



Radiant Earth
Foundation

EARTH IMAGERY FOR IMPACT

ANNUAL REPORT 2021



Vision

A strengthened global development community that benefits from high-quality and trusted ML and EO resources for positive global impact.

Mission

Empowering organizations and individuals globally with open ML and EO data, standards and tools to address the world's most critical international development challenges.

Services

1. Generating and aggregating open training data and model libraries for ML experts and practitioners.
2. Cultivating a community of practice to create interoperability standards and best practices.
3. Raising awareness about EO and ML capabilities to support practitioners working on International Development Challenges.

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Growing our Impact

10

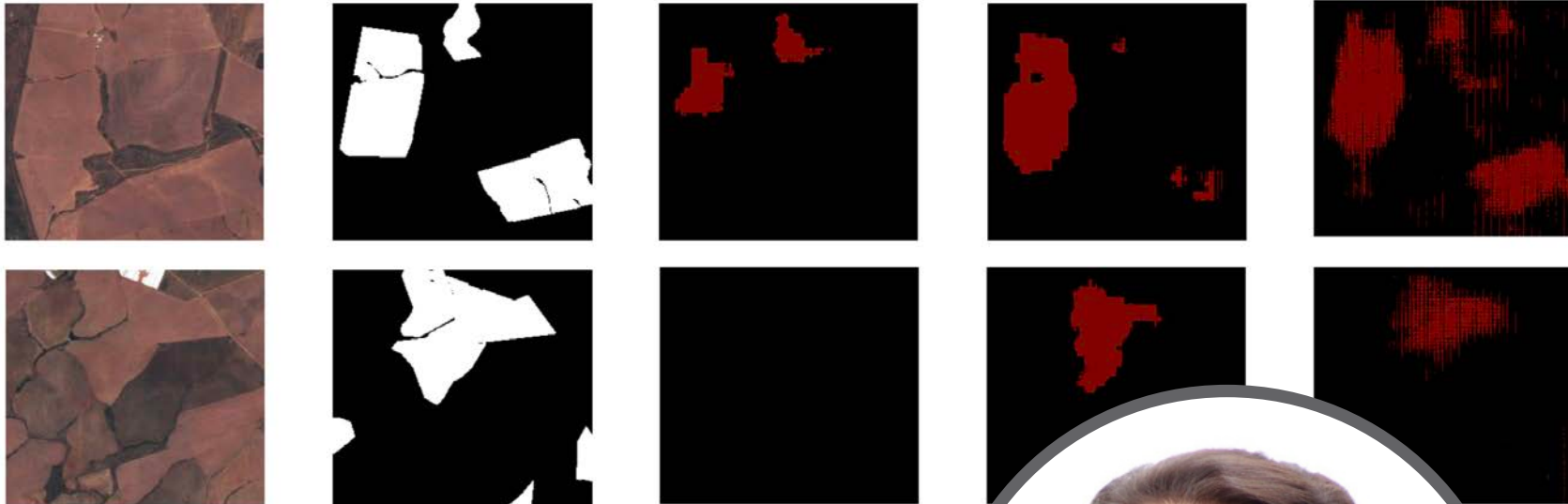
Partnerships

12

Our Team

14

Funders & Sponsors



Foreword

Radiant Earth Foundation expanded its efforts to drive meaningful impact through machine learning for Earth observation during the past year. Our goal in 2021 was to invest in critical resources that would assist the data science community in creating actionable insights into global problems.

Working with partners, we have generated and published new benchmark training datasets, enriching the catalog of data used to develop new algorithms. We have enhanced our interface to give users a more satisfactory experience exploring and downloading data. We organized data challenges to develop machine learning models and expanded the Radiant MLHub infrastructure with a model repository. It is a milestone that completes the workflow for publishing a fully reproducible machine learning project and helps organizations save money and time.

We also extended our training and capacity building activities. We successfully designed our first online bootcamp and trained a community of African regional experts with tools that can be used to address the continent's challenges through collaborative solutions. We've campaigned on many fronts, all for increasing awareness of machine learning and Earth observation principles and best practices.

Continuing around the theme of collaborative innovation, we've expanded the ecosystem of individuals and organizations who actively work to improve the accessibility and discovery functions for users looking for geospatial data and models.

As we look towards 2022, our user community can expect to see significant expansion of our data and model catalogs, the addition of features and pipelines to help them build solutions more efficiently, and improved resources for newcomers who are looking to gain new expertise and benefit from geospatial data in their products.



