

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 Observation Group (EOG) at NOAA/NCEI is producing a version 1 suite of average radiance composite images using night-time 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. Cloud 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 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 5 months. Therefore, it is imperative that users of these data utilize the cloud-free observations file and not assume a value of zero in a 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. It 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 "vcmf" respectively. The "vcmf" 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 1 additional dash separator "-". These fields are followed by a filename extension. The fields are described below using the example file `svdmb_0pp_20140331-20140331_global_vcmf_v10_c201502001154_avg_radef`

Field 1: VIIRS SDR or Product that made the composite "svdmb"
Field 2: satellite name "0pp"
Field 3: date range "20140331-20140331"
Field 4: SOC "global"
Field 5: config shorthandname "vcmf"
Field 6: version "v10" is version 1.0
Field 7: creation datetime
Extension: avg_radef

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

- "vcm-rem" (VIIRS Cloud Mask - Outer Removed) This product contains cloud-free average radiance values that have undergone a removal process to filter out fires and other ephemeral lights.
- "vcm-rem-rl" (VIIRS Cloud Mask - Outer Removed - Nighttime Lights) This product contains the "vcm-rem" average, with background (non-lights) set to zero.
- "vcm-rl" (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 6 geotiffs. Files with extension "avg_radef" contain floating point radiance values with units in `nan Watts/cm2/sr`. Note that the original DNB radiance values have been multiplied by 1E5. This was done to alleviate issues some software packages were having with the very small numbers in the original with extension "cf_ovg" are integer counts of the number of cloud-free coverages, or observations, that went into constructing the radiance image. Files with extension "ovg" 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 or kim.baugh@noaa.gov.

2015 Nighttime Light Composite

Download KMZ

Index thumbnails for nighttime light image tiles

Showing thumbnails of Jan 2015:
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 availability of the data - NODC has developed a service to geocode VIIRS images. At this site we will provide access to daily mosaic of daytime 1-Band and nighttime DNB data globally.

The global avg 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: 01/26/2019/17:00:03

