# Disaster Damage Assessment and Recovery Monitoring using Night-time Light on GEE

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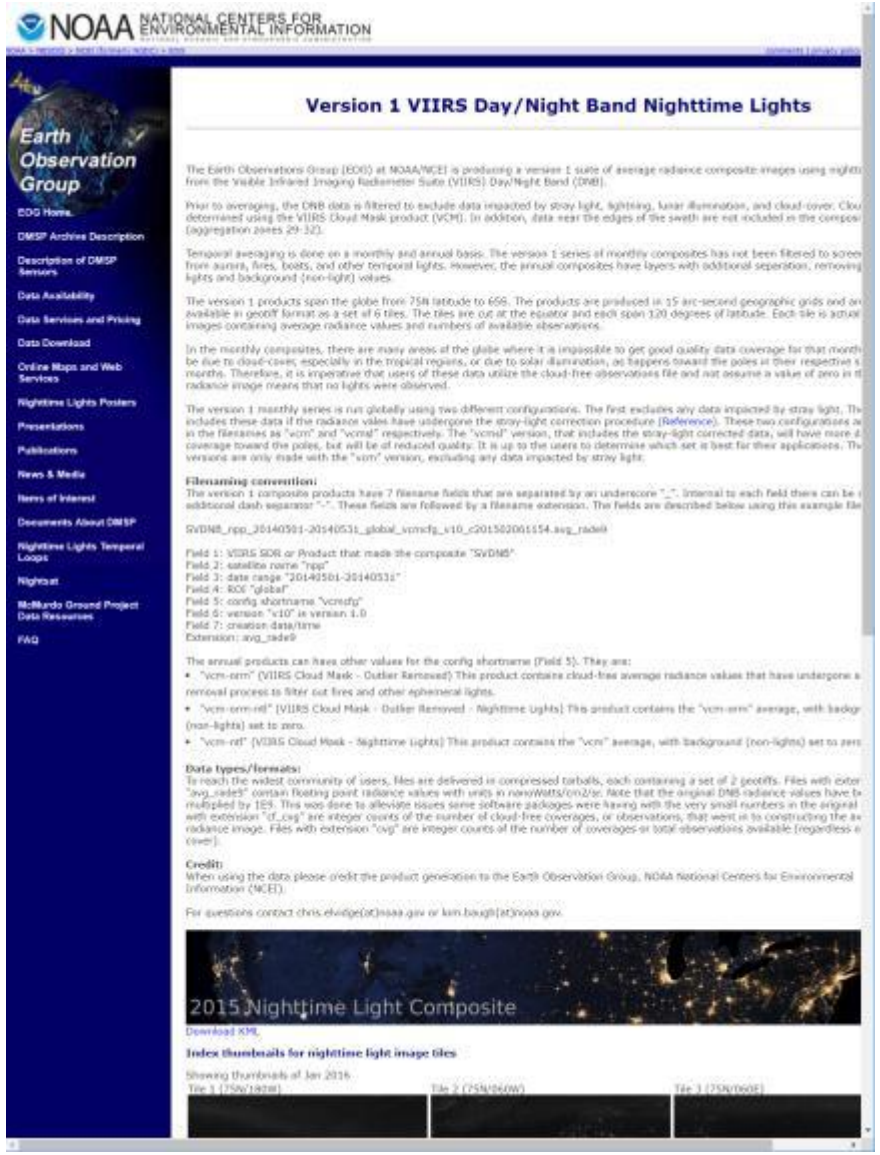
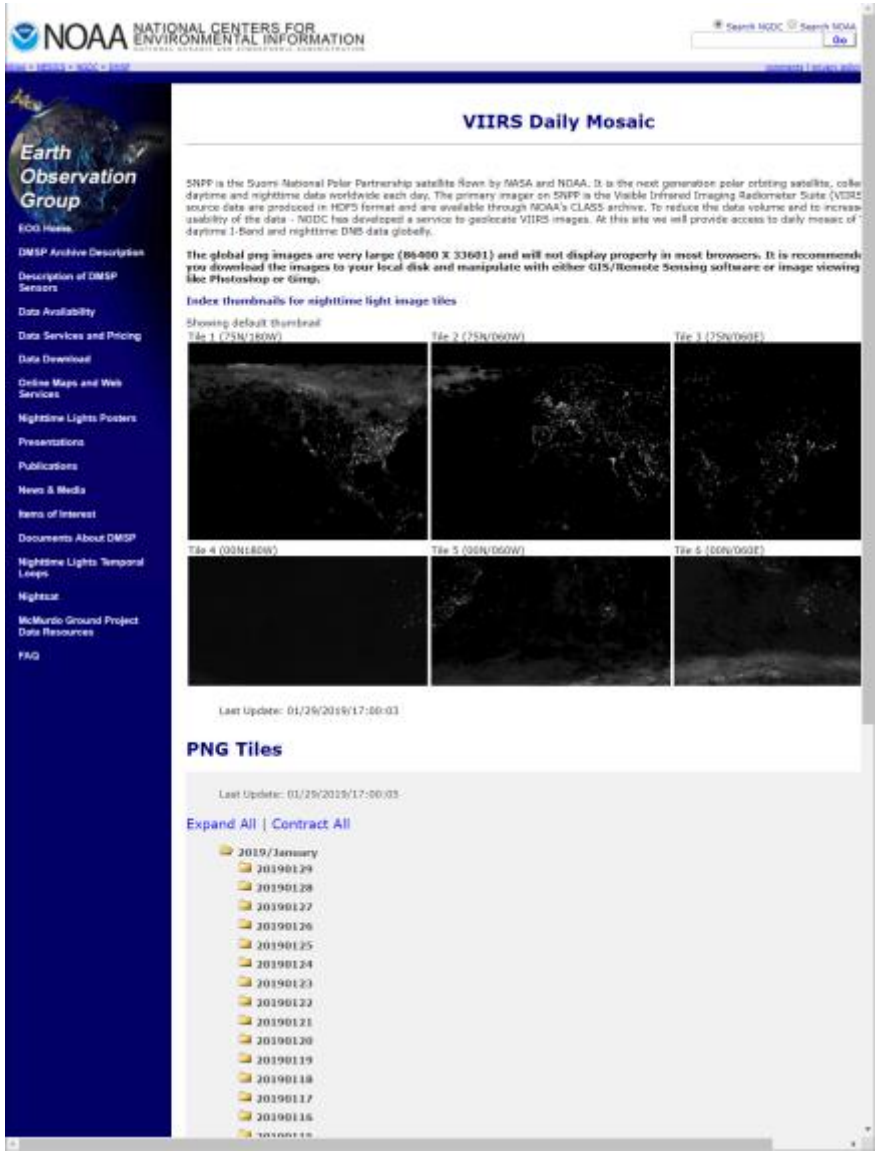
Monthly composite of night-time light data (1-2 month-delay from real-time)

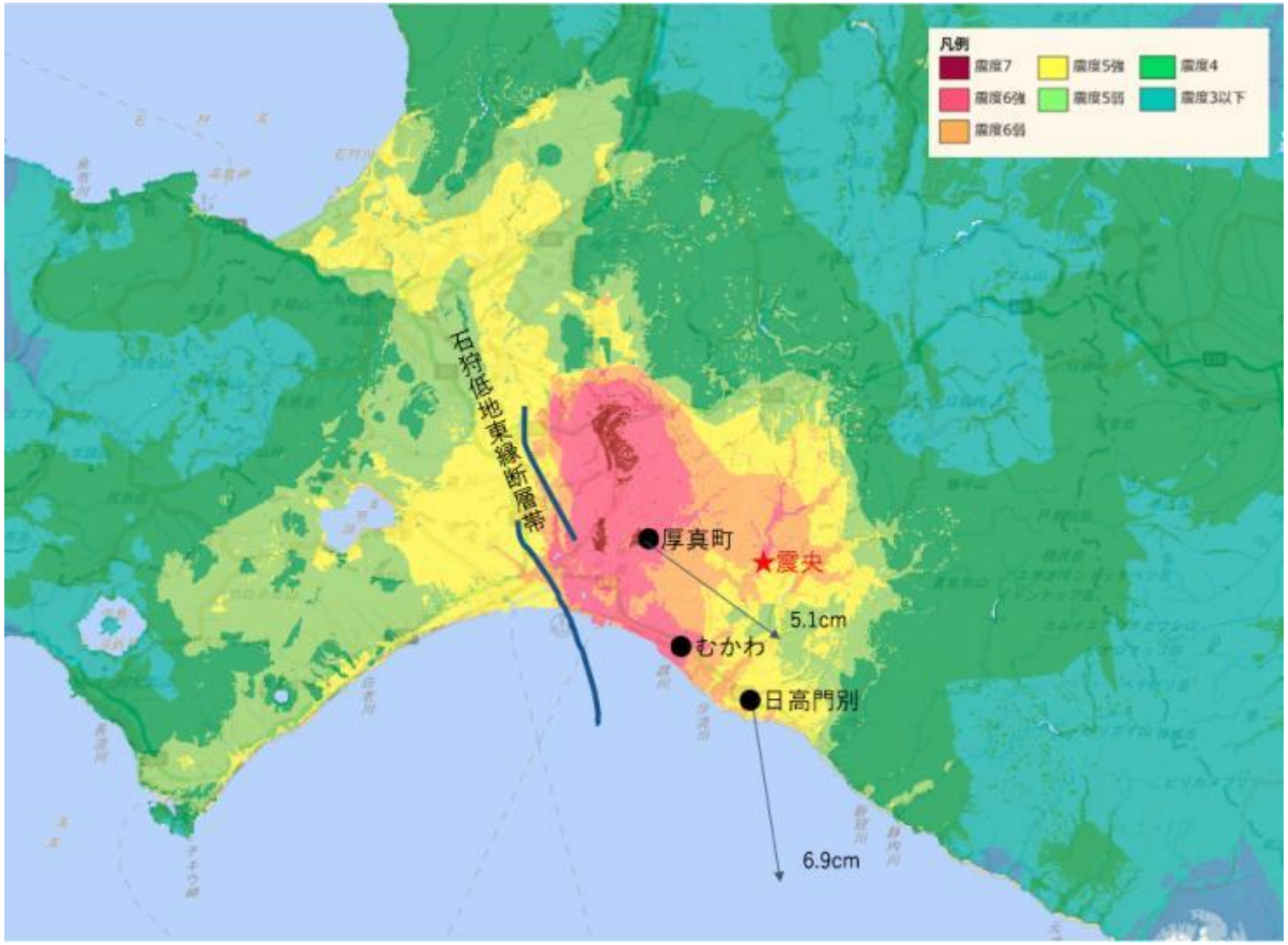



Daily mosaic of night-time light data (real-time)

