

# Penn State Windsong Observations: PERiLS – Spring 2023



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*Other participants: Kyle Nardi, Jason Horne, Allen Mewhinney,  
Katie McKeown, Brandon Garcia, Bruno Rojas*

# Introduction: PSU Windsond Operations

**Goal:** Conduct high-frequency Windsond balloon launches before and during QLCS cold pool passage

Towards this goal, we participated in **IOPs 2, 3, and 4** in Spring 2023 (with varying degrees of success)

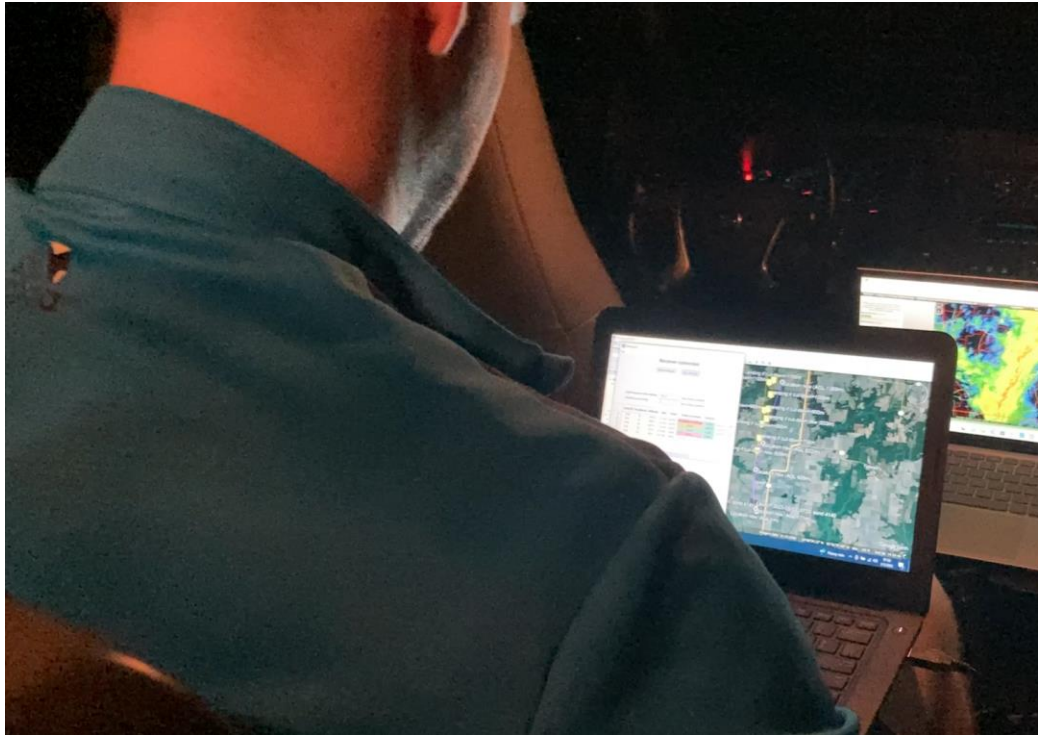


**IOP 2: 2 – 3 March 2023**

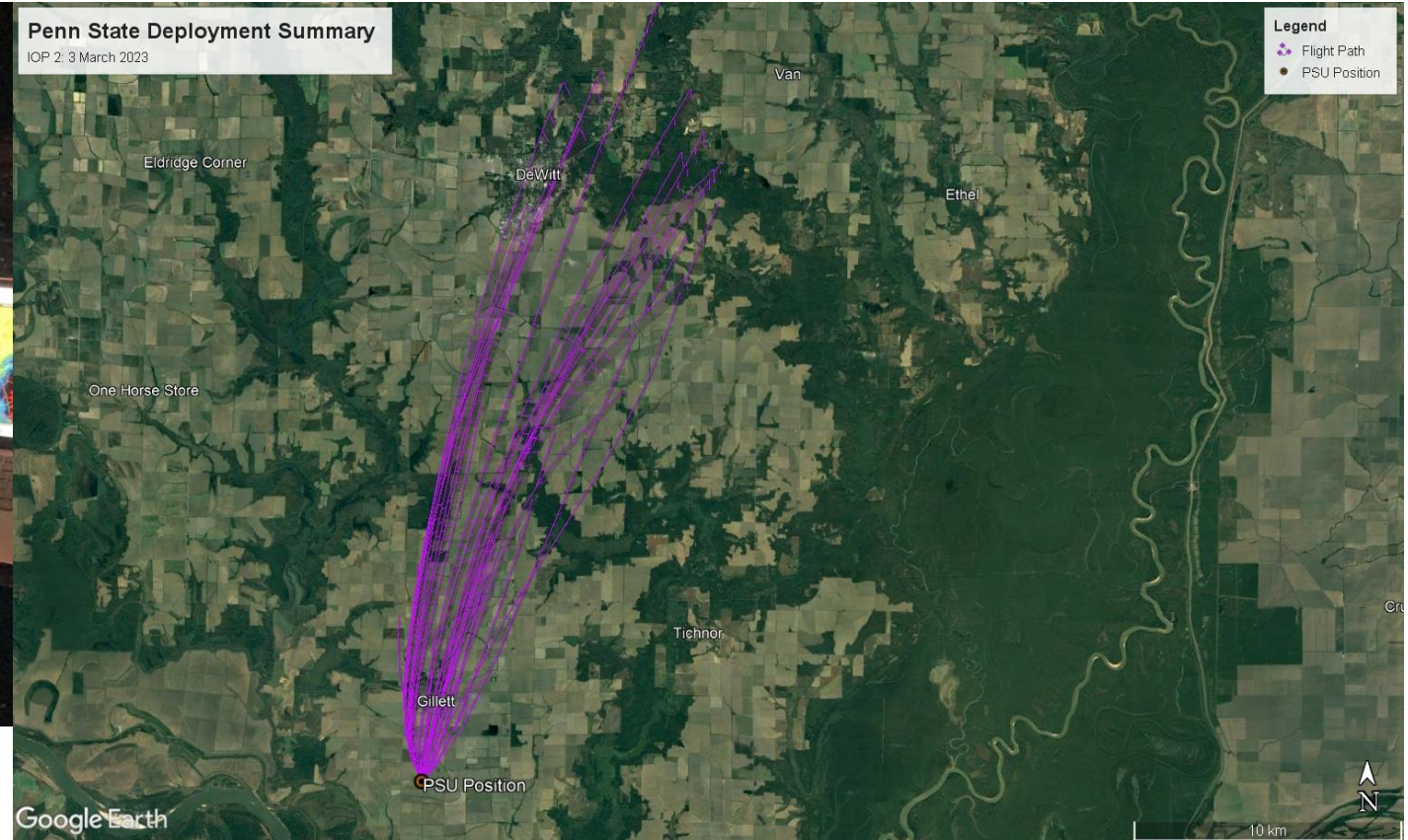
# IOP 2: 2–3 March 2023

## Deployment summary:

- Location: ~3 km south of Gillett, AR (34.0912°N, 91.3814°W)



Luke LeBel, Paul Markowski,  
Jason Horne



# IOP 2: 2–3 March 2023

## Deployment summary:

### • Launch period #1:

- 0728 UTC – 0922 UTC
- $n = 38$ , ~ every 3 minutes
- Launches occurred as a weakening nocturnal QLCS embedded in stratiform rainfall approached from the west and passed overhead

