



Vertical Ozone Profiles on the Wasatch Front

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Introduction

- Ozone is one of six pollutants with a national standard set by the EPA.
- Ground level ozone tends to accumulate in the morning and dissipate in the evening (Fig. 1).
- Vertical ozone profiles provide insight into this cycle, but not feasible using stationary sensors.
- We obtain vertical profiles using a hexarotor drone (Fig. 2).

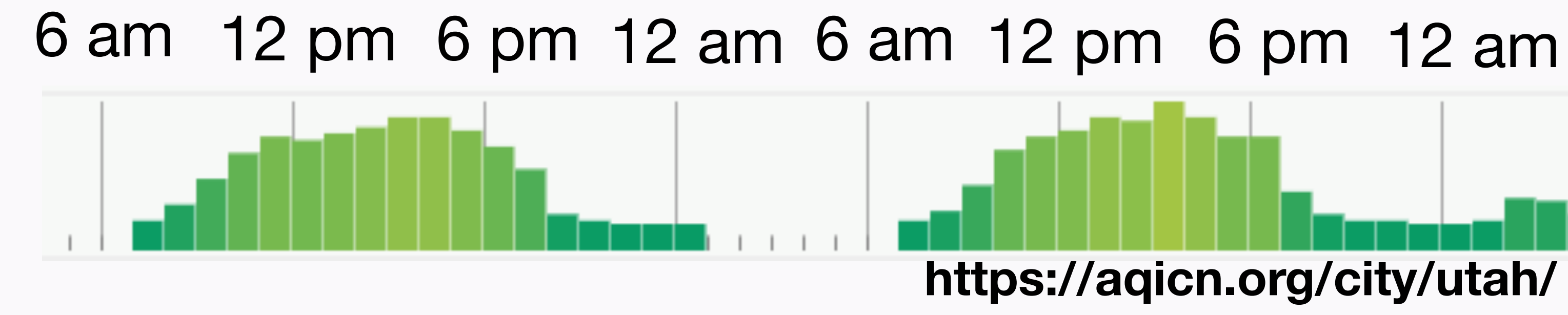


Fig. 1: Ozone concentration from a monitoring station in Salt Lake County over a two day period.



Fig. 2: Drone equipped with an ozonesonde.

CFD Simulations

- We use computational fluid dynamics (CFD) simulations to evaluate how the rotor airflow might affect measurement accuracy.
- Our simulations suggest that there is minimal disturbance above the body of the drone, but potential disturbance directly below the body of the drone.
- We also evaluate mixing and dilution using a passive scalar to represent ozone.

