



Environmental Moisture and Wind Conditions for Tropical Storm Cindy (2017) Observed by NASA CPEX

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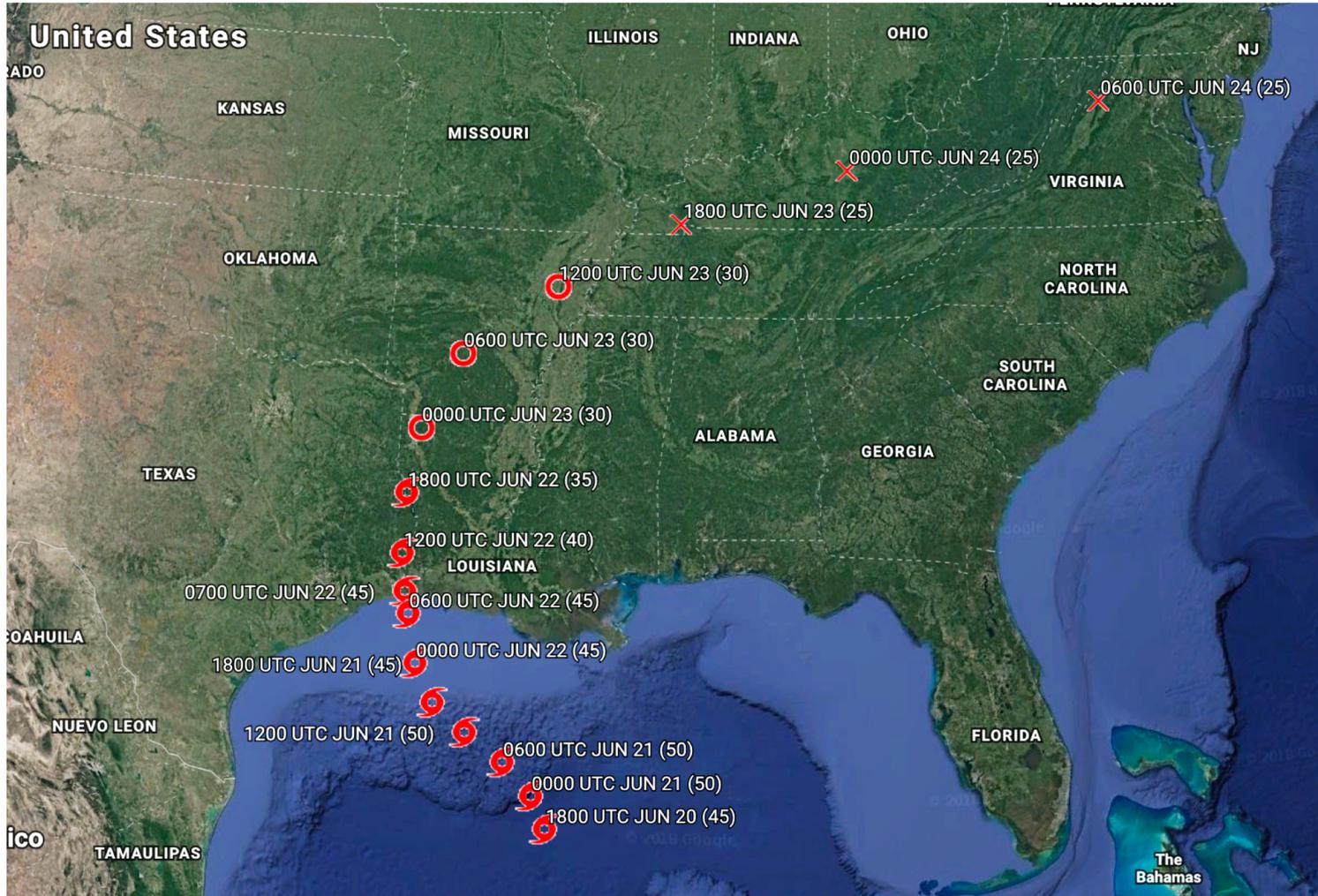
¹Jet Propulsion Laboratory, California Institute of
Technology, Pasadena, CA

²University of Washington, Seattle, WA

Introduction

- Environmental humidity and wind shear are important factors that influence tropical cyclone genesis and storm development.
- CPEX field campaign captured the environmental thermodynamic and dynamic conditions as well as convective structure of the Tropical Storm Cindy (2017) from pre-storm disturbances to developing stages.
- We are interested in how environmental conditions affect Cindy's development.
- ❖ Step 1: Document the storm development using CPEX aircraft measurements and satellite observations
- ❖ Step 2: Conduct WRF simulations to investigate the effects of environment humidity and wind shear on Cindy's development

Tropical Storm Cindy (2017)

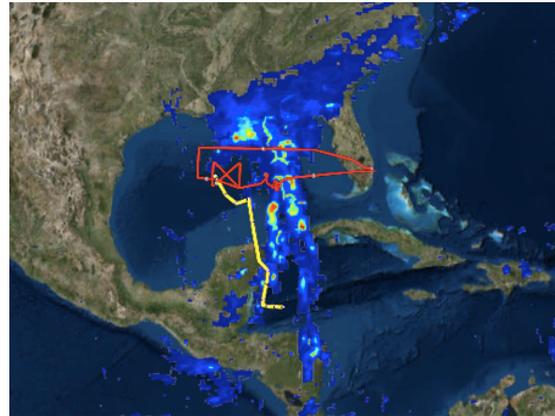


Satellite Observations

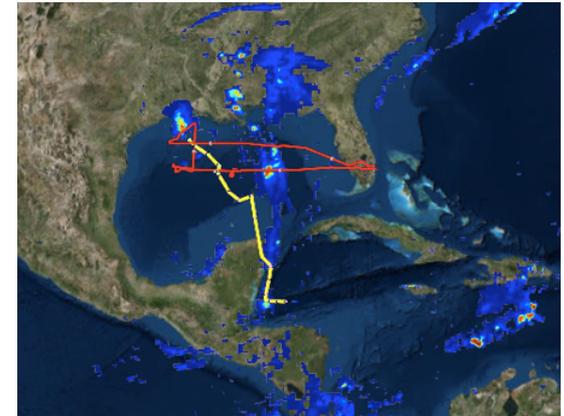
IMERG GPM Rain Rate



June 19

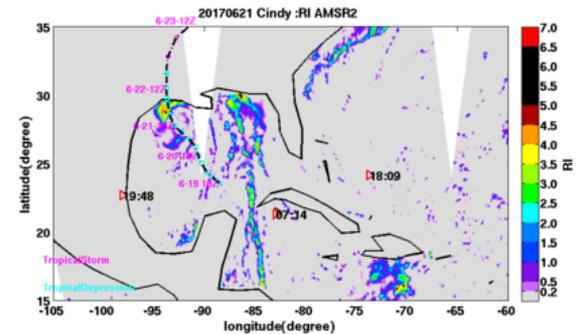
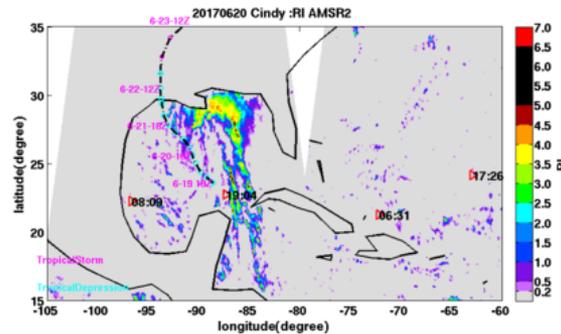
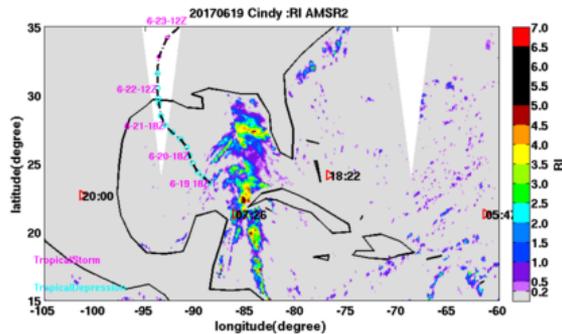


