Overview of Urban Odor Study Envirosuite Final Report

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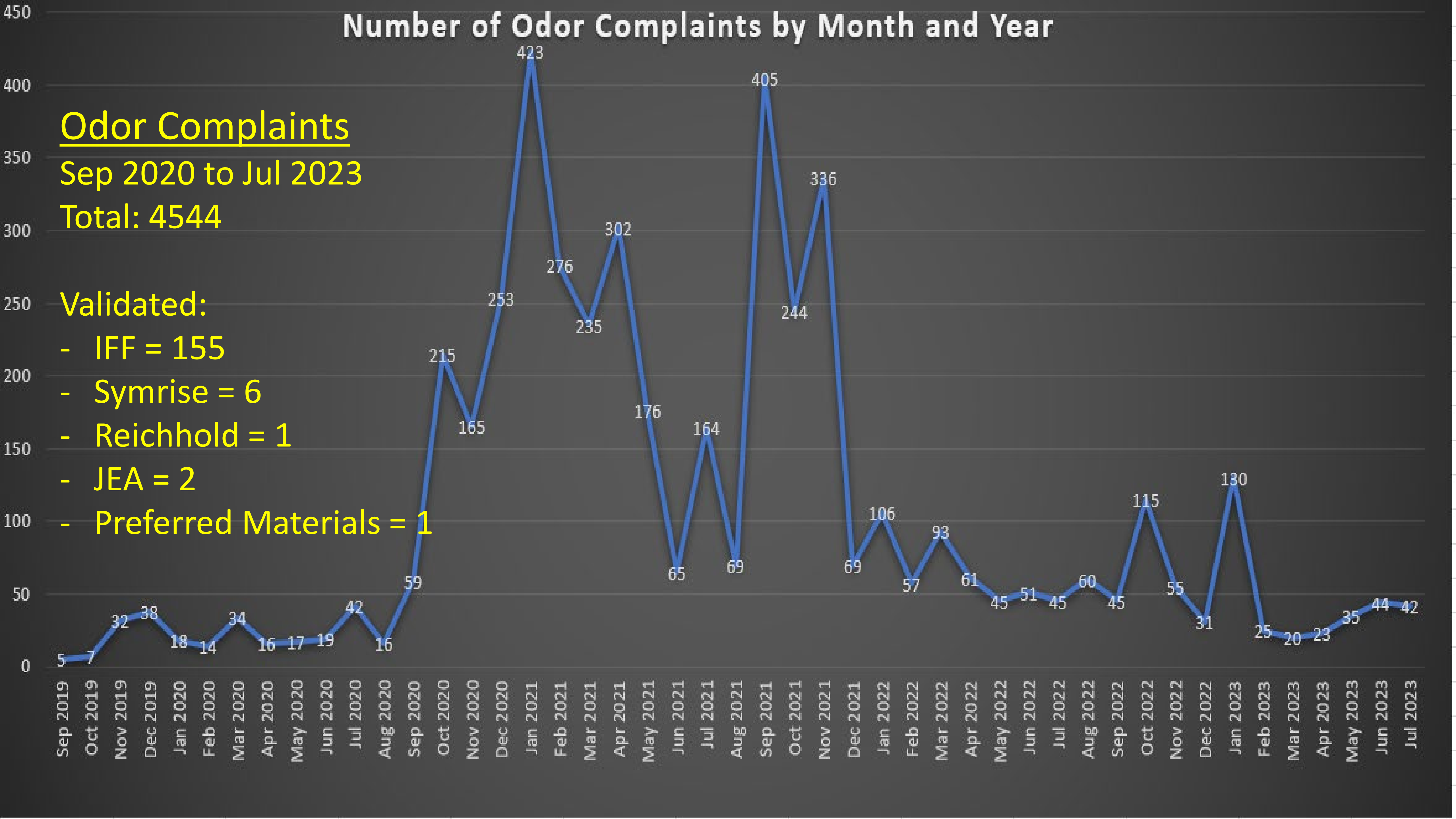

Number of Odor Complaints by Month and Year
Odor Complaints
Sep 2020 to Jul 2023
Total: 4544
Validated:
- IFF = 155
- Symrise = 6
- Reichhold = 1
- JEA = 2
- Preferred Materials = 1
450
400
350
300
250
200
150
100
50
0
5
7
32
38
18
14
34
16
17
19
42
16
59
215
165
253
423
276
235
302
176
65
164
69
405
244
336
69
106
57
93
61
45
51
45
60
45
115
55
31
130
25
20
23
35
44
42
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
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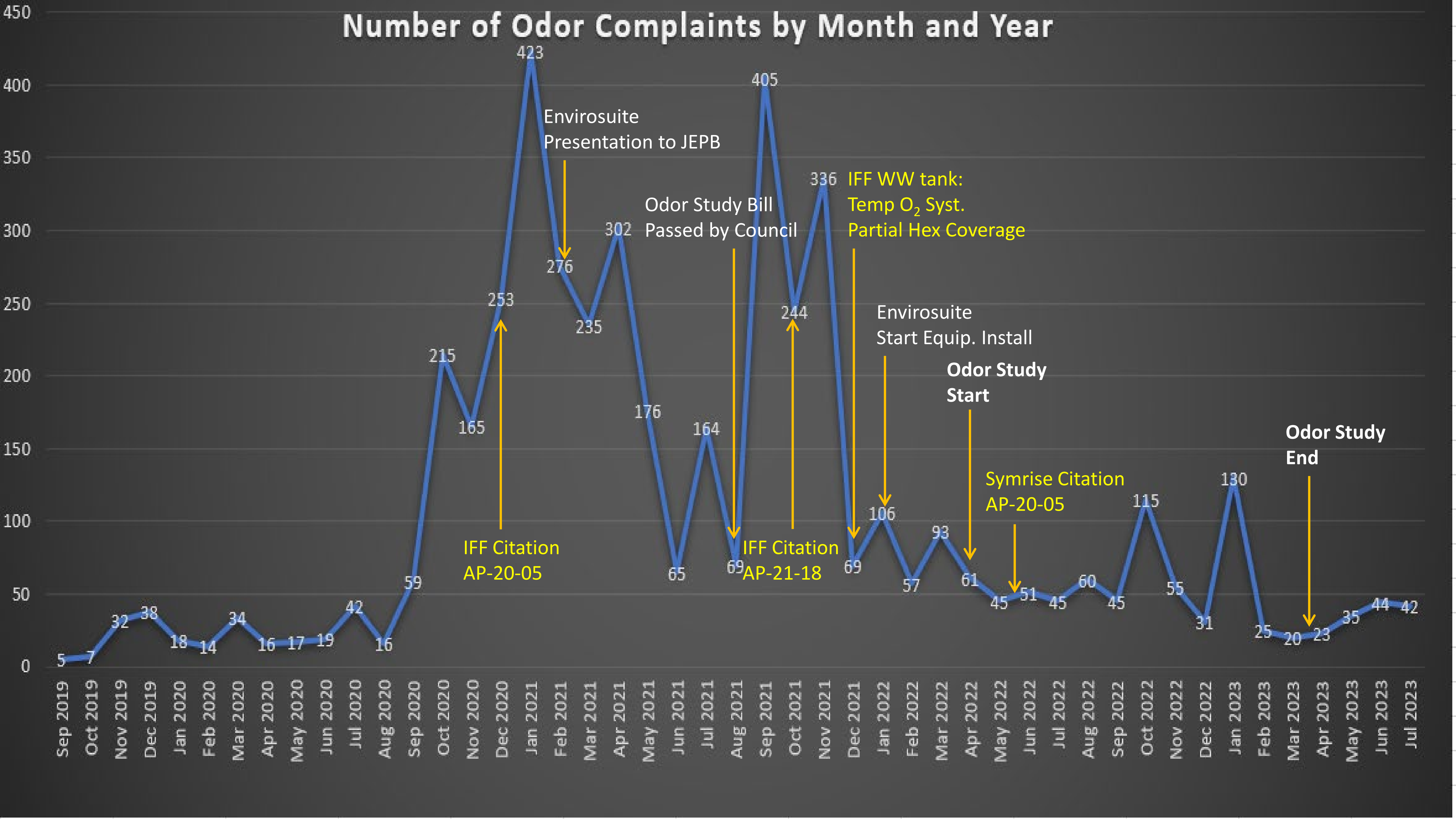

Number of Odor Complaints by Month and Year
Envirosuite Presentation to JEPB
Odor Study Bill Passed by Council
IFF WW tank: Temp O_2 Syst. Partial Hex Coverage
Envirosuite Start Equip. Install
Odor Study Start
Odor Study End
IFF Citation AP-20-05
IFF Citation AP-21-18
Symrise Citation AP-20-05
0
50
100
150
200
250
300
350
400
450
5
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Mar 2023
Apr 2023
May 2023
Jun 2023
Jul 2023

City of Jacksonville

Urban Area Odor Study

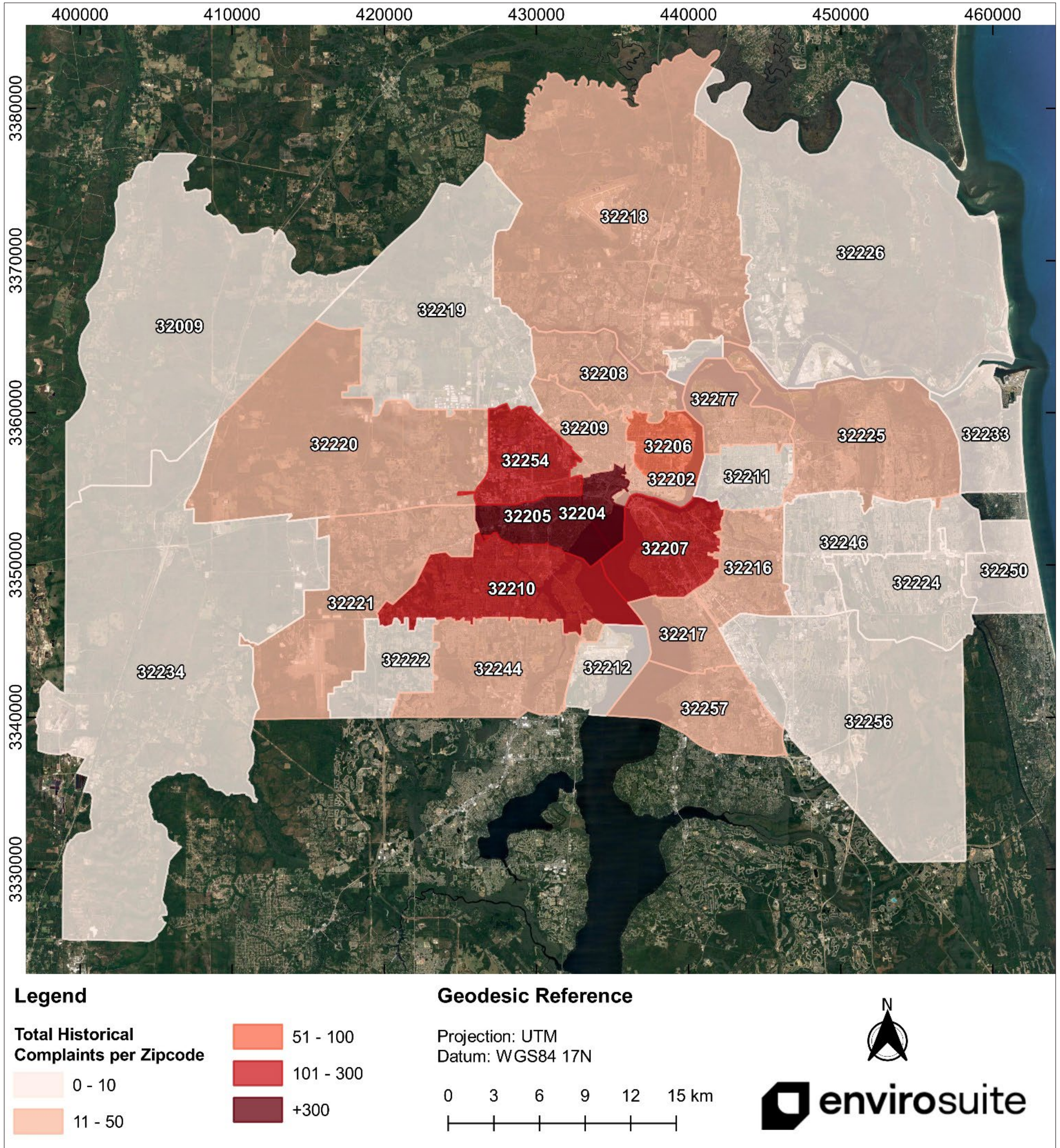
Annual Report

Date: August 2023

Table 1. Monthly and hourly distribution of historical complaints.