PNG Tiles

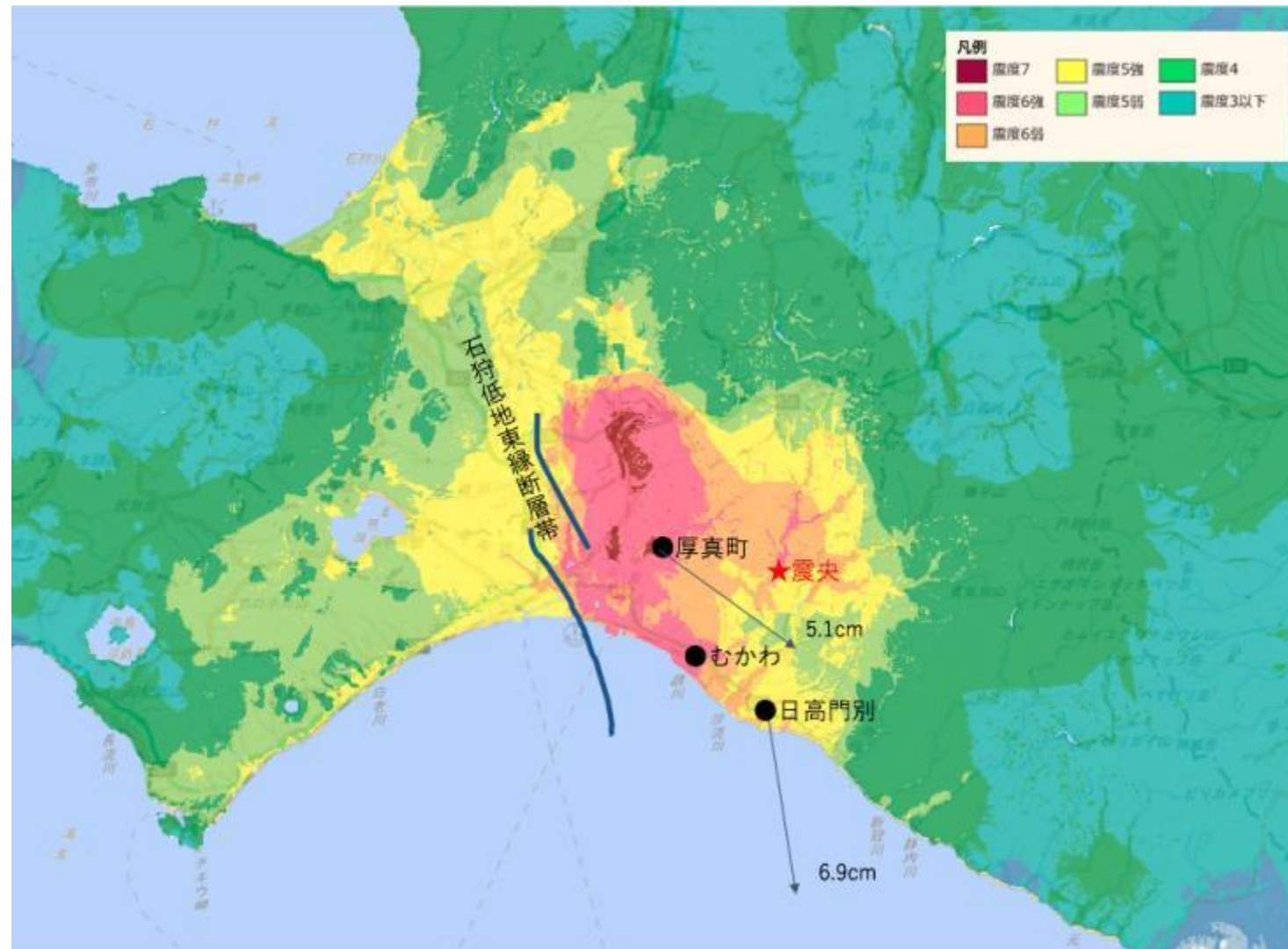
Last Update: 01/25/2019/17:00:03

Expand All | Contract All

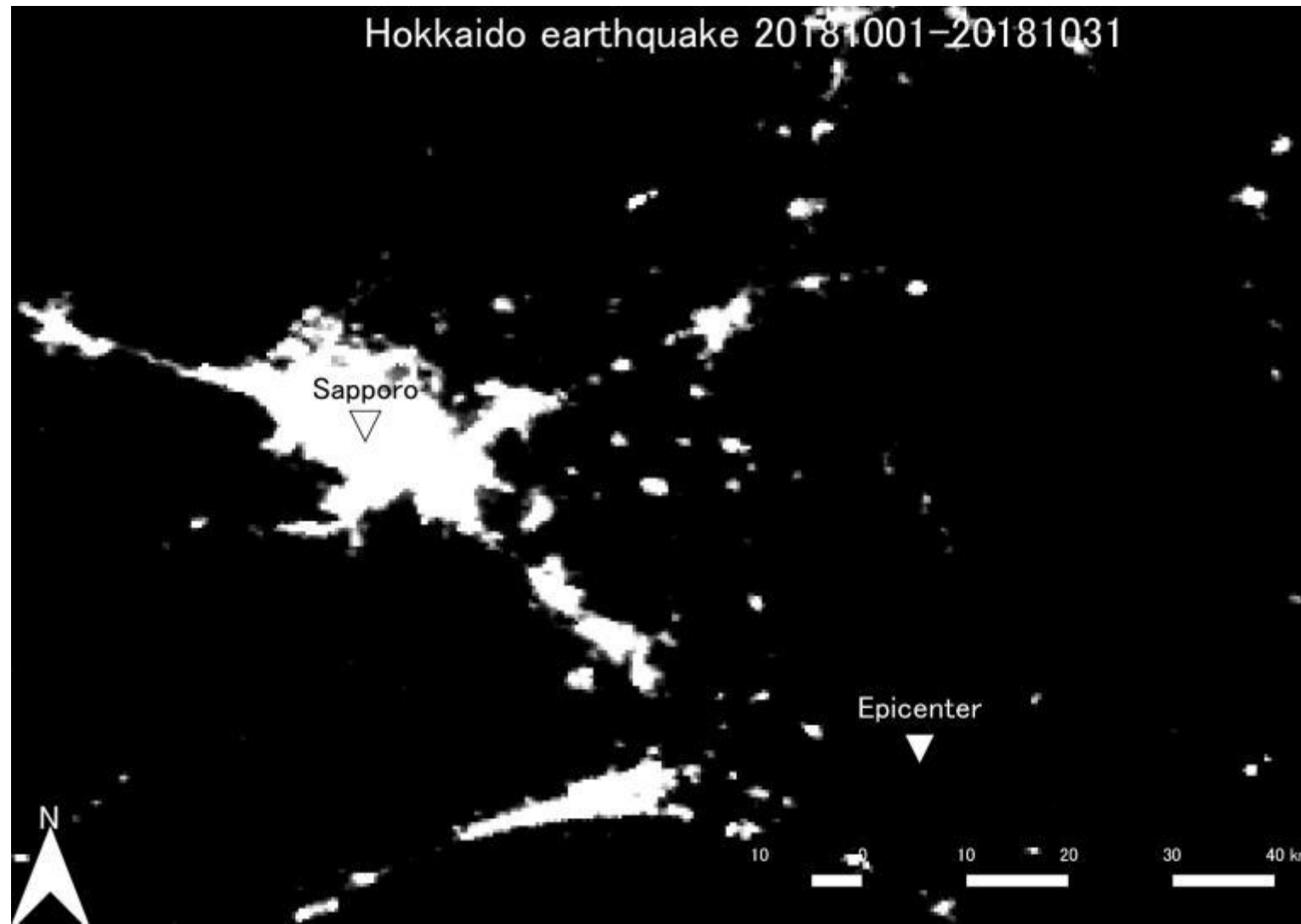
- 2019/January
 - 20190129
 - 20190128
 - 20190127
 - 20190126
 - 20190125
 - 20190124
 - 20190123
 - 20190122
 - 20190121
 - 20190120
 - 20190119
 - 20190118
 - 20190117
 - 20190116
 - 20190115

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

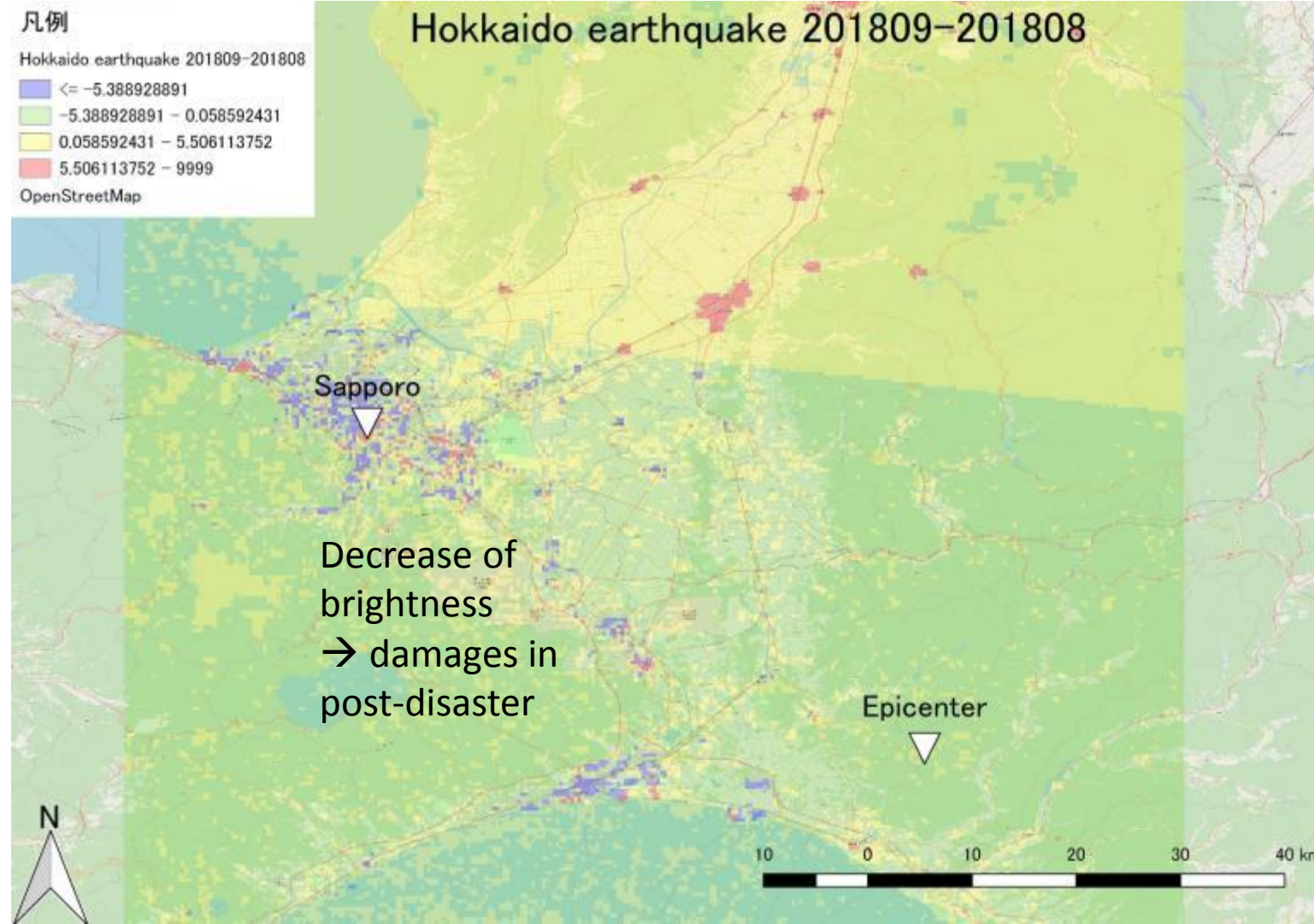
Earthquake in Hokkaido, Japan, Sept 2018



