# Non-Peer-Reviewed Sources on AlphaEarth Embeddings for Forest & Ecosystem Monitoring

## Google DeepMind Blog (2025) – *AlphaEarth Foundations helps map our planet in unprecedented detail* (Not peer-reviewed)

**Organization:** Google DeepMind (official blog post).  
**Domain/Task:** Planetary-scale land mapping with applications in **deforestation monitoring**, ecosystem mapping, agriculture, and urban change. The blog highlights real-world uses by over 50 partners, e.g. classifying **unmapped ecosystems** (Global Ecosystems Atlas) and tracking environmental changes (MapBiomas in the Amazon)[[1]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=For%20example%2C%20Global%20Ecosystems%20Atlas%2C,combat%20the%20loss%20of%20biodiversity)[[2]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Schechter%20also%20pointed%20to%20examples,deserts%2C%20wetlands%2C%20and%20other%20categories).  
**Model/Methods:** Introduces **AlphaEarth Foundations**, a “virtual satellite” AI model producing 64-dimensional **embedding** vectors for every 10×10 m land pixel, annually from 2017–2024[[3]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=uncover%20patterns%20unfolding%20worldwide). The model fuses optical, radar, LiDAR, climate and even text data into a unified representation, enabling consistent analysis despite clouds or sparse data[[4]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Unlike%20a%20continuous%20video%20feed%2C,factors%20like%20persistent%20cloud%20cover)[[5]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world). It compresses data 16× more efficiently than prior systems[[6]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=Second%2C%20it%20makes%20this%20data,scale%20analysis).  
**Metrics/Claims:** DeepMind reports **23.9% lower error** on average than competing methods in tasks like land-cover classification, especially where labels are scarce[[7]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=In%20a%20paper%20posted%20in,in%20historically%20difficult%20mapping%20scenarios). This improved efficiency allows **detailed, on-demand maps** that were previously impossible[[8]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=This%20breakthrough%20enables%20scientists%20to,of%20foundation%20for%20geospatial%20data). The embeddings are **already used operationally** by organizations like UN FAO, Harvard Forest, GEO, MapBiomas, etc., showing strong transferability[[9]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=including%20the%20United%20Nations%E2%80%99%20Food,world%20insights)[[2]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Schechter%20also%20pointed%20to%20examples,deserts%2C%20wetlands%2C%20and%20other%20categories). For example, MapBiomas found the embeddings can **“transform the way our team works”** by producing **more accurate, precise, and faster maps** than ever before[[10]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=As%20Tasso%20Azevedo%2C%20founder%20of,been%20able%20to%20do%20before).

*“The Satellite Embedding dataset can transform the way our team works – we now have new options to make maps that are more accurate, precise and fast to produce – something we would have never been able to do before.”*[[10]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=As%20Tasso%20Azevedo%2C%20founder%20of,been%20able%20to%20do%20before) – *Tasso Azevedo, founder of MapBiomas, on using AlphaEarth data*

*Suggestion: Cite this source when discussing* *operational adoption and performance gains* *of AlphaEarth (e.g. to support claims of improved accuracy/speed over traditional harmonic time-series methods, and real-world use by conservation organizations).*

@misc{DeepMind2025AlphaEarth,  
 author = {Google DeepMind},  
 title = {AlphaEarth Foundations helps map our planet in unprecedented detail},  
 year = 2025,  
 url = {https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/}  
}

## Google Earth Engine Announcement (2025) – *AI-powered pixels: Introducing Google’s Satellite Embedding dataset* (Not peer-reviewed)