June 20



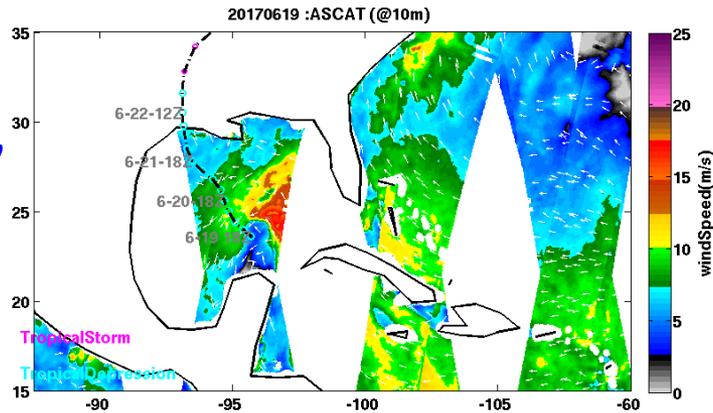
June 21

Rain Index by AMSR-2



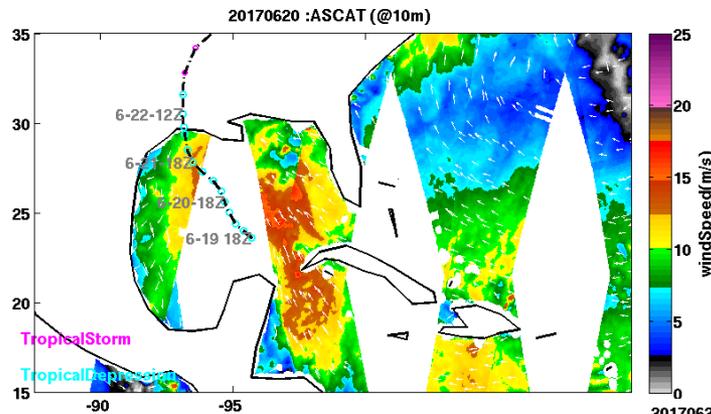
Satellite Observations

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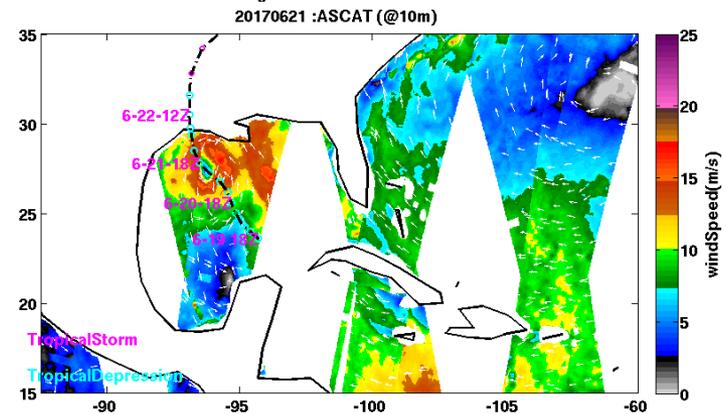


ASCAT Surface Wind

6/20/2017



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Environmental Relative Humidity

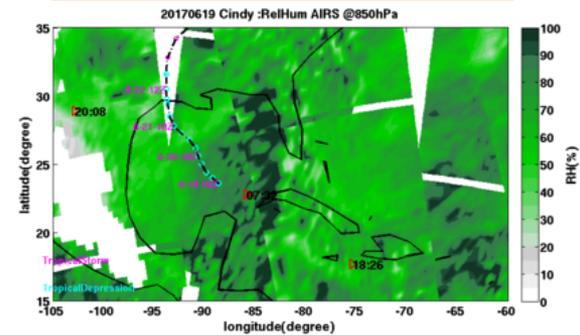
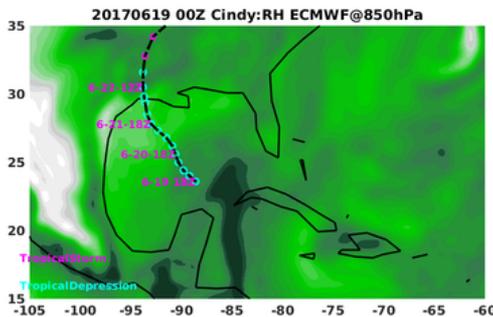
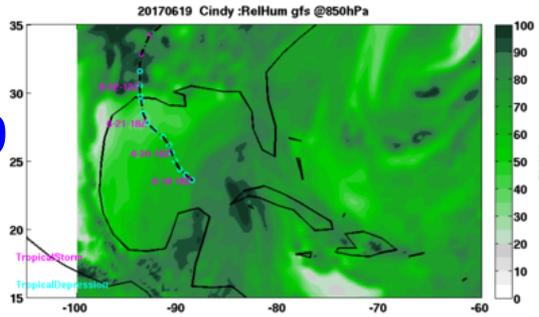
850 hPa

GFS

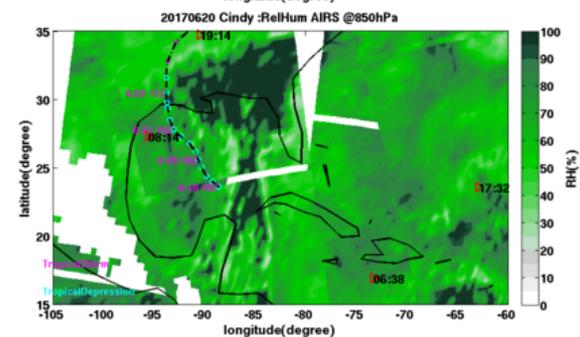
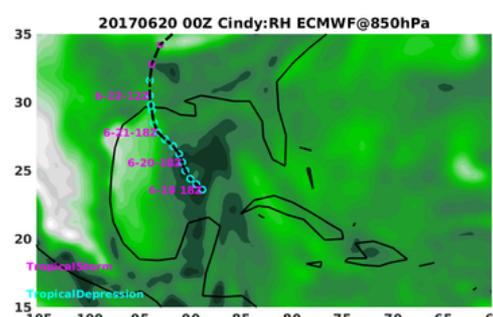
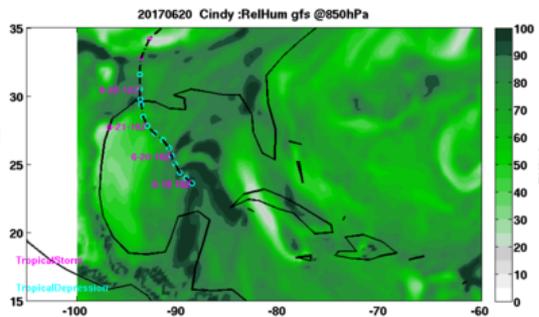
ECMWF