Post-disaster night-time light, Oct 2018



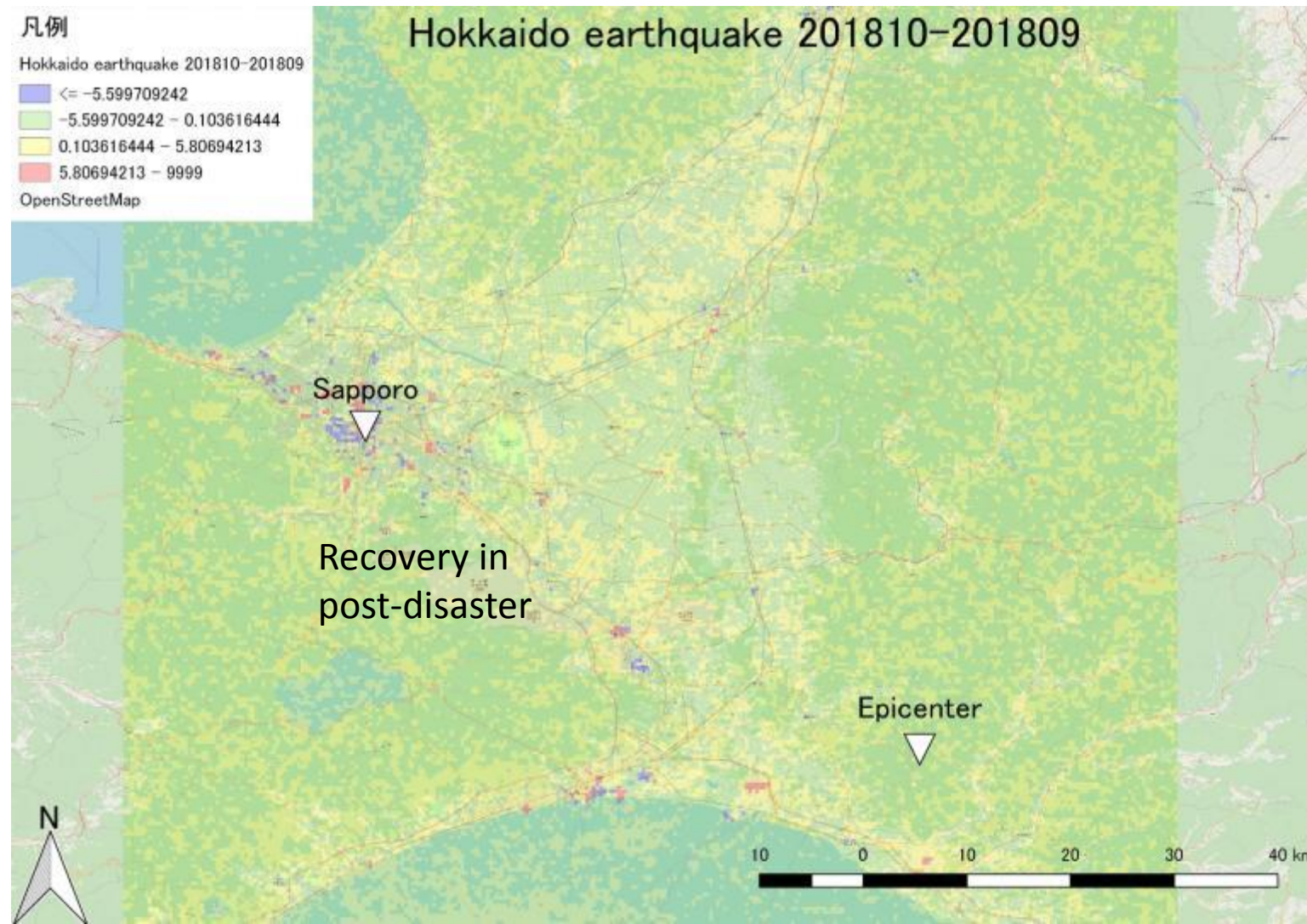
Change detection from monthly composite Changes between September – August, 2018



