



Building Capacity to Use Earth Observations in Addressing Environmental Challenges in Bhutan

Day 1 – Google Earth Engine (GEE)



Google Earth Engine (GEE)

By the end of this session attendees will be able to:

- Navigate the GEE interface to explore remote sensing datasets
- Execute JavaScript commands to retrieve satellite data and process imagery
- Visualize and analyze satellite images for one's area of interest



Google Earth Engine Account Reminder

- Make sure you sign up for a Google Earth Engine account as soon as possible using the link below:
 - <https://signup.earthengine.google.com/#!/>
 - A Gmail address is not required. It is recommended that you use your work/institutional email.

Get started using Earth Engine

Earth Engine, Google's geospatial science platform in Google Cloud, is available for [paid commercial use](#) and [remains free for academic and research use](#). Learn more about [Google Cloud projects](#).

Let's get started:



Register a Noncommercial or Commercial Cloud project



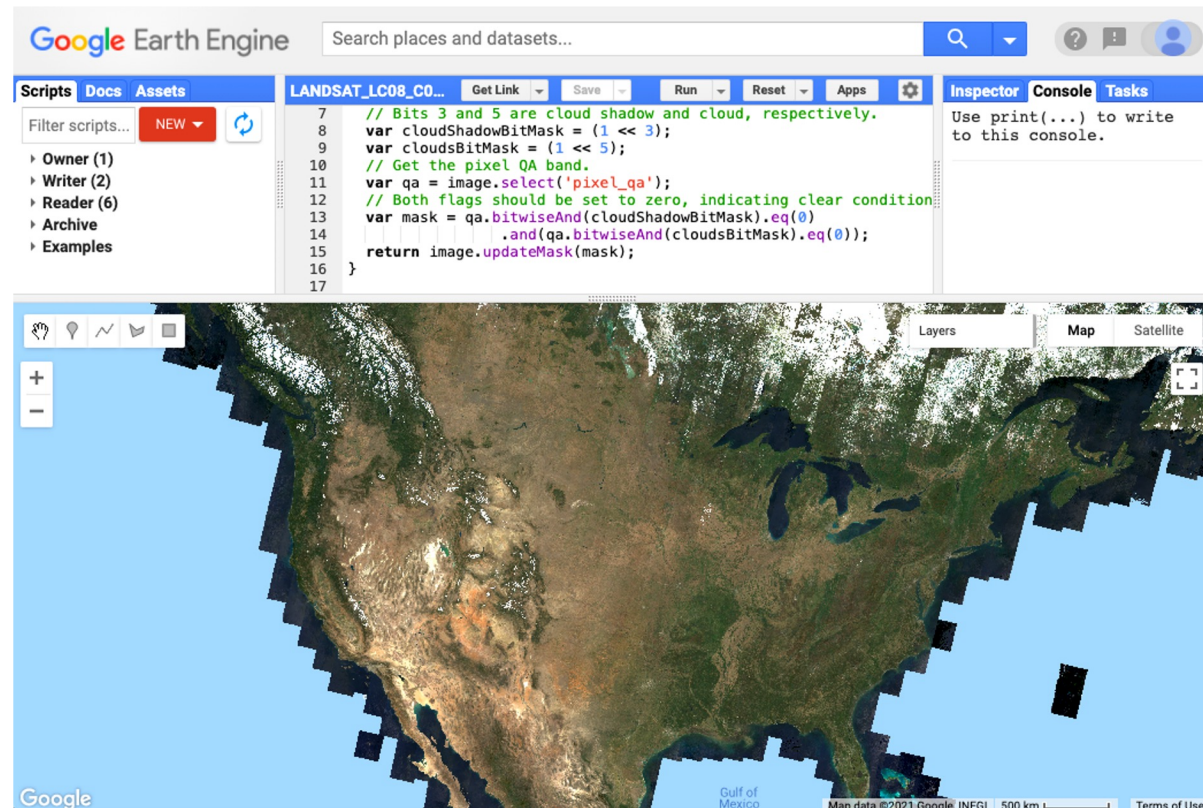
Noncommercial users can also use Earth Engine without creating Cloud projects.
[Click here for the signup form.](#)

Have an existing project? [Click here to go to the Code Editor](#)



Cloud-Based Raster Computing for Remote Sensing Analysis

- Cloud-based raster computing removes barriers and limitations related to...
 - Data hosting and storage
 - Imagery access and availability
 - Personal computing capabilities
- GEE is also free for scientists, researchers, and developers.