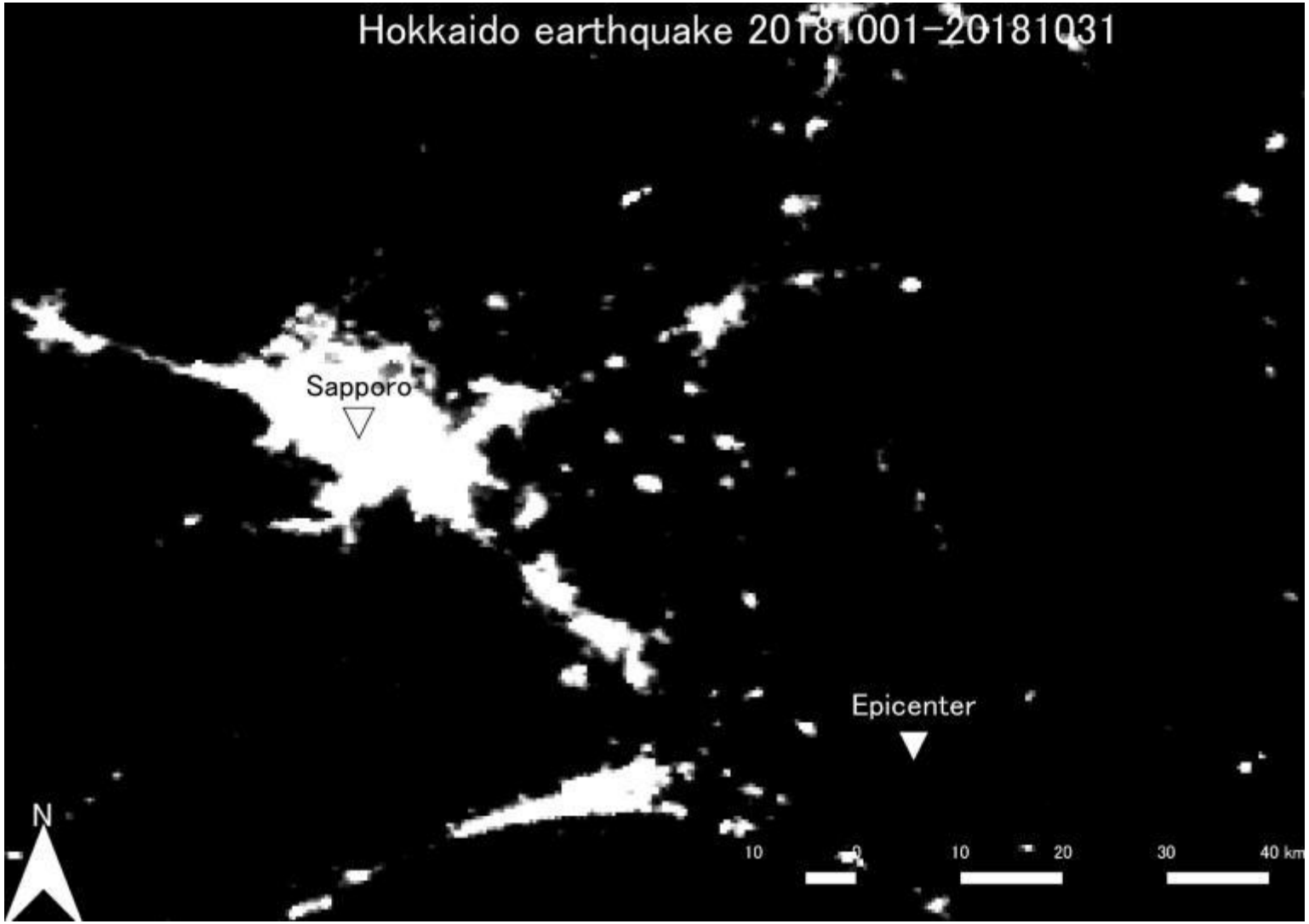



https://www.ngdc.noaa.gov/eog/viirs/download_dnb_composites.html

# Earthquake in Hokkaido, Japan, Sept 2018

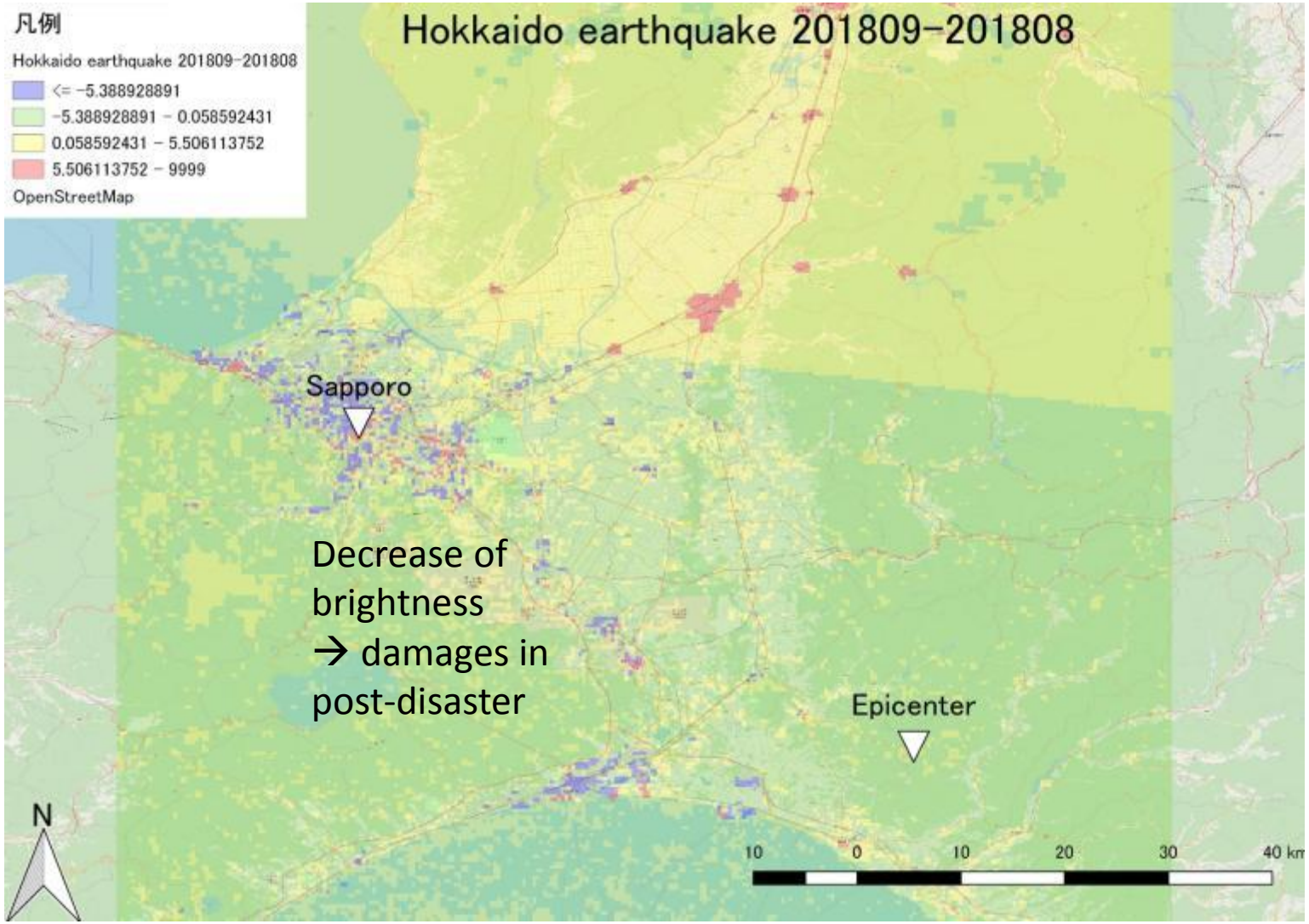


# Post-disaster night-time light, Oct 2018



## Change detection from monthly composite

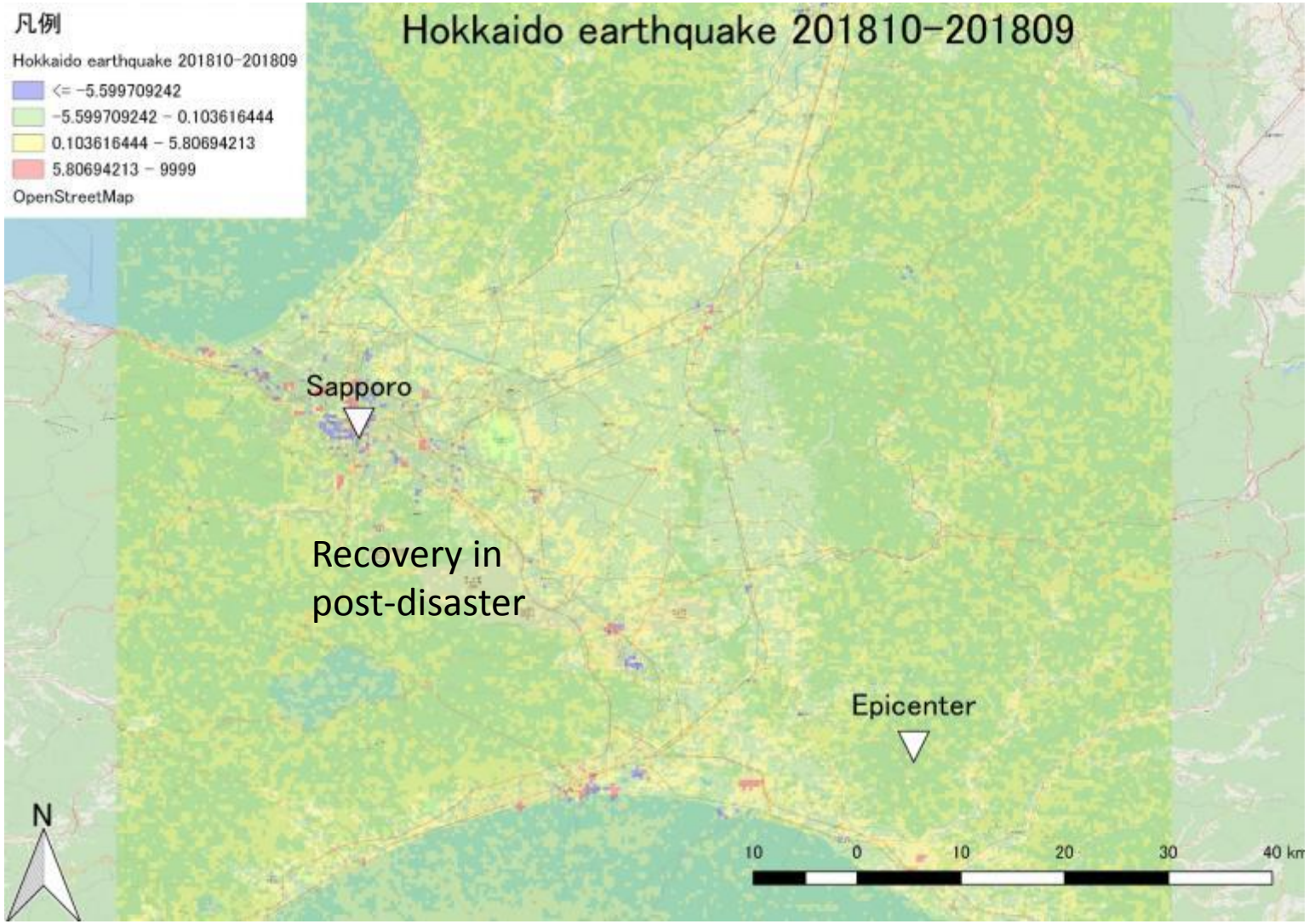
