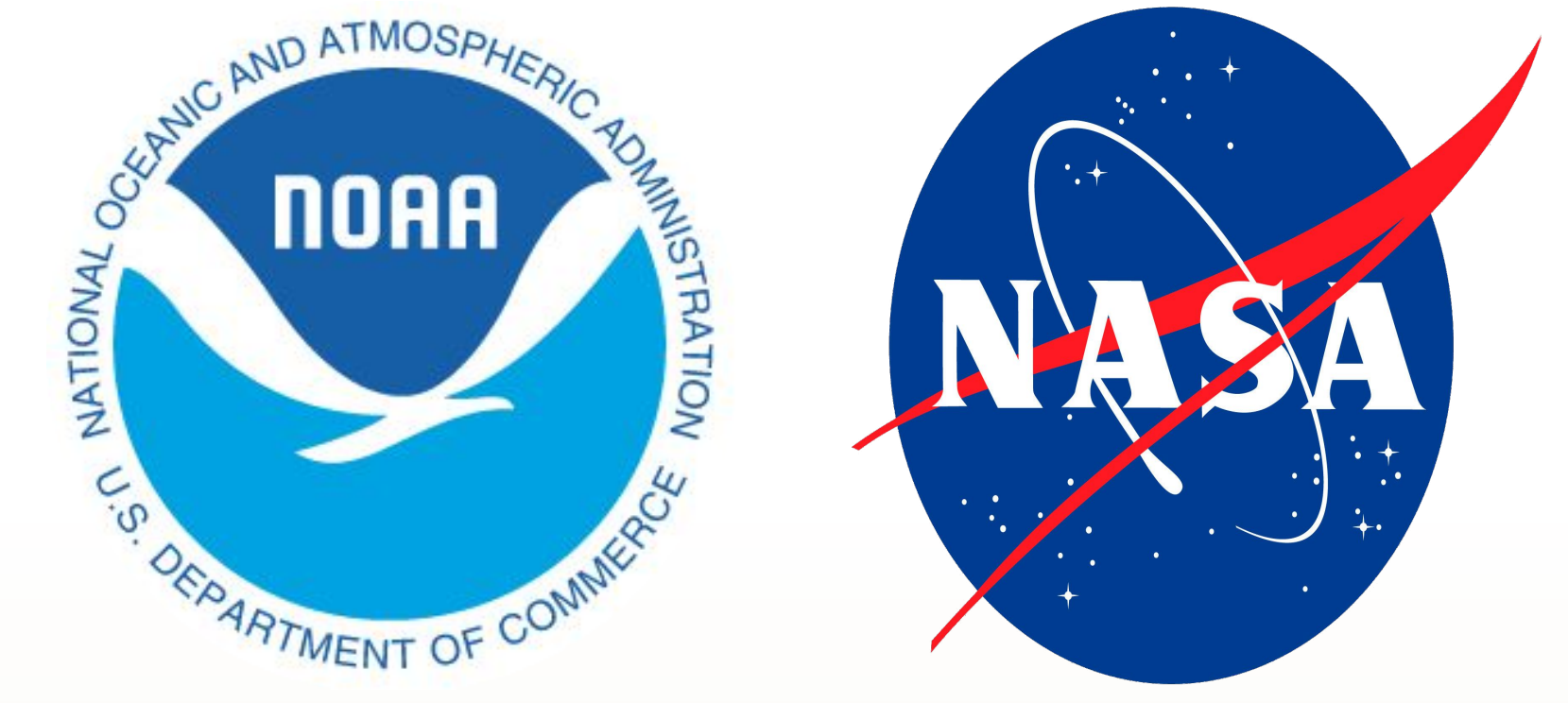


# Science Goals Related to Spray Modification of