

MODIS Land Surface Temperature: Application in Drought Monitoring

Prepared by:

Begum Rushi

NASA Science Co-ordination Team,
SERVIR, MSFC



USAID
FROM THE AMERICAN PEOPLE



RCMRD

ICIMOD



Overview of the Presentation



- Dataset Overview
- Introduction Google Earth Engine (GEE)
- Application
- Analysis and Representation

- Daily Land Surface Temperature (MODIS, MOD11A1)
- Land Cover Data (Landsat)

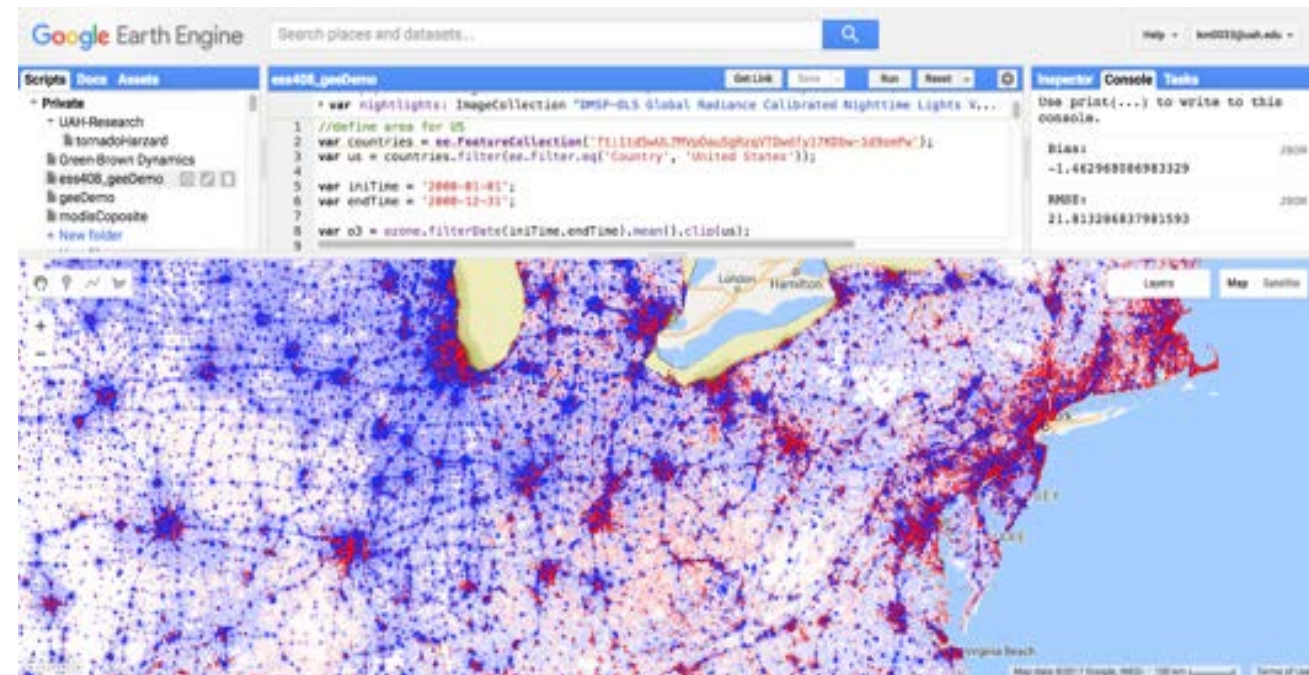
"Big Data" analysis and visualization platform

Designed *for scientists*, not software engineers

Goals: *make it easy, enable non-traditional users*

Focused on society's biggest challenges

Reduce the time needed on analysis to spend more time on impact



How do you use it?

