

Mapping RiverFarts in the Cloud with Google Earth Engine

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Project Background

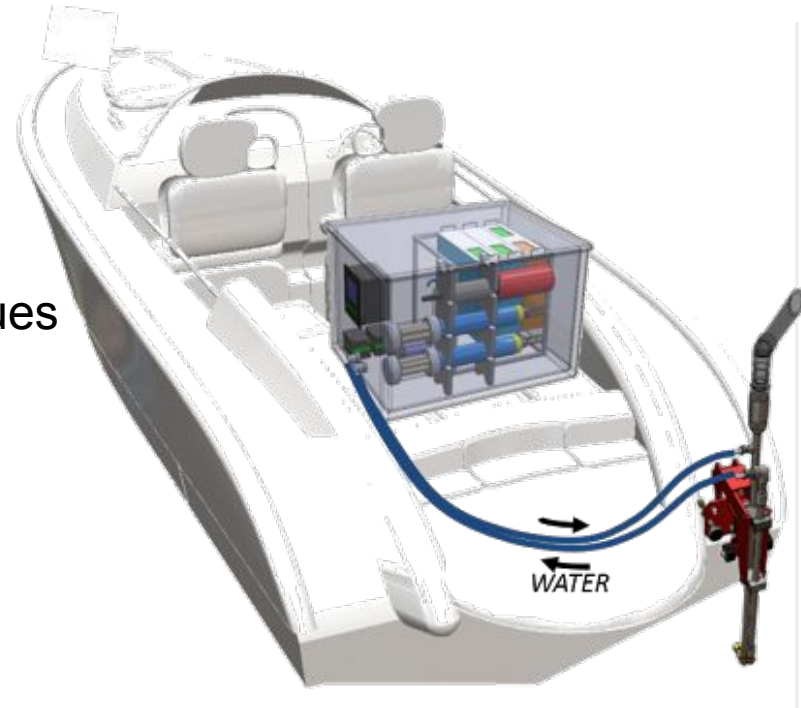
- GHG emissions in large rivers
 - CH₄ + CO₂
 - What is driving these emissions?
 - What are the spatial patterns?
 - Point Sampling, data in Excel



