National Aeronautics and Space Administration

Geostationary Satellite Assessment of Urban Heat Islands

Kevin Gallo: NOAA/NESDIS/STAR

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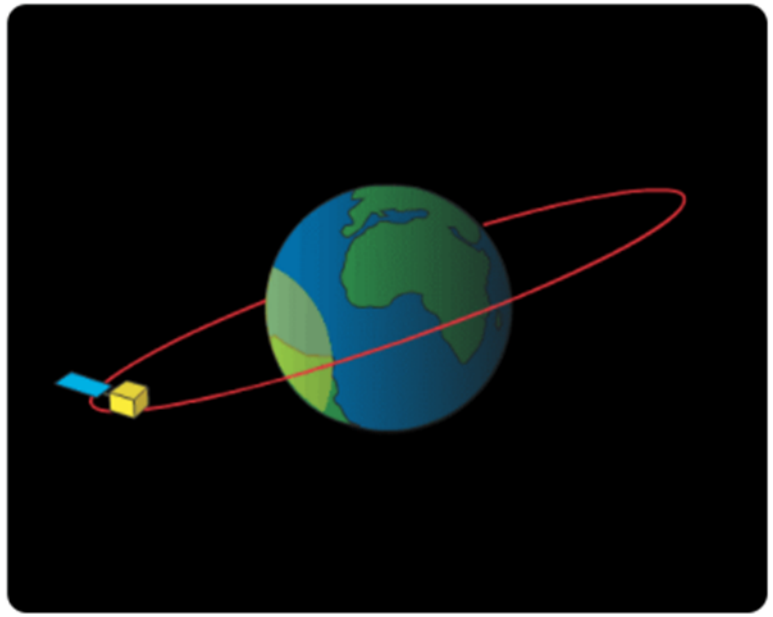
Disclaimer: The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author(s) and do not necessarily reflect those of NOAA or the Department of Commerce.

Geostationary Orbit vs. Polar Orbit

Continuous views of coverage area of Earth's Surface (24 hours per day).

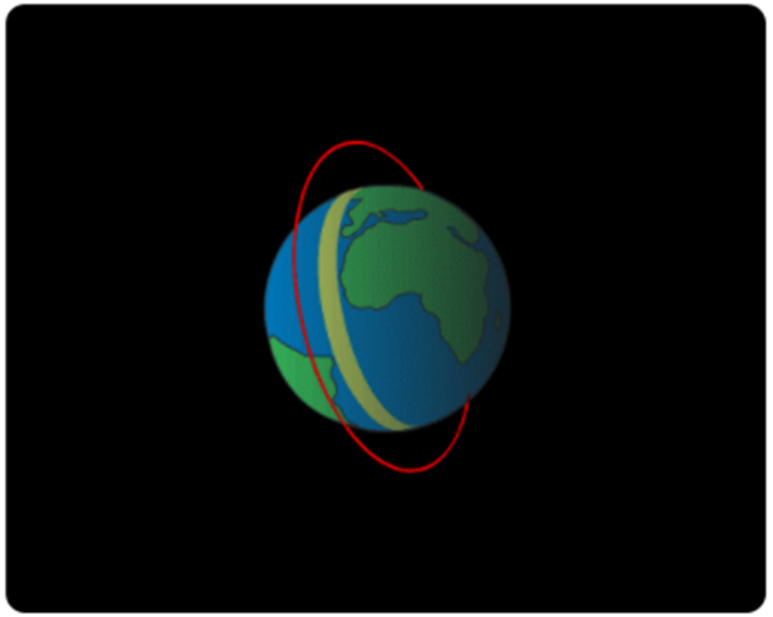


The East-West orbit of GOES satellites depicted in the yellow circle.

Spatial Resolution: ≥ 1 km

Temporal Resolution: ≤ 1 hour

Day and night views of most locations on Earth's surface (e.g., 2am and 2pm local time).

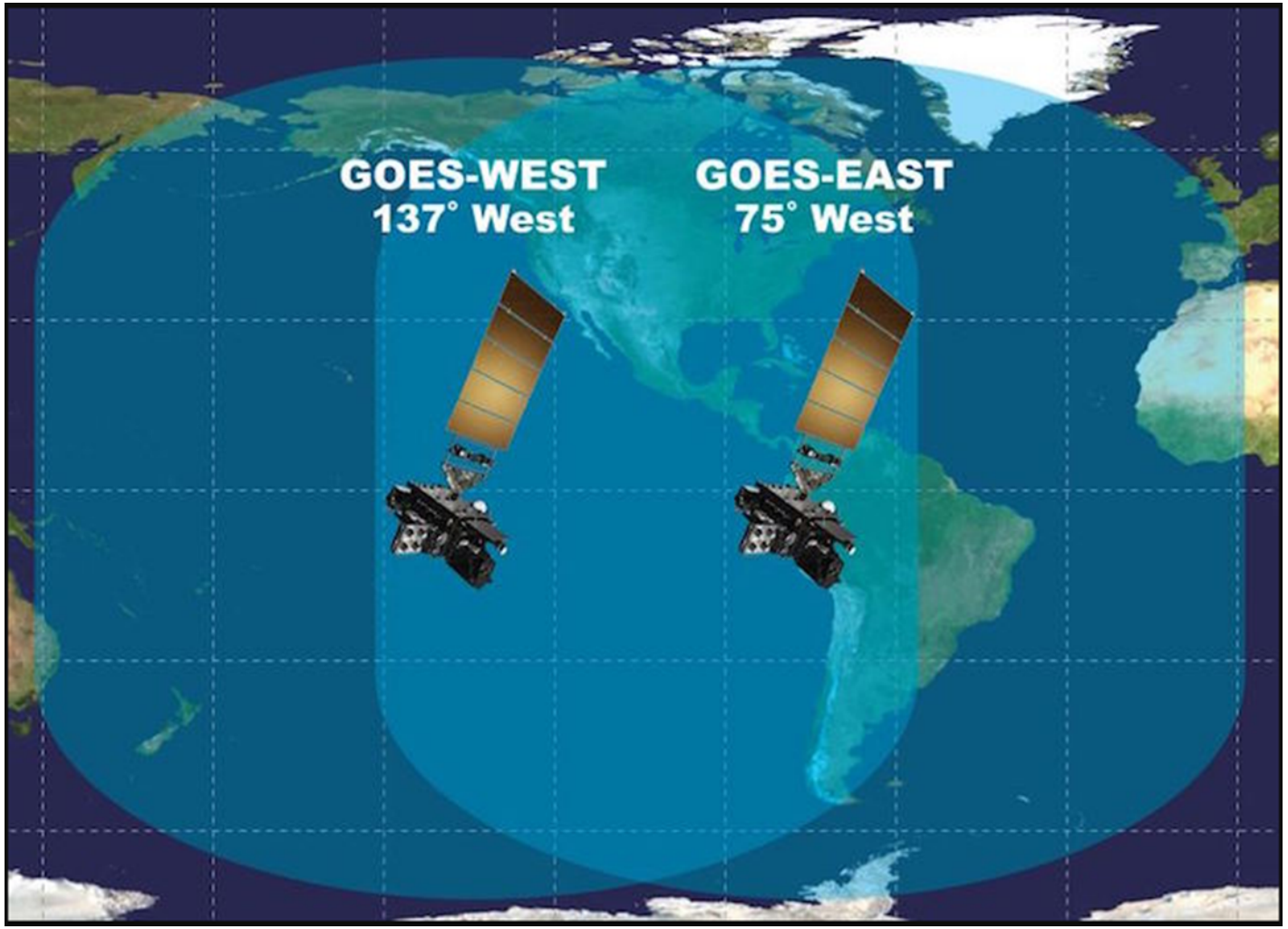


The North-South orbit of Polar orbiting satellites depicted in the yellow line.

