Comparison of NOAA's Precipitation / Temperature Products using NYC-uHMT Data

NOAA CESSRST Summer Symposium,
New York City, NY, August 9th, 2021

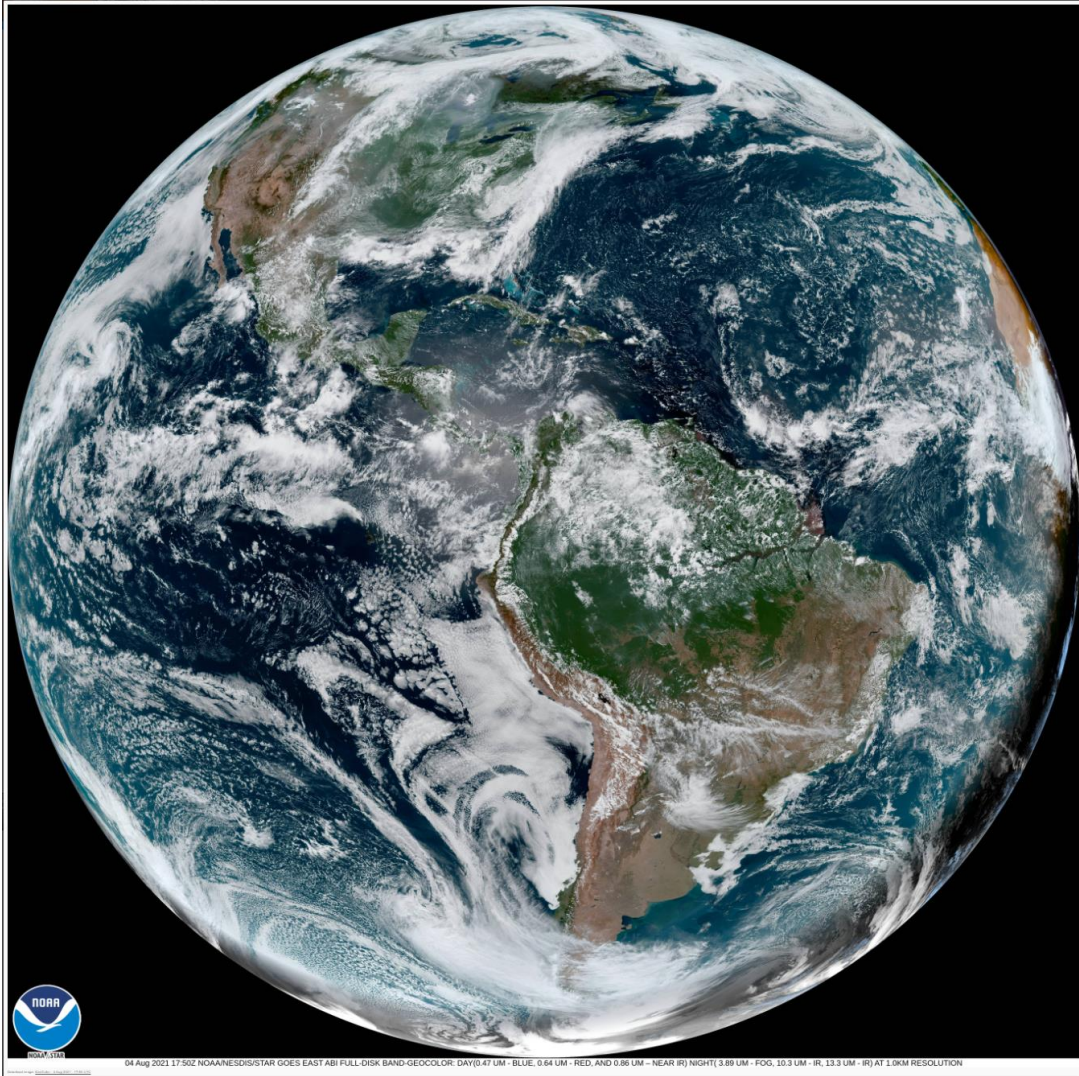Jake Longenecker[1,4] |Dimitri Ambroise[1,4] | Fatima Karami[2,8] | Daniel Ugo-Omenukwa[3,7]
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NOAA-CESSRST Summer Bridge[1] , NSF REU[2], NOAA-CESSRST HIRES[3]
City College of New York[4], Manhattan Center for Science and Math[5], Stuyvesant High School[6], Bronx Science High School of Science[7], LaGuardia Community College[8]