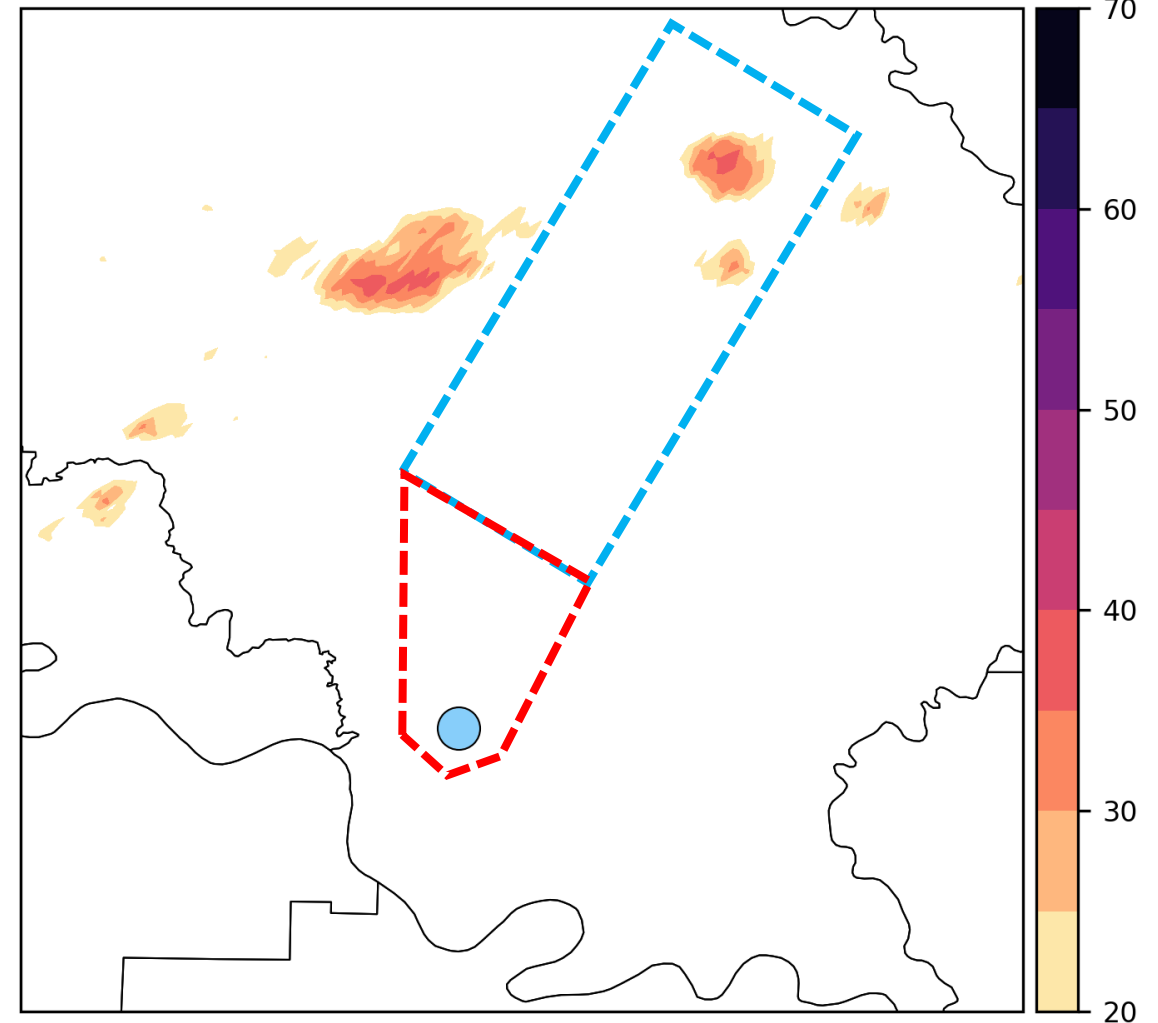
**Note:** we experienced (annoying) connection issues with our sondes during this IOP, often losing connection with sondes earlier than expected.

This issue also occurred in IOP3, before we were able to identify the problem in IOP4. The issues were restricted to one batch of sondes.

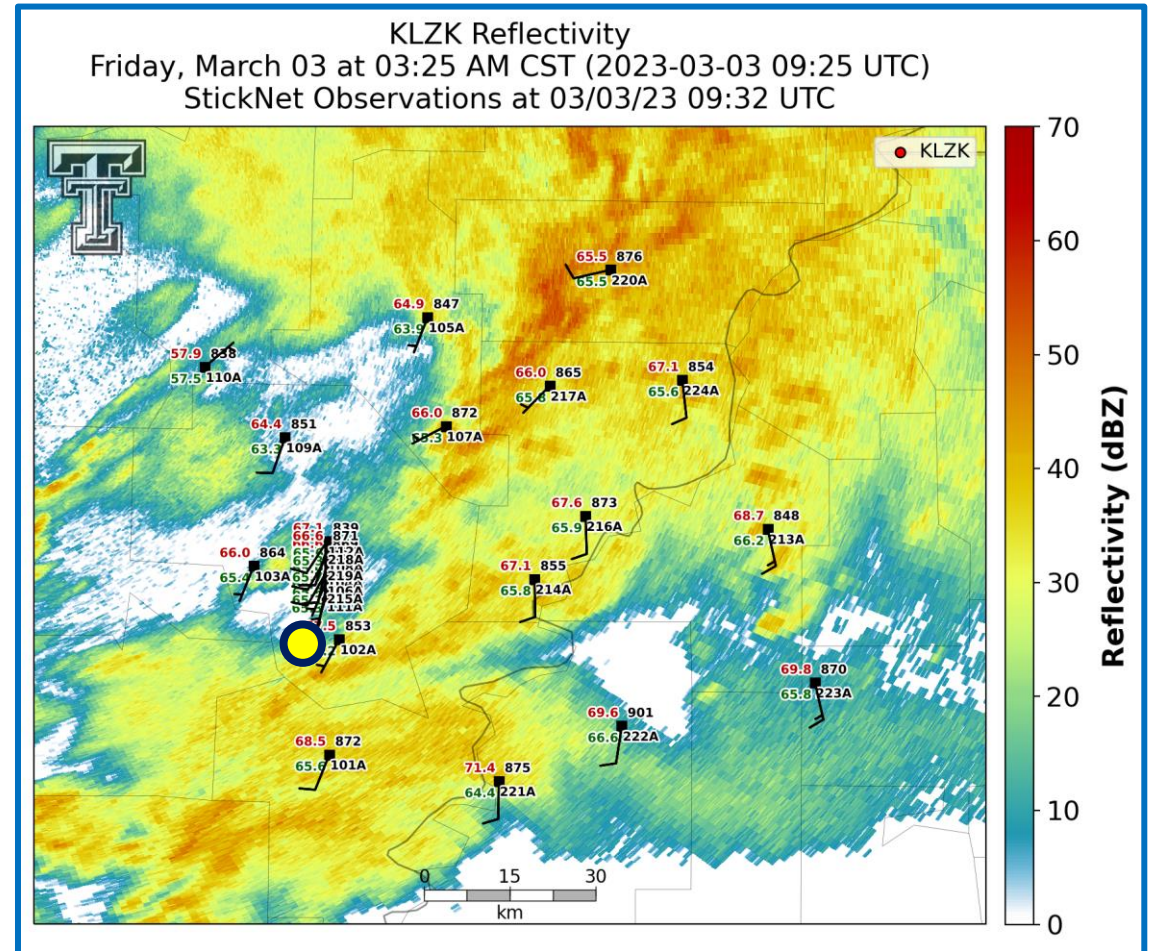
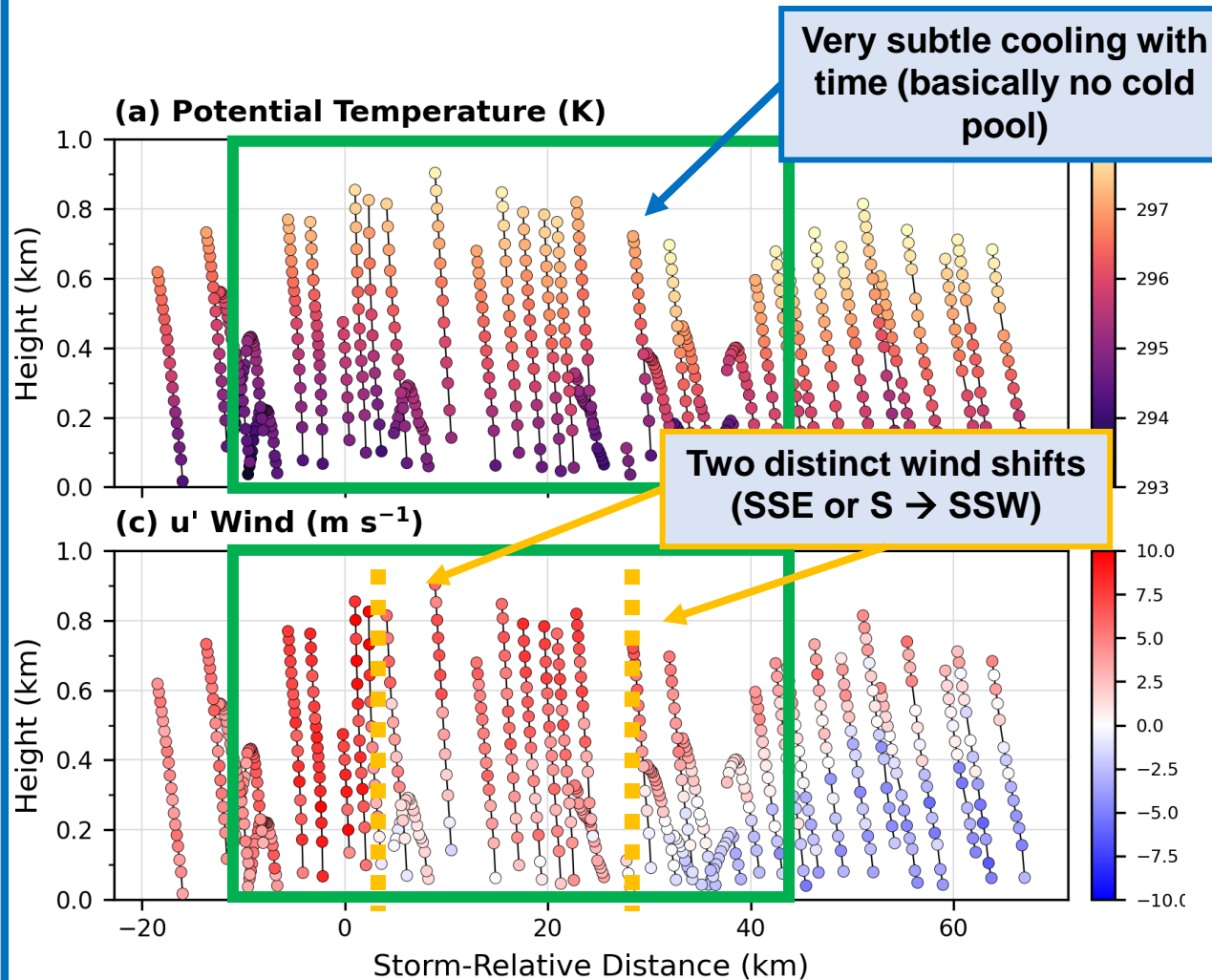
Despite these issues, we achieved very frequent sampling of the 0–1-km layer close to our site

