Mapping RiverFarts in the Cloud with Google Earth Engine

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CSE 599 Software Design, University of Washington
Technology Review | March 2nd, 2016

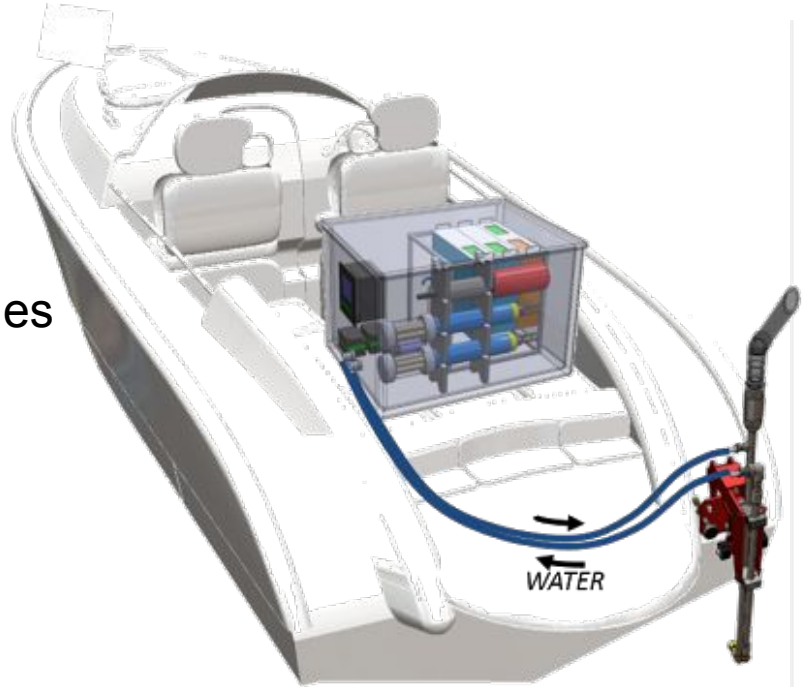
Project Background

- GHG emissions in large rivers
  - CH_4 + CO_2
  - What is driving these emissions?
  - What are the spatial patterns?
  - Point Sampling, data in Excel

