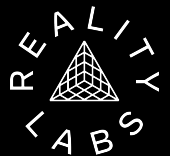


# Daylight Earth Tables

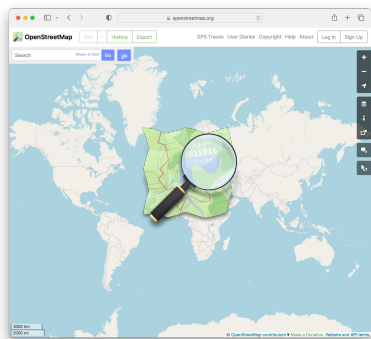
Jennings Anderson, Jonah Adkins, Jacob Wasserman



# Maps at Meta

19/October/2022

∞ Meta



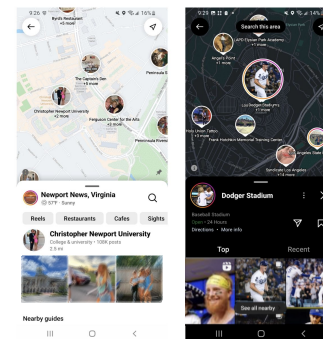
OpenStreetMap



Daylight Map Distribution



Earth Table



Maps in Meta Products

- Instagram
- Facebook Marketplace
- And more...

**Overview**

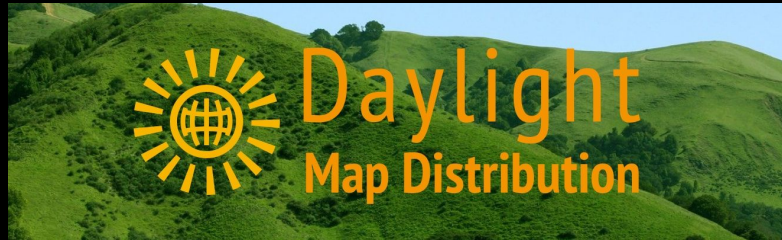
What is the Daylight Map Distribution?

What is the Earth Table?

Introducing: Daylight Earth Table

Working with the Daylight Earth Table

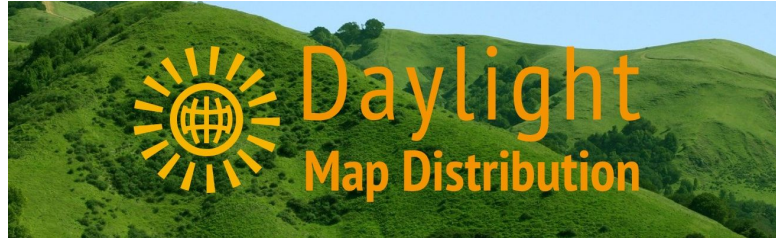
# Daylight



A monthly distribution of OpenStreetMap that undergoes a series of quality control and vandalism checks to ensure a degree of map quality and integrity.



## Timeline of Daylight OpenStreetMap Distribution



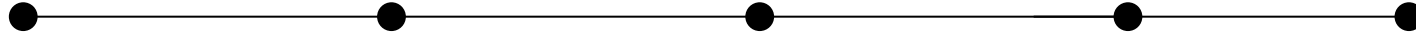
< 2019

2020

2021

2022

Today



State of the Map  
2018 & 2019

March 2020

April 2021

January 2022

October 2022

Mobius Logical  
Changesets  
(LoChas)

Announcing  
Daylight v0.1

Daylight v1.0  
released

Daylight published  
on AWS Registry of  
Open Data as PBF  
and *Analysis-Ready*  
parquet files

Daylight v1.18

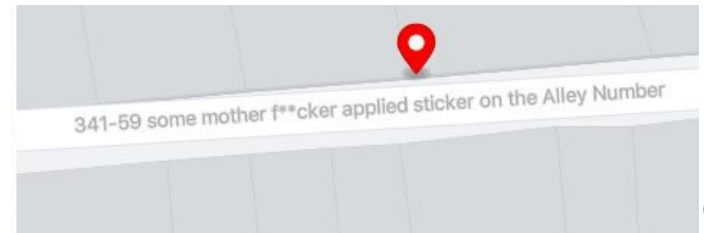
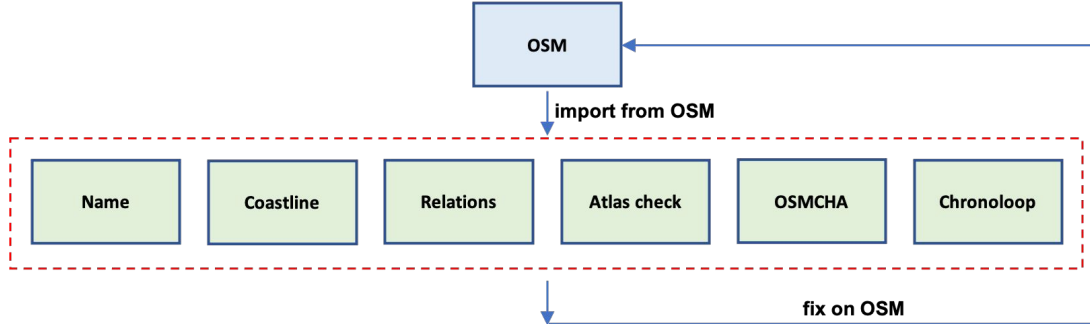
<https://daylightmap.org>