SERVIR

JavaScript API

Interactive Code Editor

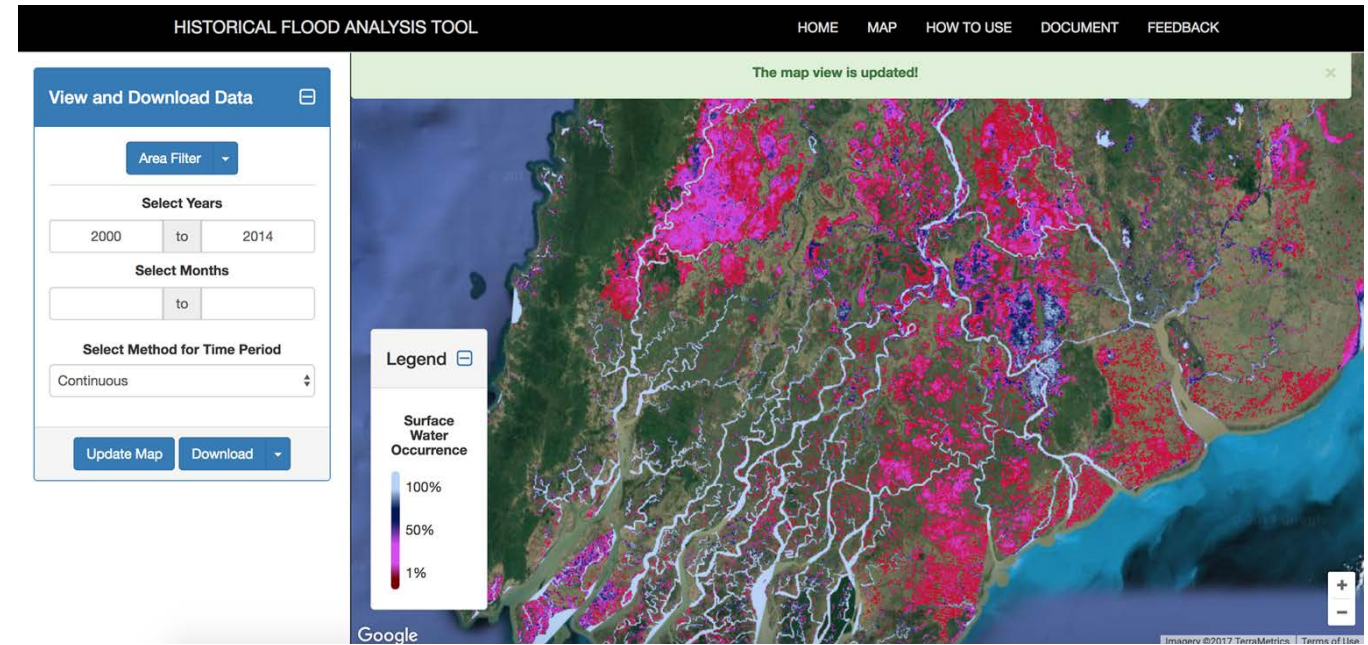
Easy to use and instant results

Python API

Python module

Web Apps with Appengine

Jupyter Notebooks*



What data does it have?

SERVIR 

9PB Public Data Catalog (and growing)

Imagery

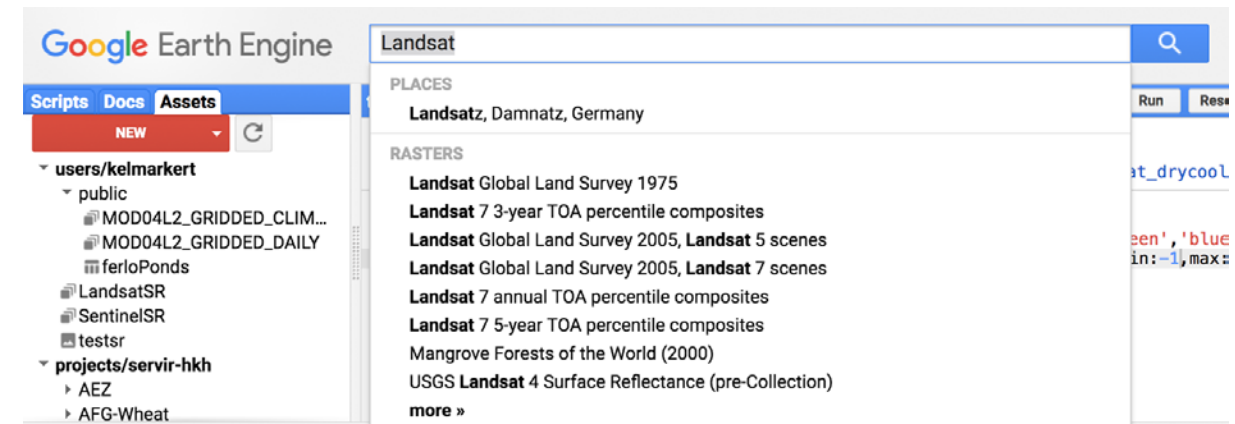
Landsat 4-8	7 bands, 30m
MODIS	250m Daily Global
Sentinel-1	10m SAR
Sentinel-2	12 bands, 10/20/60m

Geophysical

Digital Elevation
Land Cover
Surface Temperature, etc.