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2020	**12**	**5**	**2**	**3**	**6**	**11**	**29**	**56**	**107**	**90**	**65**	**30**	**35**	**16**	**27**	**23**	**23**	**16**	**13**	**24**	**29**	**35**	**24**	**11**	**692**
September	4			1					6	2	6	5	3	2	6	4	5	3	1	1	3	5	2		**59**
October	2		1			3	7	16	39	49	17	14	13	5	11	6	9	6	2	6	3	3	2	1	**215**
November	3	2			1	2	10	8	14	9	4	2	6	3	3	9	5	3	7	13	20	23	14	4	**165**
December	3	3	1	2	5	6	12	32	48	30	38	9	13	6	7	4	4	4	3	4	3	4	6	6	**253**
2021	**17**	**31**	**15**	**24**	**19**	**67**	**168**	**390**	**520**	**299**	**211**	**127**	**82**	**72**	**57**	**53**	**64**	**69**	**53**	**63**	**79**	**71**	**62**	**27**	**2640**
January	4	8	6	1	4	3	7	29	66	56	63	32	11	9	5	8	12	12	7	16	19	21	18	5	**422**
February	3	2	1	3	1	2	7	41	51	29	25	13	5	11	6	12	10	7	7	6	16	8	6	4	**276**
March		2			3	7	25	46	27	21	33	15	8	6	2	2	9	8	1	2	5	6	5	2	**235**
April	2	5	1	3		2	15	52	65	42	20	17	11	5	6	5	10	4	9	6	7	10	3	2	**302**
May	1	2	1	6	3	6	17	36	49	13	8	6	1	3	1	2	1	3	7	3	3	3	1		**176**
June				1	1	1	6	2	6	3		2	3	7	6	2	5	1	2	9	1	4	3		**65**
July	2	2	1			4	6	22	27	20	7	7	3	8	6	4	4	10	6	6	7	4	5	4	**165**
August						3	2	5	15	10	5	5	4		4	4	2	3		2	2	1		2	**69**
September	2	1		1		8	19	62	116	49	31	19	19	10	10	6	4	11	4	7	5	10	8	3	**405**
October	1	1	2		3	20	29	54	51	29	7	5	1	8		2	5		5	3	10	1	7		**244**
November	2	8	3	9	4	11	35	41	47	27	12	6	16	5	11	6	2	10	5	3	4	3	6	5	**281**
Total	**29**	**36**	**17**	**27**	**25**	**78**	**197**	**446**	**627**	**389**	**276**	**157**	**117**	**88**	**84**	**76**	**87**	**85**	**66**	**87**	**108**	**106**	**86**	**38**	**3332**

Figure 1. Historical complaints map (between September 2020 – November 2021).



Odor Complainants

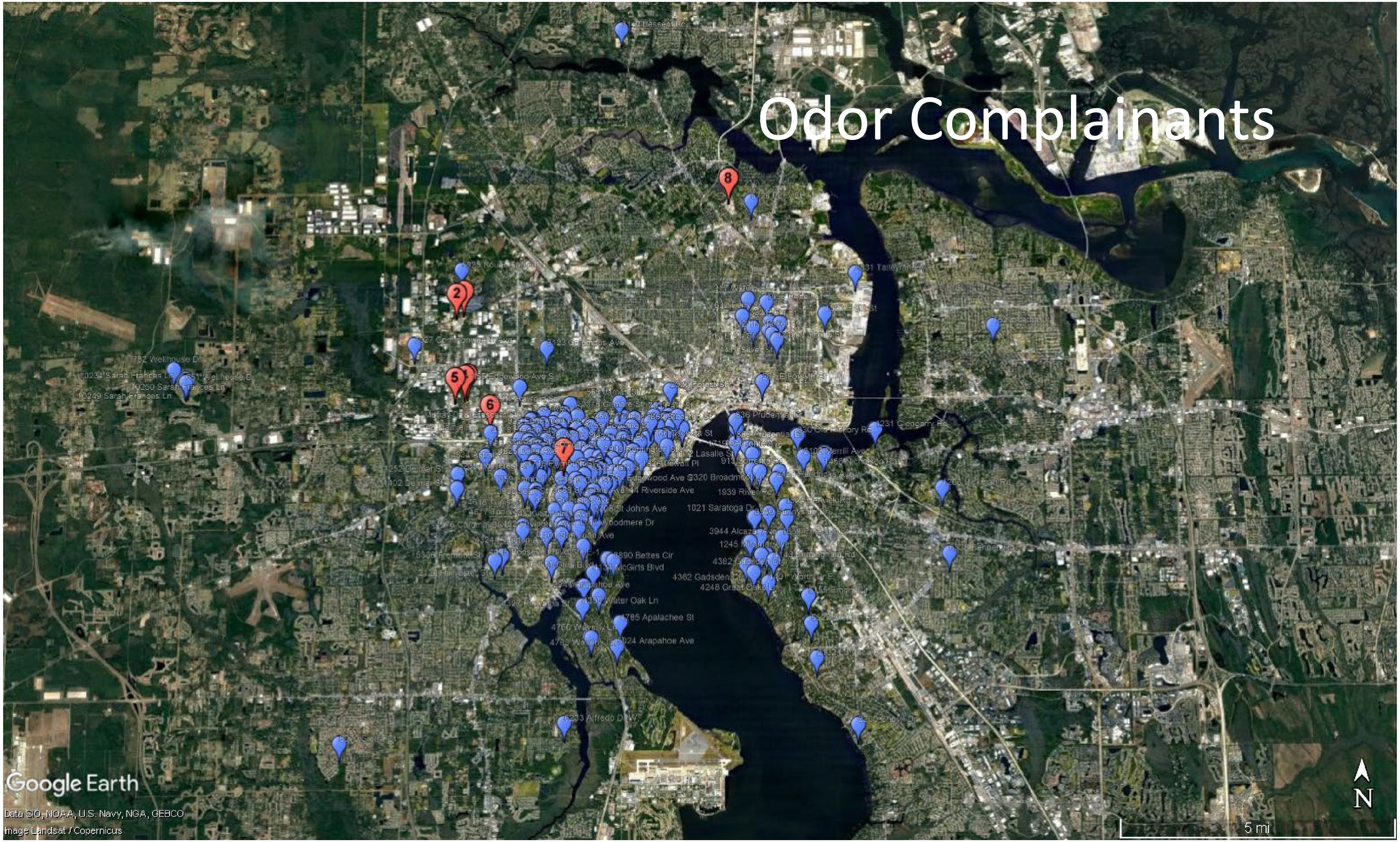


Figure 9. Wind speed and wind direction seasonal cycles for CS and ~~PP stations~~. Historical Data.

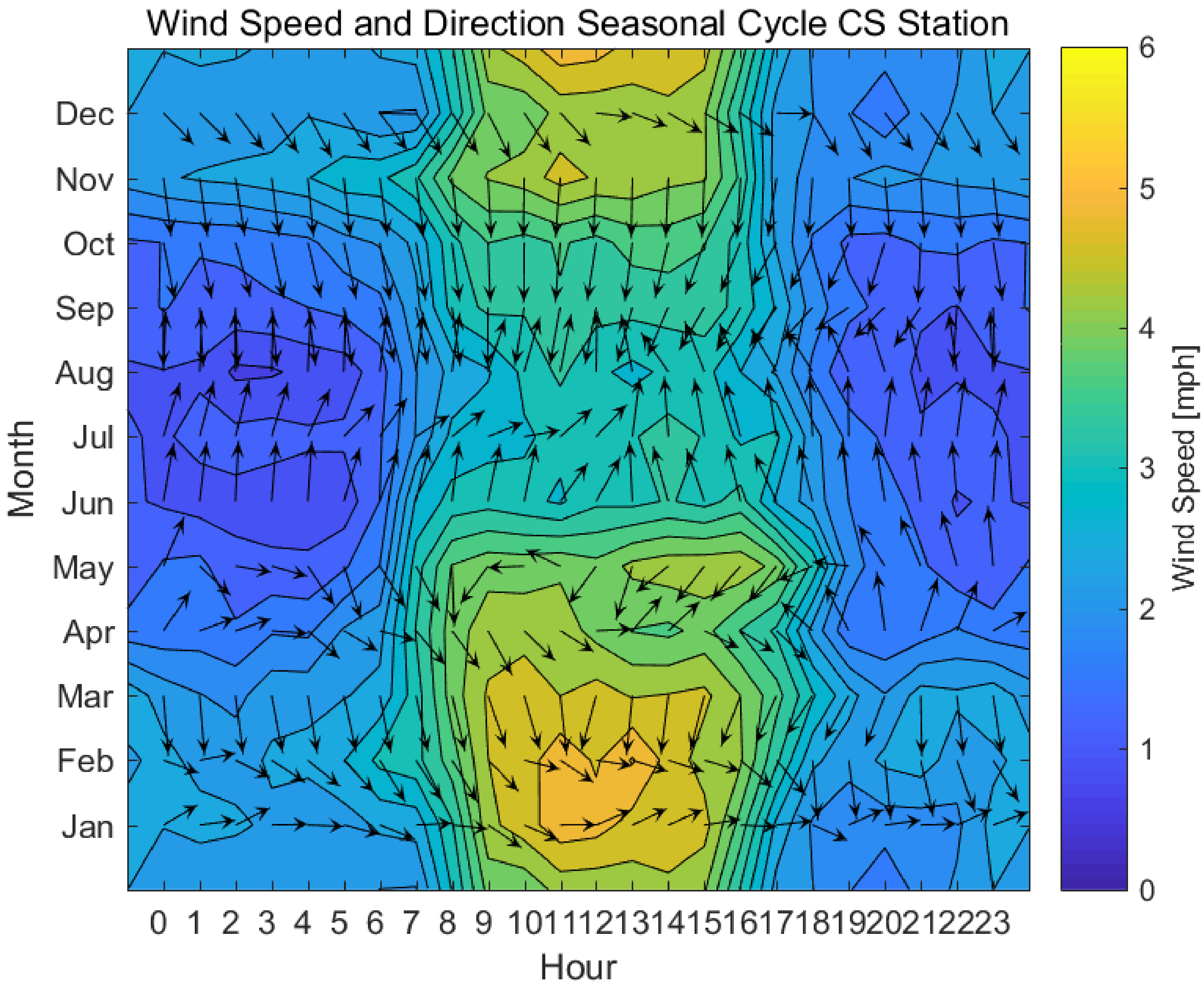


Table 3. Suspected chemicals associated with known potential odor sources.

Importance	Substance	CAS #	Synonym(s)	Facilities	Odor Threshold			VP [mm Hg]	Comments
					µg/m³	ppb	Source of OT data.		
1	beta-pinene	127-91-3		1,2		140	Odor Detection Thresholds & References (leffingwell.com)	2.93	turpentine-like odor (PubChem); Source 1 primarily beta.
1	alpha-pinene	80-56-8	2-pinene	1,2		6	Odor Detection Thresholds & References (leffingwell.com)	4.75	pine (PubChem); Source 2 primarily alpha.
1	styrene	100-42-5	ethenylbenzene, phenylethylene, vinylbenzene	3,4	110	26	TCEQ TAMIS012 02/12/2021	6.4	sweet, balsamic, floral (PubChem)
2	ethyl mercaptan	75-08-1		1,2	1	0.4	TCEQ TAMIS012 02/12/2021	442	garlic-like, skunk-like odor (CAMEO Chemicals via PubChem)
2	dimethyl disulfide	624-92-0		1,2	3		PubChem (3-14 ug/m3 detection)	28.7	garlic-like odor (CAMEO Chemicals via PubChem)
2	methyl mercaptan	74-93-1	methanethiol	1,2	1.9	0.99	TCEQ TAMIS012 02/12/2021	1510	garlic-like, rotten cabbage (PubChem)
2	(o-) xylene	95-47-6	1,2-xylene, 1-2-dimethylbenzene	4		1000	astr.cdc.gov/MHM/mmg71.pdf	6.61	sweet (PubChem)
2	vinyl acetate	108-05-4	acetic acid ethenyl ester	4	420	120	TCEQ TAMIS012 02/12/2021	90.16	sweet, initially pleasant (PubChem)
3	limonene	138-86-3	dipentene	1,2		38	Chemicalbook.com	1.64	lemon-like odor (PubChem)
3	cumene	98-82-8	(1-methylethyl)-benzene; isopropylbenzene	4	650	130	TCEQ TAMIS012 02/12/2021	25.85	gasoline-like odor
3	dicyclopentadiene	77-73-6	cyclopenadiene dimer, bicyclopentadiene, discyclopentadiene	3,4		11	Chemicalbook.com	2.29	disagreeable camphor-like odor (PubChem)
3	methyl methacrylate	80-62-6	2-methyl-methyl ester 2-Propenoic acid; 2-methyl-methyl ester-2-propenoic acid	3,4	860	210	TCEQ TAMIS012 02/12/2021	38.5	sulfur-like, sweet, sharp, acrid fruity odor (PubChem)

[4] **Importance**: 1 – Primary, 2 – Secondary, 3 – Tertiary.
Facilities: 1 – IFF, 2 – Symrise, 3 – Taylor Made Fiberglass, 4 – Reichold.

