

Over Water and Shoreline Observations at Lake Michigan Using UAS and DOAS During AGES+ 2023.



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ABSTRACT

Residents on the shoreline of Lake Michigan in southwest Wisconsin are subject to air quality issues from high ozone concentrations near ground level. Meteorological data was collected for the August 2023 AGES+ campaign concerning ozone concentration, temperature, wind speed, and wind direction. Measurements were conducted using a DJI M300, with two IMETs and POM sensors attached, with flights occurring over Lake Michigan near the Chiwaukee Prairie area. Results were then correlated with the Wisconsin DNR's ground station in Chiwaukee Prairie, which found moderate correlation of data between measurements conducted above water and on land. Ozone at low altitudes is toxic to humans and can be abundant in urban or industrial areas. Ozone at low altitudes can be formed by reactions with volatile organic pollutants and nitrogen oxides, which are abundant in urban areas as products of pollution.

INTRODUCTION

- The data collected is part of a much larger field campaign, the AGES+ national field campaign. The multi-UAS-platform field campaign has allowed us to collect large amounts of data using advanced technology including large aircrafts, lasers and drones
- This wind data we collected in our portion of the campaign is looking at how the direction of the winds, the speed of winds, ozone levels, and the temperature of the air over Lake Michigan
- The data is being compared to data from the Wisconsin DNR to find correlations between the results of the data over land and over water



Figure 1: Aerial View of the research team. Pictured Right to Left: Joseph Hupy, [unknown], Patricia Cleary, Kevin Wangen, Darby Schabacker, Jeremy Worden, [unknown], [unknown]

