NOAA-CESSRST CENTER FOR EARTH SYSTEM SCIENCES AND REMOTE SENSING TECHNOLOGIES

CUNY THE GREATEST URBAN UNIVERSITY IN THE WORLD

The City College of New York

Its Getting Hot In Here!

Utilizing an Improved Analysis from the NYC Micronet to Monitor, Forecast and Communicate Extreme Temperatures Across New York City

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Agenda

- Introduction
- Mesonet Data
- Satellite Data
- Socioeconomic Indicators in New York City
- Conclusion
- Future Works / Career Goals
- Thanks & Acknowledgements

Introduction

Bio: Haitian-American from Brooklyn, NY, USA

Education:

- SUNY Alfred State, Electrical Engineering Tech, A.A.S
- CUNY City Tech, Computer Engineering Tech, B.Tech.

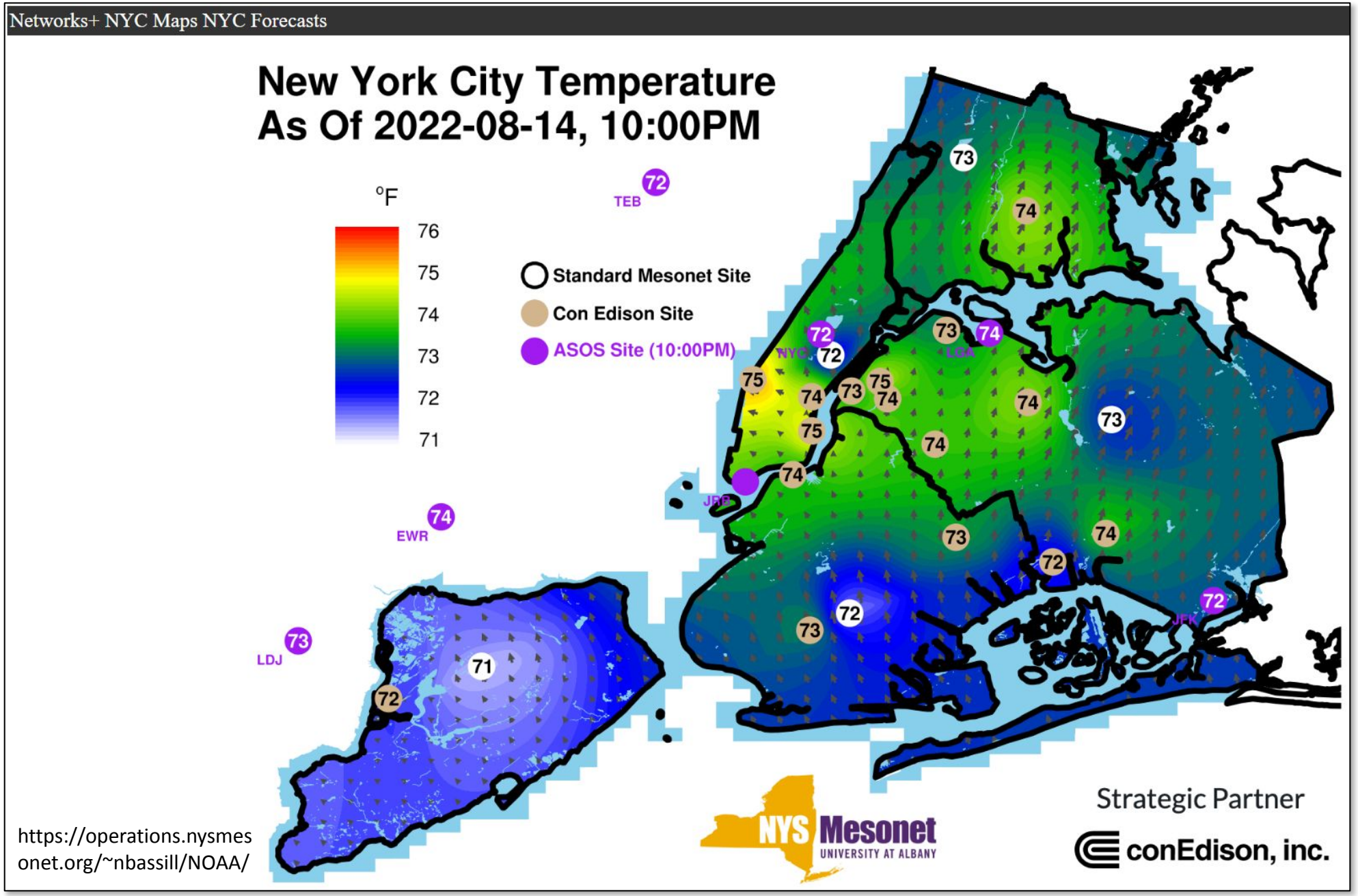
- **Pursuing M.S. in Sustainability in the Urban Environment**
- NOAA's mission alignments:
  - Weather Ready Nation
  - Understand & predict changes in climate, weather, ocean and coasts
  - Share knowledge and information with others

Professional Development Activities

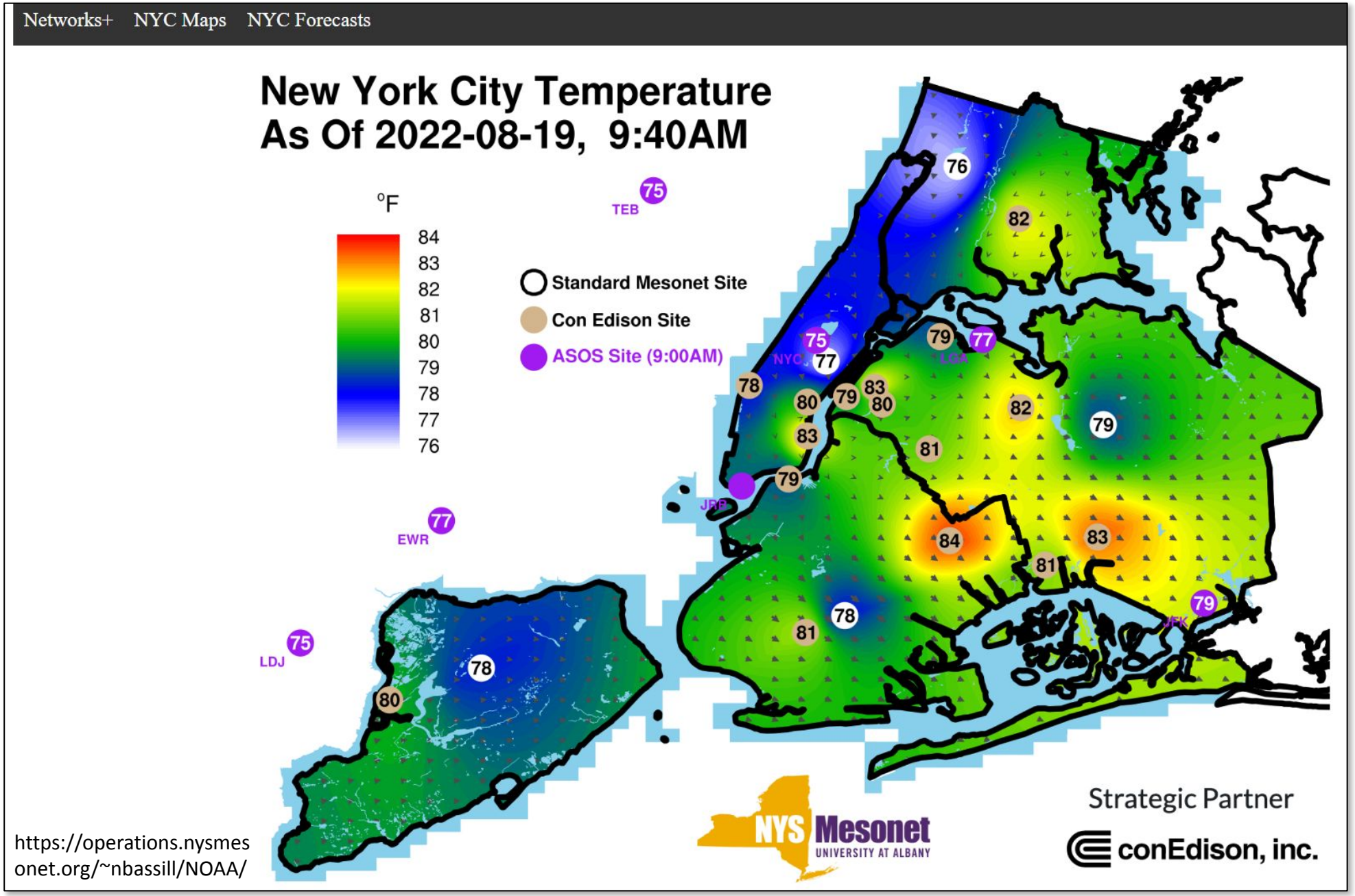
- Shadowing at NWS National Operations Center Silver Spring, MD
- Shadowing at NCEP/WPC College Park, MD
- Professional development meeting with federal employees/contractors
- Scheduled professional development seminars

NERTO Research Summary: Its Getting Hot in Here!!

