

# Mississippi Department of Environmental Quality

## **MS AERMOD Ready Met Files 5-Year Data Set 2020-2024**

### **Support Documentation**



# MS AERMOD Ready Met Files

## Supporting Documentation:

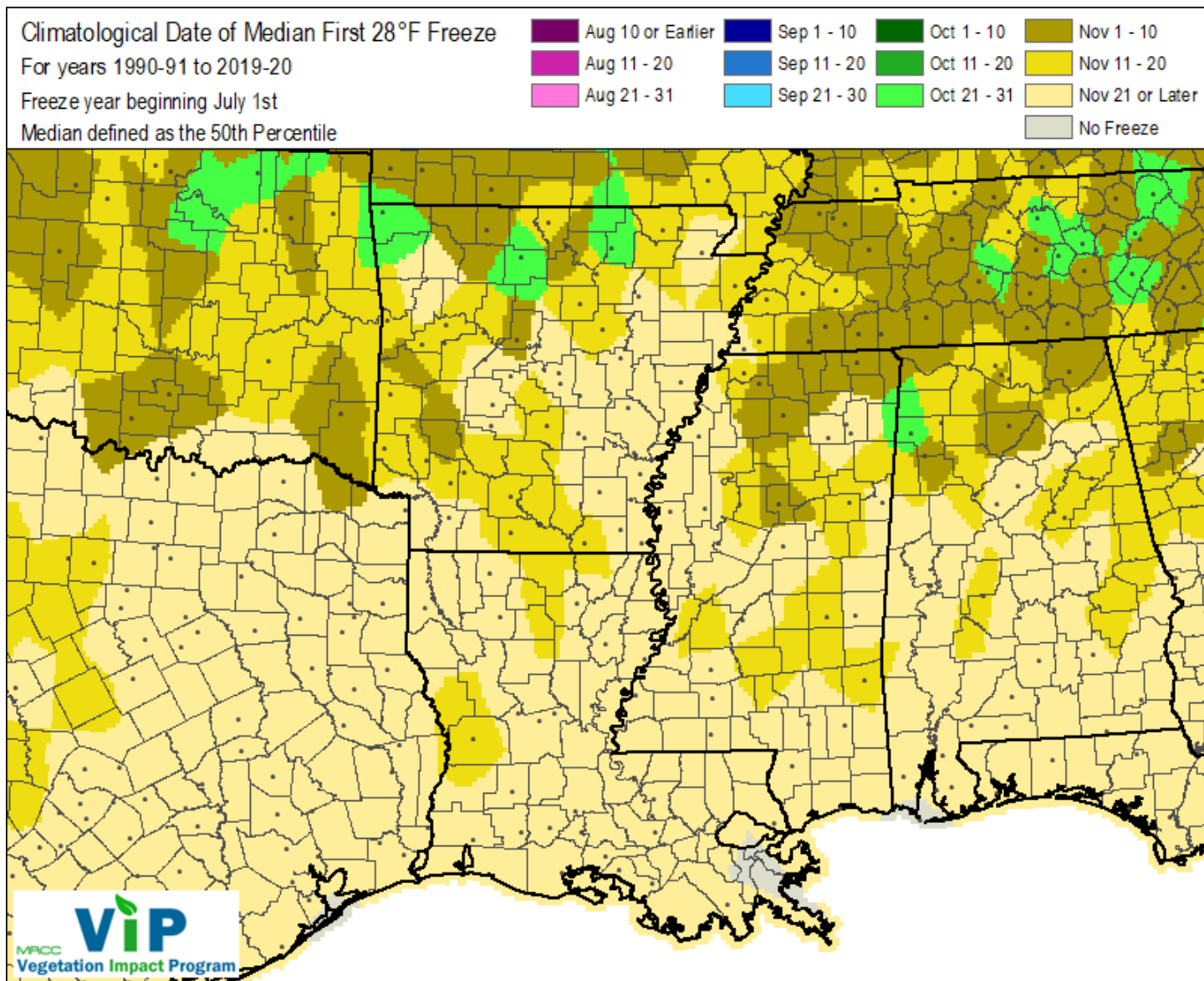
The Mississippi Department of Environmental Quality (MDEQ) has posted preprocessed meteorological files for use with the US EPA regulatory model AERMOD on the MDEQ website. The posting of these files in no way dictates their use nor supplants the use of professional judgment in determining whether the files are appropriate for any particular application. This report documents the development of the preprocessed files.

Integrated surface data were obtained from NCDC in DS3505 format ([ISH Data](#)). Radiosonde observations were obtained from the NOAA/Integrated Global Radiosonde Archive Database (<https://www.ncei.noaa.gov/data/igra/access/data-por/>). When available, one and five-minute ASOS wind data were included in the processing of the met data using AERMINUTE – Version 15272. One and five-minute data was obtained through the National Climatic Data Center (NCDC) ([One Minute Data](#) & [Five Minute Data](#)).

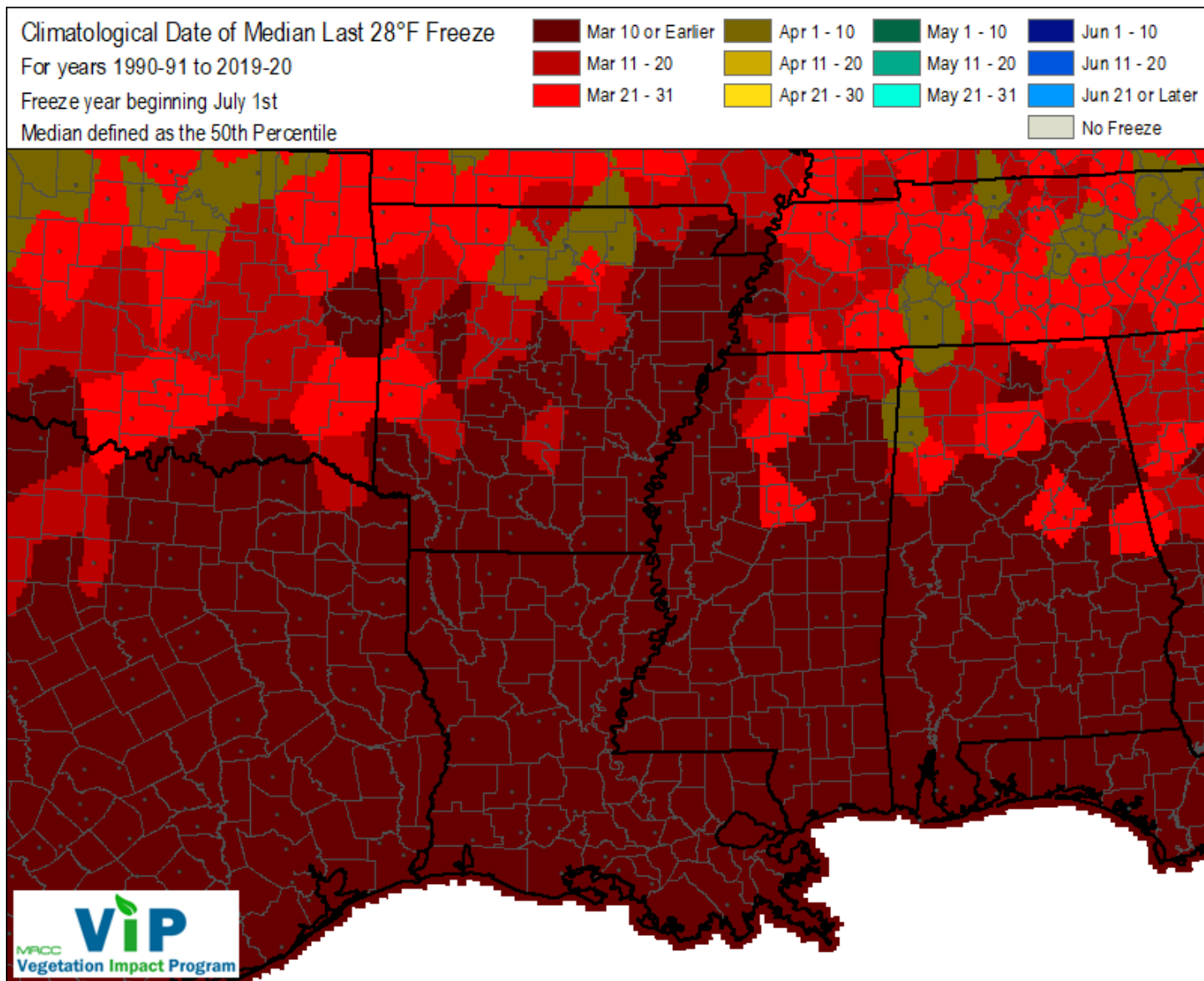
When applying the AERMET meteorological processor to prepare the meteorological data for the AERMOD model, the user must determine appropriate values for three surface characteristics: surface roughness length {zo}, albedo {r}, and Bowen ratio {Bo}. AERSURFACE (v24142), a tool that processes land cover data to determine these surface characteristics for use in AERMET, was used in the processing of the posted met files.