AIRS

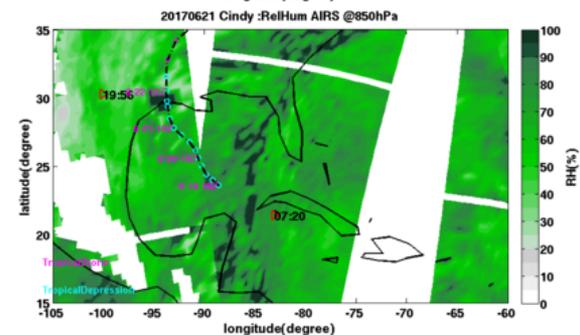
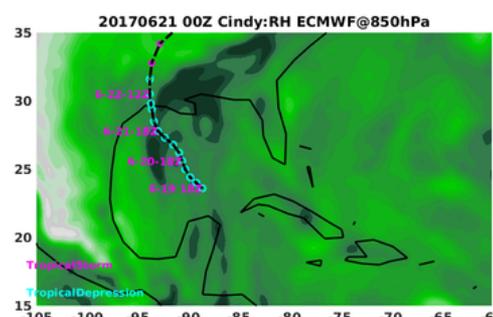
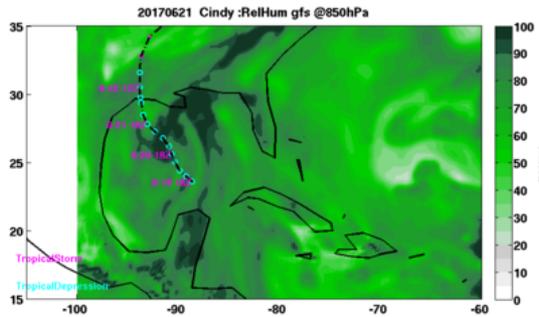
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Environmental Relative Humidity

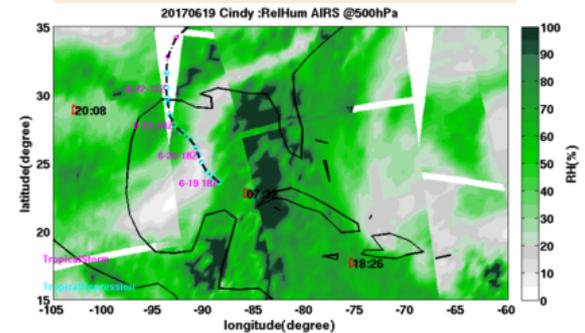
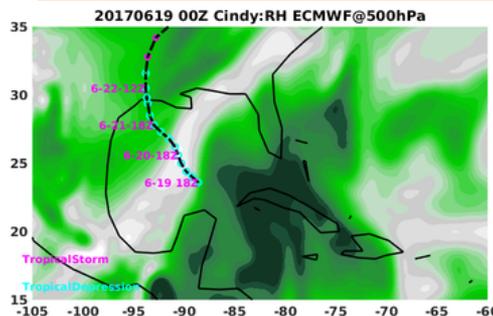
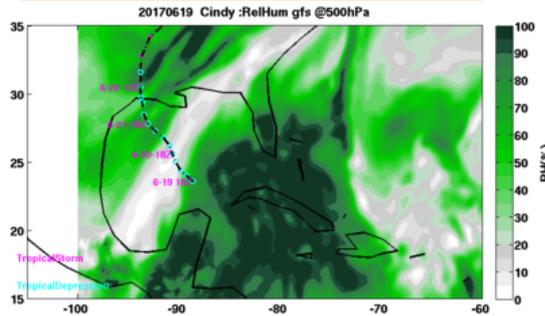
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GFS

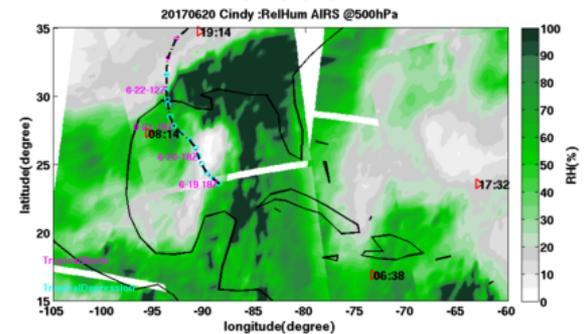
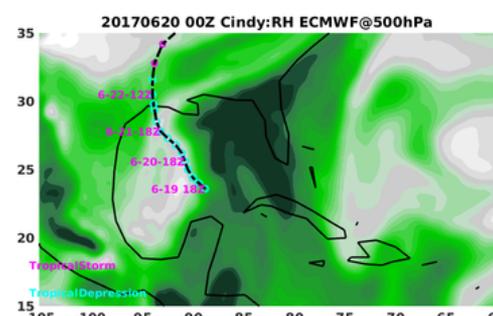
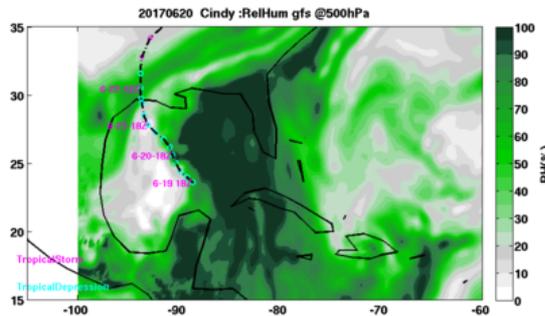
ECMWF

AIRS

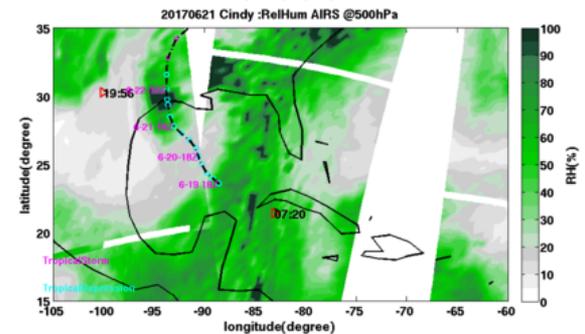
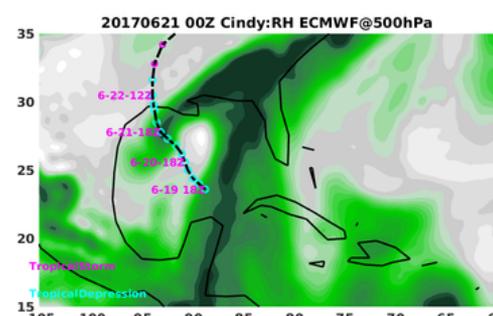
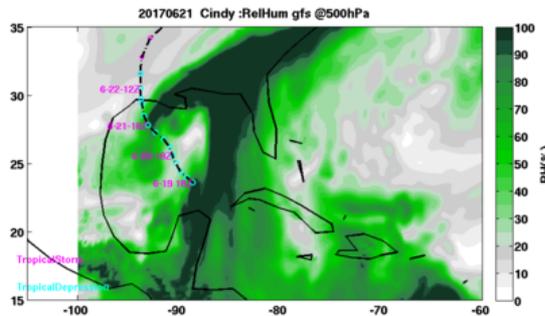
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Environmental Relative Humidity