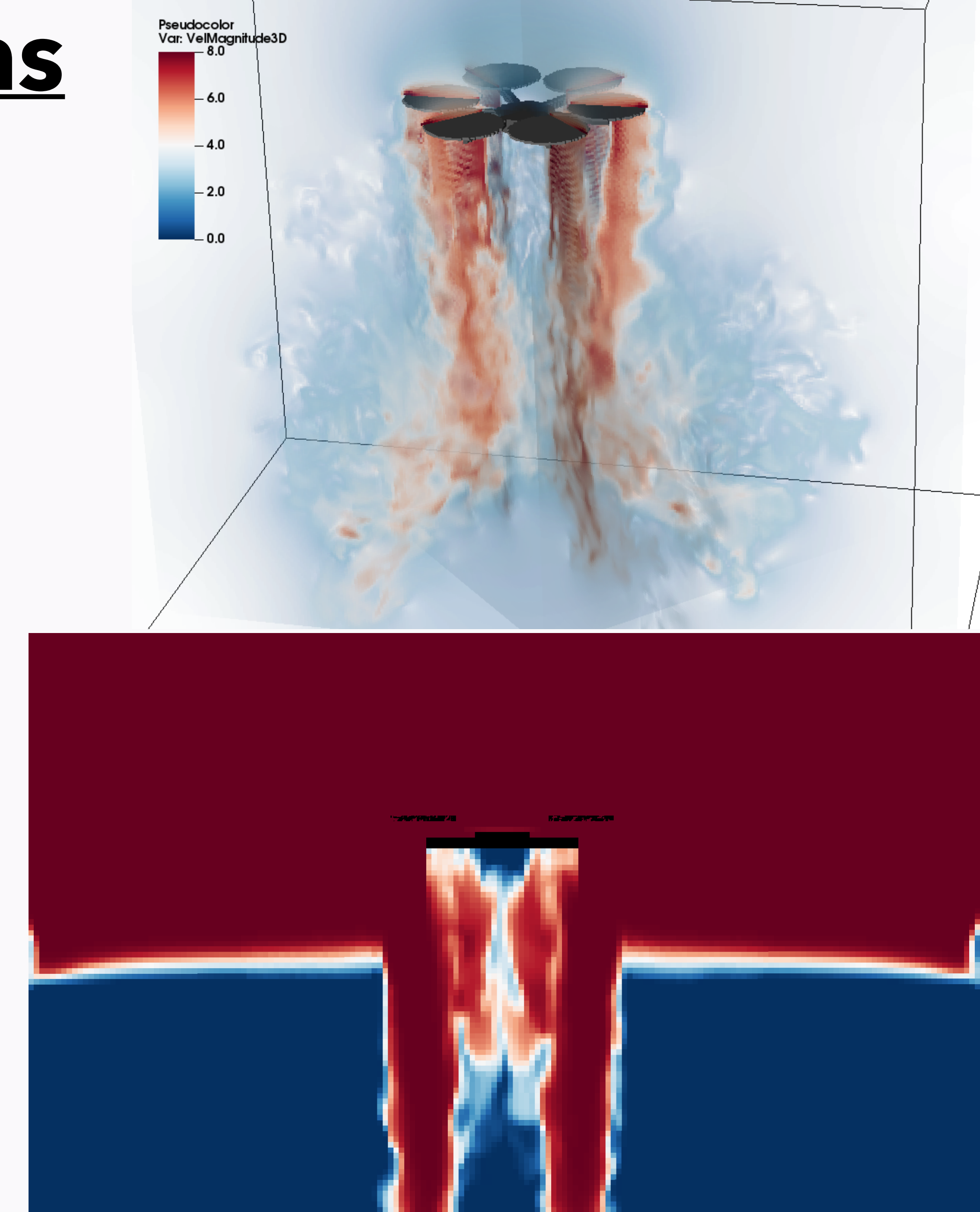


Fig. 3: 3D velocity field (top), and a 2D slice of scalar concentration (bottom).

Flight Data from August and September 2020

- Late morning and afternoon hours have uniform profiles with small deviation between ascent and descent.
- Morning hours show somewhat linear profiles with unexpected deviations between ascending and descending data.
- Using the ozonesonde intermittently is one potential source of deviations and uncertainty in the data.
- For future flights, leaving the ozonesonde on a zero filter during the times between data collection could improve measurements.

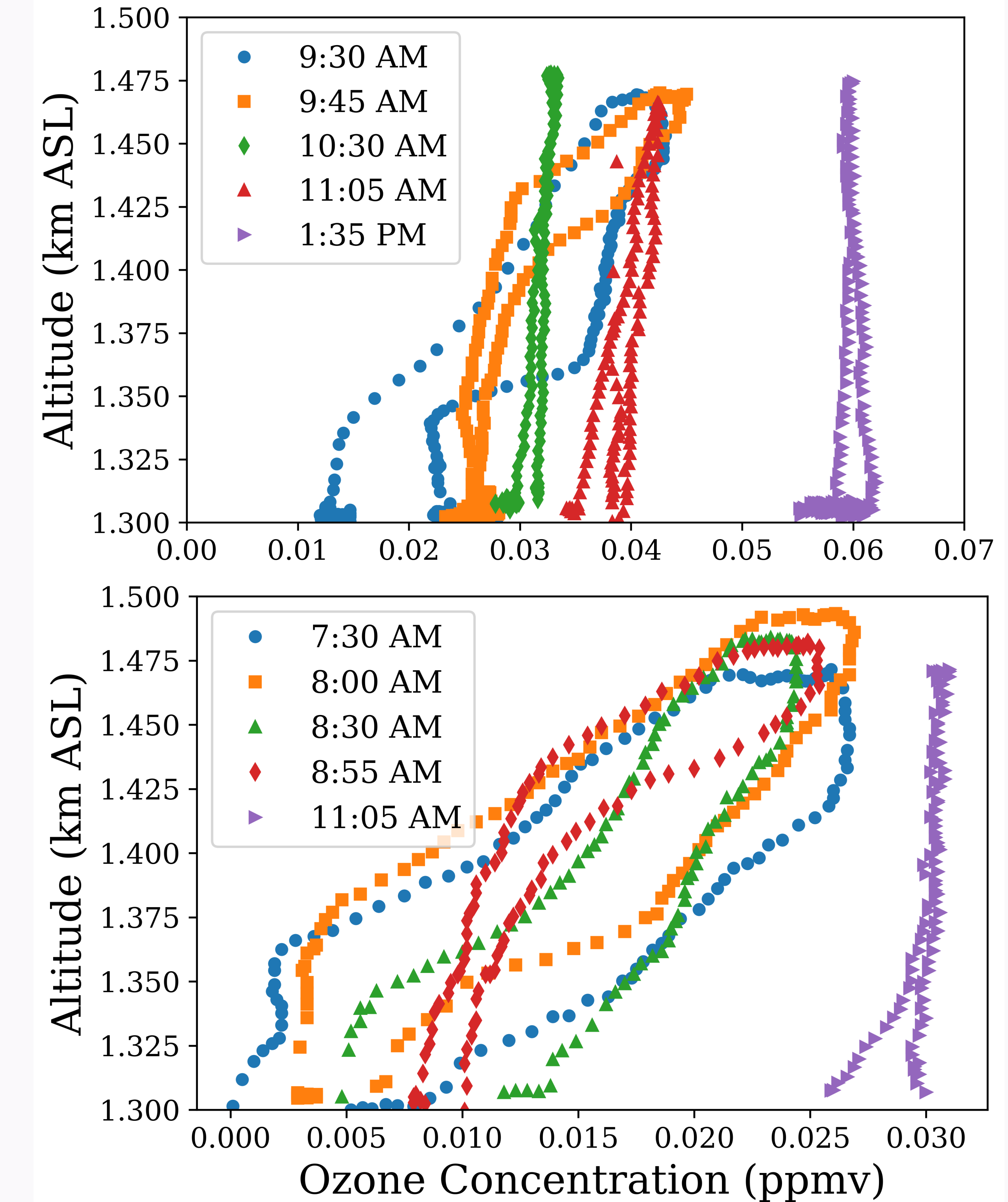


Fig. 3: Ozone profiles from August (top) and September (Bottom).

Challenges and Future Work

- We attempted to extend the ozonesonde inlet to reach above the drone where our simulations show there is less disturbance from the rotors. However, we found that the extra tubing was absorbing ozone.
- We plan to collect data using another sensor in addition to the ozonesonde, and use a high-altitude balloon in addition to the drone.