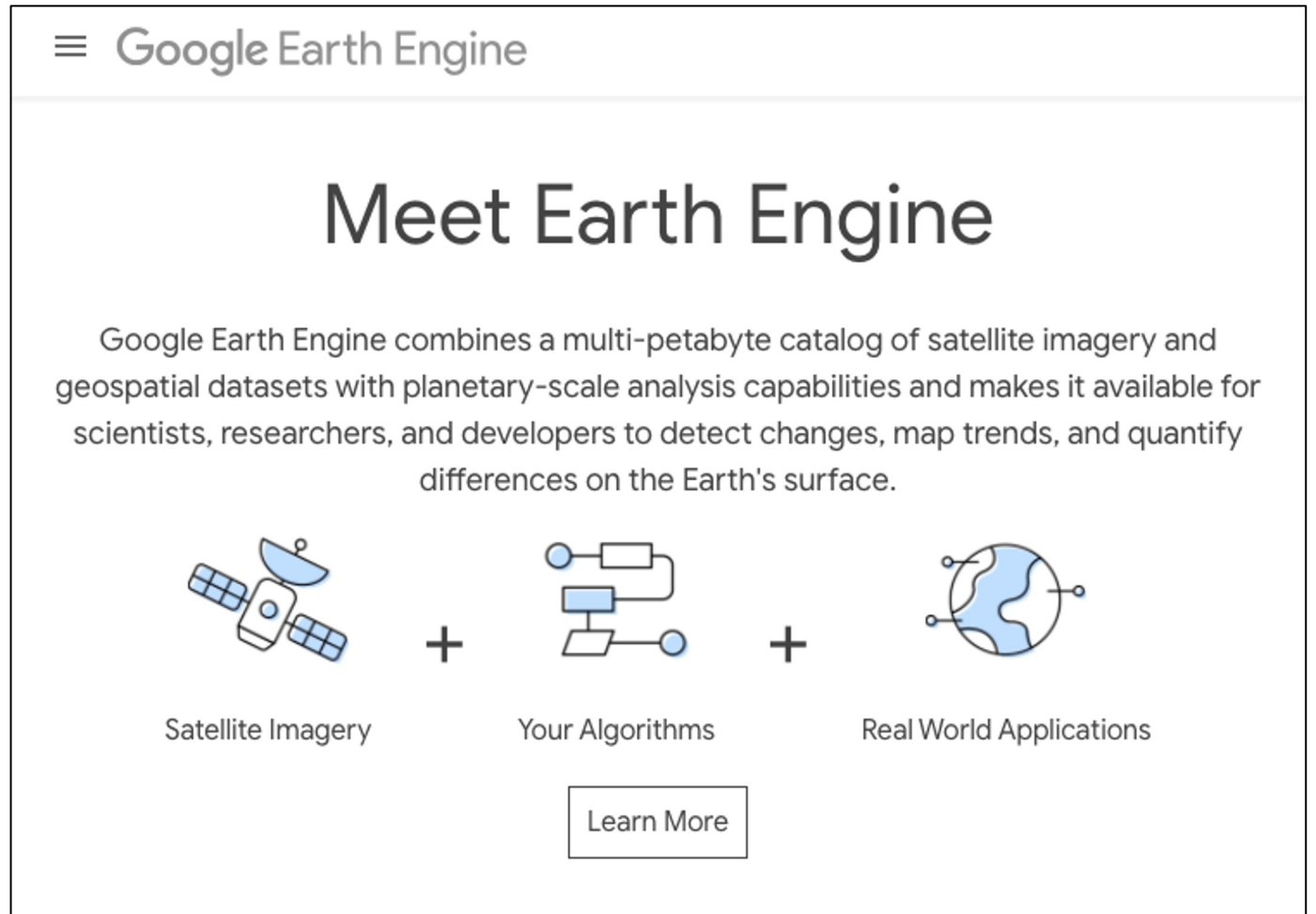


Google Earth Engine code editor interface using the JavaScript API, displaying Landsat 8 surface reflectance true color imagery for the U.S. Credit: [Google Earth Engine Developers](#)



The Google Earth Engine Platform

- Google Earth Engine (GEE) takes advantage of cloud computing capabilities to provide users with a single place for **accessing satellite data, applying remote sensing methodologies, and displaying analysis results.**
- GEE's application programming interface (API) allows users to easily apply land cover monitoring algorithms and classifications with coded commands.



