Earth Engine 101

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Google Earth Engine

Overview

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**

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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

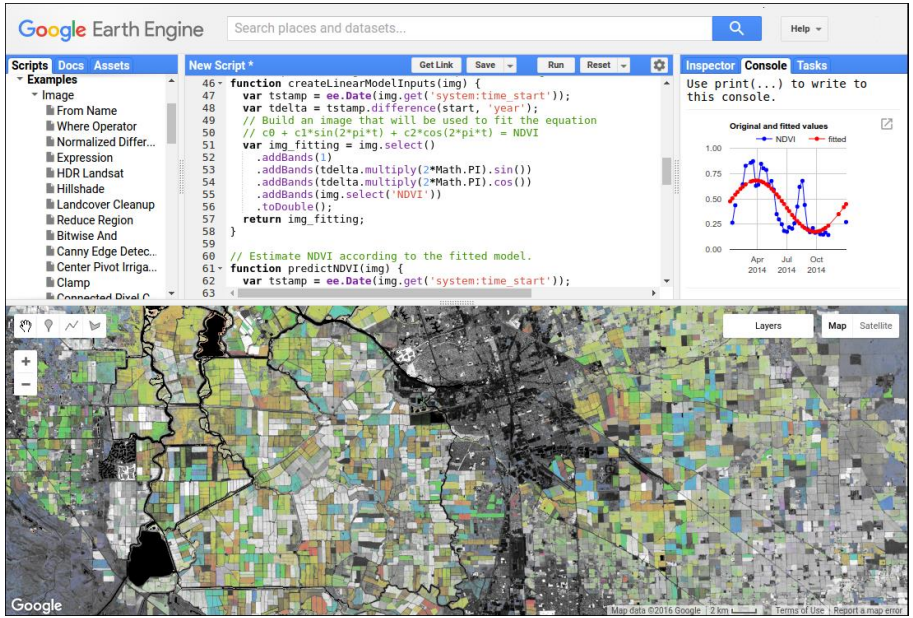
Surface Temperature, etc.

