

# An introduction to the geospatial world

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# Agenda

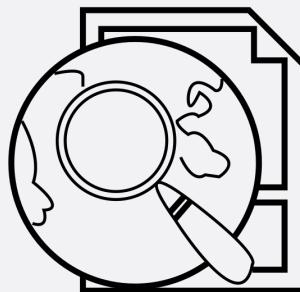
The GIS Cookbook  
Geocoding Love&Hate  
The OpenStreetMap Ecosystem  
Geospatial & Python

# the GIS cookbook



Projections

Data Model



Distribution protocols

Spatial Analysis



Rendering

special guest: geocoding

# Flat earth?



The  
FLAT EARTH  
SOCIETY

Tweet 4.607 Following 208 Follower 56.100 Mi place 638 Segui ...

**Flat Earth Society** 

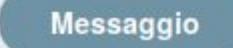
@FlatEarthOrg

Encouraging the spread of ideas and free thought since 1865! Read the FAQ: faq.tfes.org Visit us: tfes.org

 [tfes.org](http://tfes.org)

 Iscritto a dicembre 2013

 [Invia Tweet](#)

 [Messaggio](#)

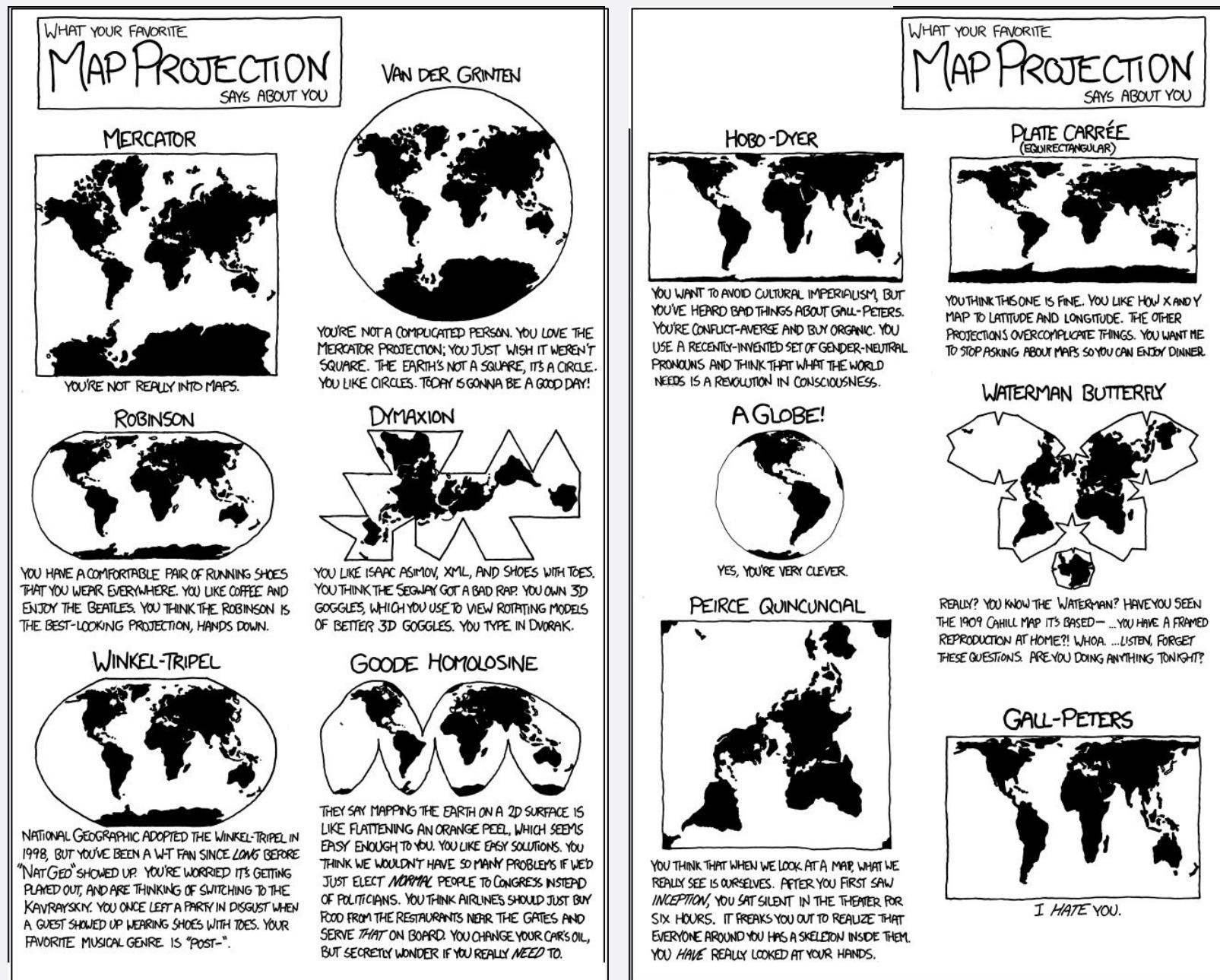
 352 foto e video

Tweet	Tweet e risposte	Contenuti
 Tweet fissato <b>Flat Earth Society</b>  @FlatEarthOrg - 1 giu In risposta a @NewYorker One has to wonder about the state of our mainstream media when staunch empiricism is described as "post-truth" by major outlets.  Traduci il Tweet  146  19  71 		
 <b>Flat Earth Society</b>  @FlatEarthOrg - 5 h <a href="http://facebook.com/FlatSoc">facebook.com/FlatSoc</a> <a href="http://tfes.org">tfes.org</a>		