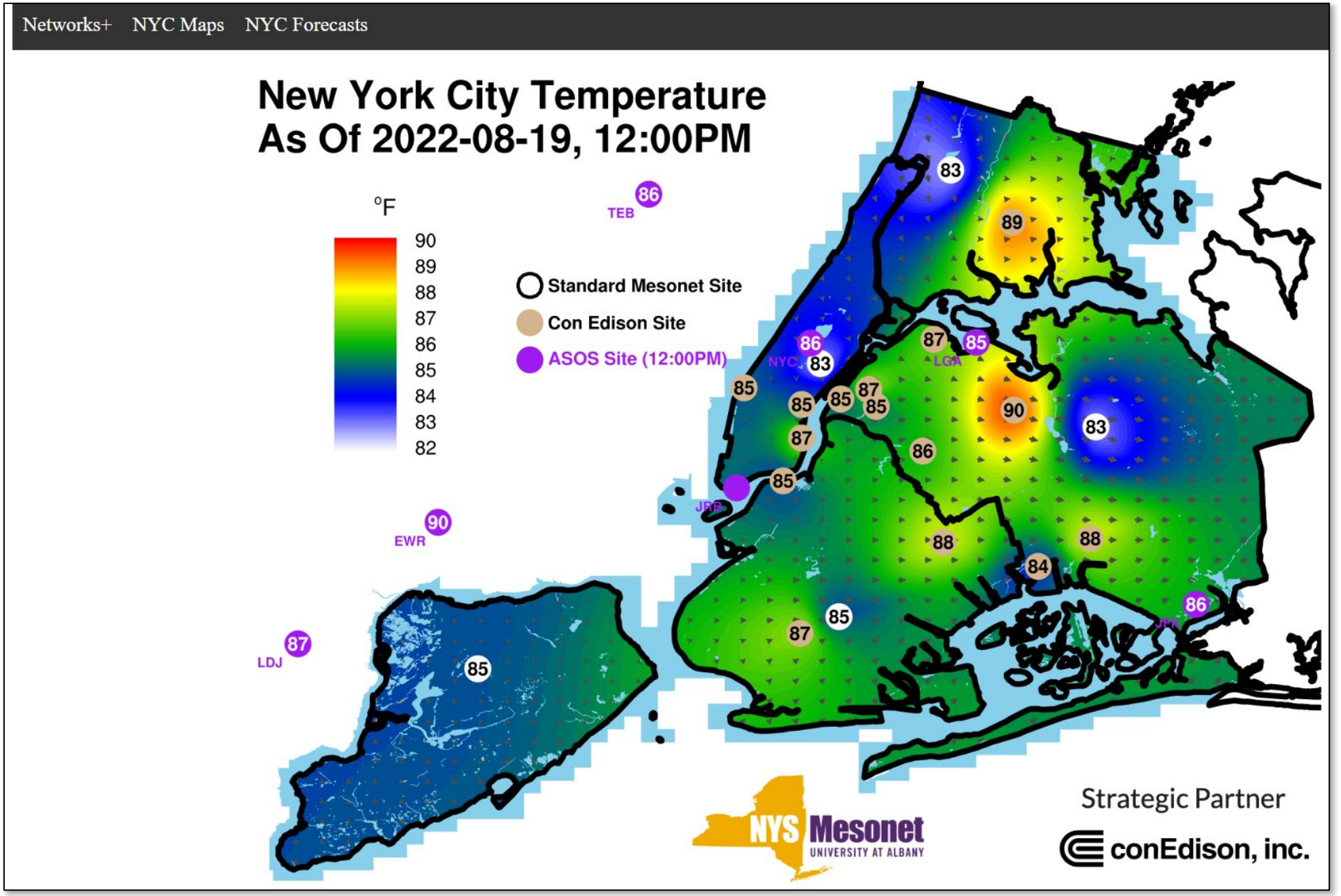
New York City Micronet



New York City Micronet



New York City Micronet



Micronet Wet Bulb Globe Temp Calculations

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: $WBGT$ = *Wet Bulb Globe Temperature Index*

$Tn = NWB$ = *Nature Wet-Bulb Temperature*

$Ta = DB$ = *Dry-Bulb Temperature*

$Tg = GT$ = *Globe Temperature*

Micronet Wet Bulb Globe Temp Calculations

	station	date_time
1326	QNLICI	2021-06-05 14:30:00
1328	QNLICI	2021-06-05 14:40:00
1329	QNLICI	2021-06-05 14:45:00
1330	QNLICI	2021-06-05 14:50:00
1331	QNLICI	2021-06-05 14:55:00
...	...	...
26492	QNLICI	2021-08-31 23:40:00

Micronet Data Date Timestamps

air_temp_c	WBGT_C
26.40	44.938048
26.88	45.780281
26.77	45.159719
26.75	45.224897
26.86	45.512376
...	...
27.55	39.981450

Fig 1

air_temp_c	WBGT_C
26.40	32.188014
26.88	32.925534
26.77	32.555663
26.75	32.650760
26.86	32.823791
...	...
27.55	29.727667

Fig 2

air_temp_c	WBGT_C
26.40	26.836880
26.88	27.013424
26.77	27.040218
26.75	26.912358
26.86	26.992067
...	...
27.55	29.727667

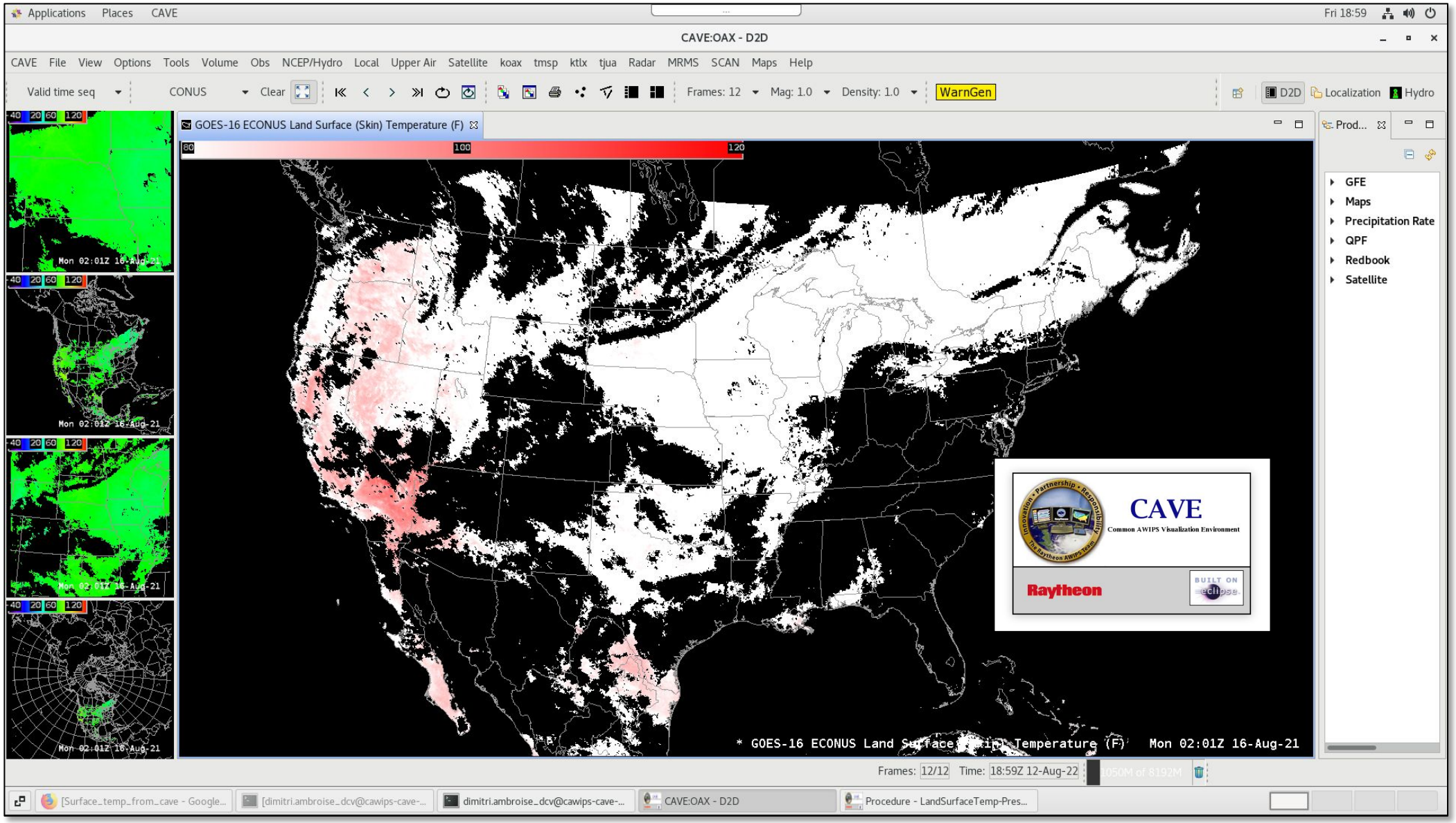
Fig 3

Fig 1: Calculating WBGT: Wetbulb formula suggested by Dr. Vincent E. Dimiceli & Steven F. Piltz; Zenith angle 90°

Fig 2: Calculating WBGT: Wetbulb formula suggested by Sean Heuser ; Zenith angle 90° ⟵

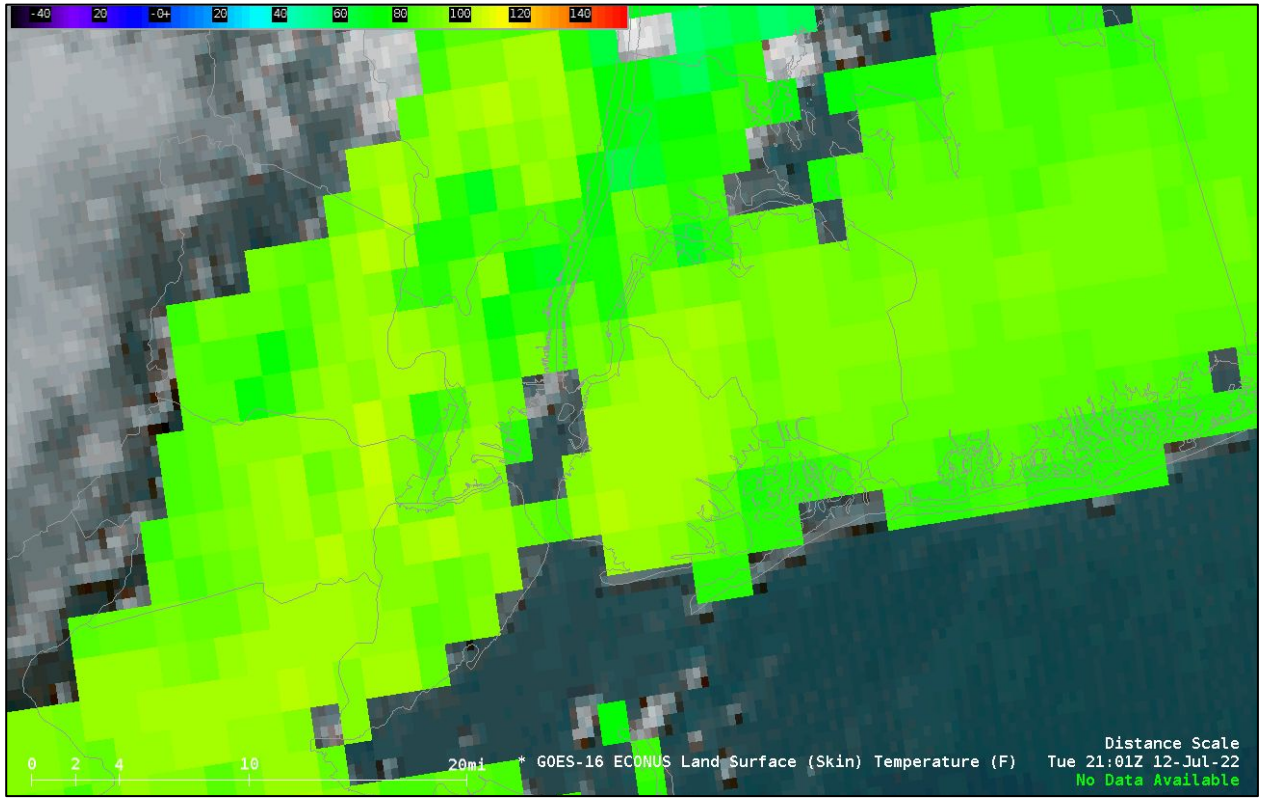
Fig 3: Calculating WBGT: Wetbulb formula suggested by Sean Heuser ; Zenith angle 89.9506° ⟵