Time: 07:25:00 UTC

Radar time: 07:24:23 UTC



# IOP 2: 2–3 March 2023



**IOP 3: 24 – 25 March 2023**

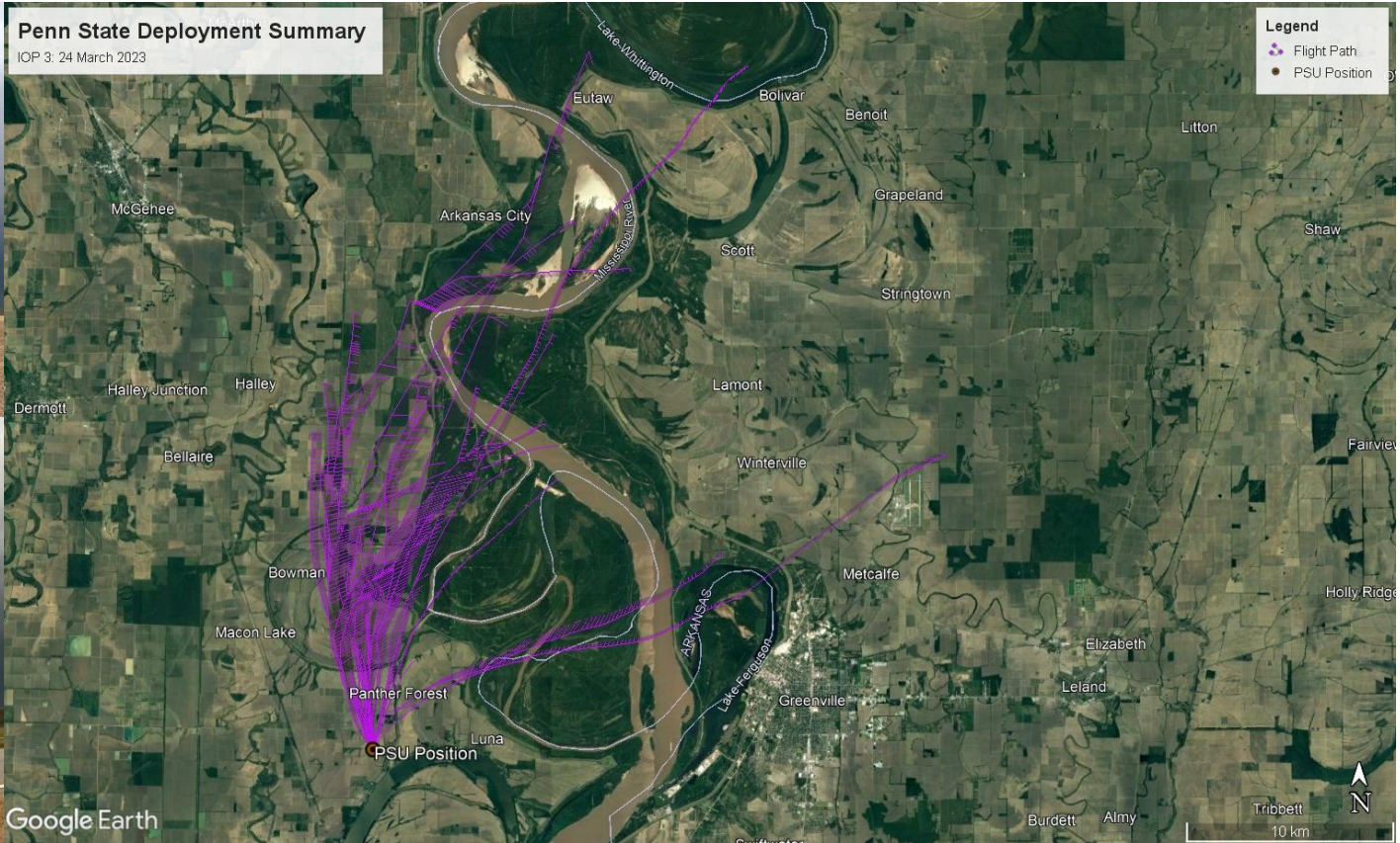
# IOP 3: 24–25 March 2023

## Deployment summary:

- Location: ~5 km north of Lake Village, AR ( $33.3790^{\circ}\text{N}$ ,  $91.2634^{\circ}\text{W}$ )
  - This was very close to one of the sounding teams (~350 m to our south)