**Organization:** Google Earth Engine (official Medium blog by V. Pasquarella & E. Schechter).  
**Domain/Task:** Launch of the **Satellite Embedding dataset** in Earth Engine for broad geospatial use. Highlights applications like **wildfire impact** detection, **forest type** differentiation, land cover mapping, and global similarity search. For instance, without any labels, clustering the embeddings can reveal hidden landscape patterns, **“differentiating various types of forests, soils, or urban development.”**[[11]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=,class%2C%20saving%20time%20and%20compute) It also enables pixel-wise change detection for events like fires and reservoir changes[[12]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=world.%20,maps%20with%20far%20less%20training)[[13]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=,need%20a%20few%20hundred%20per).  
**Model/Methods:** AlphaEarth Foundations is run globally to precompute **analysis-ready embeddings** (10 m, yearly). Each pixel’s 64 features encode multi-source temporal signals (Sentinel-1, Sentinel-2, Landsat 8/9, GEDI LiDAR, climate data, etc.)[[14]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=This%20first,end%20computers%2C%20AlphaEarth%20Foundations%20was)[[15]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=We%E2%80%99ve%20run%20AlphaEarth%20Foundations%20at,that%20embedding%20layers%20are%20analysis). **No custom model training is needed by users** – the embeddings plug into Earth Engine’s standard classifiers or clustering tools. Notably, the blog explains that these embedding images can replace traditional handcrafted features: *users can treat the 64-band embedding image like a ready-made feature stack, instead of computing indices or harmonic coefficients*[[16]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=Collection%20developers,at%20reduced%20effort%20and%20complexity). This dramatically simplifies workflows (no cloud masking or seasonal curve fitting needed) while yielding **“superior results at reduced effort and complexity.”**[[16]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=Collection%20developers,at%20reduced%20effort%20and%20complexity)  
**Metrics/Claims:** By using embeddings, far **less training data** is required for mapping tasks. Google reports that with embeddings, only ~150 samples per class sufficed to classify **87 crop and land-cover types**, a task that previously needed tens of thousands of labels[[17]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=It%E2%80%99s%20also%20more%20effective%20at,are%20missing%20from%20standard%20imagery). The embeddings capture phenology and seasonal signals automatically[[18]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=parking%20lot%20or%20a%20freeway%2C,year%20change%20events), boosting classification accuracy. The blog emphasizes the **replacement of harmonic temporal fits** – one key claim is: *“we’ve effectively packed AI-powered feature extraction into every pixel, and you can use these embedding ‘images’ in place of… spectral indices and harmonic fits… — just superior results at reduced effort.”*[[16]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=Collection%20developers,at%20reduced%20effort%20and%20complexity) This underscores that AlphaEarth embeddings can achieve what multi-band seasonal harmonics do, but more robustly and with less manual preprocessing.

*“Embedding layers are analysis-ready; no need for atmospheric correction, cloud masking, spectral transformations, speckle filtering, or other featurization techniques — just superior results at reduced effort and complexity.”*[[16]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=Collection%20developers,at%20reduced%20effort%20and%20complexity)

*Suggestion: Use this source to* *support methodological claims* *in the article – for example, when arguing that AlphaEarth’s embeddings can replace traditional harmonic analysis or indices for forest classification, improving efficiency and mapping accuracy (cite it in the context of workflow simplification and enhanced performance).*

@misc{Pasquarella2025SatelliteEmbedding,  
 author = {Pasquarella, Valerie and Schechter, Emily},  
 title = {AI-powered pixels: Introducing Google’s Satellite Embedding dataset},  
 year = 2025,  
 url = {https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650}  
}

