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A community data commons for equitable Earth Science

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Standfirst

Earth observation data are abundant but rarely analysis-ready, and the burden of preparation limits who can participate in science. For the last six years, the Google Earth Engine Community Catalog has closed that gap via community-curated, cloud-hosted, FAIR datasets built without formal funding, advancing discovery and equity worldwide.

The usability gap in Earth science

Earth and environmental science has been transformed over the past decade by an unprecedented influx of observational data. Satellite constellations operated by national space agencies and commercial providers now generate petabytes of imagery each day, and Earth system models add petabytes more. Open-data policies for Landsat and Copernicus made the foundational archives free[1], and cloud platforms made them tractable: since 2010, Google Earth Engine[2] has paired a multi-petabyte catalogue with pro-bono computing, dismantling the hardware and storage barriers that once confined planetary-scale analysis to well-resourced institutions and national laboratories, and enabling advances from global surface-water mapping to disaster response and agricultural monitoring.

Solving access, however, exposed a deeper bottleneck. Analysis-ready data are conventionally defined as products processed to a minimum standard that allows immediate analysis with little further user effort[3]. Several agency sensor products now meet that standard, but the derived datasets that most environmental research actually consumes do not: drought indices, field boundaries, canopy heights, groundwater estimates and hazard layers are typically deposited as static files in institutional or general-purpose repositories, in projections, formats and structures that must be repaired before use. This last-mile preparation is sophisticated and slow, and the burden falls unevenly. Researchers at well-resourced institutions draw on support staff, institutional knowledge and funded time; students, practitioners and scientists at smaller institutions and across the Global South, despite identical free access to platforms such as Earth Engine, frequently cannot. Field evidence confirms that institutional participation is hindered not by a lack of interest, but by the structural realities of unreliable connectivity, sparse training, and resource constraints[4]. The central challenge of data-intensive Earth science has therefore shifted from a crisis of access to a crisis of accessibility: the accumulated technical, temporal and knowledge cost of turning available data into usable information. That friction slows science and narrows who is able to do it.

A community-driven response

The Google Earth Engine Community Catalog is one grassroots answer. Launched in 2020 as an unfunded, open-source effort, it now hosts 4000+ curated, cloud-ingested datasets comprising 800+ image collections, 3000+ feature collections, ~2 million images, totalling ~590 TB, and spanning across 16 themes (e.g., climate, hydrology, natural hazards, socio-economic). Recently, Google has recognized it as Earth Engine's first and largest Community Data Catalog.

That growth reflects collective stewardship rather than mandate or central funding. The catalog runs on commons-based peer production: members request datasets they need, contribute datasets they have already prepared, and in doing so spare everyone else the same work. Its public repository has 200+ contributors, ~1,200 stars and 180+ forks, and the catalog now underpins ~150 publications across 90+ journals, from global flood-risk analysis[5] and land use[6] to regional irrigation accounting[7]. Institutional partners, including the US and Canadian Forest Services, USGS, SwissTopo, UN FAO, and others, use it to disseminate their own open datasets.

Because contributions are voluntary and research-driven, the catalog doubles as a real-time index of scientific attention: each wave of new datasets, among them drought indices, wildfire-severity layers and urban-expansion maps, traces where the community is turning next.

From open data to scientific equity

Between October 2022 and July 2026, catalog documentation served requests from 228 countries and territories, 2000+ sub-national regions, and ~18,000 cities, with Brazil, the United States and India the three largest sources (Fig. 1). Use is therefore global rather than concentrated in the countries that fund Earth observation.