# Changes between September – August, 2018




Changes were identified by $\mu \pm 2\sigma$ in the differences.

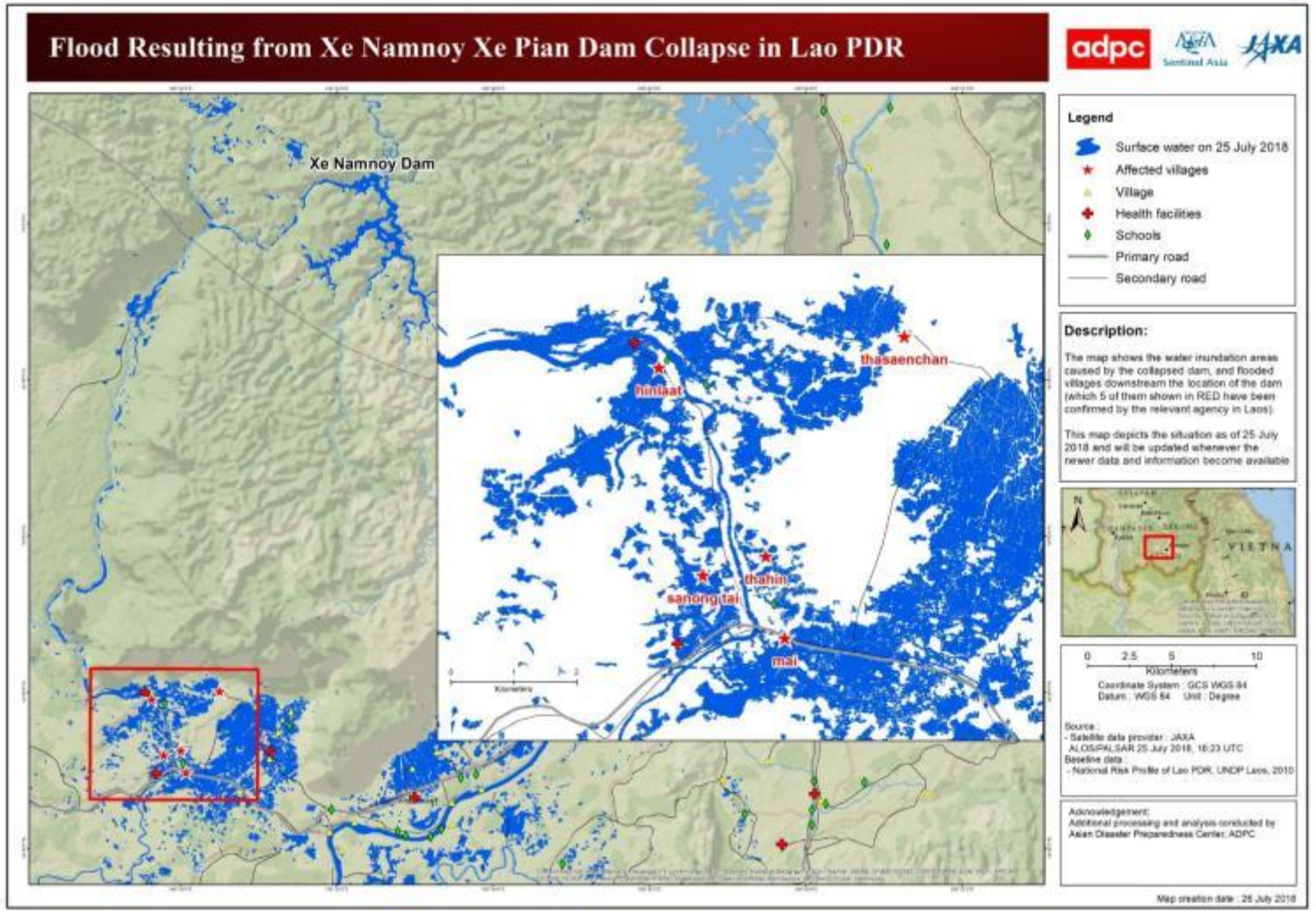
## Change detection from monthly composite

# Changes between October – September, 2018

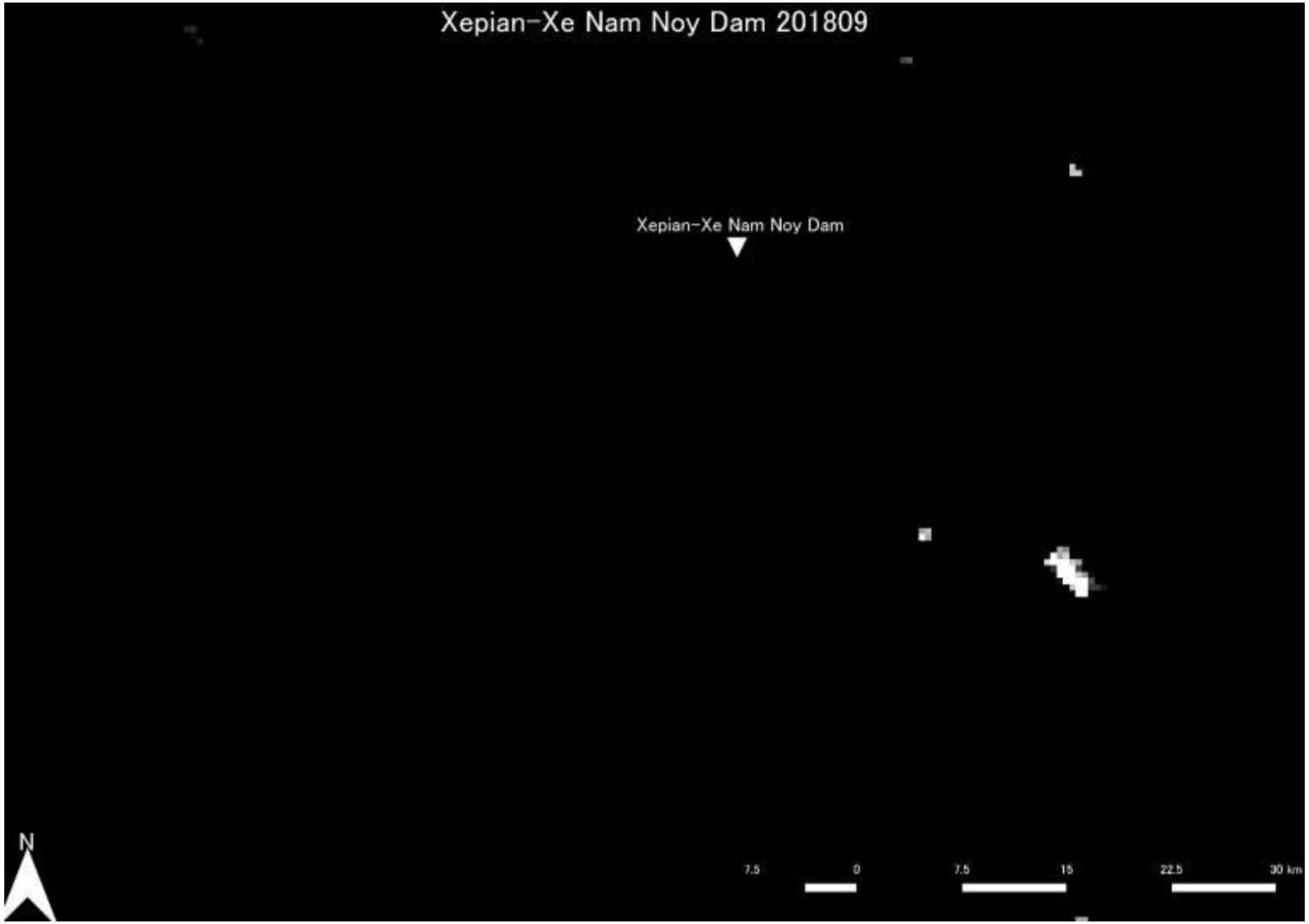



Changes were identified by $\mu \pm 2\sigma$ in the differences.

