



**GEORGIA**  
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

# Effingham Odor Modeling Updates

**Xiangyu Jiang, Ph.D.**

Modeler 3, Data and Modeling Unit

**Byeong-Uk Kim, Ph.D.**

Manager, Data and Modeling Unit



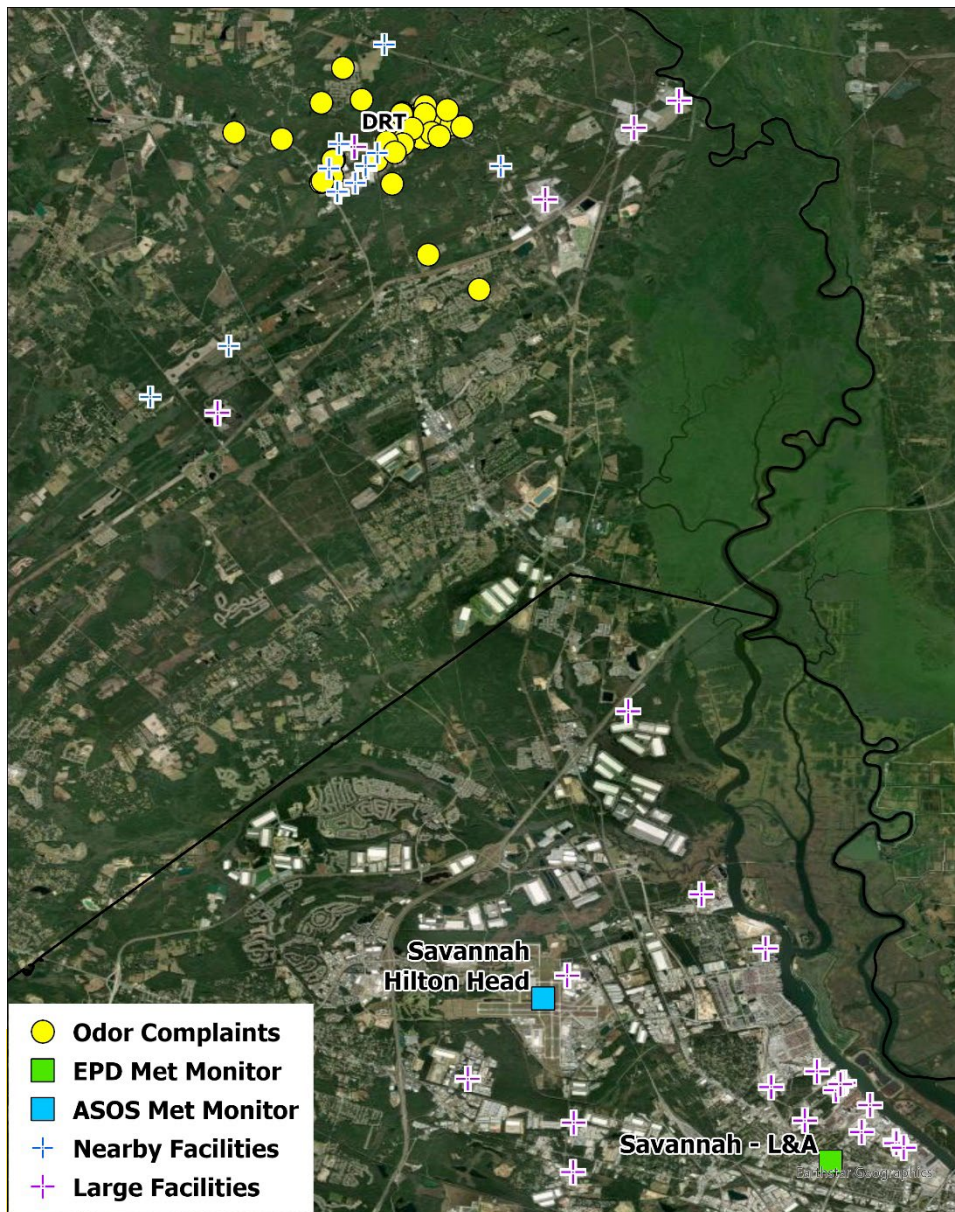
# OUTLINE

- Data and Method
- Back-Trajectory Analysis
- Temporal Analysis
- Summary



# DATA USED FOR MODELING

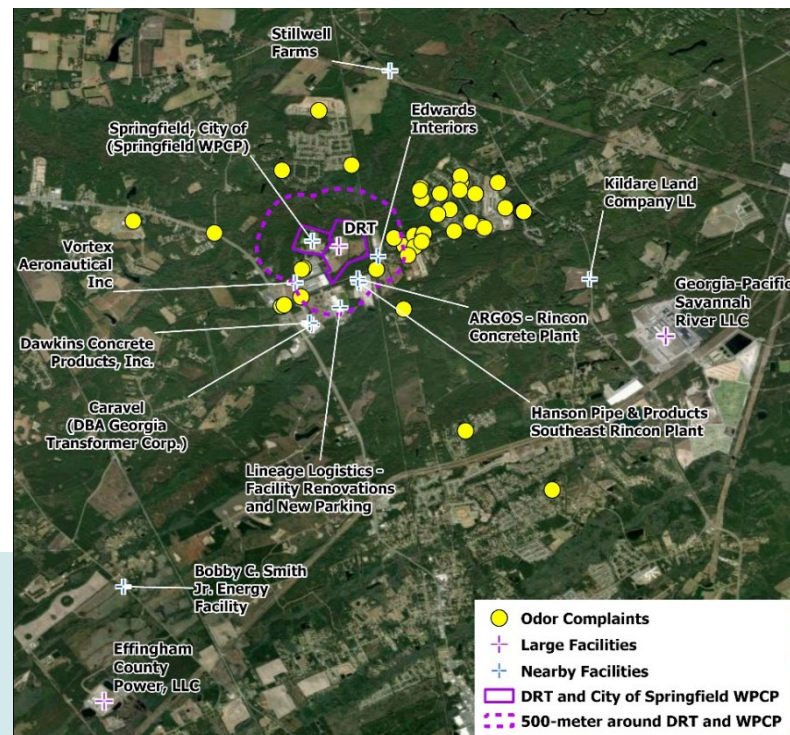
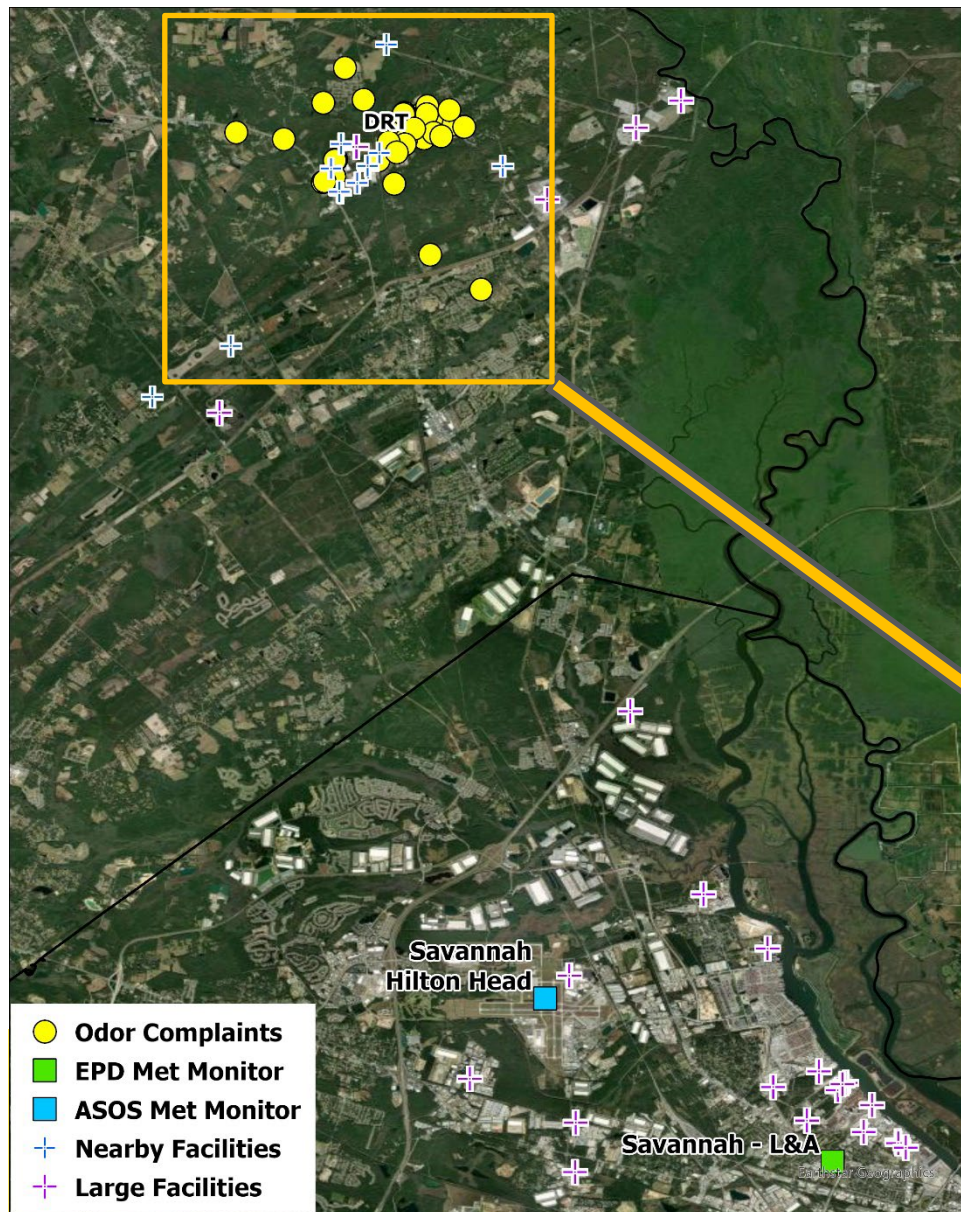
- Odor Complaints
  - A total of **103** odor complaints (11/4/2023 – 2/21/2024).
  - **91** out of 103 odor complaints (11/5/2023 – 2/21/2024) contain incidence date, time, and location information.