Confluence of Amazon + Tapajos, 2015

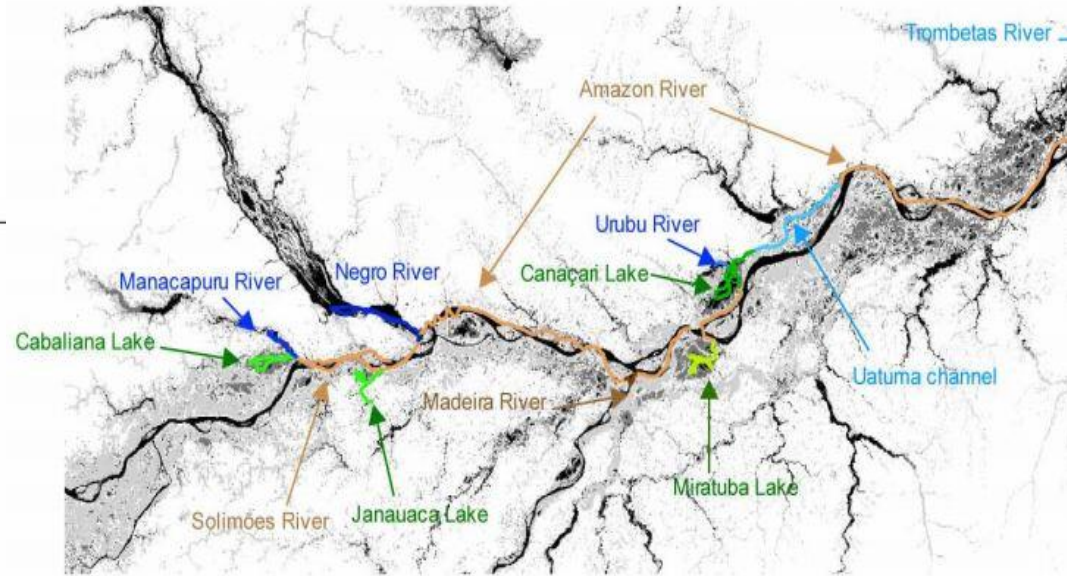
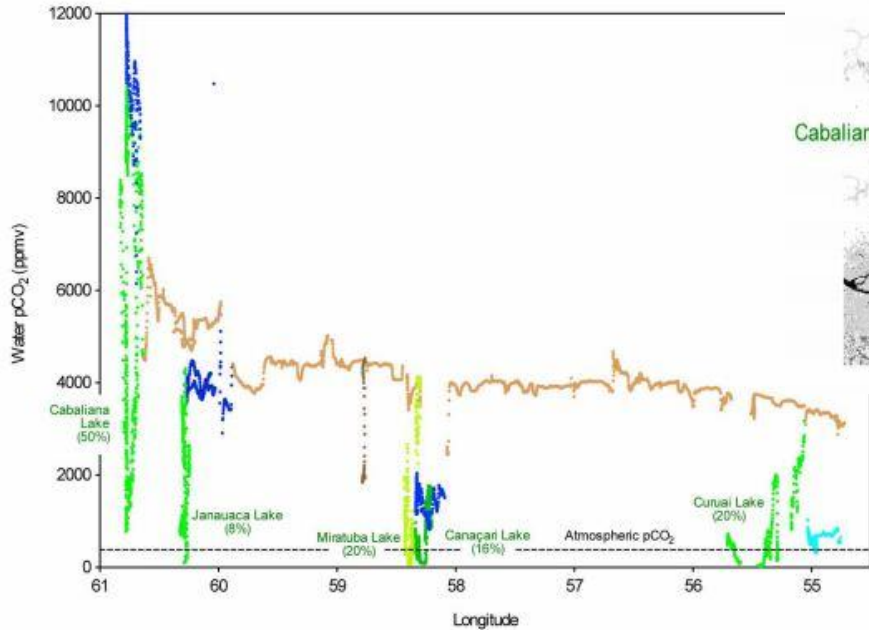
Project Background

- GHG emissions in large rivers
 - CH₄ + CO₂
 - What is driving these emissions?
 - What are the spatial patterns?
- New data collection techniques bring new issues
 - Continuous monitoring of chemical parameters(1/s)
 - Problems of data quality(spikes, drops)
 - How can researchers look at this data?
 - Technical skill ends at Excel



The “Flame”

Project Background



Project Background

We need a way to map our data:

- Interfaces w/ Python
- Cloud-Based
- Handle Raster + Vector Data
- Free!

The logo for Google Earth Engine, featuring the word "Google" in its multi-colored font followed by "Earth Engine" in a grey sans-serif font.

