

# Leave no one behind - UNDP GeoHub Spatial data visualization and analytics for policy making

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SDG Integration

@Omicum, 10:30 – 11:00, 5 July 2024



# Speaker is...

## Jin Igarashi



- Full stack GIS developer in United Nations Development Programme since 2021
- GIS software developer with more than 12 years experience
- WaSH (Water, Sanitation and Hygiene) specialist in Eastern Africa region



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# What does UNDP do?

- UNDP works in about 170 countries and territories, helping to eradicate poverty, reduce inequalities and exclusion, and build resilience so countries can sustain progress.
- UNDP plays a critical role in helping countries achieve the Sustainable Development Goals as the UN agency.



Scan QR code  
to know more  
about UNDP



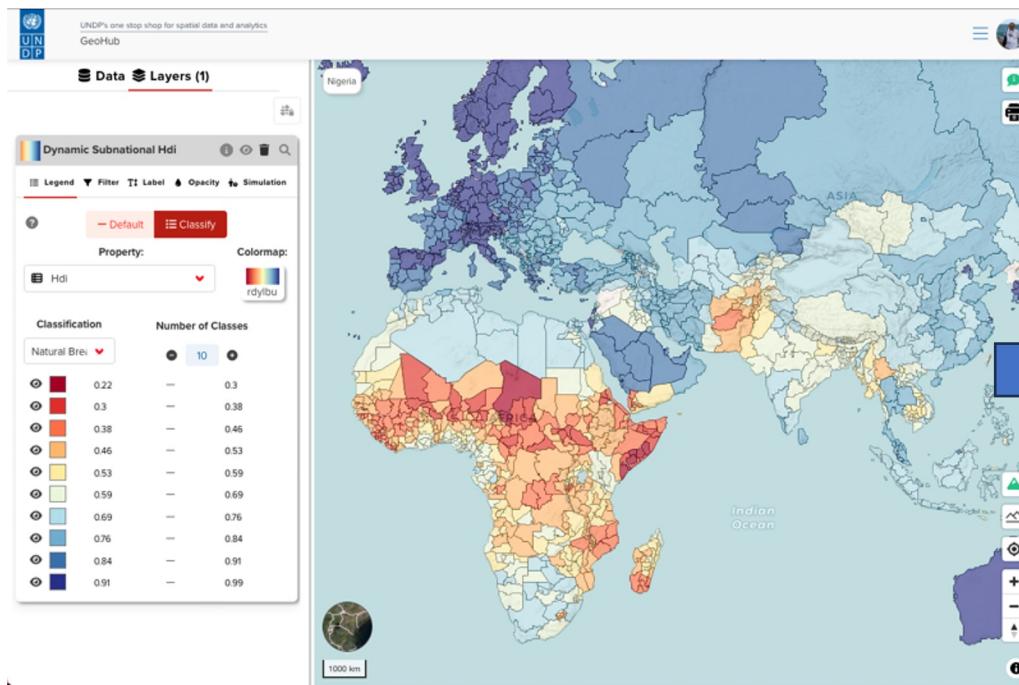
# UNDP and geospatial

- UNDP has little tradition with GEO
- Geospatial data is **UBIQUITOUS**
- Geospatial can be used to enforce **data driven policy making**
  - Where live the people without electricity access?
  - What areas have been affected by floods?
  - What villages are prone to landslides?



# What is GeoHub?

- A centralised ecosystem of geospatial services to support UNDP staff and development policy makers in the context of SDGs.



# GeoHub is



GeoHub landing page

## Work with data

- host
- style
- consume

## Visualize & Map

## Dashboard for customization

- Vector layers
  - point
  - line
  - polygon
  - heatmap
- Raster layers
  - remote
  - local

## Perform spatial analytics

- Dynamic vector layers
- On the fly algorithms
- Custom models

# 1. Centralised geospatial database



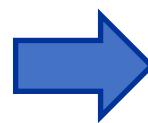
Country offices, HQ



Third party data  
STAC (Microsoft,  
etc)  
Open Data...



Other UN agencies  
(UNICEF, UNEP, FAO,  
World Bank, etc)

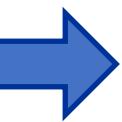


The screenshot shows the GeoHub datasets interface. At the top, there are navigation links: HOME, DATA, MAPS, TOOLS, and SUPPORT. Below this is a red 'DATA UPLOAD' button. The main area is titled 'DATASETS' with a sub-link 'MY DATA'. A table lists two datasets:

File name	Status	Size	Uploaded at
merged_prob_hrea_2022_20240620152758.tif	Processed	29.9 MB	16:28, 06/20/2024
NE 10m Lakes_20240226165854.zip	Published	2.3 MB	16:58, 02/26/2024

GeoHub data upload portal

Raster  
(COG)



Vector  
(pmtiles)



