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Lidar Collection (QL2) of all or part of Schuyler, Seneca, Steuben, Tompkins, Wayne and Yates Counties, NY Lidar

Lidar Acquisition Report

August, 2020

EXECUTIVE SUMMARY

The [New York State Information Technology Services](#) (NYSITS) contracted with [The Sanborn Map Company, Inc.](#) (Sanborn) to provide remote sensing services for NYSDOP 2020 in the form of lidar. Utilizing a multi-return system, Light Detection and Ranging (Lidar) detects 3-dimensional positions and attributes to form a point cloud. The high accuracy airborne system is integrated with both Global Navigation Satellite System (GNSS) and an Inertial Measure Unit (IMU) for accurate position and orientation. Acquisition of the project area's ~1945mi² was completed on May 13th, 2020.

The Leica TerrainMapper was used to collect data for the aerial survey campaign. The sensor is attached to the aircraft's underside and emits rapid laser pulses that are used to calculate ranges between the aircraft and subsequent terrain below. The Airborne Lidar System (ALS) is boresighted by completing multiple passes over a known ground surface before the project acquisition. During data processing, the calibration parameters are updated and used during post-processing of the lidar point cloud.

Differential GNSS unit in aircraft sampled positions at 2Hz or higher frequency. Lidar data was only acquired when GNSS PDOP is ≤ 4 and at least 6 satellites are in view. Collection conditions were for leaf-off vegetation. The atmosphere was free of clouds and fog between the aircraft and ground. The ground was free of snow and extensive flooding or any other type of inundation. See **Appendix A** for daily weather conditions.

The contents of this report summarize the methods used to establish the base station coordinates, perform the lidar data acquisition and processing as well as the results of these methods.

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1.0 INTRODUCTION

This document contains the technical write-up of the lidar campaign, including system calibration techniques, and the collection and processing of the lidar data.

1.1 Contact Information

Questions regarding the technical aspects of this report should be addressed to:

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1.2 Purpose of Lidar Acquisition

The objective of this project is to acquire detailed surface elevation data for use in conservation planning, design, research, floodplain mapping, dam safety assessments and elevation modeling, etc. Classified LAS files are used to show the manually reviewed bare earth surface. This allows the user to create Intensity Rasters, Breaklines and Raster DEM. The purpose of these lidar data was to produce high accuracy 3D hydro-flattened Digital Elevation Model (DEM) with a 1-meter cell size.

1.3 Project Location

Schuyler, Seneca, Steuben, Tompkins, Wayne, and Yates counties, New York, covering approximately 1945 square miles.