## Daylight Process: Find-Fix-Import Loop

Find: Discover errors or other issues anywhere on the map

Fix: Submit fixes on live OSM, not in an internal database

Import: Apply fixes from OSM into the Daylight map



Daylight v1.18

**525 M**

Buildings

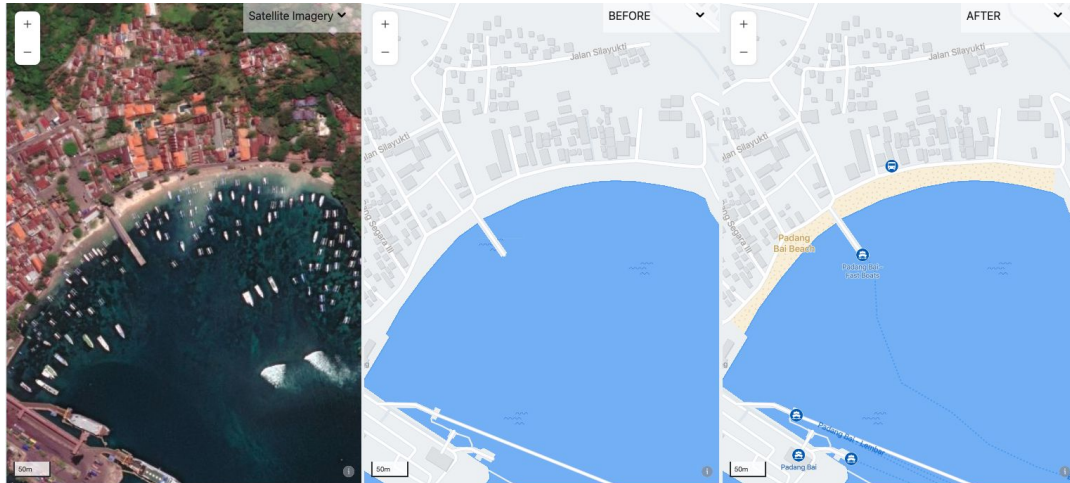
**78 M**

Kilometers of roads / paths

**100%**

OpenStreetMap Data

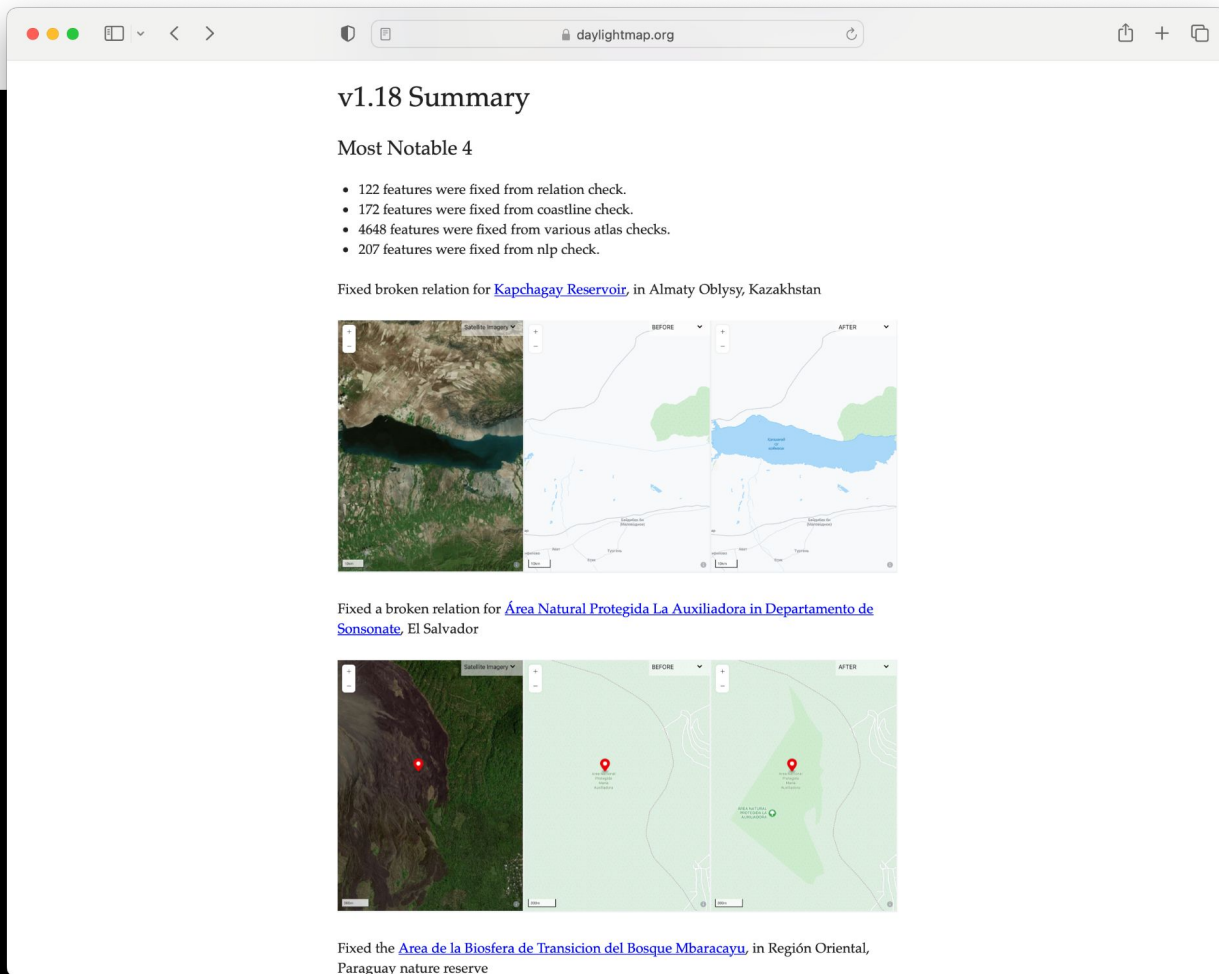
Think of Daylight as a snapshot of OSM where each feature might not be from the same snapshot.



Example: Repaired beach relation for Padang Bai Beach in Bali, Indonesia

## Daylight v1.18

Changelog and summaries of fixes made to OSM available on daylightmap.org

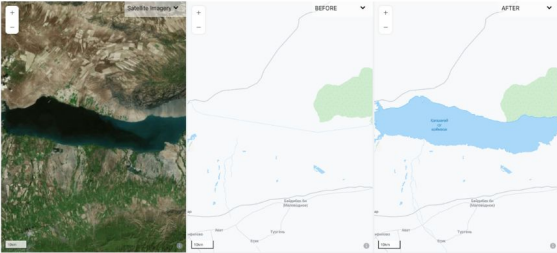


**v1.18 Summary**

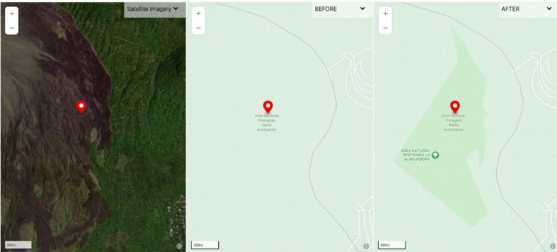
**Most Notable 4**

- 122 features were fixed from relation check.
- 172 features were fixed from coastline check.
- 4648 features were fixed from various atlas checks.
- 207 features were fixed from nlp check.

Fixed broken relation for [Kapchagay Reservoir](#), in Almaty Oblysy, Kazakhstan



Fixed a broken relation for [Área Natural Protegida La Auxiliadora](#) in [Departamento de Sonsonate](#), El Salvador

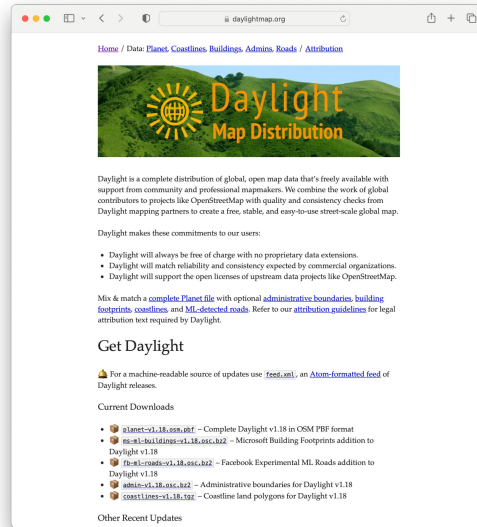


Fixed the [Área de la Biosfera de Transición del Bosque Mbaracayu](#), in Región Oriental, Paraguay nature reserve

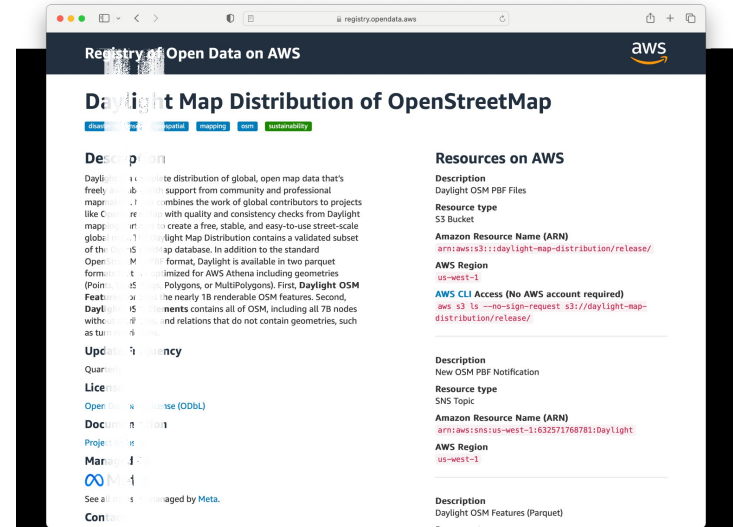


## Where can I find Daylight?

- OSM PBF Format
- Analysis-Ready Cloud-Optimized Parquet Files



daylightmap.org



registry.opendata.aws/daylight-osm/

# Earth Table



## Where did the Earth Table come from?

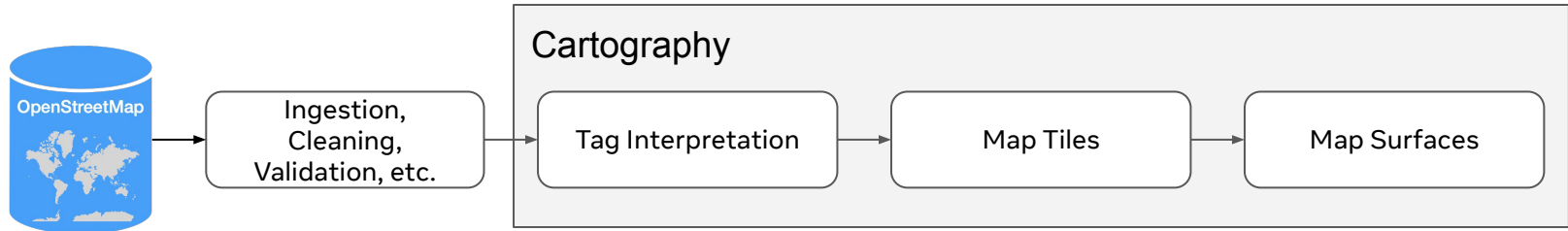
- Growing internal use cases to query the earth - “I need all the parks in the world to do x”
- Using basemaps is a cross-functional tool for projects across the org.
- Needs to be simple - tagging complexities of OSM are a high barrier to entry
- Needs to be in a single table, with easy to understand schema & hierarchy



