

NWS Central Region

Application of Ensemble Information for Decision Support Forecast Services

Ensemble Users Workshop

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Ensemble and Probabilistic Forecast Initiatives

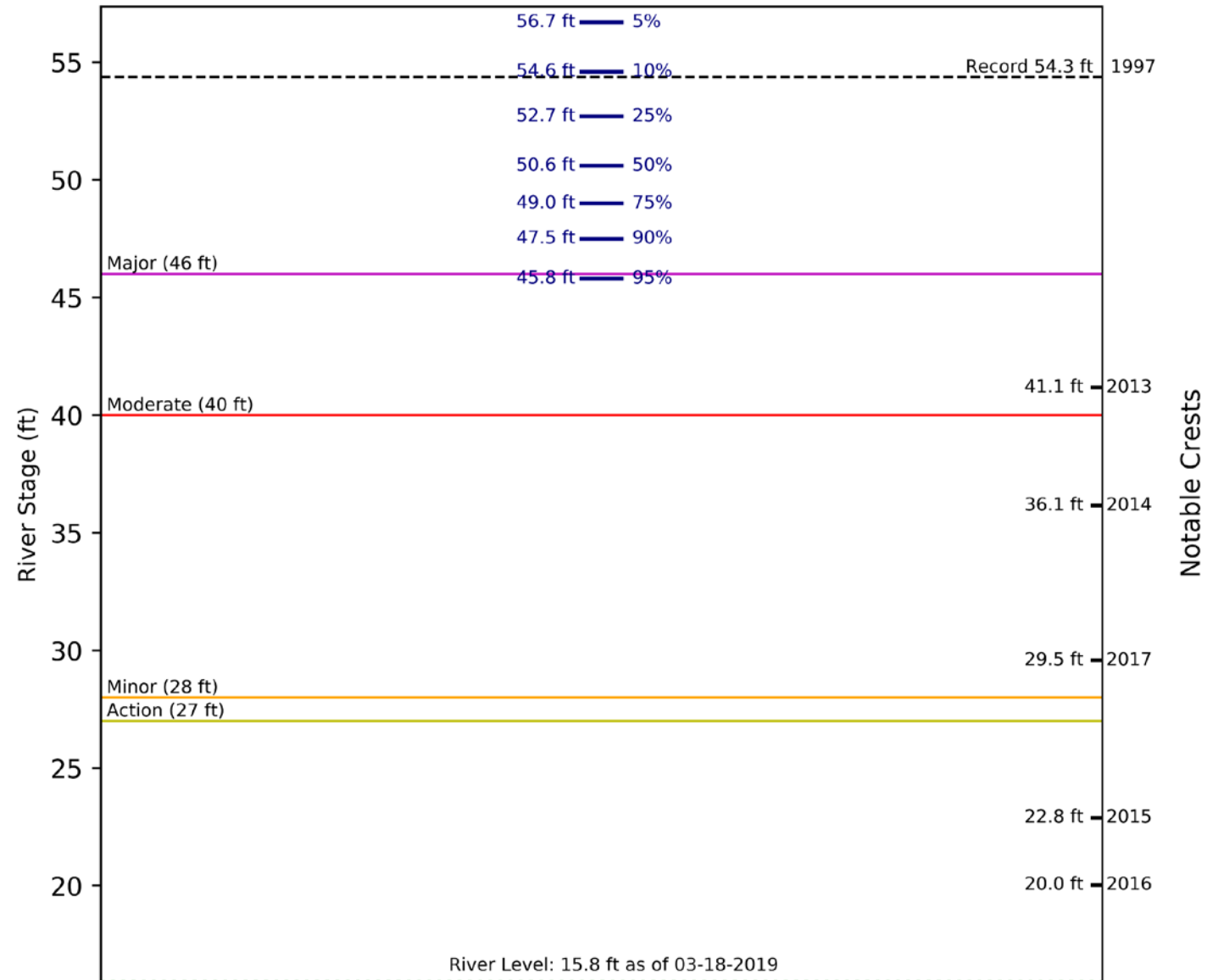
- National / Regional Initiatives with CR WFO Participation
 - WPC Probabilistic QPF Experiment (PQPF)
 - WPC Probabilistic Winter Precipitation Experiment (PWPF - Snowfall)
- Example WFO Services
 - Red River Flood Outlook Services – WFO Grand Forks
 - Client Services – WFO Detroit
 - Objectively Adding Context



WFO Grand Forks

- Seasonal Red River Flood potential
- Leveraging River Forecast Center outlooks and packaging information in an immediately digestible format for users