# 2. Searching database

**HOME / DATASETS**

## DATASETS

**DATASETS** 153 **MY DATA** 8

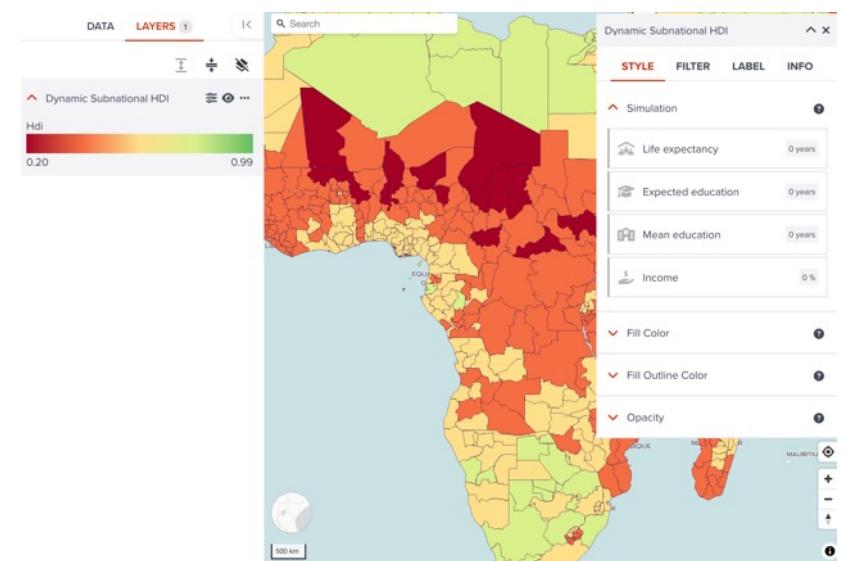
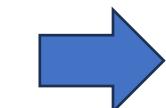
Type keywords to explore datasets...

**DATA UPLOAD** ▾

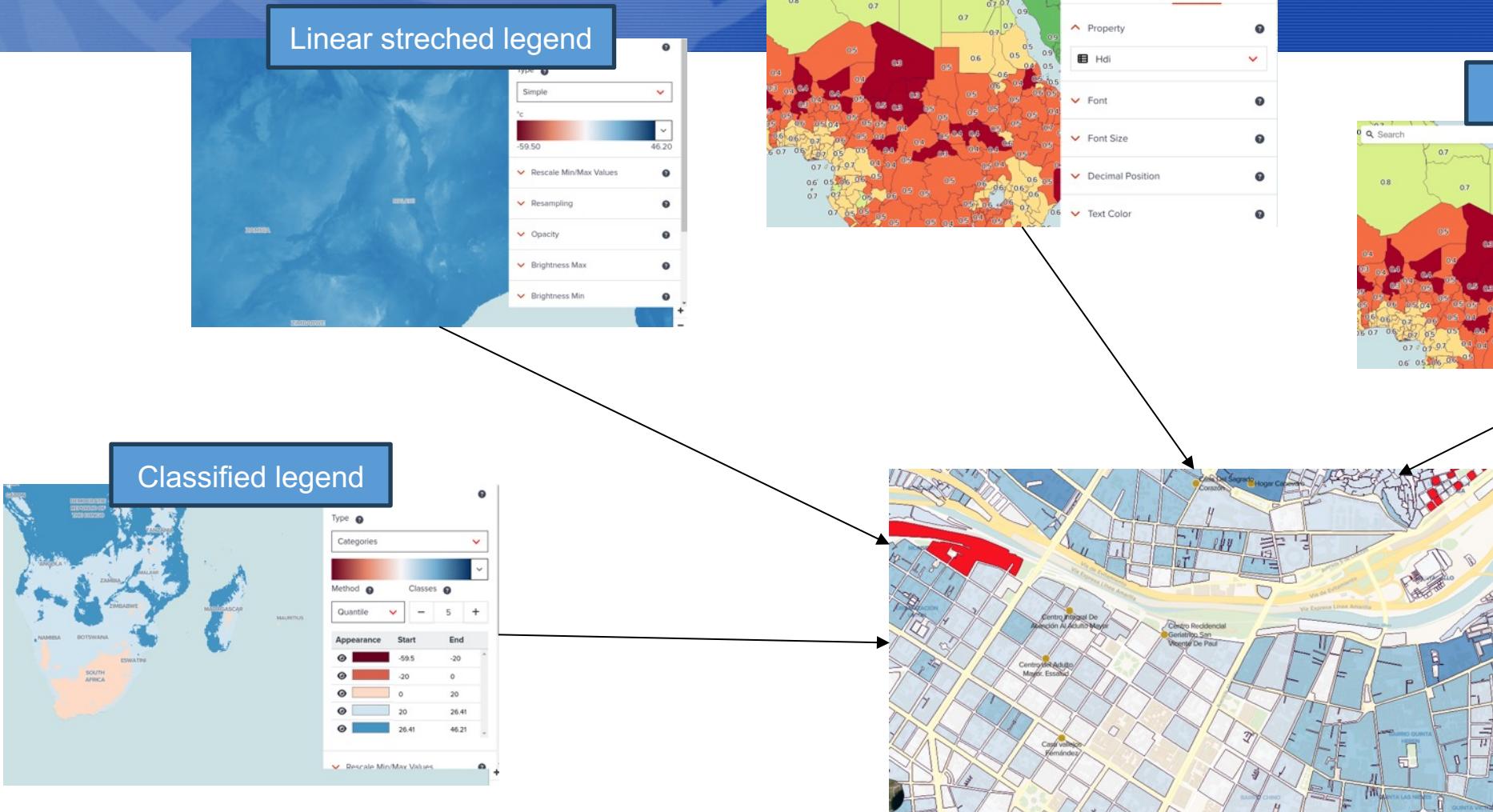
Card List Map

Dataset name	Description	SDG	License	Updated at
Overture Buildings (Cloud-Native Geo experiments)	This data is currently just a set of experiments using the new overture maps. See their <a href="#">github...</a>	11	Open Data Commons Open Database License (ODbL)	13:19, 06/20/2024
Nightly nighttime lights mosaics	Nighttime lights mosaics in COG format from Colorado School of Mines	N/A	Creative Commons Attribution 4.0 International	13:00, 06/20/2024
Google Microsoft Building Footprints as of September 2023	This dataset merges Google's V3 Open Buildings and Microsoft's latest Building Footprints which...	11	Open Data Commons Open Database License (ODbL)	11:58, 06/18/2024