Figure 12. eNose Ambient reference images.

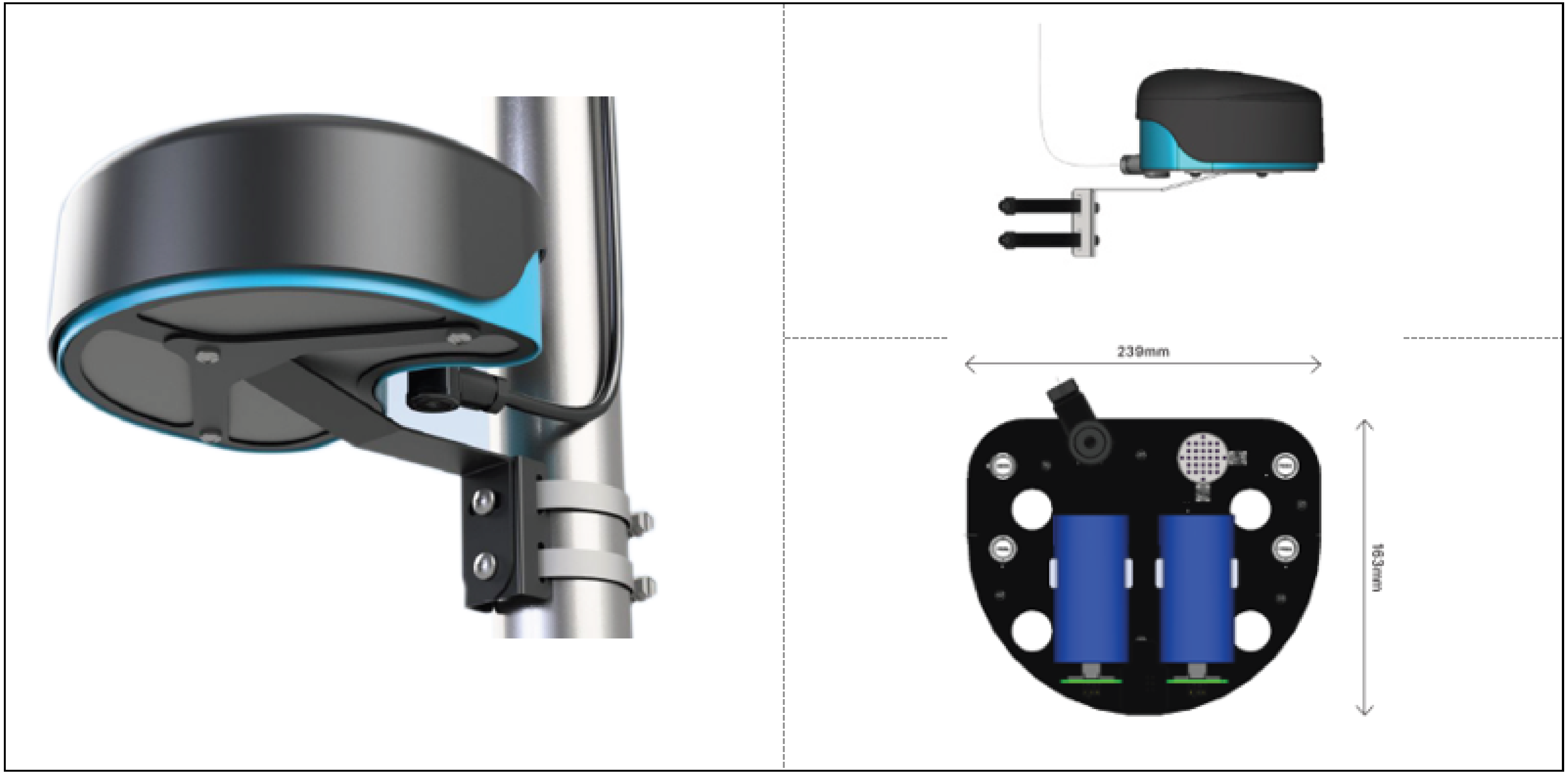


Table 6. Sensor specification per gas.

Sensor	Minimum Detection Limit	Lower Limit[4]	Upper Limit[4]	Uncertainty	Operating Range
Air Quality Sensors					
Ammonia (NH_3)	500 ppb	1 ppm	25 ppm	± 30%, Linearity < 10%	-20C to + 40 C; 10 to 90 %RH non condensing
Hydrogen sulfide (H_2S)	10 ppb	20 ppb	1 ppm	± 30%, Linearity < 10%	-20C to + 40 C; 10 to 90 %RH non condensing
Volatile organic compounds (VOCs) 10.6 eV	2 ppb	2 ppb	40 ppm	> 15 ppb ± 15%; From -10 C to 50 C	-40C to +55C; 0 to 99 %RH non condensing

Figure 13 Hardware at the City of Jacksonville. From March 2022-September 2022 (zoomed and cropped).

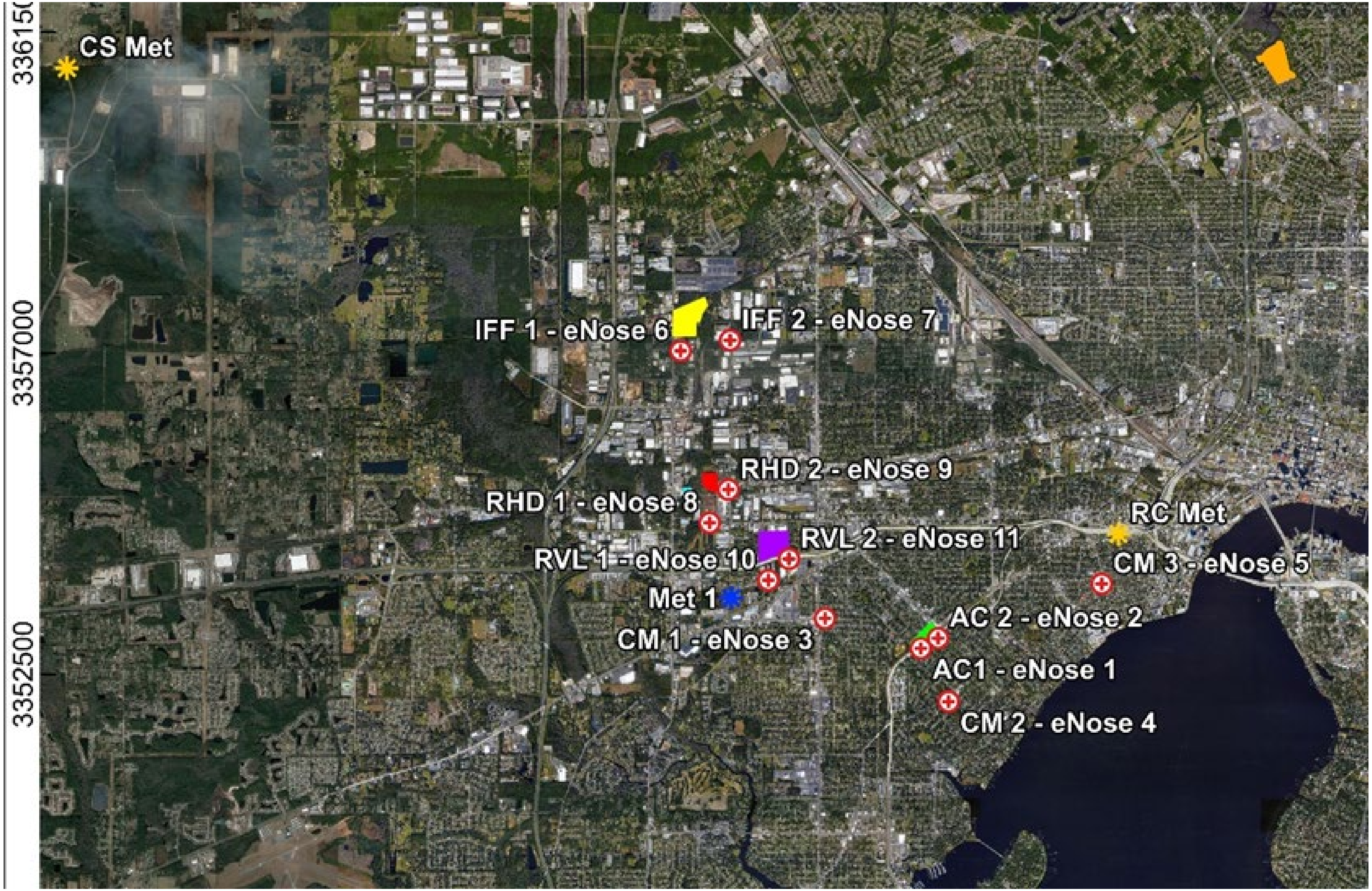


Figure 14 Hardware at the City of Jacksonville. From October 2022-March 2023.

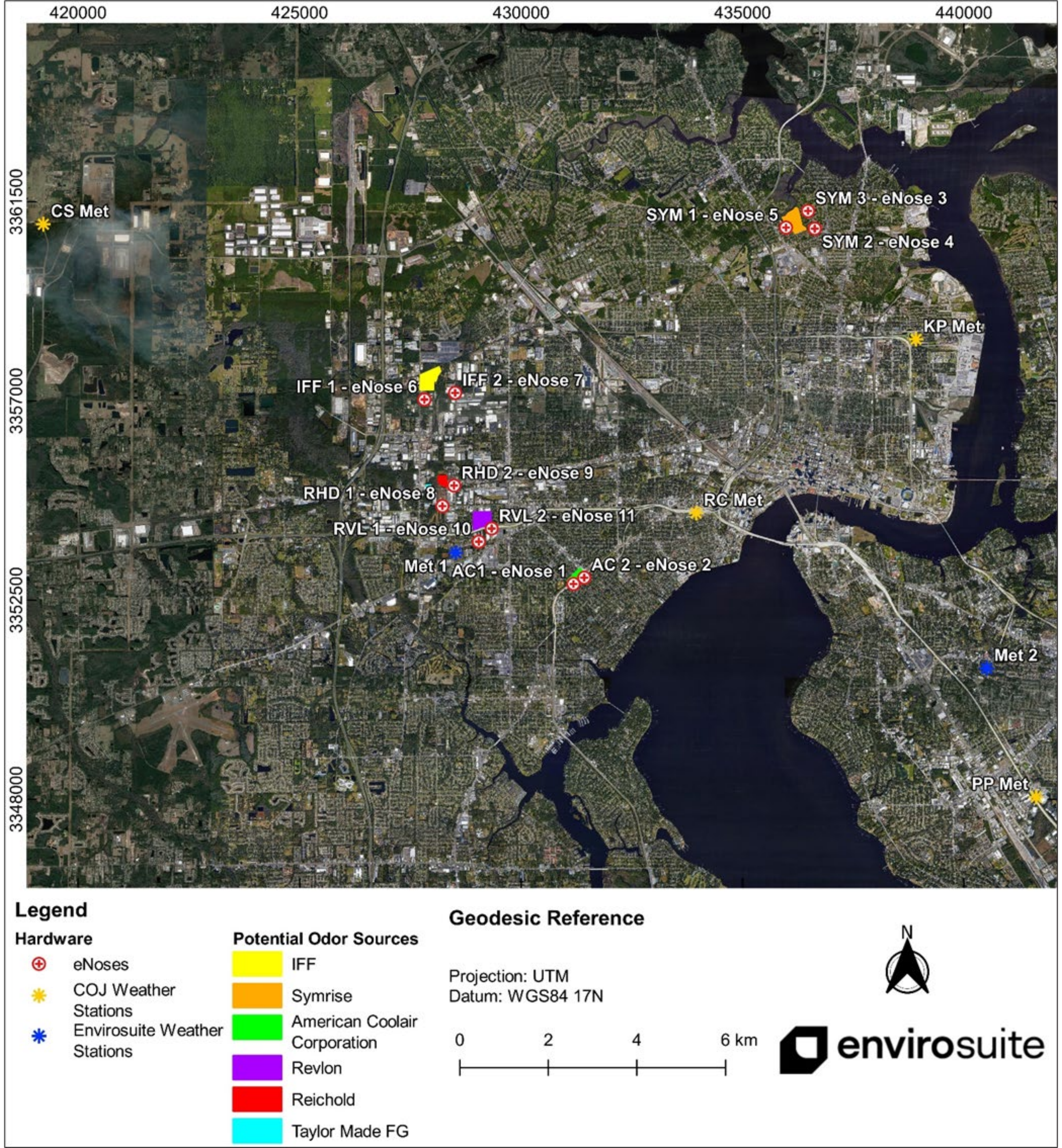


Figure 15. Deployed Hardware Photos (partial).

