

# Using Google Earth Engine for Geological Remote Sensing

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## Google Earth



3-D Globe  
Visualization

## Earth Engine

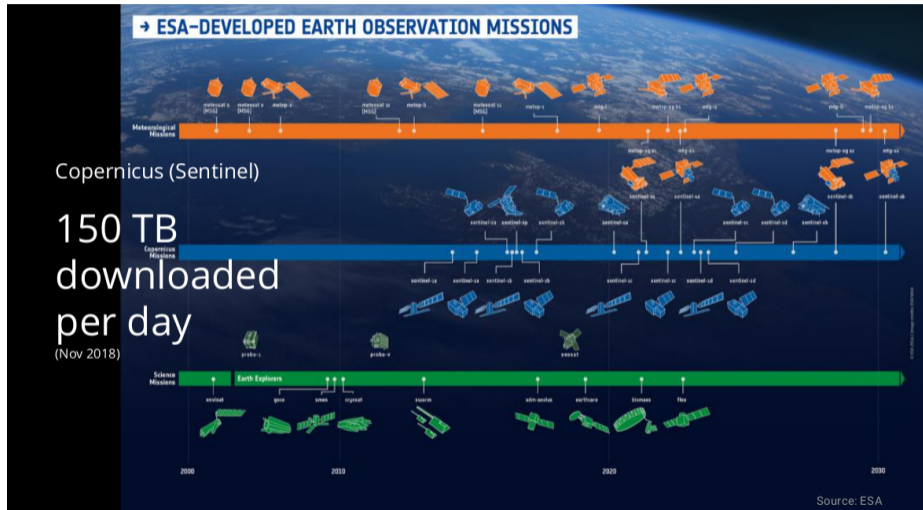


Geospatial  
Analysis

# Data volume of NASA



# Data volume of ESA



Bring processing power to the data



# User Interface: Explorer Interface

The screenshot displays the Google Earth Engine Explorer interface. At the top, the browser address bar shows the URL <https://explorer.earthengine.google.com/#workspace>. The main header includes the Google Earth Engine logo, a search bar, and links for "Send feedback" and "Sign in".

The interface is divided into several sections:

- Explorer Panel (Left):** Shows the "Data" section with a list of layers. The selected layer is "MODIS Combined 16-Day NDWI". Below the list is an "Add data" button.
- Configuration Window (Center):** A modal window titled "MODIS Combined 16-Day NDWI" is open. It features a date picker set to "Aug 7, 2020" with a "Jump to date" link. Under the "Visualization" section, the "1 band (Grayscale)" option is selected. A dropdown menu shows "NDWI". The "Range" section has input fields for "0.0" and "1.0", and a "Custom" dropdown. The "Opacity" section has a slider set to "1.00" and radio buttons for "Gamma" (selected) and "Palette". At the bottom of the window are "Save", "Apply", "Cancel", and "Help" buttons.
- Map Panel (Right):** Shows a satellite view of the world. The "Map" and "Satellite" tabs are visible. The map displays the NDWI data as a grayscale overlay on a satellite image. Navigation controls like zoom in (+) and zoom out (-) are present.

# User Interface: Programmable Interfaces

The image shows a screenshot of the Google Earth Engine web interface. The interface is divided into several panels. On the left, there is a 'Scripts, Docs, Assets' panel with a search bar and a 'NEW' button. In the center, there is a 'New Script' code editor with a 'Get Link', 'Save', 'Run', and 'Reset' menu. On the right, there is an 'Inspector Console' panel with a 'Tasks' tab and a message: 'Use print(...) to write to this console.' At the bottom, there is a map of the Mediterranean region with a 'Geometry tools' panel on the left and a 'Display' panel in the center. The map shows countries like France, Spain, Portugal, Morocco, Tunisia, Turkey, and others. The callouts are: 1. Code Editor (center), 2. Querying, tasks and status (right), 3. Scripts, Docs, Assets (left), 4. Display (center-bottom), and 5. Geometry tools (left-bottom).

