



Open Cloud-Native Geospatial Toolboxes:

STAC & MLHub Earth

Hamed Alemohammad

Lead Geospatial Data Scientist



2nd GEO - AWS Earth Observation Cloud Credits Programme Webinar
March 19th, 2019

Vision & Mission

- ▶ Open Geospatial Data for Positive Global Impact
- ▶ Connecting people globally to Earth Imagery, geospatial data, tools and knowledge to meet the world's most critical challenges





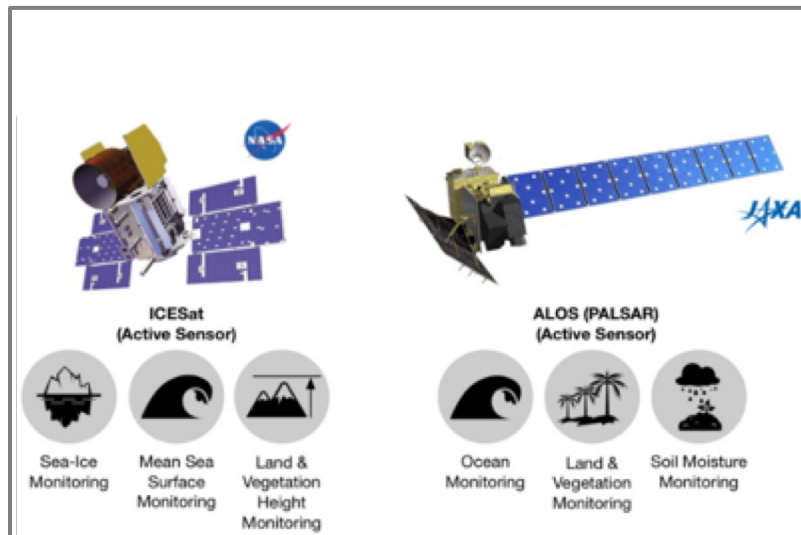
What we do

Technology Platform



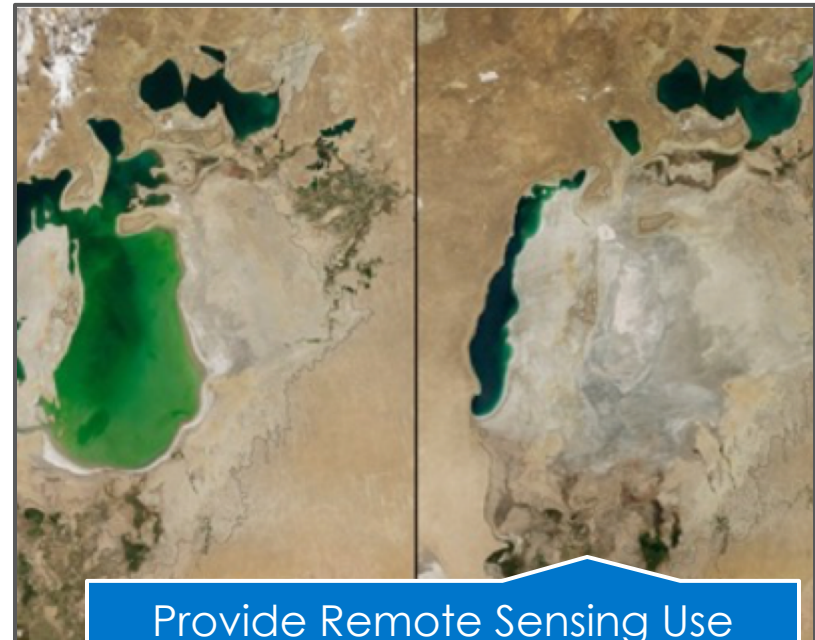
Provide Open Access to Earth
Imagery & Tools

Community Development



Provide Education on Geospatial
Data & Tools

Consultancy



Provide Remote Sensing Use
Case Analytical Support &
Advise of Procurement of
Commercial Products



