In situ observations of the near-shore atmospheric boundary layer during ATOMIC/EUREC4A from small Uncrewed Aircraft Systems

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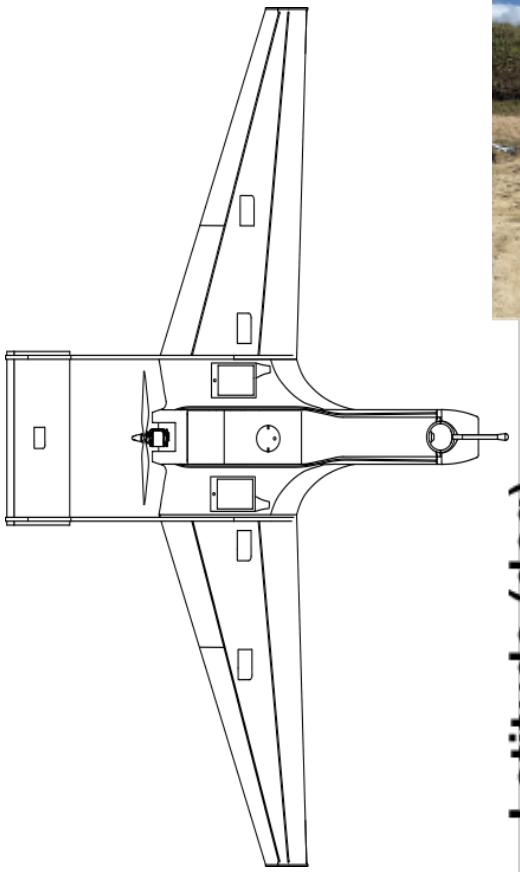
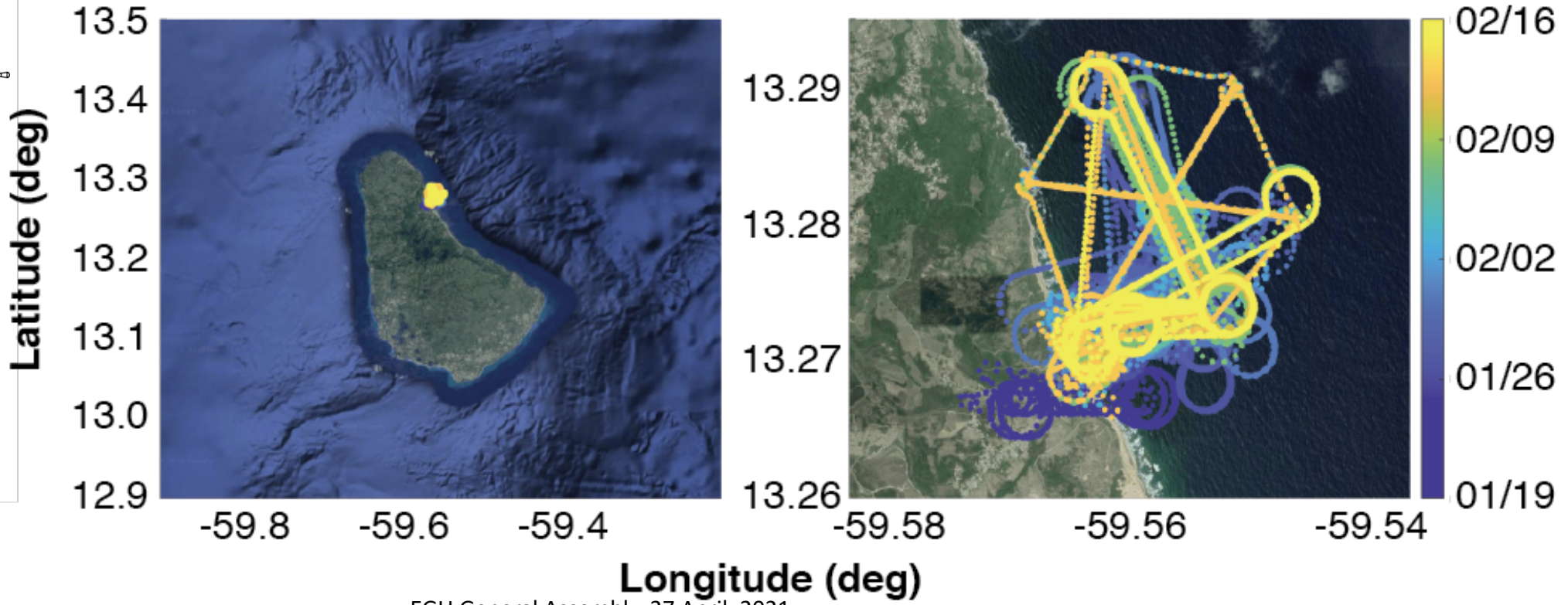
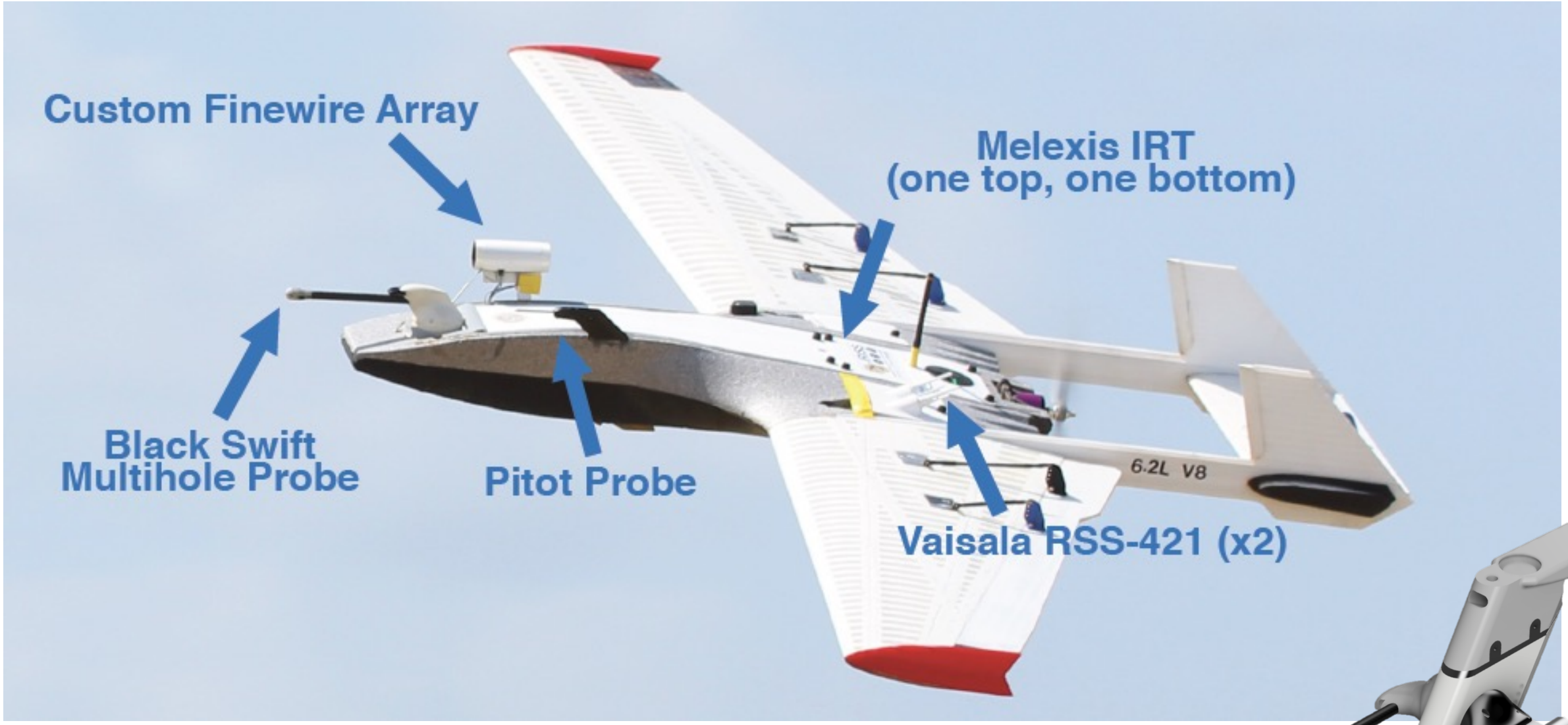
Introduction: ATOMIC Deployment