Luke LeBel, Kyle Nardi,  
Allen Mewhinney





# IOP 3: 24–25 March 2023

## Deployment summary:

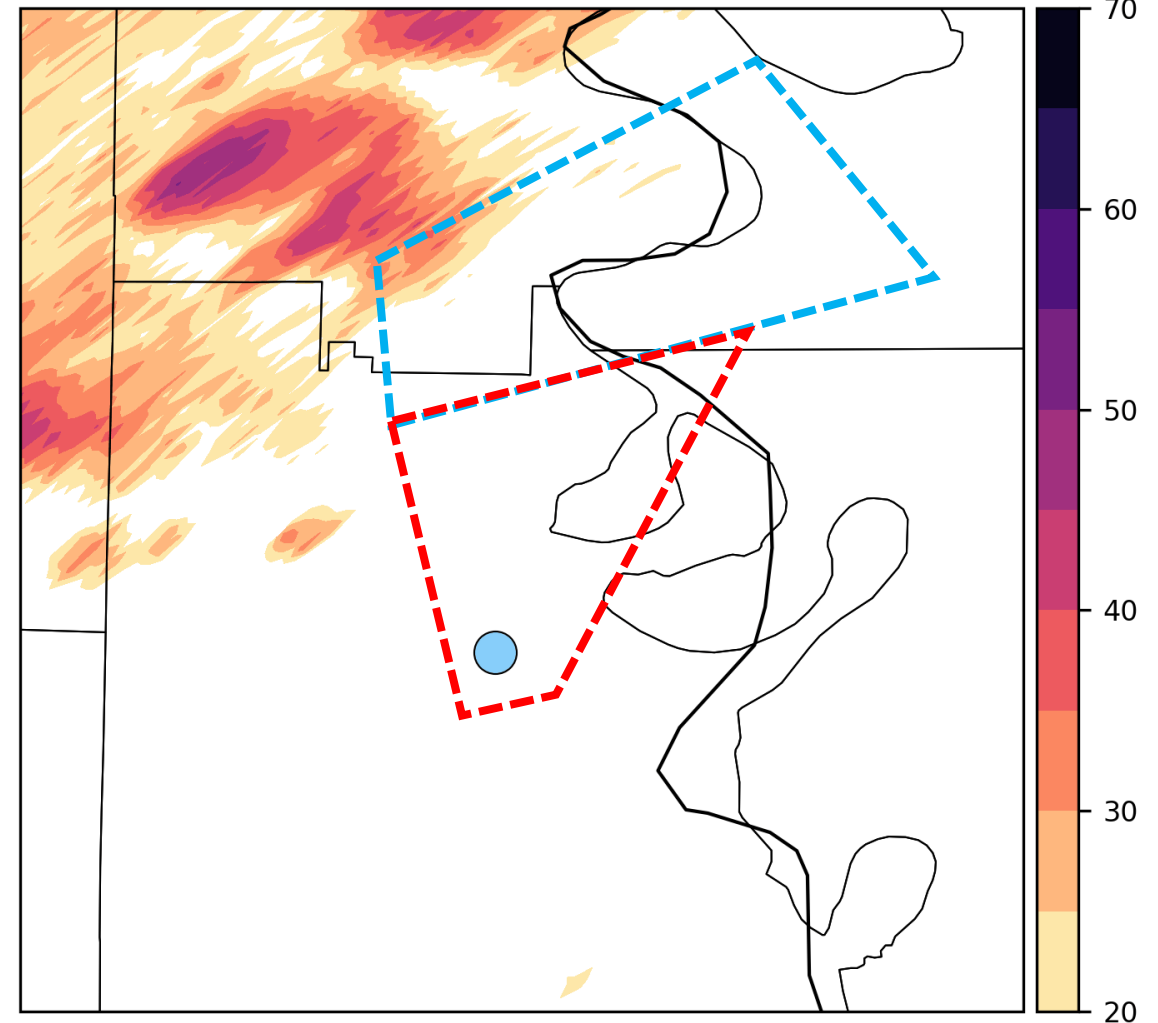
- Launch period #1:
  - 2232 UTC – 0009 UTC
  - $n = 25$ ; ~ every 1–3 minutes
  - Launches occurred as a tornado-warned supercell passed to our immediate north
  - Sondes sampled the near-field inflow and cold pool (and an additional circulation was embedded in the forward flank)

**Note:** the same connection issues as IOP2 impacted our data collection. We were not able to track sondes deep into the cold pool

Despite these issues, we achieved very frequent sampling of the 0–1-km layer close to our site, and reasonably good sampling of the forward flank + cold pool