Satellite Data via AWIPS & CAVE

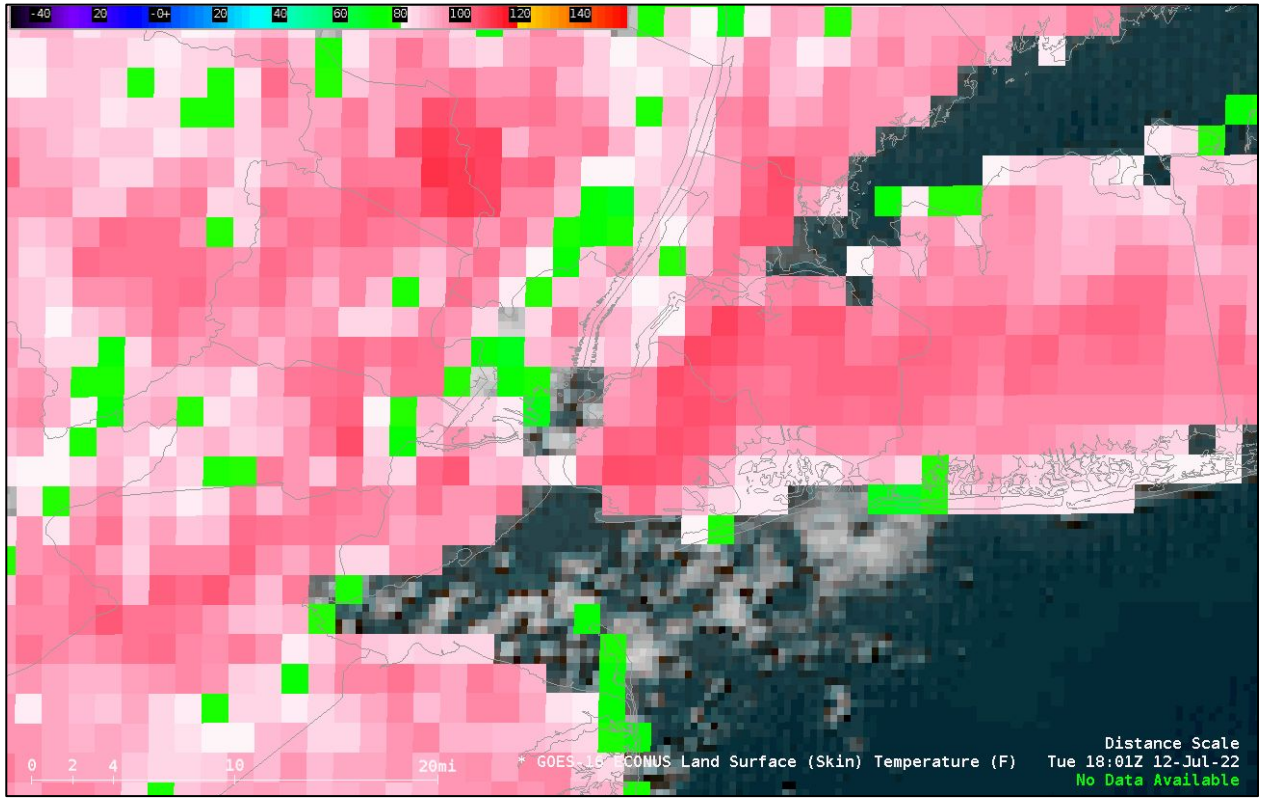


Example of AWIPS via the CAVE application

Initial Real Time Land Surface Temperature Observations, NYC

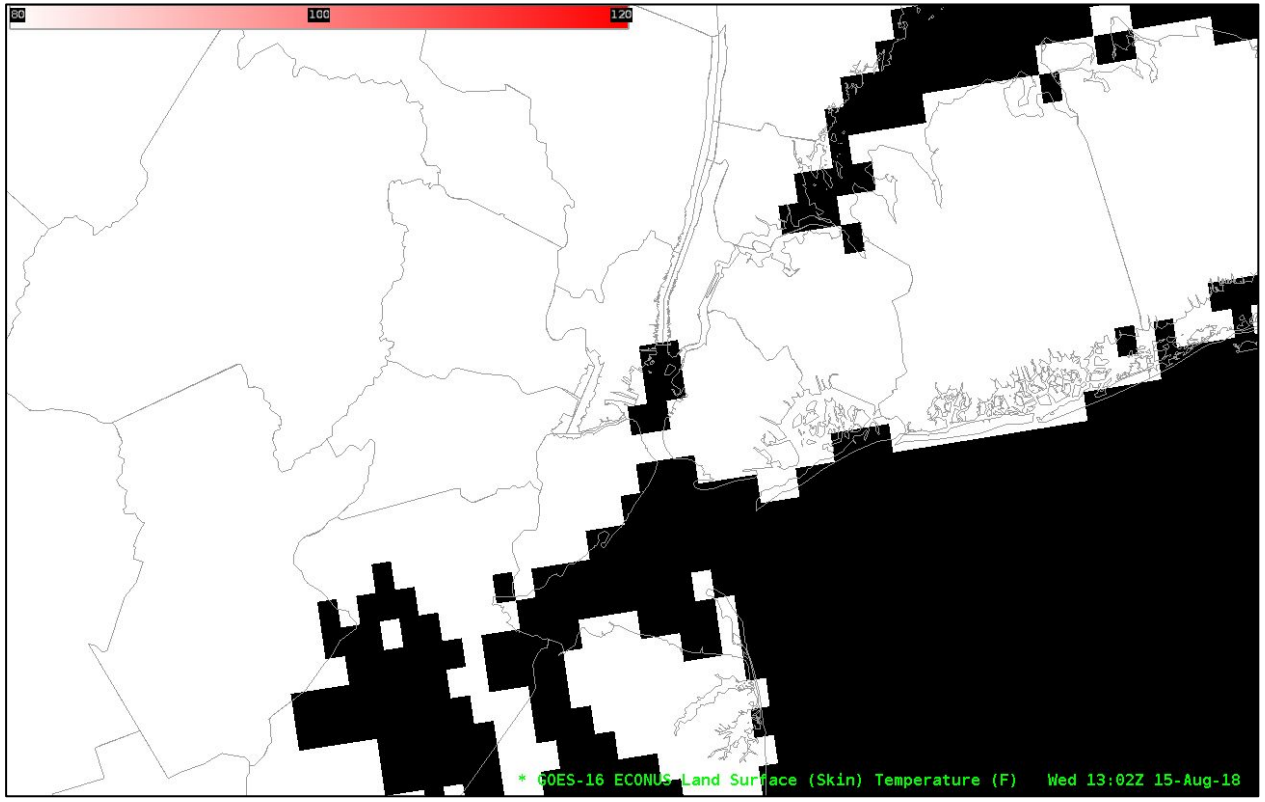


LST observation pull for Jul 12, 2022 focused on NYC temperature range (-40°F - 140°F rainbow-scale)

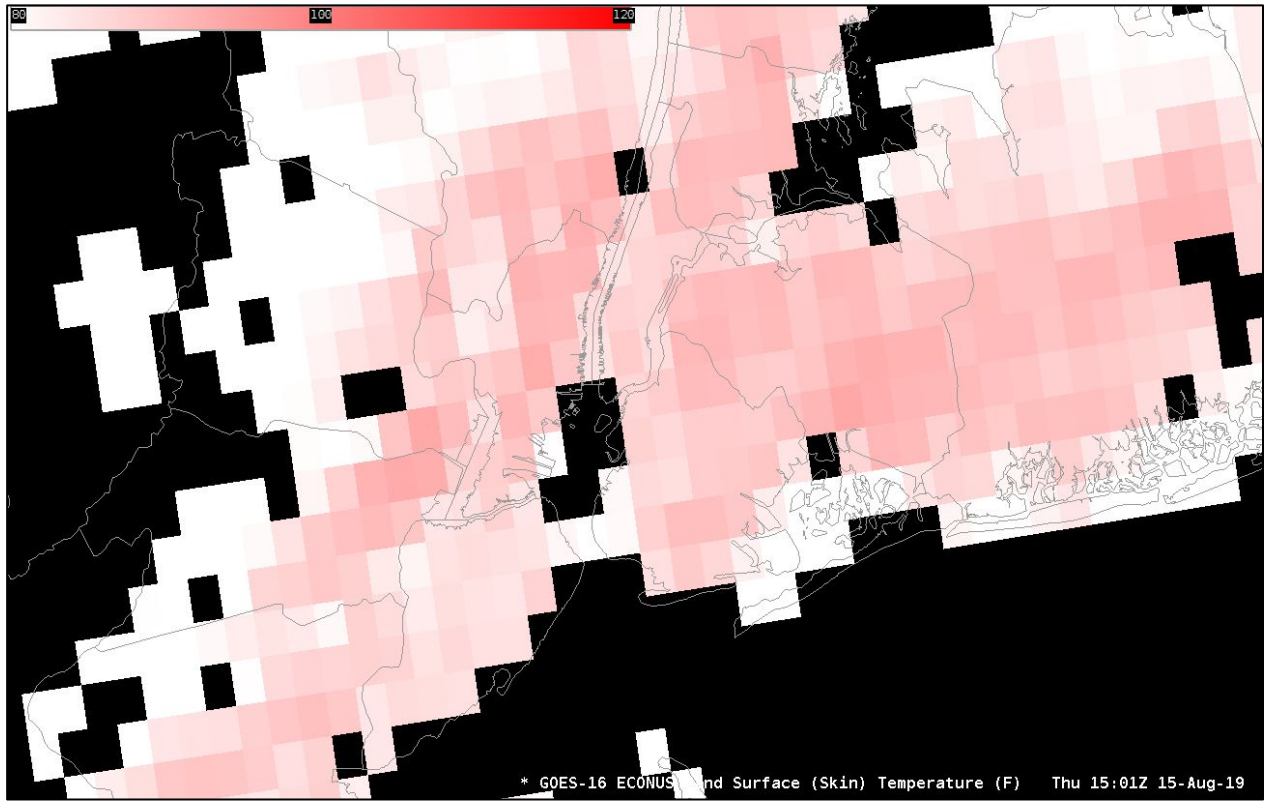


LST observation pull for Jul 12, 2022 with interpolation to highlight Heat Index temperature range (80°F - 120°F in red) focused on NYC

