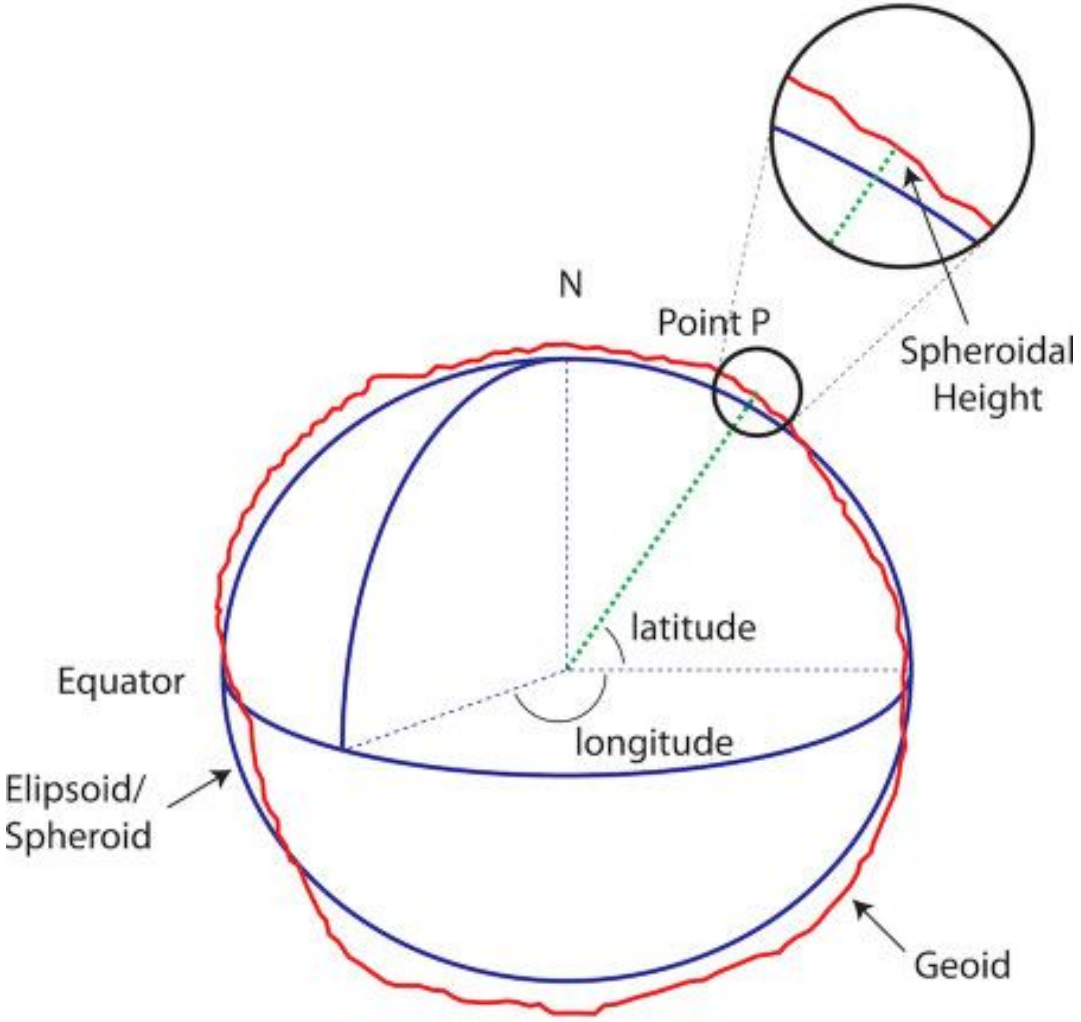
Institute for advanced architecture of Catalonia | BARCELONA

MASTER IN CITY & TECHNOLOGY
DIGITAL TOOLS AND BIG DATA
2021/2022

FACULTY DIEGO PAJARITO

Spatial

More than pairs of coordinates

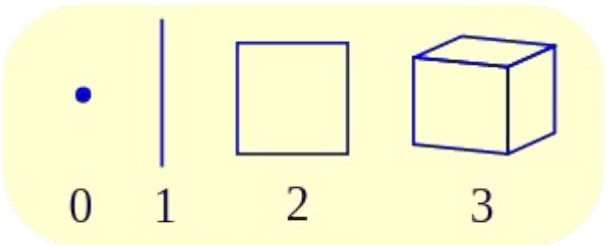


Spatial data implies a reference system (RS). This arrangement allows to determine coordinates.

