

# 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)

**Version 1 VIIRS Day/Night Band Nighttime Lights**

The Earth Observations Group (EOG) at NOAA/NCEI is producing a version 1 suite of average radiance composite images using nighttime data from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB).

Prior to averaging, the DNB data is filtered to exclude data impacted by stray light, lightning, lunar illumination, and cloud-cover. Clouds are determined using the VIIRS Cloud Mask product (VCM). In addition, data near the edges of the swath are not included in the composite (aggregation zones 29-32).

Temporal averaging is done on a monthly and annual basis. The version 1 series of monthly composites has not been filtered to screen from aurora, fires, boats, and other temporal lights. However, the annual composites have layers with additional separation, removing lights and background (non-light) values.

The version 1 products span the globe from 75N latitude to 65S. The products are produced in 15 arc-second geographic grids and are available in geotiff format as a set of 6 tiles. The tiles are cut at the equator and each span 120 degrees of longitude. Each tile is an actual image containing average radiance values and numbers of available observations.

In the monthly composites, there are many areas of the globe where it is impossible to get good quality data coverage for that month due to cloud-cover, especially in the tropical regions, or due to solar illumination, as happens toward the poles in their respective months. Therefore, it is imperative that users of these data utilize the cloud-free observations file and not assume a value of zero in the radiance image means that no lights were observed.

The version 1 monthly series is run globally using two different configurations. The first excludes any data impacted by stray light. The second includes these data if the radiance values have undergone the stray-light correction procedure (Reference). These two configurations are in the filenames as "vcm" and "vcmsl" respectively. The "vcmsl" version, that includes the stray-light corrected data, will have more coverage toward the poles, but will be of reduced quality. It is up to the users to determine which set is best for their applications. The versions are only made with the "vcm" version, excluding any data impacted by stray light.

**Filenaming convention:**  
The version 1 composite products have 7 filename fields that are separated by an underscore "\_". Internal to each field there can be an additional dash separator "-". These fields are followed by a filename extension. The fields are described below using this example file: SVDNB\_npp\_20140501-20140531\_global\_vcmcf\_g\_v10\_c201502061154\_avg\_rade9

Field 1: VIIRS SDR or Product that made the composite "SVDNB"  
Field 2: satellite name "npp"  
Field 3: date range "20140501-20140531"  
Field 4: ROI "global"  
Field 5: config shortname "vcmcf\_g"  
Field 6: version "v10" is version 1.0  
Field 7: creation date/time  
Extension: avg\_rade9

The annual products can have other values for the config shortname (Field 5). They are:

- "vcm-orm" (VIIRS Cloud Mask - Outlier Removed) This product contains cloud-free average radiance values that have undergone a removal process to filter out fires and other ephemeral lights.
- "vcm-orm-nt" (VIIRS Cloud Mask - Outlier Removed - Nighttime Lights) This product contains the "vcm-orm" average, with background (non-lights) set to zero.
- "vcm-nt" (VIIRS Cloud Mask - Nighttime Lights) This product contains the "vcm" average, with background (non-lights) set to zero.

**Data types/formats:**  
To reach the widest community of users, files are delivered in compressed tarballs, each containing a set of 2 geotiffs. Files with extension "avg\_rade9" contain floating point radiance values with units in nanoWatts/cm2/sr. Note that the original DNB radiance values have been multiplied by 1E9. This was done to alleviate issues some software packages were having with the very small numbers in the original with extension "cf\_cvg" are integer counts of the number of cloud-free coverages, or observations, that went in to constructing the average radiance image. Files with extension "cvg" are integer counts of the number of coverages or total observations available (regardless of cover).

**Credit:**  
When using the data please credit the product generation to the Earth Observation Group, NOAA National Centers for Environmental Information (NCEI).

For questions contact [chris.elvidge@noaa.gov](mailto:chris.elvidge@noaa.gov) or [kim.baugh@noaa.gov](mailto:kim.baugh@noaa.gov).

**2015 Nighttime Light Composite**  
[Download KML](#)

**Index thumbnails for nighttime light image tiles**  
Showing thumbnails of Jan 2016  
Tile 1 (75N/180W) Tile 2 (75N/060W) Tile 3 (75N/060E)

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

**VIIRS Daily Mosaic**

SNPP is the Suomi National Polar Partnership satellite flown by NASA and NOAA. It is the next generation polar orbiting satellite, collecting daytime and nighttime data worldwide each day. The primary imager on SNPP is the Visible Infrared Imaging Radiometer Suite (VIIRS) source data are produced in HDF5 format and are available through NOAA's CLASS archive. To reduce the data volume and to increase usability of the data - NGDC has developed a service to geolocate VIIRS images. At this site we will provide access to daily mosaic of daytime 1-Band and nighttime DNB data globally.

**The global png images are very large (86400 X 33601) and will not display properly in most browsers. It is recommended you download the images to your local disk and manipulate with either GIS/Remote Sensing software or image viewing like Photoshop or Gimp.**

**Index thumbnails for nighttime light image tiles**  
Showing default thumbnail  
Tile 1 (75N/180W) Tile 2 (75N/060W) Tile 3 (75N/060E)  
Tile 4 (00N/180W) Tile 5 (00N/060W) Tile 6 (00N/060E)

Last Update: 01/29/2019/17:00:03

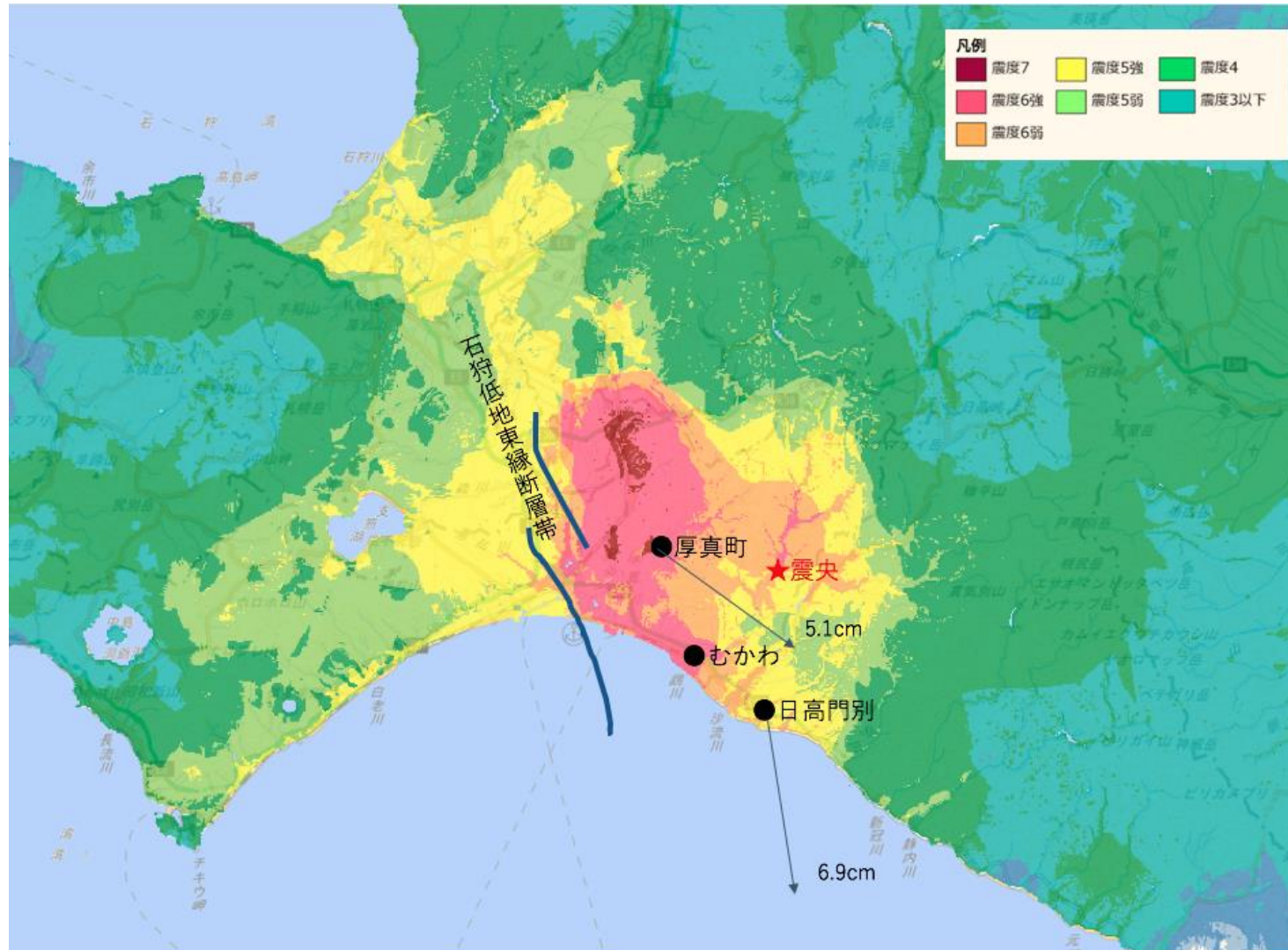
**PNG Tiles**  
Last Update: 01/29/2019/17:00:05