Search datasets to add them into the map

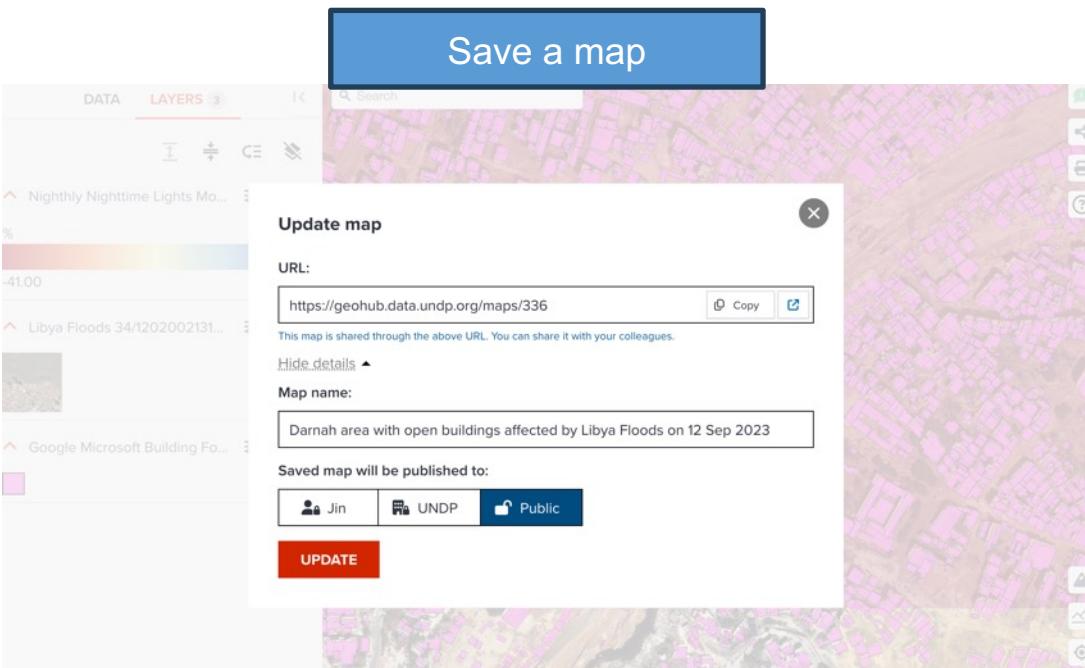


# 3. Visualisation



# 4. Map sharing

**Save a map**



Nightly Nighttime Lights Mo...  
-41.00  
Libya Floods 34/1202002131...  
Google Microsoft Building Fo...

**Update map**

URL: <https://geohub.data.undp.org/maps/336>

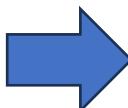
This map is shared through the above URL. You can share it with your colleagues.

Map name: Darnah area with open buildings affected by Libya Floods on 12 Sep 2023

Saved map will be published to:

Jin  UNDP  Public

**UPDATE**



**Sharing map**

**HOME / MAPS**

## EXPLORE MAPS

**NEW MAP**

Type keywords...

Search maps shared to:

