goo.gl/9sYsqW

Earth Engine 101

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Google Earth Engine

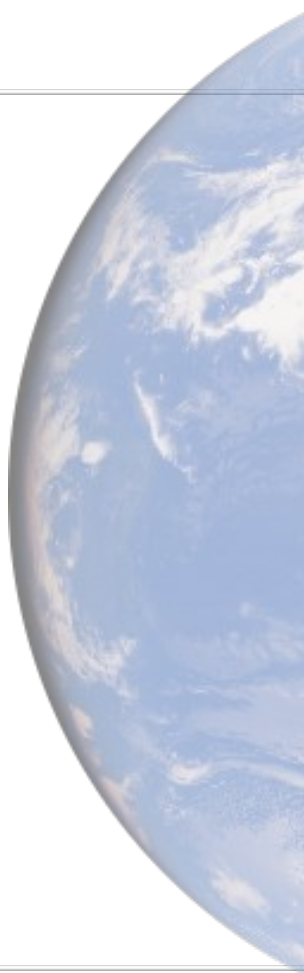
Overview

Google Earth Engine

What Is Earth Engine?

"Big Data" analysis and visualization platform

- Inherently parallel system
- Designed for scientists, not software engineers
- Goals: make it easy, **enable non-traditional users**



What Is Earth Engine?

"Big Data" analysis and visualization platform

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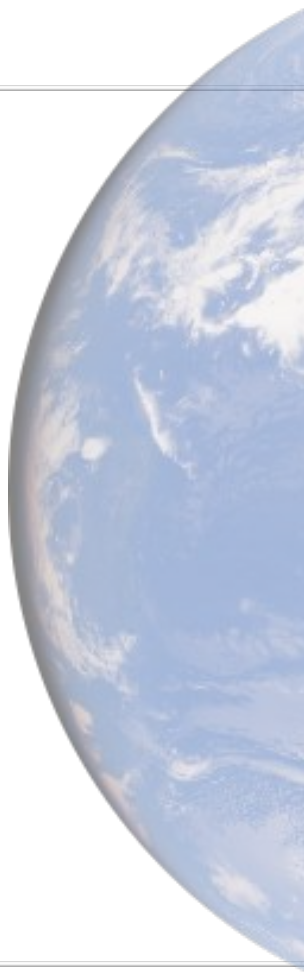
Focused on society's biggest challenges

- Deforestation
- Drought
- Disaster
- Disease
- Climate Change
- Conflict
- Global Food Security
- Sustainability



9PB Public Data Catalog

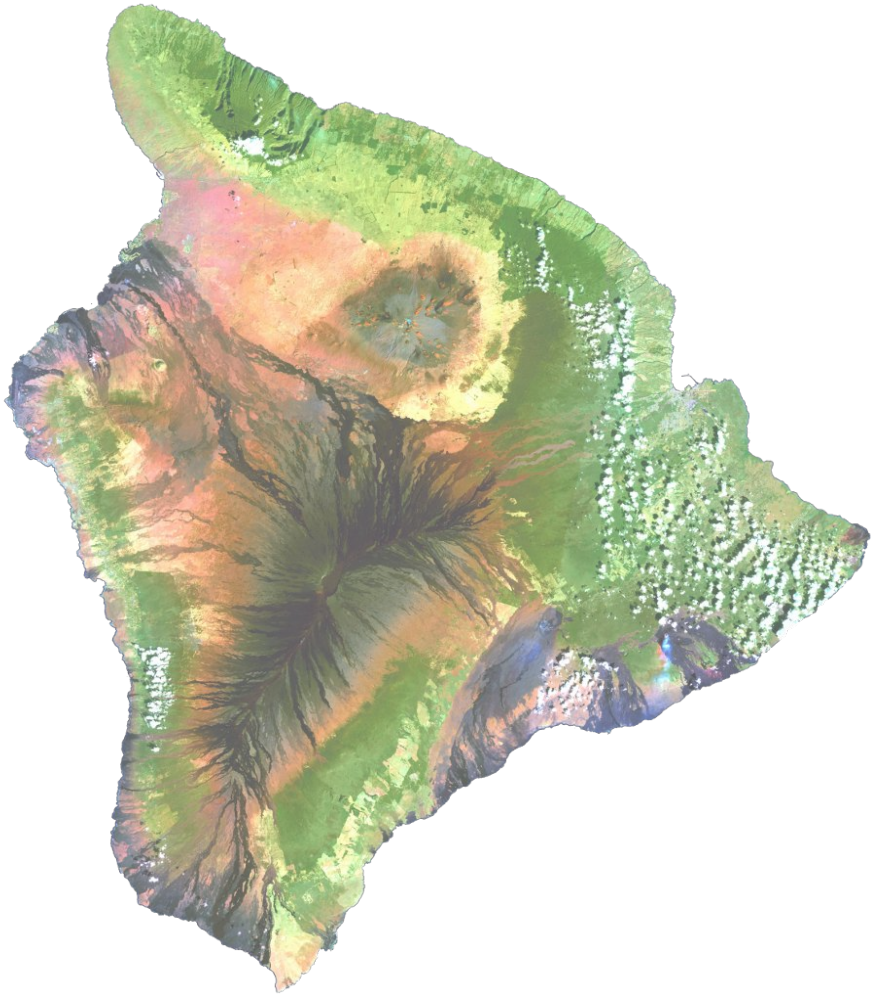
Imagery

Landsat 4-8	7 bands, 30m
MODIS	250m Daily Global
Sentinel-1	10m SAR
Sentinel-2	12 bands, 10/20/60m

Geophysical

Digital Elevation
Land Cover
Surface Temperature, etc.

Weather Forecasts, Climate Models
+300 more analysis ready datasets



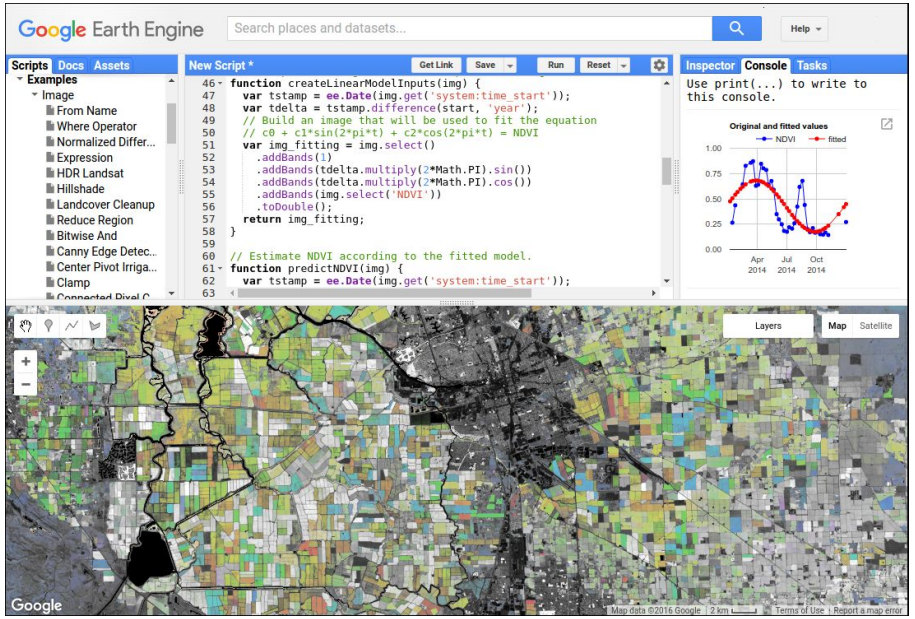
How Do I Use It?