Time: 22:30:00 UTC

Radar time: 22:29:08 UTC

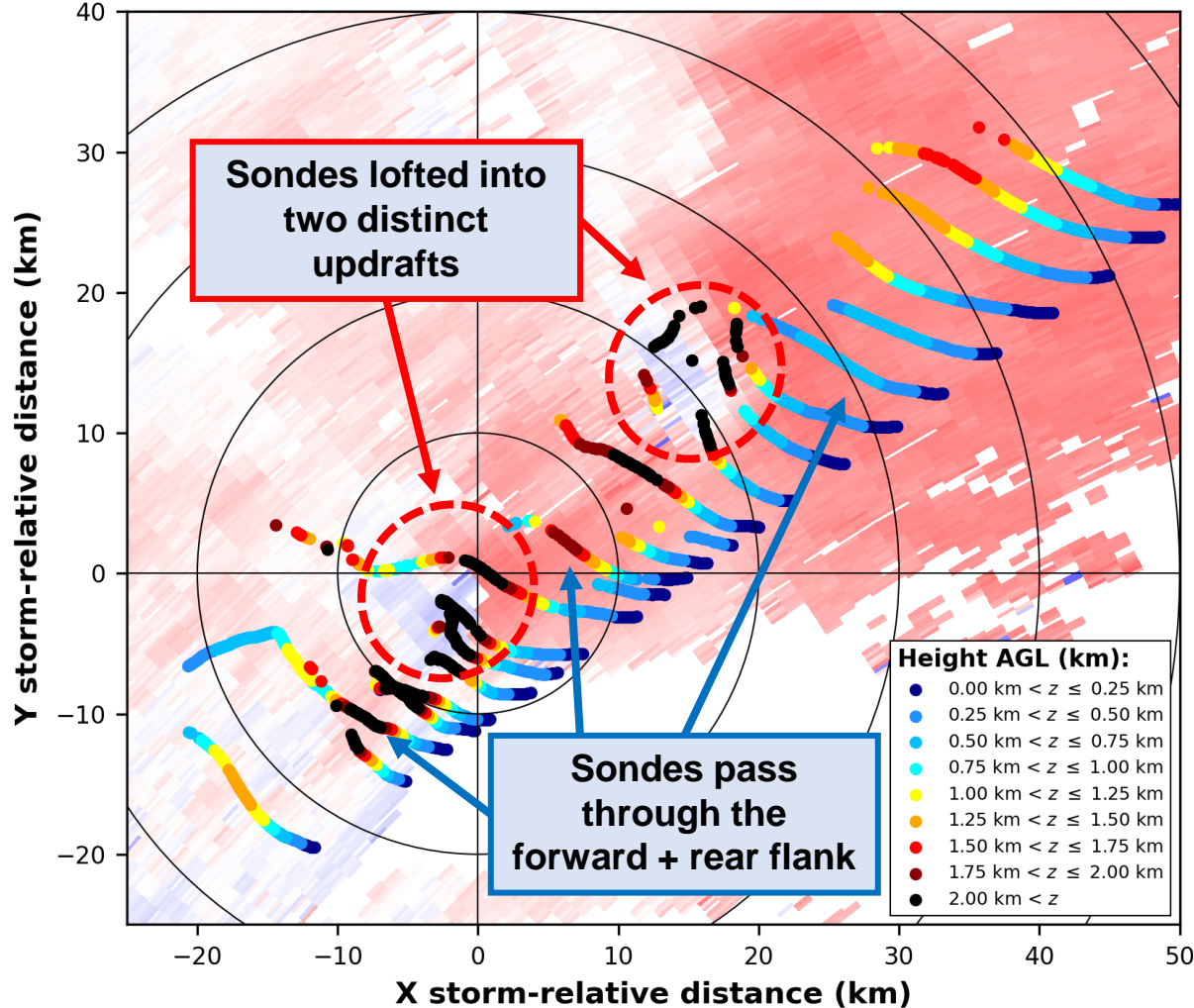


# IOP 3: 24–25 March 2023

## PSU Sondes : Storm – Relative Trajectories

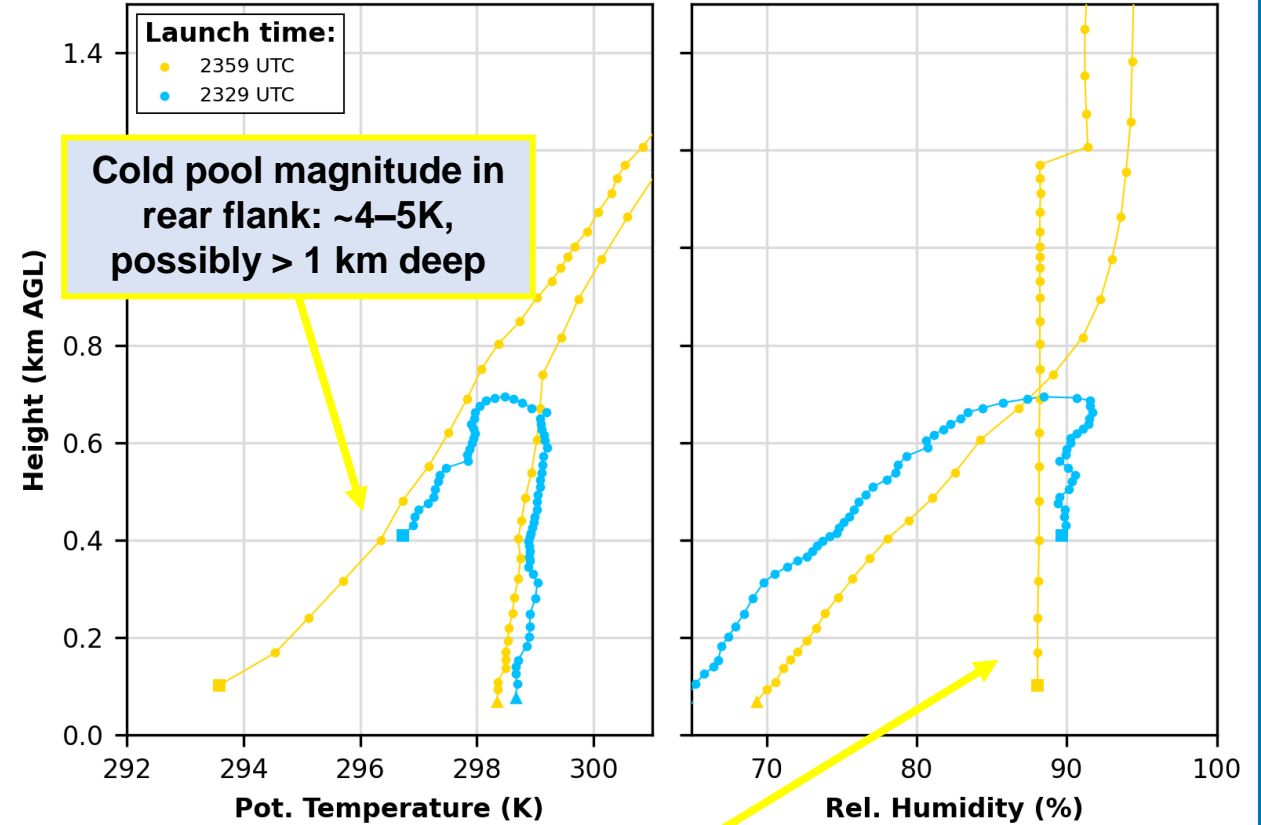
PERiLS IOP3: 24 March 2023

Radar time: 25 Mar 2023 00:04:50 UTC



## PSU Sondes : Supercell Evolution

PERiLS IOP3: 24 March 2023



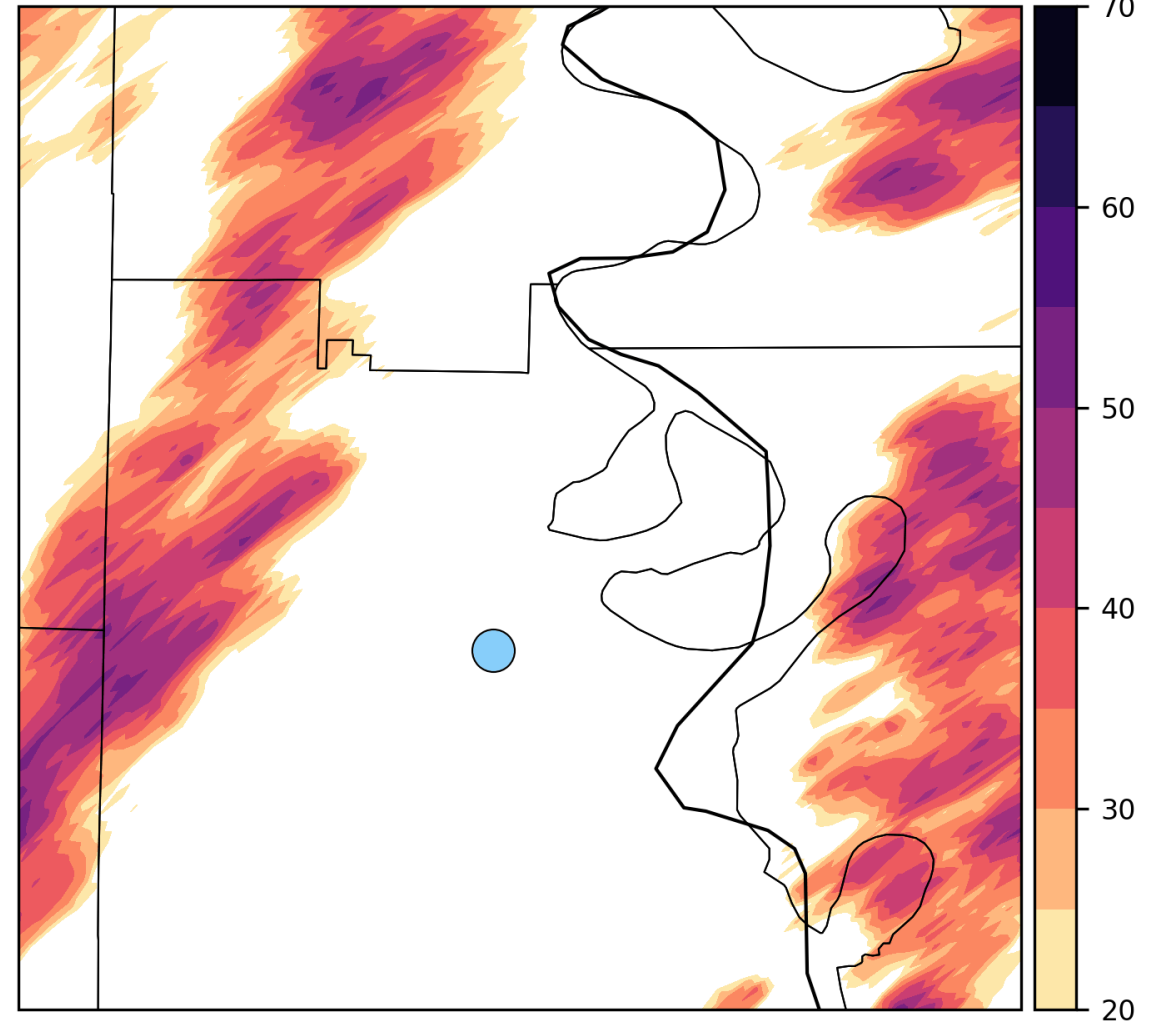
# IOP 3: 24–25 March 2023

## Deployment summary:

- Launch period #2:
  - 0101 UTC – 0112 UTC (n = 5)
  - Launches occurred ahead and during passage of a developing subsevere QLCS (including during a period of very heavy rainfall and gusty winds at the surface)