Hamed Alemohammad
Executive Director &
Chief Data Scientist



Our goal in 2021 was to invest in critical resources that would assist the data science community in creating actionable insights into global problems.

GROWING our IMPACT

Radiant MLHub

Radiant MLHub is an open cloud-based community library for geospatial machine learning projects. It provides the infrastructure that facilitates the publication of Earth observation training datasets and pre-trained machine learning models. The data available on Radiant MLHub are geographically diverse and support global missions like climate change, agriculture, and sustainable cities. Distributed with open-access licenses, anyone can access and publish data and models.

1,485

New users in 2021.

27

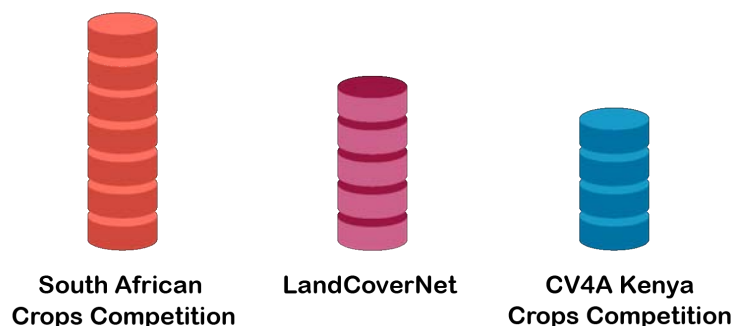
High-quality geospatial training datasets. **14** new datasets were added in 2021.

Available Geospatial Training Datasets



10,500

Data collections downloaded from Radiant MLHub.



Top training datasets downloaded.

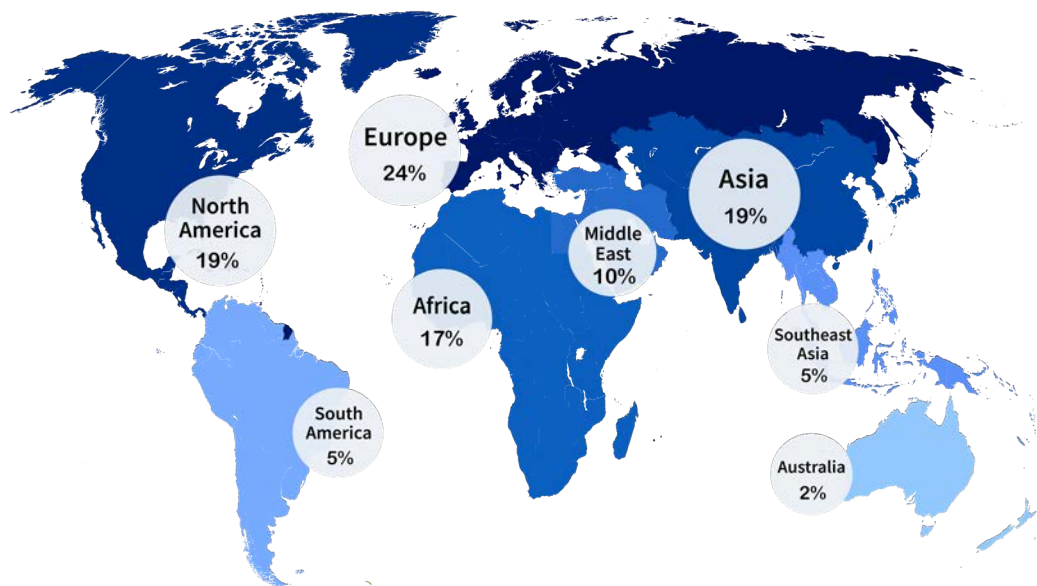


"It's hard to estimate crop yield and to take administrative decisions or implement new policies accordingly in many African countries. It was challenging to address this problem using predictive approaches and data analytics tools mainly due to the lack of high-quality training data. Now with public EO training datasets like those Radiant MLHub hosts, one can change this trajectory."

- Gedeon Muhawenayo, Machine Learning Research Engineer, Rwanda

3,773

Total users from **140** countries accessed training datasets on Radiant MLHub.



Radiant MLHub users per geographical region.



"Initiatives like Radiant MLHub are a great way to democratize access to remote sensing to help those communities most affected by issues such as climate change to circumvent hardware and technical limitations and build solutions that serve their local needs."