**Before:**

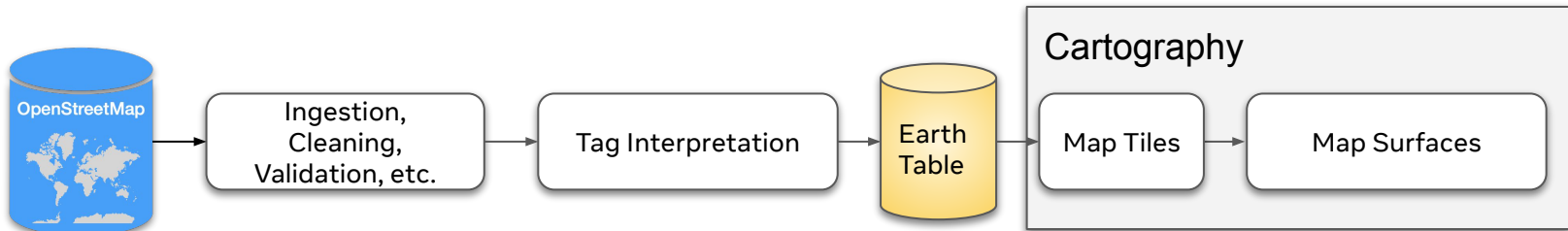
Cartography team did all of the OSM tag interpretation and created map tiles.

Needed to look inside tiles to find well-formatted, translated map data

**After:**

The earth table is created by interpreting OSM tags into a simplified 3-level ontological schema.

Anyone can access this table, especially cartography



It doesn't solve everything...

**OpenStreetMap** Edit History Export GPS Traces User Diaries Copyright

Search Where is this? Go

**Way: 98224505**  
Version #4  
set to footpath  
Edited about 6 years ago by mjfoster83  
Changeset #41836726

**Tags**

access	no
highway	footway
surface	unpaved

**Nodes**

▼ 5 nodes

- 1136317564
- 1136317632
- 1136317375
- 1136317525
- 1136317564

[Download XML - View History](#)

**Way: 1058376267**

**Version #1**

adding or improving sport objects #maproulette

Edited 5 months ago by conradoos  
Changeset #120717647

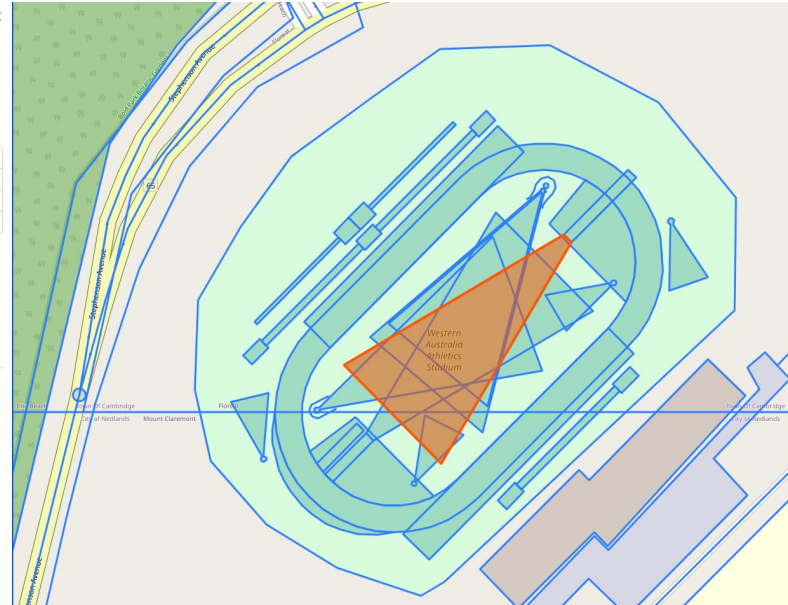
**Tags**

athletics	javelin_throw
leisure	pitch
sport	athletics
surface	grass

**Nodes**

- ▼ 5 nodes
- 9725338222 (part of way 1058376268)
  - 9725338221
  - 9725338220
  - 9725338223 (part of way 1058376268)
  - 9725338222 (part of way 1058376268)

[Download XML - View History](#)



Healthcare			
amenity	baby_hatch		A place where a baby can be, out of necessity, anonymously left to be safely cared for and perhaps adopted.
amenity	clinic		A medium-sized medical facility or health centre.
amenity	dentist		A dentist practice / surgery.
amenity	doctors		A doctor's practice / surgery.
amenity	hospital		A hospital providing in-patient medical treatment. Often used in conjunction with <code>emergency=*</code> to note whether the medical centre has emergency facilities (A&E (brit.) or ER (am.))
amenity	nursing_home		Discouraged tag for a home for disabled or elderly persons who need permanent care. Use <code>amenity=social_facility + social_facility=nursing_home</code> now.

Value	
<code>healthcare=alternative</code>	
<code>healthcare=audiologist</code>	
<code>healthcare=birthing_centre</code>	
<code>healthcare=blood_bank</code>	
<code>healthcare=blood_donation</code>	
<code>healthcare=centre</code>	
<code>healthcare=clinic</code>	
<code>healthcare=community_health_worker</code>	
<code>healthcare=counselling</code>	
<code>healthcare=dentist</code>	
<code>healthcare=dialysis</code>	
<code>healthcare=doctor</code>	
<code>healthcare=hospice</code>	
<code>healthcare=hospital</code>	
<code>healthcare=laboratory</code>	
<code>healthcare=midwife</code>	
<code>healthcare=nurse</code>	

### Way: Riverside Regional Medical Center (298161573)

#### Version #12

Roads and Sidewalks

Edited almost 2 years ago by [pardthemonster](#)  
Changeset #96888275

#### Tags

<code>addr:city</code>	Newport News
<code>addr:housenumber</code>	500
<code>addr:postcode</code>	23601
<code>addr:state</code>	VA
<code>addr:street</code>	J. Clyde Morris Boulevard
<code>amenity</code>	hospital
<code>beds</code>	450
<code>emergency</code>	yes
<code>healthcare</code>	hospital
<code>name</code>	Riverside Regional Medical Center
<code>opening_hours</code>	24/7
<code>operator</code>	Riverside
<code>phone</code>	+1 757 594 2000
<code>website</code>	<a href="https://www.riversideonline.com/trmc">https://www.riversideonline.com/trmc</a>

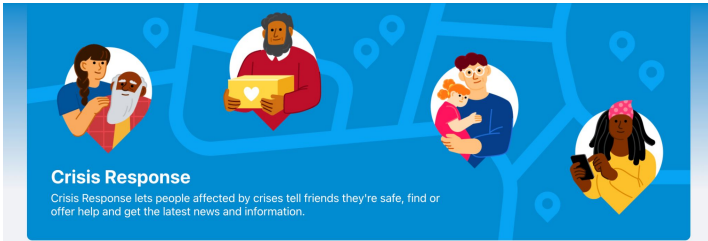


theme	class	subclass	metadata	wkt
poi	medical	hospital	<code>{"amenity":"hospital","is_area":true,"quadkey":"032010233003132"}</code>	POINT (-76.4
landuse	medical	hospital	<code>{"quadkey":"032010233003132","surface_area_sq_m":267697.27}</code>	POLYGON (

building	525,240,408
building_detail	2,232,081
infrastructure	11,226,443
land	40,831,400
landuse	39,397,340
placename	3,430,404
poi	38,777,950
road	216,890,017
transit	6,716,006
water	36,401,694

### Cartographic Data Improvements:

- land theme includes processed global coastlines
- building height information is validated and normalized
- placename theme includes simplified classification -> all places grouped into 3 classes: urban, settlement, local
- lengths and areas calculated as attribute columns
- Bing Tile Quadkey applied to each feature
- Lots of boolean evaluations for easy filtering:
  - “Is\_indoor”, “is\_intermittent”, “is\_bridge”, “is\_area”, etc
- Buildings include “landuse” class they are within
- Building\_detail includes building id they are part of



**Recent crises**

Happening around the world

**The Flooding Across Eastern El Salvador**  
Media sources indicate that heavy rainfall from Tropical Storm Julia...

6 help offers  
6 donations

[Learn more](#) [Donate](#)

**The Flooding in Huehuetenango Department,...**  
Updated media sources report that at least 28 people have been killed in Guatemala, Honduras, and El...

