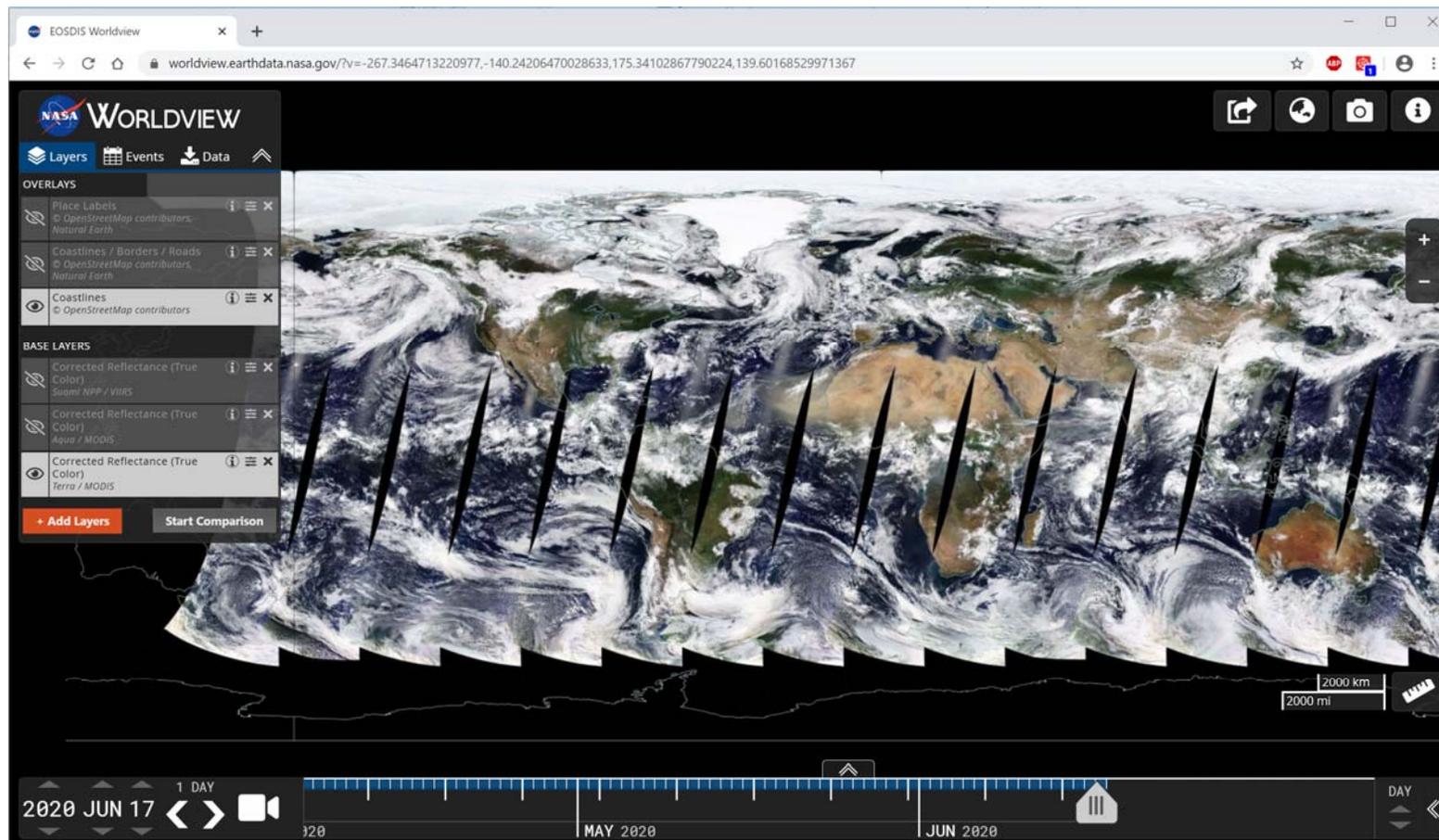
A satellite with large solar panels is shown in orbit above the Earth. The satellite is oriented diagonally across the frame, with its solar panels extending from the top right towards the bottom left. The Earth's surface is visible below, showing a mix of land and clouds. The background is the dark void of space.

# Assignment 1

## Heat Island Analysis in WorldView

NASA's **WorldView** tool has been developed as part of the Earth Observing System Data and Information System (EOSDIS). This is a web-based application. It allows to interactively browse global imagery provided by MODIS sensors onboard Terra and Aqua satellites overlay various products and then download the underlying data. Recently data from the VIIRS sensor onboard SNPP satellite has been added.