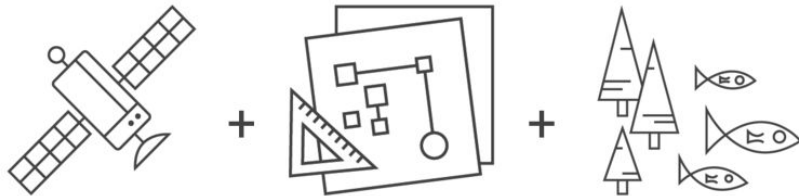
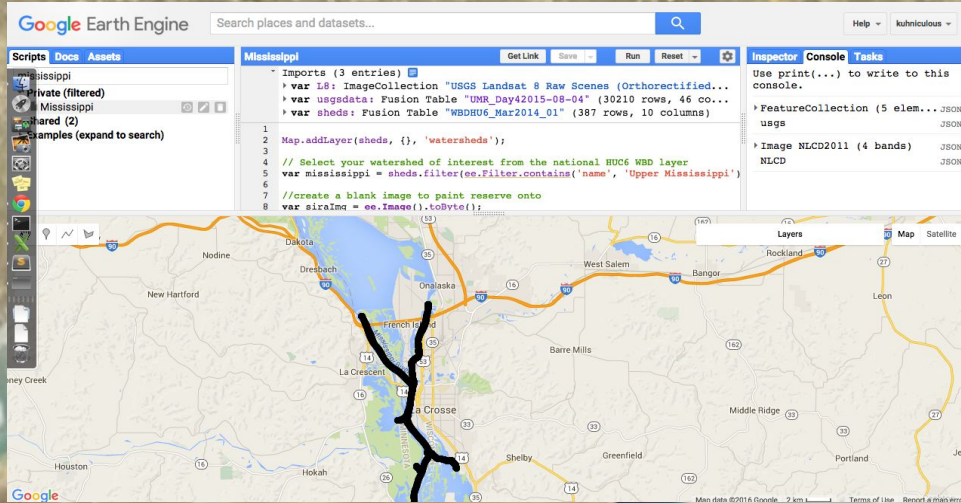
Our data sets:

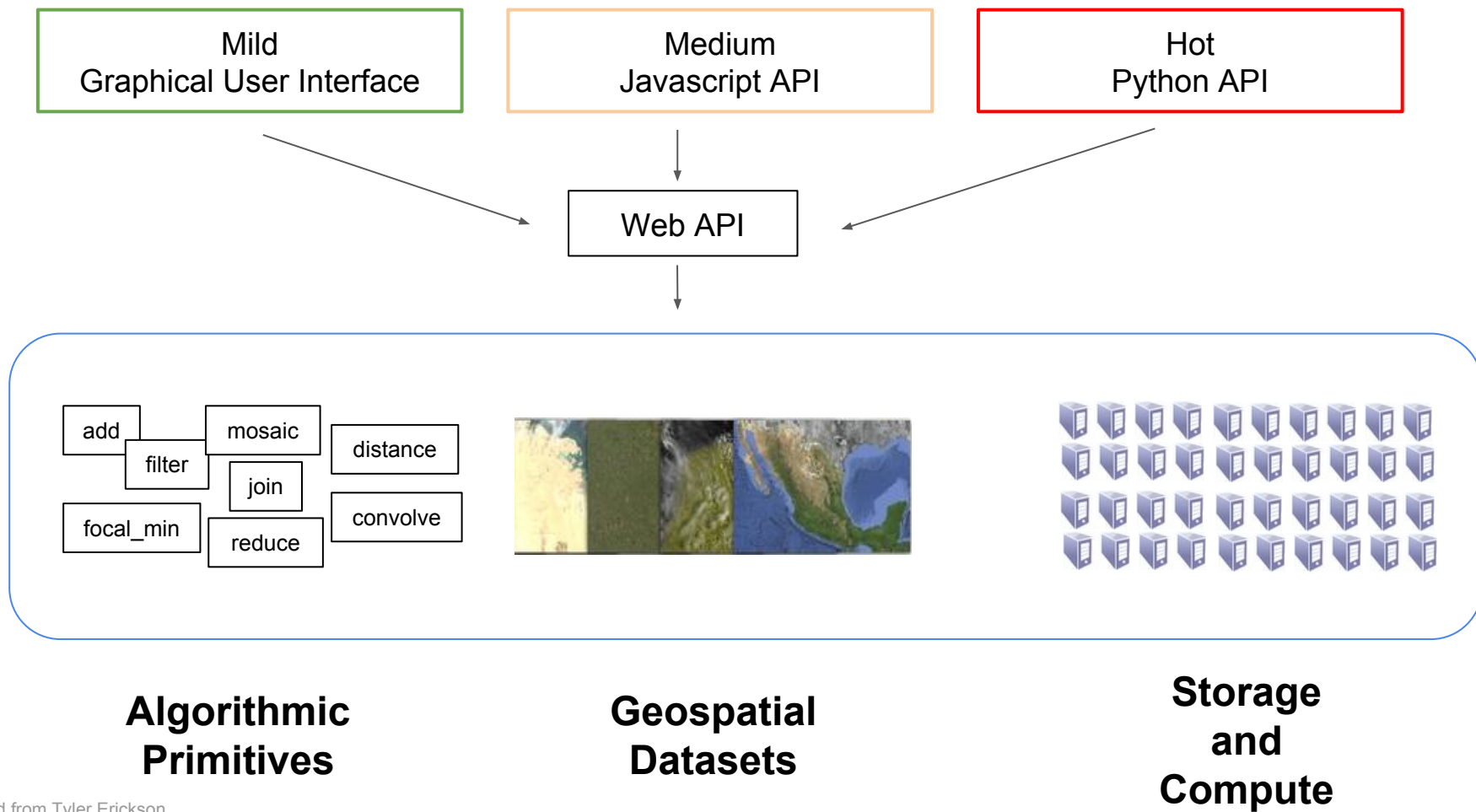




Project Architecture

What is Google Earth Engine?







Global Forest Watch & The Hansen Dataset

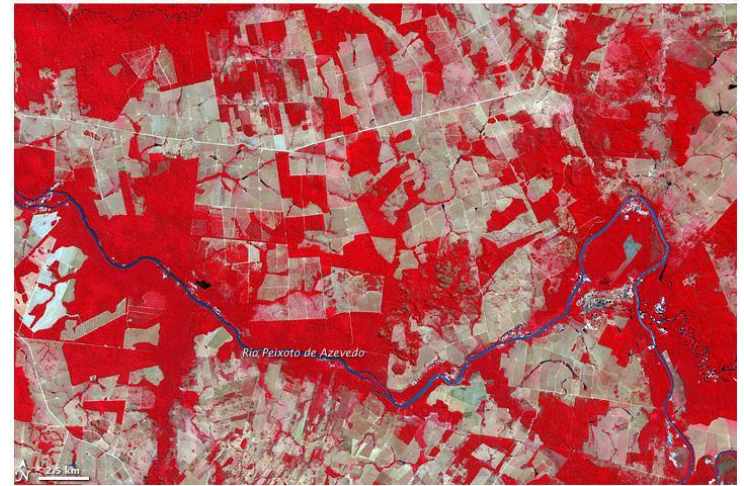
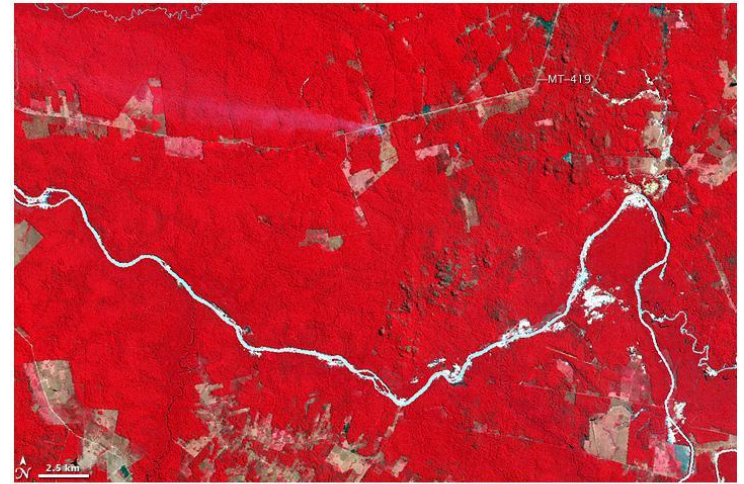
[timelapse](#)