Confluence of Amazon + Tapajos, 2015

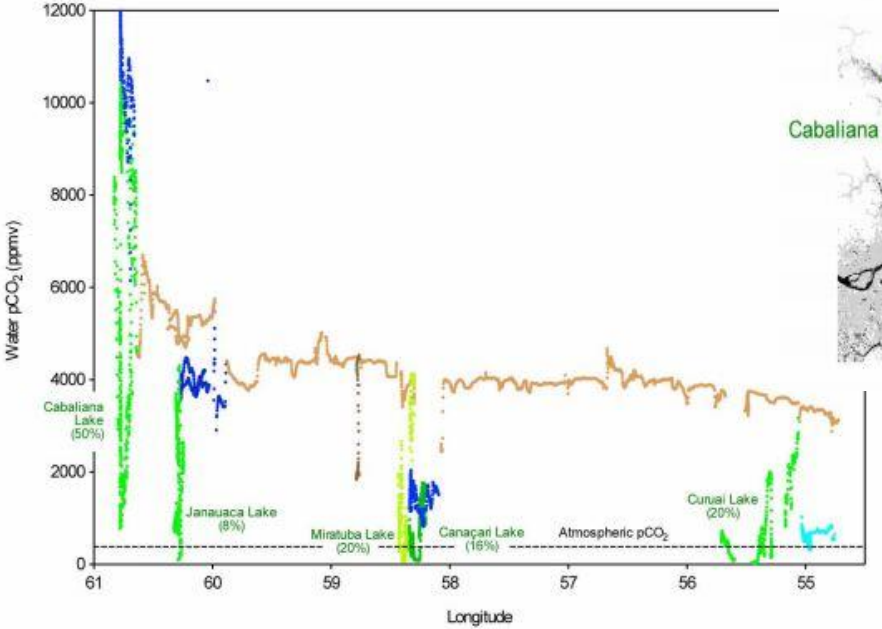
Project Background

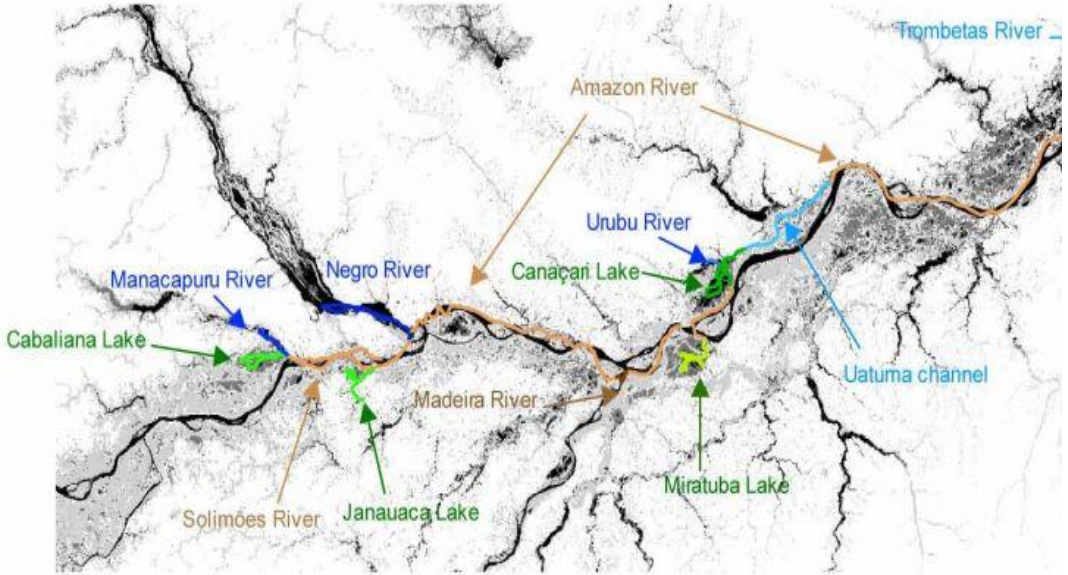
- GHG emissions in large rivers
  - CH_4 + CO_2
  - What is driving these emissions?
  - What are the spatial patterns?
- New data collection techniques bring new issues
  - Continuous monitoring of chemical parameters(1/s)
  - Problems of data quality(spikes, drops)
  - How can researchers look at this data?
    - Technical skill ends at Excel



The “Flame”

