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Precipitation Data Access and Analysis Tools in GEE

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May 8, 2023

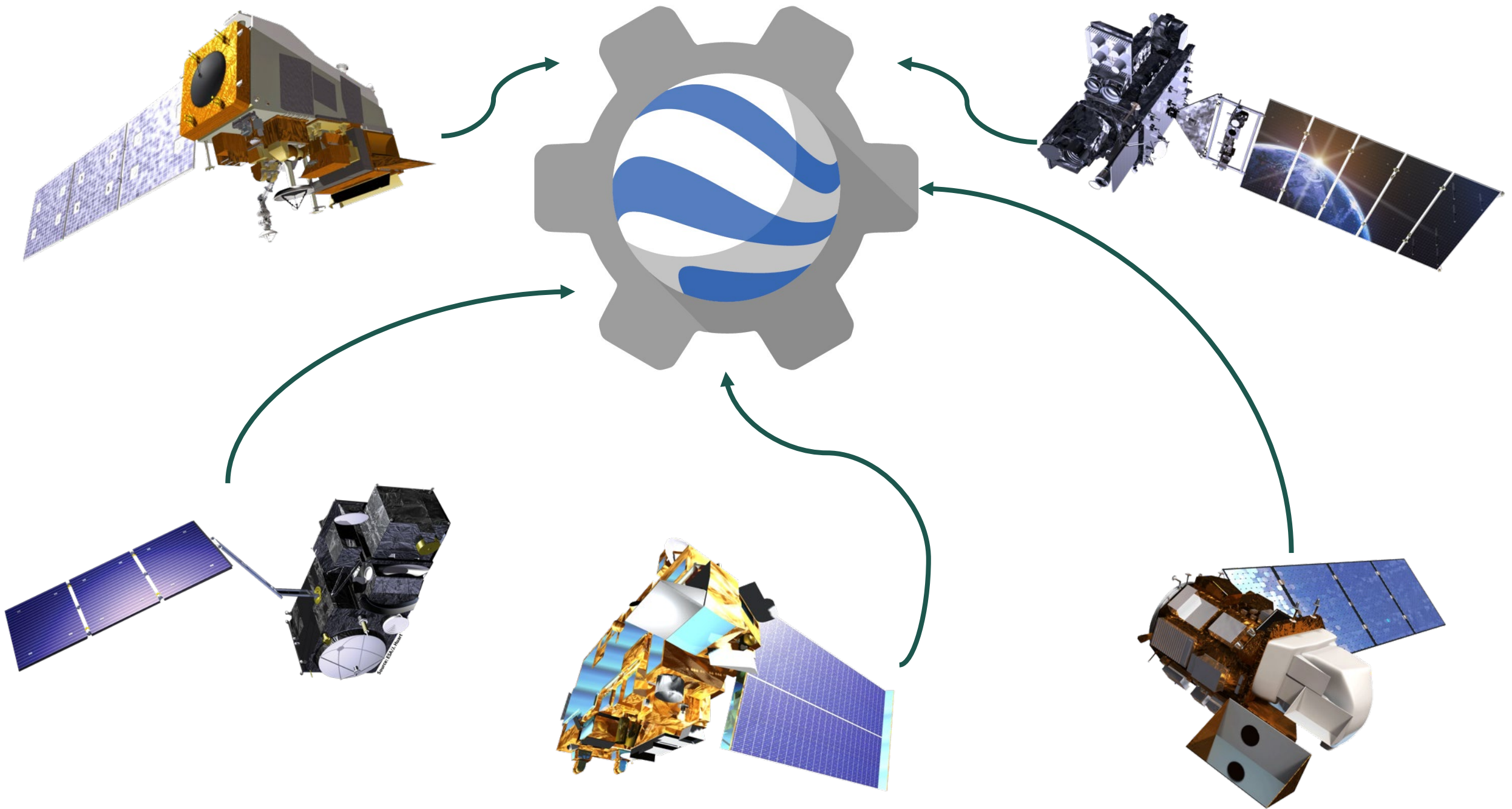
¿Qué es Google Earth Engine?

- Una “plataforma de procesamiento geoespacial basada en la nube” libre y de fuente abierta
- Comprende:
 - Un catálogo de conjuntos de datos disponibles al público
 - El poder computacional de Google
 - Una interfaz de programación de aplicaciones (Application Programming Interface o API)
 - Un editor de código

La misión de Google:

Nuestra misión es **organizar** la **información** del mundo y hacer que sea **útil** y **accesible para todos**.