% Chance of reaching or exceeding this level



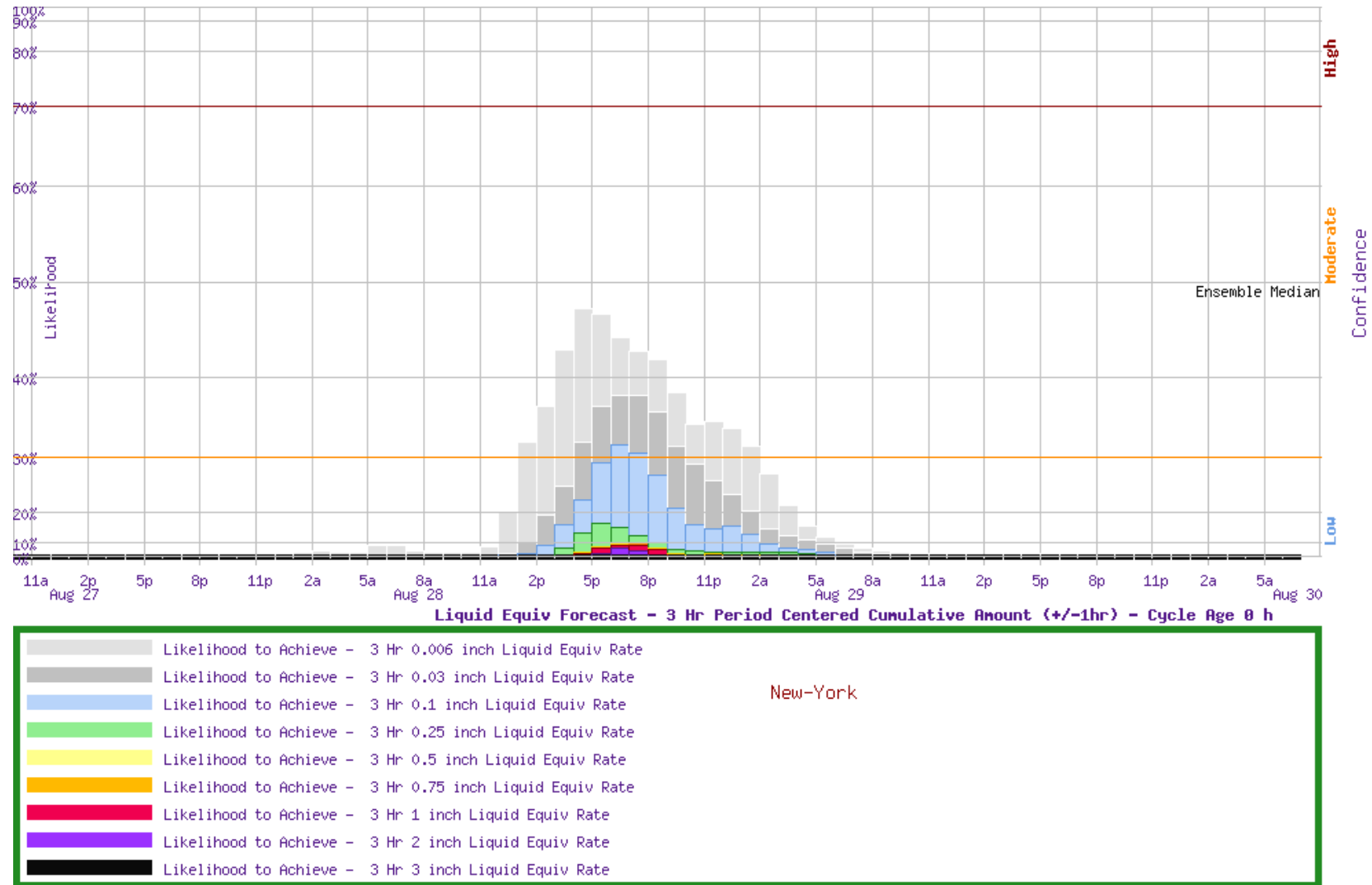
*This outlook graphic shows the most likely river stage range based on the latest forecast. There is a 5% chance of values higher than depicted here.
 **Figure created on 03-18-2019

WFO Detroit

- Premise: timeseries layered threshold probability presentation
 - Condenses information for ease of use and direct application to forecaster and client needs
- Primary clients
 - Transportation Sector
 - Wayne County Airport Authority (WCAA) – Detroit Metro Airport (DTW)
 - Michigan Department of Transportation (MDOT)
 - Supporting county/municipal road departments
 - Cleveland Center Weather Service Unit (CWSU ZOB) – FAA Detroit TRACON (D21)
 - Homeland Security
 - U.S. Coast Guard – Sector Detroit
 - City of Detroit DHS
 - Water Management
 - Detroit Water and Sewage