1 help offer

[Learn more](#) [Follow](#)

**The Building Collapse in Farash Khana, Delhi, India**  
Updated sources reported that an unspecified house has partially collapsed in the Farash Khana area, reportedly near Vainiki Mandir Temple. At least three people have...

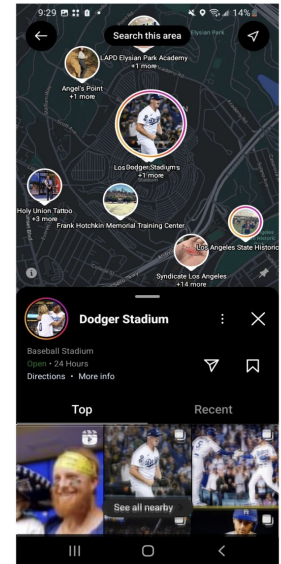
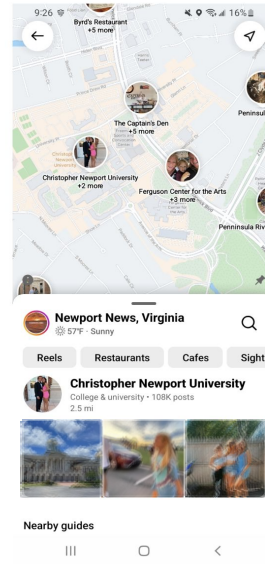
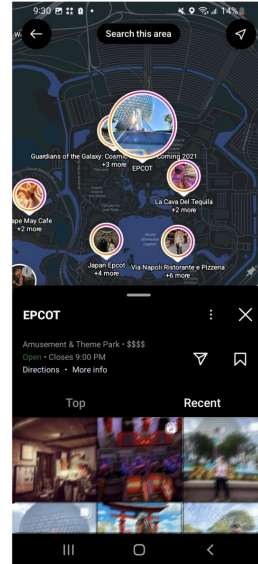
[Learn more](#) [Follow](#)

**floodin across**

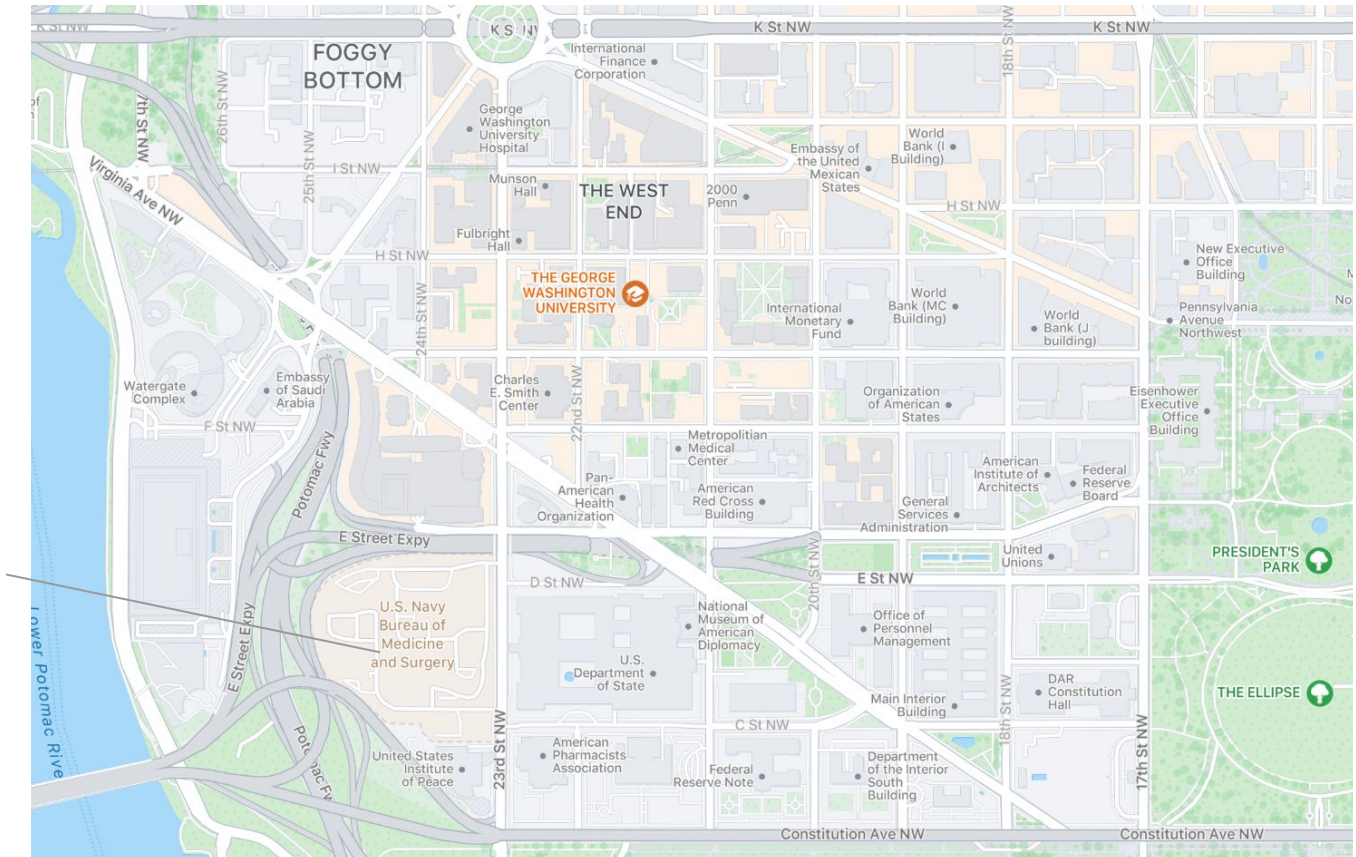
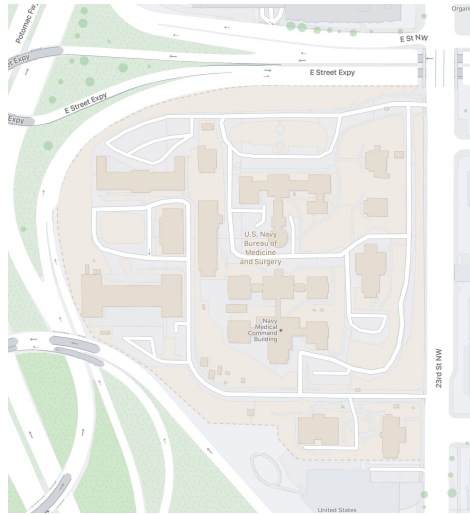
15

