

COSMIC-2 Radio Occultation Temperature and Water Vapor Soundings during Hurricane Ian (2022)

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Introduction

- This research project was focused on **comparing dropsonde and model profiles of temperature and dew point temperature to radio occultation (RO) measurements** during intensification of tropical cyclones.
- We did a **case study on Hurricane Ian (2022)**.
- COSMIC-2 consists of 6 satellites in low Earth orbit that use Radio Occultation (RO) measurements to provide vertical profiles of temperature and water vapor in areas usually sparse in data.
- Radio occultation (RO) consists of capturing GPS signals and the bending angle they experience due to differences in the density of the atmosphere.

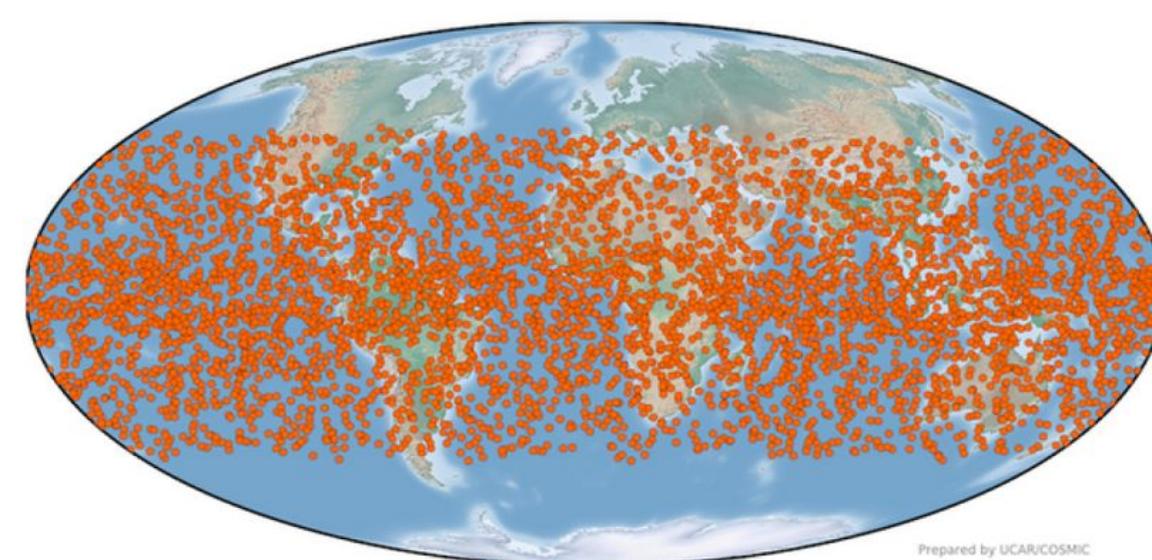
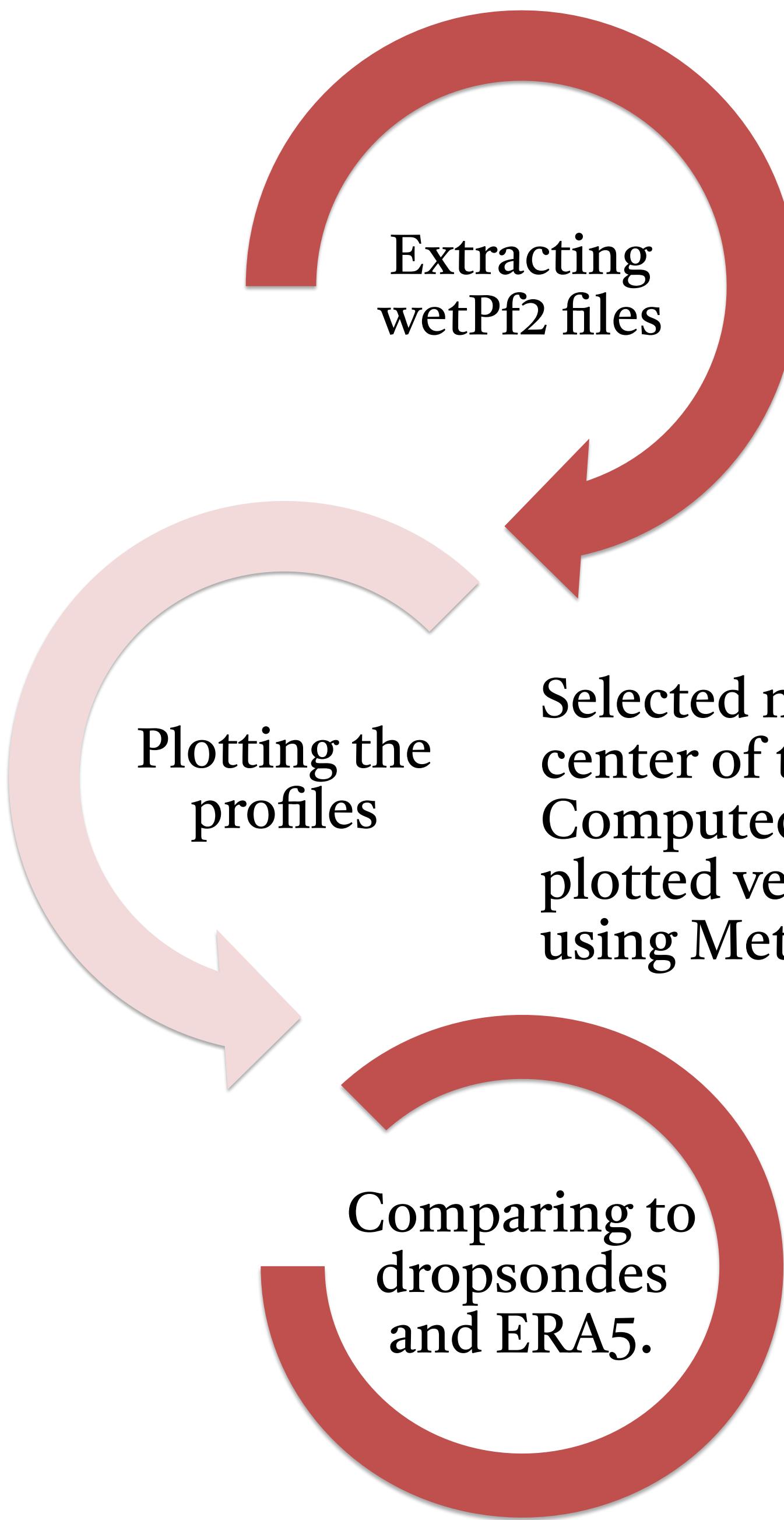