Spatial Resolution: ≤ 1 km

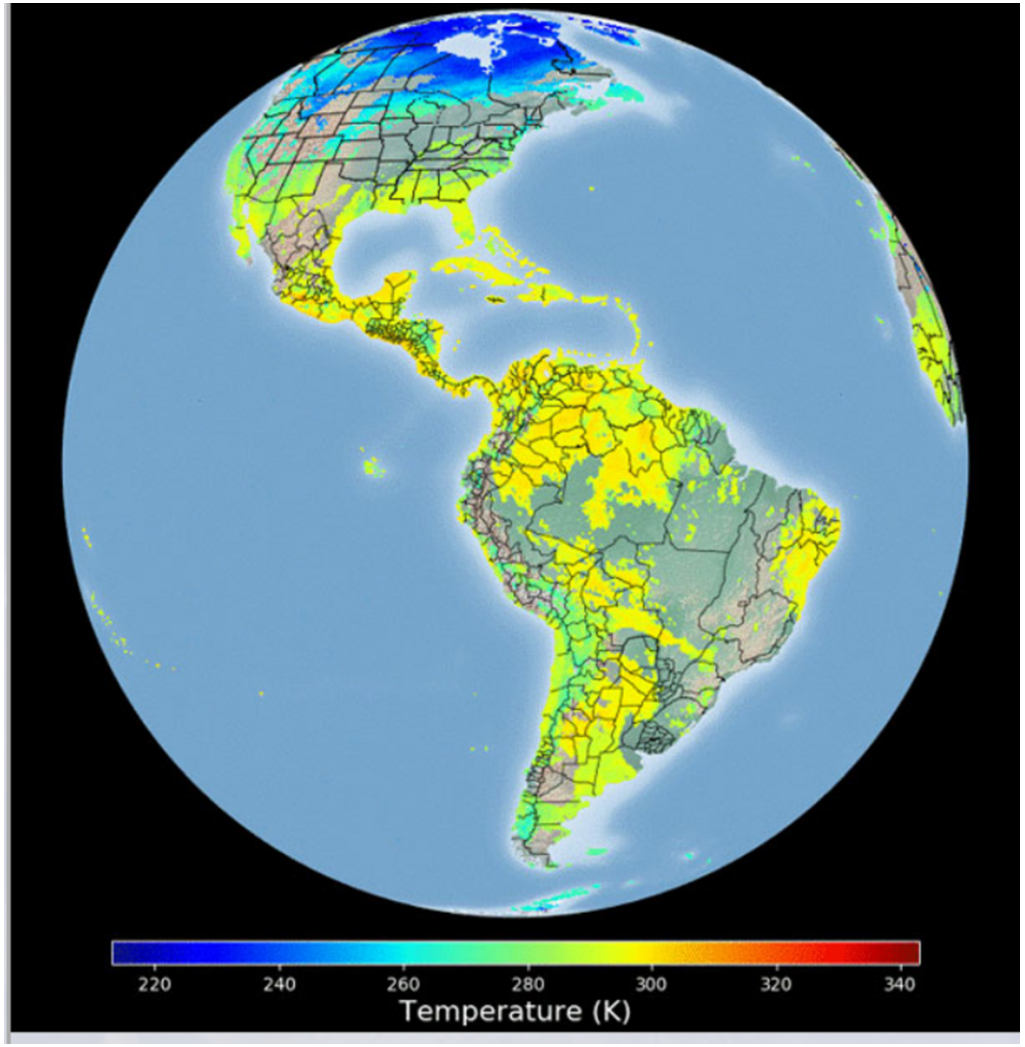
Temporal Resolution: ≥ day/night
(Landsat 16 days)

The Geostationary Operational Environmental Satellite (GOES)



Two operational GOES satellites provide coverage of N. and S. America.

Example of Land Surface Temperature (LST) Product



<u>For CONUS Region:</u>

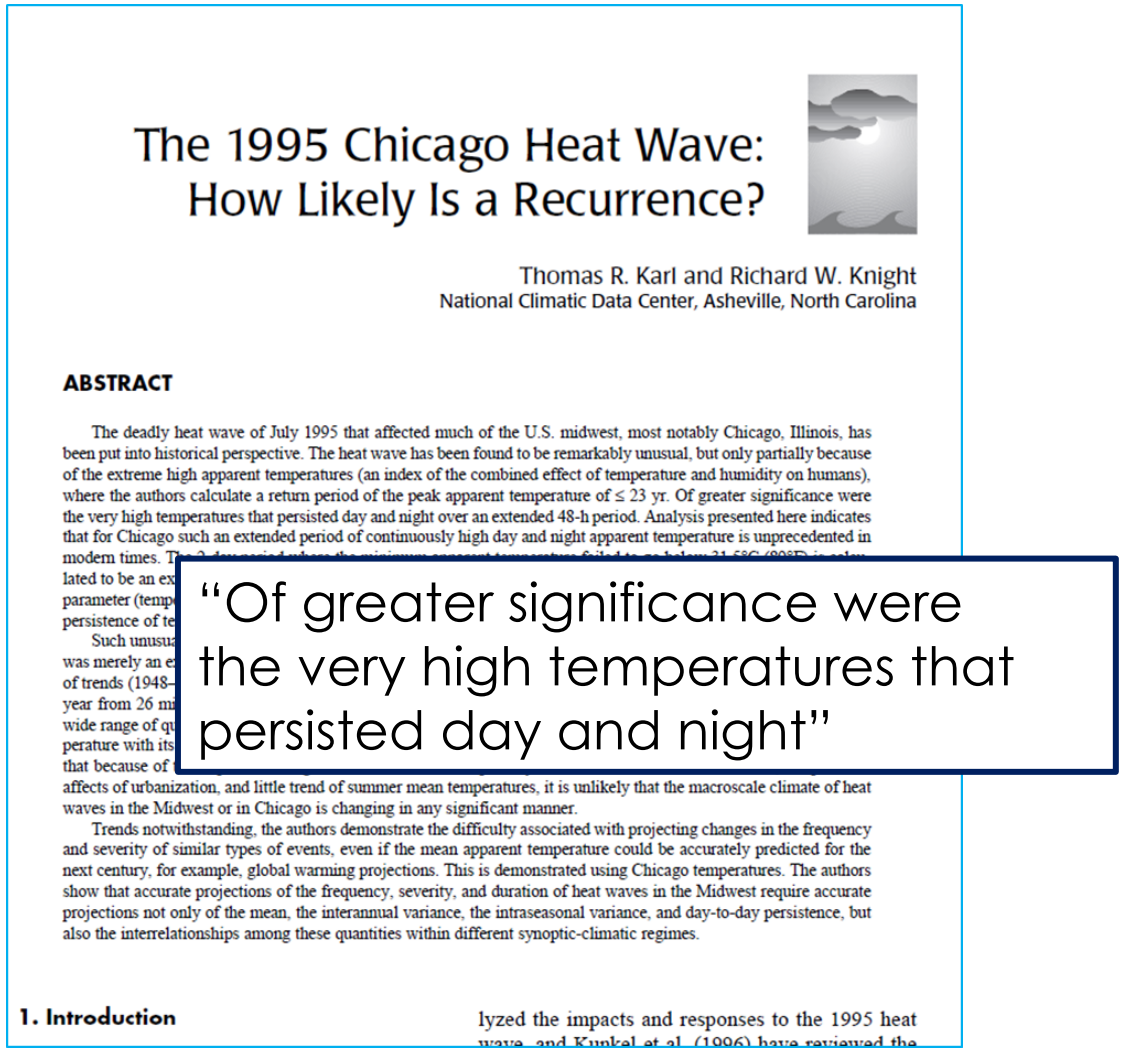
- 2 km spatial resolution
- 1 hr temporal resolution

Need for High Frequency of Observations (Temporal Resolution)

Greater temporal resolution allows greater frequency of observation and measurement of:

1) high and low temperatures, and

2) the diurnal temperature range and associated duration of temperatures.



The 1995 Chicago Heat Wave: How Likely Is a Recurrence?