Time: 01:00:00 UTC

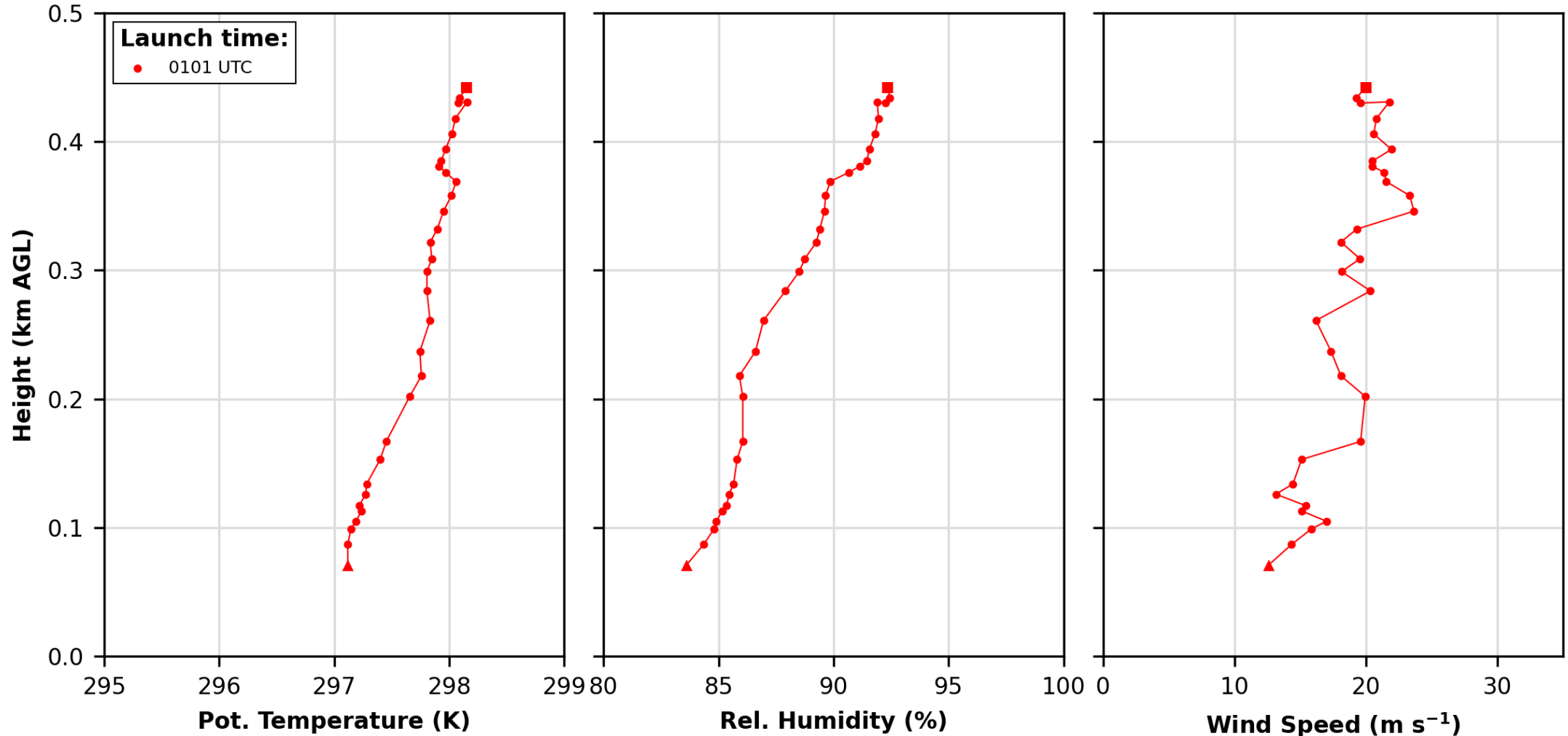
Radar time: 00:54:28 UTC



# IOP 3: 24–25 March 2023

## PSU Sondes: QLCS Evolution

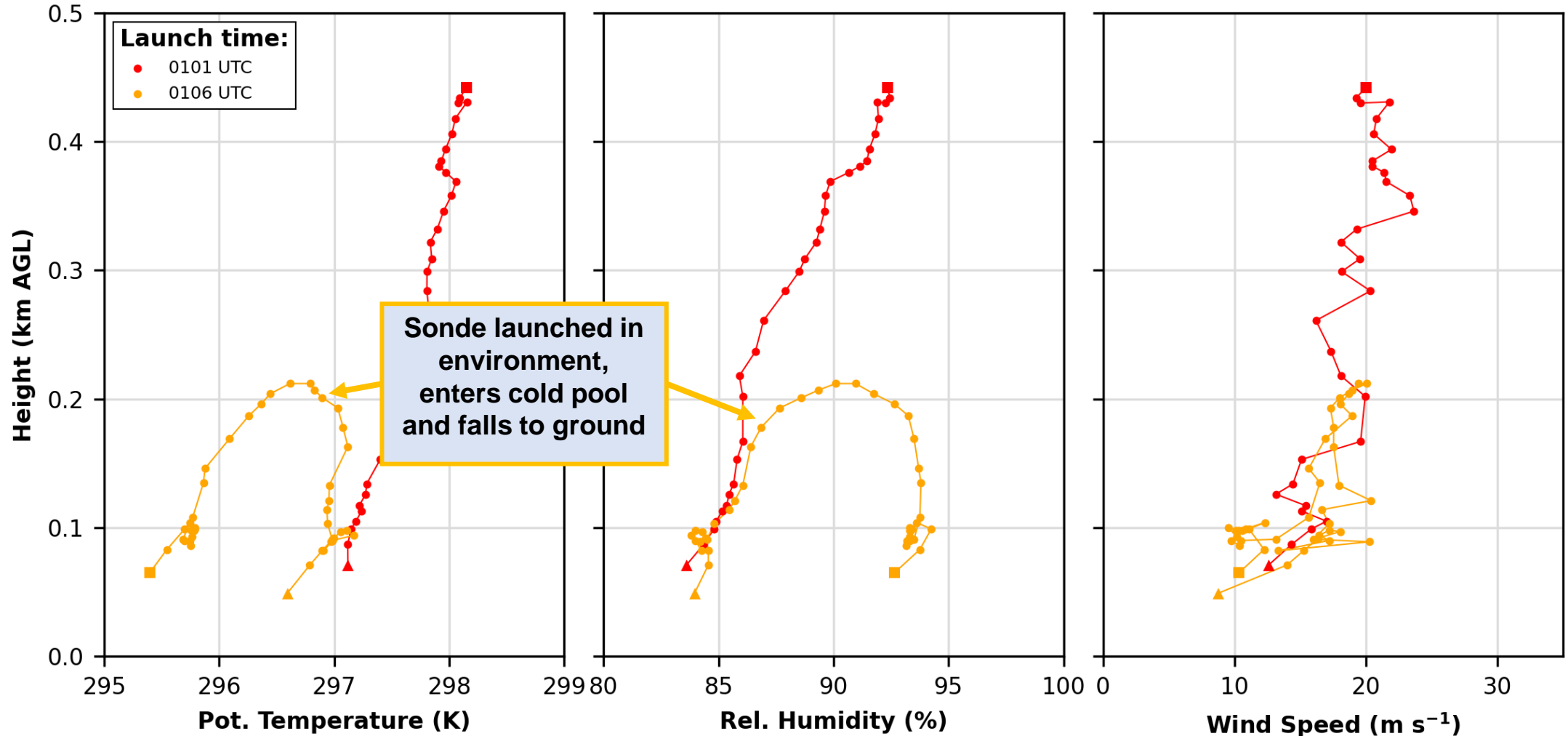
PERiLS IOP3: 24 March 2023



# IOP 3: 24–25 March 2023

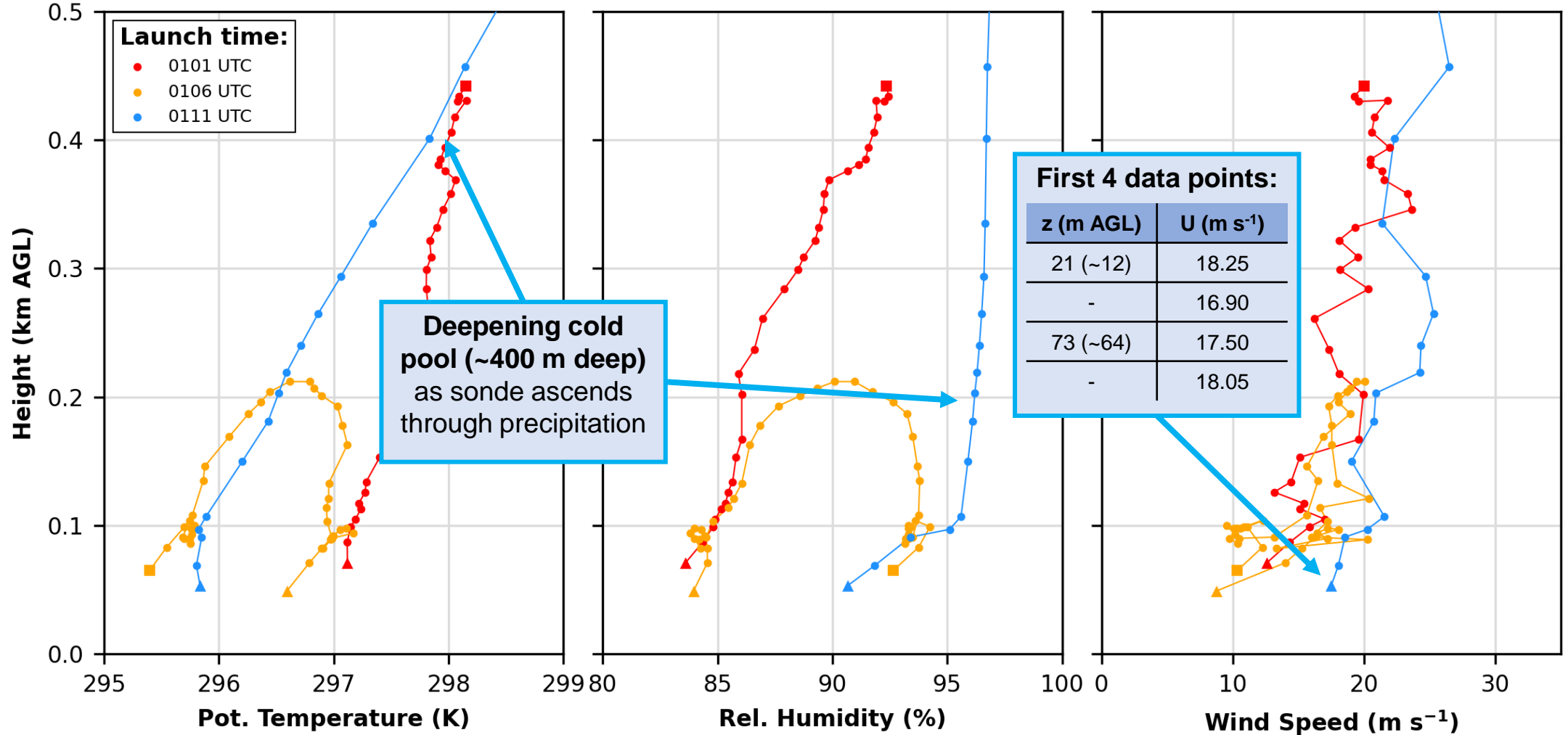
## PSU Sondes: QLCS Evolution

PERiLS IOP3: 24 March 2023



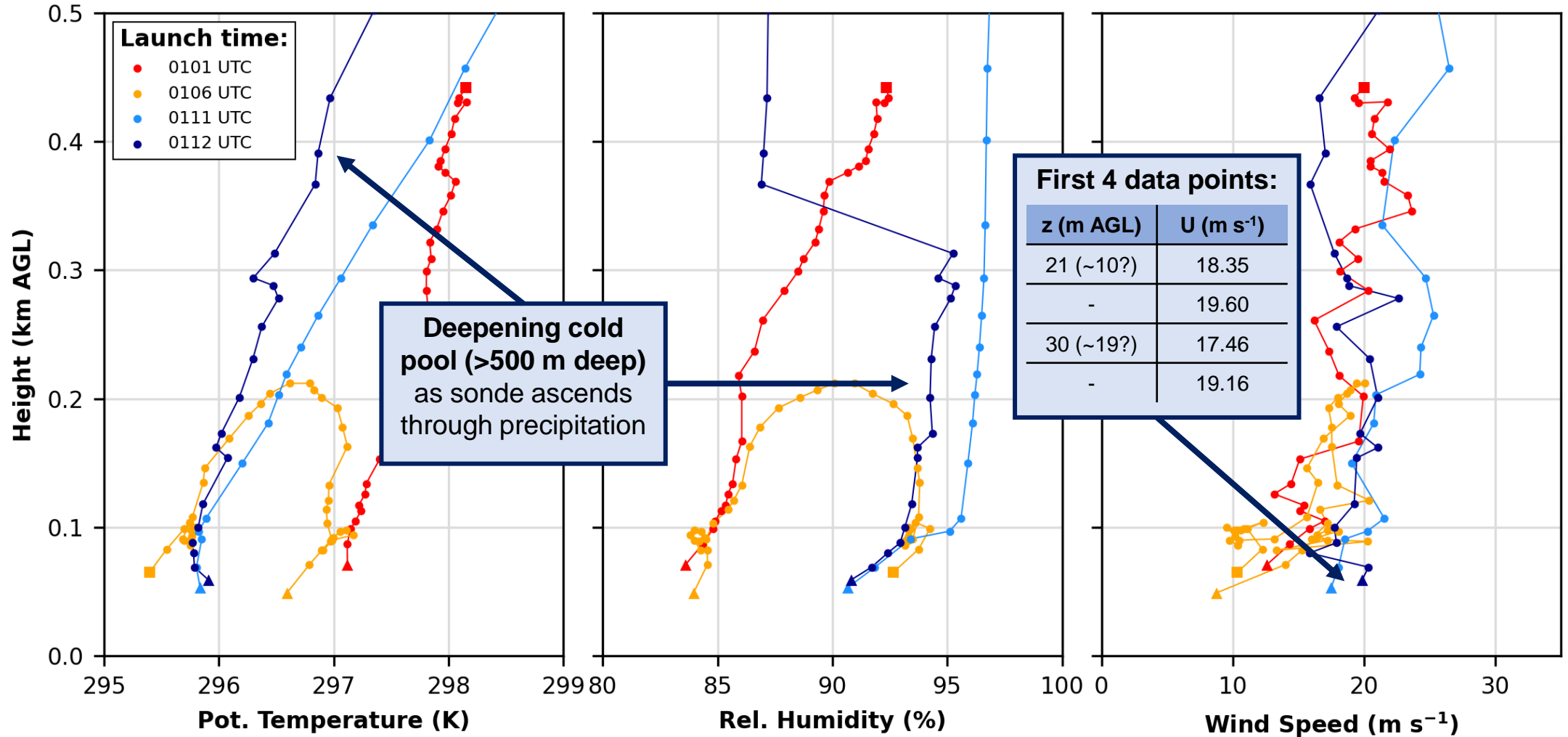