- Ruben Remelgado, Geo-computation Specialist, Germany

Geospatial Model Repository

Radiant MLHub's model repository provides benchmarked pre-trained models for use with EO data. Each model includes metadata describing the training data associated with it and its architecture. The metadata is based on the STAC ML Model Extension, which is a specification for cataloging models that apply EO data using a STAC label extension.

STAC ML Model Extension Contributors



Tropical Cyclone Wind Estimation Model

This is the first machine learning model for Earth observation data that is available on Radiant MLHub. The model can be used to estimate the surface wind speed of tropical storms. The model is trained on training data consisting of satellite images from different storms in the Atlantic and East Pacific Oceans, along with their corresponding wind speeds.

Capacity Building

Our capacity building activities are focused on empowering individuals and groups to use EO and ML for addressing global challenges. These activities shed light on how EO, combined with ML, can help us see, understand, and respond to a rapidly changing world and provide insights for policymakers. We use real-world use-cases to publish tutorials, design and host data competitions, and run hands-on bootcamps. All of these activities demonstrate the art of possible with EO and ML and lower the barrier for the broader community to benefit from these resources.



12

Lecturers hailing from Australia, Egypt, Nigeria, Uganda, and the United States.

83

Trainees trained by the Bootcamp learners.



179

People enrolled on Atingi for the self-paced ML4EO Bootcamp course.

41

Speaking events, and technology demonstrations.

Machine Learning on Earth Observation (ML4EO) Bootcamp

The ML4EO Training of Trainers Bootcamp was a virtual Training of Trainers course for data science and remote sensing practitioners. The goal was to develop a community of African regional experts that can collaborate on solutions to the continent's needs and problems. Designed with the philosophy that local capacity and skills lead to diverse machine learning applications.



39

Participants from Ghana, Rwanda, South Africa, and Uganda.



"[Radiant MLHub] It's a game-changer! These freely available, easily accessible datasets allow me to educate students on both ML and EO and to further my research. The fact that most of the data is collected for Africa is amazing, as this is a continent that is generally underrepresented. This kind of data infrastructure is empowering for researchers in developing countries."
- **Renata Thiede, Spatial Statistician, South Africa**

Data Competitions

Radiant Earth organized two data challenges:

1. The *Tropical Cyclone Wind Estimation Data Competition* to estimate the wind speeds of storms using satellite images captured throughout a storm's life cycle. This contest was designed to build a machine learning model to improve NASA IMPACT's Deep Learning-based Hurricane Intensity Estimator.
2. The *Spot the Crop Data Challenge* to identify crop types in the Western Cape region of South Africa using time-series of Sentinel-2 multi-spectral satellite data as input (track 1) to models, and in track 2 both Sentinel-2 and Sentinel-1 (radar) data as input.

In addition, Radiant partnered with others for the *AI4FoodSecurity* and the *Cloud Cover Detection* data challenges, providing training datasets in both contests, and sponsoring two prizes for the *AI4FoodSecurity* challenge. These two challenges close in 2022.

1,564

Data scientists from around the world participated in the two data competitions that Radiant launched.



"Data competitions ... are well-defined projects with a fixed scope and timeline...[to help] me narrow my focus and learn one thing at a time. Competitions are easily the best way to jumpstart your data science journey. You have the chance to solve a diverse range of real-world challenges." - **Raphael Kiminya (Kenya), Winner of the Spot the Crop Data Challenge (track 1)**

\$50,900

Raised in sponsorship to launch impact-driven data challenges in 2021 from ten organizations.



"The dataset was just great, featuring high-quality high-resolution images. Also, the large size of the dataset ensured a good correlation between local cross-validation and public leaderboard scores. Organizers did a really great job collecting and preparing this data."

- **Igor Ivanov (Ukraine), Winner of the Tropical Cyclone Wind Estimation Data Competition**

5,764

The number of model entries from data scientists that participated in the two competitions that Radiant organized.

13

Winners hailing from Belgium, Egypt, India, Kenya, Nigeria, South Africa, Ukraine, and the United Kingdom.

Radiant MLHub Impact Award

The Radiant MLHub Impact Award is a new annual prize organized by Radiant Earth Foundation. The inaugural award was funded by the support of individual donors through a crowdfunding campaign. The first prize, to be awarded in 2022, will recognize an individual or team contributing to real-world applications that address agriculture issues in Africa with geospatial training data found on Radiant MLHub. The award aims to raise awareness about the use of geospatial data to tackle the urgent challenges of climate change, promote local solutions to local problems, and facilitate greater collaboration across organizations and individual practitioners.

\$6,000

Total money raised from Radiant's first online crowdfunding campaign.

