



Healthy People. Healthy Communities.

## **Odor Complaints - BackTrajectory Analysis Summary – April 5, 2021**

### Background:

Plots of BackTrajectories (BT) were requested to help assess whether the New Indy facility (NI) in southeastern York County, and wastewater treatment plants (WWTP) in eastern York, northern Lancaster and northeastern Chester Counties, could be sources of emissions that have contributed to recent odor complaints mainly in the vicinity of York and Lancaster Counties in SC, and adjoining areas of NC.

### Method:

- The analysis focused on complaints from March 8-31, 2021.
- The HYSPLIT model was used to produce the BTs. HYSPLIT is a system for computing air parcel trajectories, including BTs - which are commonly used to determine the origin of air parcels. HYSPLIT was run using the NOAA ARL (Air Resources Laboratory) website (<https://www.arl.noaa.gov/hysplit/hysplit>). Additional information about HYSPLIT can be found at that site.

BTs were plotted for 3 low-level altitudes of 10, 100 and 300 meters, above ground level, using the HRRR (High Resolution Rapid Refresh) meteorological model within HYSPLIT. The HRRR model has a horizontal resolution of 3 km and is the most detailed resolution available for use with HYSPLIT.

Each BT was run for 6 hours, showing the trajectory of air parcels for the 6 hours preceding the time/location of interest.

- BTs were prepared for two types of complaint episodes:
  - 1) "Specific episodes" - BTs end at a specific complaint time and location; and
  - 2) "Group episodes" - BT's end at a centroid of a group of complaints that occurred near (timewise) a date/time when a high number of complaints were received.

For Specific episodes, the complaints from which to plot BTs were selected based on several factors. Due to limited time and the large number of complaints received, only a limited number of representative complaints were chosen for the analysis. The episodes chosen were those that: 1) reported a higher intensity of odor; 2) contained a detailed description of the odor observation; 3) represented a spectrum of locations; 4) occurred on a variety of dates and weather patterns; and 5) reported on the same day and very nearly the same time as when the odor was detected.

For the Group episodes, a time/frequency graph of complaints was used to identify several approximate dates/times to which a high number of complaints pertained. Nine higher frequency dates/times were selected during the period analyzed.

- A total of 34 BTs were prepared: 25 for Specific episodes and 9 for Group episodes. A list of the plots with end date/time and episode type (Specific vs. Group) is shown in Table 1 attached to this summary.
- For comparison to the HYSPLIT BTs, average surface wind speed and direction were computed at 3 nearby airports for the 6-hour period covered by each BT. The averages are based on hourly National Weather Service/FAA surface observations at these airports: Rockhill-York Co., Chester Catawba Regional

and Lancaster Co. – McWhirter Field. The averages for these sites for all 34 episodes are shown in Table 2 attached to this summary.

### BT Plots

The 34 BTs are attached to this summary in chronological order. The BTs are shown in two formats for each episode: Full-Scale and Zoomed. These are described below.

Full-Scale plots show the entire length of the BTs. The lines on the plots mark a trace of air parcels going back 6 hours from the end point (the complaint location for Specific Plots; the centroid for Group Plots). The end point is marked with a star. [Note: On 6 of the plots, an “x” was added to designate the location of NI. The “x” is not shown on the other 28 Full-Scale plots since the location of New Indy is shown in detail in the accompanying Zoomed plots described below.]

Zoomed plots show a more magnified, detailed view of the BTs in the vicinity of the complaints and NI. They are superimposed on a Google Earth aerial photograph. Also included on these plots are locations of wastewater treatment plants (WWTP) in eastern York, northern Lancaster and northeastern Chester Counties. Like the Full-Scale plots, the lines mark a trace of air parcels going back 6 hours from the end point. Other details are shown in the legend of each plot.

### Conclusions:

NI was located near or directly in/under the upstream air trajectory on most of the 34 BTs that were analyzed. This indicates air emissions from NI likely contributed to the upstream sourcing for most of the complaints assessed. While there is uncertainty inherent in these BTs, and only a small sample of BTs relative to the large number of complaints was plotted, the weight of evidence of this analysis also indicates that emissions from NI have likely contributed to a large percentage of the odor complaints received that were not assessed in this brief analysis.

One or more WWTPs – other than the one directly associated with NI - were located near the upstream air trajectory on several of the BTs plotted. However, these WWTPs varied from episode to episode depending on the wind direction. This indicates that, while emissions from WWTPs could have contributed to the upstream sourcing for several complaint episodes, it is evident that a particular WWTP did not contribute to the upstream sourcing of complaints on a consistent basis.

For each of the 34 episodes analyzed, there was general agreement between the 6-hour average winds computed from observations at nearby airports with the BTs produced from model data using HYSPLIT. This lends credence to the BTs plotted and the conclusions drawn in this summary.

**Table 1 – List of Back Trajectory Plots**

Episode	End Point (March 2021)		Episode Type	
	Date	Time		
1	8	6 a	EST	Group
2	8	10 a		Specific
3	9	6 a		Group
4	10	9 a		Specific
5	11	12 a		Group
6	11	6 a		Group
7	14	7 a	EDT	Group
8	14	8 a		Specific
9	14	8 a		Specific
10	14	11 a		Specific
11	15	8 a		Specific
12	15	12 p		Specific
13	15	2 p		Specific
14	15	9 p		Specific
15	16	3 a		Specific
16	17	3 p		Specific
17	18	8 a		Specific
18	18	12 p		Group
19	18	4 p		Specific
20	18	6 p		Group
21	18	8 p		Specific
22	19	8 a		Specific
23	21	6 p		Specific
24	23	3 p		Specific
25	23	10 p		Specific
26	24	9 a		Specific
27	24	11 a		Specific
28	24	5 p		Group
29	25	8 a		Group
30	30	6 a		Specific
31	30	12 p		Specific
32	30	6 p		Specific
33	31	12 a		Specific
34	31	6 a		Specific

**Table 2 – 6-hour Average Winds Near BackTrajectory Plots**

Per Official\* Hourly Observations at Nearby Airports

Episode	Back Trajectory Time Span (March 2021)				Average Wind Direction (DIR) and Speed (SPD) **					
					Chester (DCM)		Lancaster (LKR)		Rock Hill (UZA)	
	Date	Start	End	Unit	DIR	SPD	DIR	SPD	DIR	SPD
1	8	12 a	6 a	EST	190	0.3	N/A	calm	N/A	calm
2	8	4 a	10 a		N/A	calm	182	1.7	195	3.7
3	9	12 a	6 a		210	1.5	N/A	calm	208	3.0
4	10	3 a	9 a		N/A	calm	N/A	calm	205	5.5
5	10-11	6 p	12 a		184	2.4	210	0.6	196	3.7
6	11	12 a	6 a		212	3.4	N/A	calm	217	5.7
7	14	1 a	7 a	EDT	8	1.2	40	0.3	238	2.2
8	14	2 a	8 a		8	1.3	N/A	calm	253	1.7
9	14	2 a	8 a		8	1.3	N/A	calm	253	1.7
10	14	5 a	11 a		320	1.4	263	0.8	350	2.3
11	15	2 a	8 a		48	8.3	44	7.8	60	5.0
12	15	6 a	12 p		63	8.3	60	9.4	80	4.6
13	15	8 a	2 p		66	8.2	61	9.3	120	5.0
14	15	3 p	9 p		93	7.9	89	8.4	100	4.8
15	15-16	9 p	3 a		87	7.2	74	7.1	100	3.8
16	17	9 a	3 p		36	1.8	N/A	calm	32	1.8
17	18	2 a	8 a		115	4.9	N/A	calm	114	3.1
18	18	6 a	12 p		154	6.1	163	4.4	147	4.3
19	18	10 a	4 p		172	9.8	180	11.7	185	8.1
20	18	12 p	6 p		181	10.1	186	12.4	200	12.2
21	18	2 p	8 p		185	8.2	192	11.2	204	13.4
22	19	2 a	8 a		264	2.2	258	1.3	308	5.2
23	21	12 p	6 p		42	11.2	45	12.0	50	9.0
24	23	9 a	3 p		38	10.1	34	6.2	26	7.4
25	23	4 p	10 p		63	3.9	48	4.7	88	3.5
26	24	3 a	9 a		45	1.4	N/A	calm	40	1.4
27	24	5 a	11 a		14	1.6	N/A	calm	13	1.7
28	24	11 a	5 p		171	1.9	200	0.5	210	4.0
29	25	2 a	8 a		158	1.1	N/A	calm	30	0.2
30	30	12 a	6 a		130	1.5	N/A	calm	N/A	calm
31	30	6 a	12 p		98	1.9	95	0.6	N/A	0.6
32	30	12 p	6 p		159	4.9	169	5.4	217	6.2
33	30-31	6 p	12 a		164	3.5	190	1.9	188	5.8
34	31	12 a	6 a		162	5.0	170	3.0	181	5.8

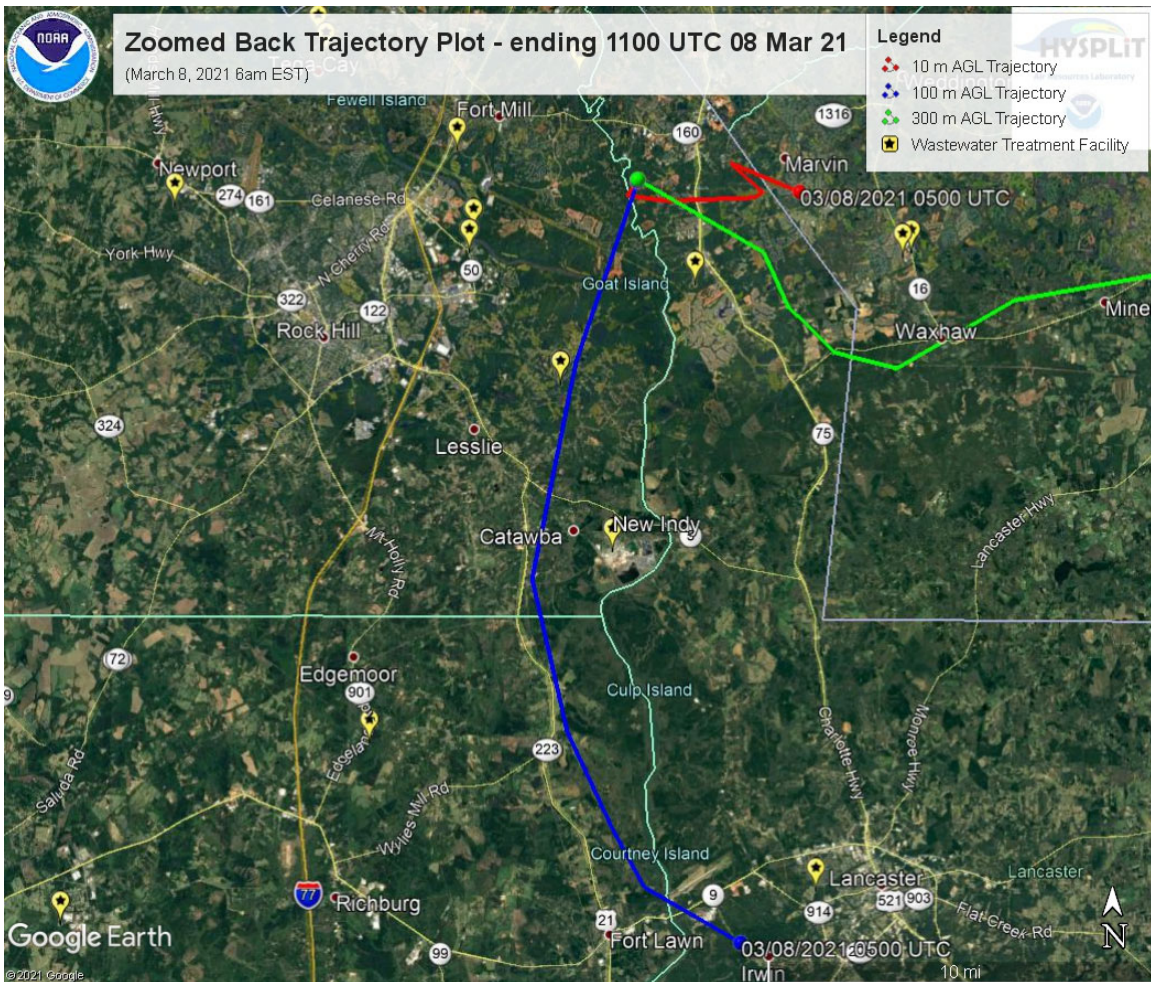
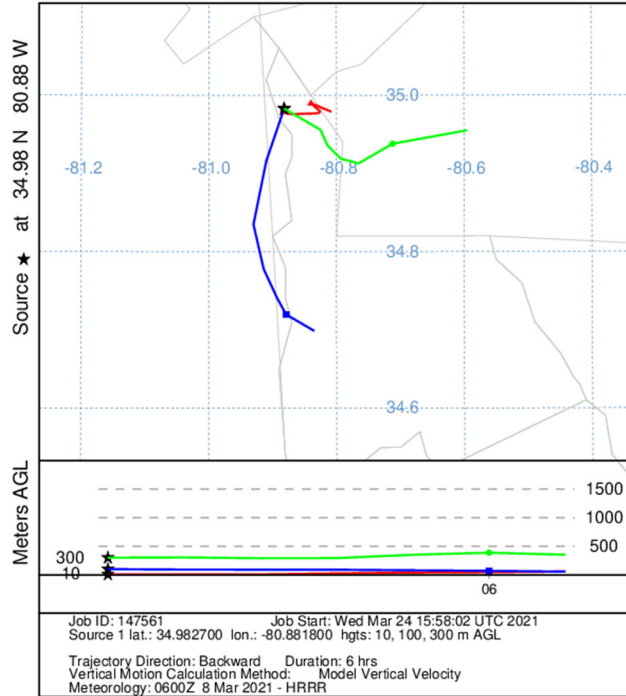
\* National Weather Service/FAA

\*\* Direction in degrees (from); Speed in knots



# Back Trajectory Episode #1

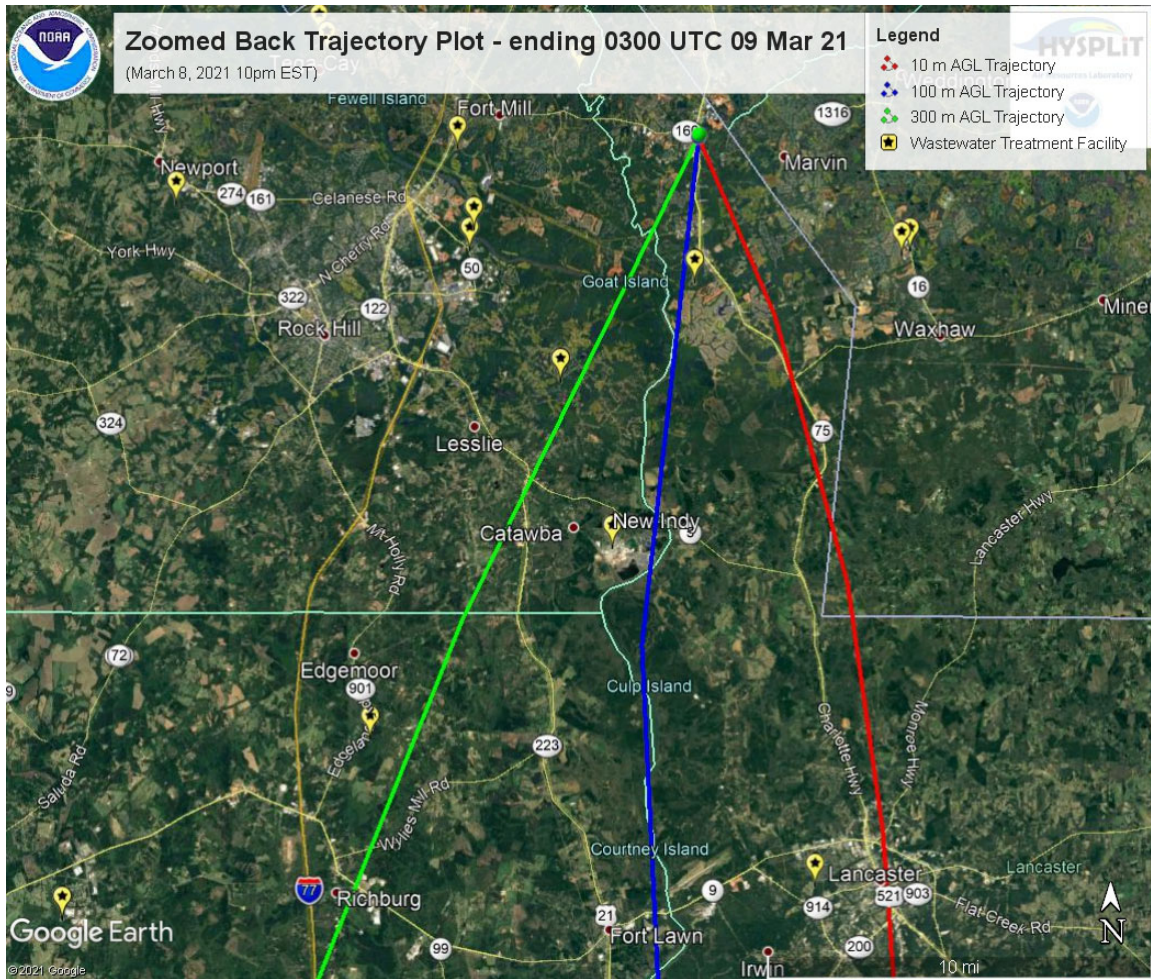
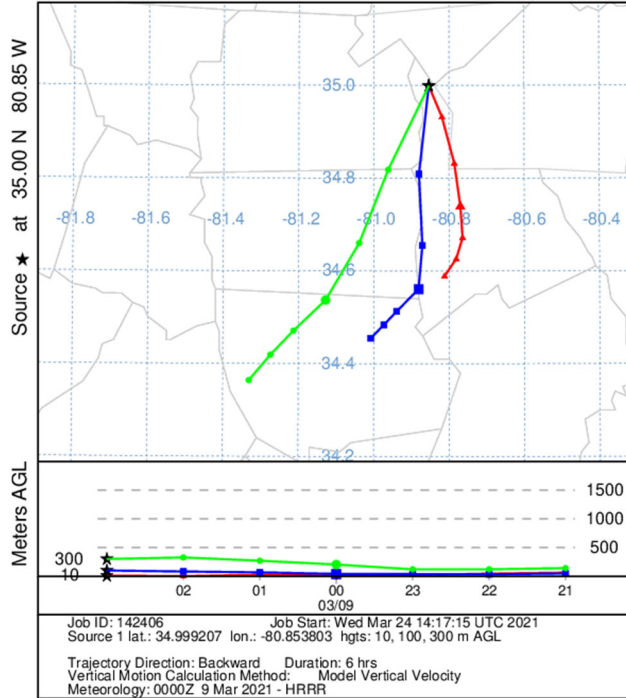
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 Backward trajectories ending at 1100 UTC 08 Mar 21  
 HRRR Meteorological Data





