



A High Spatio-temporal Resolution Land Surface Temperature (LST) Product for Urban Environments

Glynn Hulley¹, Panagiotis Sismanidis³, Jeffrey Luvall², Iphigenia Keramitsoglou³

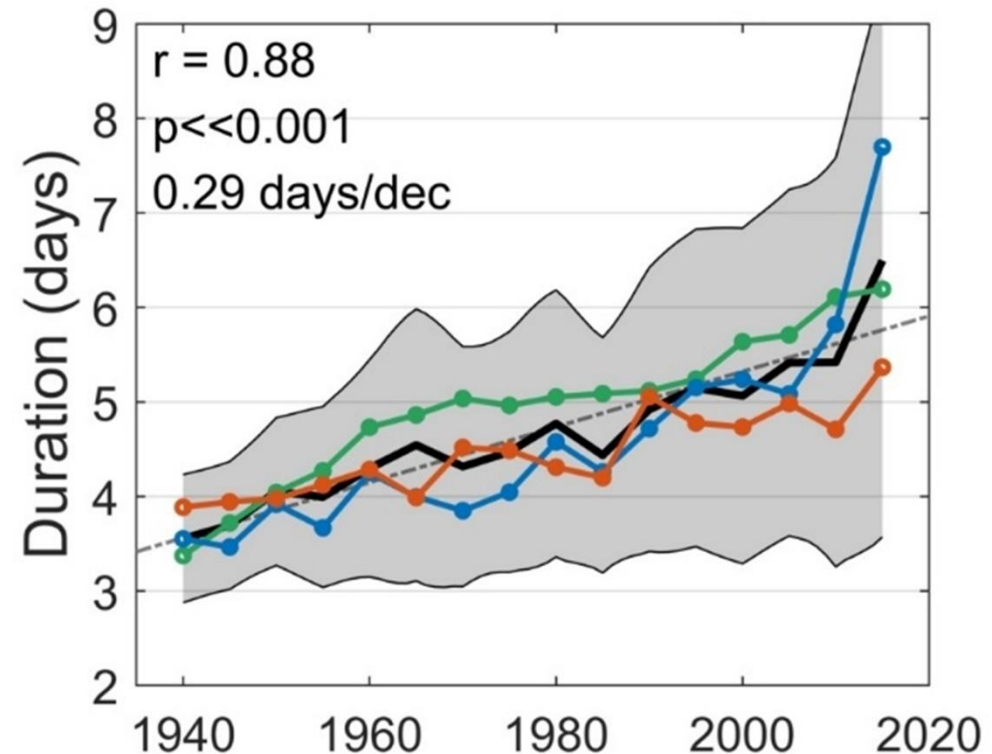
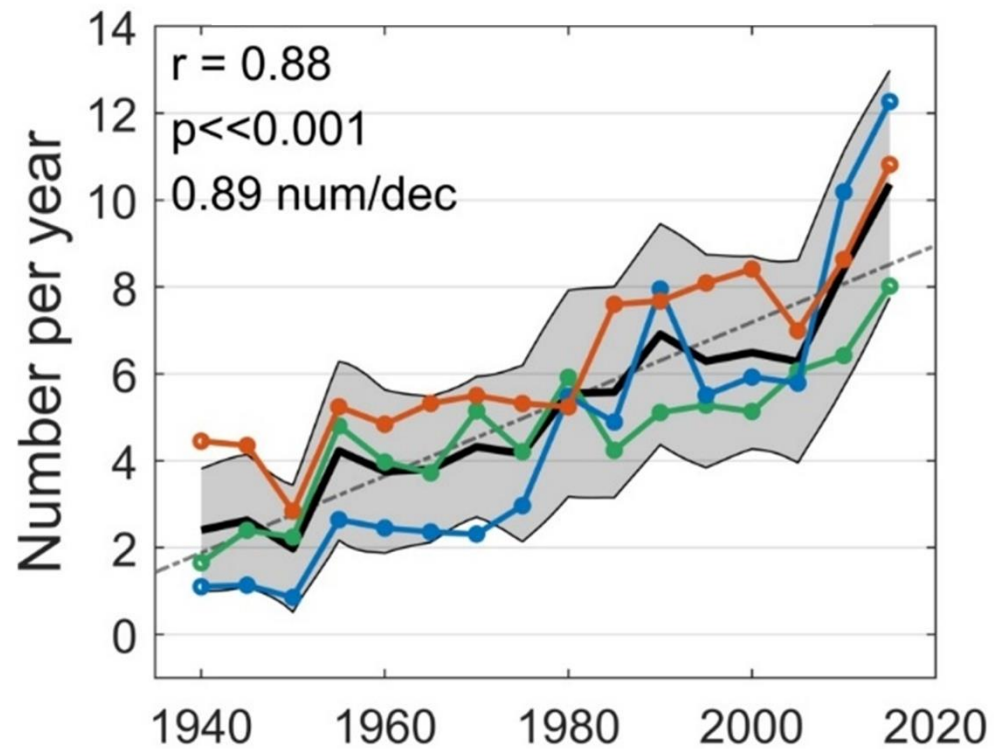
1. NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

2. NASA Marshall Space Flight Center, Huntsville, AL

3. National Observatory of Athens, Athens, Greece

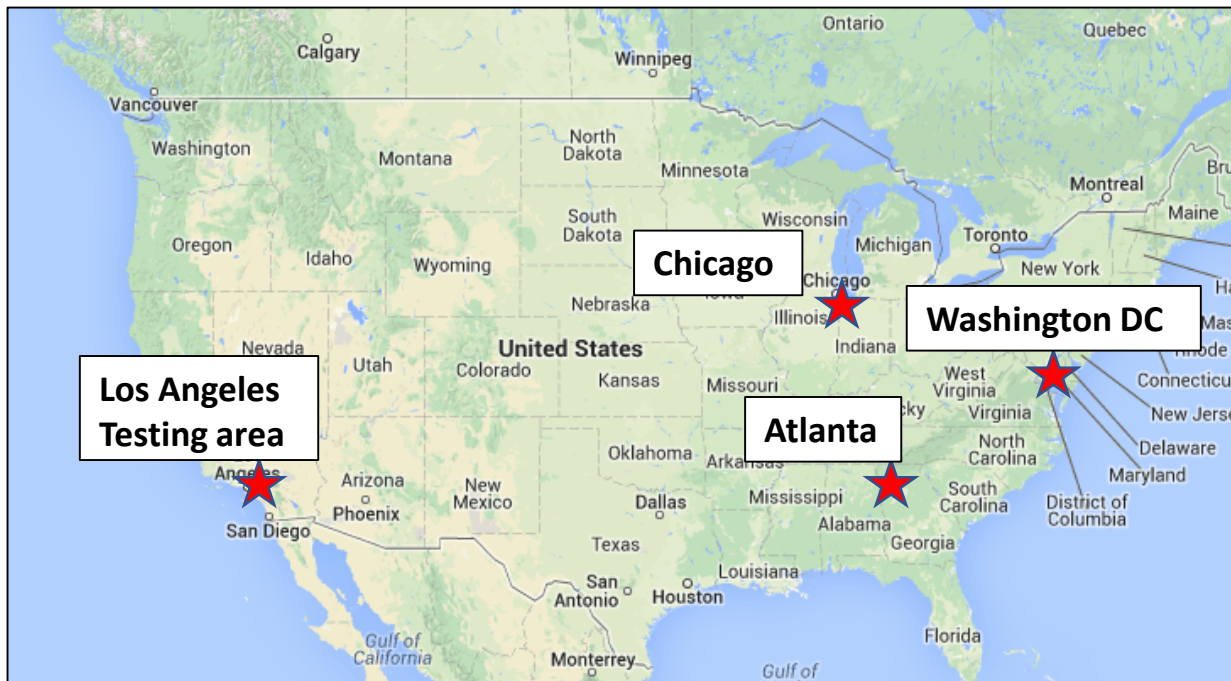
Heatwaves in urban regions are increasing at significant rates