Annual Archived Land Surface Temperature Observations, NYC

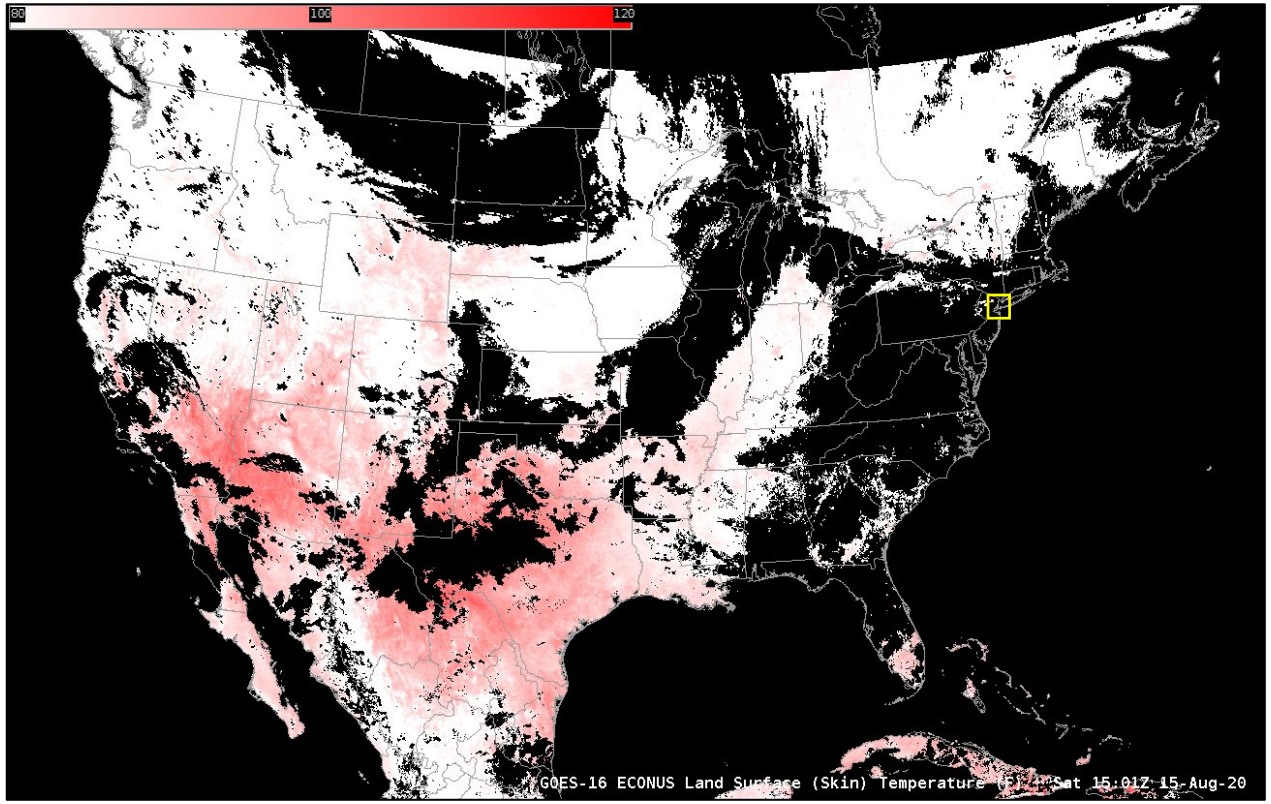


LST observation pull for Aug 15, 2018 focused on NYC
Heat Index temperature range (80°F - 120°F in red gradient)

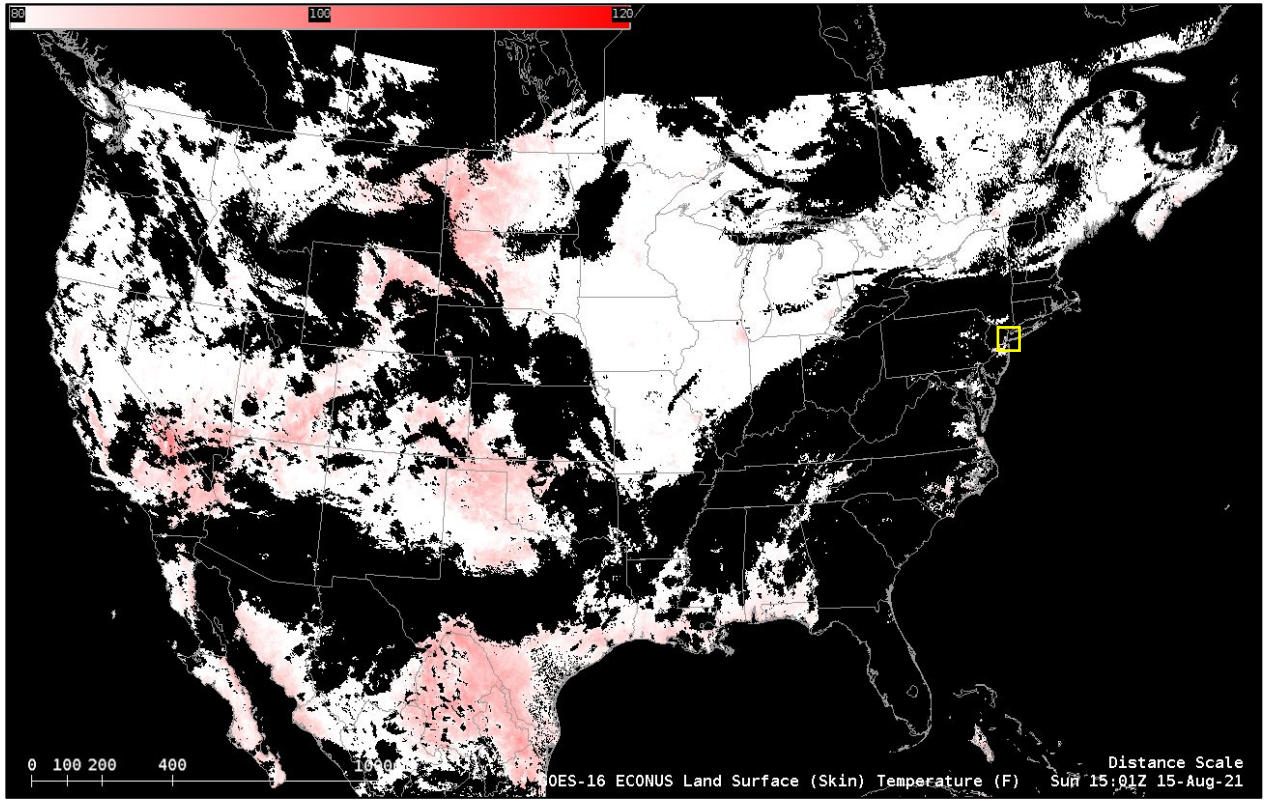


LST observation pull for Aug 15, 2019 focused on NYC
Heat Index temperature range (80°F - 120°F in red gradient)

Annual Archived Land Surface Temperature Observations, US CONUS

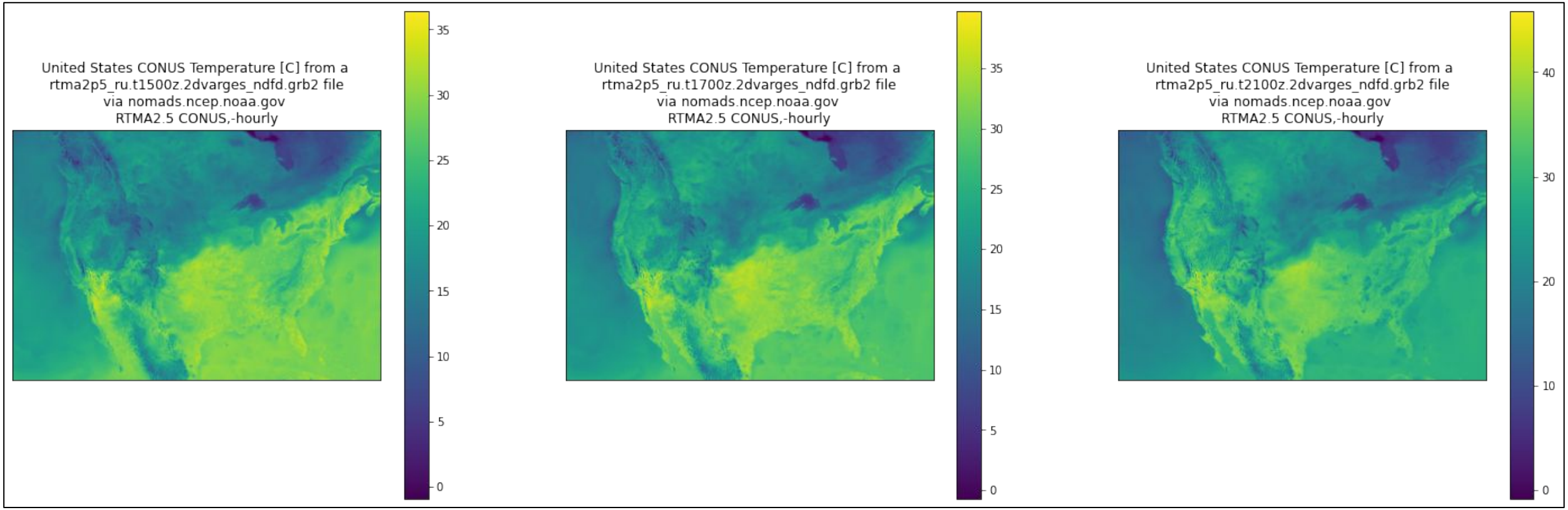


LST observation pull for Aug 15, 2020 focused on CONUS
Heat Index temperature range (80°F - 120°F in red gradient)