AC1 - eNose 1 (the same location throughout the study)	Met 1 (the same location throughout the study)
	

Table 9. Hardware maintenance records.

Name	Maintenance Completed
AC 2 - eNose 2	2/24/22 replaced VOC sensor, 4/19/22 replaced VOC sensor
CM 3 - eNose 5	5/3/22 reseated NH_3 sensor to correct null values
IFF 1 - eNose 6	3/8/22 - both internal and external battery replaced, 11/30/22 replaced eNose
RHD 1 - eNose 8	11/30/22 replaced eNose
RHD 2 - eNose 9	11/30/22 replaced eNose
RVL 1 - eNose 10	11/30/22 replaced eNose

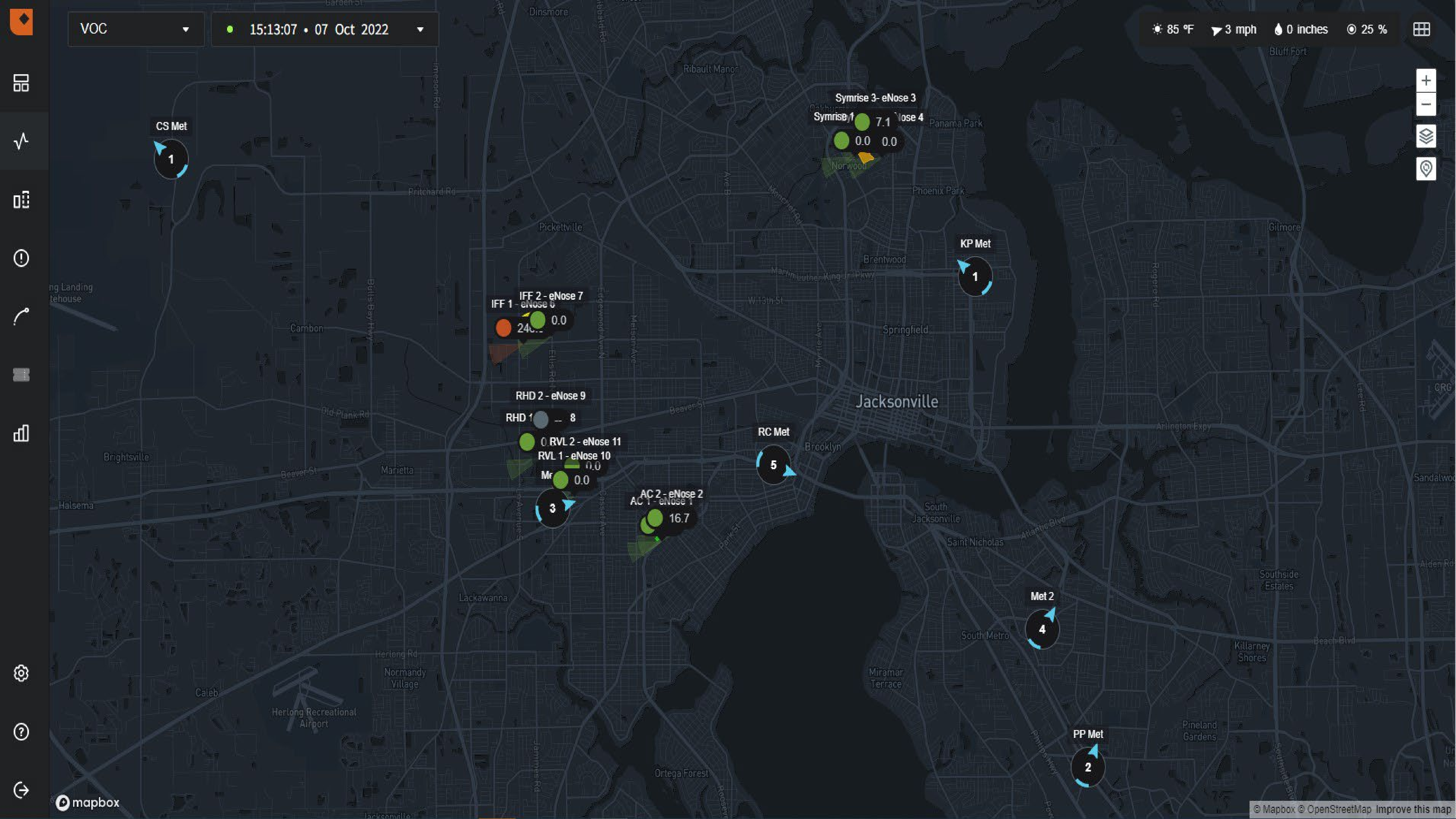

VOC
15:13:07 • 07 Oct 2022
85 °F
3 mph
0 inches
25 %
CS Met
Symrise 3- eNose 3
7.1
0.0
0.0
KP Met
IFF 2 - eNose 7
0.0
RHD 2 - eNose 9
RVL 2 - eNose 11
RVL 1 - eNose 10
0.0
0.0
AC 2 - eNose 2
16.7
RC Met
Met 2
PP Met
Jacksonville
mapbox
© Mapbox © OpenStreetMap Improve this map

Figure 17. Monitoring Module feature to view past data for selected parameters.

Figure 23. Example of observed wind field model results in OMNIS.

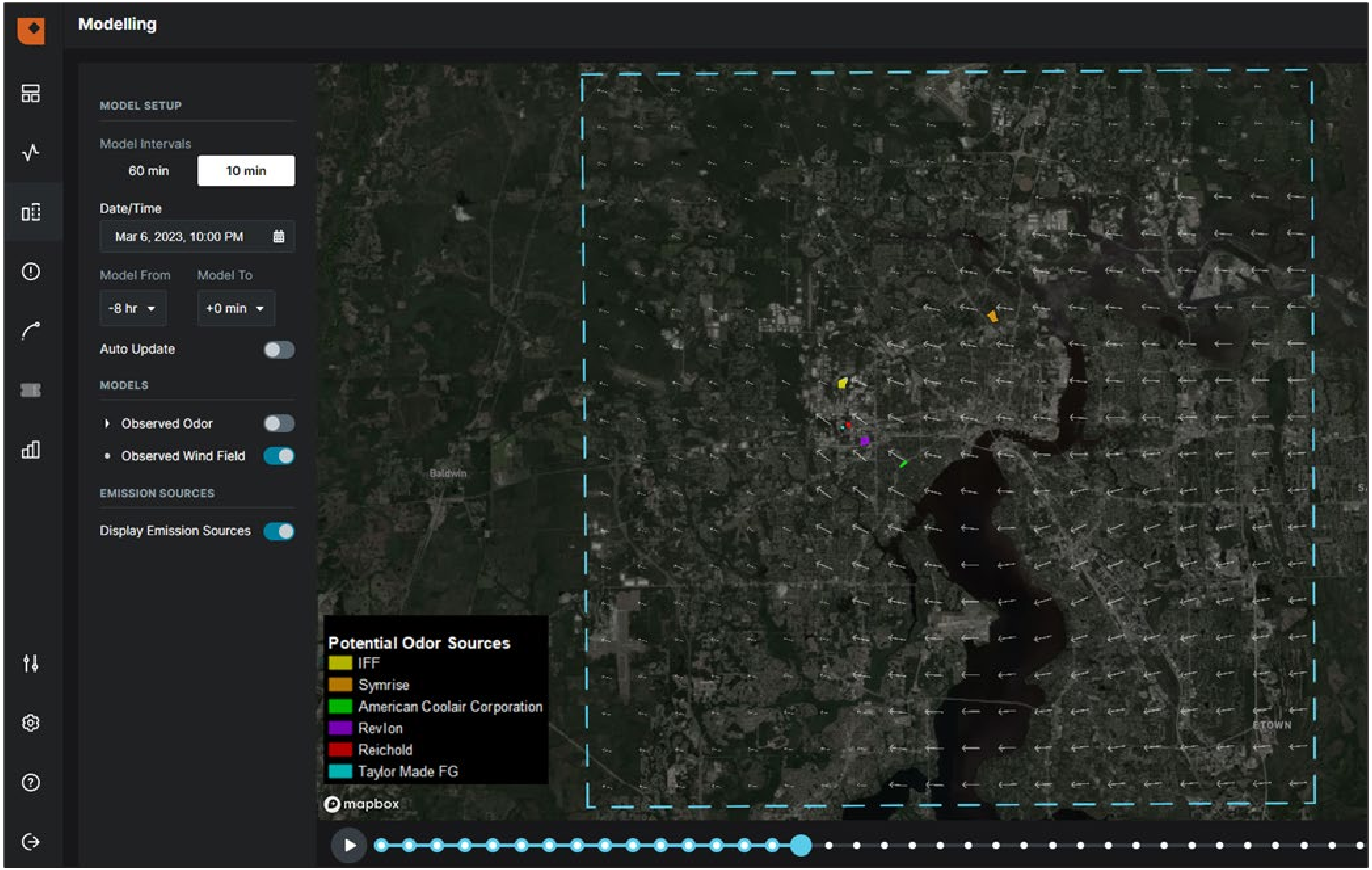


Figure 24. Example of observed odor model results in OMNIS.

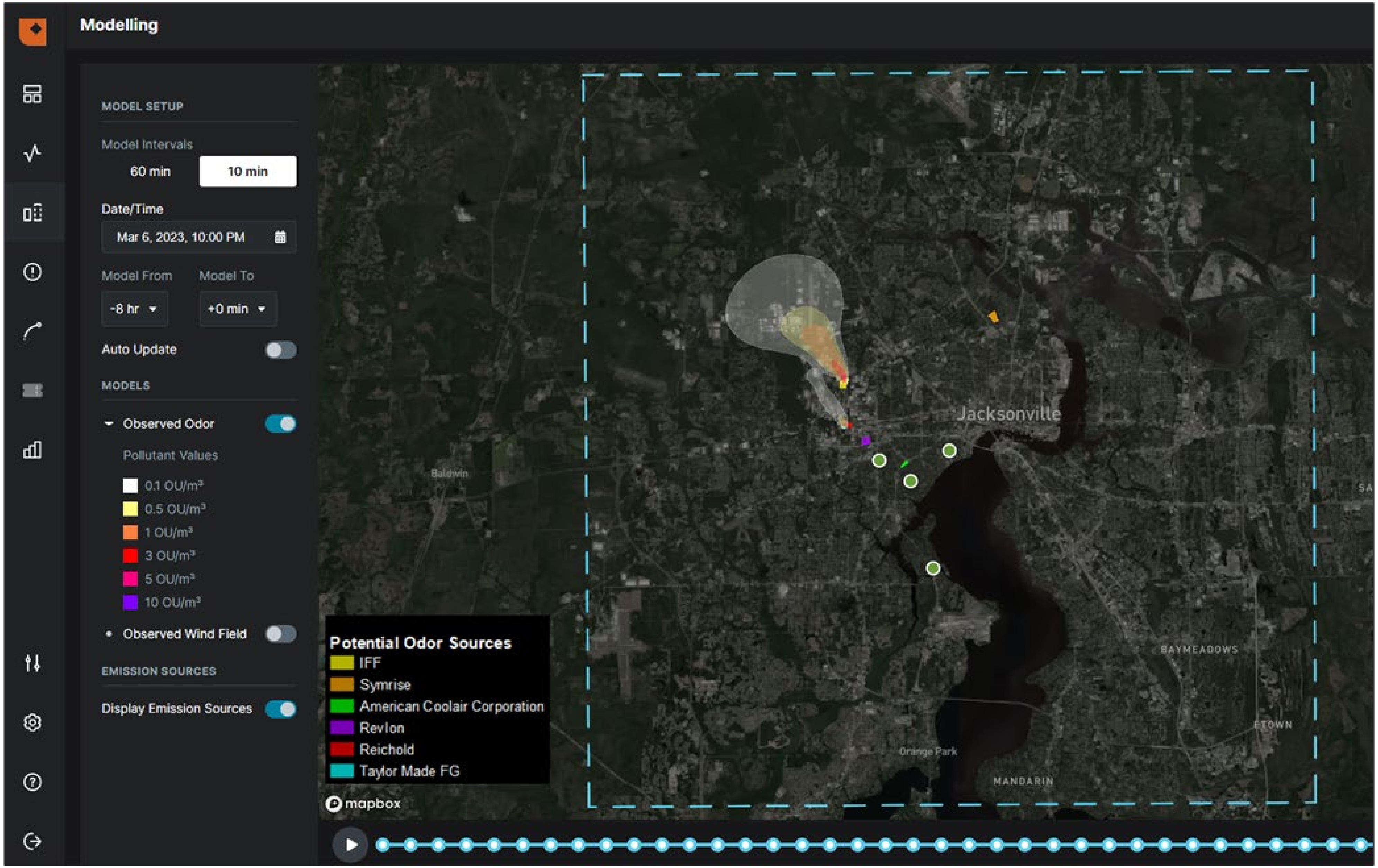


Figure 28. Example of a trajectory in path mode.