Jin  UNDP  Public

Most recent

10  Card  List

**MAP** World Regions Pop (1) (2)

**MAP** (FINAL DRAFT - UNDP INTERNAL)

**MAP** Darnah area with open buildings

**MAP** Multi-dimensional Poverty Index

# 5. Rapid Change Assessment for Floods in Derna, Libya

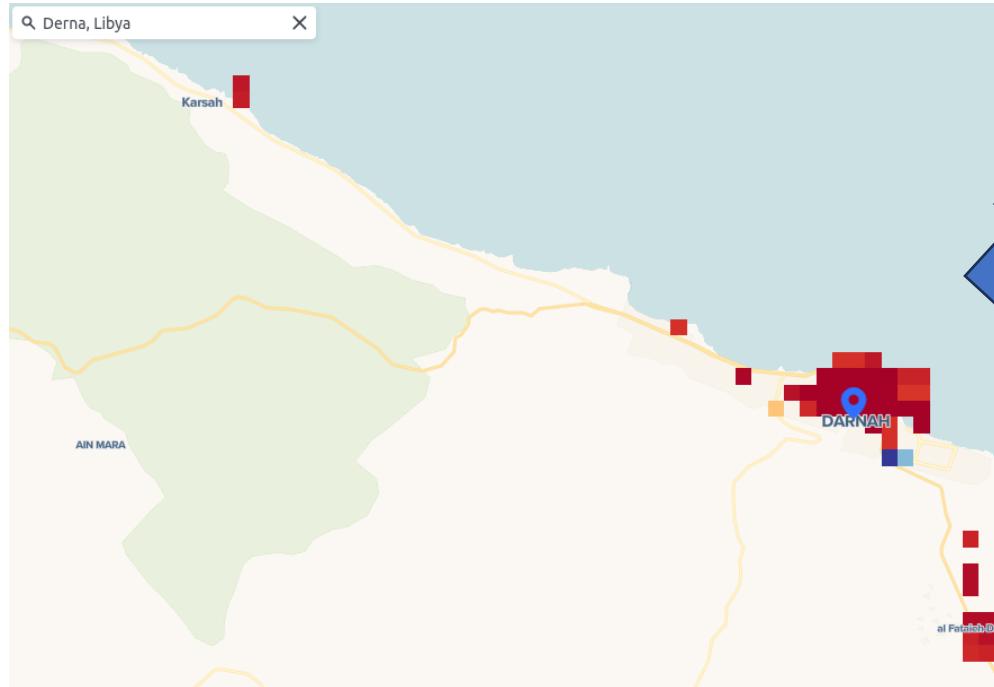


- On 11 of September 2023 a dam collapse released an estimated 30 million cubic meters (39 million cubic yards) of water, causing flooding downstream as the Wadi Derna overflowed its banks. The floods partially destroyed the city of Derna. As of 18 September, estimates for the number of casualties range from 5,300 to 20,000 people according to Wikipedia.