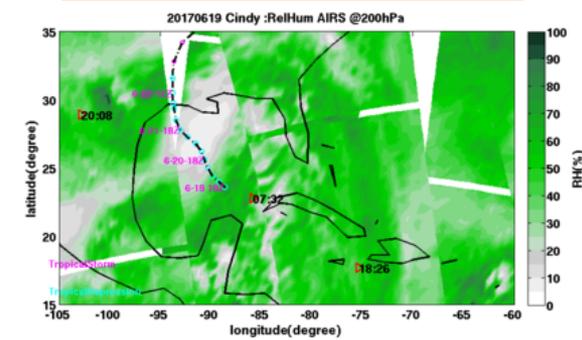
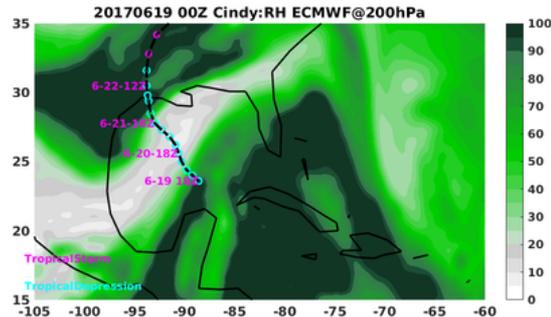
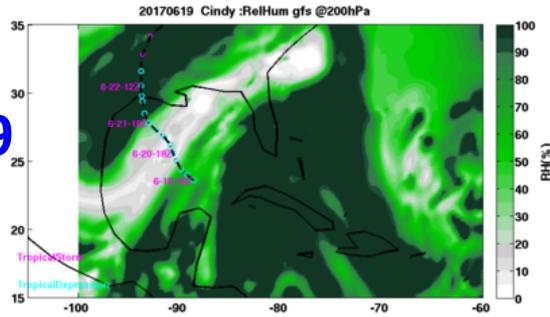
200 hPa

GFS

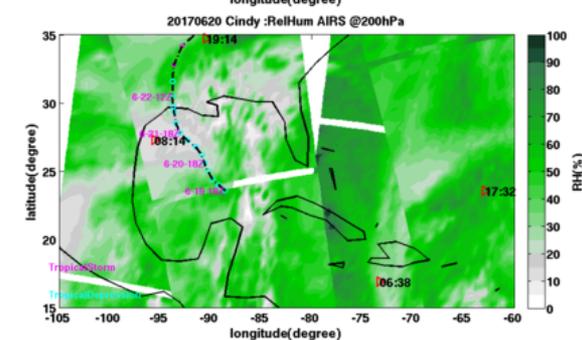
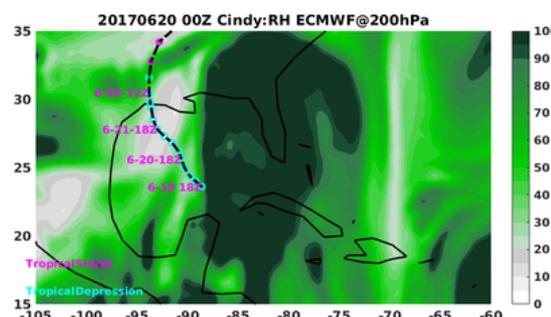
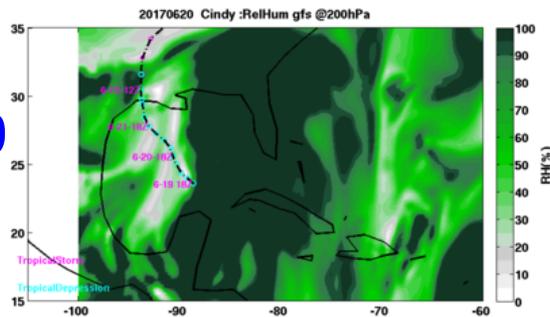
ECMWF

AIRS

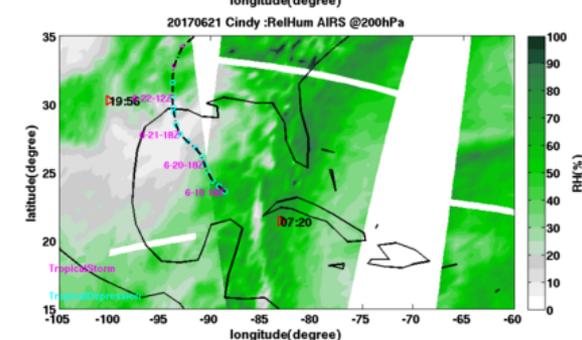
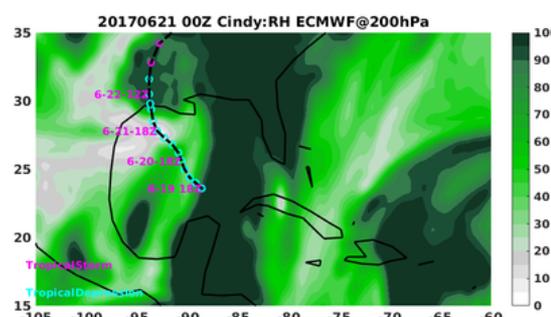
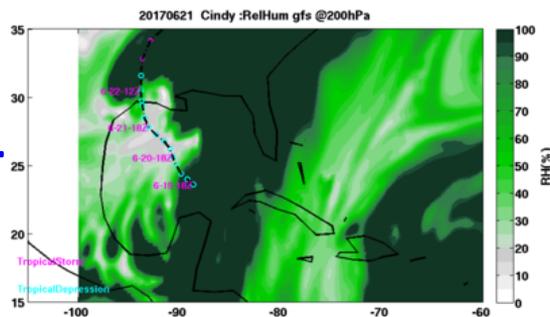
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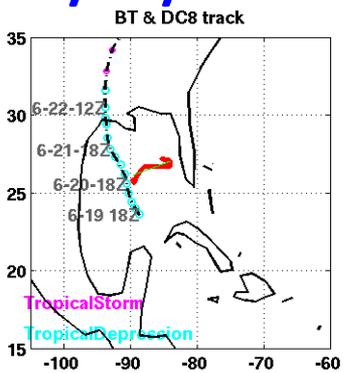