Javascript API

- Interactive Code Editor
- Node.js*

Python API

- Python module
- Web Apps with Appengine
- Jupyter Notebooks*

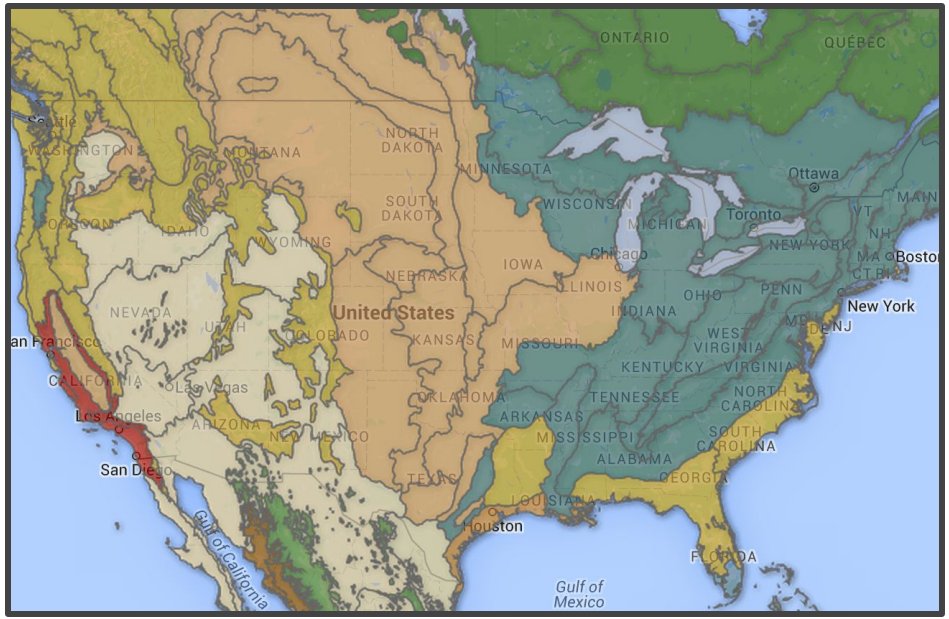


Concepts

Data Models

Feature

- Line / Point / Polygon
- List of Properties



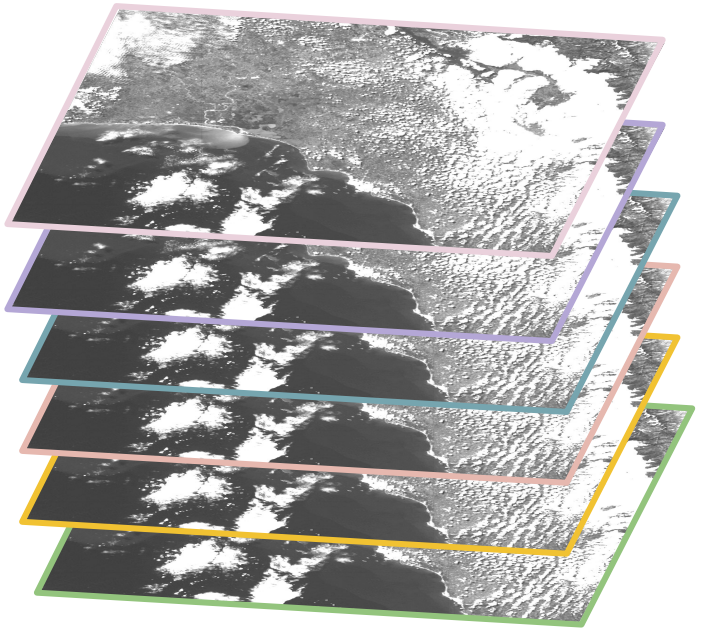
TNC Ecoregions

Data Models

Feature

Image

- Stack of Georeferenced bands
- Each band has its own:
  - Mask, Projection, Resolution
- A list of properties, including:
  - Date, Bounding-box



Data Models

Feature

Image

Collection

- Bag of Elements
  - Table of Features
  - Directory of Images
- Filter, Sort, Join, Map, Reduce

Map

Apply a function to each element of a collection

A "For Each" operation

Examples

- Compute area of each feature
- Cloud cover of each image
- Mosaic for each month

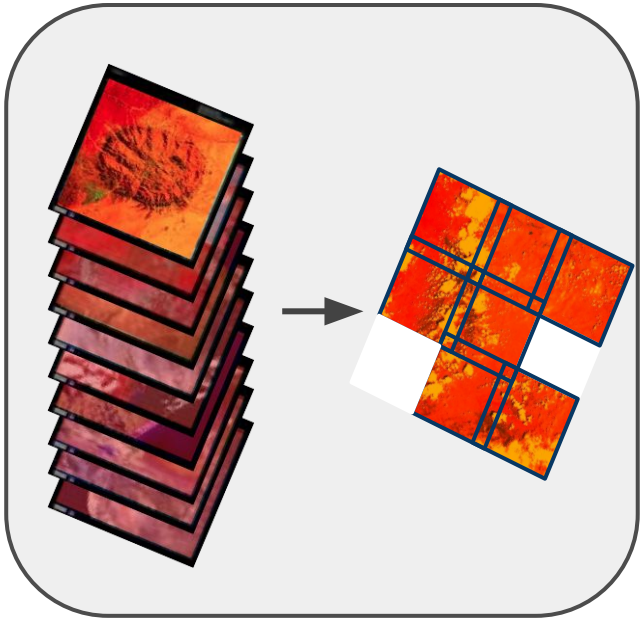
Reduce

Apply a function to everything in a collection

"Aggregation"

Examples

- Summed area over all features
- Median-pixel composite
- Train a classifier



Reducers in Earth Engine

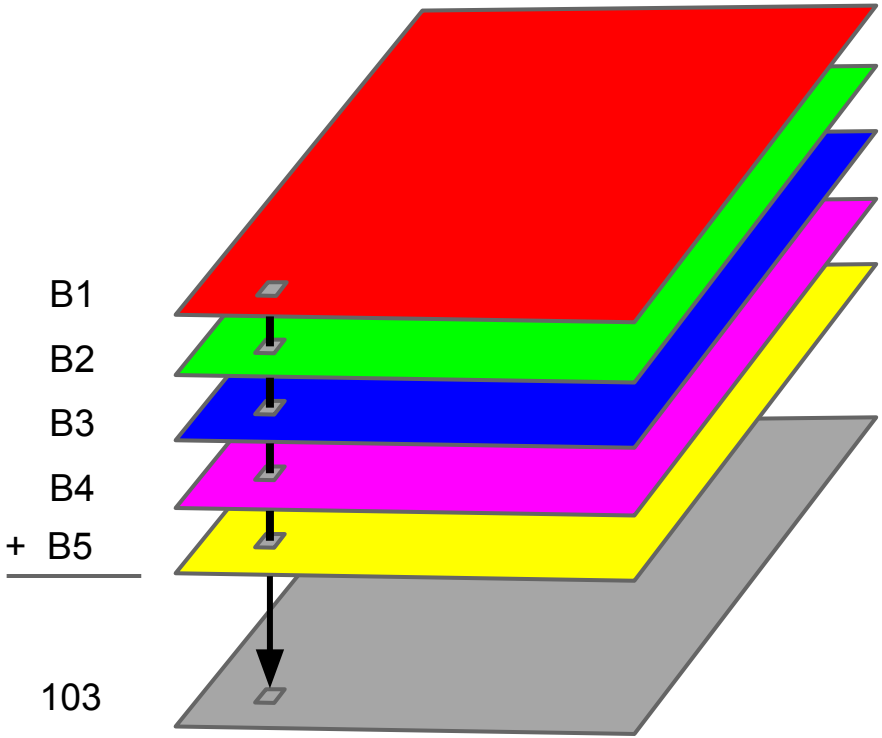
8 ways to reduce

Image.reduce
Image.reduceNeighborhood
Image.reduceRegion
Image.reduceRegions
Image.reduceToVectors
ImageCollection.reduce
FeatureCollection.reduceColumns
FeatureCollection.ReduceToImage