3 Scripts, Docs, Assets

1 Code Editor

2 Querying, tasks and status

5 Geometry tools

4 Display



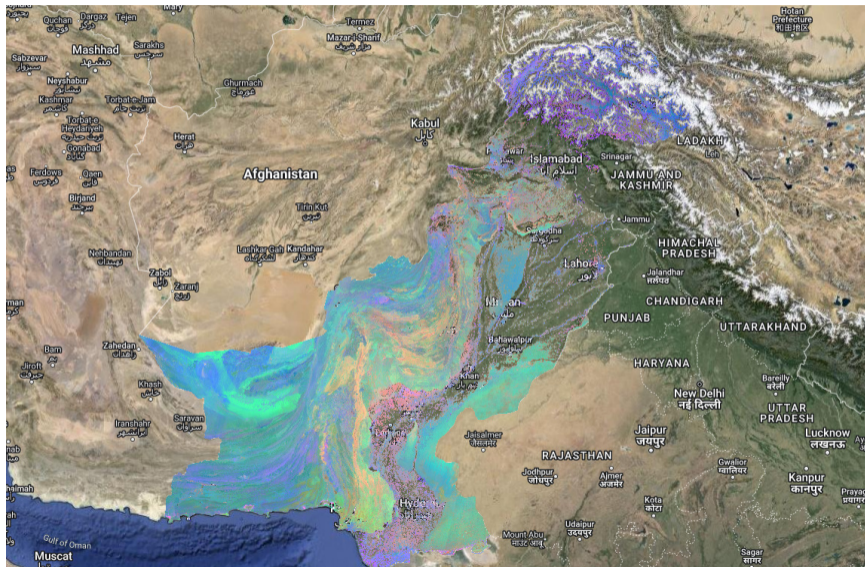
# Code editor: Javascript

```
esp2024 Get Link Save Run Reset Apps ⚙
1 /**
2  * 20240603 @ harald.vanderwerff@utwente.nl
3  * Display Sentinel-2 FCC & SRTM DEM of Pakistan
4  */
5
6 // get location data
7 var POI = ee.FeatureCollection('USDOS/LSIB_SIMPLE/2017')
8   .filter("country_na == 'Pakistan').union().first().geometry();
9
10 // Center basemap to area of interest
11 Map.centerObject(POI,6);
12
13 // set base map to satellite+roads
14 Map.setOptions('Hybrid', {});
15
16 // get SRTM elevation data covering the POI
17 var dem = ee.Image('CGIAR/SRTM90_V4').clip(POI);
18
19 // Stretch the data to a sensible data range
20 Map.addLayer(dem, {min: 0, max: 4500}, 'SRTM DEM');
21
22 // Add a custom color palette to the greyscale values
23 var demVis = {min: 0, max: 4500, palette: ['black','blue','green','yellow','orange','red','purple','white']};
24 Map.addLayer(dem, demVis, 'SRTM DEM (colored)');
25
26
```

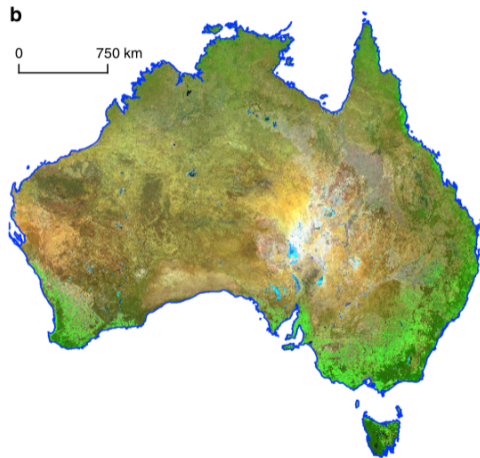
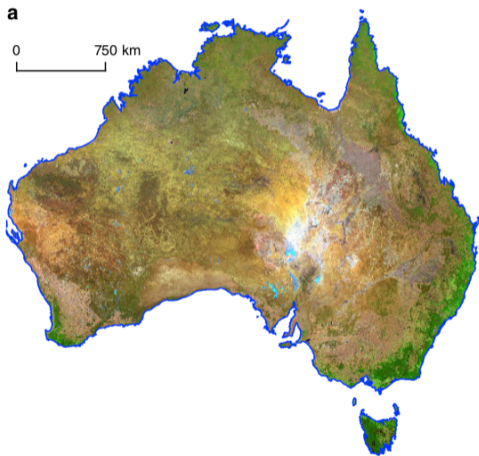