Fig. 1: Coverage of COSMIC-2 RO for October 1, 2019.

Methodology



- First step, wet profile files were extracted from the COSMIC Data Analysis and Archive Center for days September 27-29, 2022.

Selected nearest RO soundings to the center of the storm (less than 300 km). Computed dew point from RH and plotted vertical thermodynamic profile using MetPy tools.

Plotted the vertical profile of dew point and temperature for these measurements and compared to RO soundings.

Results

A. RO observed soundings

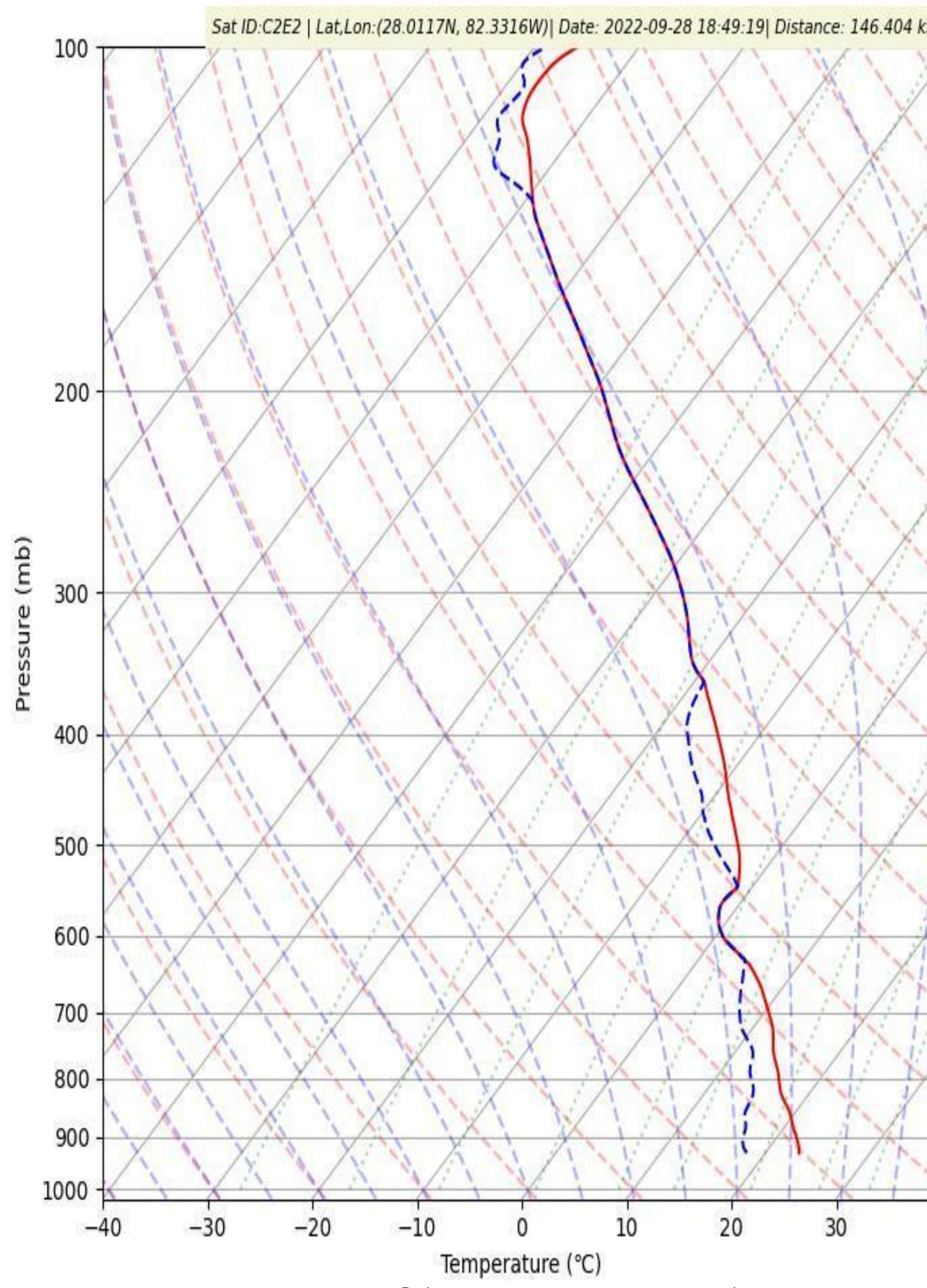


Fig. 2: RO profile on September 28, 2022 at 18:49 UTC. Distance from track: 146 km