### Aersurface Monthly Seasonal Designations

Winter with continuous snow on the ground does not occur in Mississippi; therefore, this seasonal designation was not used in the AERSURFACE input files. The AERMET user's guide defines spring as the 1-2 months after the last killing frost. Freeze/Frost occurrence data was used to determine the beginning of spring, using the 50 percent probability date for 28° F. Likewise, the fall 50 percent probability date for 28° F was used to determine the late autumn after frost and harvest seasonal designation. These dates were determined from Frost/Freeze Data 1991-2019-20 (CLIM20-01: [Freeze/Frost Occurrence Data](#)), NCDC and indicate the date on which there is a 50% probability that a freeze date may be later in the spring or earlier in the fall. Dates for the stations within a climate division were averaged.



[Frost/Freeze Guidance](#)



[Frost/Freeze Guidance](#)



Months that fall between the fall and spring dates (rounded to beginning or end of month, whichever was closer) were considered to be, “Winter with no snow/WINTERNS.”

Midsummer with lush vegetation was assumed to be months with a monthly normal temperature above 70° F. Monthly normal temperatures were taken from “[Climatography of the US No. 85, Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days 1981-2010](#)”.

Spring months were considered those between the determined Late Autumn months and the midsummer months. Autumn months were considered those between the determined midsummer months and the late autumn months. Seasonal designations used are listed in Table 2.

### **Surface Moisture**

Surface Moisture was determined using divisional precipitation ranks on the NOAA website at ([Divisional Precipitation Ranks](#)). In order to place each month and season into historical context, NCEI assigns ranks for each geographic area (division, state, region, etc.) based on how the temperature or precipitation value compares with other values throughout the entire record when sorted from lowest to highest value. The "Below Normal", "Near Normal", and "Above Normal" shadings on the color maps represent the bottom, middle, and upper tercile (or three equal portions) of the distribution, respectively. The lowest and uppermost decile (or 10%) of the distribution are marked as "Much Below Normal" and "Much Above Normal", respectively. Surface moisture was determined to be dry for ranks of “Below Normal”, average for ranks of “Near Normal” and wet for ranks “Above Normal.” Table 2 and Table 3 summarize the surface moisture designations for the years 2020 through 2024.

The Memphis, Mobile and Tallulah/Vicksburg stations are not located within Mississippi. The surface moisture for these stations was taken as that in the adjacent climate division in Mississippi.

### **AERSURFACE v24142 Inputs**

Locations of the monitoring stations included in the Aersurface files were checked by reviewing aerial photography in Google Earth and Bing Bird’s Eye View. No attempts were made to correct Aersurface runs for changes in land use after the 2021 determination.

In determining the correct runway headings, aeronautical information was used.

Runway 14/32		
Dimensions:	9002 x 150 feet / 2744 x 46 meters	
Surface:	Asphalt-Concrete / Grooved in Good Condition	
Weight Limits:	194/F/A/W/T, S-81, D-300, ST-555, DT-870	
	2S-175	
Edge Lighting:	High Intensity	
	Runway 14	Runway 32
Coordinates:	N30°24.90' / W89°4.94'	N30°23.85' / W89°3.73'
Elevation:	18.9	22.0
Traffic Pattern:	Left	Left
Runway Heading:	135° True	315° True
Markings:	Precision Instrument in good condition.	Precision Instrument in good condition.
Glide Slope Indicator:	P4R (3.00° Glide Path Angle)	P4L (3.00° Glide Path Angle)
RVR Equipment:	Touchdown	Touchdown
Approach Lights:	MALSR 1,400 Foot Medium-Intensity Approach Lighting System with runway alignment indicator lights.	MALSR 1,400 Foot Medium-Intensity Approach Lighting System with runway alignment indicator lights.
Obstacles:	50 ft Trees 1900 ft from runway, 300 ft right of center	70 ft Tower 2100 ft from runway

### Gulfport-Biloxi International Airport Aeronautical Information

The AERSURFACE inputs were selected to be consistent with the [“Users Guide for AERSURFACE Tool” \(EPA-454/B-20-008 February 2020\)](#). Various sectors Airport (AP) vs Nonairport (NONAP) were used for the determination of land cover/surface roughness and the surface parameters were selected as described above. The following is an example use case at the Gulfport airport. The standard AERSURFACE input file used also is defined below:



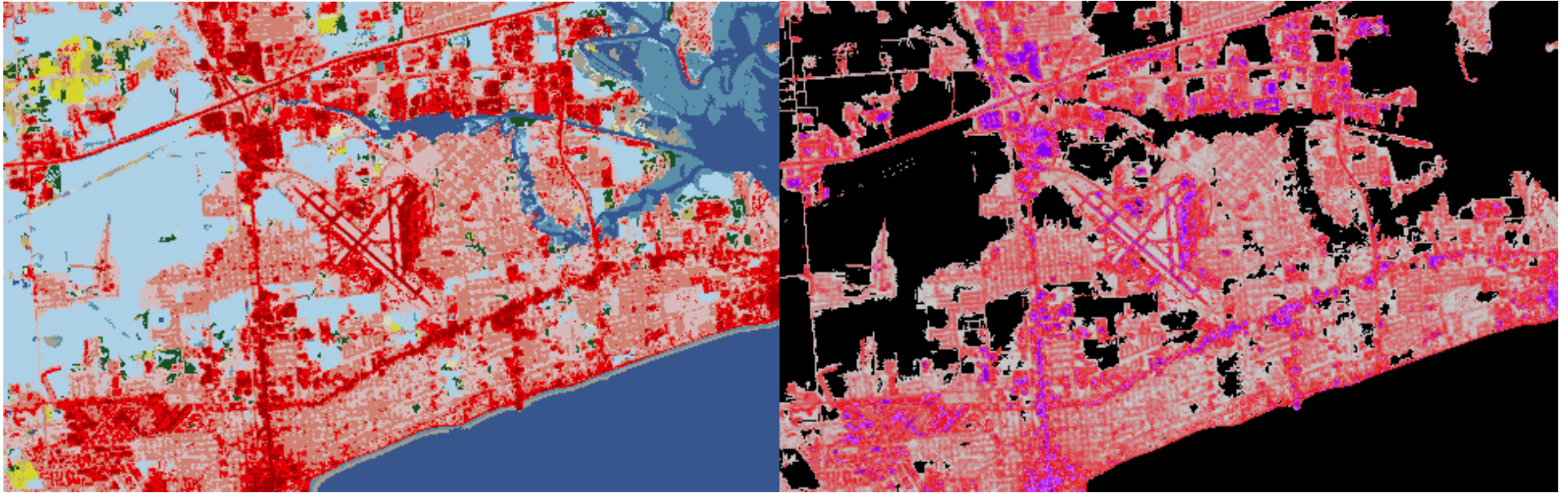
1KM radius.

Airport sector 315 degrees to 135 degrees.

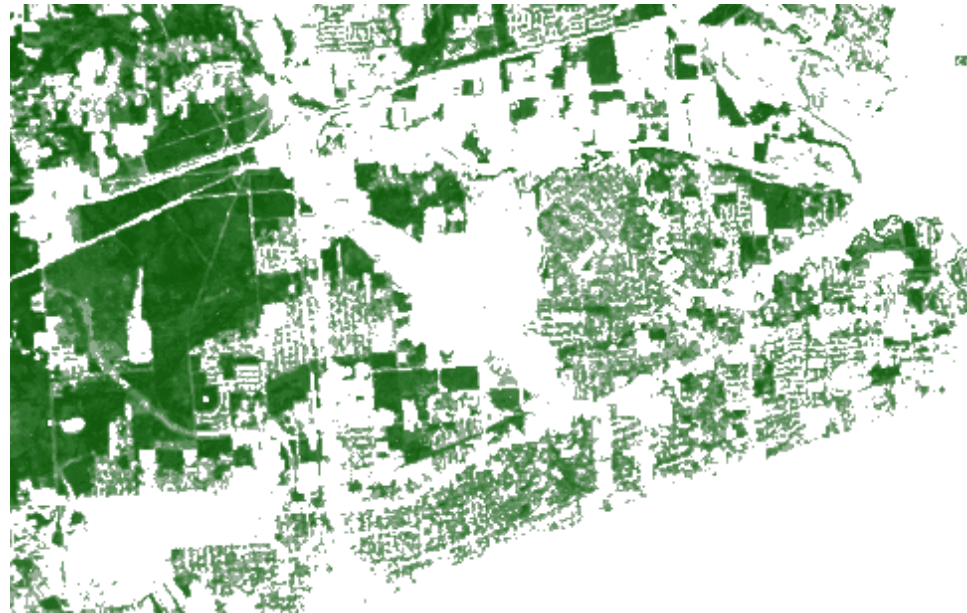
Non-Airport sector 180 degrees to 315 degrees.

Airport sector 135 degrees to 180 degrees. Total airport sector 315-180 degrees.





KGPT 2021 land cover, impervious, and  
2021 tree canopy data.



Each airport location included 2021 land cover, impervious, and 2021 tree canopy data obtained from the [Multi-Resolution Land Characteristics Consortium \(MRLC\)](#).

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\*\*Control File

CO STARTING

TITLEONE AERSURFACE Control File

TITLETWO GPT- Met Tower, 2016 NLCD

\*\* Using default options for OPTIONS keyword and parameters

OPTIONS PRIMARY ZORAD

DEBUGOPT GRID TIFF

CENTERLL 30.412000 -89.081000 NAD83

DATAFILE NLCD2016 "KGPT2019LC.tiff"

DATAFILE CNPY2016 "KGPT2016TC.tiff"

DATAFILE MPRV2016 "KGPT2019IMP.tiff"

\*\* Use default 1 km radius

ZORADIUS 1.0

CLIMATE AVERAGE NOSNOW NONARID

\*\* Get monthly values for two sectors

\*\* Vary AP/Non-AP sectors

FREQ\_SECT MONTHLY 2 VARYAP

\*\* index start end

SECTOR 1 315.00 180.00 AP

SECTOR 2 180.00 315.00 NONAP

\*\* Winter with no snow

SEASON WINTERNS 1

SEASON SPRING 2 3 4

SEASON SUMMER 5 6 7 8 9

SEASON AUTUMN 10 11 12

RUNORNOT RUN

CO FINISHED

OU STARTING

SFCCHAR "gpt\_2021\_lc\_can\_imp\_zorad\_sfc.txt"

NLCDGRID "gpt\_2021\_lc\_can\_imp\_zorad\_lc\_grid.txt"

CNPYGRID "gpt\_2021\_lc\_can\_imp\_zorad\_can\_grid.txt"

MPRVGRID "gpt\_20\_lc\_can\_imp\_zorad\_imp\_grid.txt"

OU FINISHED

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Aersurface ran with each of the surface moisture condition, Wet, Dry and Avg. The Aersurface output file for each year was merged from the three runs based on the surface moisture conditions listed in Table 3. The merged files were used in Stage 2 of AERMET.

Beginning with the draft version 19039\_DRFT and carried forward in version 20060, individual sectors can now be identified as either airport or non-airport sectors to more accurately represent the makeup of those sectors (e.g., a “Developed” category that is predominately made up of airport runways or paved lots vs buildings or structures). A sector can be identified as airport or non-airport independently of whether the meteorological tower is physically located at an airport and should be judged by the predominant land use within a kilometer radius of the meteorological tower, giving more weight to land use nearest the tower. Source: 2.3.2 Airports vs Non-Airport Locations - [“Users Guide for AERSURFACE Tool” \(EPA-454/B-20-008 February 2020\)](#)

### **AERMET 24142 Inputs**

Integrated surface data in DS3505 format was obtained from NCDC for each station. Upper air data was downloaded in IGRA format from the NOAA/IGRA Database. Observations obtained from Slidell, LA were used for the Mobile station and stations located in the Coastal Division. Observations obtained from Jackson, MS were used for all other divisions with the exception of Memphis where Little Rock, Arkansas (LZK) was used. Running individual surface files as downloaded from NCDC results in missing data for the last 6 hours of each year. To avoid this missing data in each year, the surface files were merged to include all of the years being evaluated. The upper air data was downloaded as one file encompassing the entire study period. Individual years were run from Jan 1<sup>st</sup> to Jan 1<sup>st</sup>; therefore, each output file contains one year plus the first day of the next year. These extra days can be removed from the files prior to running AERMOD or AERMOD can be set up to only read dates from the desired year.