Thomas R. Karl and Richard W. Knight
National Climatic Data Center, Asheville, North Carolina

ABSTRACT

The deadly heat wave of July 1995 that affected much of the U.S. midwest, most notably Chicago, Illinois, has been put into historical perspective. The heat wave has been found to be remarkably unusual, but only partially because of the extreme high apparent temperatures (an index of the combined effect of temperature and humidity on humans), where the authors calculate a return period of the peak apparent temperature of ≤ 23 yr. Of greater significance were the very high temperatures that persisted day and night over an extended 48-h period. Analysis presented here indicates that for Chicago such an extended period of continuously high day and night apparent temperature is unprecedented in modern times. [illegible] affects of urbanization, and little trend of summer mean temperatures, it is unlikely that the macroscale climate of heat waves in the Midwest or in Chicago is changing in any significant manner.

Trends notwithstanding, the authors demonstrate the difficulty associated with projecting changes in the frequency and severity of similar types of events, even if the mean apparent temperature could be accurately predicted for the next century, for example, global warming projections. This is demonstrated using Chicago temperatures. The authors show that accurate projections of the frequency, severity, and duration of heat waves in the Midwest require accurate projections not only of the mean, the interannual variance, the intraseasonal variance, and day-to-day persistence, but also the interrelationships among these quantities within different synoptic-climatic regimes.

1. Introduction

lyzed the impacts and responses to the 1995 heat

"Of greater significance were the very high temperatures that persisted day and night"

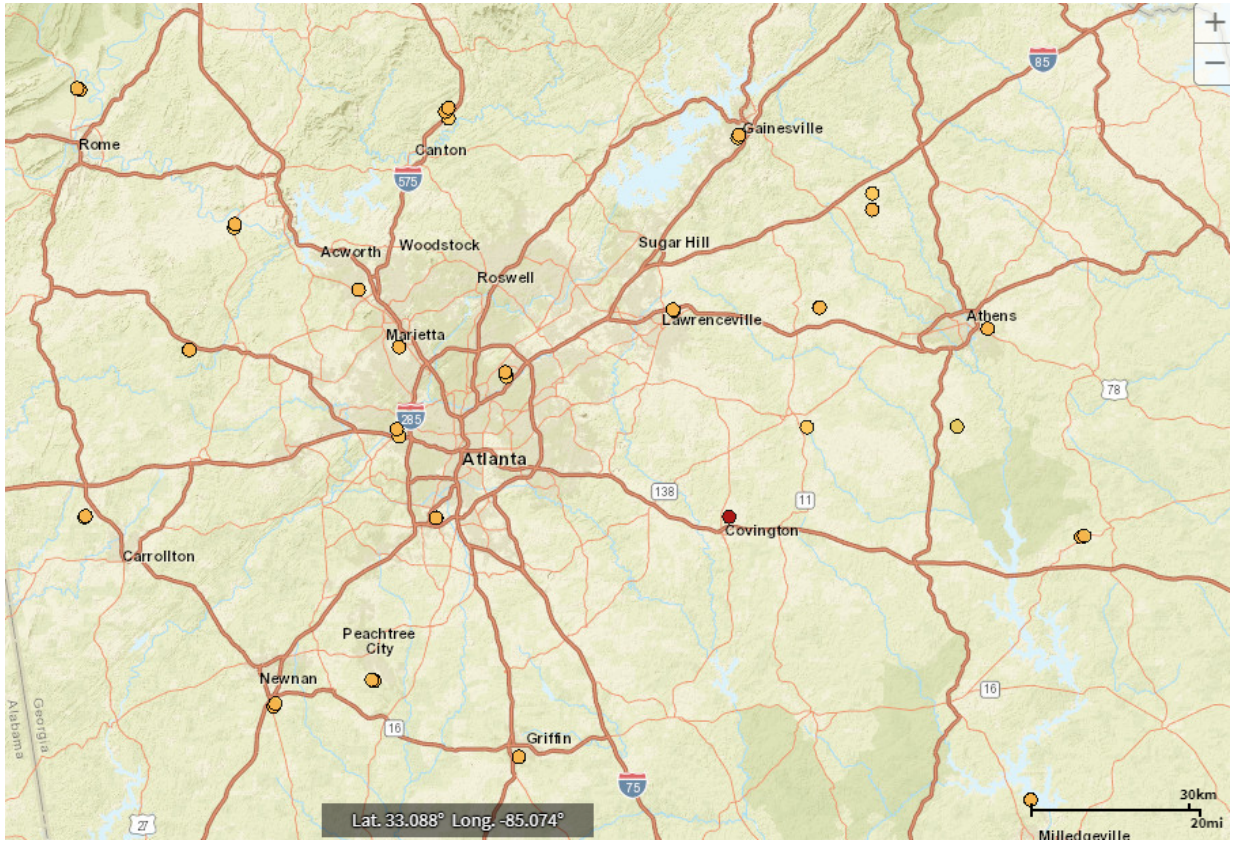
Karl TR, Knight RW. The 1995 Chicago heat wave: How likely is a recurrence. B Am Meteorol Soc. 1997;78(6):1107–1119.

Need for High Frequency of Observations (Temporal Resolution)

Diurnal temperature observations at standard climatological network locations are relatively few, even in major metropolitan regions.

LEGEND	
Hourly Global	●
Climate Reference Network	● CRN ● AL HCN-M ● US HCN-M
Local Climatological Data	●

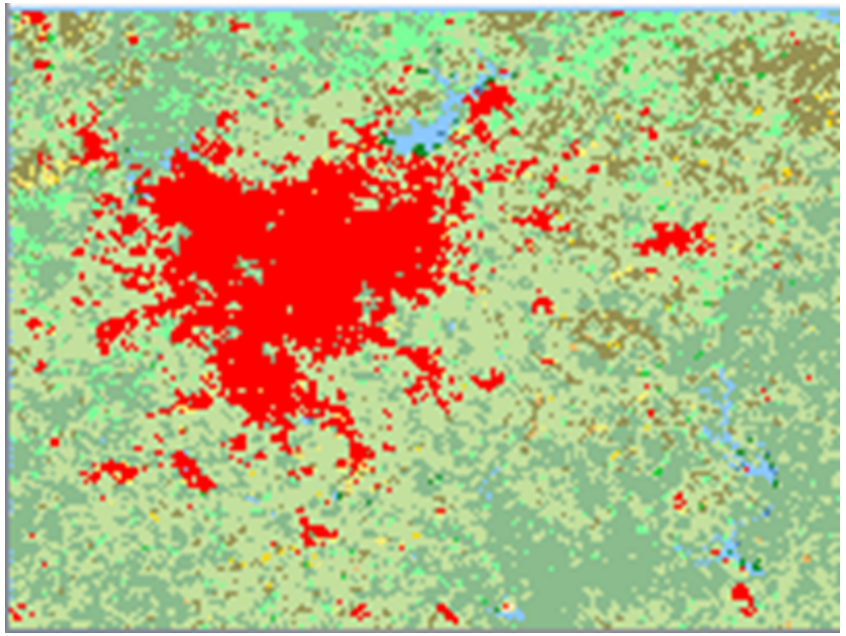
Diurnal Temperature Stations: **Atlanta Region**



https://gis.ncdc.noaa.gov/maps/ncei/cdo/hourly?layers=001

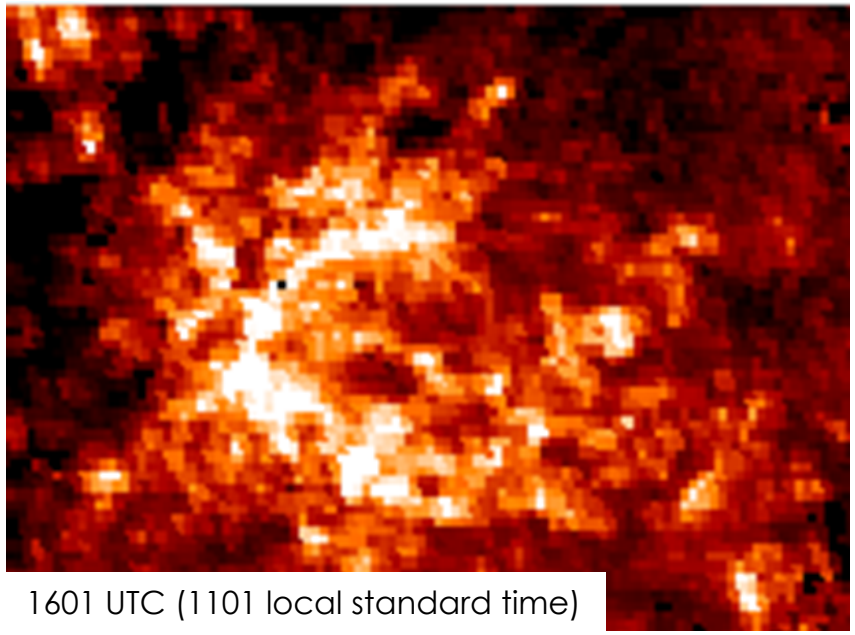
Atlanta Regional Land Cover Observations and Land Surface Temperature