[Expand All](#) | [Contract All](#)

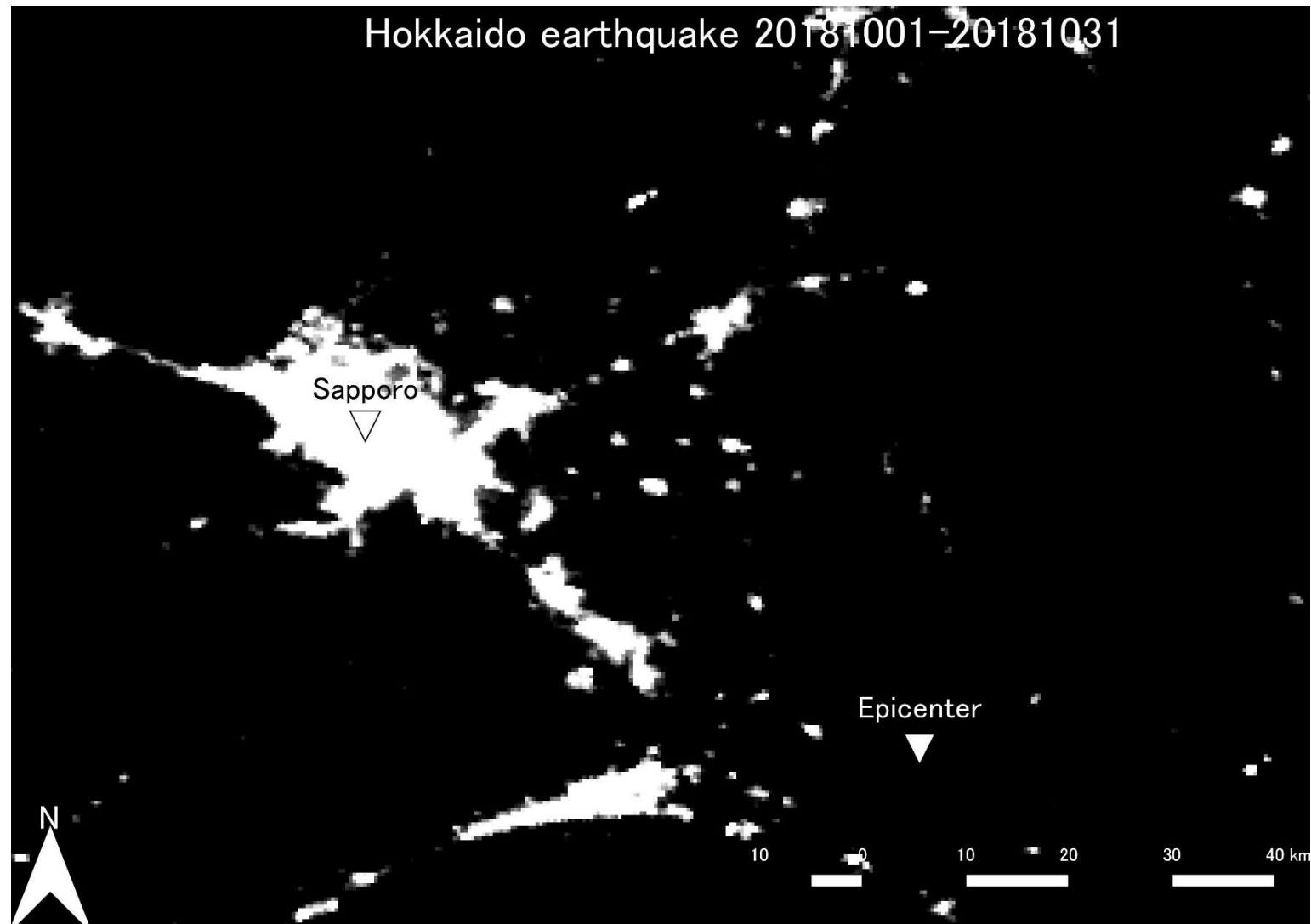
- 2019/January
  - 20190129
  - 20190128
  - 20190127
  - 20190126
  - 20190125
  - 20190124
  - 20190123
  - 20190122
  - 20190121
  - 20190120
  - 20190119
  - 20190118
  - 20190117
  - 20190116
  - 20190115

[https://www.ngdc.noaa.gov/eog/viirs/download\\_dnb\\_composites.html](https://www.ngdc.noaa.gov/eog/viirs/download_dnb_composites.html)

# Earthquake in Hokkaido, Japan, Sept 2018



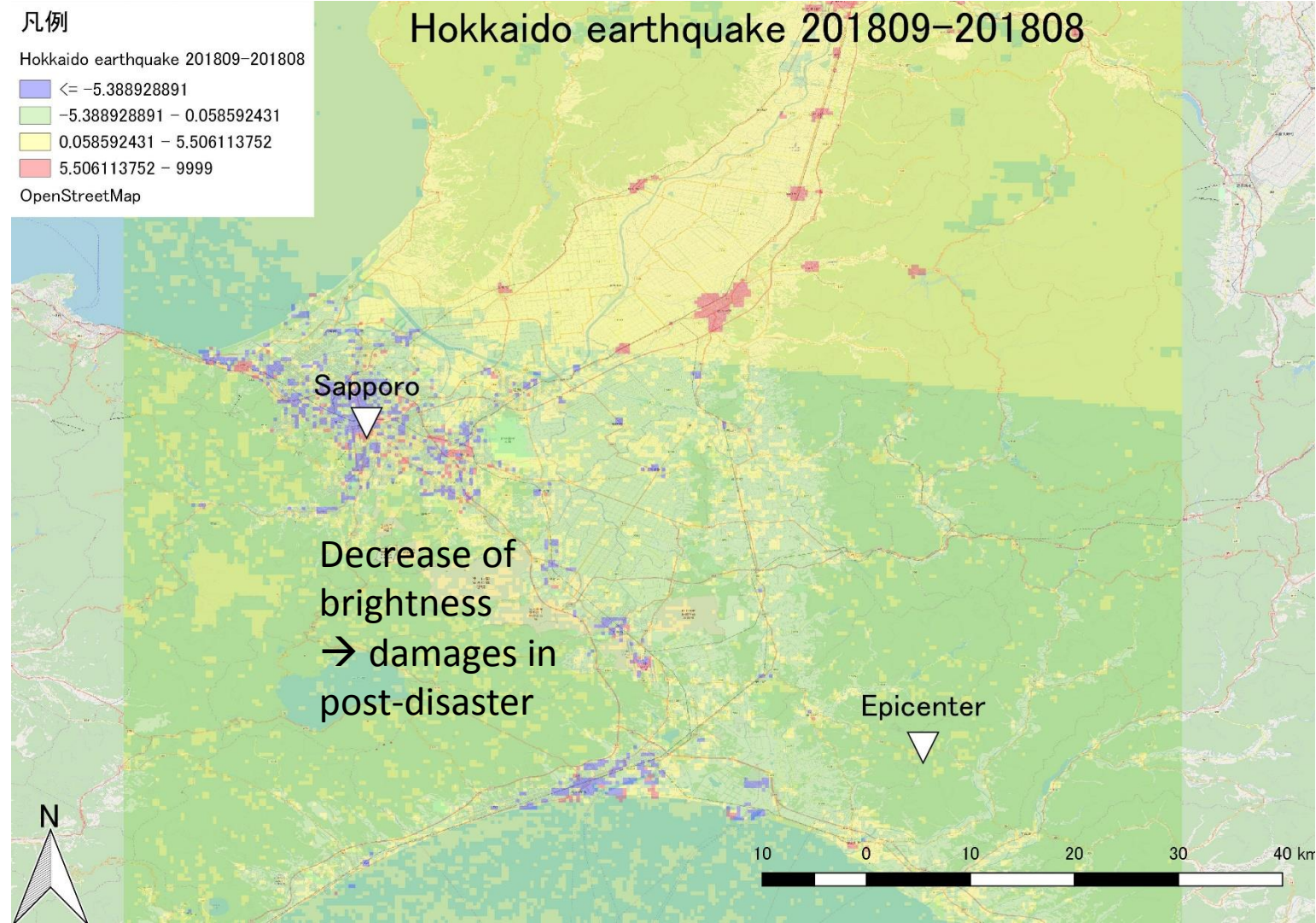
# Post-disaster night-time light, Oct 2018