When available, ASOS 1-minute and 5-minute data was incorporated using AERMINUTE version 15272. The threshold wind speed was set at 0.5 m/s in Stage 2 when ASOS 1-minute data was used. The SUBNWS parameter was also used with ASOS 1-minute data to replace wind data from the standard NWS format. The SUB\_CC and SUB\_TT parameters were indicated in the stage 2 input files. The AERMET user’s guide indicates that these are default parameters unless the application involves both NWS and ONSITE surface data. The data was processed with and without the ADJ\_U\* option in Stage 2.

Example input files for the Jackson, MS station are presented below:

## Stage 1

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### JOB

REPORT KJAN.RP1  
MESSAGES KJAN.MG1

### UPPERAIR

DATA "C:\Users\rcuevas\Documents\Modeling\MetData\AERMINUTE\KJAN\KJAN20-24UA.TXT" FSL  
EXTRACT KJAN.UAX  
AUDIT ALL  
MODIFY ALL  
QAOUT KJAN.UQA

XDATES 2020/01/01 TO 2025/01/01

\*\* Station: JACKSON, MS

LOCATION 3940 32.320N 90.070W 6

### SURFACE

\*\* Location of the Surface Data File

\*\* C:\Users\rcuevas\Documents\Modeling\MetData\AERMINUTE\KJAN\KJAN24.ish

DATA KJAN24.ish ISHD  
EXTRACT KJAN.SAX  
AUDIT ALL  
QAOUT KJAN.SQA

XDATES 2020/01/01 TO 2025/01/01

\*\* Station: Jackson-Medgar Wiley Evers International Airport

LOCATION 3940 32.317N 90.083W 6 91.00

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## Stage 2

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### JOB

REPORT KJAN.RP2  
MESSAGES KJAN.MG2

### UPPERAIR

QAOUT KJAN.UQA

### SURFACE

QAOUT KJAN.SQA

\*\* Location of the Hourly Wind Data File

\*\* C:\Users\rcuevas\Documents\Modeling\MetData\AERMINUTE\KJAN\AERMINUTE\_hour.dat

ASOS1MIN C:\Users\rcuevas\Documents\Modeling\MetData\AERMINUTE\KJAN\AERMINUTE\_hour.dat

### METPREP

MODEL AERMOD  
OUTPUT KJAN2022.sfc  
PROFILE KJAN2022.pfl  
XDATES 2022/01/01 TO 2023/01/01  
METHOD REFLEVEL SUBNWS  
METHOD WIND\_DIR RANDOM  
METHOD CCVR SUB\_CC  
METHOD TEMP SUB\_TT  
THRESH\_1MIN 0.50  
NWS\_HGT WIND 10.00

\*\* Primary Surface Characteristics

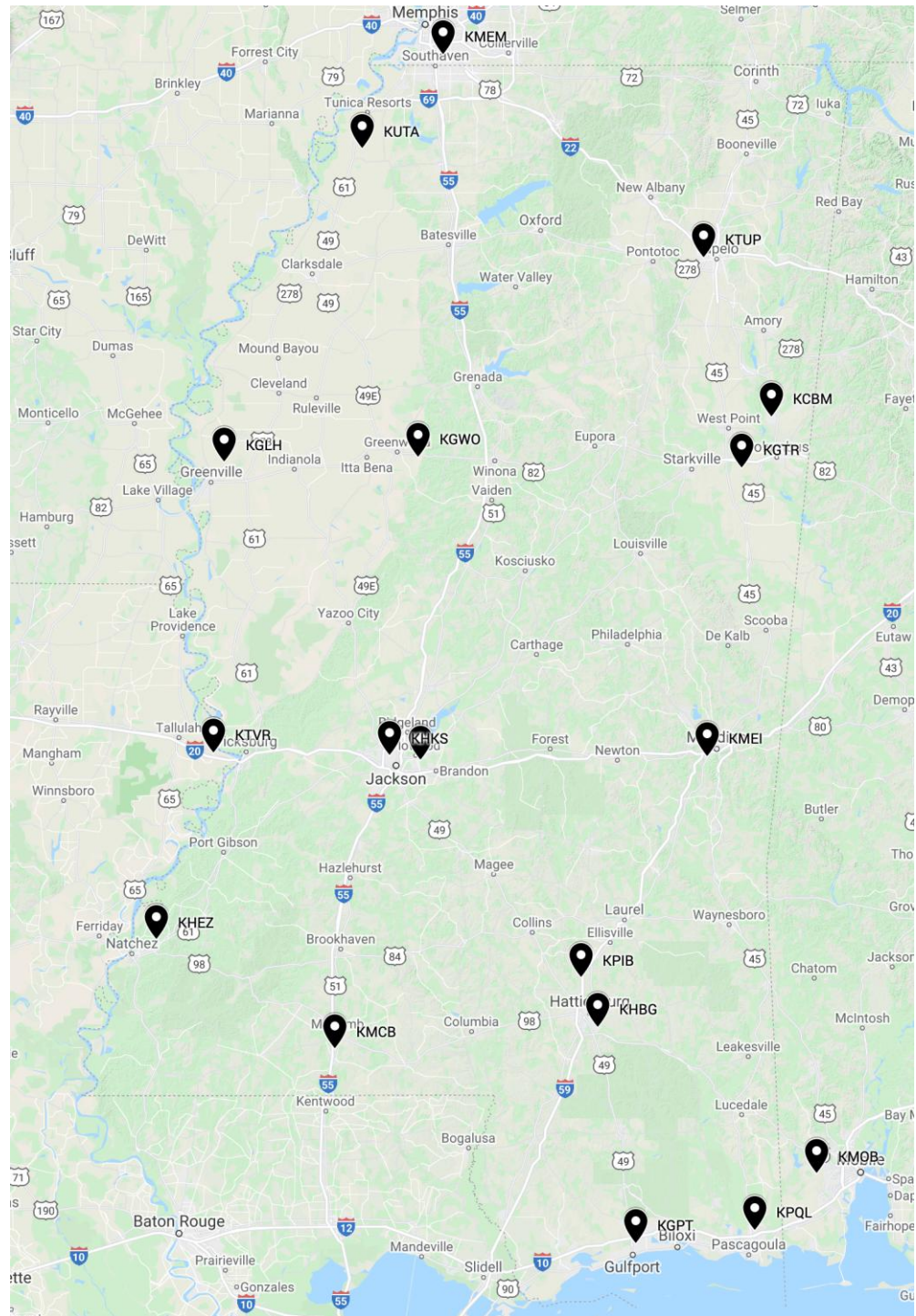
AERSURF jan\_2021\_lc\_can\_imp\_zorad\_sfc.txt