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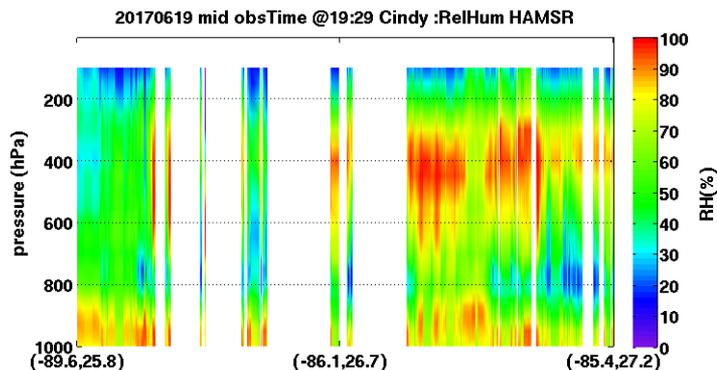


Comparing with HAMSR and AIRS Data

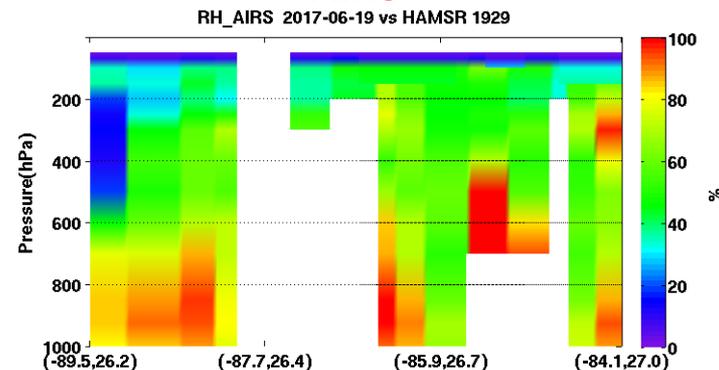
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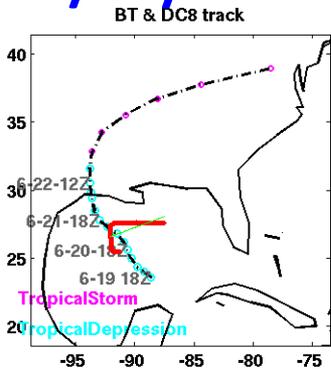
HAMSR



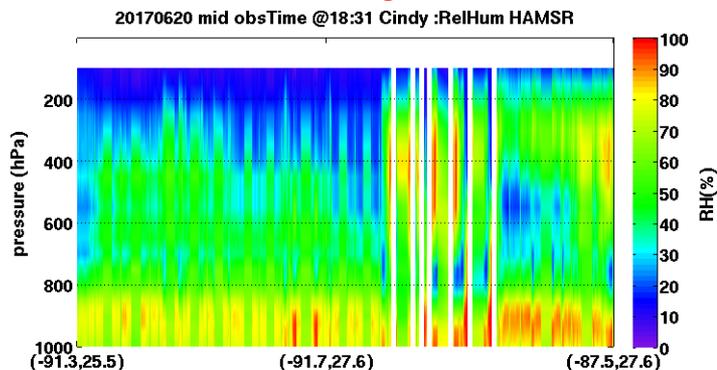
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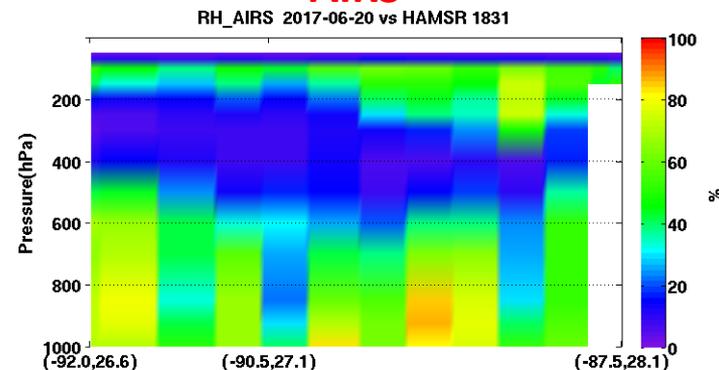
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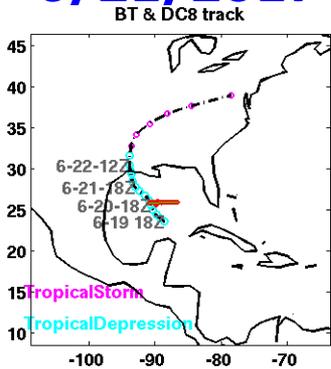
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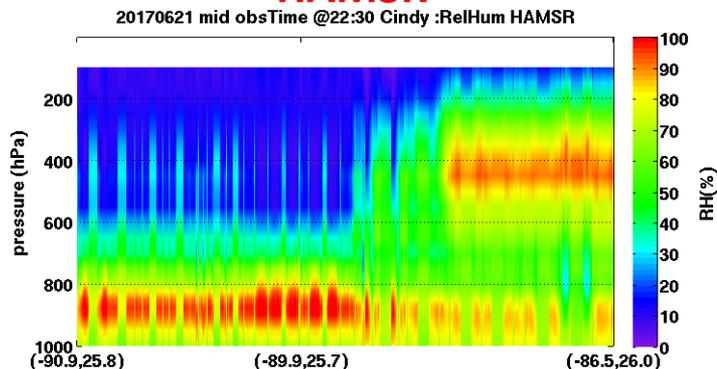
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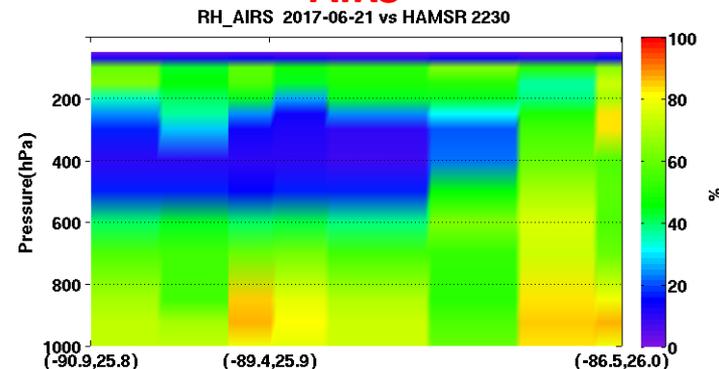
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HAMSR



AIRS



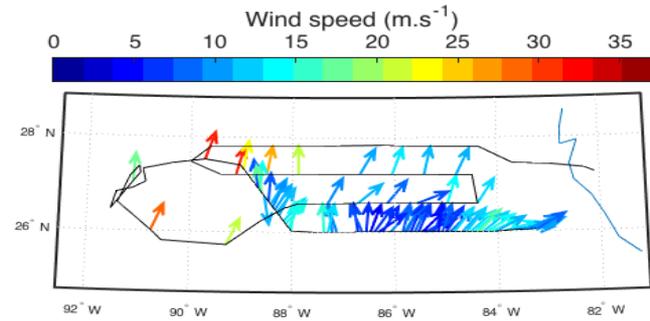
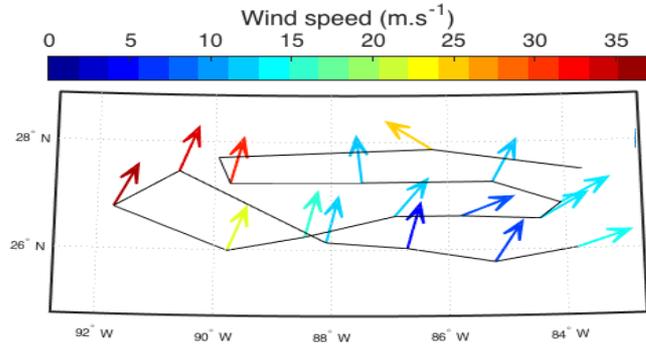
Atmospheric Winds

