

Modeling Potential Odor Sources in Brunswick, GA

Xiangyu Jiang*, Byeong-Uk Kim, and James Boylan
Georgia Environmental Protection Division, Atlanta, GA, USA

1. Background

- Odor complaints were reported in Brunswick, GA during December 2020 – February 2021.
- The goals of this study were (1) to investigate association between potential odor sources and odor complaints with modeling and (2) to compare modeling techniques due to variable proximity of potential sources to receptors.

2. Data and Method

Odor Complaints

- A total of 136 odor complaints were received.
- 95 out of 136 odor complaints contained complete information for incidence date, time, and location.

Potential Odor Sources

- Academy Creek Wastewater Treatment Plant (ACWT)
- Brunswick Cellulose (BC)

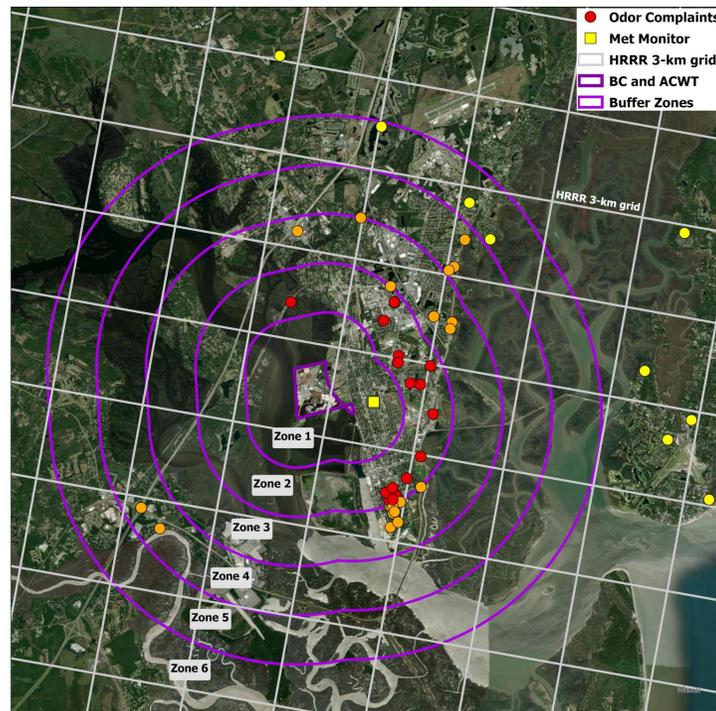


Figure 1. Study domain.

Challenge

- Distances between odor complaint sites and potential odor sources vary widely: from less than 2 miles to over 5 miles.

Modeling Methods

- Method 1: “GA EPD Approach” calculates the position of air parcels backwards from the odor report time and location using observed wind data (i.e., winds are temporally varying but not spatially); A 1-mile buffer (i.e., “Zone 1” in Figure 1) was initially set to account for possible bias in wind direction.
- Method 2: HYSPLIT modeling with a meteorological wind field from a prognostic meteorological model (i.e., winds are varying in space and time).

3. GA EPD Approach

Modeling Setup

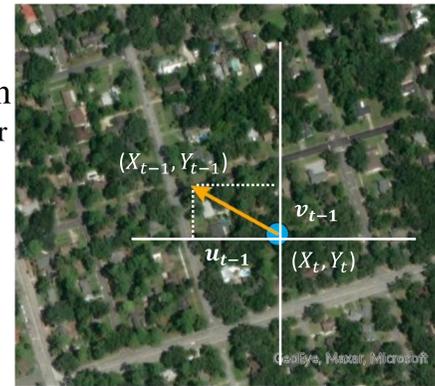
- Meteorology: wind data at the Brunswick meteorological station
- Temporal Resolution: **1-minute**
- Spatial Resolution (i.e., 1-minute segment): **0 (calm) - 504 m**
- Total Run Time: 12 hours
- Release Height: 10 m

Back-Trajectory Calculation

- Step 1: Decompose wind vector into u and v components
- Step 2: Calculate back trajectories

$$X_{t-1} = X_t - u_{t-1}$$

$$Y_{t-1} = Y_t - v_{t-1}$$



4. HYSPLIT

Modeling Setup

- Meteorology: HRRR (archive)
- Temporal Resolution: **1-hour**
- Spatial Resolution: **3 × 3 km²**
- Total Run Time: 12 hours
- Release Height: 10 m
- Vertical Motion: model vertical velocity