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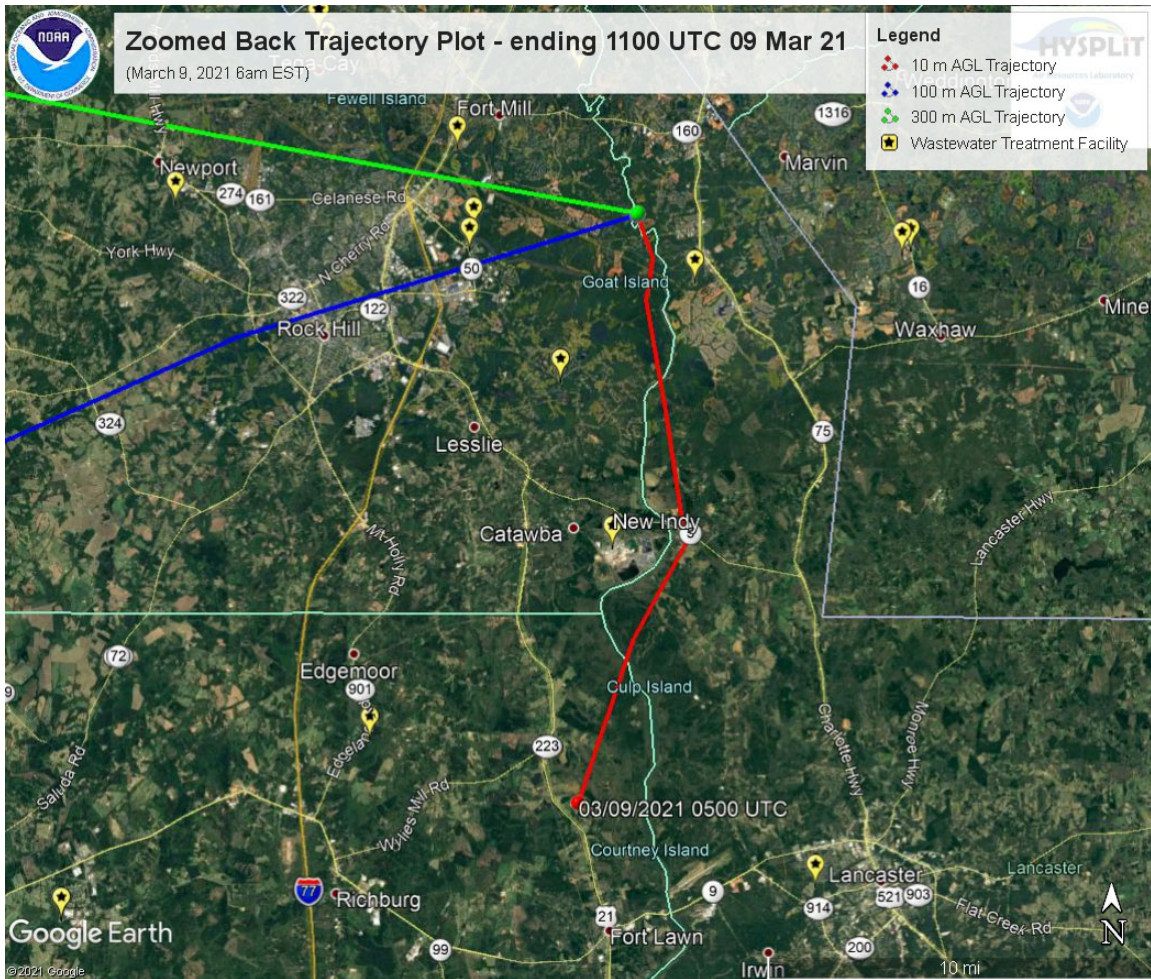
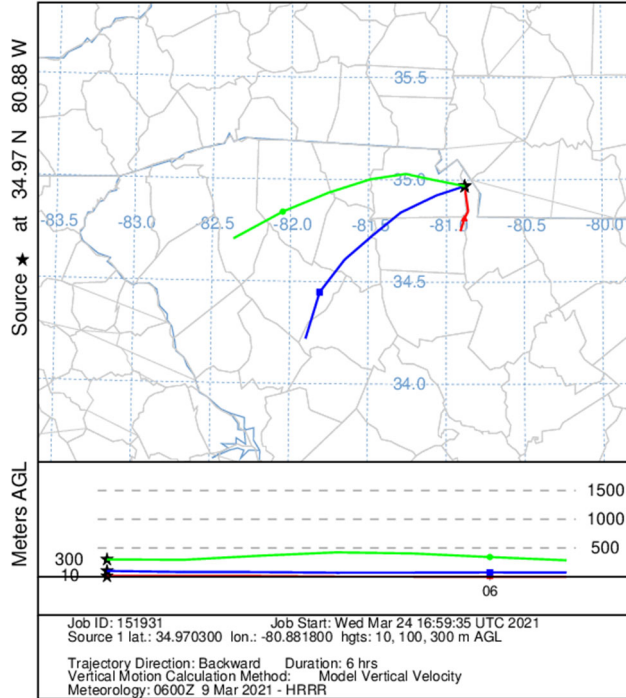
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 HRRR Meteorological Data





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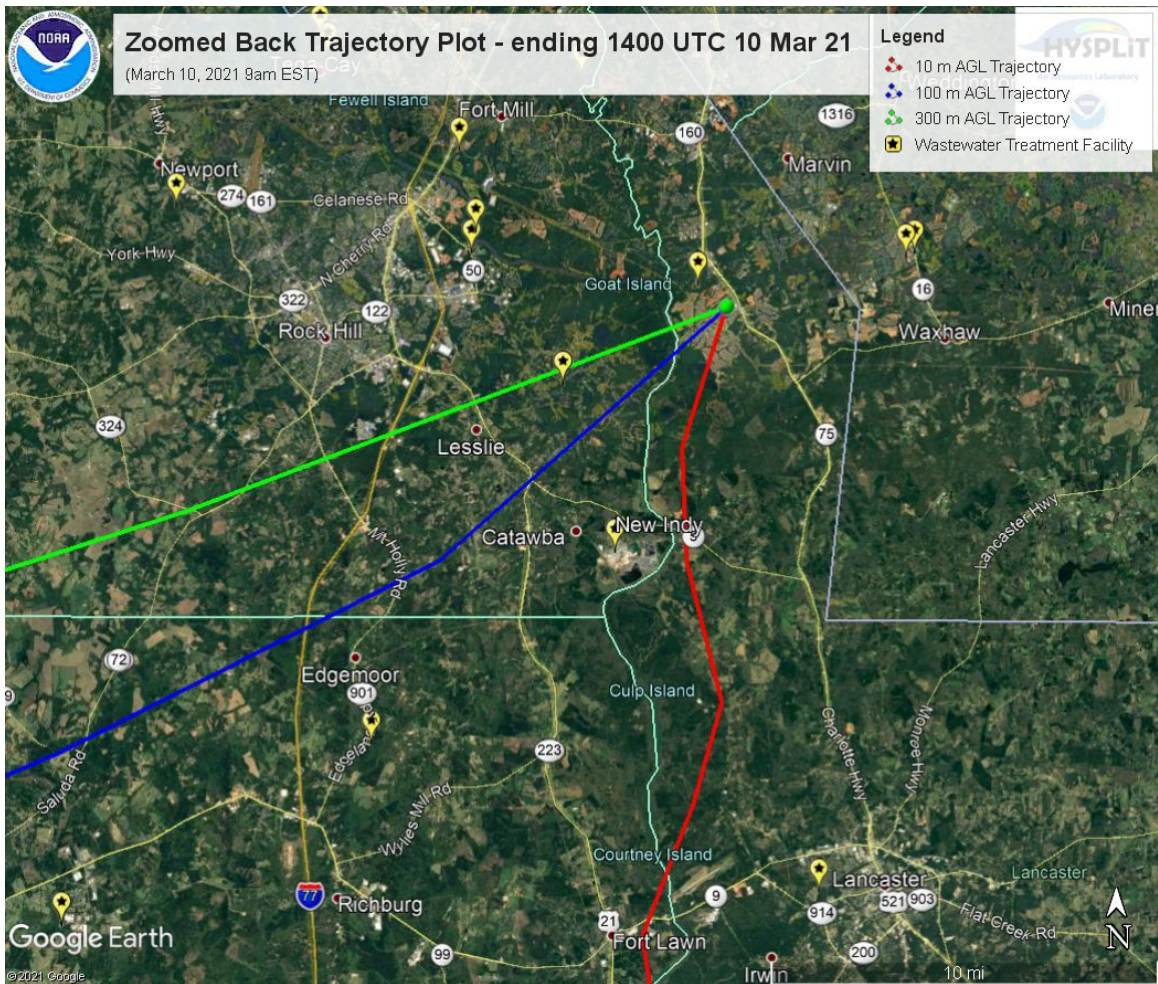
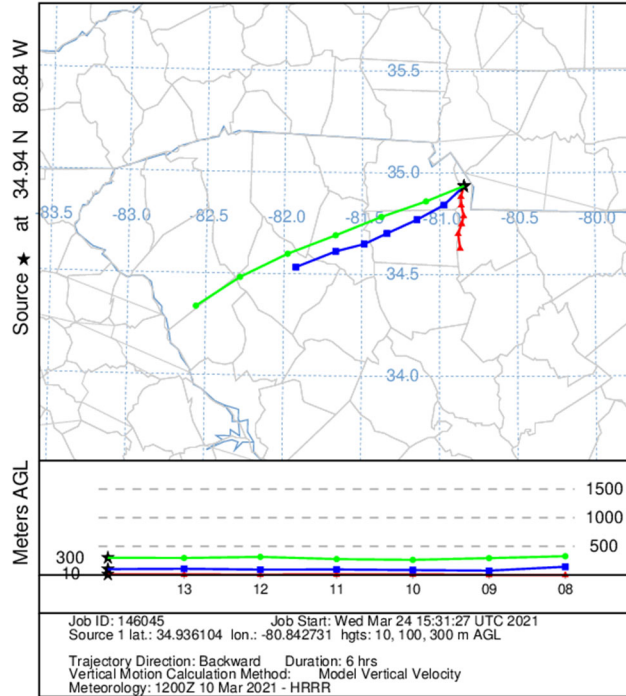
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 HRRR Meteorological Data





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NOAA HYSPLIT MODEL  
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 HRRR Meteorological Data



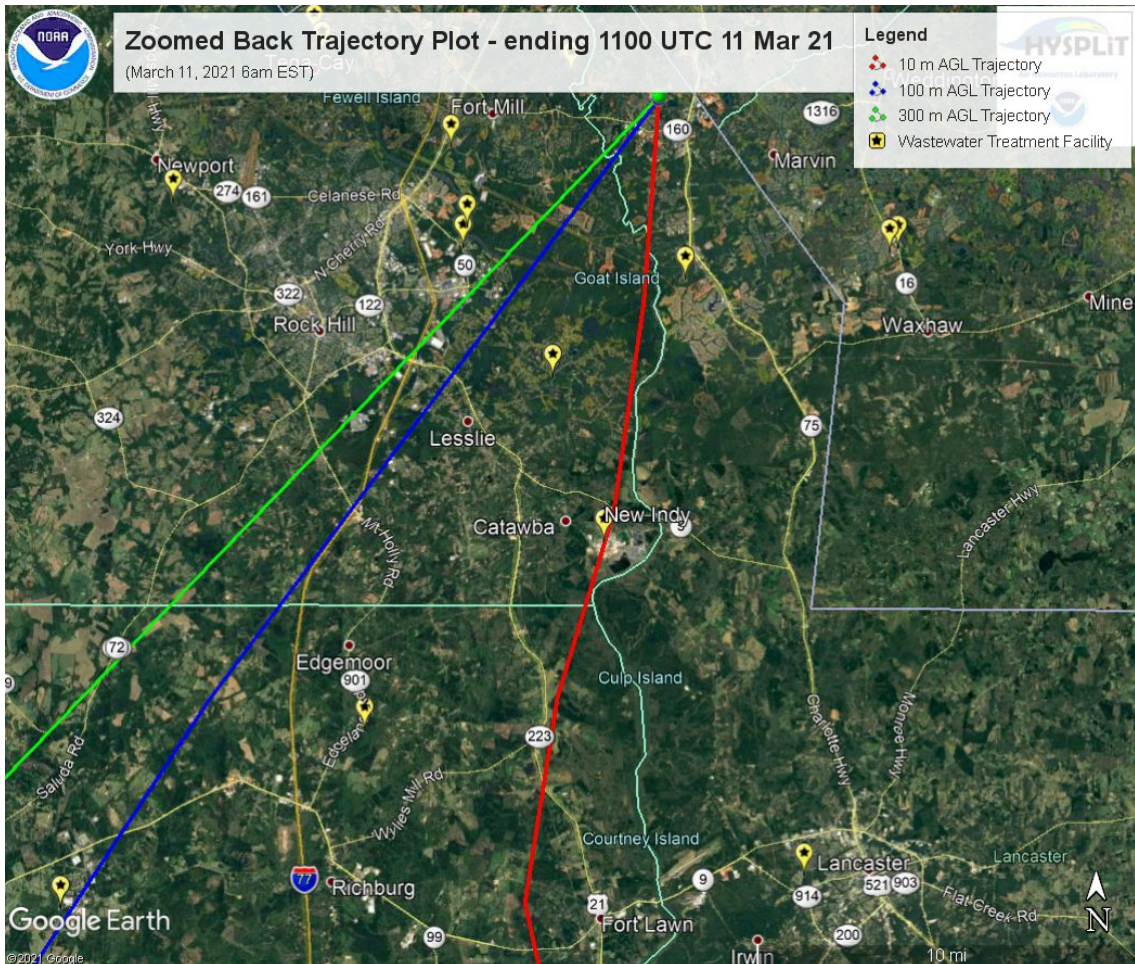
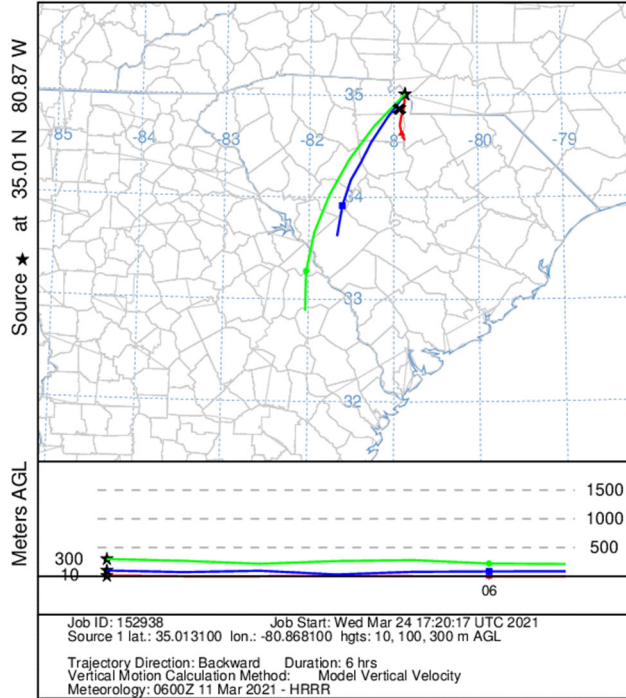






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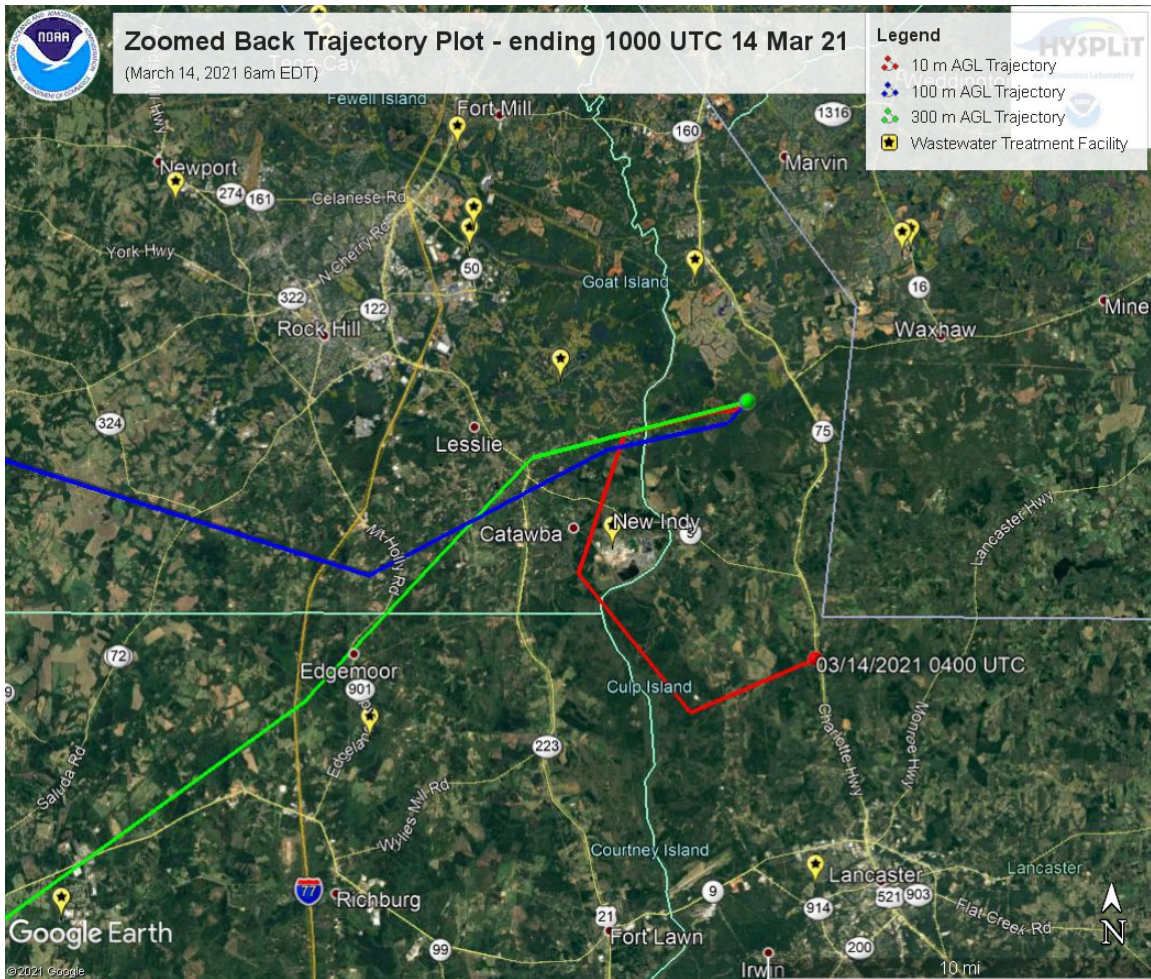
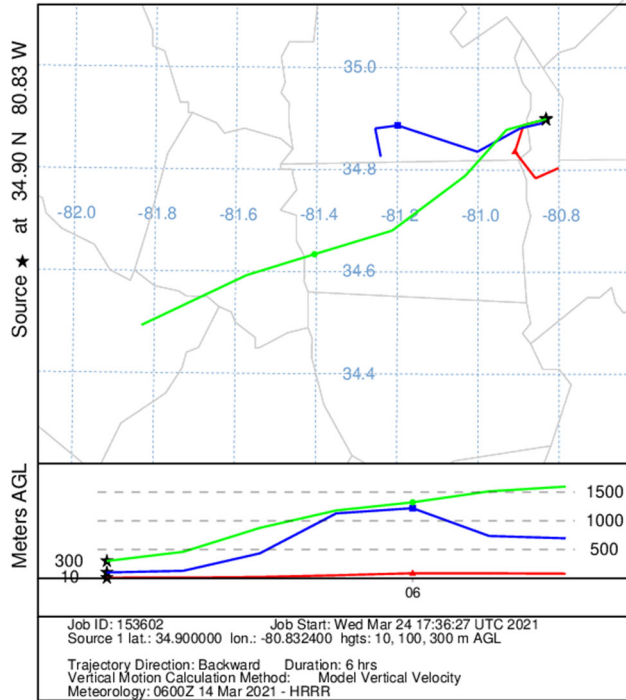
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 HRRR Meteorological Data





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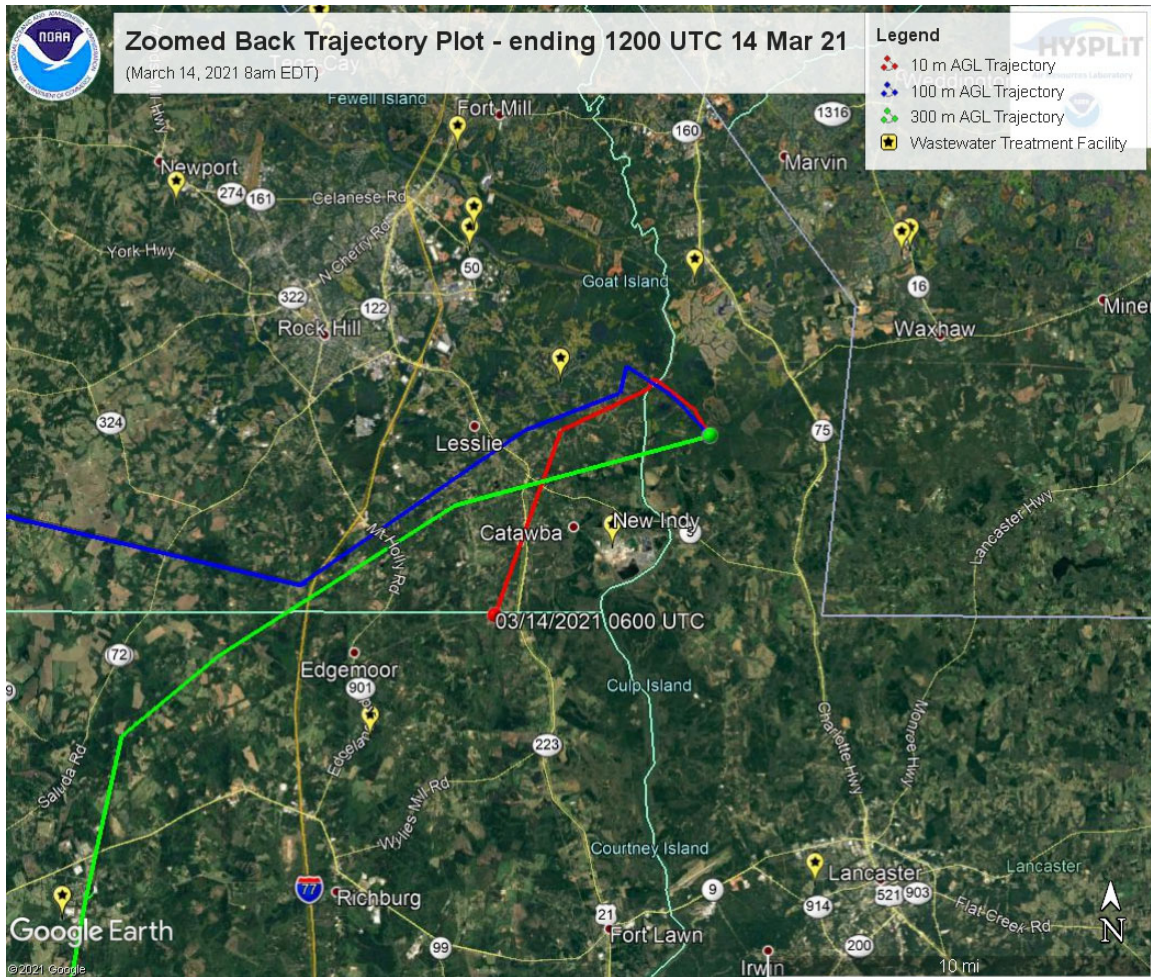
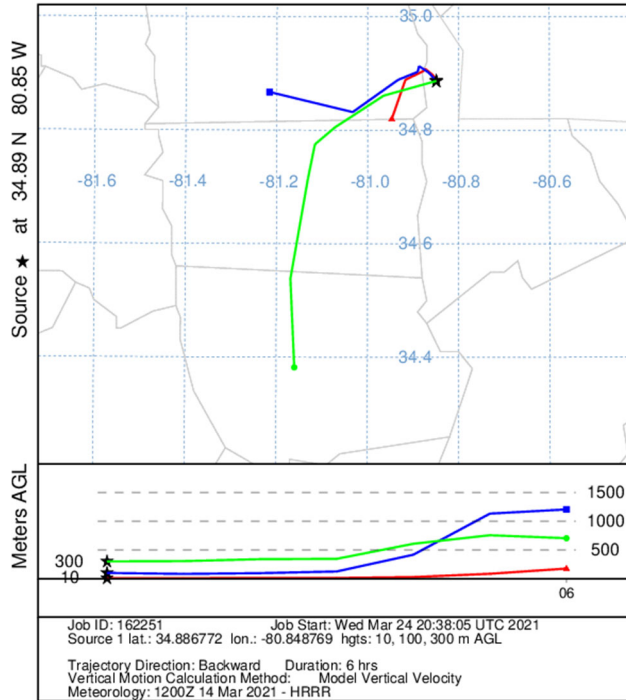
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 HRRR Meteorological Data





