Early Results from NUCAPS Demonstration in the 2017 HWT Satellite Proving Ground Experiment

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HWT Experimental Warning Program (EWP)

- <u>Mission</u>: Improve prediction of severe convective weather at the "warning scale" (0-2 hours).

- Norman has a large community of researchers, operational meteorologists, students, industry.

- But, we serve <u>all</u> National Weather Service WFOs and CWSUs nationwide.

- A vital component to the Research To Operations (R2O) process.

2017 GOES-R/JPSS Experiment

- 4 weeks (19 June, 26 June, 10 July, 17 July)
  - 3 NWS forecasters, 1 broadcast meteorologist per week
- Using AWIPS-II
- Forecasters issue experimental mesoscale forecast updates (via a blog) and severe thunderstorm and tornado warnings (WarnGen)
- We want forecasters to think about how they are using the experimental products in nowcast and warning decision making.
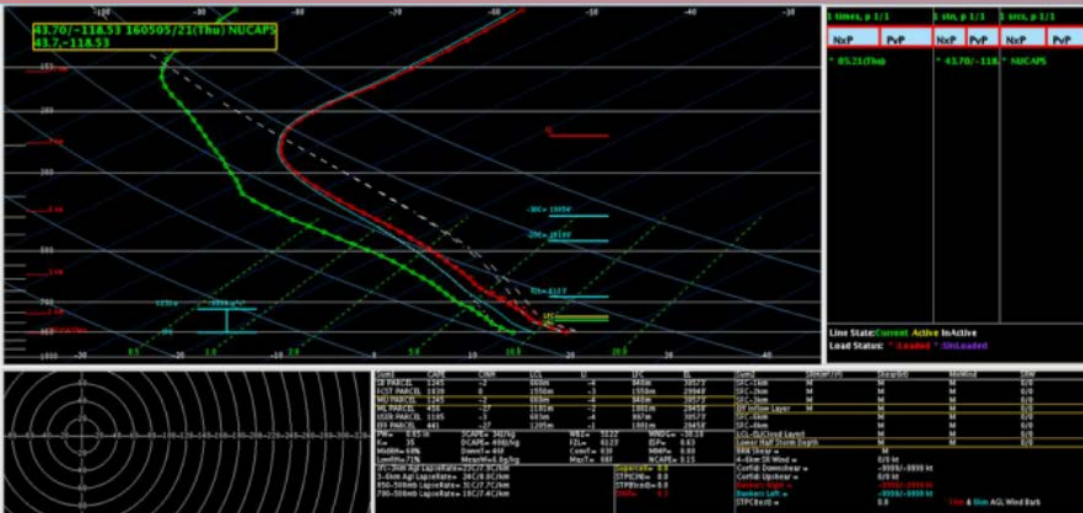
Forms of Feedback

- Daily survey (Mon-Thurs) for all products
- End-of-Week Survey (Friday morning)
- Debrief Discussions (Tues-Fri mornings)
- Real-time discussions
- **Blog**
  - **Mesoscale forecast updates**
  - **Reasoning behind warning decisions**
  - **Updates to previous warnings/forecasts**
  - **Best practices**
  - **Ideas for improvement**
  - **Any thoughts/feedback, good/bad, about the experimental products**
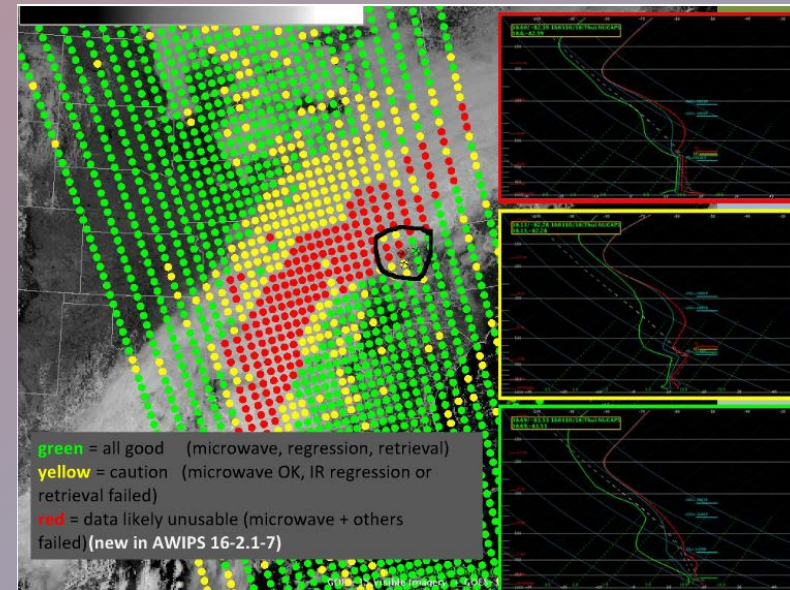 - **HWT Satellite Proving Ground Blog**
- Weekly Webinar