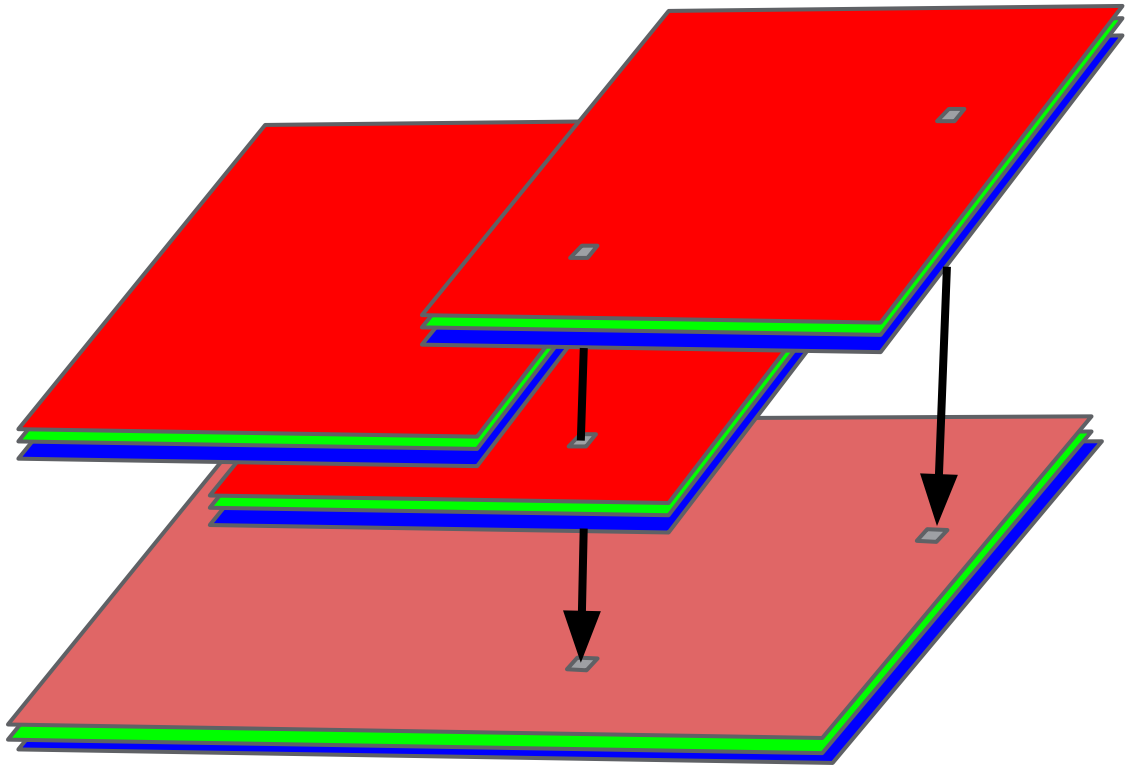
40+ reducers

Reducer.allNonZero
Reducer.and
Reducer.anyNonZero
Reducer.count
Reducer.countEvery
Reducer.histogram
Reducer.intervalMean
Reducer.linearFit
Reducer.linearRegression
Reducer.max
Reducer.mean
Reducer.median
Reducer.min
Reducer.minMax
Reducer.mode
Reducer.or
Reducer.percentile
Reducer.product
Reducer.sampleStdDev
Reducer.sampleVariance
Reducer.stdDev
Reducer.sum
Reducer.toCollection
Reducer.toList
Reducer.variance