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Table 1 – Station List

City	Station Name	WBAN	INT CALL	Latitude	Longitude	Aerminute Available	Anemometer Height (m)
GREENVILLE	MID DELTA REGIONAL AIRPORT	13939	KGLH	33.477228	-90.984658	Yes	10
GREENWOOD	GREENWOOD-LEFLORE AIRPORT	13978	KGWO	33.496194	-90.089419	Yes	10
GULFPORT	GULFPORT-BILOXI INTERNATIONAL AIRPORT	93874	KGPT	30.412000	-89.081000	Yes	10
HATTIESBURG	BOBBY L CHAIN MUNICIPAL AIRPORT	13833	KHBG	31.269483	-89.256108	Yes	10
JACKSON	HAWKINS FIELD AIRPORT	13927	KHKS	32.337572	-90.221397	Yes	10
JACKSON	JACKSON INTERNATIONAL AIRPORT	3940	KJAN	32.319836	-90.077756	Yes	10
McCOMB	McCOMB/PIKE COUNTY/JOHN E LEWIS FIELD AIRPORT	93919	KMCB	31.182278	-90.472025	Yes	10
MERIDIAN	KEY FIELD AIRPORT	13865	KMEI	32.334861	-88.750728	Yes	10
PASCAGOULA	TRENT LOTT INTERNATIONAL AIRPORT	53858	KPQL	30.463058	-88.531556	Yes	7.92
TALLULAH/VICKSBURG	VICKSBURG/TALLULAH REGIONAL AIRPORT	3996	KTVR	32.348000	-91.030000	Yes	10
TUPELO	TUPELO REGIONAL AIRPORT	93862	KTUP	34.262131	-88.771161	Yes	10
COLUMBUS	GOLDEN TRIANGLE RGNL	53893	KGTR	33.456278	-88.592656	No	10
COLUMBUS	COLUMBUS AFB	13825	KCBM	33.652258	-88.457136	No	10
NATCHEZ	NATCHEZ/HARDY(AWOS)	3961	KHEZ	31.615919	-91.297267	No	10
HATTIESBURG	HATTIESBURG LAUREL	53808	KPIB	31.465756	-89.333464	No	10
METCALFE	TUNICA MUNI	23903	KUTA	34.676575	-90.343956	No	10
MEMPHIS	MEMPHIS INTL ARPT	13893	KMEM	35.036472	-89.971861	Yes	10
MOBILE	MOBILE/BATES FIELD	13894	KMOB	30.688222	-88.245969	Yes	10



## Divisional Sections for Mississippi

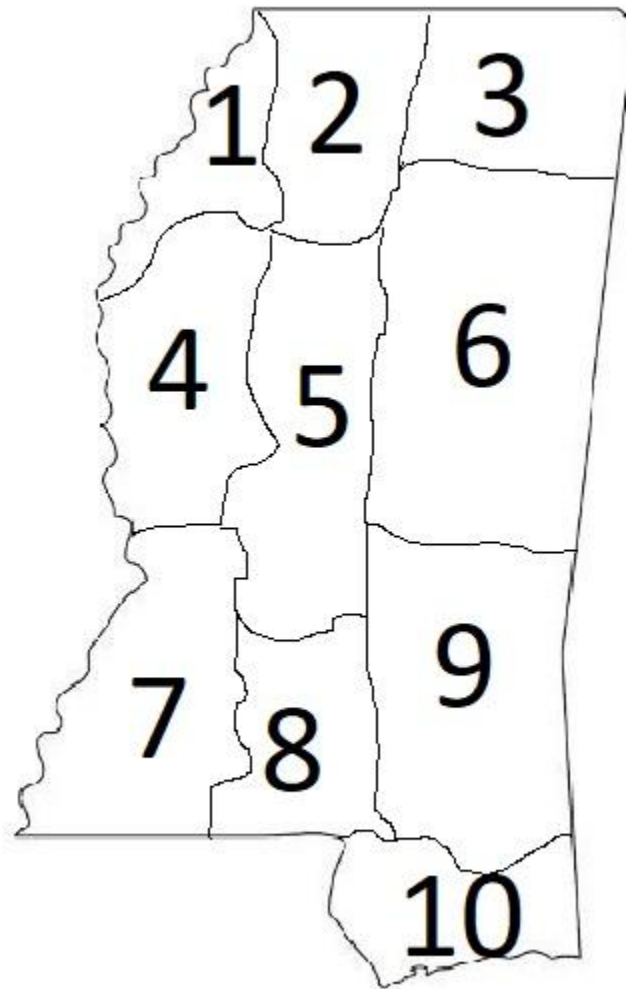


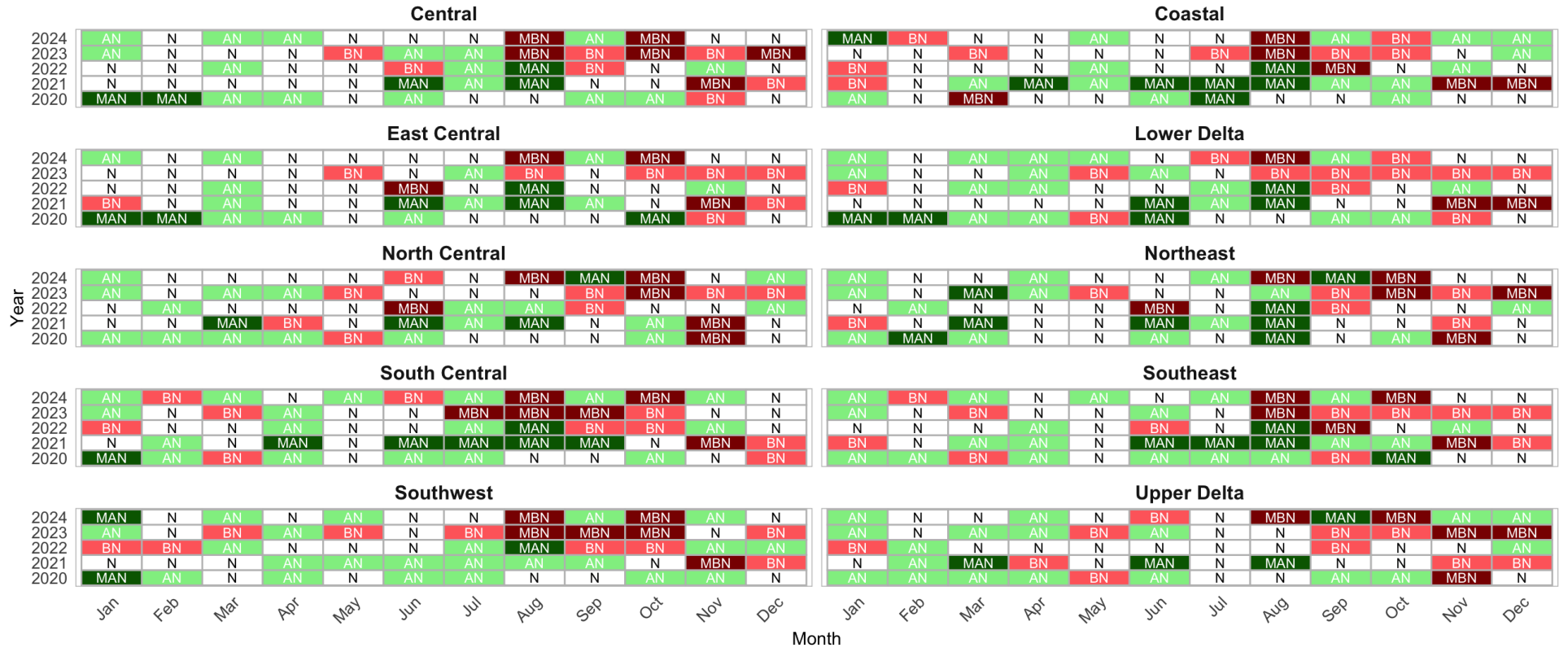
Table 2 - AERSURFACE Monthly Designations