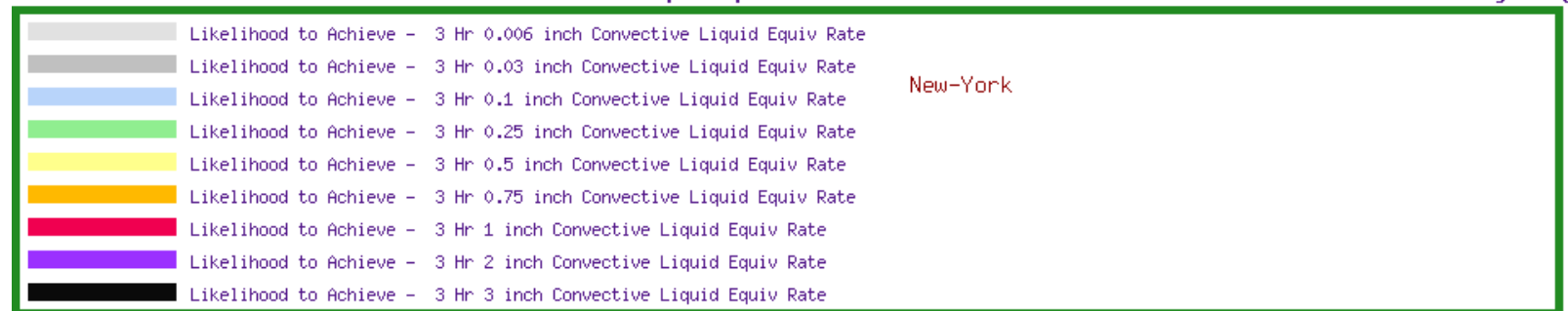
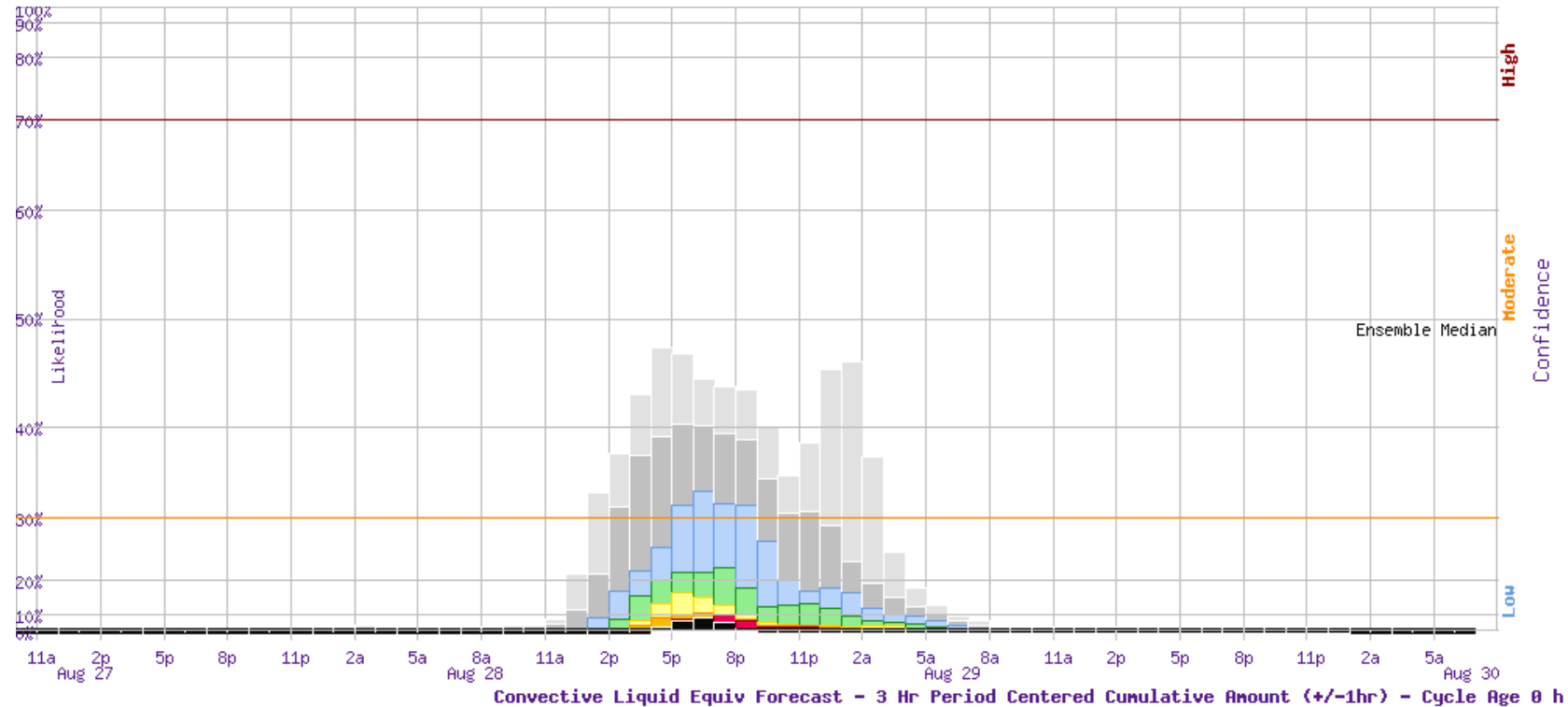
Layered Probability Timelines

- Uses all available BUFR data – decaying time lagged to bolster ensemble population sample size
- Hourly Based and Hourly Cadence
- Precipitation variables also have accumulating moving windows (3, 6, and 12 hours)
- QPF, Snow, Ice, Sleet, Snow Ratio (character), Wind / Gust, Direction Change, Apparent Temp, Freezing Temp, Extreme Temp, CAPE, Ceilings