# Change detection from monthly composite

## Changes between September – August, 2018

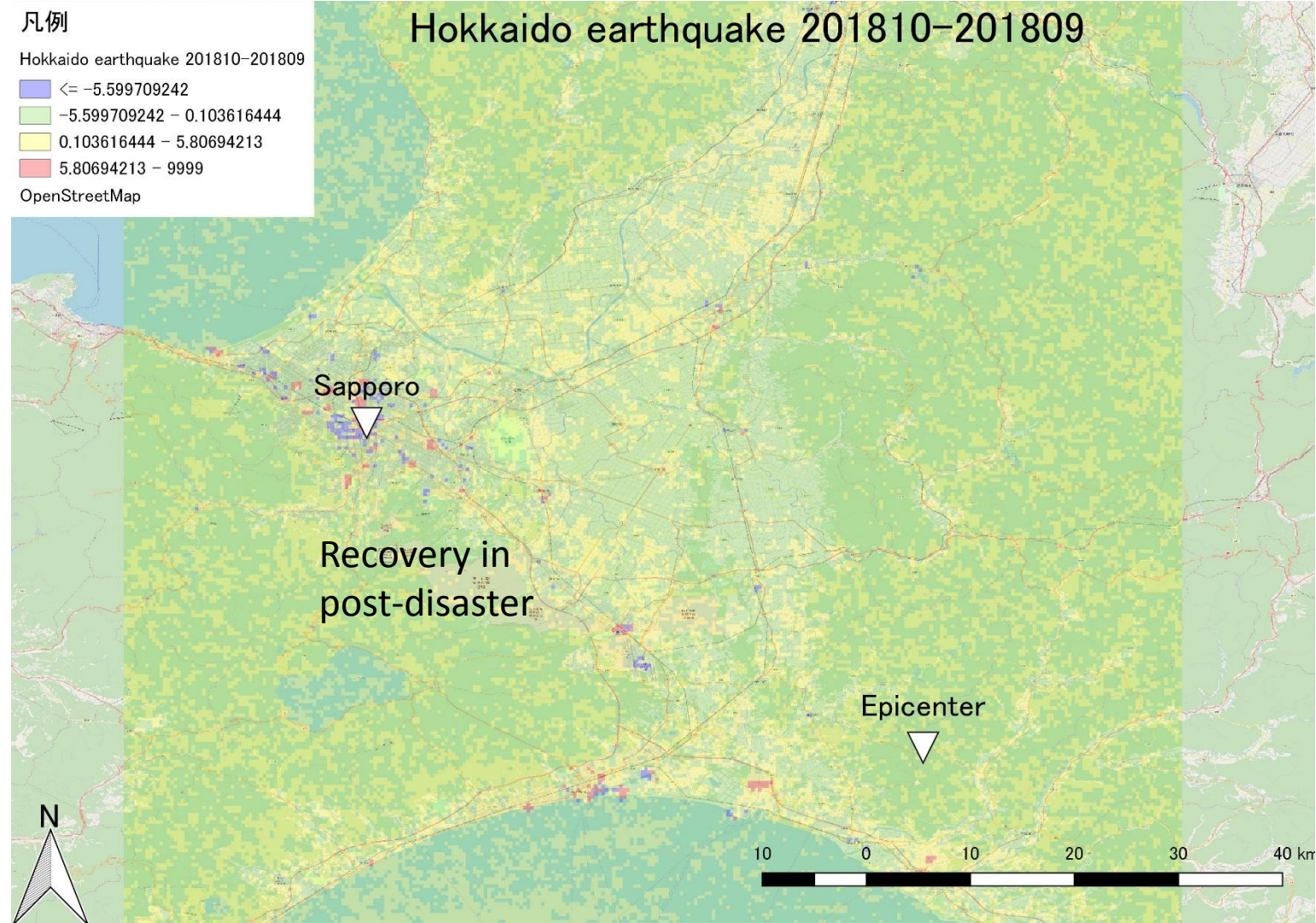


Changes were identified by  $\mu \pm 2\sigma$  in the differences.



# Change detection from monthly composite

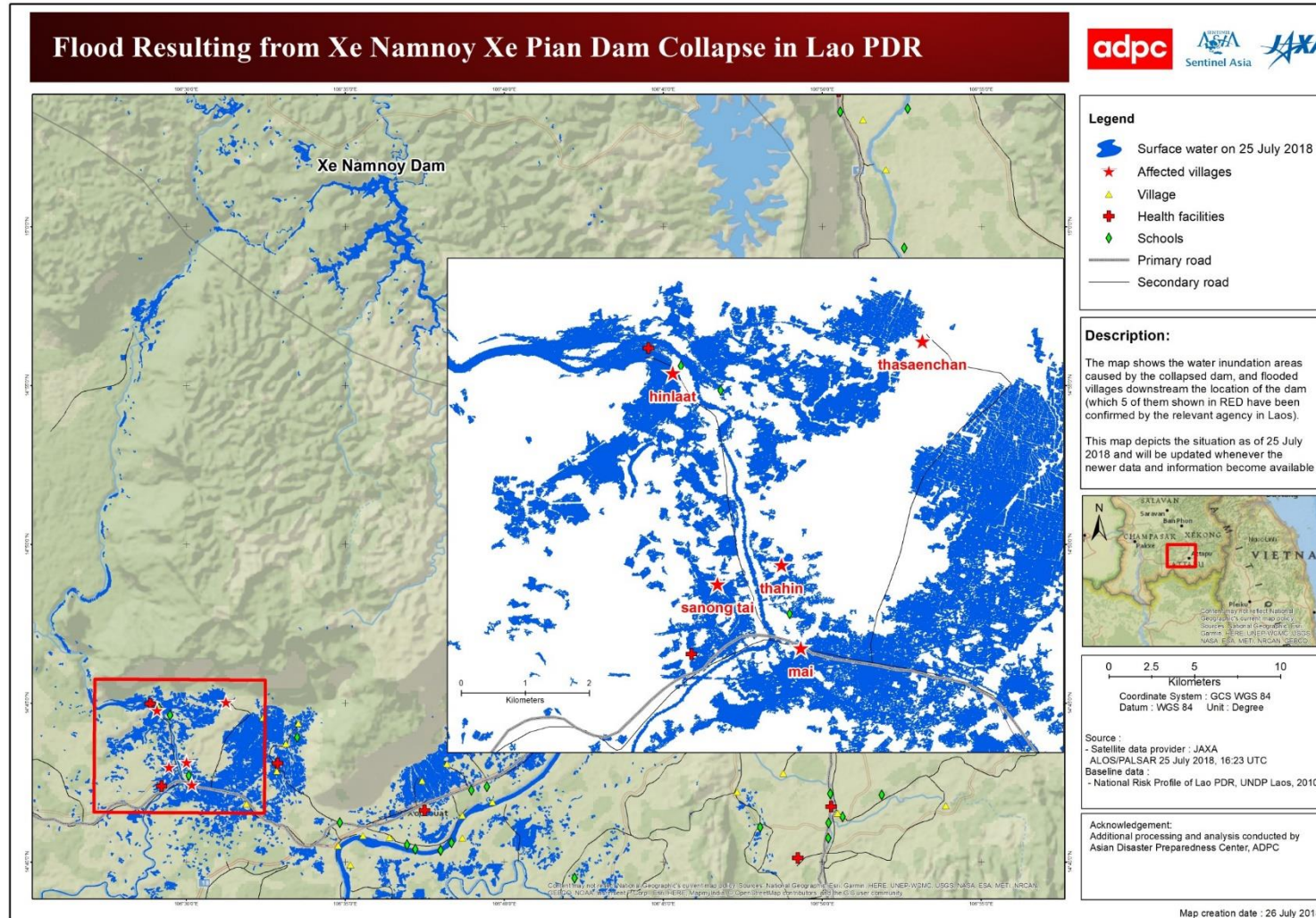
## Changes between October – September, 2018