LST observation pull for Aug 15, 2021 focused on NYC
Heat Index temperature range (80°F - 120°F in red gradient)

US CONUS Real-Time Temperature [C] Observations

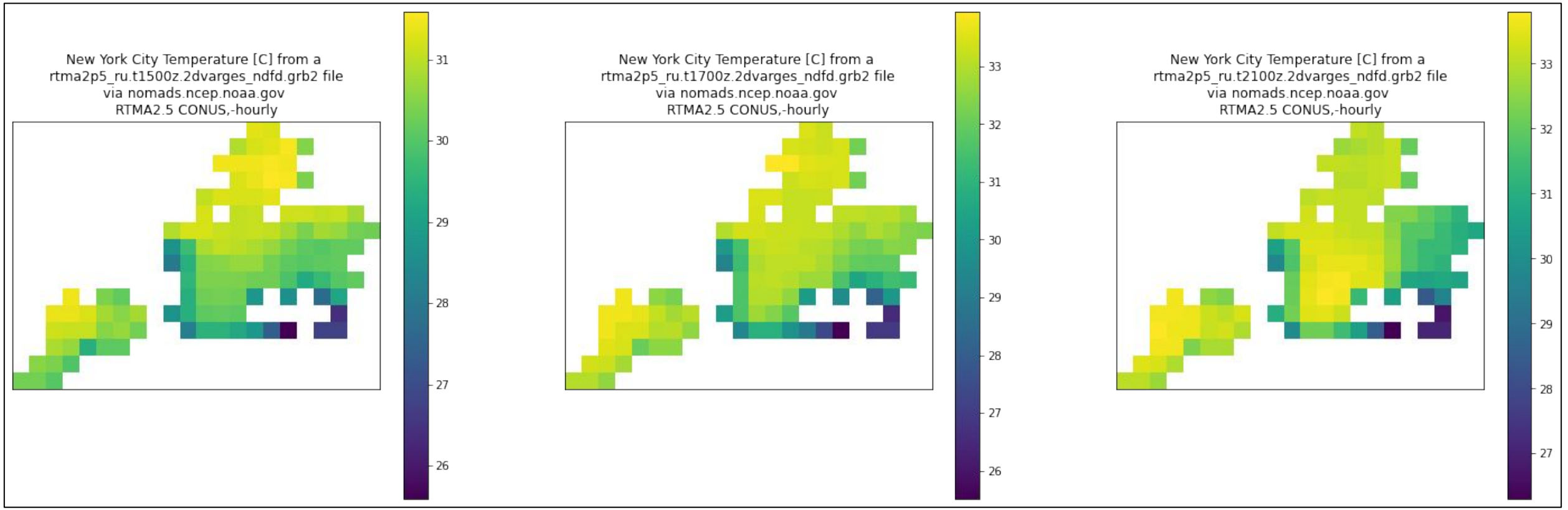


Aug 7th 2022, 1500z (11am EST)

Aug 7th 2022, 1700z (1pm EST)

Aug 7th 2022, 2100z (5pm EST)

NYC Real-Time Temperature [C] Observations

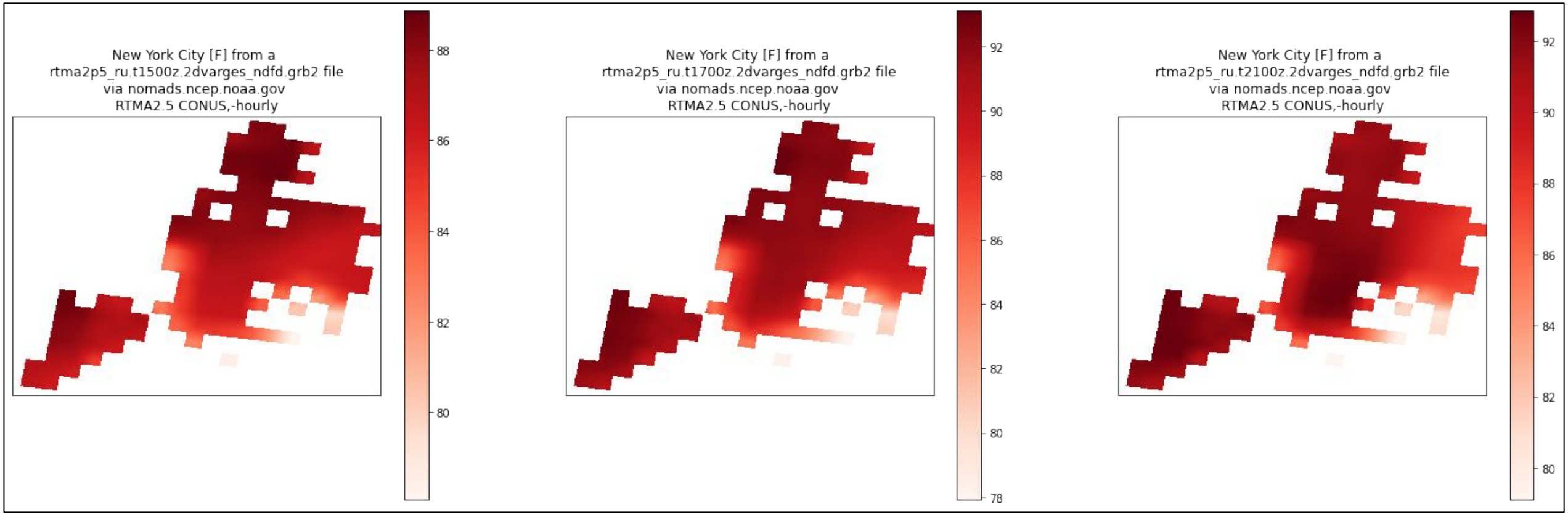


Aug 7th 2022, 1500z (11am EST)

Aug 7th 2022, 1700z (1pm EST)

Aug 7th 2022, 2100z (5pm EST)

NYC Real-Time Temperature [C] Observations



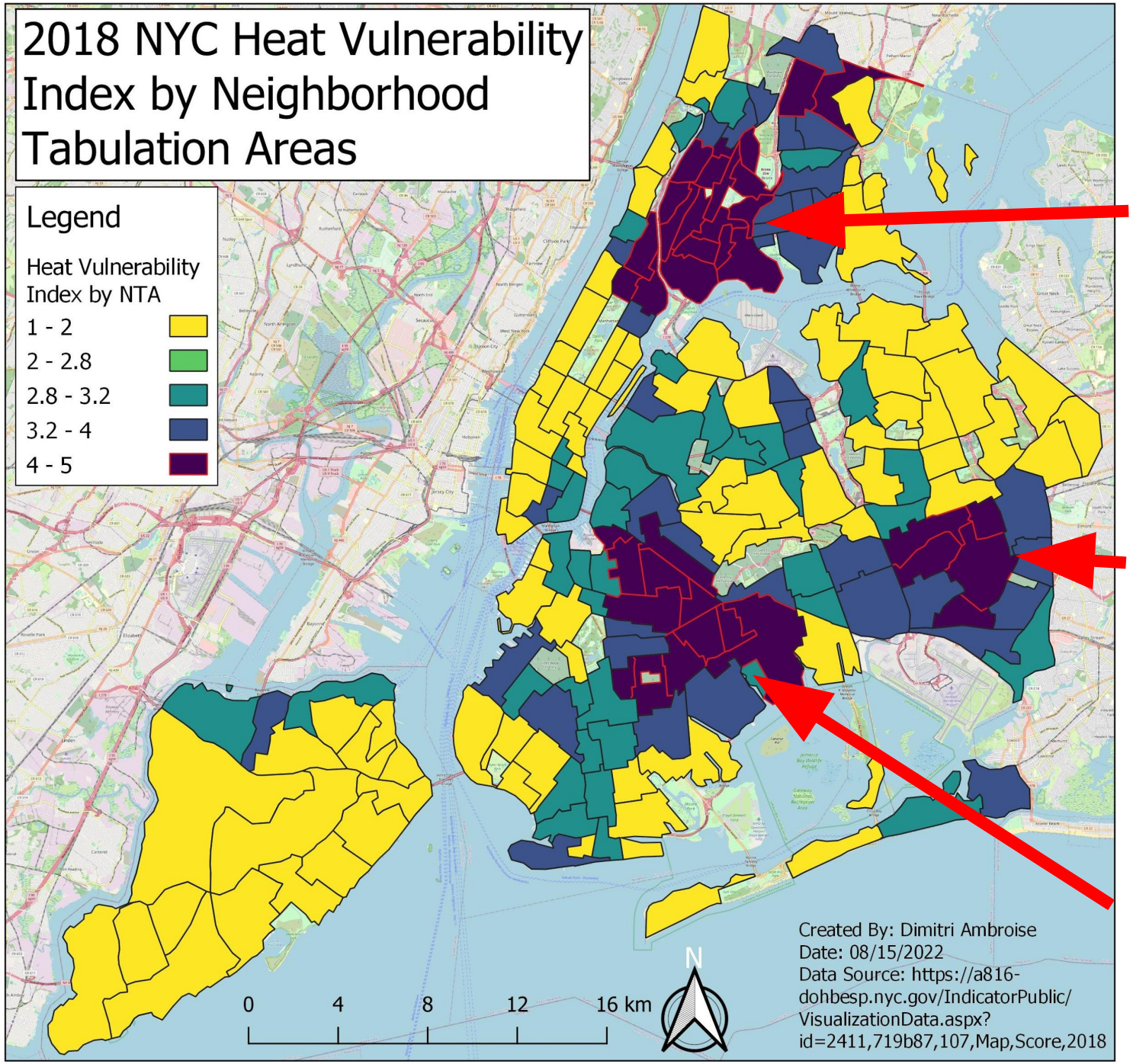
Aug 7th 2022, 1500z (11am EST)