<https://worldview.earthdata.nasa.gov/>

# WorldView Features

- 100+ products and imagery from MODIS sensors data
- Imagery and products are at 0.5-1 km spatial resolution
- Updates available mostly within 3 hours after observation
- Base layers (true-color MODIS Terra, MODIS Aqua and SNPP VIIRS)
- Overlays
  - Static (places, coastlines, borders, roads, population , etc.)
  - Dynamic (Satellite products, e.g., temperature, snow, fires, etc.)
    - Mostly MODIS, also VIIRS, AURA, AMSR2, other sensors
- Three projections (arctic, antarctic, geographic)
- **Data since mid-2012**

## Functions

- Zoom in/out
- Overlay opacity
- Color palette selection for overlays
- Color palette adjustment: Set thresholds

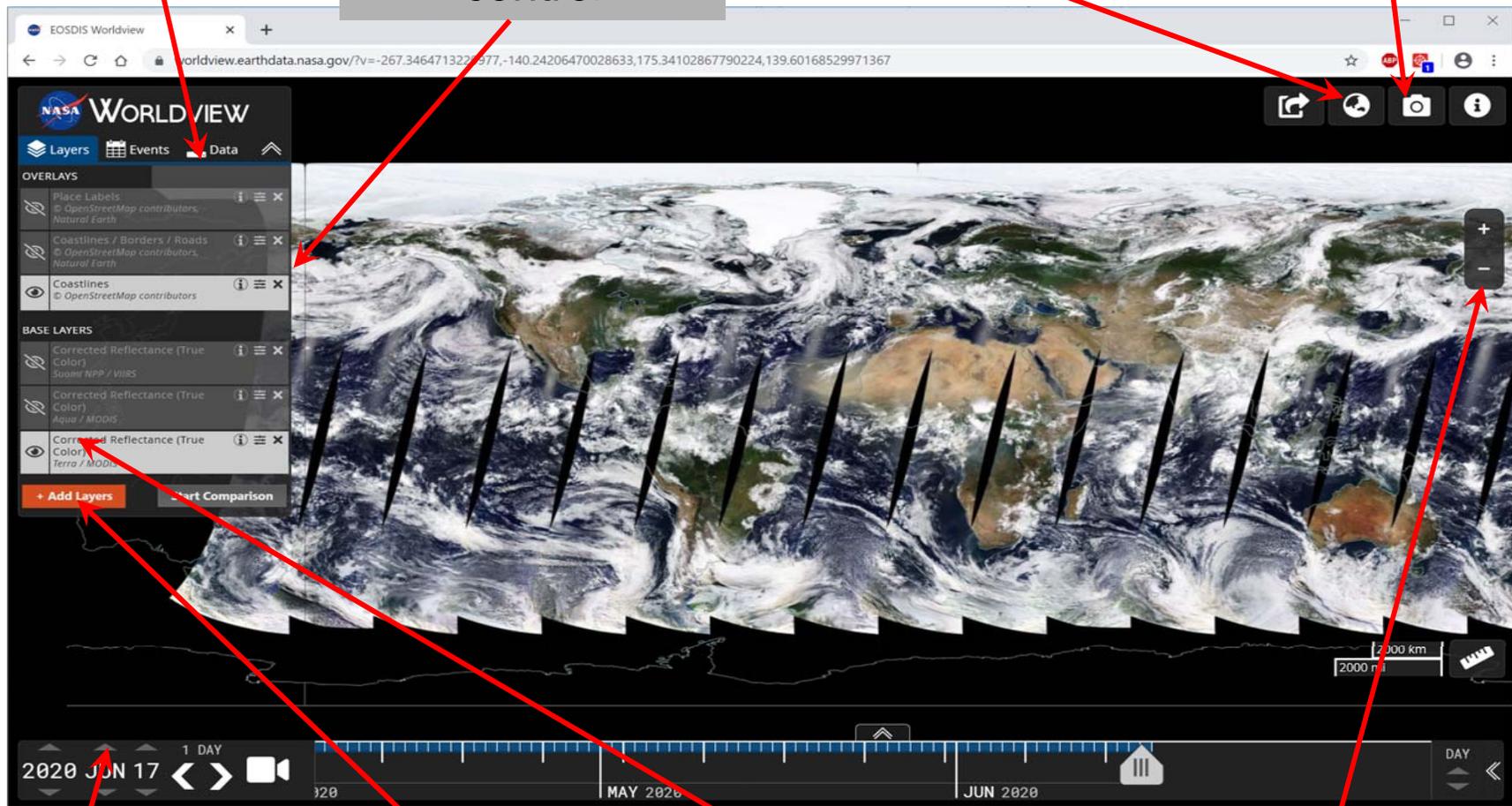
# WorldView Basic Functions: very few, very simple