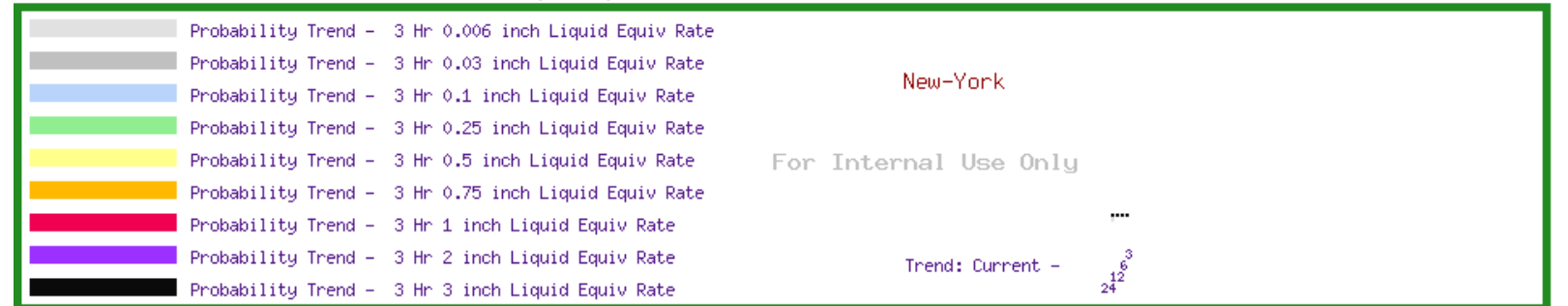
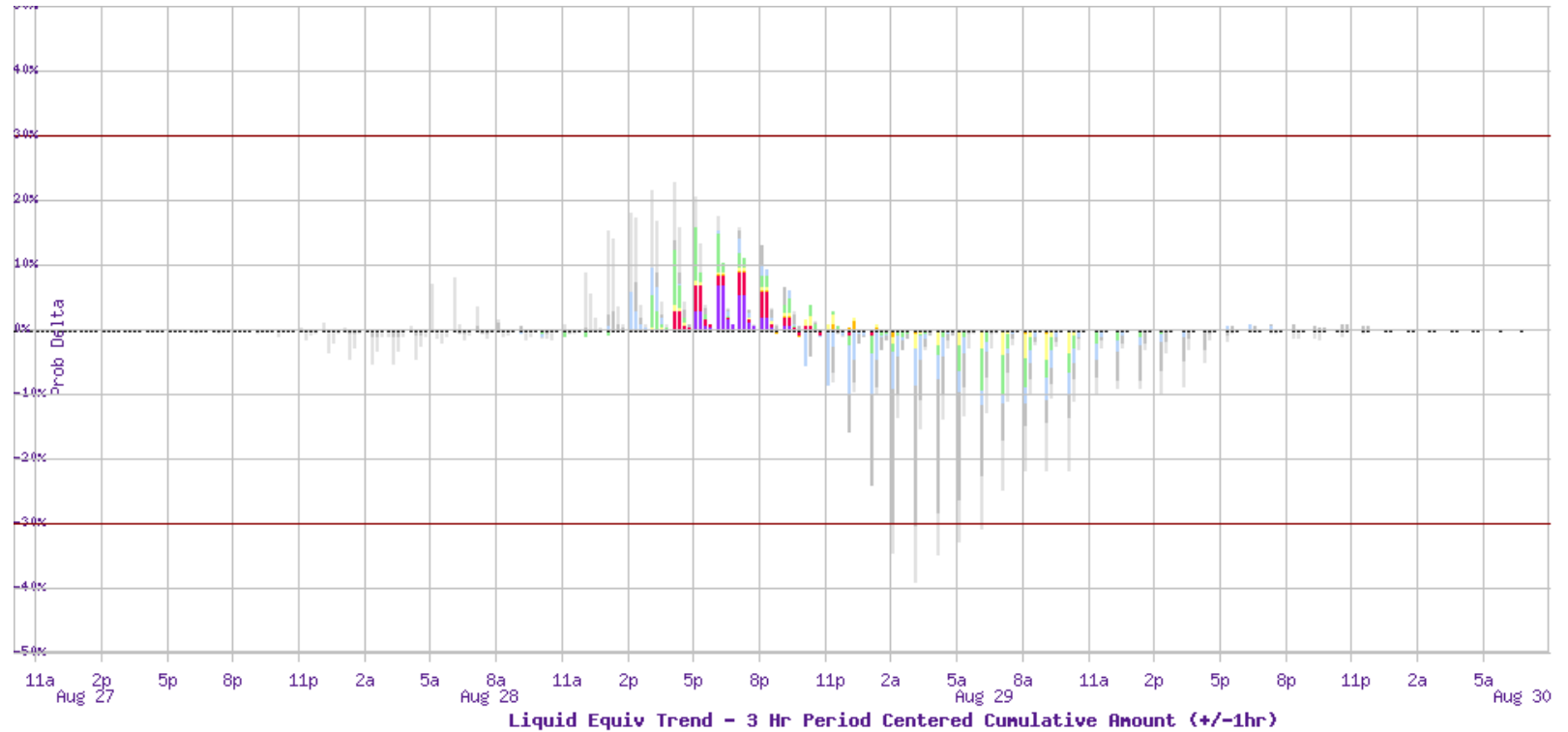
Conditional PQPF - Convection

- Filter ensemble output using other diagnostics
- Example PQPF where MUCAPE > 100 J/kg



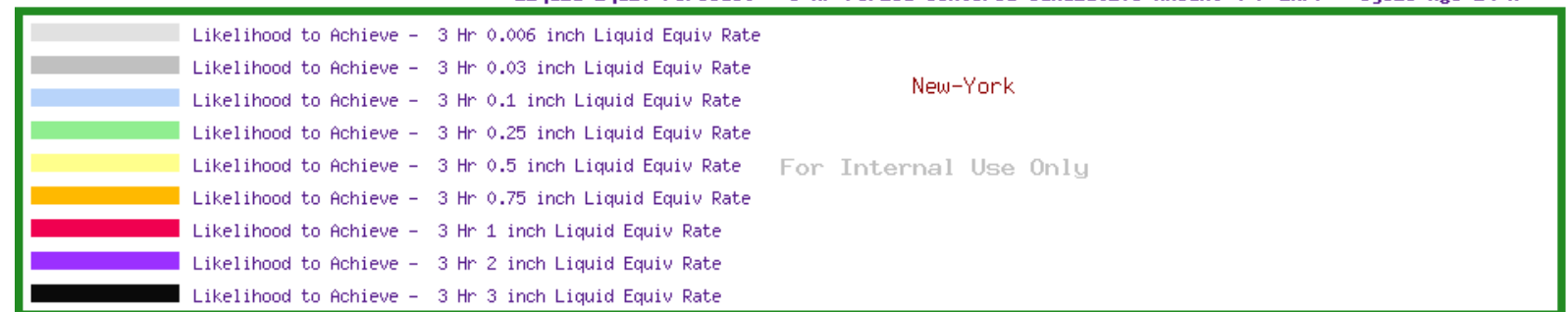
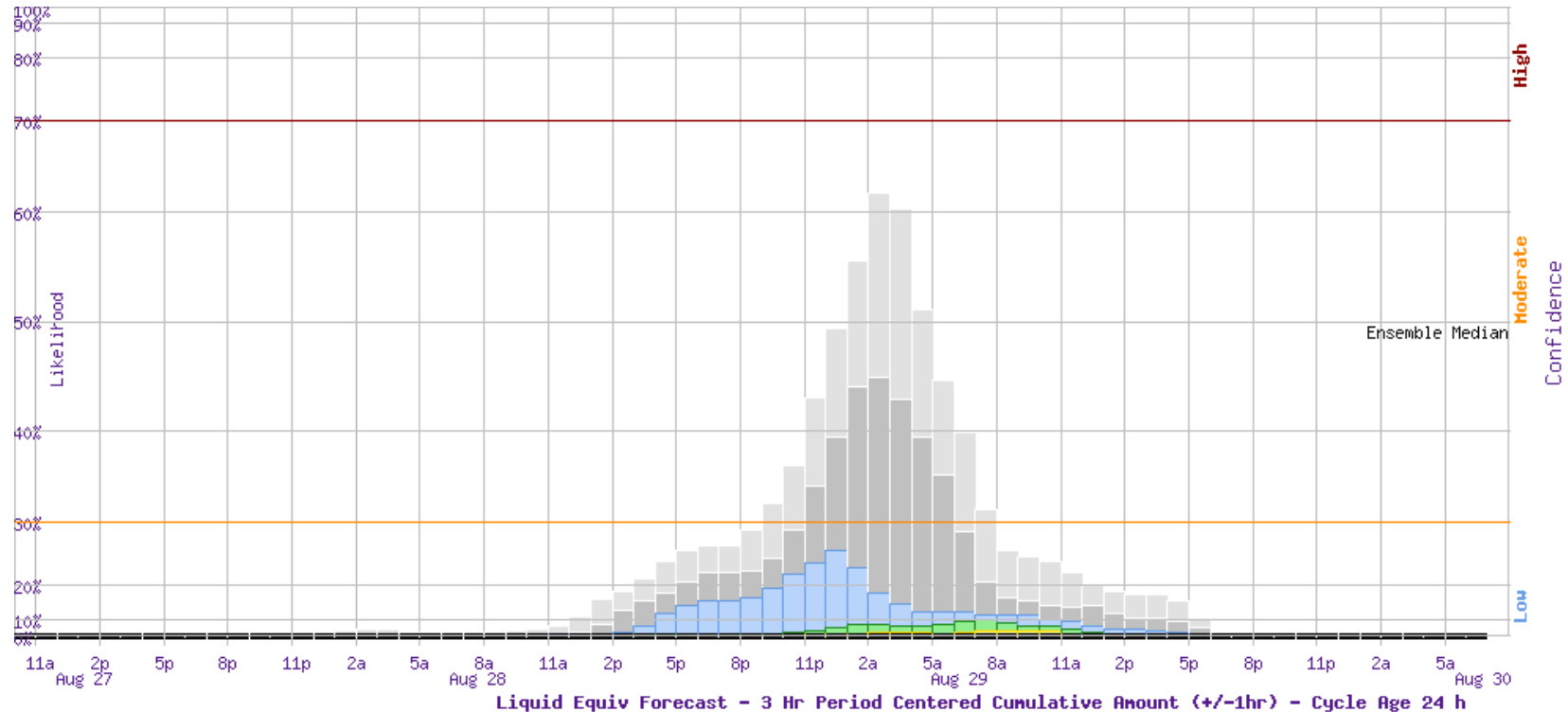
Forecast Tendencies