# DATA USED FOR MODELING

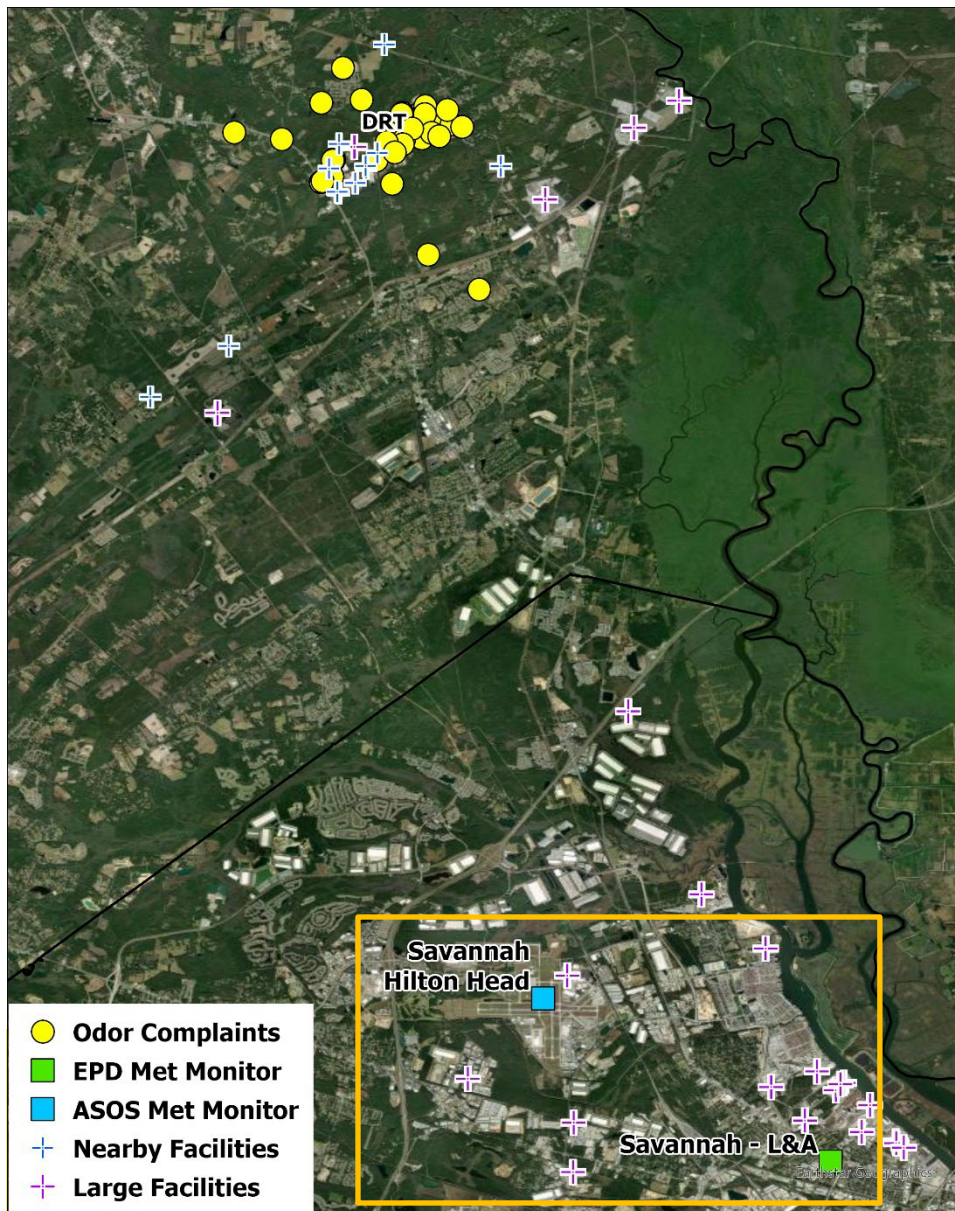
- Odor Complaints
  - A total of **103** odor complaints (11/4/2023 – 2/21/2024).
  - **91** out of 103 odor complaints (11/5/2023 – 2/21/2024) contain incidence date, time, and location information.





# DATA USED FOR MODELING

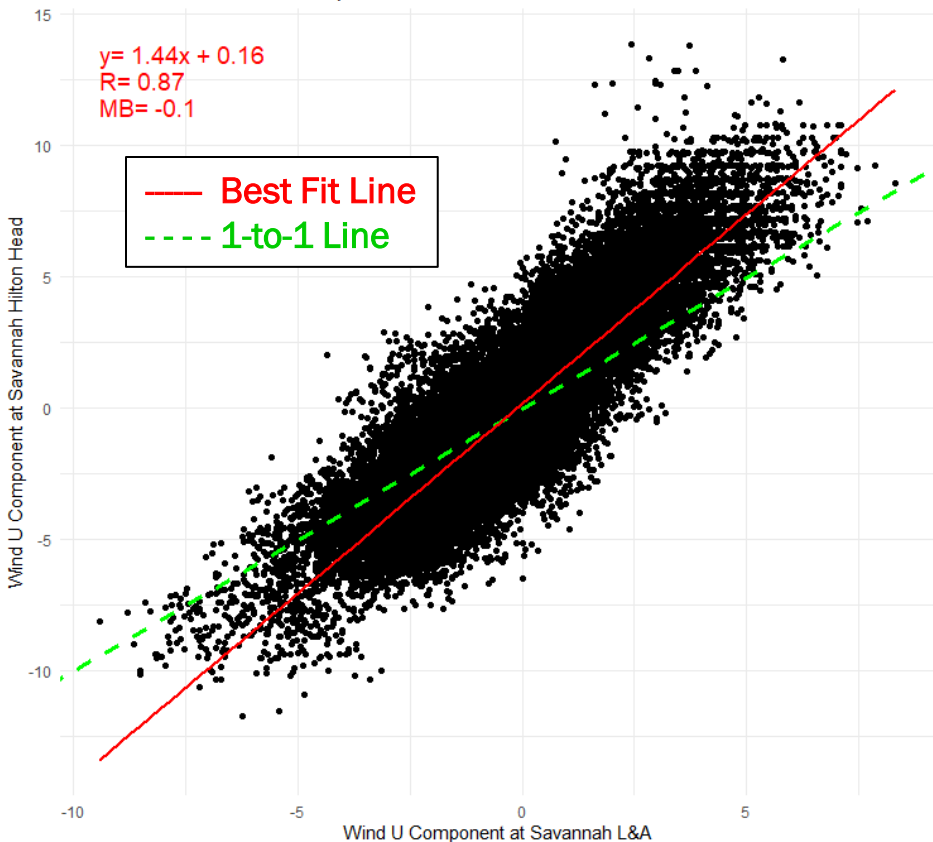
- Back-trajectory with wind data
  - Both the Savannah L&A monitor and the ASOS station at the Savannah Hilton Head airport meteorological station provide 1-minute wind speed and wind direction data.
  - **1-minute wind data collected at the Savannah L&A monitor are used for this study.**