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*

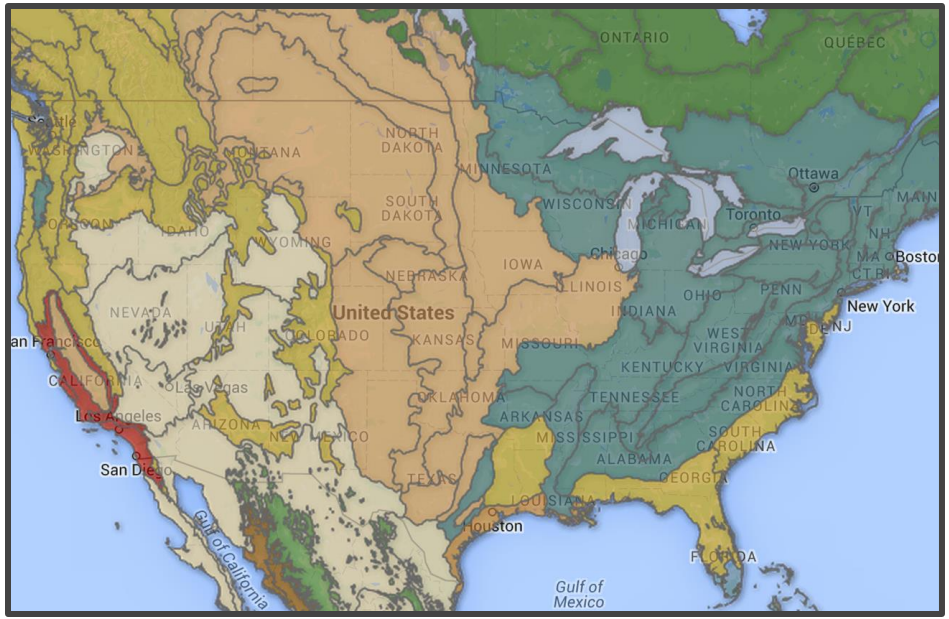


Concepts

Data Models

Feature

- Line / Point / Polygon
- List of Properties



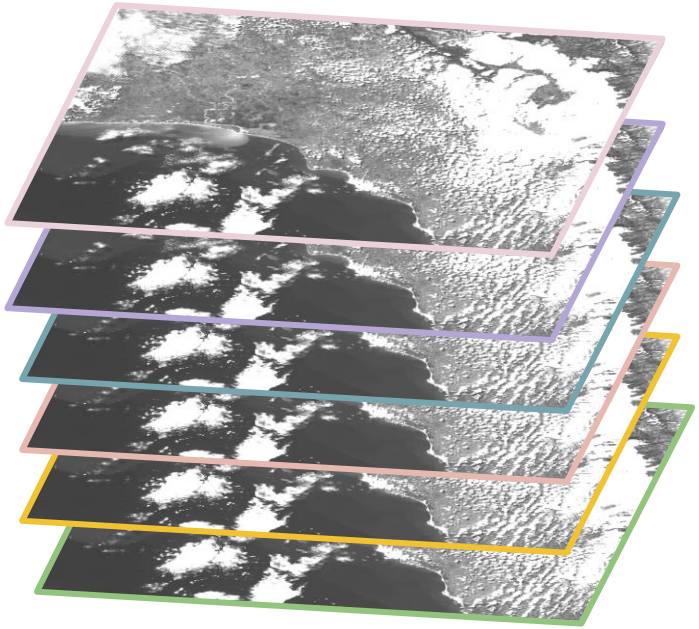
TNC Ecoregions

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

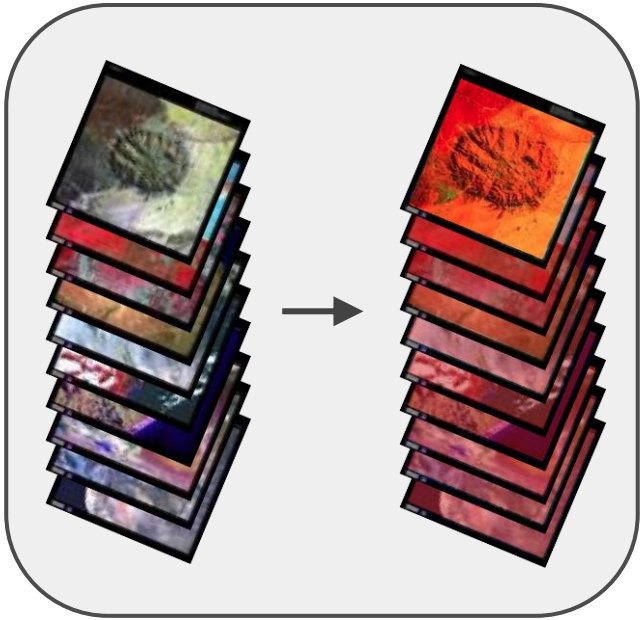
Collection

- 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

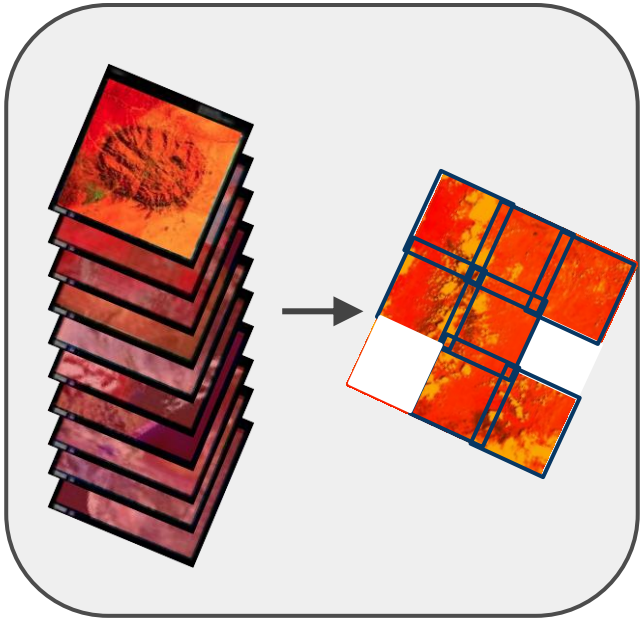
Reduce

Apply a function to everything in a collection

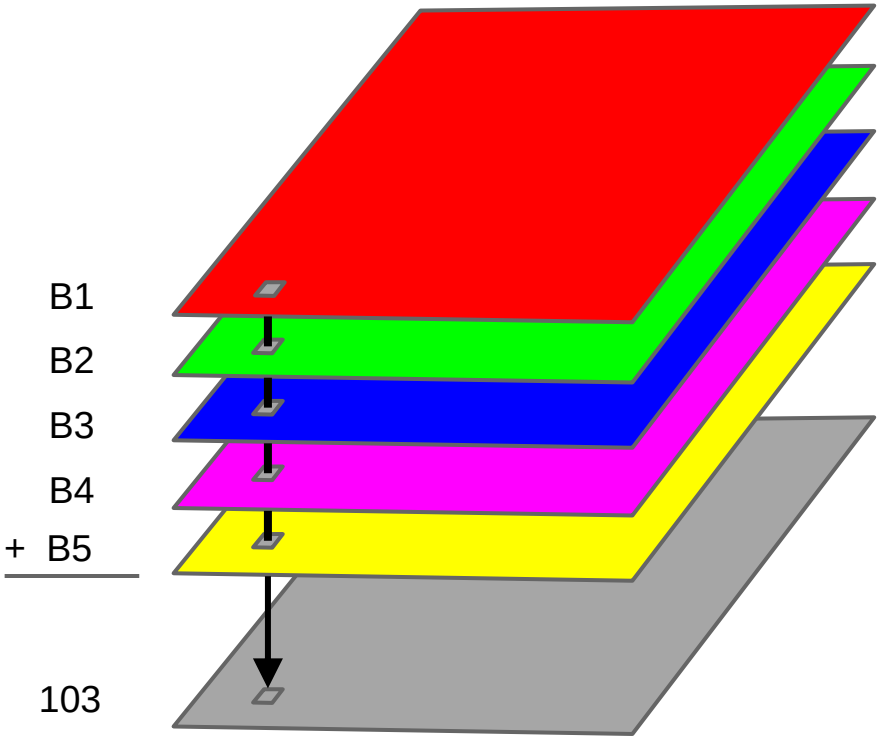
"Aggregation"

Examples

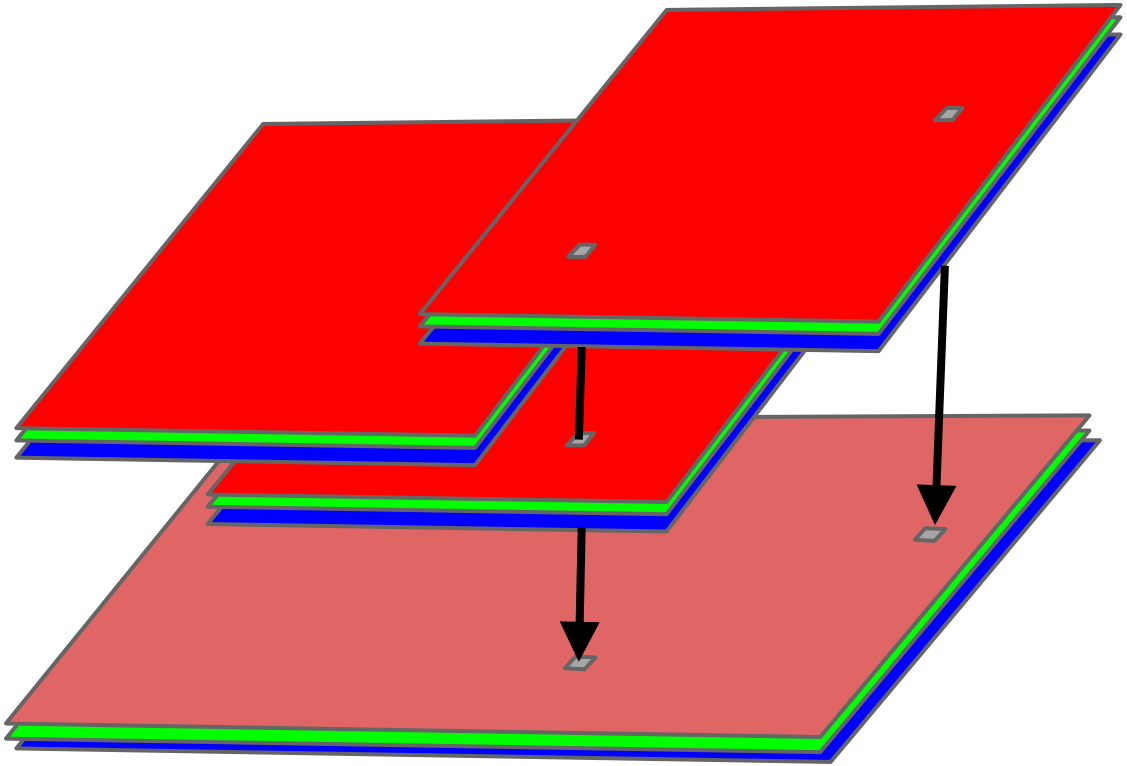
- Summed area over all features
- Median-pixel composite
- Train a classifier