Introduction

04 Aug 2021 17:50Z NOAA/NESDIS/STAR GOES EAST ABI FULL-DISK BAND-GEOCOLOR: DAY(0.47 UM - BLUE, 0.64 UM - RED, AND 0.86 UM – NEAR IR) NIGHT(3.89 UM - FOG, 10.3 UM - IR, 13.3 UM - IR) AT 1.0KM RESOLUTION

To better model the microclimate within New York City, a high-resolution precipitation and temperature product must first be made available.

- We propose to create these products via the merger of:
  - 19-station NYC-uHMT (Hydromet) array
  - 1km NWS radar station data
  - 1km NCEP NSSL radar station data
  - 4km GOES-R satellite data

- Data will be automatically sourced and processed with aims to produce a ≥ 15-min, 1km merged, publicly facing dataset.

- Final product will be compared against cleaned Hydromet readings and existing precipitation and temperature products to determine efficacy of the merged product.

- These products will offer insight to locally induced flash flood characteristics and allow for more precise power distribution.

Methodology

Accomplished

I. Accessed the desired datasets via Python scripts.

II. Processed the acquired data via Python, Octave and GDAL command line scripts.

III. Created representative maps in QGIS and charts in MS Excel.

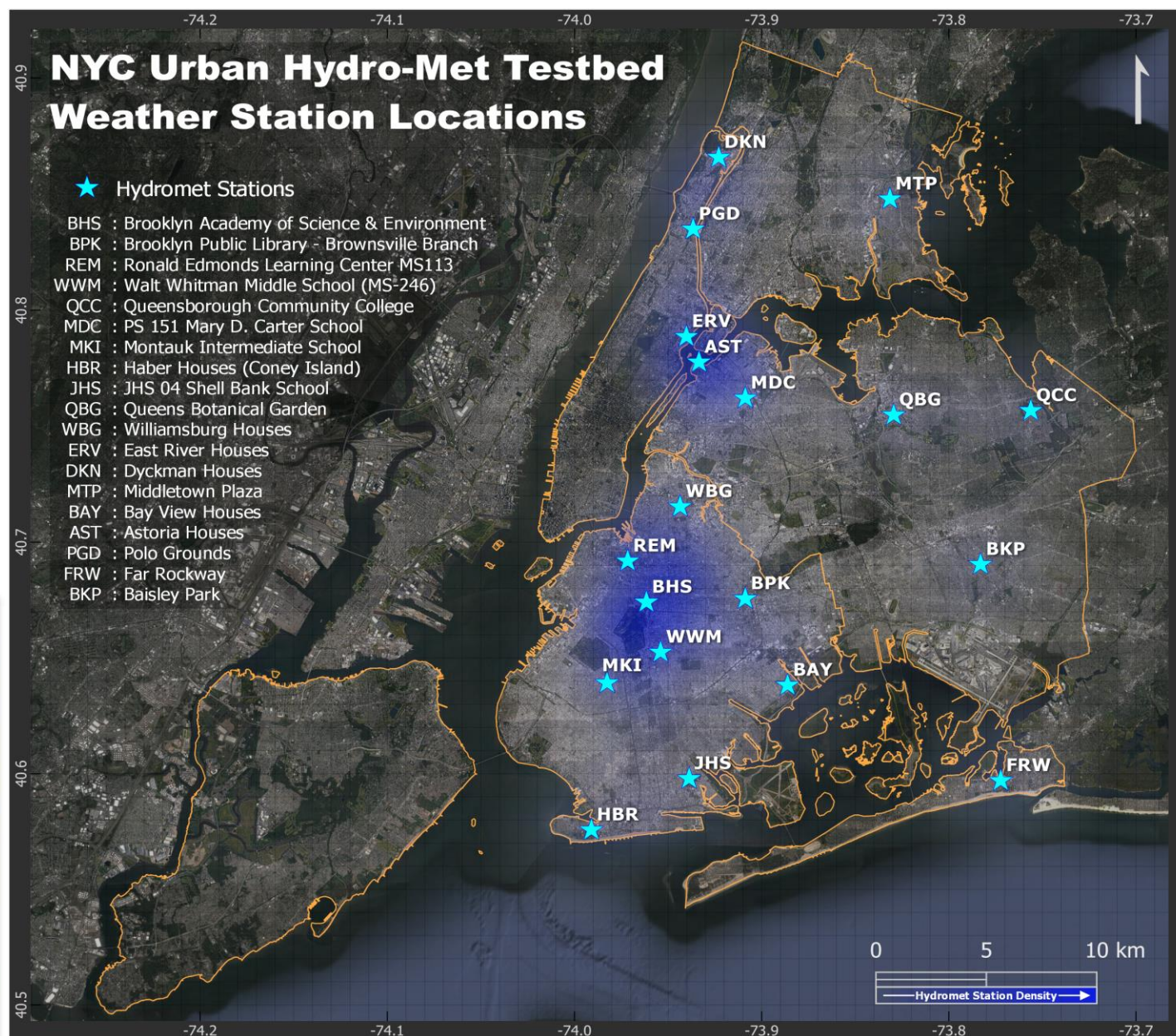IV. Learned programming skills to accomplish further tasks.
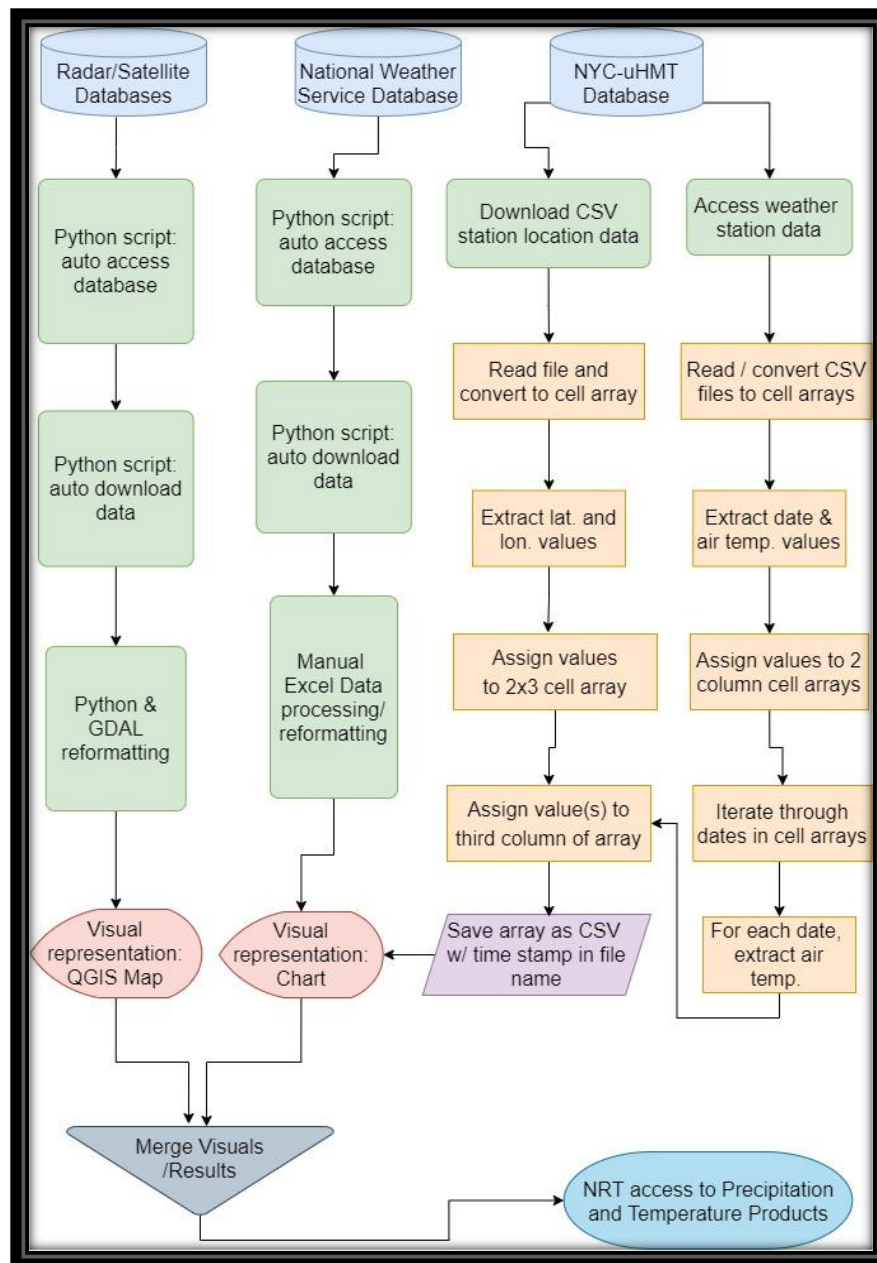
To-be Accomplished