Image download

Overlay color control

Change projection

Take Snapshot



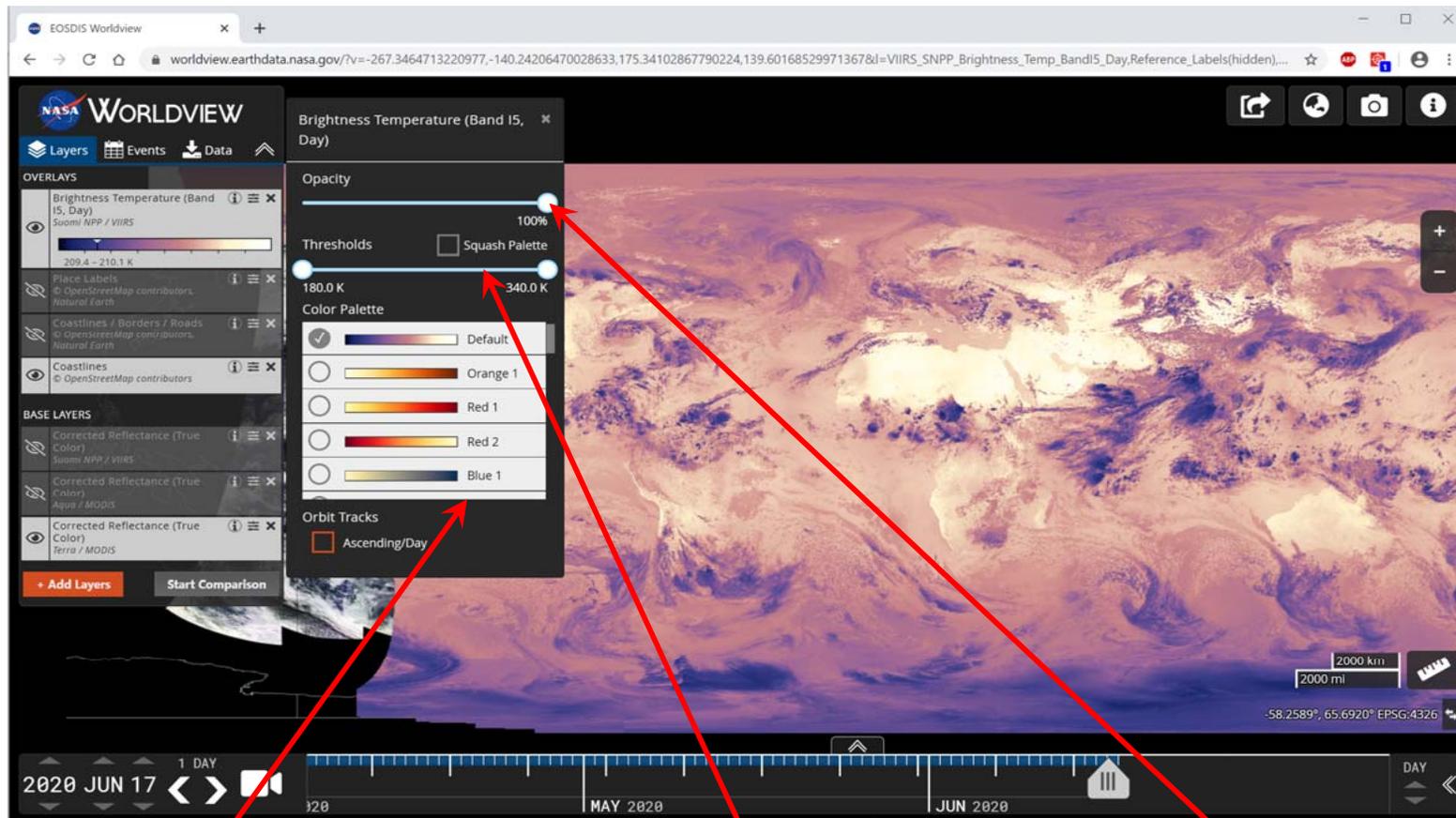
Change Date

Add Layer

Turn layer/overlay on/off

Zoom in/out

# WorldView: Overlay color control

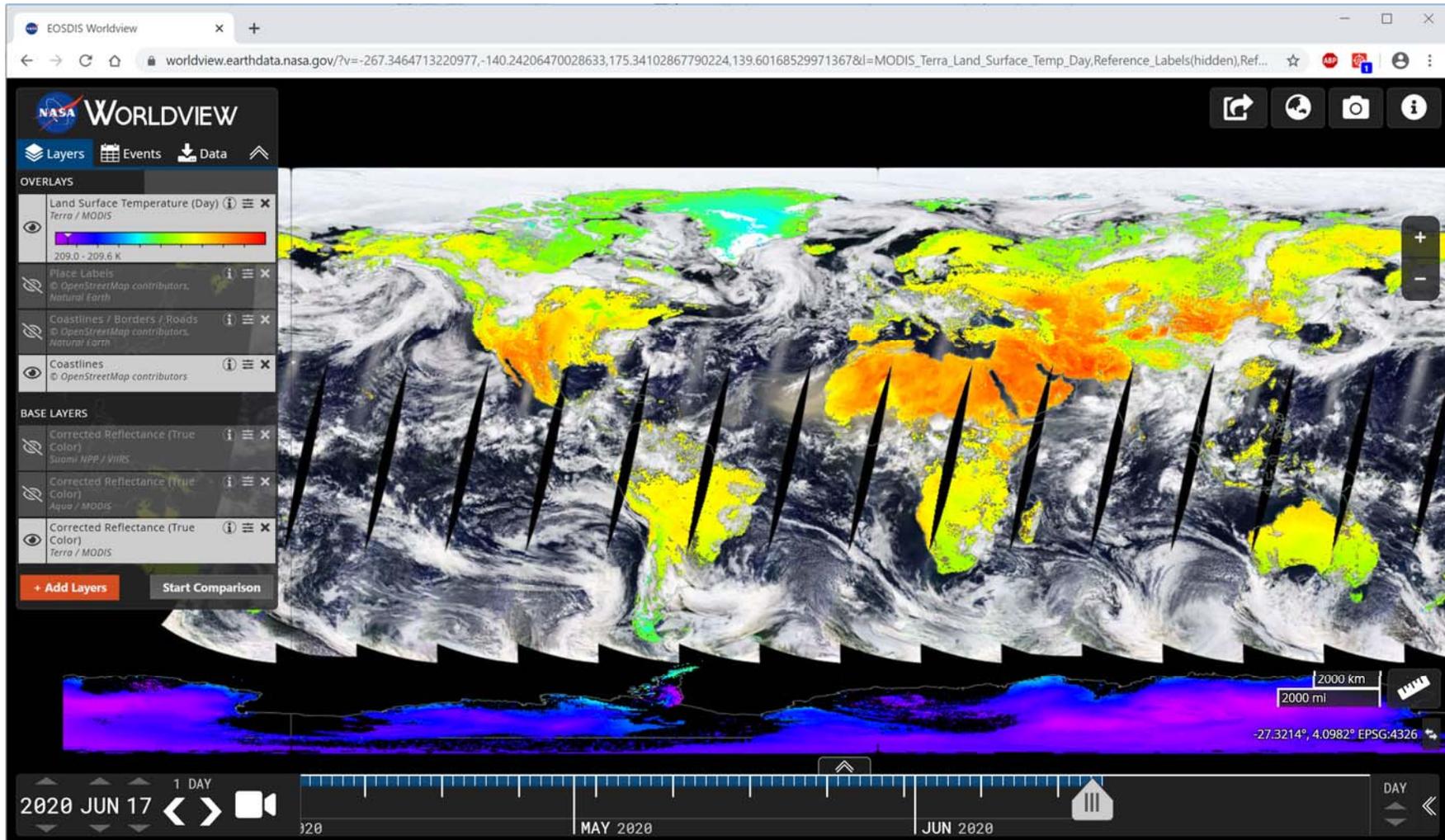


