Deltares
Enabling Delta Life

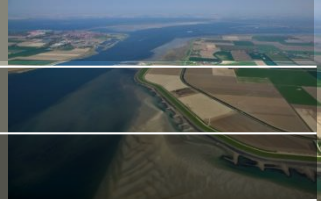
Introduction to Google Earth Engine and Applications for Water Quality

Or: can we really teach you Earth Engine in 90 minutes?

15 november 2018

Arjen Haag

Google Earth Engine (GEE)



Google Earth ≠ **Earth Engine**

3-D Globe Visualization

Geospatial Analysis

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Google Earth Engine (GEE)

https://earthengine.google.com/

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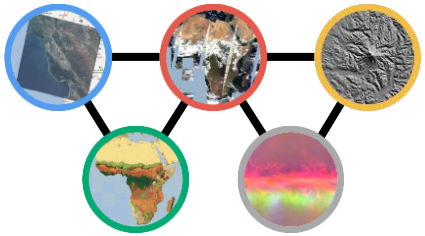
GEE Quick Overview



Geospatial Datasets

(> 20 Petabyte)

python

JavaScript

API

Code editor

Google Earth Engine

Code repository

git

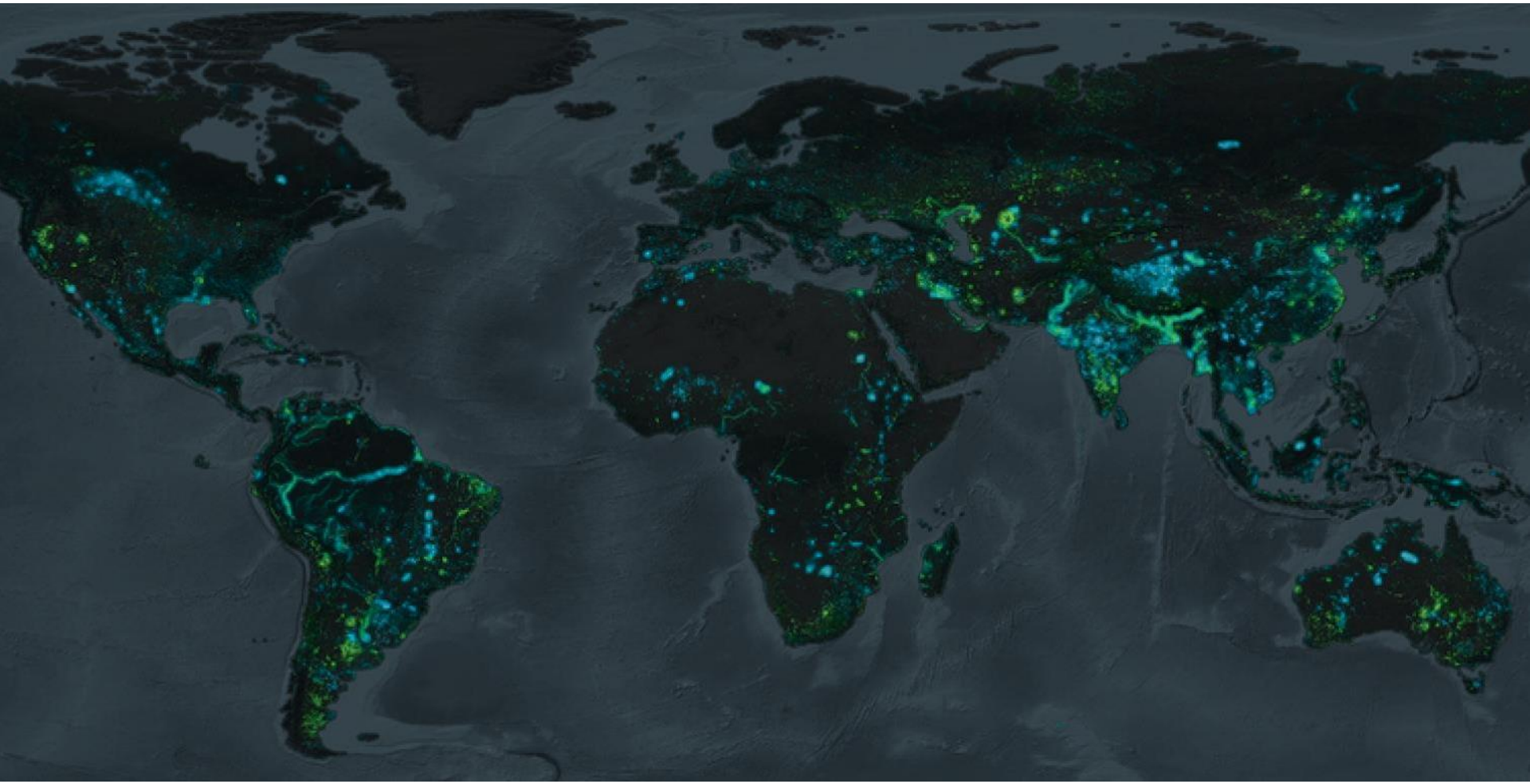
GitHub

Personal storage

(250 Gb)

Cloud storage and computing

GEE example applications (1)



http://aqua-monitor.deltares.nl/

https://www.deltares.nl/en/software/aqua-monitor/

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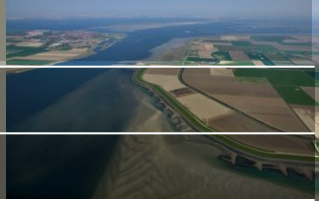
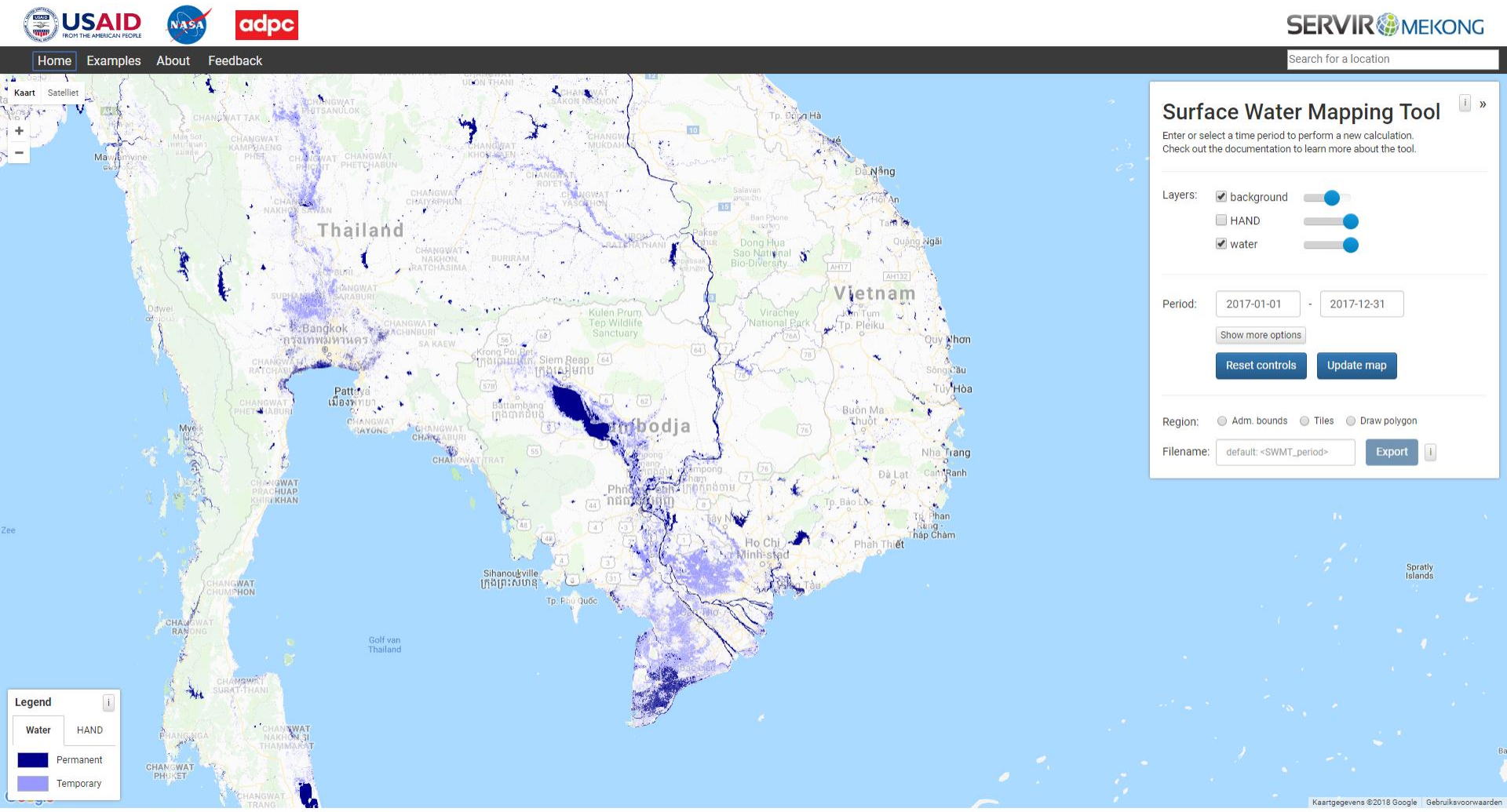
GEE example applications (2)