NOAA Unique Combined Atmospheric Processing System (NUCAPS) in the 2017 Experiment

- NUCAPS algorithm generates temperature and moisture profiles using information from instruments aboard the Joint Polar Satellite System (JPSS) Suomi-NPP polar-orbiting satellite.
- Products include:
  - NUCAPS Profile Availability (Time/Location) with quality control flags
  - NUCAPS Vertical Temperature and Moisture Profiles (SNPP, MetOp-A, and MetOp-B)
  - Experimental modified NUCAPS Vertical Temperature and Moisture Profiles
  - Multi-level, gridded plan views of NUCAPS thermodynamic info
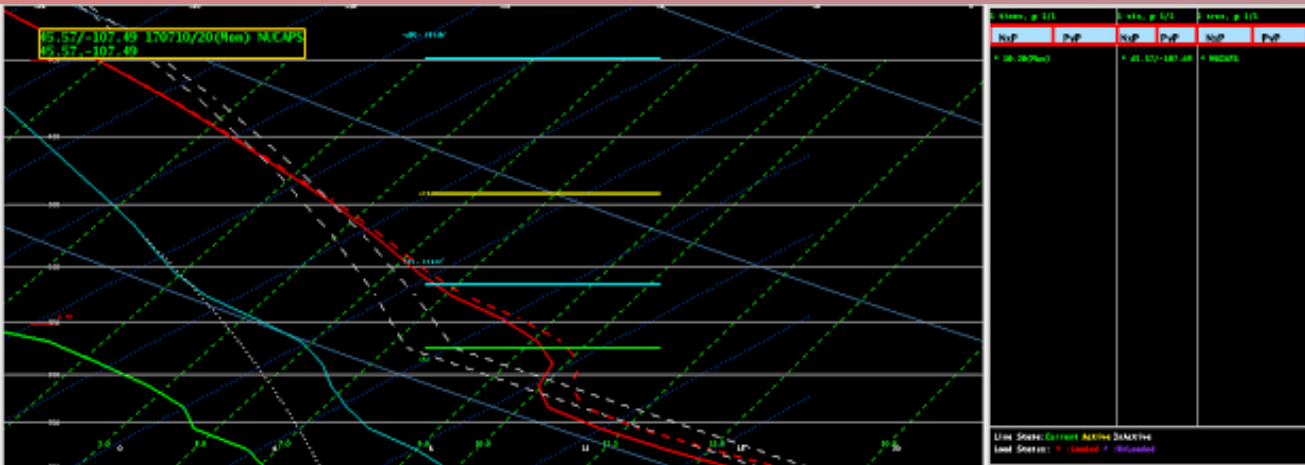
Example NUCAPS Sounding