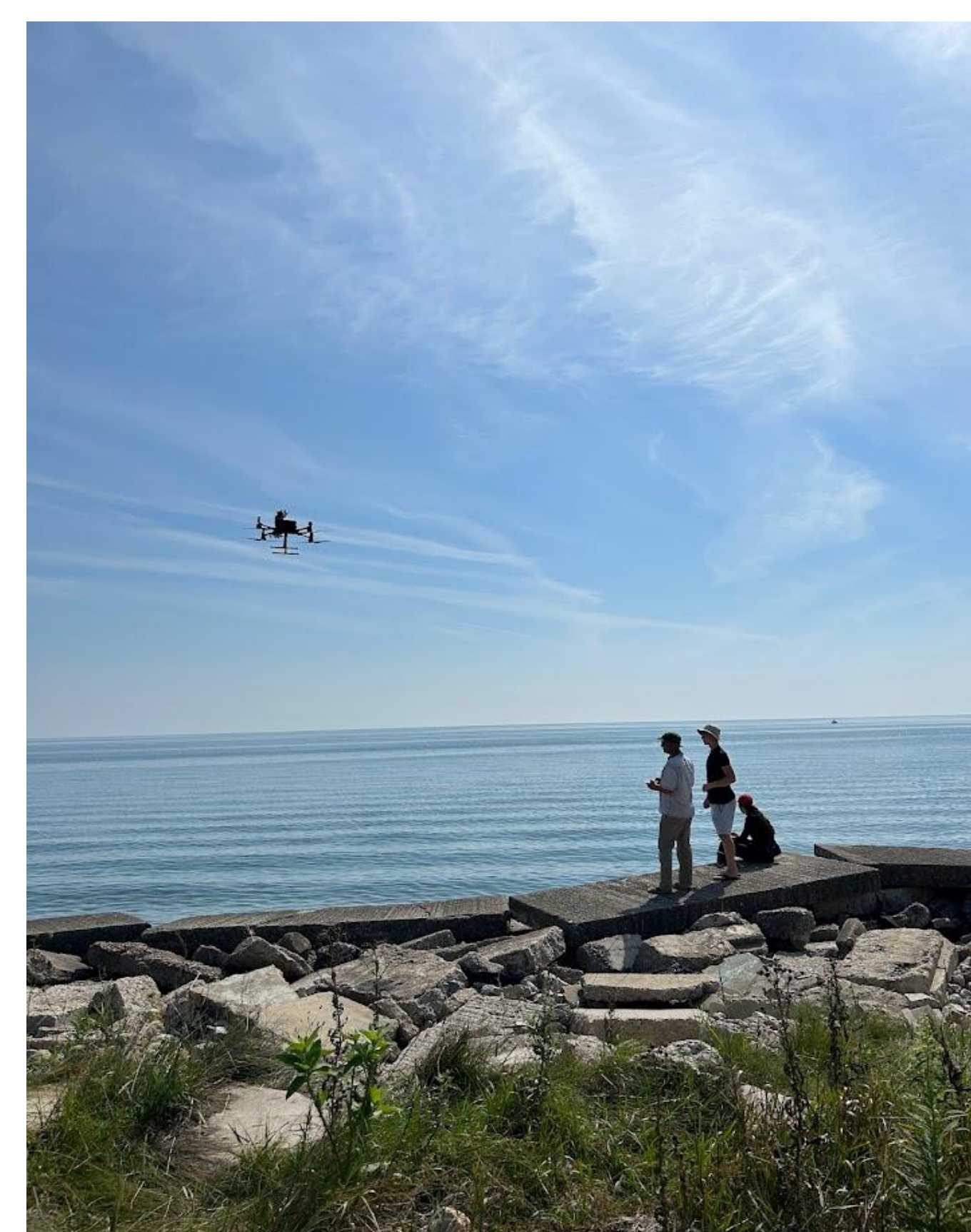


Figure 2: Data collection flight over water

METHODS AND MATERIALS

- Drones were flown over Lake Michigan, to collect our data. Professors and research students released the drones from the ground EPA site that was being directed by the WI department of natural resources
- The drones were directed into the wind, resulting in the to be almost motionless in the air as they collected the data as shown below
- The data collected was derived from the flight controller and pulled from Air Data
- Ozone measurements were made with a Personal Ozone Monitor (POM), which tracks ozone concentrations in the air via ultraviolet absorption spectrometry at a wavelength of 254 nm