- Need for data-driven recommendations to advise on policy decisions
- Heat mitigation, cooling, risk assessments, sustainability
- Requires: hourly, <100m fine scale surface/air temperature data

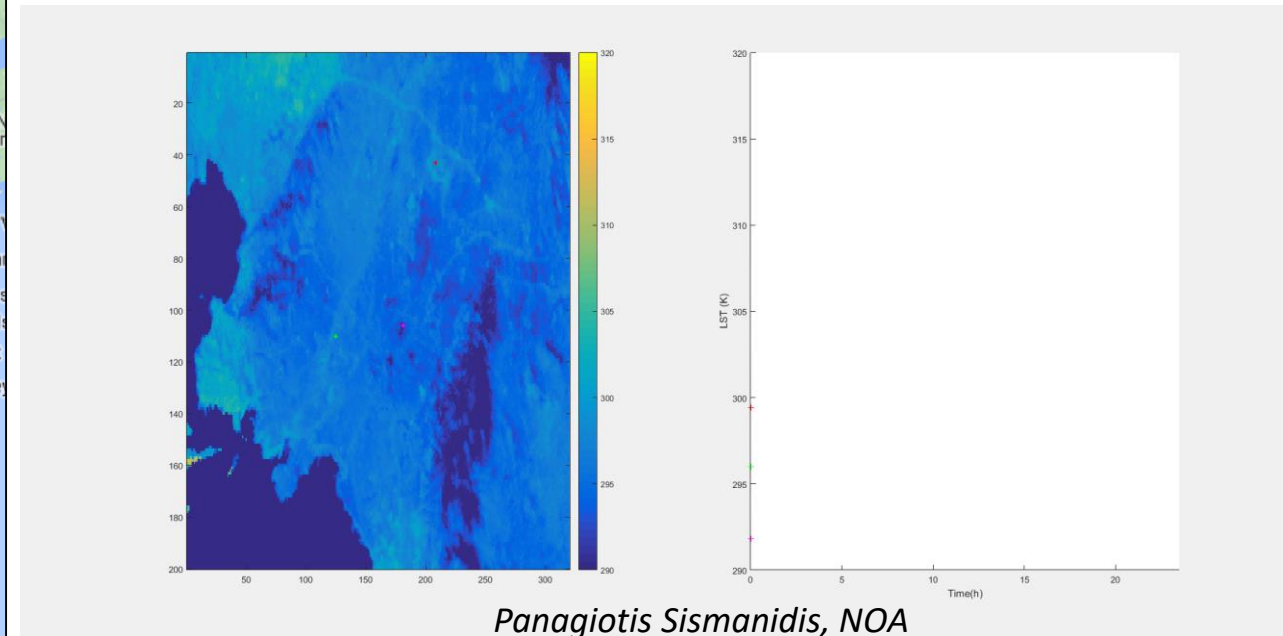


MuSLI Type 2 Prototype Product:

Product	Data	Spatial	Temporal
Urban Land Surface Temperature (LST)	Thermal: GOES-16, ECOSTRESS	100m	hourly
	Optical: Landsat 8, Sentinel-2, HLS		



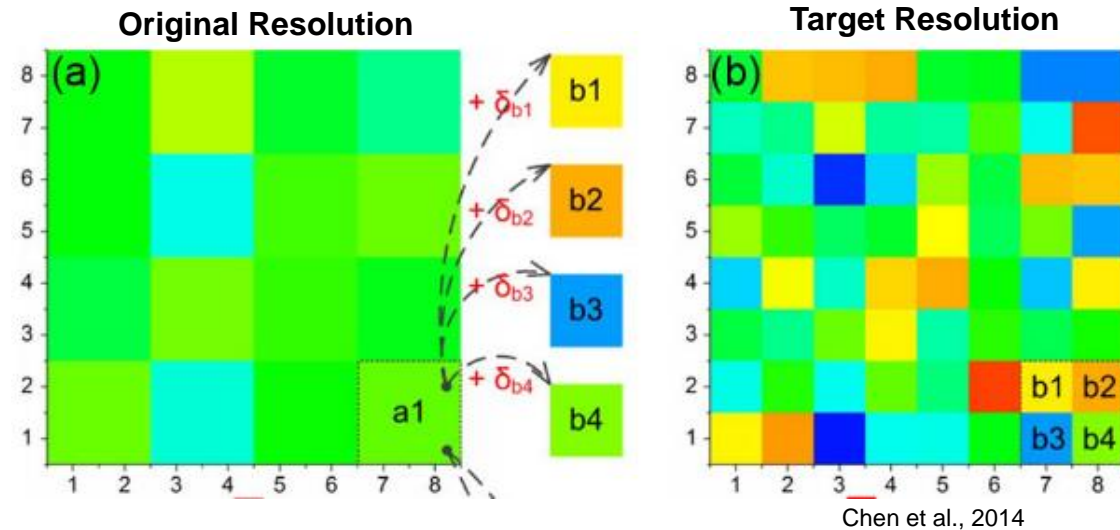
Athens, Greece



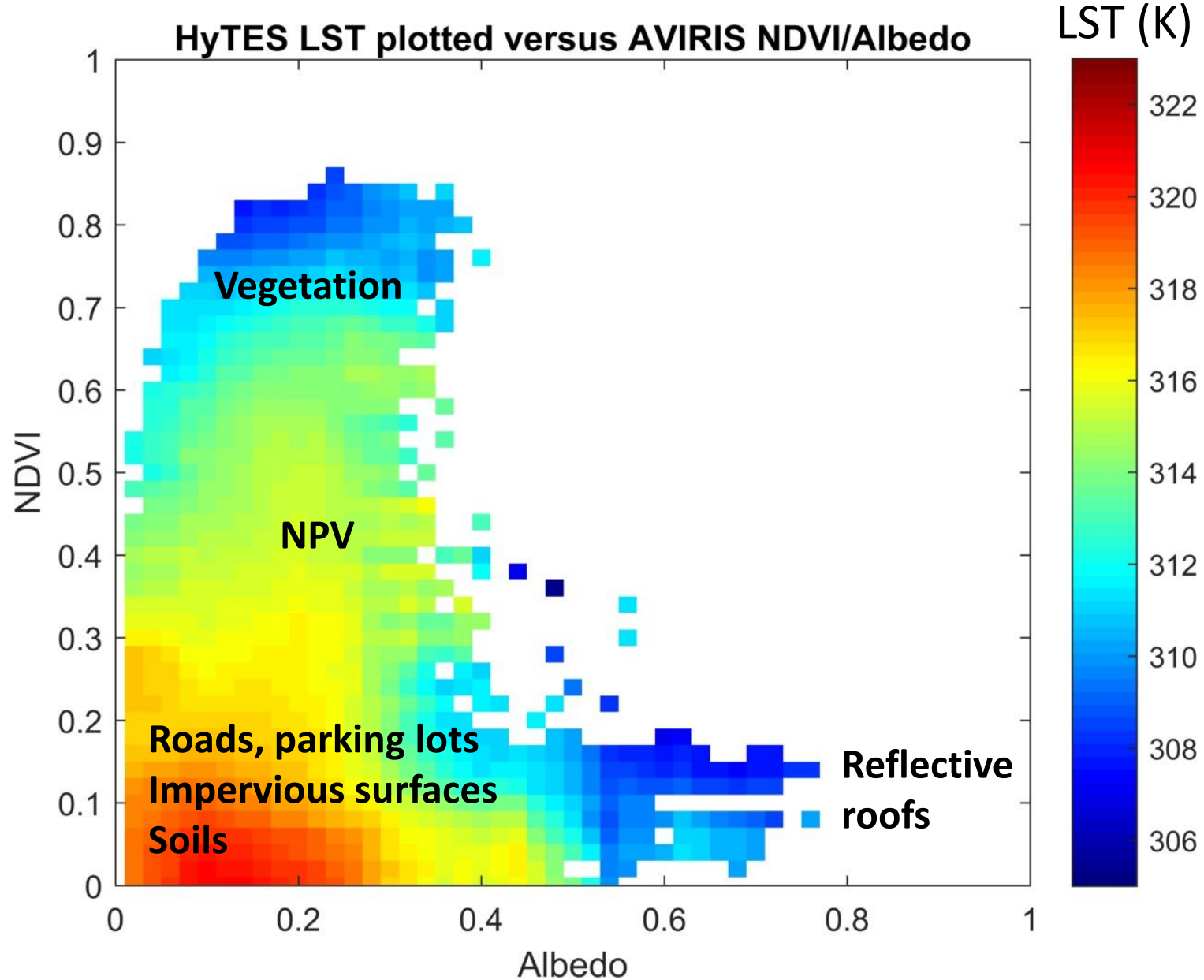
Land Surface Temperature (LST) Downscaling