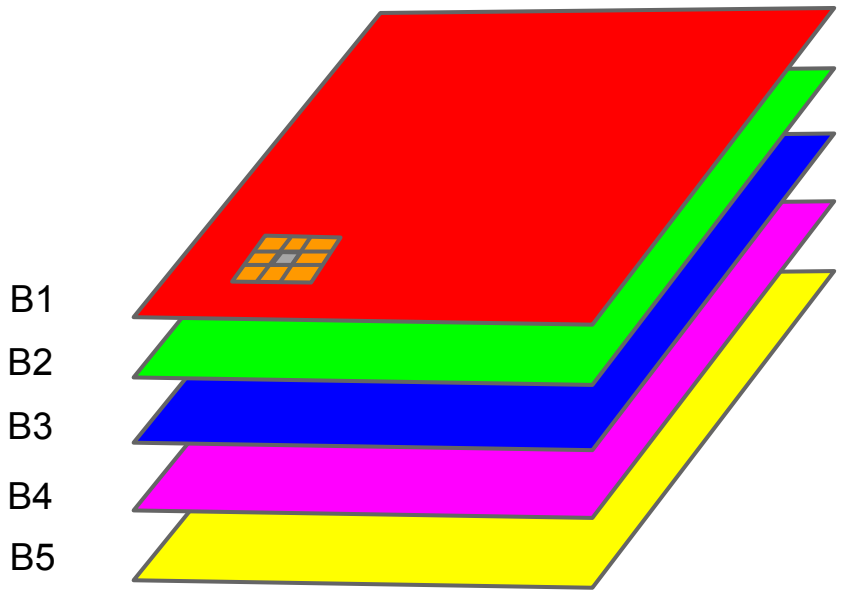
Reduce Bands



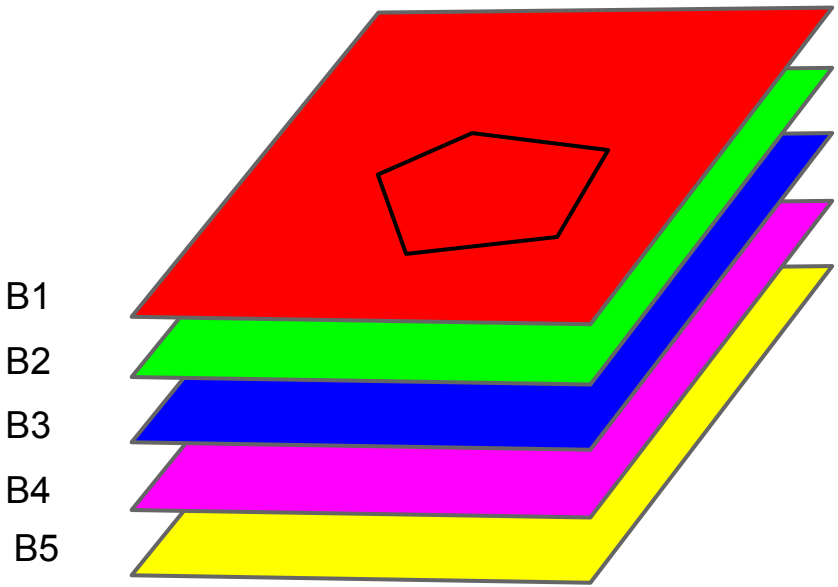
Reduce Image Collection



Reduce Neighborhood

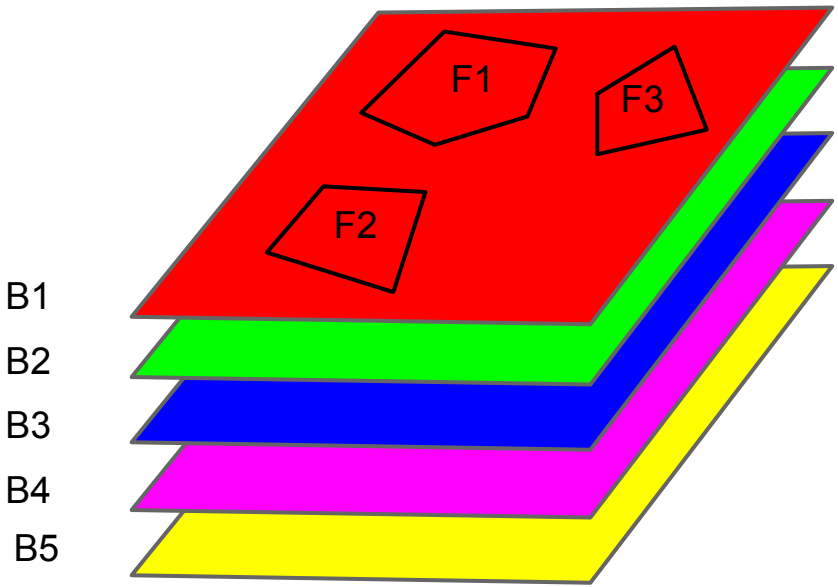


Reduce Region



Dictionary
{
B1: 8.3,
B2: 14,
B3: 176,
B4: 1.6,
B5: 7
}

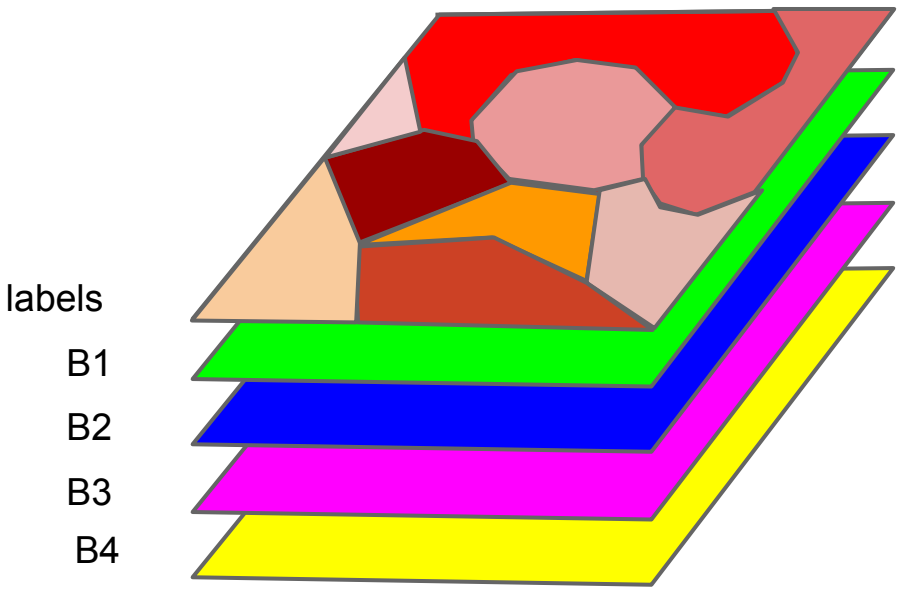
Reduce Regions



FeatureCollection

	B1	B2	B3	B4	B5
F1					
F2					
F3					

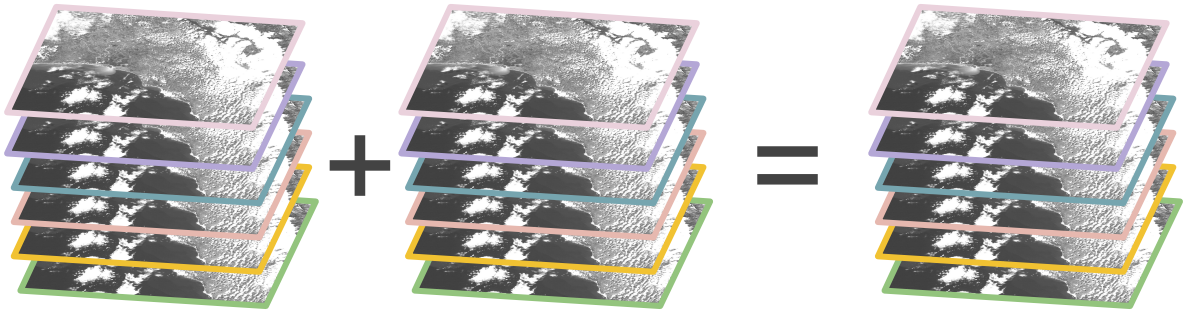
Reduce To Vectors



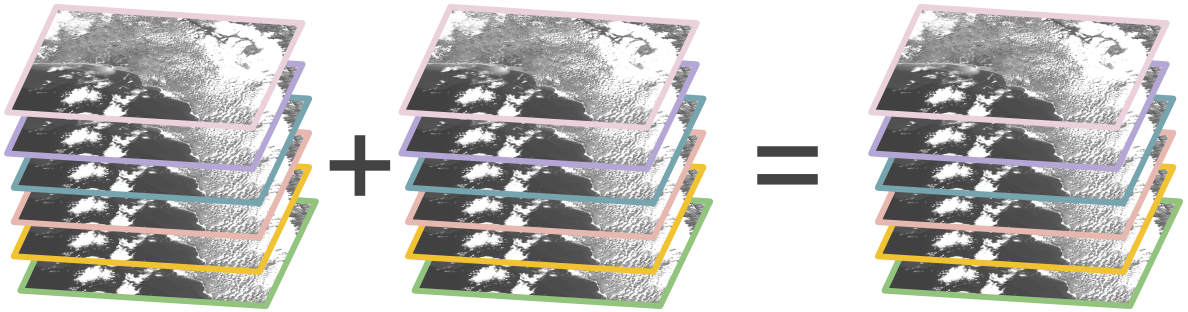
FeatureCollection

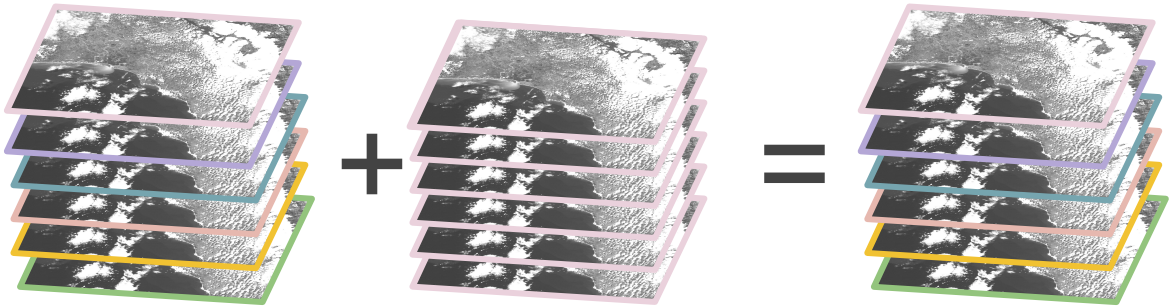
	B1	B2	B3	B4
F1				
F2				
F3				
F4				
F5				
...				