 @napo



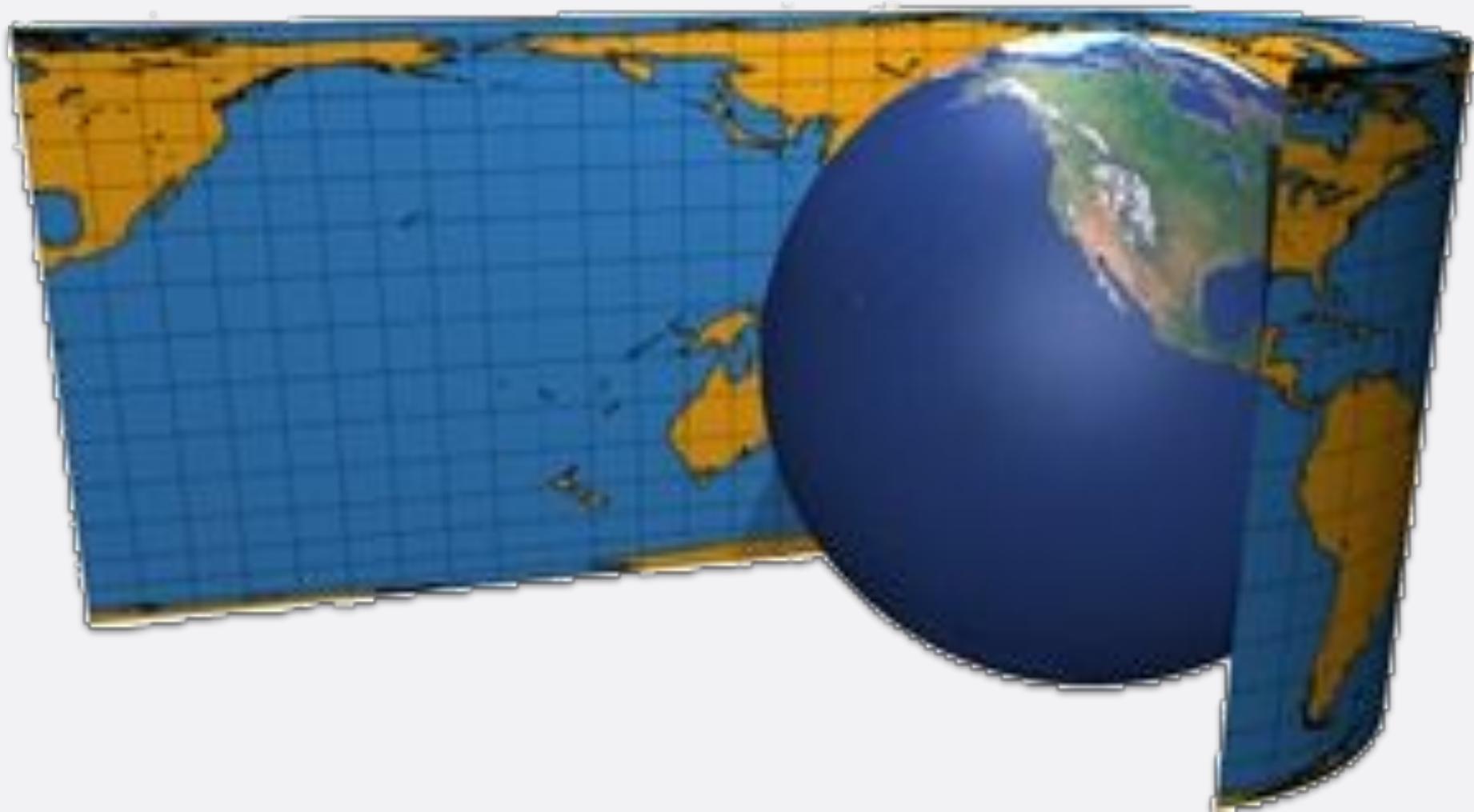
# Projections



# Dymaxion

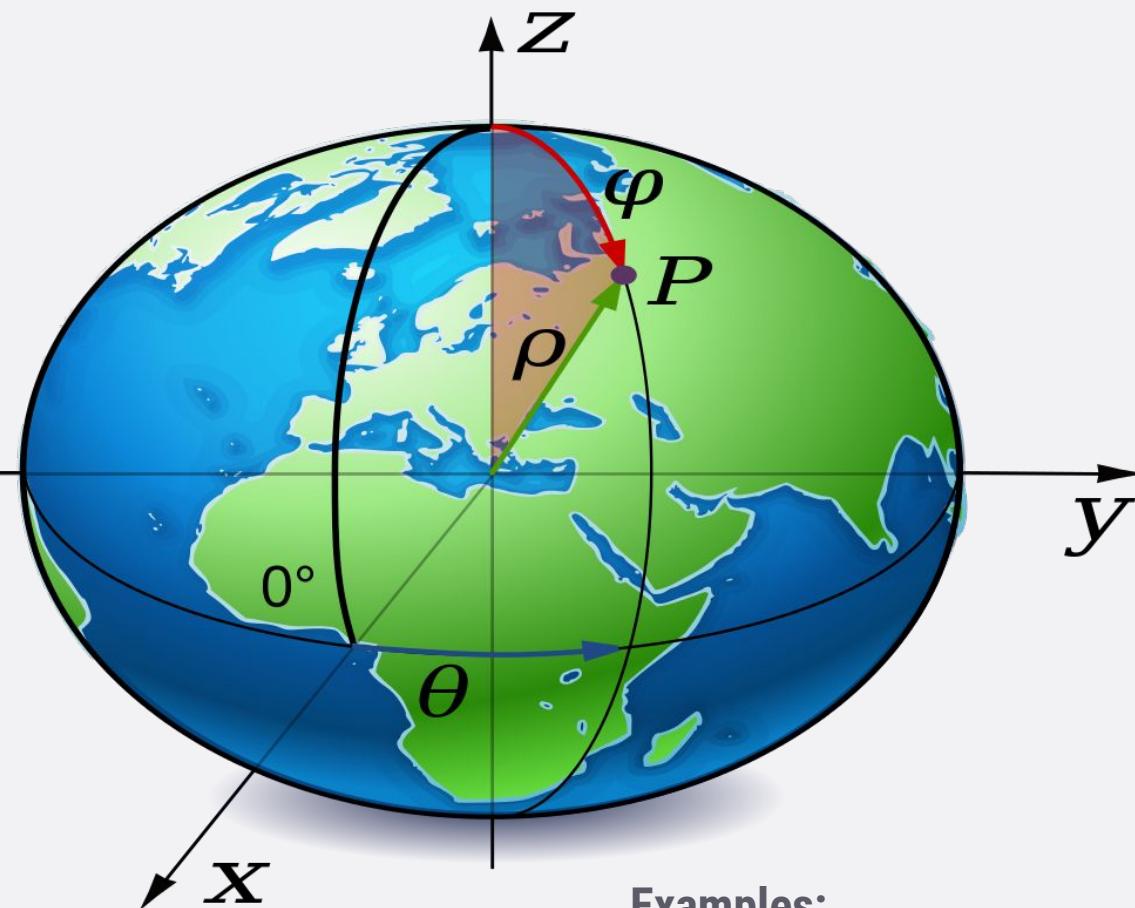


# Cylindrical projection

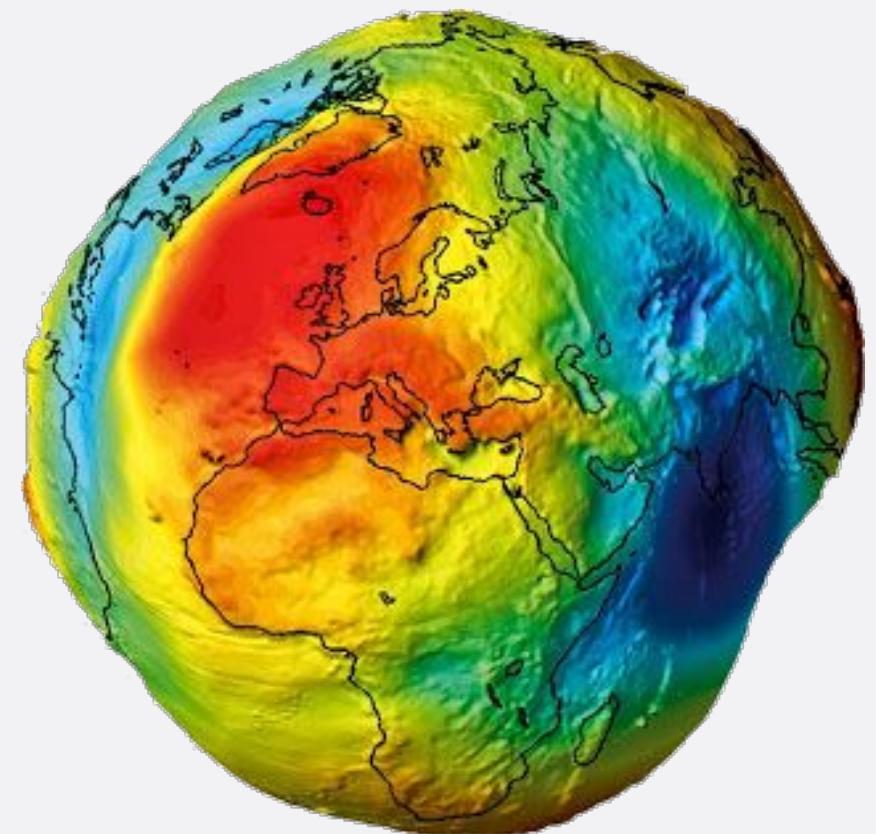


# Datum

oblate spheroid



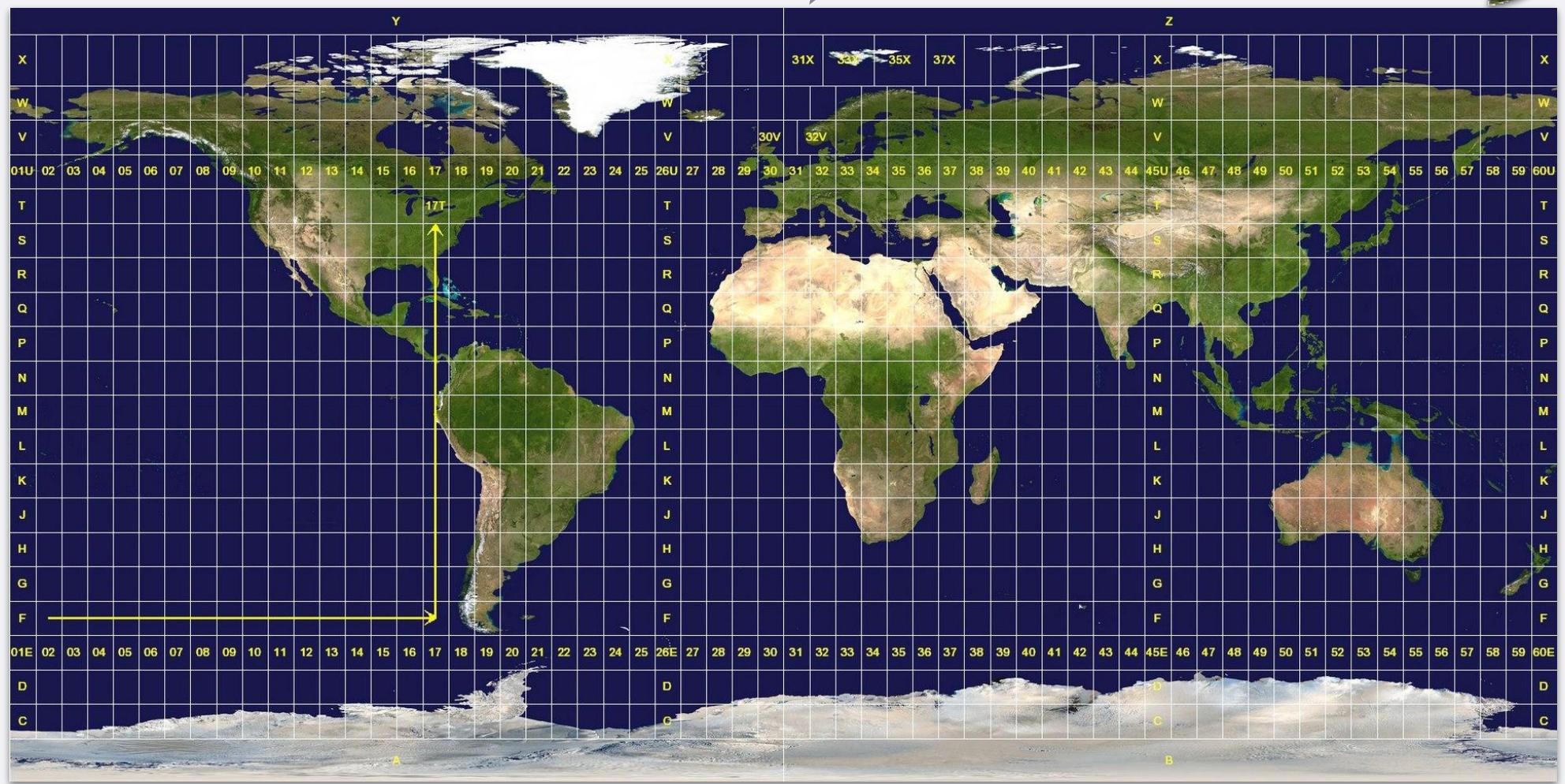
geoid



Examples:

- **Rome 40**
- **European Datum 1950**
- **European Terrestrial Reference System 1989**
- **World Geodetic System 1984**

# Universal Transverse Mercator



# The most used for the web

## **EPSG:4326 - WGS84**

- Degree (lat/long)
- WGS84

## **EPSG: 3857 - Web Mercator**

- Meters
- WGS84
- World without polos

former EPSG: 900913 Google  
Mercator  
(digit version of the word Google)

# EPSG???



International  
Association  
of Oil & Gas  
Producers

**former**  
**European Petroleum Survey Group**

<http://www.epsg.org/>



<http://spatialreference.org/>



<http://epsg.io/>

# DATA MODELS

## Discrete Data

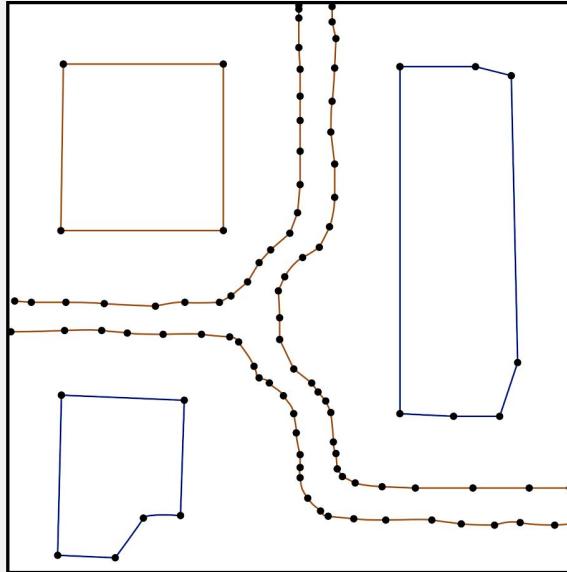
Vectors with attributes

Eg.

Points

Lines

Polygons



## Continuous Data

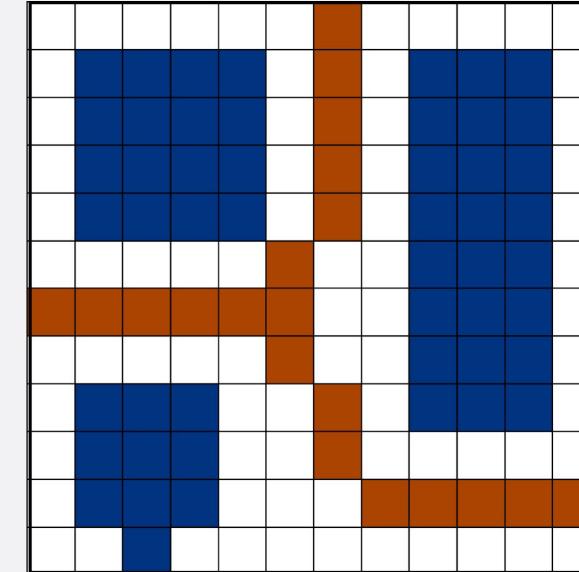
Matrix

Eg.