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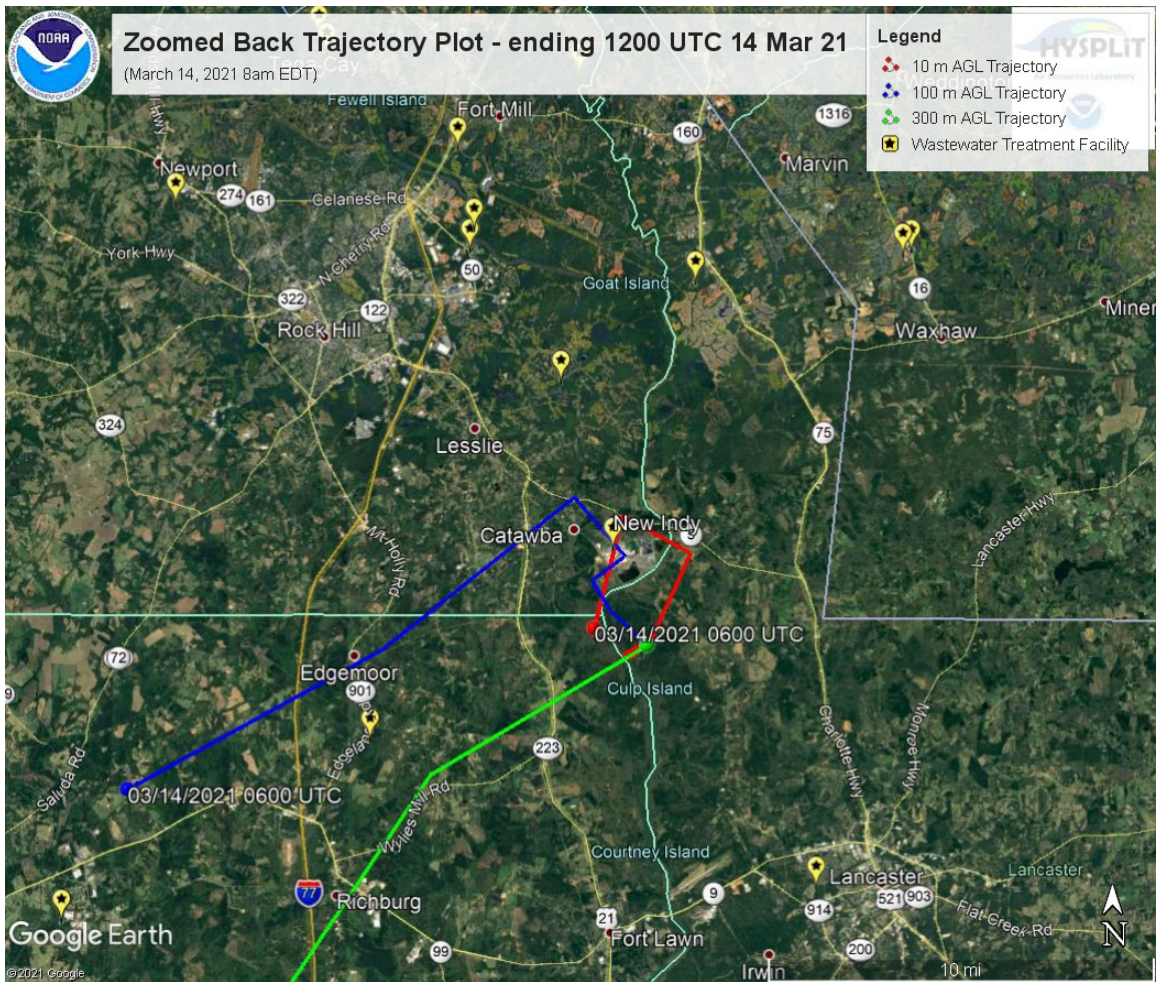
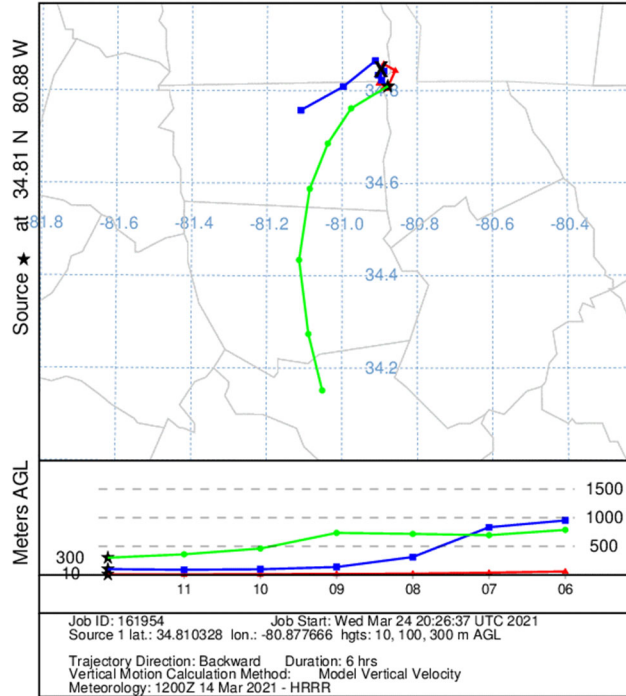
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 HRRR Meteorological Data





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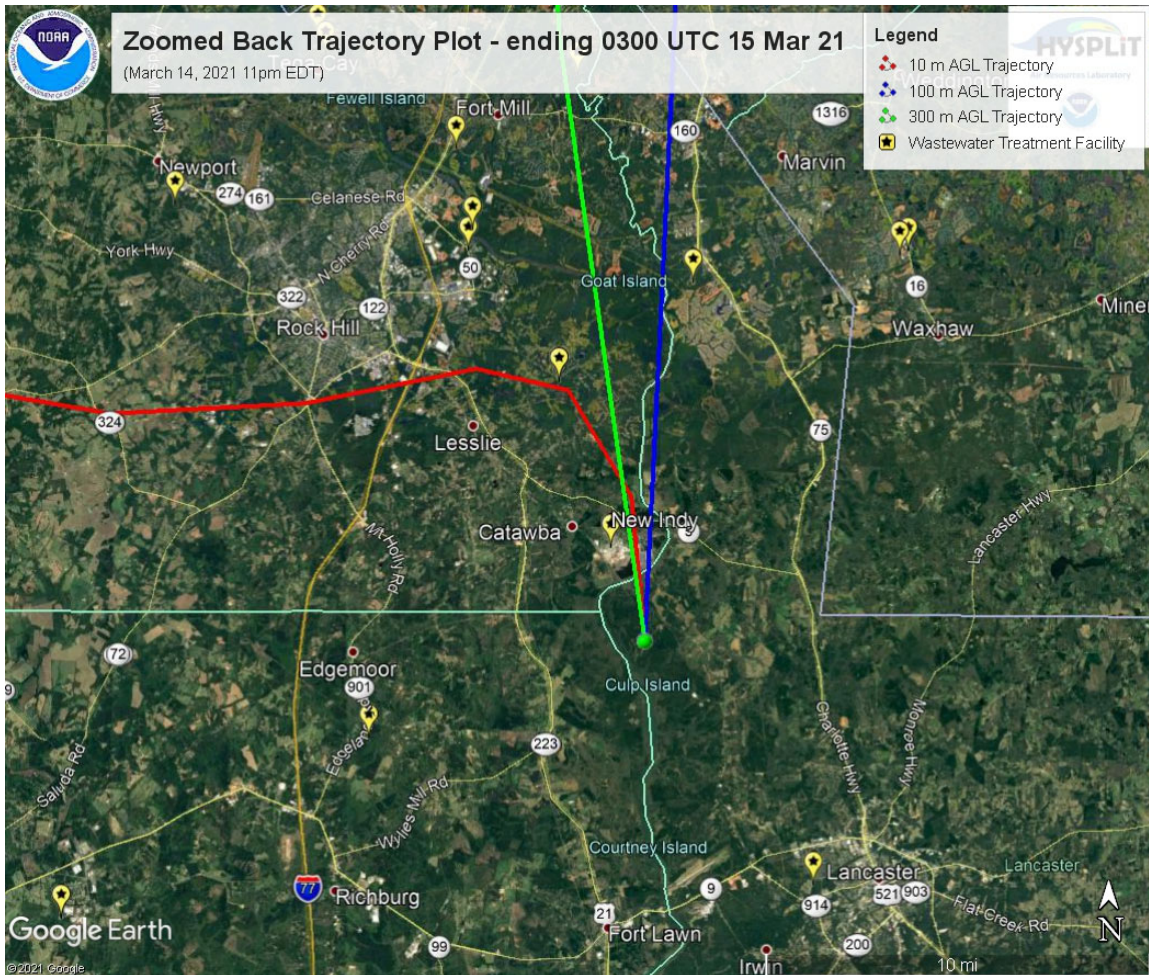
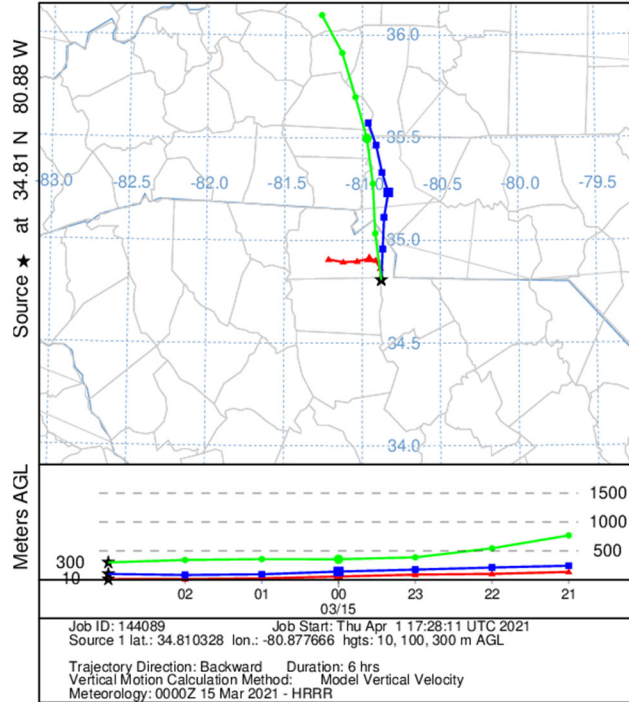
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 HRRR Meteorological Data





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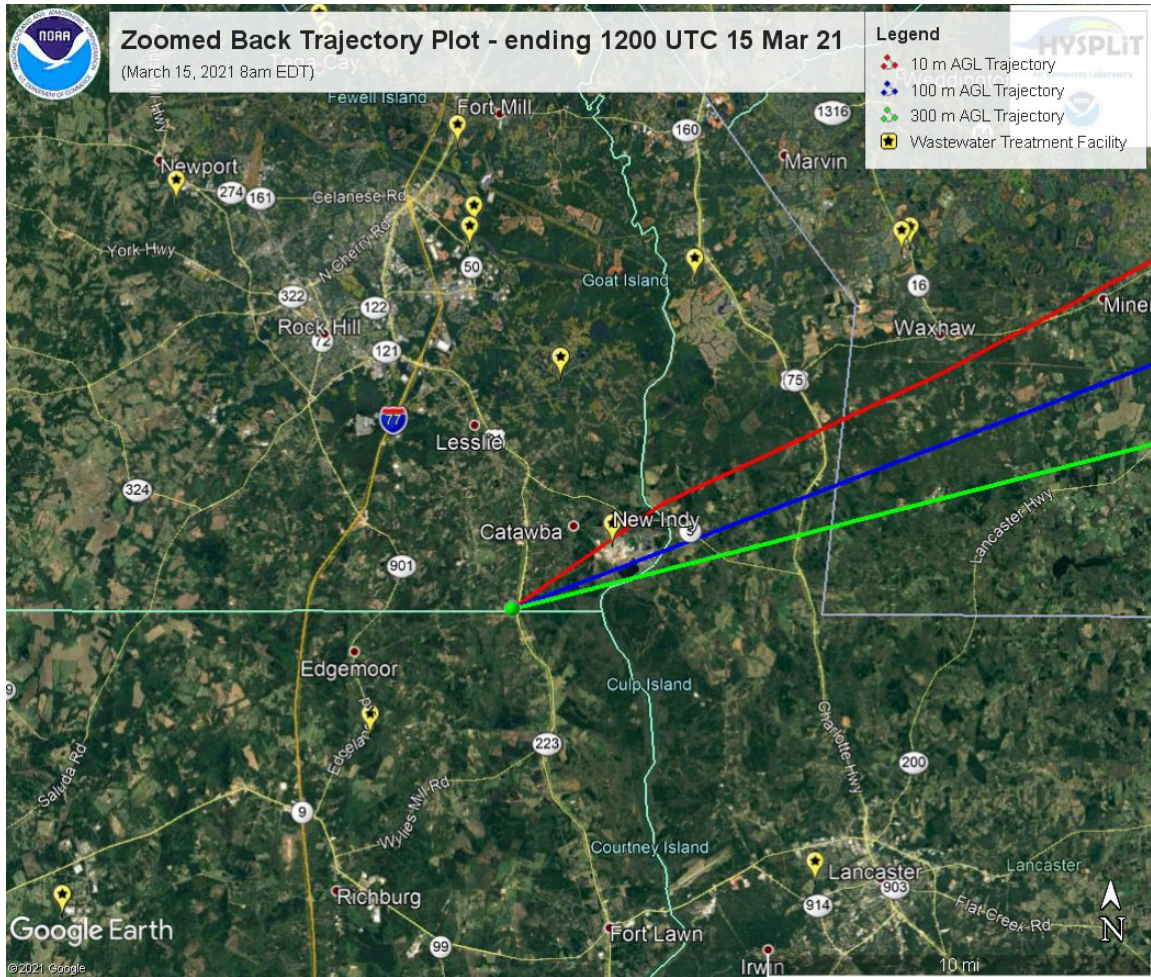
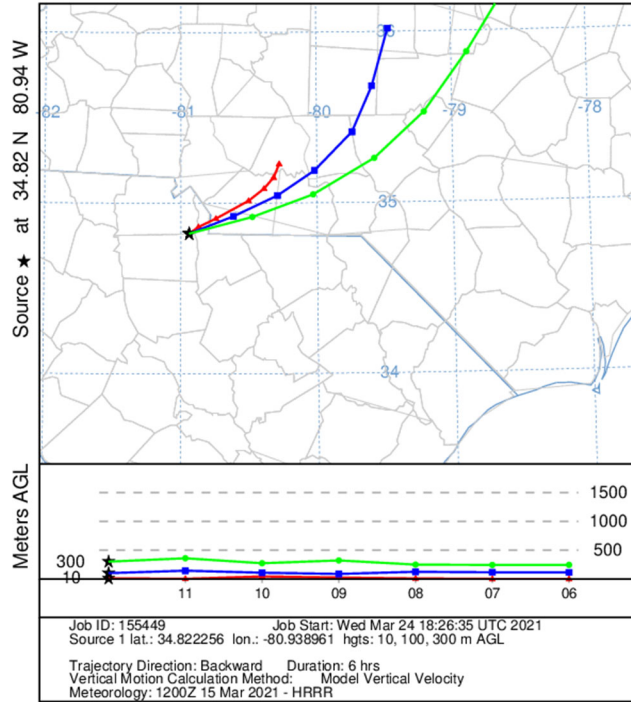
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 HRRR Meteorological Data





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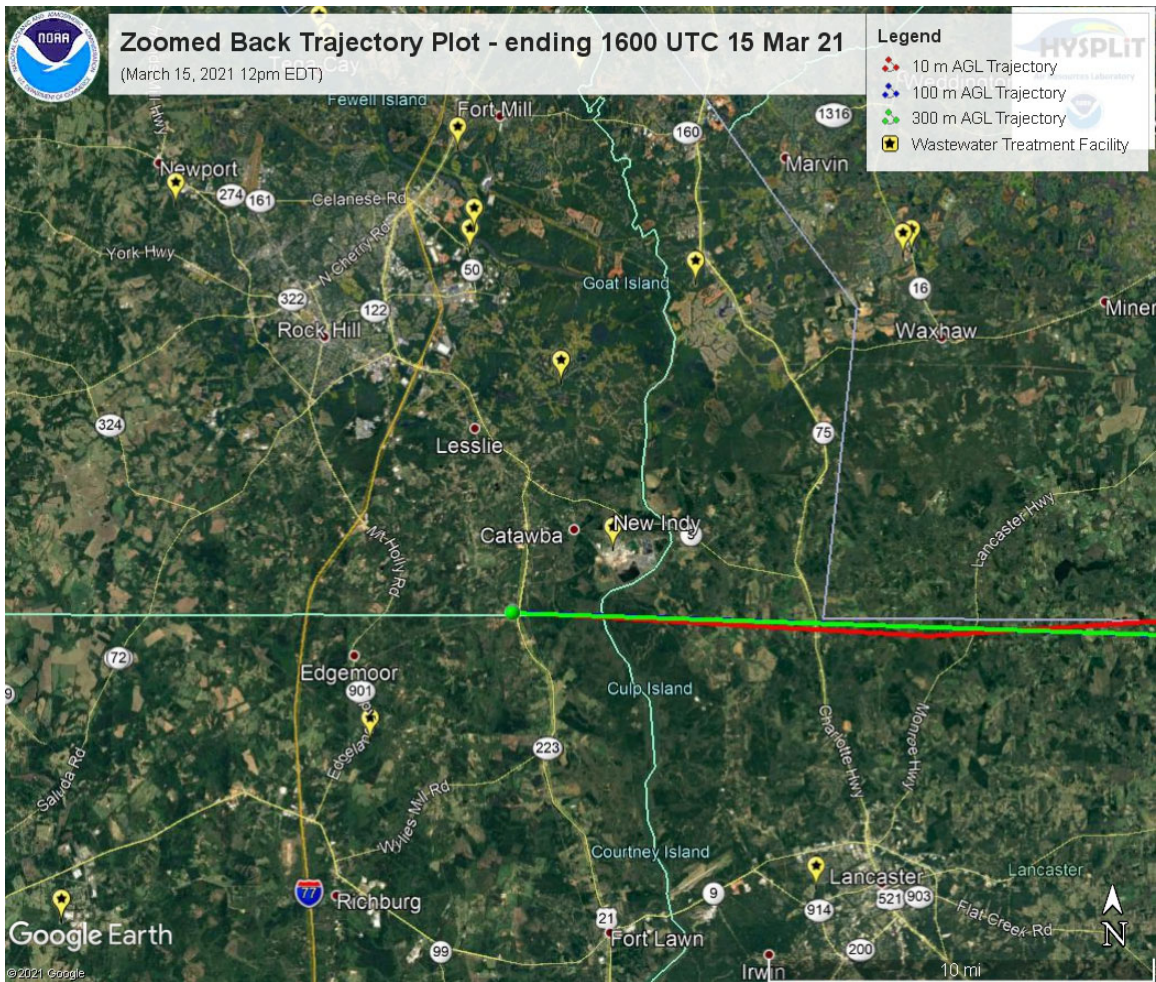
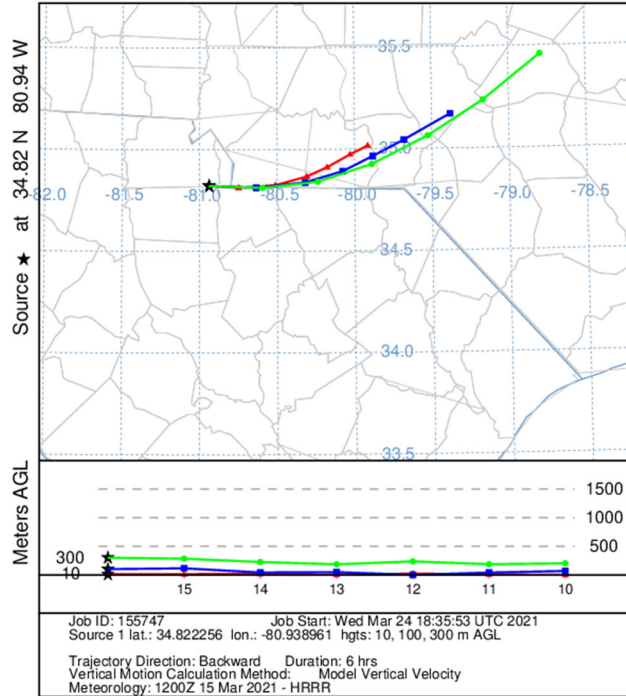
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 Backward trajectories ending at 1200 UTC 15 Mar 21  
 HRRR Meteorological Data