## CARTO Case Study (2025) – *From Imagery to Insight: Google AlphaEarth Foundations in CARTO* (Not peer-reviewed)

**Organization:** CARTO (industry blog by L. García-Duarte, CARTO data scientist).  
**Domain/Task:** **Operational integration** of AlphaEarth embeddings into a spatial analytics platform. The article demonstrates how businesses can use the Satellite Embedding dataset for **climate risk assessment** and environmental monitoring. A featured use-case is mapping **wildfire risk**: by performing a similarity search in embedding space, CARTO identifies U.S. regions with environments analogous to known high-fire-risk areas[[19]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=match%20at%20L253%20,planning%20by%20mapping%20terrain%20and)[[20]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=match%20at%20L275%20indicating%20higher,similarity%29%20search). The result is a map of locations sharing the same “embedding profile” as a wildfire-prone reference zone, effectively flagging areas of elevated fire risk without requiring new satellite imagery or complex modeling[[20]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=match%20at%20L275%20indicating%20higher,similarity%29%20search)[[21]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=Image). This showcases the embeddings’ value in **forest disturbance mapping** (wildfire burn scars, etc.) and disaster planning.  
**Model/Methods:** CARTO loads Google’s 64-dimensional annual embeddings directly into its pipelines, eliminating manual data processing[[22]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=and%20spatial%20models%20built%20in,analytical%20and%20data%20processing%20workflows)[[23]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=This%20new%20addition%20means%20that,Keep%20reading%20to%20learn%20how). They highlight that the embeddings provide **global coverage** at 10 m and inherently capture spectral, temporal, and environmental patterns, which can be leveraged via clustering or similarity metrics[[24]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=%2A%20Global%20coverage%C2%A0,spectral%2C%20temporal%2C%20and%20environmental%20features). In the wildfire example, they computed similarity between embedding vectors of Zip Code Tabulation Areas (ZCTAs) and correlated the results with a US Forest Service wildfire risk index (spearman ρ ≈ 0.75)[[25]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=probability%20estimates%20provided%20by%20the,748). Many high-burn-probability zones aligned with the embedding-derived hotspots, indicating the model effectively learned features related to fire-prone vegetation and climate[[26]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=Image). Differences (e.g. certain areas not flagged due to different fuel types) provided additional insight into fire ecology[[27]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=this%20approach%20has%20strong%20potential,vegetation%20shape%20regional%20wildfire%20behavior).  
**Metrics/Claims:** The blog makes qualitative claims that this integration **“unlocks new opportunities for environmental monitoring, climate risk analysis, urban planning, and biodiversity research.”**[[28]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=A%20New%20Era%20of%20Geospatial,Analysis) By bridging raw imagery and insights, the embeddings accelerate analyses that typically required extensive preprocessing. It specifically notes that *“whether you’re mapping wildfire risks, tracking ecosystem changes, or identifying new areas for conservation, the recently launched satellite embeddings open the door to richer, more informed decision-making.”*[[29]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=By%20bringing%20Google%E2%80%99s%20Satellite%20Embeddings,urban%20planning%2C%20and%20biodiversity%20research) This underscores the **transferability** of AlphaEarth embeddings to real-world operational settings (insurance risk models, conservation planning, etc.) beyond research.

*“By bringing Google’s Satellite Embeddings into CARTO, we’re bridging the gap between raw satellite imagery and actionable environmental insights. This unlocks new opportunities for environmental monitoring, climate risk analysis, urban planning, and biodiversity research.”*[[28]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=A%20New%20Era%20of%20Geospatial,Analysis)

*Suggestion: Reference this case study in sections discussing* *operational use and transferability* *– for example, to support a statement that AlphaEarth embeddings are already being employed in industry tools for tasks like wildfire risk mapping and ecosystem change tracking (demonstrating practical impact beyond the academic realm).*

@misc{GarciaDuarte2025CARTO,  
 author = {Garc\'{i}a-Duarte, Luc\'{i}a},  
 title = {From Imagery to Insight: Google AlphaEarth Foundations in CARTO},  
 year = 2025,  
 url = {https://carto.com/blog/google-alphaearth-foundations-in-carto}  
}