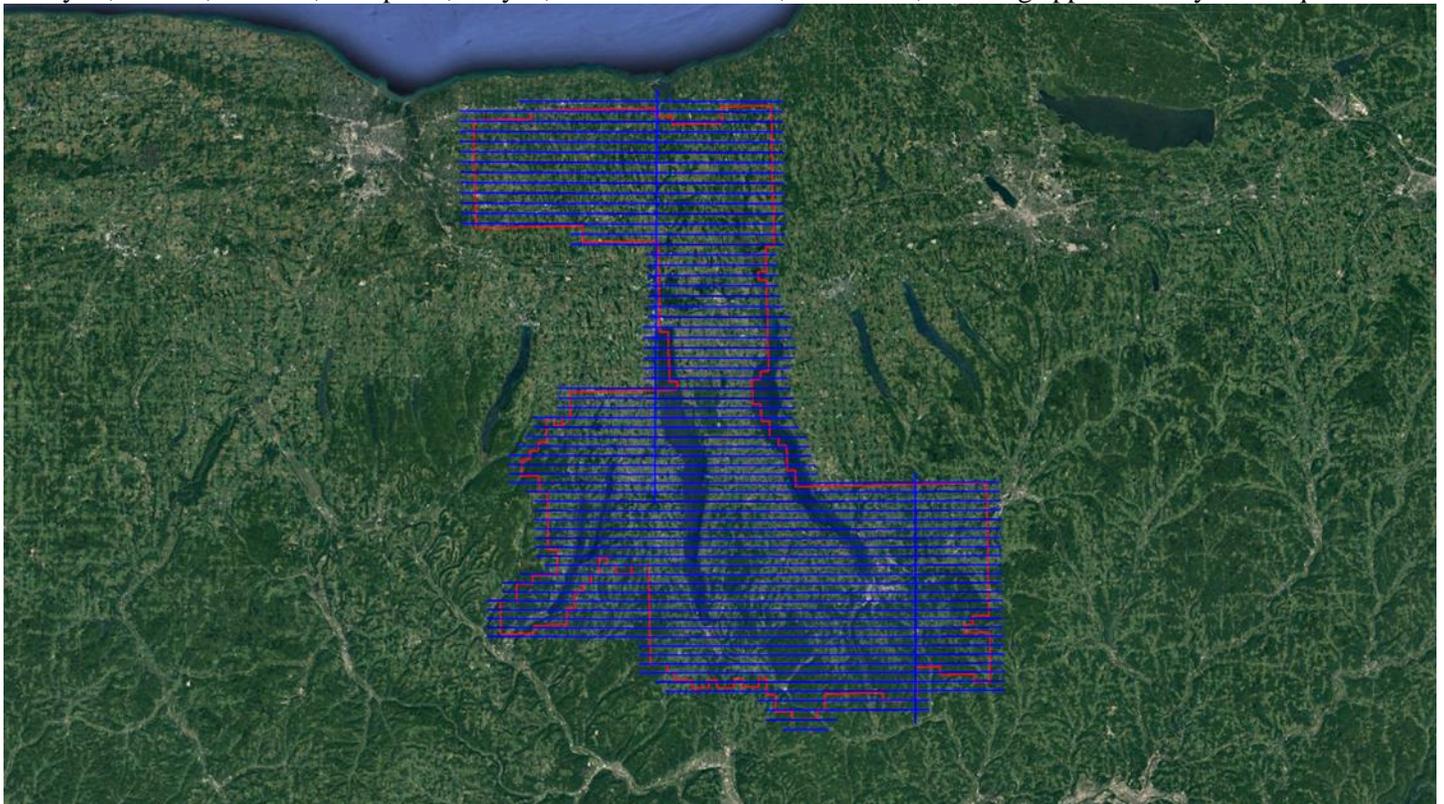


Figure 1: AOI and Trajectories As-Flown

2.0 ACQUISITION

2.1 Introduction

This section outlines the lidar system, flight reporting and data acquisition methodology used during the collection of the NYSITS 2020 lidar campaign. Although Sanborn conducts all lidar missions with the same rigorous and strict procedures and processes, all lidar collections are unique.

2.2 Flight Planning

Sanborn prepared a project flight plan designed for the Leica TerrainMapper to meet and/or exceed [USGS Lidar Base Specifications v2.1](#) Quality Level 2 lidar data. The plan consisted of sixty-eight (68) project and cross-tie flight lines. Cross-tie flight lines are planned at each end and/or center of flight blocks to aid in the angular correction of the dataset if necessary.