# 5. Floods in Derna, Libya after applying RCA

Compare night time light  
between 9 Sep 23 and 15  
Sep 23

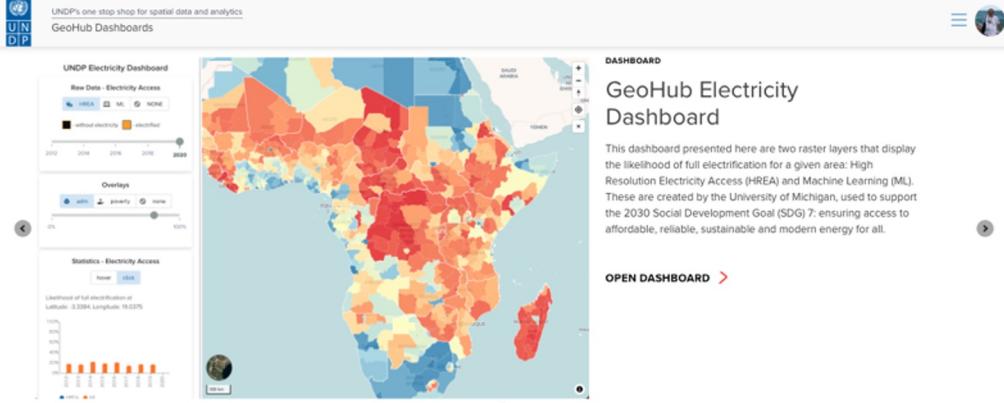


Overlay on Maxar Open data



Overlay Microsoft/Google Open buildings

# 6. Dashboards for specific datasets



**UNDP's one stop shop for spatial data and analytics  
GeoHub Dashboards**

**UNDP Electricity Dashboard**

Raw Data - Electricity Access

- HREA
- ML
- NONE

without electricity    electrified

Overlays

- Adm
- Poverty
- None

Likelihood of full electrification at Latitude: 3.2284, Longitude: 19.0275

Statistics - Electricity Access

Hover Click

Likelihood of full electrification at Latitude: -1.2577, Longitude: 36.7432

Report Fraud, Abuse, Misconduct

Submit Social Or Environmental Complaint

Scam Alert

Terms Of Use

**GEOHUB**

- GeoHub
- Shared Maps
- User Guide

**DASHBOARD**

- Dashboards
- Electricity Dashboard

**FOR DEVELOPERS**

- Github Repo
- GeoHub API documentation
- Svelte UNDP design system

**Report Fraud, Abuse, Misconduct**

**Submit Social Or Environmental Complaint**

**Scam Alert**

**Terms Of Use**

**Twitter** **Facebook** **YouTube** **Instagram** **LinkedIn**

**UNDP Electricity Dashboard**

**Raw Data - Electricity Access**

HREA ML NONE