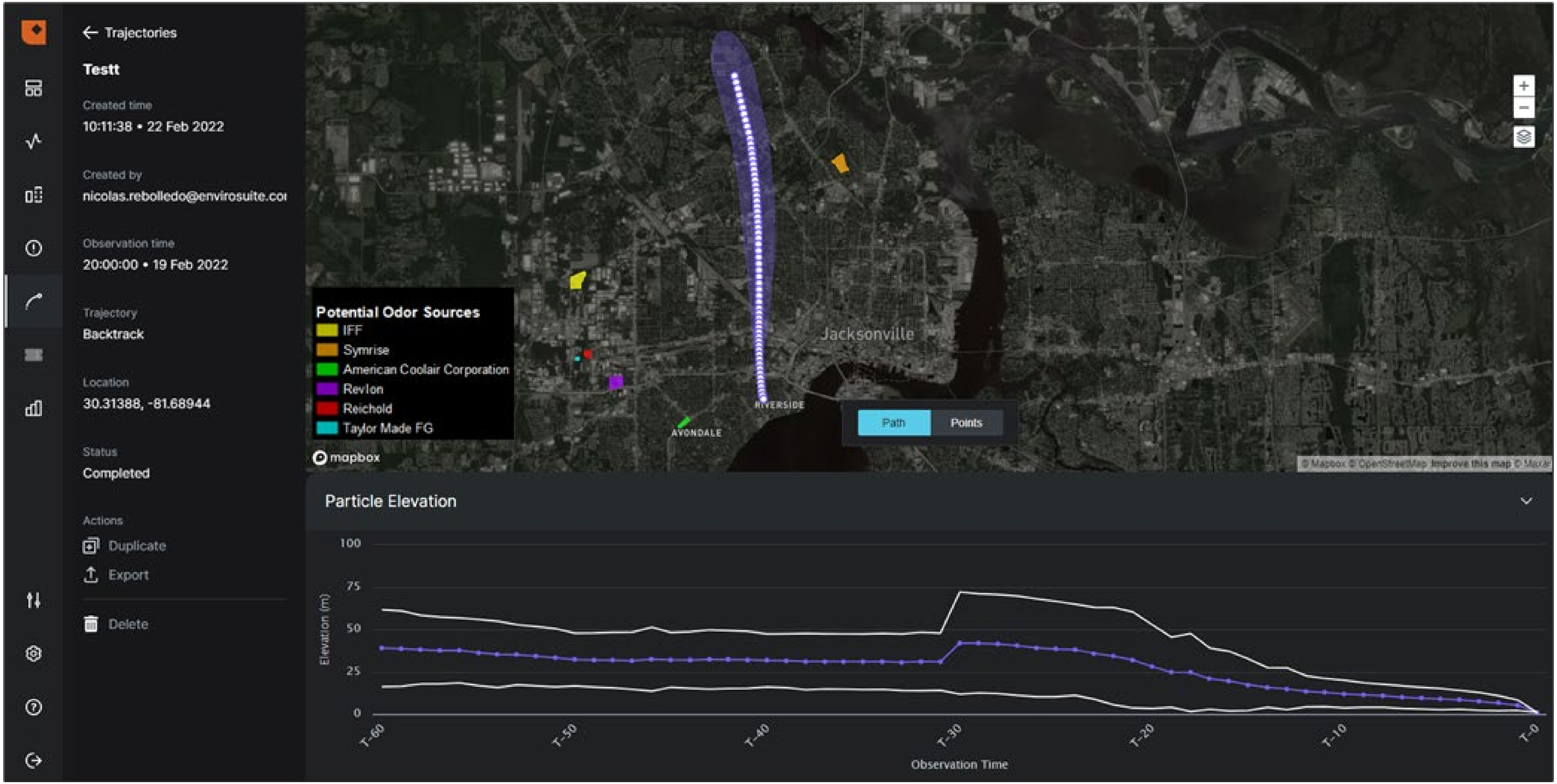


Figure 103. VOC hourly, daily, weekly, and monthly cycles at SYM3 – eNose 3, SYM2 – eNose 4, SYM1 – eNose 5.

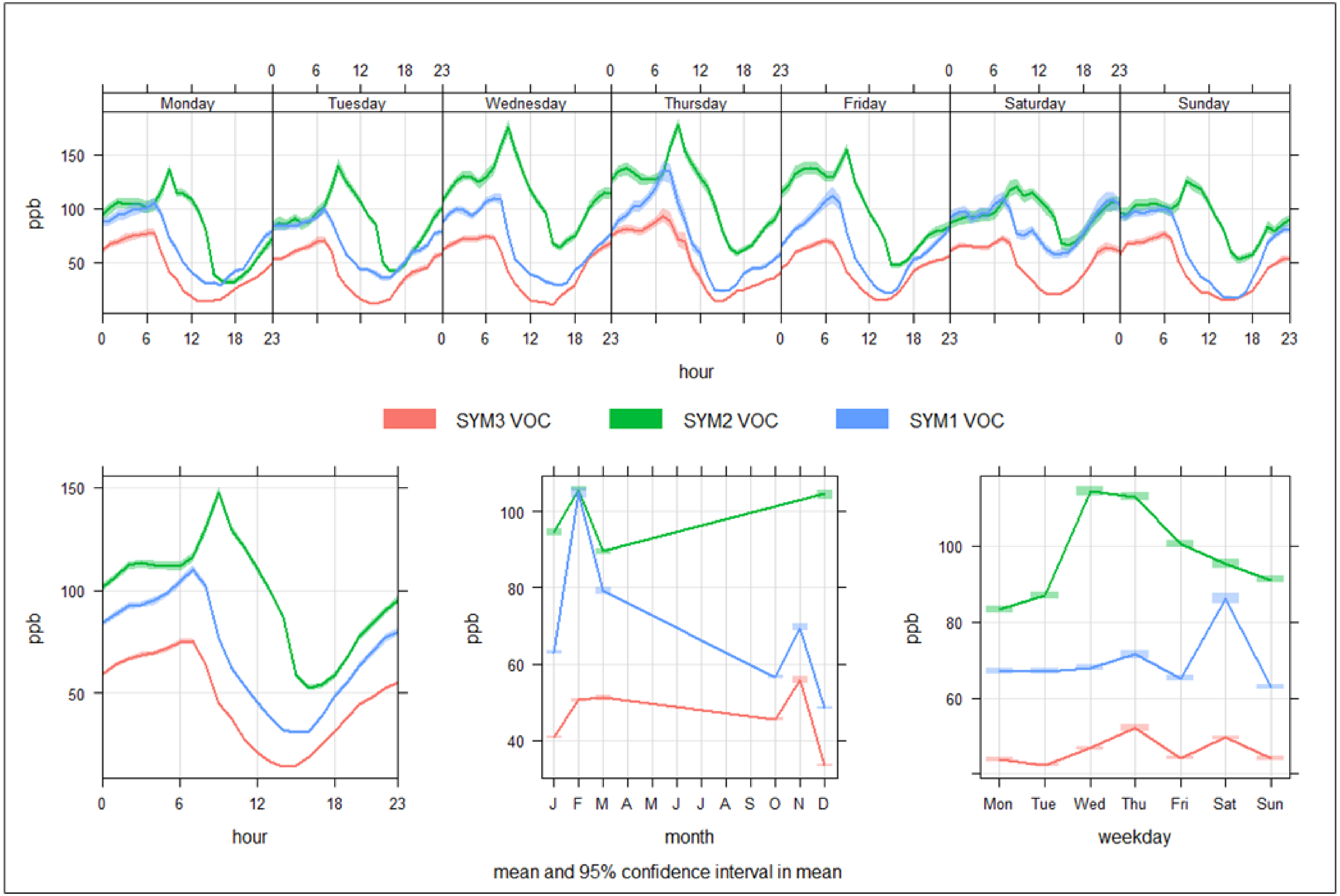


Figure 128. VOC Time series at RHD1 – eNose 8 and RHD2 – eNose 9.

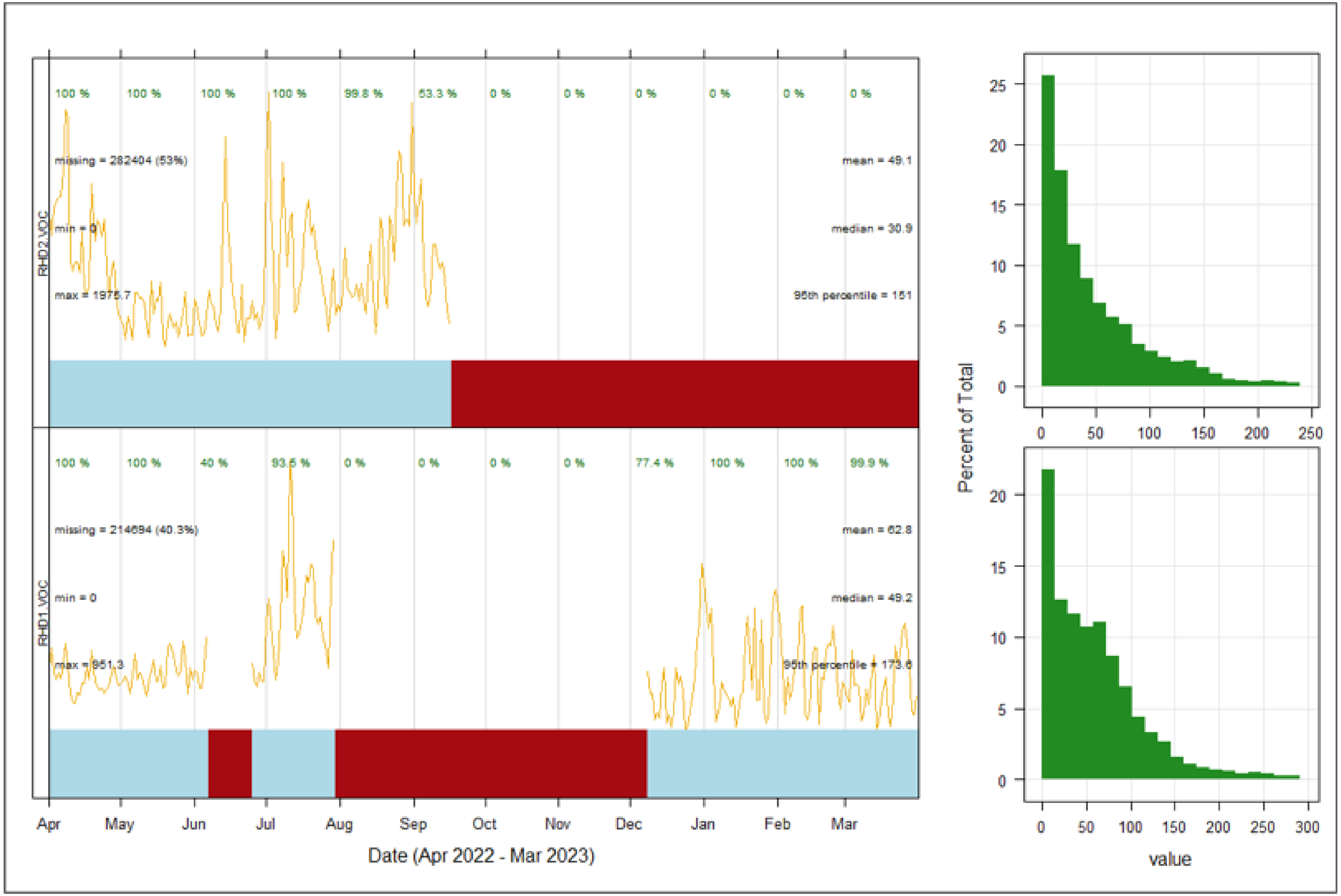


Figure 115. VOC time series at IFF1 – eNose 6 and IFF2 – eNose 7.