Band Math



Band Math





A Computation Example

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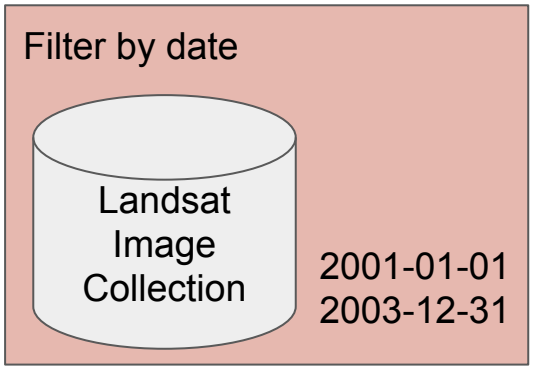

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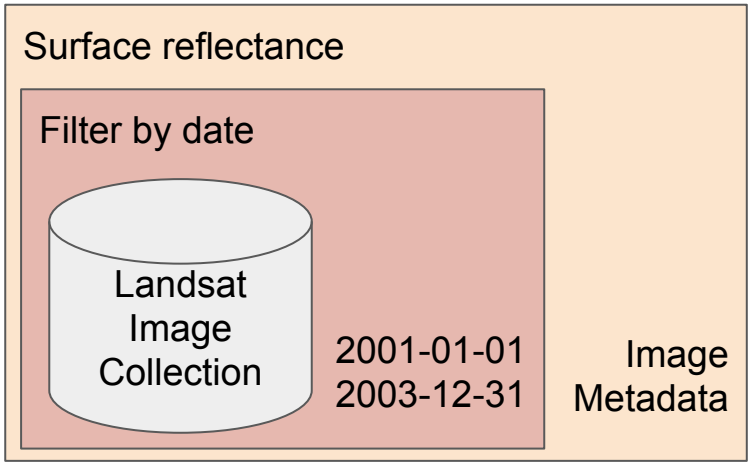

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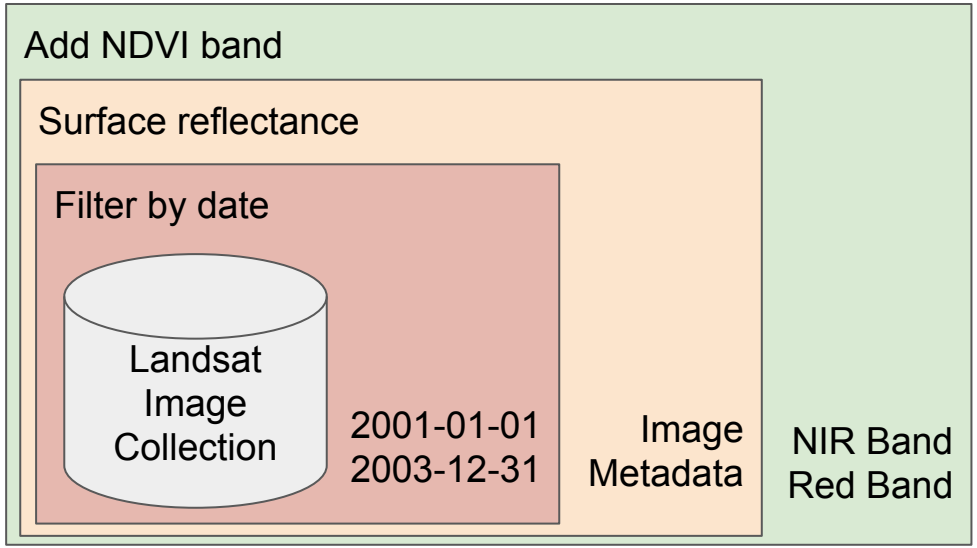
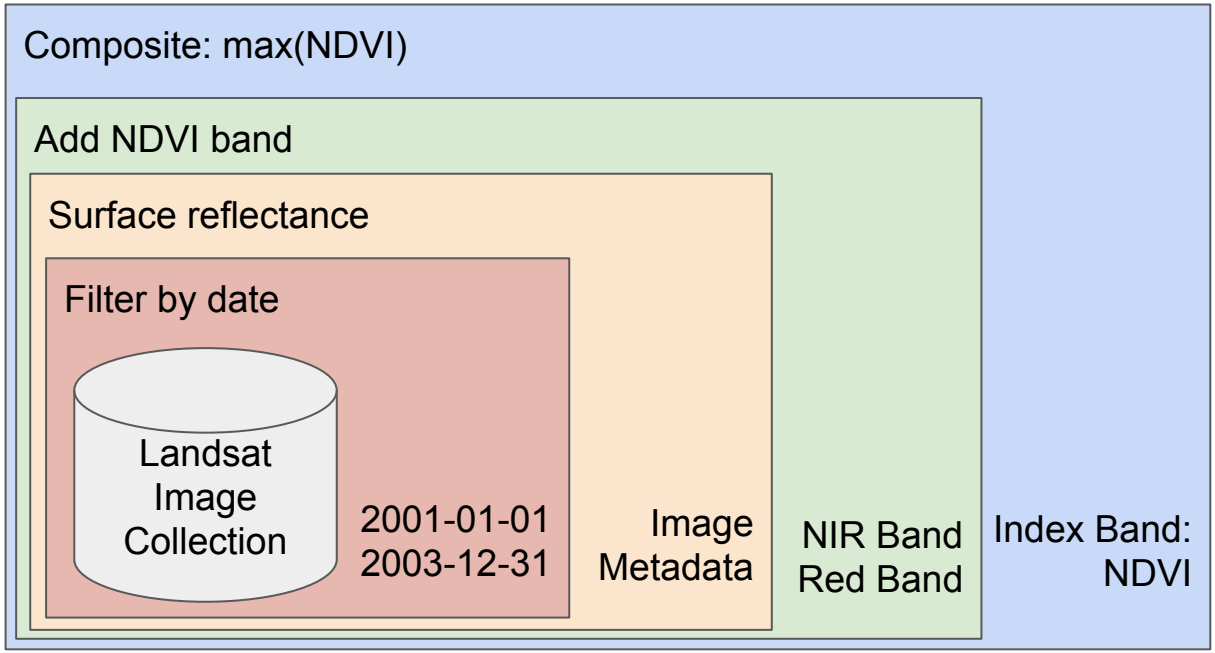