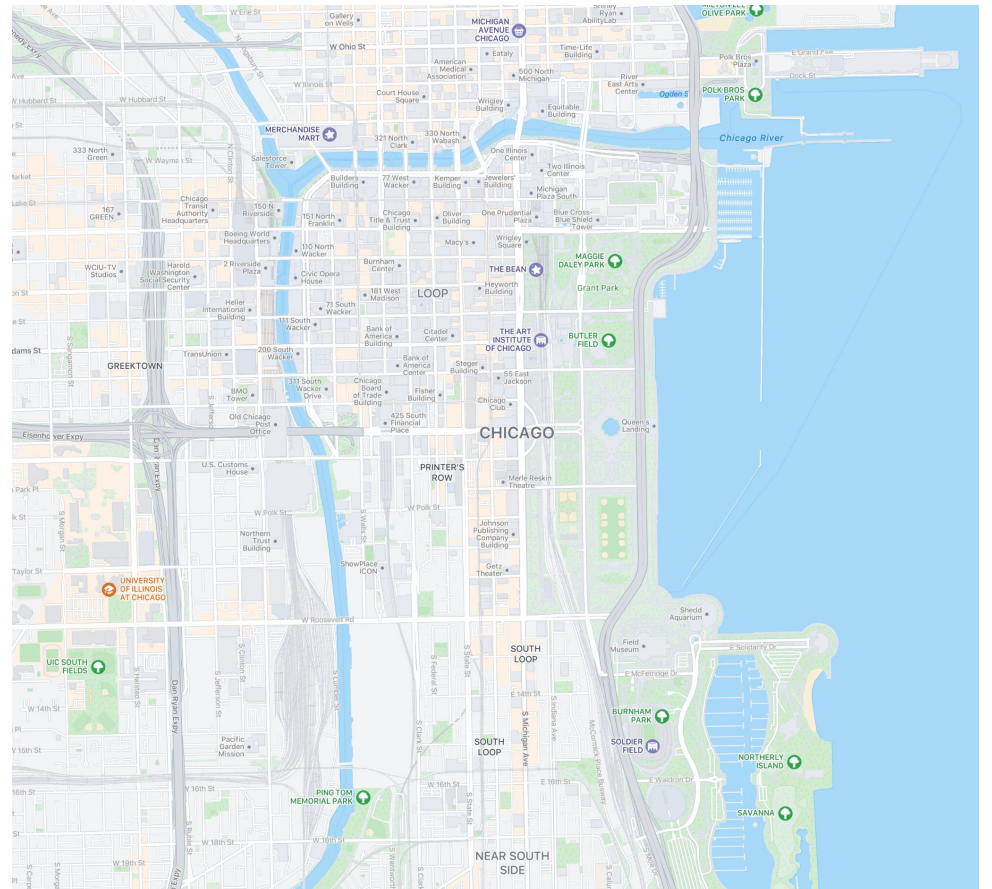
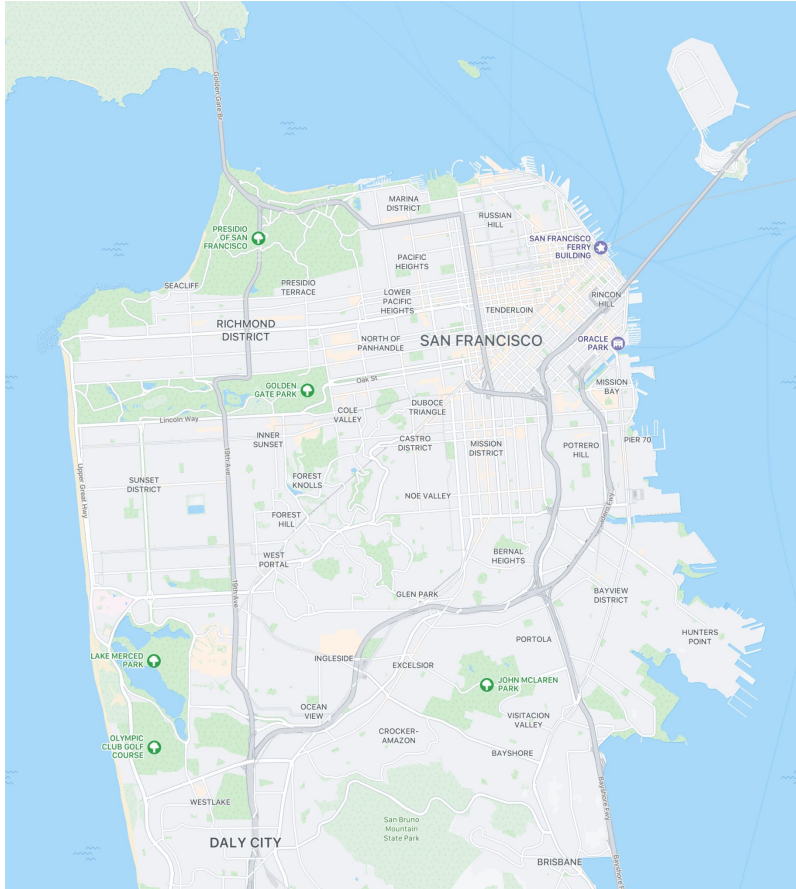
[Lea](#)

<b>83%</b>	Earth Table Data Source
<b>16%</b>	Internal Data Sources that are “Earthified”
<b>1%</b>	Curated Cartographic Map Features





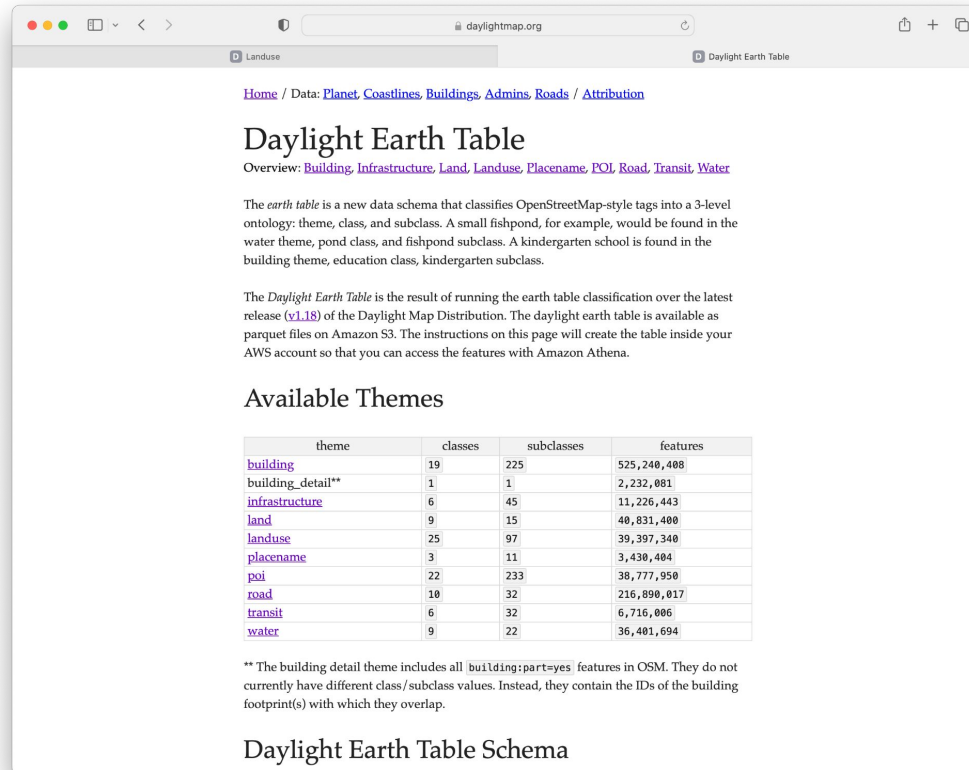






# Accessing Daylight Earth Tables

s3://daylight-openstreetmap/earth



Home / Data: [Planet](#), [Coastlines](#), [Buildings](#), [Admins](#), [Roads](#) / [Attribution](#)

## Daylight Earth Table

Overview: [Building](#), [Infrastructure](#), [Land](#), [Landuse](#), [Placename](#), [POI](#), [Road](#), [Transit](#), [Water](#)

The *earth table* is a new data schema that classifies OpenStreetMap-style tags into a 3-level ontology: theme, class, and subclass. A small fishpond, for example, would be found in the water theme, pond class, and fishpond subclass. A kindergarten school is found in the building theme, education class, kindergarten subclass.

The *Daylight Earth Table* is the result of running the earth table classification over the latest release ([v1.18](#)) of the Daylight Map Distribution. The daylight earth table is available as parquet files on Amazon S3. The instructions on this page will create the table inside your AWS account so that you can access the features with Amazon Athena.