Digital Elevation Models

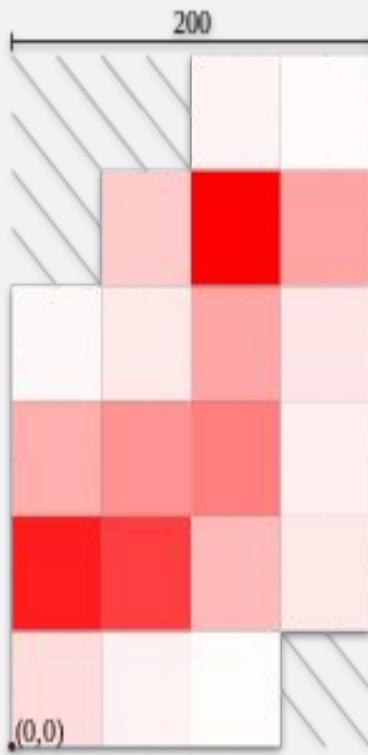
Solar Power Cells

Orthophotos



# Example RASTER

GRID IMAGE



VALUES

	25	75	125	175
275	NA	NA	5	2
225	NA	20	100	36
175	3	8	35	10
125	32	42	50	6
75	88	75	27	9
25	13	5	1	NA

ASCII Grid Format

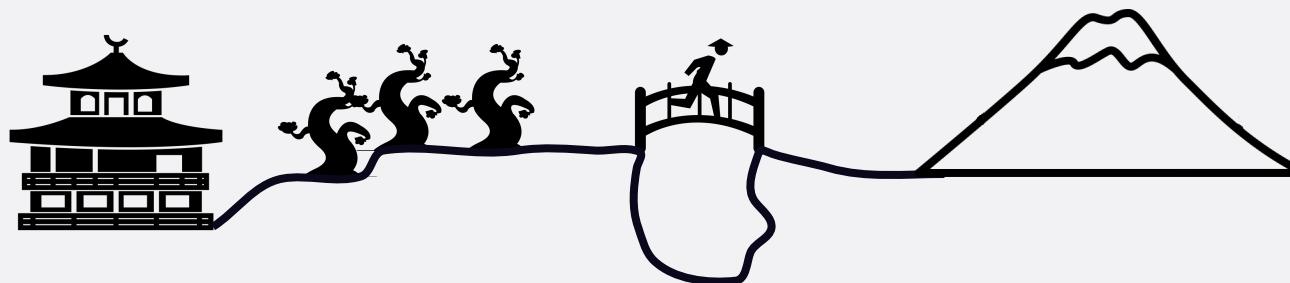
```
ncols          4
nrows          6
xllcorner     0.0
yllcorner     0.0
cellsize       50.0
NODATA_value -9999
-9999 -9999 5 2
-9999 20 100 36
3 8 35 10
32 42 50 6
88 75 27 9
13 5 1 -9999
```

[https://en.wikipedia.org/wiki/Esri\\_grid](https://en.wikipedia.org/wiki/Esri_grid)

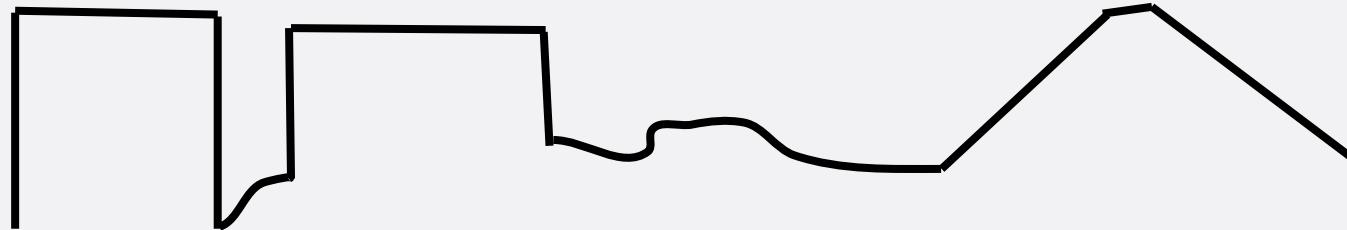
# DSM vs DTM

DEM is often used as a generic term for DSMs and DTMs

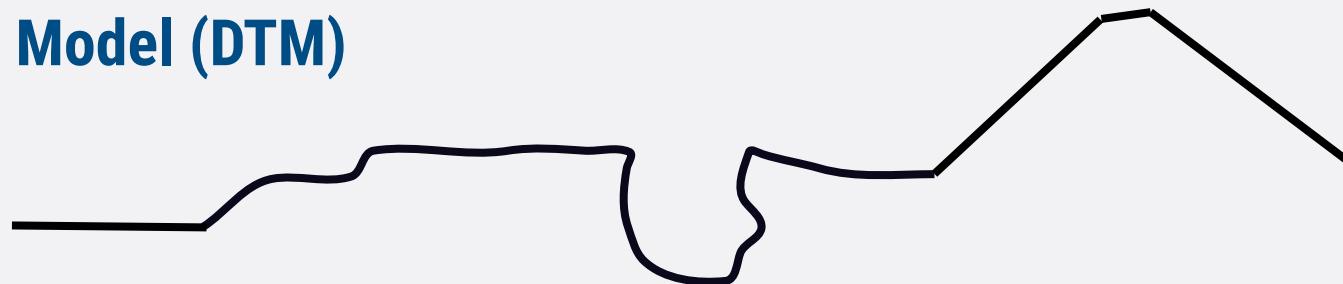
## Real World



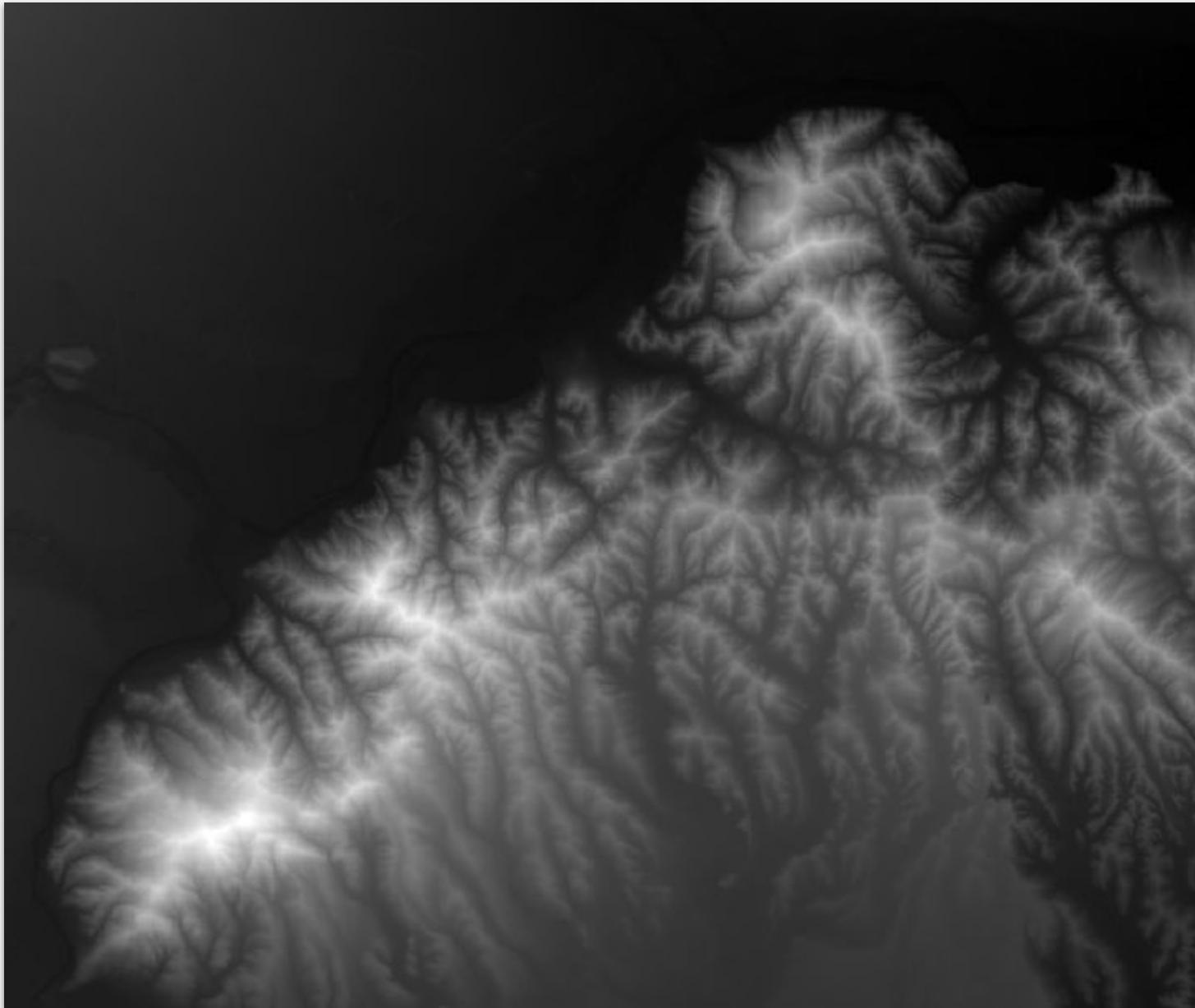
## Digital Surface Model (DSM)