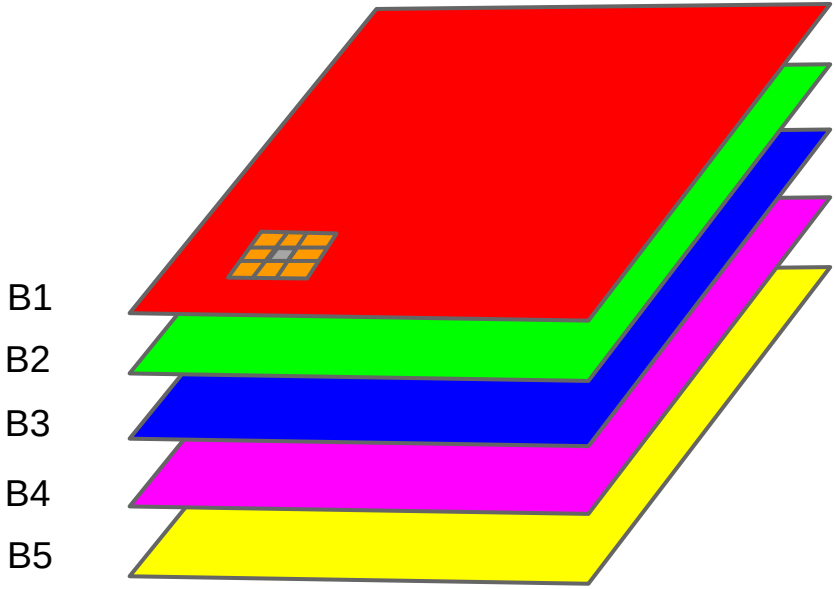
Reduce Bands



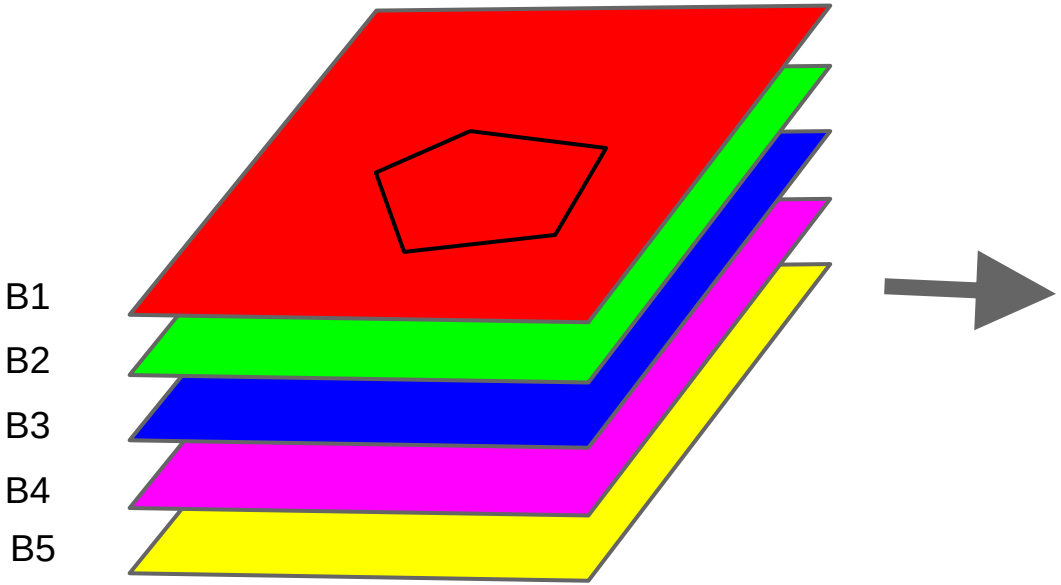
Reduce Image Collection



Reduce Neighborhood

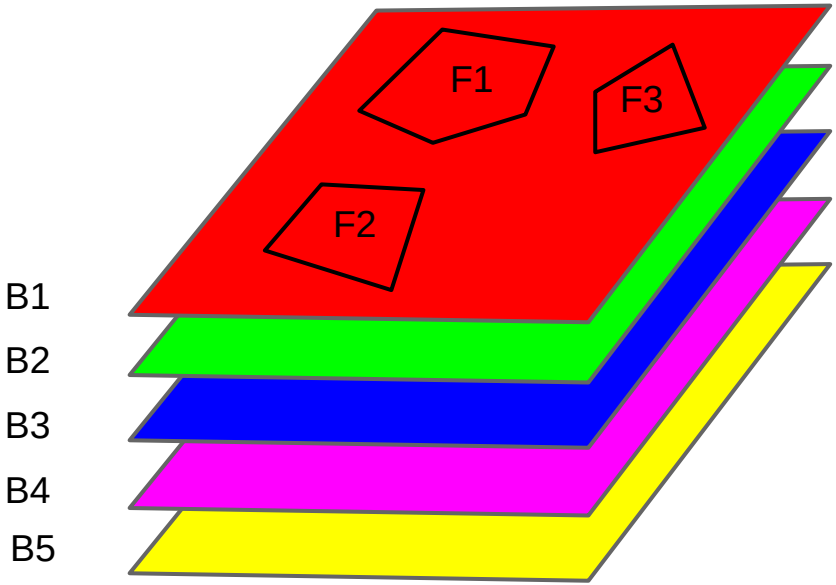


Reduce Region



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

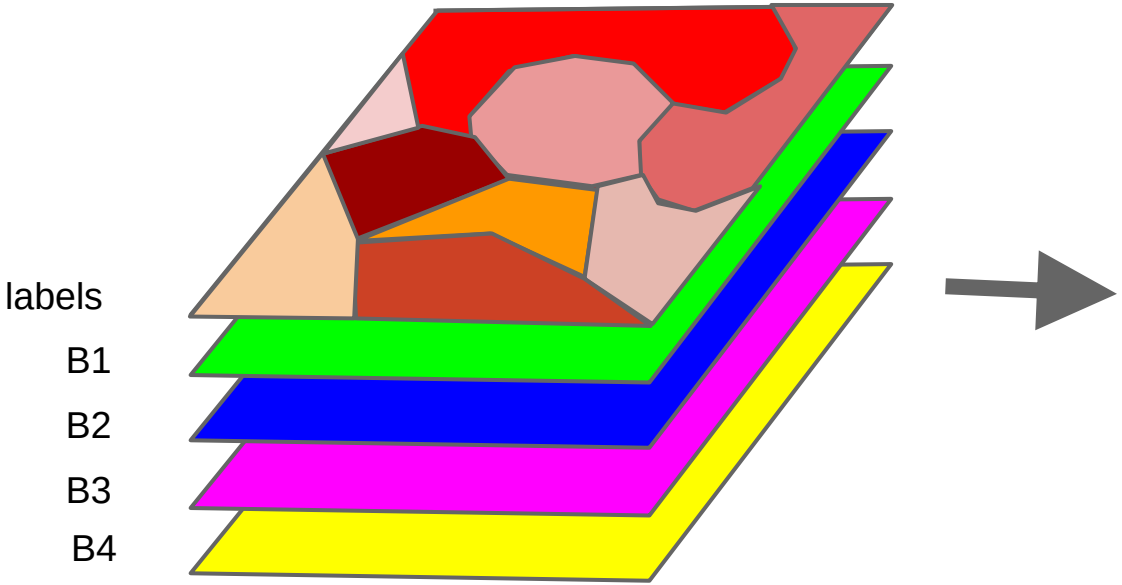
Reduce Regions



FeatureCollection

	B1	B2	B3	B4	B5
F1					
F2					
F3					

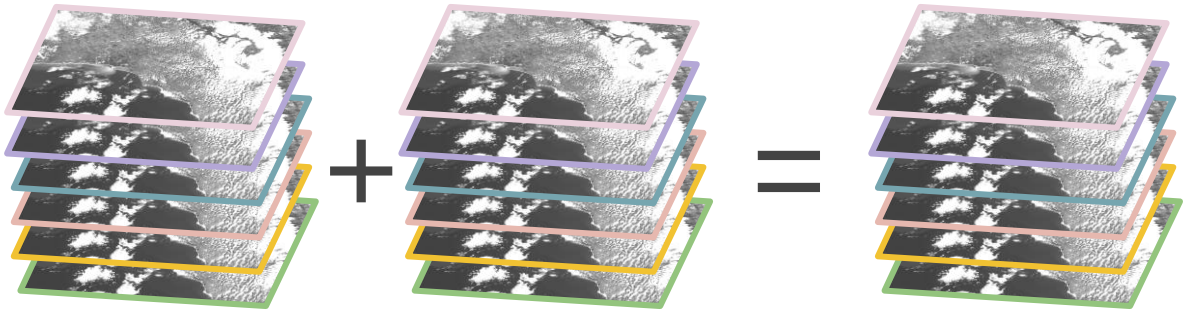
Reduce To Vectors