Visible Infrared Imaging Radiometer Suite (VIIRS) Land Surface Type Product



Urban & built up
Woody Savana
Mixed Forest
Water

GOES-16 Advanced Baseline Imager Land Surface Temperature: 16 Aug 2019

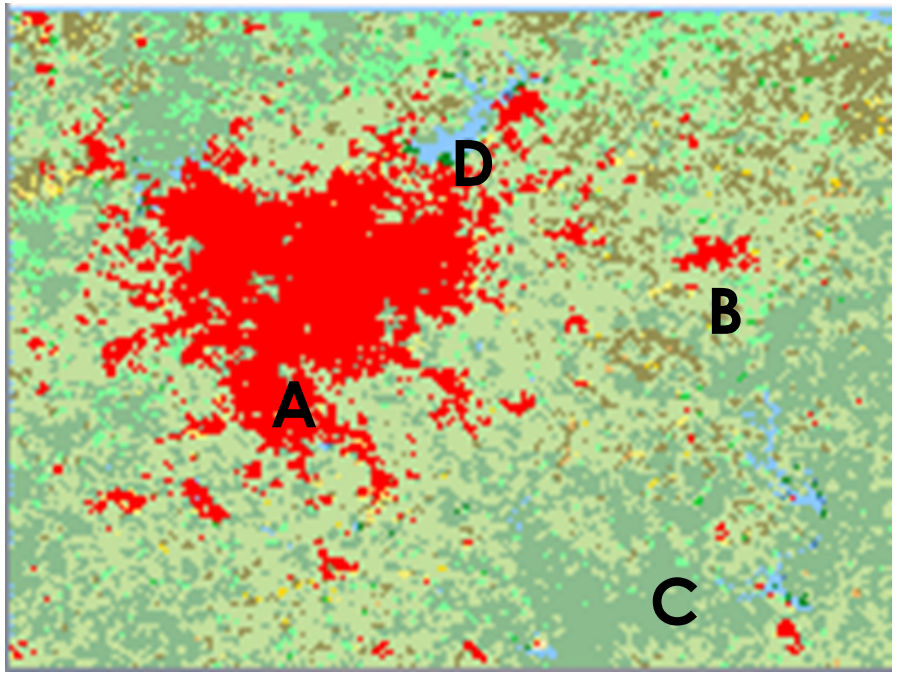


1601 UTC (1101 local standard time)

Low High
Land Surface Temperature

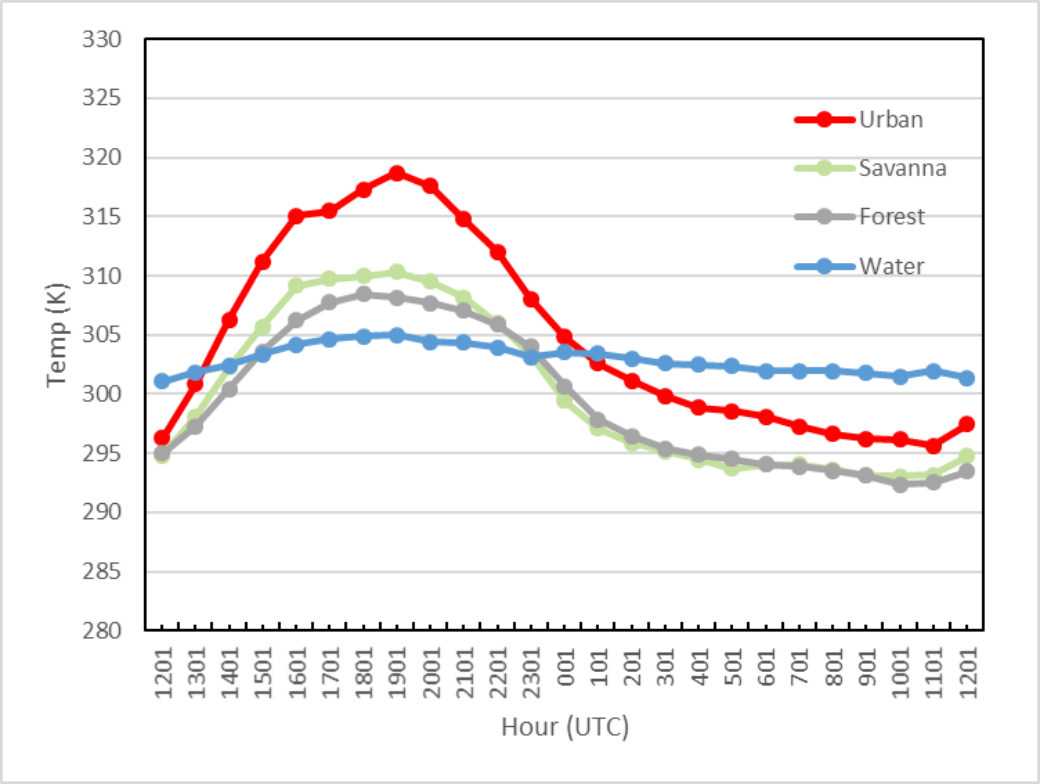
Land Cover Observations of Diurnal Land Surface Temperature

Land Surface Type



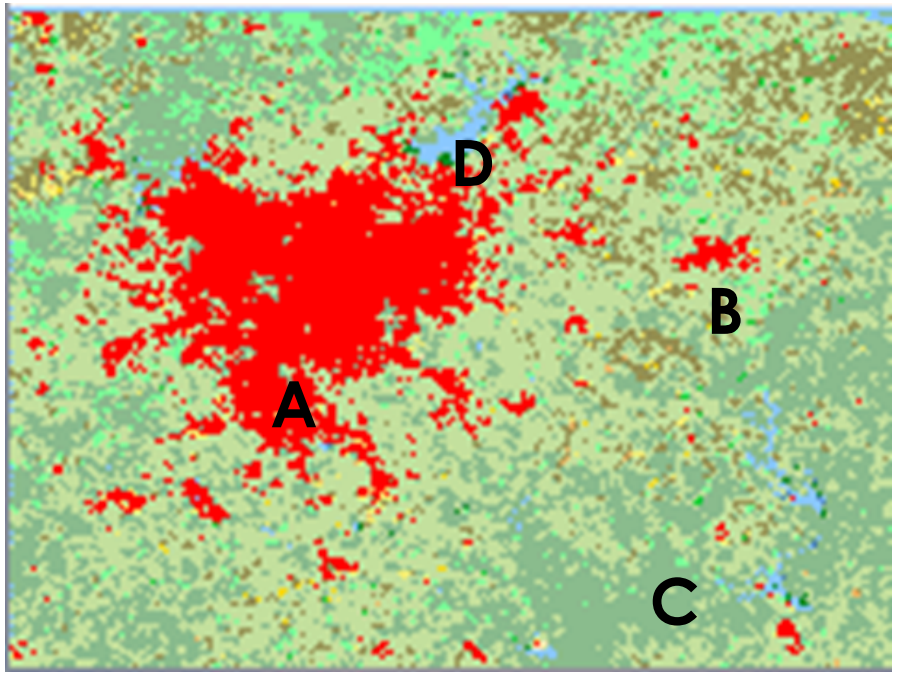
A Urban & built up
B Woody Savanna
C Mixed Forest
D Water