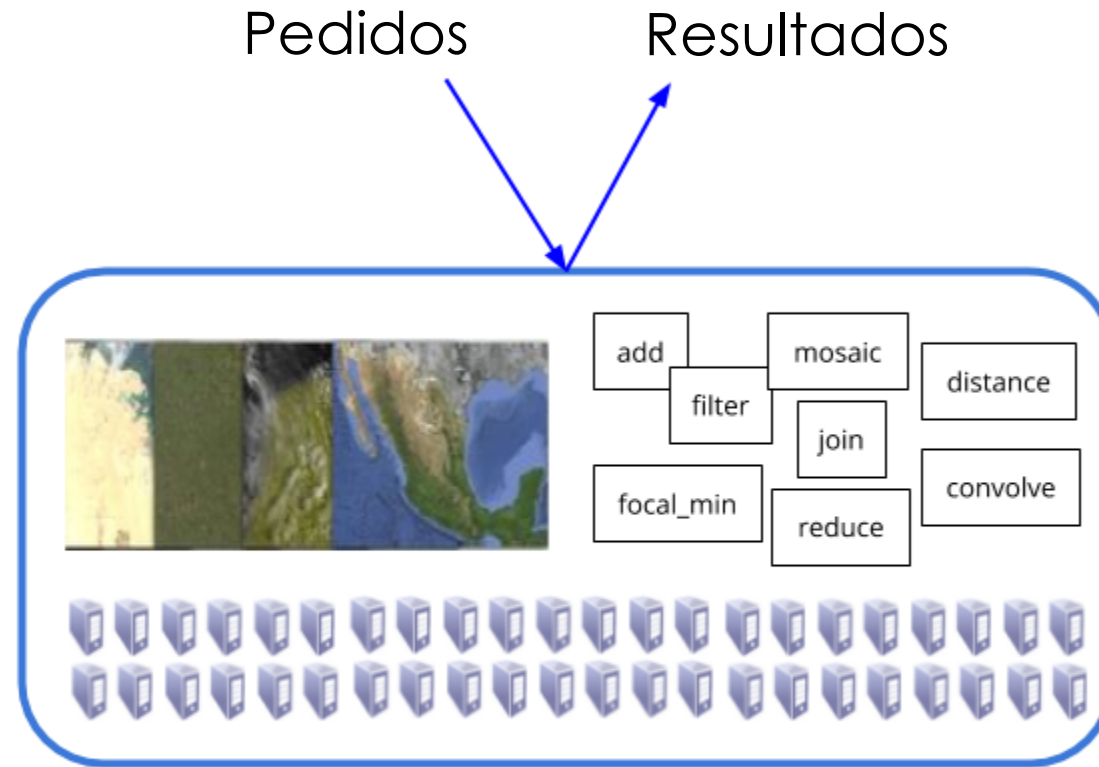
Cómo Funciona GEE

- En la nube
 - Funciones de cliente vs. funciones de servidor
 - Los usuarios manipulan objetos “proxy” a través del servidor
 - Se envían las instrucciones a Google para su procesamiento y los resultados los envían de vuelta al navegador web para su visualización
- Preconfigurado con Proyecciones WGS84
- Capacidades/Limitaciones
 - Escala planetaria
 - Hay restricciones de cuotas debido a que es de fuente abierta
 - Hay memoria limitada para cada usuario





Conjuntos de Datos Geoespaciales



Primitivas Algorítmicas

Almacenamiento y Cómputo

Glosario de Términos

- **Google Earth Engine Asset**

- Conjunto de datos externos cargado a Google Earth Engine para el análisis

- **Table**

- Datos vectoriales en formato shapefile
- Ejemplo: Datos de ubicaciones verificados con datos en el suelo

- **Image**

- Datos ráster compuestos de una o más bandas
- Ejemplo: Distancia euclidiana

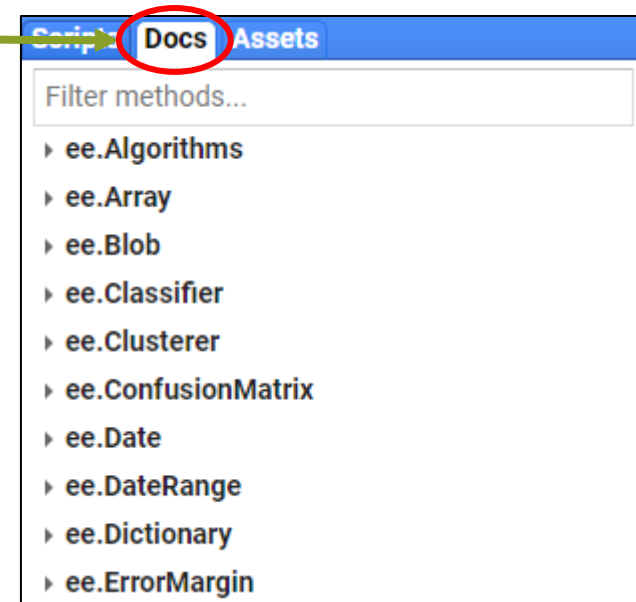
- **Image Collection**

- Una pila o serie temporal de imágenes
- Ejemplo: Imágenes de Landsat 8



Recursos para Ayuda

- Pestaña “Docs”
- [Developer’s Guide](#)
- [Google Earth Engine Developers Group](#)



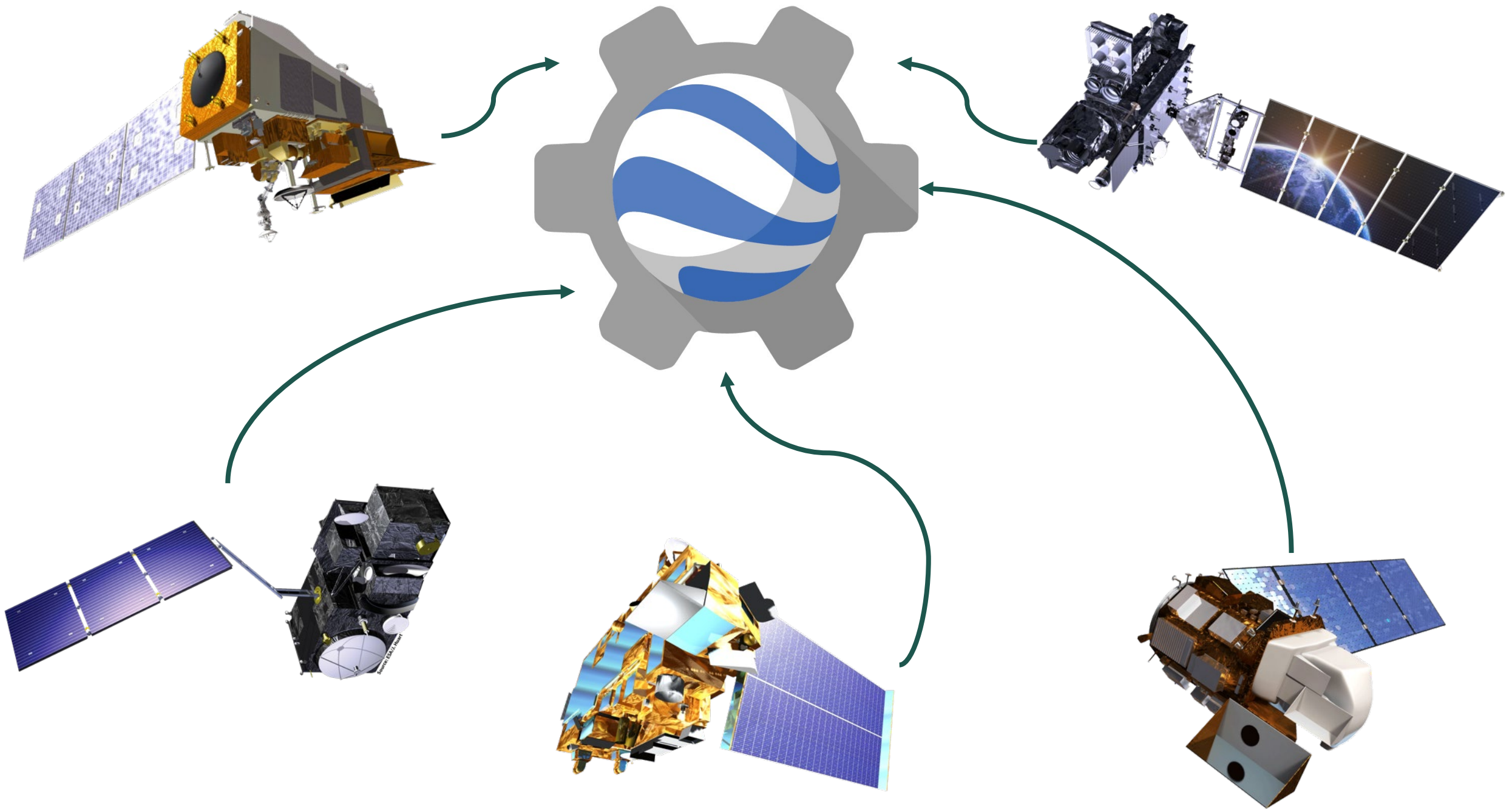
What is Google Earth Engine?