5. Modeling Results (I)

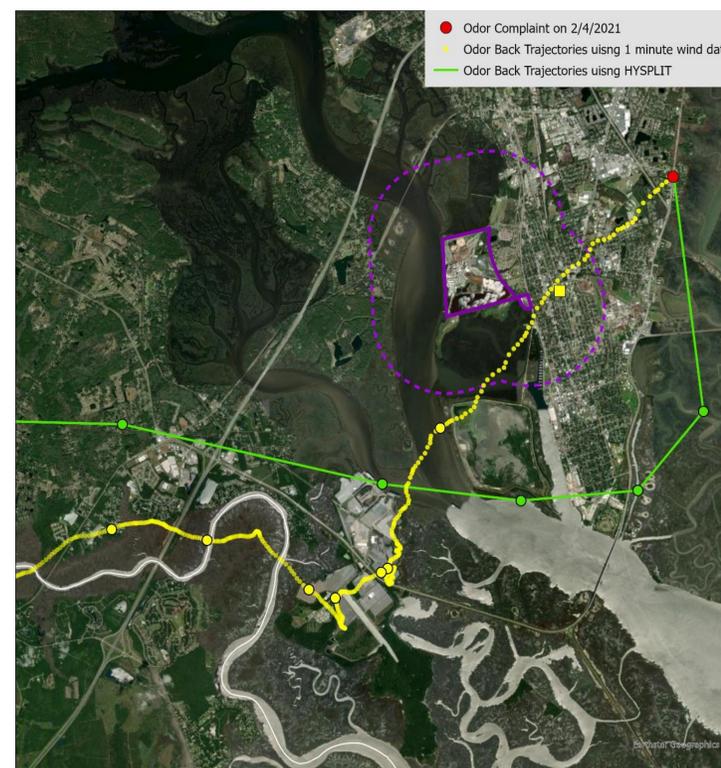


Figure 2. 1-min back-trajectory based on GA EPD approach (yellow dots) and 1-hour back-trajectory based on HYSPLIT approach (green lines) for incidence occurred on 2/4/2021 at 12:00 PM. The odor complaint is 3.02 miles away from the centroid of BC and ACWT.

5. Modeling Results (II)

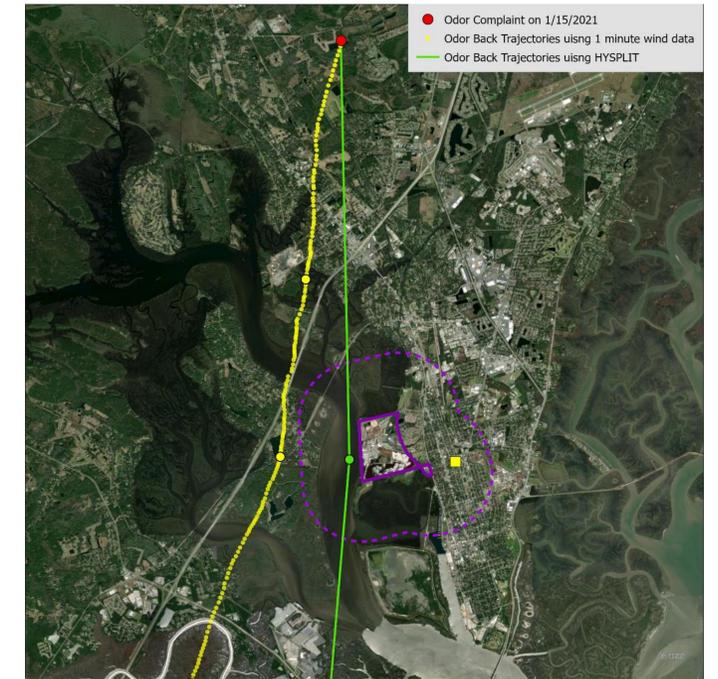


Figure 3. 1-min back-trajectory based on GA EPD approach (yellow dots) and 1-hour back-trajectory based on HYSPLIT approach (green lines) for incidence occurred on 1/15/2021 at 8:00 AM. The odor complaint is 6.85 miles away from the centroid of BC and ACWT.

6. Summary

Number of back-trajectories passing the 1-mile buffer

Zone	Number of Incidences	1-Mile Buffer	
		GA EPD	HYSPLIT
2	45	45 (100%)	43 (95.6%)
3 and 4	39	29 (74.4%)	27 (69.2%)
5 and 6	11	5 (45.5%)	7 (63.6%)
Total	95	79 (83.2%)	77 (81.1%)

- The odor source(s) are likely within the 1-mile buffer zone surrounding BC and ACWT.
- In cases where the meteorological monitoring station, odor source, and odor complaint are relatively close together, the GA EPD Approach appears to work significantly better than the HYSPLIT approach.
- In cases when the meteorological monitoring station, odor source, and odor complaint are further apart, the HYSPLIT 1-hour approach appears to work slightly better than the Georgia EPD 1-min approach.