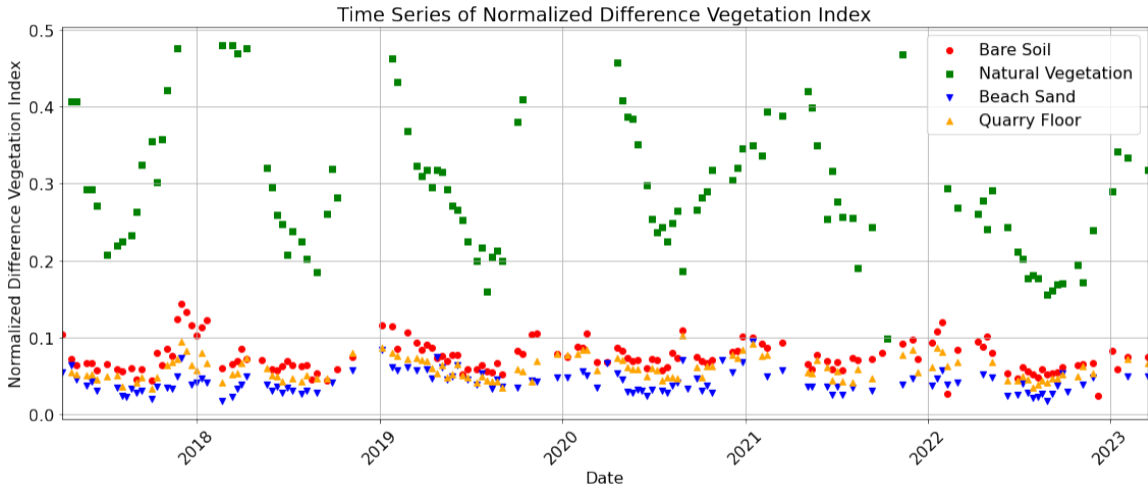
# Mosaic of geological indices



# Mosaicking by optimal pixel selection

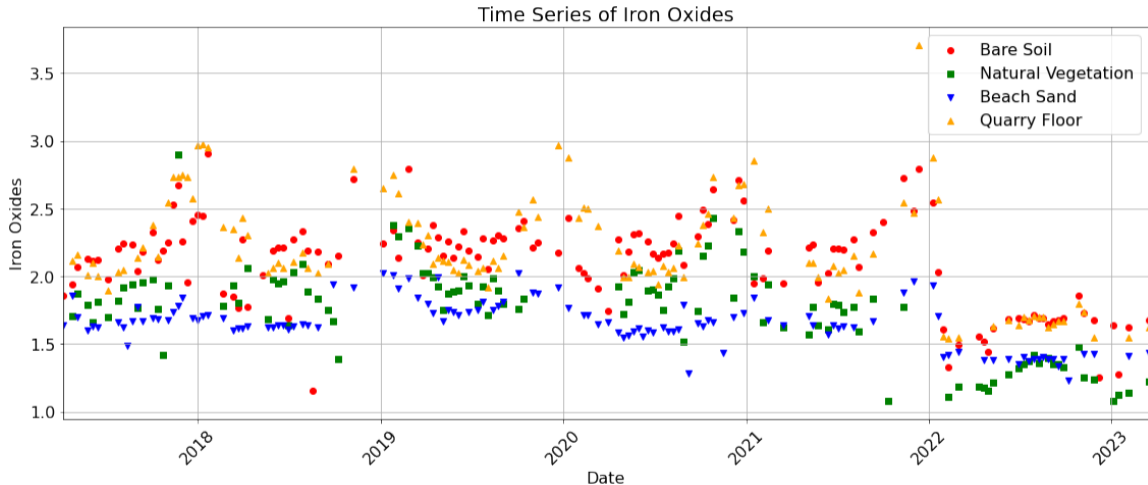


# Time-series: Vegetation index



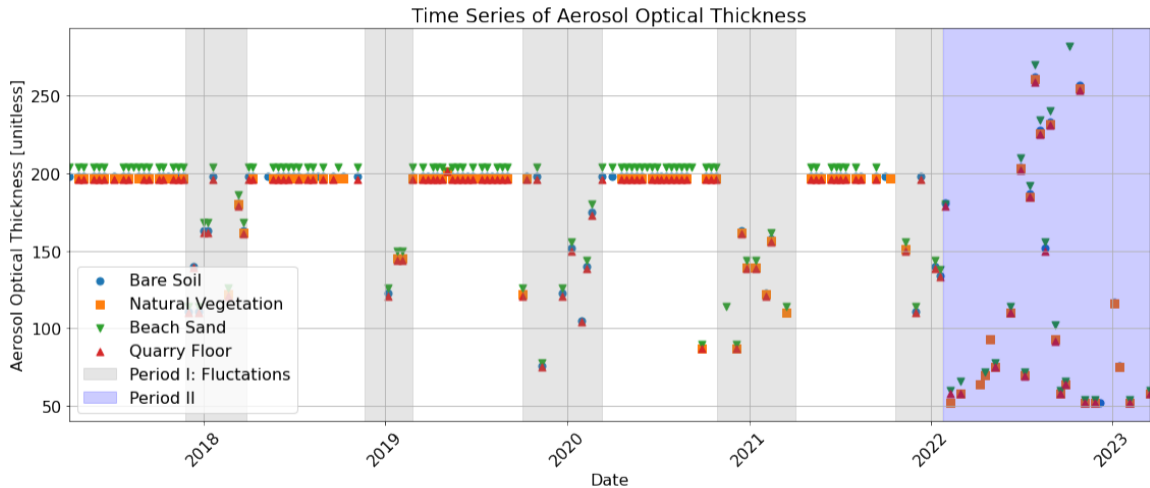
band 8 (842 nm) & band 4 (665 nm)

# Time-series: Iron oxide index

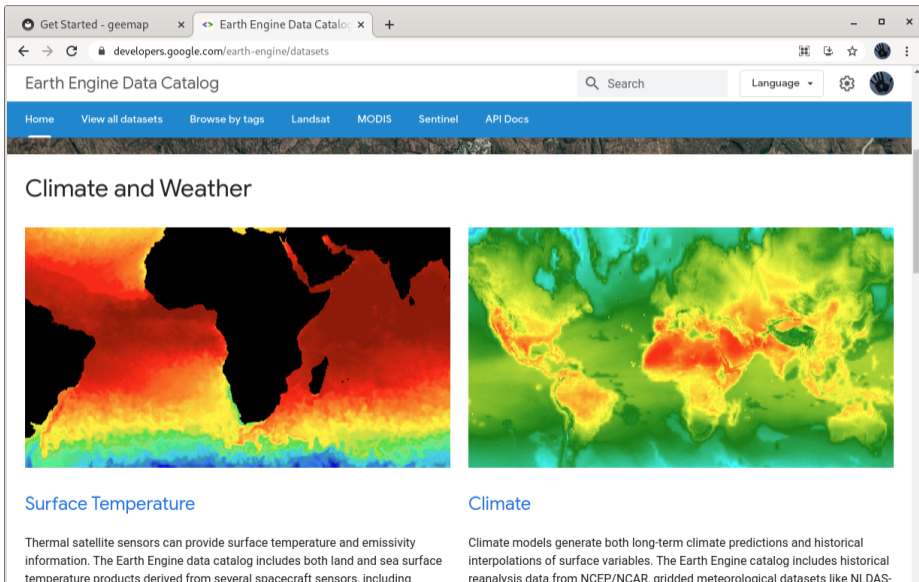


band 4 (665 nm) / band 2 (490 nm)

# Time-series: Atmospheric parameters



# Data catalog: Also climate and vector data



The screenshot shows the Earth Engine Data Catalog interface. The browser address bar displays 'developers.google.com/earth-engine/datasets'. The page title is 'Earth Engine Data Catalog'. A navigation bar includes links for 'Home', 'View all datasets', 'Browse by tags', 'Landsat', 'MODIS', 'Sentinel', and 'API Docs'. A search bar and a language dropdown are also present. The main content area is titled 'Climate and Weather' and features two data categories:

- Surface Temperature**: Accompanied by a heatmap of the African continent and surrounding regions, showing temperature variations from blue (cooler) to red (warmer).
- Climate**: Accompanied by a global heatmap showing climate data across the world, with similar color coding from blue to red.



# Pro's and con's

Of course, there are some considerations on using GEE:

- Free as in “free beer” (so payment happens in other ways. . . );
- Not free as in “free speech”, the scripts are but the environment is not;
- Service is commercial and falls under US legislation;

But the pro's are huge:

- Google Earth Engine is most advanced at the moment;
- The only way to manage “big” earth data;
- Climate, census and remote sensing data.

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