Open Geospatial Data Platform

app.radiant.earth

The screenshot shows the Radiant Earth app interface. On the left, there is a login/sign up overlay with social media icons (Facebook, Instagram, Google+, Twitter) and input fields for email and password. The main area displays a map of the Amazon region with NDVI and False Colour overlays. The map is titled "Amazonas - NDVI and False Colour". Below the map, there are sliders for adjusting the image's brightness and contrast, and a settings panel for image processing with options for RED, GREEN, and BLUE channels, and a Saturation checkbox. The map shows a large area of green forest with a yellowish-brown river network, overlaid on a map of the Amazon region with labels for various locations like Belem, Santarem, and Manaus.

doc.radiant.earth

The screenshot shows the Radiant Earth API documentation page. The page is titled "Radiant Earth API" and "Earth Imagery for Impact". It features a navigation menu on the left with sections for "INTRODUCTION", "Authentication", "CORE RESOURCES", and "Projects". The main content area is titled "Introduction" and contains text describing the platform's capabilities and how to use the API. Below the introduction, there is a section for "Authentication" and a section for "Core Resources".

INTRODUCTION

Authentication

CORE RESOURCES

Projects

- Get a list of projects
- Create a project
- Get project details
- Update a project
- Delete a project
- Get a list of the labels used on a project
- Get annotation groups belonging to a ...
- Create annotation group for this project
- Get annotation group for project
- Update annotation group
- Delete annotation group and all associ...
- Get annotations belonging to a project
- Create annotations for a project
- Delete all annotations from a project

Introduction

The Radiant Earth Foundation platform API allows developers to find, view, and analyze geospatial data in the Radiant Earth Foundation platform. It's especially useful for working with large raster datasets like satellite imagery.

Radiant Earth Foundation's platform is built with an openly licensed, open source code base. If you'd like to peek under the hood, make a request, or become a contributor, see the project on GitHub.

Authentication

Our API identifies applications and users with JSON Web Tokens (JWT). Refresh tokens can be created in your Radiant Earth Foundation account and used to generate example requests signed with valid session tokens (detailed instructions are available here).

Core Resources

SpatioTemporal Asset Catalog (STAC)