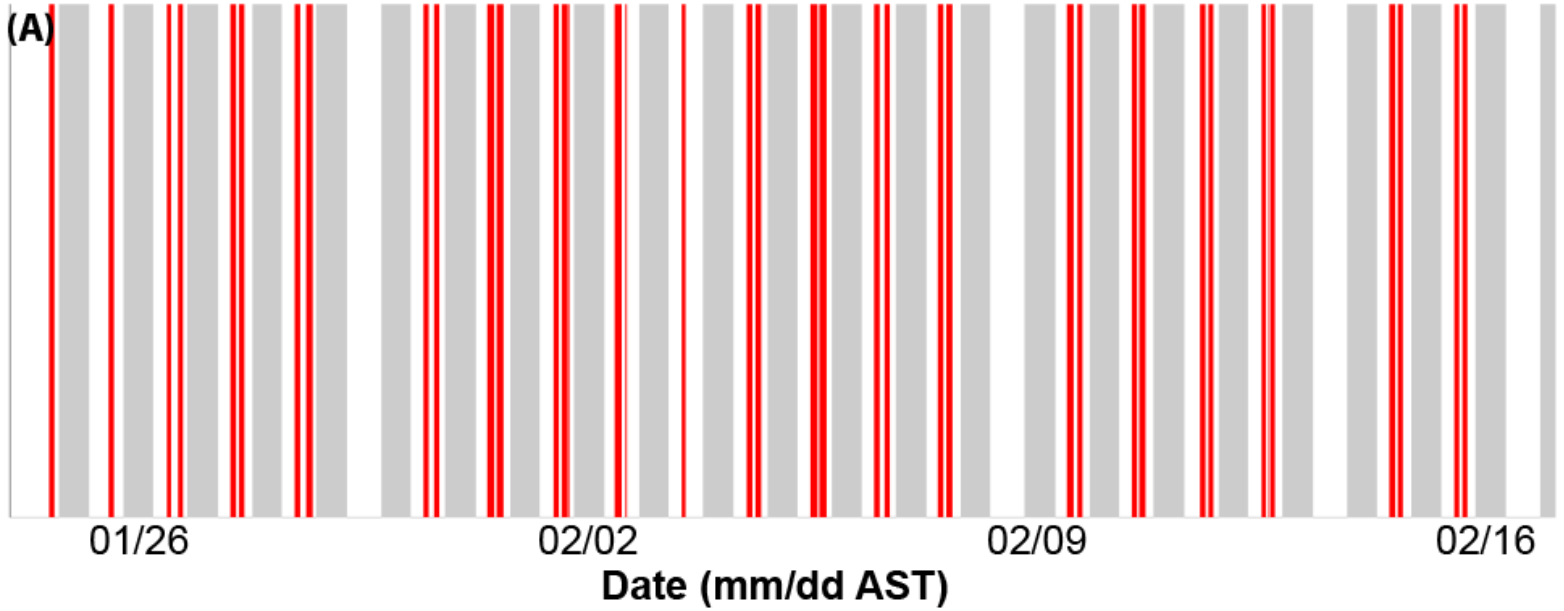
CU RAAVEN Sensors for ATOMIC

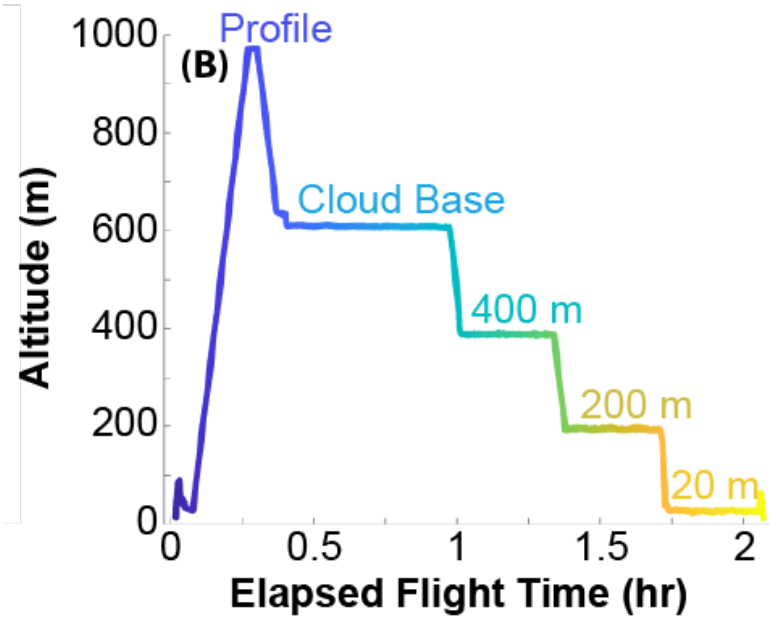


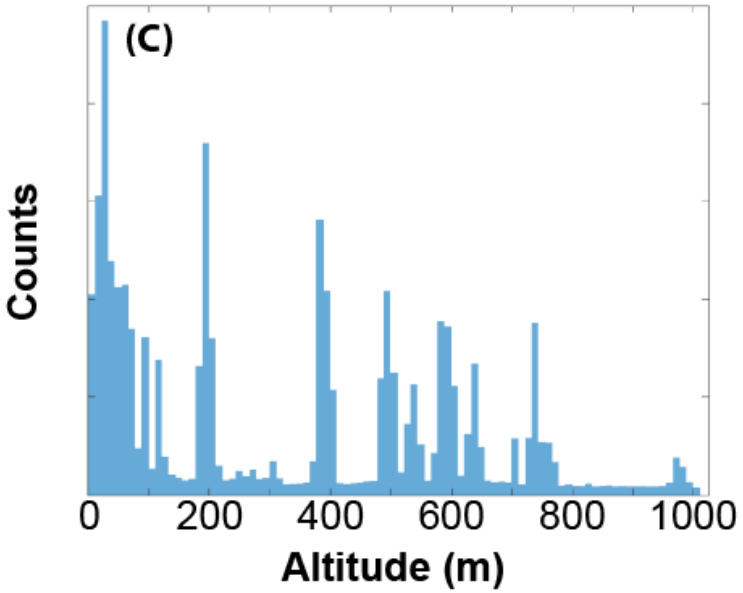
Sensor combination derived from NOAA/CU *miniFlux* instrument, which has additionally been deployed in the Arctic on both UAS and manned research aircraft platforms.

ATOMIC Sampling Strategy