Aug 7th 2022, 1700z (1pm EST)

Aug 7th 2022, 2100z (5pm EST)

Heat Wave Social and Socioeconomic Indicators

NYC Heat Vulnerability Index

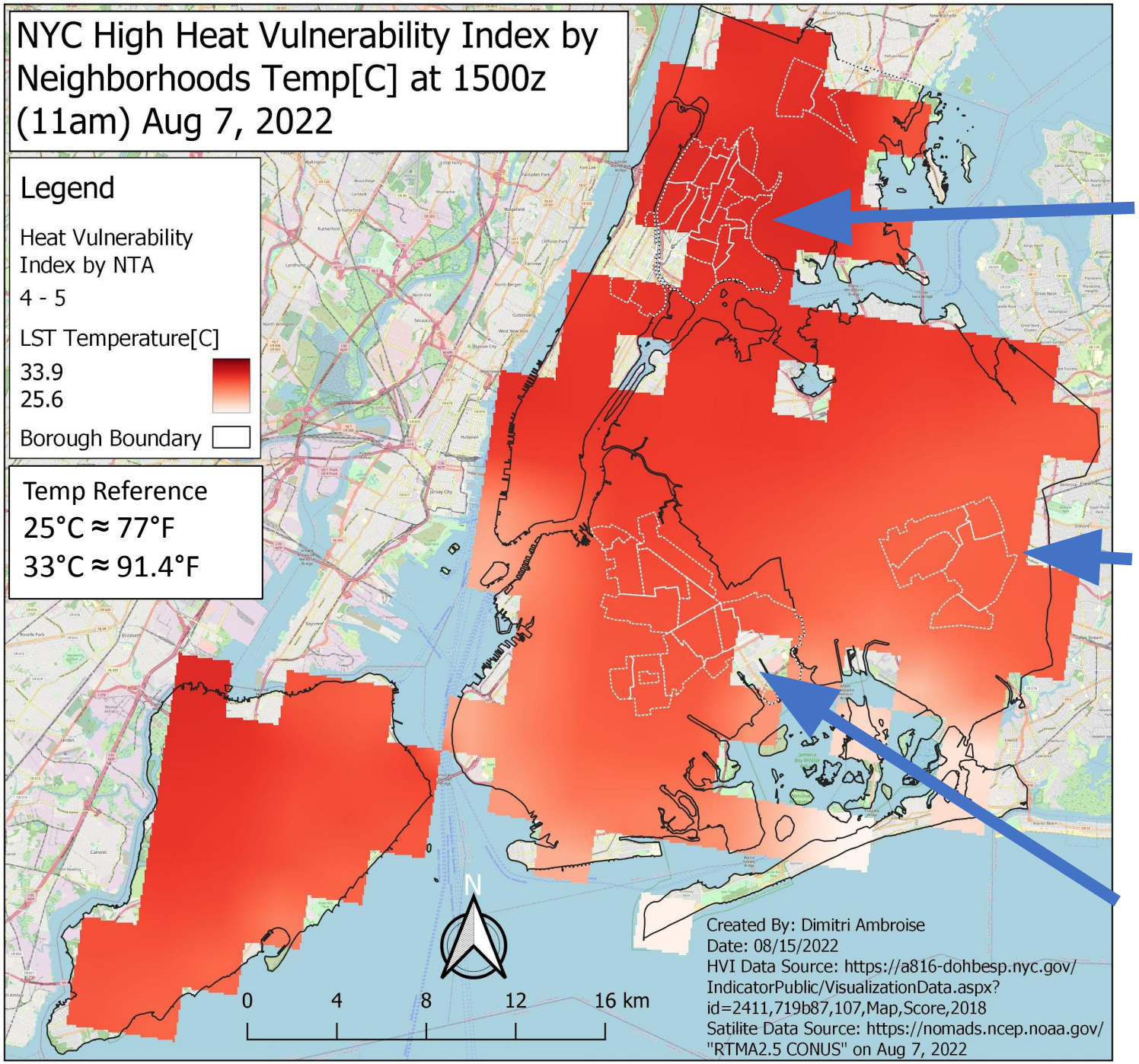


Harlem/ Spanish-East Harlem, Manhattan & South Bronx, Bronx

Jamaica /Hollis/ St. Albans Queens

East New York/ Bedford-Stuyvesant/ Williamsburg, Brooklyn

NYC Hot Surface Temperatures



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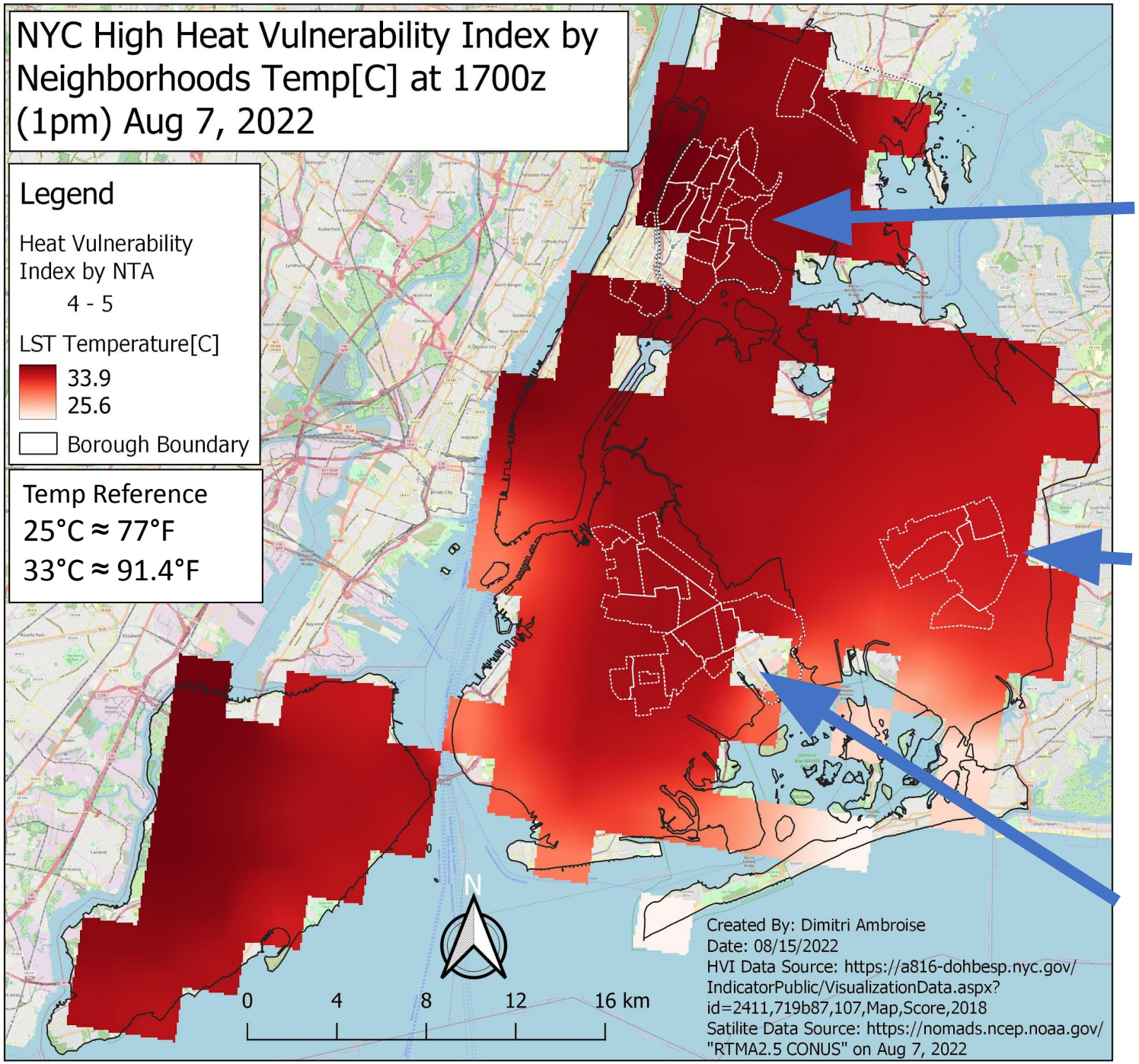
NYC Hot Surface Temperatures