Weather Forecasts, Climate Models
+300 more analysis ready datasets

Custom user assets



Introduction to GEE

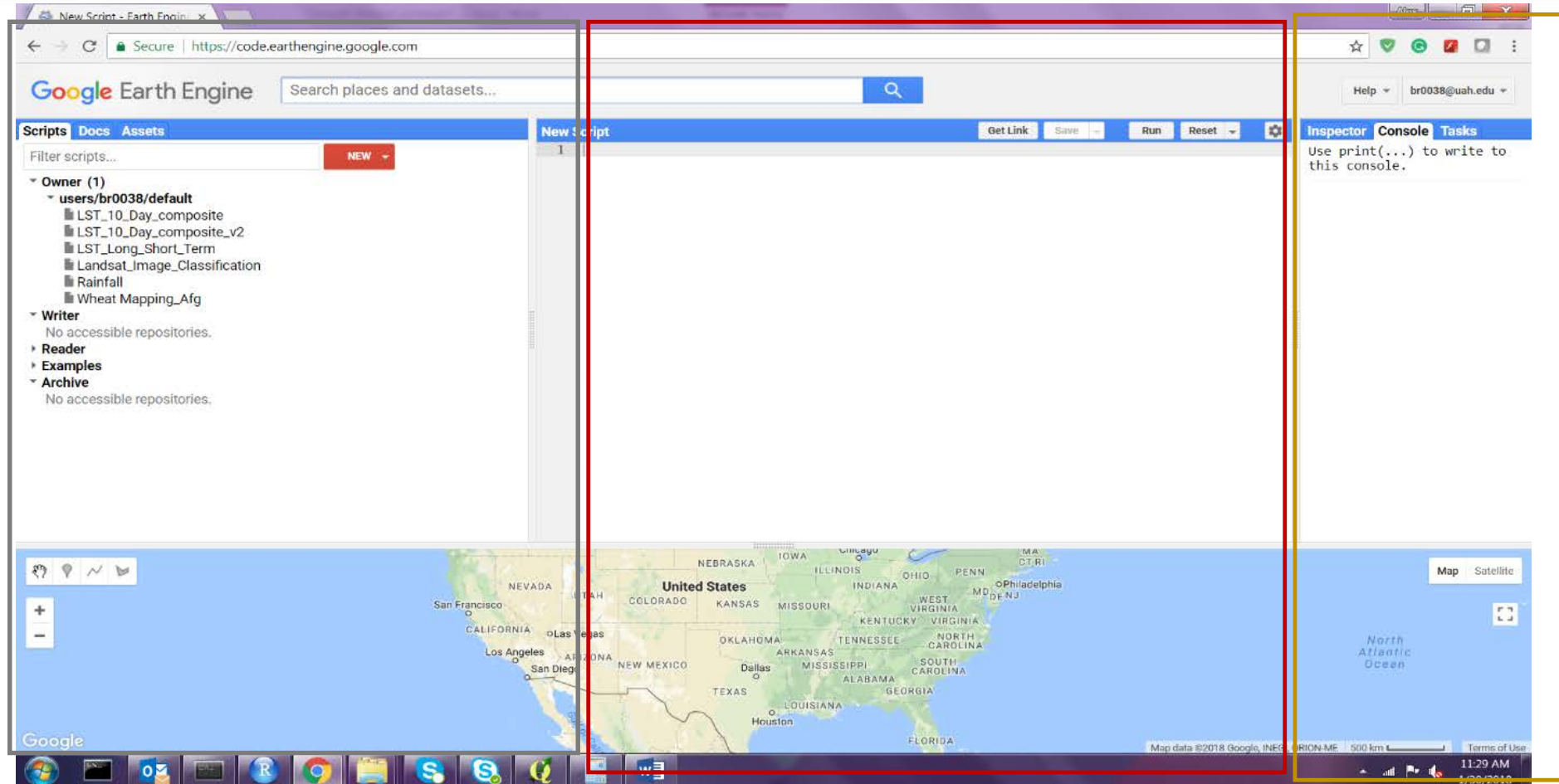


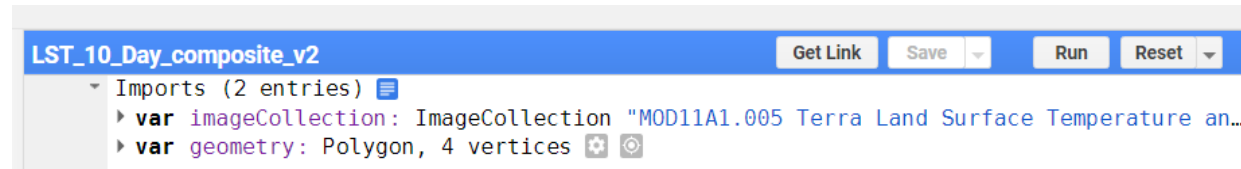
Table of Contents

Scripts

Console



Enter the name of the MODIS Land Surface Temperature to load



Designating the interested region

```
1
2 //Choose country using GEE Feature Collection
3 var region = ee.FeatureCollection('ft:1tdSwUL7MVp0auSgRzqVT0wdfy17KDbw-1d9omPw').filterMetadata('Country', 'equals', 'Bangladesh');
4
5
6
7 //Add region outline to layer - for selected countries
8 //Map.addLayer(region, {}, 'Bangladesh');
9
10 Map.addLayer(geometry);
11
```



Collecting bands and scale

```
11
12 // Collect bands and scale
13 var modisLSTday = ee.ImageCollection('MODIS/MOD11A1').select('LST_Day_1km');
14 var modisLSTnight = ee.ImageCollection('MODIS/MOD11A1').select('LST_Night_1km');
15 var modLSTday = modisLSTday.map(function(img) {
16   return img.multiply(0.02).subtract(273.15).copyProperties(img,['system:time_start','system:time_end']);
17 });
18 var modLSTnight = modisLSTnight.map(function(img) {
19   return img.multiply(0.02).subtract(273.15).copyProperties(img,['system:time_start','system:time_end']);
20 });
21
```

Selecting study period

```
--  
22  
23 // Select dates  
24 var collection05night = ee.ImageCollection(modLSTnight.filterDate('2001-01-01', '2017-12-31'));  
25 var collection05day = ee.ImageCollection(modLSTday.filterDate('2001-01-01', '2017-12-31'));  
26  
27
```



Cropping the data for the region

```
31  
32 // Cropping the data for the region  
33  
34 var collection = collection05day.filterBounds(region);  
35  
36
```