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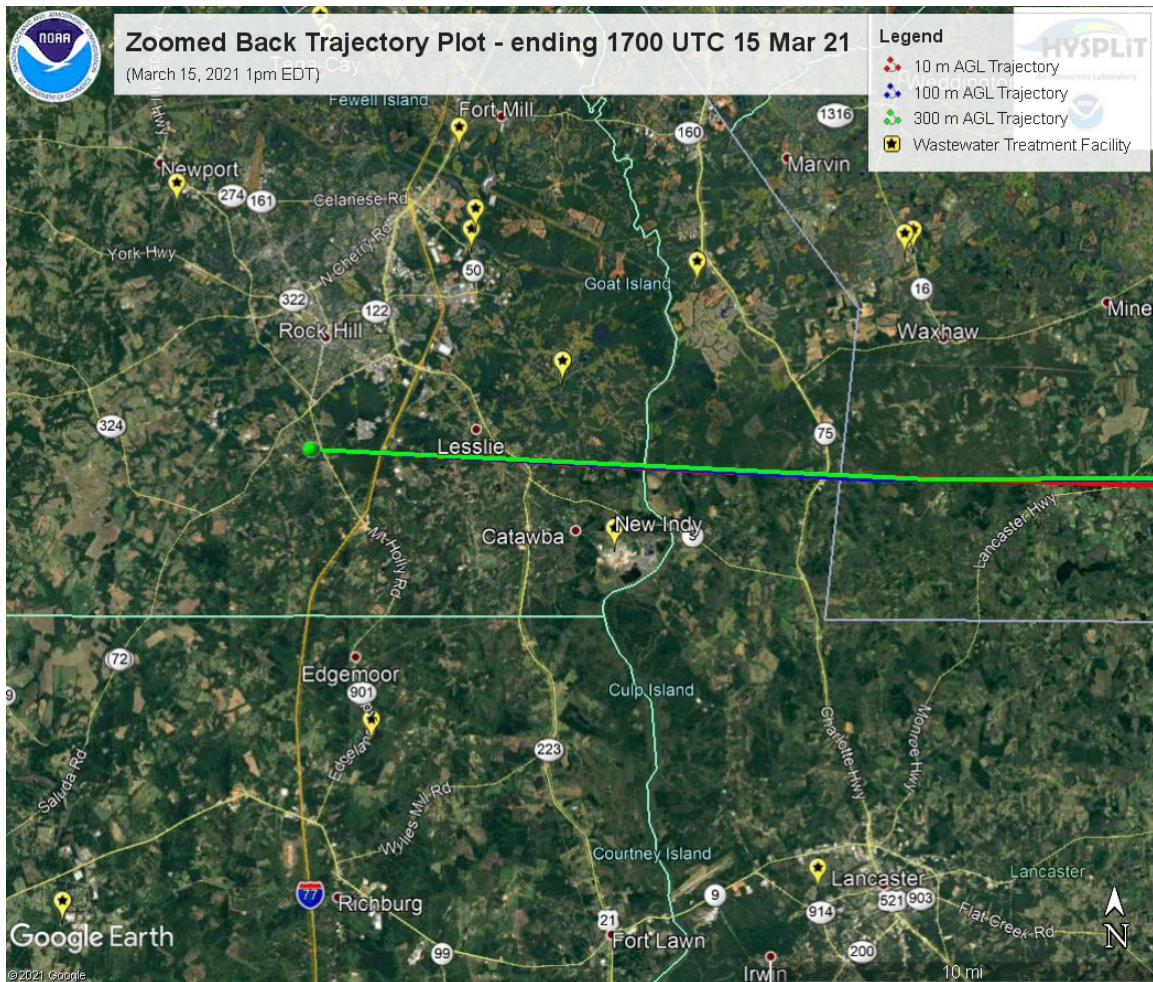
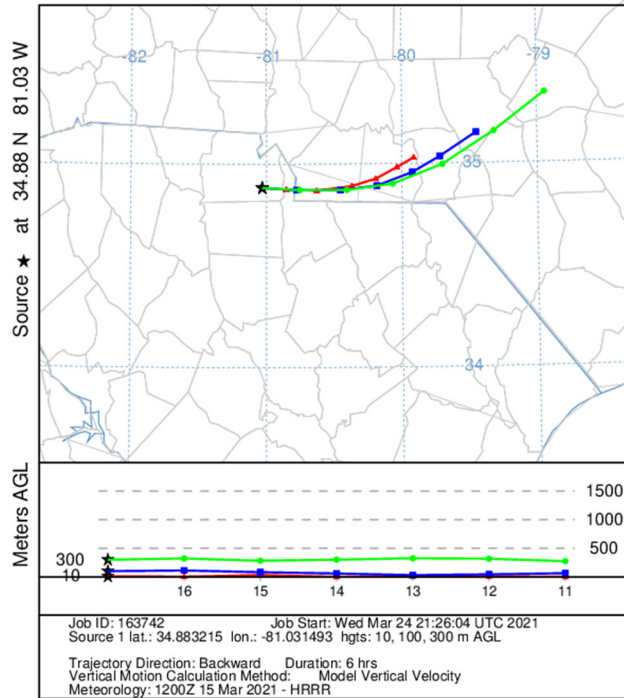
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 Backward trajectories ending at 1600 UTC 15 Mar 21  
 HRRR Meteorological Data





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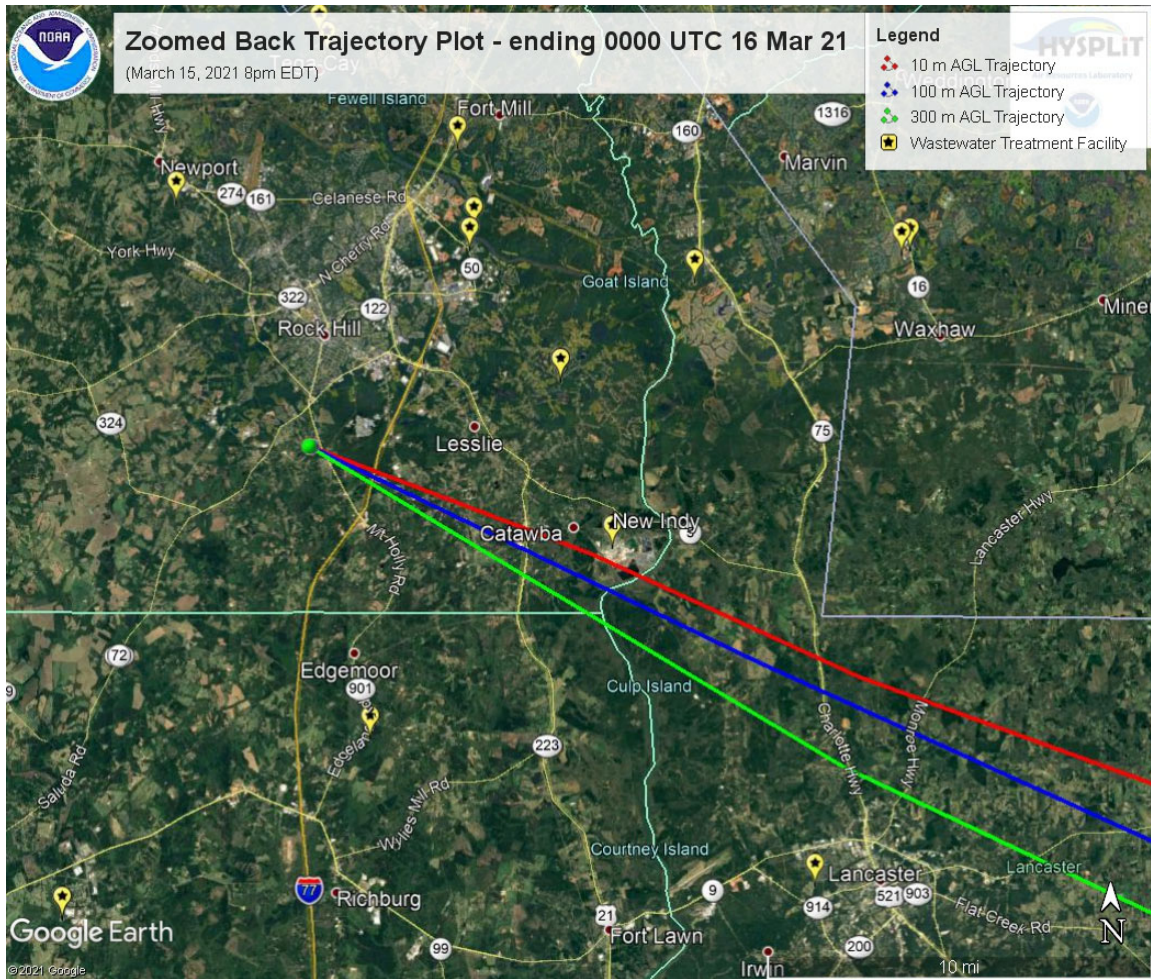
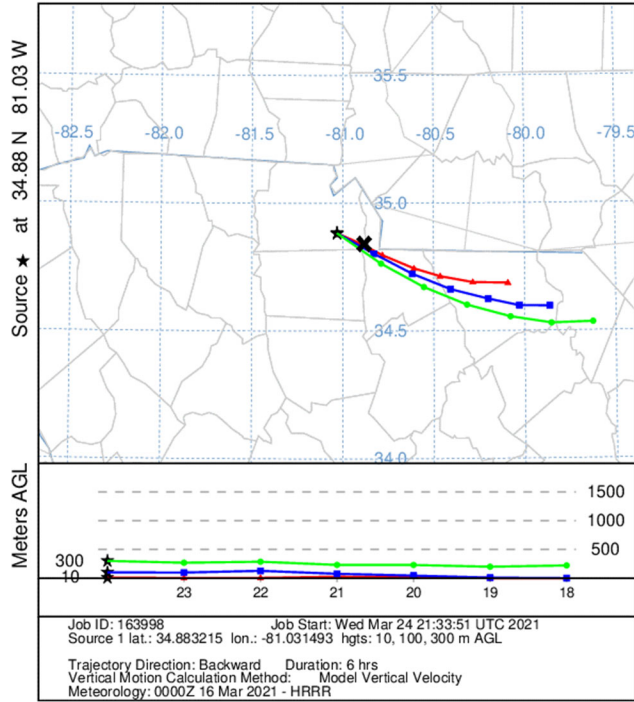
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 Backward trajectories ending at 1700 UTC 15 Mar 21  
 HRRR Meteorological Data





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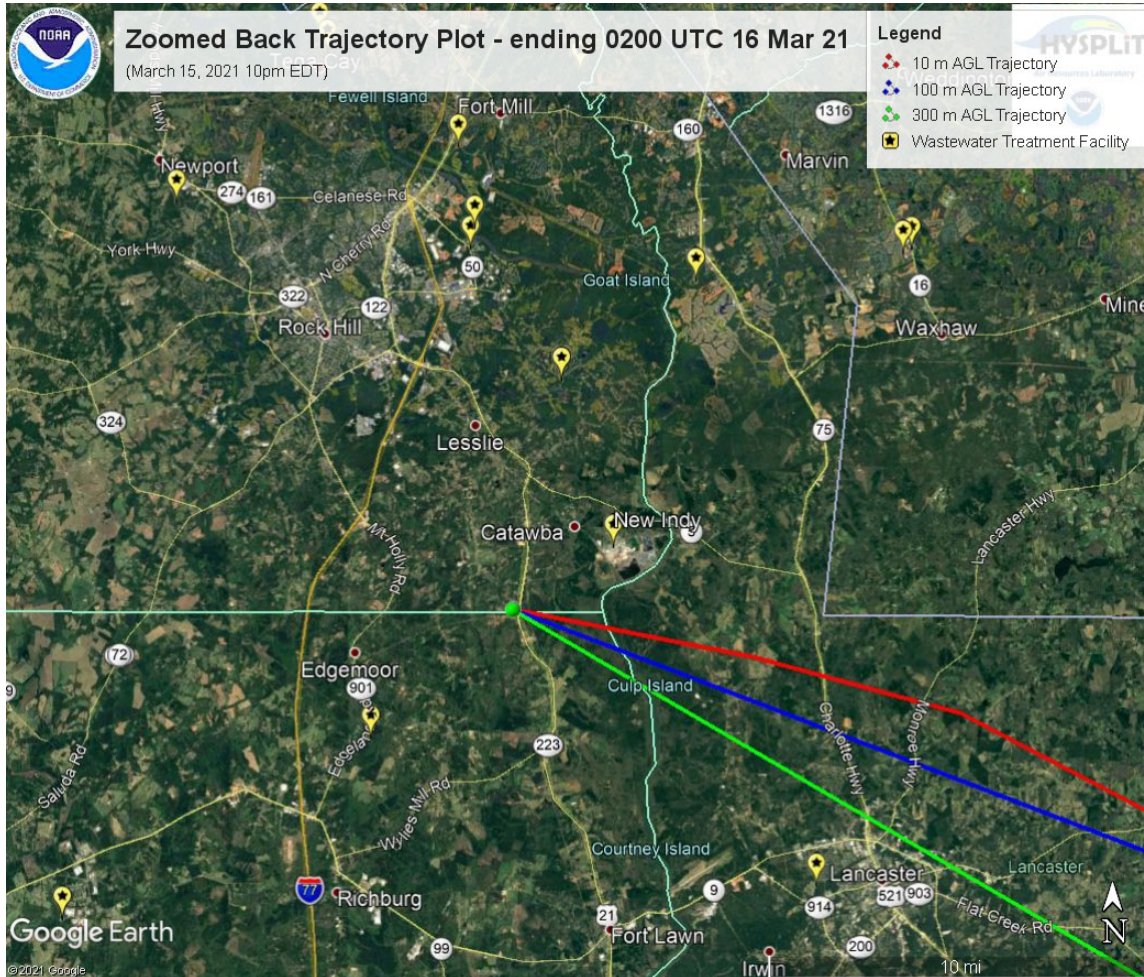
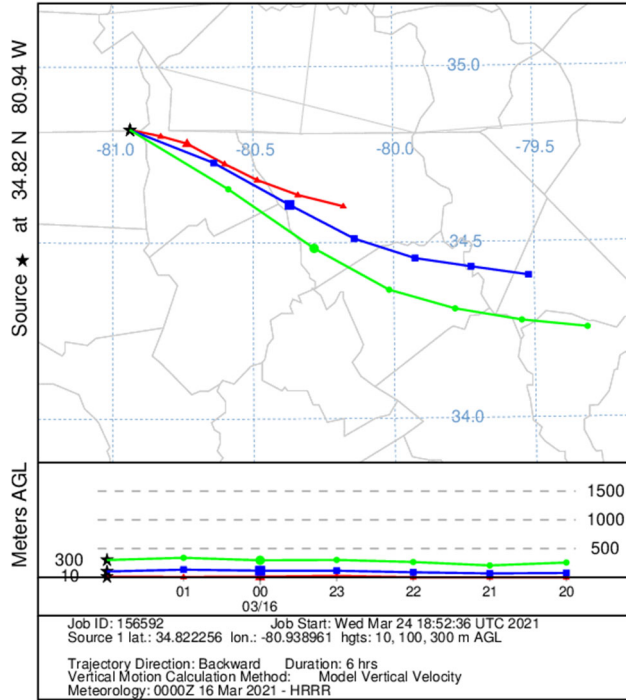
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 Backward trajectories ending at 0000 UTC 16 Mar 21  
 HRRR Meteorological Data





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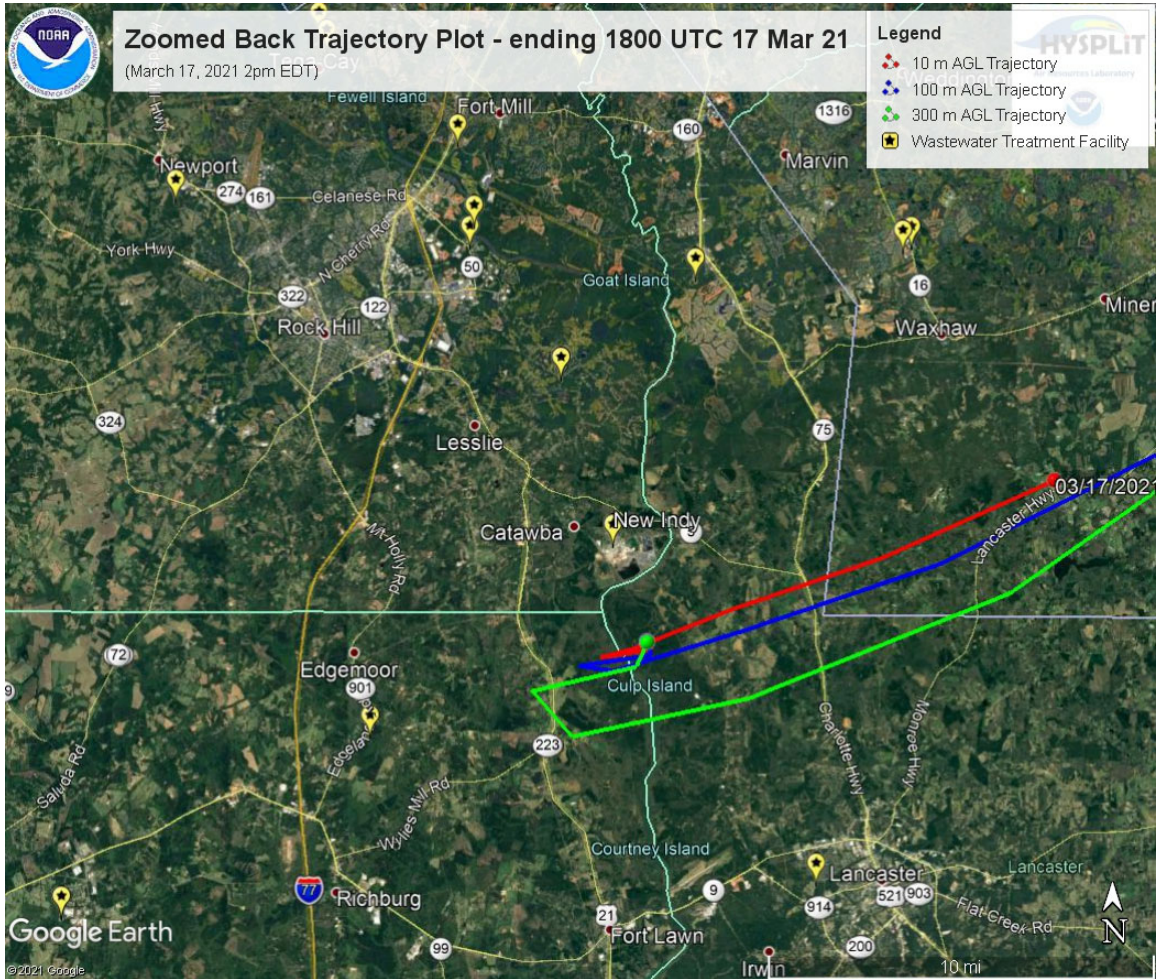
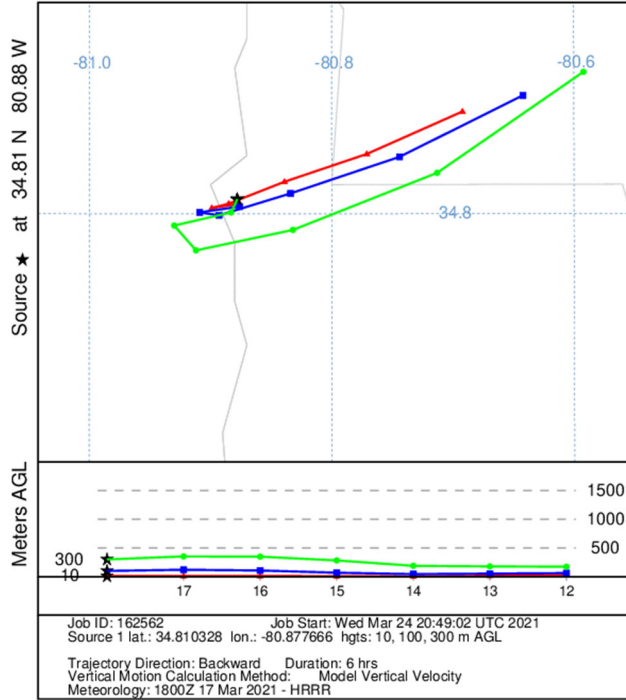
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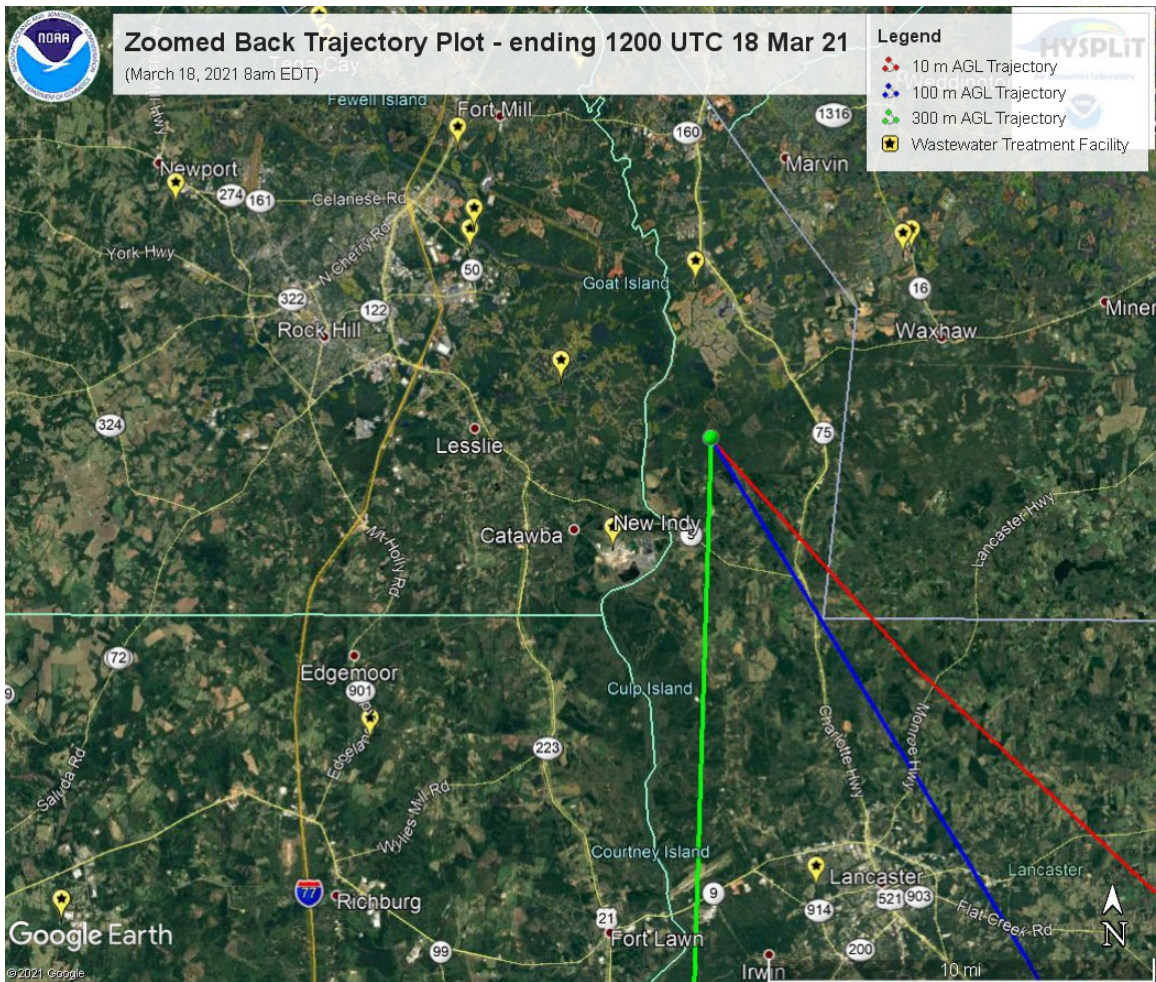
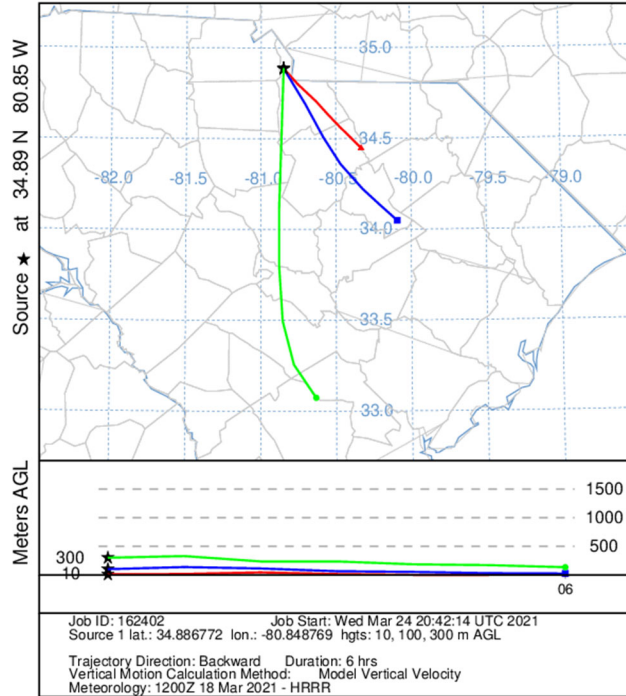
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 Backward trajectories ending at 1800 UTC 17 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #17