FeatureCollection

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

Band Math



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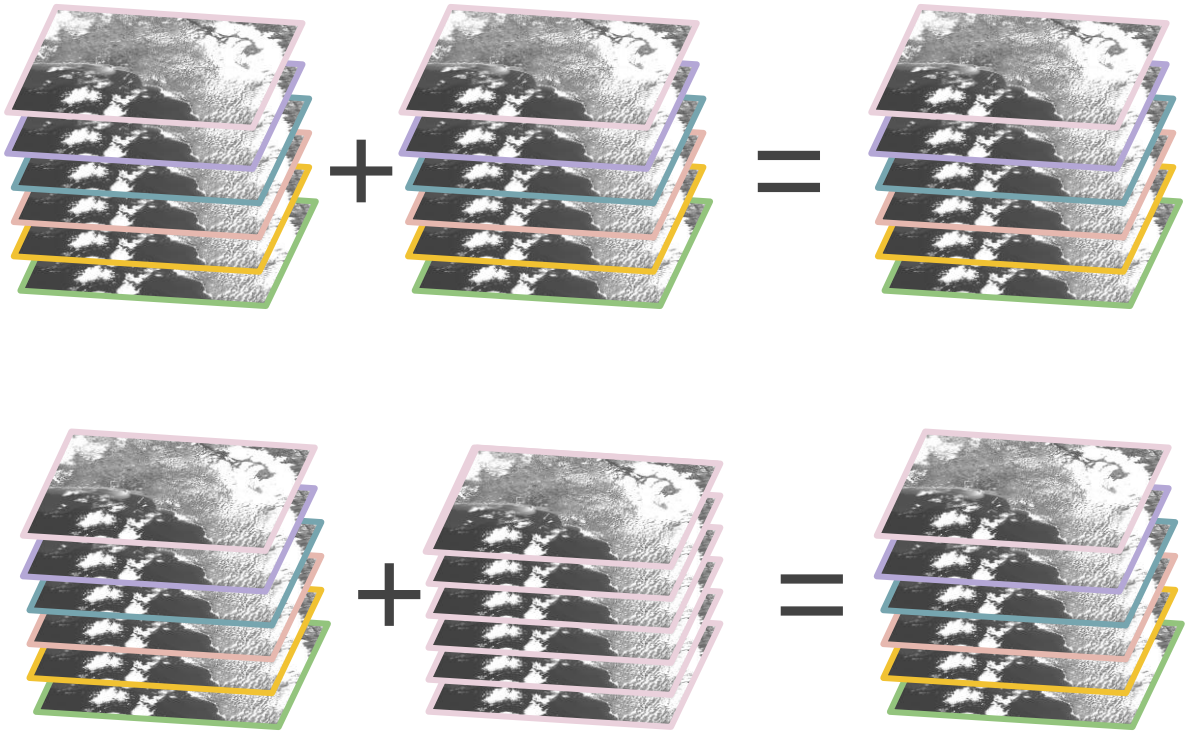
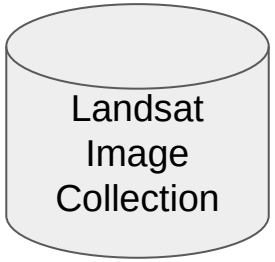


A Computation Example



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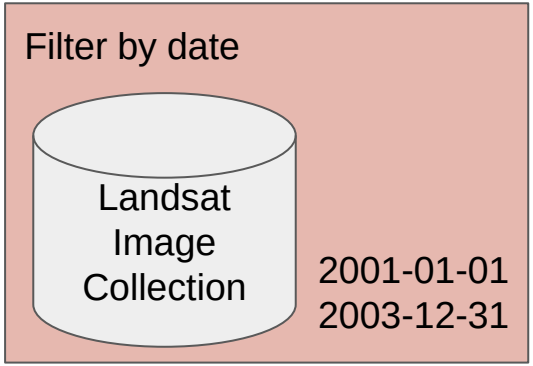

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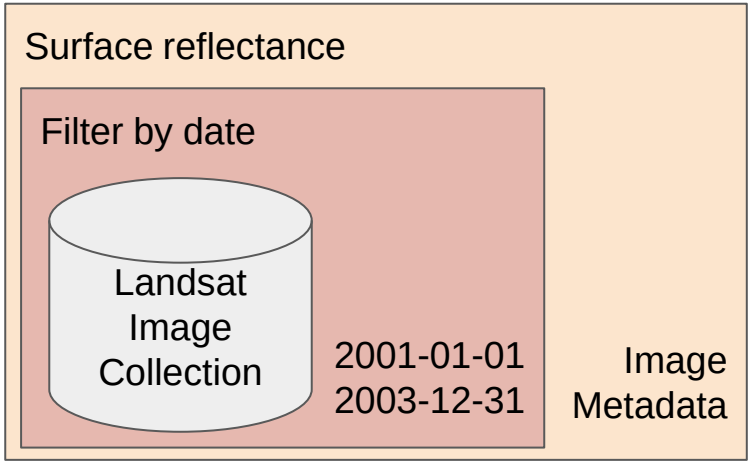