I. Merge / overlay dataset results to determine similarity of created and existing datasets.

II. Automate all acquisition, transformation and visualization processes.

III. Create a near-real-time portal where high resolution temperature and precipitation maps can be uploaded for public use.

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- 19 weather stations with temporal resolution of 15-min for temperature and precipitation.

- Program created to pull and modify station files from CUNY CREST data server.

- Future additions to script will aid in automation allowing for comparison to existing datasets.

NYC Urban Hydro-Met Testbed Weather Station Locations

★ Hydromet Stations

BHS : Brooklyn Academy of Science & Environment
BPK : Brooklyn Public Library - Brownsville Branch
REM : Ronald Edmonds Learning Center MS113
WWM : Walt Whitman Middle School (MS-246)
QCC : Queensborough Community College
MDC : PS 151 Mary D. Carter School
MKI : Montauk Intermediate School
HBR : Haber Houses (Coney Island)
JHS : JHS 04 Shell Bank School
QBG : Queens Botanical Garden
WBG : Williamsburg Houses
ERV : East River Houses
DKN : Dyckman Houses
MTP : Middletown Plaza
BAY : Bay View Houses
AST : Astoria Houses
PGD : Polo Grounds
FRW : Far Rockaway
BKP : Baisley Park

- Data Source: National Center for Environmental Protection's National Sever Storm Lab (NCEP NSSL) .

- 24-hour MultiSensor Quantitative Precipitation Estimate Dataset (QPE).
  - Temporal resolution of 1-hour
  - Spatial resolution of 1km

- Precipitation accumulation measured in millimeters (mm).