Dropsondes

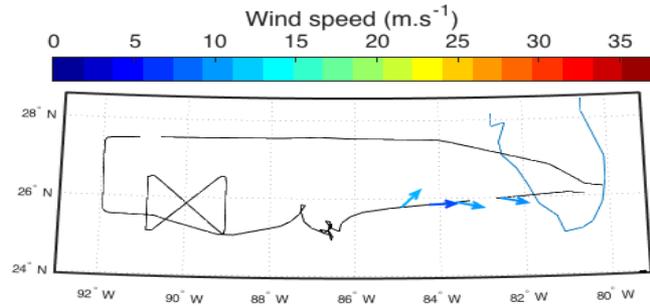
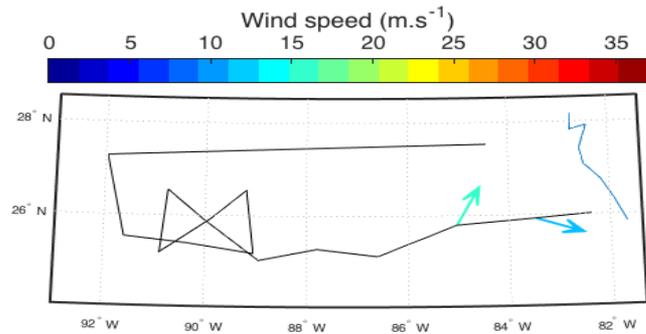
200 hPa

DAWN

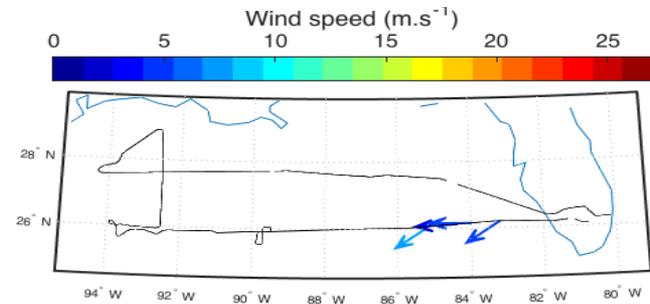
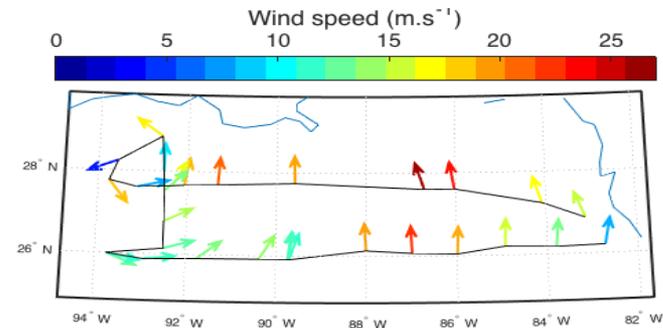
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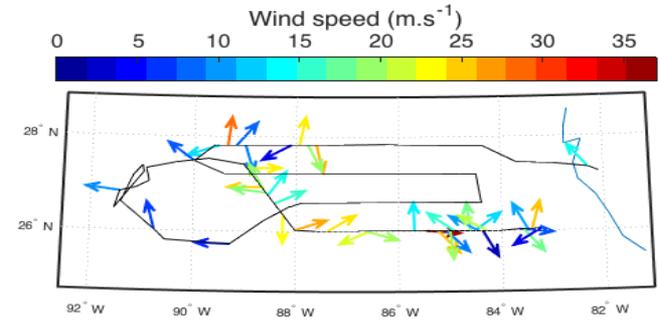
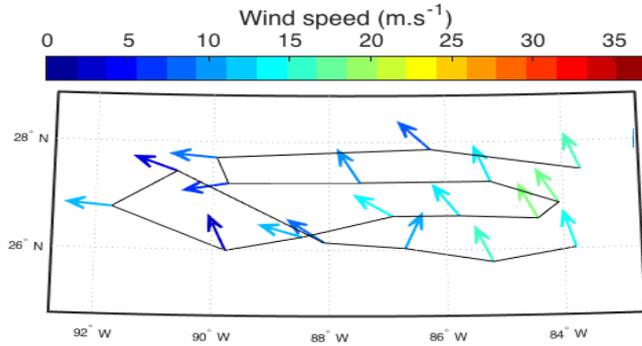
Atmospheric Winds

Dropsondes

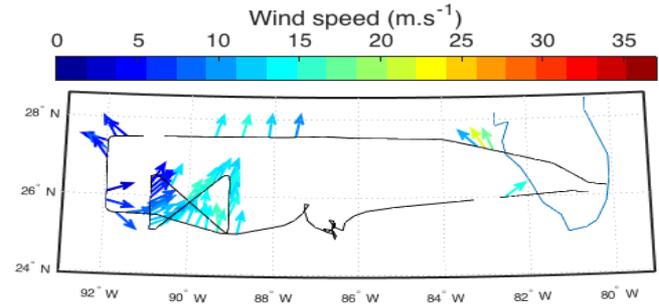
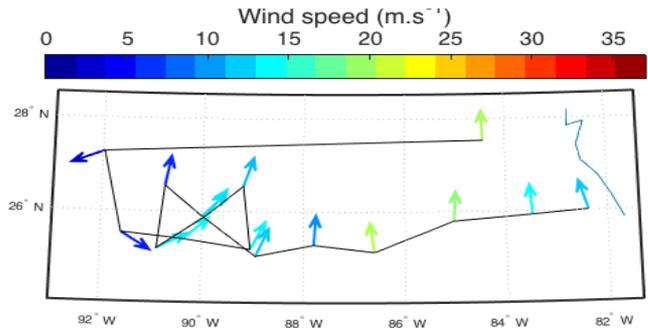
500 hPa