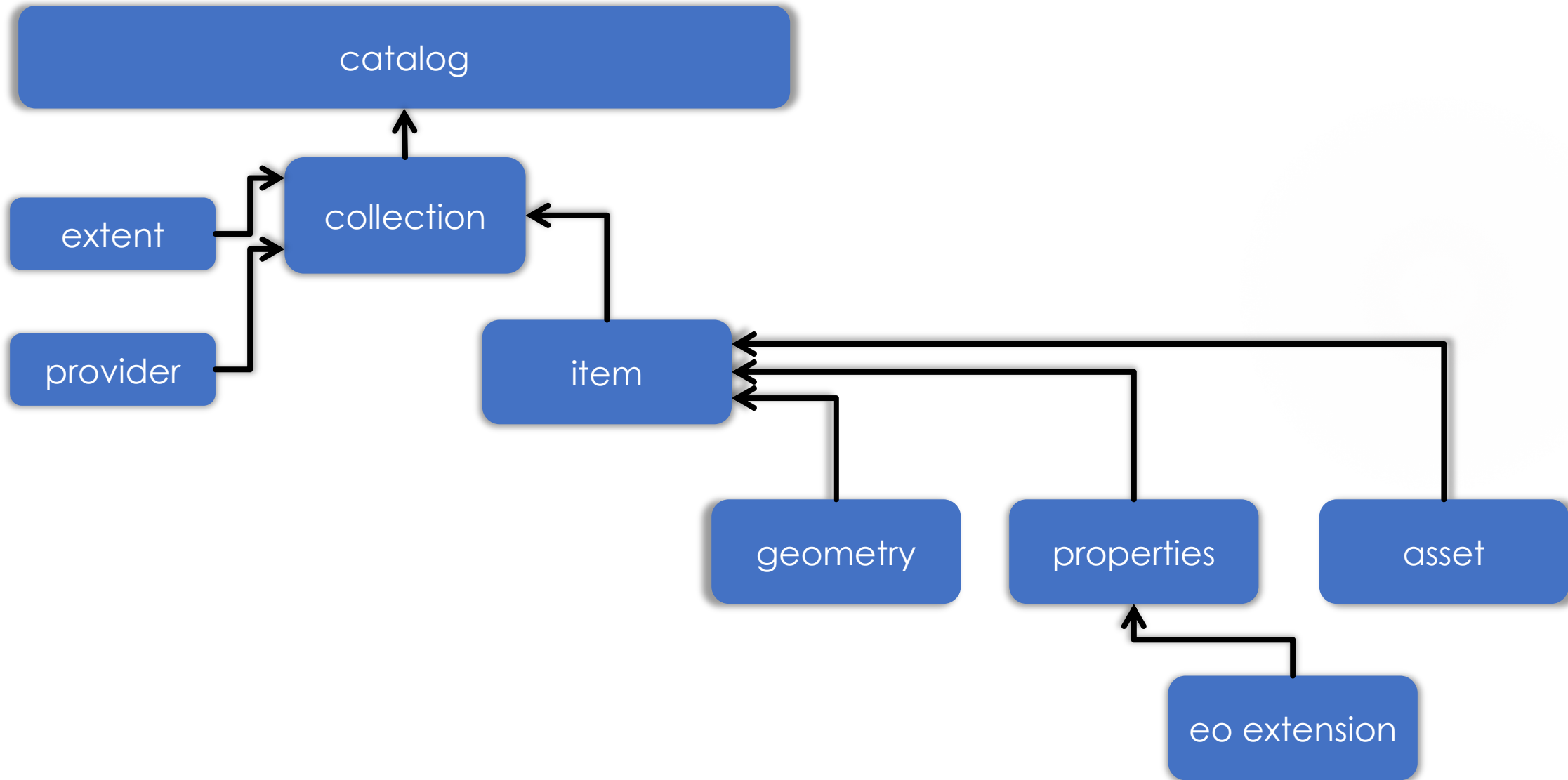
▶ Why?

- ▶ Searching for geospatial data is hard
- ▶ Each portal has its own API with specific parameters
- ▶ Users need to build unique pipeline for each collection

▶ Solution:

- ▶ An open specification to increase the interoperability of searching for geospatial data.
- ▶ The end goal is to enable a global index of all:
 - ▶ imagery (satellite, aerial, drone, etc)
 - ▶ derived data products
 - ▶ alternative geospatial captures (LiDAR, SAR, Full Motion Video, Hyperspectral, etc).

SpatioTemporal Asset Catalog (STAC)



SpatioTemporal Asset Catalog (STAC)

Collection fields

Element	Type	Description
stac_version	string	REQUIRED. The STAC version the collection implements.
id	string	REQUIRED. Identifier for the collection that is unique across the provider.
title	string	A short descriptive one-line title for the collection.
description	string	REQUIRED. Detailed multi-line description to fully explain the collection. CommonMark 0.28 syntax MAY be used for rich text representation.
keywords	[string]	List of keywords describing the collection.
version	string	Version of the collection.
license	string	REQUIRED. Collection's license(s) as a SPDX License identifier or expression or <code>proprietary</code> if the license is not on the SPDX license list. Proprietary licensed data SHOULD add a link to the license text, see the <code>license</code> relation type.
providers	[Provider Object]	A list of providers, which may include all organizations capturing or processing the data or the hosting provider. Providers should be listed in chronological order with the most recent provider being the last element of the list.
extent	Extent Object	REQUIRED. Spatial and temporal extents.
links	[Link Object]	REQUIRED. A list of references to other documents.

SpatioTemporal Asset Catalog (STAC)

Item fields

This object describes a STAC Item. The fields `id`, `type`, `bbox`, `geometry` and `properties` are inherited from GeoJSON.