# Impact of dam eruption in Laos, July 2018

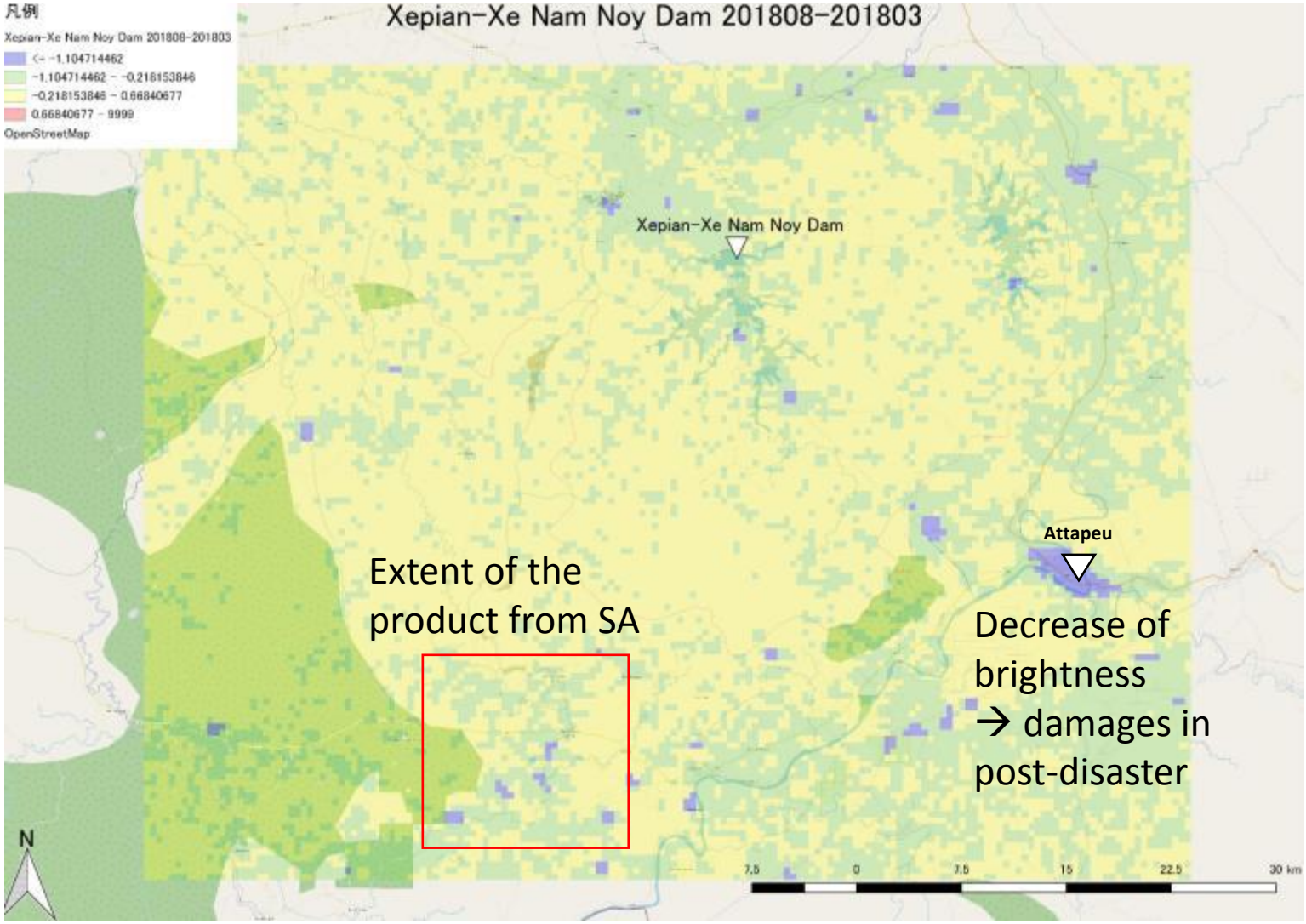


# Night-time light in post-disaster, September, 2018



## Change detection from monthly composite

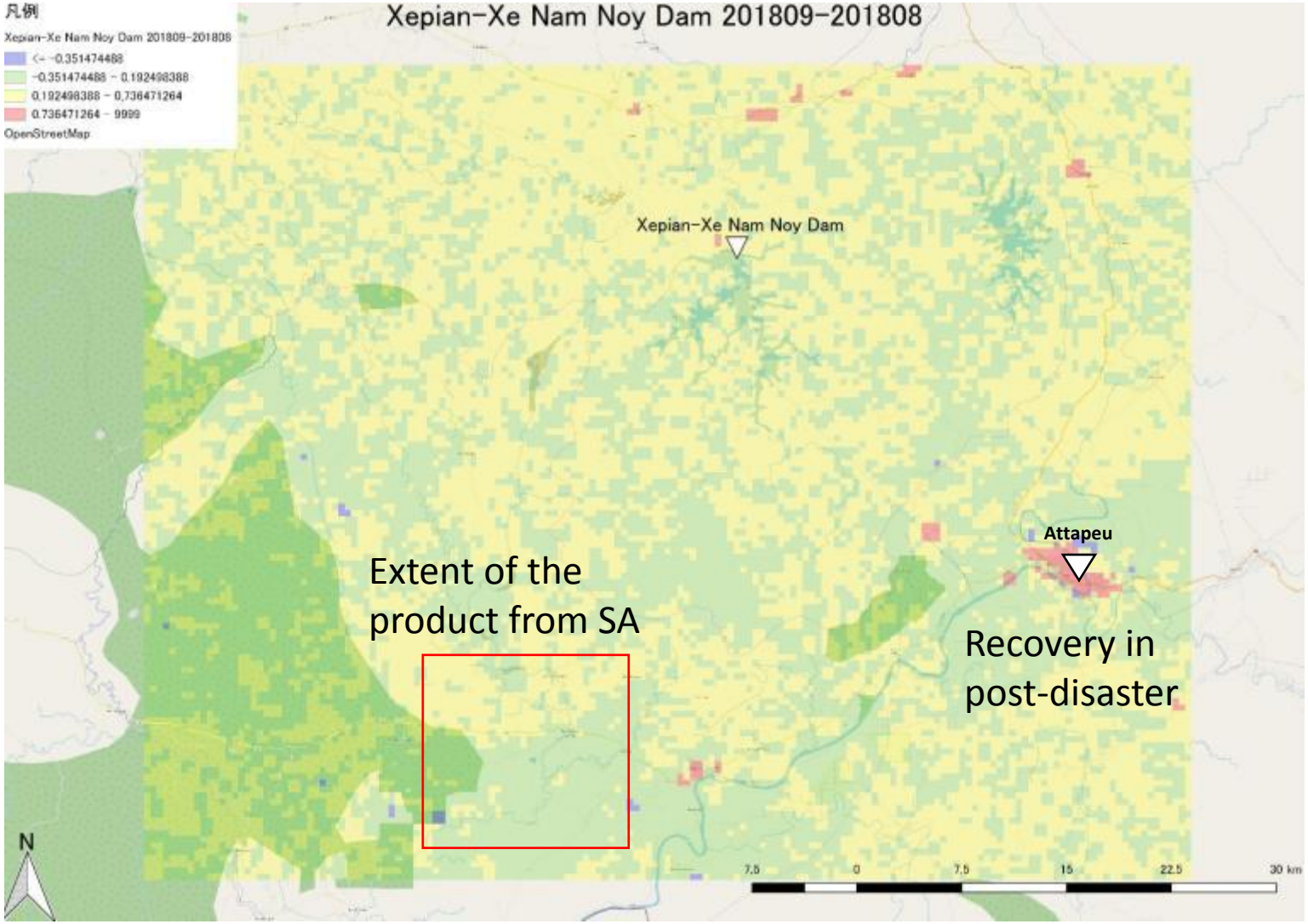
# Changes between August – March, 2018




Changes were identified by $\mu \pm 2\sigma$ in the differences.