without electricity    electrified

2012 2014 2016 2018 2020

**Overlays**

Adm Poverty None

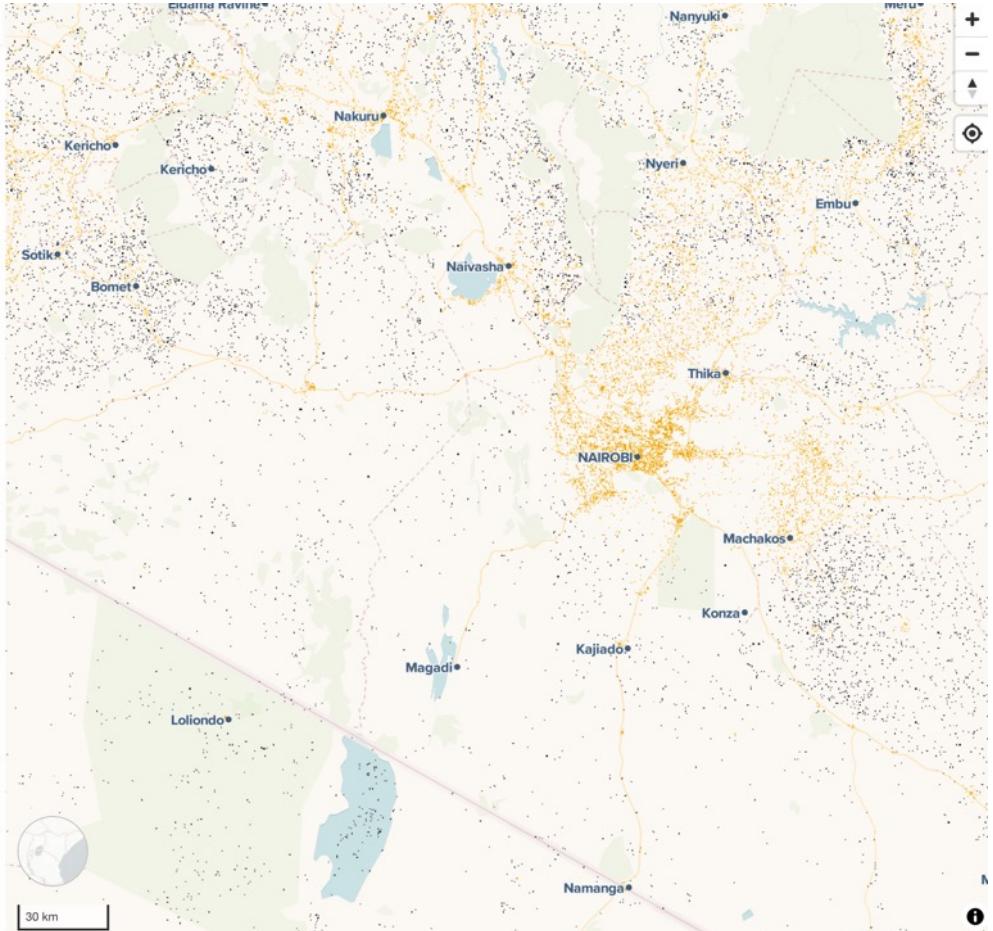
**Statistics - Electricity Access**

Hover Click

Likelihood of full electrification at Latitude: -1.2577, Longitude: 36.7432

2012 2013 2014 2015 2016 2017 2018 2019 2020

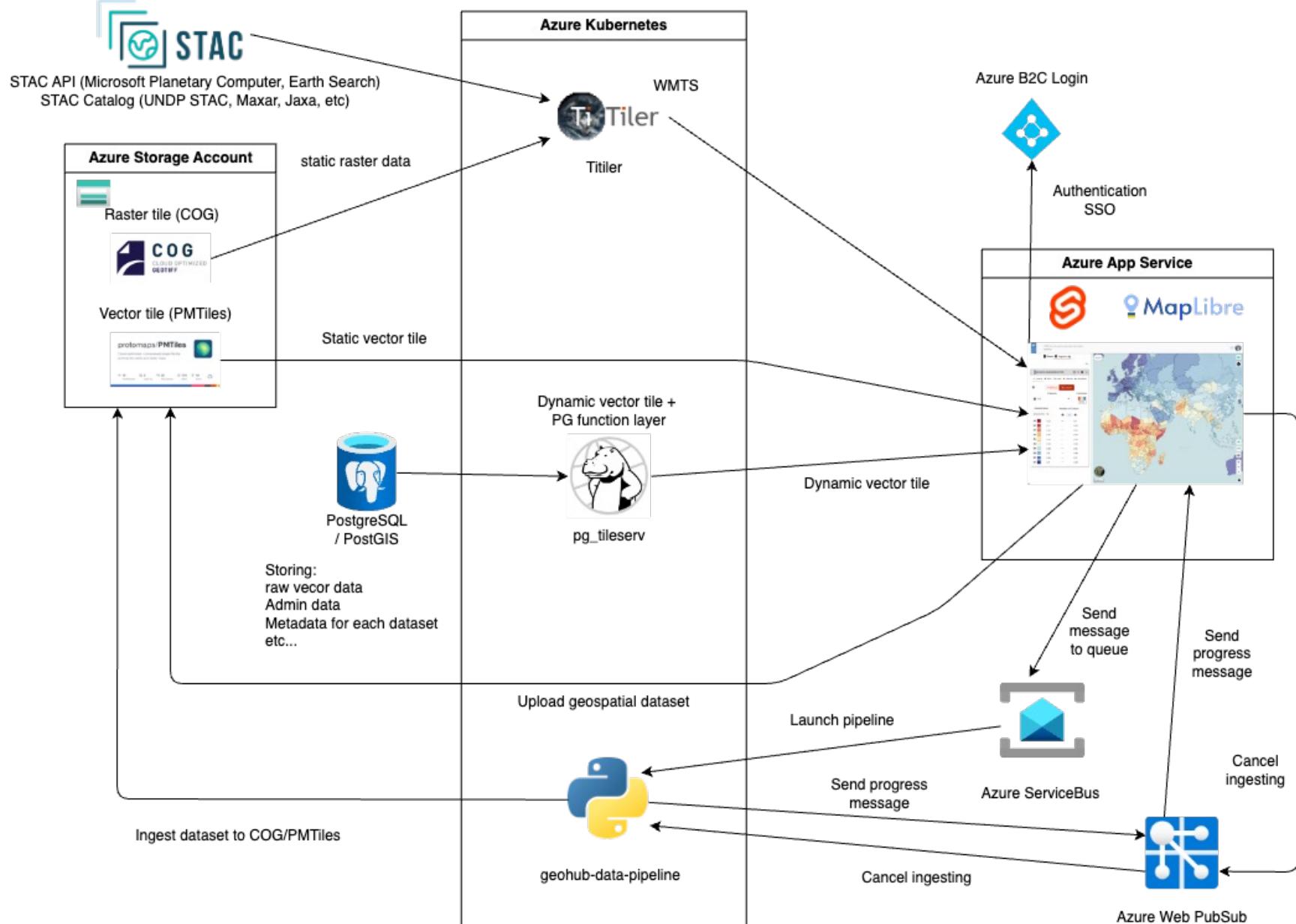
HREA ML



Dashboard for High Resolution Electricity Access data

<http://www-personal.umich.edu/~brianmin/HREA/>

# Technologies and software libraries/components



# 1. Dynamic Vector Tile Service

Enable users to change parameters to simulate specific scenarios. For example,

- Human Development Index (HDI)
  - risk indices (climate, population)



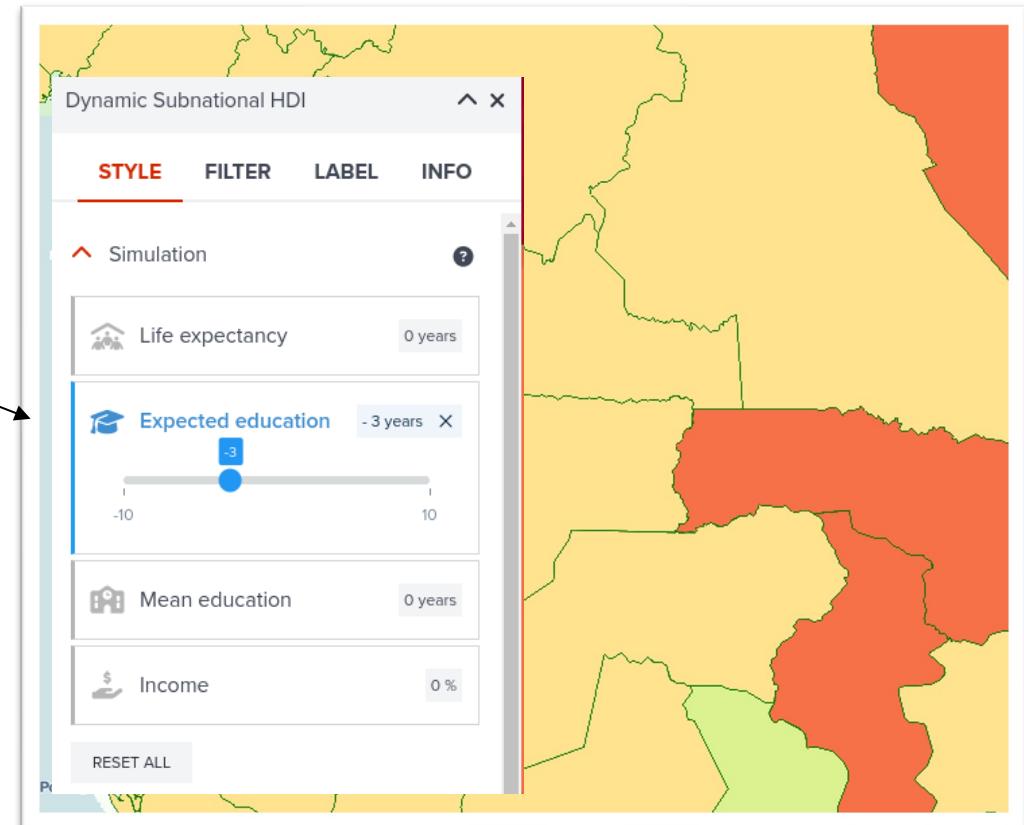
# PostgreSQL /PostGIS

```
CREATE OR REPLACE FUNCTION admin.dynamic_subnational_hdi(
    z integer default 0,
    x integer default 0,
    y integer default 0,
    params varchar default '{'
        "le_incr": {
            "id": "le_incr",
            "param_name": "life expectancy increment"
        }
    }'
```