Land Surface Temperature:
16-17 August 2019

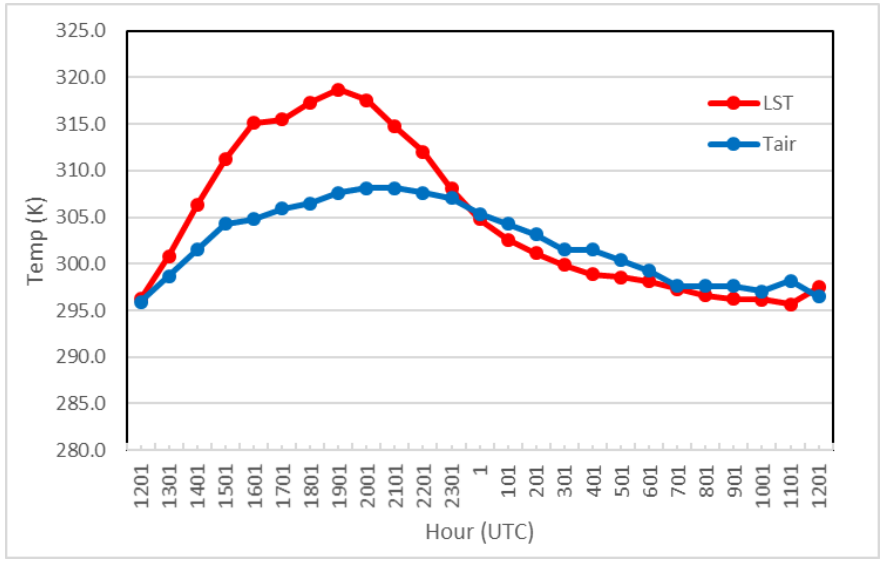


Land Cover Observations of Diurnal Air and Land Surface Temperature

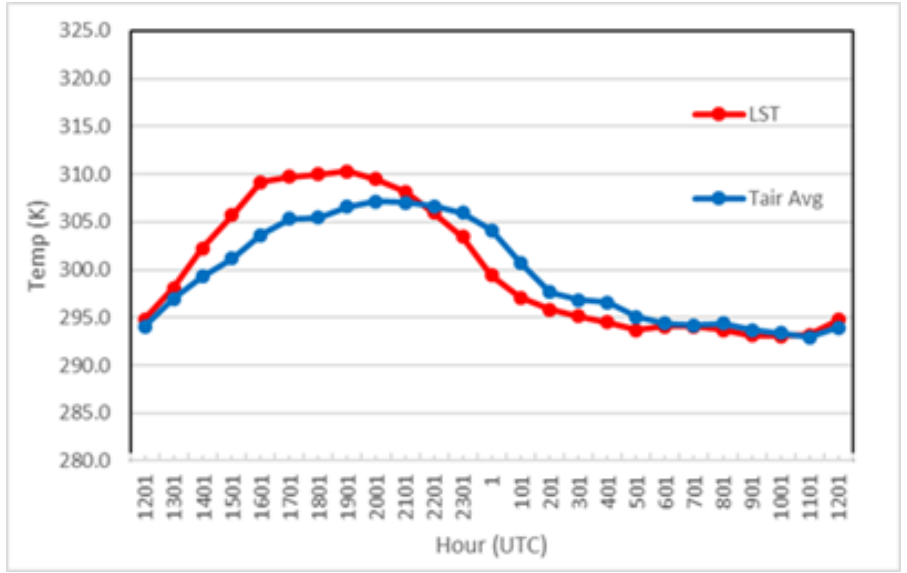
Land Surface Type



A Urban & built up
B Woody Savanna
C Mixed Forest
D Water



A

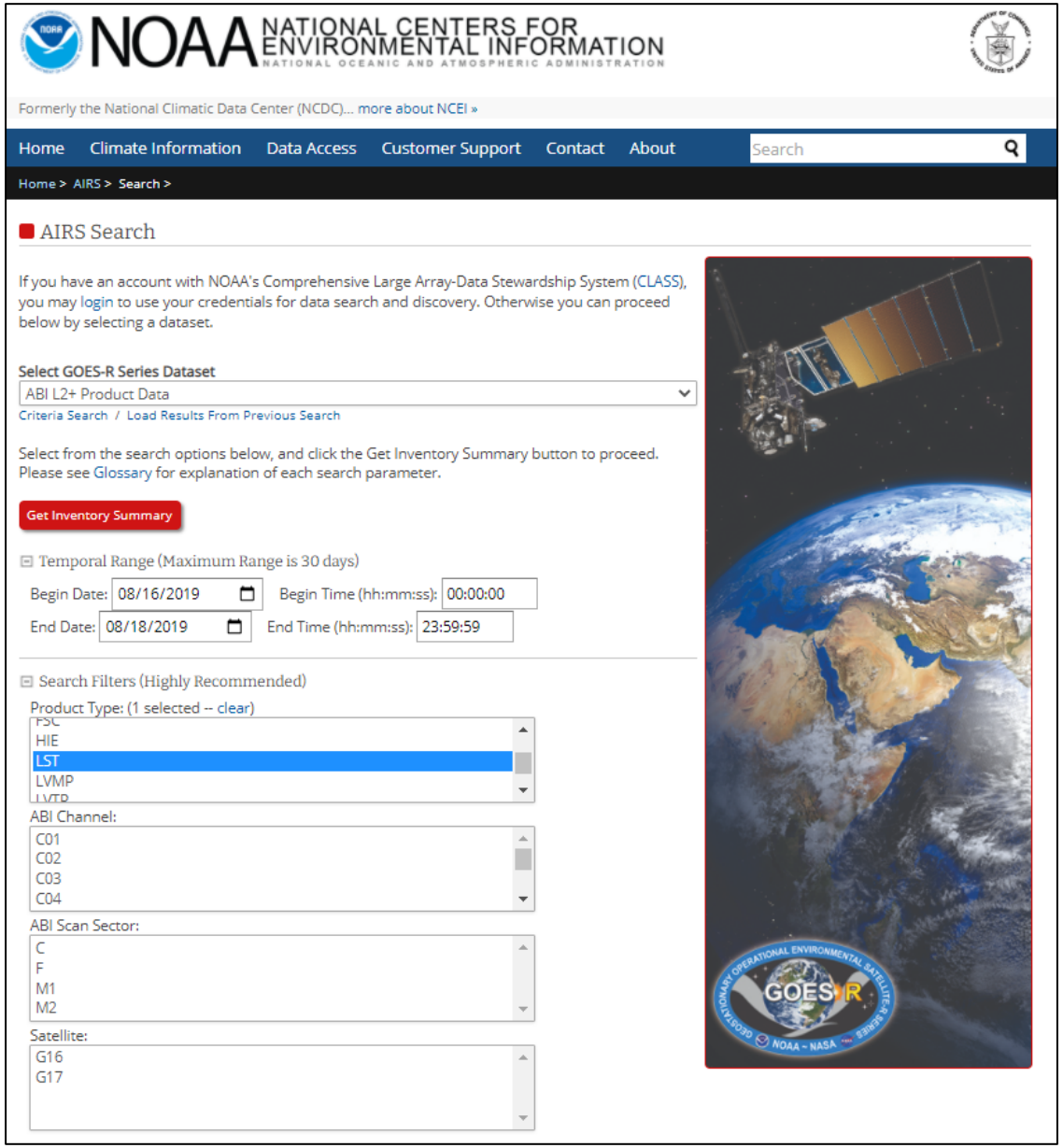


B

How to Obtain the GOES Land Surface Temperature (LST) Product

NOAA's Archive Information Request System (AIRS)