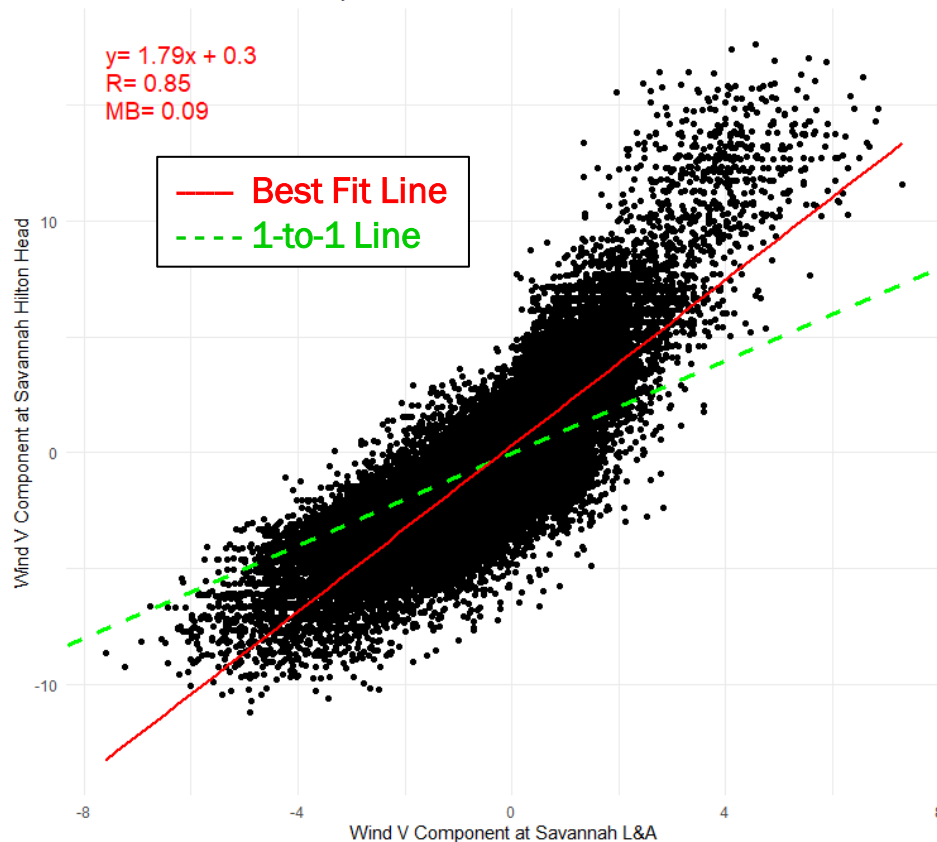


# DATA USED FOR MODELING

Scatter Plot of Wind U Component at Savannah L&A vs Savannah Hilton Head



Scatter Plot of Wind V Component at Savannah L&A vs Savannah Hilton Head

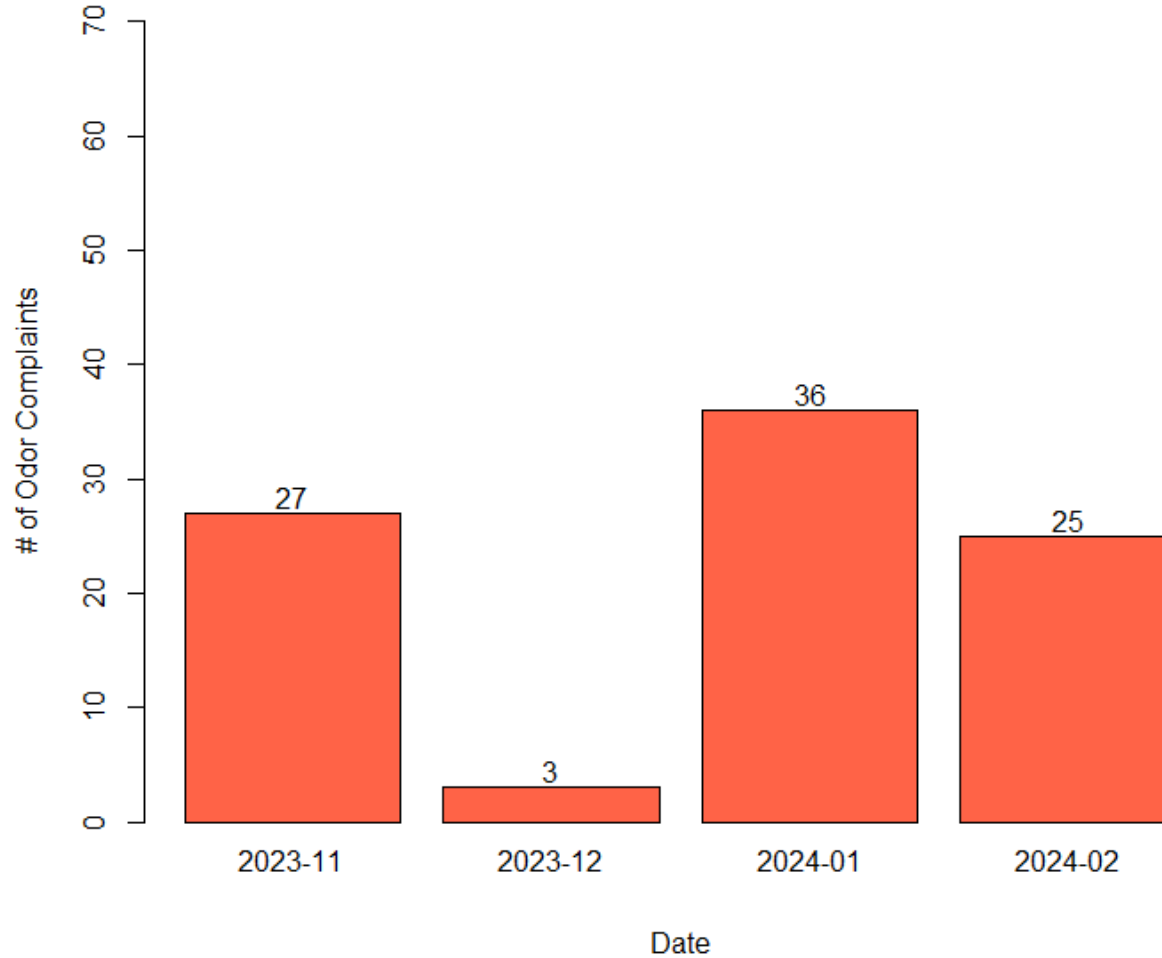


Good correlation of wind data between the Savannah L&A monitor and the ASOS station at the Savannah Hilton Head airport. Wind speed resolution at the Savannah L&A monitor (0.1 m/s) is higher than those obtained at the ASOS at the Savannah Hilton Head airport (0.514 m/s). Therefore, the DMU decided to use wind data at the Savannah L&A monitor.