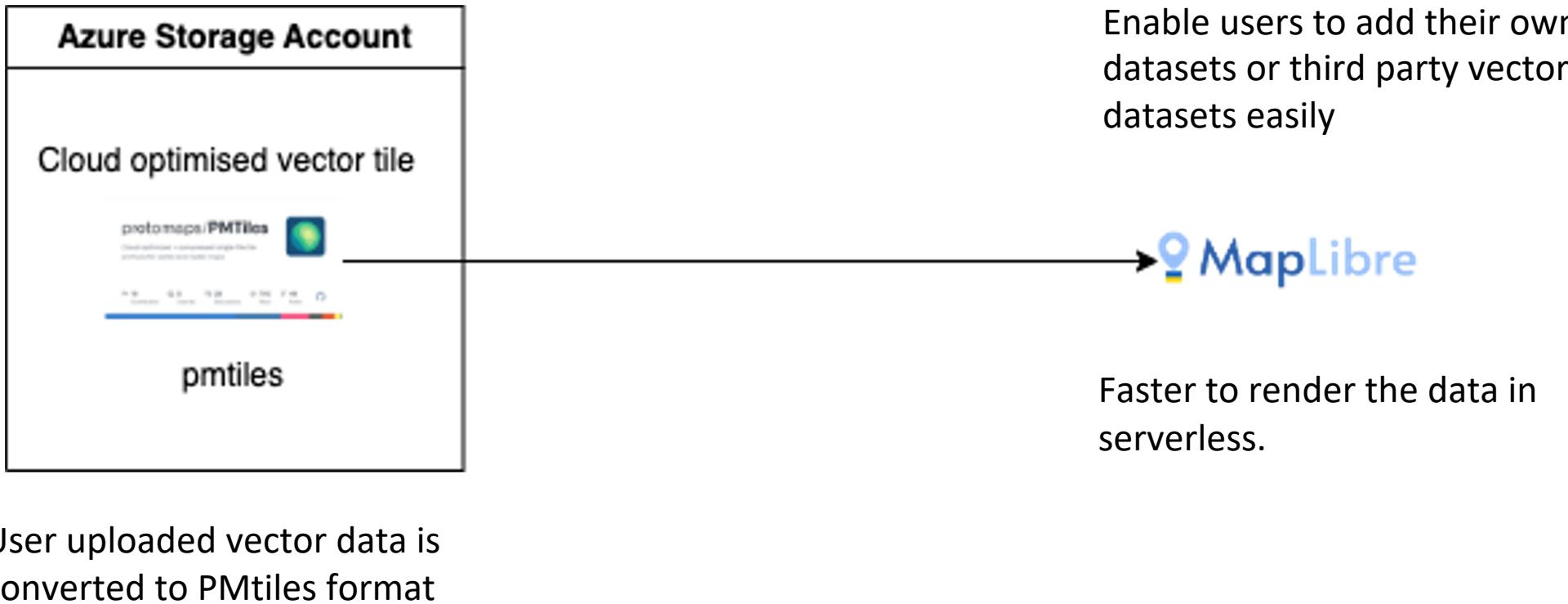
## pg\_tileserv

```
    {
      "id": "admin.dynamic_subnational_hdi",
      "schema": "admin",
      "name": "dynamic_subnational_hdi",
      "description": "This is dynamic subnational hdi",
      "arguments": [
        {
          "name": "params",
          "type": "character varying",
          "default": "{\n            \"le_ir": \"\n          }\n        }\n      }\n    }\n  }\n}\n
```



# maplibre

## 2. Static Vector Tile Service

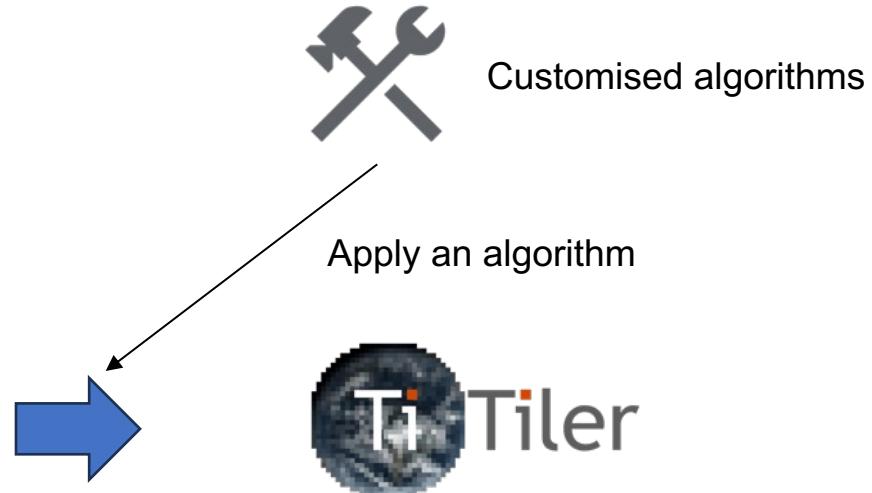


# 3. Raster tile service

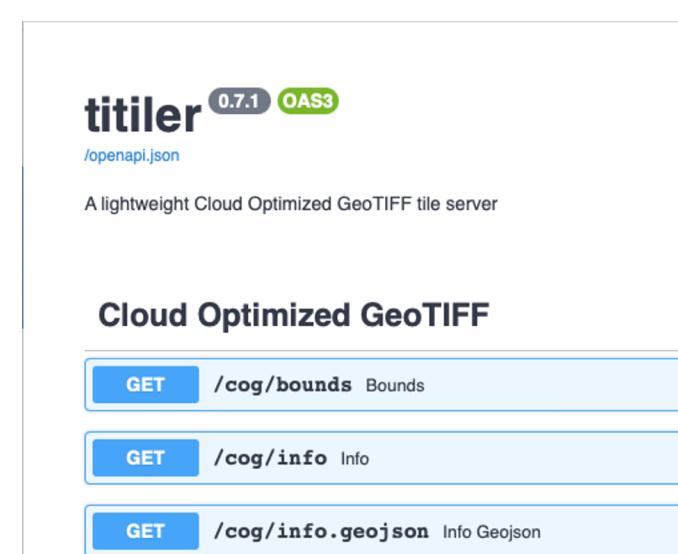
UNDP STAC  
Microsoft Planetary Computer  
Earth Search  
Maxar  
JAXA...