- A free, open-source, “cloud-based geospatial processing platform”
- Comprised of:
 - A catalog of publicly available datasets
 - Google’s computation power
 - An Application Programming Interface (API)
 - A code editor

Google’s Mission:

Our mission is to **organize** the world’s **information** and make it **universally accessible** and **useful**.

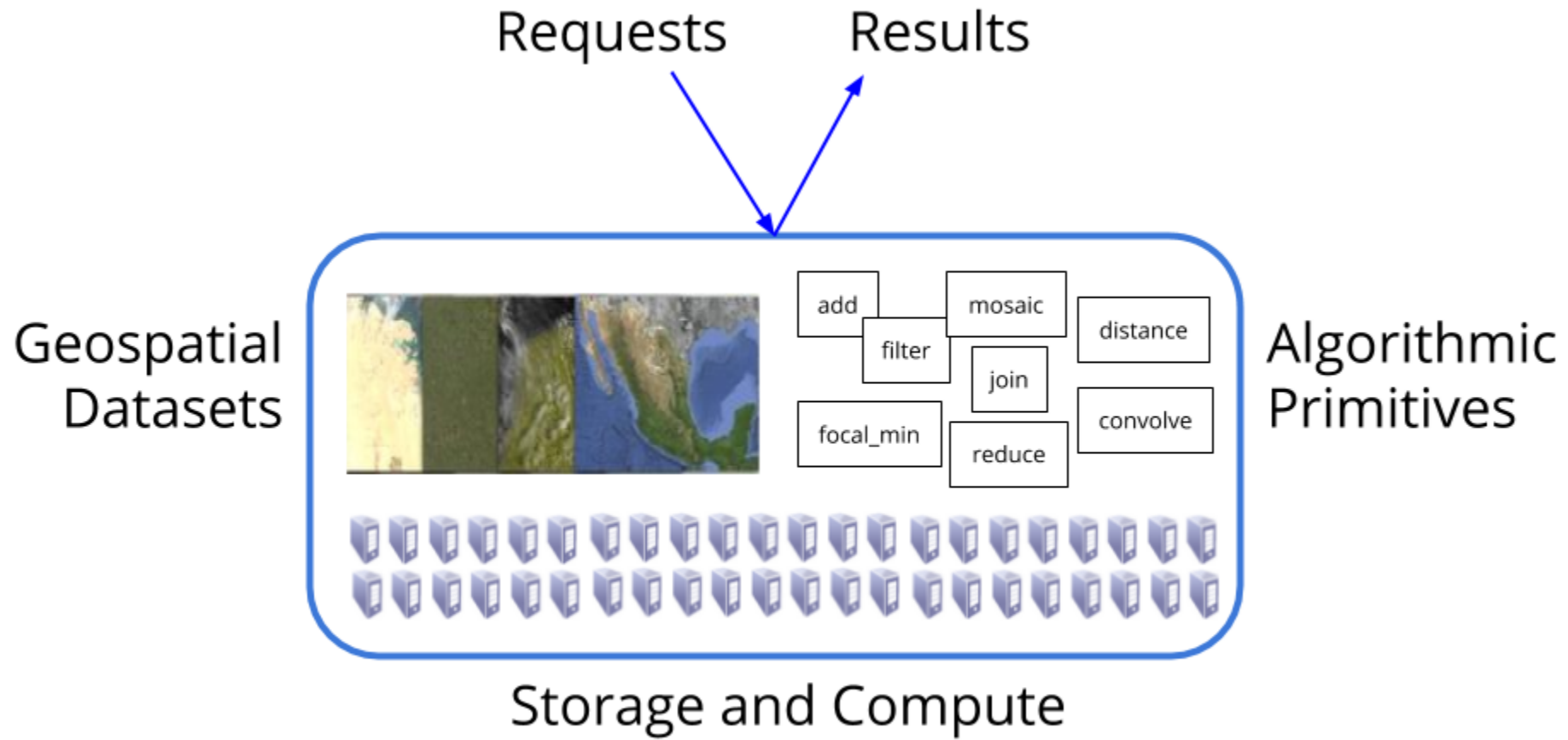




How GEE Works

- Cloud-Based
 - Client vs. server functions
 - Users manipulate “proxy” objects through the server
 - Instructions sent to Google for processing and results sent back to web browser for display
- Defaults to WGS84 Projections
- Capabilities/Limitations
 - Planetary-scale
 - Quota restrictions due to open-source nature
 - User memory limited