Statistical downscaling **disaggregates** coarse-scale LST to its components

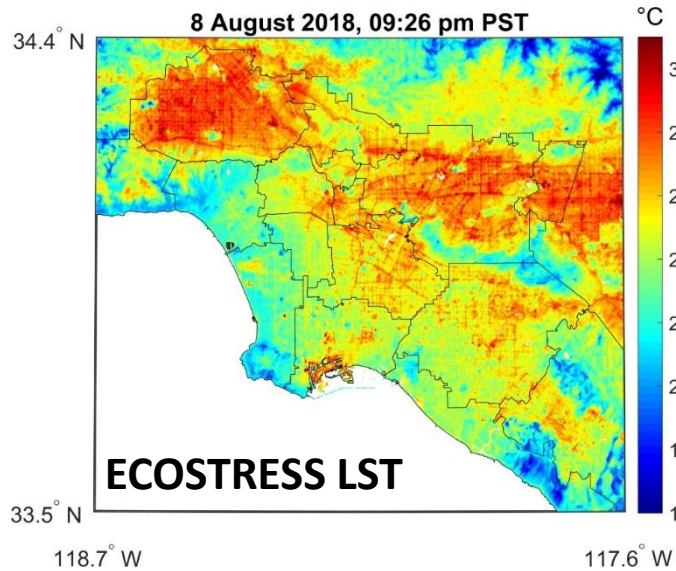
Using higher spatial resolution data **statistically correlated** to the LST



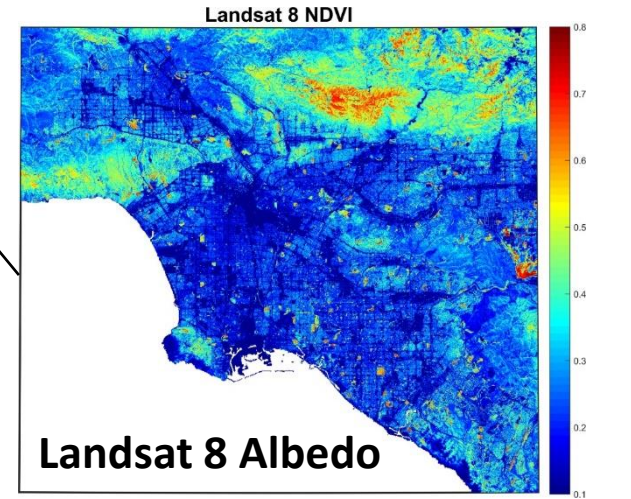
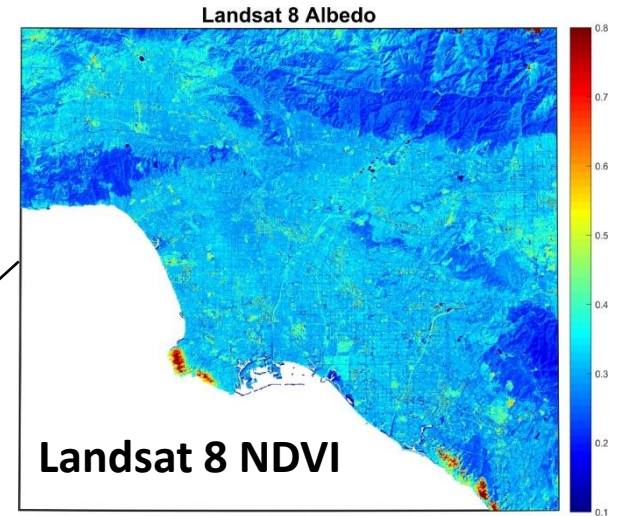
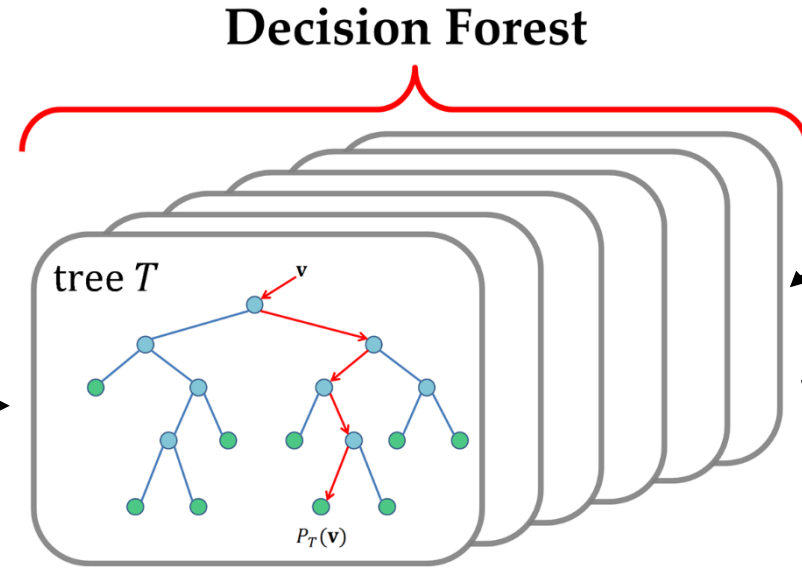
Albedo/NDVI/LST Urban Statistical Relationships