## Digital Terrain Model (DTM)



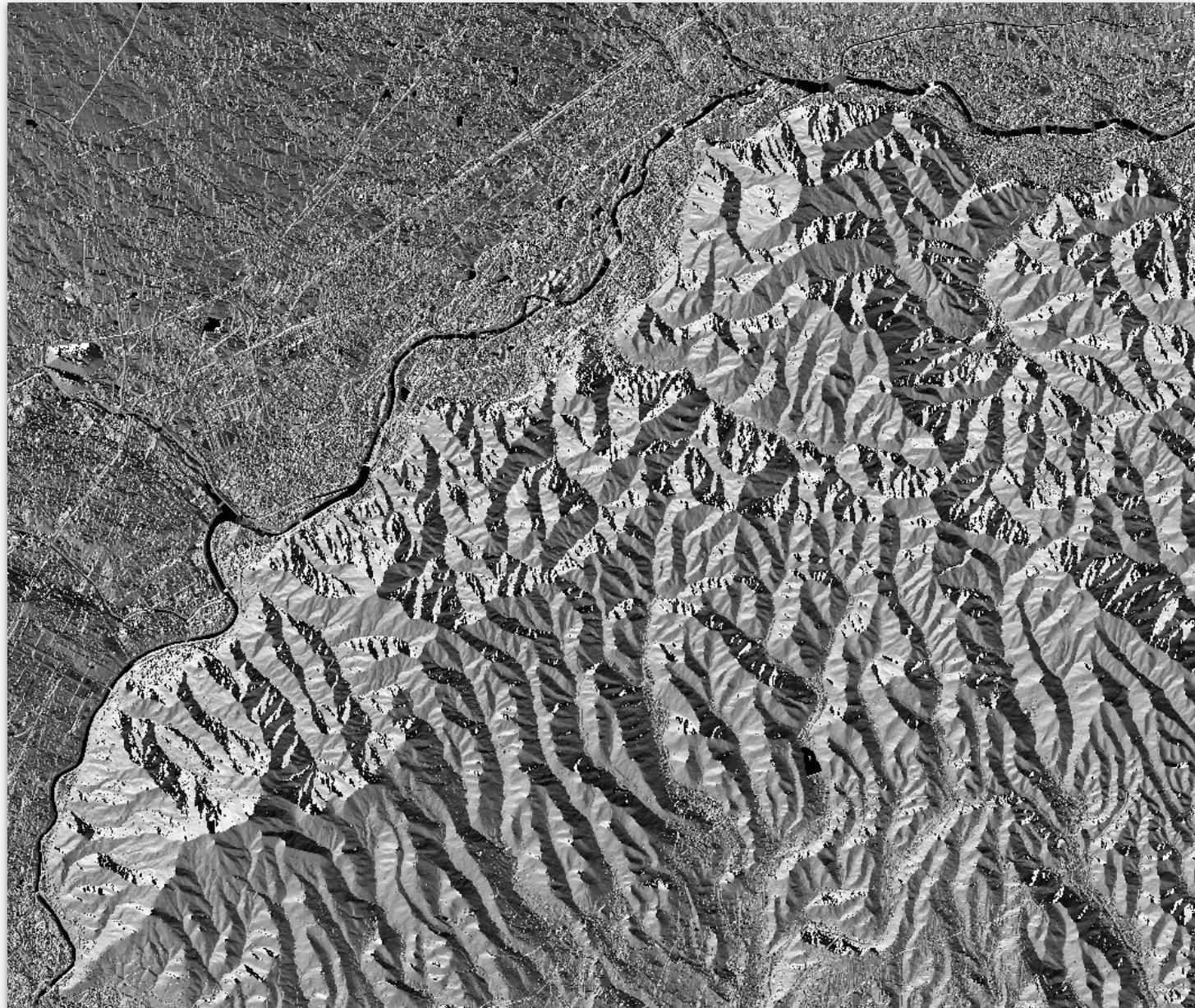
# DTM - shades of gray



# DTM - slope

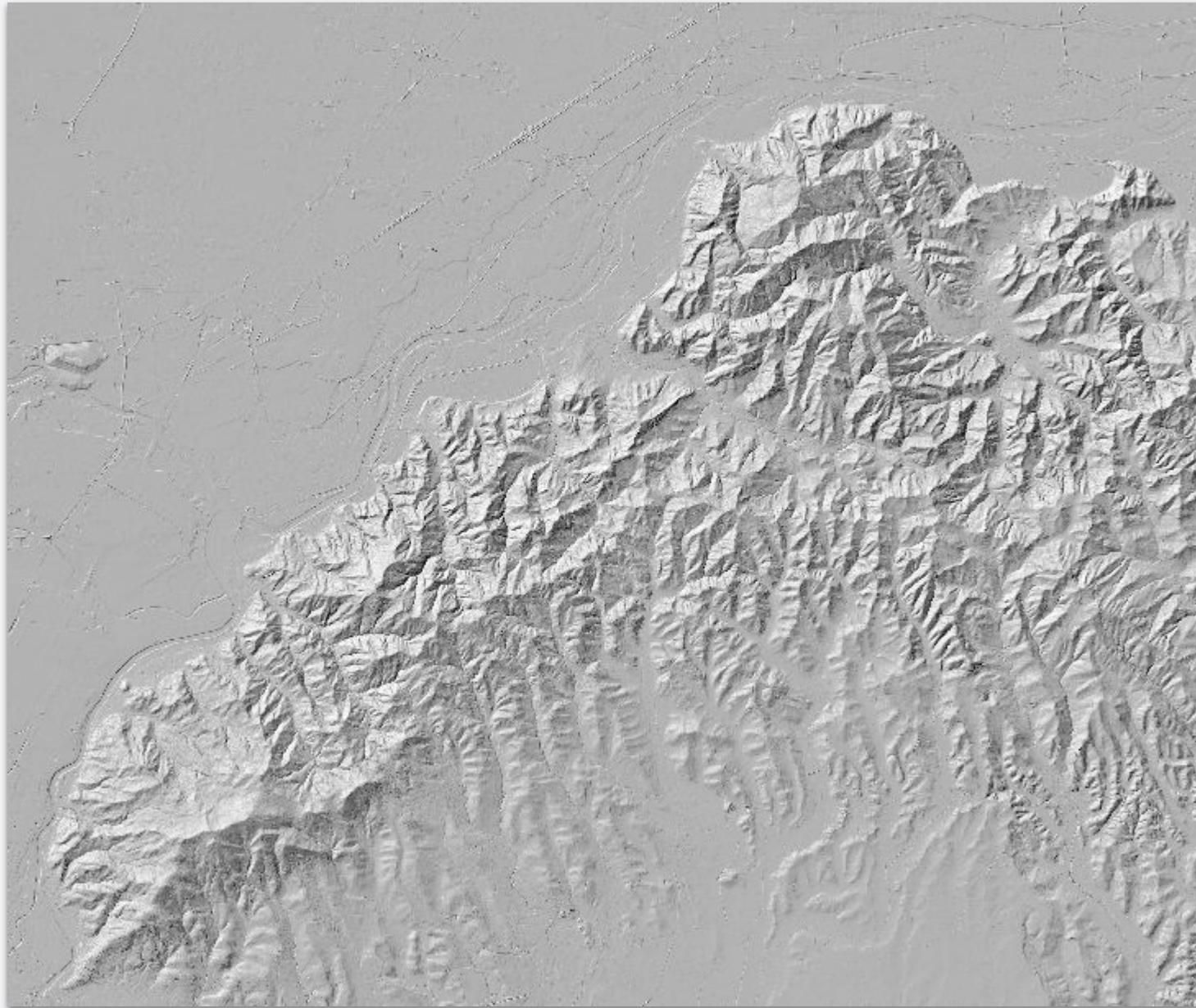


# DTM aspect



aspect is the compass direction that a slope faces

# DTM Hillshade



simulation of lighting intensity with a shading effect from an azimuth and altitude of light  
it can be used to produce the impression of the terrain relief.

# Example Vector

```
{  
  "type": "FeatureCollection",  
  "features": [  
    {  
      "type": "Feature",  
      "geometry": {  
        "type": "Point",  
        "coordinates": [  
          11.1215698,  
          46.0677293  
        ]  
      },  
      "properties": {  
        "name": "Fontana dell'Aquila",  
        "amenity": "drinking-water"  
      }  
    }  
  ]  
}
```