# ODOR COMPLAINTS OVER MONTHS

Monthly Trend of Odor Complaints





# MODELING METHOD



- Initial Information
  - Odor Complaints ( $X_t, Y_t$ )
- Back-Trajectories Equation
  - Step 1: Decompose wind vector into u and v components
  - Step 2: Calculate back trajectories (initially up to 12 hours)
$$X_{t-1} = X_t - u_{t-1}$$
$$Y_{t-1} = Y_t - v_{t-1}$$
- Assumption
  - Measured wind speed and wind direction are representative across the entire modeling domain.

This approach was successfully used for an odor modeling case in the past.



# EXAMPLE BACK-TRAJECTORY



- Initial Information
  - Odor Complaints ( $X_t, Y_t$ )
- Back-Trajectories Equation
  - Step 1: Decompose wind vector into u and v components
  - Step 2: Calculate back trajectories (initially up to 12 hours)
$$X_{t-1} = X_t - u_{t-1}$$
$$Y_{t-1} = Y_t - v_{t-1}$$
- Assumption
  - Measured wind speed and wind direction are representative across the entire modeling domain.

This approach was successfully used for an odor modeling case in the past.



# TRAVEL DISTANCE AND DISPLACEMENT

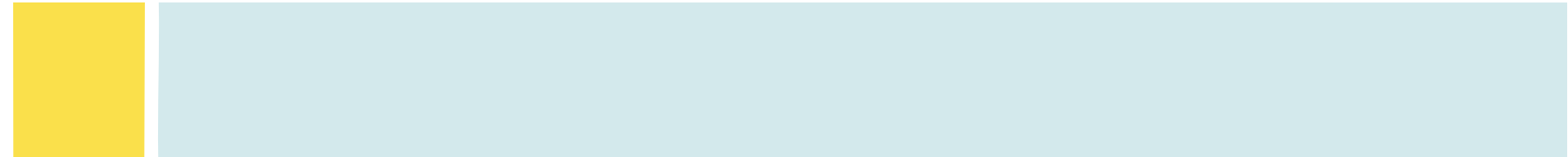


- **Travel Distance:** sum of each segment
  - E.g., Travel Distance =  $\text{seg1} + \text{seg2} + \dots + \text{seg6}$
- **Displacement:** distance between starting point and end point
- If displacement/travel distance is close to 1, then it indicates the wind direction is consistent over the time.

This approach was successfully used for an odor modeling case in the past.

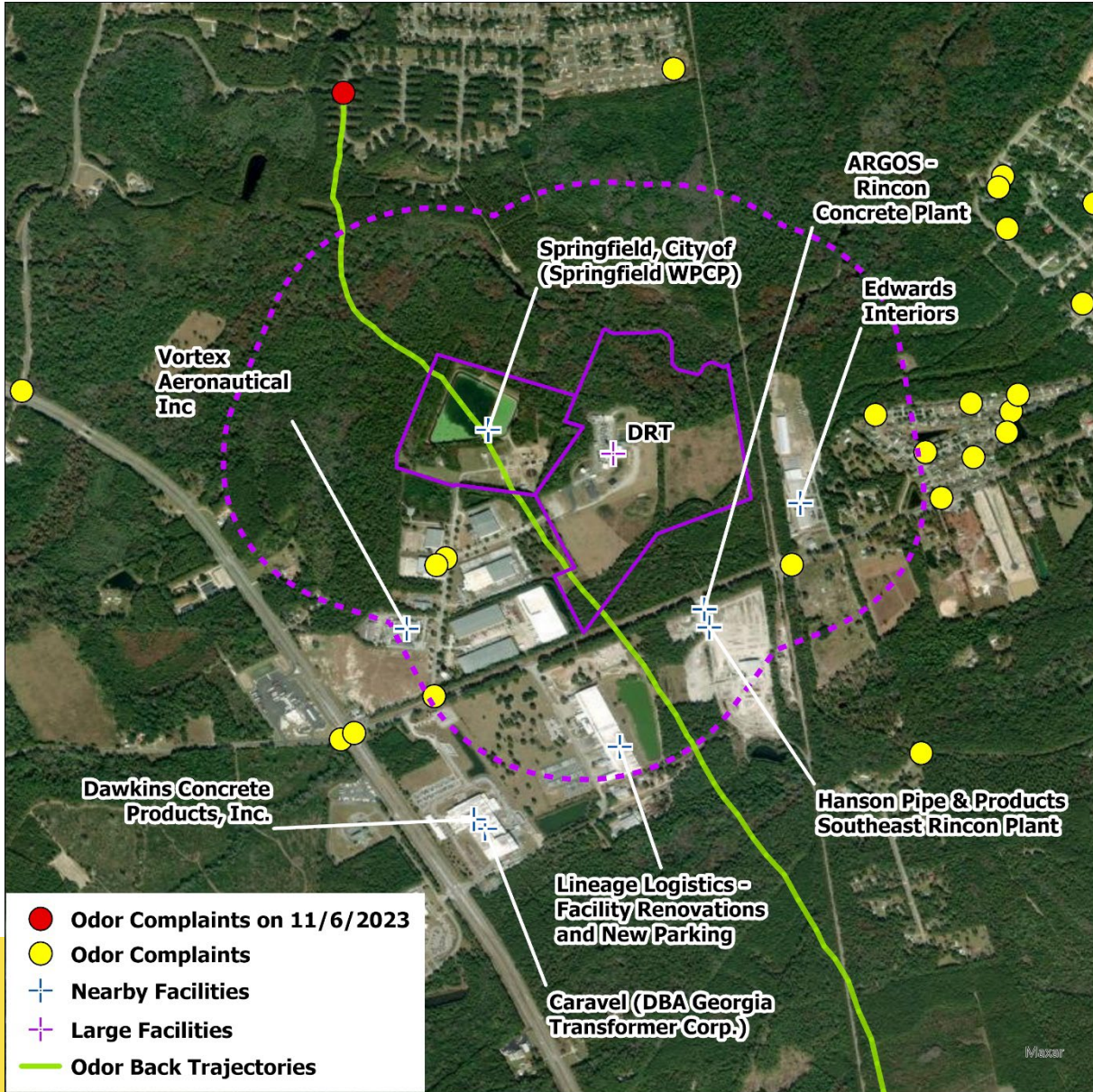


# **BACK-TRAJECTORY MODELING ANALYSIS**





# NOVEMBER 6, 2023 BACK-TRAJECTORIES



Incidence Date: 11/06/2023  
(Monday)