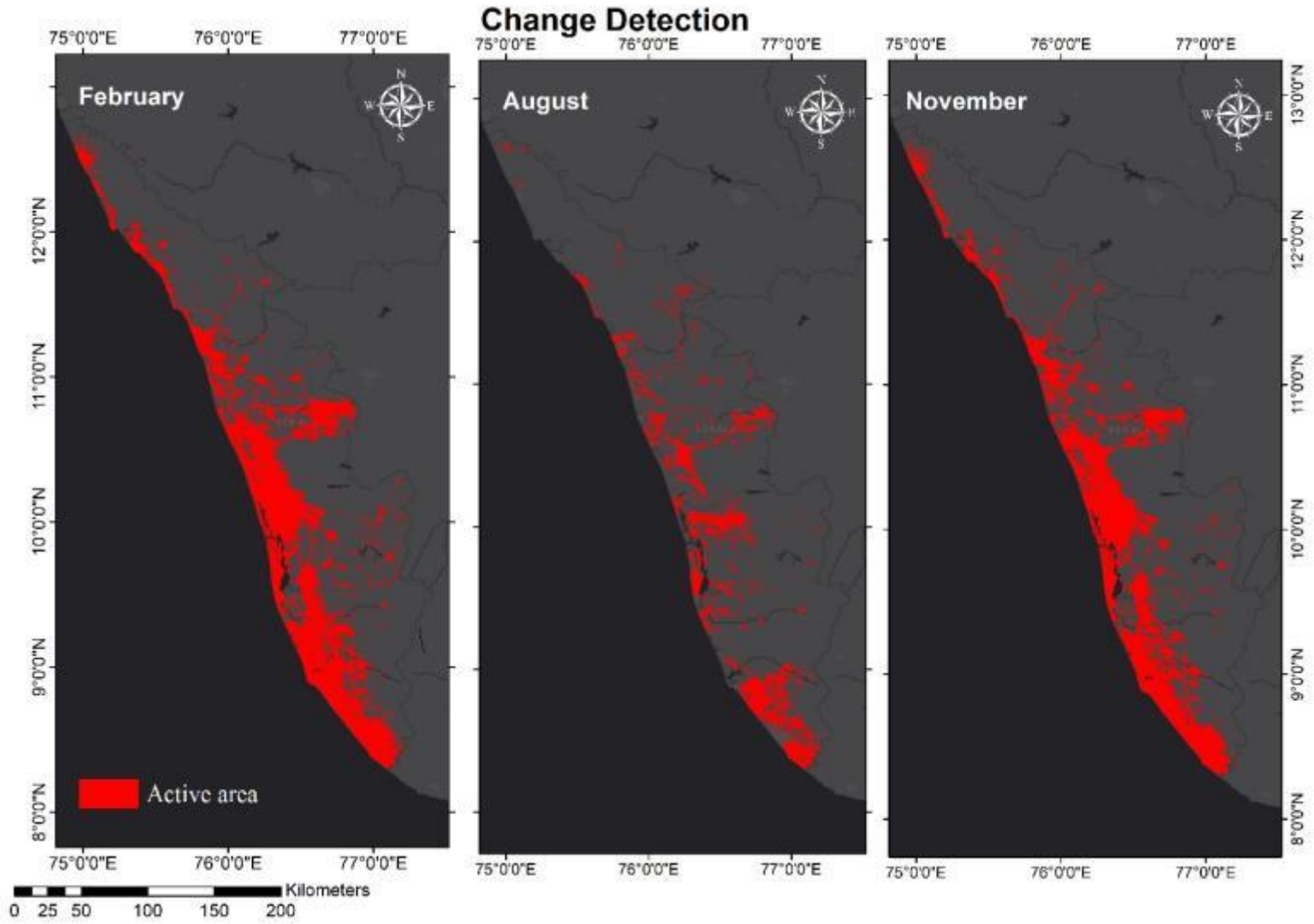
# Change detection from monthly composite

## Changes between September – August, 2018

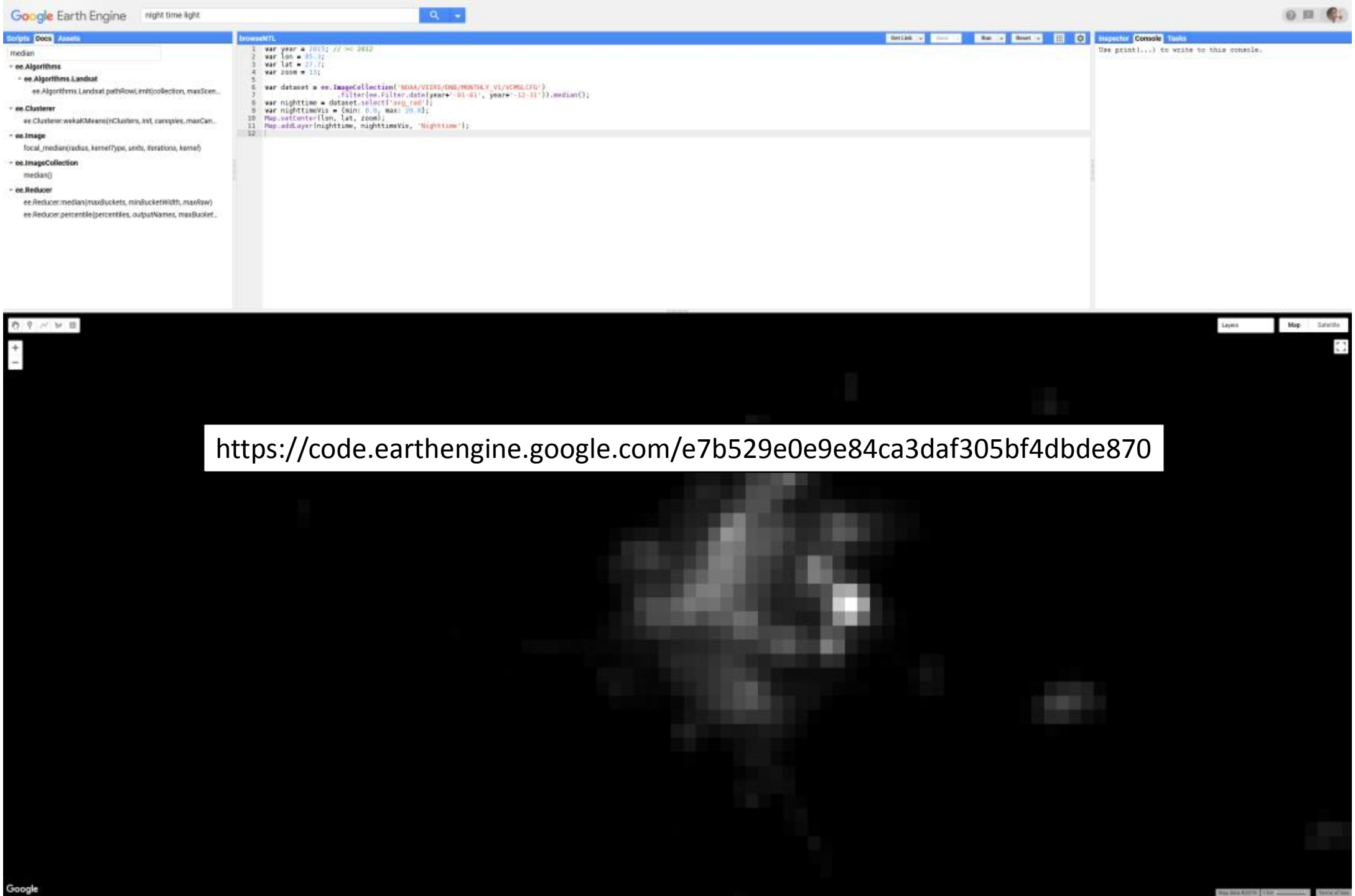


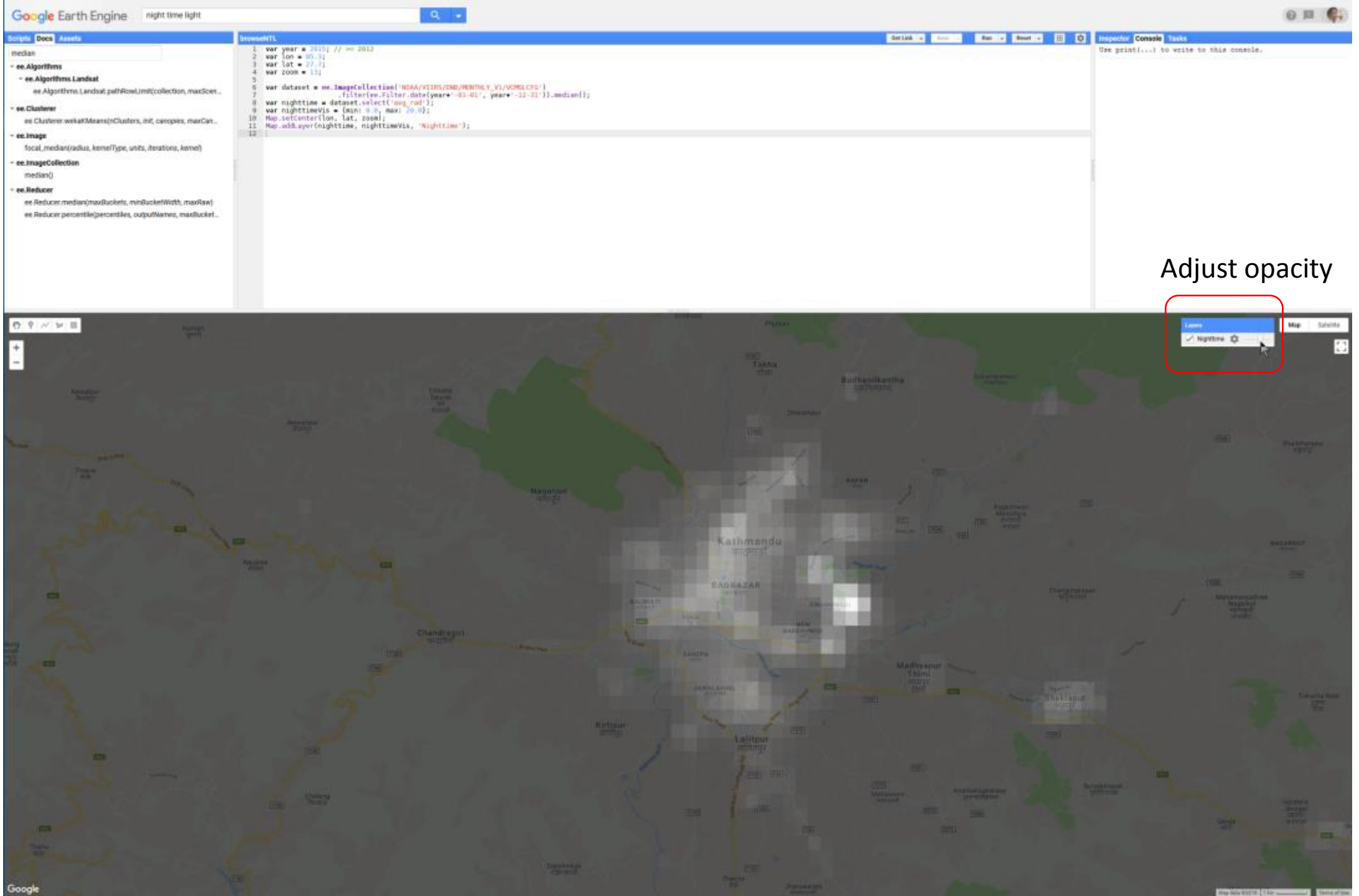

Changes were identified by $\mu \pm 2\sigma$ in the differences.