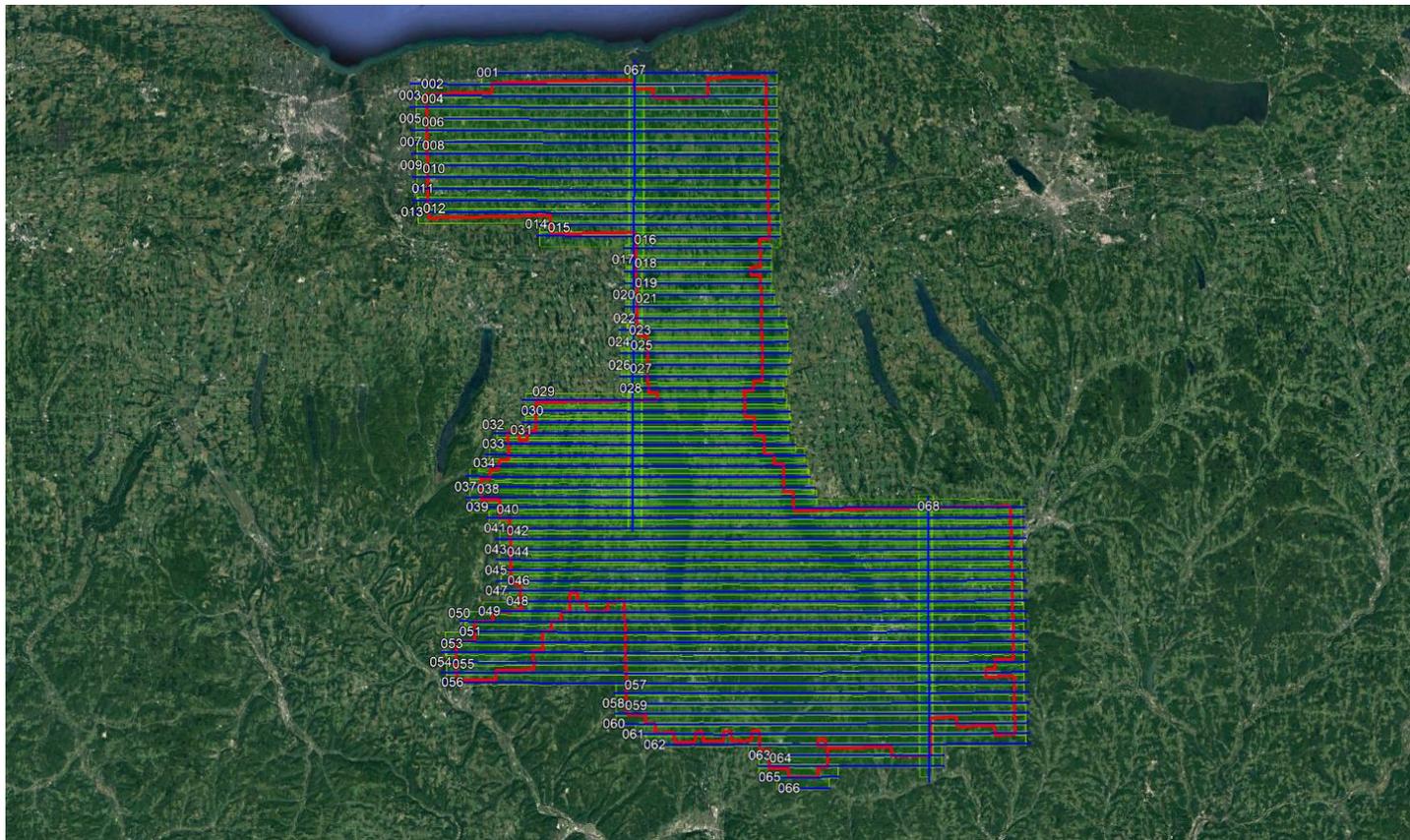


Figure 2: AOI and Flight Plan

2.3 Acquisition Parameters

Sanborn specifically defined the collection parameters to accomplish the desired project specifications. **Table 1** shows the planned acquisition parameters utilized for this aerial survey with the sensor(s) installed.

Planned Acquisition Parameters	
Sensor	Leica TerrainMapper
Aircraft	N603ET - Cessna TU206F
Flying Height (AGL)	3228
Air Speed (kts)	160
Field of View (degrees)	40
Overlap (%)	20
Pulse Rate (kHz)	668.3
Scan Rate (Hz)	87
Laser Footprint (m)	0.75
Mode (PIA)	Gateless
Point Spacing (m)	0.66
Point Density (pls/m²)	2.27
Swath Width (m)	2350

Table 1: Lidar Acquisition Parameters

2.4 Field Work Procedures

Sanborn's standard procedure before every mission is to perform pre-flight checks to ensure correct operation of all systems. All cables were checked and the sensor head glass was cleaned. A three-minute static session was conducted on the ground with the engines running prior to take-off in order to establish fine-alignment of the IMU and to resolve GNSS ambiguities.

The project acquisition consisted of eight (8) mission(s) where sixty-six (66) project lines and two (2) cross-tie lines were collected. The cross-tie lines were not utilized during lidar processing. During the data collection, the operator recorded information on log sheets which includes weather conditions, lidar operation parameters, flight line statistics and PDOP. Near the end of each mission, GNSS ambiguities are again resolved by flying within ten kilometers of the base stations to aid in post-processing.