Field Name	Type	Description
<code>id</code>	string	REQUIRED. Provider identifier. As most geospatial assets are already defined by some identification scheme by the data provider it is recommended to simply use that ID. Data providers are advised to include sufficient information to make their IDs globally unique, including things like unique satellite IDs.
<code>type</code>	string	REQUIRED. Type of the GeoJSON Object. MUST be set to <code>Feature</code> .
<code>geometry</code>	GeoJSON Geometry Object	REQUIRED. Defines the full footprint of the asset represented by this item, formatted according to RFC 7946, section 3.1 . The footprint should be the default GeoJSON geometry, though additional geometries can be included. Specified in Longitude/Latitude based on EPSG:4326.
<code>bbox</code>	[number]	REQUIRED. Bounding Box of the asset represented by this item. Specified in Longitude/Latitude based on EPSG:4326 - first two numbers are longitude and latitude of lower left corner, followed by longitude and latitude of upper right corner. This field enables more naive clients to easily index and search geospatially. Most software can easily generate them for footprints. STAC compliant APIs are required to compute intersection operations with the item's geometry field, not its <code>bbox</code> .
<code>properties</code>	Properties Object	REQUIRED. A dictionary of additional metadata for the item.
<code>links</code>	[Link Object]	REQUIRED. List of link objects to resources and related URLs. A link with the <code>rel</code> set to <code>self</code> is required.
<code>assets</code>	Map<string, Asset Object>	REQUIRED. Dictionary of asset objects that can be downloaded, each with a unique key. Some pre-defined keys are listed in the chapter 'Asset types'.

SpatioTemporal Asset Catalog (STAC)

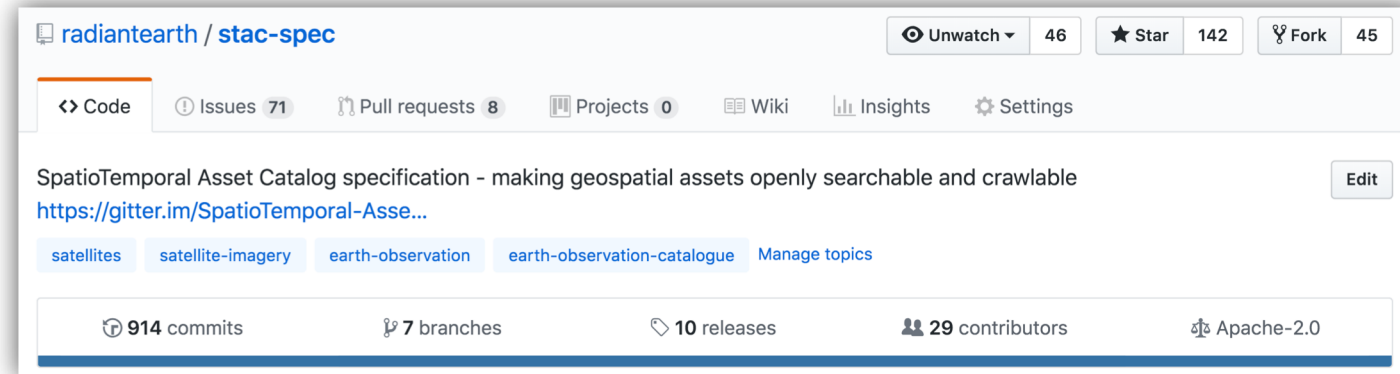
EO Extension Specification (eo)