49

Individual donors.



Claudia Juech @cjjuech · Sep 27, 2021

As fan and Board member of **Radiant Earth** I encourage you to consider their donation request. Funds will be used to establish an annual prize for outstanding real-world applications addressing environmental issues using open geospatial training data and EO machine learning models



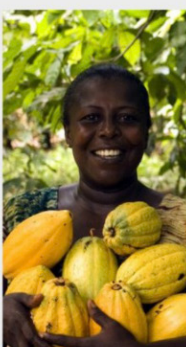
Radiant Earth Foundation @OurRadiantEarth · Sep 13, 2021

Donate to help us launch the Radiant MLHub Impact Award!

#RadiantMLHub empowers practitioners with open #EO training data to support global challenges! We're raising funds to award the best application built by our #ML4EO community.

Join us » bit.ly/MLHubImpactLau...

DONATE NOW TO MAKE AN IMPACT



LAUNCH THE
**Radiant MLHub
Impact Award**
FOR SUSTAINABLE
AGRICULTURE

Radiant Earth
Foundation



Criteria

Nominations will be evaluated based on the minimum criteria of building agricultural-related applications for Africa with geospatial training data found on Radiant MLHub, and the ability to demonstrate the following:

- How the application relates to the theme of agriculture
- The importance of the problem the application addresses
- Innovativeness and uniqueness of the application
- Impact on the communities benefiting from the application

Submit Nominations

<https://bit.ly/MLHubAward2022>

SpatioTemporal Asset Catalog Specification

The STAC specification is an open metadata standard that provides a common language to describe a range of geospatial information, so it can more easily be indexed and discovered. STAC is a community-driven effort and aims to connect geospatial data into a network of information about the Earth.

STAC Browser

The [STAC Browser](#) is a user interface that makes it easy for users to search and access geospatial data catalogs interactively. Since its inception, we have had a Radiant Technology Fellow maintaining and adding new features to the browser. In 2021, the new version 3.0.0 was designed which is rewritten from the old versions to support the STAC APIs, permit search queries across any catalog and temporal and spatial extent. Additional features include better navigation, the ability to visualize metadata assets, a more detailed overview list for all collections and items, and editable themes and asset sharing functionality.



"Geospatial data processing in the cloud is the future. And we had an opportunity to get the metadata right for it. Now, data providers have a simple, common language to describe their holdings."

**-Chris Holmes, Technology Fellow,
Radiant Earth, VP of Strategy, Planet**

STAC API

The [API specification](#) enables the 'search' function of a STAC Catalog. It also extends and aligns with the OGC API — Features standard, so any client that works with the OGC standard will work with STAC. In 2021, we invested in updating the STAC API specification to 1.0.0 release through our technology fellowship program, and currently version 1.0.0-beta.2 is released.

STAC Version 1.0.0 Released



\$105,500

Raised in sponsorships for the STAC 1.0 specification.

\$85,500

Raised to support the STAC Ecosystem in general.

PySTAC

[PySTAC](#) is a Python library for working with STAC catalogs, including reading, writing, and crawling STAC catalogs. It is considered a foundational library in the Python STAC ecosystem and is used in other projects like [pystac-client](#), [stactools](#), and [stac-validator](#). In 2021, we coordinated the first stable release of the library (v1.0.0), following the first stable release of the STAC Specification, as well as subsequent minor version and patch releases. These releases included a significant improvement in test coverage, major changes to the documentation bringing it up to date and making it more user-friendly, implementation of many new STAC Extensions, and significant refactoring of the code to institute consistent style, and type checking.

Radiant MLHub Python Client

We released our [Python Client](#) as a STAC compliant client in 2021 that allows Radiant MLHub users to discover and download training datasets and models without managing complex API requests.

PARTNERSHIPS

New Collaborations



Radiant Earth and the Regional Centre for Mapping of Resources for Development (RCMRD) partnered to develop a joint capacity building program focused on machine learning for Earth observation in Africa. The goal is to strengthen local geospatial and machine learning expertise for addressing global challenges on the continent.



"...building the capacity of institutions and individuals in machine learning is considered a plus as we all forge ahead within the context of the 4th Industrial Revolution." - **Kenneth Kasera, User Engagement Lead, RCMRD**



Radiant Earth and Microsoft AI for Earth established a new partnership to integrate Radiant MLHub and Microsoft Planetary Computer. This integration will give users access to better AI data, workflows, and training resources to accelerate solving global challenges using geospatial data. As a result, Microsoft's grantees, which includes 700 projects, can publish their data and models on Radiant MLHub thereby expanding open training datasets and models, and Radiant MLHub users can seamlessly access our training datasets and models through the Planetary Computer.