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

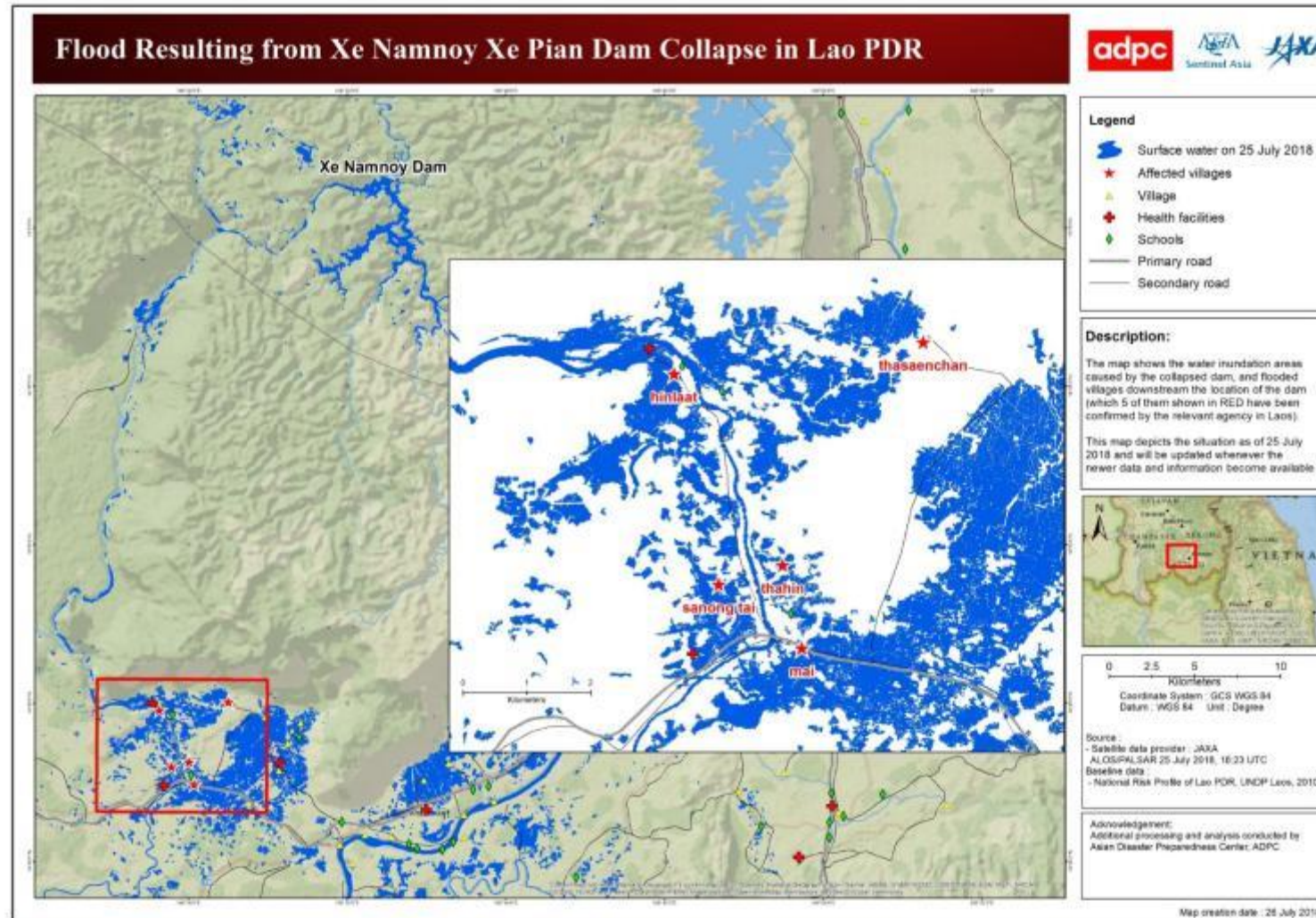
Change detection from monthly composite

Changes between October – September, 2018

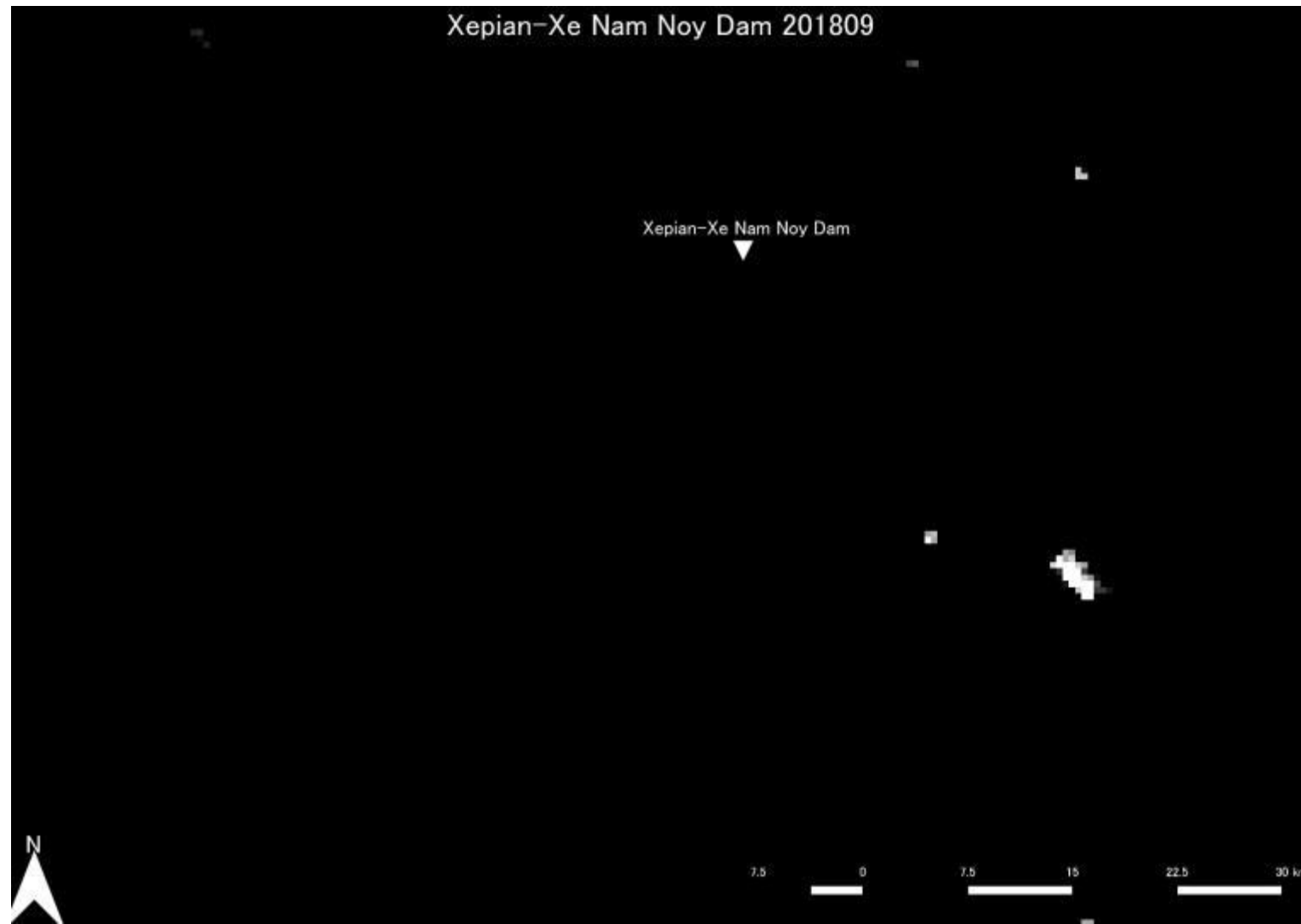


Changes were identified by $\mu \pm 2\sigma$ in the differences.

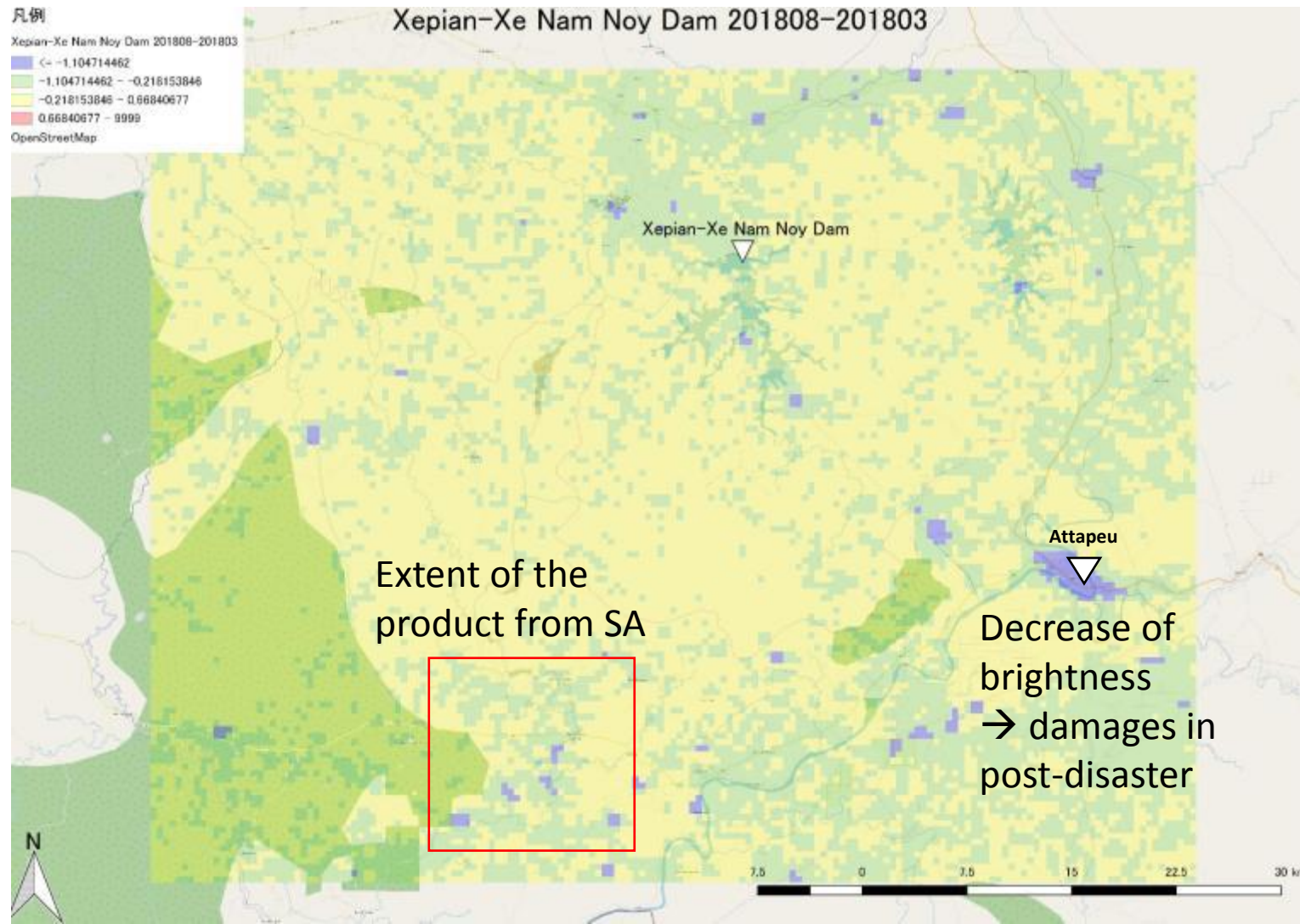
Impact of dam eruption in Laos, July 2018