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Spatial Informatics Group
SEI STOCKHOLM ENVIRONMENT INSTITUTE
Google Earth Engine

https://servir.adpc.net/tools/surface-water-mapping-tool

http://surface-water-servir.adpc.net/

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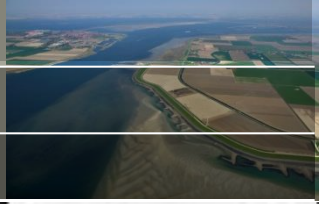
GEE example applications (3)



https://www.globalforestwatch.org/

https://earthengine.google.com/case_studies/

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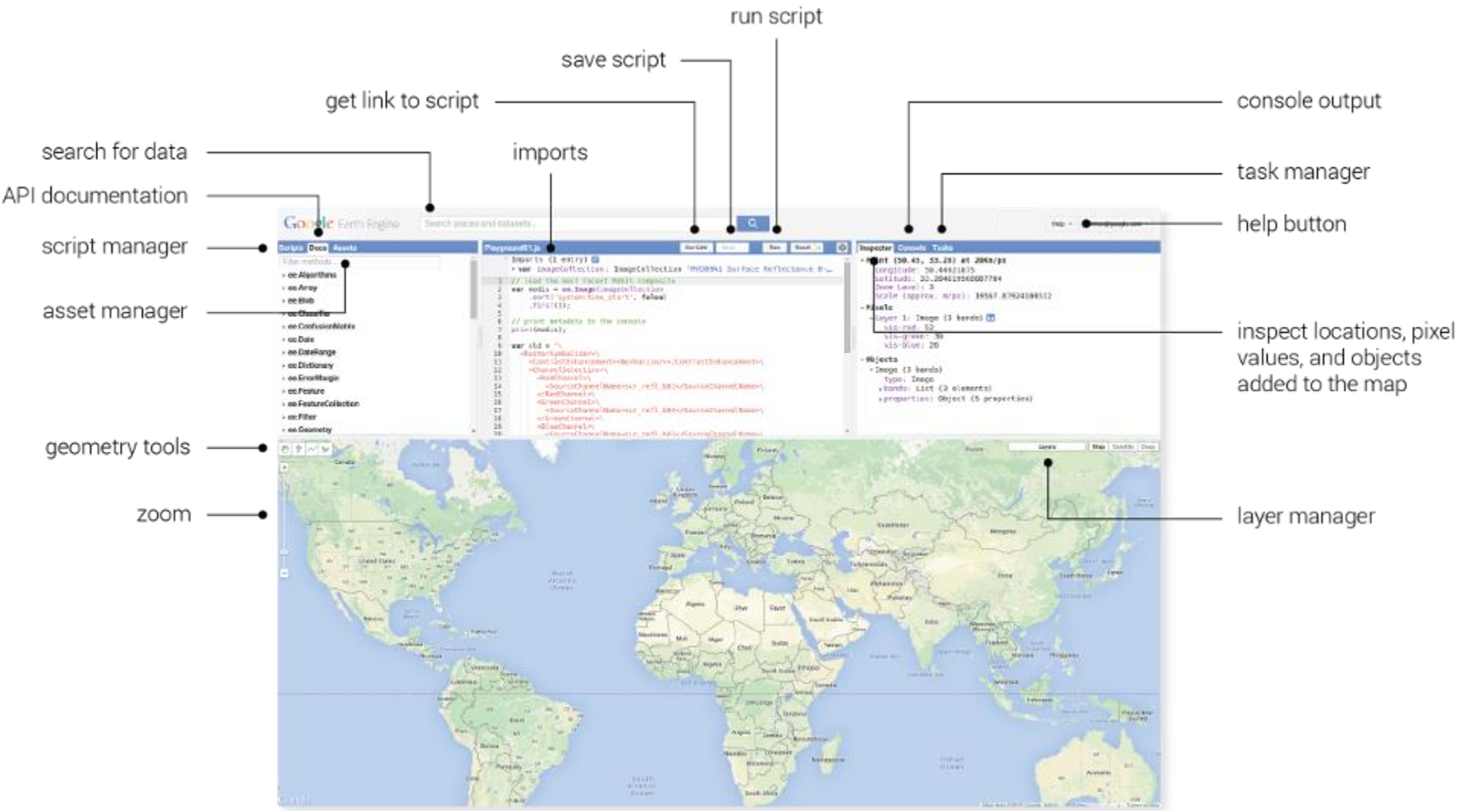
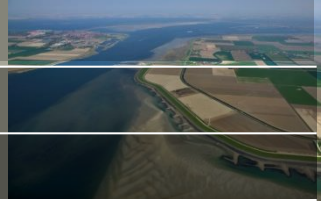
GEE Code Editor