Built-in color palettes

Set thresholds for  
overlay color palette

Set overlay opacity

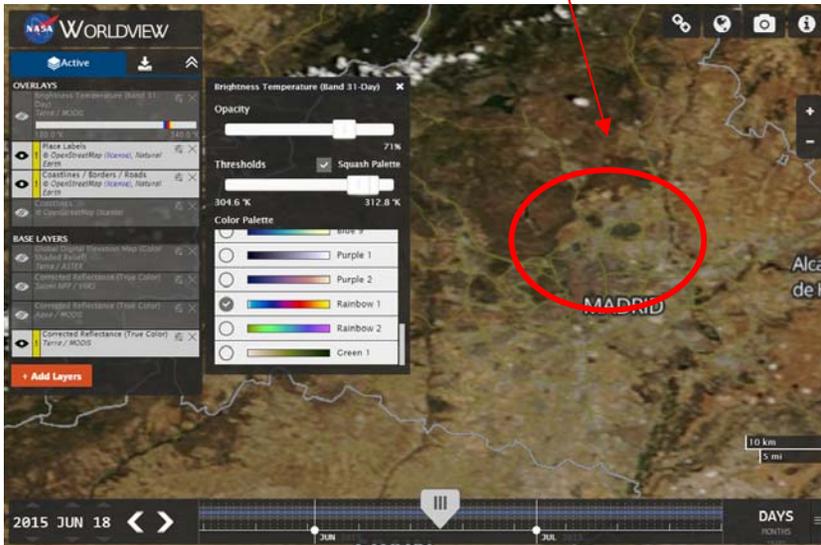
# WorldView examples: MODIS true color image with MODIS land surface temperature overlaid