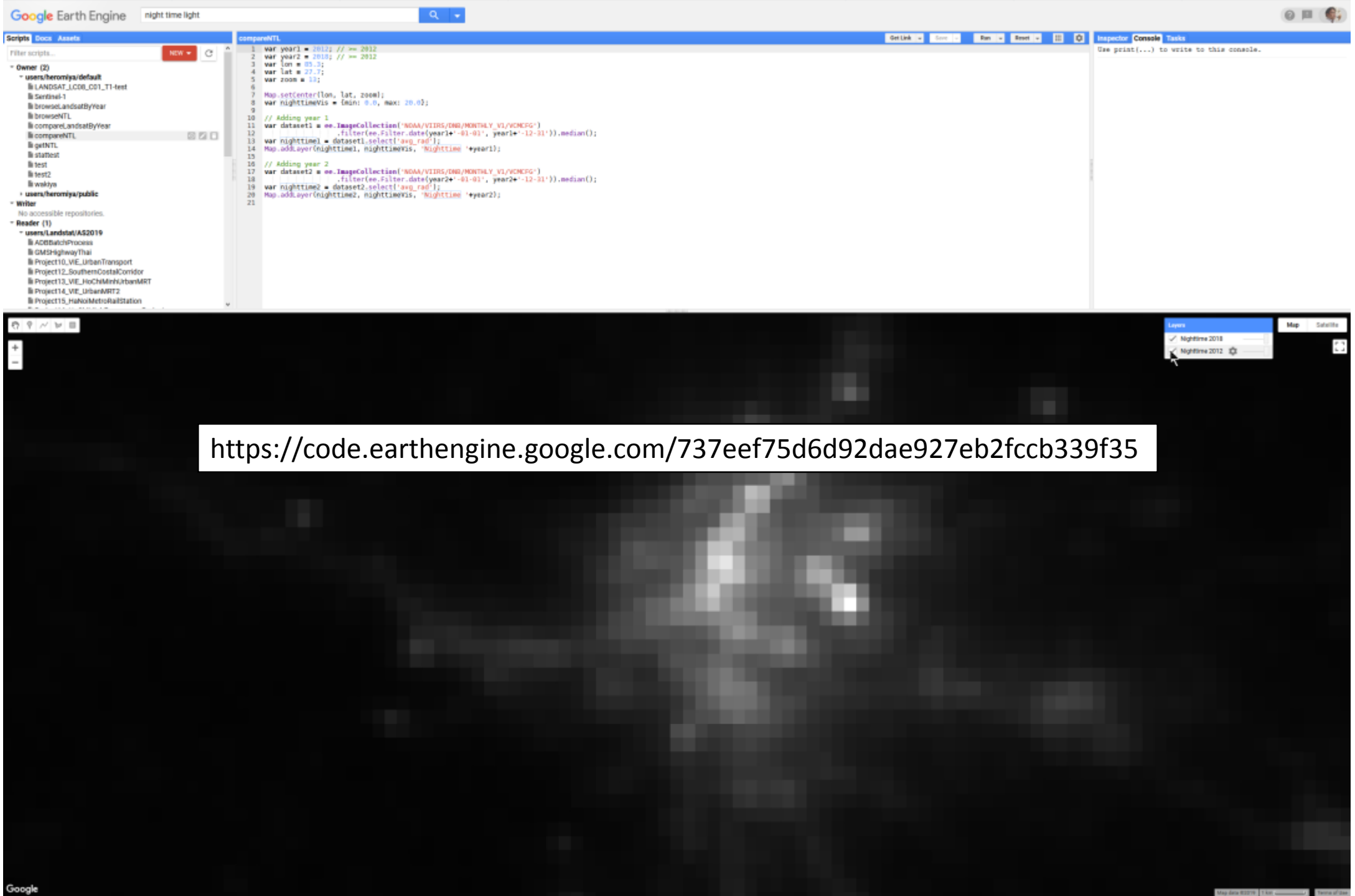
# 2018 Kerala Floods, India
# Extents of active settlements identified from NTL



# Browse NTL on GEE

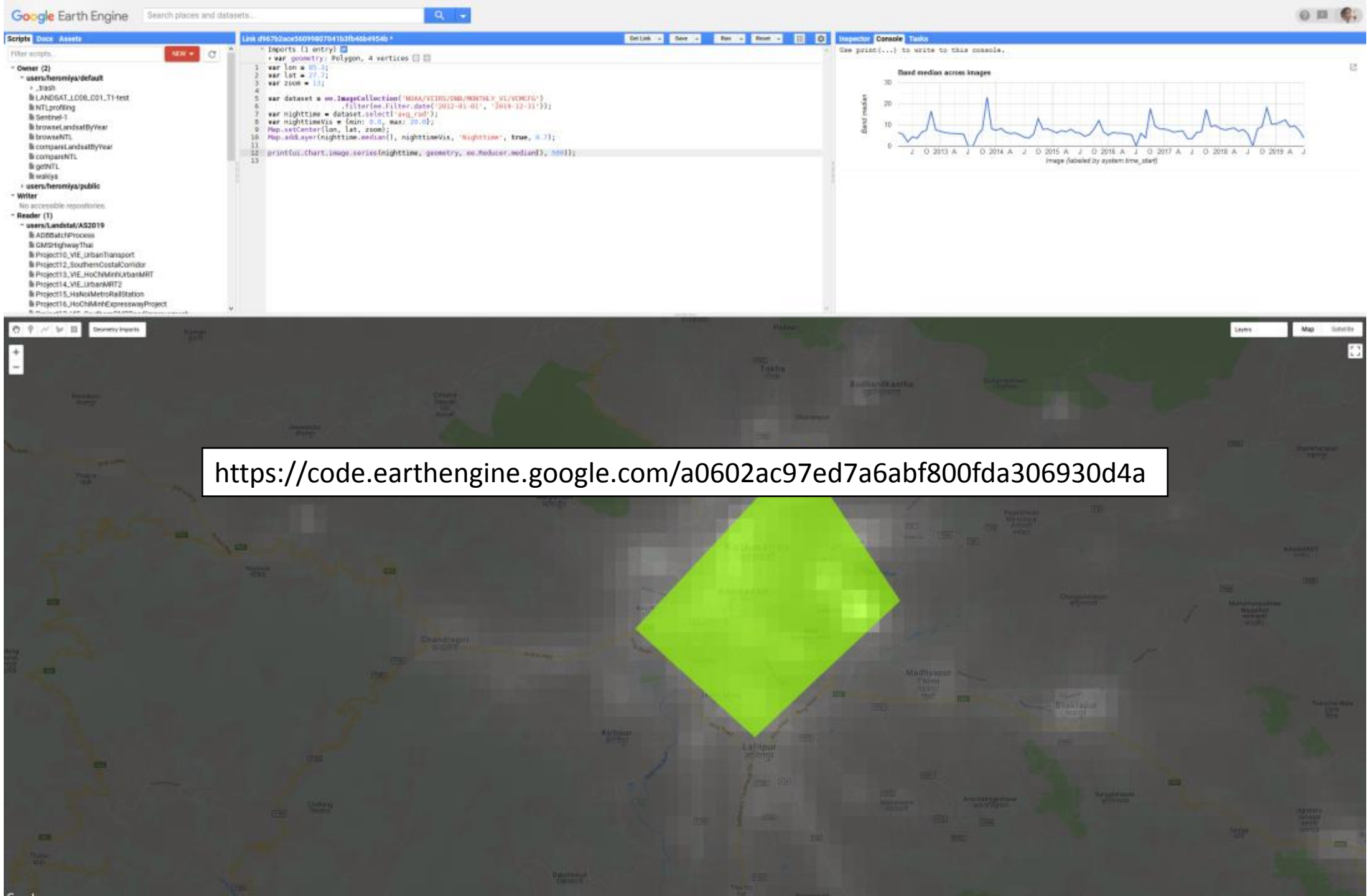

Google Earth Engine
night time light
Scripts
Docs
Assets
median
ee.Algorithms
ee.Algorithms.Landsat
ee.Clusterer
ee.Image
ee.ImageCollection
ee.Reducer
browseNTL
Inspector
Console
Tasks
Use print(...) to write to this console.
var year = 2015; // >= 2012
var lon = 85.3;
var lat = 27.7;
var zoom = 10;
var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMSLCFG')
.filter(ee.Filter.date(year+'-01-01', year+'-12-31')).median();
var nighttime = dataset.select('avg_rad');
var nighttimeVis = {min: 0.0, max: 20.0};
Map.setCenter(lon, lat, zoom);
Map.addLayer(nighttime, nighttimeVis, 'Nighttime');
https://code.earthengine.google.com/e7b529e0e9e84ca3daf305bf4dbde870
Google


Google Earth Engine
night time light
Scripts Docs Assets
median
ee.Algorithms
ee.Algorithms.Landsat
ee.Algorithms.Landsat.pathRowLimit(collection, maxScen...
ee.Clusterer
ee.Clusterer.wekaKMeans(nClusters, init, canopies, maxCan...
ee.Image
focal_median(radius, kernelType, units, iterations, kernel)
ee.ImageCollection
median()
ee.Reducer
ee.Reducer.median(maxBuckets, minBucketWidth, maxRaw)
ee.Reducer.percentile(percentiles, outputNames, maxBucket...
browseNTL
Get Link
Save
Run
Reset
Inspector Console Tasks
Use print(...) to write to this console.
1 var year = 2015; // >= 2012
2 var lon = 85.3;
3 var lat = 27.7;
4 var zoom = 11;
5
6 var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMSLCFG')
7 .filter(ee.Filter.date(year+'-01-01', year+'-12-31')).median();
8 var nighttime = dataset.select('avg_rad');
9 var nighttimeVis = {min: 0.0, max: 20.0};
10 Map.setCenter(lon, lat, zoom);
11 Map.addLayer(nighttime, nighttimeVis, 'Nighttime');
12
Adjust opacity
Layers
Nighttime
Map
Satellite
Kathmandu
Chandragiri
Lalitpur
Google