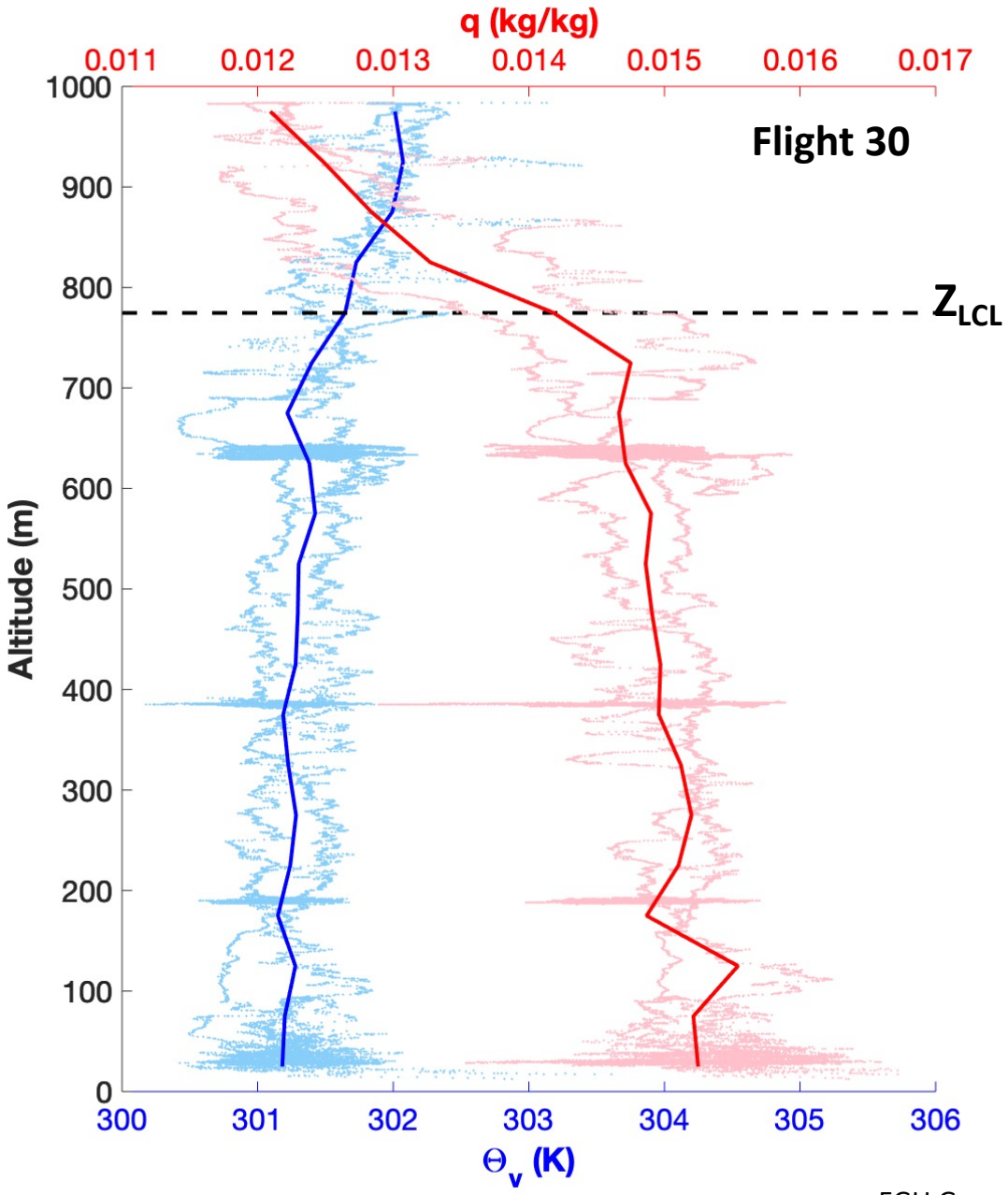
- Flights between 1/24-2/15
- 2x daily flights of approximately 2 hours each
- One flight mid-morning, one flight early afternoon
- Most flights follow “stair-step” pattern, with profile to 1000 m, and then extended sampling at cloud base, 400 m, 200 m and 20 m MSL
- Some calibration flights for wind data in “star” pattern.