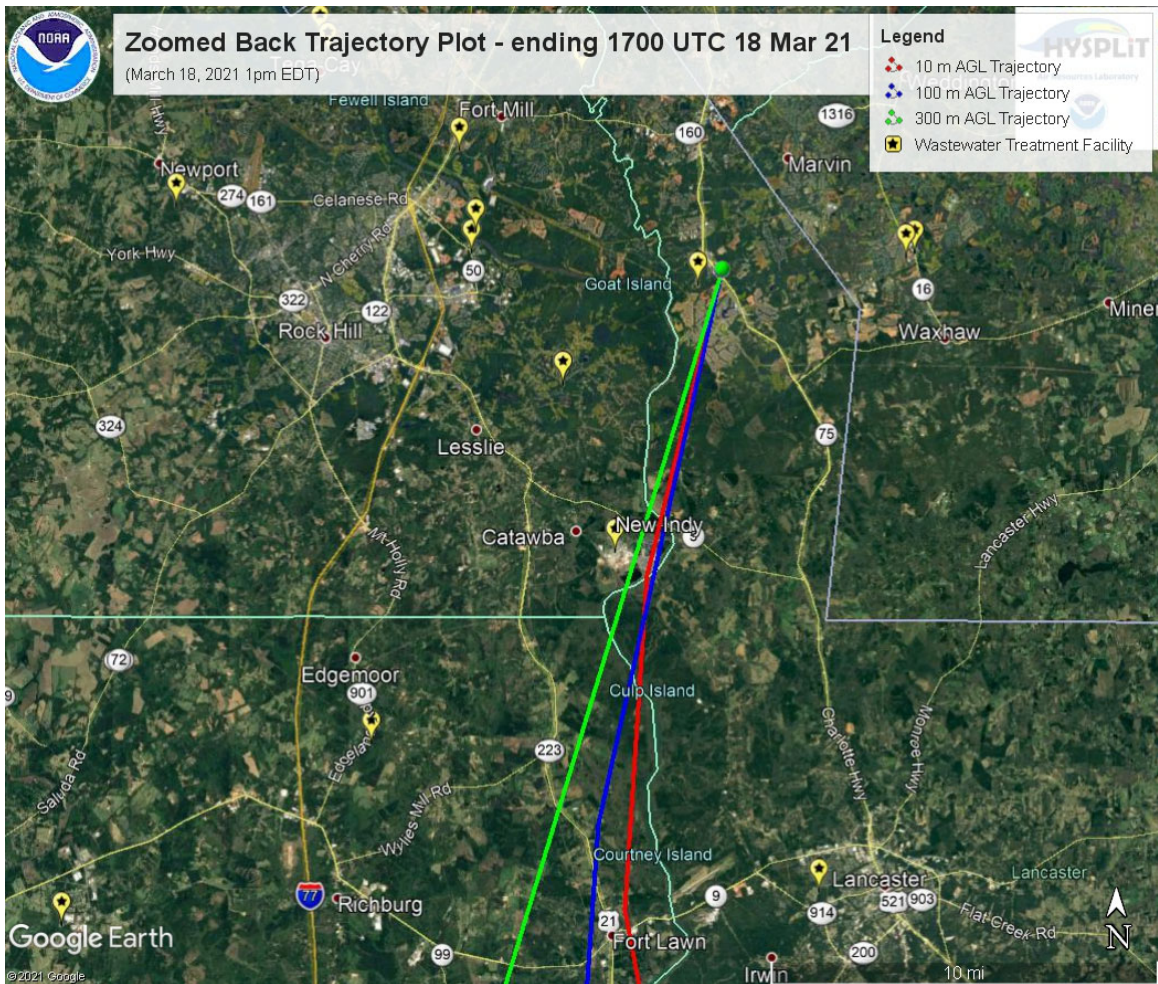
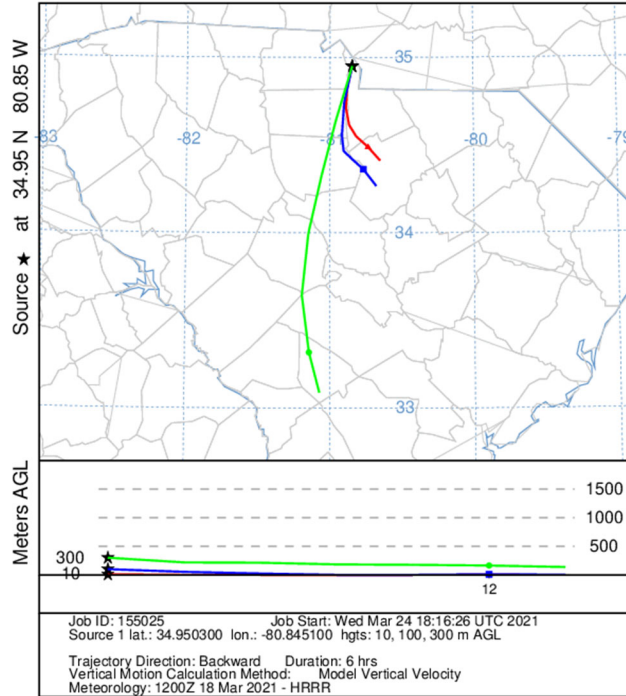
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 Backward trajectories ending at 1200 UTC 18 Mar 21  
 HRRR Meteorological Data





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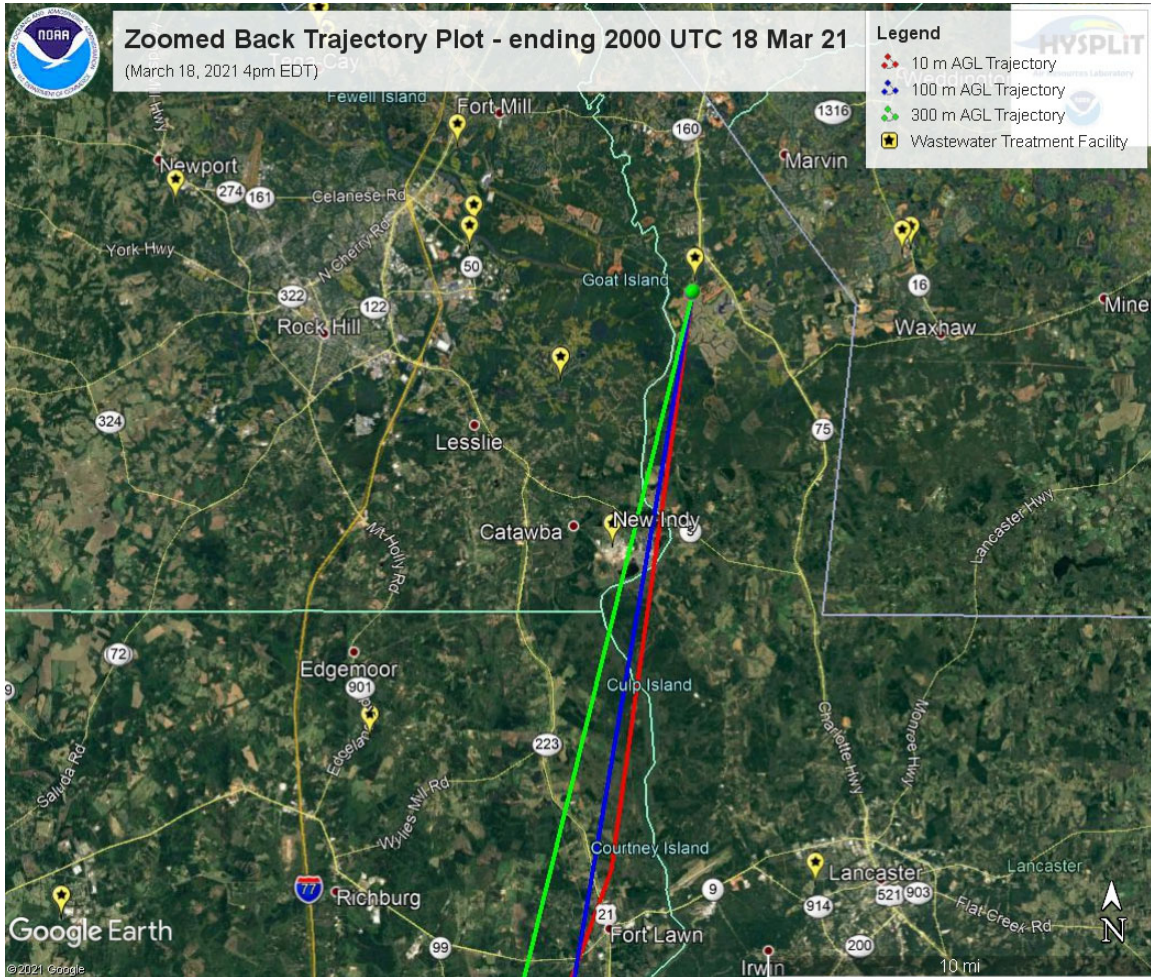
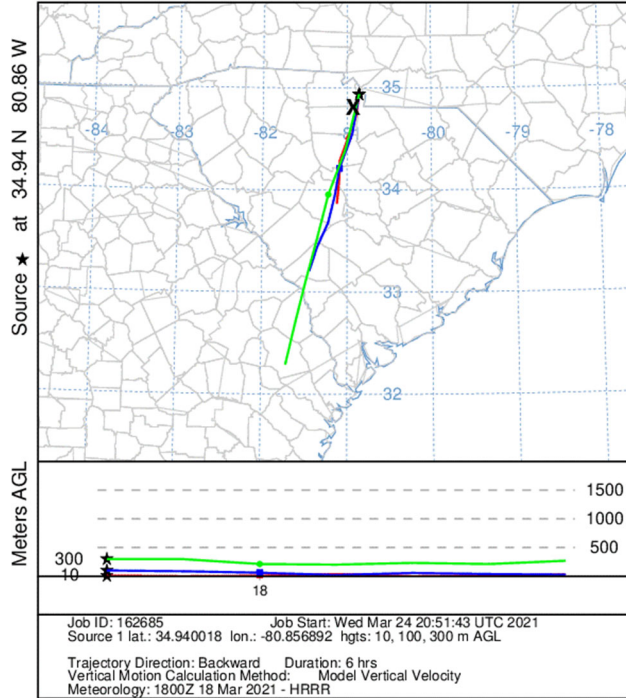
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 HRRR Meteorological Data





# Back Trajectory Episode #19

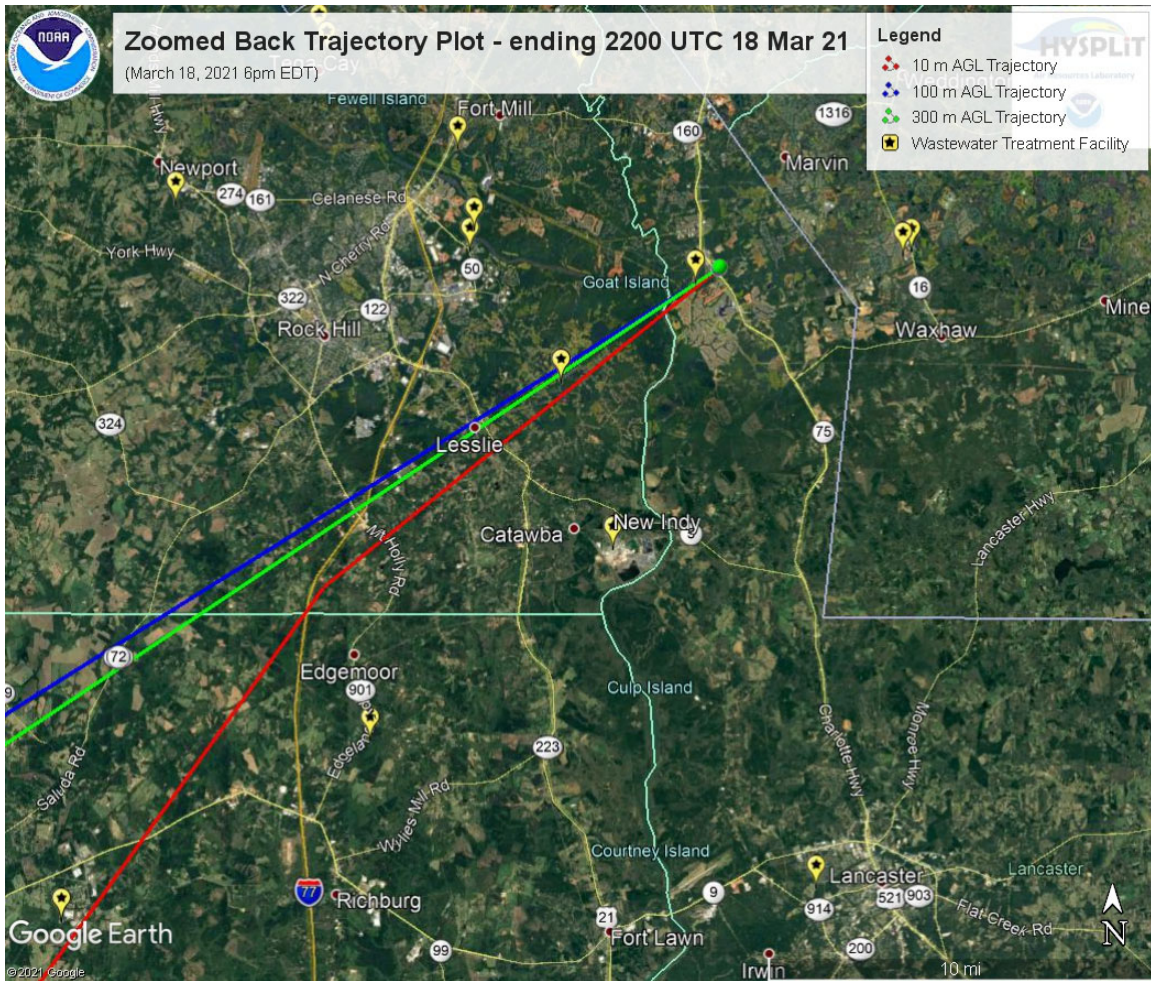
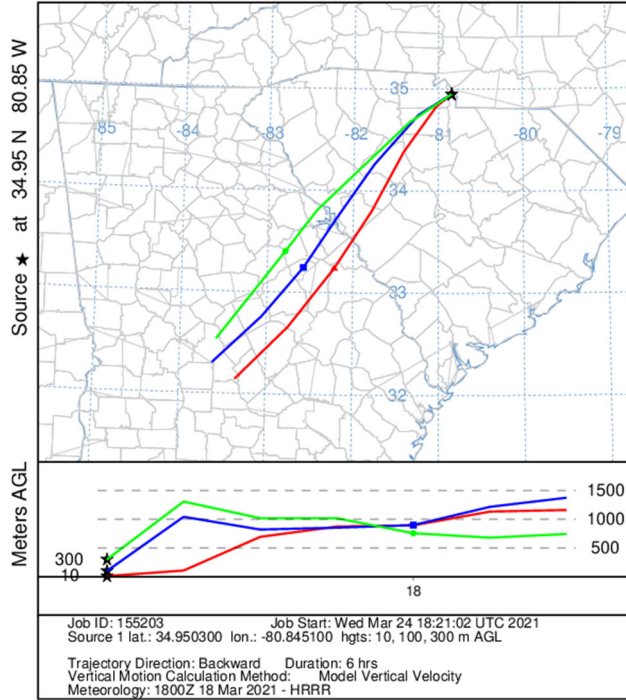
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 Backward trajectories ending at 2000 UTC 18 Mar 21  
 HRRR Meteorological Data