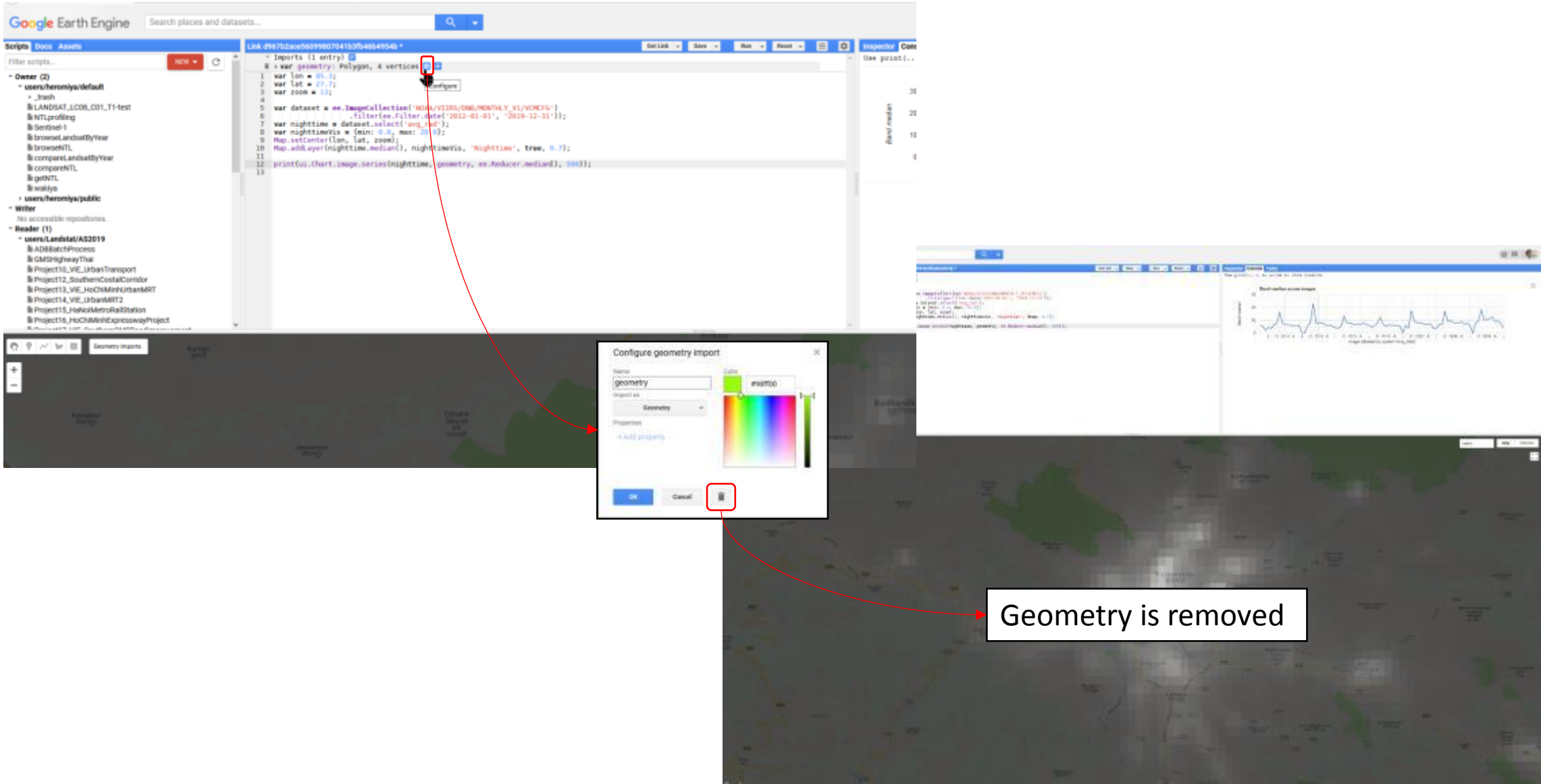

Google Earth Engine
night time light
Scripts
Docs
Assets
NEW
Owner (2)
users/heromiya/default
LANDSAT_LC08_C01_T1-test
Sentinel-1
browseLandsatByYear
browseNTL
compareLandsatByYear
compareNTL
getNTL
stattest
test
test2
waktya
users/heromiya/public
Writer
No accessible repositories.
Reader (1)
users/Landstat/AS2019
ADBBatchProcess
GMSHighwayThai
Project10_VIE_UrbanTransport
Project12_SouthernCostalCorridor
Project13_VIE_HoChiMinhUrbanMRT
Project14_VIE_UrbanMRT2
Project15_HaNoiMetroRailStation
compareNTL
Get Link
Save
Run
Reset
var year1 = 2012; // >= 2012
var year2 = 2018; // >= 2012
var lon = 85.3;
var lat = 27.7;
var zoom = 13;
Map.setCenter(lon, lat, zoom);
var nighttimeVis = {min: 0.0, max: 20.0};
// Adding year 1
var dataset1 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMCFG')
.filter(ee.Filter.date(year1+'-01-01', year1+'-12-31')).median();
var nighttime1 = dataset1.select('avg_rad');
Map.addLayer(nighttime1, nighttimeVis, 'Nighttime '+year1);
// Adding year 2
var dataset2 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMCFG')
.filter(ee.Filter.date(year2+'-01-01', year2+'-12-31')).median();
var nighttime2 = dataset2.select('avg_rad');
Map.addLayer(nighttime2, nighttimeVis, 'Nighttime '+year2);
Inspector
Console
Tasks
Use print(...) to write to this console.
Layers
Nighttime 2018
Nighttime 2012
Map
Satellite
https://code.earthengine.google.com/737eef75d6d92dae927eb2fccb339f35
Google


Google Earth Engine
night time light
Scripts Docs Assets
NEW
compareNTL
Get Link
Save
Run
Reset
Inspector Console Tasks
Use print(...) to write to this console.
var year1 = 2012; // >= 2012
var year2 = 2018; // >= 2012
var lon = 85.3;
var lat = 27.7;
var zoom = 13;
Map.setCenter(lon, lat, zoom);
var nighttimeVis = {min: 0.0, max: 20.0};
// Adding year 1
var dataset1 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMCFG')
.filter(ee.Filter.date(year1+'-01-01', year1+'-12-31')).median();
var nighttime1 = dataset1.select('avg_rad');
Map.addLayer(nighttime1, nighttimeVis, 'Nighttime '+year1);
// Adding year 2
var dataset2 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMCFG')
.filter(ee.Filter.date(year2+'-01-01', year2+'-12-31')).median();
var nighttime2 = dataset2.select('avg_rad');
Map.addLayer(nighttime2, nighttimeVis, 'Nighttime '+year2);
On/off visibility of the images to compare
Layers
Nighttime 2018
Nighttime 2012
Map
Satellite
Google