Project Background





Avril et al. 2014

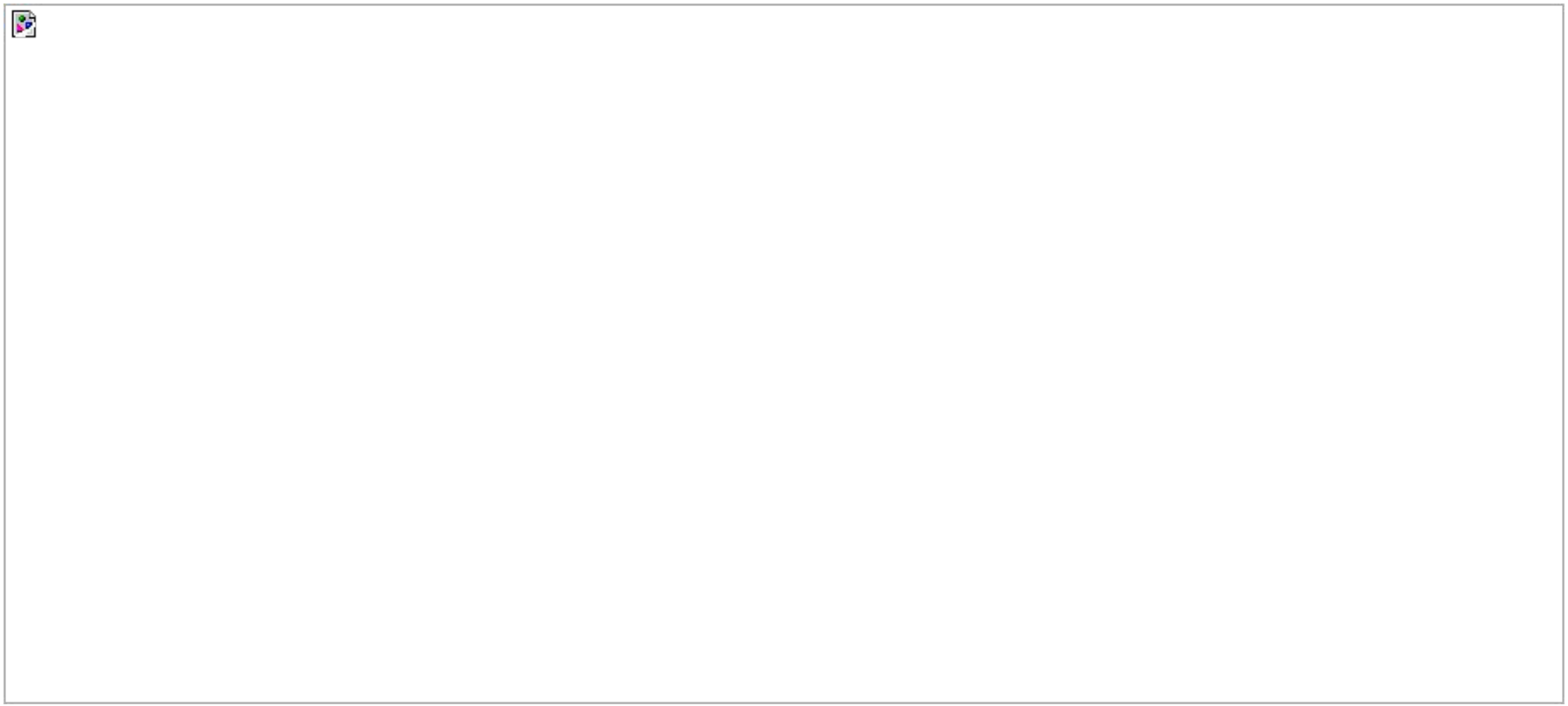
Project Background

We need a way to map our data:

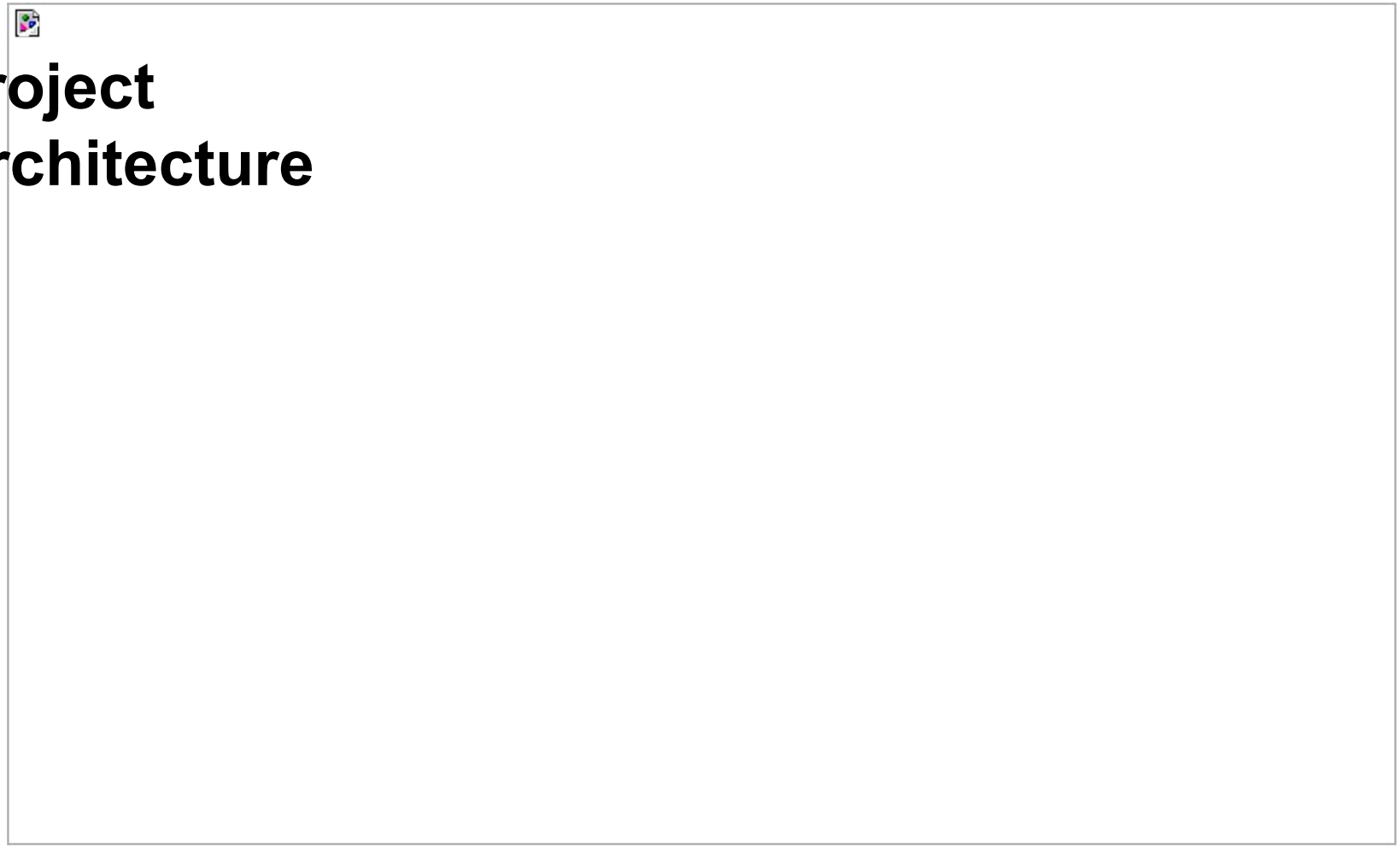
- Interfaces w/ Python
- Cloud-Based
- Handle Raster + Vector Data
- Free!

Google Earth Engine

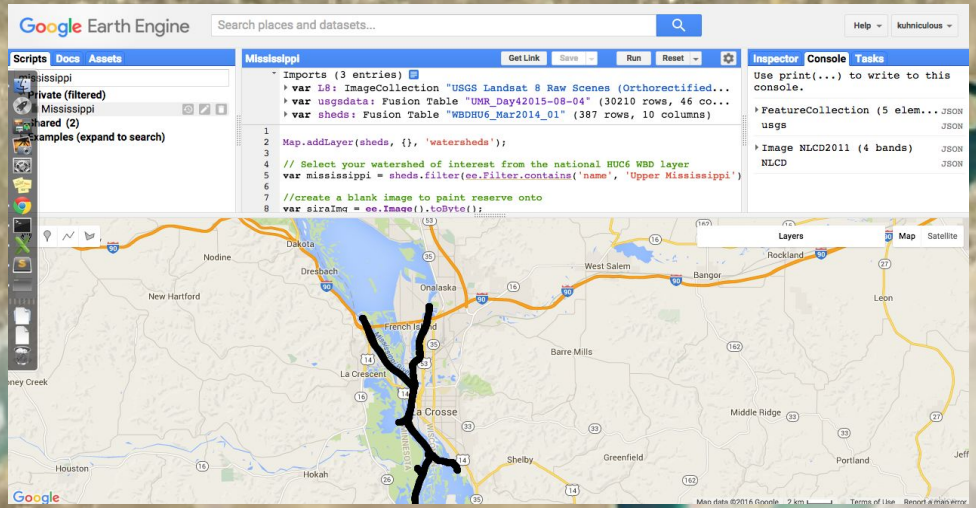
Our data sets:

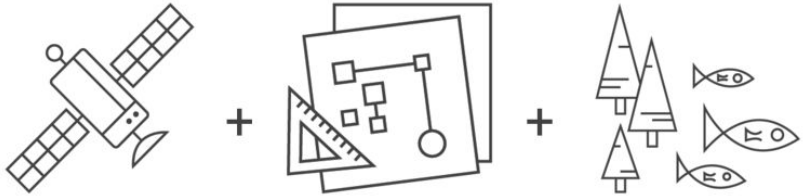


Project Architecture



What is Google Earth Engine?