"The Planetary Computer already makes extensive use of the open standards and tools that have developed under the guidance of Radiant Earth, and we are thrilled to extend our collaboration to include Radiant MLHub as well." - **Dan Morris, Former Principal Scientist, Microsoft AI for Earth**

Expanding Existing Collaborations



Enabling Crop
Analytics at Scale

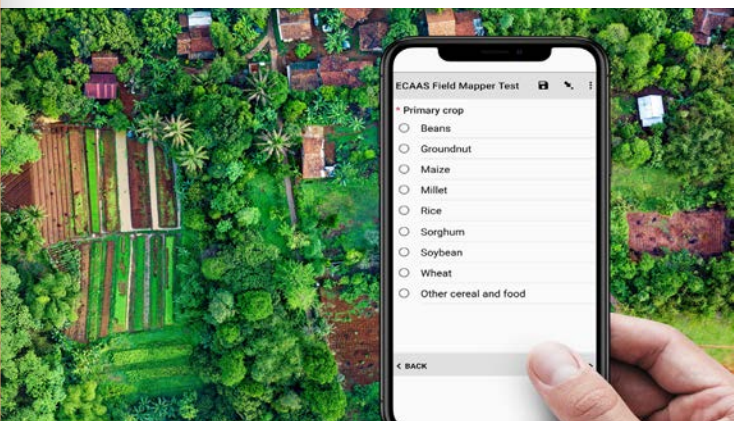


TETRA TECH

We have expanded our collaboration with the Enabling Crop Analytics at Scale (ECAAS) initiative that is managed by Tetra Tech with funding from the Bill & Melinda Gates Foundation in 2021 in multiple ways. We developed a new data collection toolkit in partnership with ODK and integrated it with Radiant MLHub. We engaged with the ECAAS' Technical Advisory Group, and joining efforts with IDinsight, we are developing a new benchmark dataset for agricultural mapping in India.



In collaboration with ODK, Radiant Earth developed the ECAAS Field Mapper Toolkit to standardize agricultural reference data collection and publication. The questionnaire was developed through multiple rounds of stakeholder engagement and testing. The integration of this Toolkit with Radiant MLHub is empowering users to easily submit their datasets for publication on Radiant MLHub.



IDinsight

Radiant Earth and IDinsight embarked on creating AgriFieldNet, a high-quality ground reference benchmark dataset for machine learning models in agriculture. IDinsight will collect data on crop types and field boundaries in four Indian States. Radiant Earth will in turn use this ground reference data to generate a training dataset and develop a baseline model focused on field boundary detection. The dataset and model will be made publicly available via Radiant MLHub.



"[Working] with Radiant Earth on this project...will help us both develop our internal capabilities to collect high-quality ground-truthing data and also contribute to the global learning agenda using machine learning models in agriculture." - **Krishanu Chakraborty, Associate Director, IDinsight**

Our TEAM

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Technology Fellow

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Programs and Operations



Data Competitions

- Computer Vision for Global Challenges
- Descartes Labs
- FAIR Forward, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH & German Federal Ministry for Economic Cooperation and Development (BMZ)
- Microsoft AI for Earth
- Western Cape Department of Agriculture