OLS NIGHTTIME LIGHTS

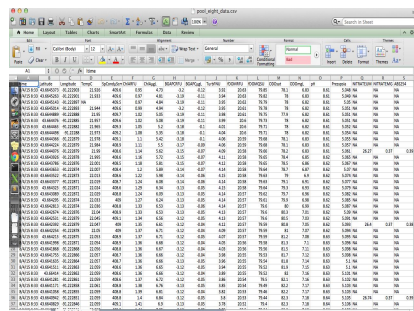
Illegal fishing



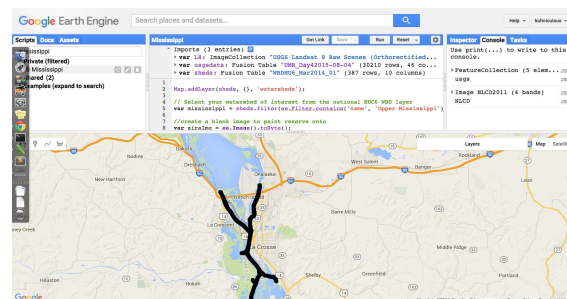
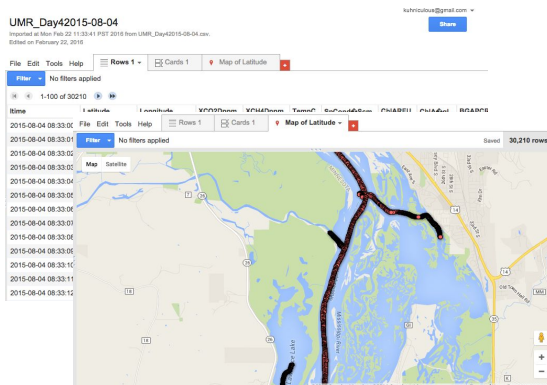
Deforestation from Narco Trafficking in Central America & Mexico



Ins & Outs | Data Pipeline



A screenshot of a CSV file opened in a spreadsheet application. The file is titled 'UMR_Day42015-08-04'. The table has columns for 'Time', 'Latitude', 'Longitude', 'Speed', 'Heading', 'Altitude', 'Roll', 'Pitch', 'Yaw', 'Roll_Rate', 'Pitch_Rate', 'Yaw_Rate', 'Roll_Acc', 'Pitch_Acc', 'Yaw_Acc', 'Roll_Vel', 'Pitch_Vel', 'Yaw_Vel', 'Roll_Acc', 'Pitch_Acc', 'Yaw_Acc', 'Roll_Vel', 'Pitch_Vel', 'Yaw_Vel'. The data is organized into rows, with a filter applied to show rows 1 to 100 of 30210.



CSV



Fusion
Tables



Earth Engine
Web API



Google
Drive

Check your environment

Make sure that you are in the correct environment. To check your current environment, type the following. The environment you are in will have a star next to it.

```
conda info --envs
```

If you are not in the ee-python environment, you can switch into it using

```
source activate ee-python
```

Import & Authentication

```
In [4]: # Import the Earth Engine Python Package into Python environment.
import ee

# Initialize the Earth Engine object, using the authentication credentials.
ee.Initialize()
```

Visualize Geographic Data

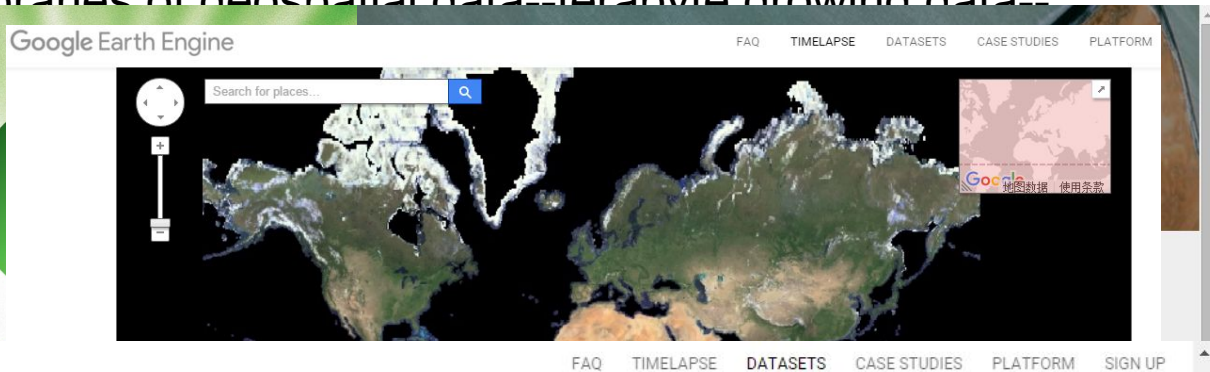
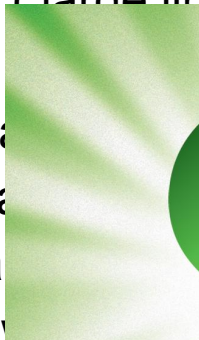
```
In [5]: image = ee.Image('srtm90_v4')
from IPython.display import Image
Image(url=image.getThumbUrl({'min':0, 'max': 3000}))
```