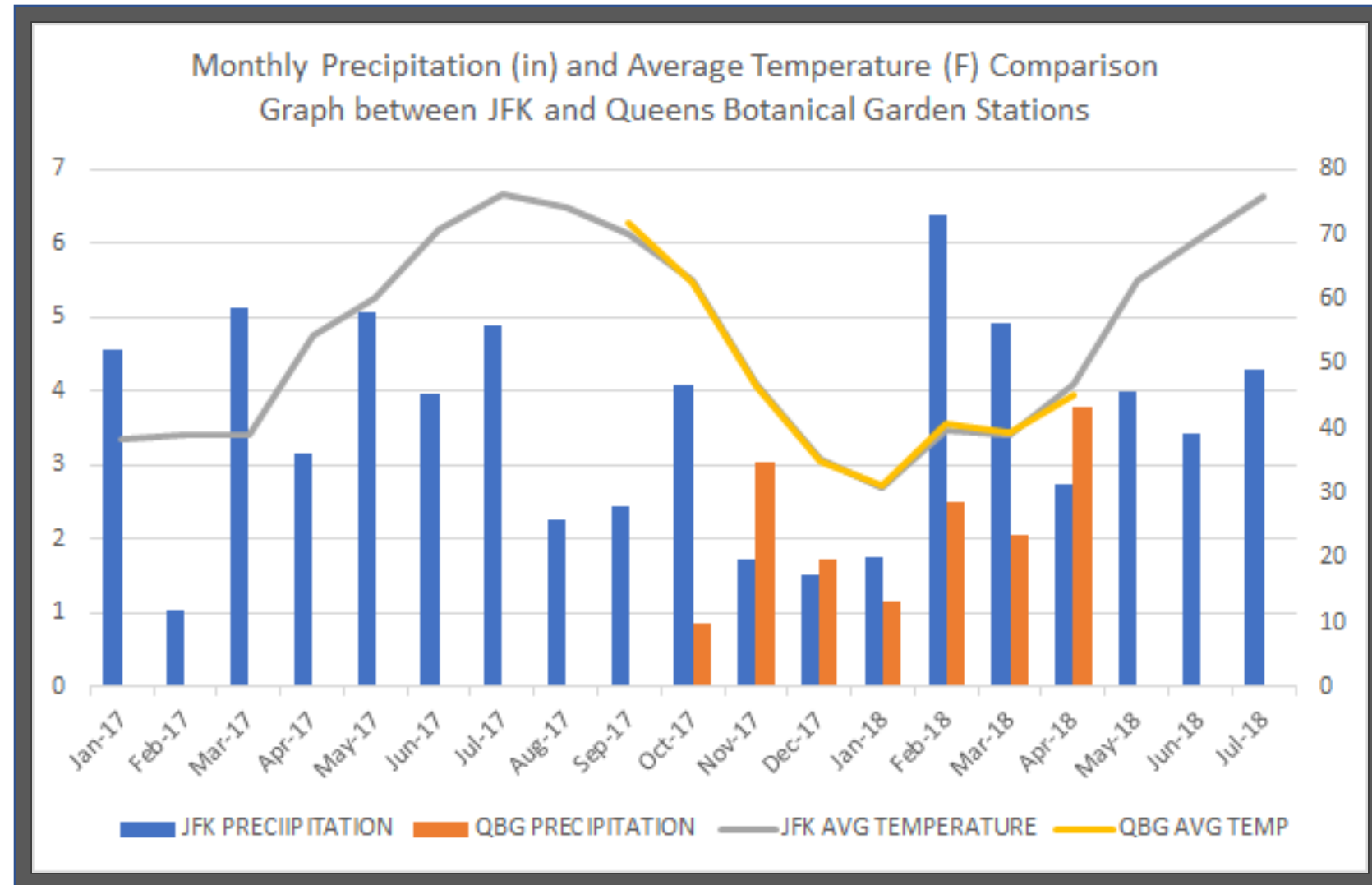- Data was modified with the 'gdalwrap' command from within the GDAL library.
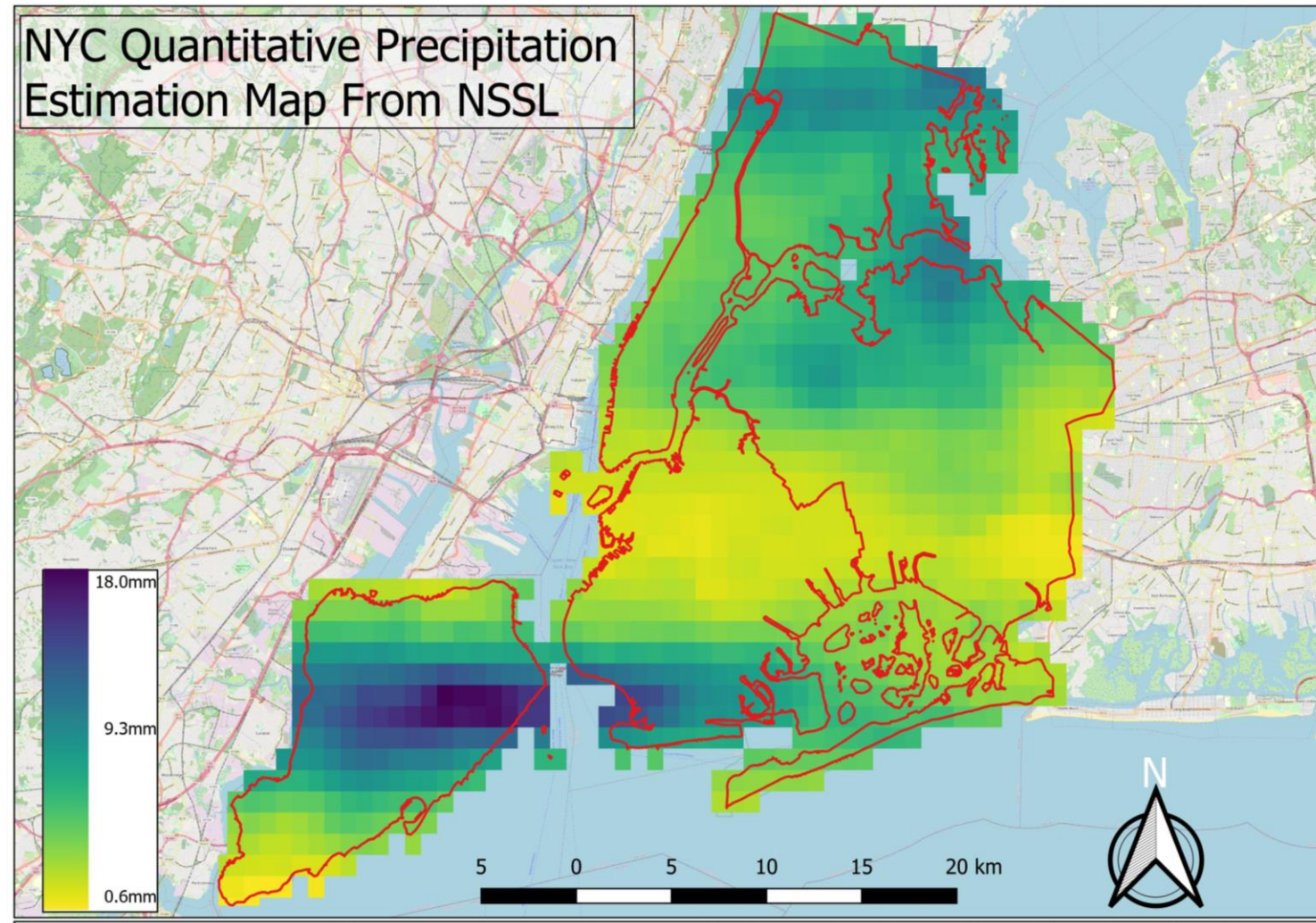
24-hour MultiSensor Quantitative Precipitation Estimate from