Google Earth Engine



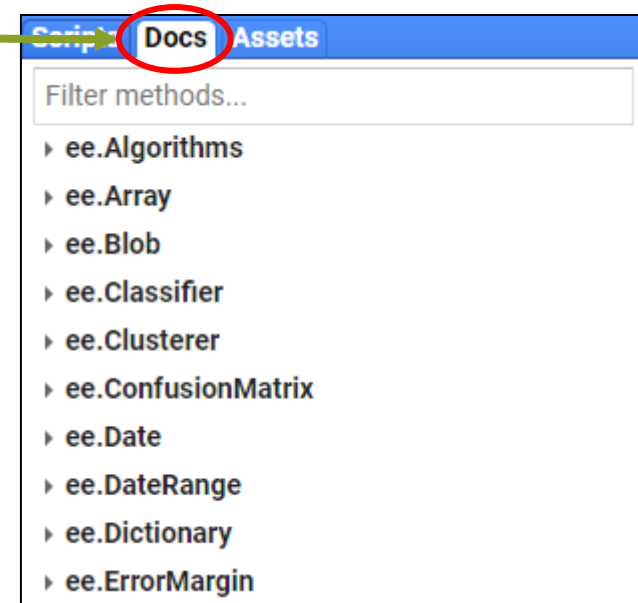
Glossary of Terms

- **Google Earth Engine Asset**
 - External dataset loaded into Google Earth Engine for analysis
- **Table**
 - Vector data in shapefile format
 - Example: Ground-truthed location data
- **Image**
 - Raster data composed of one or more bands
 - Example: Euclidean distance to stream
- **Image Collection**
 - A stack or time series of images
 - Example: Landsat 8 imagery



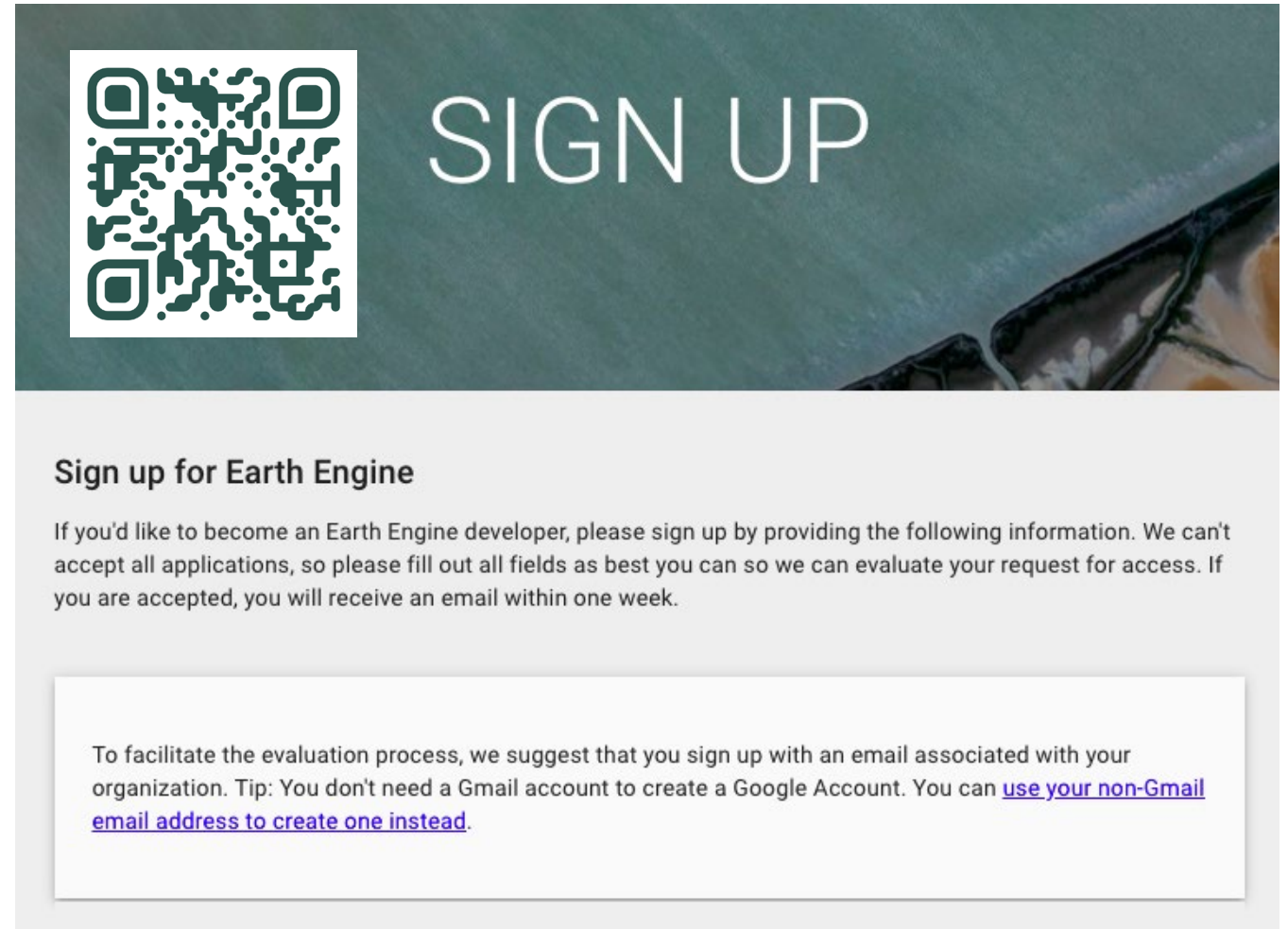
Resources for Help

- Docs Tab
- [Developer's Guide](#)
- [Google Earth Engine Developers Group](#)



Google Earth Engine Account Reminder

- Make sure you sign up for a Google Earth Engine account as soon as possible, if you haven't already, by scanning the QR code or 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.