Example NUCAPS Coverage with QC flags

green = all good   (microwave, regression, retrieval)
yellow = caution   (microwave OK, IR regression or retrieval failed)
red = data likely unusable (microwave + others failed)(new in AWIPS 16-2.1-7)
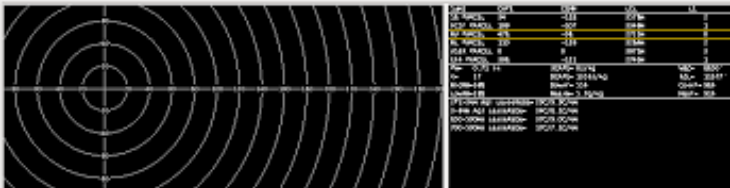
Example Cases and Feedback
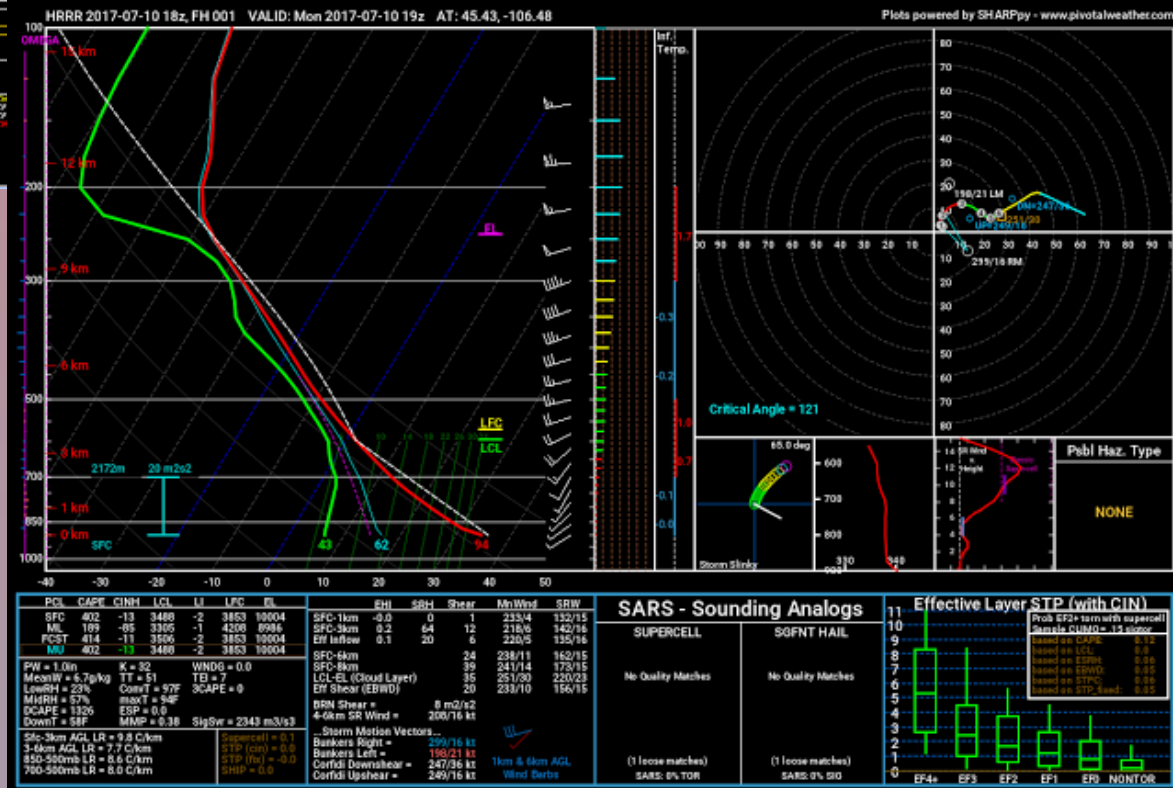
NUCAPS Used in Fire Case


HRRR Forecast Sounding

NUCAPS Sounding

- A noticeable inversion was detected near/just above 700mb.
- Compared to HRRR, RAP, and NAM soundings taken at a similar time, guidance was unable to detect this feature.
- Decided to investigate a smoke plume seen from KBLX radar

NUCAPS Used in Fire Case

- "The placement of the fire and smoke plume suggests some accuracy of the NUCAPS capture of the inversion, which is missing from model guidance."