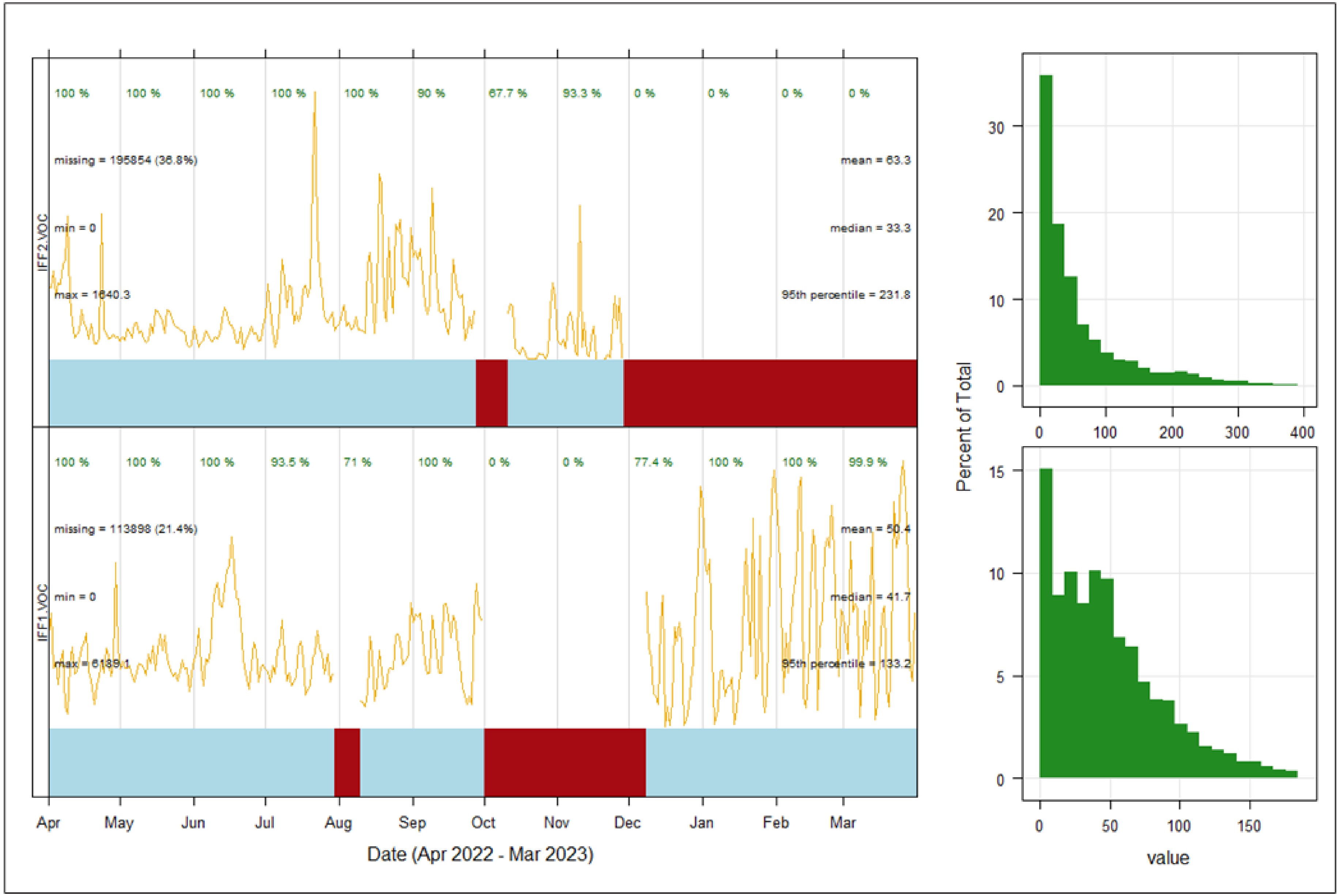


Figure 152. Inversion strength diurnal and monthly cycles.

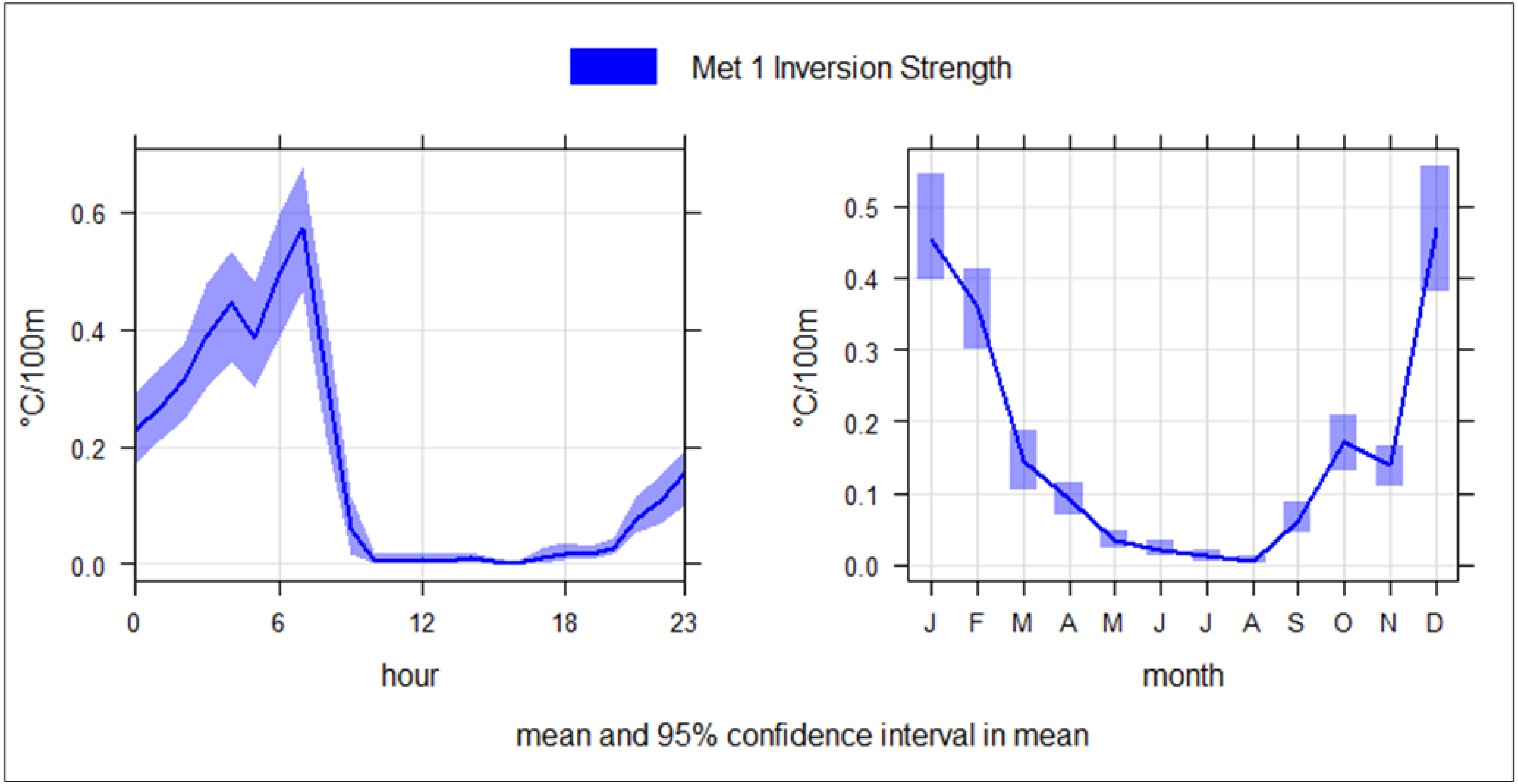


Figure 157. Odor events during the study period.

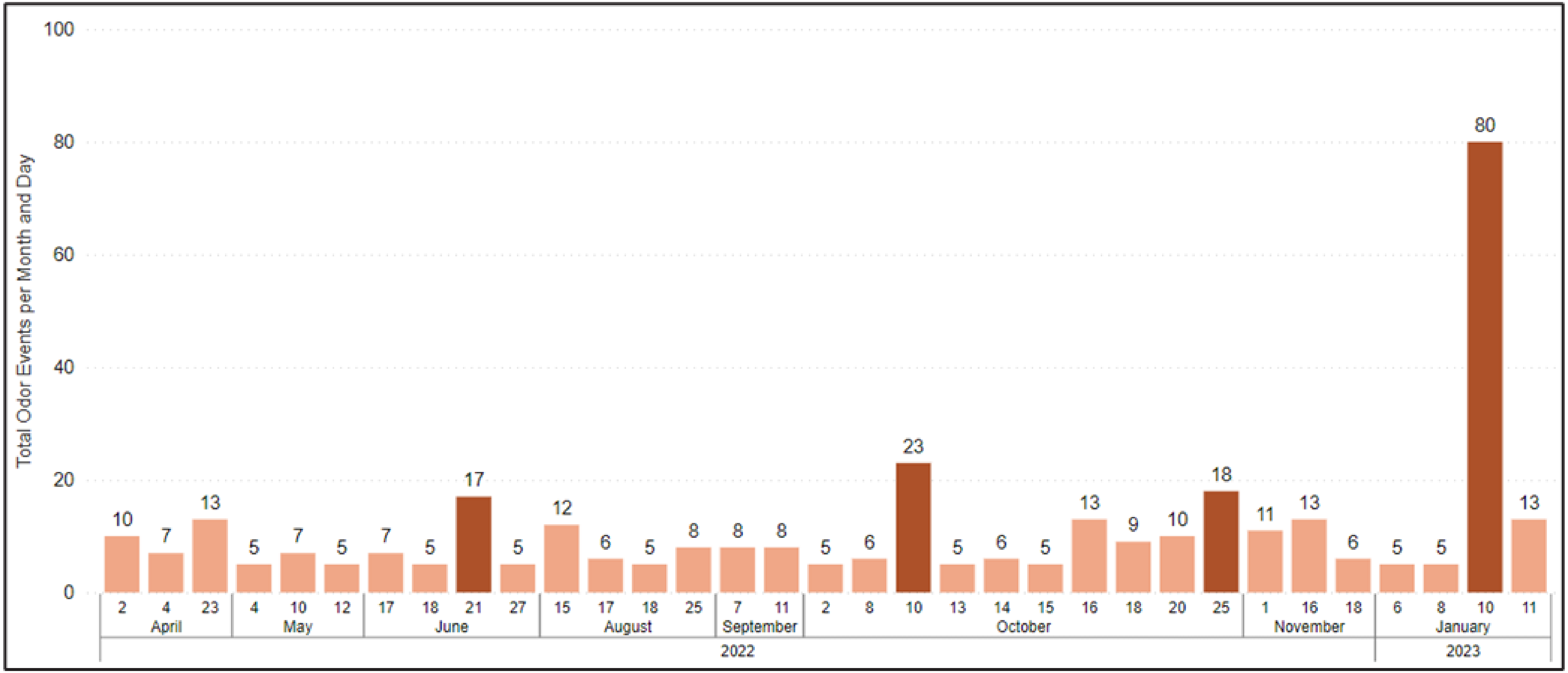


Figure 160. Wind and odor forecast models on June 21, 2022, at 7am.