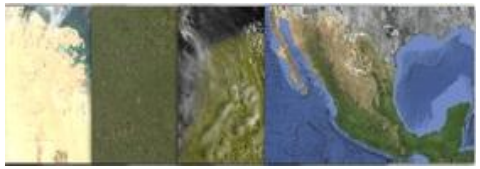
Mild
Graphical User Interface

Medium
Javascript API

Hot
Python API

Web API

add
filter
mosaic
join
distance
focal_min
reduce
convolve

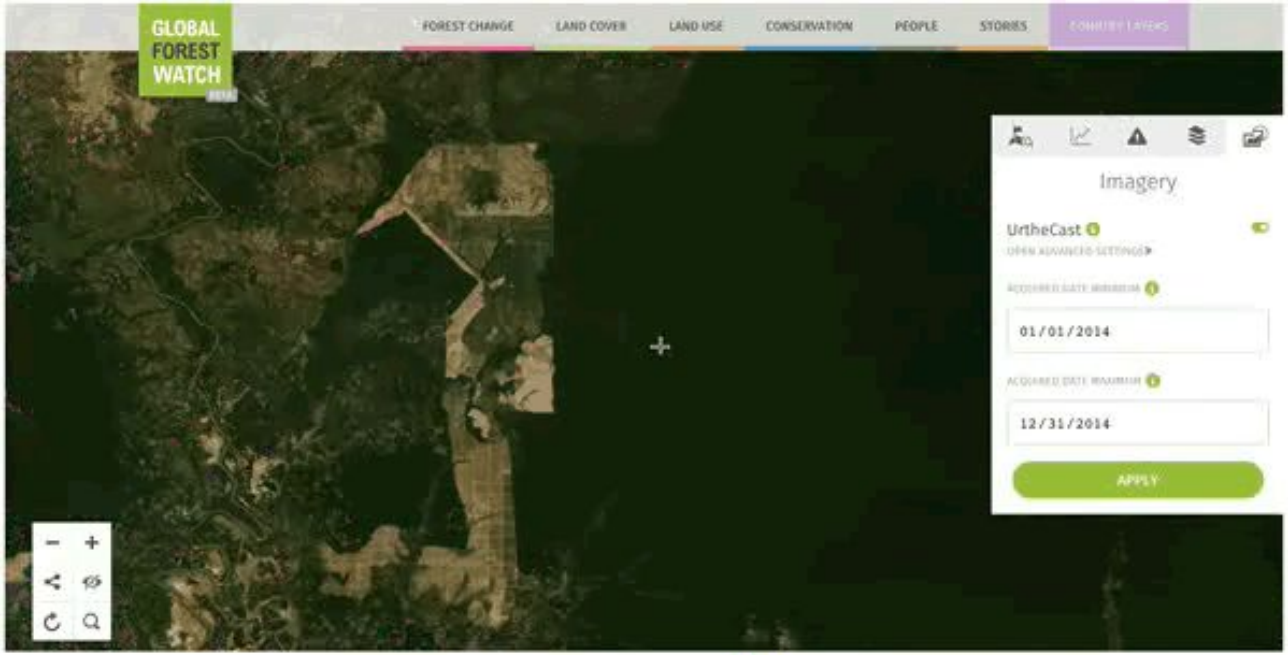


Algorithmic Primitives

Geospatial Datasets

Storage and Compute

adapted from Tyler Erickson

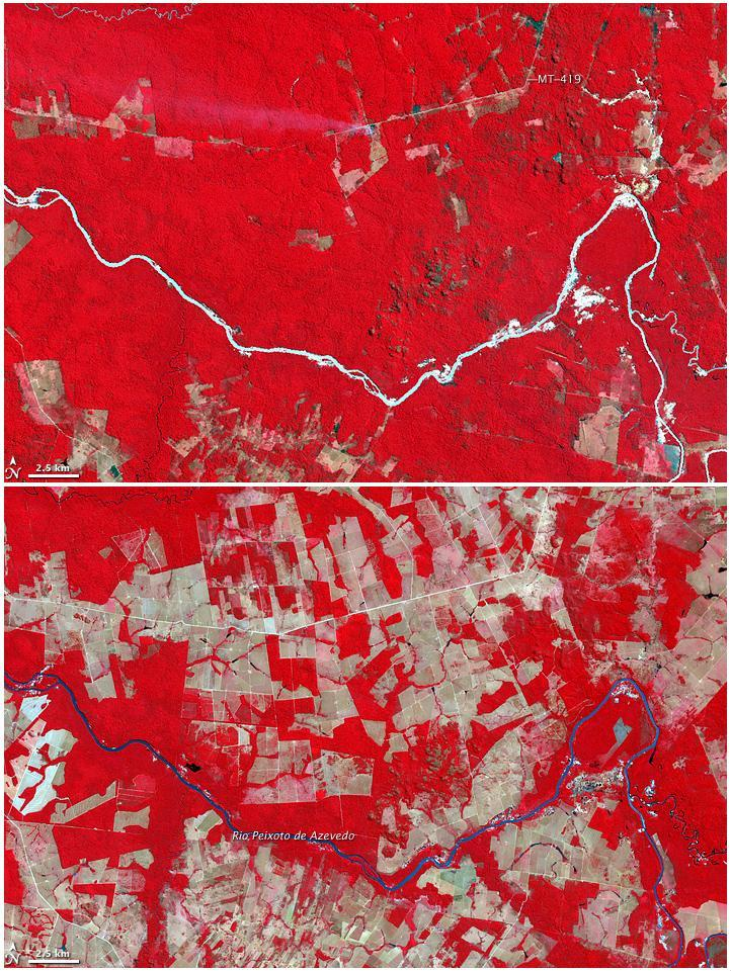


Global Forest Watch & The Hansen Dataset