- Trends over the past day from the grand ensemble



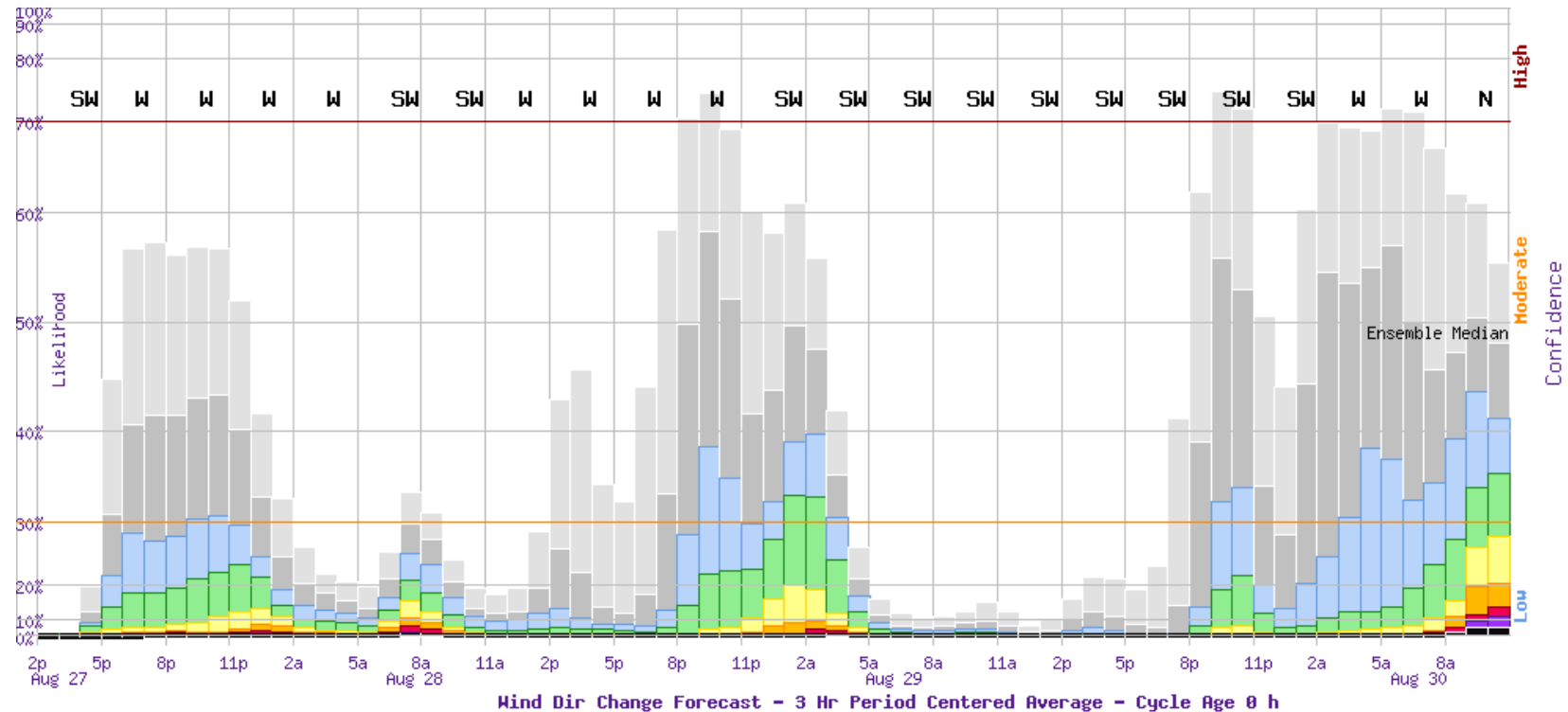
Forecast Tendencies

- Trends over the past day from the grand ensemble
- Very popular with forecasters in conveying changes to end users