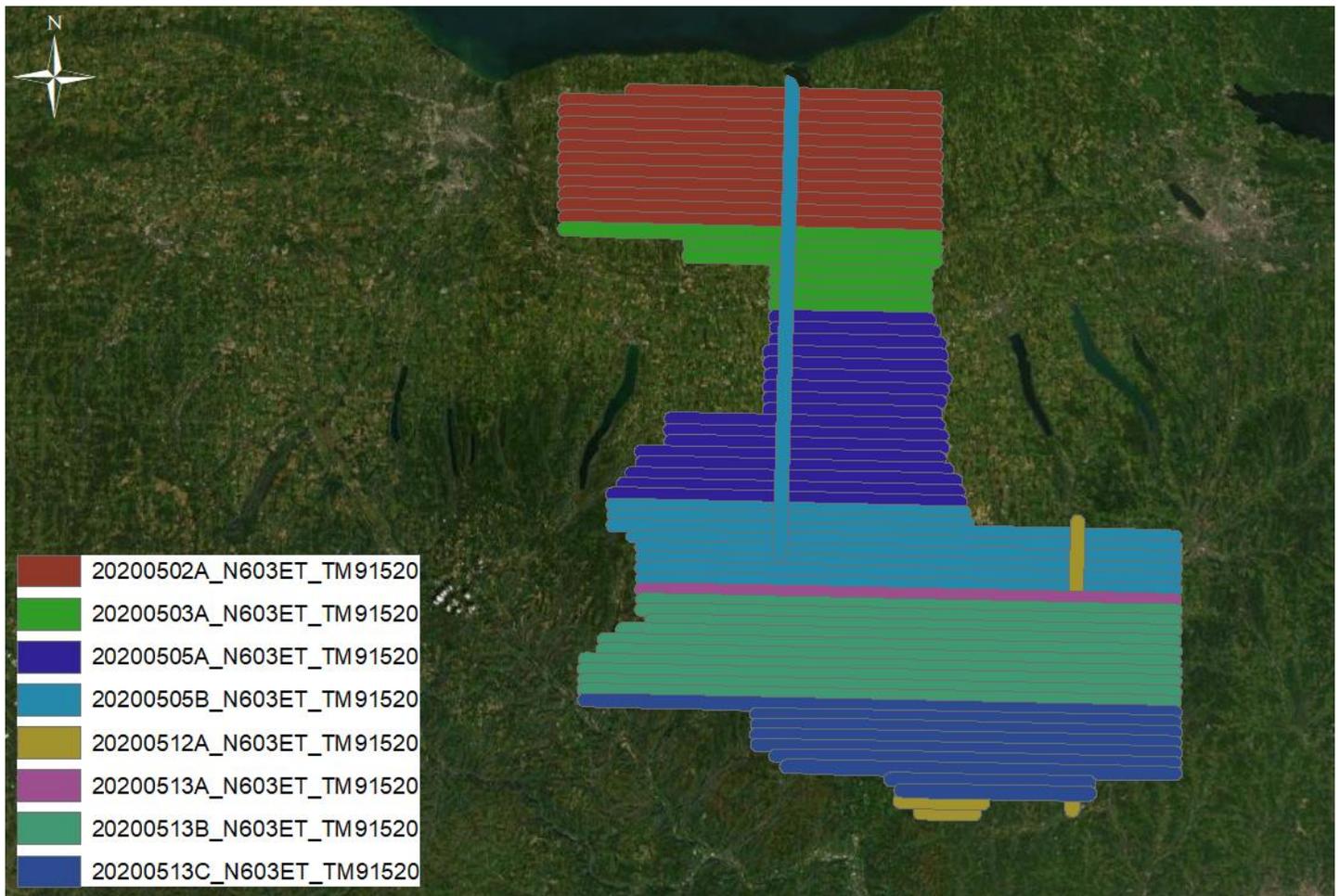


Figure 3: Missions by Date

2.5 Preliminary Data Processing

Preliminary data processing was performed in the field immediately following the missions for quality control of GNSS data and to ensure sufficient coverage of the project AOI. Any problematic data could then be re-flown immediately as required. Final data processing was completed in the Colorado Springs, CO office. **Table 2** below shows the flight acquisition metrics for the entire collection. **Table 3** contains the base station names and locations in operation during acquisition. Base station coordinates are provided in NAD83 (2011), Geographic Coordinate System, Ellipsoid, Meters.

Date	Sensor	Serial #	Tail #	MissionID	PDOP	Start (UTC)	End (UTC)	Lines
5/2/2020	Leica TerrainMapper	TM91520	N603ET	20200502A	1.7	11:23:01	16:16:15	12
5/3/2020	Leica TerrainMapper	TM91520	N603ET	20200503A	1.8	11:41:44	14:45:54	7
5/5/2020	Leica TerrainMapper	TM91520	N603ET	20200505A	1.6	14:04:53	19:05:43	17
5/5/2020	Leica TerrainMapper	TM91520	N603ET	20200505B	1.6	20:16:38	1:09:34	9
5/12/2020	Leica TerrainMapper	TM91520	N603ET	20200512A	1.7	11:10:30	12:32:34	3
5/13/2020	Leica TerrainMapper	TM91520	N603ET	20200513A	1.8	12:32:43	13:36:37	1
5/13/2020	Leica TerrainMapper	TM91520	N603ET	20200513B	1.6	20:10:04	1:21:03	10
5/13/2020	Leica TerrainMapper	TM91520	N603ET	20200513C	1.6	1:47:56	5:35:21	9

Table 2: Collection Date Time by Mission

Designation	Type	PID	Latitude (N)	Longitude (W)	Elevation
0502A	OPUS	n/a	43 07 06.47537	077 39 27.11549	125.679
0503A	OPUS	n/a	43 07 06.43296	077 39 27.10278	125.636
0505A	OPUS	n/a	42 39 28.97820	077 03 32.52755	185.249
0512A	OPUS	n/a	42 29 14.96332	076 27 36.77490	291.577
0513A	OPUS	n/a	42 29 14.96332	076 27 36.77490	291.577
NYCL	CORS	DI0448	42 35 03.70726	076 12 40.79269	330.887
NYPF	CORS	DI0614	43 05 35.48476	077 31 31.11257	113.478
NYWG	CORS	DK7408	42 21 03.79604	076 52 33.30068	283.556
NYWL	CORS	DI0626	42 53 55.22725	076 51 07.30237	109.959