# IOP 3: 24–25 March 2023

## PSU Sondes: QLCS Evolution PERiLS IOP3: 24 March 2023



# IOP 3: 24–25 March 2023

## PSU Sondes: QLCS Evolution PERiLS IOP3: 24 March 2023



**IOP 4: 31 March – 1 April 2023**



# IOP 4: 31 March – 1 April 2023

## Deployment summary:

- Location: ~15 km west of Florence, AL (34.8303°N, 87.8610°W)

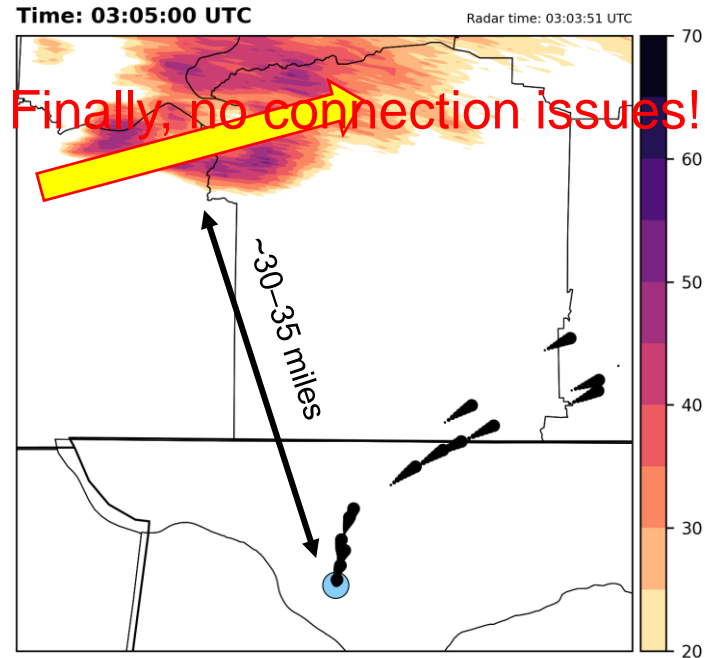


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# IOP 4: 31 March – 1 April 2023