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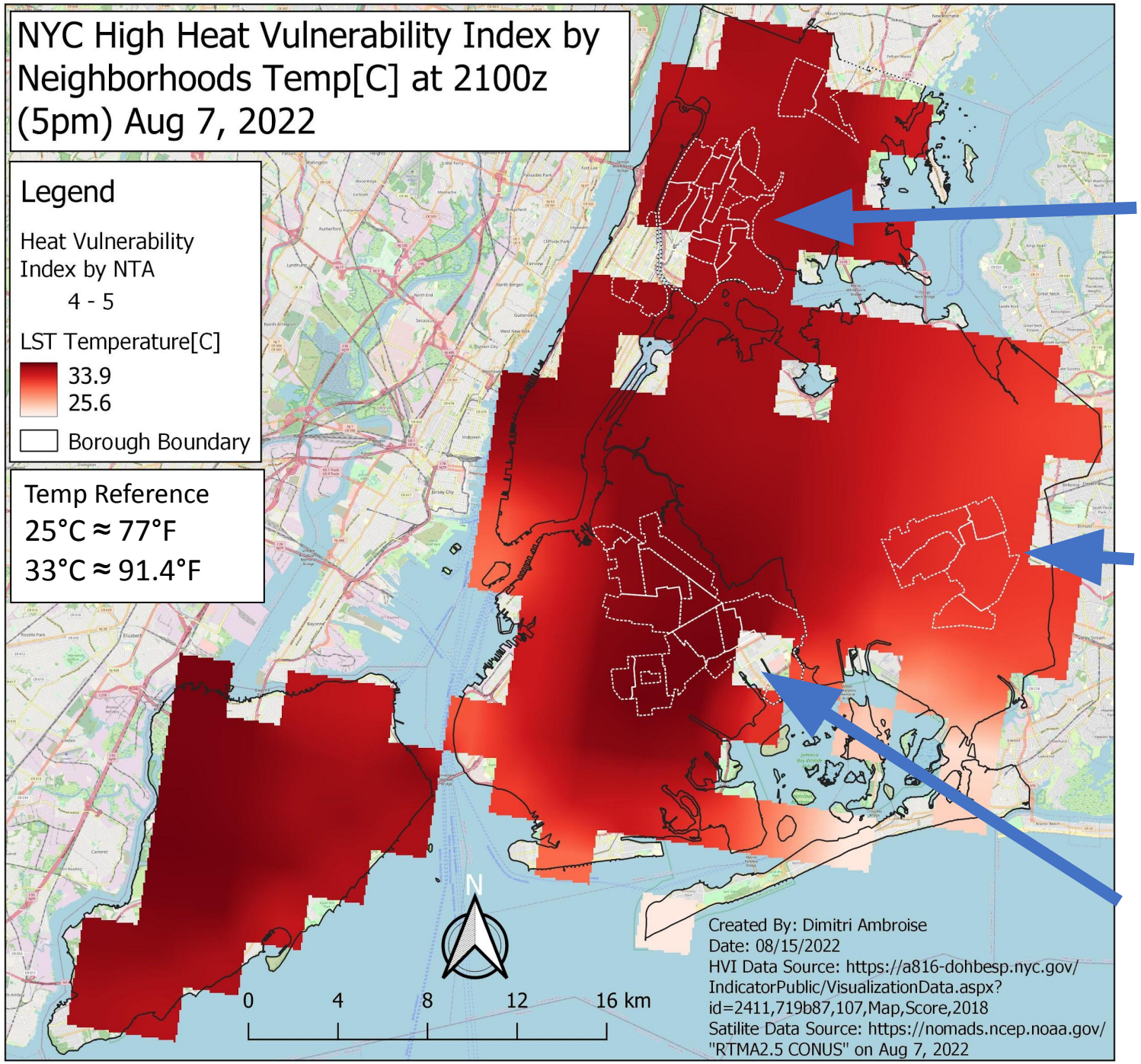
NYC Hot Surface Temperatures



Harlem/ Spanish-East Harlem, Manhattan & South Bronx, Bronx

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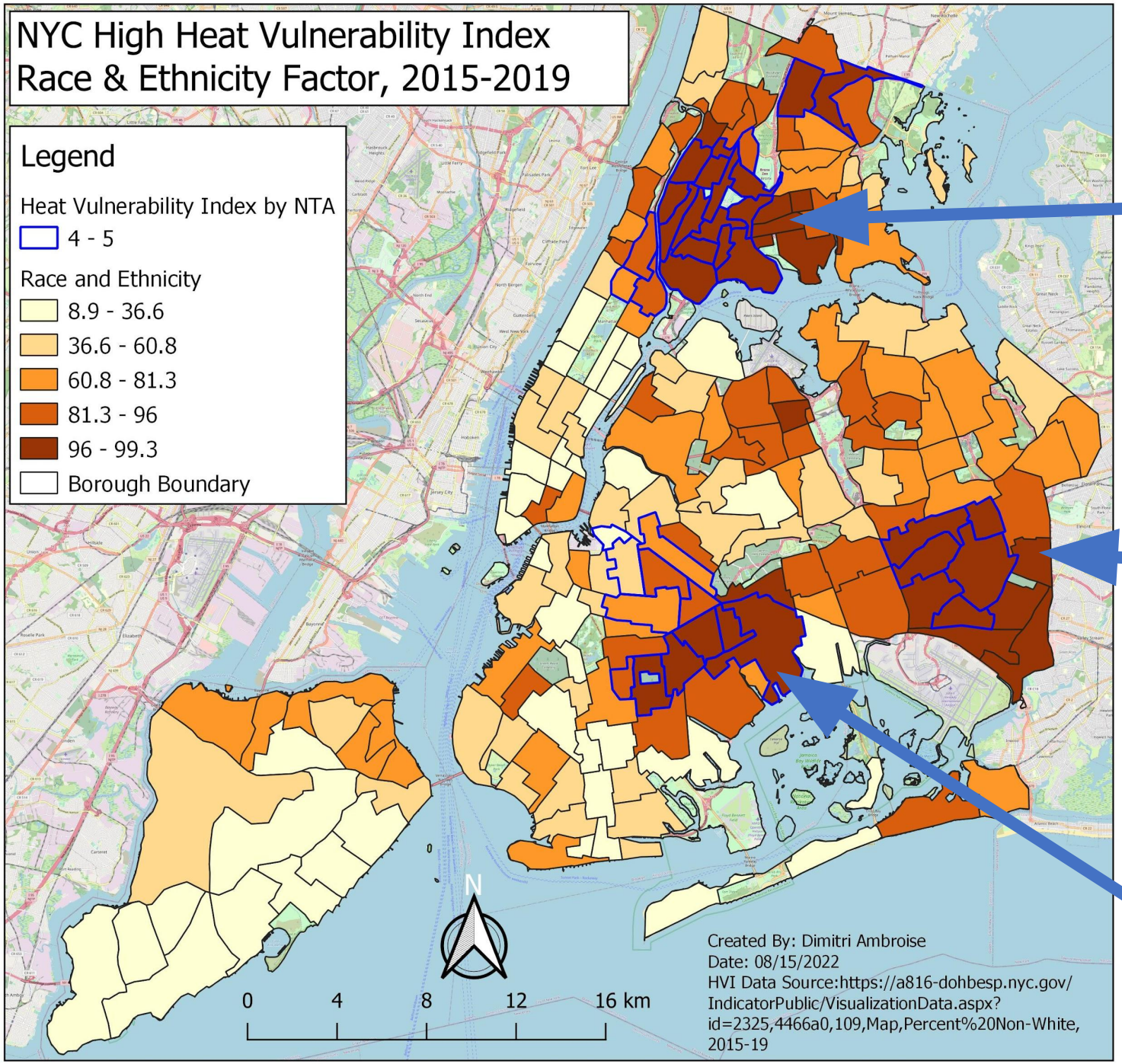
NYC Race and Ethnic Profile



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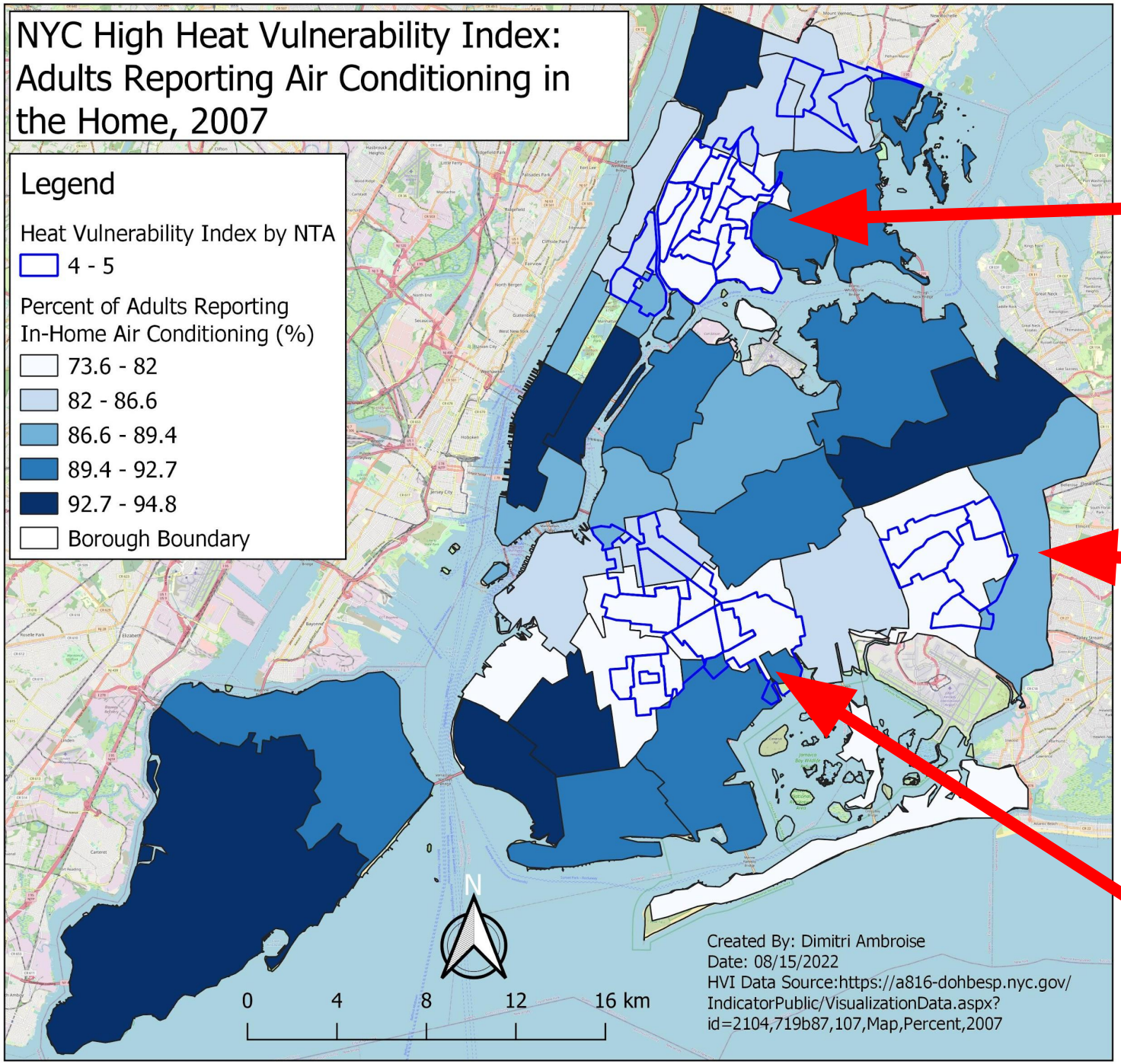
NYC Home Air Conditioning