Collecting Metadata Properties

```
34
35 // Get a list of all metadata properties.
36 var properties = collection.propertyNames();
37 print('Metadata properties: ', properties); // ee.List of metadata properties
38
39 // Get the date range of images in the collection.
40
41 var dates = ee.List(collection.get('date_range'));
42 var dateRange = ee.DateRange(dates.get(0), dates.get(1));
43 print('Date range: ', dateRange);
44
45
```

Calculating 10 Day Composite Data

```
ST_10_Day_composite
Get Link Save Run Reset
44
45 //Calculating the 10 Day Composite
46
47 var startyear = 2001;
48 var endyear = 2017;
49 // Run the loop
50 for (var yr= startyear; yr <= endyear; yr = yr + 1) {
51   var startdate = 1;
52   //var enddate = 365;
53   var enddate = ((yr%4)===0) ? 366 : 365;
54   //print('This is enddate ' +enddate);
55
56   for (var dt= startdate; dt <= enddate; dt = dt + 10) {
57
58     // Use ee.Filter.calendarRange to filter by year and month
59     var img = collection.filter(ee.Filter.calendarRange(yr,yr,'year'))
60     .filter(ee.Filter.calendarRange(dt,dt+9,'day_of_year'));
61     // reduce image collection with mean()
62     if (dt == 1){
63       var mean = img.mean().rename('LST_'+dt+'_' +(dt+9)+'_' +yr);
64     }
65     else {
66       mean = mean.addBands(img.mean().rename('LST_'+dt+'_' +(dt+9)+'_' +yr))
67     }
68   }
69   print(mean)
70 }
```