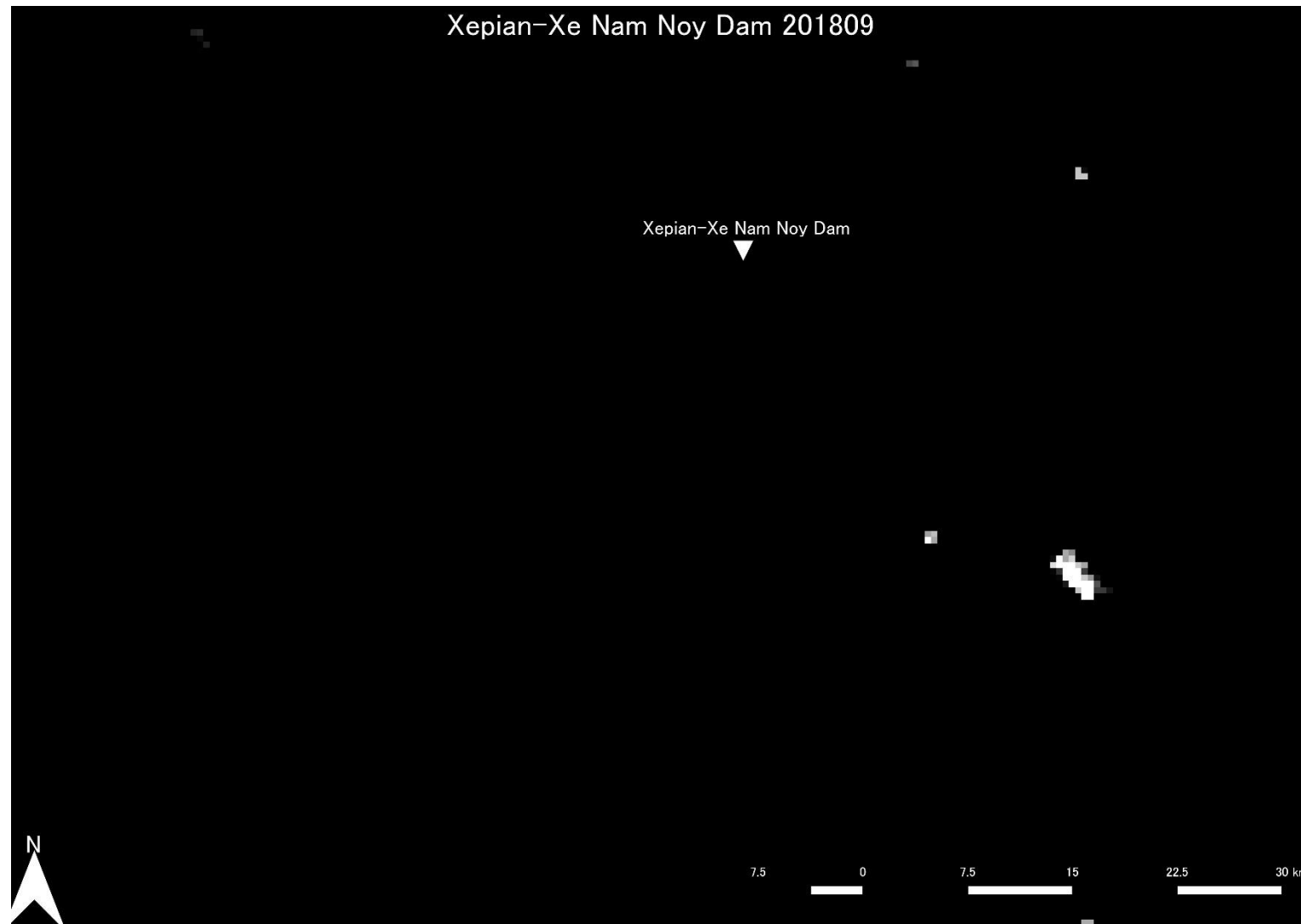
Changes were identified by  $\mu \pm 2\sigma$  in the differences.



# Impact of dam eruption in Laos, July 2018



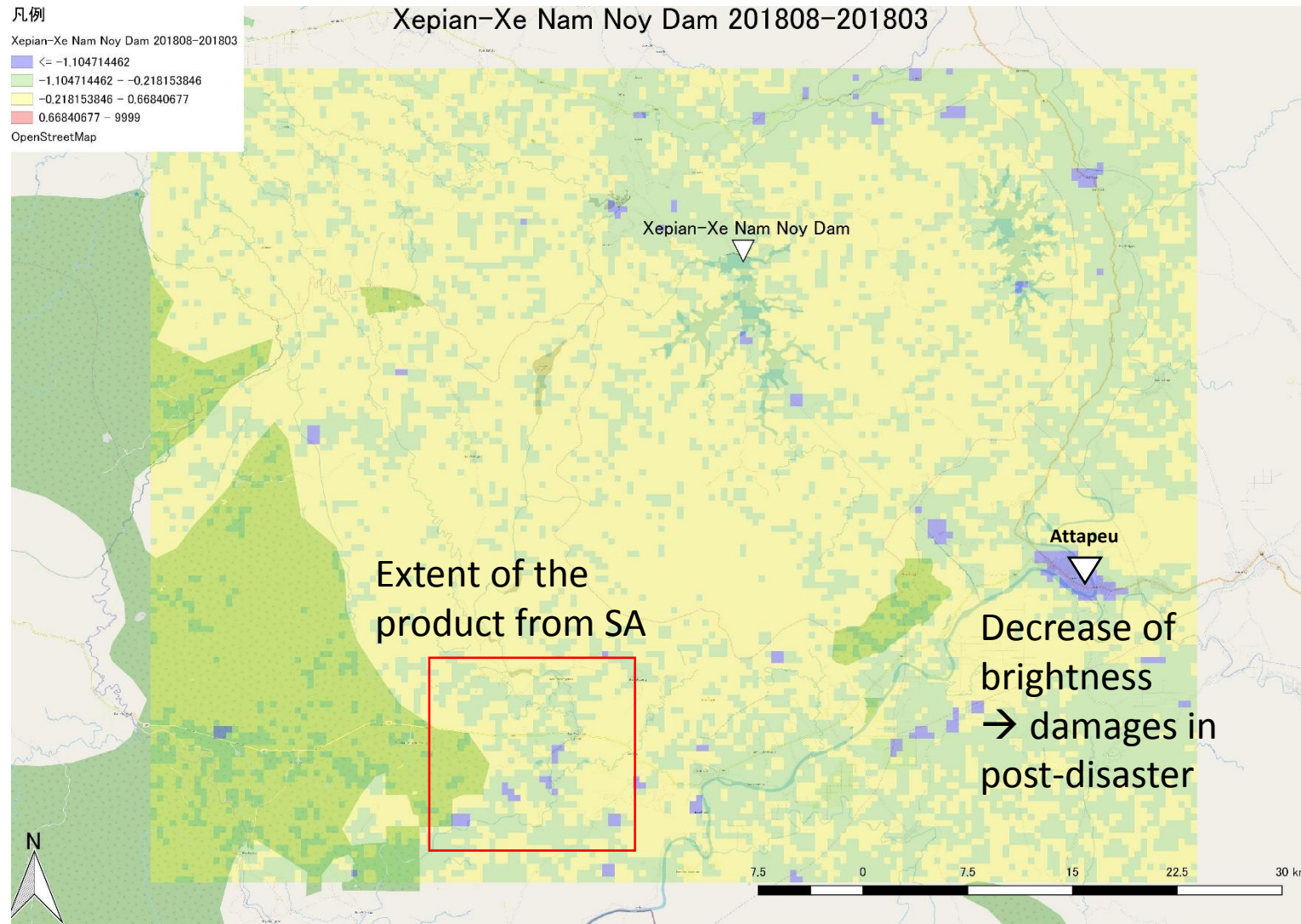
# Night-time light in post-disaster, September, 2018