Thermodynamic Structure



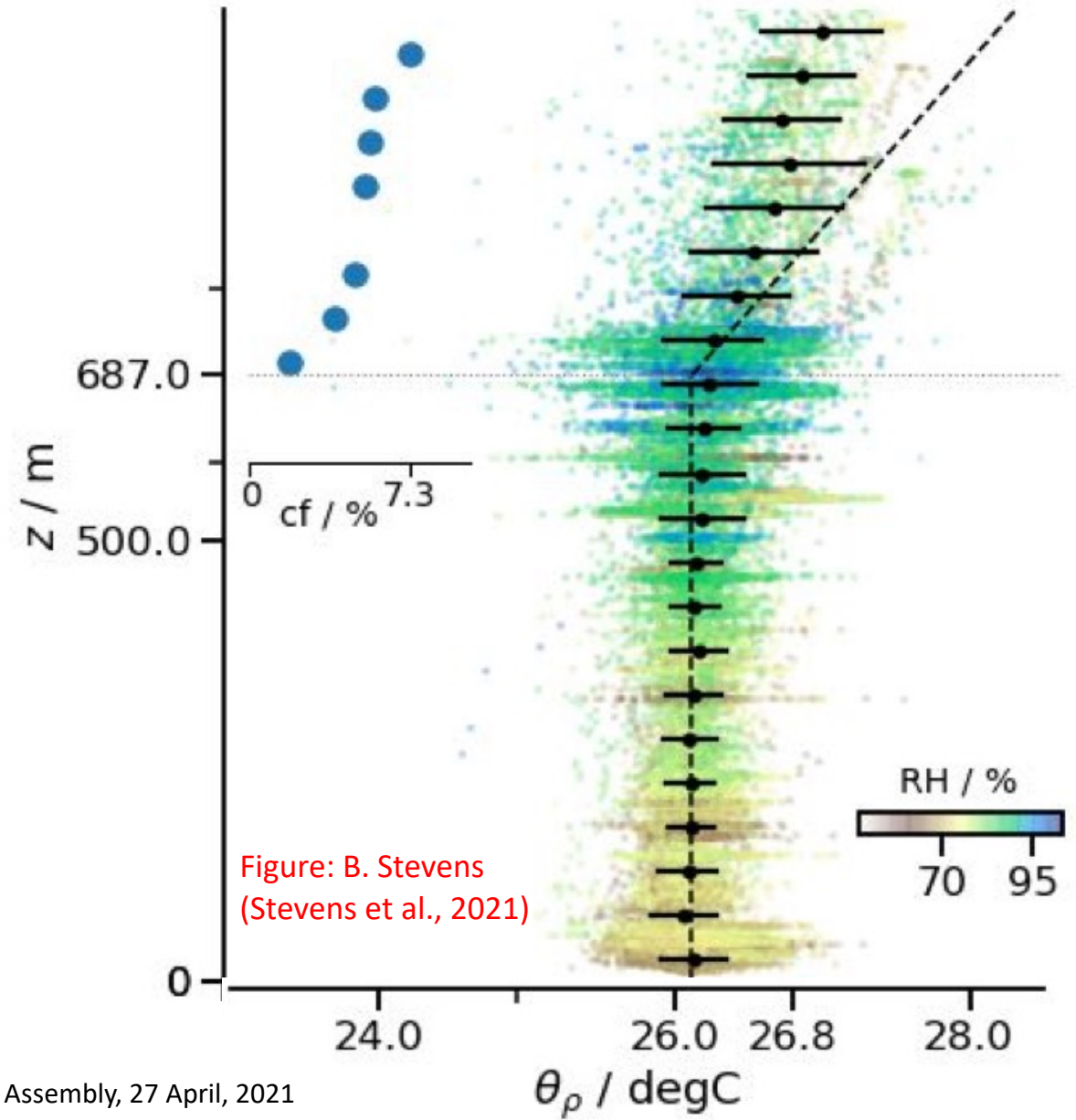
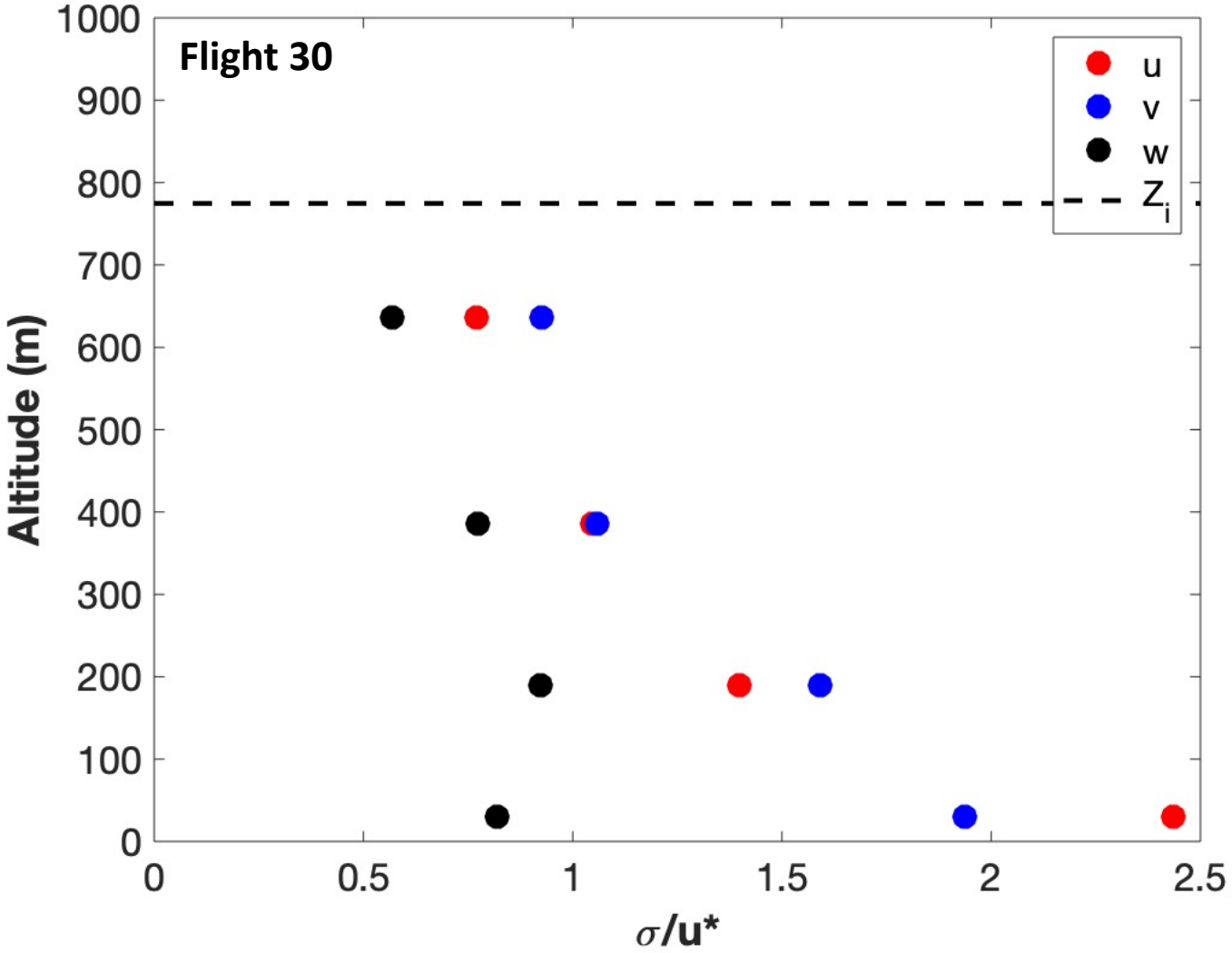