Incidence time: 6 PM

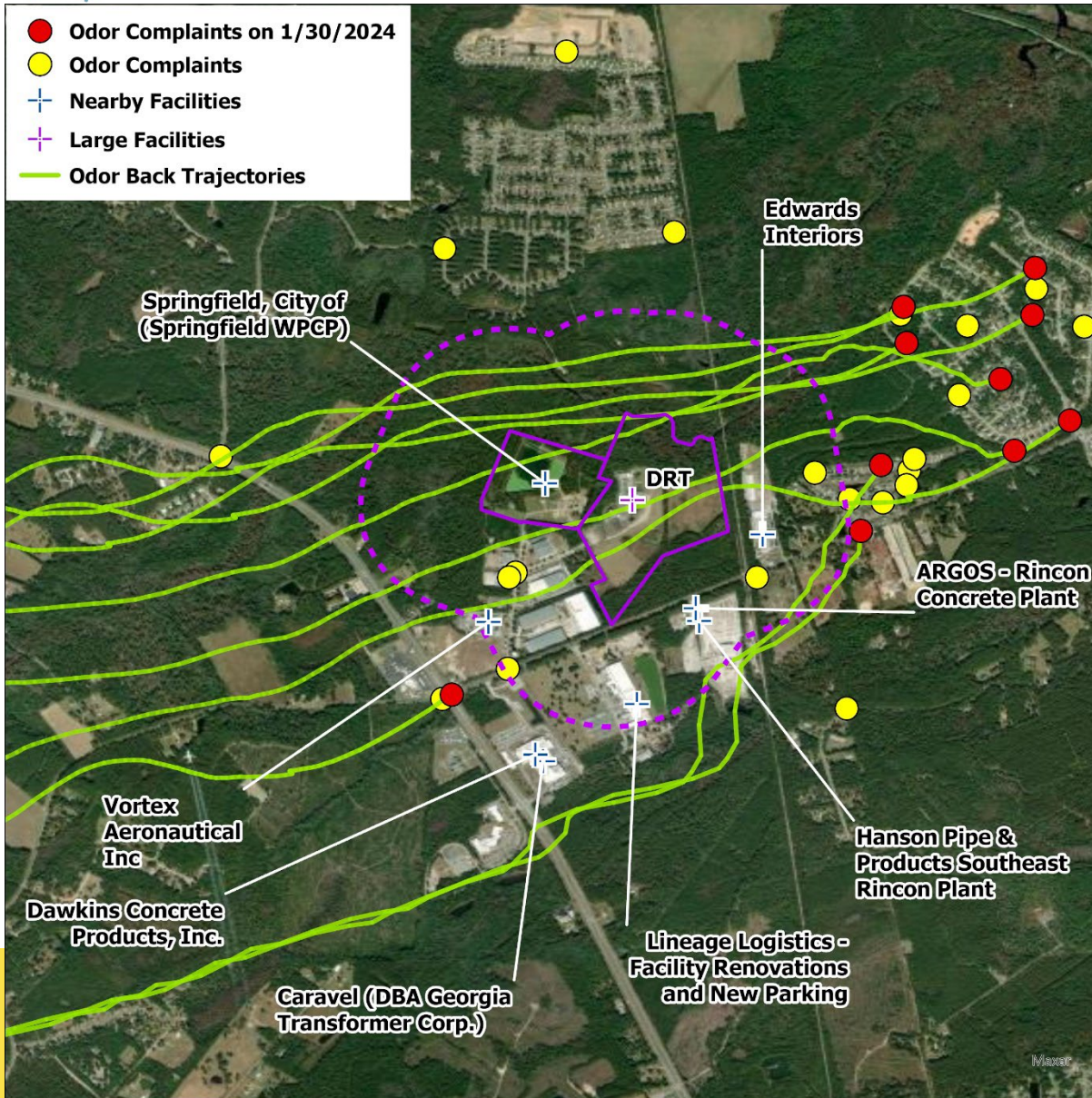
# of incidences: 1

Average Wind Speed for 12 hours:  
2.56 mph

Displacement/Travel Distance:  
0.62



# JANUARY 30, 2024 BACK-TRAJECTORIES



Incidence Date: 01/30/2024  
(Tuesday)

Incidence time: 7 AM - 12:20 PM

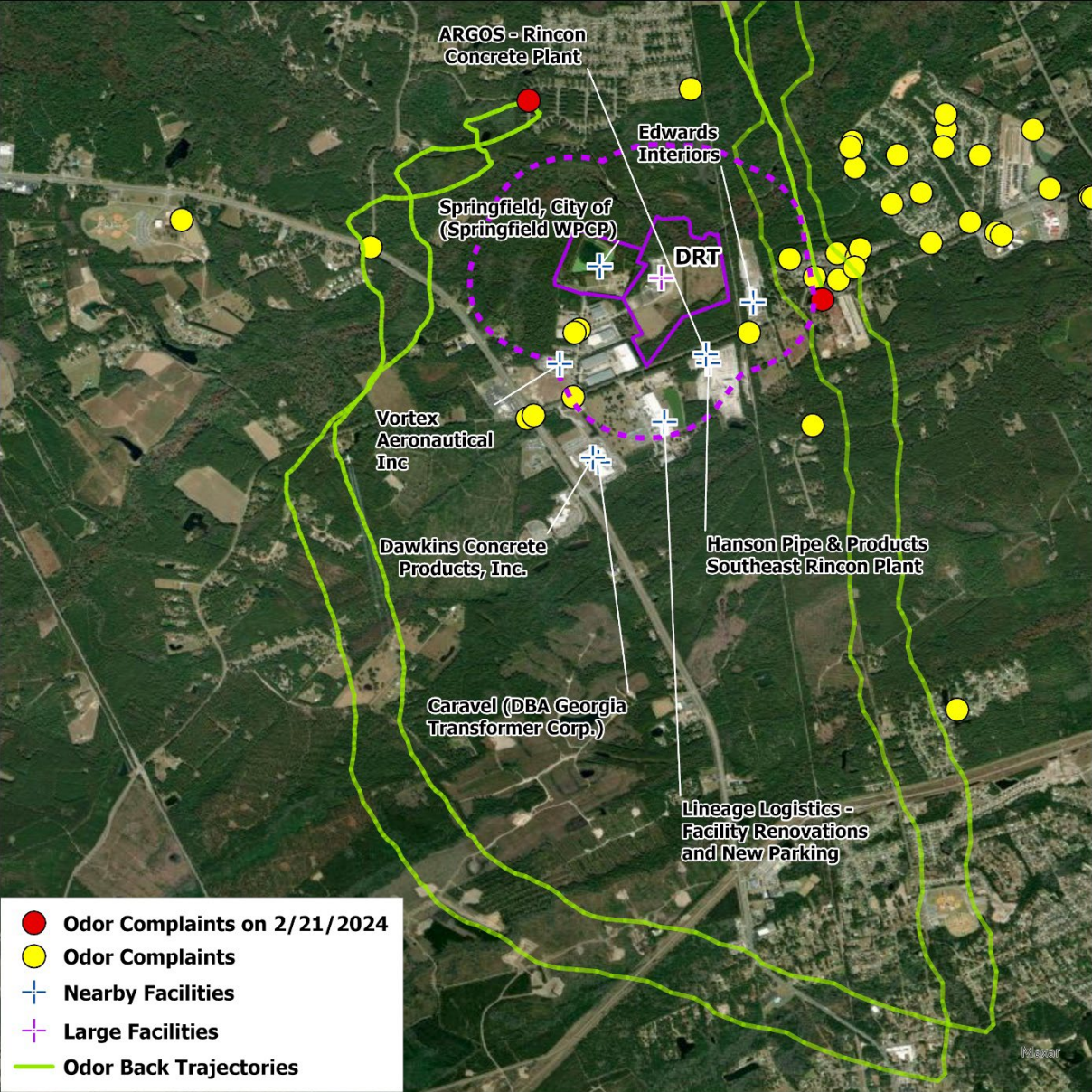
# of incidences: 10

Average Wind Speed for 12 hours:  
1.4 - 1.75 mph

Displacement/Travel Distance:  
0.8-0.93 (i.e., very consistent  
wind direction)



# FEBRUARY 21, 2024 BACK-TRAJECTORIES



Incidence Date: 02/21/2024  
(Wednesday)