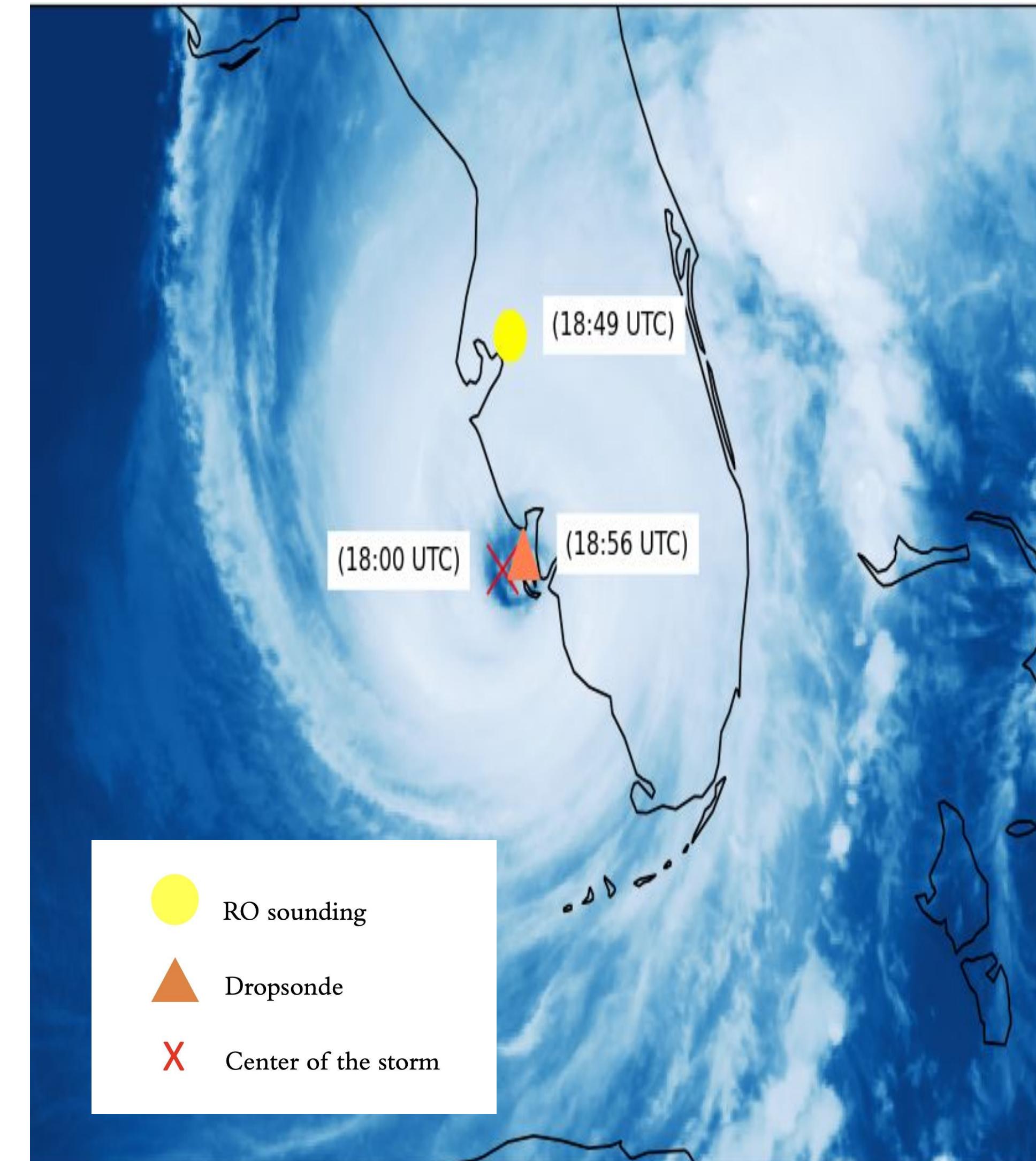


Fig. 3: GOES-16 Satellite image on September 28, 2022 at 18:45 UTC.