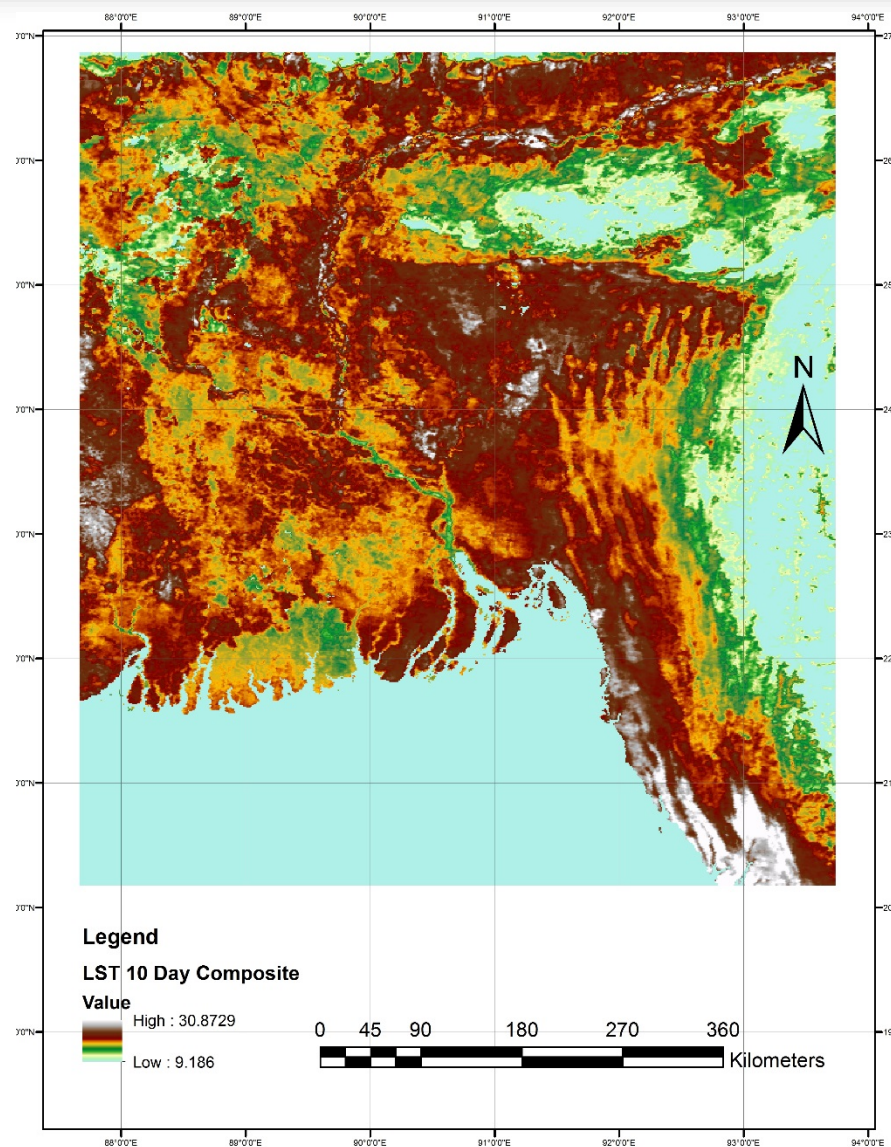


Exporting the output

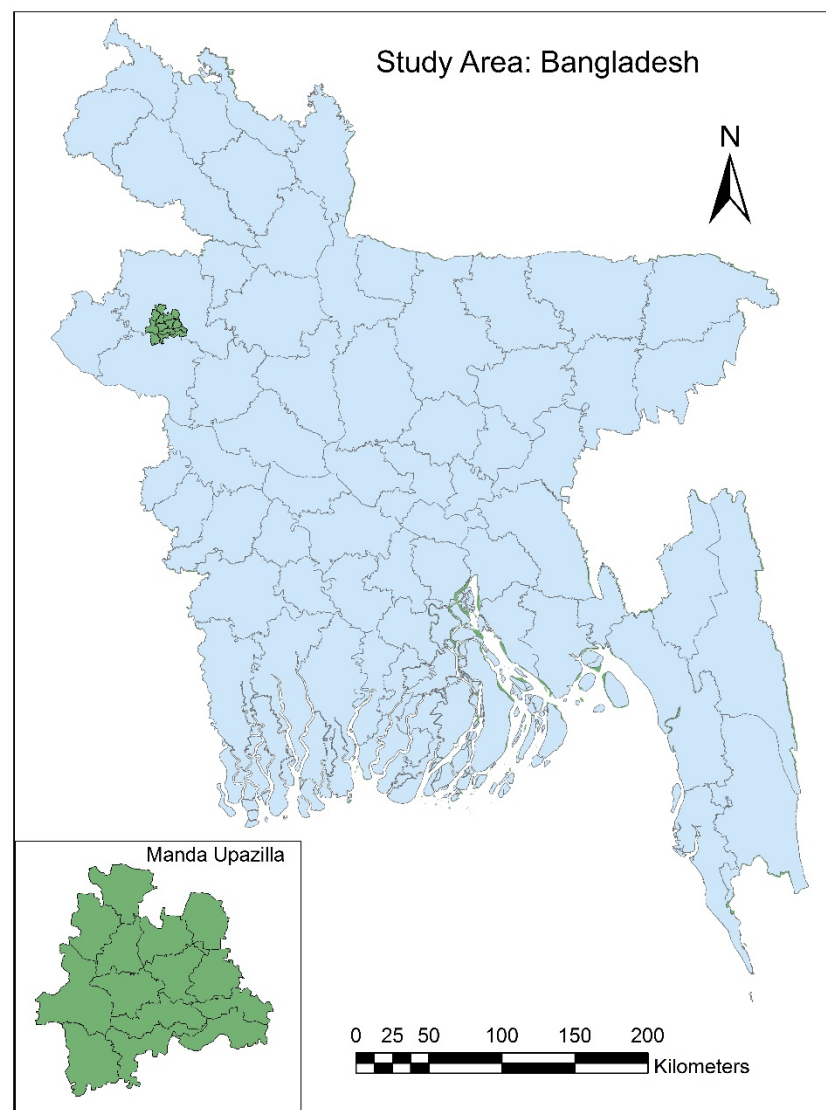
```
71
72 // Export the image, specifying scale and region.
73 Export.image.toAsset({
74   image: mean,
75   description: 'LST_10Day_' + yr,
76   assetId: 'projects/servir-hkh/MODIS_LST_10_Day_Composite/LST_10Day_'+yr,
77   scale: 1000,
78   region: geometry,
79   maxPixels: 3E11,
80   pyramidingPolicy: {
81     '.default': 'mean',
82   }
83 });
84
85 }
86
87
```