Field Name	Type	Description
eo:gsd	number	REQUIRED. Ground Sample distance. The nominal distance between pixel centers available, in meters.
eo:platform	string	REQUIRED. Unique name of the specific platform the instrument is attached to. For satellites this would be the name of the satellite (e.g., landsat-8, sentinel-2A), whereas for drones this would be a unique name for the drone.
eo:constellation	string	Name of the constellation that the platform belongs to. See below for details.
eo:instrument	string	REQUIRED. Name of instrument or sensor used (e.g., MODIS, ASTER, OLI, Canon F-1).
eo:bands	[Band Object]	REQUIRED. This is a list of the available bands where each item is a Band Object.
eo:epsg	integer null	EPSG code of the datasource, <code>null</code> if no EPSG code.
eo:cloud_cover	number	Estimate of cloud cover as a percentage (0-100) of the entire scene. If not available the field should not be provided.
eo:off_nadir	number	Viewing angle. The angle from the sensor between nadir (straight down) and the scene center. Measured in degrees (0-90).
eo:azimuth	number	Viewing azimuth angle. The angle measured from the sub-satellite point (point on the ground below the platform) between the scene center and true north. Measured clockwise from north in degrees (0-360).
eo:sun_azimuth	number	Sun azimuth angle. From the scene center point on the ground, this is the angle between true north and the sun. Measured clockwise in degrees (0-360).
eo:sun_elevation	number	Sun elevation angle. The angle from the tangent of the scene center point to the sun. Measured from the horizon in degrees (0-90).

SpatioTemporal Asset Catalog (STAC)

► GitHub Repo:

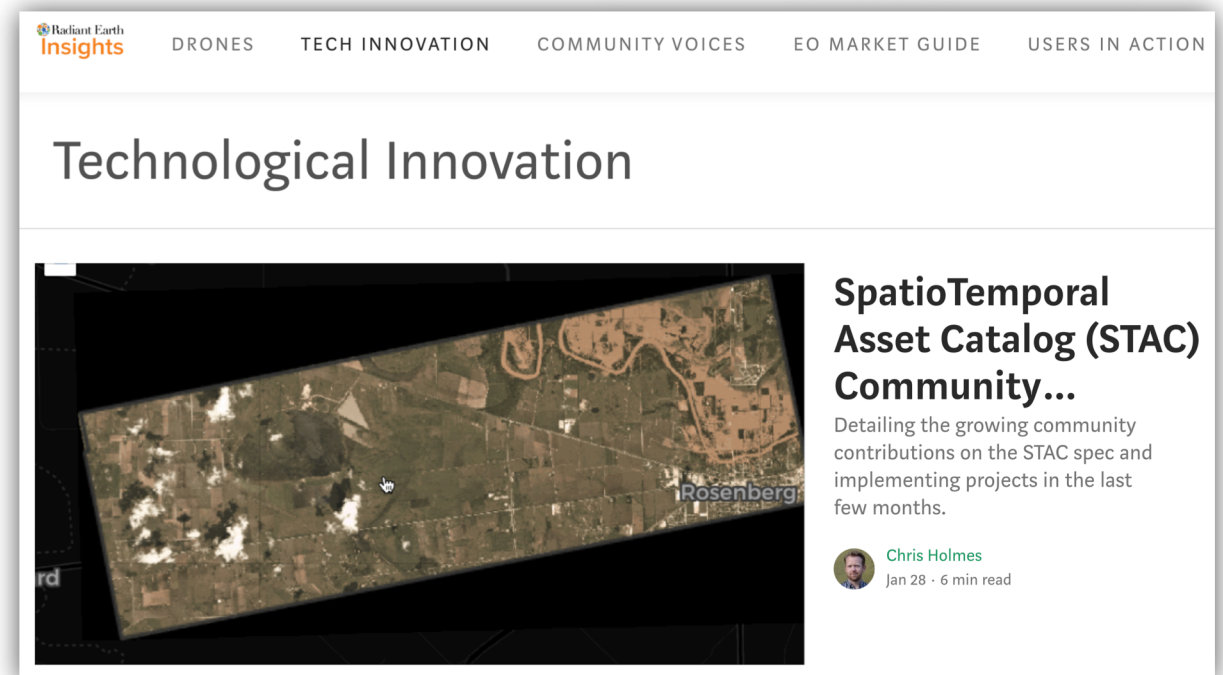
github.com/radiantearth/stac-spec



The screenshot shows the GitHub repository page for `radiantearth / stac-spec`. At the top right, there are buttons for 'Unwatch' (46), 'Star' (142), and 'Fork' (45). Below the repository name, there are tabs for 'Code', 'Issues' (71), 'Pull requests' (8), 'Projects' (0), 'Wiki', 'Insights', and 'Settings'. The main content area displays the repository description: 'SpatioTemporal Asset Catalog specification - making geospatial assets openly searchable and crawlable' with a link to <https://gitter.im/SpatioTemporal-Asse...> and an 'Edit' button. Below the description are topic tags: 'satellites', 'satellite-imagery', 'earth-observation', 'earth-observation-catalogue', and 'Manage topics'. At the bottom, there is a summary bar showing '914 commits', '7 branches', '10 releases', '29 contributors', and 'Apache-2.0' license.

► Radiant Earth Insights:

medium.com/radiant-earth-insights



The screenshot shows a Medium article from the 'Radiant Earth Insights' publication. The article is titled 'Technological Innovation' and features a satellite image of a landscape with a grid overlay and the name 'Rosenberg' visible. The article title is 'SpatioTemporal Asset Catalog (STAC) Community...'. The text below the title reads: 'Detailing the growing community contributions on the STAC spec and implementing projects in the last few months.' The author is identified as 'Chris Holmes' with a profile picture, and the article was published on 'Jan 28' and is a '6 min read'.

SpatioTemporal Asset Catalog (STAC)

STAC in Action:

iserv.stac.cloud

Supported by STAC Browser:

github.com/radiantearth/stac-browser

▶ Machine Learning commons for EO

- ▶ Training data
- ▶ Models
- ▶ Standards and best practices



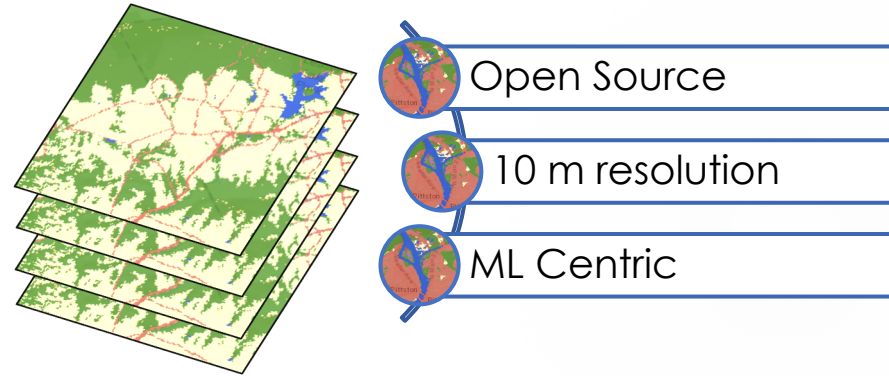
- ▶ Repository of training data to be hosted on AWS S3 bucket
- ▶ Registry of training data hosted on other repositories by the provider.
 - ▶ Enabling search of all training data stored with a STAC catalog

MLHub Earth

Phase I: MLHub Earth as a repository and registry of training data

Summer

- ▶ Radiant will publish two datasets:
 - ▶ Global Land Cover Classes
 - ▶ Major Crop Types in Africa



Mid-Spring

- ▶ Radiant will operationalize a label generator platform to publish open-source training data in a STAC compliant catalog.
- ▶ An API to search and access the training data on MLHub Earth will be provided to the community

MLHub Earth

Tasks: 0 of 9 complete SAVE PROJECT

Task 1	✓
Task 2	✓
Task 3	✓
Task 4	✓
Task 5	✓
Task 6	✓
Task 7	✓
Task 8	✓
Task 9	✓

Labels

- farm

1



Radiant Earth Foundation

EARTH IMAGERY FOR IMPACT



Get in touch

hello@radiant.earth

www.radiant.earth

app.radiant.earth

github.com/radiantearth

Follow Us



[@OurRadiantEarth](https://twitter.com/OurRadiantEarth)



fb.com/OurRadiantEarth



medium.com/radiant-earth-insights