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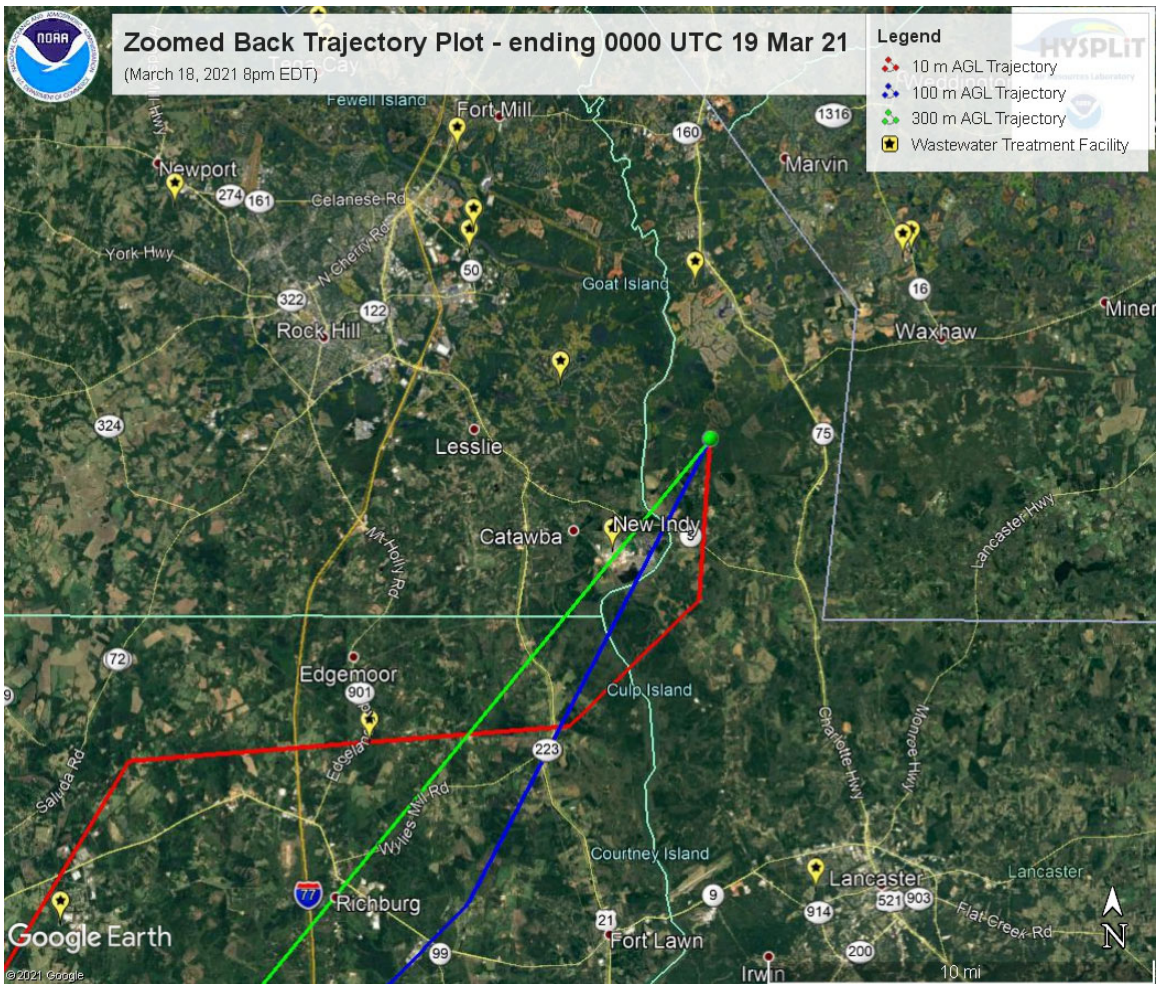
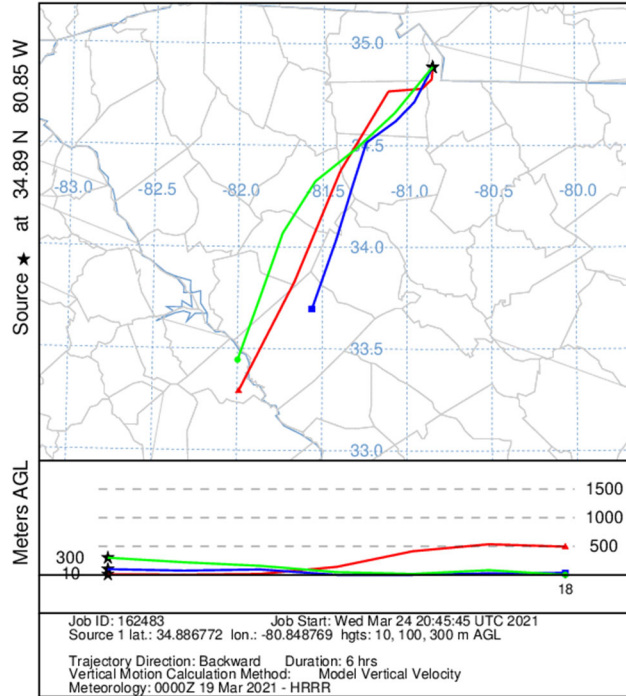
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 Backward trajectories ending at 2200 UTC 18 Mar 21  
 HRRR Meteorological Data





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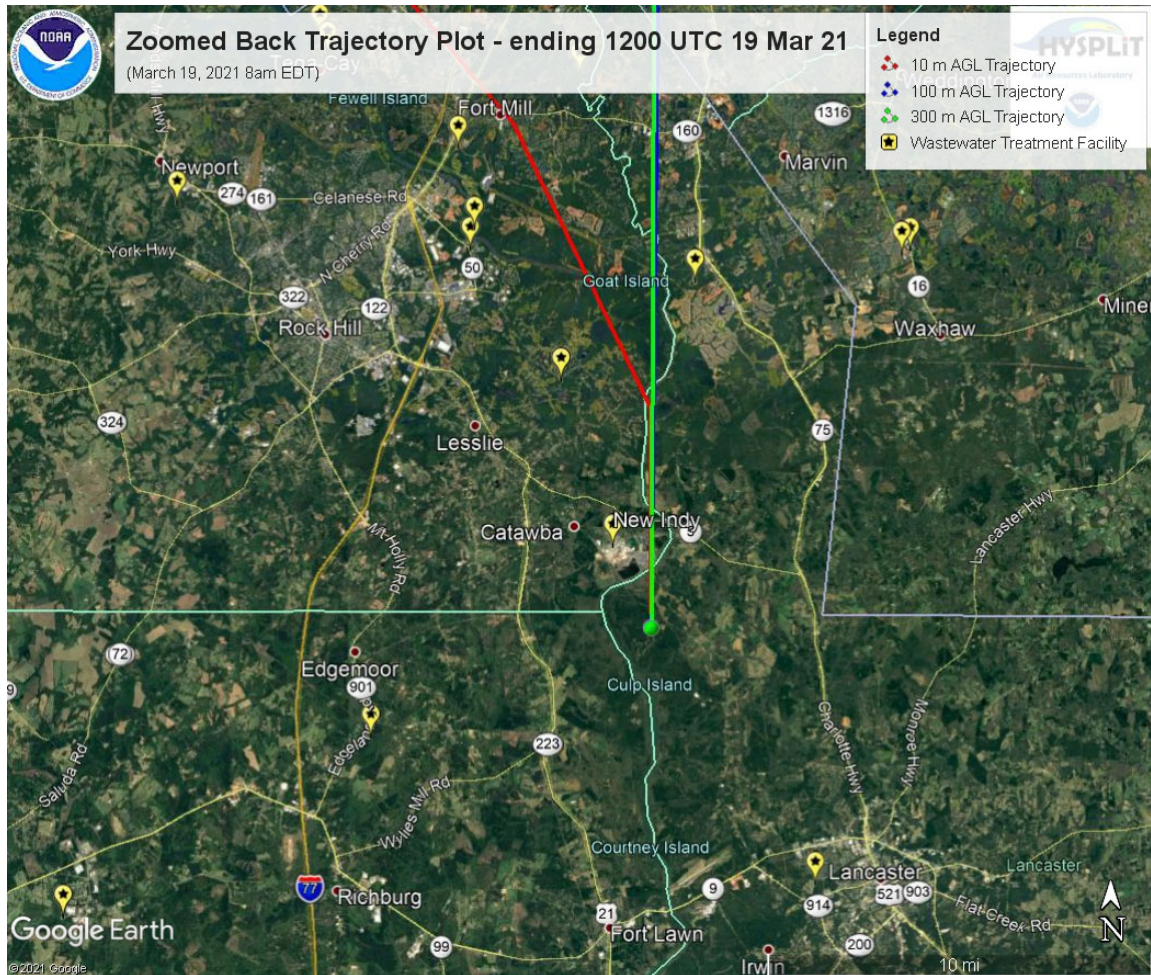
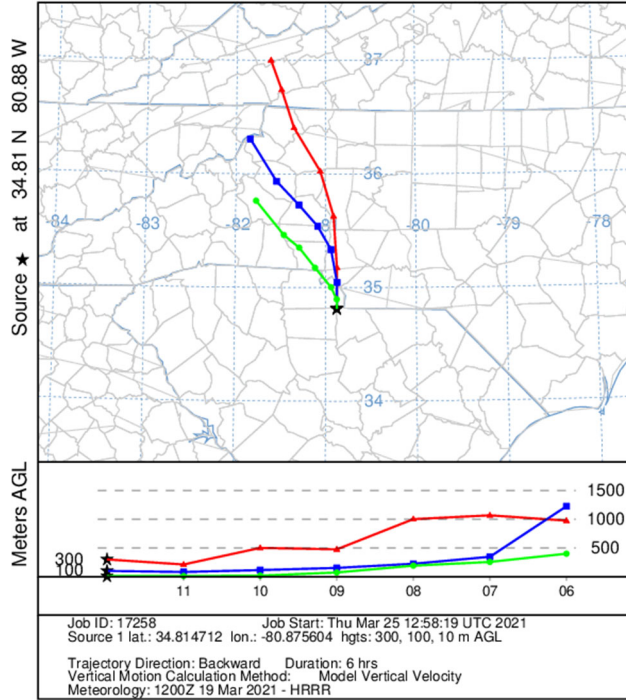
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 19 Mar 21  
 HRRR Meteorological Data





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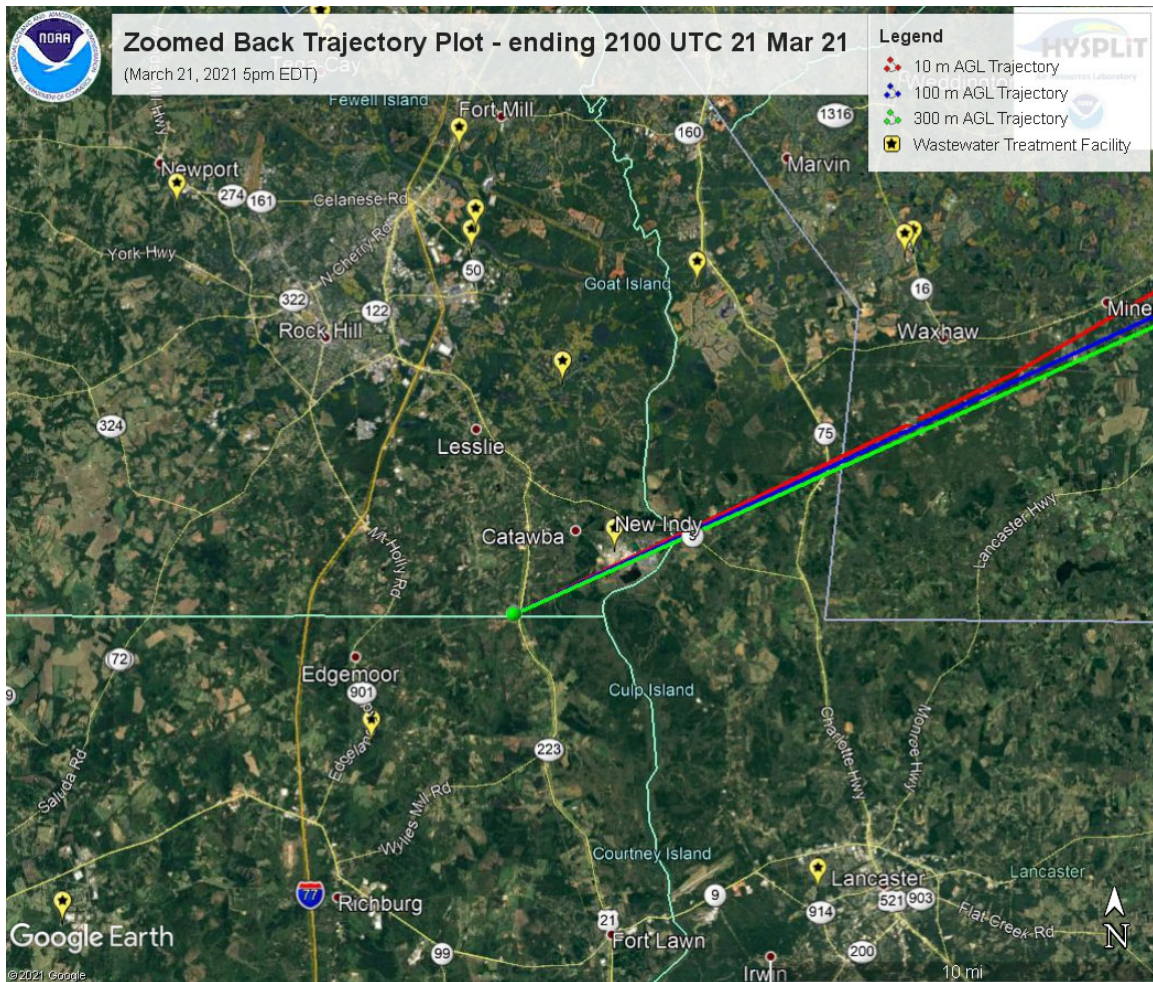
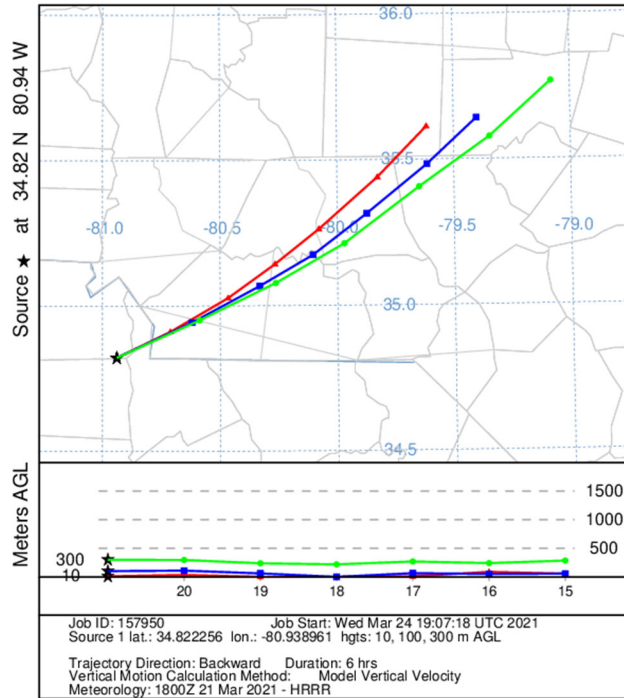
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 Backward trajectories ending at 1200 UTC 19 Mar 21  
 HRRR Meteorological Data





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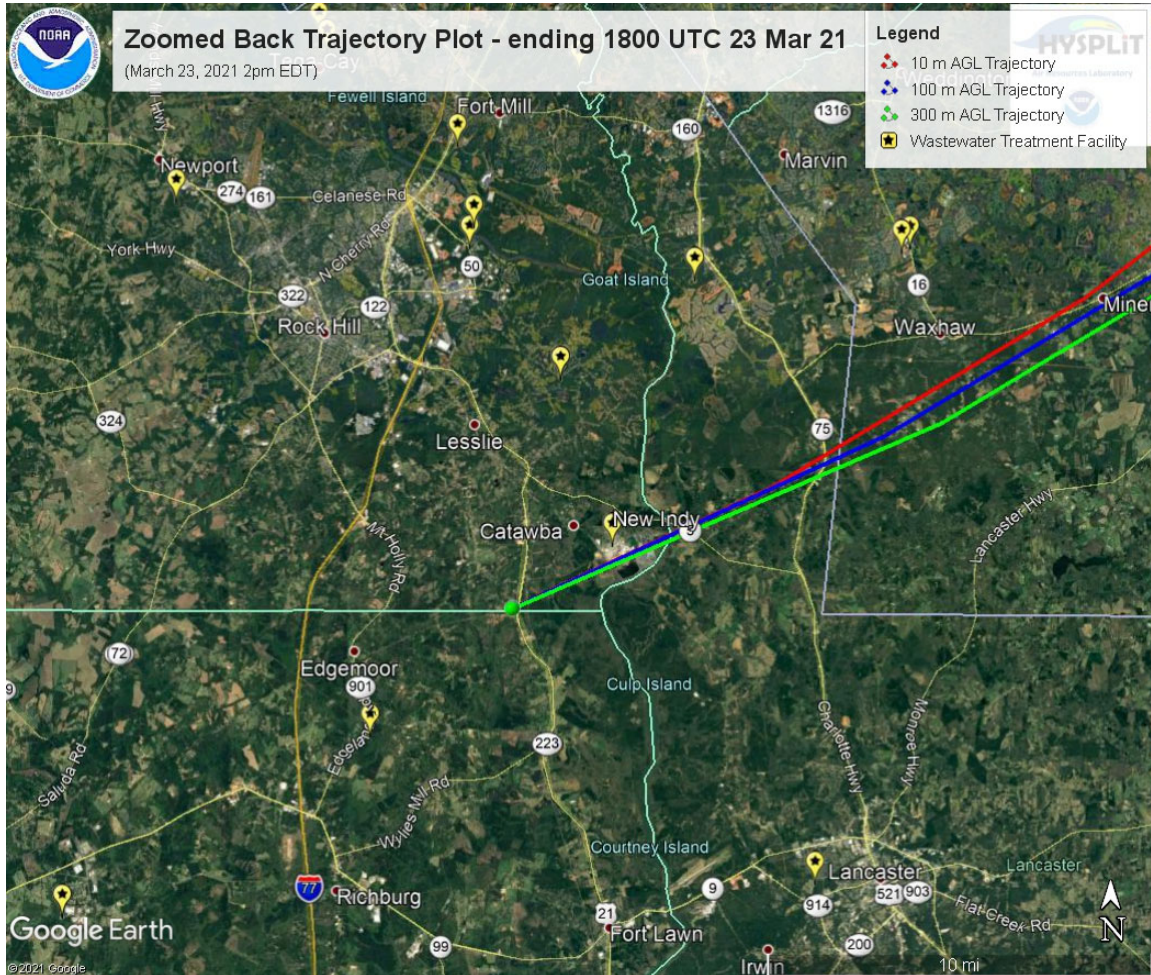
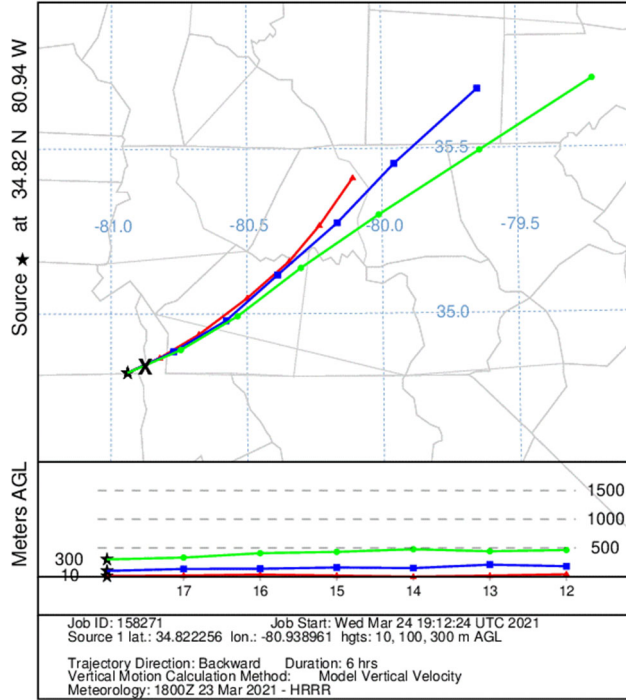
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 Backward trajectories ending at 2100 UTC 21 Mar 21  
 HRRR Meteorological Data





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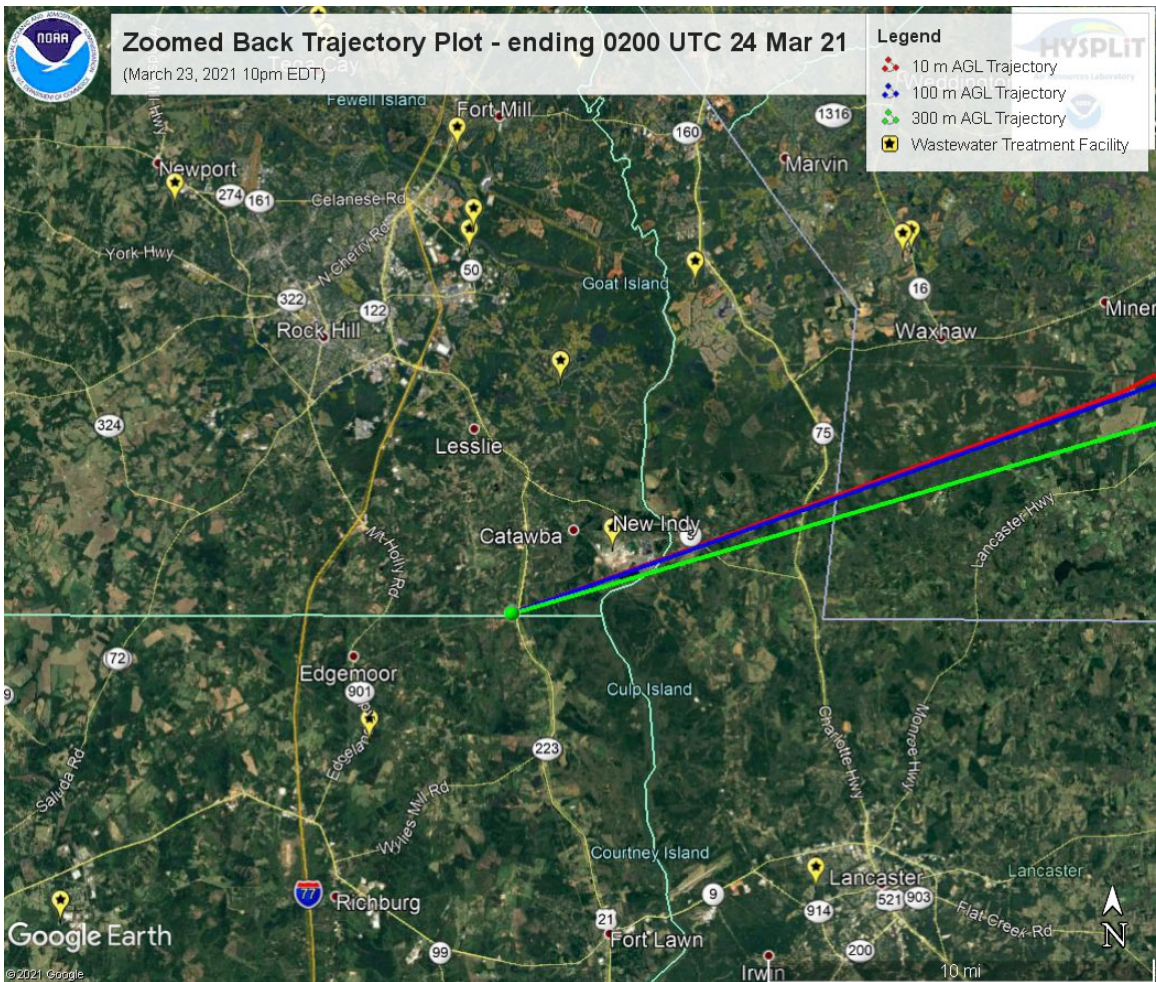
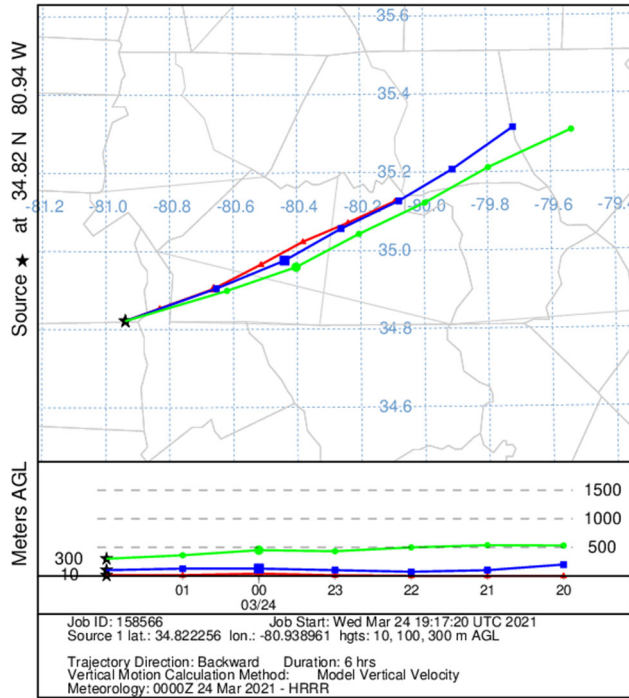
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 Backward trajectories ending at 1800 UTC 23 Mar 21  
 HRRR Meteorological Data