- "Additionally, it has been noticed that as convection has pushed eastward this afternoon, it's intensity has been decreasing, which could be an impact of the inversion."
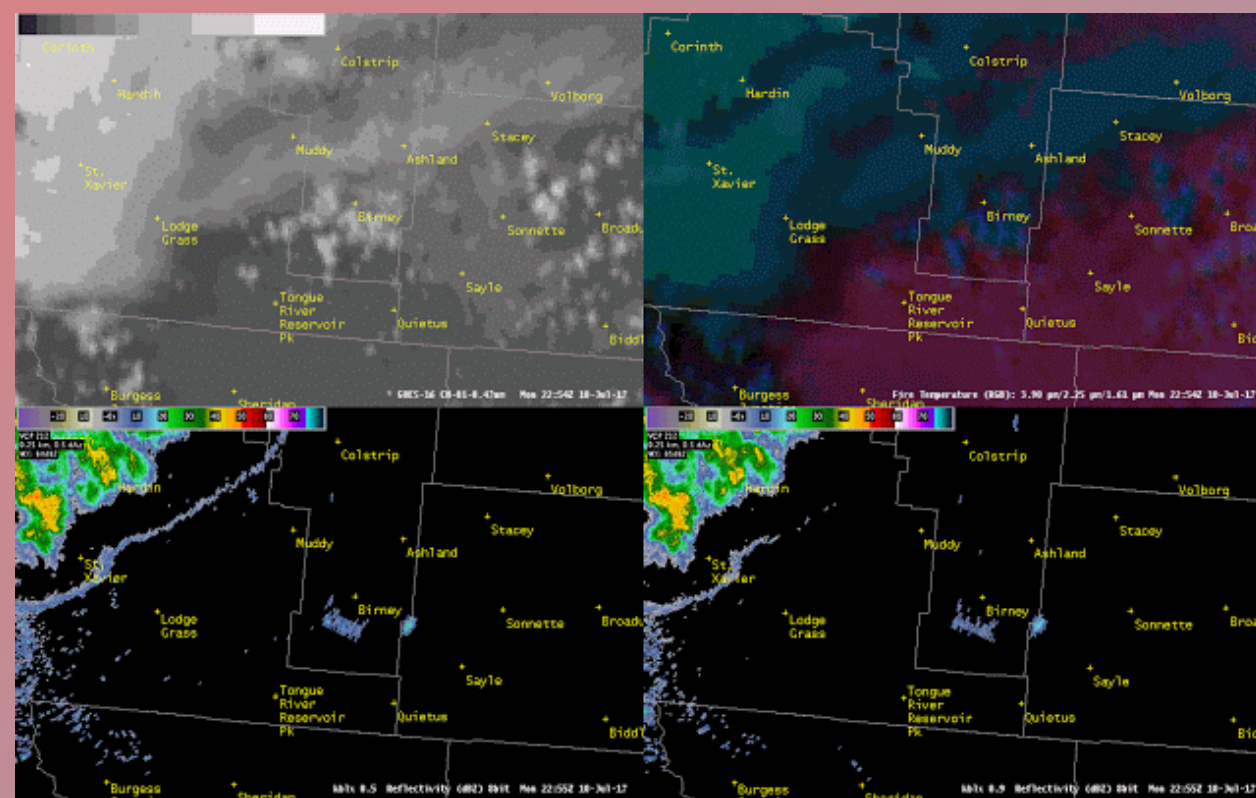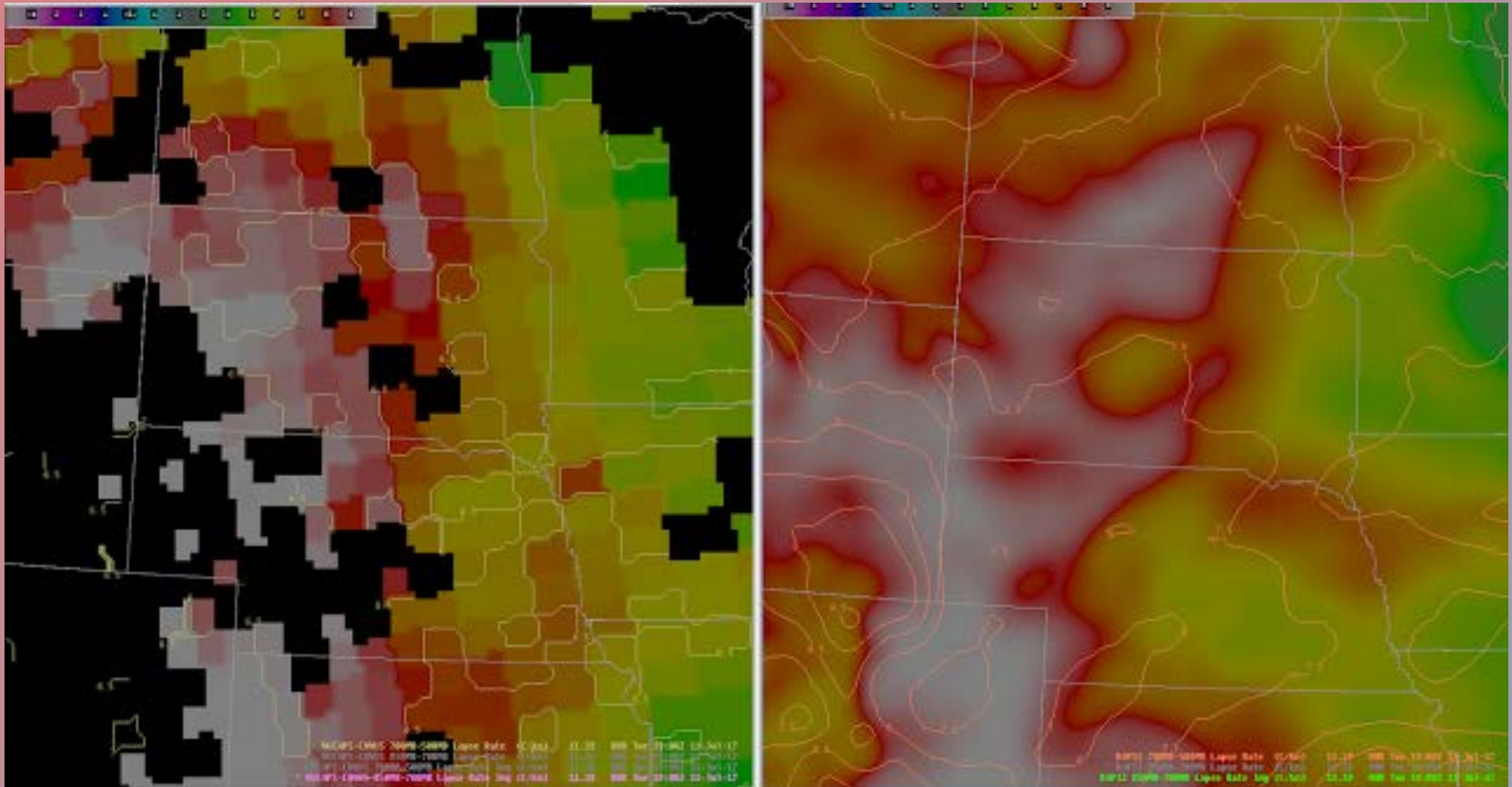