RESULTS

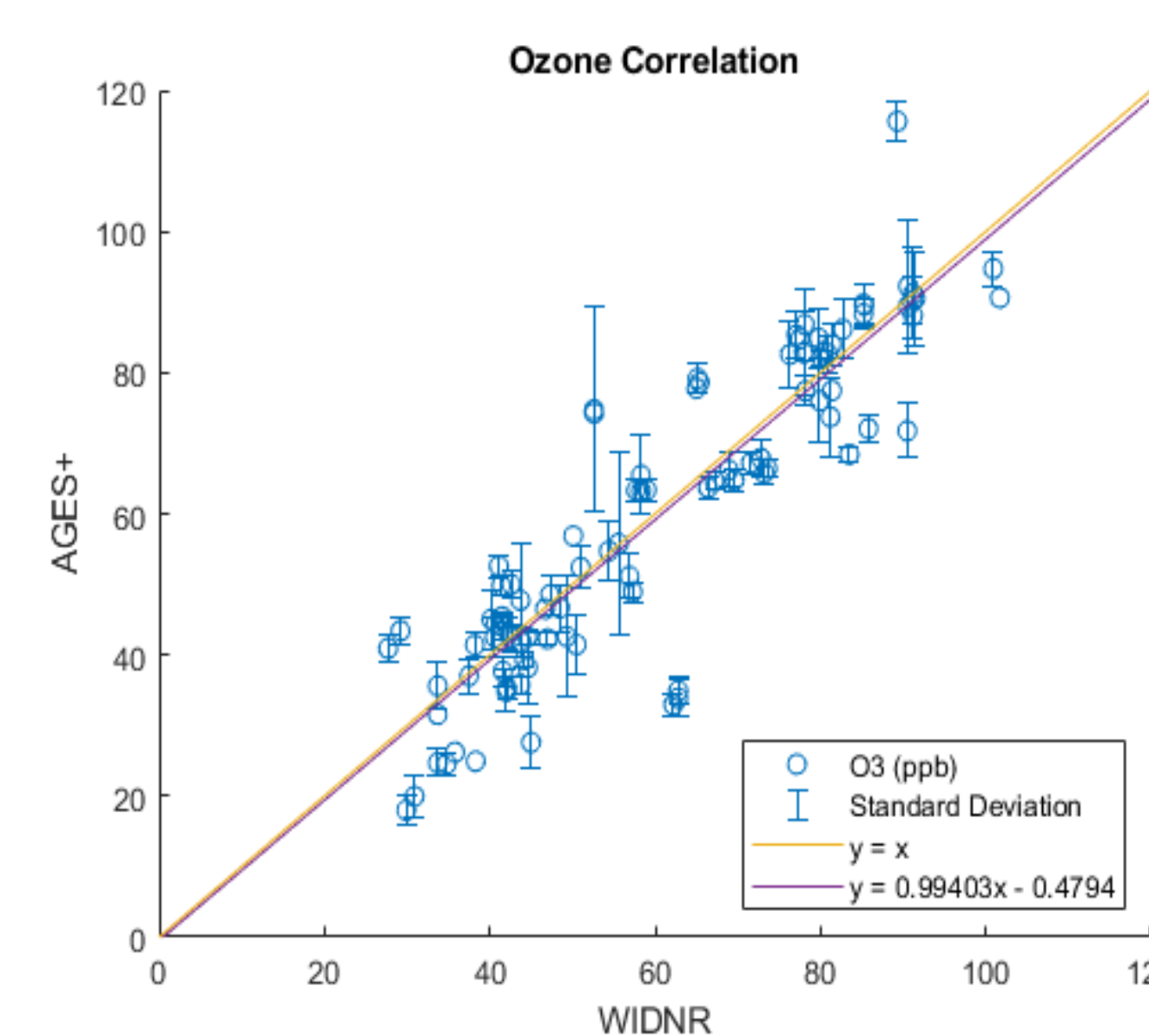


Figure 4. Ground-Level ozone correlation plot

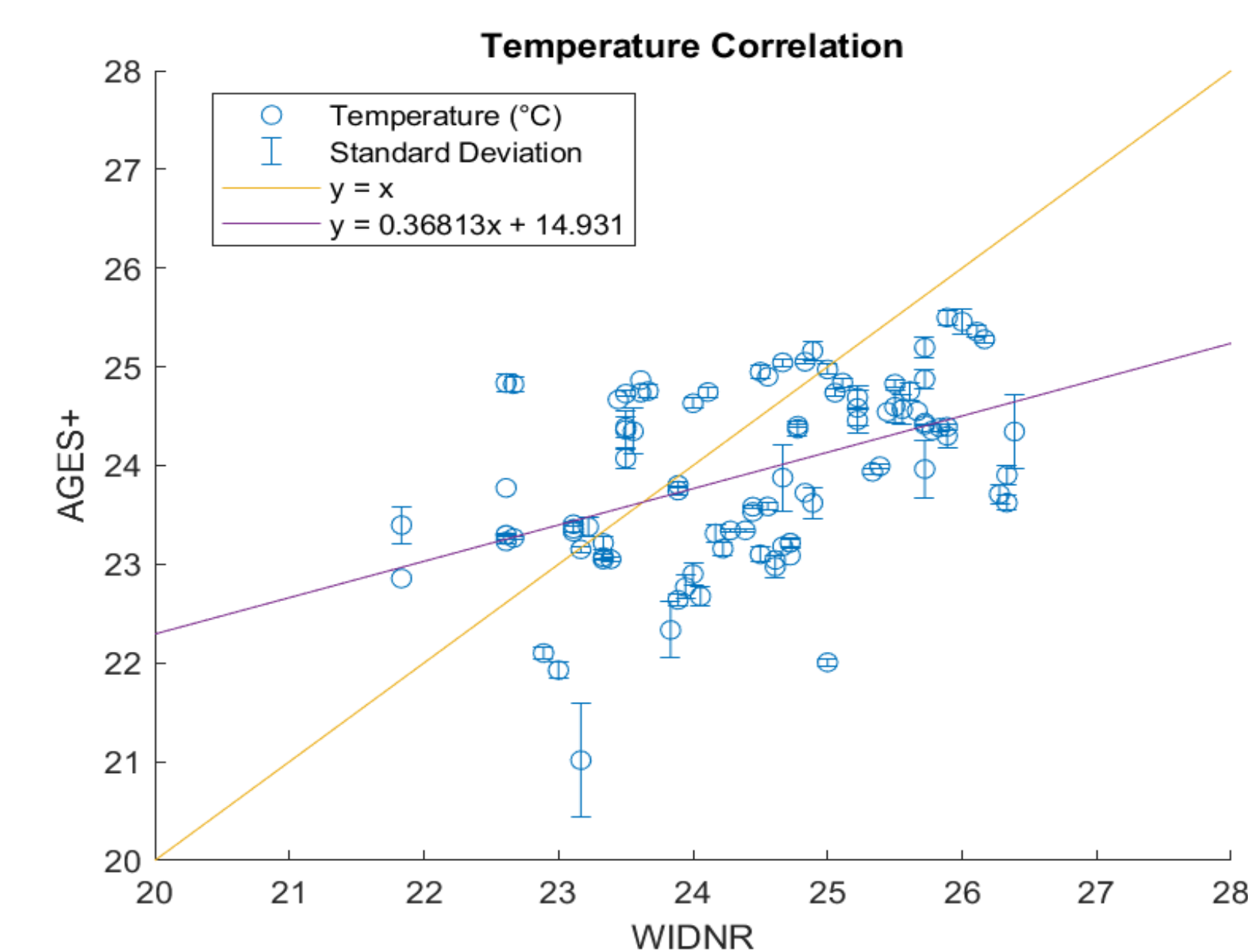


Figure 5. Ground-Level temperature correlation plot