# Change detection from monthly composite

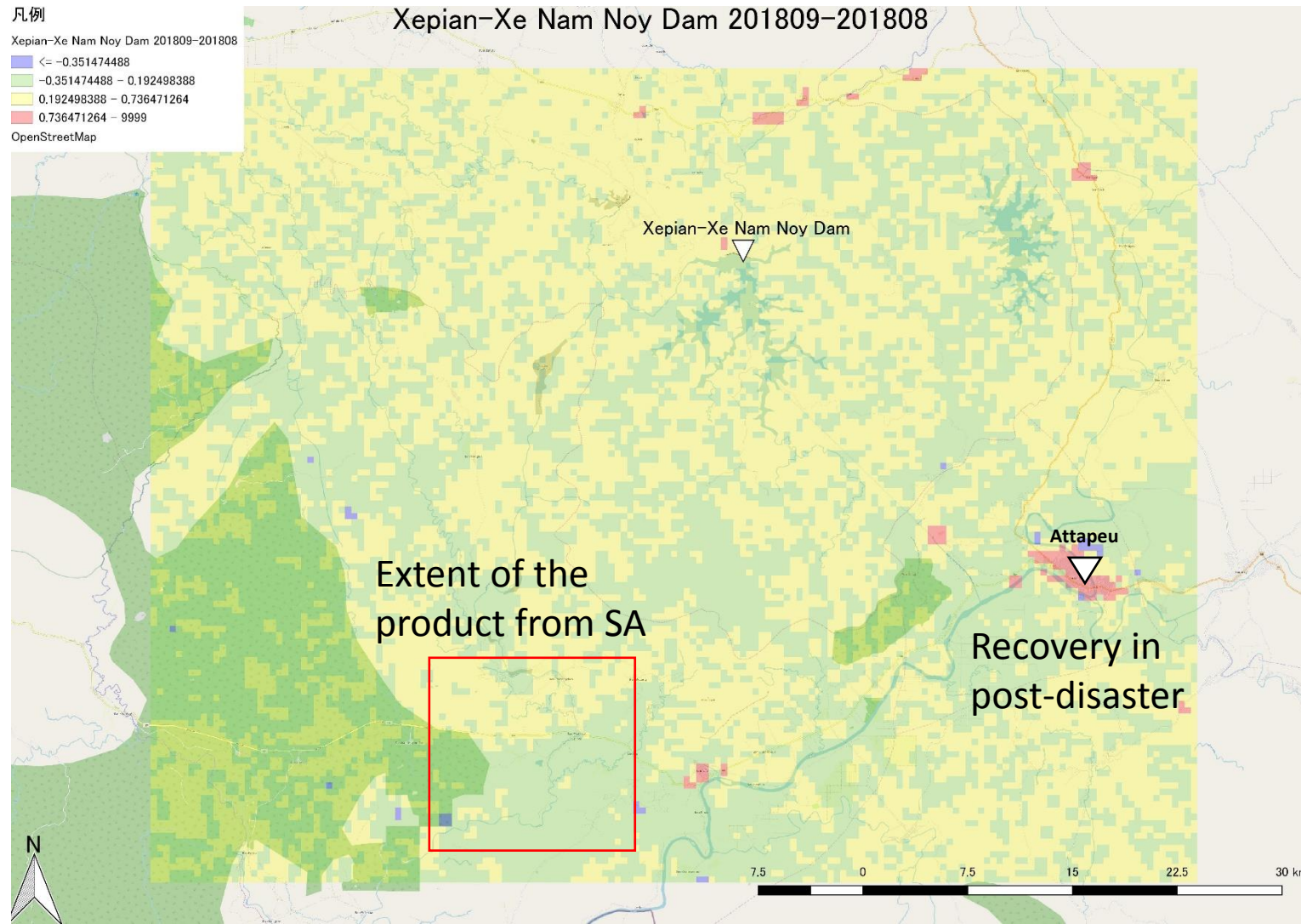
## Changes between August – March, 2018



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.

Browse NTL on GEE

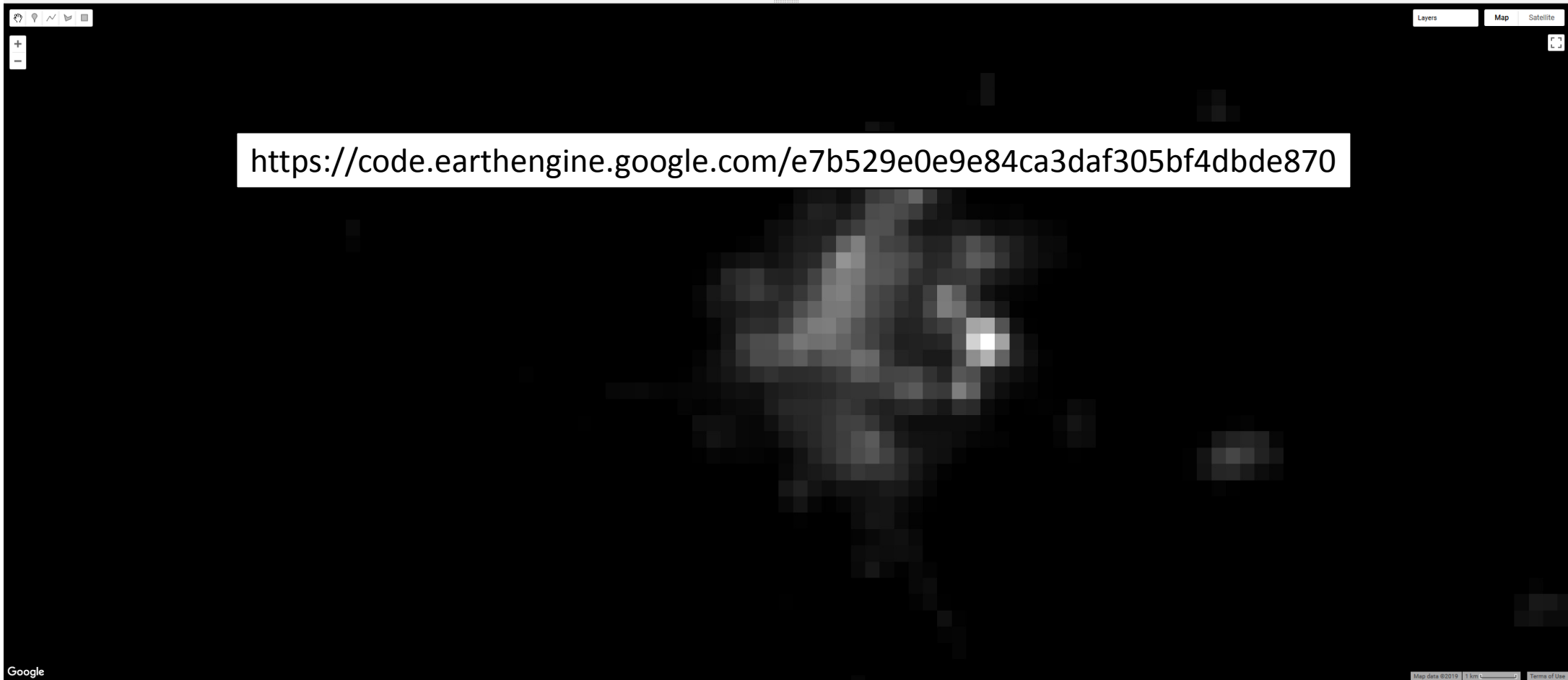


median

- 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...

```
1 var year = 2015; // >= 2012
2 var lon = 85.3;
3 var lat = 27.7;
4 var zoom = 13;
5
6 var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/CMSSLCFG')
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
```

Use print(...) to write to this console.



```

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...
    
```