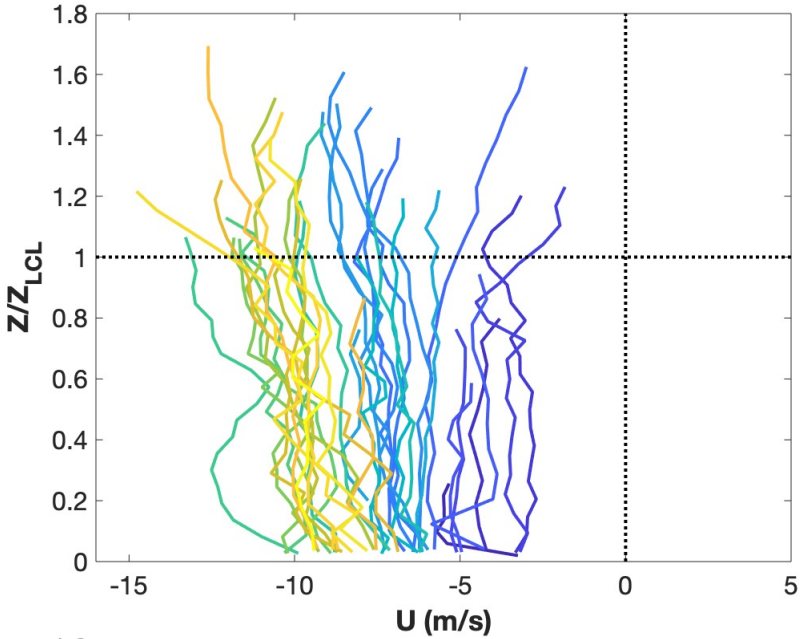
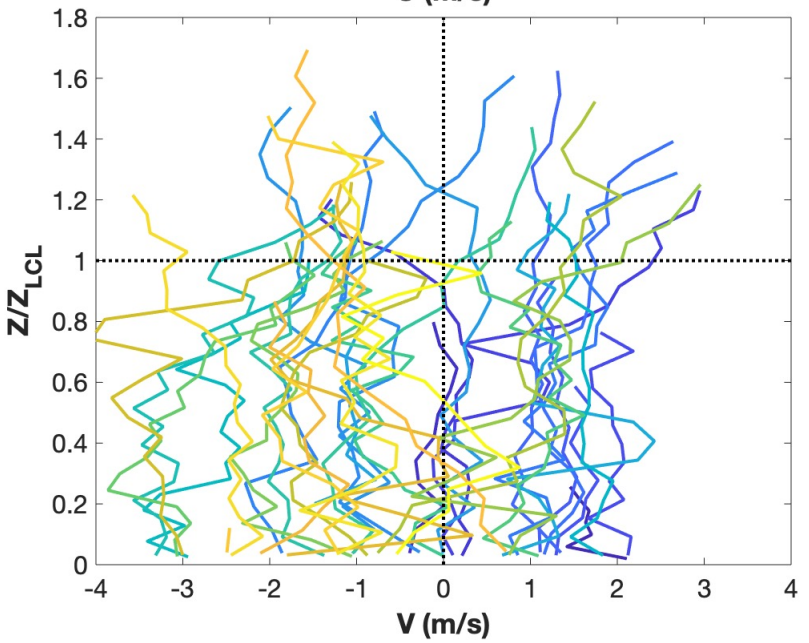