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



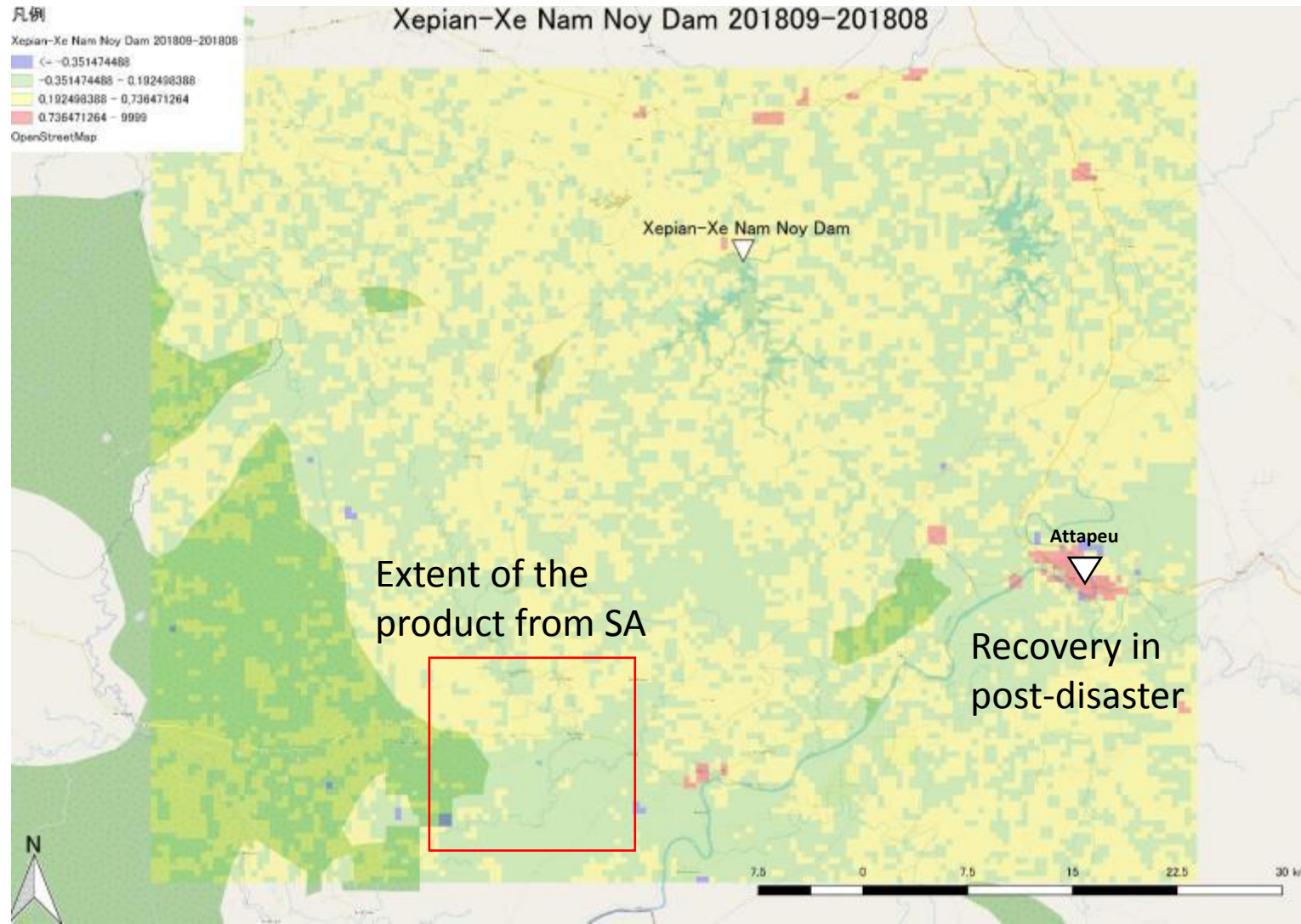
Change detection from monthly composite Changes between August – March, 2018



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

Change detection from monthly composite

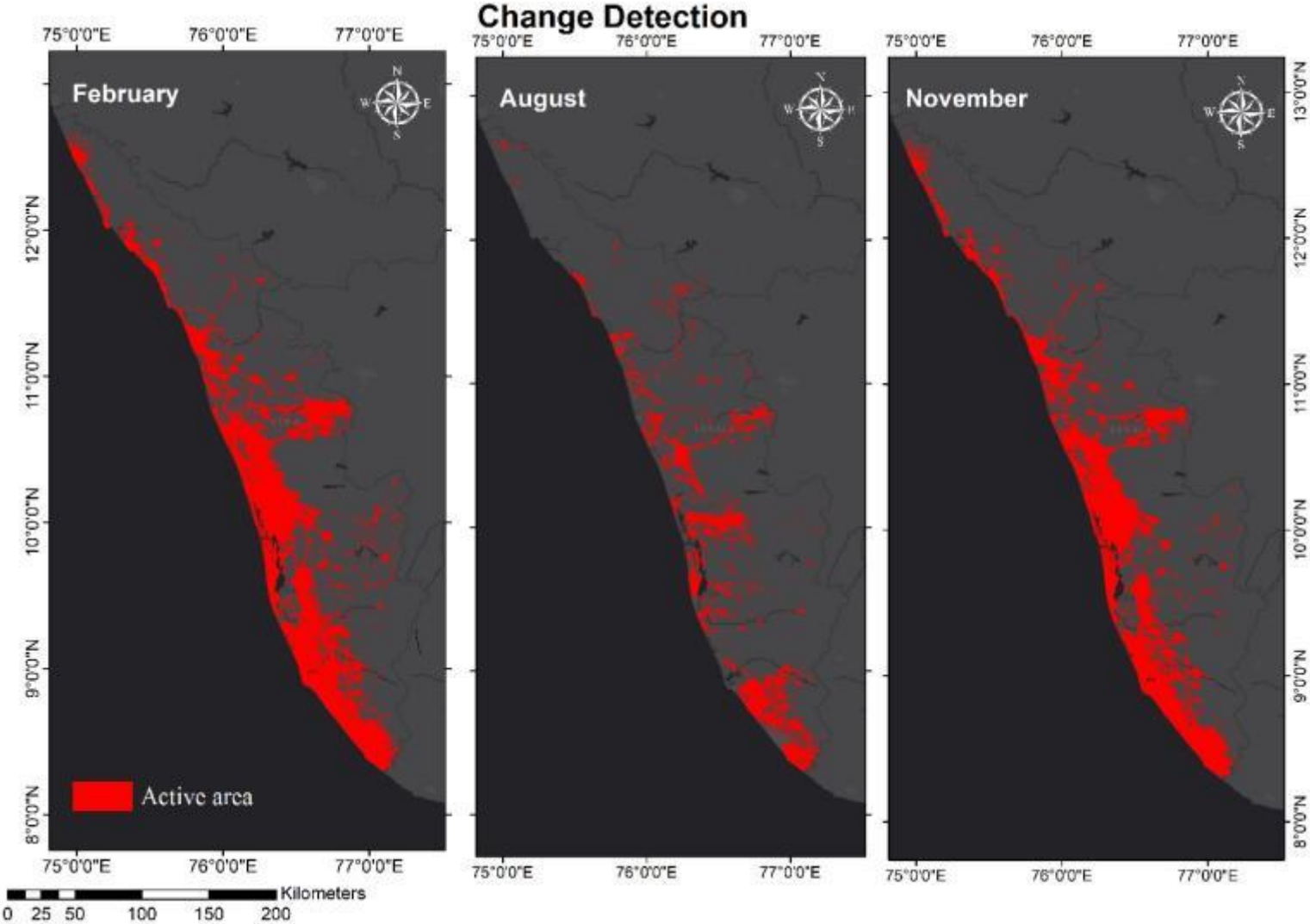
Changes between September – August, 2018