Table 3: GNSS Reference Station Coordinates

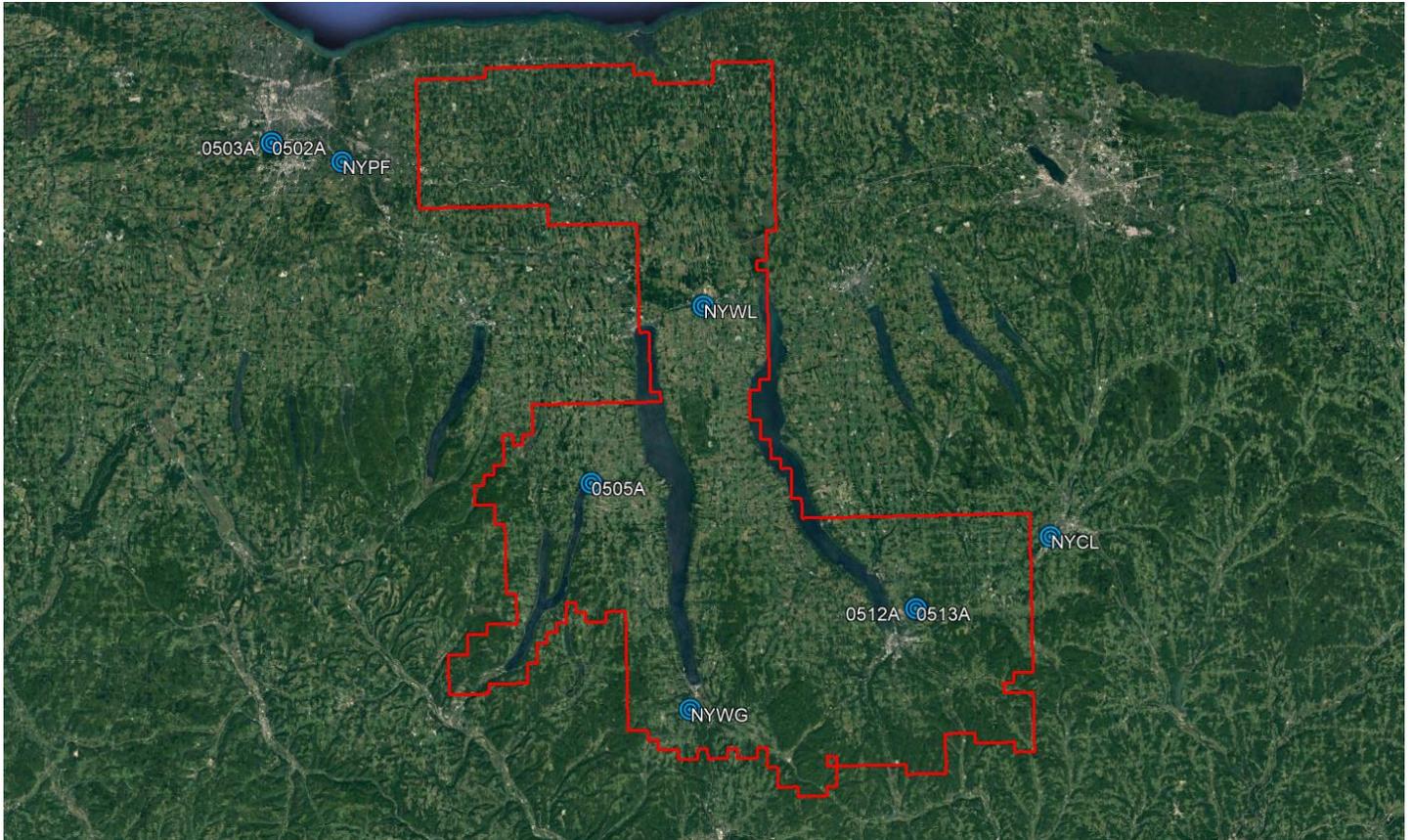


Figure 4: GNSS Reference Stations

2.6 Daily Reporting

Sanborn provided daily acquisition reports containing ground conditions, weather outlooks, completion status, and notes.

NYS DOP 2020 Lidar Acquisition Report

Prepared By: The Sanborn Map Company Inc.

Status as of:

6/15/2020

General Notes

Lidar AOI is approved to fly as of 3/10/20

Ground Condition Reports

Lidar AOI is currently leaf and free.

Current Acquisition Outlook/Weather Status Report

Weather looks poor most of the week.