A Computation Example



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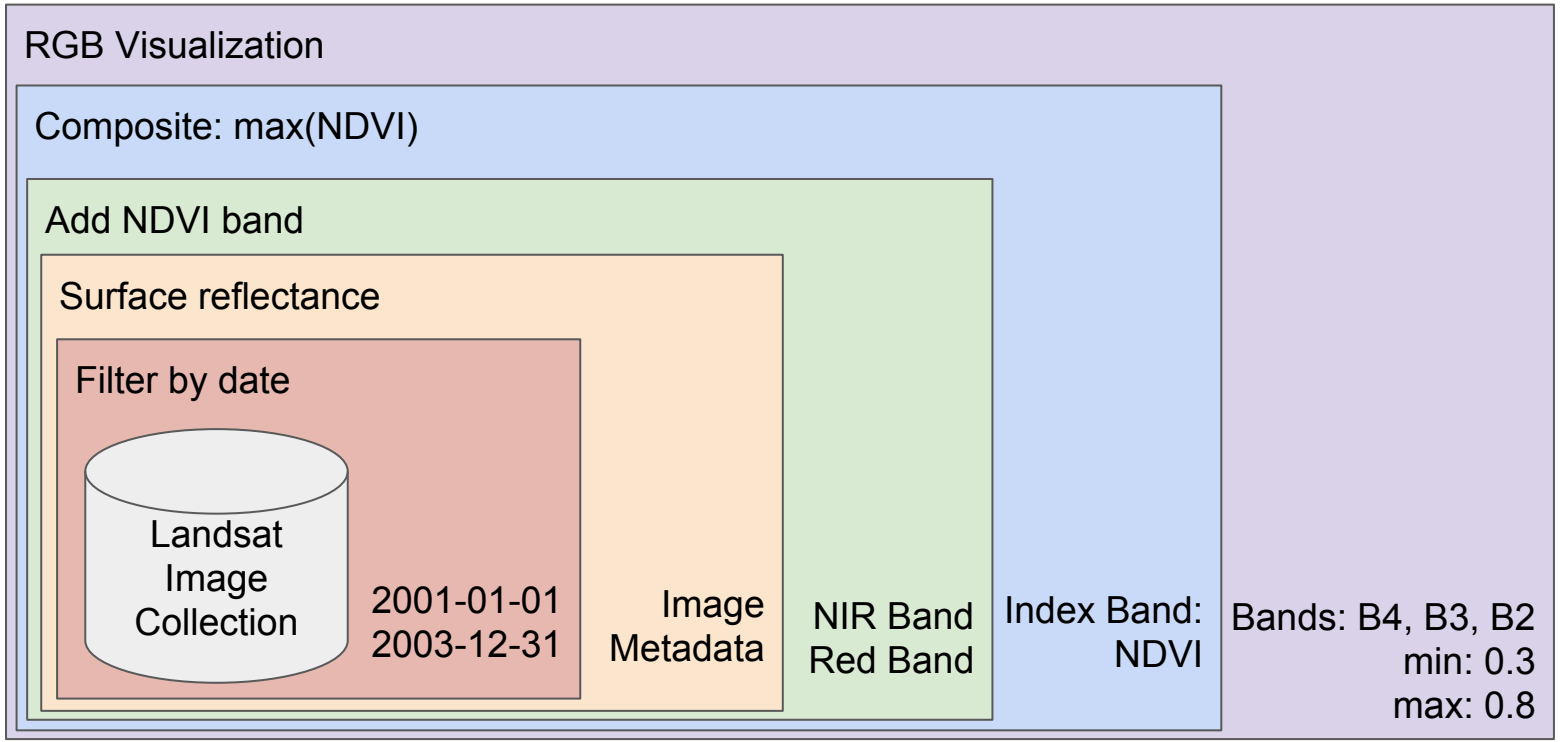

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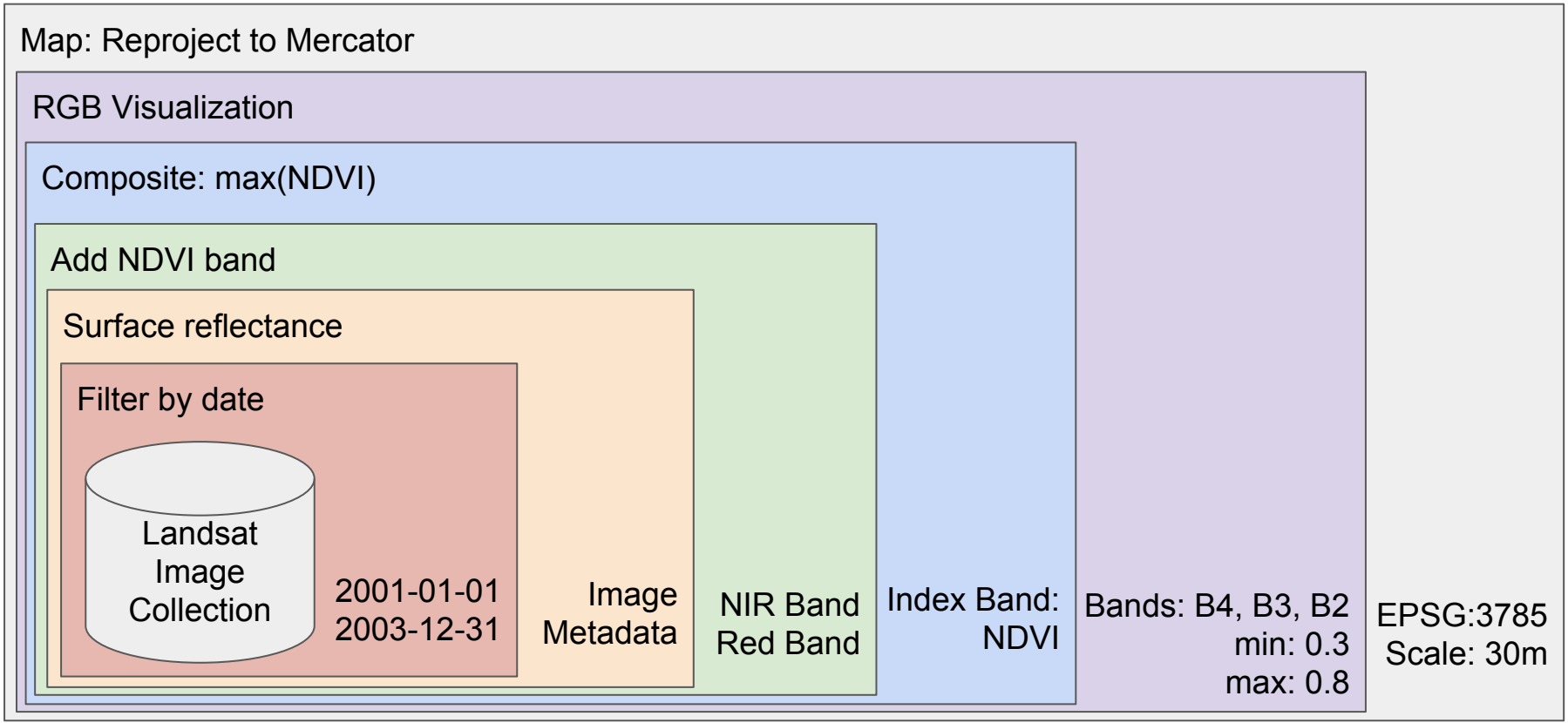