Outputs

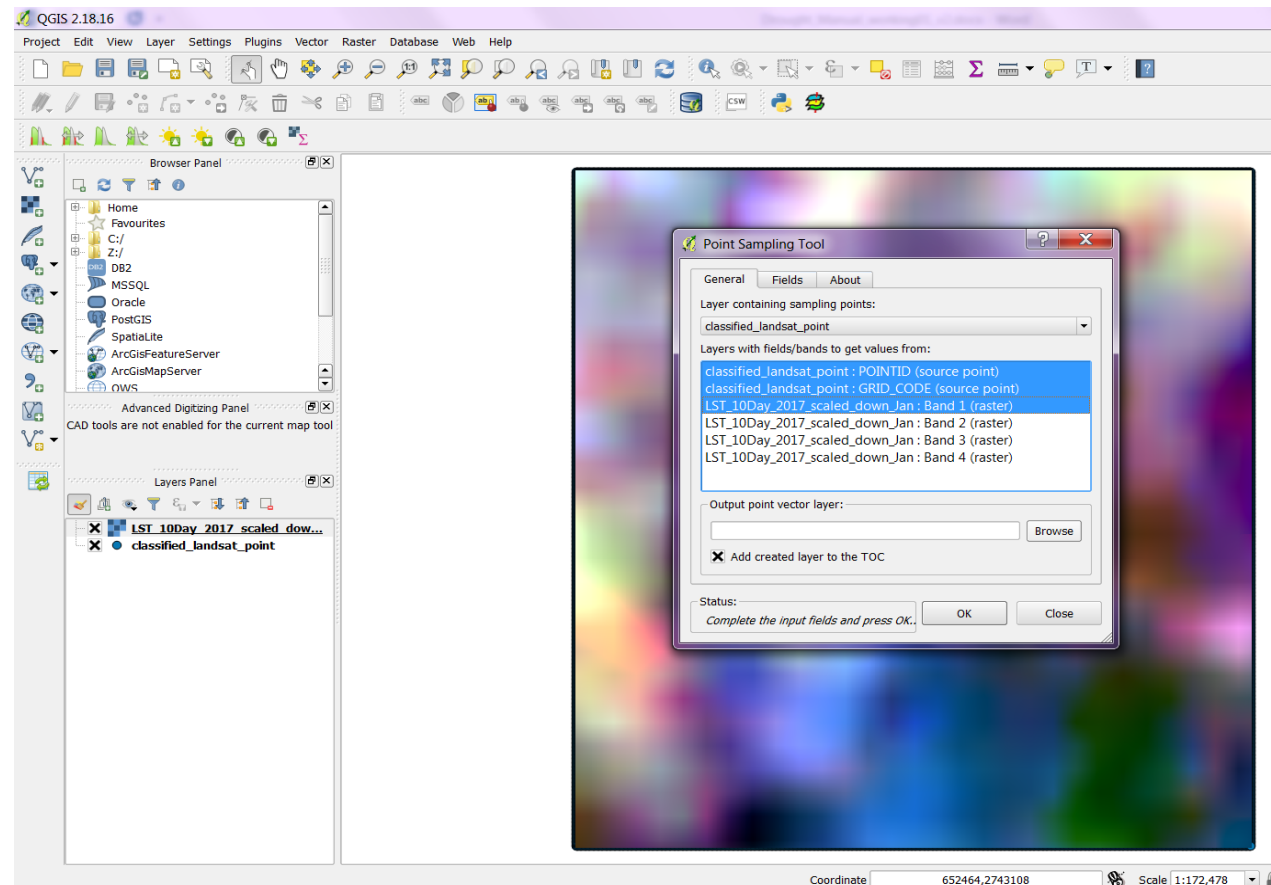
- MODIS LST 10 Day Composite



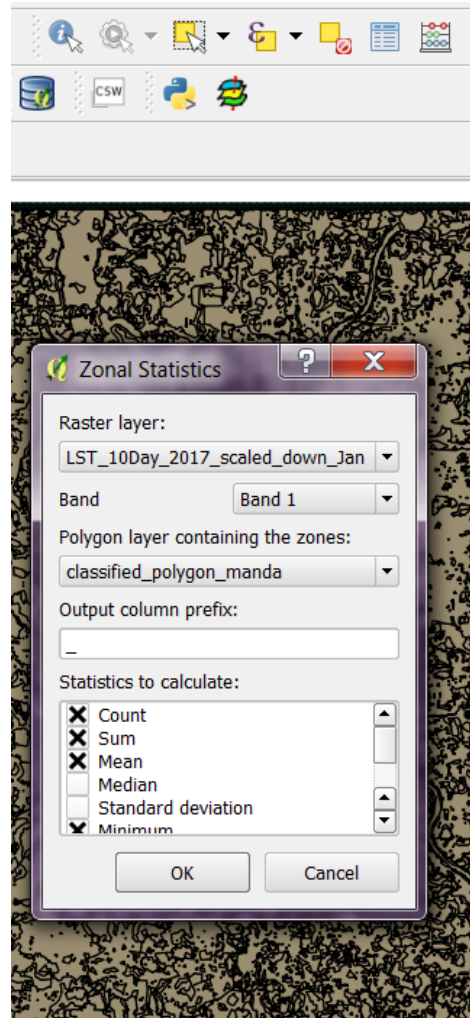
- Study Area



- Extracting LST for each landcover type



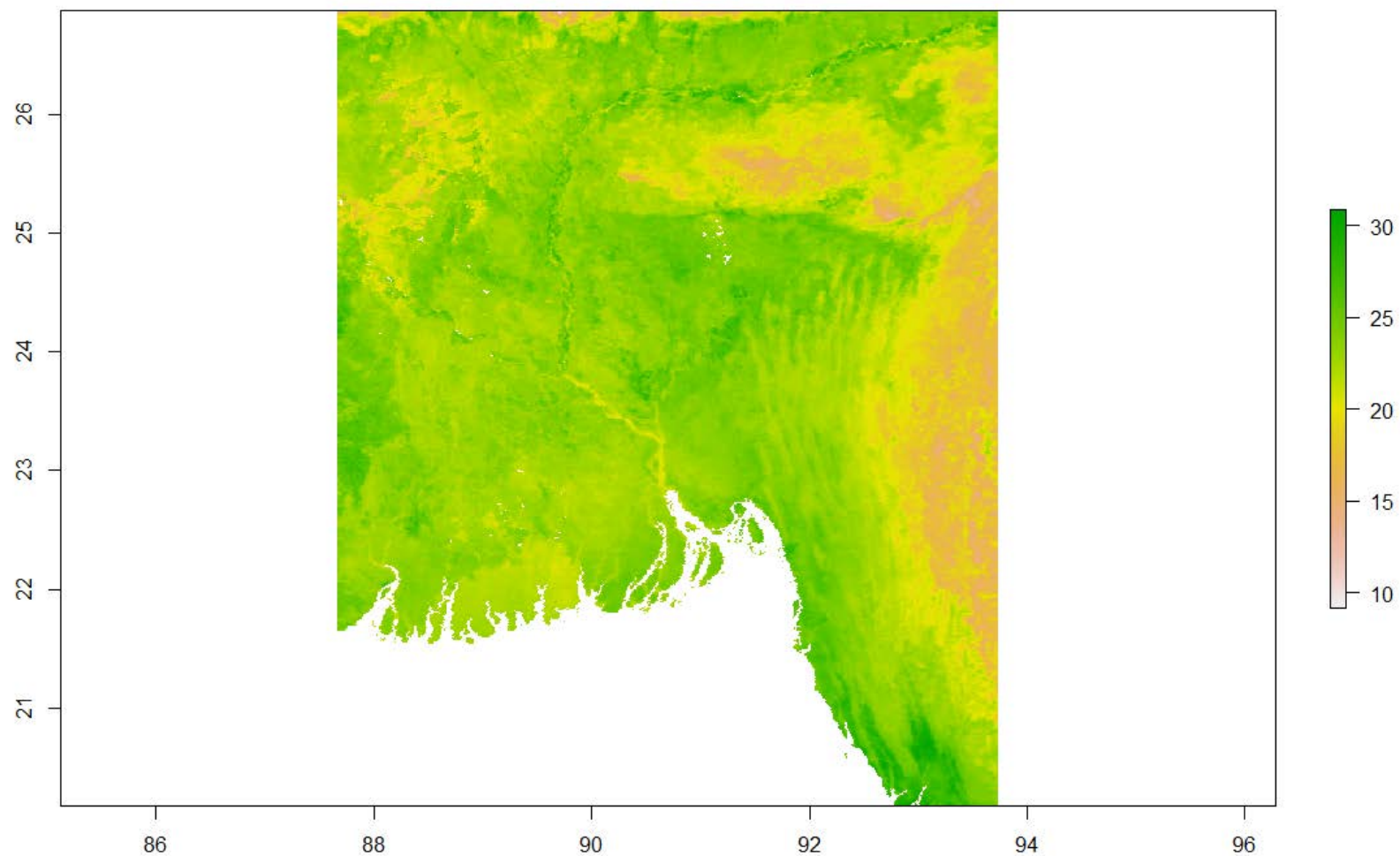