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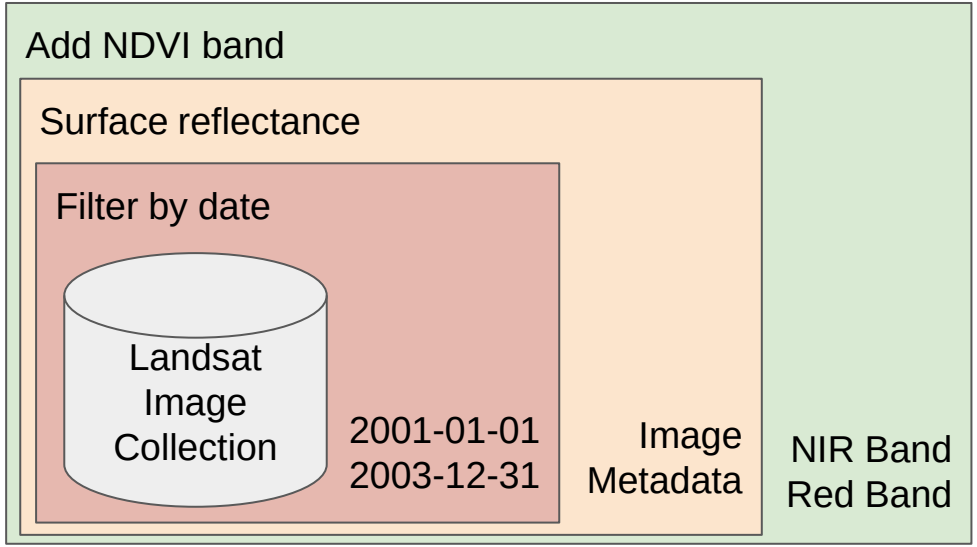

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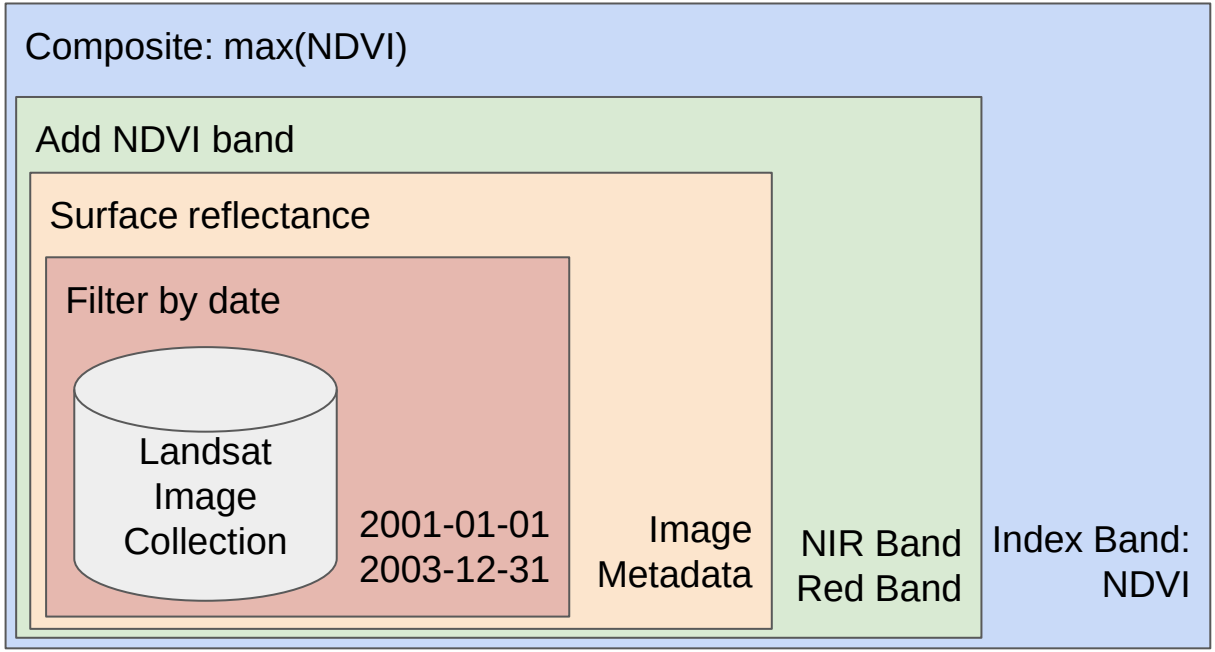

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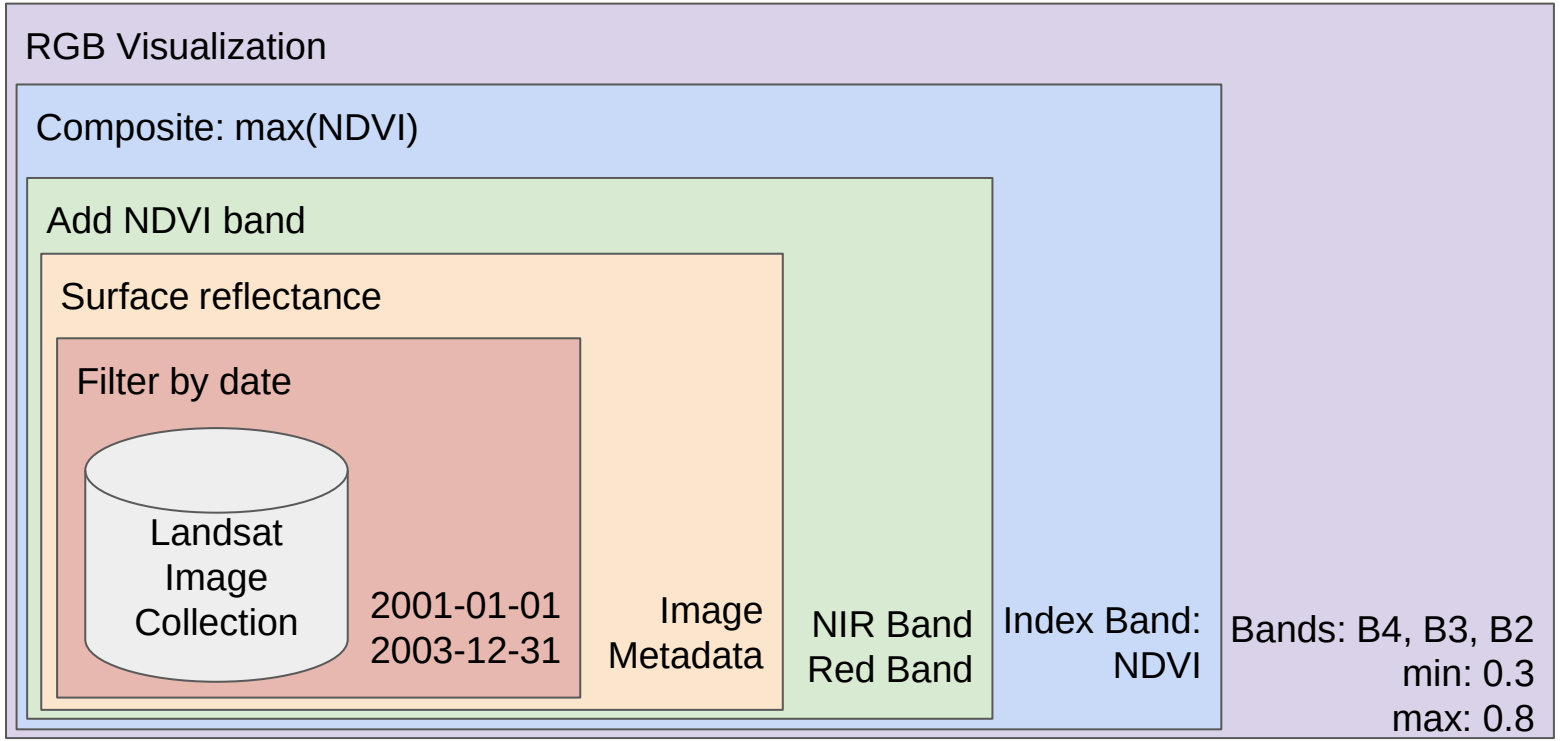