# Points



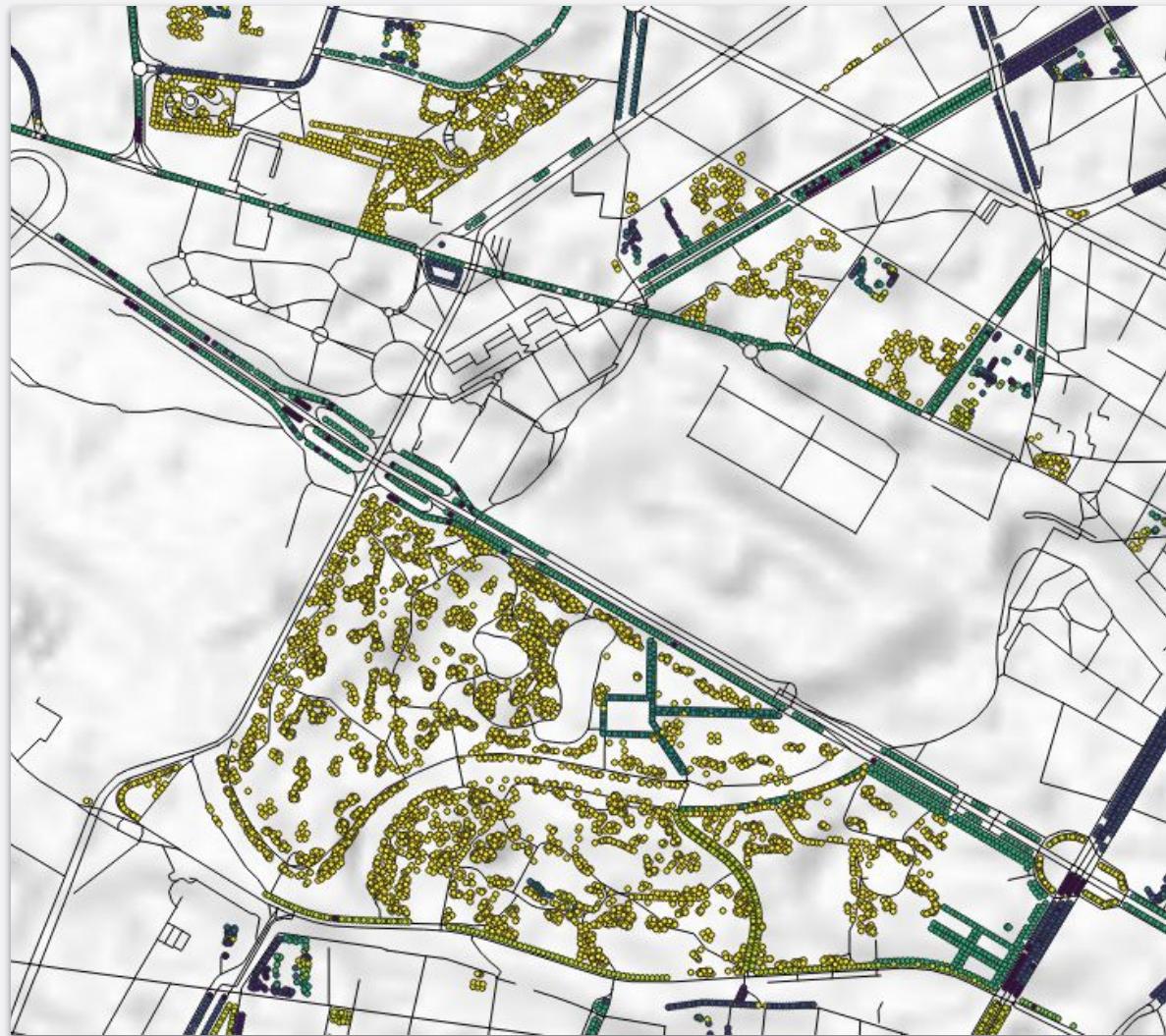
# Lines



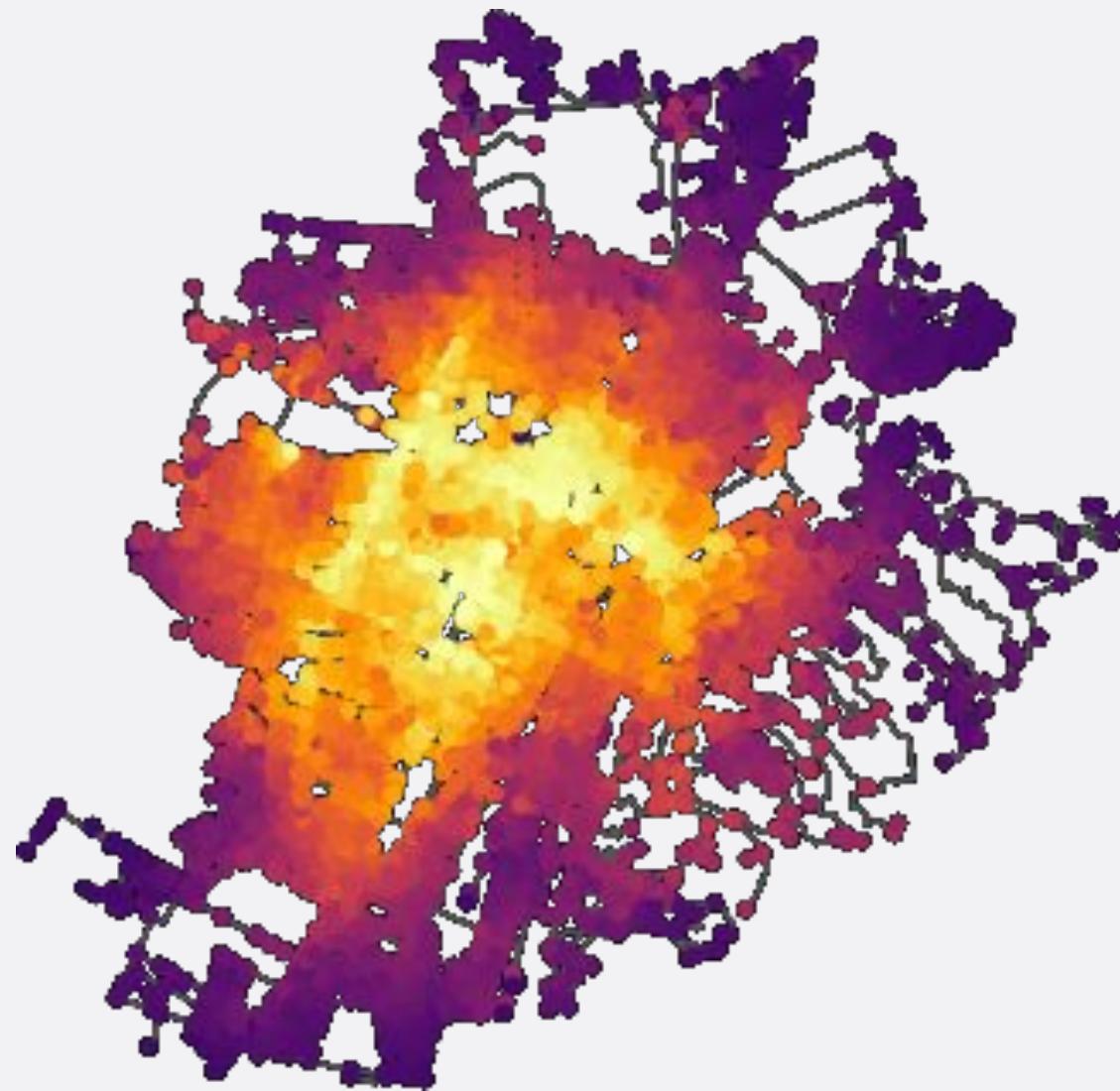
# Overlay



# Queries



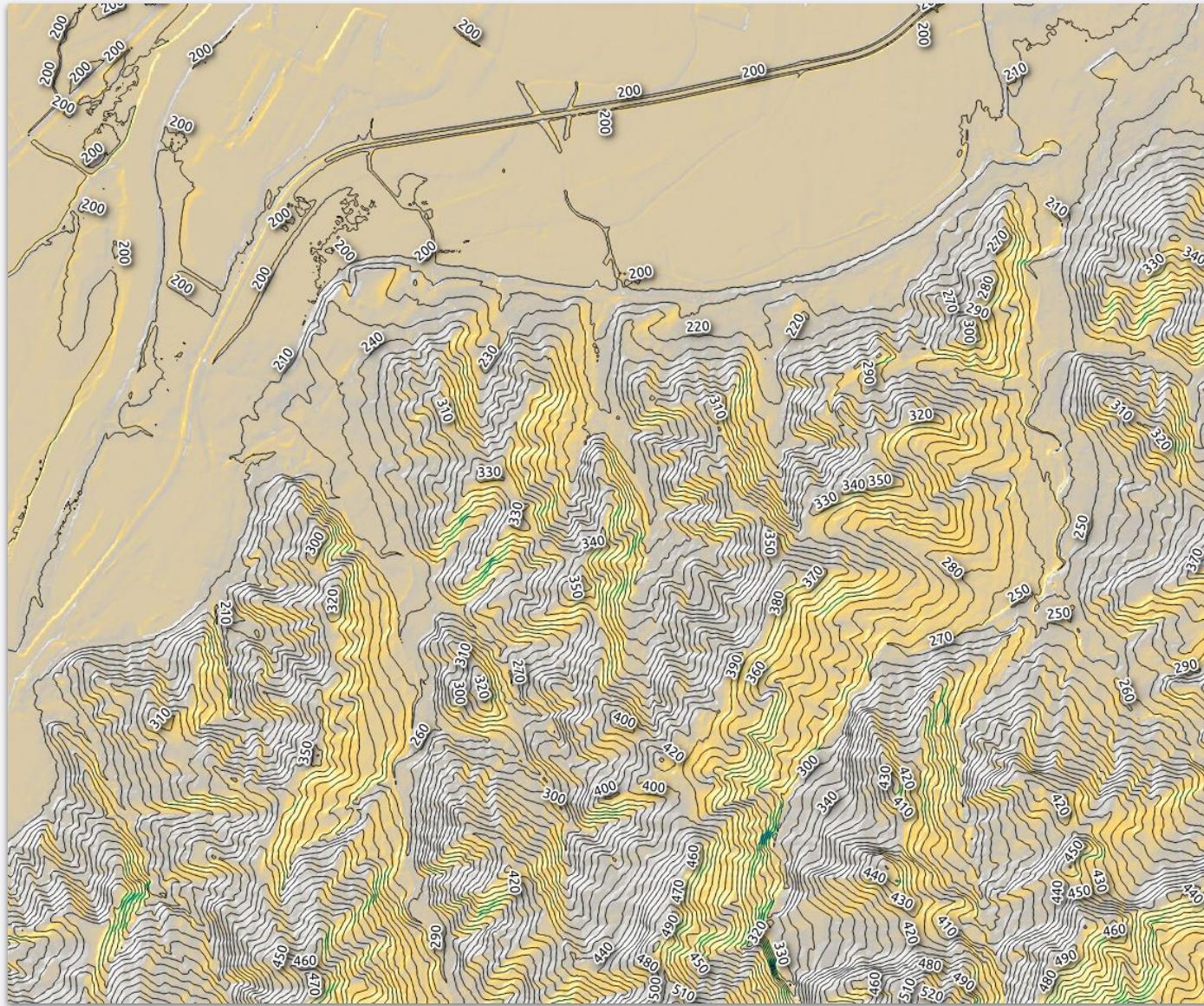
# Network Analysis



# Isochrones



# Raster to Vector



the dark lines are created from the DTM values where the altitude is the same (**isopleths**)

# Formats

## Vectors

- ESRI Shapefile
- WKT
- GeoJSON
- KML
- ...

## Raster

- Ascii Grid
- GeoTiff
- MBtiles

...



<http://www.gdal.org/>

# ESRI Shapefile

## Standard de facto

from 3 to 7 files with the same name and different extension

**filename.shp** →  
**filename.shx** →  
**filename.dbf** →  
**filename.prj** →

geometry  
index  
table  
projection

# The future is in GeoPackage



## GeoPackage



### An Open Format for Geospatial Information

GeoPackage is an open, standards-based, platform-independent, portable, self-describing, compact format for transferring geospatial information.

The GeoPackage Encoding Standard describes a set of conventions for storing the following within an SQLite database:

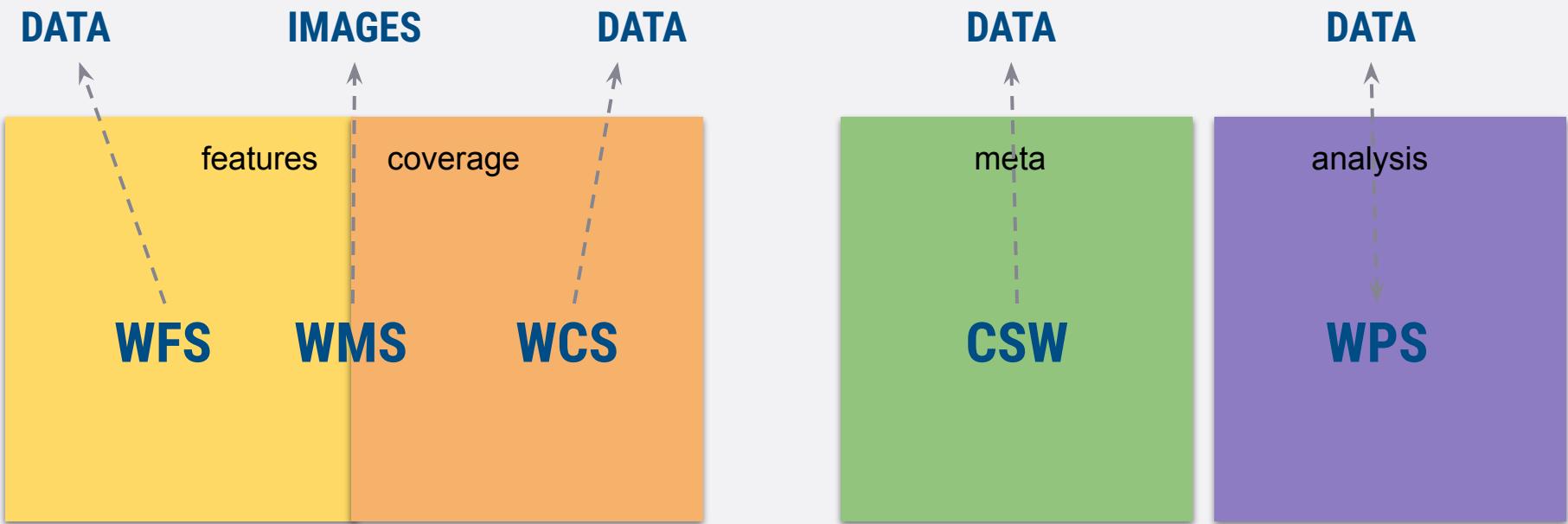
- vector features
- tile matrix sets of imagery and raster maps at various scales
- attributes (non-spatial data)
- extensions

To be clear, a GeoPackage is the SQLite container and the GeoPackage Encoding Standard governs the rules and requirements of content stored in a GeoPackage container. The GeoPackage standard defines the schema for a GeoPackage, including table definitions, integrity assertions, format limitations, and content constraints. The required and supported content of a GeoPackage is entirely defined in the standard. These capabilities are built on a common base and the extension mechanism provides implementors a way to include additional functionality in their GeoPackages.

Since a GeoPackage is a database container, it supports direct use. This means that the data in a GeoPackage can be accessed and updated in a "native" storage format without intermediate format translations. GeoPackages that comply with the requirements in the standard and do not implement vendor-specific extensions are interoperable across all enterprise and personal computing environments. GeoPackages are particularly useful on mobile devices such as cell phones and tablets in communications environments where there is limited connectivity and bandwidth.

<http://www.geopackage.org/>

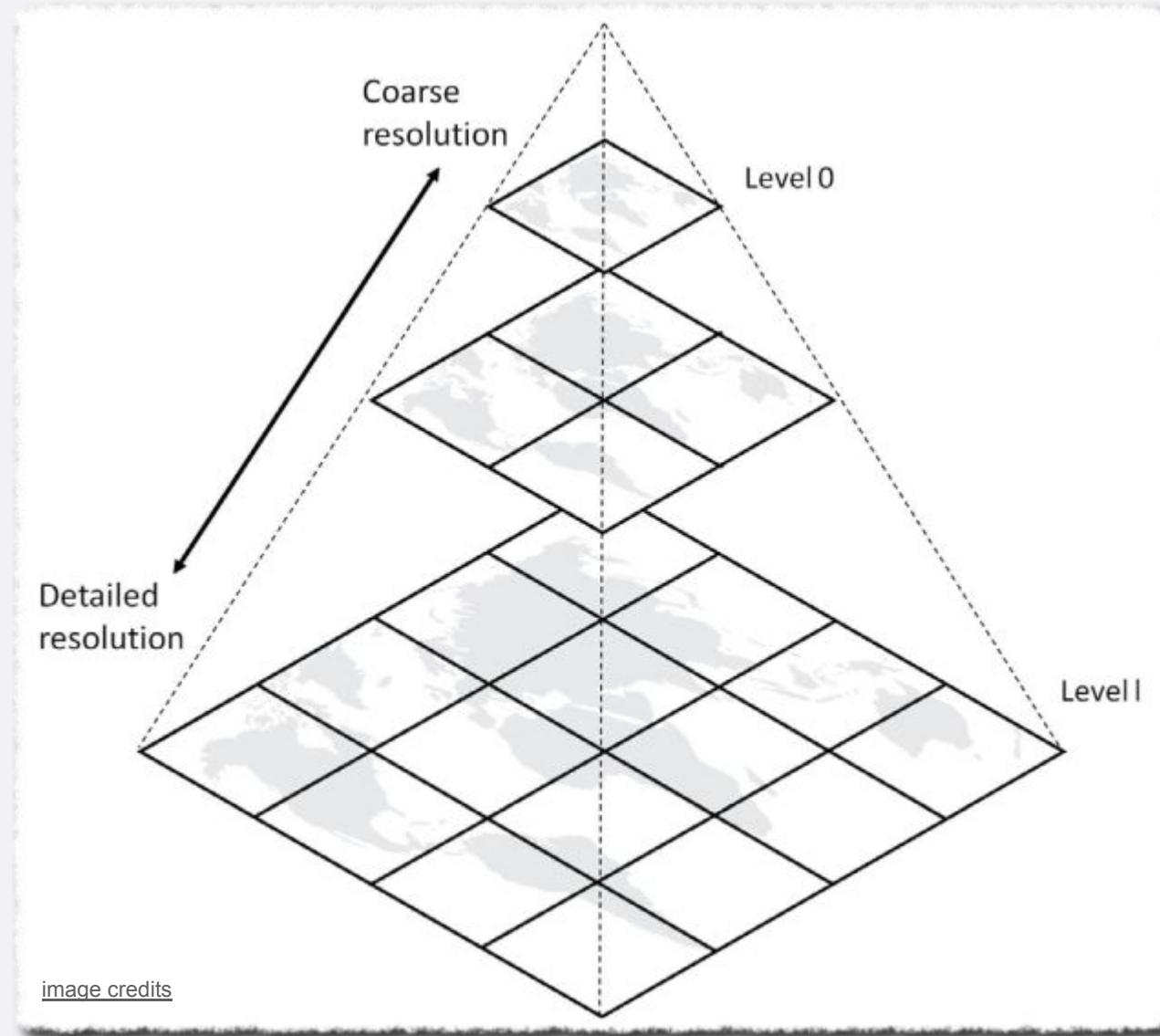
# OGC Protocols



- |            |   |                             |
|------------|---|-----------------------------|
| <b>WMS</b> | - | Web Map Service             |
| <b>WFS</b> | - | Web Feature Service         |
| <b>WCS</b> | - | Web Coverage Service        |
| <b>WPS</b> | - | Web Processing Service      |
| <b>CSW</b> | - | Catalog Service for the Web |



# TMS



## Tile Map Service

# Geocoding Suggestions

## How it works

- name of a location in input
- matching algorithm (place, region, country)
- output a geometry (in most of the cases a point) expressed in wgs84

## notes

### human vs computer

a query mediated by a human with a geocoder works better as an automate script

### enrich the query

better you write your location in input and better the geocoder can guess the name

Eg. you are looking for *TOP-IX, Via M. Vittoria, Torino*

Suggestions:

- write the complete name of the street: Via Maria Vittoria
- add the civic number: 38
- add the zipcode: 10123
- add the name of the city: Torino
- add the acronym of the province: TO
- add the name of the State: Italy

the new query is: *Top-ix, Via Maria Vittoria, 38, 10123 Torino TO, Italy*

### use all the feedbacks of the geocoder service

a good geocoder give you back an indicator of ranking of the result

# Geocoders: love and hate

getlon.lat Help! I need a geocoder.