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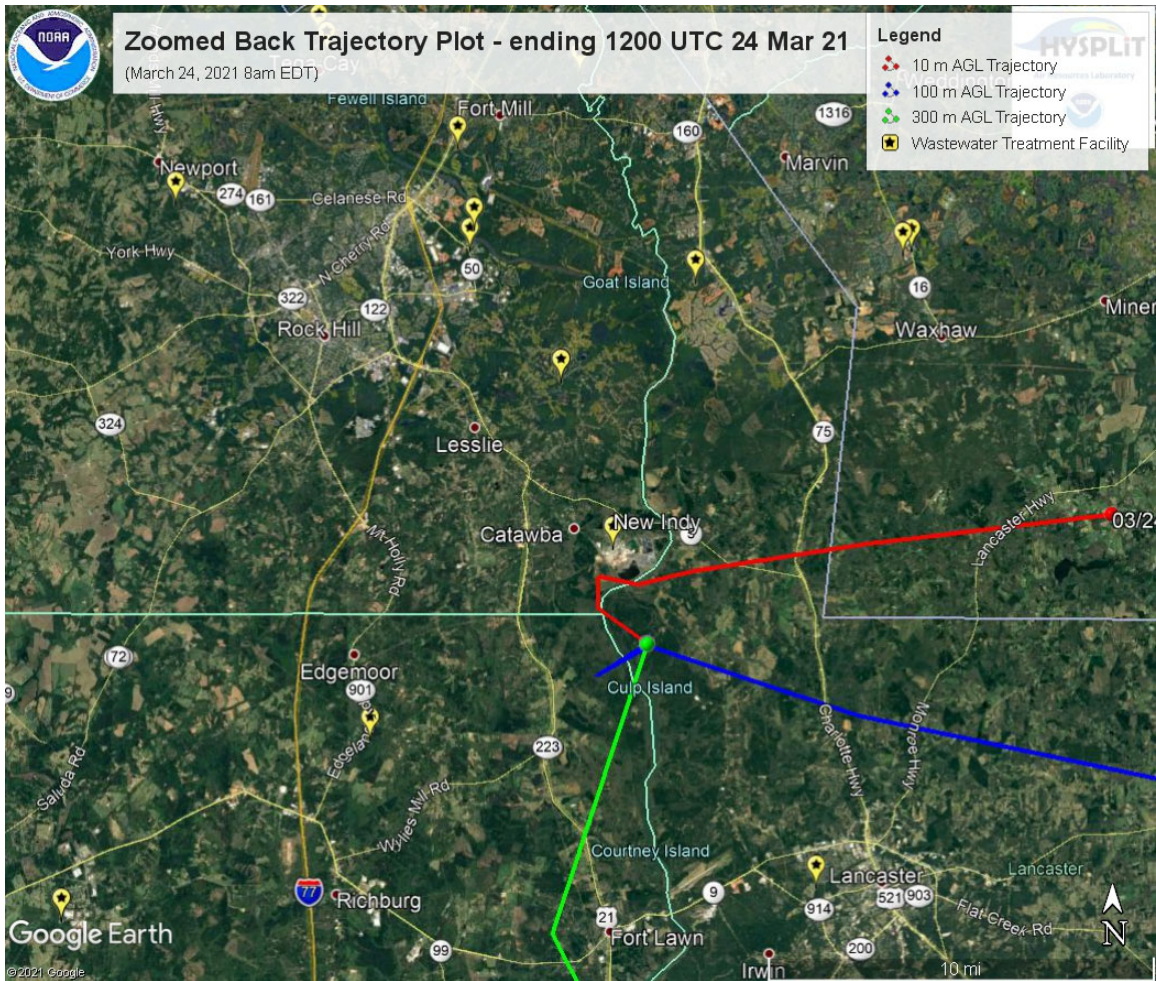
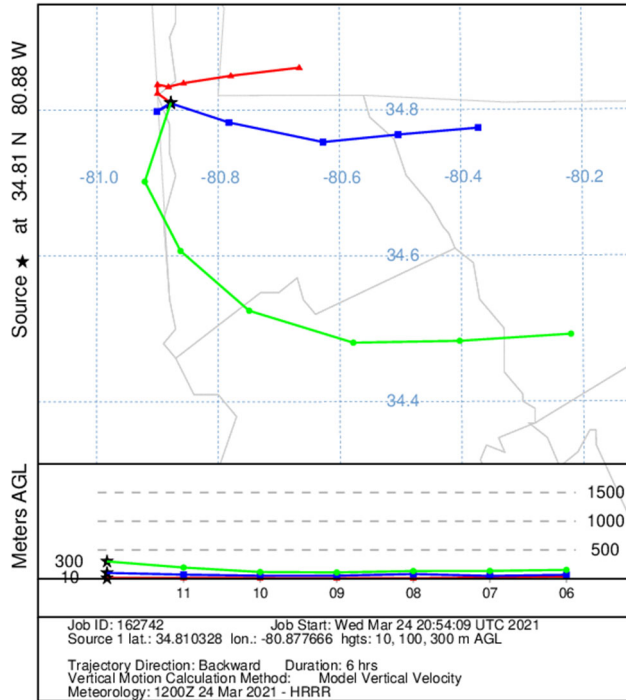
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0200 UTC 24 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #26

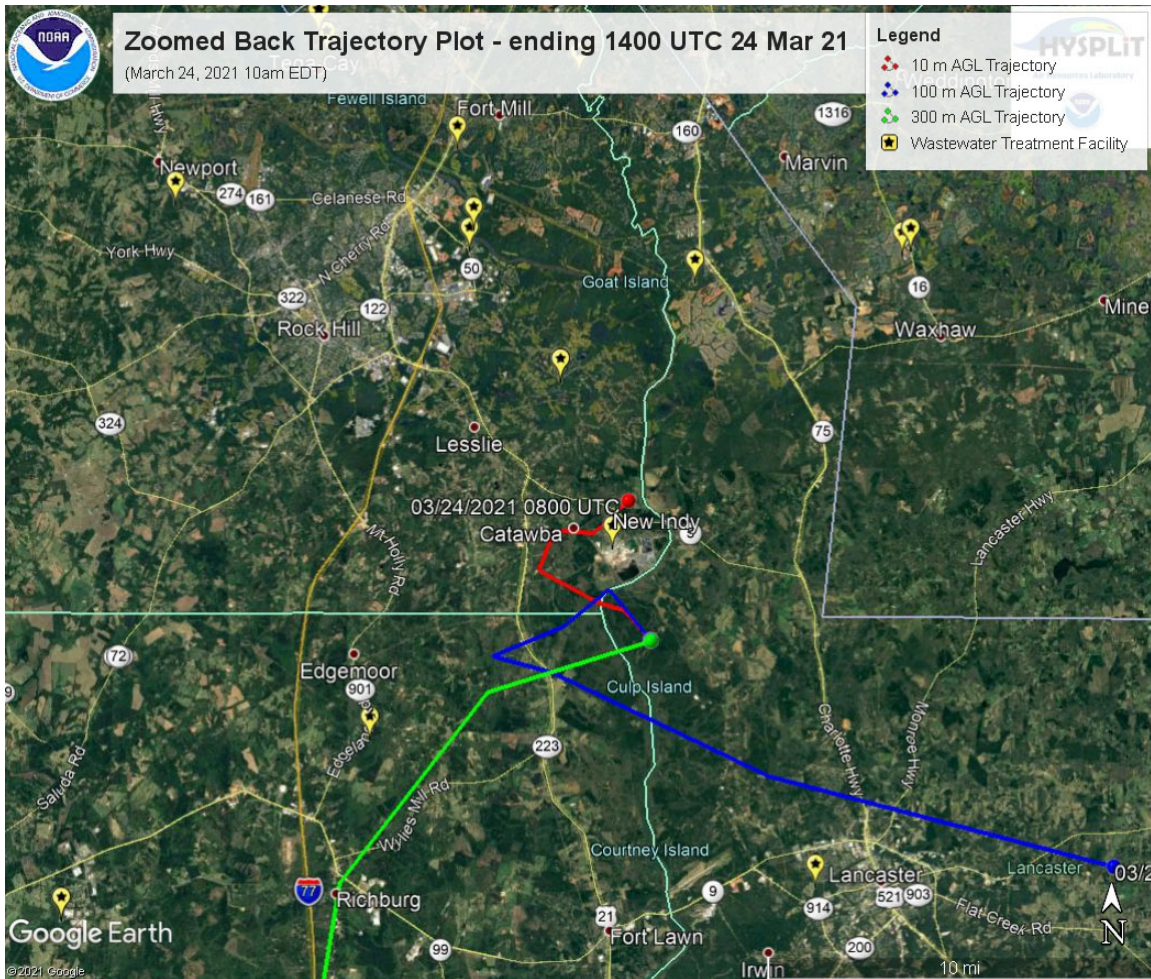
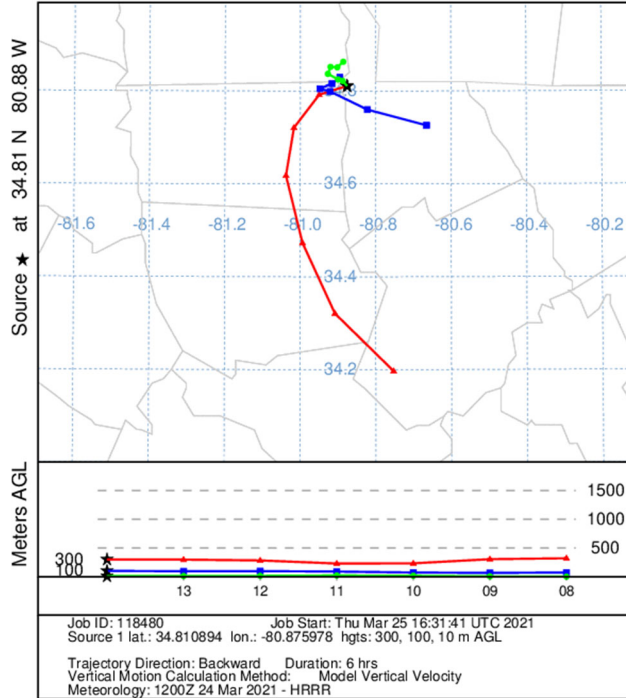
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 24 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #27

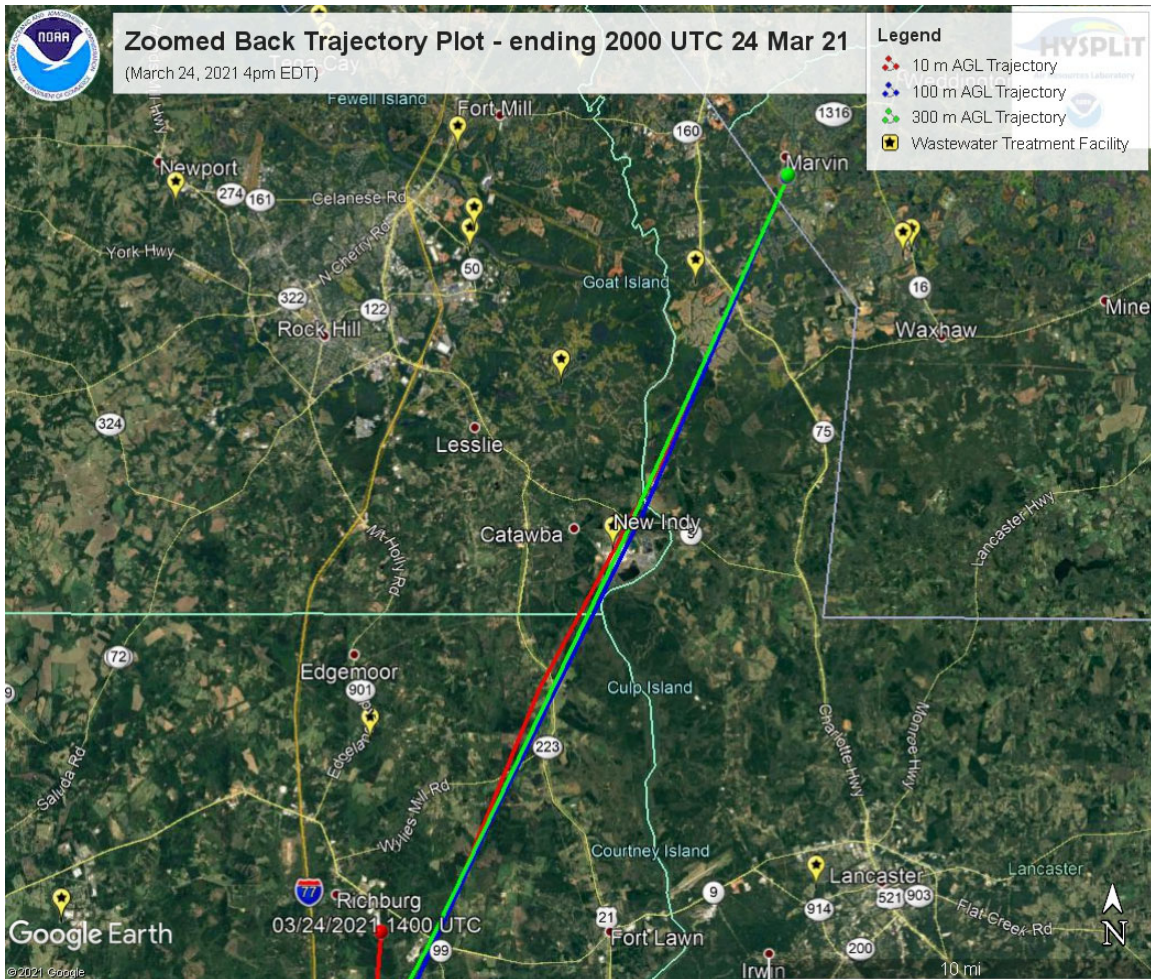
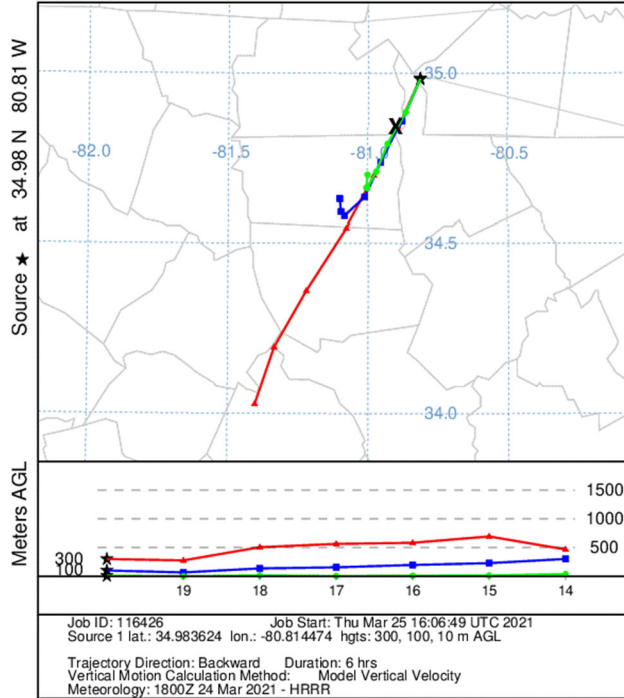
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1400 UTC 24 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #28

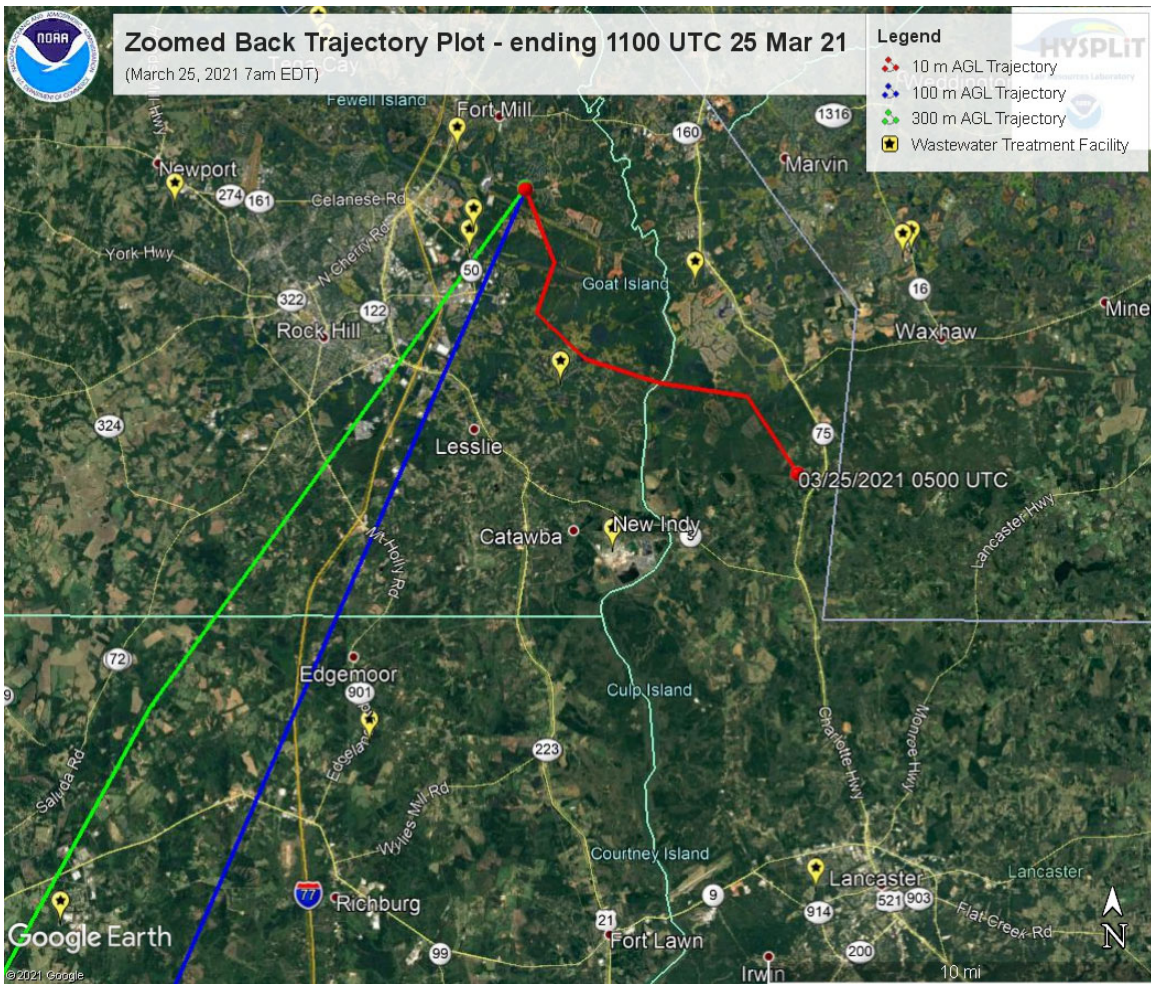
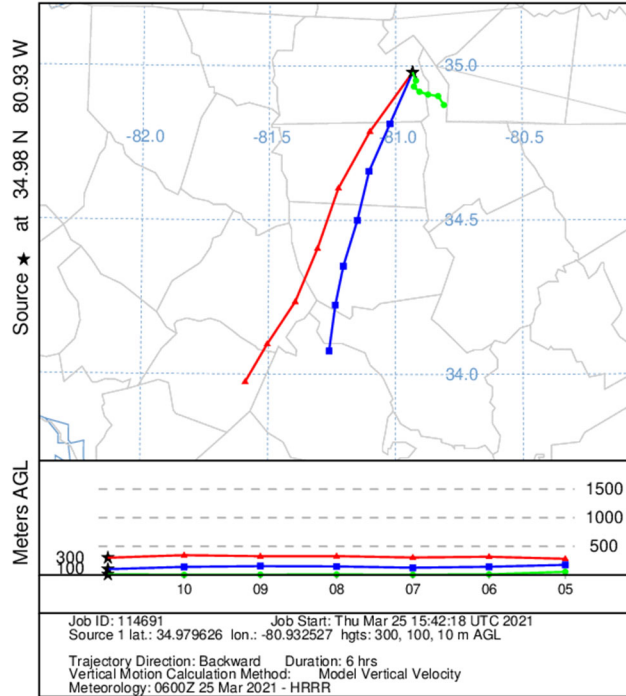
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2000 UTC 24 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #29