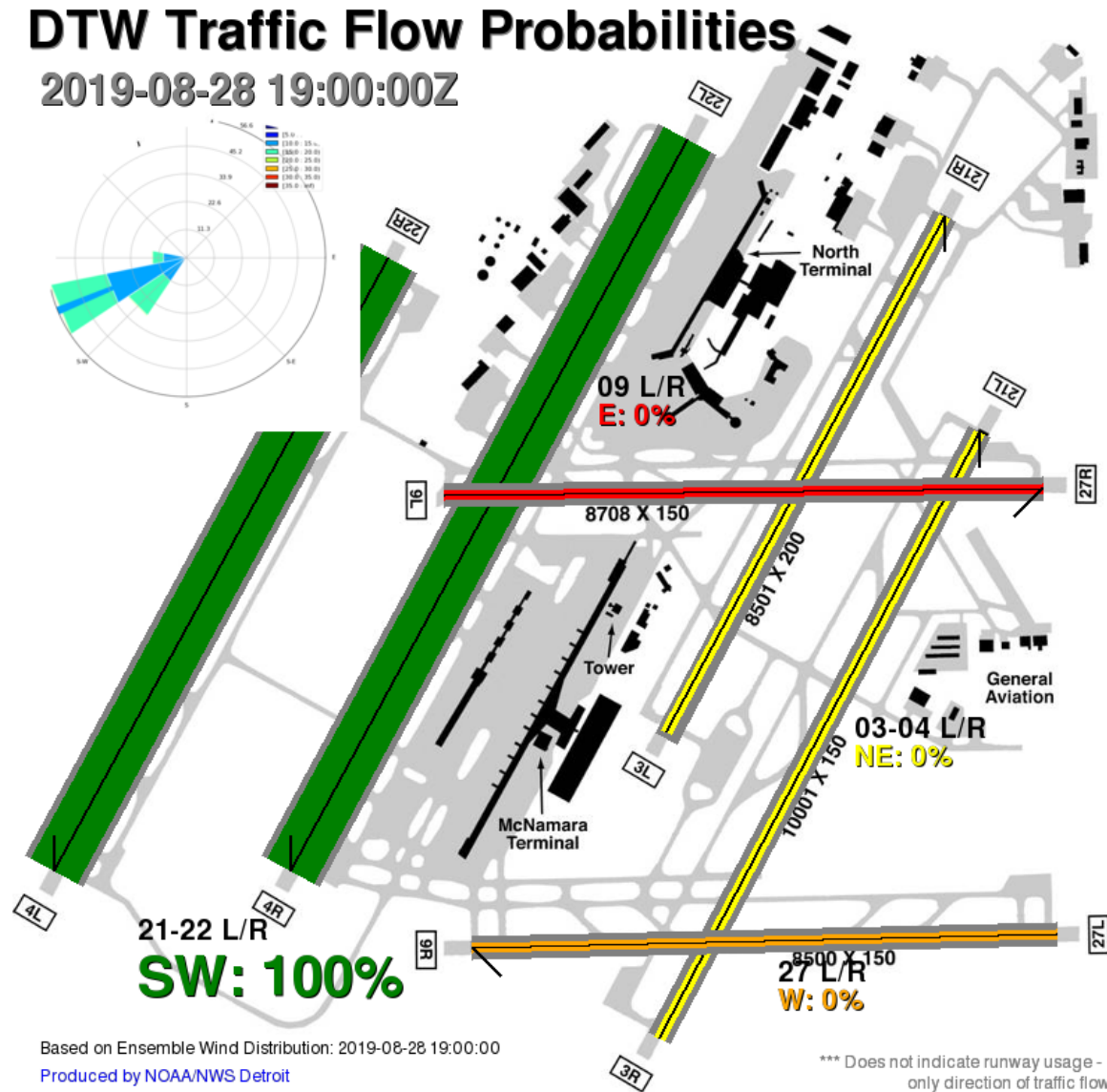
Forecast Decision Aids – Wind Direction Delta

- Terminal Forecast and Airport Flow requirements



Mapping to Definable Impacts

- Internal support for Center Weather Service Unit at FAA Cleveland Center
- Traffic Flow for airfield is highly directionally dependent for speeds greater than 6 knots
 - Impacts arrival flow rates and resultant National Airspace routing
- Map ensemble winds to airfield flow decision thresholds