Land surface temperature retrievals are provided only for cloud-clear observations

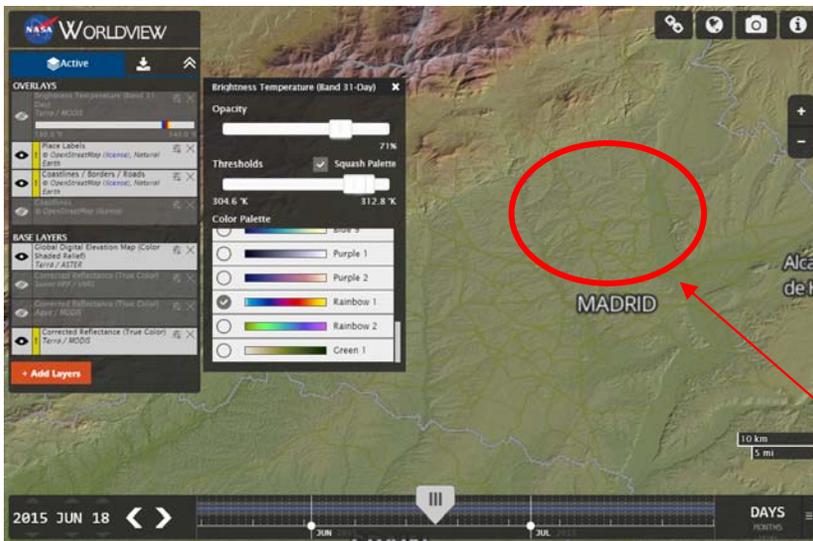
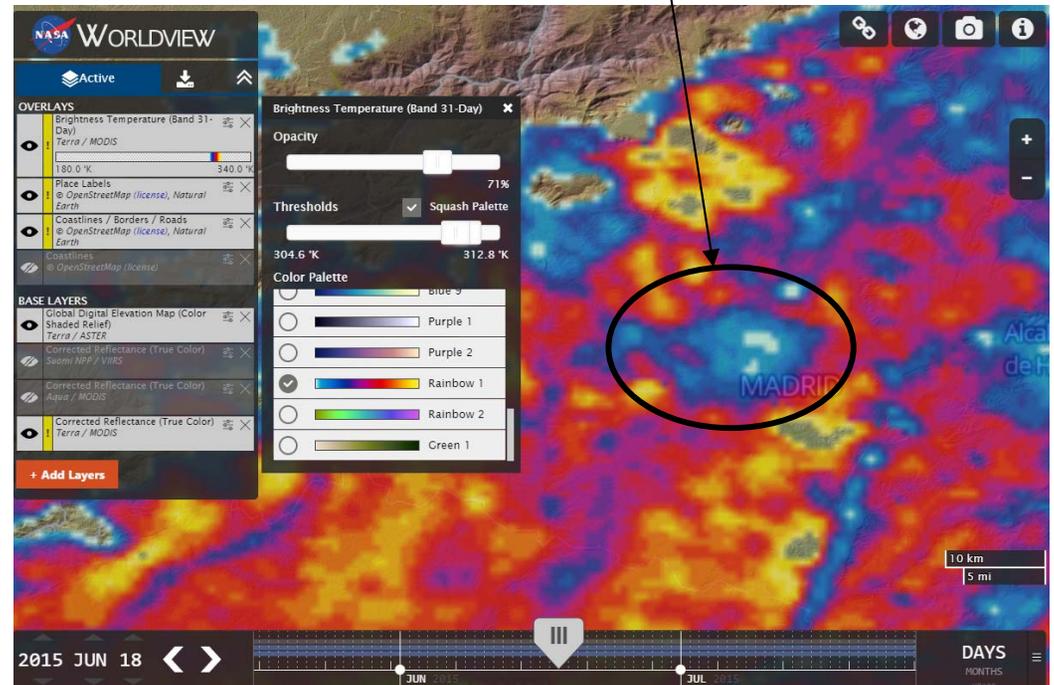
# WorldView is not quite fit for quantitative analysis of the imagery, but...