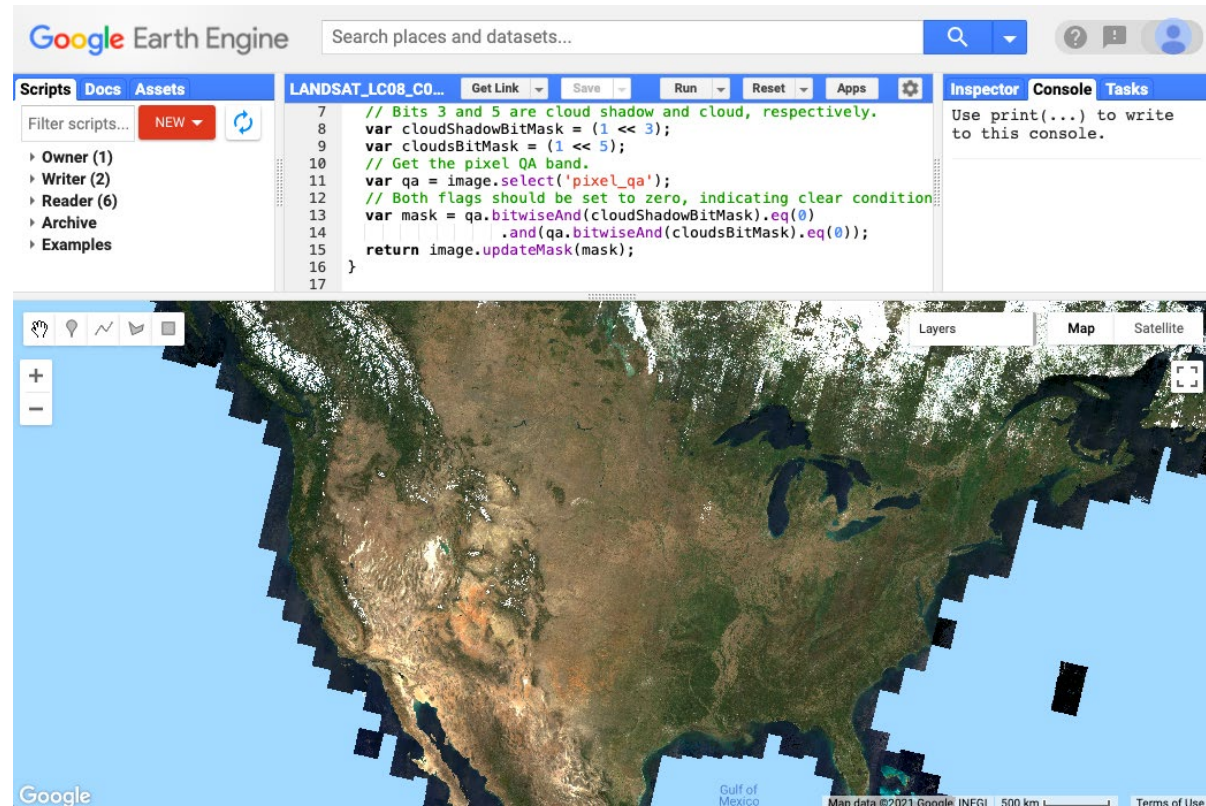


The banner features a QR code on the left and the text "SIGN UP" in large white letters on a dark teal background. Below the banner, the text reads: "Sign up for Earth Engine. If you'd like to become an Earth Engine developer, please sign up by providing the following information. We can't accept all applications, so please fill out all fields as best you can so we can evaluate your request for access. If you are accepted, you will receive an email within one week." A white box at the bottom contains the text: "To facilitate the evaluation process, we suggest that you sign up with an email associated with your organization. Tip: You don't need a Gmail account to create a Google Account. You can [use your non-Gmail email address to create one instead.](#)"



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.