*Geocoding service APIs from dozens of different providers analysed to help you choose. [More information.](#)*

I use about	ArcGIS	OpenCage	Geocode.xyz	Mapquest
5000 <input type="button" value="^"/> <input type="button" value="v"/>	Geosearch, Not Stored  \$0 for 1,000,000 /mo. <ul style="list-style-type: none"><li>• <input checked="" type="checkbox"/> Must not store geocodes.</li><li>• <input checked="" type="checkbox"/> Must not combine with third-party basemaps</li><li>• <a href="#">Terms and conditions</a></li></ul>	Free Trial  \$0 for 2,500 /day (76,000 /mo.) Rate limit: 1 per sec <ul style="list-style-type: none"><li>• <input checked="" type="checkbox"/> Based on open data</li><li>• <input checked="" type="checkbox"/> Storing geocodes ok</li><li>• <input checked="" type="checkbox"/> Third-party basemaps ok</li><li>• AU: ★★★ GNAF, elsewhere: ★★☆ OSM + other open data sources</li></ul>	Throttled API  \$0 for unlimited /mo. 86,400 requests per day max. Rate limit: 1 per sec <ul style="list-style-type: none"><li>• <input checked="" type="checkbox"/> Based on open data</li><li>• <input checked="" type="checkbox"/> Storing geocodes ok</li><li>• <input checked="" type="checkbox"/> Third-party basemaps ok</li><li>• <input checked="" type="checkbox"/> No auto-complete</li></ul>	Free  \$0 for 15,000 /mo. <ul style="list-style-type: none"><li>• <input checked="" type="checkbox"/> Must not store geocodes.</li><li>• <input checked="" type="checkbox"/> Must not combine with third-party basemaps</li><li>• <input checked="" type="checkbox"/> No scripted queries</li><li>• AU: ★★☆ Unit-level</li><li>• <a href="#">Terms and conditions</a></li></ul>
geocodes per month <input type="button" value="^"/> <input type="button" value="v"/> 100 <input type="button" value="^"/> <input type="button" value="v"/> geocodes on busy days <input type="button" value="^"/> <input type="button" value="v"/> 1 <input type="button" value="^"/> <input type="button" value="v"/> geocodes per second				
My app is:				
<input type="checkbox"/> Accessible to the public				
<input type="checkbox"/> Free of charge				
I need to:				
<input type="checkbox"/> Store geocodes permanently				
<input type="checkbox"/> Carry out bulk jobs not triggered by users				
	\$0/yr	\$0/yr	\$0/yr	\$0/yr

Built by [Steve Bennett](#). Github: [Stevage](#). Twitter: [@steverage1](#). Disclaimer: Geocoder plans change all the time. Obviously. Use at your own risk.

<http://getlon.lat/>

# Open Geo Data Turin

Region Piedmont - OGC Services

<http://www.geoportale.piemonte.it/cms/bdtre/modalita-di-pubblicazione-e-fruizione>

WMS ortofoto - AGEA 2015

[http://geomap.reteunitaria.piemonte.it/WEBCAT/CAPABILITIES/wmts\\_regp\\_ortofoto\\_ice\\_nir\\_2010.xml](http://geomap.reteunitaria.piemonte.it/WEBCAT/CAPABILITIES/wmts_regp_ortofoto_ice_nir_2010.xml)

wms [http://geomap.reteunitaria.piemonte.it/ws/taims/rp-01/taimsortoregp/wms\\_ortoregp2010](http://geomap.reteunitaria.piemonte.it/ws/taims/rp-01/taimsortoregp/wms_ortoregp2010)

wmts [http://geomap.reteunitaria.piemonte.it/WEBCAT/CAPABILITIES/wmts\\_rp\\_ortofoto\\_2010.xml](http://geomap.reteunitaria.piemonte.it/WEBCAT/CAPABILITIES/wmts_rp_ortofoto_2010.xml)

3) DTM 2010 5x5 m2

[http://www.datigeo-piem-download.it/static/regp01/DTM5\\_ICE/RIPRESA\\_AEREA\\_ICE\\_2009\\_2011\\_DTM-SDO\\_CTR\\_FOGLI50-155-EPSG32632-TIF.zip](http://www.datigeo-piem-download.it/static/regp01/DTM5_ICE/RIPRESA_AEREA_ICE_2009_2011_DTM-SDO_CTR_FOGLI50-155-EPSG32632-TIF.zip)

[http://www.datigeo-piem-download.it/static/regp01/DTM5\\_ICE/RIPRESA\\_AEREA\\_ICE\\_2009\\_2011\\_DTM-SDO\\_CTR\\_FOGLI50-156-EPSG32632-TIF.zip](http://www.datigeo-piem-download.it/static/regp01/DTM5_ICE/RIPRESA_AEREA_ICE_2009_2011_DTM-SDO_CTR_FOGLI50-156-EPSG32632-TIF.zip)

4) City of Turin

<http://geoportale.comune.torino.it/web/cartografia/catalogo-dei-metadati>

# The OpenStreetMap Ecosystem

# What is OpenStreetMap?



Local Knowledge



Community Driven

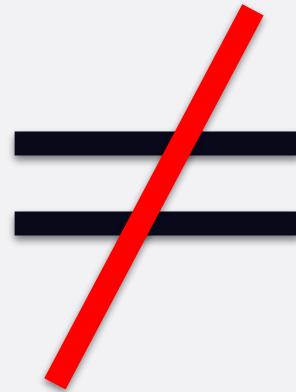


Open Data

**OpenStreetMap is built by a community of mappers that contribute and maintain data about roads, trails, cafés, railway stations, and much more, all over the world.**