1. MODIS Terra True color image showing no clouds over Madrid, Spain

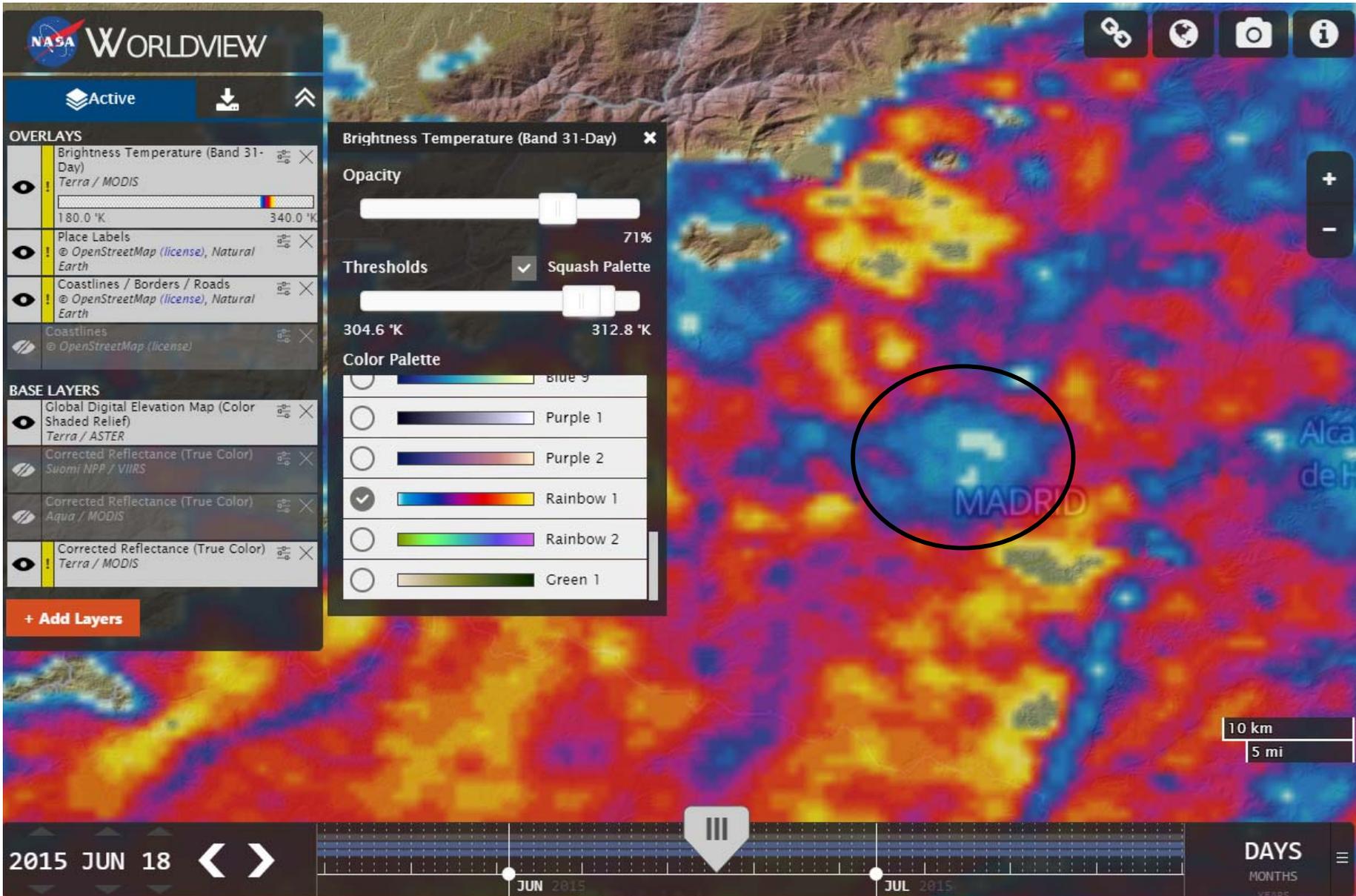


Madrid, Spain:  
40.4<sup>0</sup>N, 3.7<sup>0</sup>W

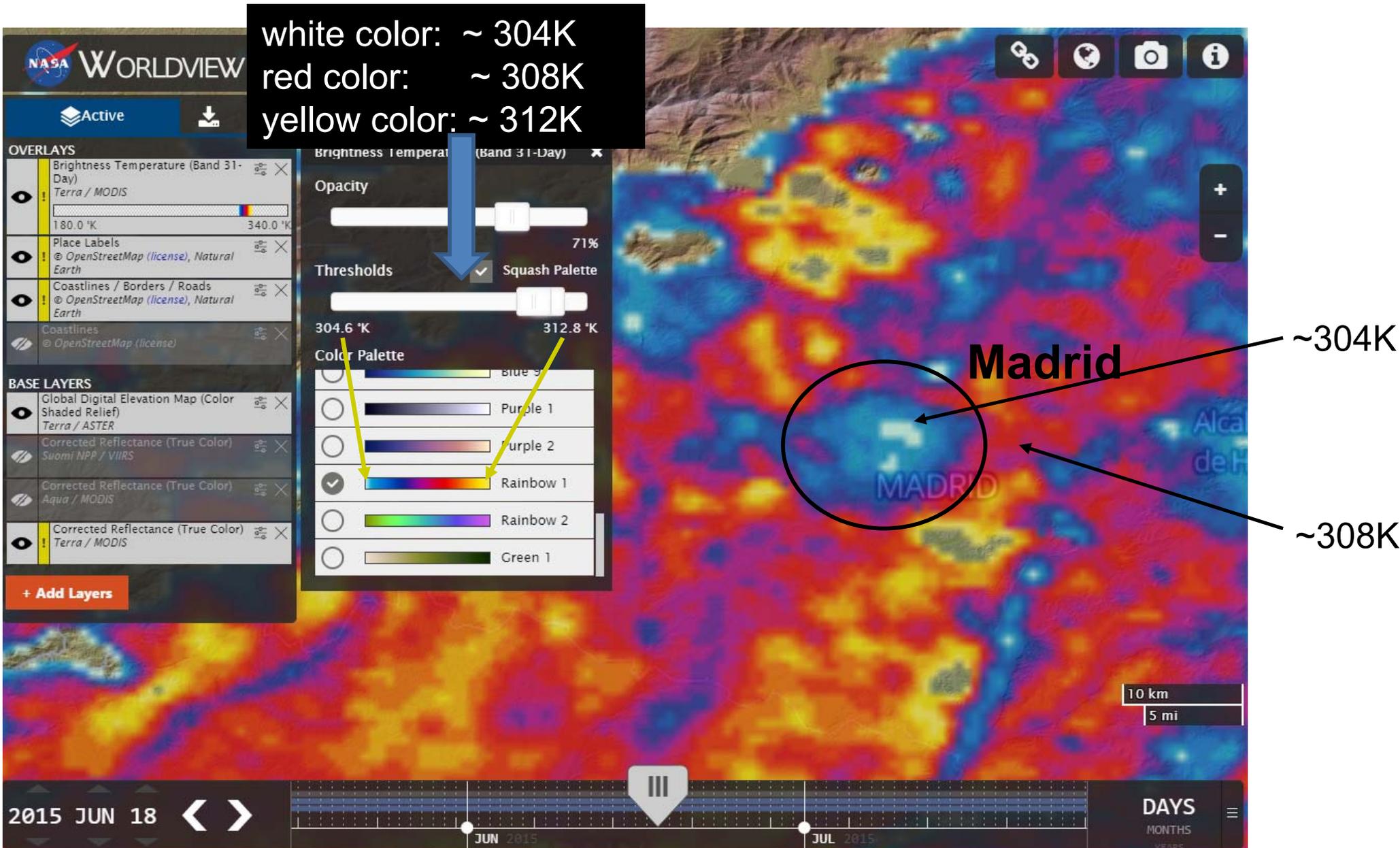
3. Overlaid MODIS brightness temperature data reveals cooler temperatures over Madrid than over surrounding area



2. Topography data shows that Madrid, Spain is located on a generally flat area



By selecting proper temperature range for the color palette you can make the temperature spatial contrast more obvious.