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.Algorithms.Landsat.pathRowId(collection, maxScan...
- ee.Clusterer
 - ee.Clusterer.weka4Means(nClusters, lat, coordinates, maxCen...
- ee.Image
 - focal_median(radius, kernelType, units, iterations, kernel)
- ee.ImageCollection
 - median()
- ee.Reducer
 - ee.Reducer.median(maxBuckets, minBucketWidth, maxRow)
 - ee.Reducer.percentile(percentiles, outputNames, maxBucket...

```
1 var year = 2012; // => 2012
2 var lon = 85.0;
3 var lat = 23.7;
4 var zoom = 15;
5
6 var dataset = ee.ImageCollection("MODIS/VIRS/DNB/MONTHLY_V1/CMGLFDF")
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
```

Inspectors Console Tools

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

<https://code.earthengine.google.com/e7b529e0e9e84ca3daf305bf4dbde870>

Google

Google Earth Engine night time light

Scripts Docs Assets

- ee.Algorithms
- ee.Algorithms.Landsat
- ee.Clusters
- ee.Image
- ee.ImageCollection
- ee.Reducer

```
1 var year = 2015; // == 2012
2 var lon = 85.31;
3 var lat = 27.71;
4 var zoom = 11;
5
6 var dataset = ee.ImageCollection('MODIS/VIIRS/VNP2/RENTLE_VI/VN02LCP0')
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

The image shows a satellite map of Kathmandu, Nepal, with a semi-transparent nighttime light overlay. The overlay is a grayscale heatmap where brighter areas indicate higher light intensity. A red rectangular box highlights the 'Layers' panel in the top right corner of the map interface. In this panel, the 'nighttime' layer is listed with a checkmark and a gear icon, and an opacity slider is visible next to it. The map interface includes standard navigation controls like a compass, zoom in (+) and zoom out (-) buttons, and a scale bar at the bottom left.

Google Earth Engine

night time light

Scripts Docs Assets

```
compareNTL
1 var year1 = 2012; // == 2012
2 var year2 = 2012; // == 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
```

Inspector Console Tasks

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

Owner (20)

- users/beromiya/default
 - LANDSAT_LC08_C01_T1-test
 - Sentinel-1
 - browseLandsatByYear
 - browseNTL
 - compareLandsatByYear
 - compareNTL
 - getNTL
 - statTest
 - test
 - test2
 - wakiya
- users/beromiya/public

Writer

No accessible repositories.

Reader (1)

- users/Landstat/AS2019
 - ACBBatchProcess
 - GMSHighwayThai
 - Project10_VE_UrbanTransport
 - Project12_SouthernCostalCorridor
 - Project13_VE_HoChiMinhUrbanMRT
 - Project14_VE_UrbanMRT2
 - Project15_HanoiMetroRailStation

Layers

- Nighttime 2018
- Nighttime 2012

Map Satellite

Google

Map data ©2019

Terms of Use

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

Google Earth Engine night time light

Scripts Docs Assets

- Filter scripts... NEW
- Owner (20)
 - users/beromiya/default
 - LANDSAT_LC08_C01_T1-test
 - Sentinel-1
 - browseLandsatByYear
 - browseNTL
 - compareLandsatByYear
 - compareNTL
 - getNTL
 - statTest
 - test
 - test2
 - wakiya
 - users/beromiya/public
- Writer
 - No accessible repositories.
- Reader (1)
 - users/Landstat/AS2019
 - ACBBatchProcess
 - GMSHighwayThai
 - Project10_VE_UrbanTransport
 - Project12_SouthernCostalCorridor
 - Project13_VE_HoChiMinhUrbanMRT
 - Project14_VE_UrbanMRT2
 - Project15_HanoiMetroRailStation

```
compareNTL
1 var year1 = 2012; // == 2012
2 var year2 = 2012; // == 2012
3 var lon = 83.3;
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
```

Inspector Console Tasks

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

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

Link d96792ac04090807041b2fb404e954b