Using NUCAPS During Storm Interrogation
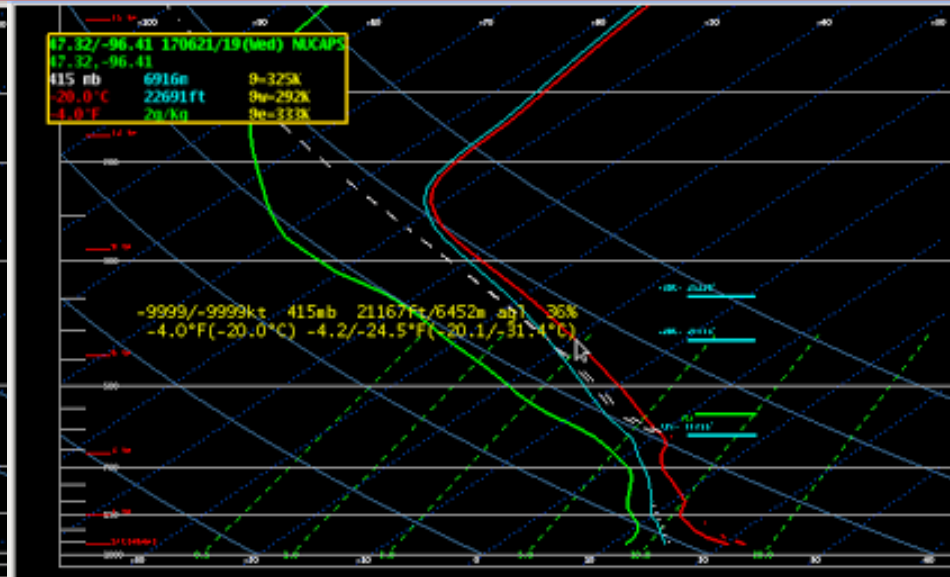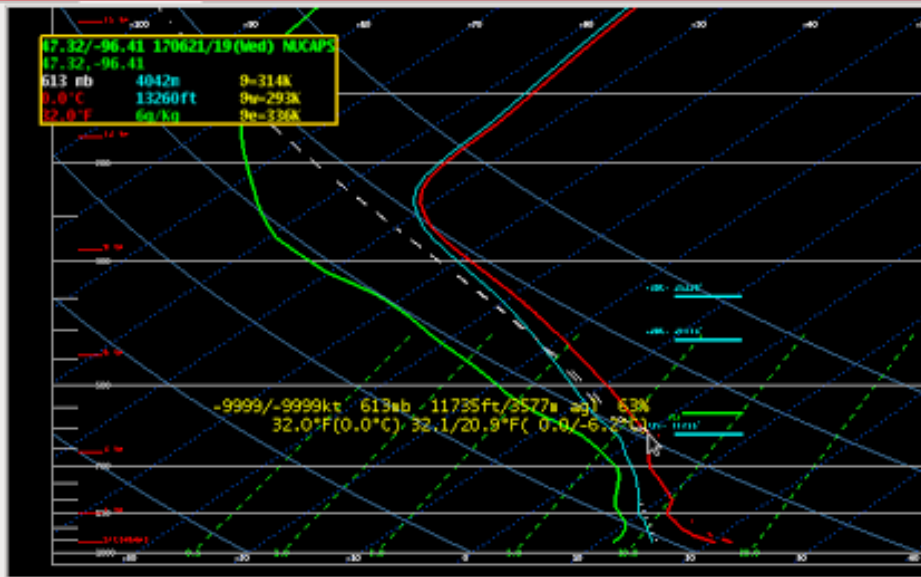
- Another use of the NUCAPS soundings is to quickly identify the 0C and -20C levels from an actual observation.
- "I found this information very valuable during warning operations."
- "I used these heights when assessing heights of 50 and 60 dBZ, which helped in my warning issuance. "