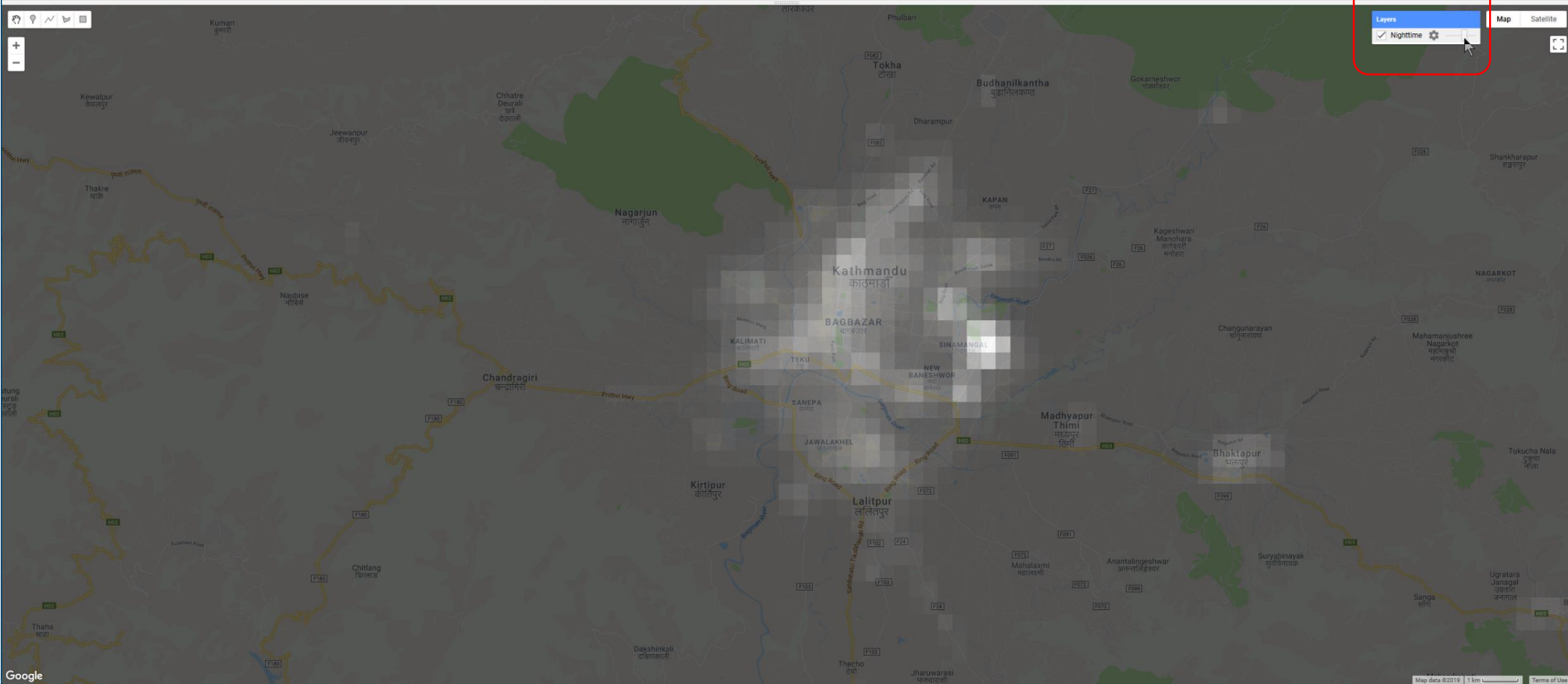
```

browseNTL
1 var year = 2015; // >= 2012
2 var lon = 85.3;
3 var lat = 27.7;
4 var zoom = 13;
5
6 var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/CMSEL/CFG')
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
    
```

Inspector Console Tasks

Use print(...) to write to this console.