- Calculating mean temperature for each landcover type



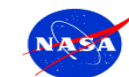
Outputs

SERVIR

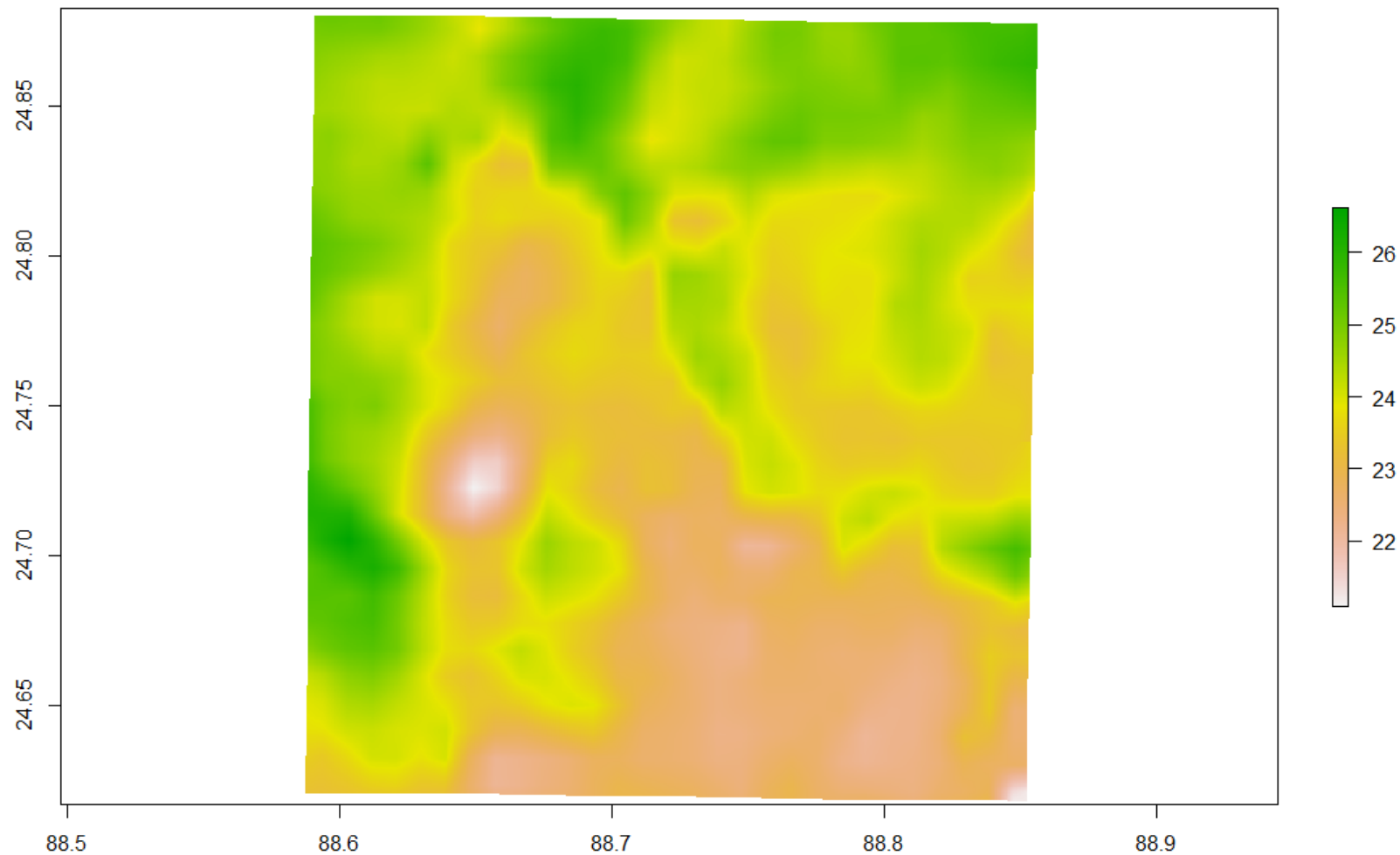
LST 10 Day Composite (January 1-10, 2017)