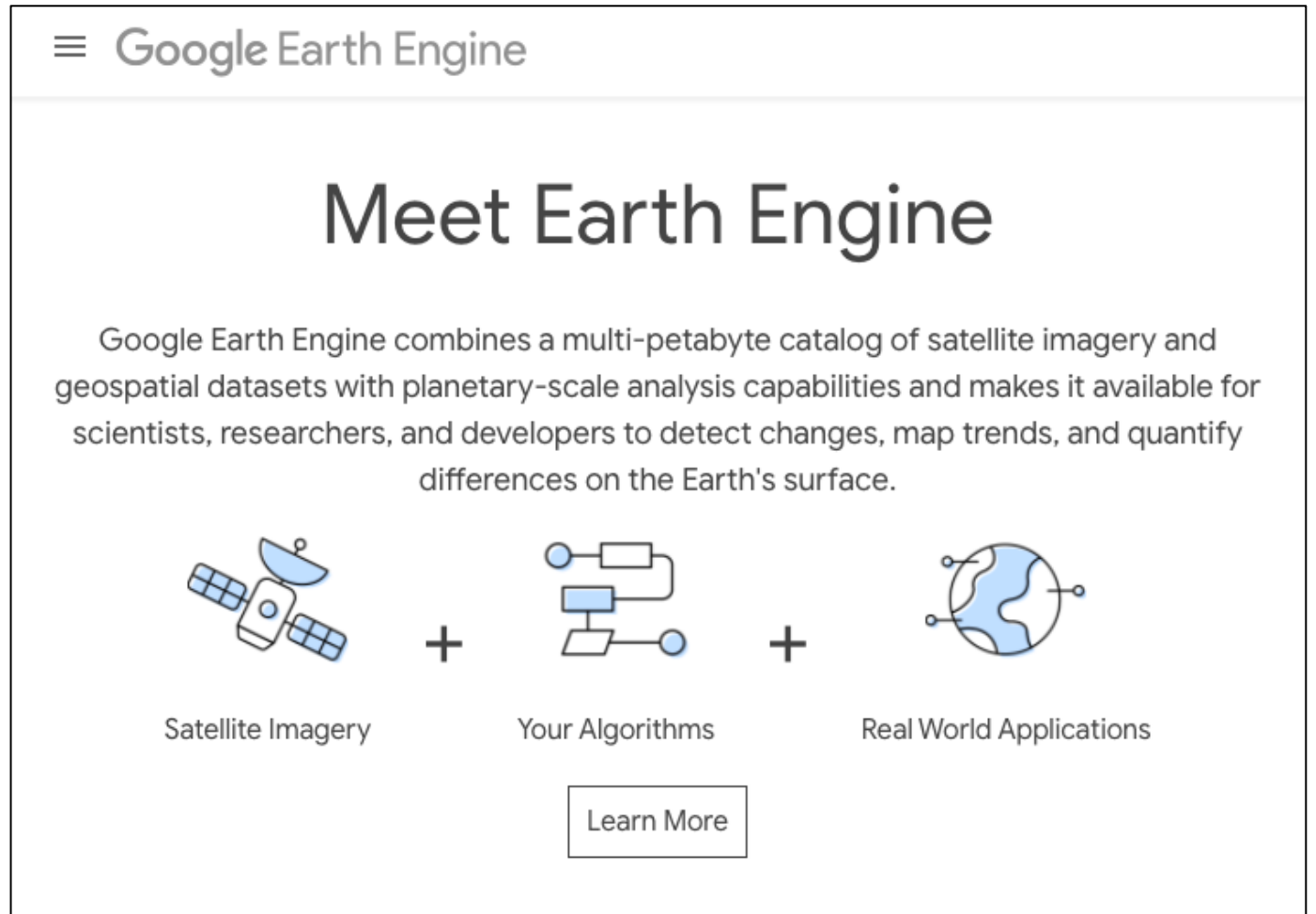


Google Earth Engine code editor interface using the JavaScript API, displaying Landsat 8 surface reflectance true color imagery for the U.S. Credit: [Google Earth Engine Developers](#)



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. Each icon is followed by a plus sign and a text label: "Satellite Imagery", "Your Algorithms", and "Real World Applications". At the bottom center of the diagram is a "Learn More" button.

Image Credit: [Google Earth Engine](#)

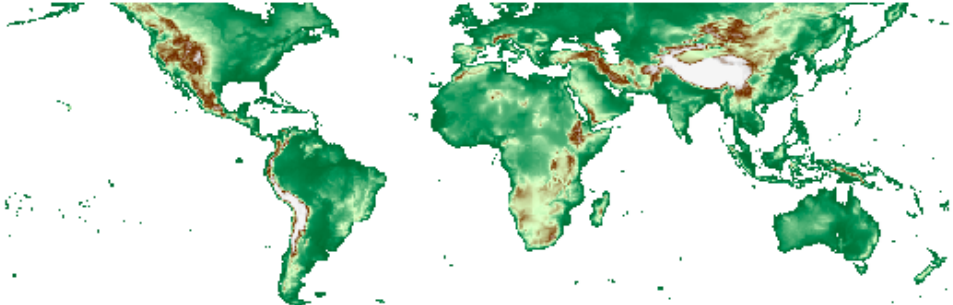


Application Programming Interface (API)

- 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.
 - This is a bit more complicated than working directly in the GEE code editor with JavaScript.

```
# 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']}))
```

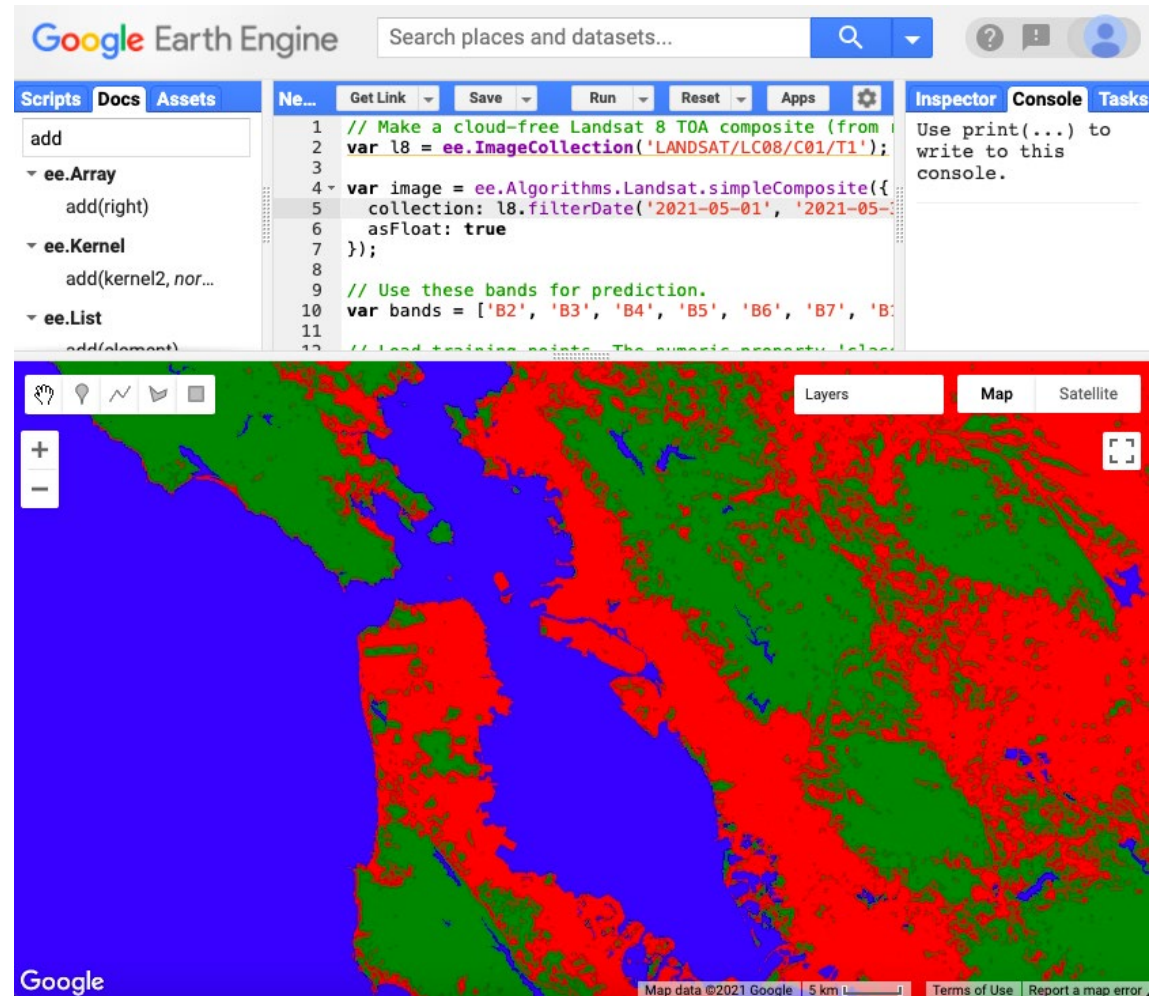


Google Colab notebook using a coded section to display elevation in an output cell. Credit: [Google Colab](#)