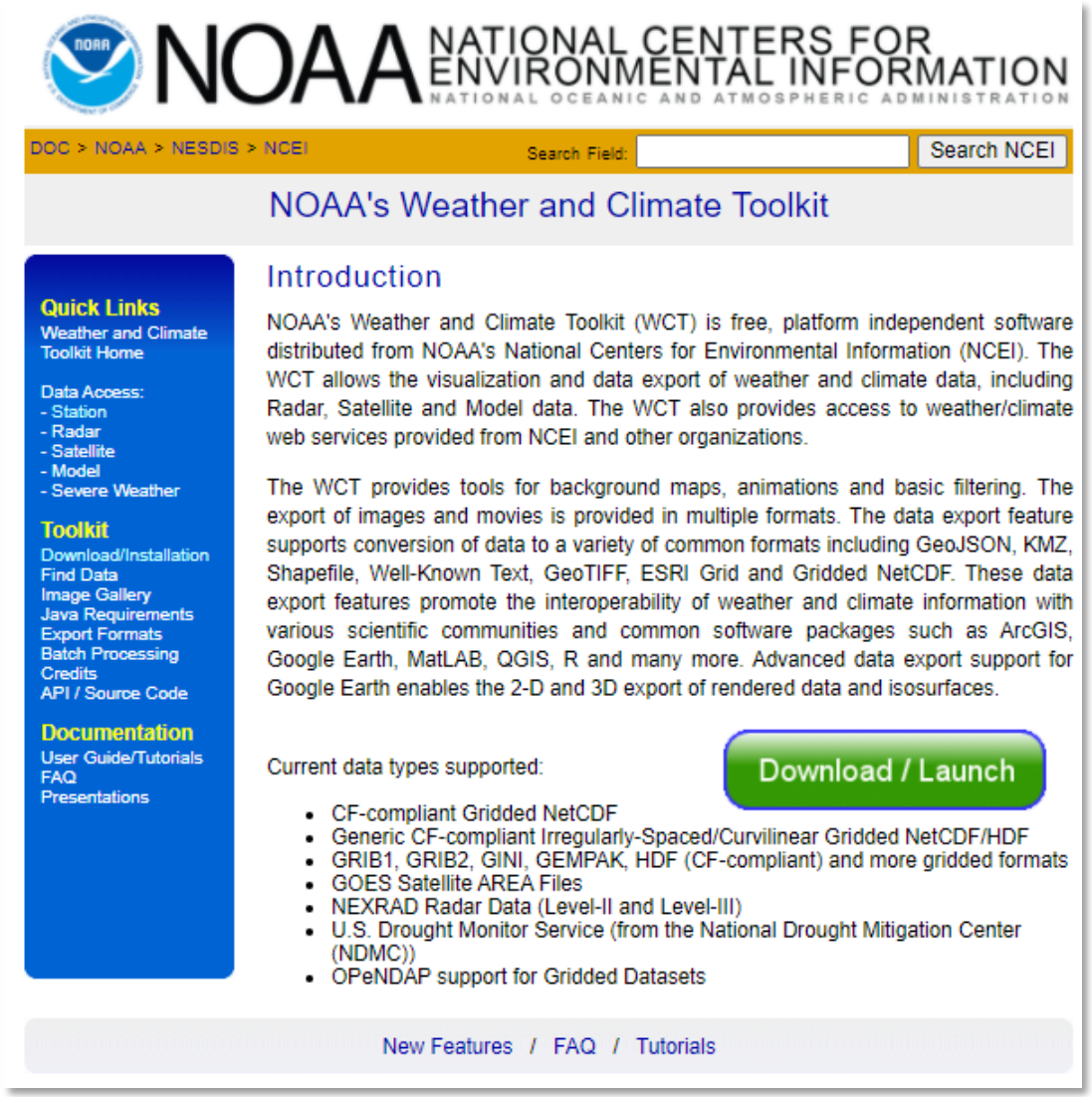
https://www.ncdc.noaa.gov/airs-web/search



How to Obtain the GOES LST Product

NOAA's Weather and Climate Toolkit

https://www.ncdc.noaa.gov/wct/

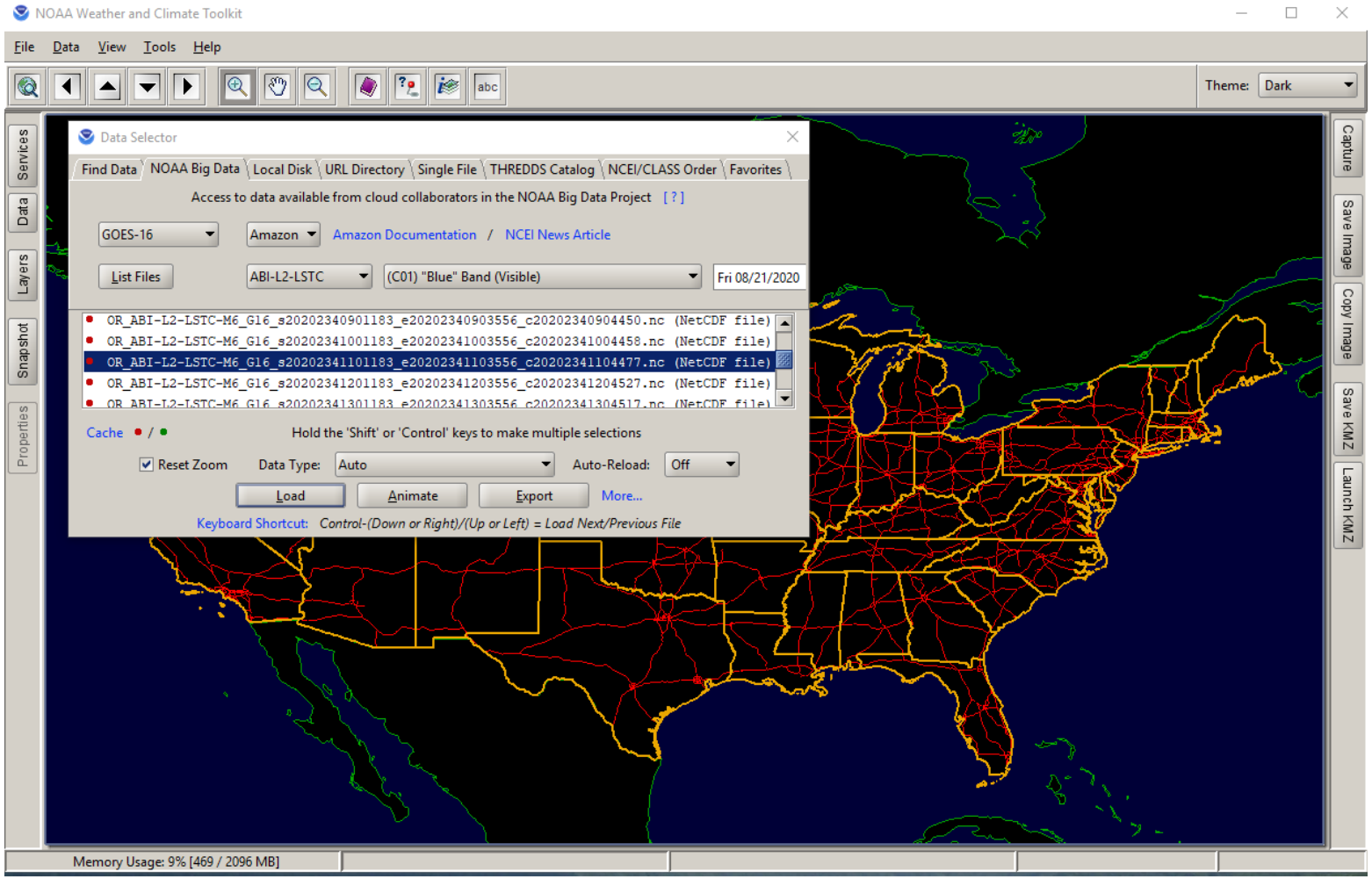


How to Obtain the GOES LST Product

NOAA's Weather and Climate Toolkit

Data are:

- Retrieved



How to Obtain the GOES LST Product

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Data are:

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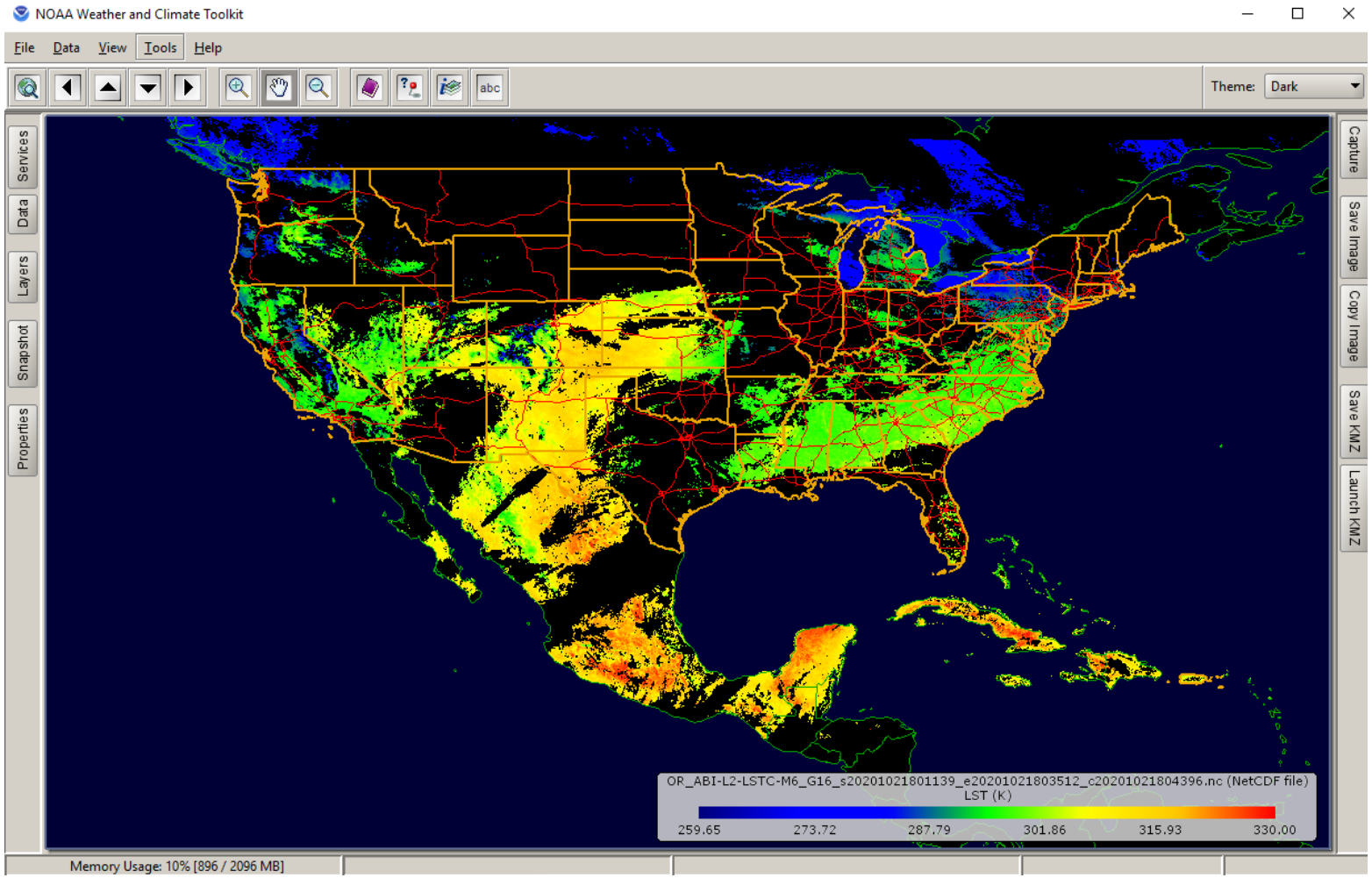
- Viewed

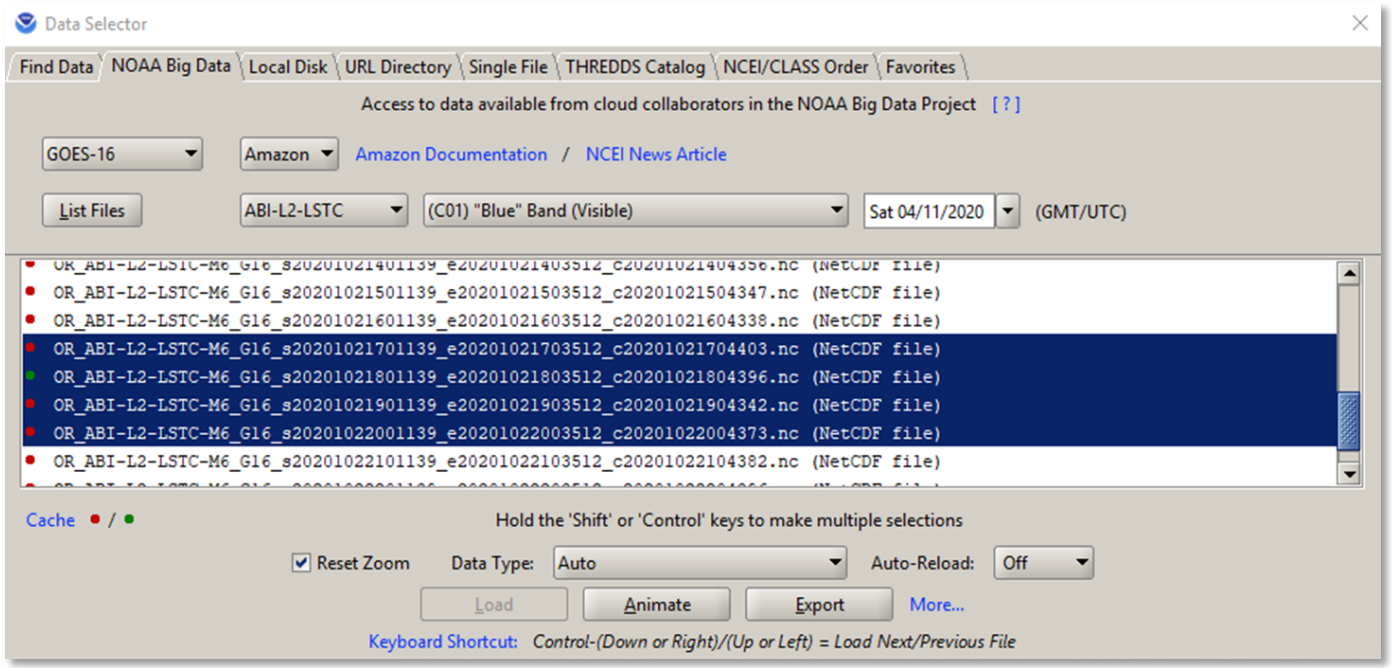


How to Obtain the GOES LST Product

NOAA's Weather and Climate Toolkit

Data are:

- Retrieved
- Viewed
- Custom Processed

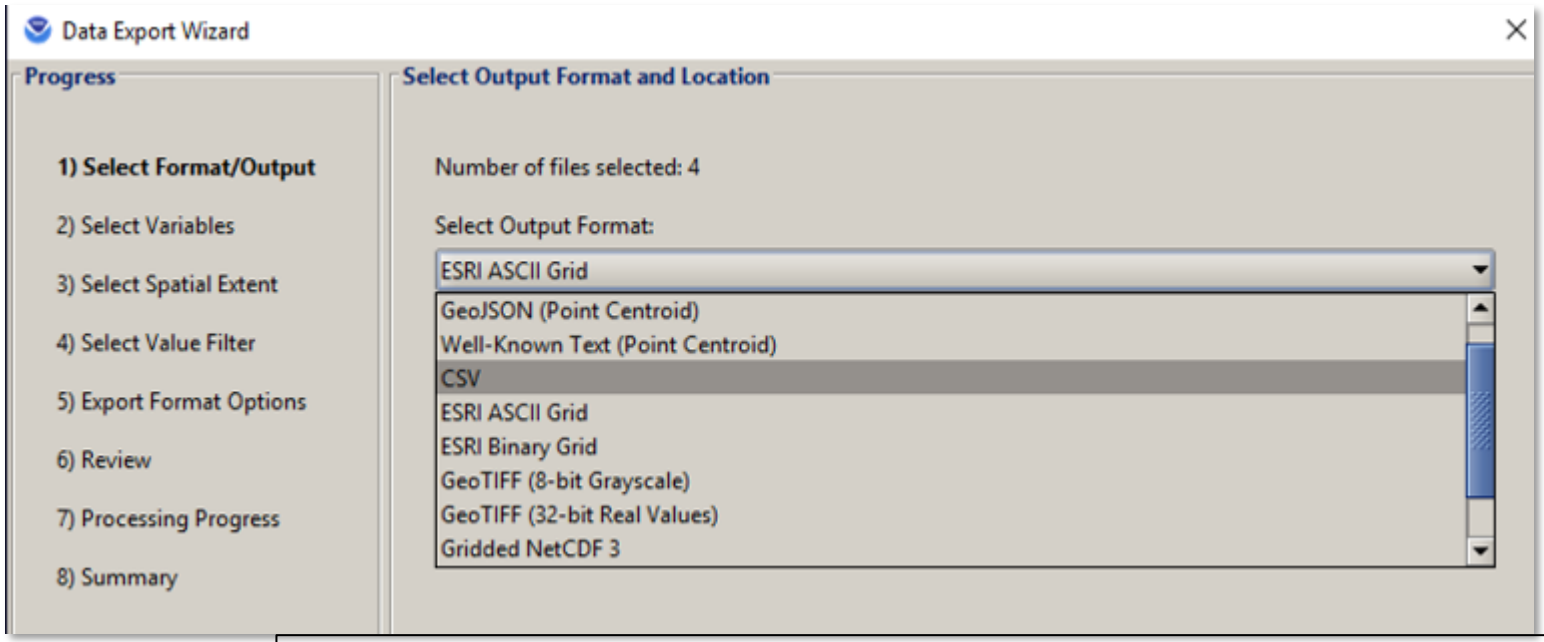


How to Obtain the GOES LST Product

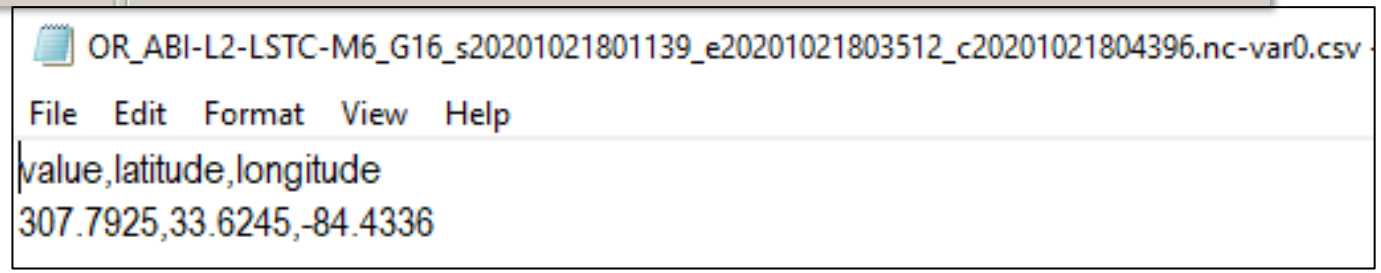
NOAA's Weather and Climate Toolkit

Data are:

- Retrieved
- Viewed
- Custom Processed
- Exported in Several Formats



CSV Format (single location)



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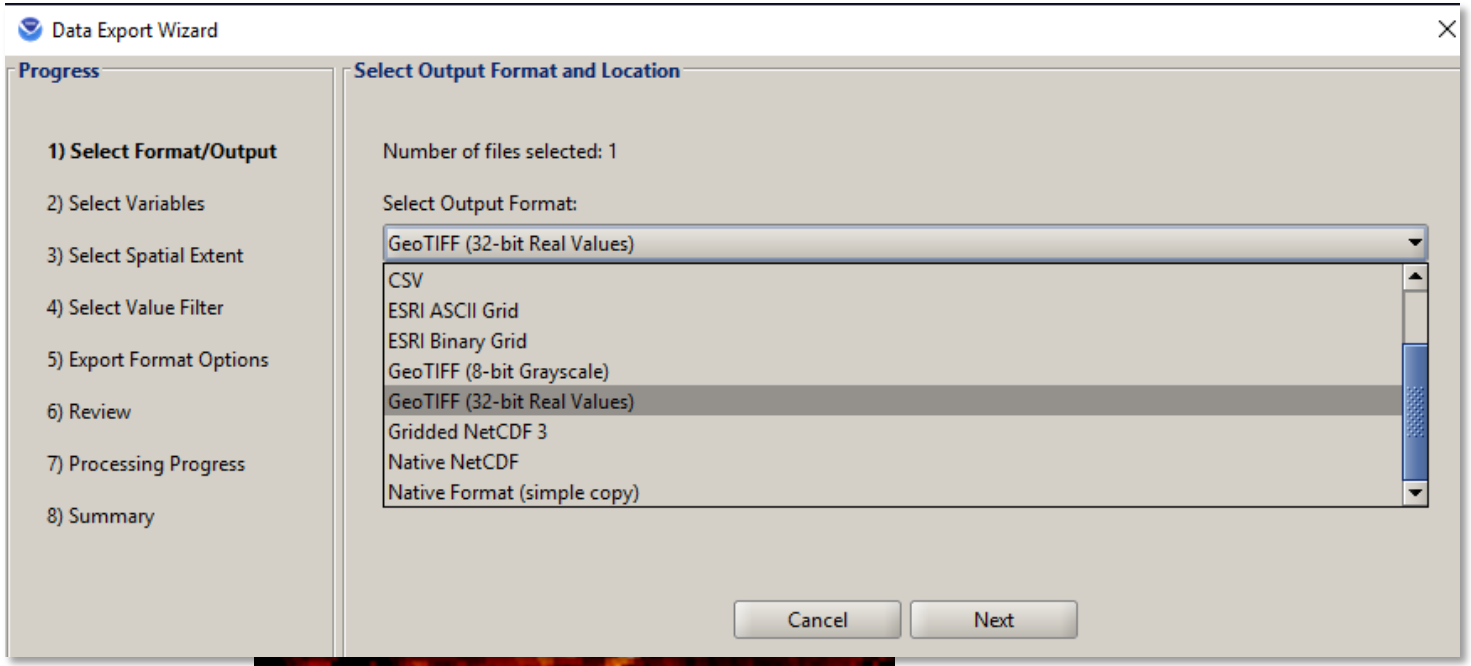
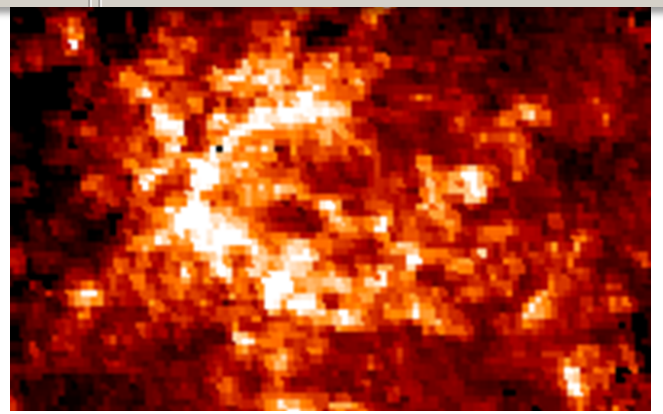


GeoTIFF Format

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