Current Project Status Graphic

All lines have been collected - collection complete pending office QC

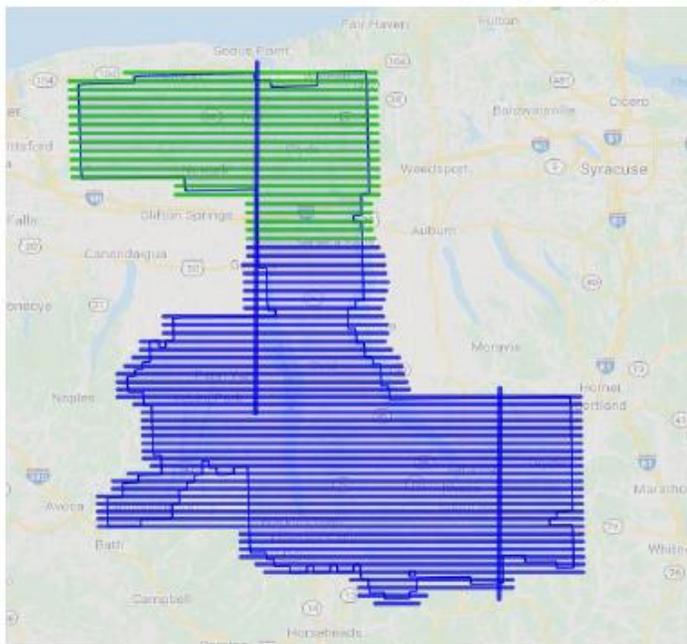
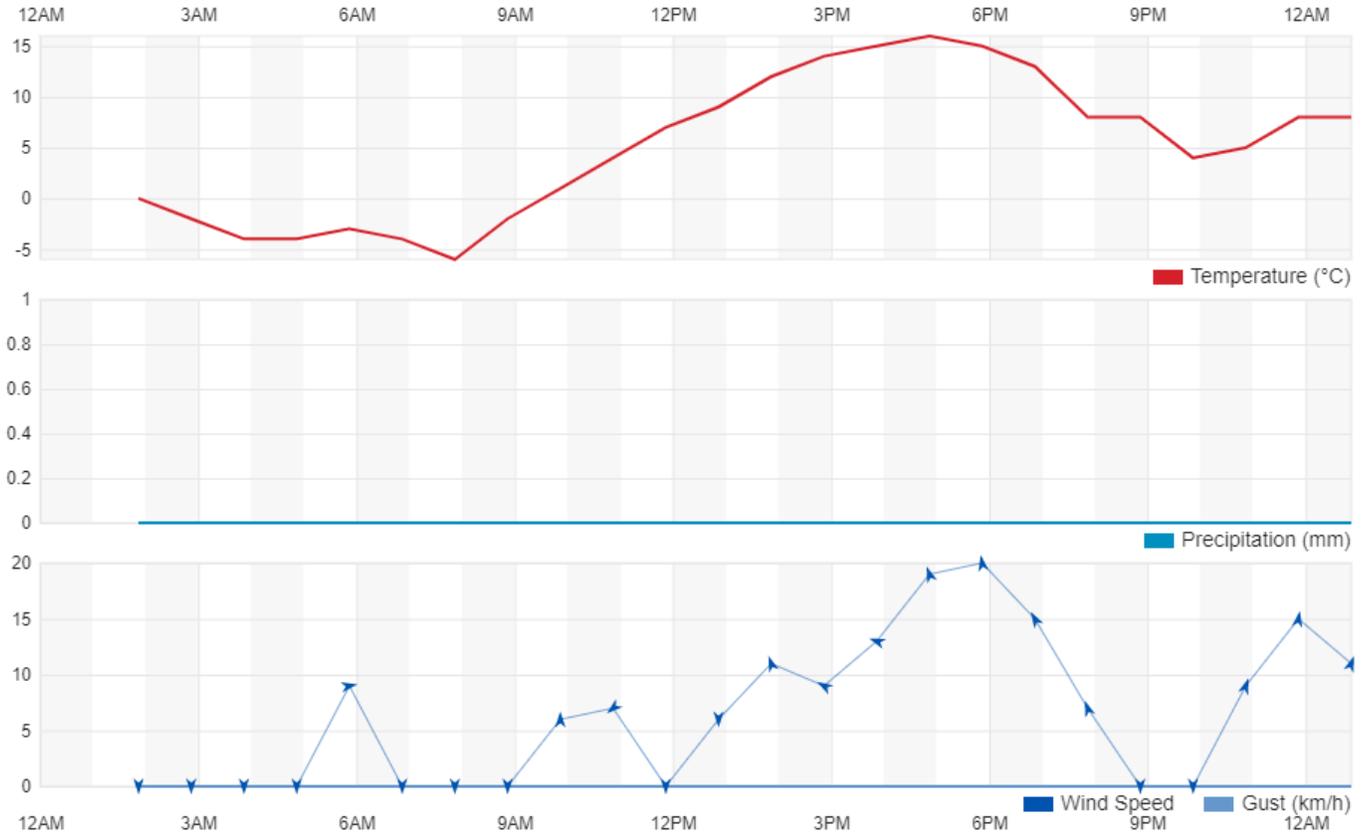