Hurricane



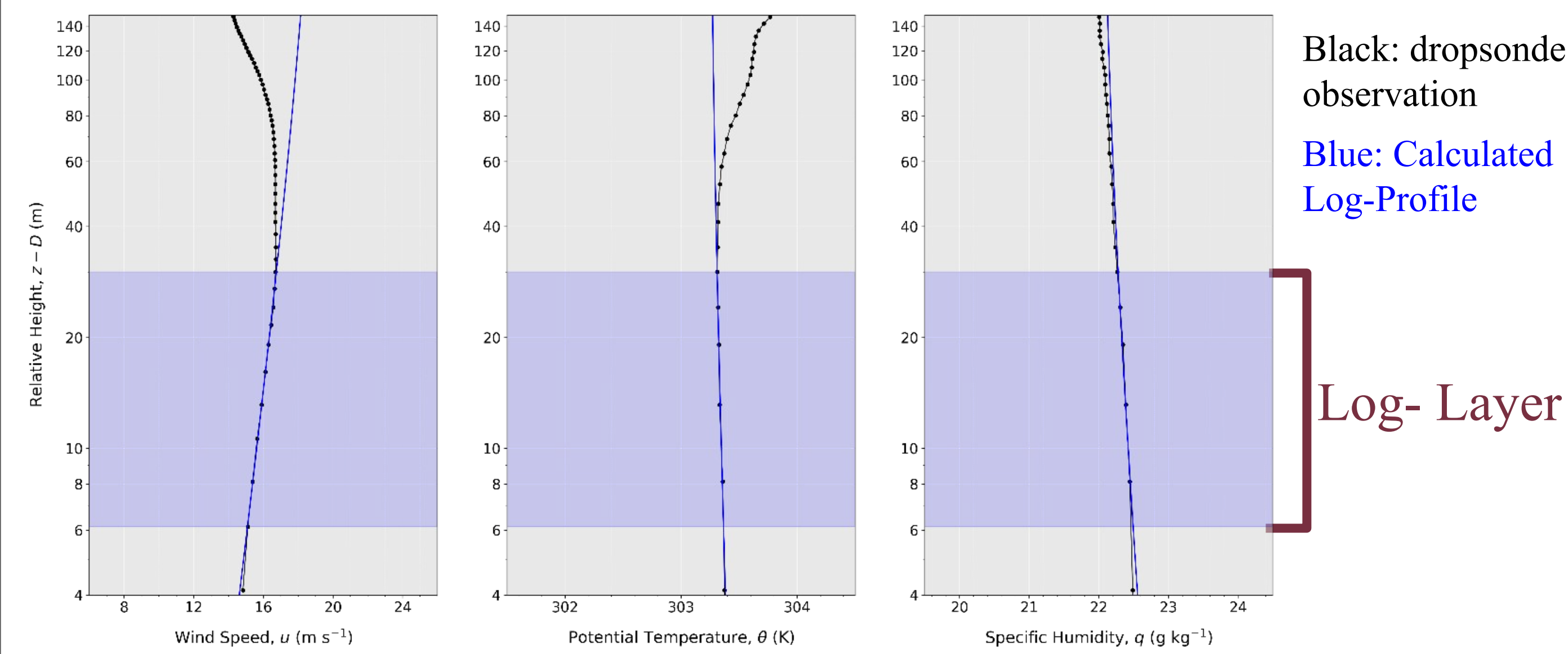
## Winds and Turbulent Fluxes