Tiling

Images are tiled during ingestion

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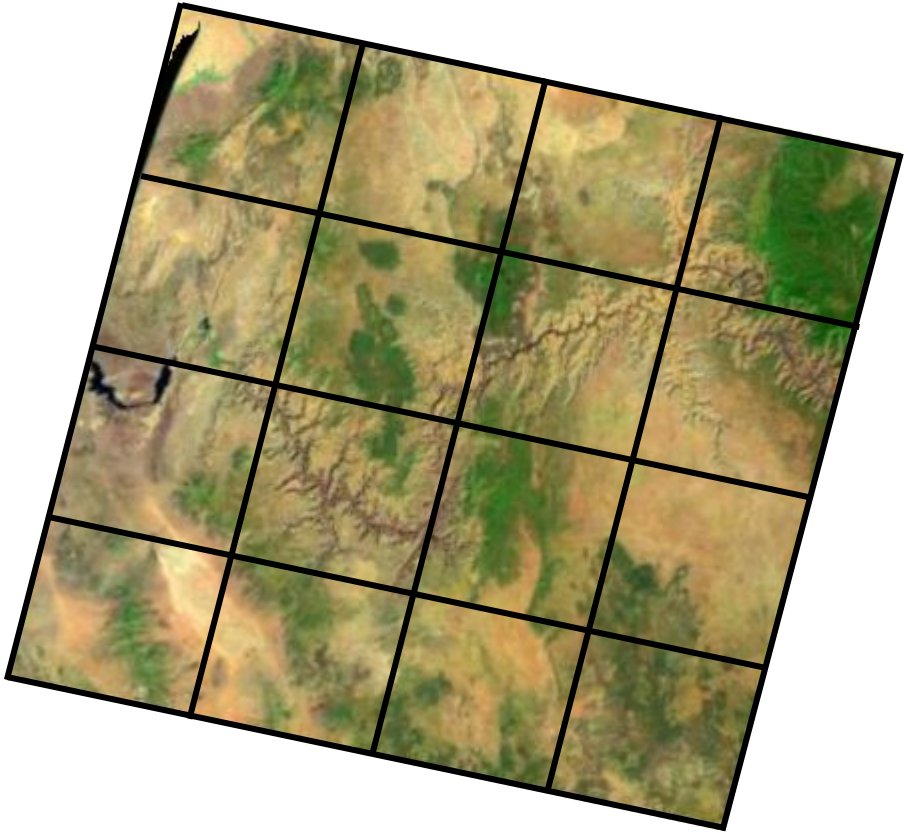
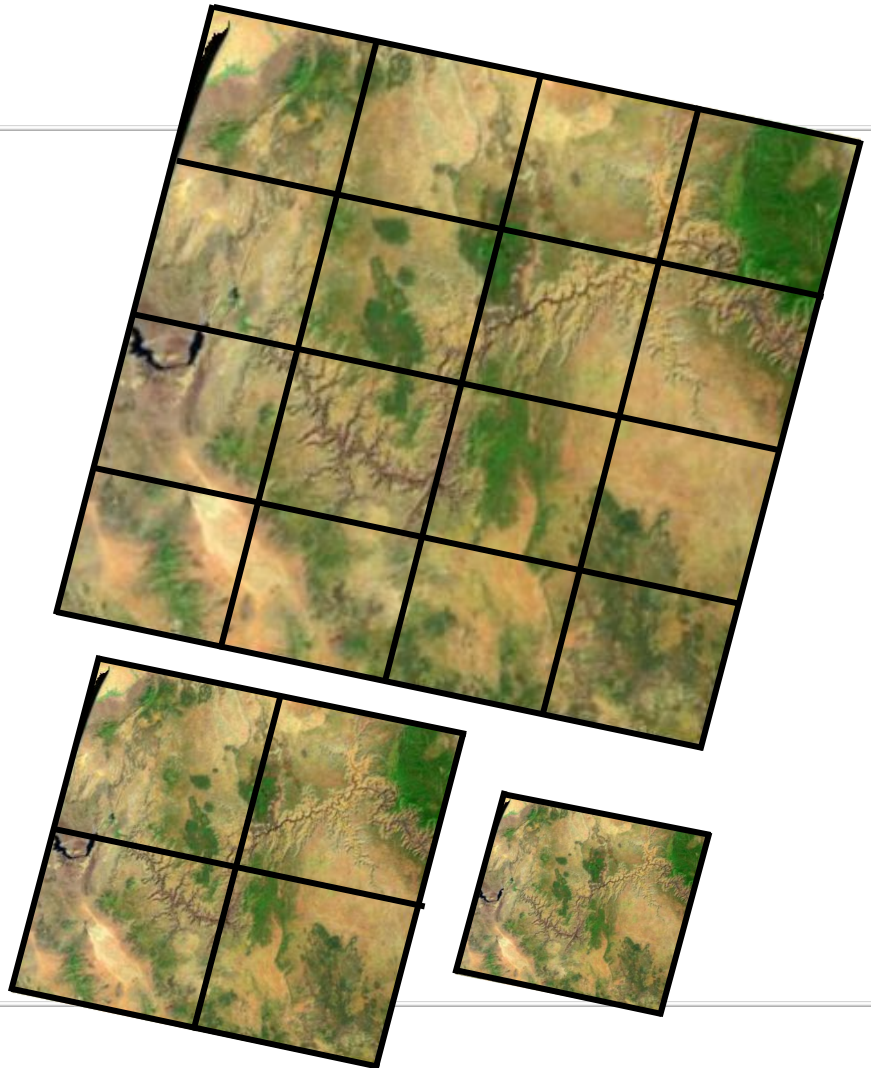


Tiling

Images are tiled during ingestion

Downsampled by averaging



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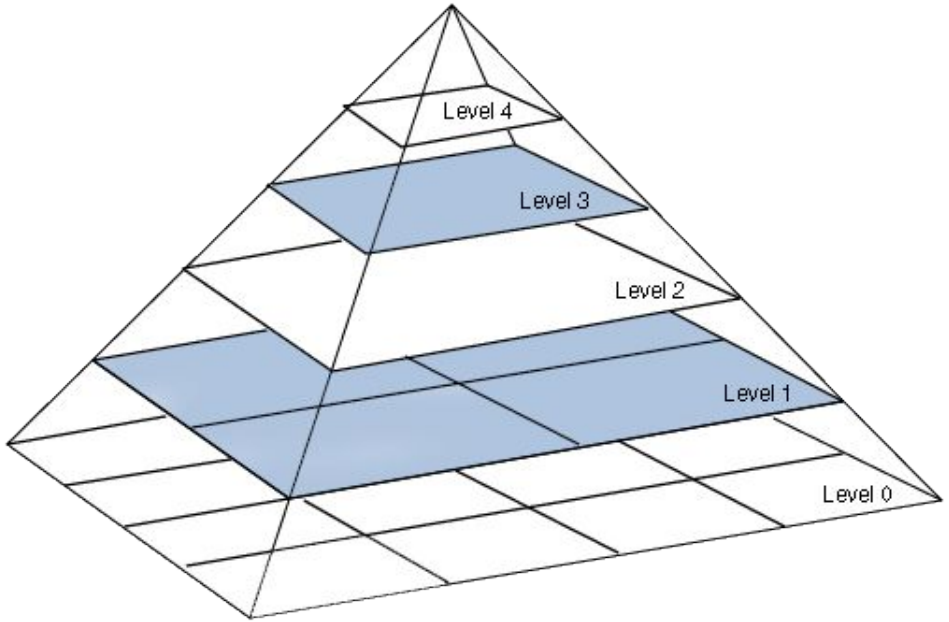

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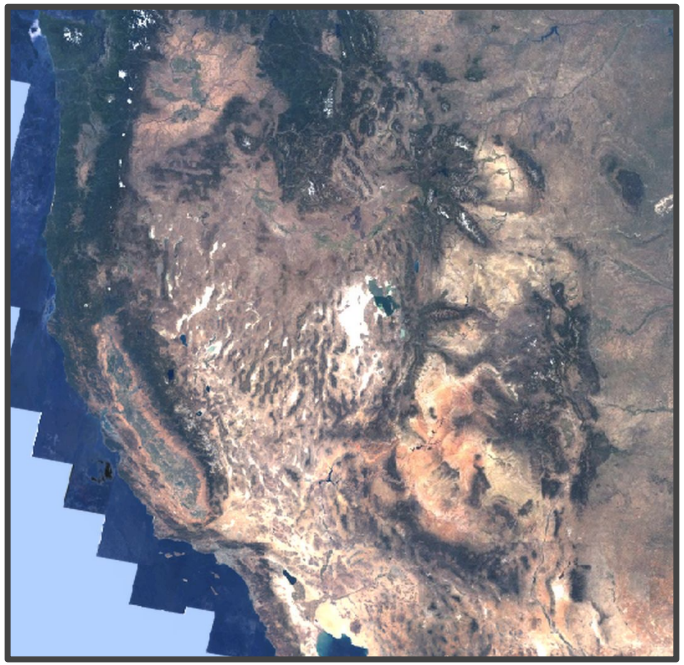
During computation