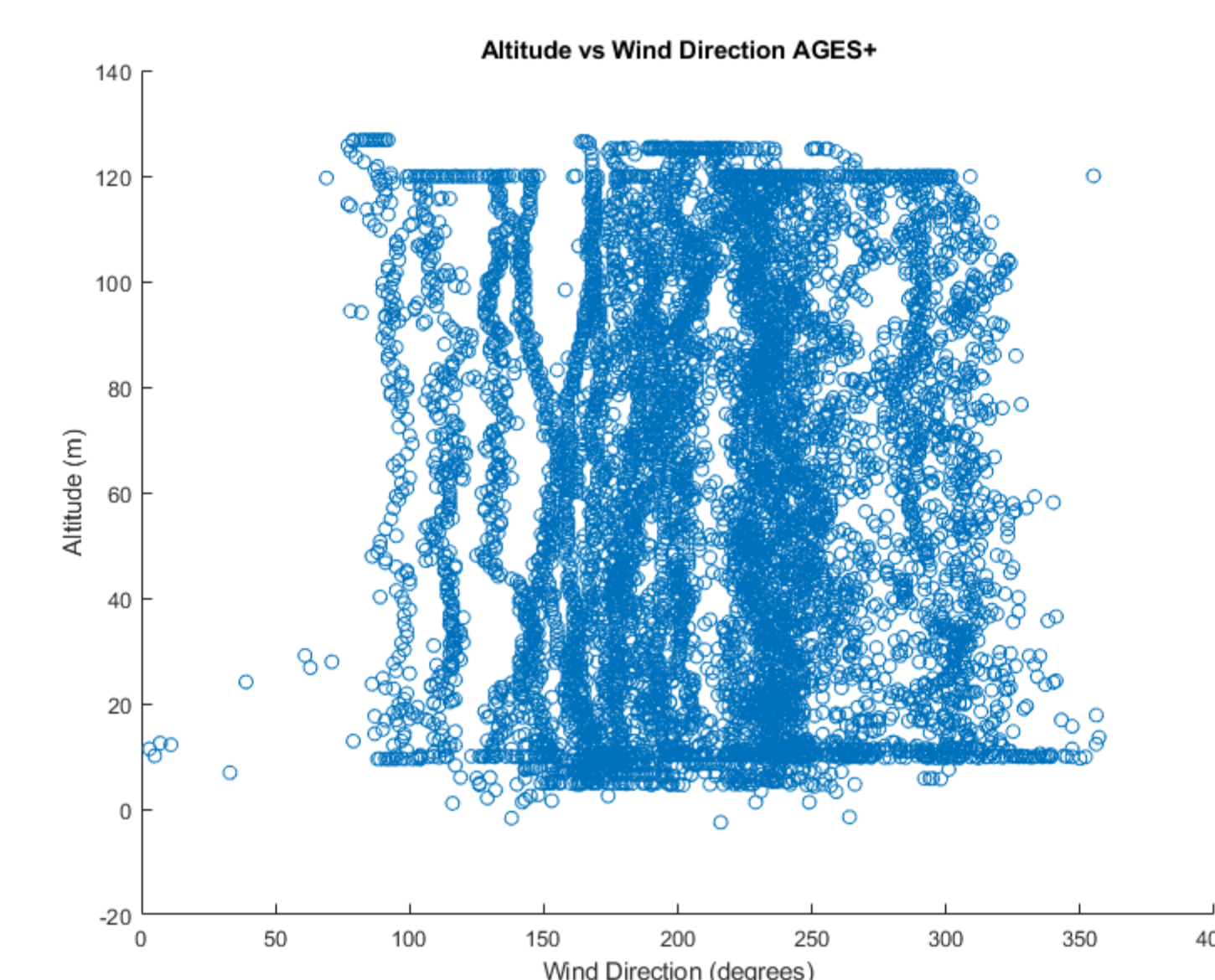


Figure 6. AGES+ Altitude vs Wind Direction

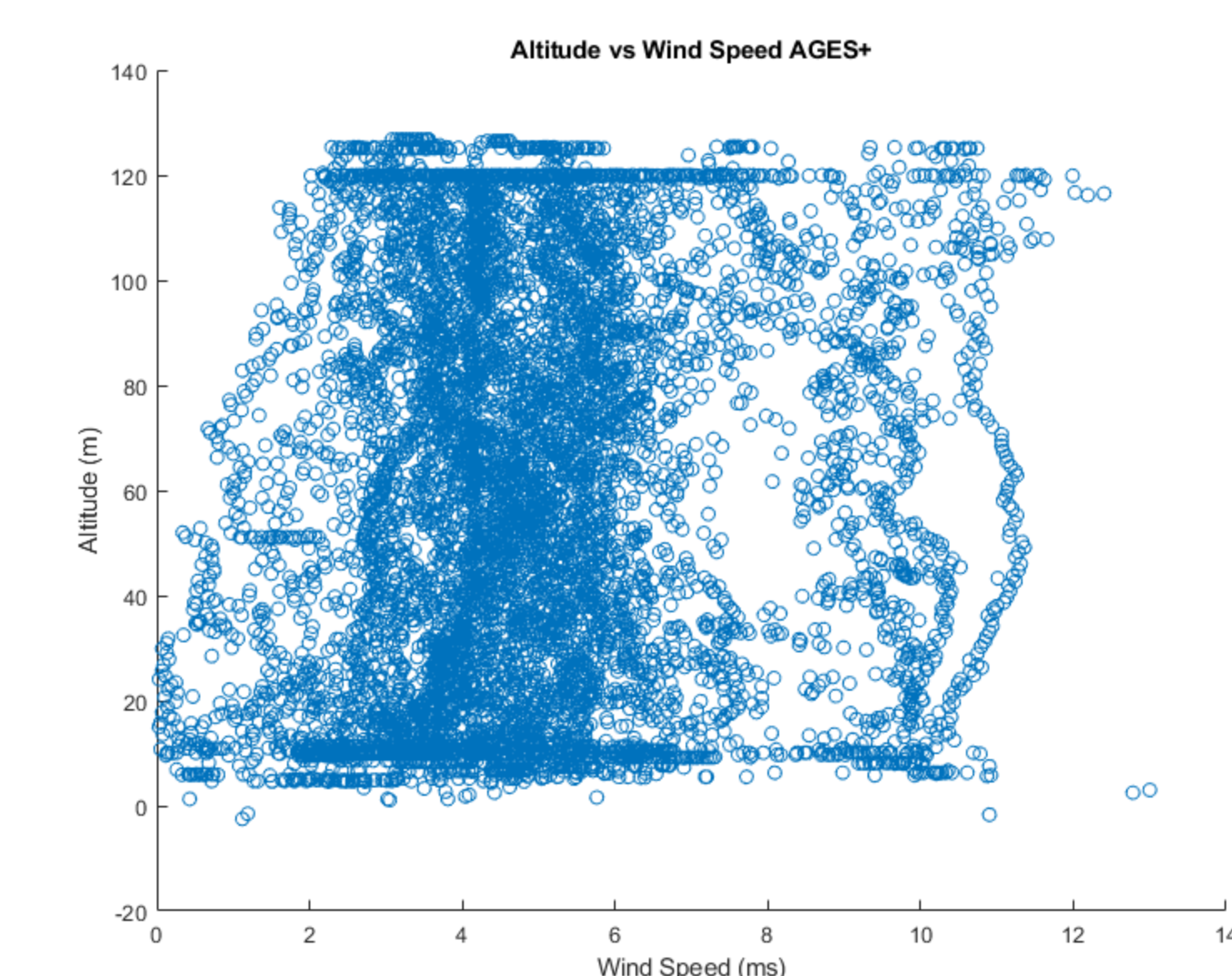


Figure 7. AGES+ Altitude vs Wind Speed



Figure 3: Satellite view of Chiwaukee Prairie



Figure 8. Aerial view of the WIDNR's ground station



Figure 9. Intercomparison Flight between two drones

ACKNOWLEDGEMENTS

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