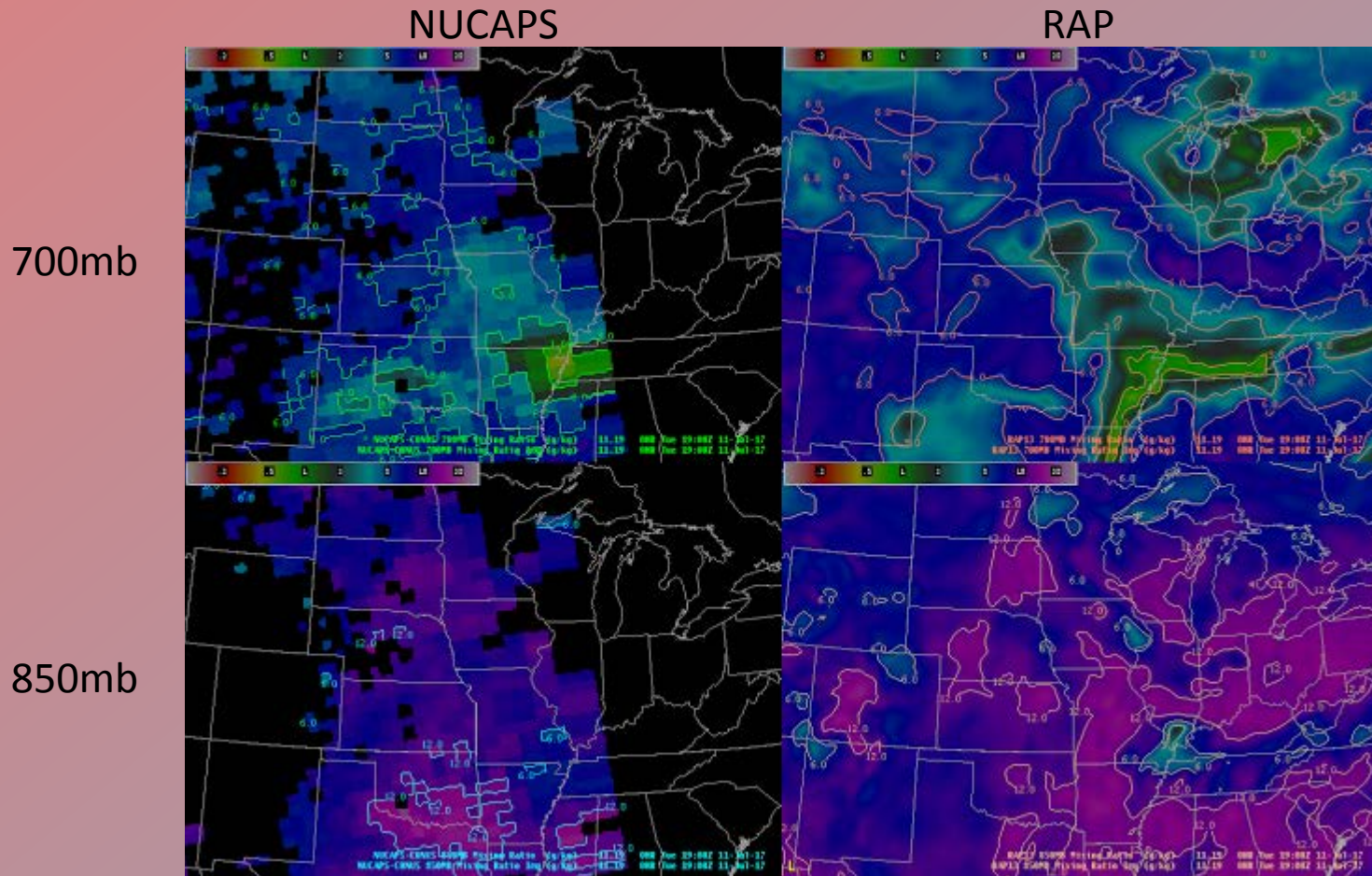# Operational vs. Experimental Soundings

Gridded NUCAPS

NUCAPS (left) and RAP (right) with a gridded 850-700mb Lapse Rates and 700-500mb LRs contoured.

"Overall, I think the NUCAPS data provides a good assessment of the mid level conditions in this case."