B. Comparison to dropsondes and ERA5 reanalysis model

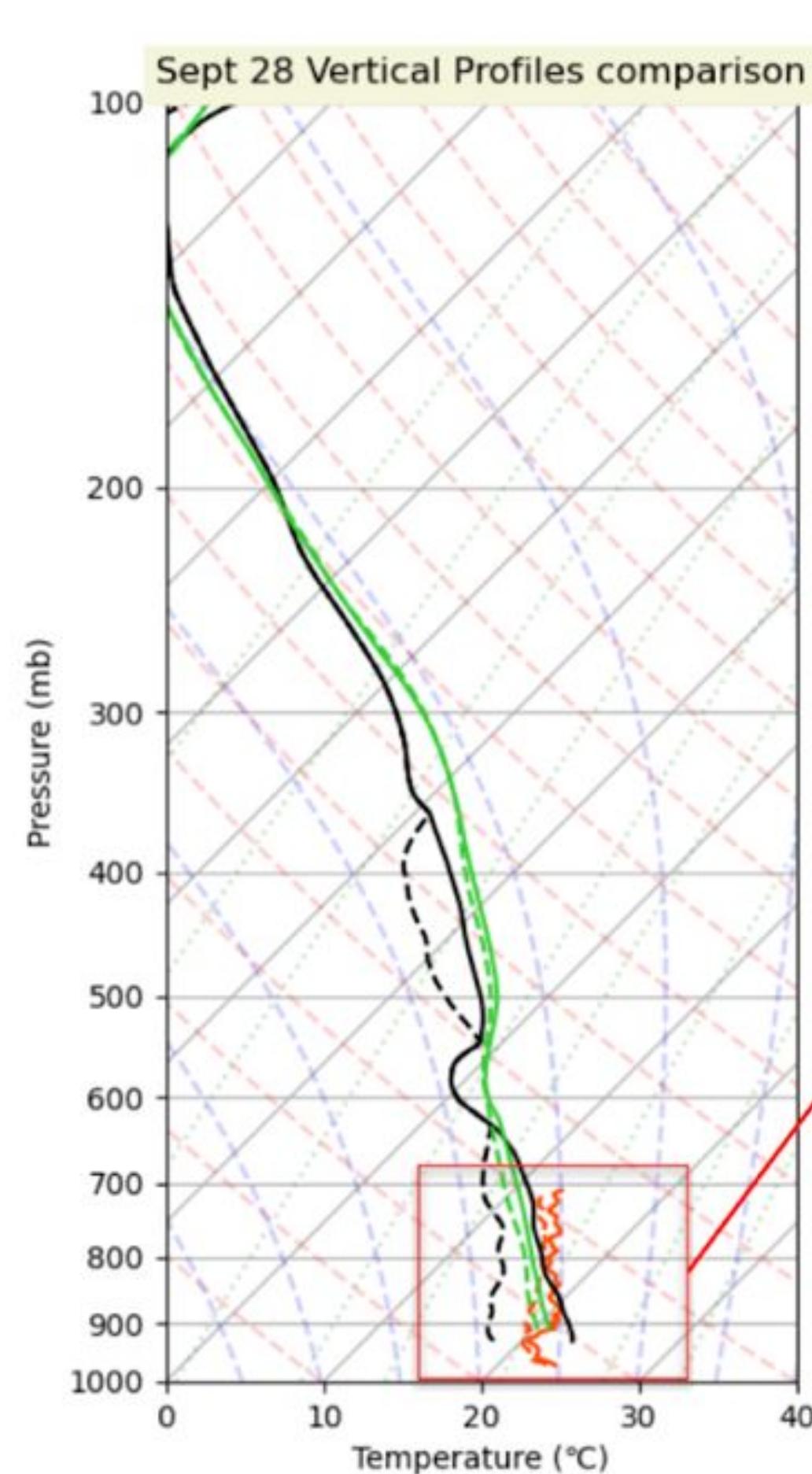


Fig. 4: Comparison of RO sounding for September 28, 2022 at 18:49 UTC, ERA5 reanalysis and dropsonde measurements. Distance and time difference between RO sounding and dropsonde launch: 150 km and 0:12 h.

Discussion

A. RO observed soundings

- Soundings from RO on September 28 and September 27 capture saturation from 350 mb. Dense cloud structures can be observed in RO soundings.
- For September 29, the sounding falls outside of the cloud area of the system but are a good reference of how RO capture drier environments

B. Comparison to dropsondes and ERA5 reanalysis model

- Differences between the measurements types in terms of temperature and dew point temperature are less than 3°C in most profiles.

The employment of RO measurements can complement aircraft, radiosondes, dropsondes and other satellites observations.

Future work

- As next steps for this research project we would add to the comparison the models MERRA-2, JRA and GFS and work on additional hurricanes case studies.
- Future areas of study could hurricanes upper to lower stratosphere effects.

Acknowledgements

- This material is based upon work supported by the National Science Foundation under Grant No. AGS-2230301 (SOARS). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
- Special thanks to my research mentors: Richard Anthes, Jon Starr, Bill Randel and John Braun, computing mentor Keith Maull, writing mentor Abigail Smith/ Andrea Ray, community mentor Rosimar Rios-Berrios and peer mentor Jennifer Zaragoza.

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