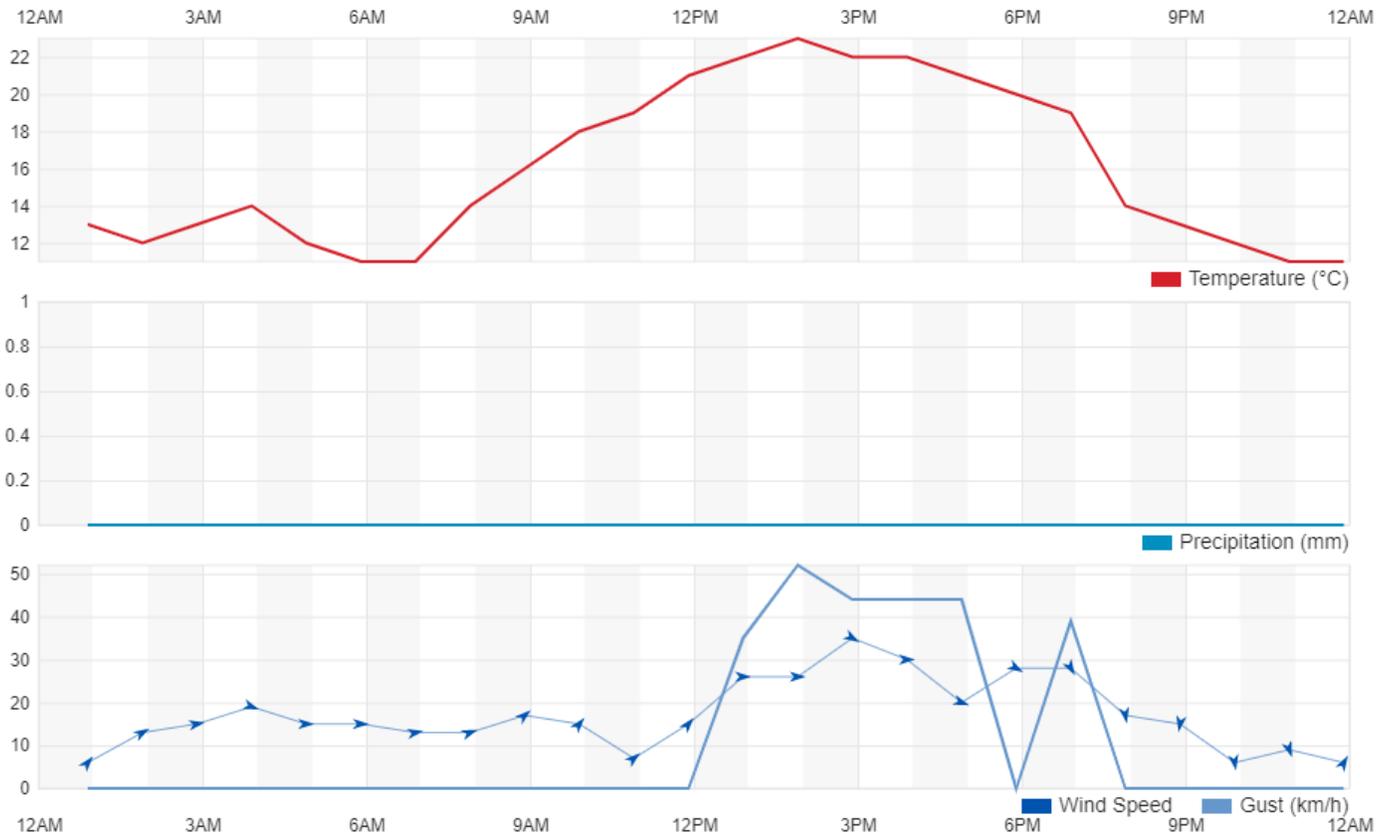
Figure 5: Daily Acquisition Report Sample