User uploaded raster data is converted to COG (Cloud optimized GeoTiff)



Titiler enables users to dynamically change various parameters to create analytical raster map.  
<https://titiler.undpgeohub.org/docs>



A screenshot of the Titiler API documentation page. At the top, it shows the "titiler 0.7.1 OAS3" logo and a link to "/openapi.json". Below this, a brief description reads "A lightweight Cloud Optimized GeoTIFF tile server". The main content area is titled "Cloud Optimized GeoTIFF" and lists three API endpoints:

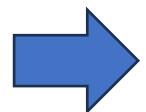
- GET /cog/bounds Bounds
- GET /cog/info Info
- GET /cog/info.geojson Info Geojson

# UNDP STAC catalog for analysis



Nighttime light mosaic from School of Mines, Colorado

<https://eogdata.mines.edu/products/vnl/>

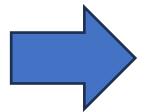


geo-undpstac-pipeline

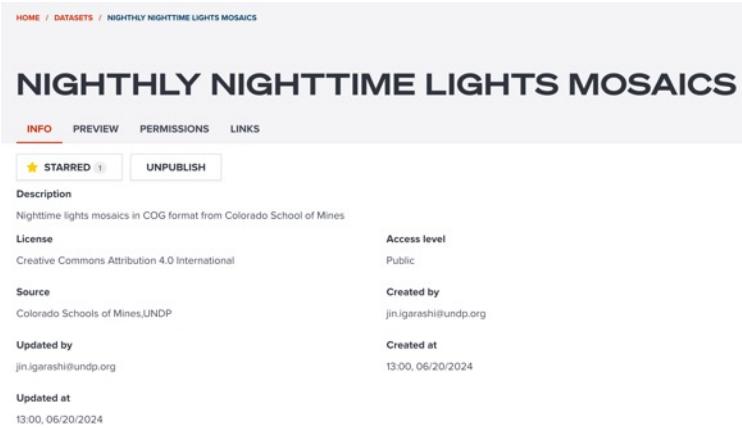
PyStac  
GDAL

<https://github.com/UNDP-Data/geo-undpstac-pipeline>

```
{
  "type": "Collection",
  "id": "nighttime-lights",
  "stac_version": "1.0.0",
  "description": "Nighttime lights mosaics in COG format from Colorado School of Mines",
  "links": [
    {
      "rel": "root",
      "href": "../catalog.json",
      "type": "application/json",
      "title": "UNDP STAC repository"
    },
    {
      "rel": "child",
      "href": "./2024/catalog.json".
    }
  ]
}
```



UNDP STAC Catalog



# Rapid change assessment (RCA) on Crisis



## NIGHTLY NIGHTTIME LIGHTS MOSAICS

Nighttime lights mosaics in COG format from Colorado School of Mines

EXPLORE FROM CATALOG    TOOLS

TOOL MENU / RAPID CHANGE ASSESSMENT TOOL

Select input data

Start date image (Required)

The image before the event

End date image (Required)

The image after the event

Start date cloud mask (Required)

The cloud mask of the image before the event

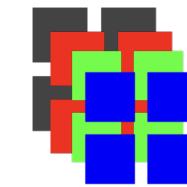
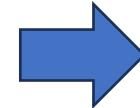
End date cloud mask (Required)

The cloud mask of the image after the event

Detect changes by subtracting relative radiances between two images taken between and after an event

Pick 2 dates of night time light data from UNDP STAC catalog



Virtual raster

↗ Rapid Change Assessment Tool C...

Customize parameters

Threshold 10 %

Only pixels with change above this threshold will be returned

Cloud mask threshold Almost no clouds



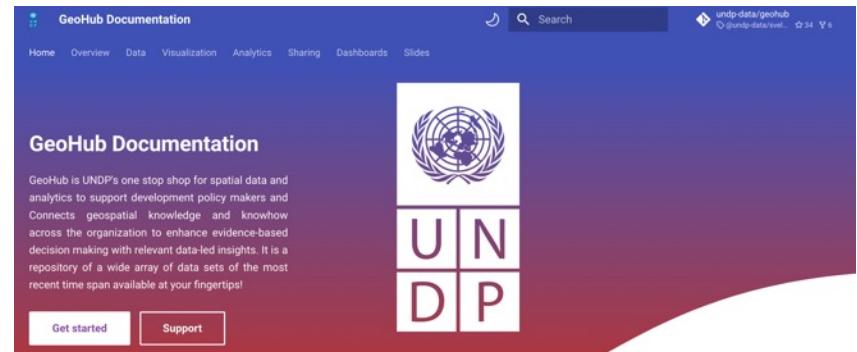
Rapid Change Assessment algorithm



Visualize changes between two dates

# 4. Other updates since FOSS4G Kosovo

- UI/UX Improvements with a UI designer
- User authentication
  - UN B2C: allows all UN staffs to sign in
  - GitHub: enables GitHub users to authenticate to GeoHub
- User permission feature
  - Viewer/Editor/Owner setting for each dataset and map
- Comprehensive user documentation
  - <https://docs.undpgeohub.org/>



# What's next?

- Bringing analytical tools
  - Flood detection algorithm
  - Clean Energy Equity Index (CEEI) dashboard
- Building a storymap from GeoHub maps
  - UI to configure stories
  - UI to share a storymap
- Improvement of UI for Electricity Dashboard



GeoHub

[geohub.data.undp.org](https://geohub.data.undp.org)



Github repo

[UNDP-Data/geohub](https://UNDP-Data/geohub)

A centralized ecosystem of services to support development policy makers

# GeoHub