Station	Months Normal above 70°F	Spring 50% Probability @ 28° F.	Fall 50% Probability @ 28° F	Late Autumn Months	Transitional Spring Months	Midsummer Months	Autumn Months
MS-01 Upper Delta	May-Sep	3-Mar	21-Nov	12, 1, 2	3,4	5,6,7,8,9	10,11
MS-02 North Central	June-Sep	20-Mar	9-Nov	11,12, 1, 2,3	4,5	6,7,8,9	10
MS-03 Northeast	June-Sep	19-Mar	12-Nov	11,12, 1, 2,3	4,5	6,7,8,9	10
MS-04 Lower Delta	May-Sep	23-Feb	26-Nov	12, 1, 2	3,4	5,6,7,8,9	10,11
MS-05 Central	May-Sep	11-Mar	15-Nov	12, 1,2	3,4	5,6,7,8,9	10,11
MS-06 East Central	May-Sep	10-Mar	15-Nov	12, 1,2	3,4	5,6,7,8,9	10,11
MS-07 Southwest	May-Sep	25-Feb	26-Nov	12, 1, 2	3,4	5,6,7,8,9	10,11
MS-08 South Central	May-Sep	27-Feb	25-Nov	12, 1, 2	3,4	5,6,7,8,9	10, 11
MS-09 Southeast	May-Sep	2-Mar	24-Nov	12, 1, 2,	3,4	5,6,7,8,9	10,11
MS-10 Coastal	May-Sep	12-Feb	16-Dec	1	2,3,4	5,6,7,8,9	10,11,12

Table 3 – Surface Moisture Based on NCEI Divisional Precipitation Ranks 2020-2024

## Mississippi Divisional Precipitation Rankings (2020-2024)

Rankings out of 131 years of record



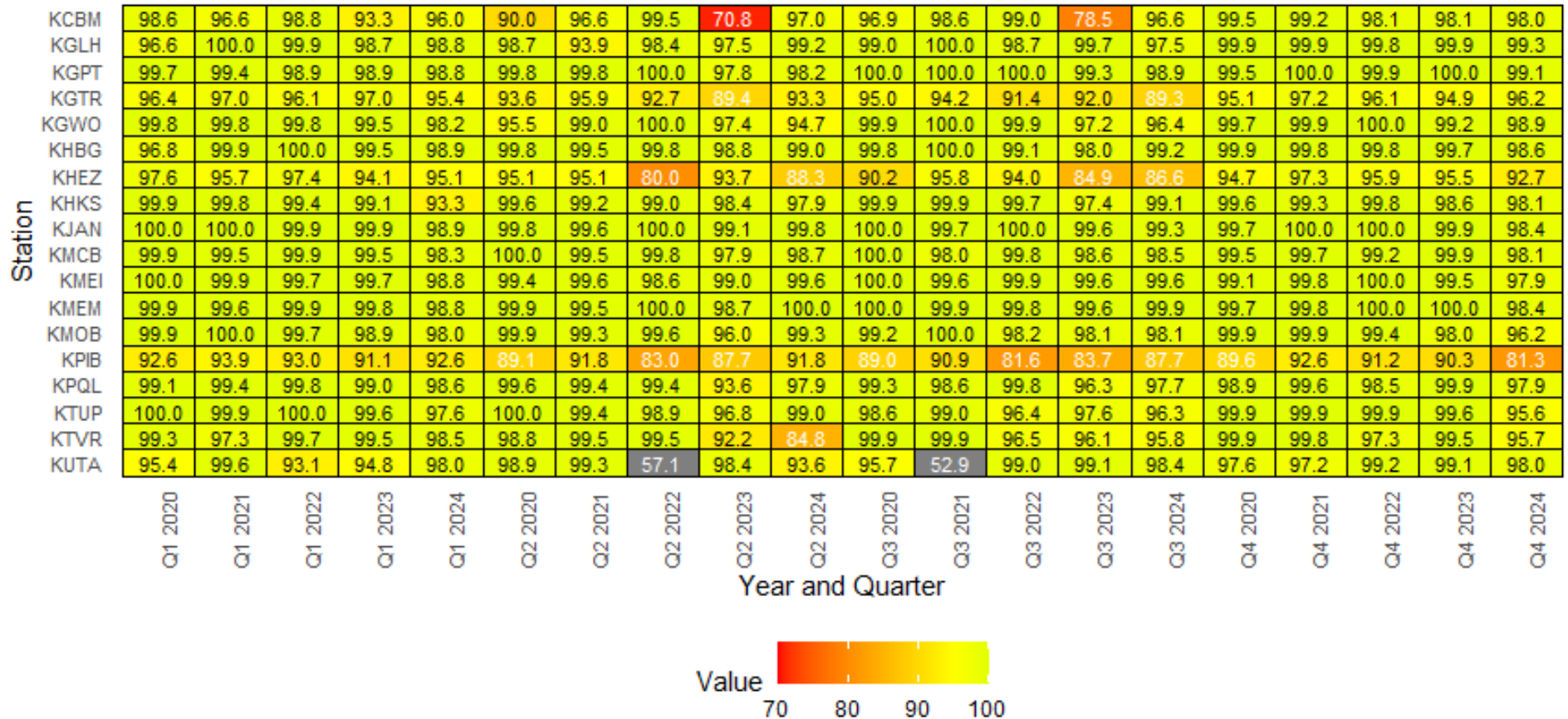
Data source: NCEI Climate at a Glance  
 MBN: Much Below Normal (1-13), BN: Below Normal (14-39), N: Near Normal (40-91),  
 AN: Above Normal (92-117), MAN: Much Above Normal (118-131)



## Data Completeness

The processed meteorological files were used in test runs with AERMOD version 24142. The files were run by quarter and the percentage of data completeness was calculated. The attached heatmap visualizes the completeness check results across all stations from Q1 2020 through Q4 2024. Completeness must satisfy EPA's requirement of 90 percent or greater per quarter. The color gradient indicates completeness levels, with red cells showing values below 90% (failing), yellow cells indicating values near the 90% threshold, and green cells showing high completeness values approaching 100%.

Quarterly Completeness by Station (2020-2024)