Random forest training

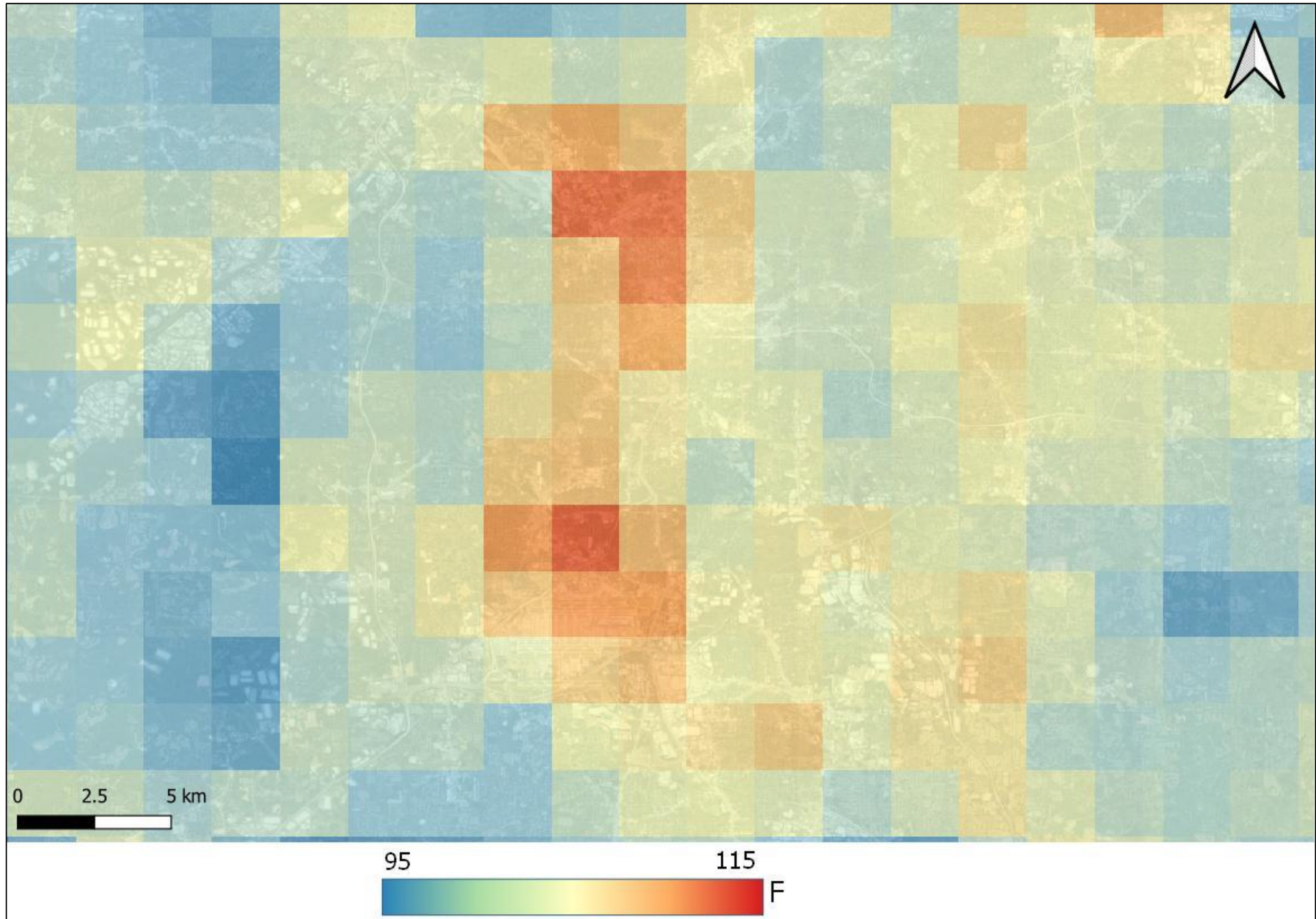


ECOSTRESS LST at 3-hourly intervals over diurnal cycle

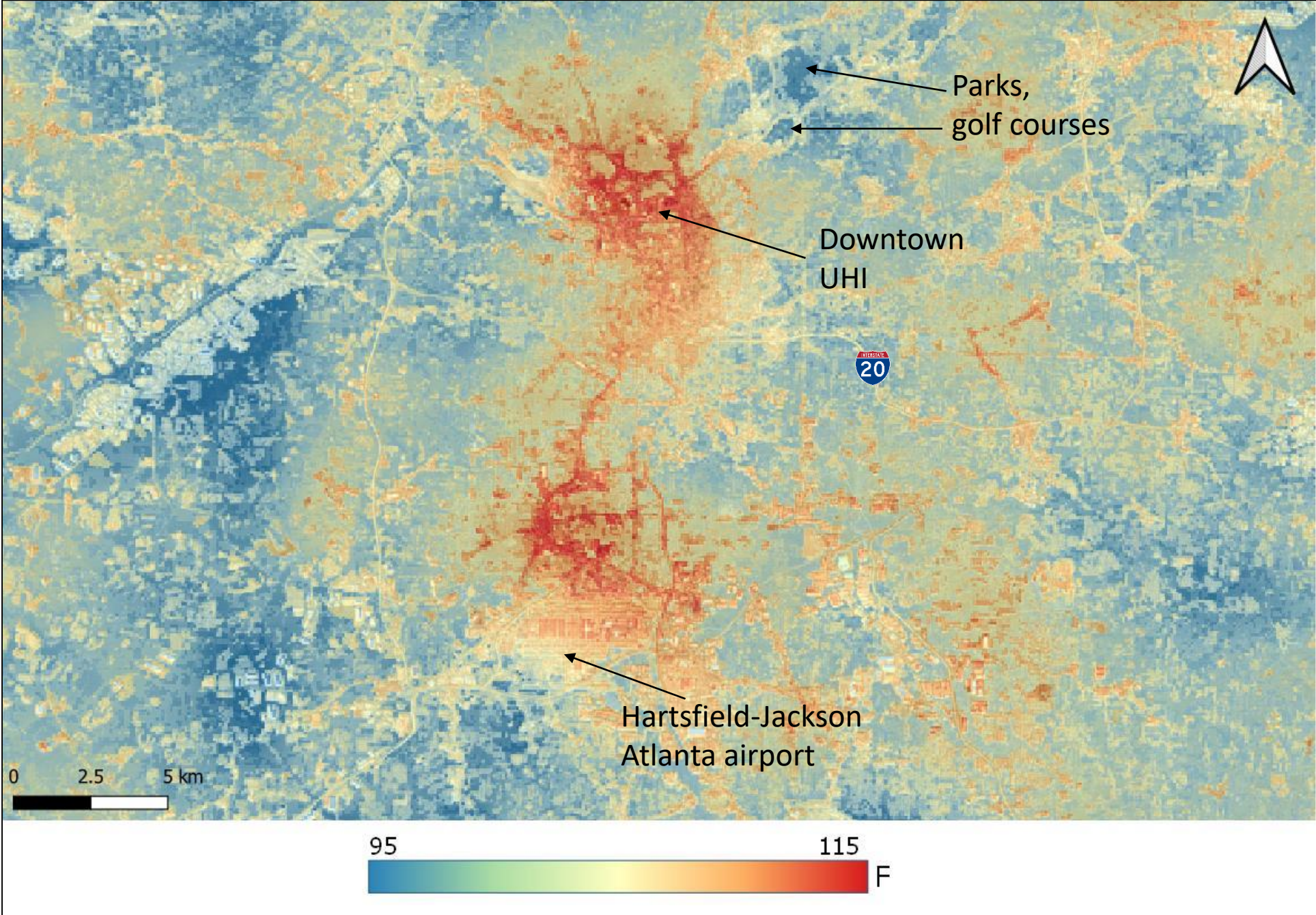


T (time of day, city, season)
100 trees = ~ 3 K RMSE

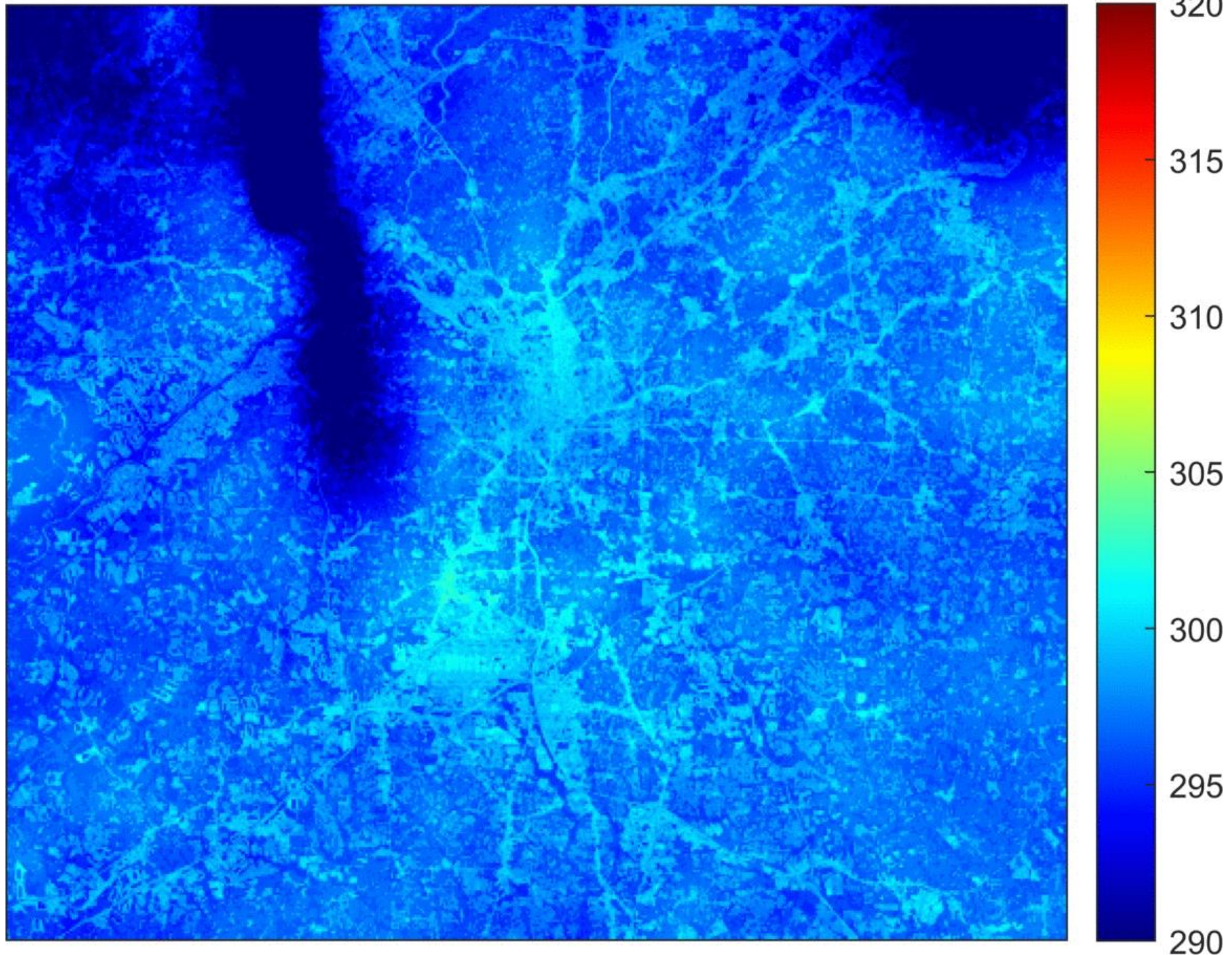
GOES-16 LST, Atlanta, 10/04/2019



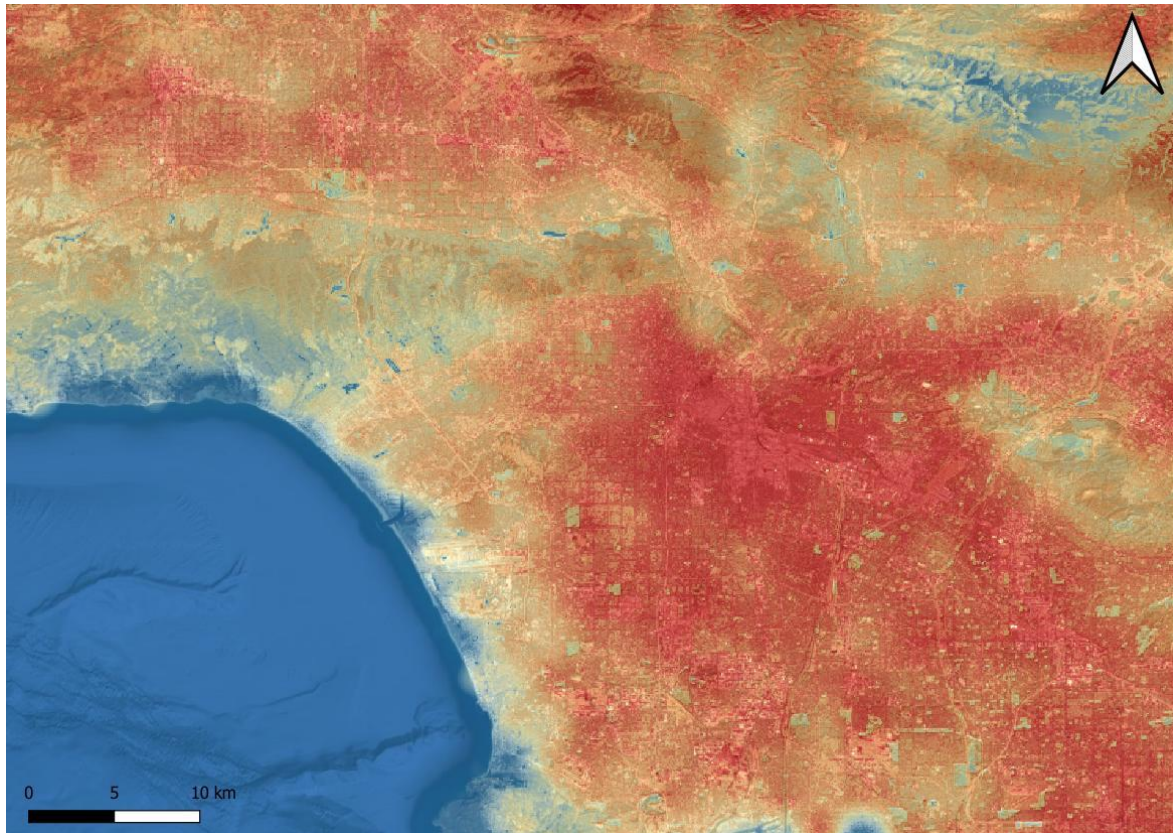
MuSLI Urban LST, Atlanta, 10/04/2019



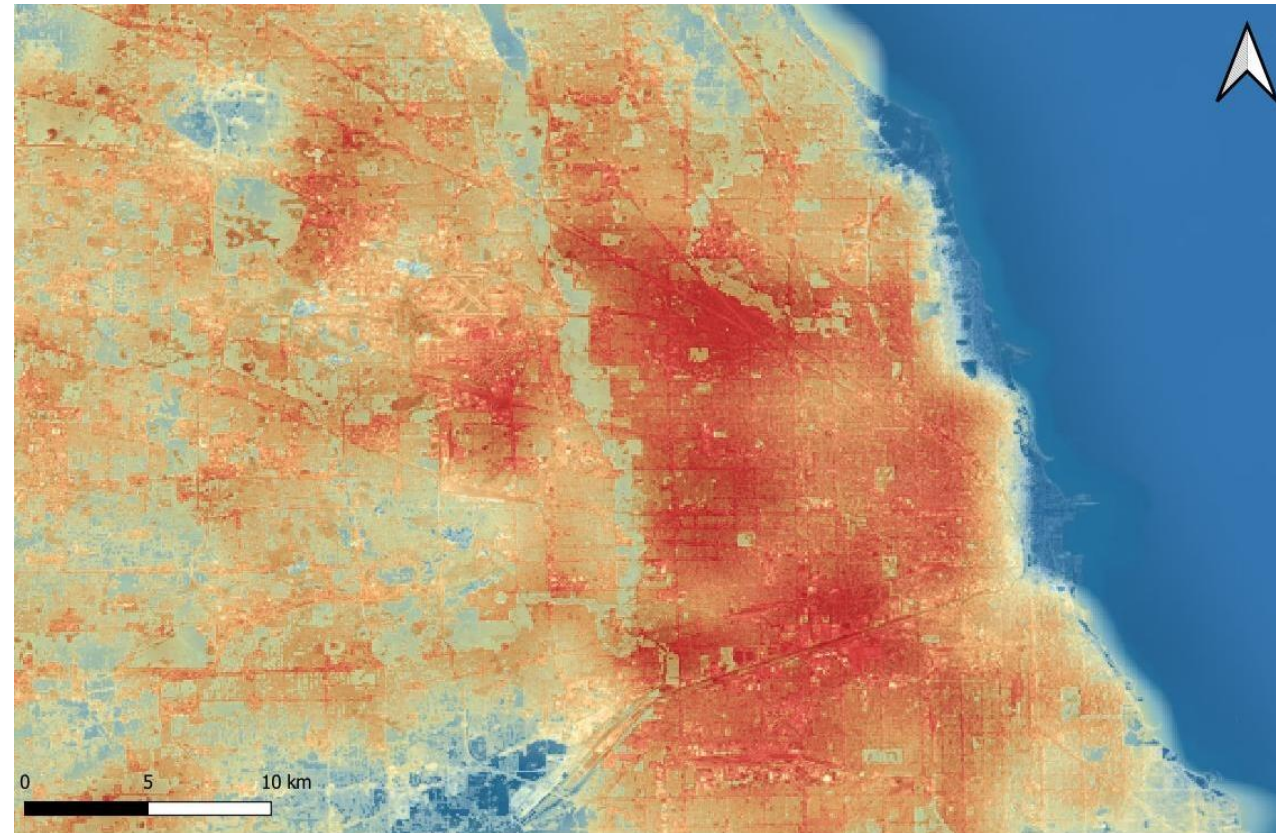
08:00



Los Angeles, 10/03/2019, 11 am



Chicago, 06/10/2019, 5 pm



Data available in repository at https://ter.ps/lcluchulley

The screenshot shows the Google Drive interface. At the top, there is a search bar with the text "Search in Drive". Below the search bar, the breadcrumb path is "LCLUC-PI-Hulley > MuSLI Urban LST > 2019 > 06". The main content area displays a table of files and folders. The table has three columns: "Name", "Last modified", and "File size". The "Name" column lists folders numbered 01 through 12. The "Last modified" column shows the date and time "2:19 PM me" for each folder. The "File size" column shows a dash "-" for each folder. On the left side, there is a sidebar with navigation options: "New", "My Drive", "Shared drives", "Shared with me", "Recent", "Starred", "Trash", and "Storage". The "Storage" section shows "1.4 GB of 15 GB used" and a "Buy storage" link. On the right side, there is a vertical sidebar with a calendar icon showing "31", a search icon, a checkmark icon, and a plus sign.

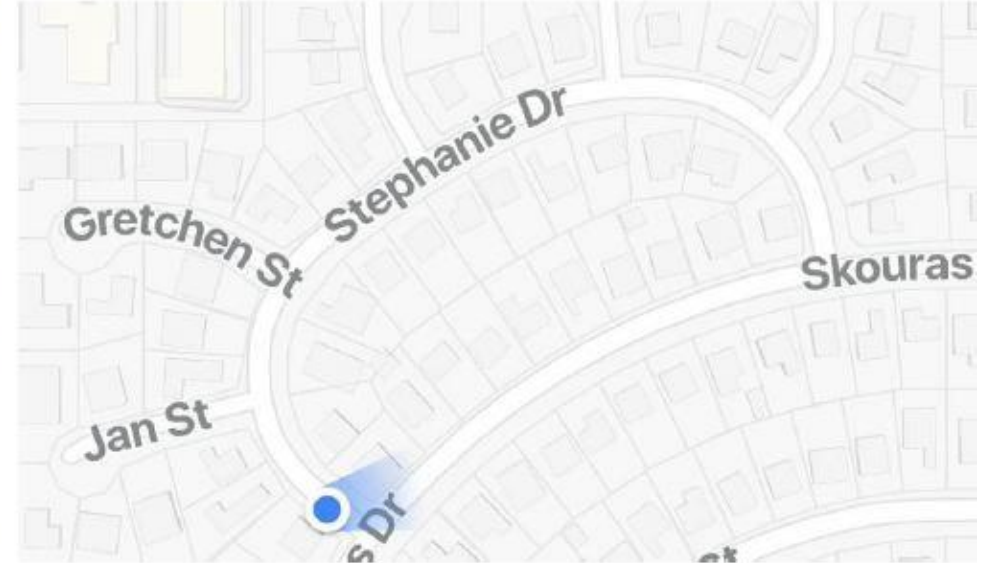
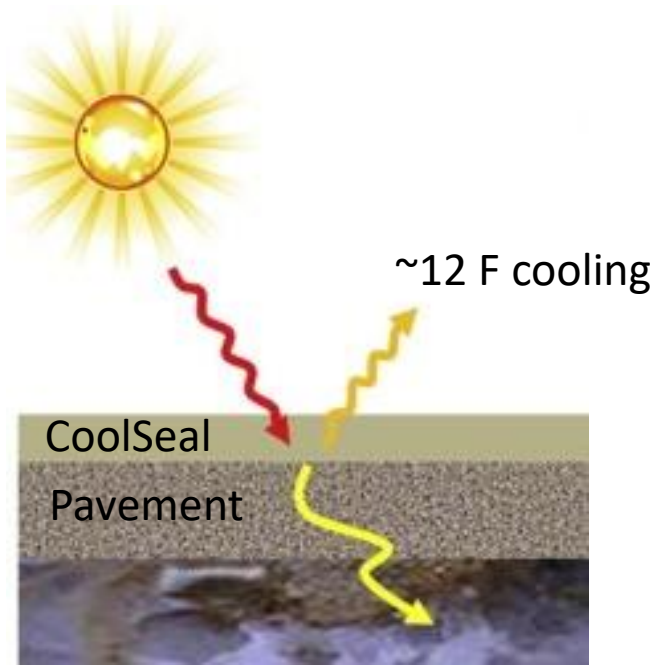
Name	Last modified	File size
01	2:19 PM me	-
02	2:19 PM me	-
03	2:19 PM me	-
04	2:19 PM me	-
05	2:19 PM me	-
06	2:19 PM me	-
07	2:19 PM me	-
08	2:19 PM me	-
09	2:19 PM me	-
10	2:19 PM me	-
11	2:19 PM me	-
12	2:19 PM me	-

Current Data Users

Institution	PI/Contact	Application
Climate Resolve, Los Angeles	Jonathan Parfrey	Used to inform optimal areas for cool pavements, bus shelters, tree planting in L.A.
University of Chicago	Dr. Kyoung Choe	Examining impacts of heat stress on cognitive functioning in Chicago neighborhood
Bloomberg Associates, NYC	Jacob Koch	Urban heat mapping to address heat issues for vulnerable population groups in NYC
UrbanCanopy/Hackathon	Katie Patrick	Mapping heat islands in major U.S. cities to help educate residents
Global Cool Cities	Kurt Shickman	Urban heat mapping for long-term climate sustainability in U.S. cities
LA County Sustainability Office, Bureau of Street Services	Rita Kampalath, Gregg Spotts	LA climate sustainability, heat mitigation efforts, cooling centers