Figure: B. Stevens
(Stevens et al., 2021)

Kinematic Profiles



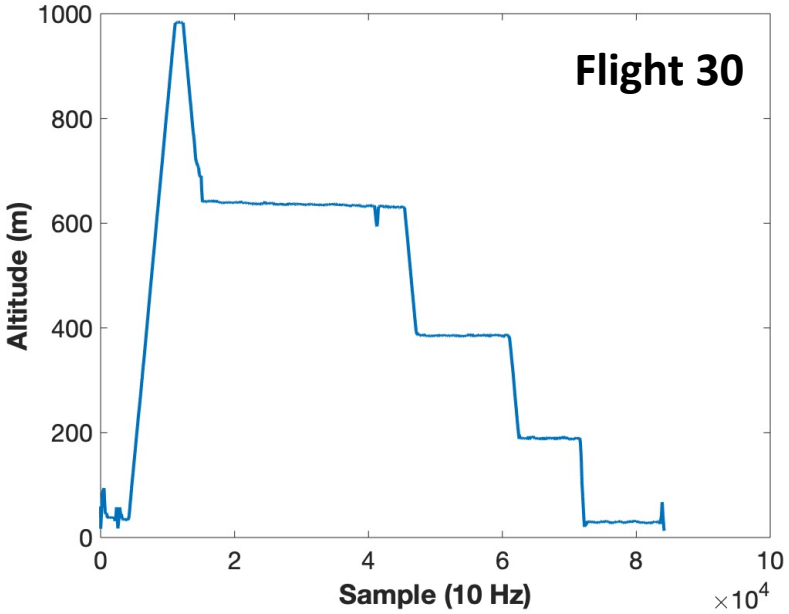


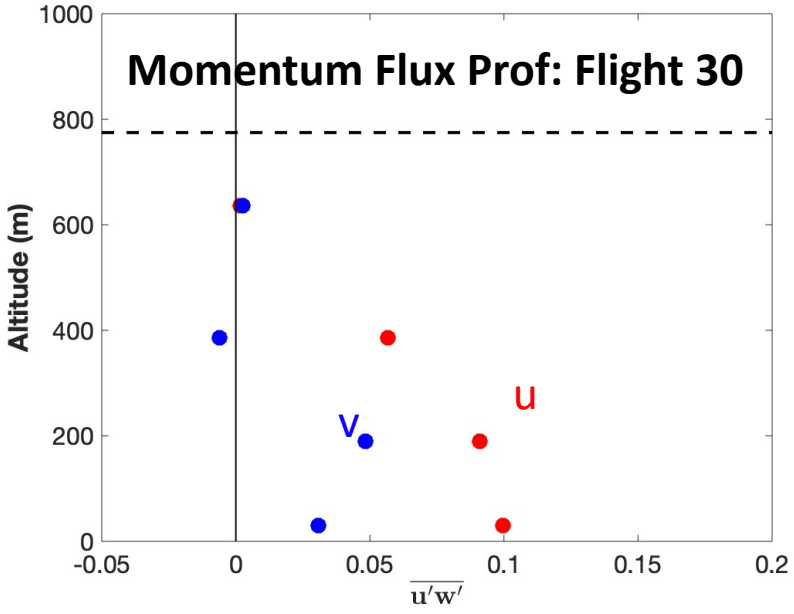


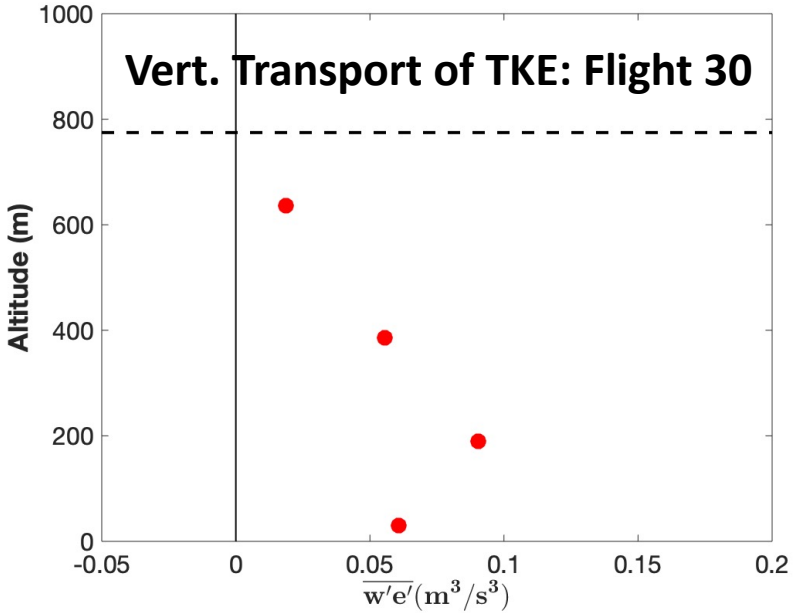
σ = variance

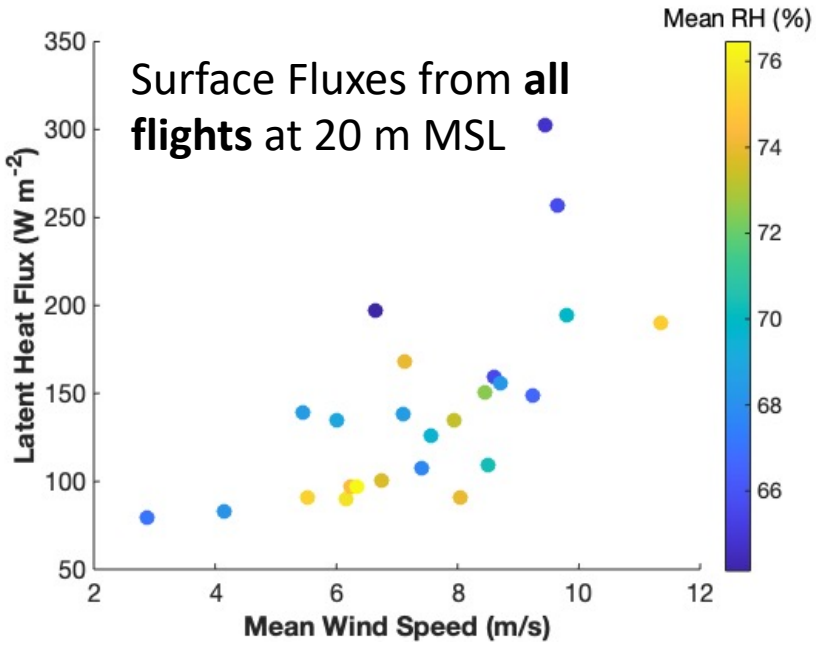
$$u_* = \left(\frac{\tau}{\rho}\right)^{\frac{1}{2}} = \left[-\left(\overline{u'w'}\right)\right]^{\frac{1}{2}}$$