GEE objects



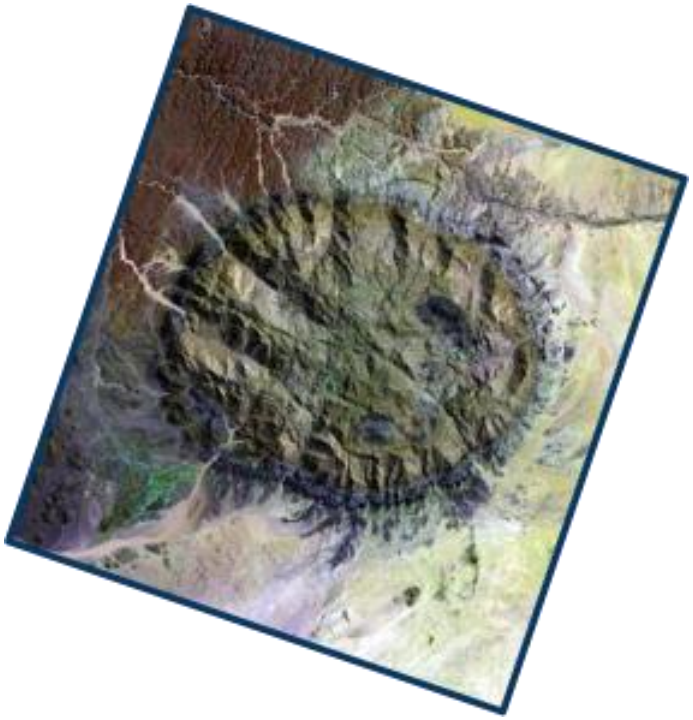
Most important GEE objects:

- Image: a raster object with a certain timestamp and spatial extent
- ImageCollection: a collection of Images with different timestamps and/or spatial extents
- Feature: a vector object with multiple geometries and properties
- FeatureCollection: a collection of Features (“shapefile”)

- List: a list containing any number of different GEE objects
- Array: a list containing numbers only (multiple dimensions possible)
- …