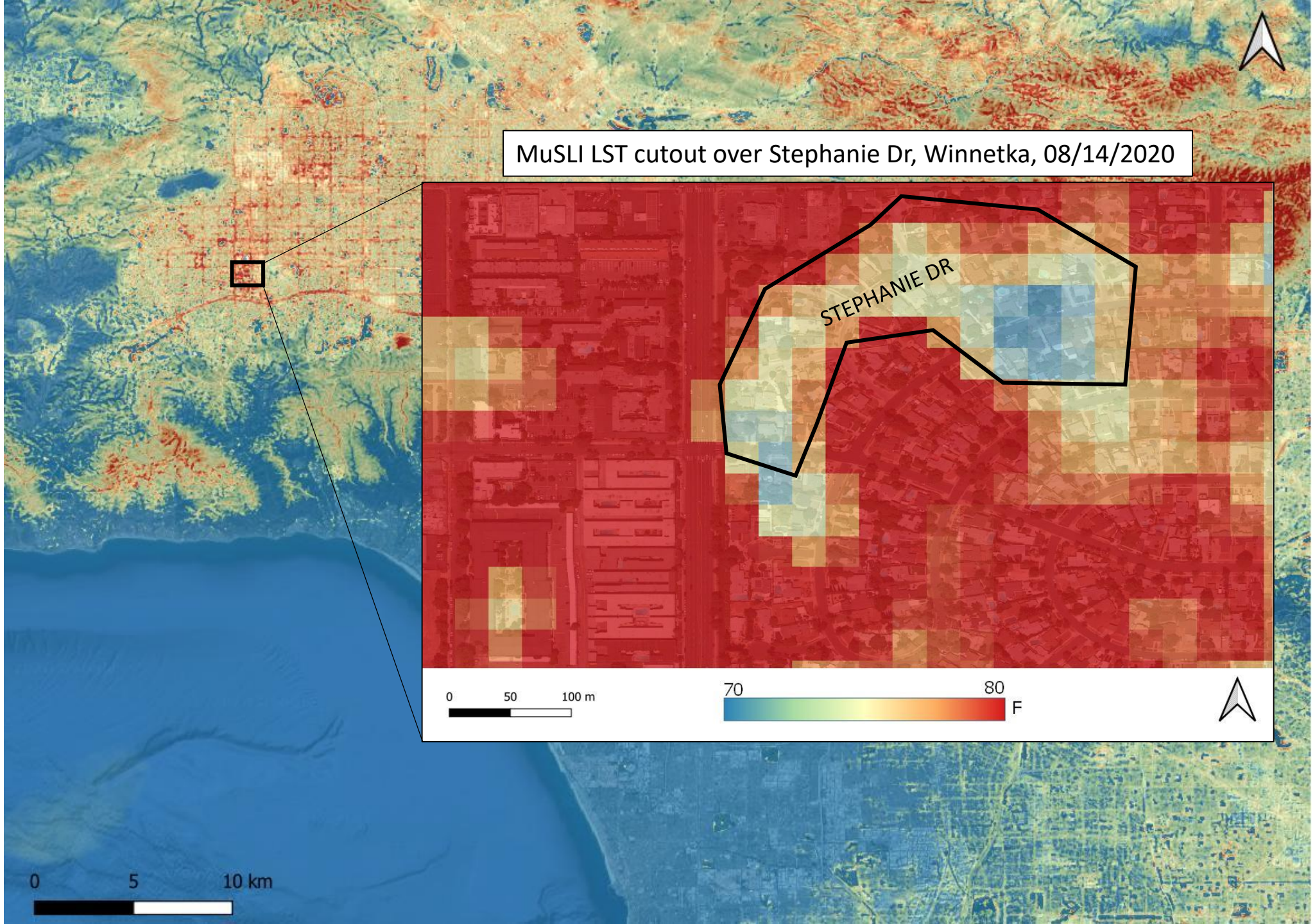


May 2019: First Neighborhood-Level Cool Pavement Project Winnetka, Cool Seal on 11 Residential Blocks



Images courtesy Greg Spotts, LA Bureau of Street Services

MuSLI LST cutout over Stephanie Dr, Winnetka, 08/14/2020



0 5 10 km

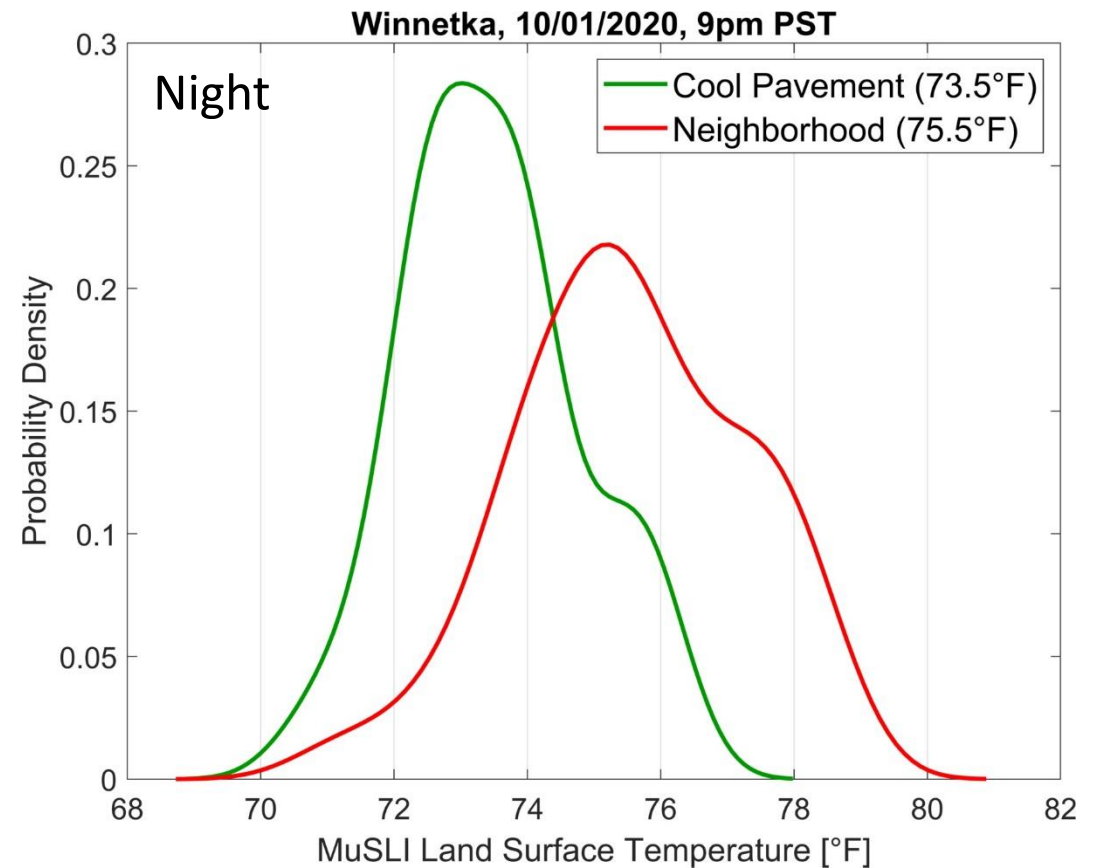
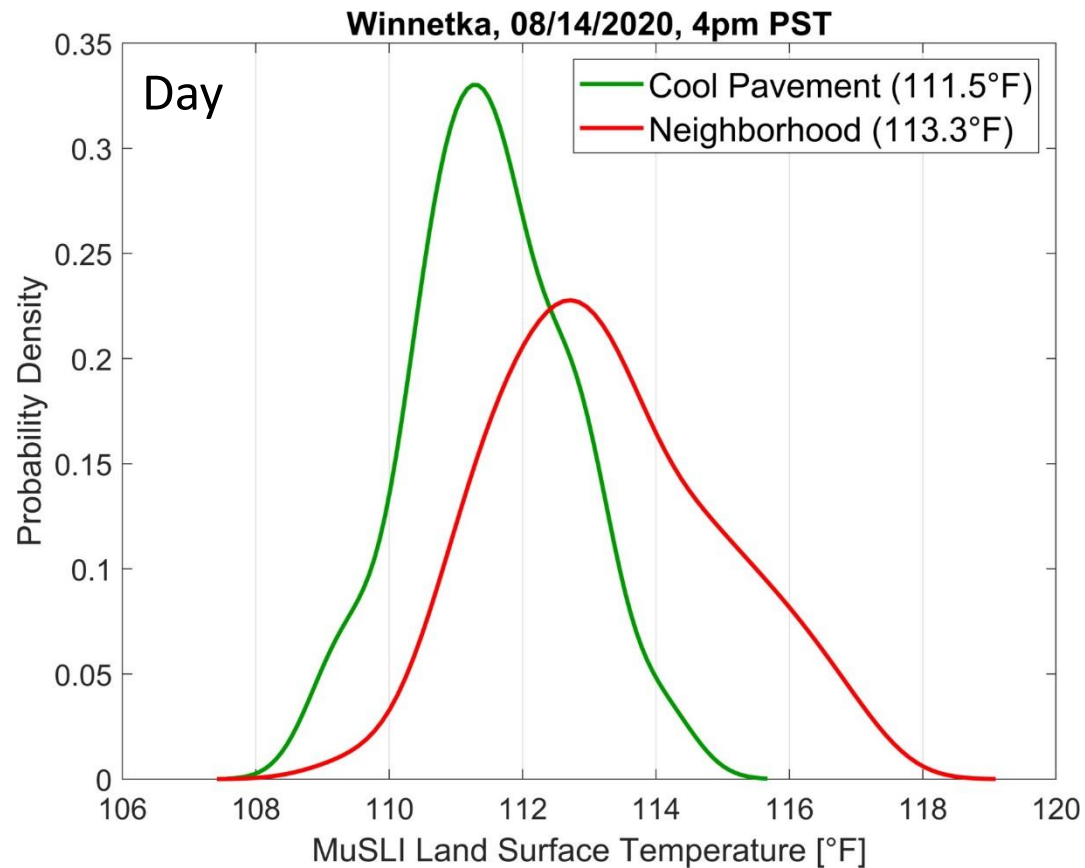
0 50 100 m