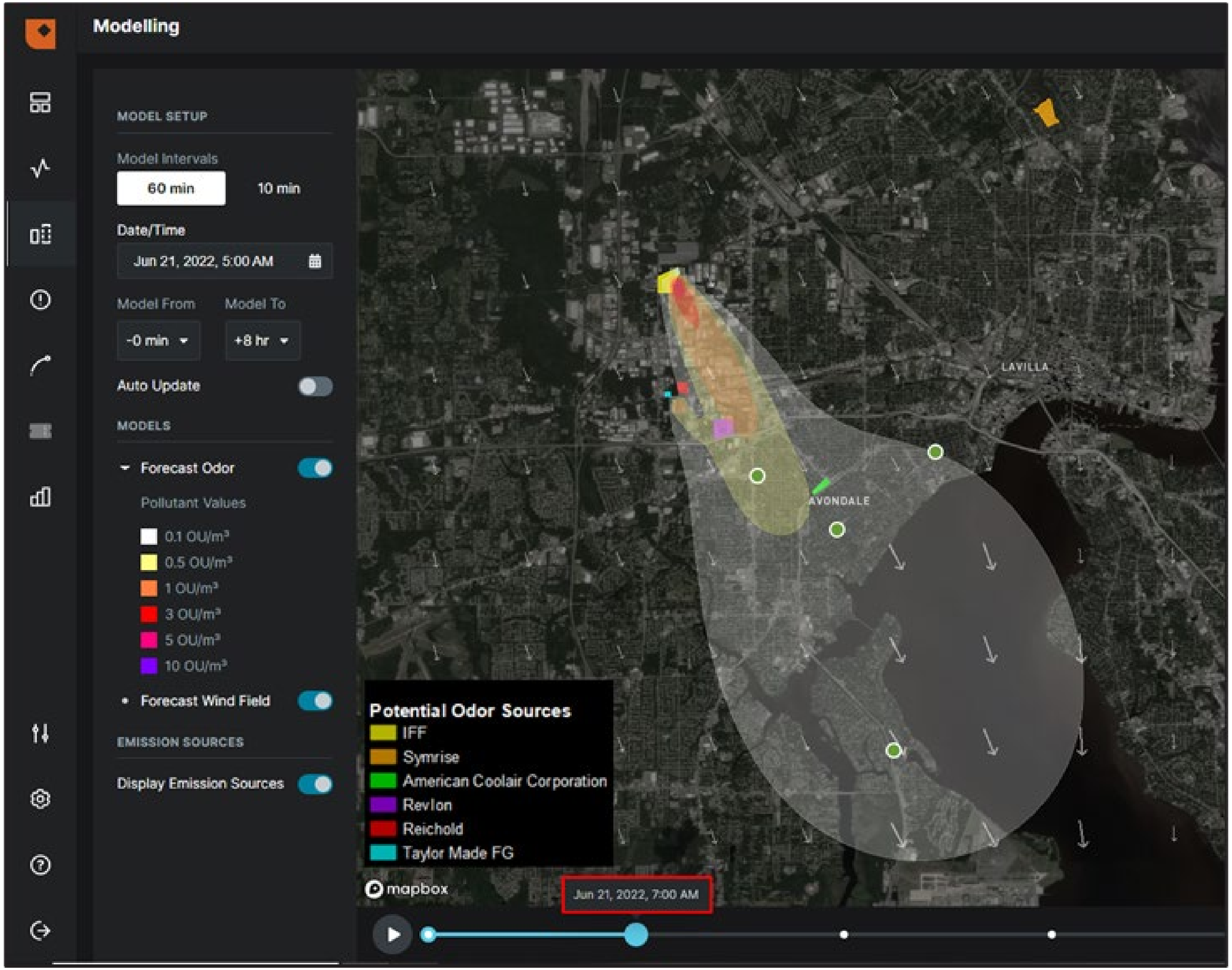


Figure 161. Backward trajectory on June 21, 2022, at 7:00 am.

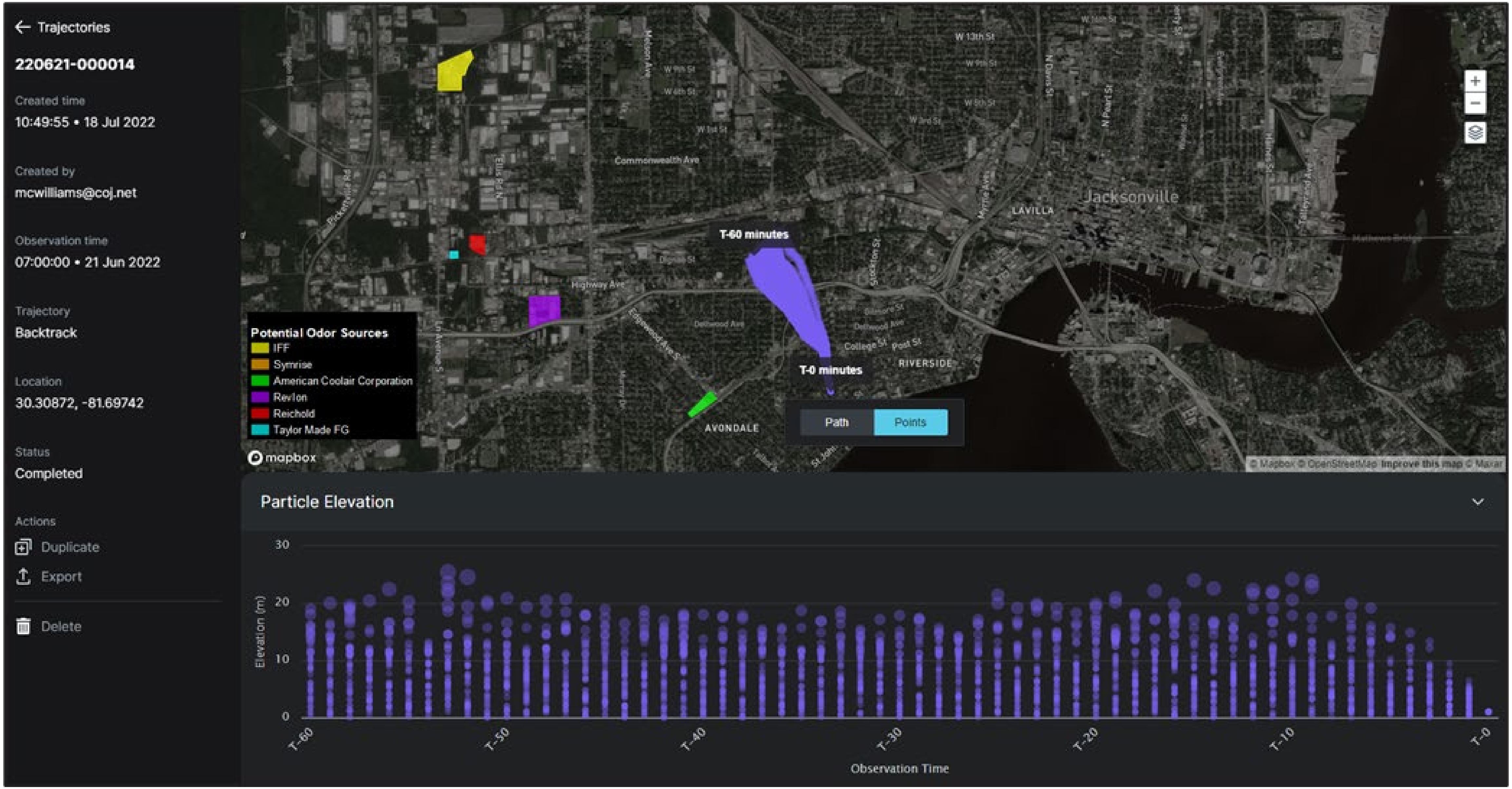


Figure 162. Backward trajectory on June 21, 2022, at 7:30 am.

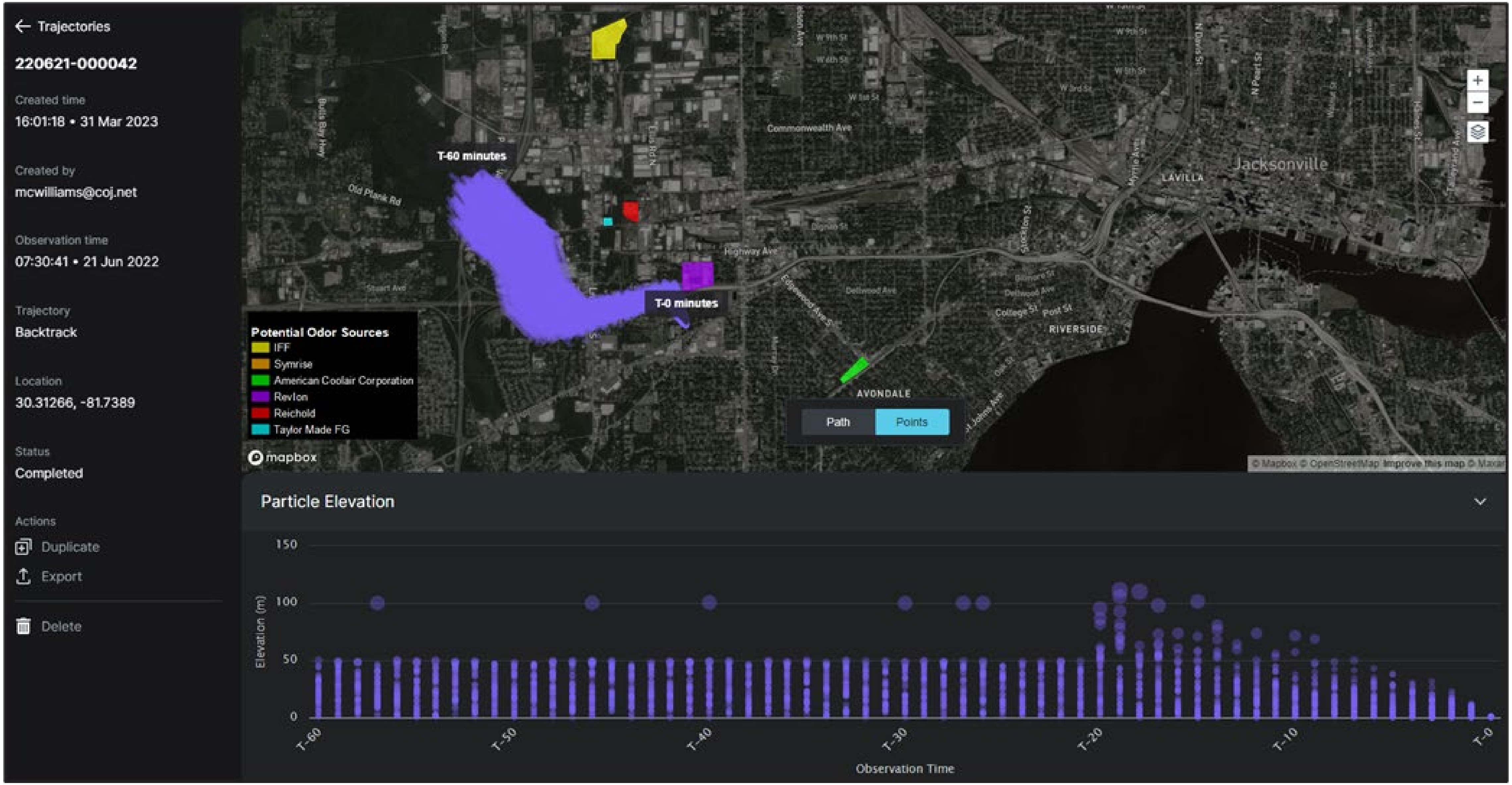


Figure 164. Wind and odor forecast models on October 10, 2022, at 8am.