<http://www.openstreetmap.org/about>

# OpenStreetMap is NOT an alternative to Google Maps



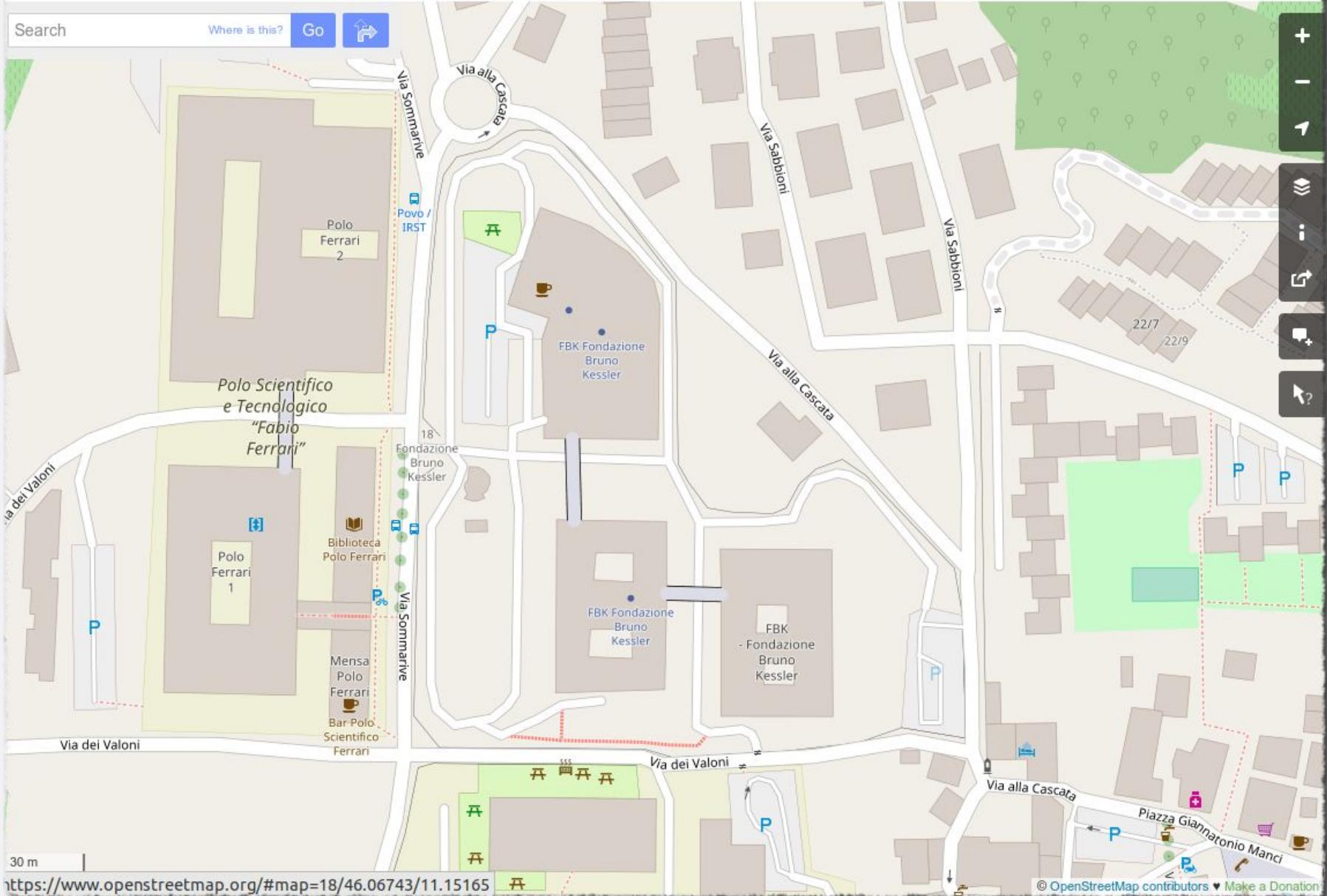


OPEN DATA

IS A COMMONS

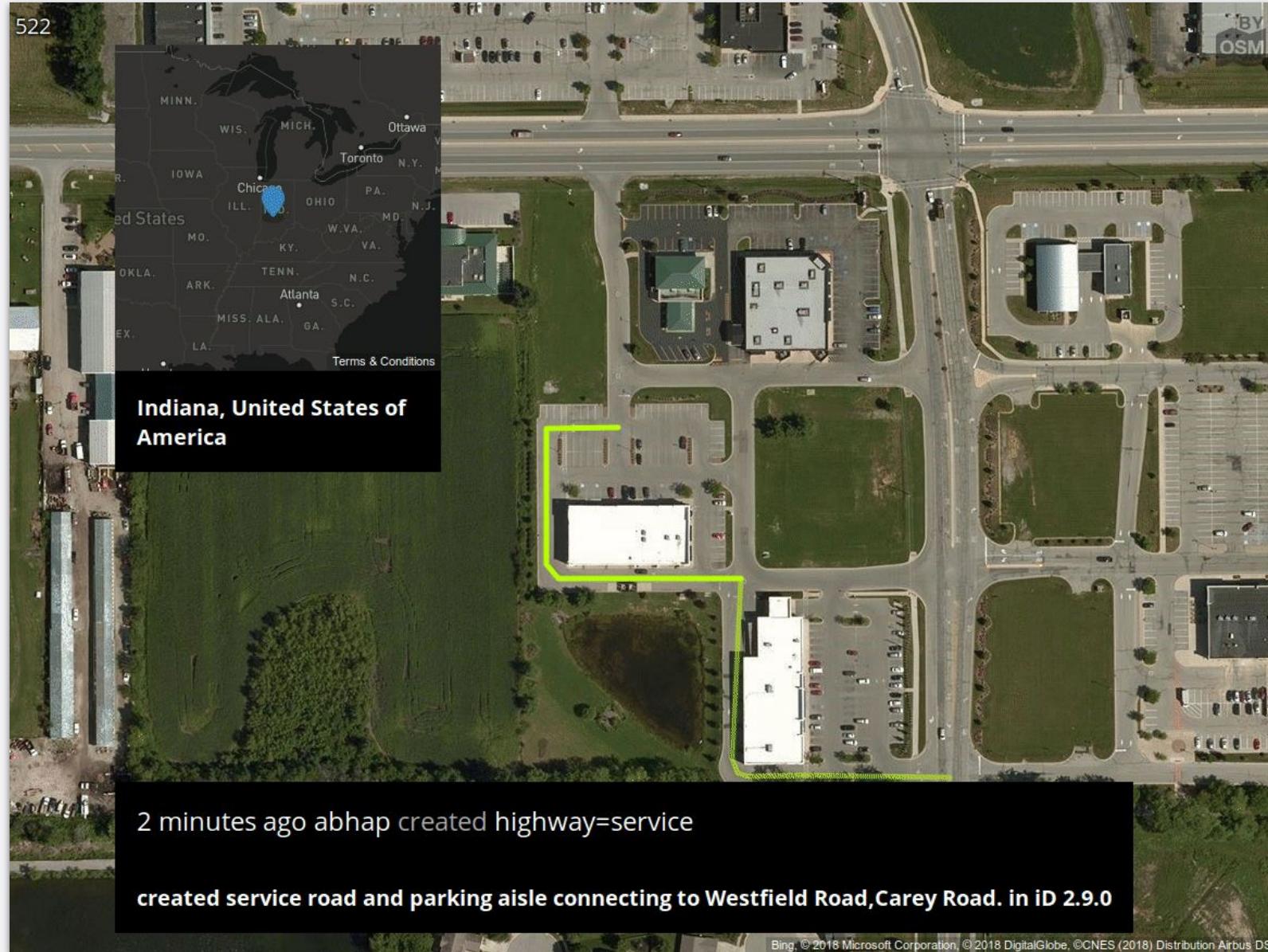
OpenStreetMap [Edit](#) History Export GPS Traces User Diaries Copyright Help About napo 1 napo

Search Where is this? Go 



This OpenStreetMap screenshot shows a detailed map of the Polo Scientifico e Tecnologico "Fabio Ferrari" area in Turin, Italy. The map includes several buildings labeled: 'Polo Ferrari 2' (large yellow building), 'Polo Ferrari 1' (grey building), 'Biblioteca Polo Ferrari' (with a book icon), 'Mensa Polo Ferrari' (with a coffee cup icon), 'Bar Polo Scientifico Ferrari' (with a coffee cup icon), 'Fondazione Bruno Kessler' (multiple locations), and 'FBK Fondazione Bruno Kessler' (multiple locations). Streets visible include Via Sommarive, Via alla Cascata, Via dei Valoni, and Piazza Giannantonio Manci. A red circle highlights the 'Edit' button in the top left corner. The bottom of the map features a URL: <https://www.openstreetmap.org/#map=18/46.06743/11.15165>.

# What's happening now



<http://osmlab.github.io/show-me-the-wav/>

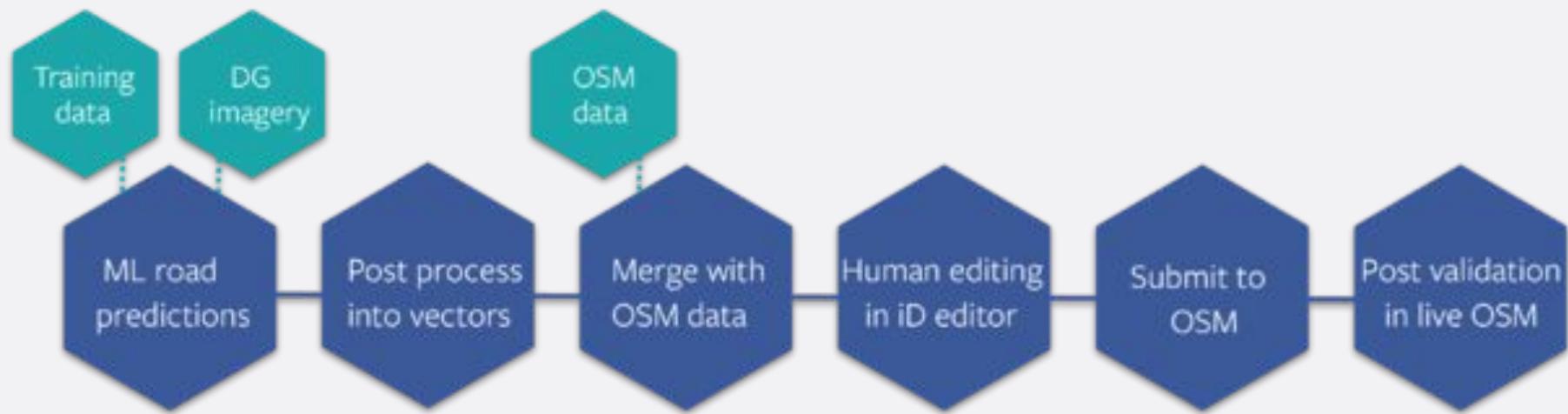




**TOP-IX Consortium**

The screenshot shows a Facebook page for 'TOP-IX Consortium'. The cover photo is a black and white photograph of a modern office space with wooden desks, people working, and a large wooden shelving unit. To the left of the main content area, there's a sidebar with links like 'Home', 'Informazioni', 'Recensioni', 'Foto', 'Video', 'Note', 'Eventi', 'Post', 'Community', and 'Informazioni e inserzioni'. A green button at the bottom of this sidebar says 'Crea una Pagina'. The main content area includes a 'Scrivi un post...' input field, a 'Recensioni' section with a 4.0 rating and 8 reviews, and a 'Foto' section with a thumbnail image. On the right side, there are sections for 'Community' (with stats like 1247 likes and 1240 followers) and 'Informazioni' (with a map showing the location at Via Maria Vittoria, 38). The top navigation bar shows the user 'Maurizio' and other standard Facebook icons.

# facebook



[https://wiki.openstreetmap.org/wiki/AI-Assisted\\_Road\\_Tracing](https://wiki.openstreetmap.org/wiki/AI-Assisted_Road_Tracing)



## Atlas

build passing

The [Atlas](#) is a way to efficiently represent OpenStreetMap data in memory. A subset of the data is in a "navigable network" form, meaning anything that is assumed to be navigable will be in a form of `Node`s and `Edge`s in a way a routing algorithm could traverse it. It also provides easy to use APIs to access geographical data. On top of it all, it is easy to shard and re-stitch, making it perfect for distributed processing!

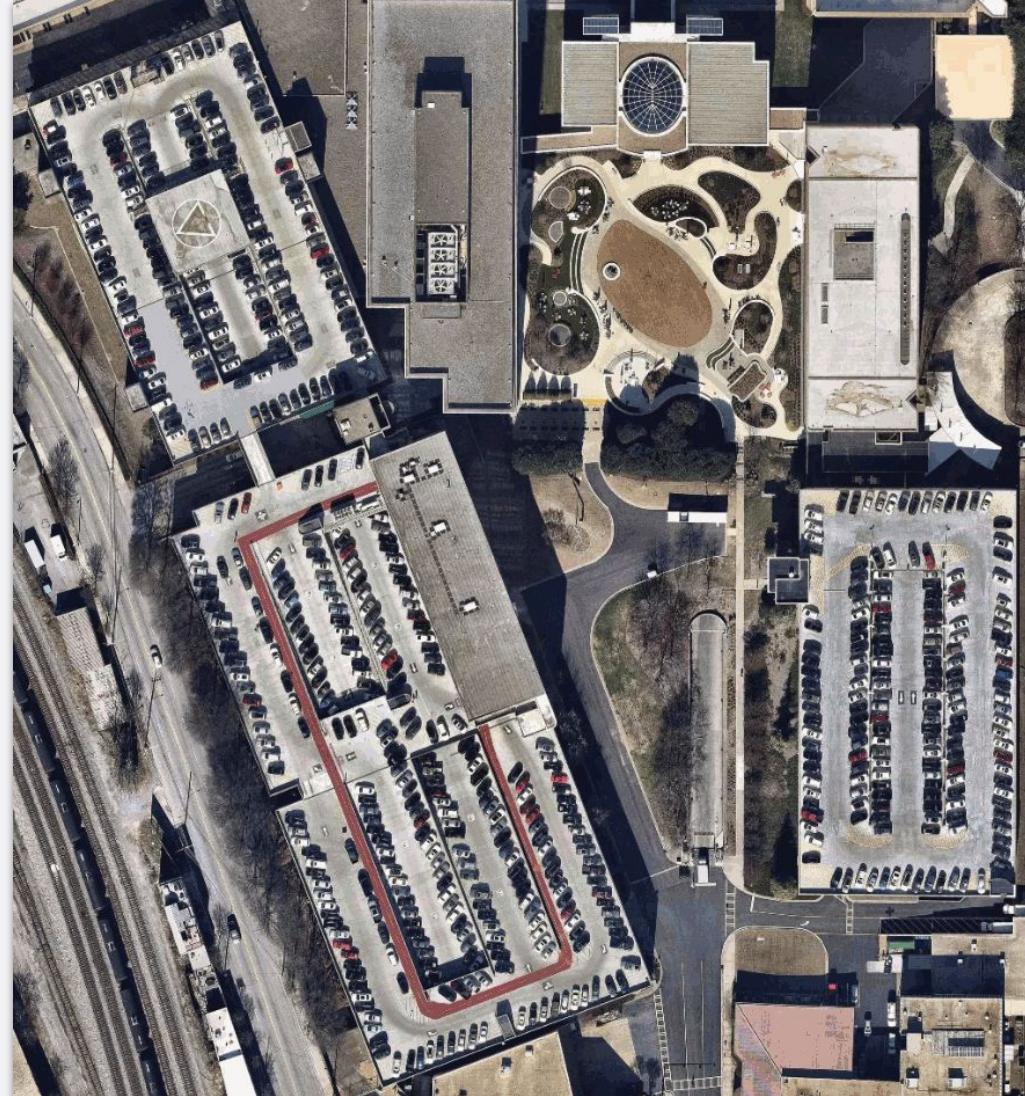
Projects using Atlas:

- [atlas-generator](#): A Spark job to distribute Atlas shards generation
- [atlas-checks](#): A suite of tools to check OSM data integrity using Atlas, and Spark.
- [josm-atlas](#): A JOSM plugin to visualize Atlas data.