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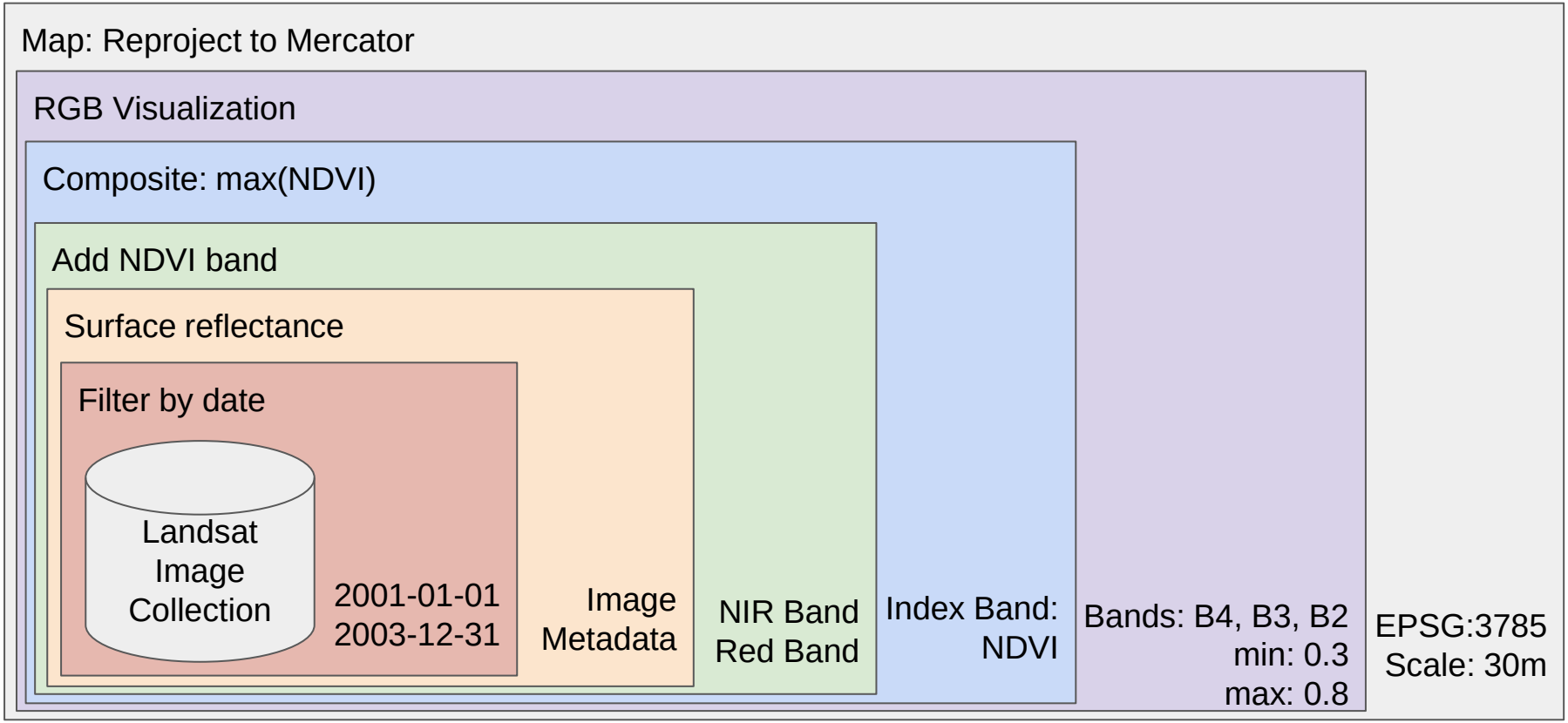

Tiling

Images are tiled during ingestion

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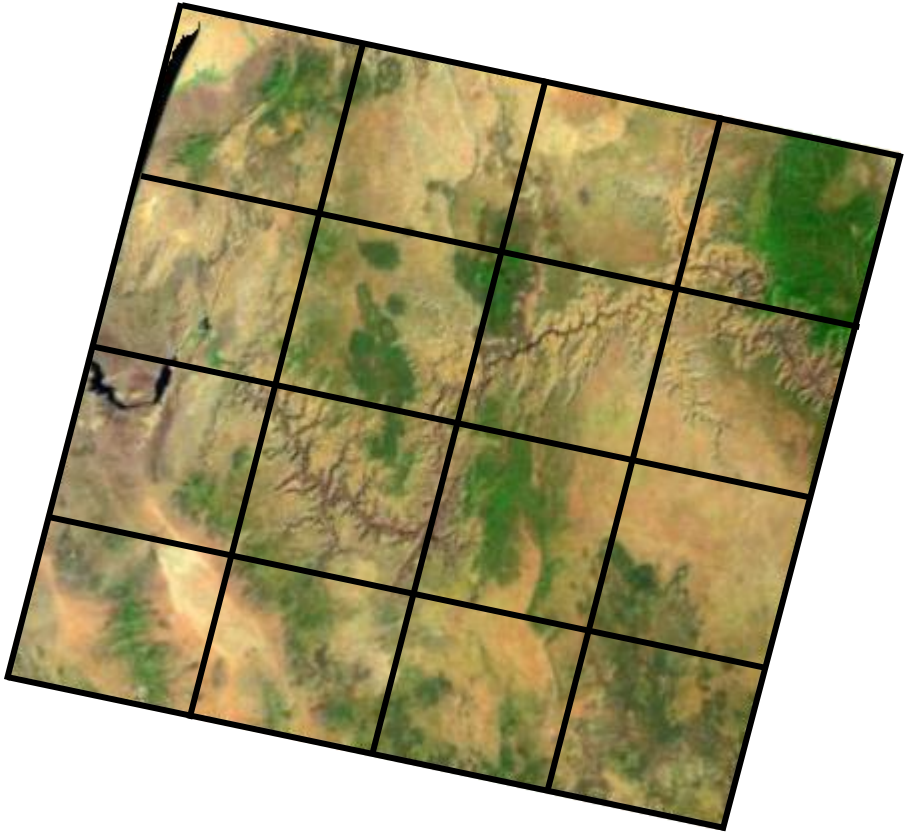

