Flow | DTW Flow (Gust) | LAMP | TAFs

Discussion Date: 1800 UTC – Apr. 26, 2016
Next Discussion: 1000 UTC – Apr. 27, 2016



Ceilings should remain locked around 1500-2000ft through the evening as cool flow off Lake Huron keeps the inversion intact. Drier air associated with high pressure to the north will drop southward through the region tonight bringing improved conditions.

Ceilings improve after 06Z when the southern extent of the high builds in. Should go mostly SKC around 12Z.