70 80 F

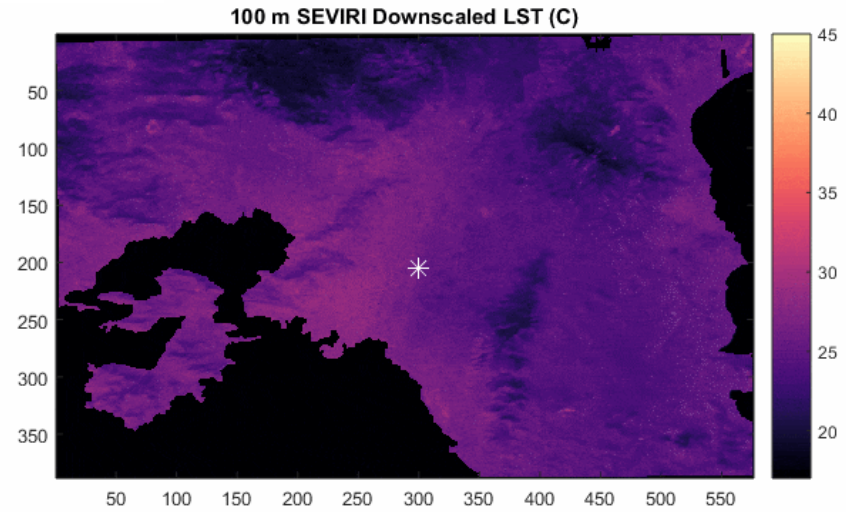
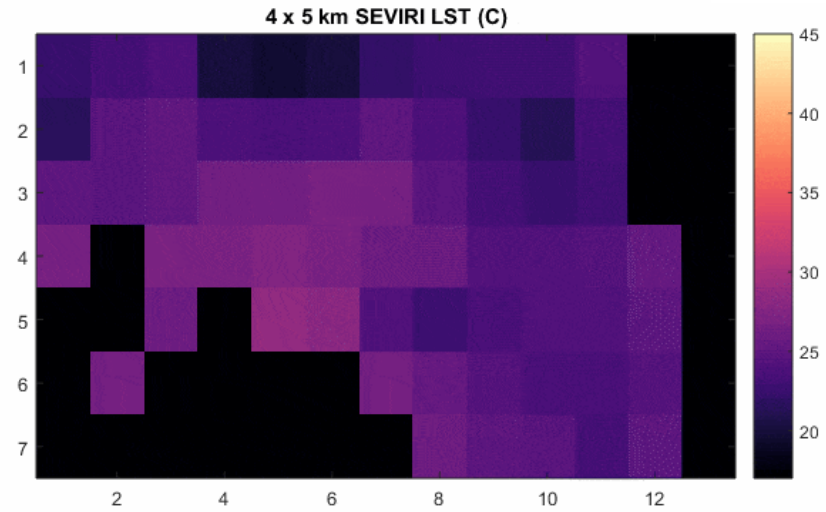
Effect of cool pavements:

~**10-12%** increase in albedo (Landsat 8) – *Arthur Elmes, UMass Boston*

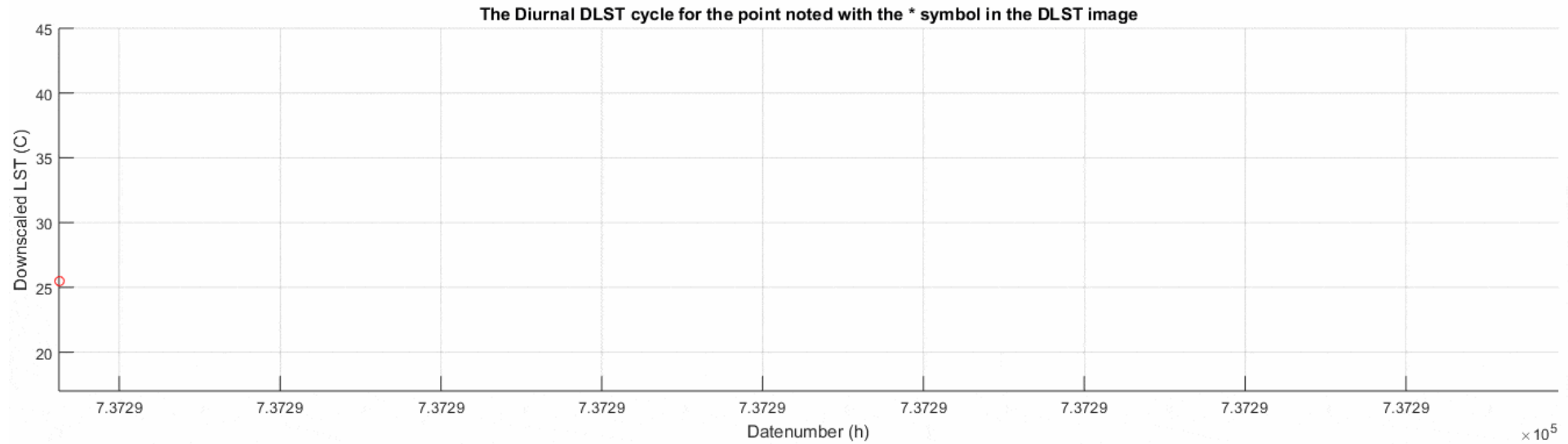
~**2 °F** decrease in surface temperature (MuSLI Urban LST)



Athens, Greece



Panagiotis Sismanidis, NOA



Questions? glynn.hulley@jpl.nasa.gov

Validation

ECOSTRESS comparison at 100m resolution – 4:30 am