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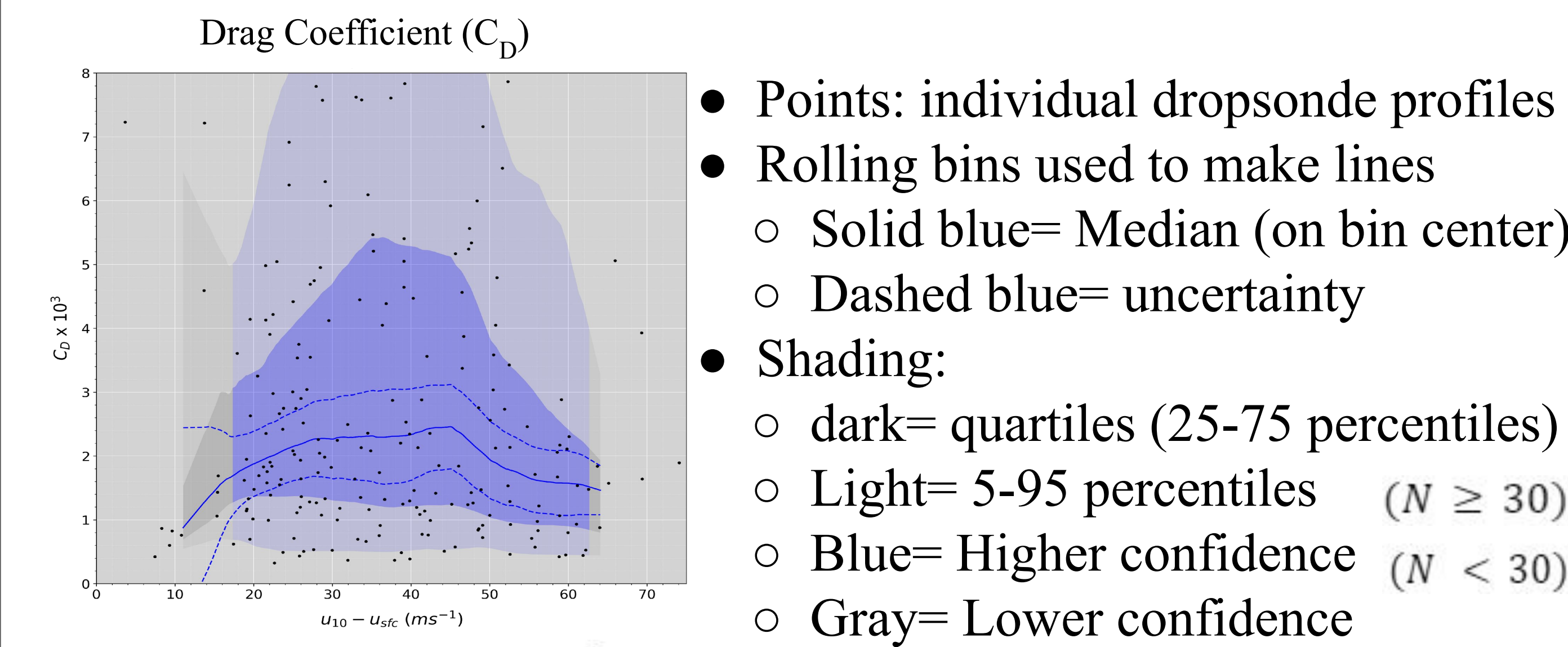