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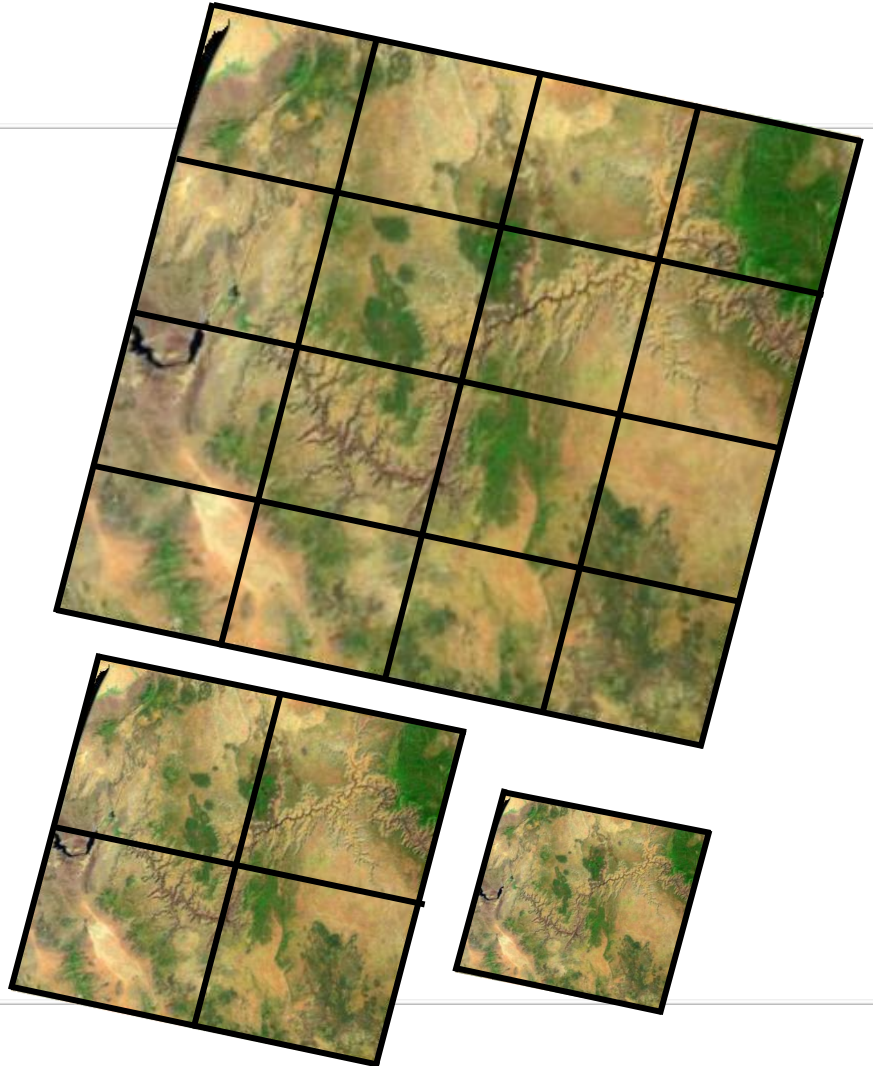
Downsampled by averaging



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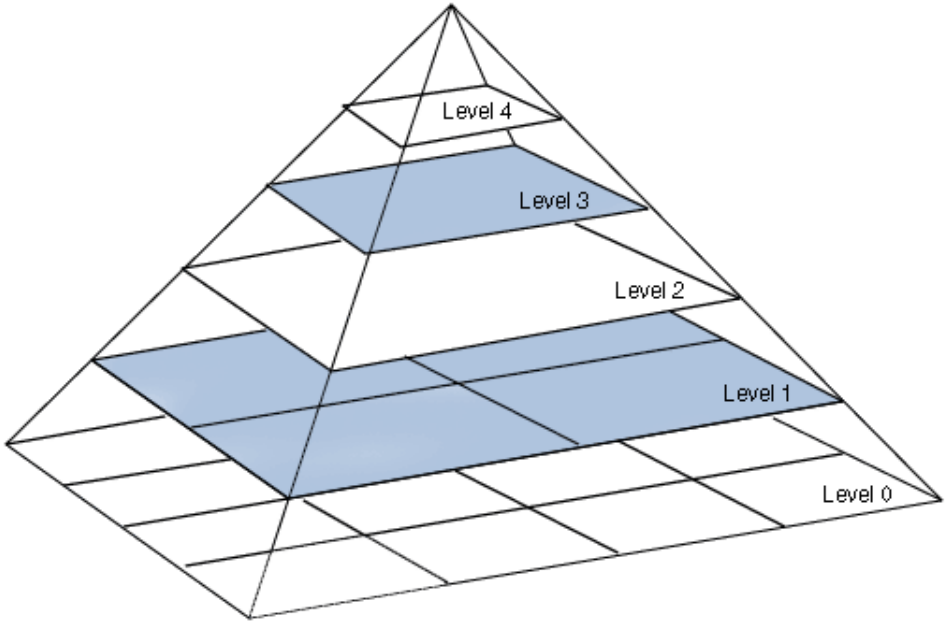

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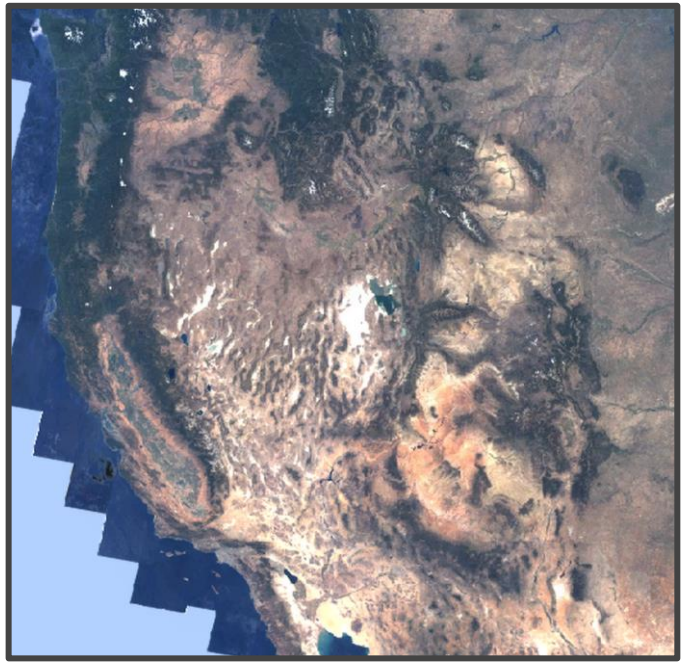
During computation