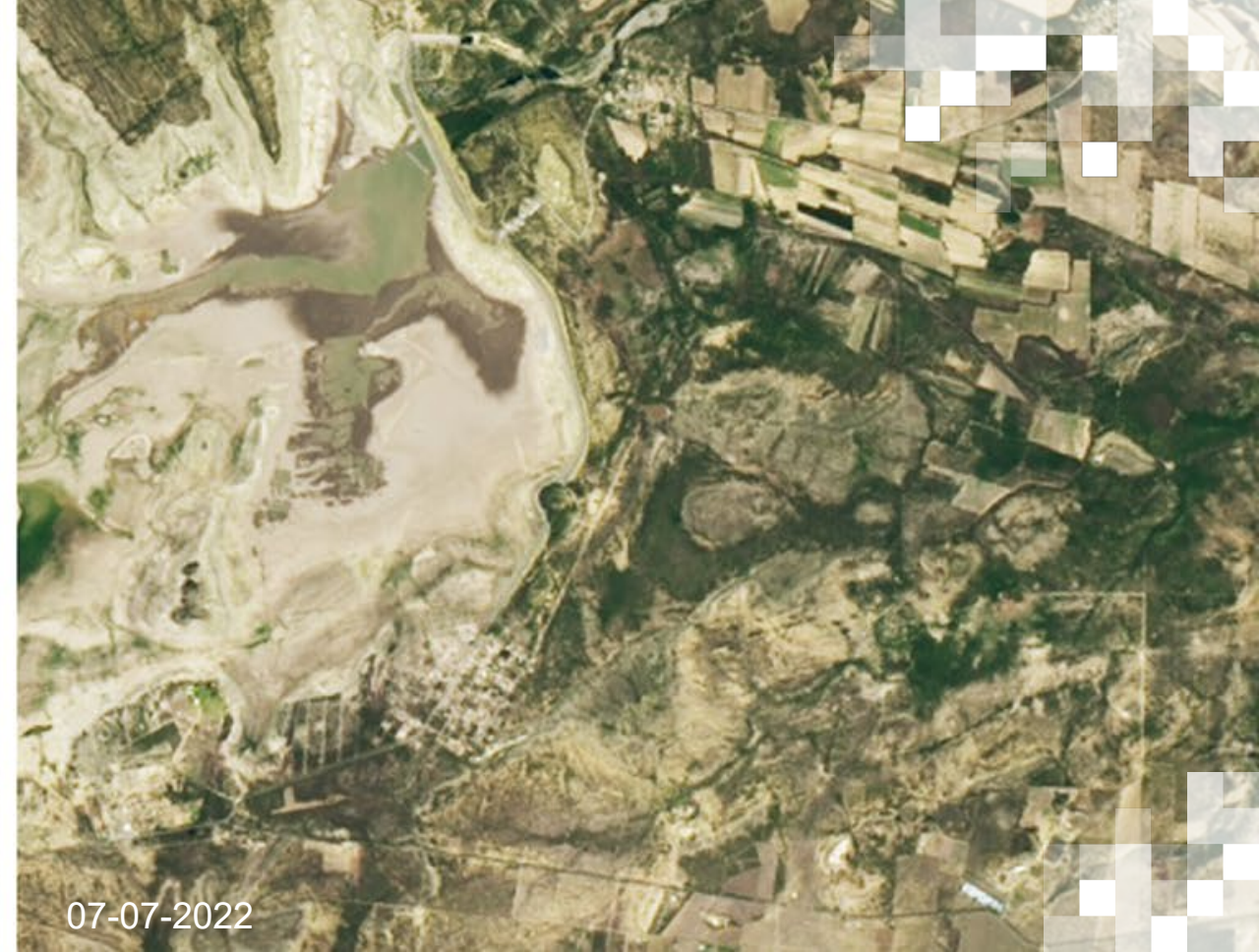
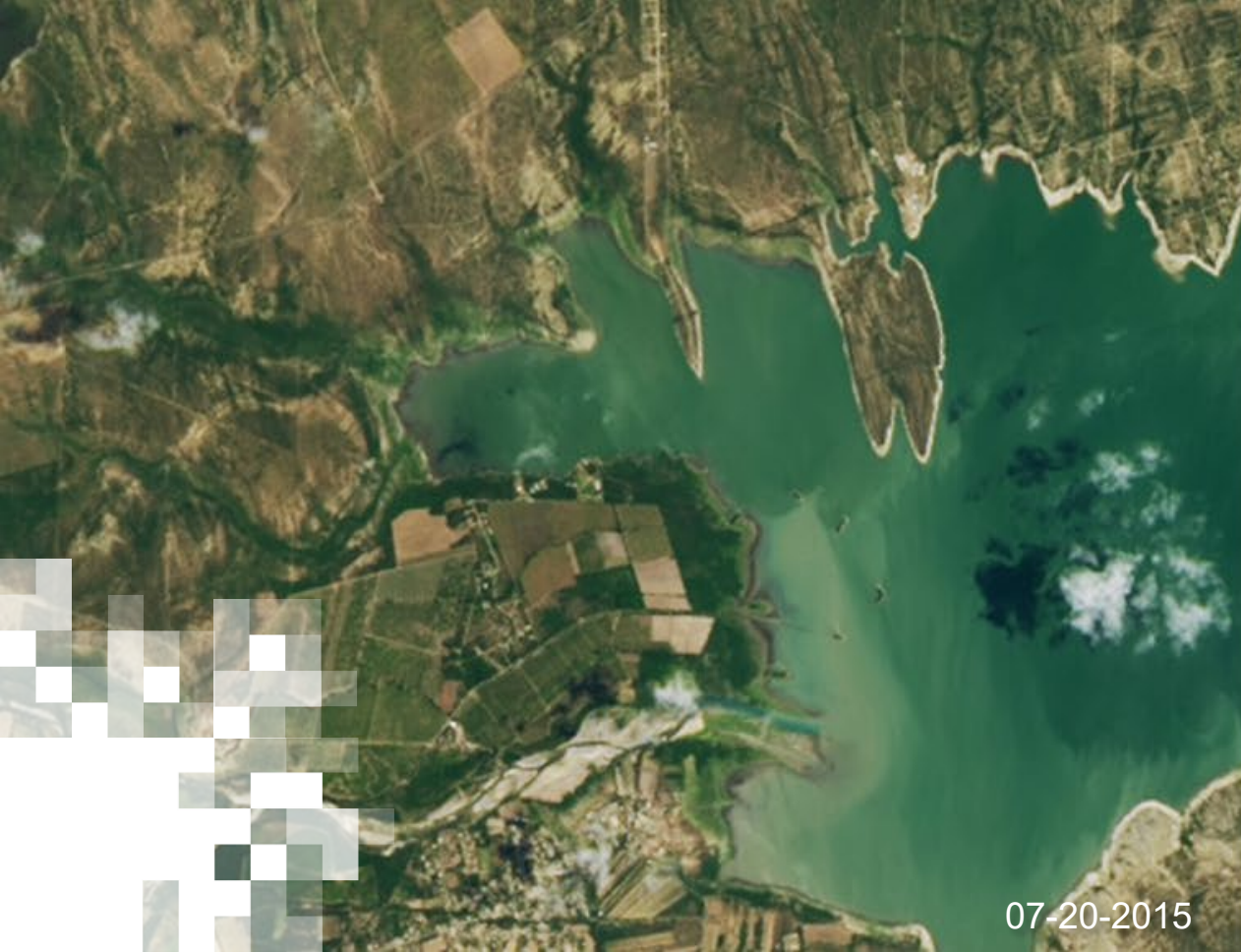
Google Earth Engine Functionality