### Past Work

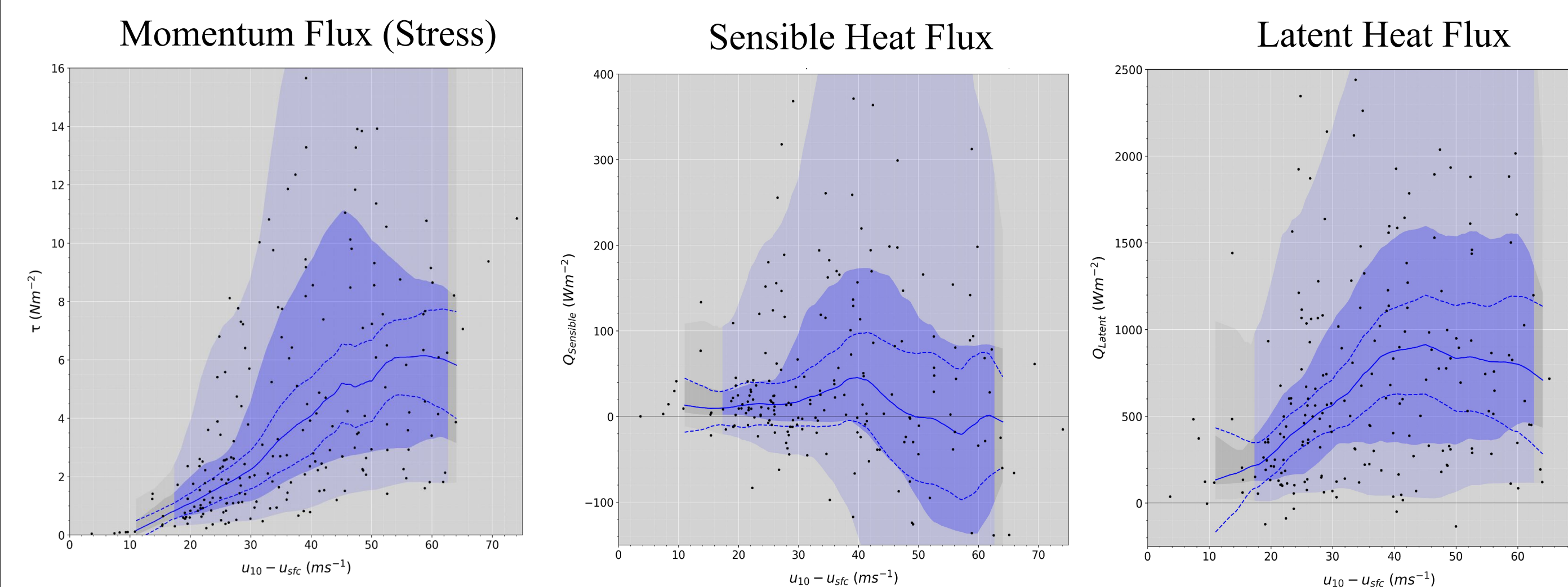
Dropsonde selection was done visually and required that the profiles of temperature, moisture, and wind speed all had a log-linear layer.



10m winds are estimated from the solution at 10m above the displacement height.



$$C_D(10m) = \left( \frac{u_*}{u_{10} - u_{zfc}} \right)^2$$



$$\tau = \rho u_* |u_*| = \rho C_D (u - u_{zfc})^2$$

$$Q_{sen} = -\rho C_p |u_*| \theta_*$$

$$Q_{lat} = -\rho L_V |u_*| q_*$$

### Goals

- Science Goals:
  - Better estimates of the transfer coefficients in tropical cyclones
  - Better estimates of the impact of spray and evaporation on the apparent surface temperature and humidity
  - Ratios of enthalpy flux to drag
- Improved roughness lengths
- Increase size of dataset



Lockheed WP-3D NOAA42 "Kermit"  
Photo credit: LT K. Doremus 2017



NCAR NRD41 (Left) and RD41 (Right) Dropsondes [Hock 2020]



Saildrone Explorer 1045  
Photo from Saildrone

### Plans

To improve the roughness lengths for momentum, potential temperature, and specific humidity:

- Hard constraint: prescribed value
- Soft constraint:

$$weight \cdot (\ln(z_{o-solution}) - (\ln(z_{o-theory})))$$

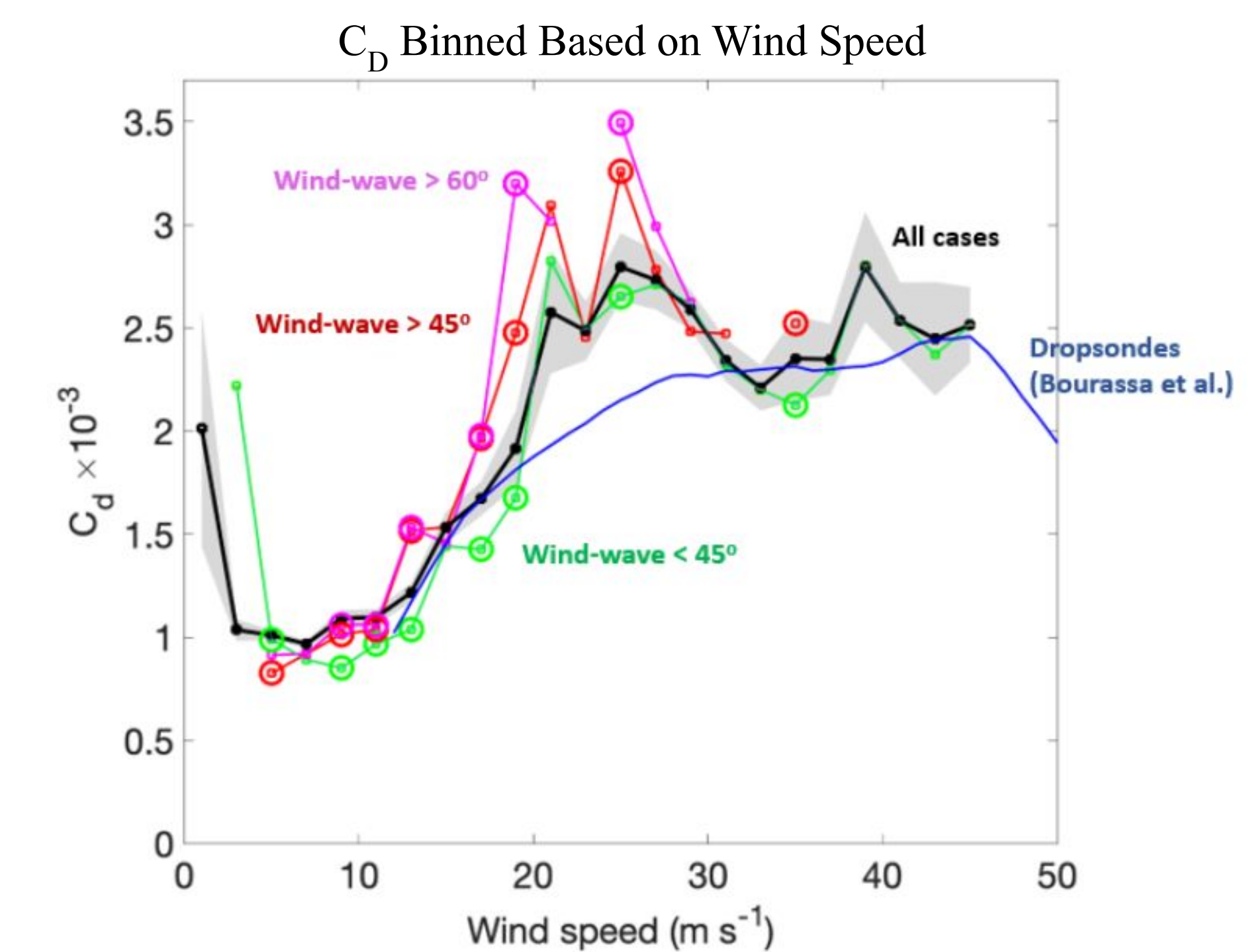
When compared to other terms in the function

- Weight small: roughness length within a few orders of magnitude of the theoretical value
- Weight large: roughness lengths are way too big or too small

To increase the size of the dataset:

- Automate the selection process

Compare our work using dropsondes in the log-layer to similar work being done by Greg Foltz using Saildrones at the surface in order to understand what might be going on in the spray layer between them



### Expectations

- Improving the roughness lengths will reduce noise in the roughness lengths and also have a smaller reductions in the drag coefficient's noise
- Increasing the size of the dataset will make a better estimate of the mean
- Address questions with spray and enthalpy fluxes

### References

Wallace, D. E., Bourassa, M. A., Holbach, H. M., 2023: Log-Profile Analysis of the Near-Surface Layer and Air-Sea Turbulent Fluxes in Hurricanes Using Dropsondes. M.S. thesis, Dept. of Earth, Ocean, and Atmospheric Sciences, Florida State University (in review).

### Contact

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*Please feel free to reach out with any questions!*

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