## Ultralytics Blog (2025) – *Google AlphaEarth uses observation data for global mapping* (Not peer-reviewed)

**Organization:** Ultralytics (tech blog by A. Vina).  
**Domain/Task:** Overview of AlphaEarth’s impact on **earth observation and climate applications**. Emphasizes the model’s role in **tracking land cover changes** (e.g. forest loss) in **100+ countries** and aiding conservation and planning. For instance, the article notes AlphaEarth has been applied to monitor tropical forest changes, melting ice, crop cycles, and urban expansion in near-real time[[30]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Google%20DeepMind%20%20has%20debuted,to%20uncover%20patterns%20unfolding%20worldwide)[[31]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=analysis%20without%20rebuilding%20the%20entire,model). By integrating diverse data, the model can detect subtle environmental shifts even in challenging conditions like the cloud-covered Amazon, thereby improving **deforestation alerting** and habitat monitoring[[32]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world)[[33]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=rainforest%2C%20where%20cloud%20cover%20is,from%20patterns%20around%20the%20world).  
**Model/Methods:** Describes AlphaEarth as a **self-supervised vision model** that treats multi-year satellite imagery as “frames of a video,” enabling it to learn temporal patterns. It produces annual embedding grids (available in Earth Engine) that stakeholders can directly use. Importantly, **re-training is not needed per application** – the same precomputed embeddings support wildfire response, urban tree mapping, and biodiversity analyses alike[[34]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=In%20benchmark%20tests%2C%20it%20reduced,be%20retrained%20for%20every%20application)[[35]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=,use%20planning). The blog explains that the model performs classic remote sensing tasks: **image classification** (identifying forests, croplands, wetlands, etc.), **segmentation** (thematic pixel labeling for land cover types), and **change detection** (e.g. flagging **deforestation** or wildfire burn scars by comparing yearly embeddings)[[36]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=Here%E2%80%99s%20how%20the%20model%20applies,vision%20tasks%20to%20Earth%20observation)[[37]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,finding%20patterns%20without%20labels). It even mentions unsupervised clustering for uncovering vegetation shifts or climate anomalies in new regions[[38]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,data%20is%20limited%20or%20missing).  
**Metrics/Claims:** The Ultralytics post reiterates key performance metrics: ~**24% reduction in misclassification errors** versus prior approaches, and **16× storage efficiency** per pixel[[39]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=land%20changes%20by%20learning%20from,patterns%20around%20the%20world). It stresses **robustness and adaptability**: AlphaEarth works globally “even in tricky areas” with data gaps, and its general-purpose embeddings can be reused across tasks without specialized tuning[[40]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world)[[34]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=In%20benchmark%20tests%2C%20it%20reduced,be%20retrained%20for%20every%20application). Notably, *“so far, the model has been used to monitor land changes across more than 100 countries, including tropical forests… These insights are being used to support smarter planning and more informed climate decisions.”*[[41]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=analysis%20without%20rebuilding%20the%20entire,model). In practical terms, the ability to consistently detect land-use changes like **deforestation, wildfire impacts, or urban growth** from the embeddings is highlighted as a major advantage[[37]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,finding%20patterns%20without%20labels). This confirms that AlphaEarth’s embeddings are effective for **forest disturbance mapping** (e.g. detecting tree cover loss) and broadly transferable to various Earth observation challenges.

*“By comparing annual embeddings for the same location, AlphaEarth can detect shifts in land use and land cover, such as* *deforestation, wildfire impacts, or urban growth.”*[[37]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,finding%20patterns%20without%20labels)

*Suggestion: Cite this source to* *underline the model’s real-world deployment and versatility* *– for example, when discussing how AlphaEarth’s embeddings enable reliable forest disturbance monitoring (deforestation alerts, wildfire damage) at scale, and how the approach has already been adopted across numerous countries for climate and conservation applications.*

@misc{Vina2025AlphaEarth,  
 author = {Vina, Abirami},  
 title = {Google AlphaEarth uses observation data for global mapping},  
 year = 2025,  
 url = {https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping}  
}

[[1]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=For%20example%2C%20Global%20Ecosystems%20Atlas%2C,combat%20the%20loss%20of%20biodiversity) [[6]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=Second%2C%20it%20makes%20this%20data,scale%20analysis) [[8]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=This%20breakthrough%20enables%20scientists%20to,of%20foundation%20for%20geospatial%20data) [[9]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=including%20the%20United%20Nations%E2%80%99%20Food,world%20insights) [[10]](https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/#:~:text=As%20Tasso%20Azevedo%2C%20founder%20of,been%20able%20to%20do%20before) AlphaEarth Foundations helps map our planet in unprecedented detail - Google DeepMind

<https://deepmind.google/discover/blog/alphaearth-foundations-helps-map-our-planet-in-unprecedented-detail/>