SpatioTemporal Asset Catalog

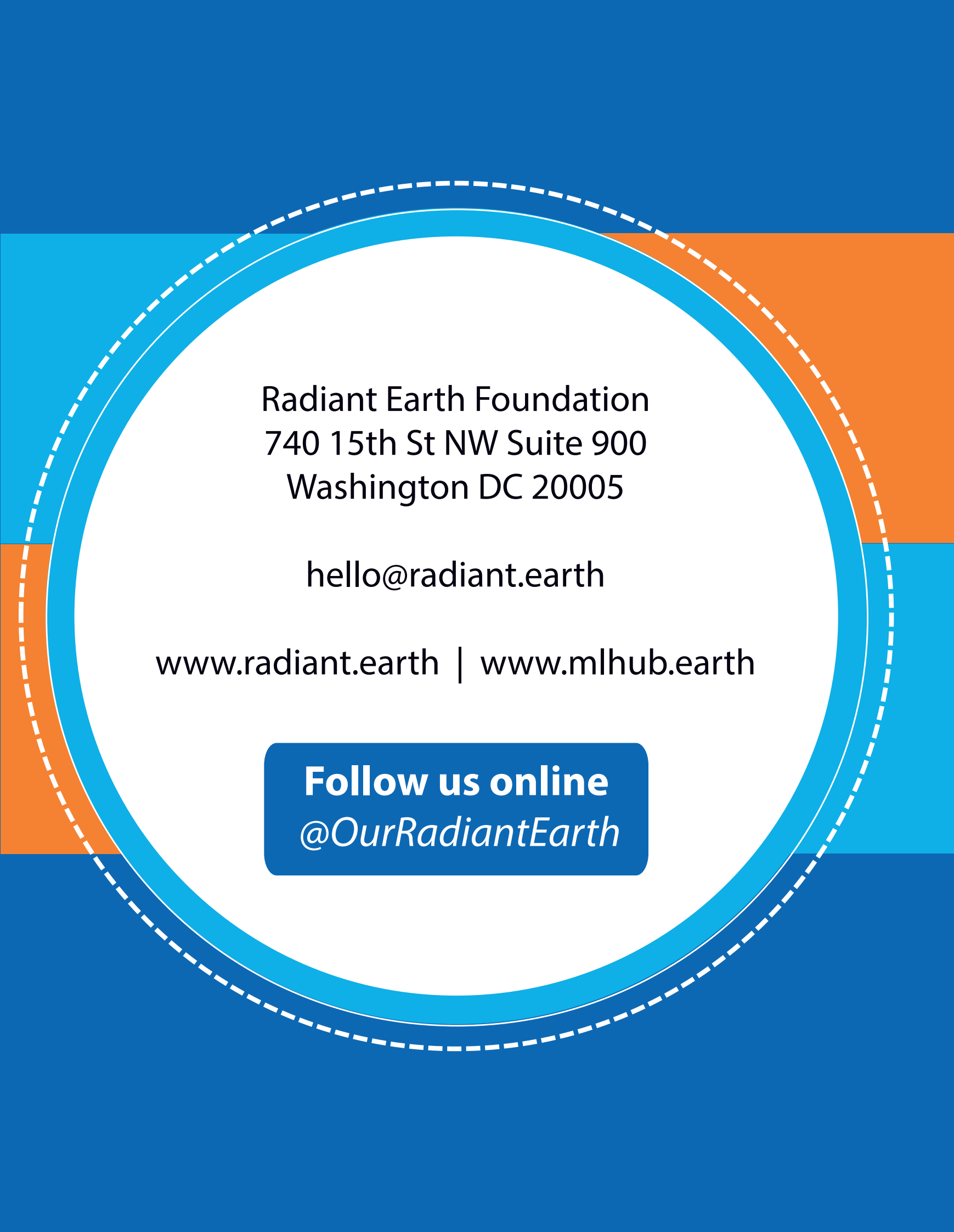
- Arturo
- Azavea
- Development Seed
- Element 84
- Geoscience Australia
- Hydrosat
- Microsoft AI for Earth
- Planet
- Sparkgeo
- Toitū Te Whenua Land Information New Zealand
- Umbra

Radiant MLHub Impact Award Donors

- Anonymous
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- Ali Zockaie Kheiraie
- Amber Myers
- Anne Miglarese
- Antony Desmeaux
- Charlotte Myers
- Charlotte Wilczok
- Chris Holmes
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- Development Seed
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- Steven Brumby
- Steven Ramage
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- Vincent Sarago
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Collaborators

- AI2ES
- AI4EO
- Amazon Web Services
- Azavea
- CRIM
- Development Seed
- Digital Earth Africa
- DrivenData
- ESA Phi-Lab
- GEOGLAM
- IDinsights
- Lacuna Fund
- Locus Charter
- Makerere University
- Microsoft
- NASA Harvest
- NASA IMPACT
- NRCAN
- Oak Ridge National Laboratory
- Open Data Kit (ODK)
- OpenEO
- PLACE
- Planet
- RCMRD
- Sinergise
- TaQadam
- TetraTech
- Future Lab on AI4EO (TUM/DLR)
- University of Alabama in Huntsville
- VAIS
- Zindi

The graphic features a large white circle centered on a blue background. The circle is bordered by a solid light blue ring and a dashed white ring. The background is divided into four quadrants by a horizontal and vertical line, with the top-left and bottom-right quadrants being dark blue, and the top-right and bottom-left quadrants being orange. Inside the white circle, the contact information for the Radiant Earth Foundation is displayed in black text.

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