Incidence time: 7:45 AM - 10 PM

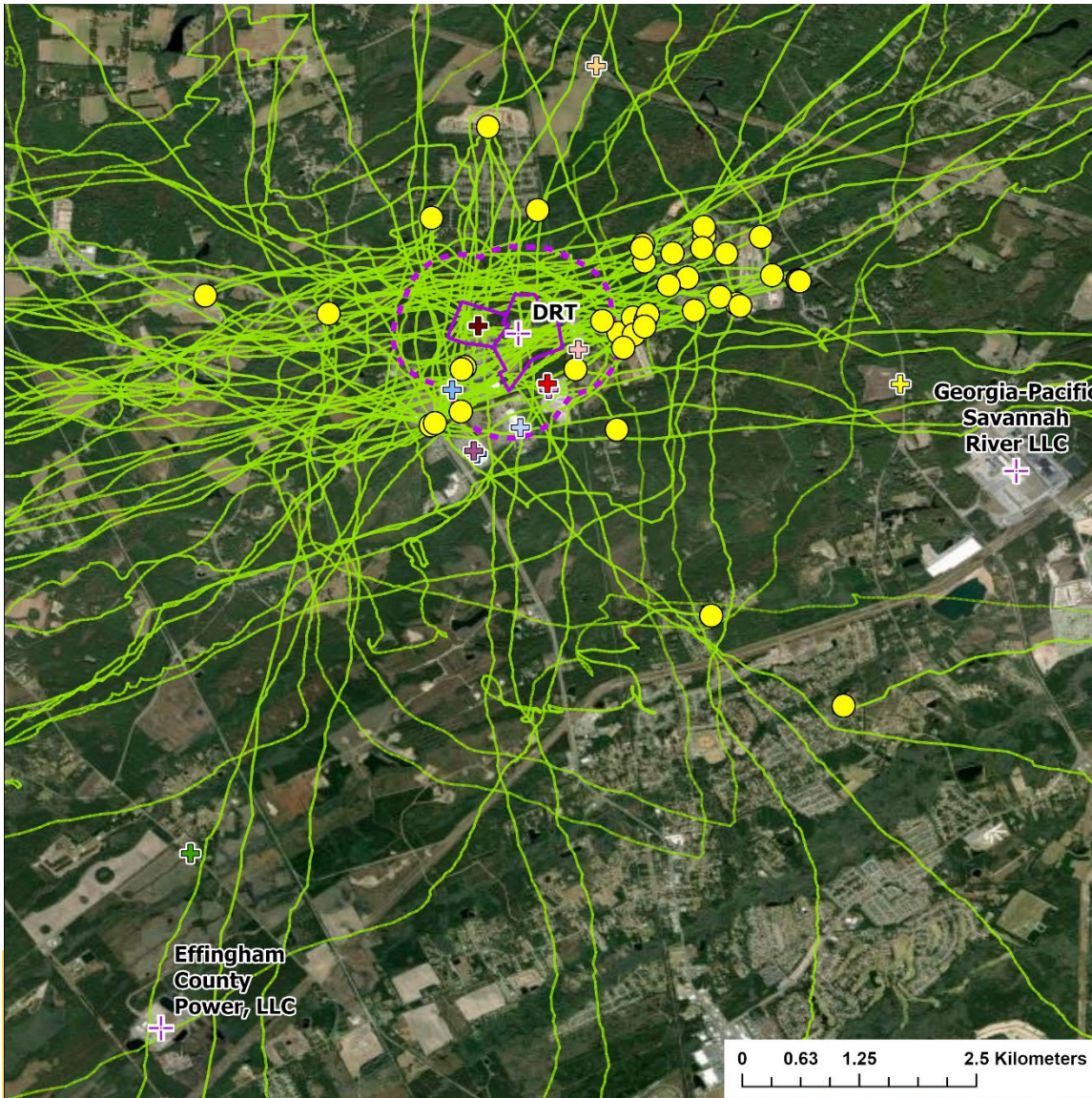
# of incidences: 3

Average Wind Speed for 12 hours:  
2.63-4.05 mph

Displacement/Travel Distance:  
0.67-0.71



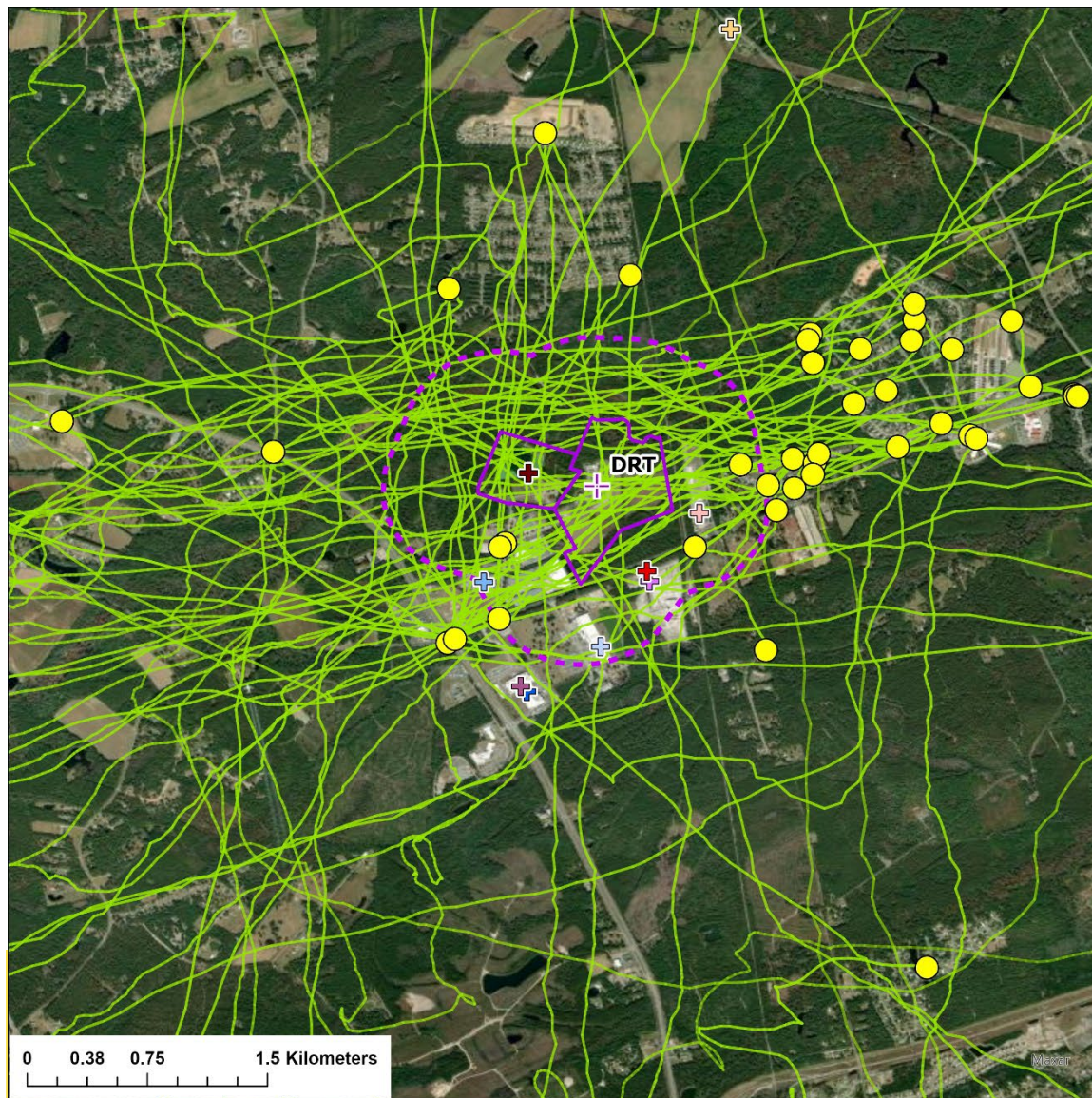
# ALL (91) 12-HOUR BACK-TRAJECTORIES



- + Large Facilities
- + ARGOS - Rincon Concrete Plant
- + Bobby C. Smith Jr. Energy Facility
- + Caravel (DBA Georgia Transformer Corp.)
- + Dawkins Concrete Products, Inc.
- + Edwards Interiors
- + GA Power Co Plt McIntosh
- + Georgia Transmission
- + Hanson Pipe & Products Southeast Rincon Plant
- + Interfor - Meldrim Division
- + Kildare Land Company LL
- + Lineage Logistics - Facility Renovations and New Parking
- + Portfresh Logistics
- + Rincon Compressor Station
- + Springfield, City of (Springfield WPCP)
- + Stillwell Farms
- + Vortex Aeronautical Inc
- Odor Complaints
- Odor Back Trajectories
- DRT and City of Springfield WPCP
- ⋯ 500-meter around DRT and WPCP