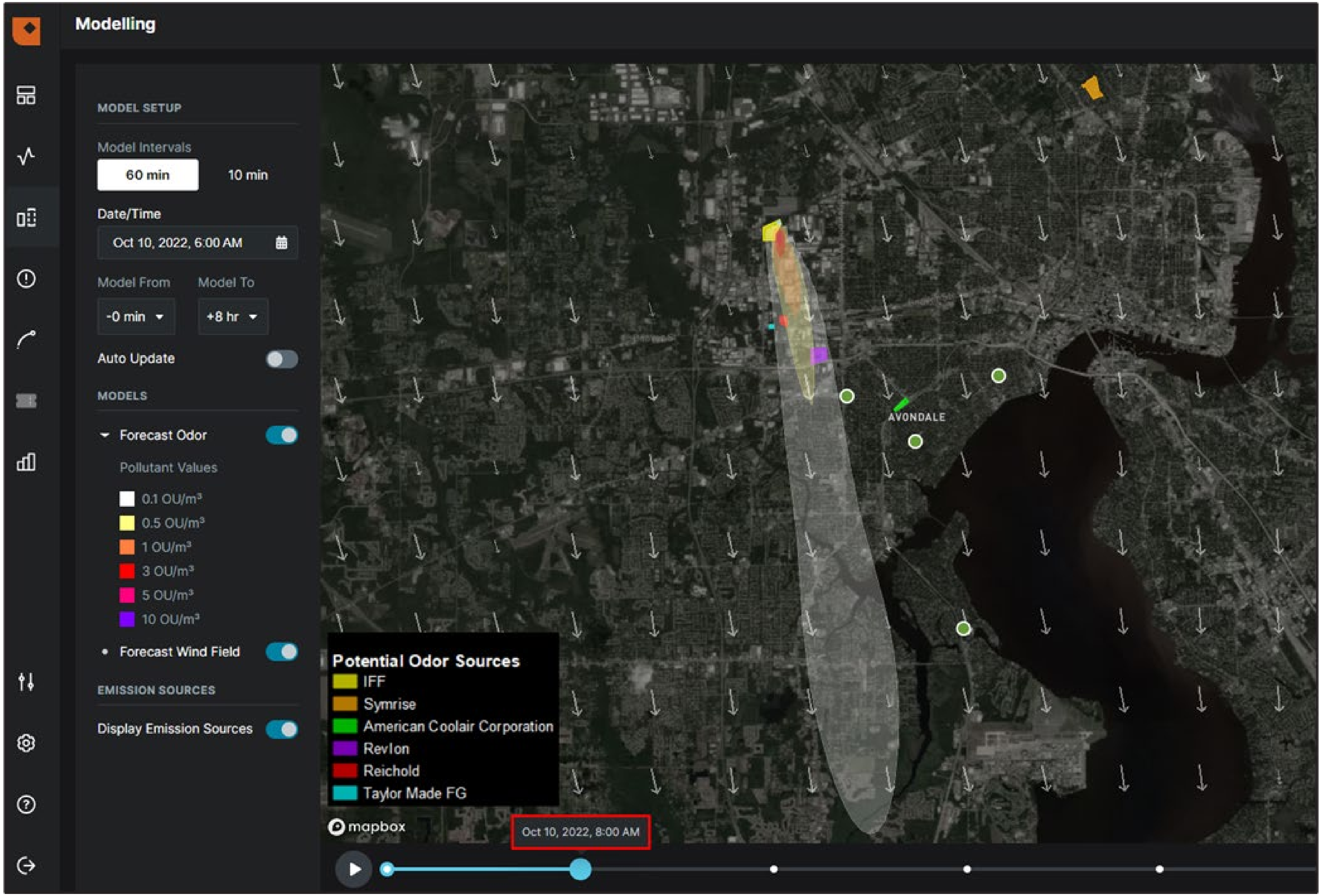
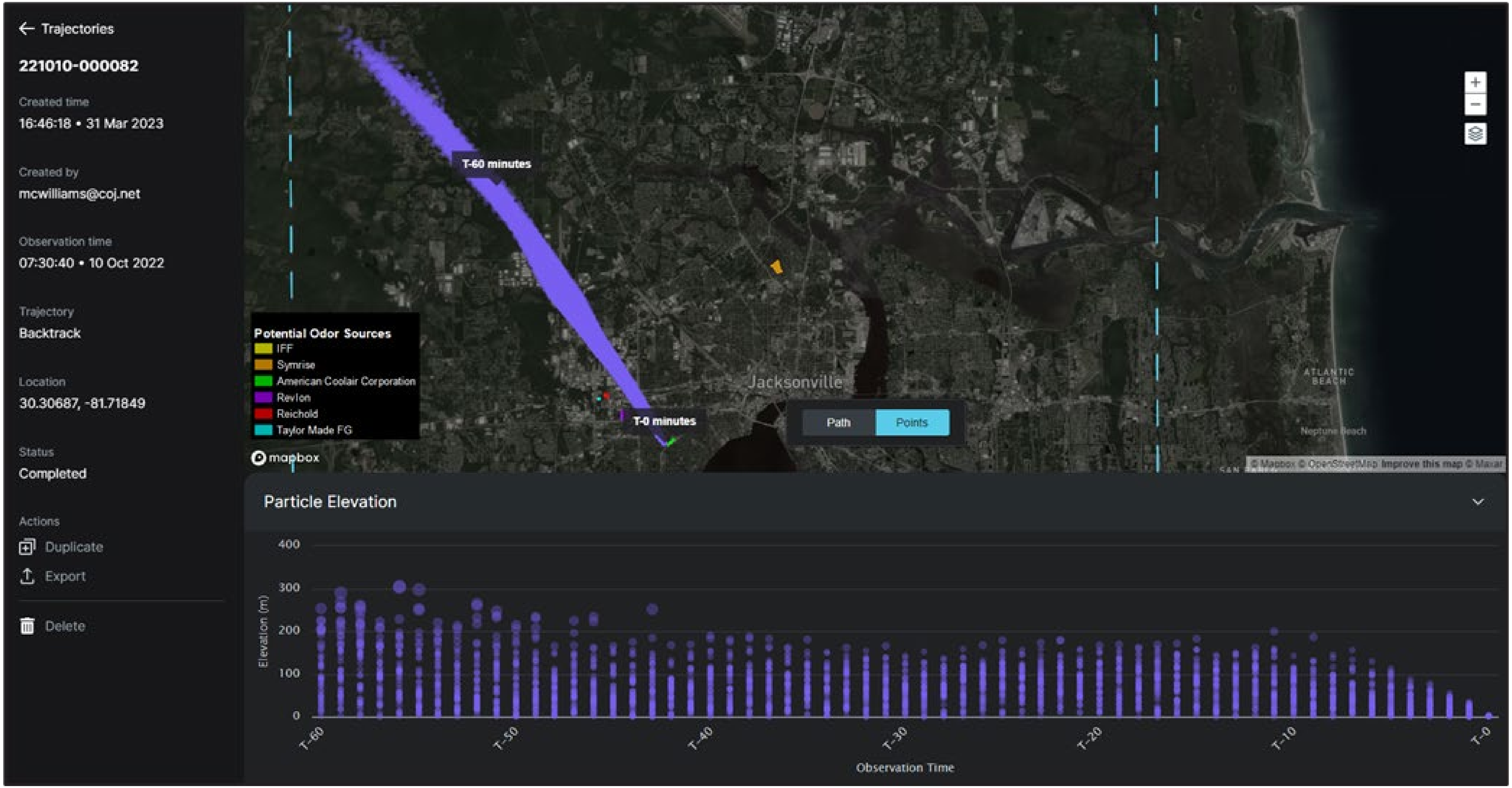
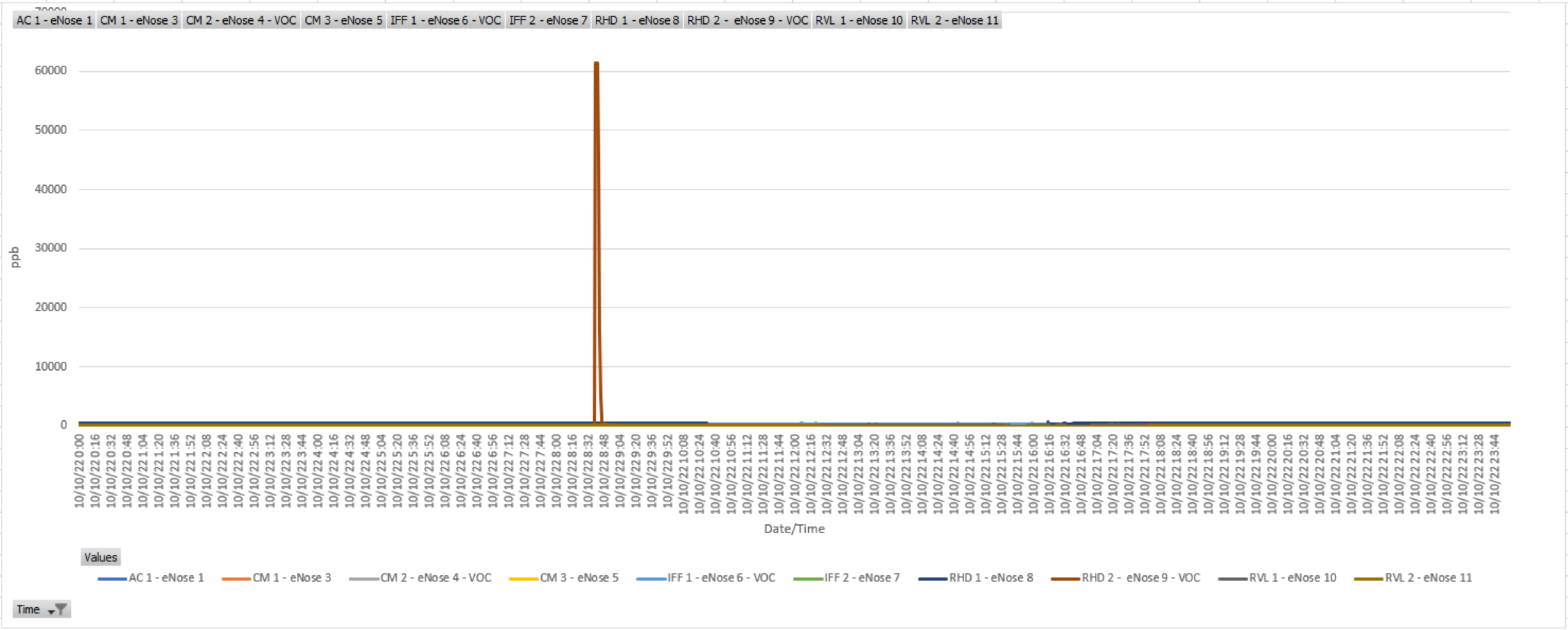


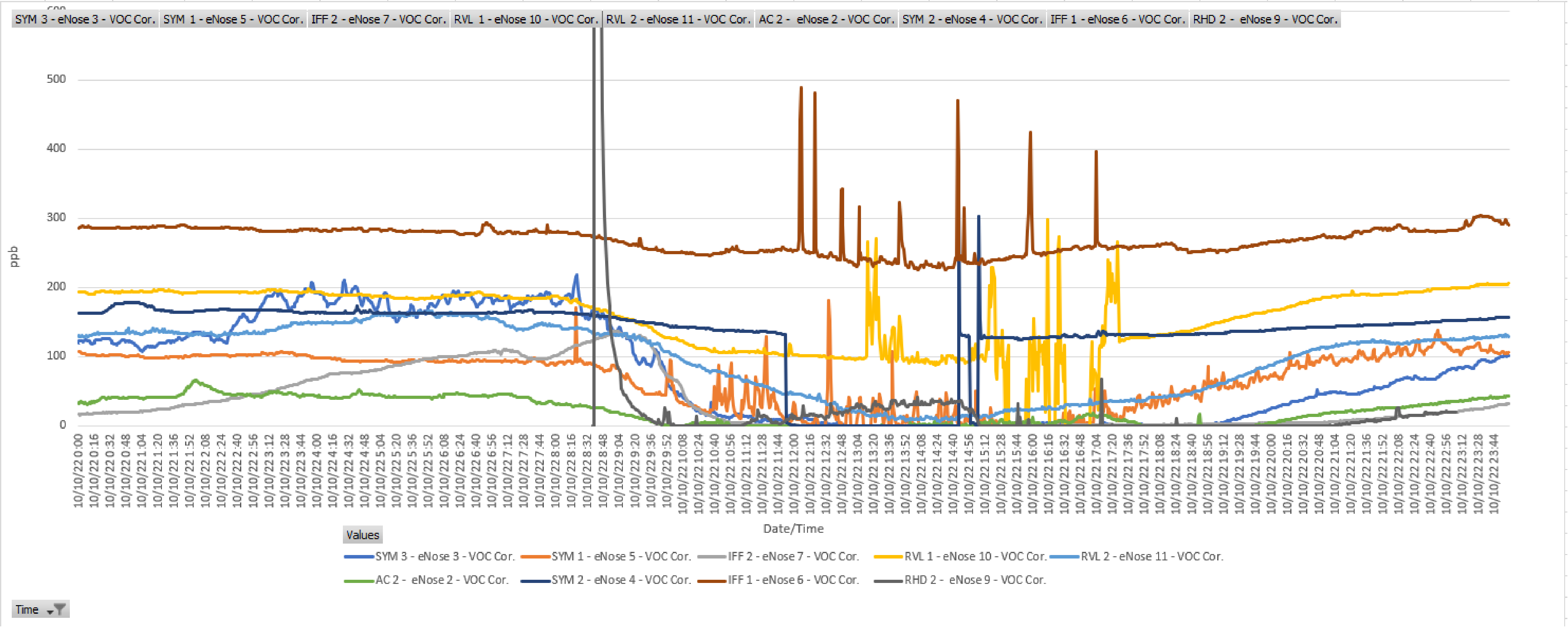
Figure 165. Backward trajectory on October 10, 2022, at 7:30 am.



VOC Data – October 10, 2022



VOC Data – October 10, 2022



January 10, 2023

Conclusions

- The software platform was very useful in predicting when an odor episode was occurring or about to occur, which assisted in assigning resources as well as confirming sources after-the-fact.
- The hydrogen sulfide and ammonia sensors performed well. We were disappointed with the VOC sensors – they were not very useful after about halfway through the study.
- We consider the odor study to be a success despite the poor performance of the VOC sensors.