GEE processing

Get a single Image



Each image has its own native projection and resolution. An image can contain multiple bands (single band: 2D raster, multiple bands: 3D raster).

https://developers.google.com/earth-engine/image_overview

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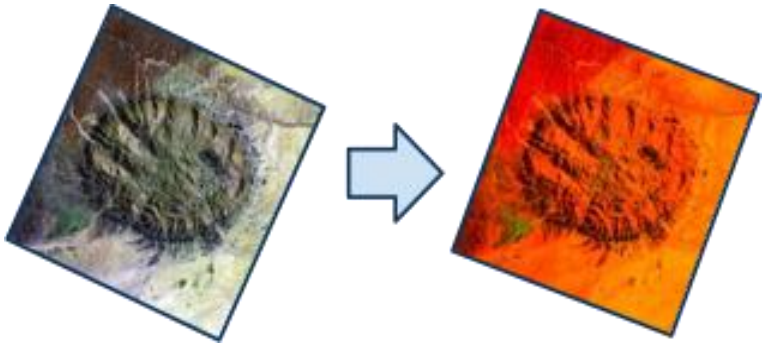
GEE processing

Get a single Image

Apply an algorithm to an image



Use available library functions or write your own. Can be applied on a single band or multiple bands at once.

https://developers.google.com/earth-engine/image_overview

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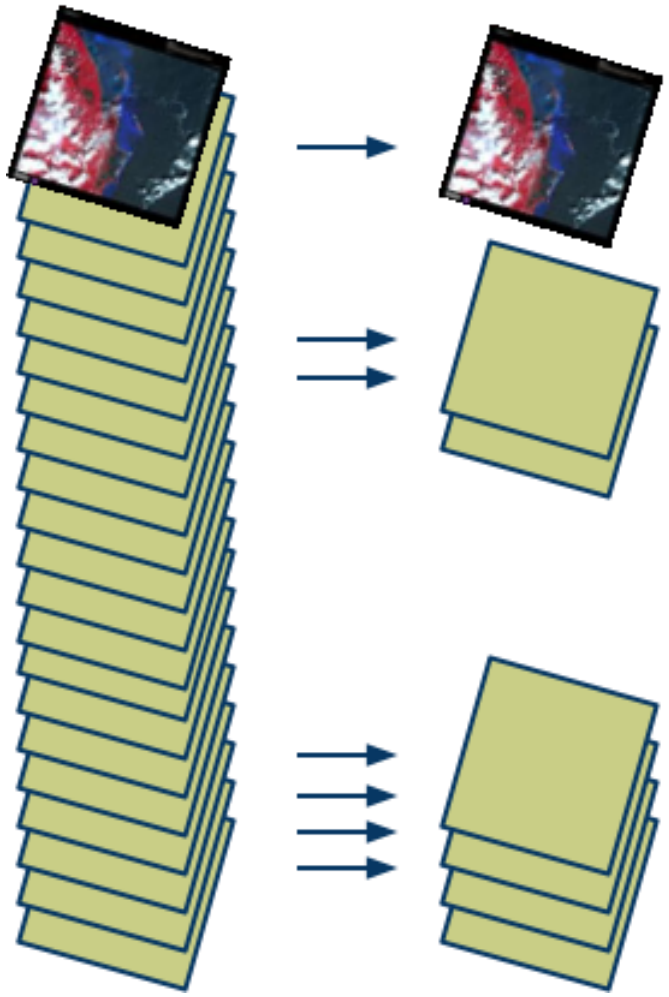
GEE processing

Get a single Image

Apply an algorithm to an image

Filter a collection



Filter on time, space, metadata, etc.