```
Imports [1 entry]
+ var geometry: Polygon, 4 vertices
1 var lon = 85.3;
2 var lat = 27.7;
3 var zoom = 11;
4
5
6 var dataset = ee.ImageCollection('MODIS/VIIRS/DM3/MONTHLY_V1/VCREF0')
7   .filter(ee.Filter.date('2012-01-01', '2018-12-31'));
8 var nighttime = dataset.select('a10_rad');
9 var nighttimeVis = {min: 0.0, max: 20.0};
10 Map.addLayer(nighttime.median(), nighttimeVis, 'Nighttime', true, 0.7);
11
12 print(ui.chart.image.series(nighttime, geometry, ee.Reducer.median(), 500));
13
```

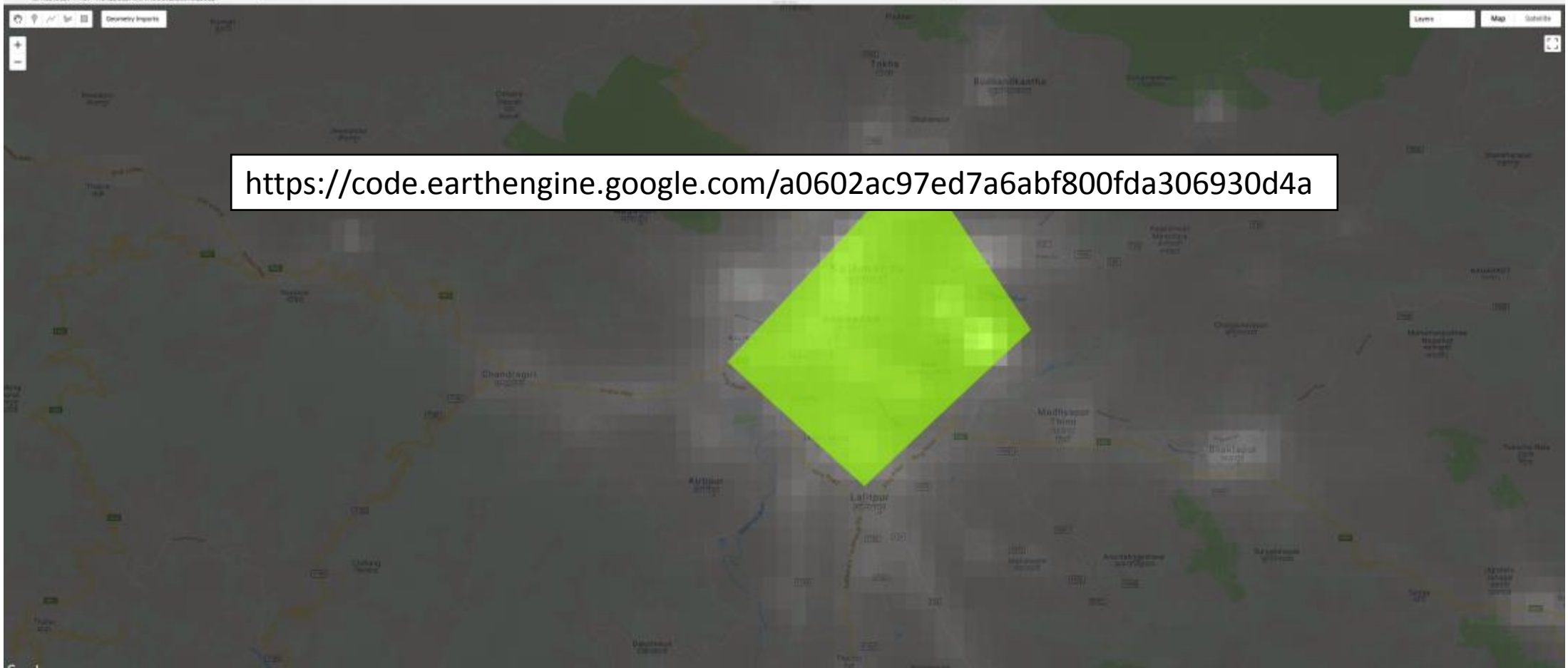
Inspector Console Tools

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

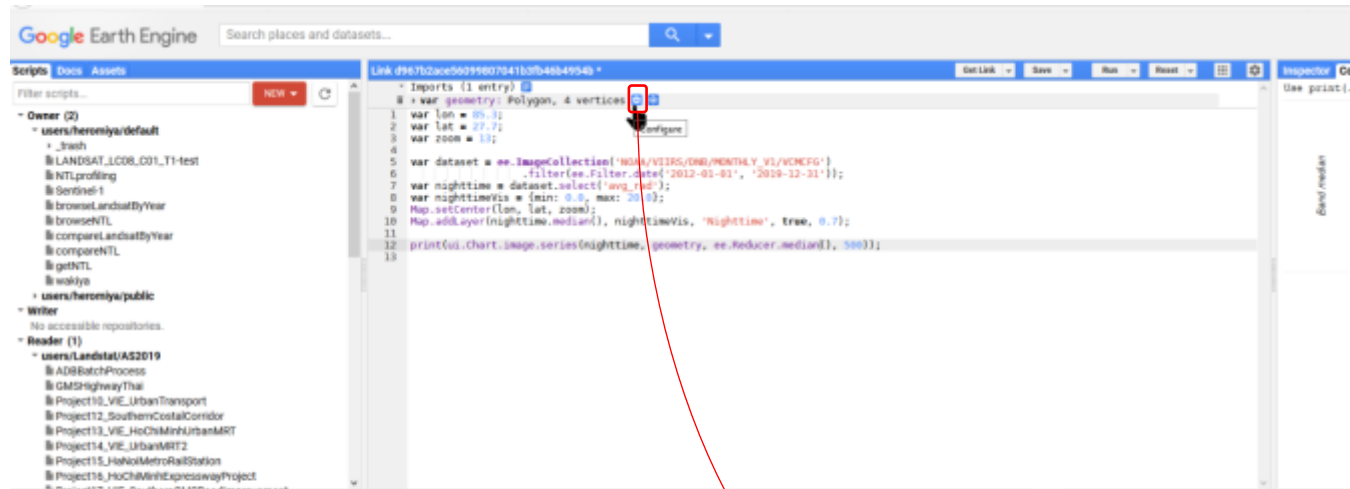
Band median across images

Band median

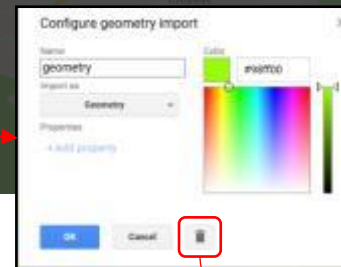
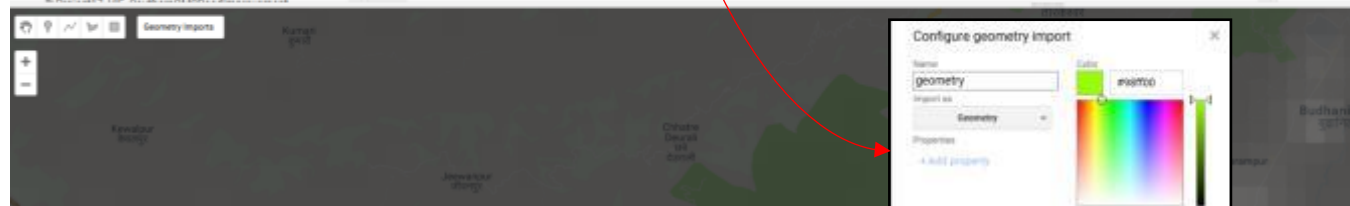
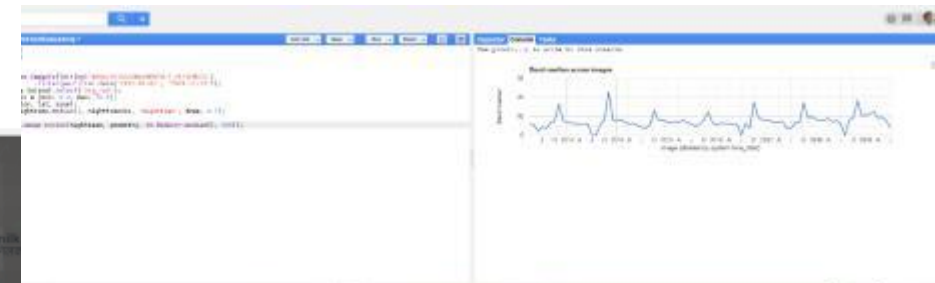
Image (labeled by system:time_start)



Configure areas to profile night-time light