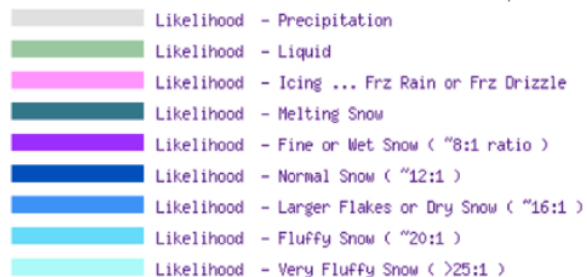
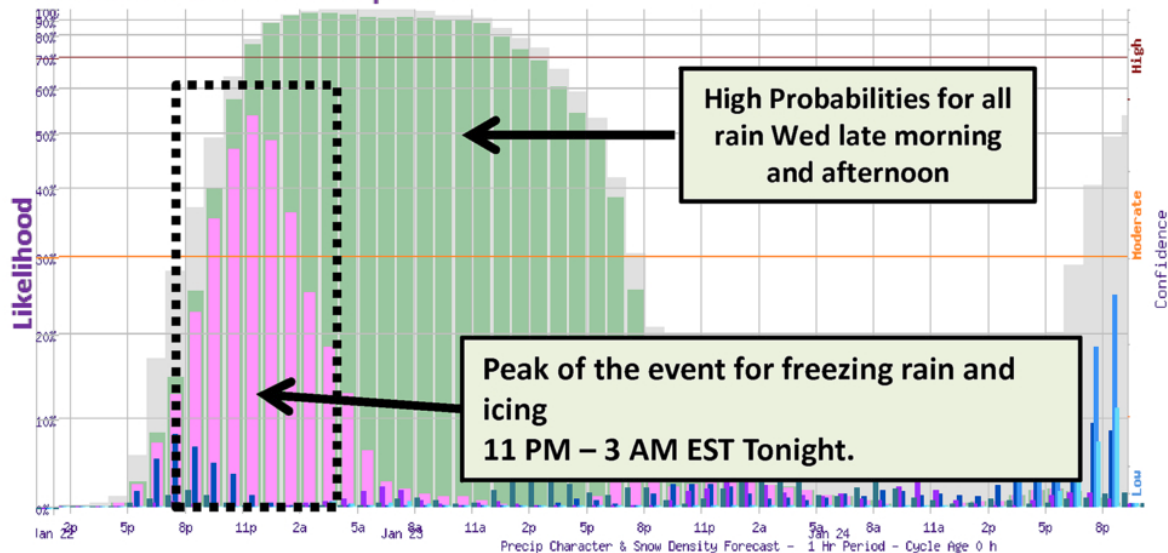
Example Briefings to WCAA

Airport Ground Operations Winter Weather Support

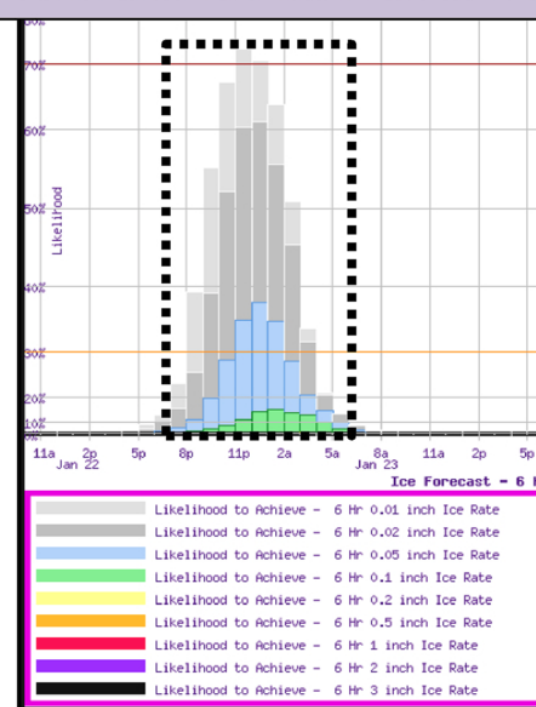
Narrative For Tonight & Early Wednesday

- Precipitation will spread across DTW this evening. A brief period of snow will be possible at the start of the event.
- Latest indications are that a good chunk of the precipitation will fall tonight as freezing rain.
- Window for freezing rain is between 9 PM – 5 AM EST. Peak of the event is expected to occur between 11 PM – 3 AM EST.
- Total accumulations of ice in excess of 0.10 inch is possible.
- Precipitation will become warm rain by 5 AM EST.

Probabilistic Snow to Liquid Ratio



Probabilistic 6 hr Guidance for Ice



Probabilities are increasing rapidly in support of freezing rain at DTW tonight.

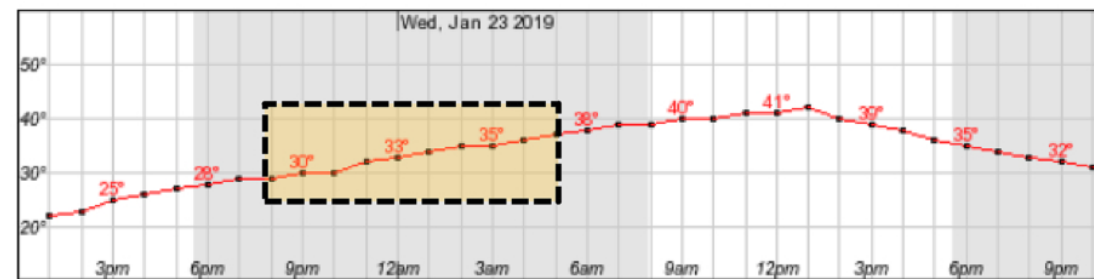
The likelihood for icing of reaching and exceeding 0.10 inch is increasing.

Greatest time window for freezing rain is 9 PM – 5 AM EST.

Uncertainty does exist with how exactly how fast surface air temperatures will rise and how cold pavement temps will respond.

Temperatures:

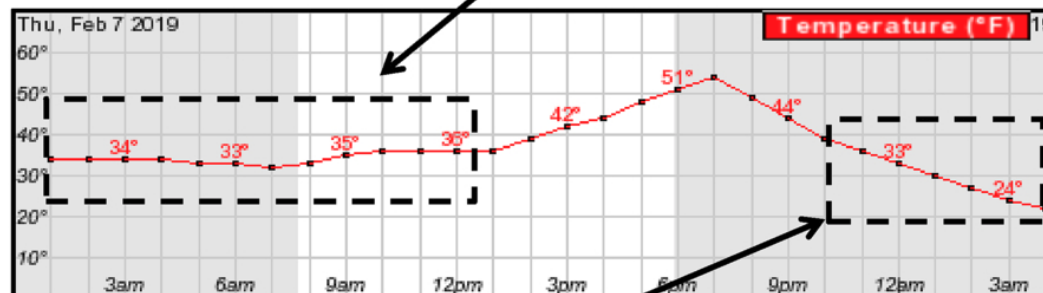
- Uncertainty exists with how fast temperatures will warm. Latest forecast information slows down the timing of above freezing temps.
- Latest forecast information suggests air temperatures not rising above the freezing mark until 3 AM EST.