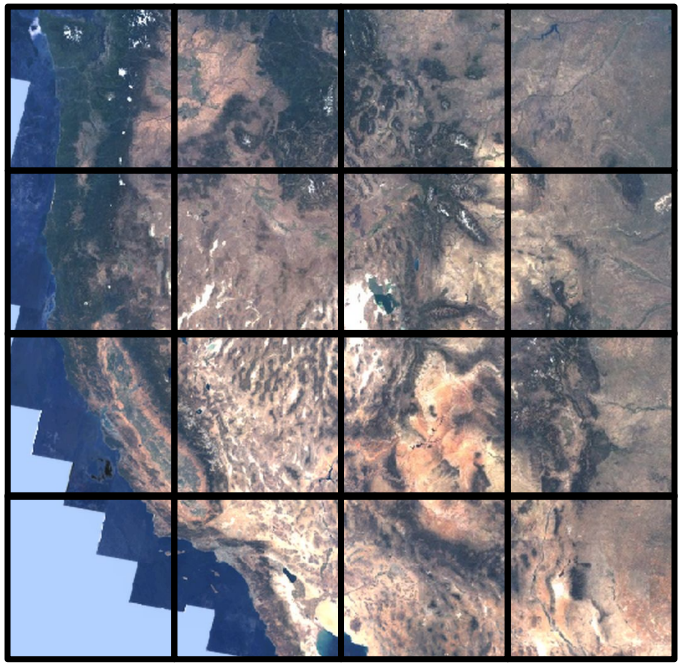
Tiling

Images are tiled during ingestion

- Downsampled by averaging

During computation

- Compute output tiles



Tiling

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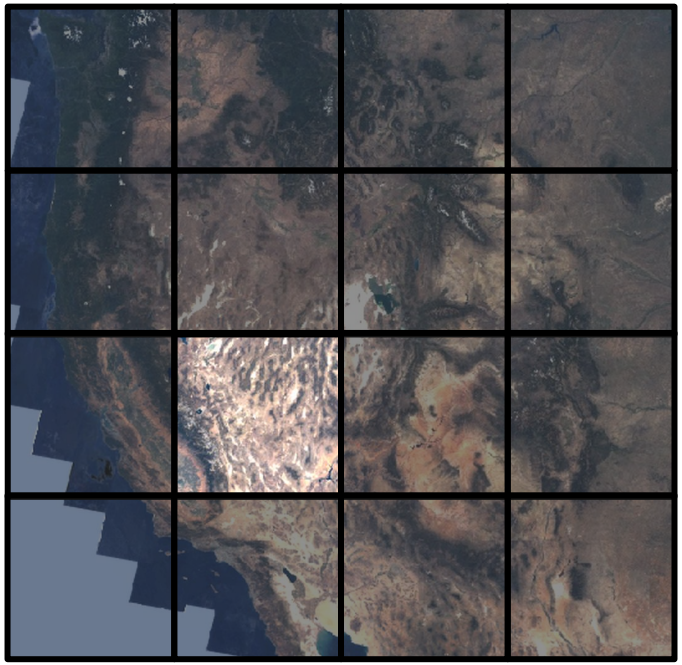
During computation

- Compute output tiles



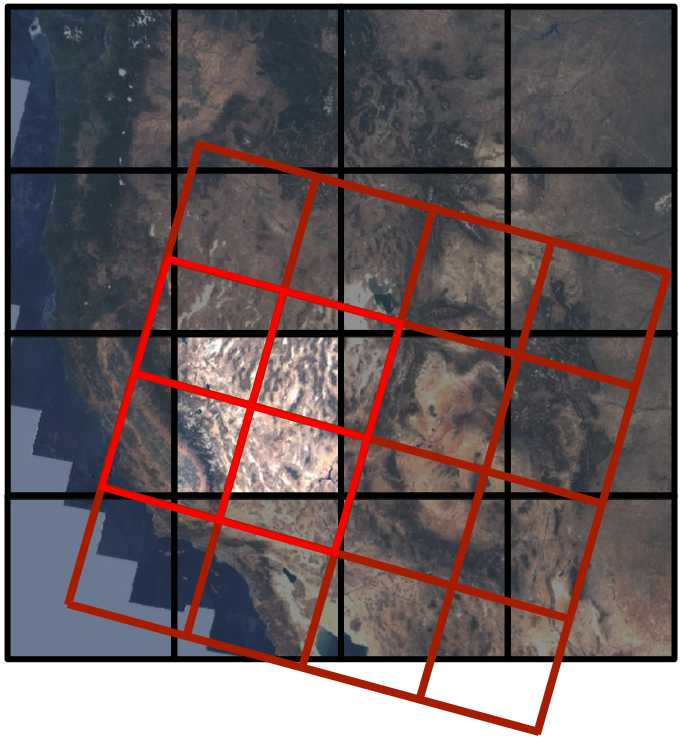
Tiling

Images are tiled during ingestion

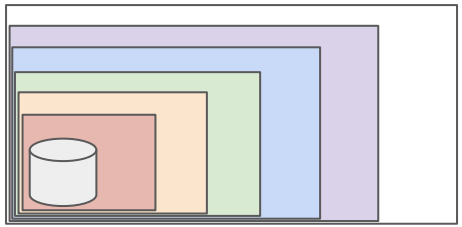
- Downsampled by averaging

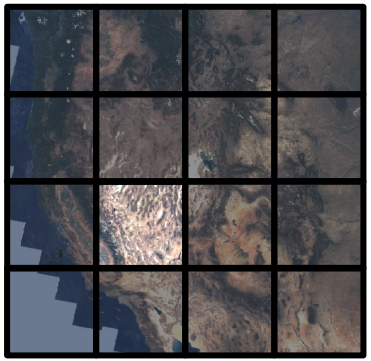
During computation

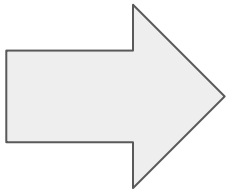
- Compute output tiles
- Find intersecting source tiles
- Reproject into the output projection

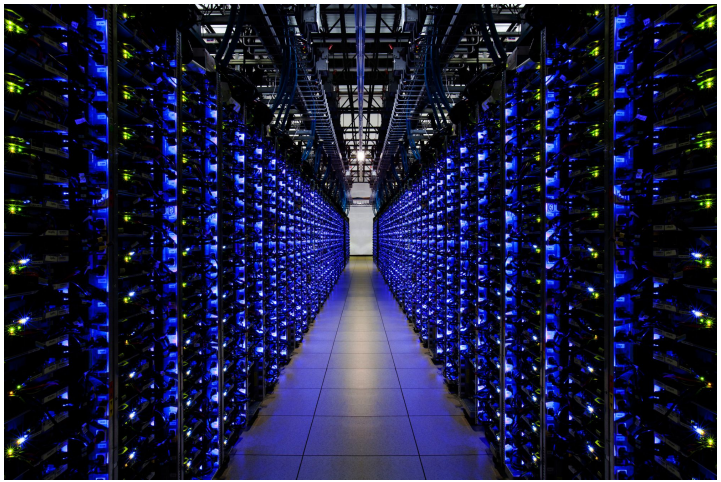


Running a Computation









Scripts: goo.gl/bno3Qo