Gridded NUCAPS

NUCAPS　　　　　　　　RAP

700mb

850mb

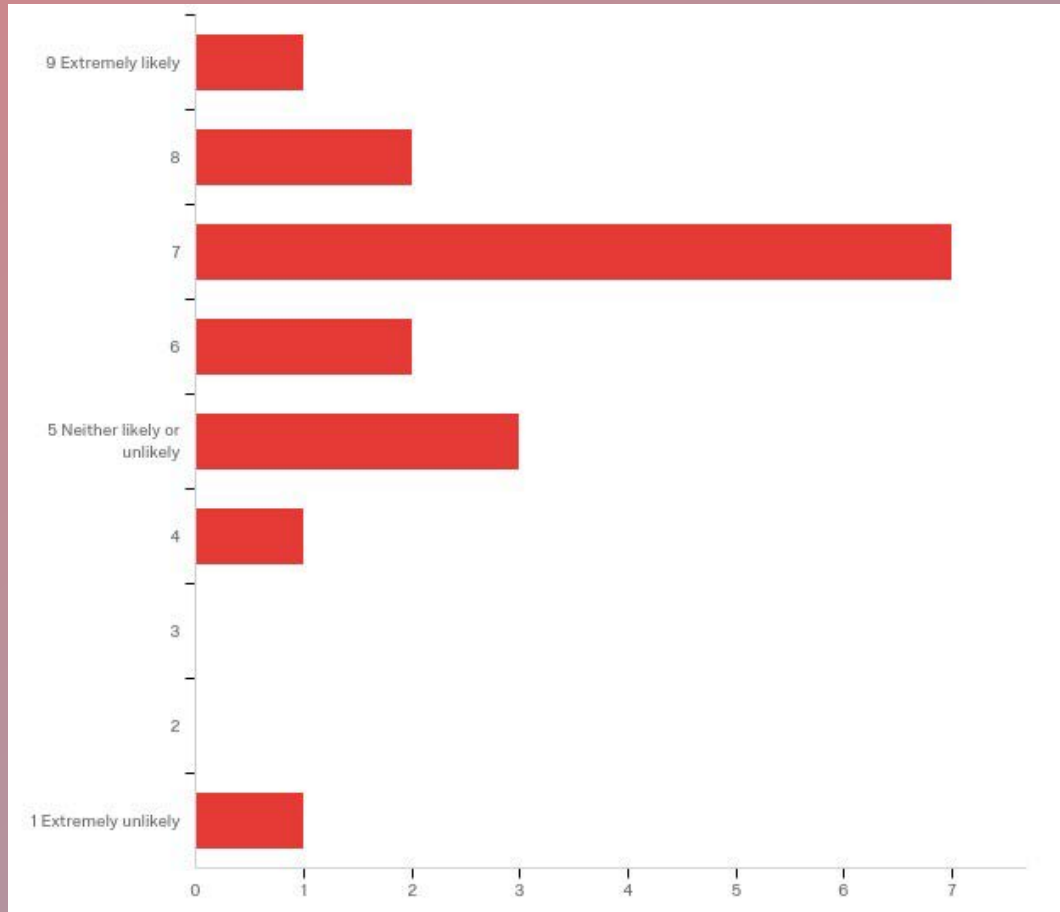"Thus, confidence may be a bit better at levels at or above 700mb, but not so good for 850mb or lower. Overall, as you get closer to the surface, it looks like there is a tendency for NUCAPS to trend towards a drier solution than the models."

Summary and Initial Feedback

How likely are you to use NUCAPS Products at your home office?

Summary and Initial Feedback

- Found the availability of NUCAPS soundings very beneficial in the field particularly for offices in the western U.S. and other data void regions.

- Some work can be done to increase its utility in the field (better temporal resolution, tailored fields of interest for a forecast, better gridded data viewing...little ragged at times, and training for forecast operations).

- It would very useful in the field to be able to get multiple passes during the day to be able to monitor evolution of fields of interest Like mixed layer depth evolution, monitoring inversion (stable layers) which are critical for downslope wind storms, air quality, convective suppression or cap breaking, and stability evolution (assuming better temporal resolution).

- Most see the utility in having both the operational NUCAPS soundings available alongside the experimental surface obs adjusted values. Even though the correction may be oversimplified in assuming a perfectly well mixed layer of moisture, it is still useful to see.

- Most like having both soundings and gridded data to get the full potential of the NUCAPS data.

- The gridded NUCAPS were found to be a little clunky at first but currently there are no easy menu options to view data and has to be built using the volume and product browsers. This would need to be streamlined greatly. The high vertical resolution is also valuable in that it allows you to evaluate plan views of temperature, moisture, possibly even heights of temperature surfaces (example freezing levels, -20, inversion heights) and whatever pressure level is available.

- Latency is still the main issue from using regularly in ops.

Improvement Ideas

- Would like to see a readout, similar to a ProbSevere readout, when sampling the dots of some important parameters such as: CAPE, Lapse Rates, Freezing Level, etc...

- Need some type of labeling (station ID) to identify the sounding points from each other, the Lat/Lon readout is insufficient to remember which point was chosen.

- Would like to be able to overlay multiple soundings at once. (May be AWIPS issue)

- Similarly, forecasters like the idea of using the pop-up Skew-T, but would like the readout of some parameters along with the pop-up sounding.

- Need more useful parameters for the gridded data like SBCAPE and other surface based indices instead of having to choose pressure levels. (Ex. 1000mb CAPE only along coasts and 925mb CAPE misses surface features most places besides the mountains.)

- Would like to see some type of winds get integrated within the soundings if possible.

Thank You!