APPENDIX A – DAILY WEATHER

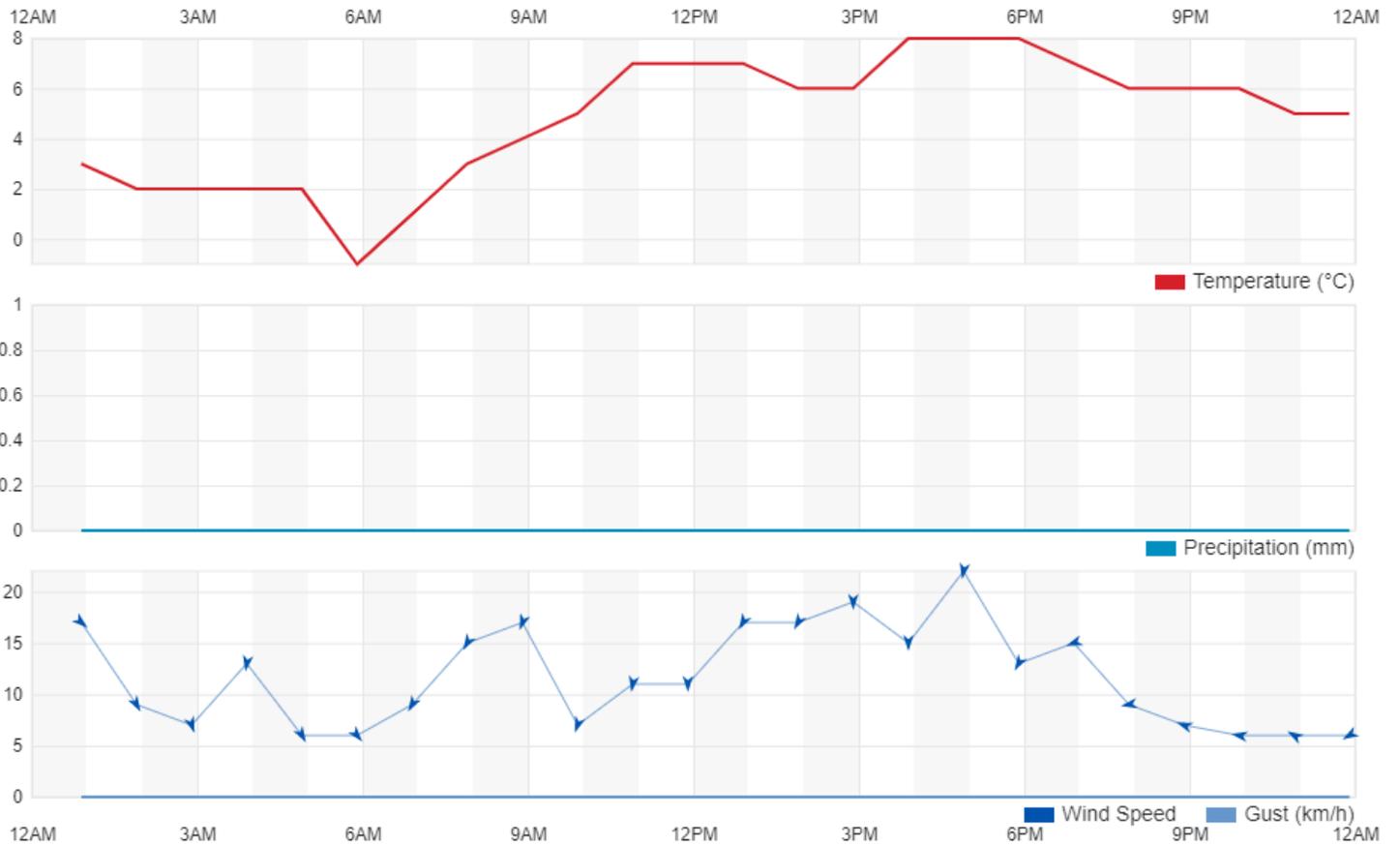
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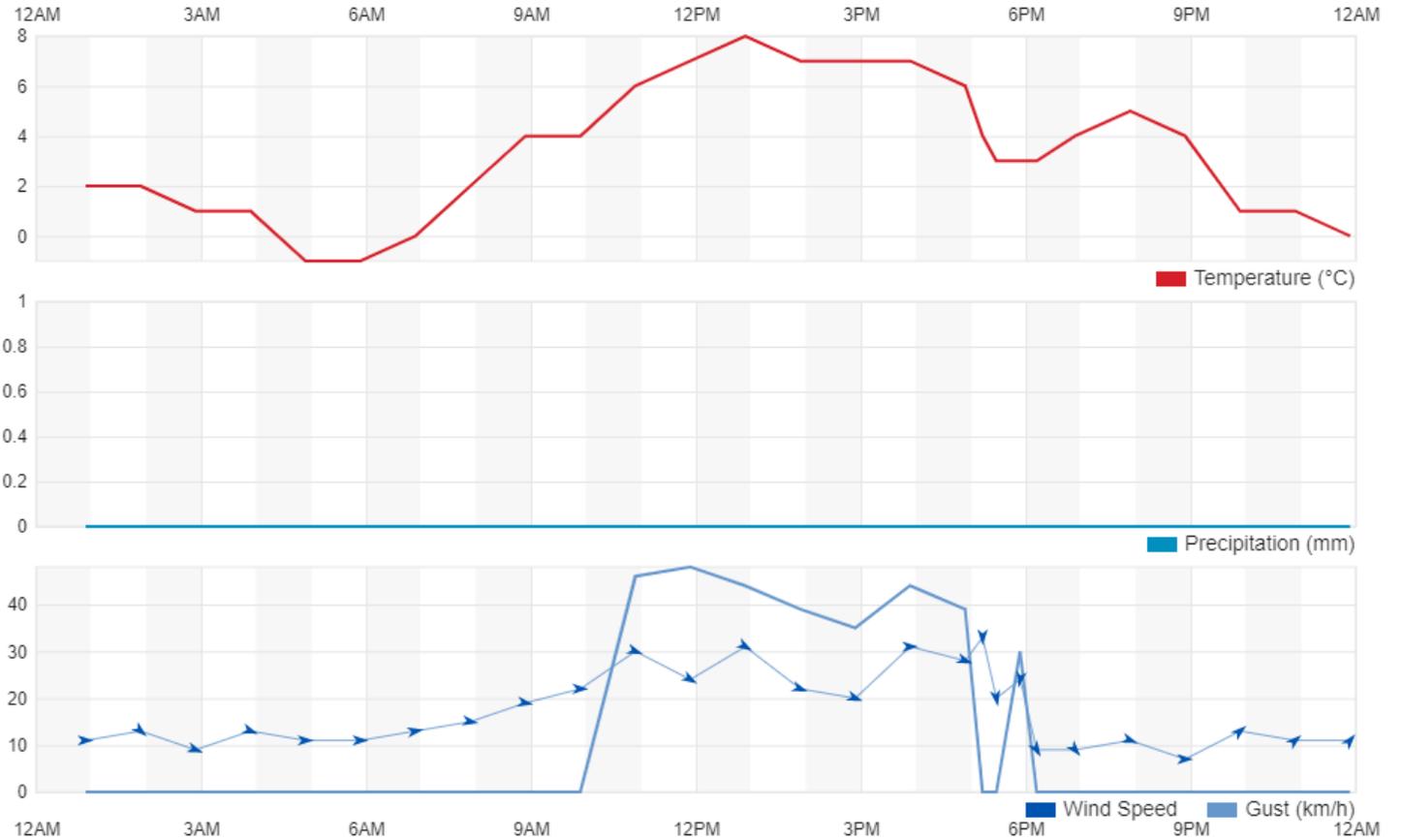
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20200512



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