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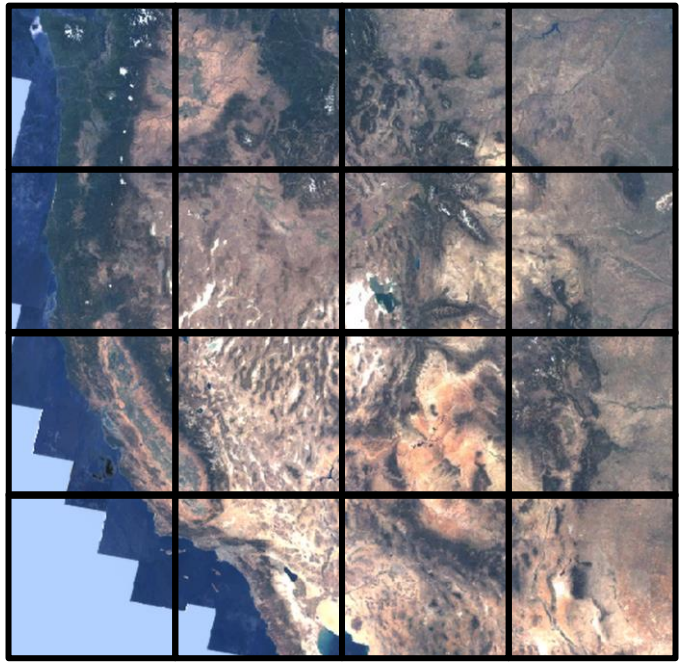
Downsampled by averaging

During computation

Compute output tiles



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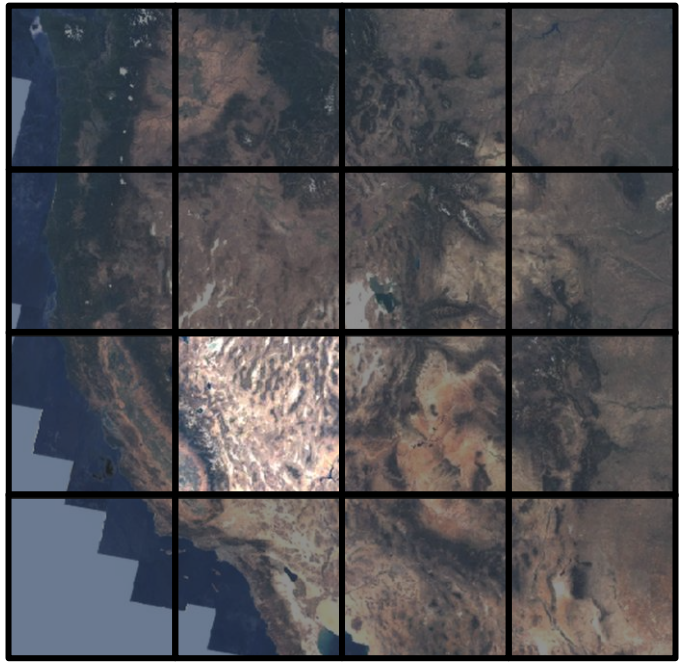
During computation

Compute output tiles



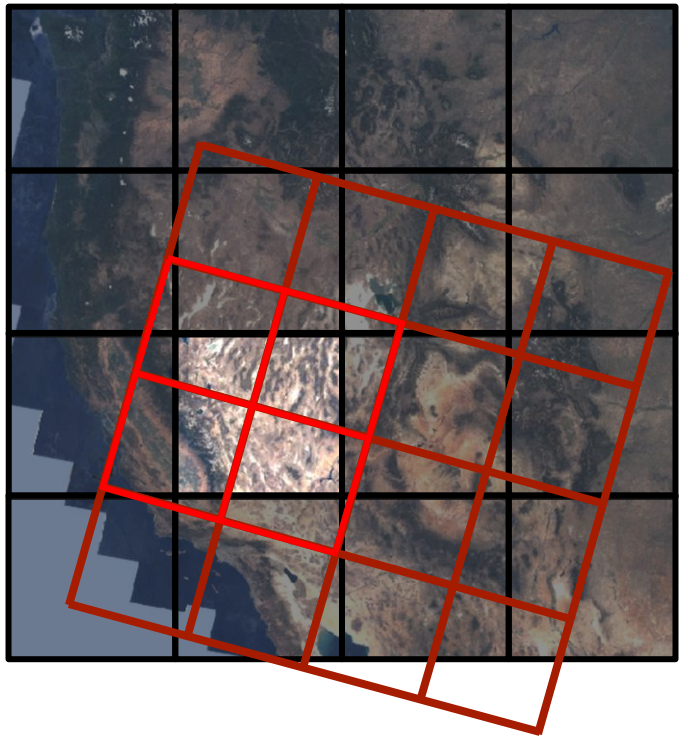
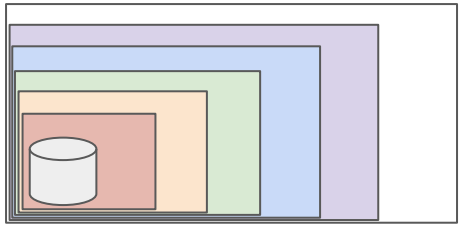
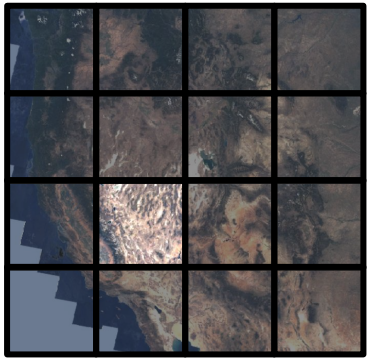
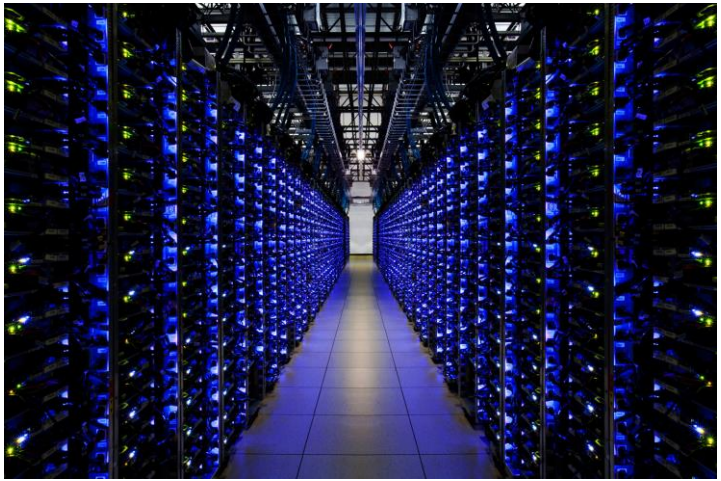
Tiling

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