USAID
FROM THE AMERICAN PEOPLE

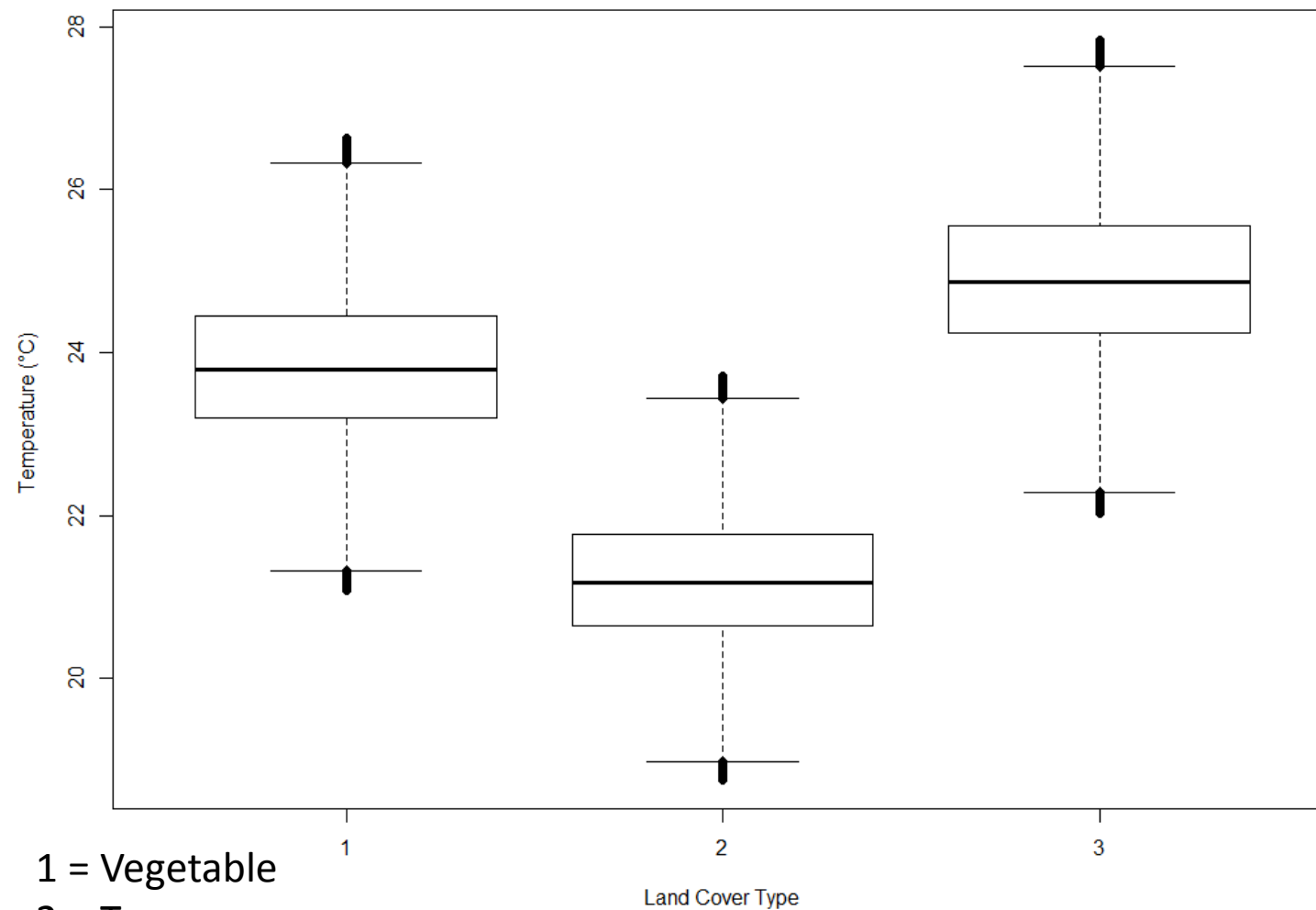


LST 10 Day Composite (June 1-10, 2017): Manda Upazilla



LST 10 Day Composite Comparison among Land Cover Types

LST in Manda Upazilla (June 1st -10th ,2017)



1 = Vegetable
2 = Tree
3 = Rice

Temperature Distribution for Crop Landcover (Manda Upazilla)