Adjust opacity



Scripts Docs Assets

Filter scripts... NEW ↕ ↻

- Owner (2)
  - users/heromiya/default
    - LANDSAT\_LC08\_C01\_T1-test
    - Sentinel-1
    - browseLandsatByYear
    - browseNTL
    - compareLandsatByYear
    - compareNTL
    - getNTL
    - statteest
    - test
    - test2
    - wakiya
  - 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
1 var year1 = 2012; // >= 2012
2 var year2 = 2018; // >= 2012
3 var lon = 85.3;
4 var lat = 27.7;
5 var zoom = 13;
6
7 Map.setCenter(lon, lat, zoom);
8 var nighttimeVis = {min: 0.0, max: 20.0};
9
10 // Adding year 1
11 var dataset1 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMSFG')
12   .filter(ee.Filter.date(year1+'-01-01', year1+'-12-31')).median();
13 var nighttime1 = dataset1.select('avg_rad');
14 Map.addLayer(nighttime1, nighttimeVis, 'Nighttime '+year1);
15
16 // Adding year 2
17 var dataset2 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMSFG')
18   .filter(ee.Filter.date(year2+'-01-01', year2+'-12-31')).median();
19 var nighttime2 = dataset2.select('avg_rad');
20 Map.addLayer(nighttime2, nighttimeVis, 'Nighttime '+year2);
21
```

Inspector Console Tasks

Use print(...) to write to this console.



<https://code.earthengine.google.com/737eef75d6d92dae927eb2fccb339f35>



Scripts Docs Assets

Filter scripts... NEW ↕ ↻

- Owner (2)
  - users/heromiya/default
    - LANDSAT\_LC08\_C01\_T1-test
    - Sentinel-1
    - browseLandsatByYear
    - browseNTL
    - compareLandsatByYear
    - compareNTL
    - getNTL
    - statteest
    - test
    - test2
    - wakiya
  - 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

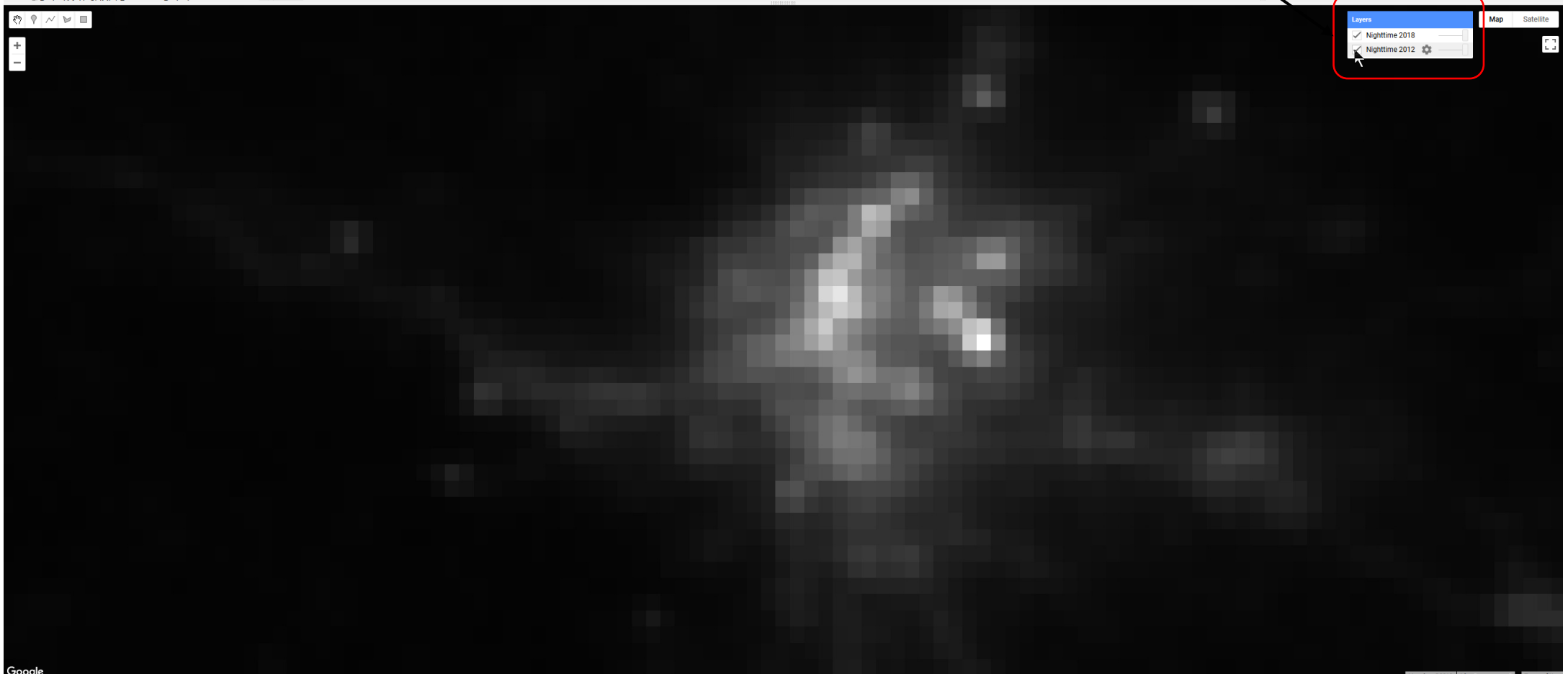
```
compareNTL
1 var year1 = 2012; // >= 2012
2 var year2 = 2018; // >= 2012
3 var lon = 85.3;
4 var lat = 27.7;
5 var zoom = 13;
6
7 Map.setCenter(lon, lat, zoom);
8 var nighttimeVis = {min: 0.0, max: 20.0};
9
10 // Adding year 1
11 var dataset1 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/CMCFG')
12   .filter(ee.Filter.date(year1+'-01-01', year1+'-12-31')).median();
13 var nighttime1 = dataset1.select('avg_rad');
14 Map.addLayer(nighttime1, nighttimeVis, 'Nighttime '+year1);
15
16 // Adding year 2
17 var dataset2 = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/CMCFG')
18   .filter(ee.Filter.date(year2+'-01-01', year2+'-12-31')).median();
19 var nighttime2 = dataset2.select('avg_rad');
20 Map.addLayer(nighttime2, nighttimeVis, 'Nighttime '+year2);
21
```

Get Link Save Run Reset

Inspector Console Tasks

Use print(...) to write to this console.

On/off visibility of the images to compare



Night-time light profiling

Filter scripts...

NEW

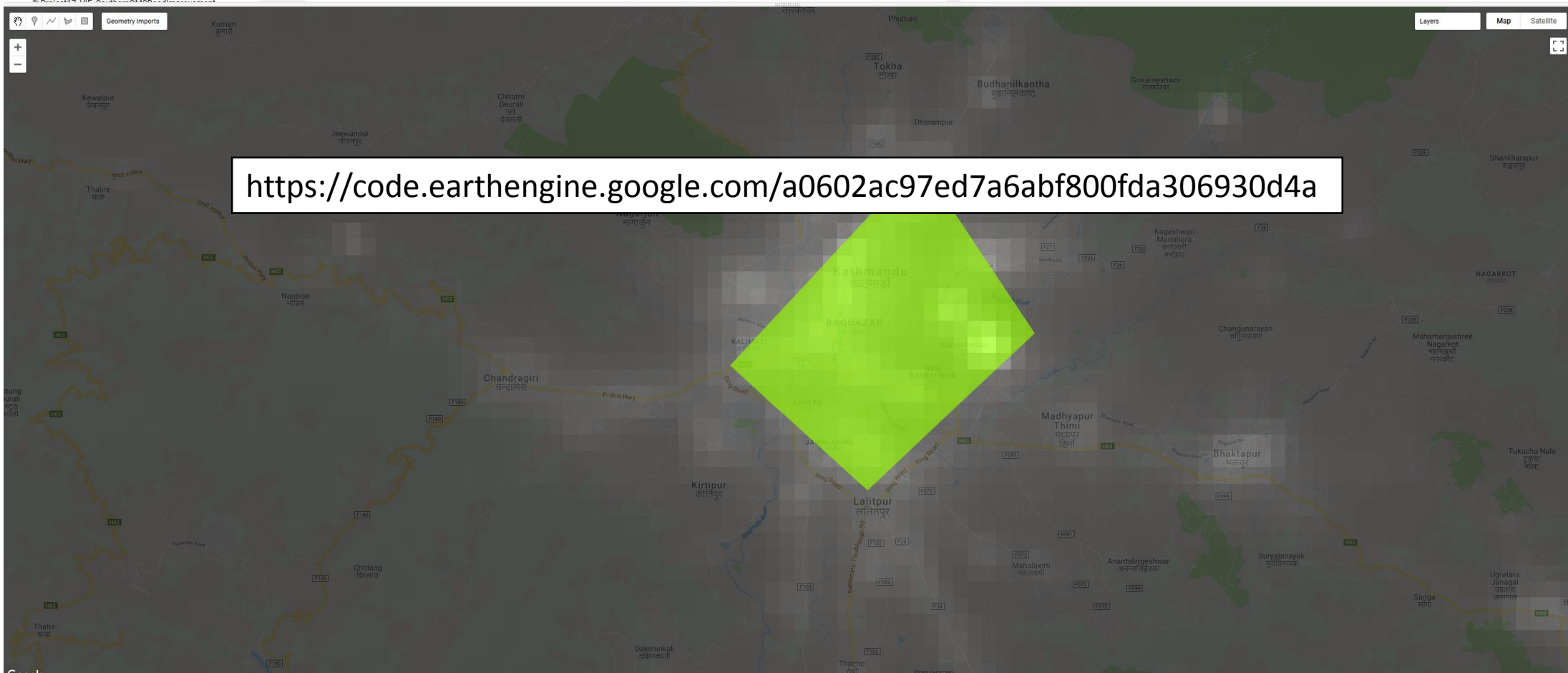
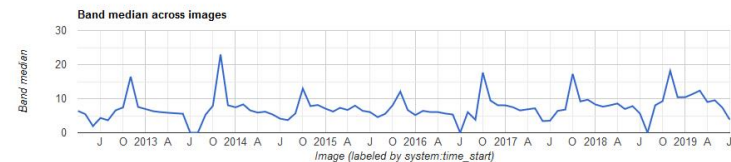
- Owner (2)
  - users/heromiya/default
    - \_trash
    - LANDSAT\_LC08\_C01\_T1-test
    - NLTProfling
    - Sentinel-1
    - browseLandsatByYear
    - browseNTL
    - compareLandsatByYear
    - compareNTL
    - getNTL
    - wakiya
  - users/heromiya/public
- Writer
  - No accessible repositories.
- Reader (1)
  - users/Landstat/AS2019
    - ADBBatchProcess
    - GMSHighwayThai
    - Project10\_VIE\_UrbanTransport
    - Project12\_SouthernCostalCorridor
    - Project13\_VIE\_HoChiMinhUrbanMRT
    - Project14\_VIE\_UrbanMRT2
    - Project15\_HaNoiMetroRailStation
    - Project16\_HoChiMinhExpresswayProject

```

Imports (1 entry)
var geometry: Polygon, 4 vertices
1 var lon = 85.3;
2 var lat = 27.7;
3 var zoom = 13;
4
5
6 var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/VCMSFG')
7   .filter(ee.Filter.date('2012-01-01', '2019-12-31'));
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.median(), nighttimeVis, 'Nighttime', true, 0.7);
12 print(ui.Chart.image.series(nighttime, geometry, ee.Reducer.median(), 500));
13

```

Use print(...) to write to this console.

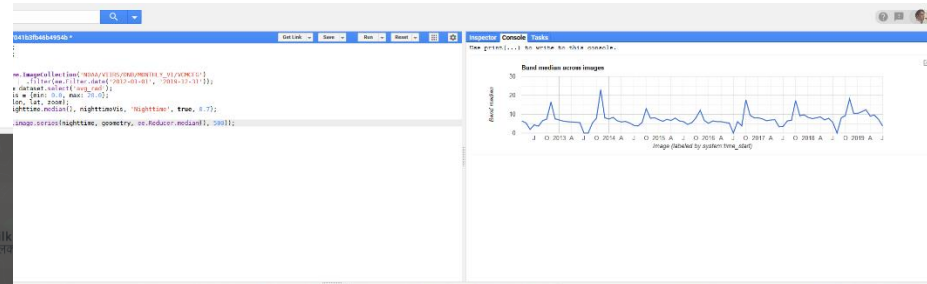




# Configure areas to profile night-time light