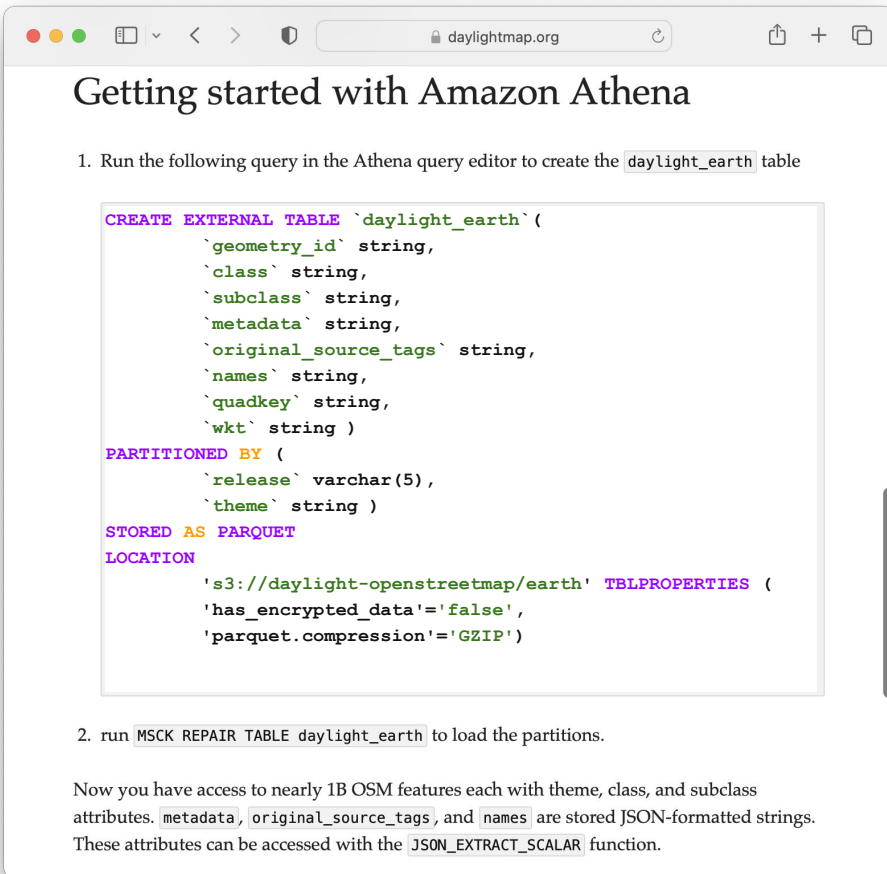
### Available Themes

theme	classes	subclasses	features
<a href="#">building</a>	19	225	525,240,408
<a href="#">building_detail**</a>	1	1	2,232,081
<a href="#">infrastructure</a>	6	45	11,226,443
<a href="#">land</a>	9	15	40,831,400
<a href="#">landuse</a>	25	97	39,397,340
<a href="#">placename</a>	3	11	3,430,404
<a href="#">poi</a>	22	233	38,777,950
<a href="#">road</a>	10	32	216,890,017
<a href="#">transit</a>	6	32	6,716,006
<a href="#">water</a>	9	22	36,401,694

\*\* The building detail theme includes all `building:part=yes` features in OSM. They do not currently have different class/subclass values. Instead, they contain the IDs of the building footprint(s) with which they overlap.

### Daylight Earth Table Schema

## Using Amazon Athena



Getting started with Amazon Athena

1. Run the following query in the Athena query editor to create the `daylight_earth` table

```
CREATE EXTERNAL TABLE `daylight_earth` (  
  `geometry_id` string,  
  `class` string,  
  `subclass` string,  
  `metadata` string,  
  `original_source_tags` string,  
  `names` string,  
  `quadkey` string,  
  `wkt` string )  
PARTITIONED BY (  
  `release` varchar(5),  
  `theme` string )  
STORED AS PARQUET  
LOCATION  
  's3://daylight-openstreetmap/earth' TBLPROPERTIES (  
    'has_encrypted_data'='false',  
    'parquet.compression'='GZIP')
```

2. run `MSCK REPAIR TABLE daylight_earth` to load the partitions.

Now you have access to nearly 1B OSM features each with theme, class, and subclass attributes. `metadata`, `original_source_tags`, and `names` are stored JSON-formatted strings. These attributes can be accessed with the `JSON_EXTRACT_SCALAR` function.

The screenshot displays the Amazon Athena Query Editor interface. The browser address bar shows 'us-west-2.console.aws.amazon.com'. The AWS Services navigation bar is visible at the top, with 'Athena' and 'S3' selected. The main interface is titled 'Amazon Athena > Query editor' and includes tabs for 'Editor', 'Recent queries', 'Saved queries', and 'Settings'. The 'Workgroup' is set to 'primary'.

On the left side, the 'Data' panel shows the 'Data source' as 'AwsDataCatalog', the 'Database' as 'daylight', and 'Tables and views' with 8 tables and 0 views. The 'Query 1' editor contains the following SQL code:

```

1 CREATE EXTERNAL TABLE `daylight_earth`(
2   `geometry_id` string,
3   `class` string,
4   `subClass` string,
5   `metadata` string,
6   `original_source_tags` string,
7   `names` string,
8   `quadkey` string,
9   `wkt` string)
10 PARTITIONED BY (
11   `release` varchar(5),
12   `theme` string)
13 STORED AS PARQUET
14 LOCATION
15   's3://daylight-openstreetmap/earth'
16 TBLPROPERTIES (
17   'has_encrypted_data'='false',
18   'parquet.compression'='GZIP')

```

Below the query editor, the 'Run' buttons are visible: 'Run again', 'Explain', 'Cancel', 'Save', 'Clear', and 'Create'. The 'Query results' tab is active, showing a 'Completed' status with the following metrics: 'Time in queue: 115 ms', 'Run time: 440 ms', and 'Data scanned: -'. A message at the bottom of the results area states 'Query successful.'

The footer of the interface includes a 'Feedback' link, a note about language selection, and copyright information: '© 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences'.

The screenshot shows the AWS Athena console interface. The browser address bar indicates the URL is `us-west-2.console.aws.amazon.com`. The console header shows the user is logged in as Jennings Anderson in the Oregon region. The main content area is divided into several sections:

- Data Source:** Set to `AwsDataCatalog` and `daylight`.
- Tables and views:** Shows 8 tables and 0 views.
- Query Editor:** Contains the following SQL query:
 

```

            1 select theme,
            2   count(geometry_id)
            3   from daylight_earth
            4   group by theme
            5   order by count(geometry_id) DESC
            
```
- Query Execution:** The query is labeled as `Query 5` and is in a `Completed` state. Performance metrics show: `Time in queue: 108 ms`, `Run time: 4.453 sec`, and `Data scanned: 5.04 GB`.
- Results:** A table with 10 rows is displayed. The columns are `#`, `theme`, and `_col1`.
 

#	theme	_col1
1	building	525240408
2	road	216890017
3	land	40831400
4	landuse	39397340
5	poi	38777950
6	water	36401694
7	infrastructure	11226443

At the bottom of the console, there is a footer with a feedback link, a language selection notice, and copyright information for Amazon Web Services, Inc. (© 2022).



Query 25 × | Query 2 × | ✔ Query 3 × | Query 4 × | Query 5 × | Query 6 × | Query 7 × | Query 8 × | Query 9 × | Query 10 ×

```

1 SELECT *
2 FROM daylight_earth
3 WHERE theme = 'building'
4 AND JSON_EXTRACT_SCALAR(metadata, '$.landuse') = 'developed:industrial'
5 LIMIT 100
    
```

SQL Ln 5, Col 10



Run again

 Explain 
Cancel
Save ▼
Clear
Create ▼

Query results | Query stats

✔ Completed
Time in queue: 168 ms
Run time: 6.46 sec
Data scanned: 15.19 GB

**Results (100+)**

Copy
 
Download results

<
1
>
⚙️

#	geometry_id	class	subclass	metadata	original_source_tags
1	w496485510@1	general	building	{ "building": "yes", "landuse": "developed:industrial", "quadkey": "031333211101132", "surface_area_sq_m": 268.9 }	{ "building": "yes", "source": "Eusko Jaurlaritza-Gobierno Vasco. GeoEuskadi." }

## Earth Table Metadata

Normalize attributes into metadata such as height

Append additional information from other themes for overlapping features

`earth_table`

Way: 519759719

Version #1

Various changes and additions

Edited almost 5 years ago by goadelic  
Changeset #51557981

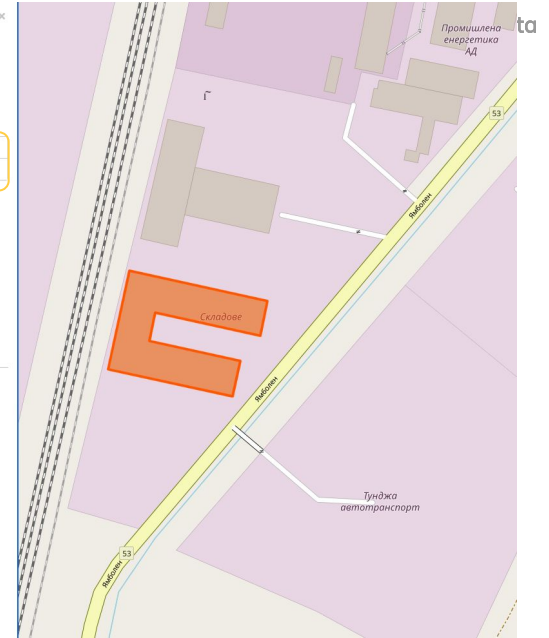
### Tags

building	warehouse
building:levels	6

### Nodes

- ▼ 9 nodes
- 5067554746
- 5067554747
- 5067554748
- 5067554749
- 5067554750
- 5067554751
- 5067554752
- 5067554753
- 5067554746

[Download XML](#) - [View History](#)



source: **osm**  
theme: **building**  
class: **industrial**  
subclass: **warehouse**

height: **20.52 meters**  
area: **4962 square meters**  
landuse class: **developed,**  
landuse subclass: **industrial**  
wkt: POLYGON ((26.483607 ...))