Out[5]:



Earth Engine-Pros

- Open-source(<https://signup.earthengine.google.com/#/>)
- Planetary scale (large libraries of geospatial data--terabyte growing data-- Time lapse)
- Ready-to-use data (e.g. vegetation indices, land use, demographic)--a
- Rich library of a
- Interfaces both



Google Earth Engine

FAQ TIMELAPSE DATASETS CASE STUDIES PLATFORM SIGN UP

IMAGERY

GEOPHYSICAL

CLIMATE & WEATHER

DEMOGRAPHIC



Landsat

Landsat, a joint program of the USGS and NASA, has been observing the Earth continuously from 1972 through the present day. Today the Landsat satellites image the entire Earth's surface at a 30-meter resolution about once every two weeks, including multispectral and thermal data. Earth Engine makes this data available in its raw form, as TOA-corrected reflectance, and in various ready-to-use computed products such as NDVI and EVI vegetation indices.

[Search Landsat data in Earth Engine.](#)

Earth Engine Python API-Cons

- Really sparse documentation for ee python
- Very small user community (Hansen group, google developers)
- Parallelization paralyzes certain types of methods (Interpolation)
- Limited to what Google developers put on the table to use
- Struggles with high dimensional vector data



A wide-angle landscape photograph showing a light-colored dirt road that curves gently to the right, leading the viewer's eye into the distance. The road is flanked by a field of tall, dry, golden-brown grass. In the background, a series of rolling hills and mountains are visible, with some peaks covered in patches of snow. The sky is a deep blue, filled with large, white, puffy cumulus clouds. The overall scene conveys a sense of a quiet, open natural environment.

THANKS & QUESTIONS

Application Programming Interface (API)

Saved Scripts

Documentation

Asset Manager

Coding
Console

Inspector

Output
console

Export Tasks

```
Example: Image Collection > Linear
1 // Compute the trend of
2
3 // Add a band containing image date as years since 1991.
4 function createTimeBand(img) {
5   var year = ee.Date(img.get('system:time_start')).get('year').subtract(1991);
6   return ee.Image(year).byte().addBands(img);
7 }
8
9 // Fit a linear trend to the nighttime lights collection.
10 var collection = ee.ImageCollection('NOAA/DMSP-OLS/NIGHTTIME_LIGHTS')
11   .select('stable_lights')
12   .map(createTimeBand);
13 var fit = collection.reduce(ee.Reducer.linearFit());
14
15 // Display a single image
16 Map.setCenter(30, 45, 4);
17 Map.addLayer(ee.Image(collection.select('stable_lights').first()),
18   {min: 0, max: 63},
19   'stable_lights first asset');
20
21 // Display trend in red/blue, brightness in green.
22 Map.addLayer(fit,
23   {min: 0, max: [0.10, 20, -0.18], bands: ['scale', 'offset', 'scale']},
24   'stable_lights trend');
25
```



Map

Nighttime lights from DMSP (linear fit) from 1991 to 2013

[code here](#)