...and make some quantitative estimates of the temperature and temperature spatial gradients.

In this case the surface temperature in Madrid was at least 4-5K lower than in surrounding areas. This is the example of the “cool” island

# At Home

Get familiar with the software

Practice

- Using basic functions
- Putting overlays (e.g., temperature, fires)
- Adjusting color palette
- Determining temperature of the land surface and clouds
- Look for interesting/unusual features
  - Fires,
  - Dust storms
  - Hurricanes

# Assignment I

## Examining urban heat island using MODIS imagery with WorldView

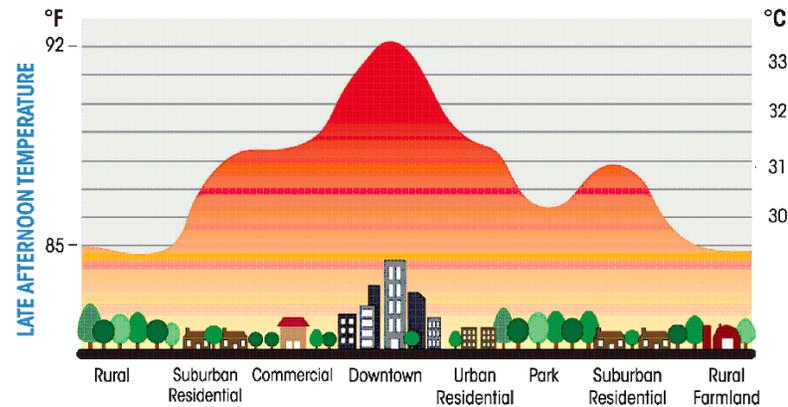
Due to human activity and associated modification of the land surface properties in big cities their thermal regime changes. As a result temperature in the center of a big city may be several degree warmer than in the suburbs. The urban heat island effect is better pronounced over large cities in mid- and high latitude regions in summer and in winter at calm weather conditions.

In cities located in deserts or surrounded by sparsely vegetated areas the urban “heat island” may not be seen. Moreover an opposite effect may develop with cooler temperatures in the city than in the suburbs. The latter is due to larger fraction of vegetated areas inherent to southern cities which reduces the daytime heating of the surface as compared to adjacent rural areas.

# Assignment I

## Examining urban heat island using MODIS imagery with WorldView

In this Assignment you will examine surface temperature around big cities and estimate the urban-rural temperature difference with MODIS data. WorldView web-based application will be used.



# Assignment I

## Examining urban heat island using MODIS imagery

### Assignment:

- Determine 3 relatively big cities to focus on. Cities should be located in different climate zones. Select cities with population of at least one million. Select cities located away from the sea shore or lake shore and located in a flat area (not in the mountains). To check whether the areas is relatively flat you can use the Global Digital Elevation Map available as an overlay within WorldView.
- Use WorldView true color imagery from MODIS to identify the time period when the area around the city was mostly free of clouds for several sequential days. Turn on
- For clear-sky scene(s) overlay the brightness temperature on the true color image. To do this click “Add Layer” button and select “Brightness Temperature”. In the list of available brightness temperature overlays select MODIS daytime band 31 brightness temperature. Make sure that the true color image and the temperature overlay are from one satellite (Terra or Aqua)

# Assignment I

## Examining urban heat island using MODIS imagery

### Assignment:

- Zoom onto the city and adjust the color palette to get the best color contrast for the rural and urban temperature range. Examine brightness temperature within 20-50 km around the city
- Determine (approximately) the temperature difference between rural areas and the center of the city. Repeat the procedure for couple of days when the area around the city remains cloud-clear. Check a different season. Does the temperature pattern remain ?
- Describe what you have found out
- Prepare two-three slides on each city illustrating your findings.
- Get ready to present the slides at the next class and answer questions