https://developers.google.com/earth-engine/ic_filtering

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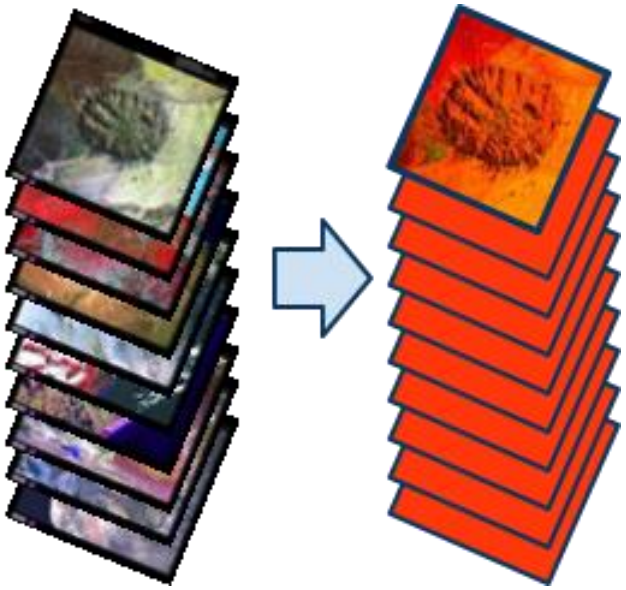
GEE processing

Get a single Image

Apply an algorithm to an image

Filter a collection

Map an algorithm over a collection



Apply a function/algorithm on each image within a collection (N → N)

https://developers.google.com/earth-engine/ic_mapping

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GEE processing

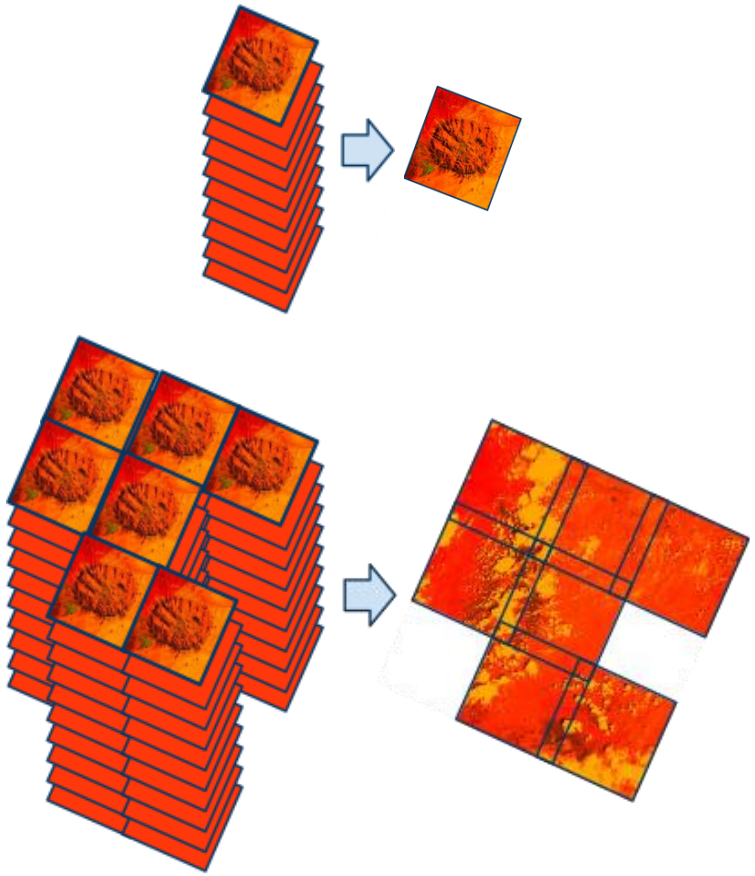
Get a single Image

Apply an algorithm to an image

Filter a collection

Map an algorithm over a collection

Reduce a collection



Use a function to reduce a collection of images to a single value per pixel
(N → 1, for the same spatial extent, or N → M, for different spatial extents)

https://developers.google.com/earth-engine/ic_reducing

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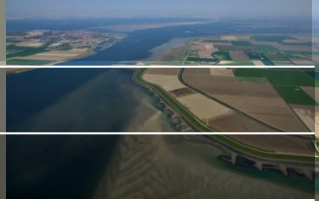
Wrap-up



Google Earth Engine is a cloud-based platform for performing spatial analyses on large datasets, hosting available open data, allowing users to easily share code and applications and which is free to use for research purposes.