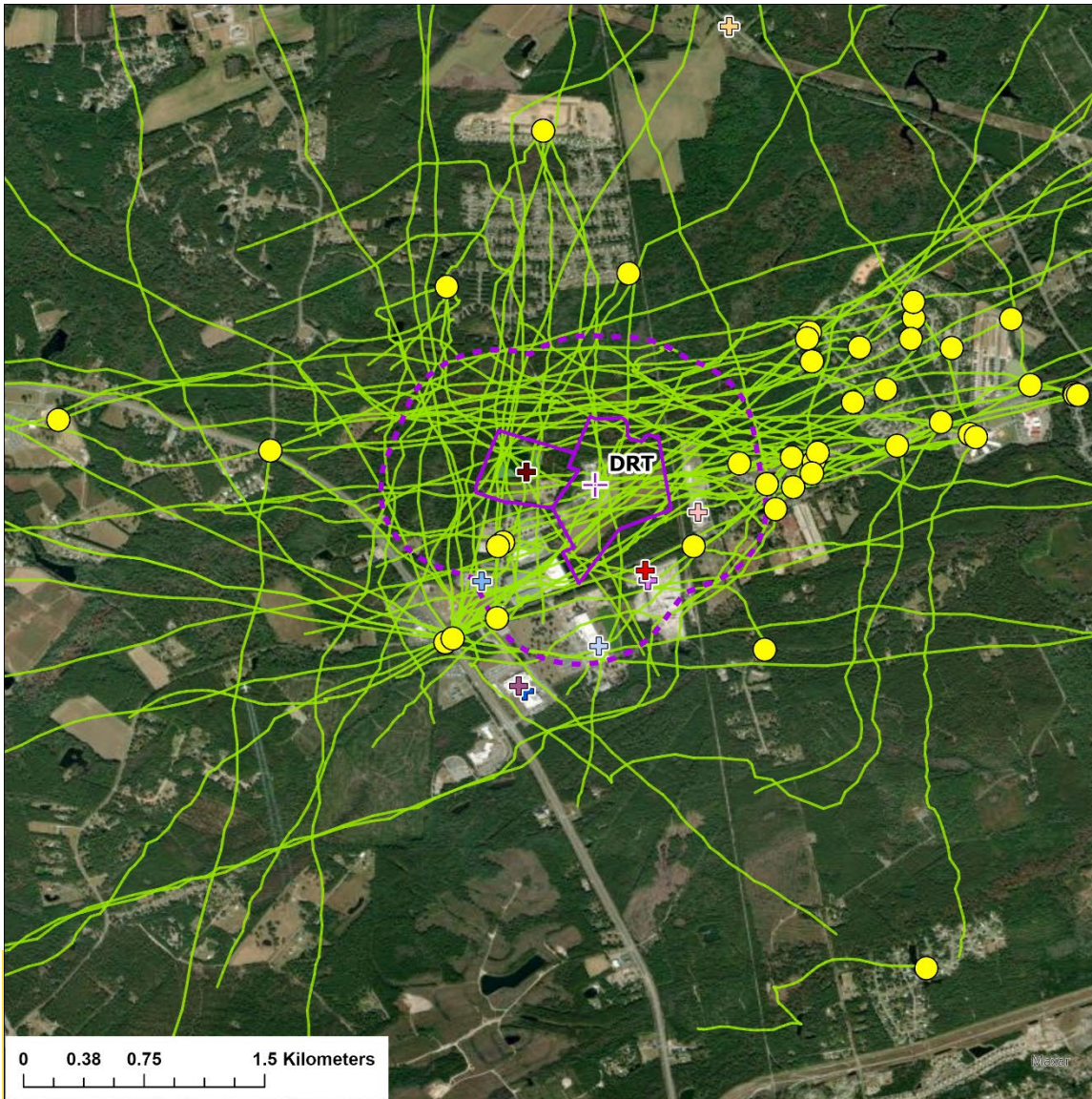
# ZOOM-IN 12-HOUR BACK-TRAJECTORIES



- + Large Facilities
- + ARGOS - Rincon Concrete Plant
- + Bobby C. Smith Jr. Energy Facility
- + Caravel (DBA Georgia Transformer Corp.)
- + Dawkins Concrete Products, Inc.
- + Edwards Interiors
- + GA Power Co Plt McIntosh
- + Georgia Transmission
- + Hanson Pipe & Products Southeast Rincon Plant
- + Interfor - Meldrim Division
- + Kildare Land Company LL
- + Lineage Logistics - Facility Renovations and New Parking
- + Portfresh Logistics
- + Rincon Compressor Station
- + Springfield, City of (Springfield WPCP)
- + Stillwell Farms
- + Vortex Aeronautical Inc
- Odor Complaints
- Odor Back Trajectories
- ▭ DRT and City of Springfield WPCP
- ▭ 500-meter around DRT and WPCP



# ZOOM-IN 1-HOUR BACK-TRAJECTORIES



- + Large Facilities
- + ARGOS - Rincon Concrete Plant
- + Bobby C. Smith Jr. Energy Facility
- + Caravel (DBA Georgia Transformer Corp.)
- + Dawkins Concrete Products, Inc.
- + Edwards Interiors
- + GA Power Co Plt McIntosh
- + Georgia Transmission
- + Hanson Pipe & Products Southeast Rincon Plant
- + Interfor - Meldrim Division
- + Kildare Land Company LL
- + Lineage Logistics - Facility Renovations and New Parking
- + Portfresh Logistics
- + Rincon Compressor Station
- + Springfield, City of (Springfield WPCP)
- + Stillwell Farms
- + Vortex Aeronautical Inc
- Odor Complaints
- Odor Back Trajectories
- ▭ DRT and City of Springfield WPCP
- ⋯ 500-meter around DRT and WPCP

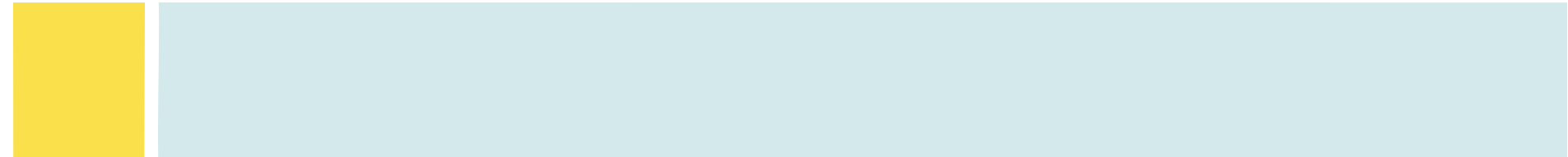


# 1-HOUR BACK-TRAJECTORIES PASSING EACH AREA

Period	# of Incidences	DRT	WPCP	DRT or WPCP	500-meter Buffer
11/5/2023 – 2/21/2024	91	31 (34.1%)	15 (16.5%)	39 (42.9%)	68 (74.7%)