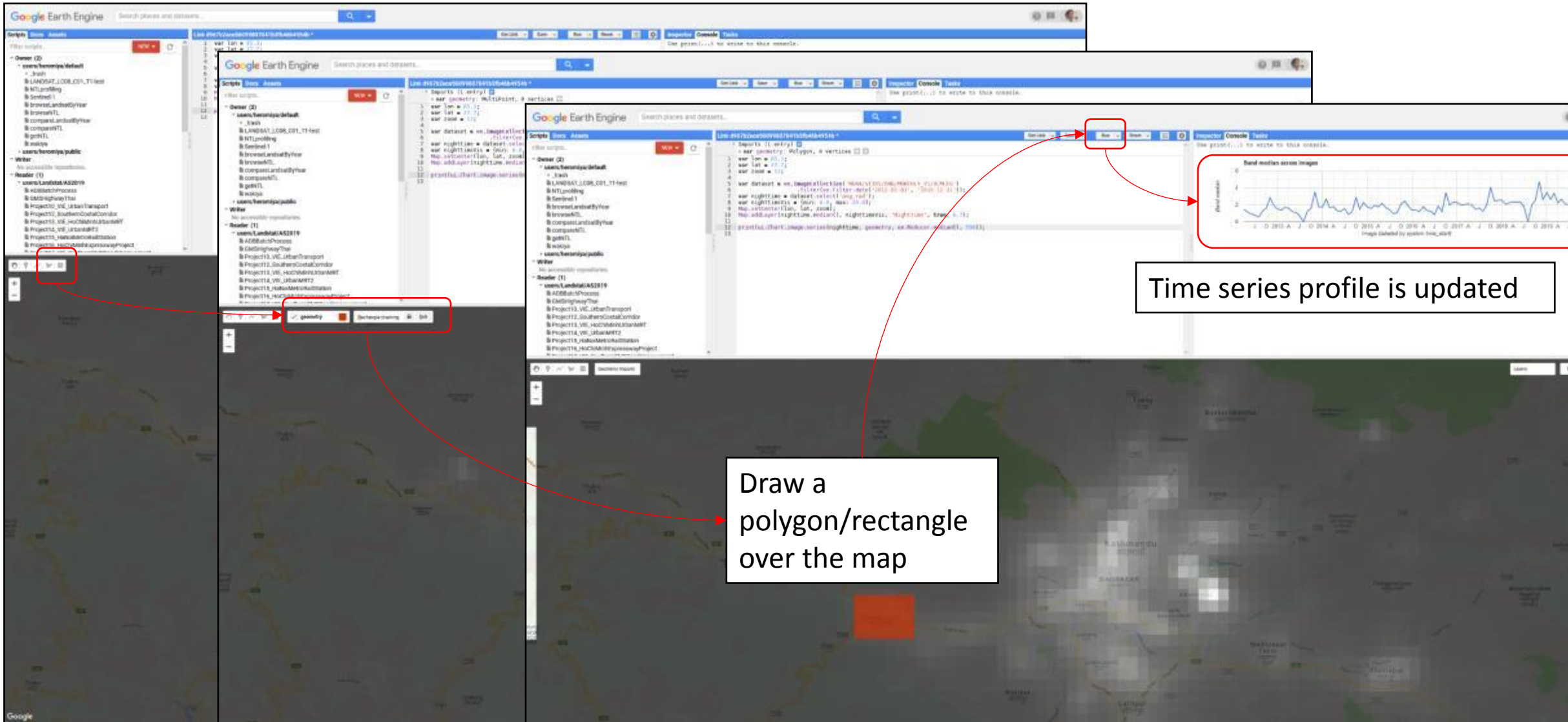
# Night-time light profiling


Google Earth Engine
Search places and datasets...
Scripts
Docs
Assets
Owner (2)
users/heromiya/default
LANDSAT_LC08_C01_T1-test
NTLprofiling
Sentinel-1
browseLandsatByYear
browseNTL
compareLandsatByYear
compareNTL
getNTL
wakiya
users/heromiya/public
Writer
No accessible repositories
Reader (1)
users/Landsat/AS2019
ADBBatchProcess
GMSHighwayThai
Project10_VIE_UrbanTransport
Project12_SouthernCostalCorridor
Project13_VIE_HoChiMinhUrbanMRT
Project14_VIE_UrbanMRT2
Project15_HaNoiMetroRailStation
Project16_HoChiMinhExpresswayProject
var lon = 85.3;
var lat = 27.7;
var zoom = 13;
var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMCFG')
.filter(ee.Filter.date('2012-01-01', '2019-12-31'));
var nighttime = dataset.select('avg_rad');
var nighttimeVis = {min: 0.0, max: 20.0};
Map.setCenter(lon, lat, zoom);
Map.addLayer(nighttime.median(), nighttimeVis, 'Nighttime', true, 0.7);
print(ui.Chart.image.series(nighttime, geometry, ee.Reducer.median(), 500));
Band median across images
Band median
Image (labeled by system:time_start)
https://code.earthengine.google.com/a0602ac97ed7a6abf800fda306930d4a

# Configure areas to profile night-time light



# Configure areas to profile night-time light



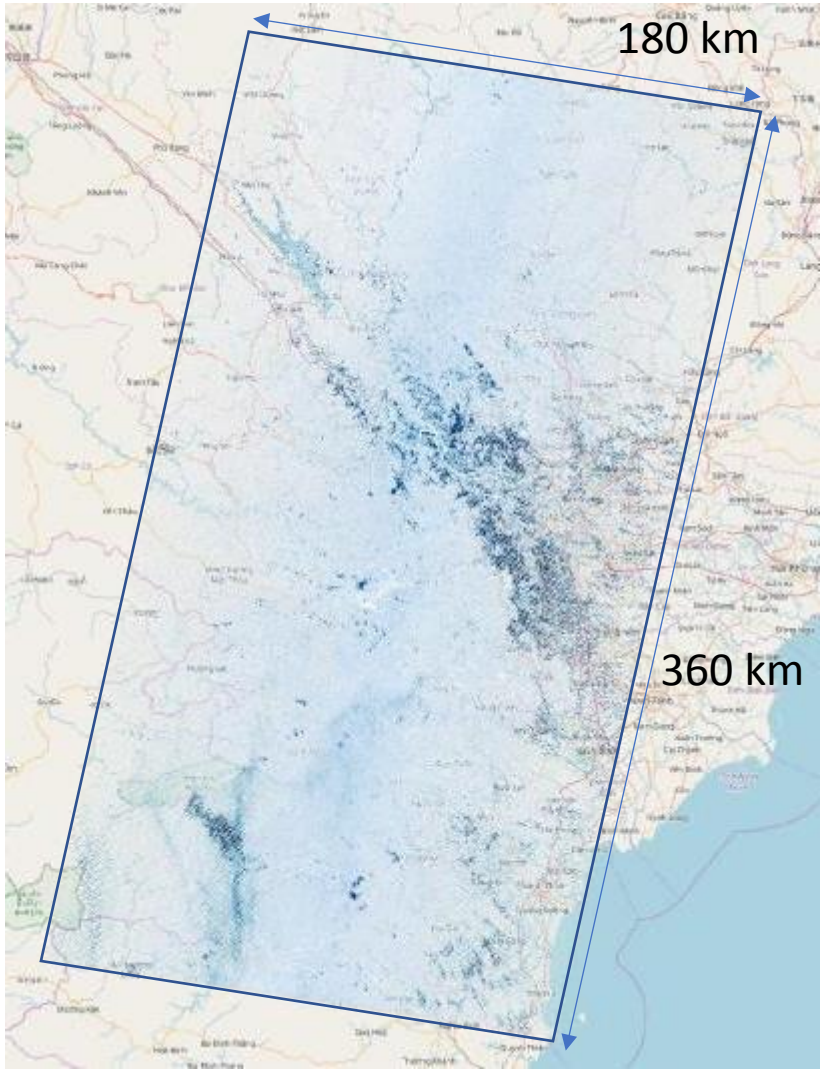
(Not implemented and validated very well)

# Change detection in Landsat archive

# Advantages of Satellite Data in Flood Observations

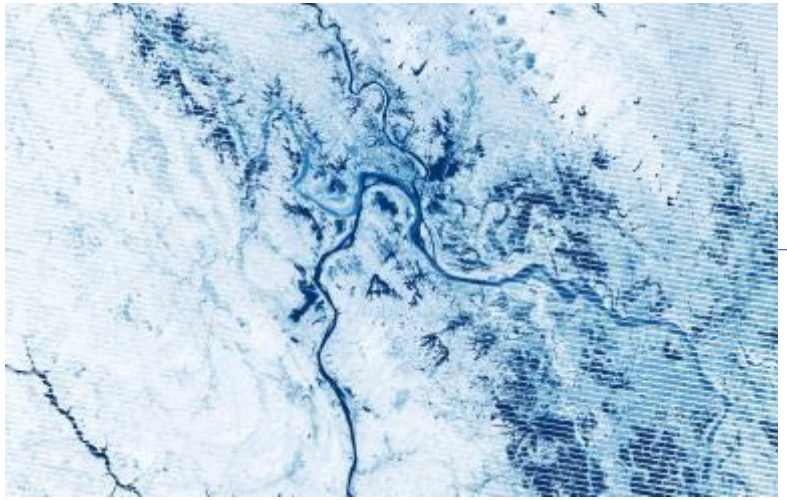
- Simultaneous observation of large extent
- Map-friendly
  - Useful to visualization
  - Overlay with other layers for integration
- Observation of dangerous and remote areas

Observation of a flood, November 2008

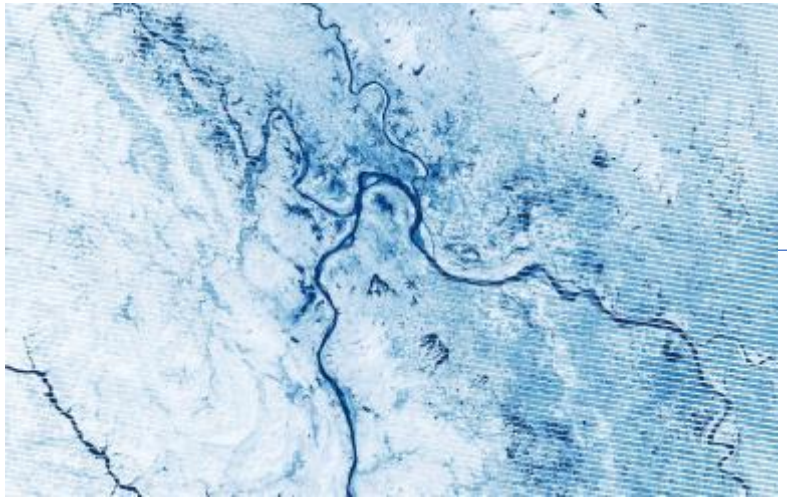


# Flood observation from satellites

Waterbody extent (post-flood, 10 Nov 2008)

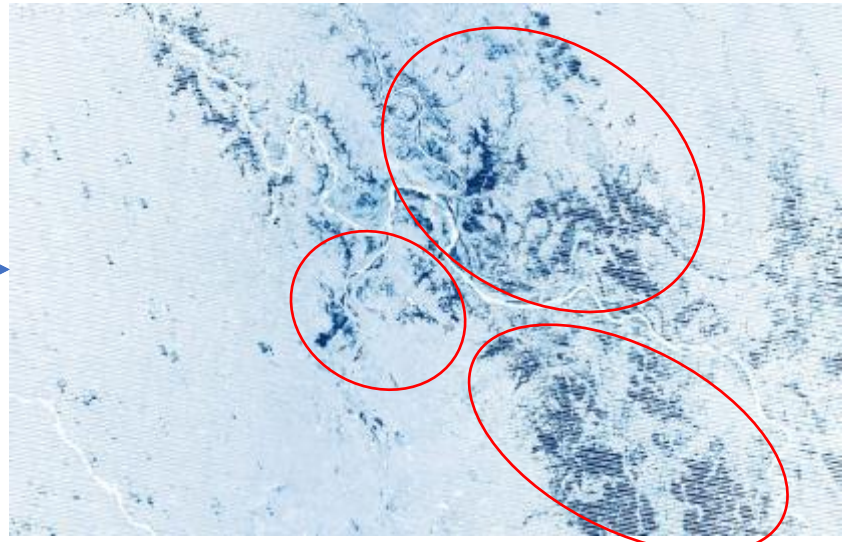


Waterbody extent (pre-flood, 8 Nov 2007)



Change detection

Extent of the flood in November 2008



# Concept

1. Pre-disaster data → Cloud-free Landsat data with 1-year composite before a disaster using - ee.Algorithms.Landsat.simpleComposite(collection, *percentile*, *cloudScoreRange*, *maxDepth*, *asFloat*)
2. Post-disaster data → Cloud-free Landsat data with 1-month or 3-month composite after a disaster using - ee.Algorithms.Landsat.simpleComposite(collection, *percentile*, *cloudScoreRange*, *maxDepth*, *asFloat*)
3. Calculate differences of NDVI/NDWI etc. between pre-disaster and post-disaster images
4. Label pixels beyond $\mu \pm 2\sigma$ in the difference image as significant changes.