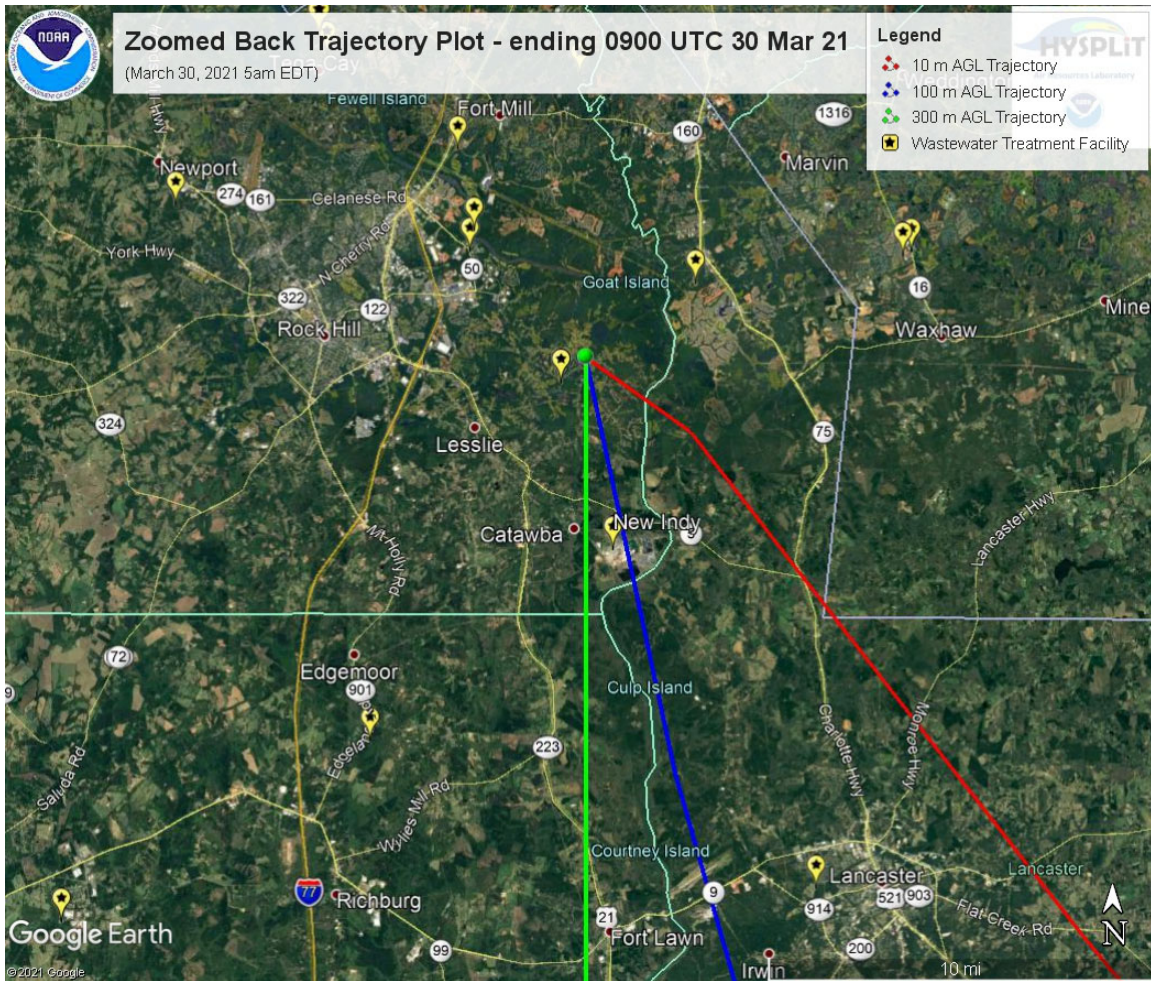
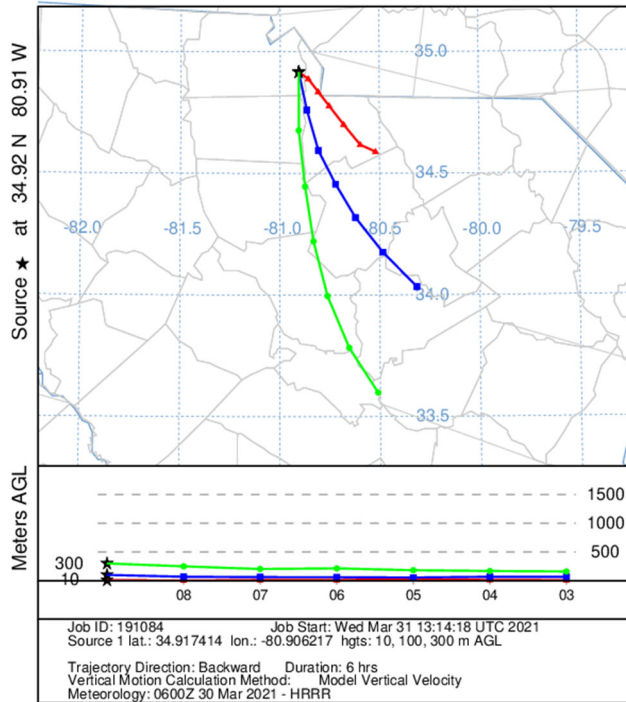
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1100 UTC 25 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #30

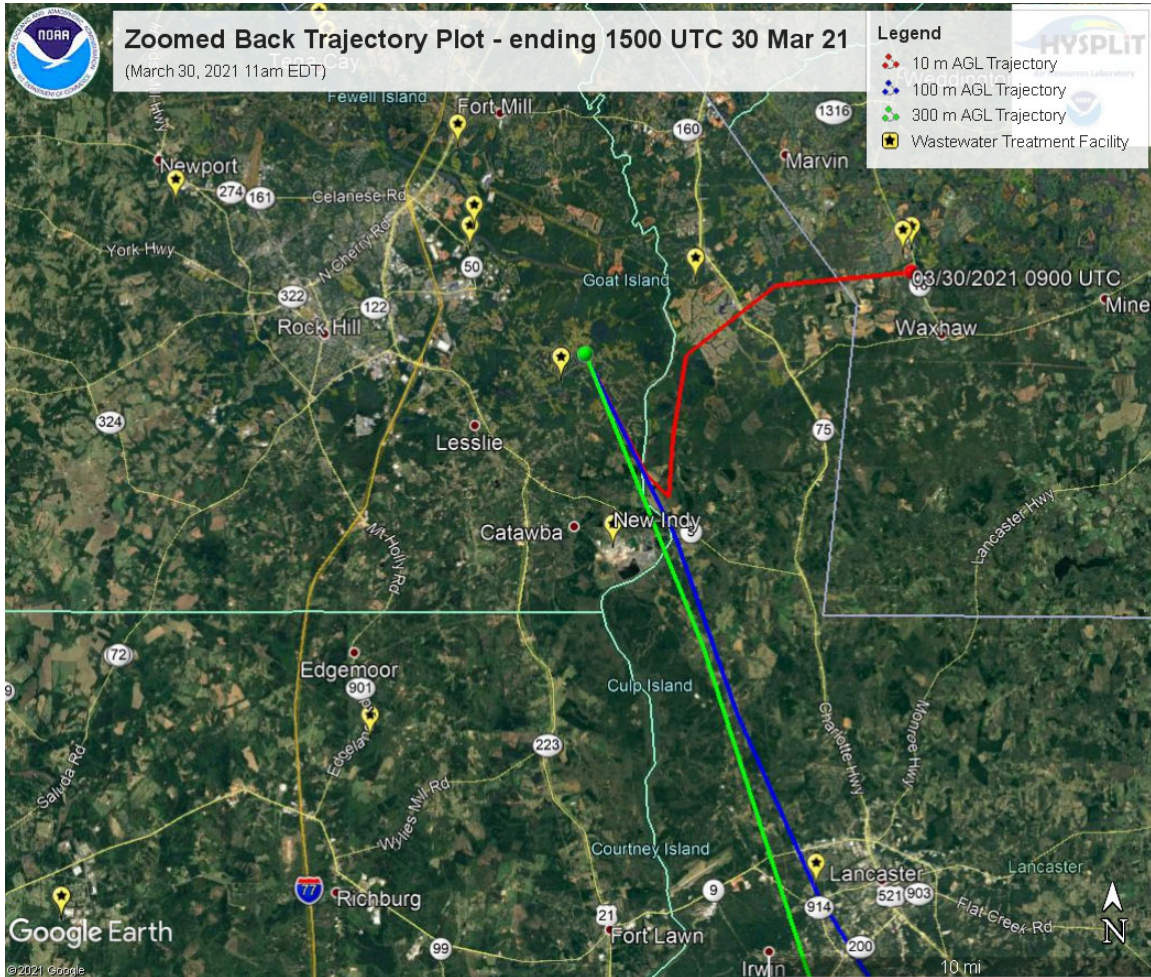
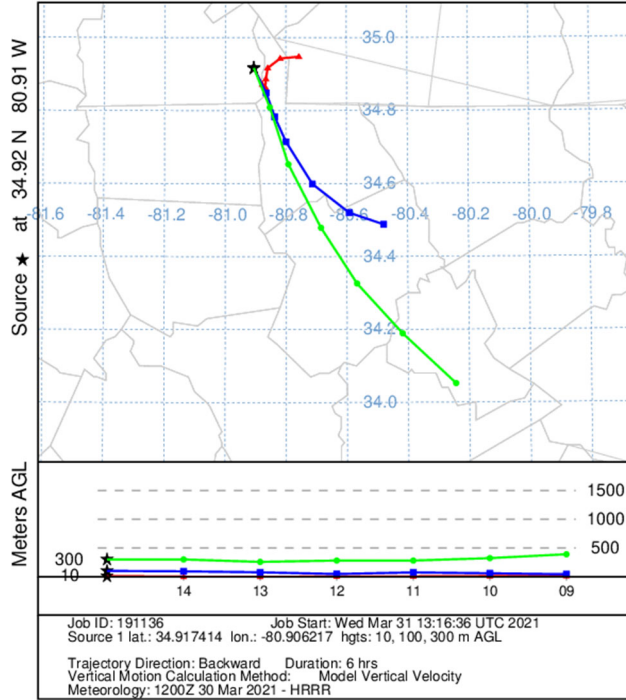
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0900 UTC 30 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #31

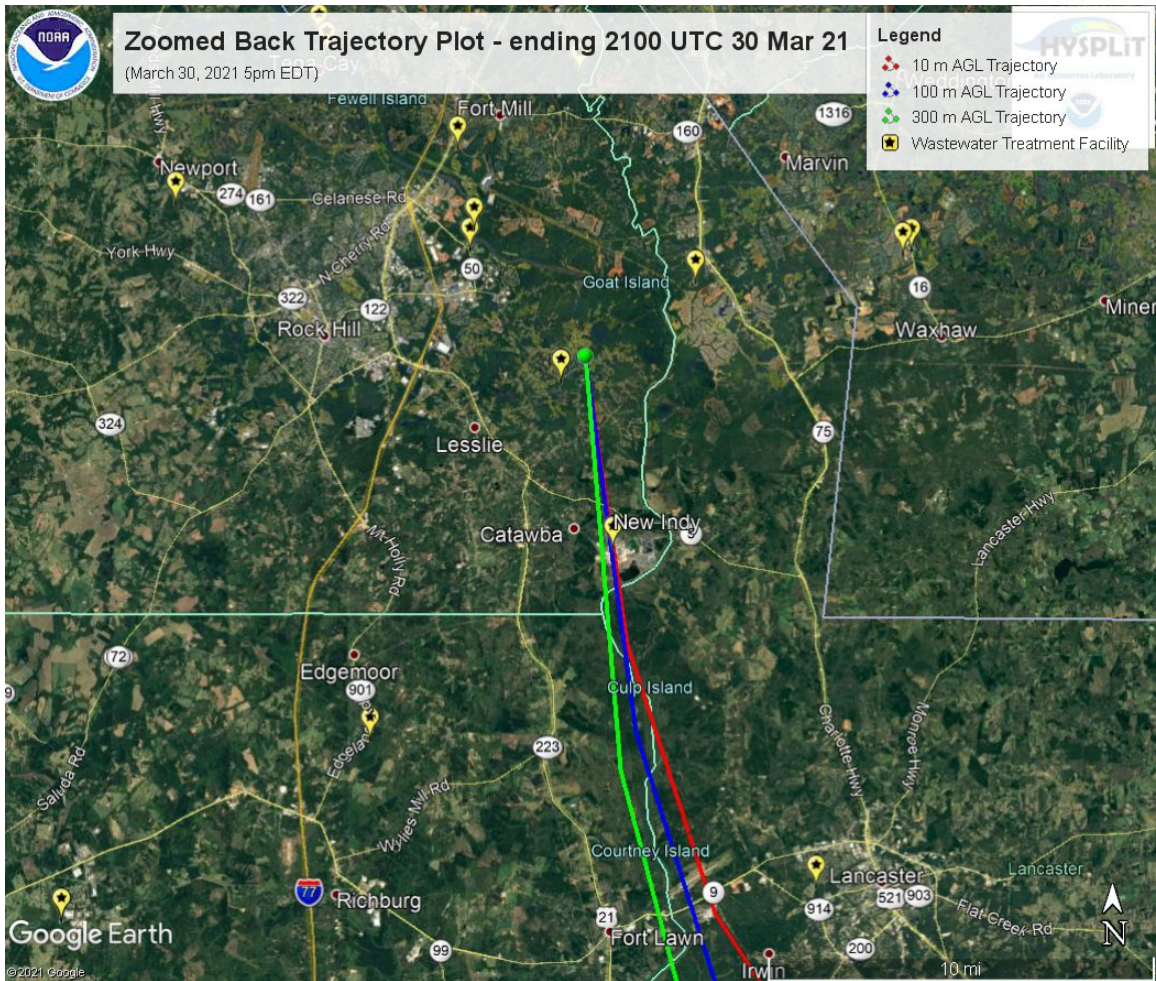
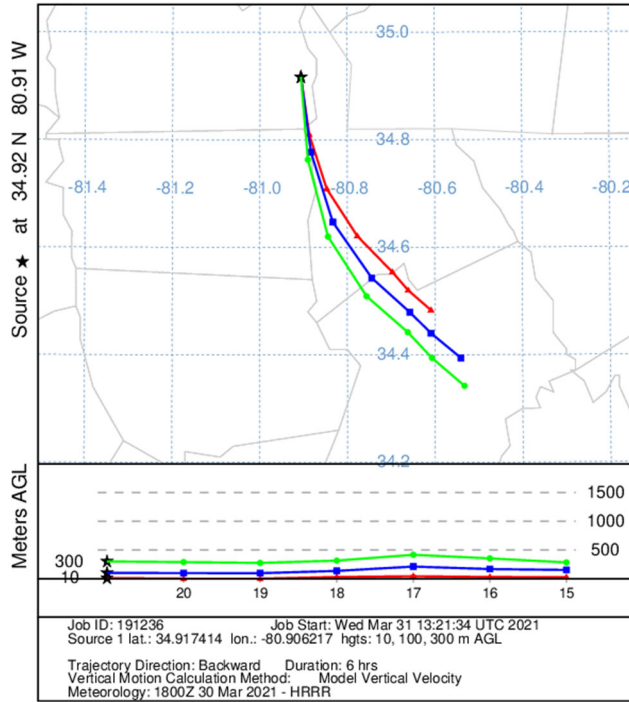
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1500 UTC 30 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #32

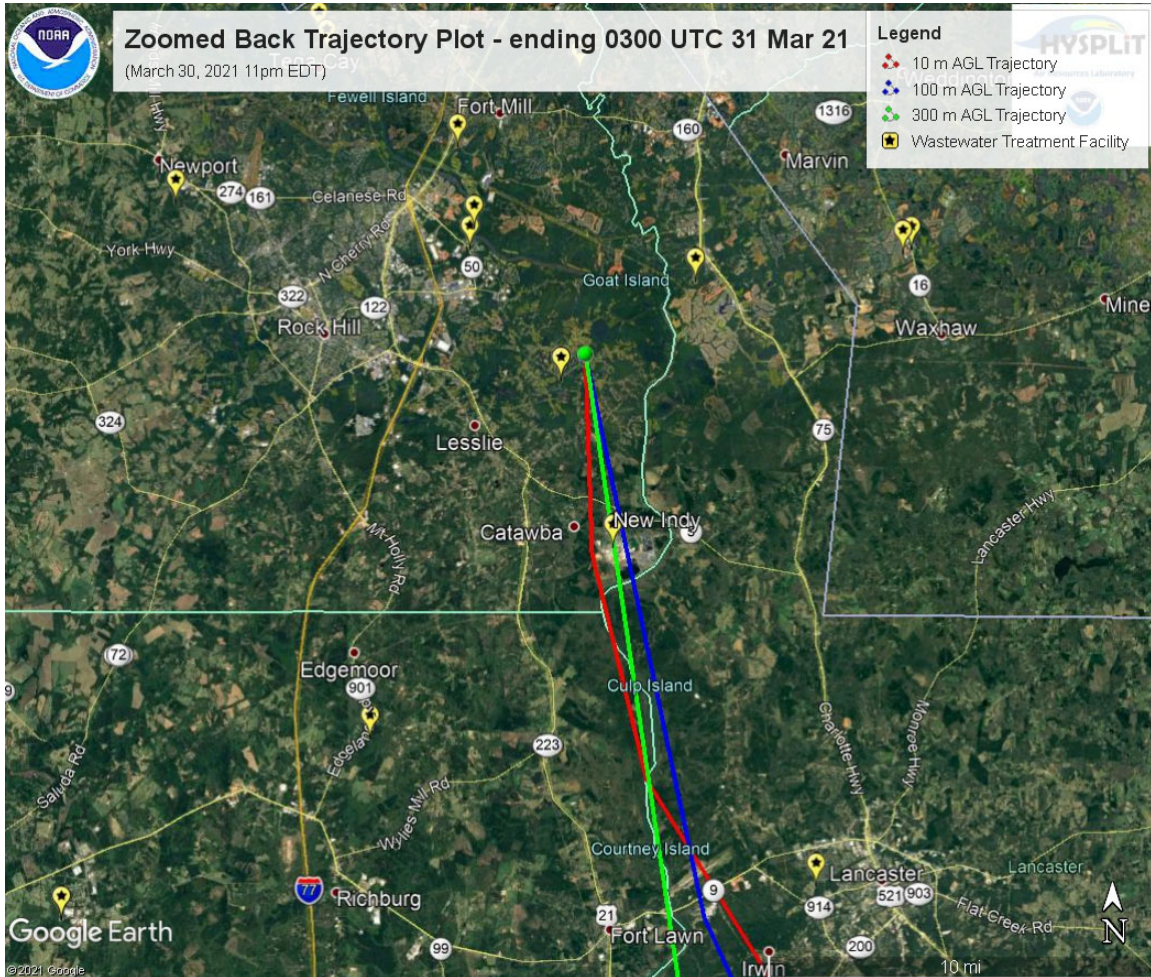
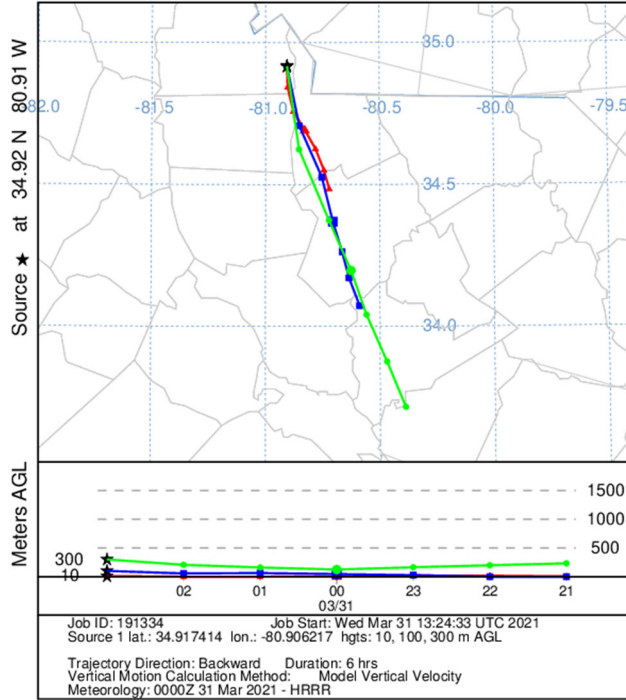
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2100 UTC 30 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #33

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0300 UTC 31 Mar 21  
 HRRR Meteorological Data





# Back Trajectory Episode #34

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0900 UTC 31 Mar 21  
 HRRR Meteorological Data