Theme: landuse

Landuses from OSM.

Geometry Type	features
LineString	471,658
MultiLineString	2,882
MultiPolygon	97,018
Point	7,794
Polygon	38,817,988

Metadata keys

key name	description of values
landuse	value of landuse tag in OSM
layer	value of layer tag in OSM
level	value of level tag in OSM
length_m	Length of feature in meters (if a line)
natural_tag	value of natural tag in OSM
sport	value of sport tag in OSM
surface_area_sq_m	Area of feature in square meters (if a polygon)
surface	value of surface tag in OSM
wikidata	Wikidata ID (if present in OSM)

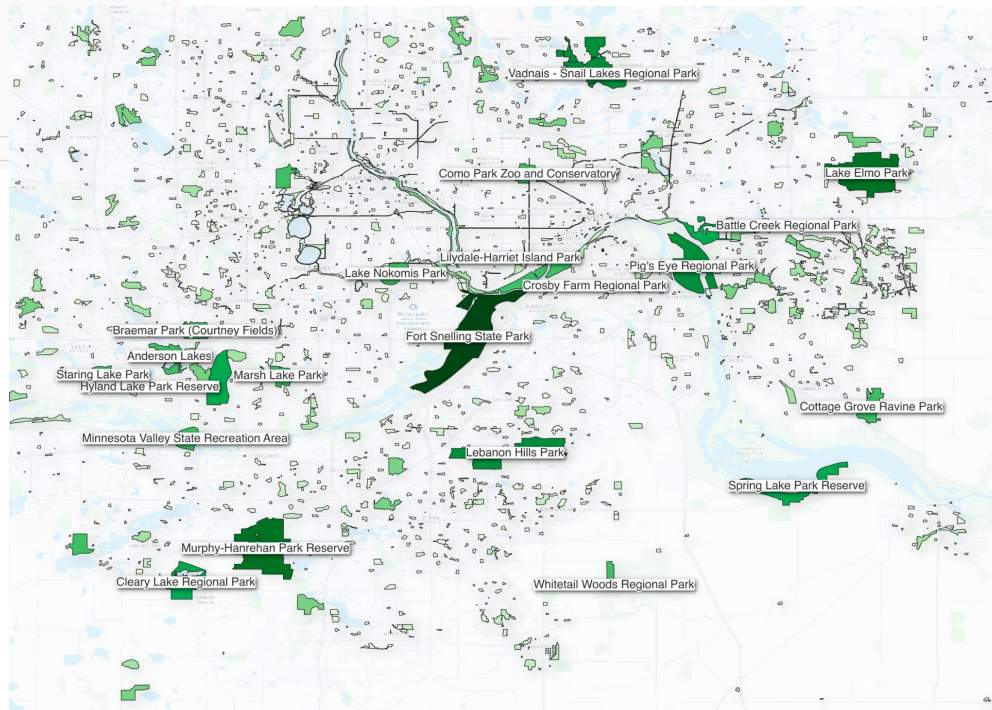
Feature counts per class and subclass in Daylight v1.18

Class	Subclass	Feature Count	Example Feature in OSM
agriculture	farmland	7,993,053	<a href="#">w953845420@1</a>
agriculture	farmyard	1,124,138	<a href="#">w765544240@1</a>
agriculture	meadow	362,980	<a href="#">w392437867@3</a>
agriculture	animal_keeping	4,189	<a href="#">w762969249@2</a>
airport	helipad	34,099	<a href="#">w433701531@1</a>
airport	aerodrome	18,302	<a href="#">w564067476@8</a>

```

1 SELECT
2   geometry_id,
3   class,
4   subclass,
5   JSON_EXTRACT_SCALAR(names, '$.local') as name,
6   CAST(JSON_EXTRACT_SCALAR(metadata, '$.surface_area_sq_m') AS double) as area,
7   wkt
8 FROM daylight_earth
9 WHERE release = 'v1.18'
10  AND theme = 'landuse'
11  AND class = 'park'
12  AND subclass <> 'grass'
13  AND quadkey like '021333011%'
    
```

geometry_id	class	subclass	name	area	wkt
w43377655@2	park	park	Snail Lake Marsh Park	170479.69	POLYGON ((-93.1
w522449122@5	park	park	Bunker Hill Park	62740.8	POLYGON ((-93.1
w216244611@2	park	park		22752.91	POLYGON ((-93.1
w47652678@7	park	park	East Phillips Park	29728.08	POLYGON ((-93.1
w336407468@1	park	park		1591.29	POLYGON ((-93.1
w35079781@1	park	park		19078.45	POLYGON ((-93.1
w329050291@5	park	park	Erickson Park	180152.37	POLYGON ((-93.1
w1085852524@1	park	park		200599.63	POLYGON ((-93.1
w314677340@2	park	park		44831.66	POLYGON ((-92.5
w912557268@1	park	park		7700.07	POLYGON ((-93.1
w635018766@1	park	park	Wargo Court	1806.61	POLYGON ((-93.1
w960891048@1	park	park		5114.3	POLYGON ((-93.1
w36657367@8	park	park	Cedar Manor Lake Park	60402.83	POLYGON ((-93.1
w893835529@4	park	park		115032.29	POLYGON ((-92.1
w894770103@3	park	park		35738.3	POLYGON ((-92.5
w1003253264@2	park	park	Dean Parkway	17493.68	POLYGON ((-93.1
w886329369@2	park	park	Edgerton Park	71072.74	POLYGON ((-93.1



```

1 SELECT
2   geometry_id,
3   class,
4   subclass,
5   JSON_EXTRACT_SCALAR(names, '$.local') as name,
6   wkt
7 FROM daylight_earth
8 WHERE theme = 'water'
9 AND class = 'river'
10 AND ST_CONTAINS(
11   ST_GEOMETRYFROMTEXT('POLYGON((-109.06409916585731 41.008769739828494,
12     ,-109.07238952929733 37.000860715568436, -109.06409916585731 41.00
13   )

```

SQL Ln 5, Col 51

Run again

Explain [↗](#)