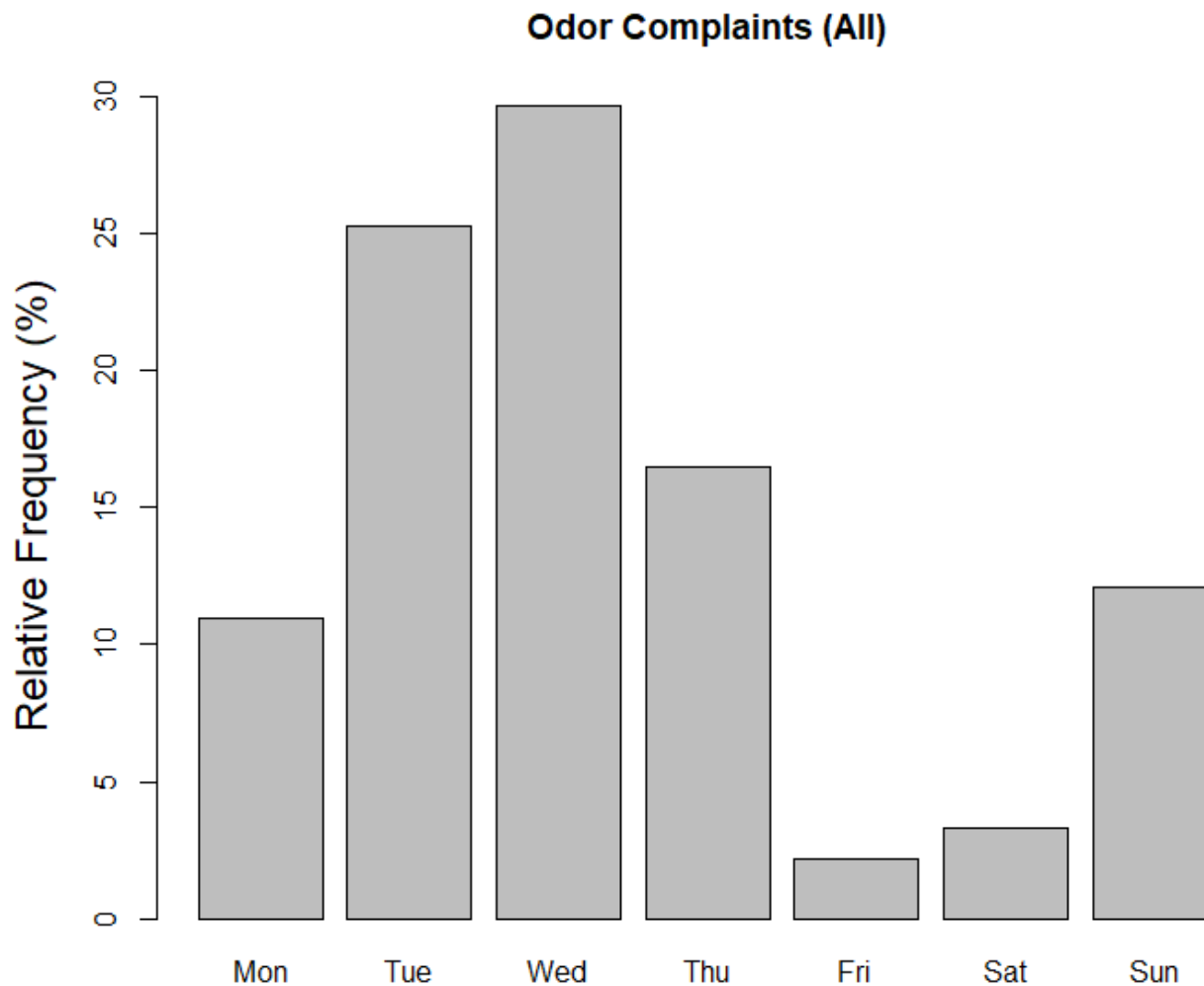


# TEMPORAL ANALYSIS





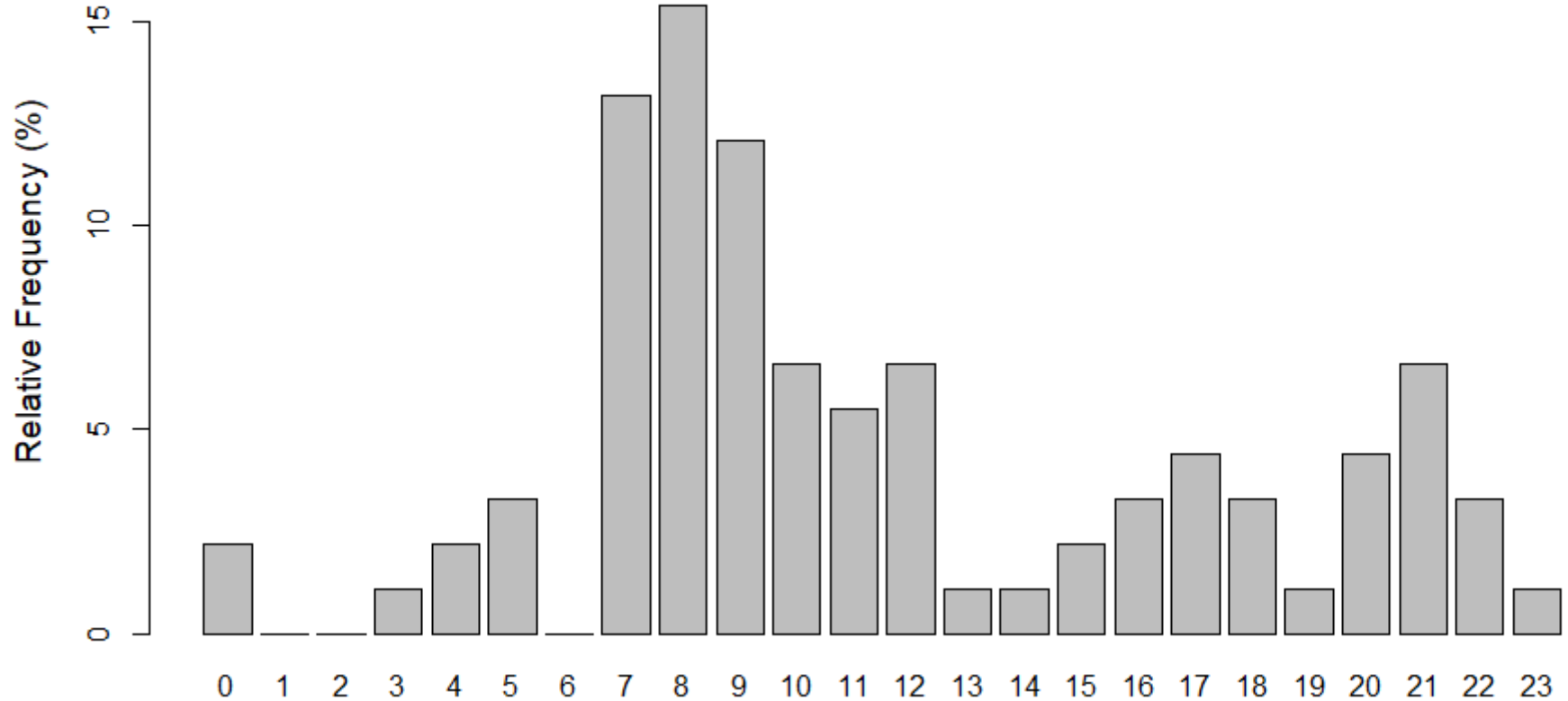
# DAY-OF-WEEK FREQUENCY OF COMPLAINTS





# HOUR-OF-DAY FREQUENCY OF COMPLAINTS

Odor Complaints (All)





# EFFINGHAM ODOR SUMMARY

- 91 out of 103 incidences have time and location information (11/5/2023 – 2/21/2024).
  - 62 out of 91 (68.1%) incidences occur after 7:00 am and before 1:00 pm.
  - Most of incidences occur on Tuesday and Wednesday.
- Using the GA EPD 1-min approach, 68 out of 91 (**74.7%**) back-trajectories passed the 500-meter buffer zone for the 1<sup>st</sup> hour of back-trajectories from incident locations.
- The odor source(s) are likely in and/or near the 500-meter buffer zone surrounding DRT and Springfield WPCP.



## CONTACT INFORMATION

**Xiangyu Jiang, Ph.D.**

**Georgia Dept. of Natural Resources  
4244 International Parkway, Suite 120  
Atlanta, GA 30354**

**Xiangyu.Jiang@dnr.ga.gov  
(470)-251-2610**



# QUESTIONS?