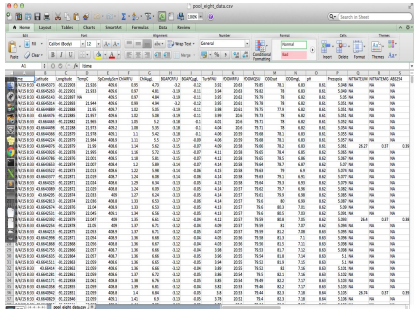
timelapse

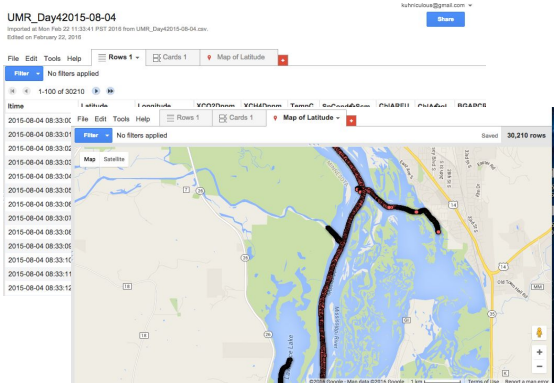
OLS NIGHTTIME LIGHTS

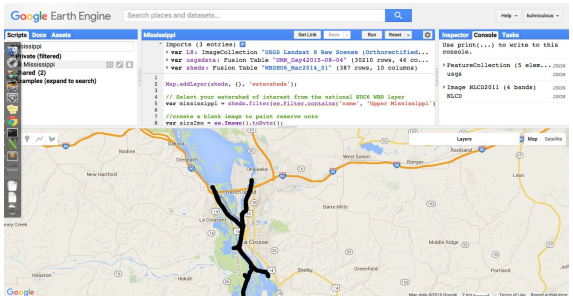
Deforestation from Narco Trafficking in Central America & Mexico



Ins & Outs |Data Pipeline



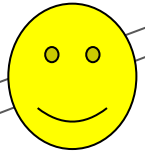




CSV

Fusion Tables

Earth Engine Web API



Google Drive

jupyter map Last Checkpoint: Last Wednesday at 10:14 PM (unsaved changes)