Cancel

Save ▼

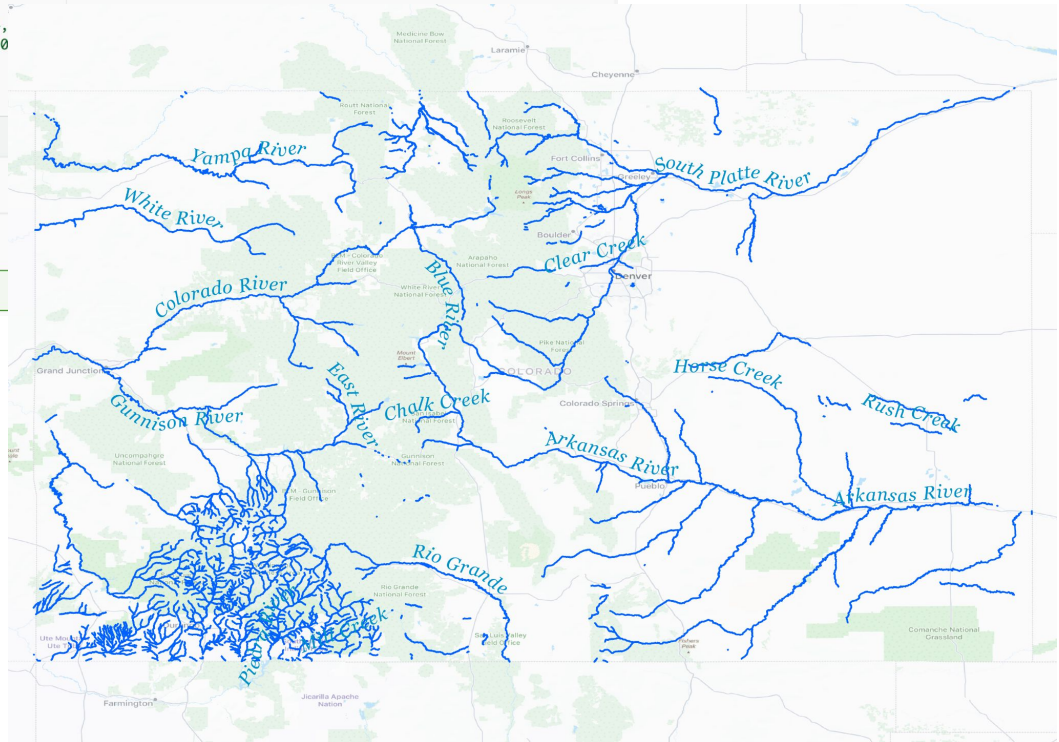
Clear

Create ▼

Query results

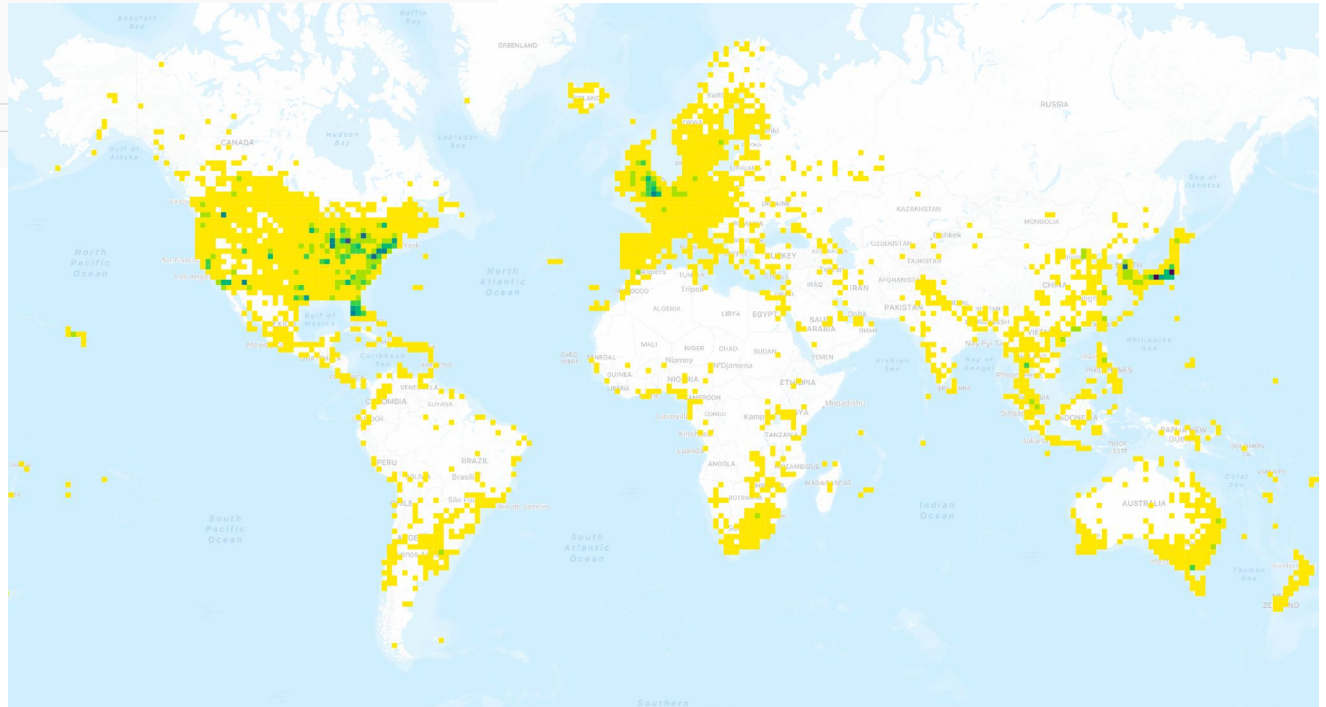
Query stats

✔ Completed



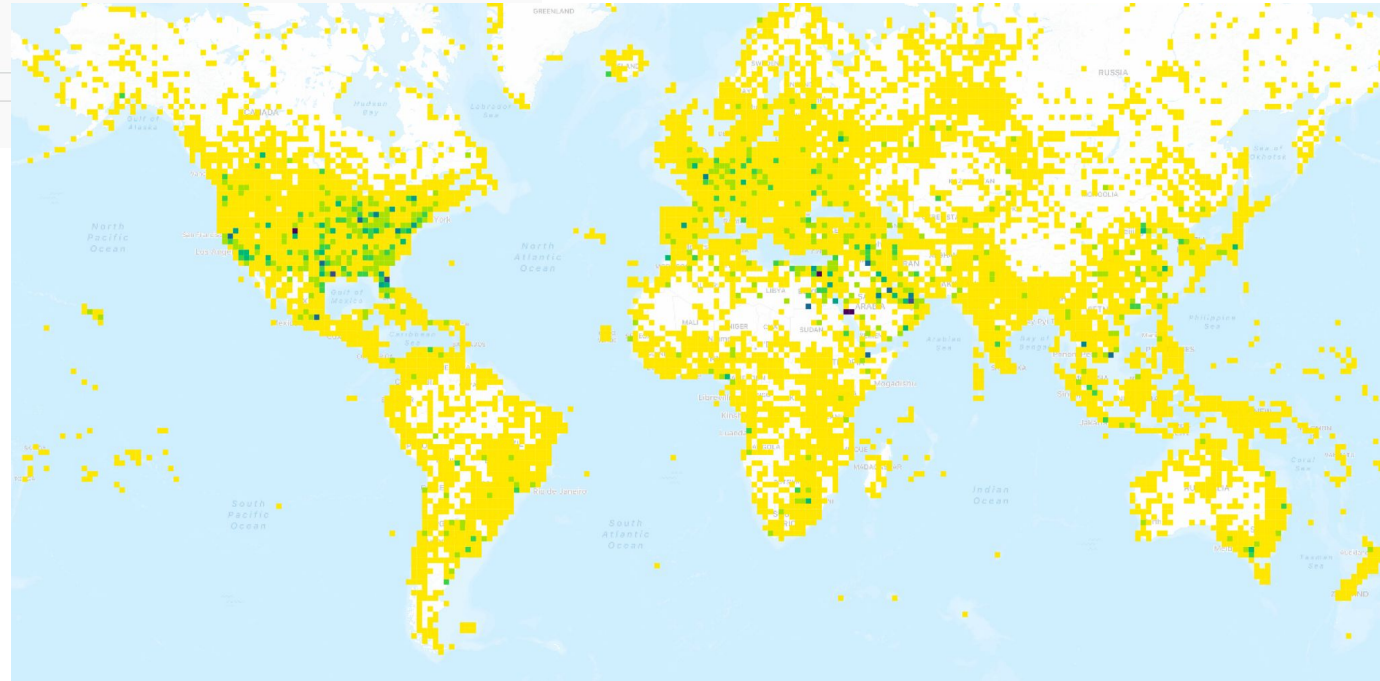
## ✔ Query 3

```
1 select BING_TILE_POLYGON(BING_TILE(substr(quadkey, 1, 8))),
2     sum(
3     cast(
4     JSON_EXTRACT_SCALAR(metadata, '$.surface_area_sq_m')
5     as double)
6     ) / 1000000 AS sq_km_golf
7 from daylight_earth
8 where theme = 'landuse'
9     and class = 'golf'
10 group by substr(quadkey, 1, 8)
```



## ✔ Query 3

```
1 select BING_TILE_POLYGON(BING_TILE(substr(quadkey, 1, 8))),
2     sum(
3     cast(
4         JSON_EXTRACT_SCALAR(metadata, '$.surface_area_sq_m')
5         as double)
6     ) / 1000000 AS sq_km_airport
7 from daylight_earth
8 where theme = 'landuse'
9     and class = 'airport'
10 group by substr(quadkey, 1, 8)
```



Thank you

[daylightmap.org/earth](https://daylightmap.org/earth)

[jenningsa@meta.com](mailto:jenningsa@meta.com)

[jonahadkins@meta.com](mailto:jonahadkins@meta.com)