[[2]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Schechter%20also%20pointed%20to%20examples,deserts%2C%20wetlands%2C%20and%20other%20categories) [[3]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=uncover%20patterns%20unfolding%20worldwide) [[4]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Unlike%20a%20continuous%20video%20feed%2C,factors%20like%20persistent%20cloud%20cover) [[7]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=In%20a%20paper%20posted%20in,in%20historically%20difficult%20mapping%20scenarios) [[17]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=It%E2%80%99s%20also%20more%20effective%20at,are%20missing%20from%20standard%20imagery) [[30]](https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai#:~:text=Google%20DeepMind%20%20has%20debuted,to%20uncover%20patterns%20unfolding%20worldwide) Google DeepMind's AlphaEarth Tracks Earth's Changes - IEEE Spectrum

<https://spectrum.ieee.org/google-deepmind-alphaearth-foundations-ai>

[[5]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world) [[31]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=analysis%20without%20rebuilding%20the%20entire,model) [[32]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world) [[33]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=rainforest%2C%20where%20cloud%20cover%20is,from%20patterns%20around%20the%20world) [[34]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=In%20benchmark%20tests%2C%20it%20reduced,be%20retrained%20for%20every%20application) [[35]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=,use%20planning) [[36]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=Here%E2%80%99s%20how%20the%20model%20applies,vision%20tasks%20to%20Earth%20observation) [[37]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,finding%20patterns%20without%20labels) [[38]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=%E2%80%8D%20,data%20is%20limited%20or%20missing) [[39]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=land%20changes%20by%20learning%20from,patterns%20around%20the%20world) [[40]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=A%20key%20benefit%20of%20AlphaEarth,from%20patterns%20around%20the%20world) [[41]](https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping#:~:text=analysis%20without%20rebuilding%20the%20entire,model) Google AlphaEarth Uses Observation Data for Mapping

<https://www.ultralytics.com/blog/google-alphaearth-uses-observation-data-for-global-mapping>

[[11]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=,class%2C%20saving%20time%20and%20compute) [[12]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=world.%20,maps%20with%20far%20less%20training) [[13]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=,need%20a%20few%20hundred%20per) [[14]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=This%20first,end%20computers%2C%20AlphaEarth%20Foundations%20was) [[15]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=We%E2%80%99ve%20run%20AlphaEarth%20Foundations%20at,that%20embedding%20layers%20are%20analysis) [[16]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=Collection%20developers,at%20reduced%20effort%20and%20complexity) [[18]](https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650#:~:text=parking%20lot%20or%20a%20freeway%2C,year%20change%20events) AI-powered pixels: Introducing Google’s Satellite Embedding dataset | by Google Earth | Google Earth and Earth Engine | Jul, 2025 | Medium

<https://medium.com/google-earth/ai-powered-pixels-introducing-googles-satellite-embedding-dataset-31744c1f4650>

[[19]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=match%20at%20L253%20,planning%20by%20mapping%20terrain%20and) [[20]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=match%20at%20L275%20indicating%20higher,similarity%29%20search) [[21]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=Image) [[22]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=and%20spatial%20models%20built%20in,analytical%20and%20data%20processing%20workflows) [[23]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=This%20new%20addition%20means%20that,Keep%20reading%20to%20learn%20how) [[24]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=%2A%20Global%20coverage%C2%A0,spectral%2C%20temporal%2C%20and%20environmental%20features) [[25]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=probability%20estimates%20provided%20by%20the,748) [[26]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=Image) [[27]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=this%20approach%20has%20strong%20potential,vegetation%20shape%20regional%20wildfire%20behavior) [[28]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=A%20New%20Era%20of%20Geospatial,Analysis) [[29]](https://carto.com/blog/google-alphaearth-foundations-in-carto#:~:text=By%20bringing%20Google%E2%80%99s%20Satellite%20Embeddings,urban%20planning%2C%20and%20biodiversity%20research) From Imagery to Insight: Google AlphaEarth Foundations in CARTO

<https://carto.com/blog/google-alphaearth-foundations-in-carto>