The screenshot shows the Google Earth Engine website. At the top left is a hamburger menu icon followed by the text "Google Earth Engine". The main heading is "Meet Earth Engine". Below this is a paragraph: "Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface." Below the text is a diagram consisting of three icons: a satellite, a flowchart representing algorithms, and a globe representing real-world applications. These are connected by plus signs. Below the diagram is a "Learn More" button.

Image Credit: [Google Earth Engine](#)

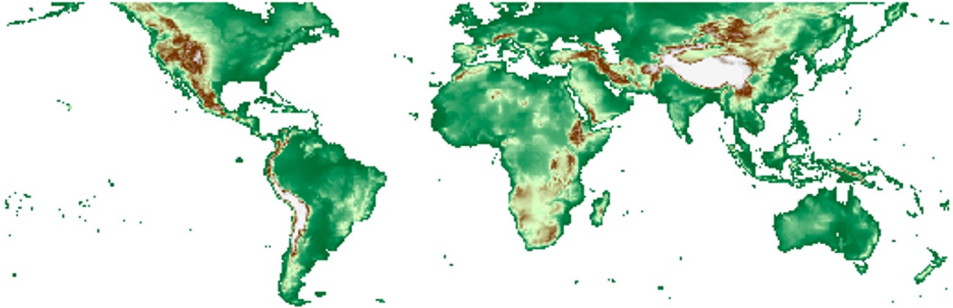


Application Programming Interface (API)

- The Earth Engine JavaScript API is currently the most widely used method of working with GEE.
- A Python API through Google Colaboratory (Colab) is also available for those interested in using Python.
- In this workshop we will be using the **JavaScript API**.

```
# Import the Image function from the IPython.display module.
from IPython.display import Image

# Display a thumbnail of global elevation.
Image(url = dem.updateMask(dem.gt(0))
      .getThumbURL({'min': 0, 'max': 4000, 'dimensions': 512,
                    'palette': ['006633', 'E5FFCC', '662A00', 'D8D8D8', 'F5F5F5']}))
```



Google Colab notebook using a coded section to display elevation in an output cell.
Credit: [Google Colab](#)



GEE Land Applications

- Long-term monitoring of landscape change and land cover type
- Computation of indices relevant to land management, such as normalized difference indices for vegetation, water, snow, soil, and urban areas
- Landscape time series analysis and change detection
- Summary statistics
- Validation and accuracy assessment methods
- Visualization and presentation of results



Time series of MODIS NDVI displayed using Google Earth Engine.
Image Credit: [Google Earth Engine Developers](#)





Basic Functions in GEE JavaScript API

<https://code.earthengine.google.com/00b566d9ba821f7fb3011468533bccc9>

Summary

- The GEE platform provides users with cloud-based computing resources that can decrease barriers like data storage space and personal computing power.
- The capabilities of GEE are similar to those of many GIS platforms used to manipulate satellite data for key land-related remote sensing processes, including algorithm application and land cover classification.
- GEE hosts many datasets relevant to land monitoring.
 - Landsat Series, MODIS, Sentinel-2, and Sentinel-1 SAR
- The JavaScript API enables coding and automation of basic remote sensing functions like imagery filtering and vegetation index calculation.
- Users interested in the Python API can explore Google Colab.
- Session II: Land Cover Classification & Accuracy Assessment



Resources

Relevant resources to GEE guides, tutorials, user groups, datasets, and JavaScript Code:

- <https://developers.google.com/earth-engine>
- <https://developers.google.com/earth-engine/guides>
- <https://developers.google.com/earth-engine/tutorials>
- <https://developers.google.com/earth-engine/datasets>
- <https://groups.google.com/g/google-earth-engine-developers>



Image Credit: [Google Earth Engine](#)





Thank You!