Websites overview:

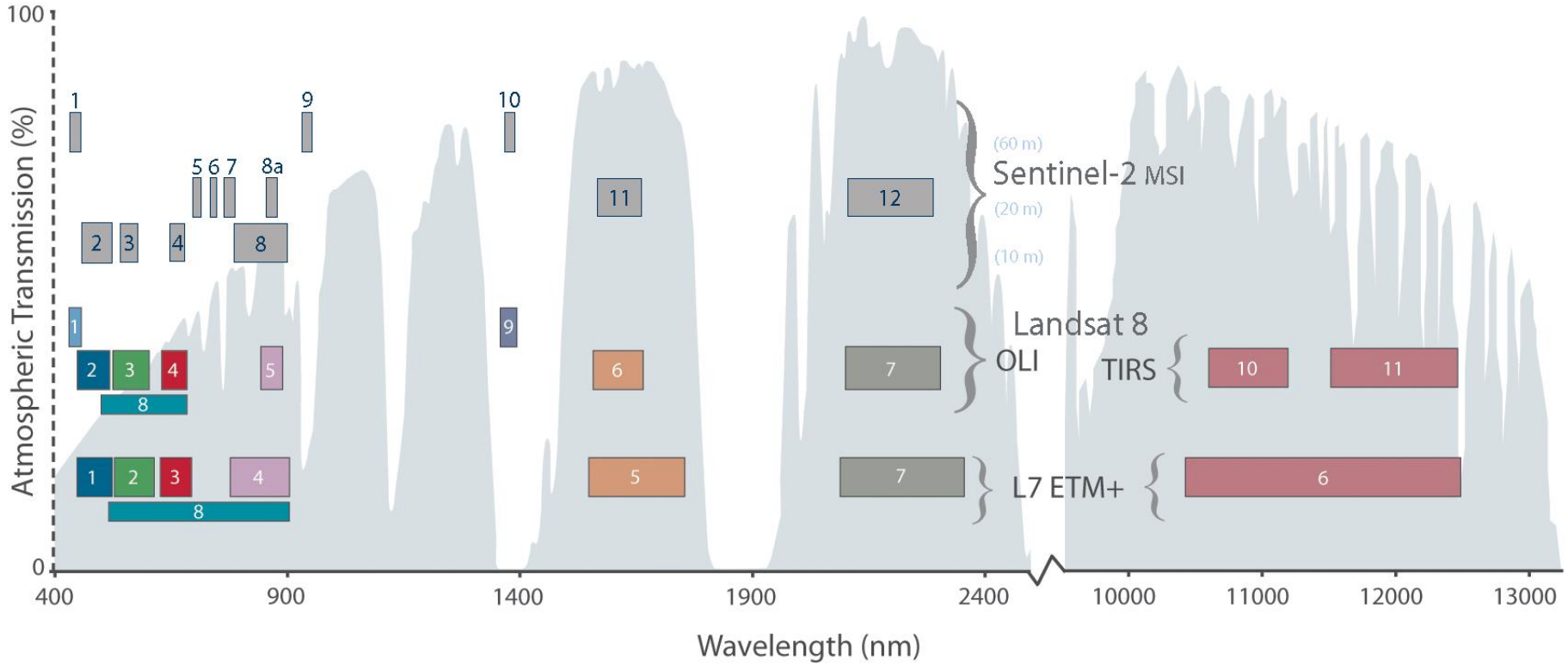
- General website: https://earthengine.google.com/
- Documentation: https://developers.google.com/earth-engine/
- Data Catalog: https://developers.google.com/earth-engine/datasets/
- Code Editor: https://code.earthengine.google.com/
- Developers Forum: https://groups.google.com/forum/#!forum/google-earth-engine-developers

Additional tips & tricks:

- Lazy evaluation (https://en.wikipedia.org/wiki/Lazy_evaluation)
- Client vs. Server (https://developers.google.com/earth-engine/client_server)
  - Do NOT use regular ‘for-loops’ !
  - Be careful with regular ‘if-statements’ !
- More Earth Engine concepts: https://developers.google.com/earth-engine/concepts_overview

Questions?

Extra: multispectral satellite data



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