<https://github.com/osmlab/atlas>

27 lines (21 sloc) | 1.52 KB

```
1 Copyright (c) 2015-2018, Apple Inc. All rights reserved.  
2  
3 Redistribution and use in source and binary forms, with or without modification,  
4 are permitted provided that the following conditions are met:  
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6 1. Redistributions of source code must retain the above copyright notice,  
7   this list of conditions and the following disclaimer.  
8  
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11   and/or other materials provided with the distribution.  
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24 WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)  
25 ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE  
26 POSSIBILITY OF SUCH DAMAGE.
```



<https://github.com/mapbox/robosat>

# The ODbL license by examples

```
<?xml version='1.0' encoding='UTF-8'?>
<osm version="0.6" generator="osmconvert 0.7m" timestamp="2014-09-29T20:21:02Z">
  <bounds minlat="45.9775306" minlon="11.0224735" maxlat="46.1530112" maxlon="11.1948226"/>
  <node id="9191867" lat="46.104119" lon="11.0899633" version="4" timestamp="2010-09-01T22:36:26Z" changeset="5658159" uid="330007" user="pikappa79"/>
  <node id="9191982" lat="46.0499659" lon="11.1169915" version="6" timestamp="2011-08-06T16:07Z" changeset="8939495" uid="330007" user="pikappa79"/>
  <node id="9192136" lat="46.054435" lon="11.1180986" version="6" timestamp="2012-12-14T22:11:48Z" changeset="14276412" uid="330007" user="pikappa79"/>
  <node id="9192343" lat="46.1140579" lon="11.0871511" version="6" timestamp="2010-09-01T22:36:35Z" changeset="5658159" uid="330007" user="pikappa79"/>
  <node id="9192428" lat="46.076984" lon="11.112499" version="2" timestamp="2011-01-19T18:32:46Z" changeset="7023211" uid="76312" user="scratara"/>
  <node id="9192494" lat="45.977028" lon="11.114043" version="1" timestamp="2006-06-30T11:53:08Z" changeset="48807" uid="573" user="Jörg Ostertag">
    <tag k="created_by" v="JOSM"/>
  </node>
  <node id="9192593" lat="46.0521296" lon="11.1170876" version="9" timestamp="2011-08-06T16:15:07Z" changeset="8939495" uid="330007" user="pikappa79"/>
  <node id="9192771" lat="46.0181248" lon="11.1274916" version="4" timestamp="2011-02-16T13:31:43Z" changeset="7303863" uid="330007" user="pikappa79"/>
  <node id="9193403" lat="45.9945344" lon="11.1215165" version="2" timestamp="2009-07-06T23:57:51Z" changeset="1757920" uid="136835" user="user_136835">
    <tag k="created_by" v="JOSM"/>
  </node>
  <node id="9193405" lat="46.0313027" lon="11.1277415" version="5" timestamp="2011-02-16T13:31:31Z" changeset="7303863" uid="330007" user="pikappa79"/>
  <node id="9193447" lat="45.9697045" lon="11.1130485" version="4" timestamp="2008-08-04T17:14:50Z" changeset="57846" uid="20610" user="napo">
    <tag k="created_by" v="JOSM"/>
  </node>
  <node id="9193468" lat="46.0763371" lon="11.1130076" version="10" timestamp="2013-04-21T11:37:25Z" changeset="15809662" uid="330007" user="pikappa79"/>
  <node id="9193589" lat="46.0098562" lon="11.1251955" version="3" timestamp="2013-07-07T06:28:42Z" changeset="16856691" uid="530691" user="Peterfritz"/>
  <node id="9193607" lat="46.054411" lon="11.1295695" version="6" timestamp="2011-11-28T21:45:33Z" changeset="9982706" uid="330007" user="pikappa79"/>
  <node id="9193619" lat="46.0744894" lon="11.1124451" version="9" timestamp="2013-04-21T11:37:25Z" changeset="15809662" uid="330007" user="pikappa79"/>
  <node id="9193812" lat="46.0514793" lon="11.1157438" version="5" timestamp="2010-08-09T13:10:36Z" changeset="5443649" uid="24966" user="alesstoz"/>
  <node id="9193846" lat="46.1201572" lon="11.0860899" version="6" timestamp="2011-02-02T16:18:24Z" changeset="7217702" uid="330007" user="pikappa79"/>
  <node id="9193873" lat="46.0869729" lon="11.104303" version="5" timestamp="2010-09-01T22:35:55Z" changeset="5658159" uid="330007" user="pikappa79"/>
  <node id="9193877" lat="46.0521785" lon="11.1175845" version="11" timestamp="2011-08-06T16:15:07Z" changeset="8939495" uid="330007" user="pikappa79"/>
  <node id="9193996" lat="46.0534124" lon="11.1185143" version="9" timestamp="2013-05-21T19:07:54Z" changeset="16228624" uid="330007" user="pikappa79"/>
  <node id="9194295" lat="46.0533991" lon="11.1278855" version="8" timestamp="2011-05-07T00:08:51Z" changeset="5452578" uid="nfranz" user="nfranz"/>
  <node id="9194326" lat="46.0533991" lon="11.1278855" version="8" timestamp="2011-05-07T00:08:51Z" changeset="5452578" uid="nfranz" user="nfranz"/>
</osm>
```



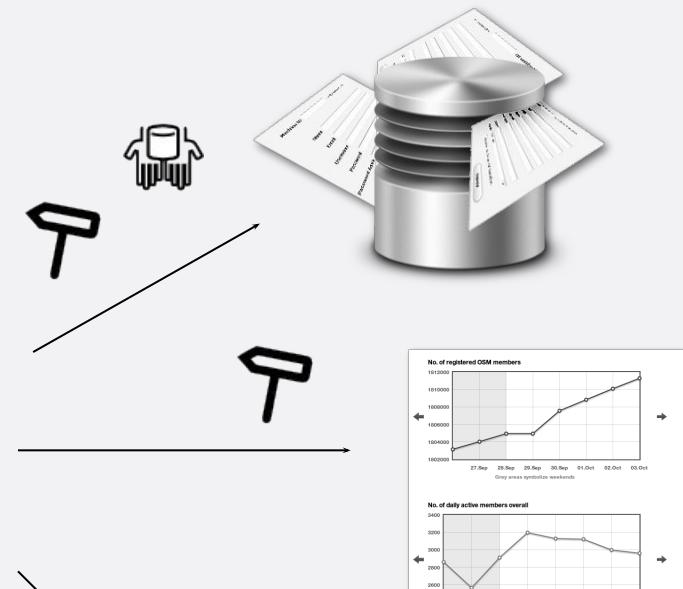
Graphhopper maps

Powered by Graphhopper API

Search Bar: Matera

Search Results:

- City Boundary Matera, MT, BAS, Italy
- Hamlet Matera, AP, MAR, Italy
- Locality La Matera, San Esteban de Gormaz, Provincia de Soria, Castile and León, Spain
- County Boundary MT, BAS, Italy
- Archaeological Site Matera, Vista Filiars, Northwood, Irvine, Orange, California, 92620, United States of America



OpenStreetMap

Search Bar: Matera

Search Results:

- Results from OpenStreetMap Nominatim
  - City Boundary Matera, MT, BAS, Italy
  - Hamlet Matera, AP, MAR, Italy
  - Locality La Matera, San Esteban de Gormaz, Provincia de Soria, Castile and León, Spain
  - County Boundary MT, BAS, Italy
  - Archaeological Site Matera, Vista Filiars, Northwood, Irvine, Orange, California, 92620, United States of America

More results



# Licence/Community Guidelines/Geocoding - Guideline

< [Licence](#) | [Community Guidelines](#)

Status: Endorsed by the OSMF board 2017-08-24

## Contents

[\[hide\]](#)

### [1 Background](#)

### [2 Definitions: Geocoding, Geocoding Results, and Geocoder](#)

### [3 The Guideline](#)

### [4 Examples](#)

- [4.1 Searching on a non-OSM map](#)
- [4.2 Adding location names to photos](#)
- [4.3 Geocoding store locations](#)
- [4.4 Enriching an OSM-based geocoding database](#)
- [4.5 Using OSM-based Geocoding Results together with non-OSM Geocoding Results.](#)

### [5 Geocoding Guideline FAQ](#)

- [5.1 Why did the LWG decide to take up work on a geocoding guideline?](#)

## Tech Corner: how obtain the data

### Talk with OSM

API for special queries

<http://overpass-api.de>

Overpass Turbo

<http://overpass-turbo.eu>



### Areas in different formats

<http://https://osmaxx.hsr.ch/>

<https://export.hotosm.org/en/v3/>

<http://download.geofabrik.org>

### Routing services

<http://project-osrm.org/>

<http://vroom-project.org/>

<http://www.opentripplanner.org/>

<https://www.graphhopper.com/>

<https://openrouteservice.org/>

<http://vroom-project.org>

# Python GIS



# Python libraries :)

## Projections

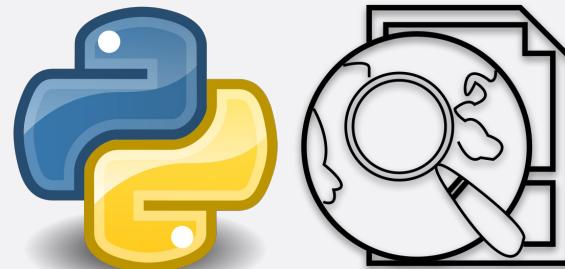
pyproj

## Vector Data

geopandas  
shapely  
osmnx

## Raster Data

rasterio



## Analysis

osmnx  
shapely  
geopandas  
pysal

## Geocoding

geopy  
geocoder

## Visualization

matplotlib  
seaborn  
folium  
bouquet

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dffeeded on May 7

1 contributor

656 lines (655 sloc) | 17.6 KB

[Code](#) [Raw](#) [Blame](#) [History](#) [Edit](#) [Delete](#)

## Introduction to geospatial vector data in Python

In [ ]: %matplotlib inline

```
import pandas as pd
import geopandas
```

```
pd.options.display.max_rows = 10
```

### Importing geospatial data

Geospatial data is often available from specific GIS file formats or data stores, like ESRI shapefiles, GeoJSON files, geopackage files, PostGIS (PostgreSQL) database, ...

We can use the GeoPandas library to read many of those GIS file formats (relying on the fiona library under the hood, which is an interface to GDAL/OGR), using the `geopandas.read_file` function.

<https://github.com/jorisvandenbossche/geopandas-tutorial>

# resources



## Python

[http://darribas.org/qds15/labs/Lab\\_08.html](http://darribas.org/qds15/labs/Lab_08.html)  
<https://github.com/puntofisso/SpikesMap>  
<https://geohackweek.github.io/schedule.html>  
<https://automating-gis-processes.github.io>  
<http://geopandas.org>  
<https://shapely.readthedocs.io/en/latest/>  
<https://rasterio.readthedocs.io/en/latest/>  
<http://pysal.readthedocs.io/en/latest/>  
<https://geohackweek.github.io/vector/04-geopandas-intro/>

## GIS

<https://volaya.github.io/gis-book/en/index.html>  
<http://qgis.org>  
<http://www.qgistutorials.com/en/>  
<http://grass.osgeo.org>  
<http://postgis.org>  
[https://postgis.net/docs/manual-2.4/using\\_postgis\\_dbmanagement.html#RefObject](https://postgis.net/docs/manual-2.4/using_postgis_dbmanagement.html#RefObject)  
<https://blog.gvsig.org/2017/07/12/learning-gis-with-game-of-thrones-free-book/>

## OpenStreetMap

<https://overpass-turbo.eu>  
<https://export.hotosm.org/en/v3/>  
<https://planet.openstreetmap.org>  
<https://openrouteservice.org/example-apartment-search-with-ors/>

# Contacts



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@napo

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images - wikipedia, openstreetmap