Weather Overview

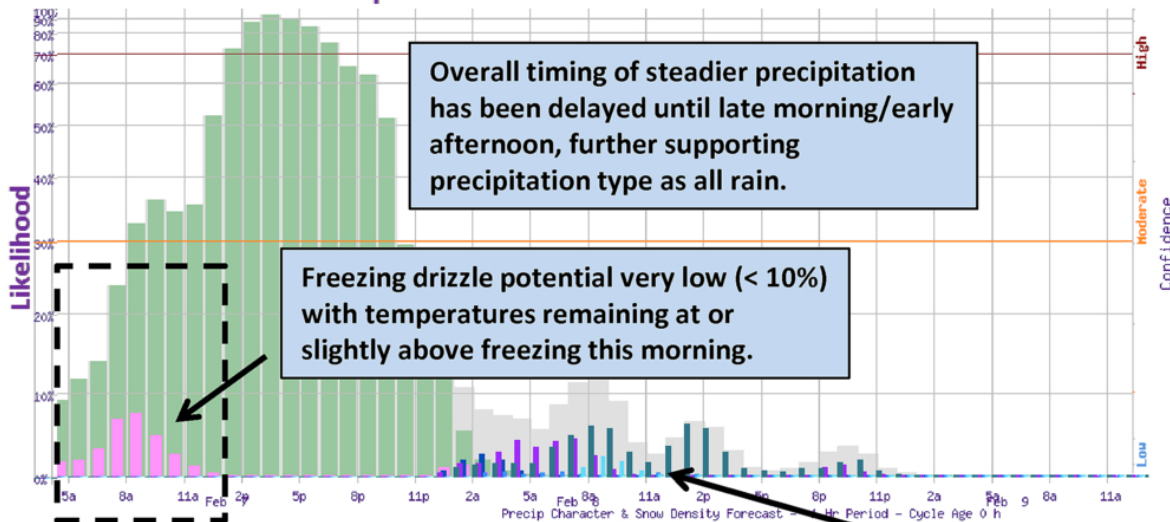
- Strong storm system will bring mainly rain to the airport today. Very low potential for freezing drizzle early this morning, as temperatures remain at or slightly above freezing.
- Gusty west winds expected this evening into Friday morning, especially 7pm-1am. Peak gusts up to 40 mph possible.
- Temperatures will fall rapidly below freezing after midnight tonight. After today's rain, there is a low potential for flash freezing of wet pavement surfaces.
- A few lake effect snow showers possible Friday with little to no accumulation.

Temperatures hover at or slightly above freezing this morning before warming well above freezing by noon.



As temperatures rapidly fall below freezing after midnight tonight, potential for flash freeze of wet pavement. Confidence in this occurring is low as gusty winds may act to dry, rather than freeze any lingering moisture on pavement.

Probabilistic Snow to Liquid Ratio



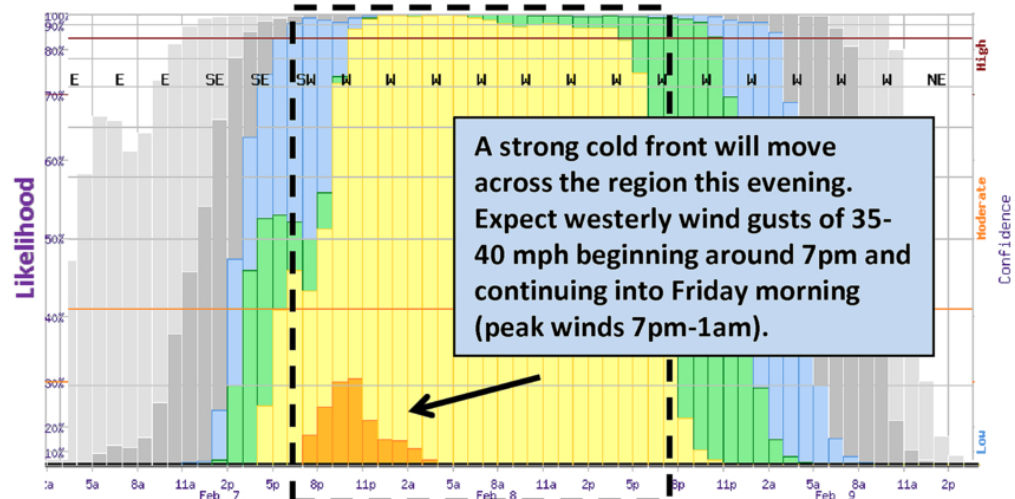
Overall timing of steadier precipitation has been delayed until late morning/early afternoon, further supporting precipitation type as all rain.

Freezing drizzle potential very low (< 10%) with temperatures remaining at or slightly above freezing this morning.

Lake effect snow showers will be possible Friday, although bulk of activity will remain north of the airport. Little to no accumulation.



Probabilistic 1 hr Guidance for Wind Gust



A strong cold front will move across the region this evening. Expect westerly wind gusts of 35-40 mph beginning around 7pm and continuing into Friday morning (peak winds 7pm-1am).



Some Considerations

- Layered information content provides greater context
- Timelines meet vast majority of WFO client needs more directly
- While calibration is nice – ensemble information content depth has great value
 - Users will use uncalibrated single solution data in the absence of useable ensemble data
- Interpretative services must include conditionality to aid decision process – includes informing the forecast process
- Simplicity is not desired – rather clarity
 - Spectra of outcomes is necessary to enable decision-makers to appropriately apply portions of action plans or playbooks
- Forecast spectra tendencies provide important additional value
- Flexibility to extract and ask questions of the data is paramount