EPA Requirement: Data completeness  $\geq$  90% per quarter

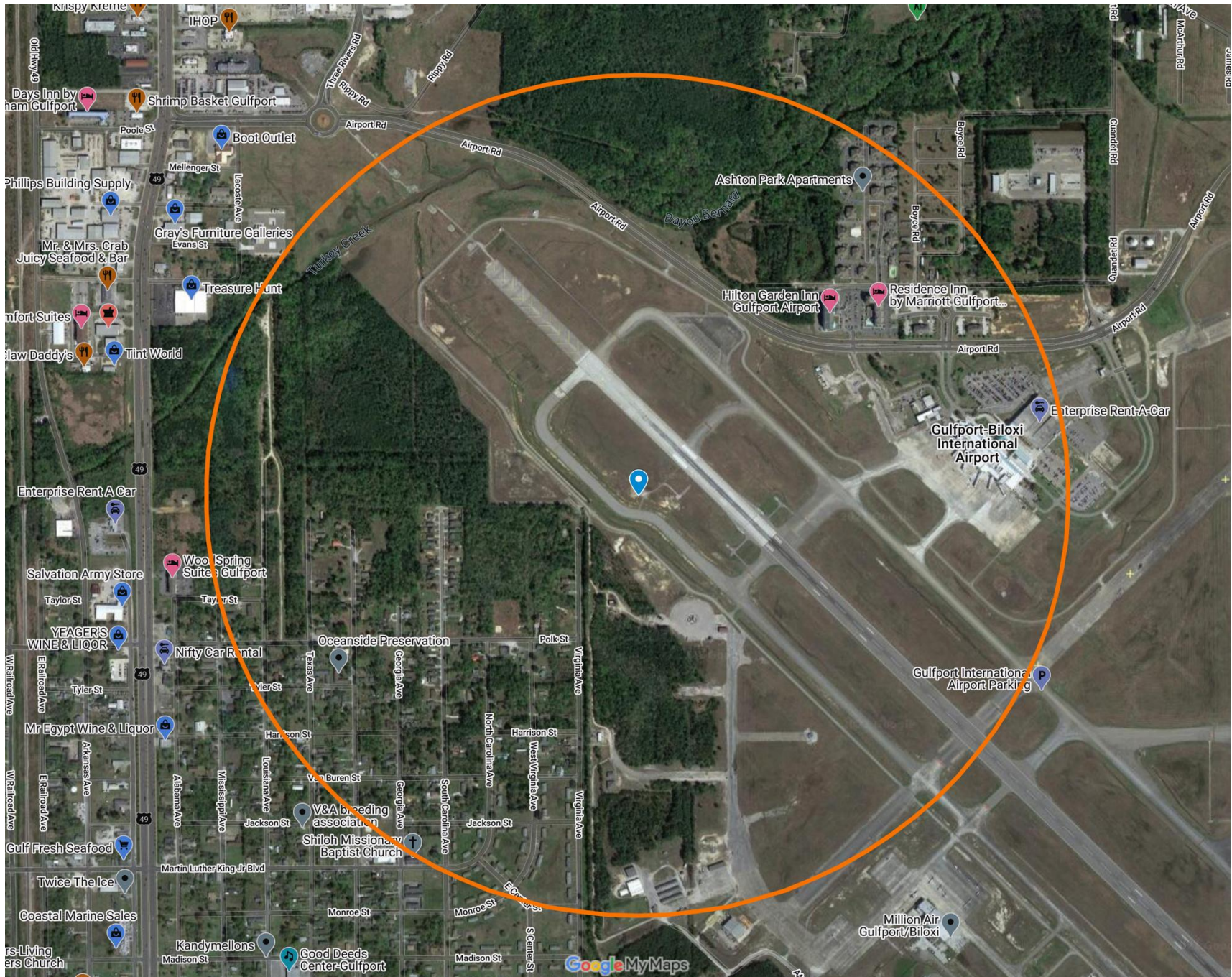
Table 4 - Data Completeness by Quarter







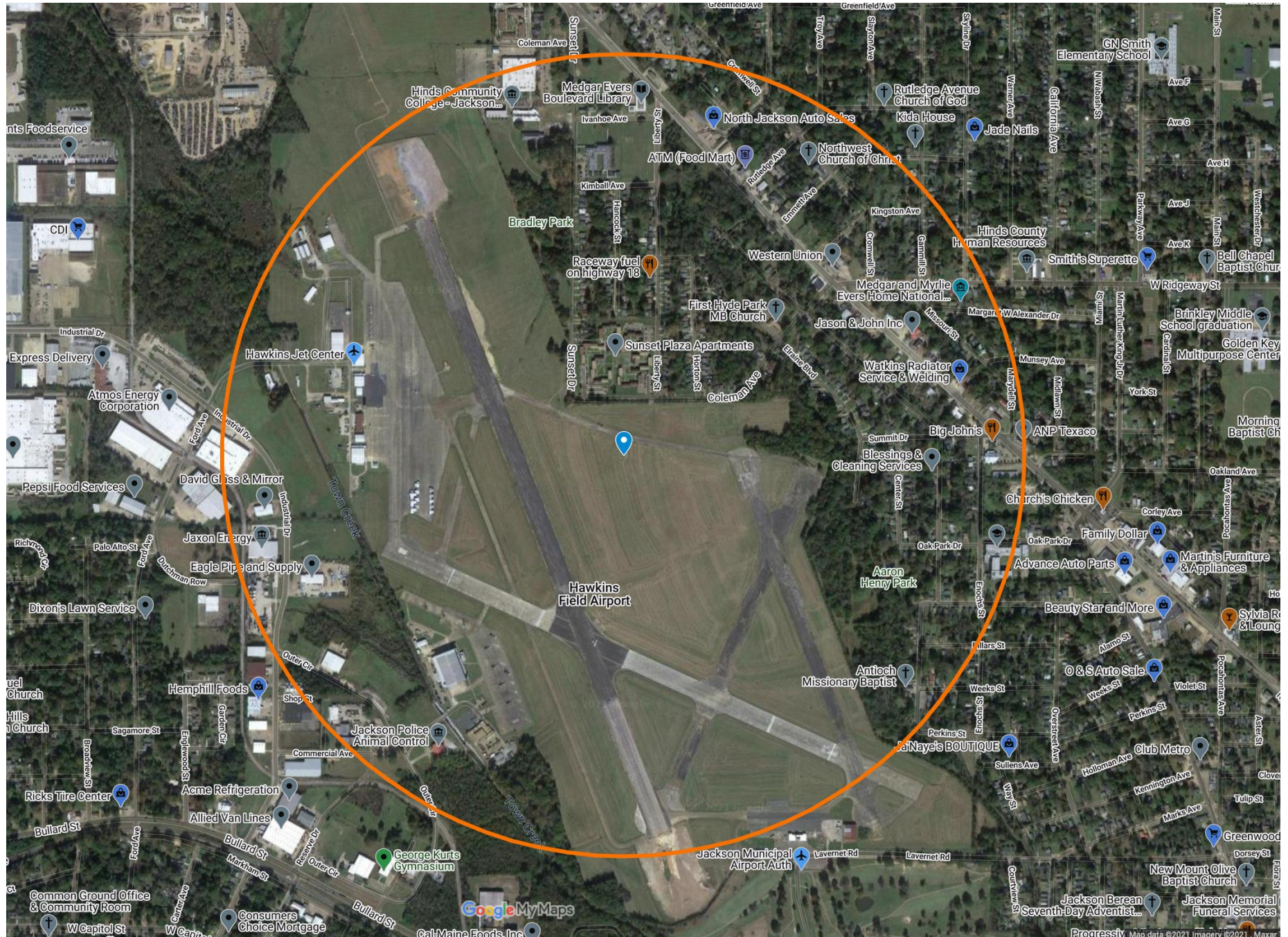














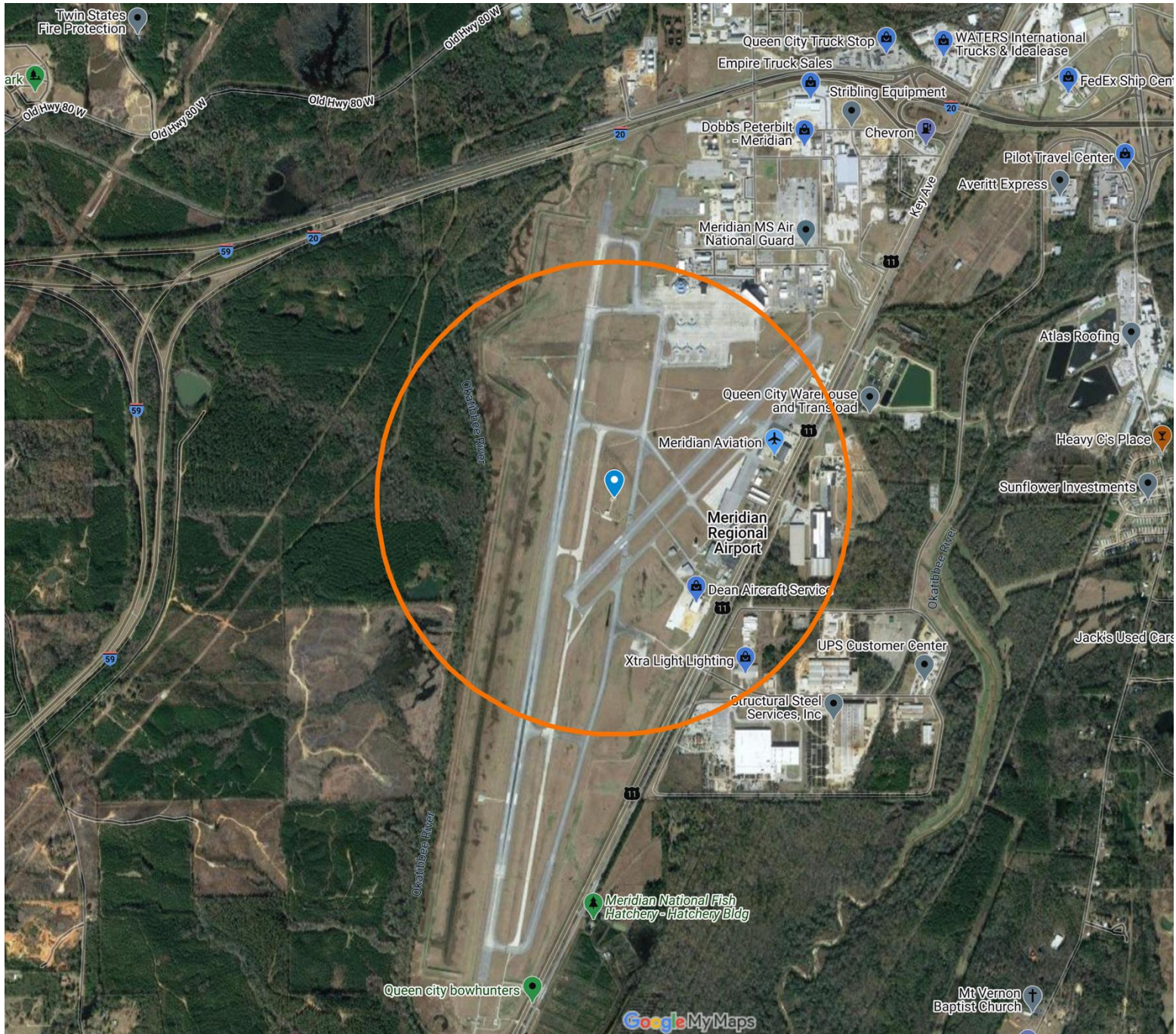






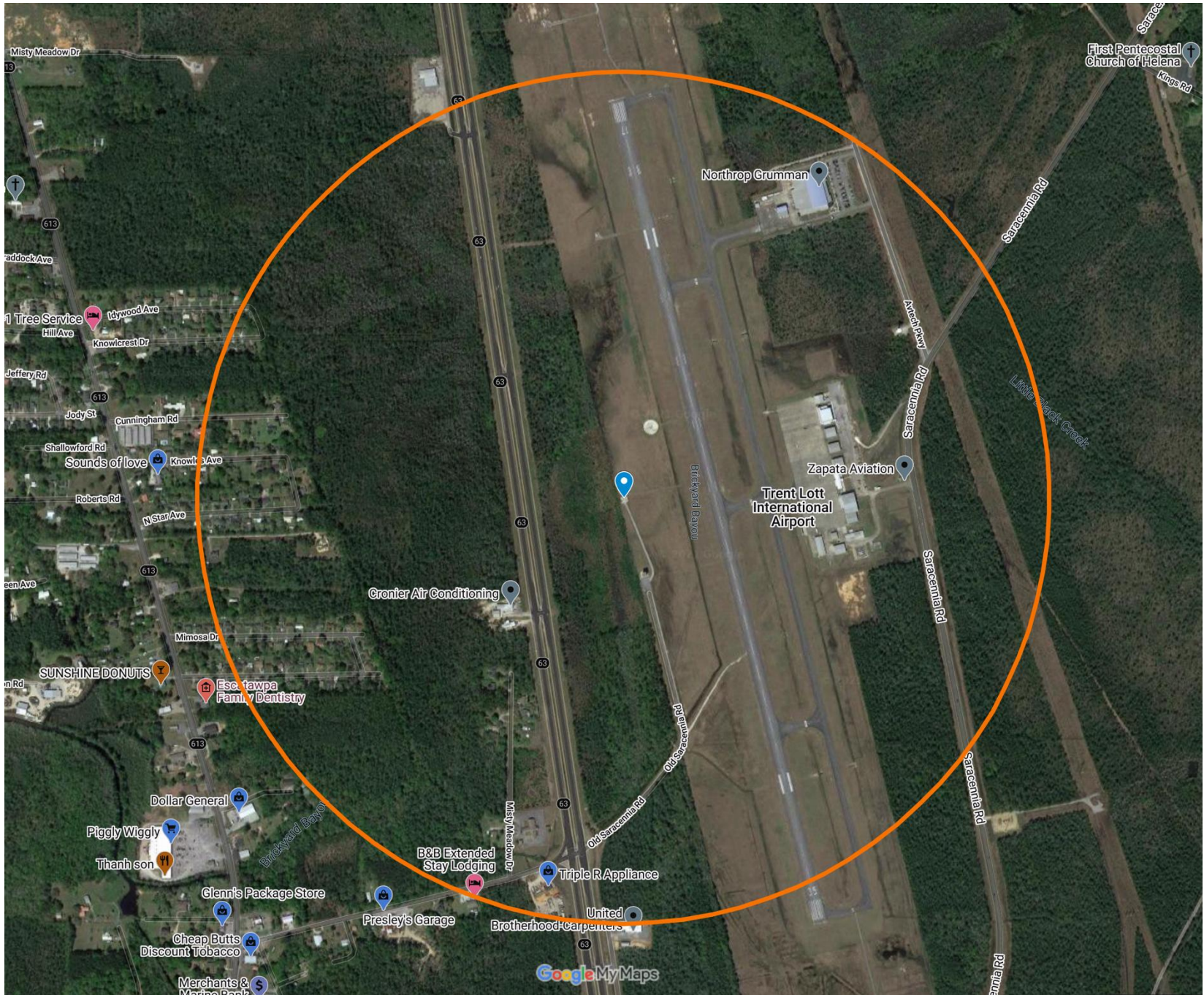


MERIDIAN	KEY FIELD AIRPORT	13865	KMEI	32.334861	-88.750728
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PASCAGOULA	TRENT LOTT INTERNATIONAL AIRPORT	53858	KPQL	30.463058	-88.531556
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TUPELO	TUPELO REGIONAL AIRPORT	93862	KTUP	34.262131	-88.771161	Yes
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