DAWN

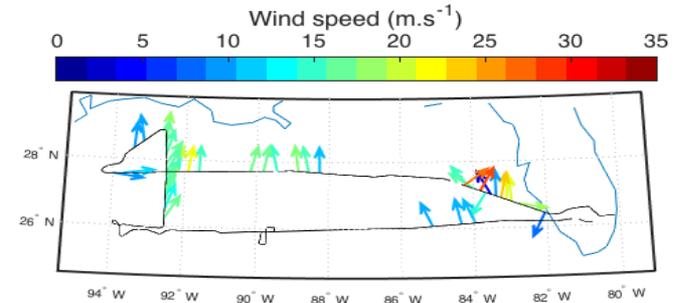
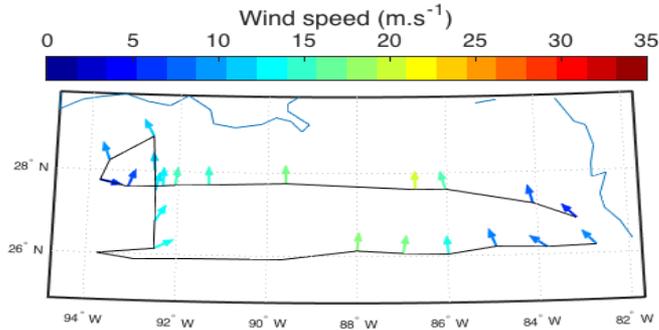
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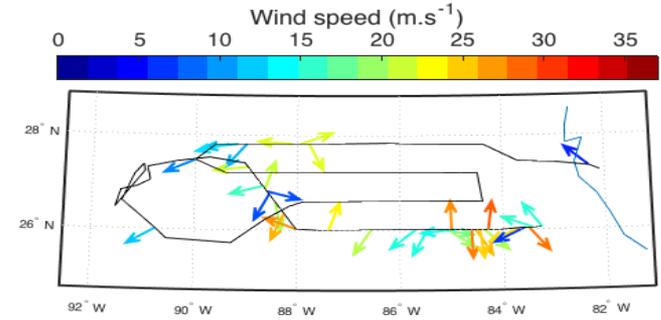
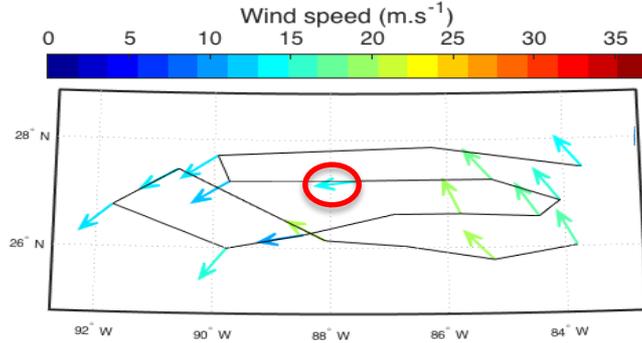
Atmospheric Winds

850 hPa

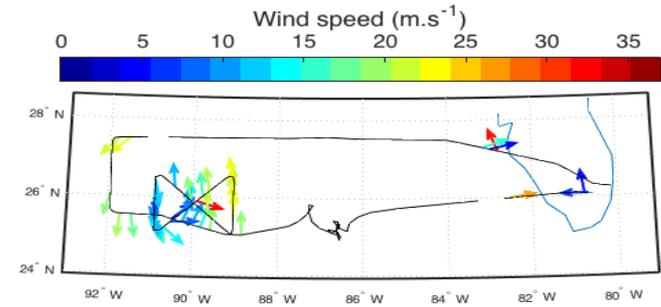
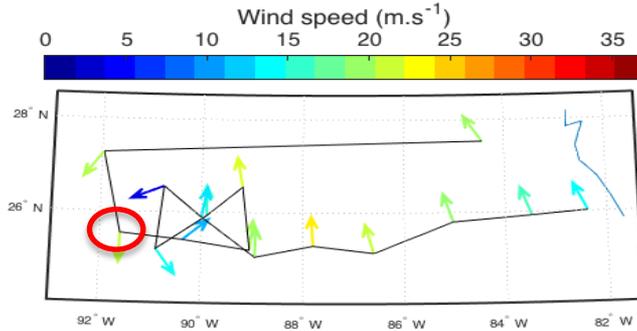
Dropsondes

DAWN

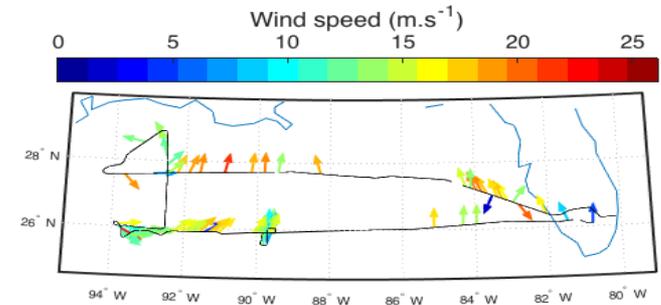
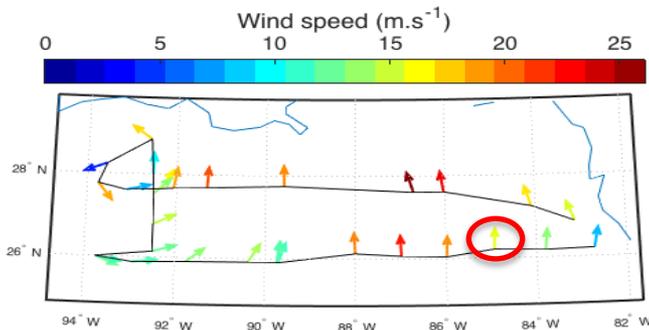
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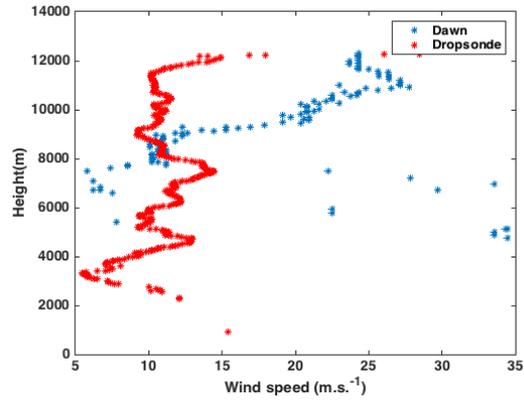
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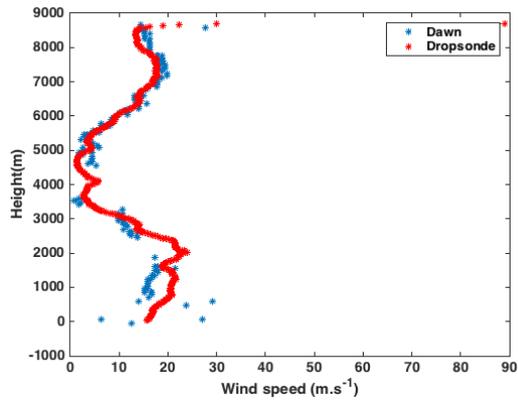
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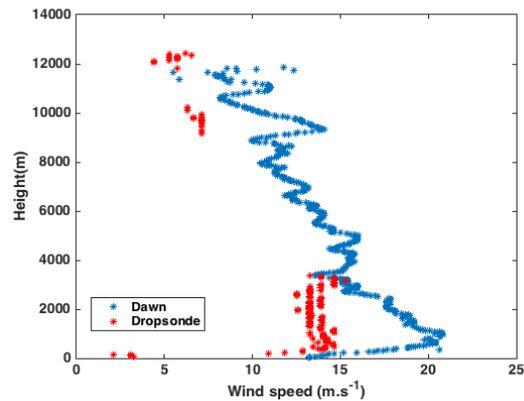
Wind speed