File Edit View Insert Cell Kernel Help Python 2

Code CellToolbar

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()
```

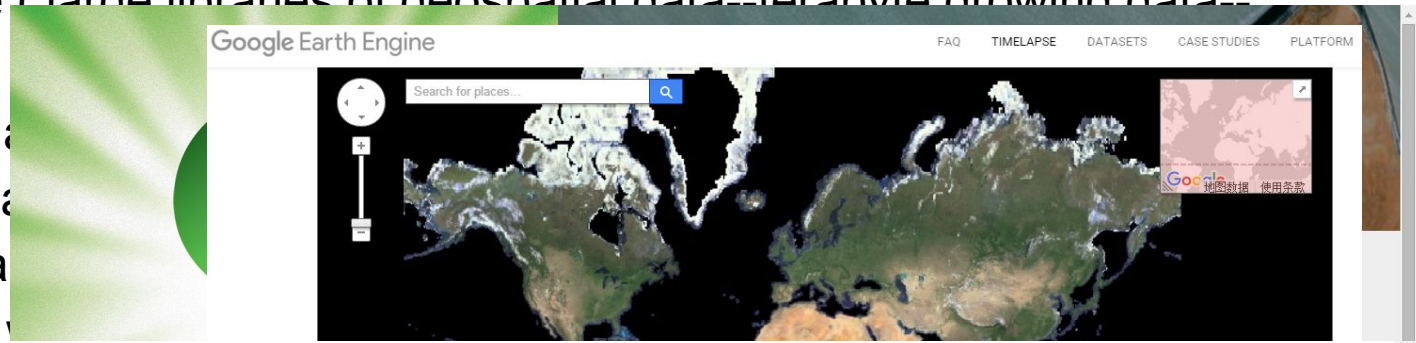
Visualize Geographic Data

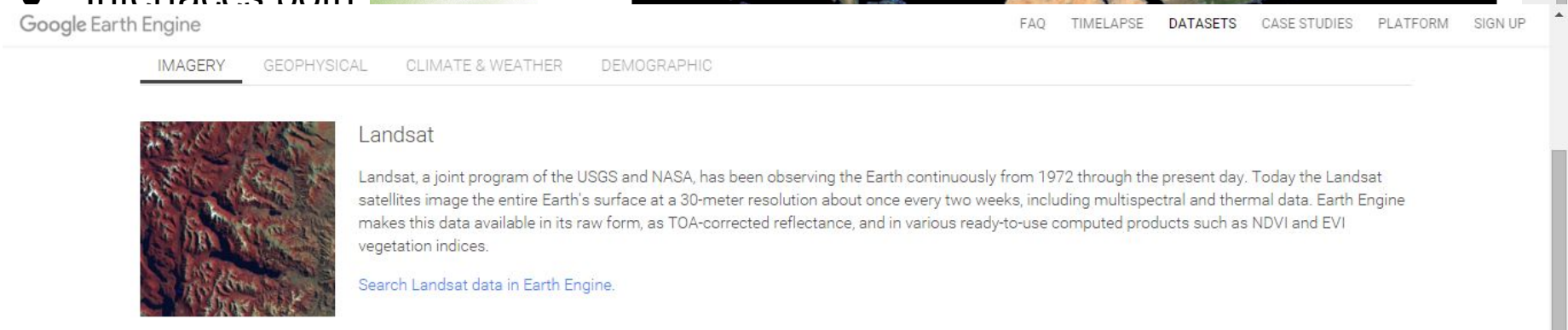
In [5]:
```
image = ee.Image('srtm90_v4')
from IPython.display import Image
Image(url=image.getThumbUrl({'min':0, 'max': 3000}))
```

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 da demographic)--a
- Rich library of a
- Interfaces both





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

Google Earth Engine

THANKS & QUESTIONS

Application Programming Interface (API)

Saved Scripts

Documentation

Asset Manager

Coding Console

Inspector

Output console

Export Tasks

Map

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

code here