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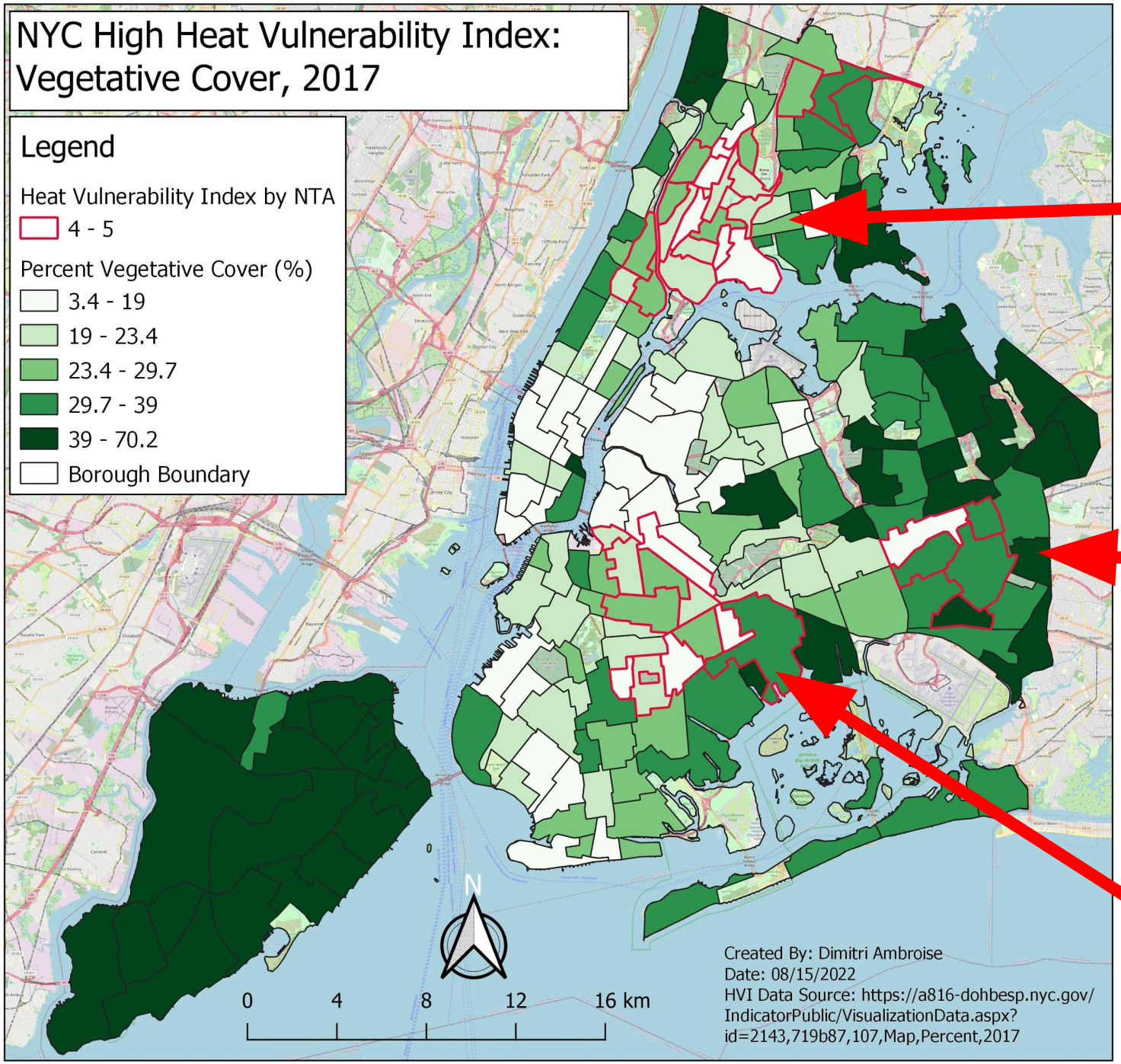
NYC Vegetation Cover



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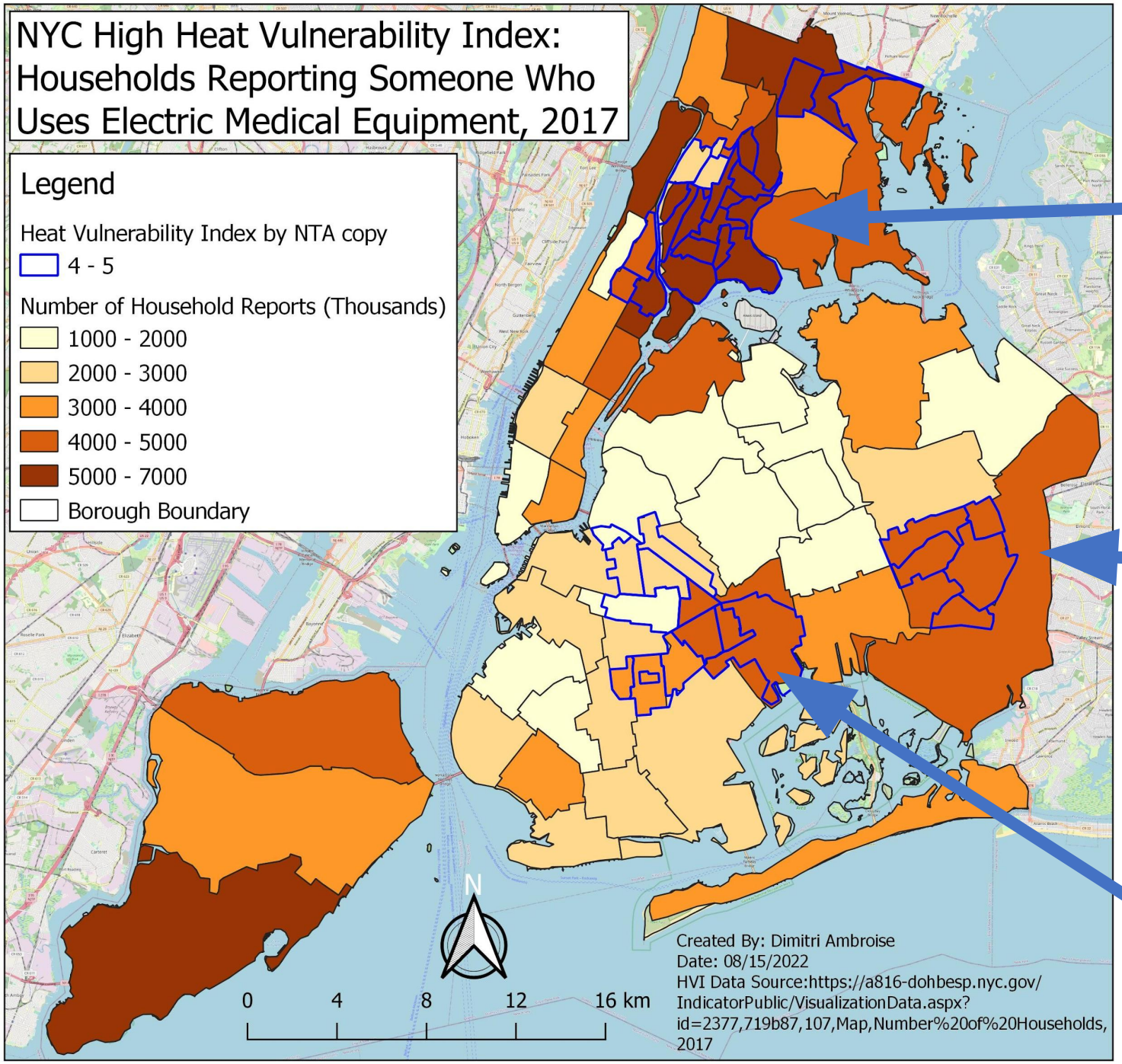
NYC House Holds with In-Home Medical Equipment



Harlem/ Spanish-East Harlem, Manhattan & South Bronx, Bronx

Jamaica /Hollis/ St. Albans Queens

East New York/ Bedford-Stuyvesant/ Williamsburg, Brooklyn

NERTO Research Summary: Conclusions

- Heat Waves have the capacity to increase in frequency and intensity
- The individuals most likely to be affected:
  - Young / Elderly
  - Minority
  - Medically Disabled
  - Low Income
- The individuals least likely to be affected:
  - Working Age
  - White / White-Passing Individuals
  - Able Bodied
  - Wealthy/ Affluent
- More vegetative cover in the high risk neighborhoods have the capacity to lead to reduced surface temperatures

Future Works

- Complete Data Cleaning
  - Verify WBGT Accuracy for Micronet
  - Calculate WBGT for RTMA Data
  - Automate Zenith Angle calculation
- Effect of wind direction over land and water, is transplanting or transferring heat
- Effect of bodies of water, is it cooling or heating
- Combine/correlate Micronet data with satellite data
- More extensive social impact research
  - Income/ wealth distribution
  - Crime rates
  - Language Barrier
  - Percent of persons 65+ living independently
  - Concentration of NYCHA buildings
    - Design of windows to allow AC Install
  - Local hospital locations

Future Professional and Career Goals

- M.S. Graduation Winter 2022/23
- Continue to expand on active NOAA related projects
- Publish a guide for beginner Data Scientists
- Apply to Physical Scientist positions with NOAA
- Possible grant proposal to conduct field research in the Caribbean

Thanks & Acknowledgements

- Mentors:
  - CESSRST Advisor: Dr. Tarendra Lakhankar
  - NOAA/NERTO Mentor(s): Dr. Jordan Gerth, Dr. Dave Radell , Dr. Nick Bassill
- Python Advisors:
  - Emanuella Igwe, NOAA TOWR-S Team
  - Salman Aslam, NOAA TOWR-S Team
  - Javier A. Villegas Bravo, NOAA Weather and Ocean Prediction Centers
  - Dr. Greg Carbin, NWS Forecast Operations Branch Chief
- Shadow Leaders/Participants:
  - Brian Montgomery |, Alex Lamers| NOAA/NWS NCEP WPC, Dr. Ashton Robinson | NOAA NWS WPC, Dr. Jose Galvez | WPC International Desk, Dr. Alima Diawoula | WPC International Desk,
- AWIPS Advisors:
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  - Kashaud Bowman | NOAA TOWR-S Team

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Thank You!

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Any Questions?