6/19

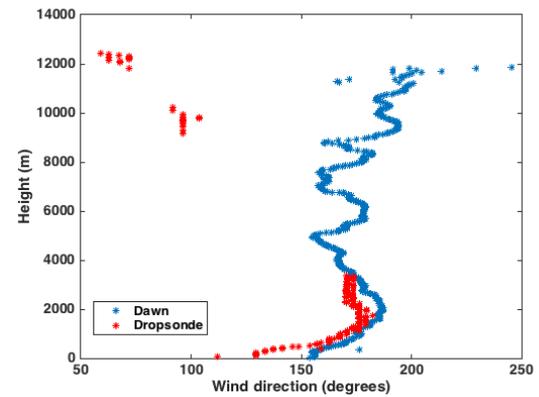
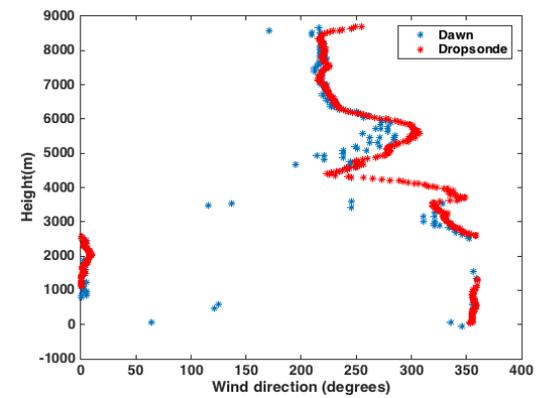
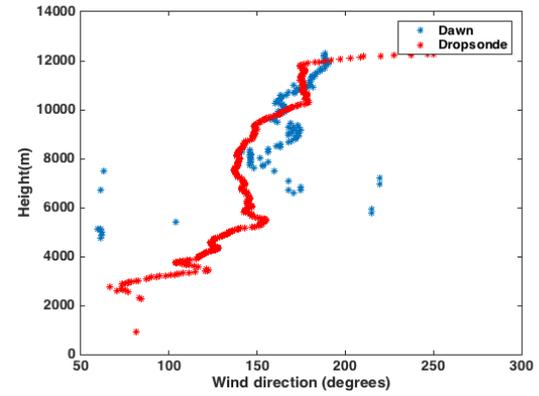


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Wind direction

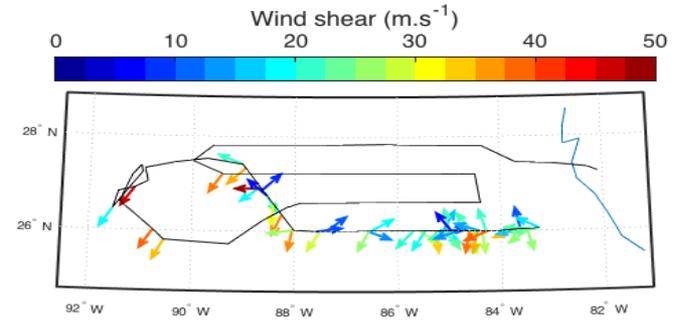
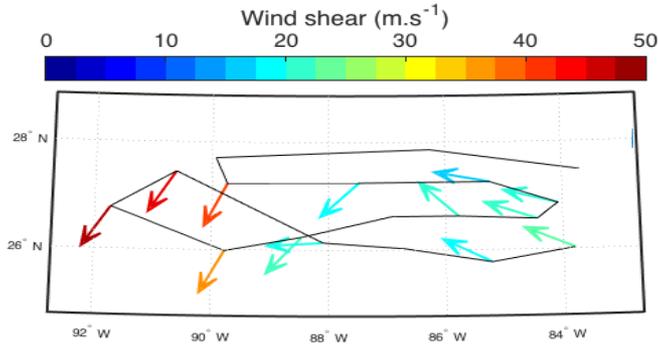


Vertical Wind Shear

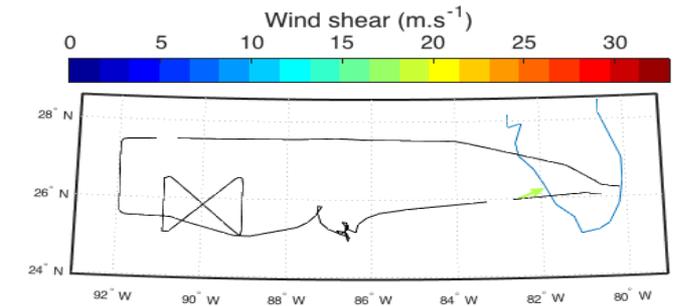
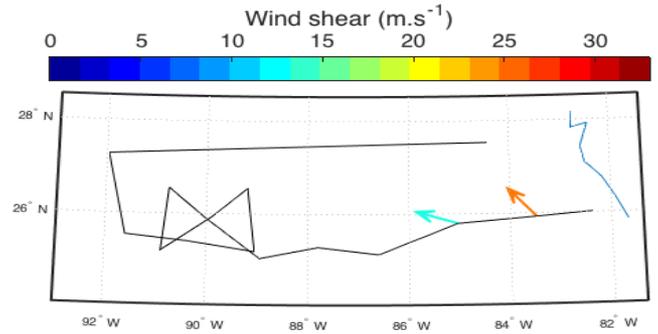
Dropsondes

DAWN

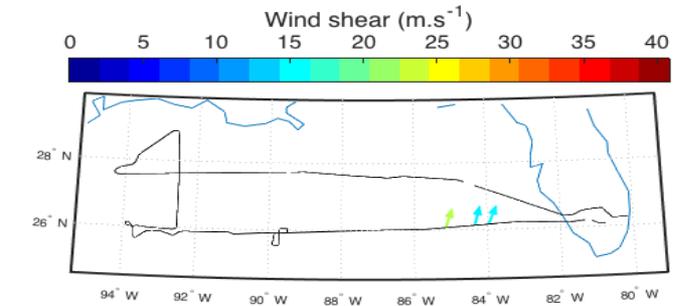
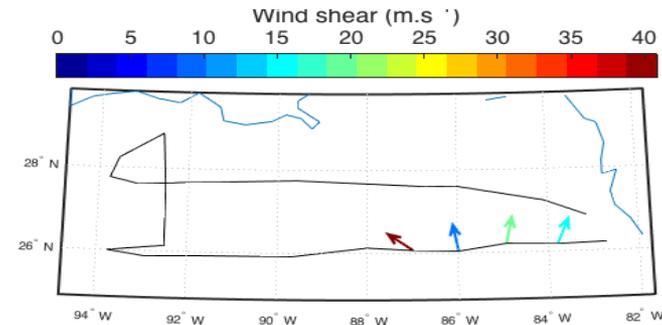
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Summary

- Tropical Storm Cindy (2017) encountered very dry air to its west and a moderate to strong wind shear, which limited its intensification.
- GFS forecast and ECMWF reanalysis have moist biases in the mid-upper troposphere compared to AIRS and HAMSR.
- DAWN wind retrieval and the dropsondes winds sometimes agree well but sometimes don't.
- These observations will be used to validate WRF simulations and guide the modeling study to understand the mechanisms for tropical storm development.