the National Center for Environmental Prediction National Severe Storm Laboratory for 2021/07/28 at 1400 (UTC).
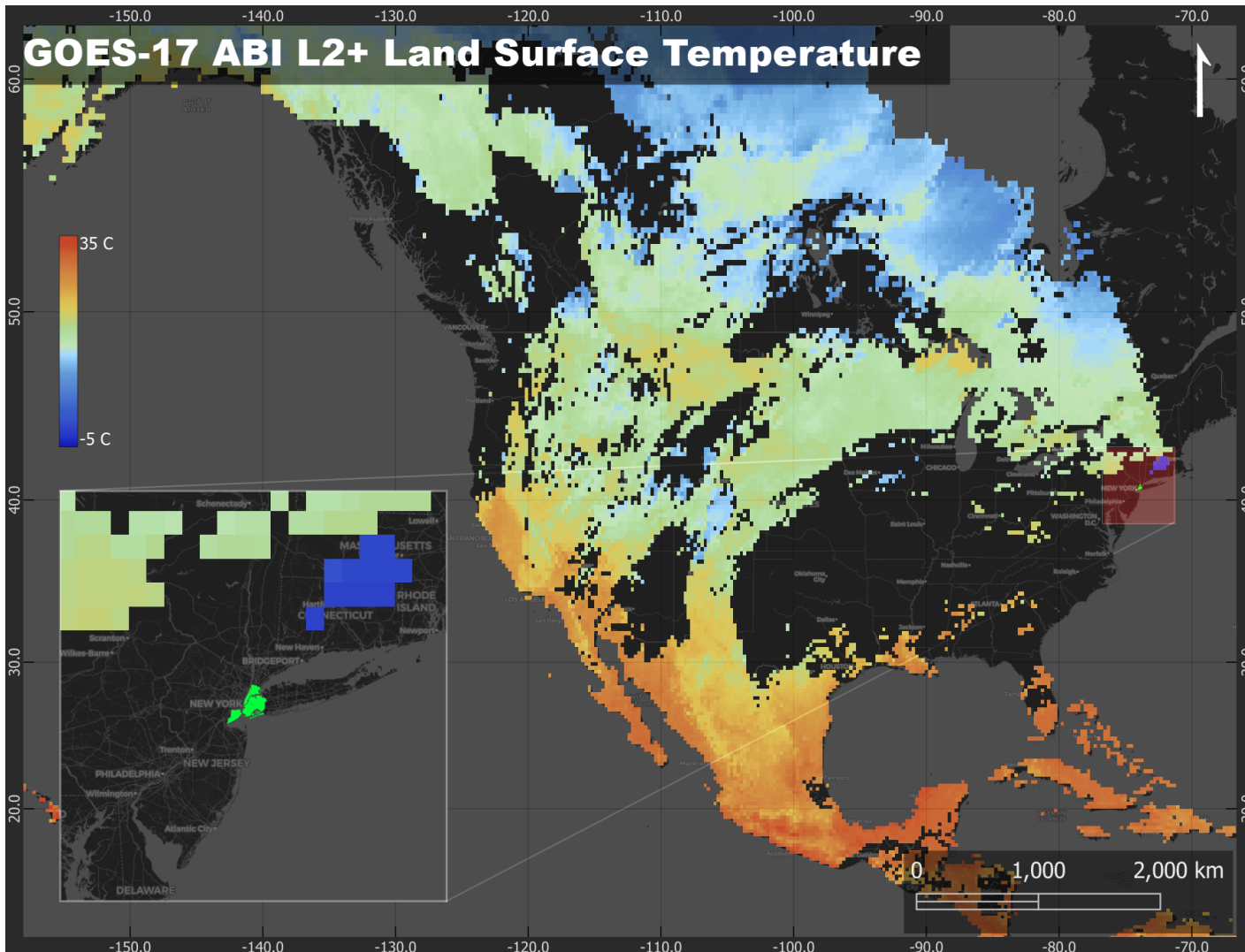Source: NCEP NSSL MRMS QPE 24H Pass 1, NYC OpenData, OpenStreetMap