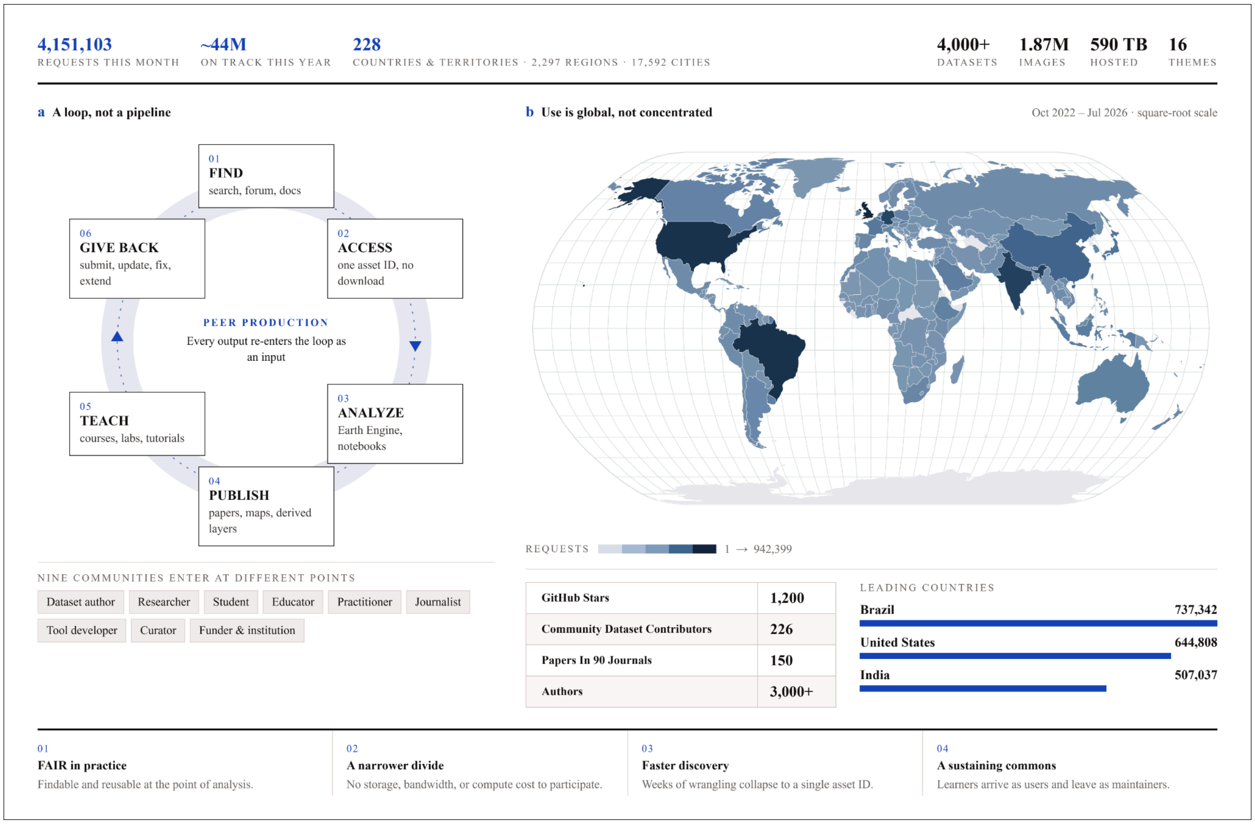

Fig. 1 | A community-curated data commons and its global reach. **a.** Six activities form a closed loop; outputs of one journey re-enter as inputs to the next, which is what sustains an unfunded catalog. Nine communities of practice enter at different points. **b.** Requests to the catalog documentation by country, October 2022 – July 2026, on a five-class square-root scale; grey indicates no requests. All requests are counted, measuring documentation reach rather than unique users. The headline monthly figure, catalog holdings, and statistics as of July 2026.

Other initiatives pursue this goal from different directions. Publishing utilities such as Source Cooperative and the open-data programmes of major cloud providers host cloud-native datasets at scale; regional platforms such as Digital Earth Africa deliver analysis-ready cubes for defined territories. What distinguishes a community catalog is not volume but where curation happens:

datasets are nominated by the people who need them, preprocessed into a form the platform can read, documented with working code, and placed inside the environment where analysis is already taking place. That makes the FAIR principles[8] operational rather than aspirational, and it removes the local download step that remains prohibitive under constrained bandwidth and storage. Planned adoption of the SpatioTemporal Asset Catalog specification will extend the same datasets to the wider geospatial ecosystem.

Curation of this kind carries obligations that any such effort must meet: versioned releases, archived identifiers and explicit provenance, so that a re-hosted dataset cannot silently diverge from its authoritative source and credit stays with the original creators. Where those conditions hold, the payoff is tangible. Curated flood and wildfire layers inform emergency response; soil-moisture and evapotranspiration datasets support irrigation accounting and food security; and high-resolution land-cover and climate layers underpin biodiversity conservation[9] and urban heat mitigation[10].

Toward a resilient scientific commons

The catalog showcases a different kind of research infrastructure altogether: distributed, fast-moving, community-governed and responsive to needs as they emerge rather than as they are planned. It complements, rather than replaces, the centralized institutions that produce the underlying observations, and the model transfers to any field in which findability and usability, not availability, is the binding constraint.

The qualities that make it agile also make it fragile, and two dependencies deserve naming. The first is human: curation rests on a handful of maintainers, and volunteer effort at this intensity is not indefinitely renewable. The second is structural: the resource sits on computing donated by a single company. Neither observation is a criticism of what has been built; both are reasons to build around it.

Three steps would help. Funders and space agencies should treat the preparation and cloud deposition of derived data products as a fundable deliverable rather than an unpaid courtesy; the demand documented here is evidence that the work has value. Institutions that already depend on the catalog, including the agencies now distributing data through it, could form a consortium offering stable support without displacing community leadership. And continued movement toward open standards would let the commons outlive any single platform.

Timely, usable environmental data have never mattered more. Community-built commons are not an optional supplement to the scientific landscape; they are infrastructure, and funding, governing and contributing to them accordingly is what will make science faster, more collaborative and more equitable.

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Competing interests

The authors declare no competing interests.

Related links

https://gee-community-catalog.org/

https://github.com/samapriya/awesome-gee-community-datasets

https://developers.google.com/earth-engine/datasets/community/sat-io

https://g4g.gee-community-catalog.org/

https://gee-community-catalog.org/contributors

https://stacspec.org/en

https://digitalearthafrica.org/en_za/