```
Link #98762ace5609907041b0546849545 *
+ Imports (1 entry)
0 + var geometry: Polygon, 4 vertices
1 var lon = 10.3;
2 var lat = 27.7;
3 var zoom = 13;
4
5 var dataset = ee.ImageCollection('MODIS/VIIRS/DNB/MONTHLY_V1/VCMSFG')
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
```



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 shows three sequential steps:

- Top Panel:** The Google Earth Engine interface with the 'Scripts' panel open, showing a code editor with JavaScript code for defining a polygon and a time series profile.
- Middle Panel:** The same interface, but with the 'Run' button highlighted, indicating the execution of the script.
- Bottom Panel:** The Google Earth Engine map view with a red polygon drawn over a city area. A callout box states "Time series profile is updated". A graph titled "Band profiles across images" is visible on the right, showing a time series profile of the night-time light data.

Draw a polygon/rectangle over the map

Time series profile is updated

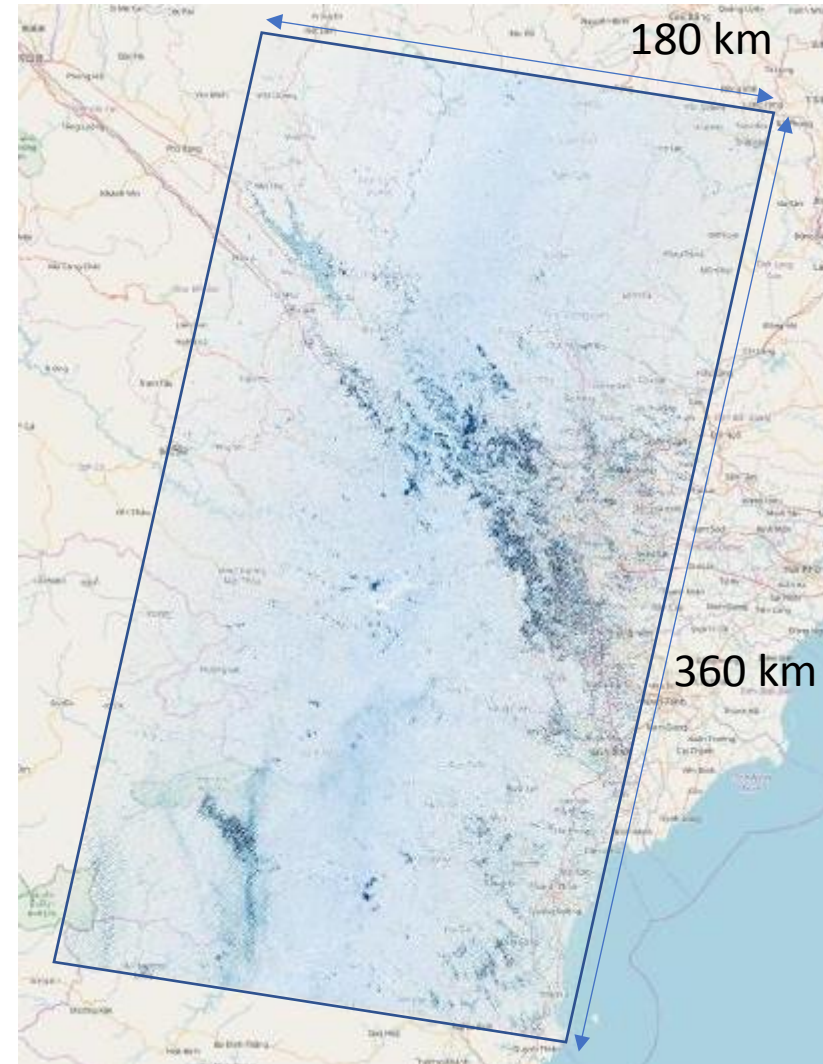
(Not implemented and validated very well)

Change detection in Landsat archive

Advantages of Satellite Data in Flood Observations

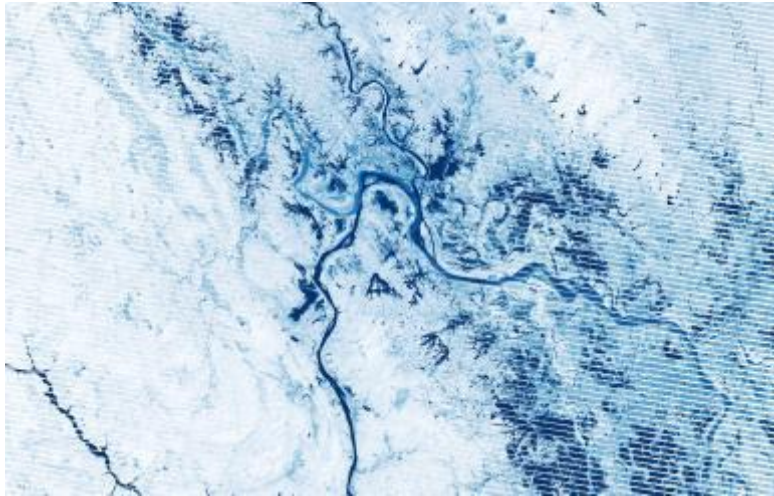
- Simultaneous observation of large extent
- Map-friendly
 - Useful to visualization
 - Overlay with other layers for integration
- Observation of dangerous and remote areas

Observation of a flood,
November 2008

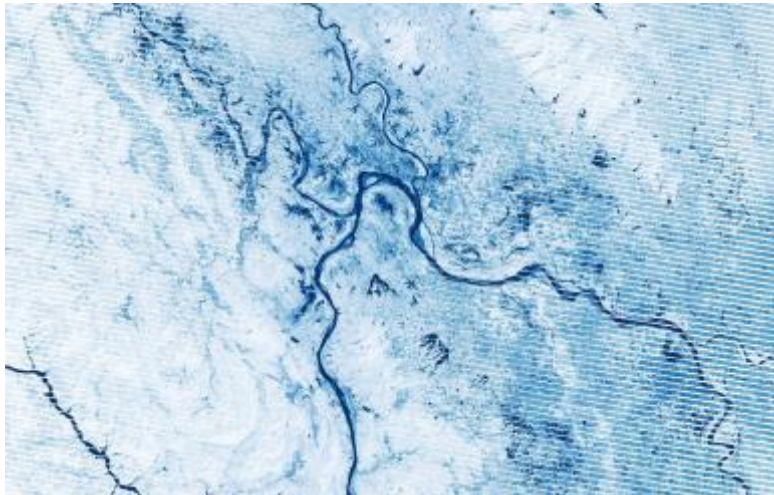


Flood observation from satellites

Waterbody extent (post-flood, 10 Nov 2008)

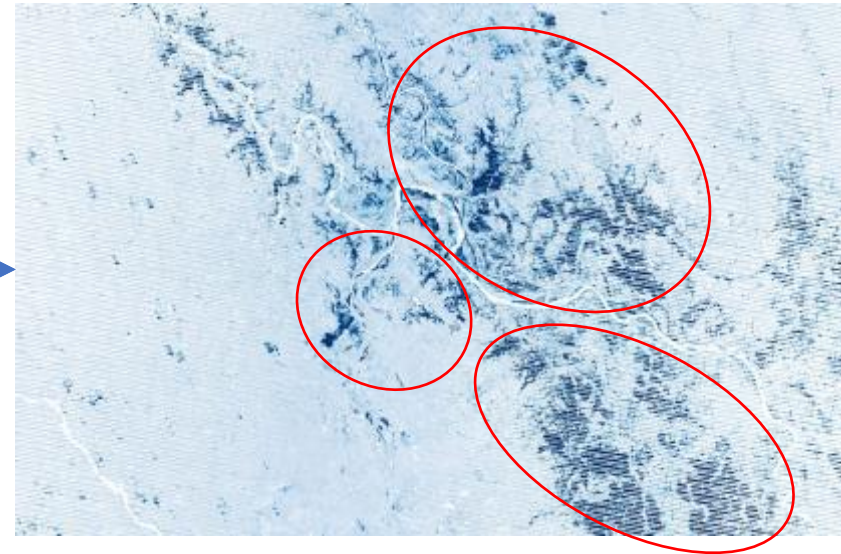


Waterbody extent (pre-flood, 8 Nov 2007)



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.