- Comparison of two NYC precipitation/temperature datasets sources: NYC-uHMT and NWS station

- While the monthly temperature results are similar, the precipitations surpass each other every month.

- Comparisons between the other NWS stations (Central Park and LaGuardia Airport) and the other 18 uHMT stations will take place in future research.

Monthly Precipitation (in) and Average Temperature (F) Comparison Graph between JFK and Queens Botanical Garden Stations

Legend: JFK PRECIPITATION, QBG PRECIPITATION, JFK AVG TEMPERATURE, QBG AVG TEMP

GOES-R Full Disk thermal map for 01/01/2021. Values of nodata over NYC due to clouds.
Source: GOES-17 ABI L2+ LST from NOAA CLASS, NYC OpenData, OSM

Preliminary investigations sourced GOES-17 ABI L2+ Land Surface Skin Temperature (LST) Full Disk products from the NOAA CLASS.

- NETCDF Full Disk products acquired via python.
  - Spatial resolution of 25km
  - Temporal resolution of 30-minutes
  - Spectral resolution of 0.35K at 300K

- Continued development will source the higher resolution 4km GOES-16 Thermal-IR LST dataset via FTP.

- Aims to produce fully automated data manipulation and assimilation.

Summary & Future Works

We aim to better understand induced flash flood characteristics via localized precipitation events and aim to better understand minute heat island temperature fluctuations to allow for more precise power distribution via the Con-Edison grid.

- Our derivatives may help to forecast surge events for both flooding and electricity as the occurrence of both is directly tied to their requisite variable.
    - Precipitation: More precise flood prediction may allow for the preemptive diversion of traffic thereby lowering travel times and decreasing emissions.
    - Temperature: Better measurements may allow for increased grid efficiency thereby lowering demand, and production, emissions.
        - Positive effect on the citizens of NYC.

- Future work will aim to acquire additional NWS and satellite datasets; Automate all file transformations and assimilation of datasets; Create near-real-time (NRT), publicly facing, merged datasets of precipitation and temperature for NYC.

Acknowledgements