```
Imports (1 entry)
  var geometry: Polygon, 4 vertices
1 var lon = 85.3;
2 var lat = 27.7;
3 var zoom = 13;
4
5 var dataset = ee.ImageCollection('NOAA/VIIRS/DNB/MONTHLY_V1/CMCFG')
6   .filter(ee.Filter.date('2012-01-01', '2019-12-31'));
7 var nighttime = dataset.select('avg_rad');
8 var nighttimeVis = {min: 0.0, max: 20.0};
9 Map.setCenter(lon, lat, zoom);
10 Map.addLayer(nighttime.median(), nighttimeVis, 'Nighttime', true, 0.7);
11
12 print(ui.Chart.image.series(nighttime, geometry, ee.Reducer.median(), 500));
13
```

Inspector  
Band median  
0  
10  
20  
30



Configure geometry import

Name: geometry

Color: #9eff00

Import as: Geometry

Properties: + Add property

OK Cancel

Geometry is removed

# Configure areas to profile night-time light

The image illustrates the process of configuring areas to profile night-time light in Google Earth Engine. It consists of three overlapping screenshots of the Earth Engine interface:

- Top-left screenshot:** Shows the 'Scripts' panel with a script for night-time light analysis. The script includes variables for longitude, latitude, and a geometry, and uses the `ee.Reducer.median` function to calculate the band median across images.
- Top-right screenshot:** Shows the 'Inspector' panel with a 'Run' button highlighted, indicating the execution of the script.
- Bottom screenshot:** Shows a map with a red polygon drawn over a city area. A callout box states 'Time series profile is updated'. A 'Band median across images' chart is visible on the right side of the map, showing the time series profile of the night-time light data.

Key elements and annotations:

- Map:** A satellite view of a city area with a red polygon drawn over it, indicating the area of interest for the night-time light profile.
- Inspector:** A panel on the right side of the map showing the 'Run' button, which is used to execute the script and update the time series profile.
- Callout:** A text box stating 'Time series profile is updated' is positioned near the 'Run' button.
- Chart:** A 'Band median across images' chart is visible on the right side of the map, showing the time series profile of the night-time light data.

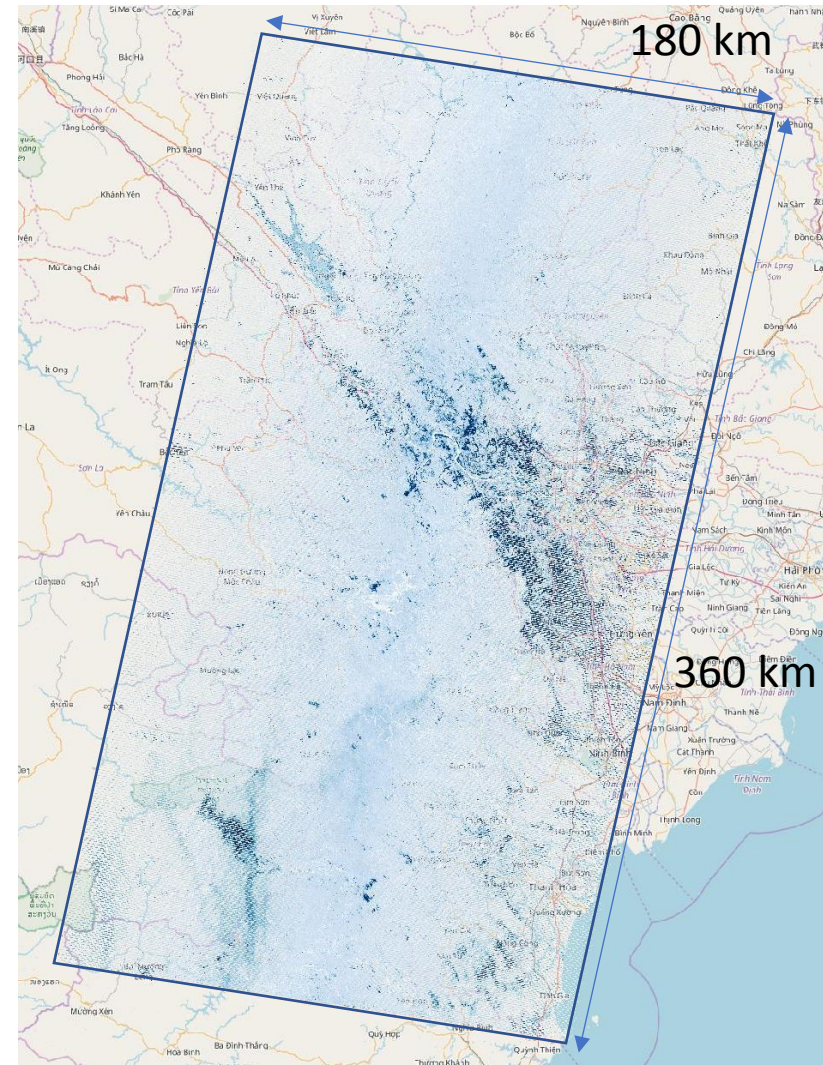
(Not validated very well)

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

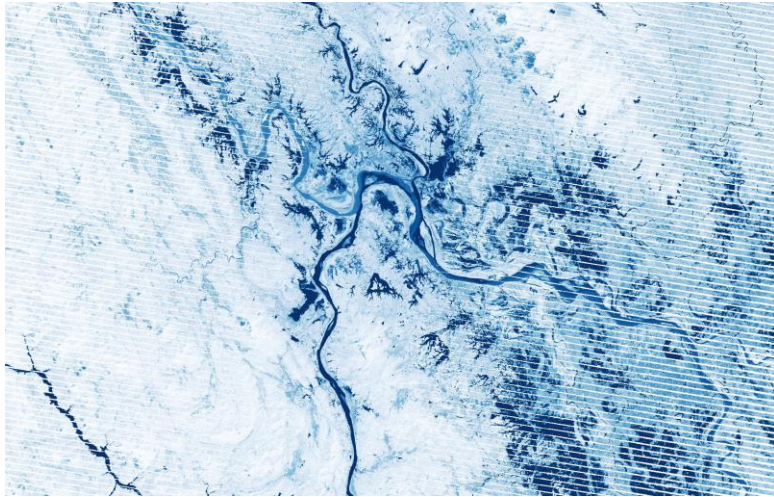
Observation of a flood, November 2008



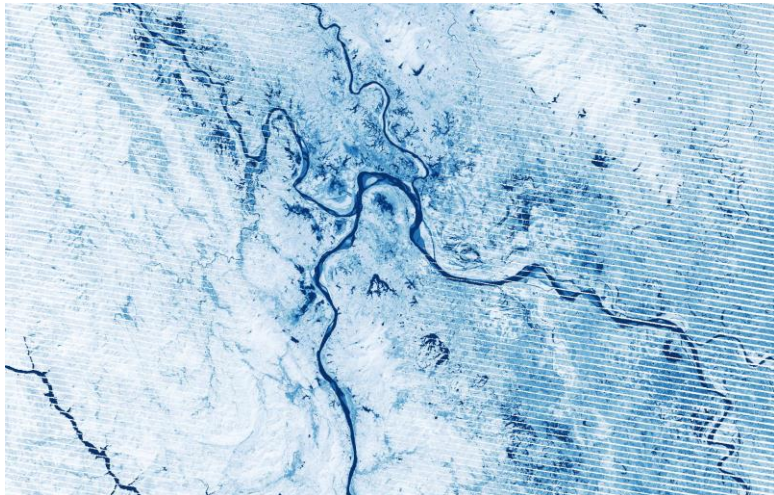


# Flood observation from satellites

Waterbody extent (post-flood, 10 Nov 2008)

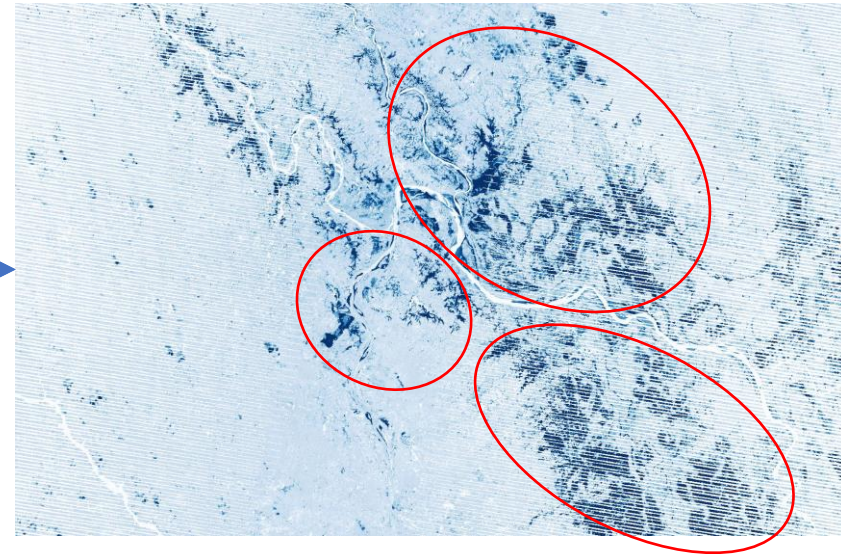


Waterbody extent (pre-flood, 8 Nov 2007)



Change  
detection

Extent of the flood in November 2008



# Concept

- Pre-disaster data → Cloud-free Landsat data with 1-year composite before a disaster using -  
`ee.Algorithms.Landsat.simpleComposite(collection, percentile, cloudScoreRange, maxDepth, asFloat)`
- 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)`