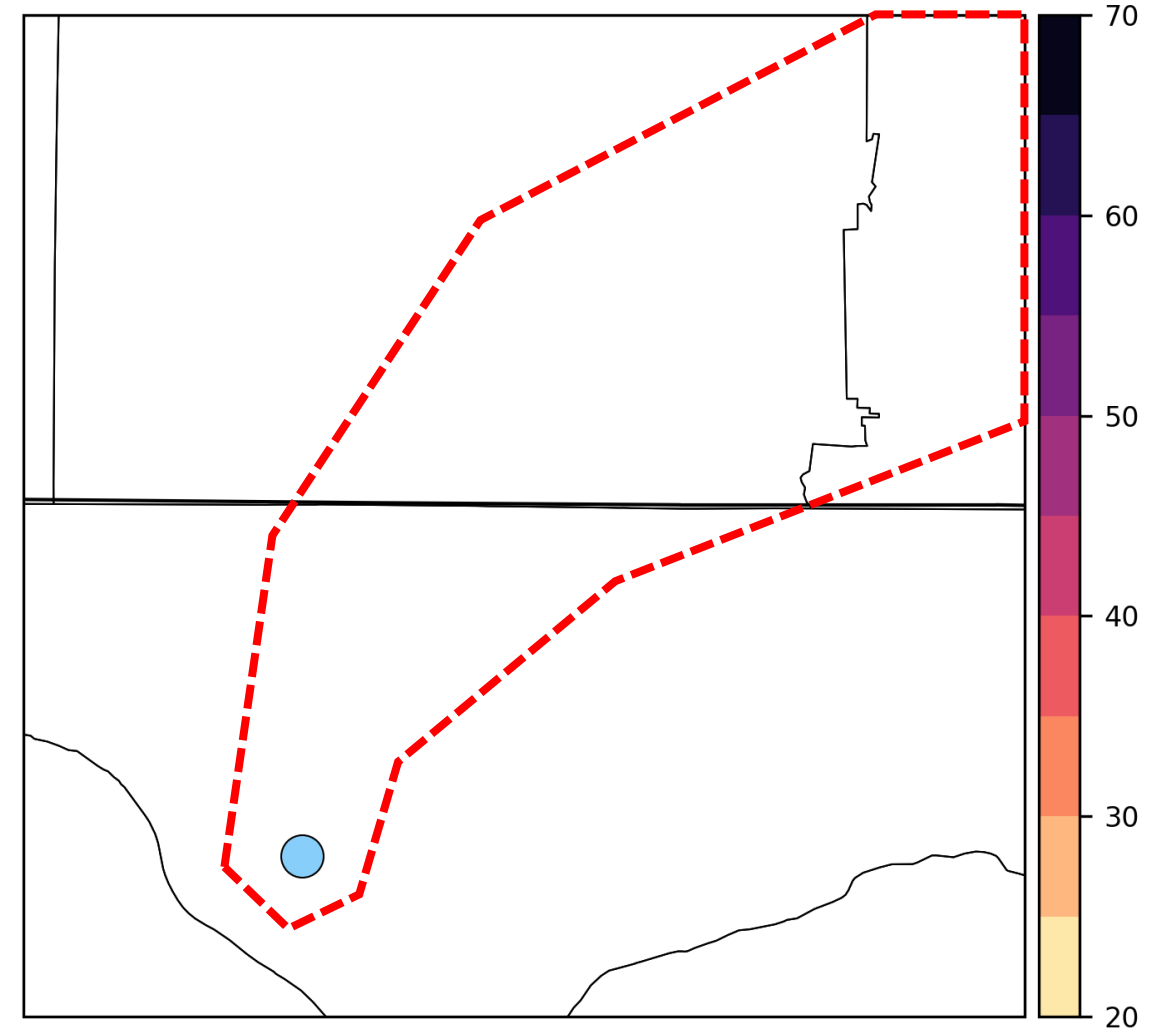
## Deployment summary:

- Launch period #1:
  - 0211 UTC – 0316 UTC
  - $n = 34$ ; ~ every 1–3 minutes
  - Sondes sampled the (very) far-field inflow of a strong supercell well to our north



Time: 02:10:00 UTC

Radar time: 02:09:50 UTC



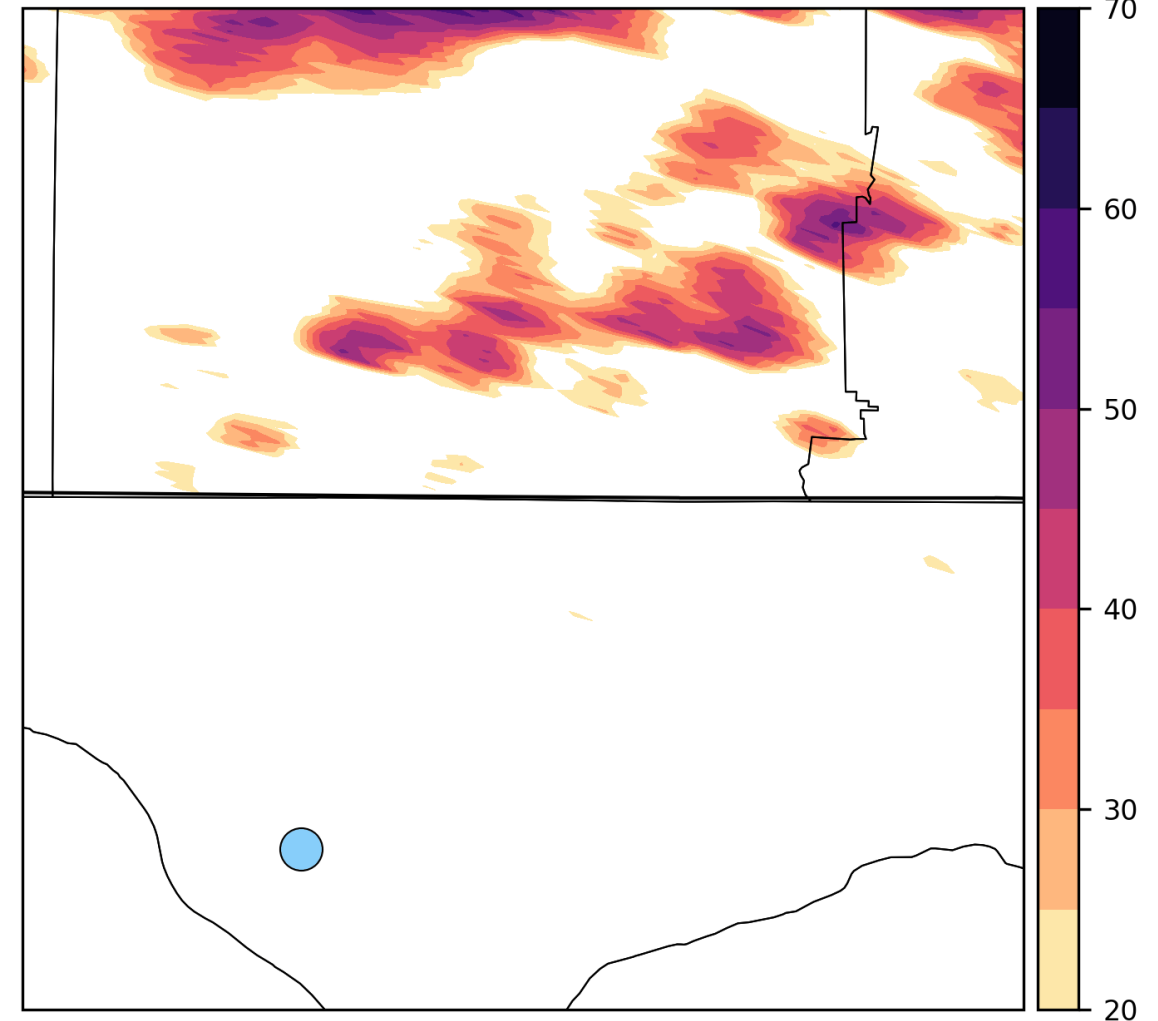
# IOP 4: 31 March – 1 April 2023

## Deployment summary:

- Launch period #2:
  - 0552 UTC – 0606 UTC
  - $n = 7$ ; ~ every 1–3 minutes
  - Launches occurred as a broken line of supercells/developing QLCS approached our location

Time: 05:50:00 UTC

Radar time: 05:49:00 UTC



# Summary

# Summary: PSU Windsond Observations

## Observations were collected for 2023 IOPs 2, 3, and 4:

- a) **IOP 2:** Rapid (every ~3 minutes) balloon launches throughout the passage of a weakening, nocturnal QLCS that was embedded within stratiform rainfall
- b) **IOP 3:** Rapid (every ~1–3 minutes) balloon launches in the near-inflow region of a nontornadic (but tornado-warned) supercell with a few balloons reaching the supercell cold pool; a small number of balloon launches before and within a developing sub-severe QLCS
- c) **IOP 4:** Rapid (every ~1–3 minutes) launches in the far-inflow region of a weakening tornadic supercell thunderstorm; a small number of balloon launches in advance of a tornado-warned supercell/developing QLCS

**Proof of concept:** Windsonds can be *safely* and *rapidly* launched for QLCS applications, *including in heavy precipitation*. This is very encouraging for the future use of such balloon-borne observation systems in QLCS research endeavors.

*If you are interested in using these observations in research, please feel free to contact me at [ljl5305@psu.edu](mailto:ljl5305@psu.edu)*

*Our observations will also be made available soon via the EOL Field Data Archive*