- Uses of GEE for satellite imagery analysis include:
 - Automation of data processing and display
 - Near real-time monitoring (limited by the availability of data in the catalog)
 - Machine learning algorithm application
 - Graphical User Interface implementation



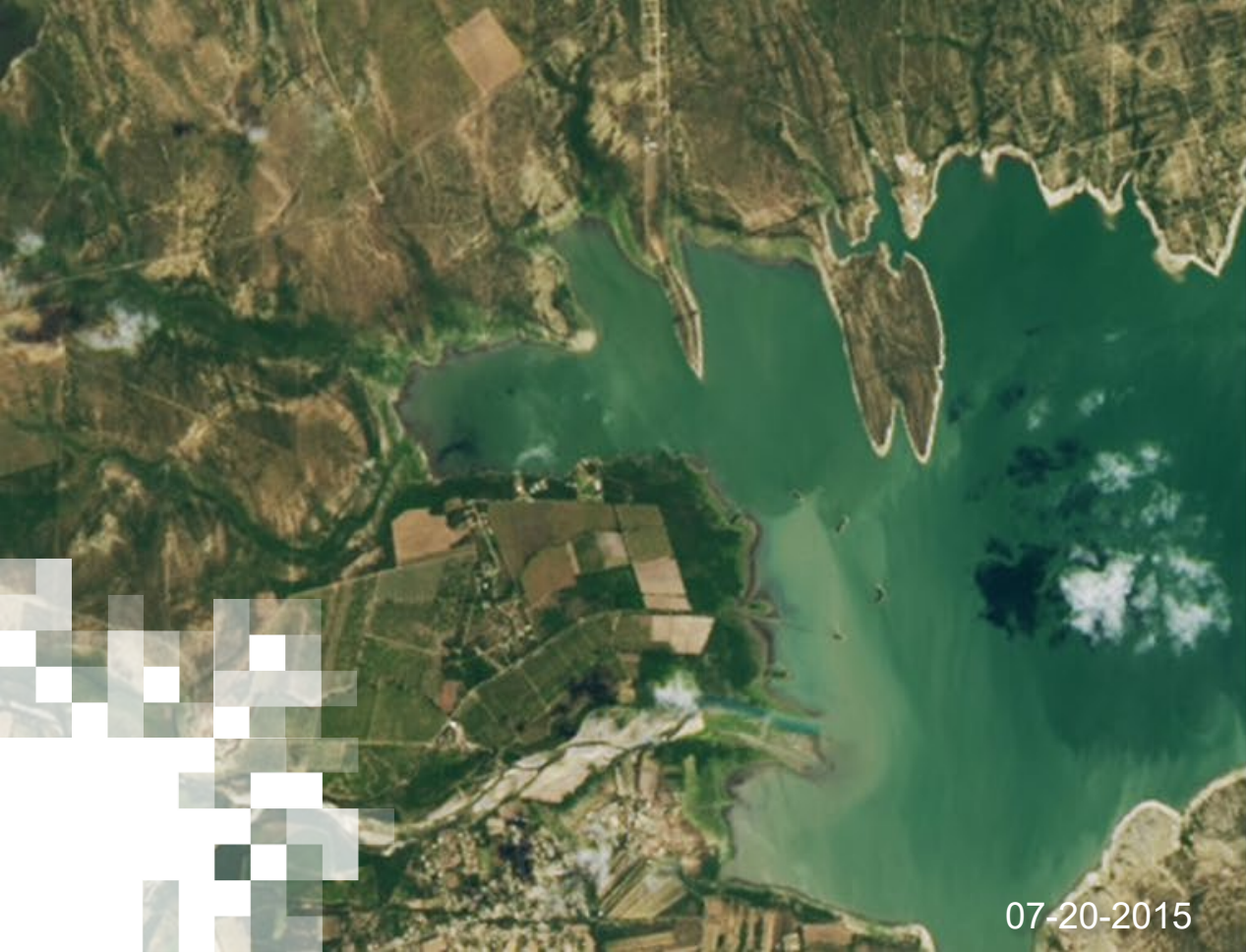
Simple Classification and Regression Trees (CART) classifier implemented in the GEE API to identify three classes urban, forest, and water in the San Francisco Bay Area for May 2021 using Landsat 8 imagery. Credit: [Google Earth Engine Developers](#)





Basic Functions in GEE JavaScript API Activity

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



Python API Demonstration

<https://colab.research.google.com/github/google/earthengine-api/blob/master/python/examples/ipynb/ee-api-colab-setup.ipynb>

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 2: Land Cover Classification & Accuracy Assessment





Thank You!