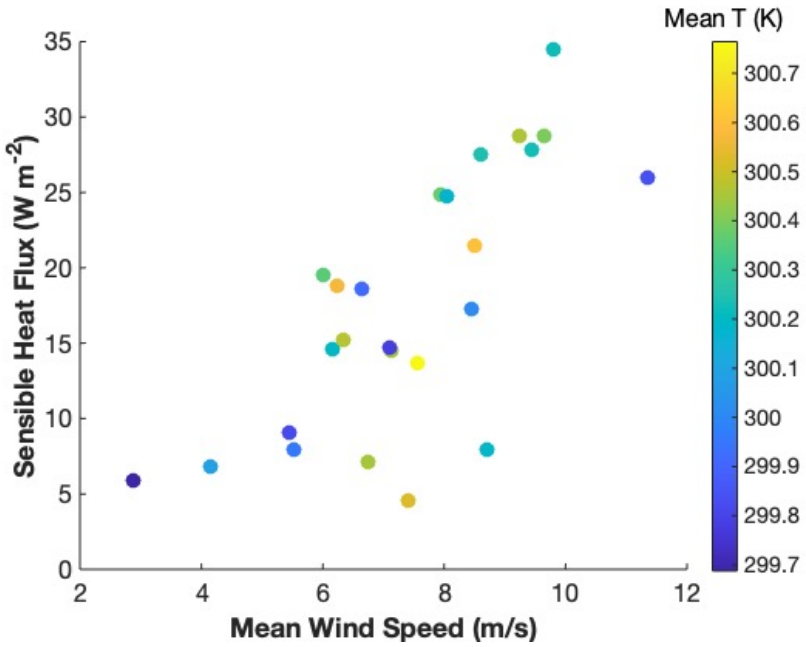
Turbulent Fluxes

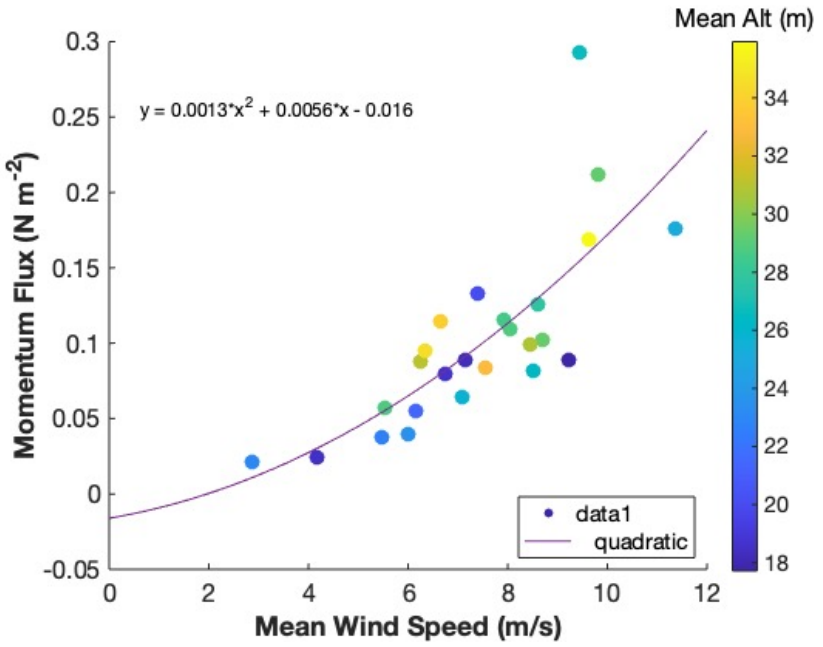




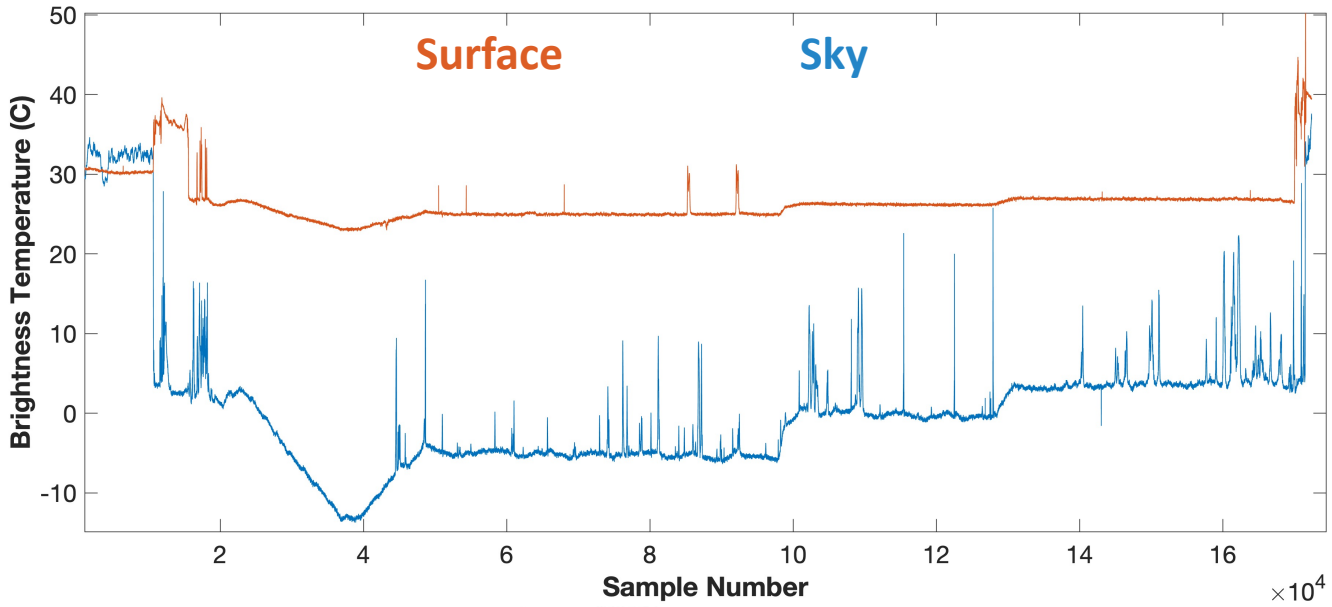


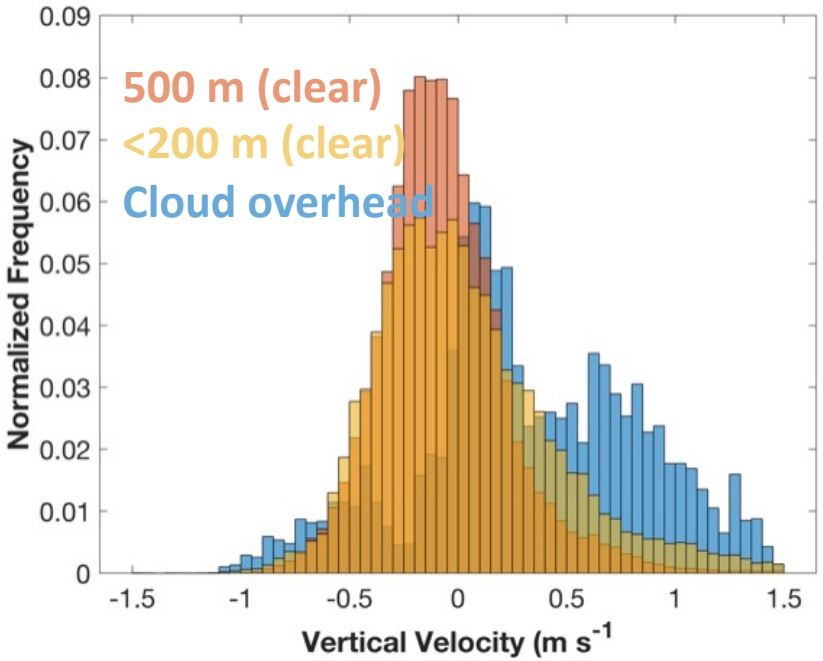


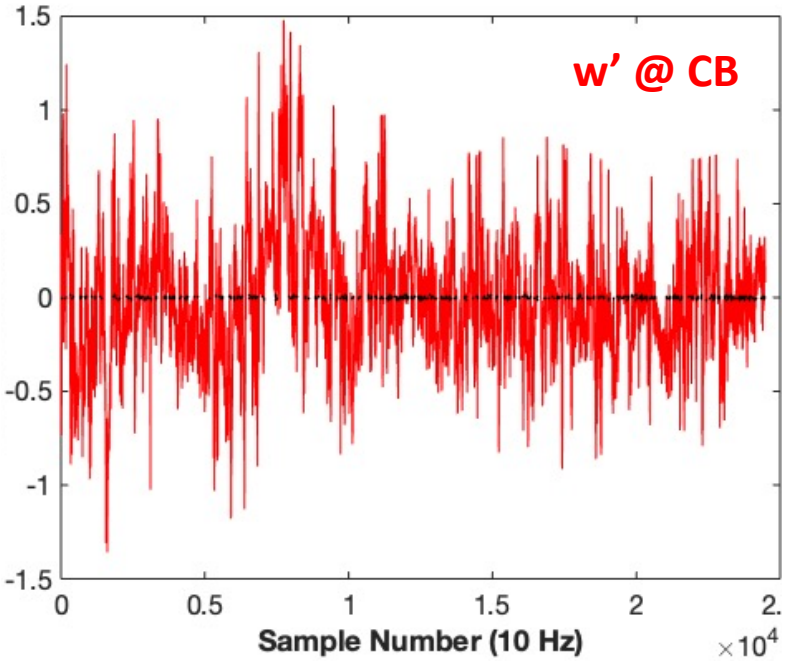


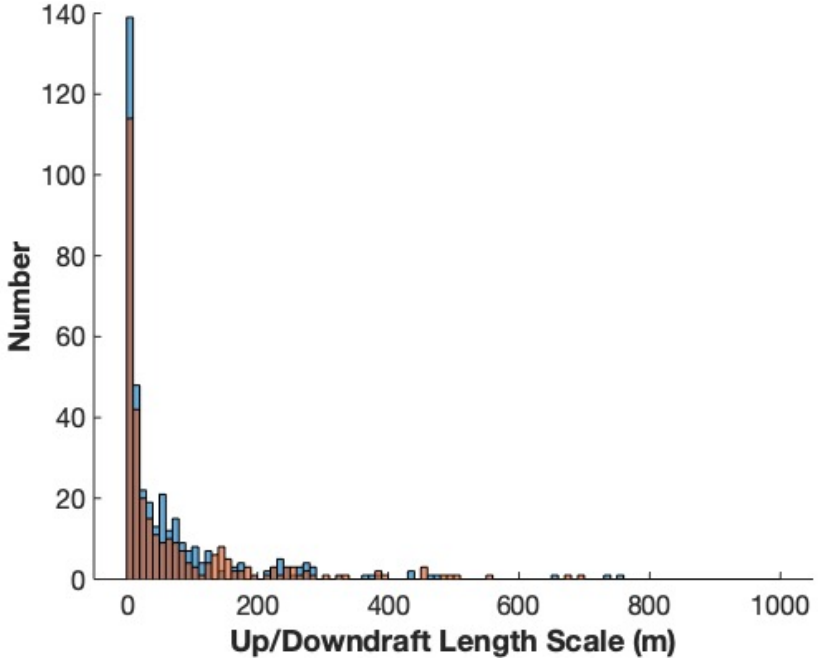


Cloud-Base Vertical Velocities









Summary

- The University of Colorado RAAVEN operated out of Morgan Lewis, Barbados during the 2020 ATOMIC field campaign
- The aircraft completed 39 flights totaling nearly 80 hours of flight time
- These data provide detailed perspectives on the near-coastal atmospheric boundary layer between the surface and 1 km
- Quality-controlled data are on NOAA NCEI (https://doi.org/10.25921/jhnd-8e58), and described in a paper to be submitted to Earth System Science Data

- Support for RAAVEN flights during ATOMIC was provided by the NOAA Physical Sciences Laboratory, NOAA Uncrewed Aircraft Systems (UAS) Program Office, and NOAA Climate Project Office