Space is, in some cases, a geographical space.

Analysts need to know the data's RS. A compatible RS is needed for any analysis (e.g. epsg:4326 / epsg:32631)

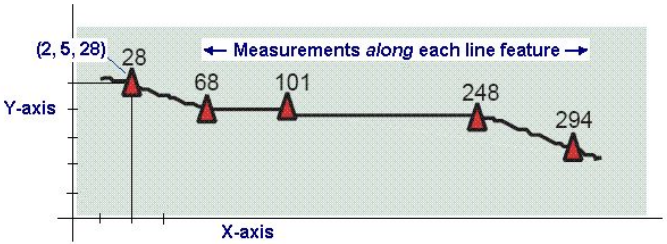
Source: https://www.compose.com/articles/geofile-spatial-reference-systems-2/

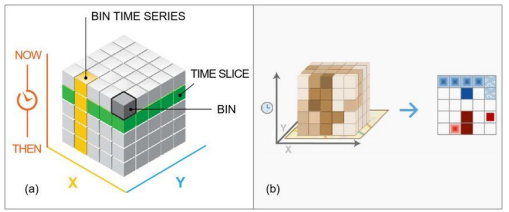


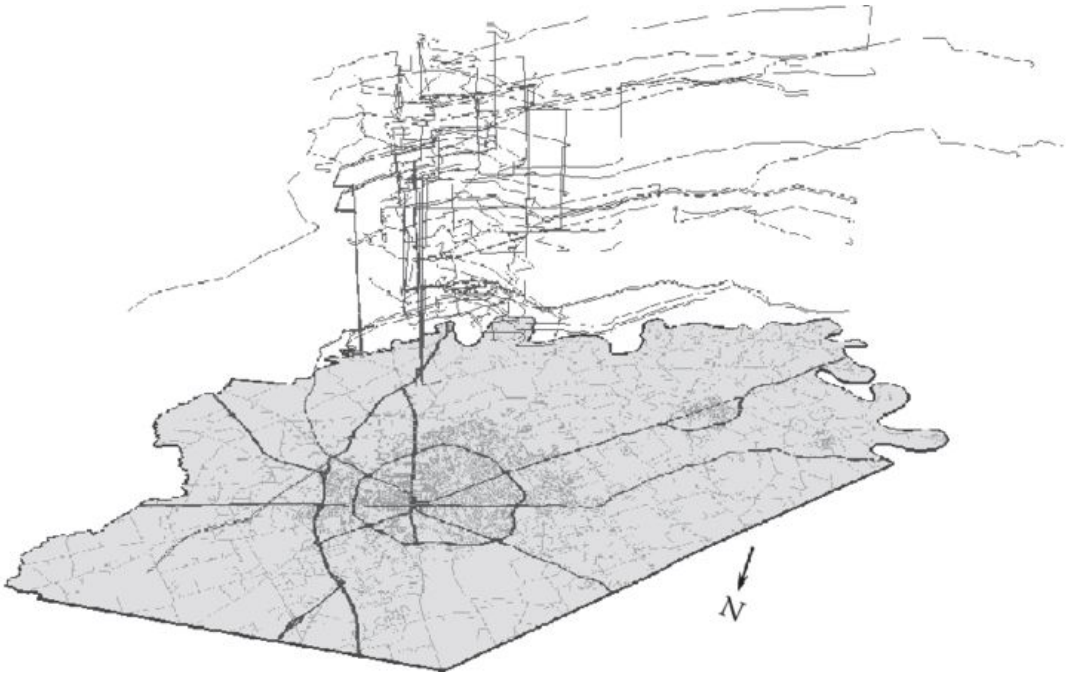
Depending on the nature of every object, the representation corresponds to a dimensional space.

Most objects in space can have a representation. However, they need to have a precise delimitation.

Source: https://www.britannica.com/science/dimension-geometry







When adding additional spatial features, there are options for creating multiple dimensions

(e.g., distance-from, distance-to, epoc, time, t-time, etc.)

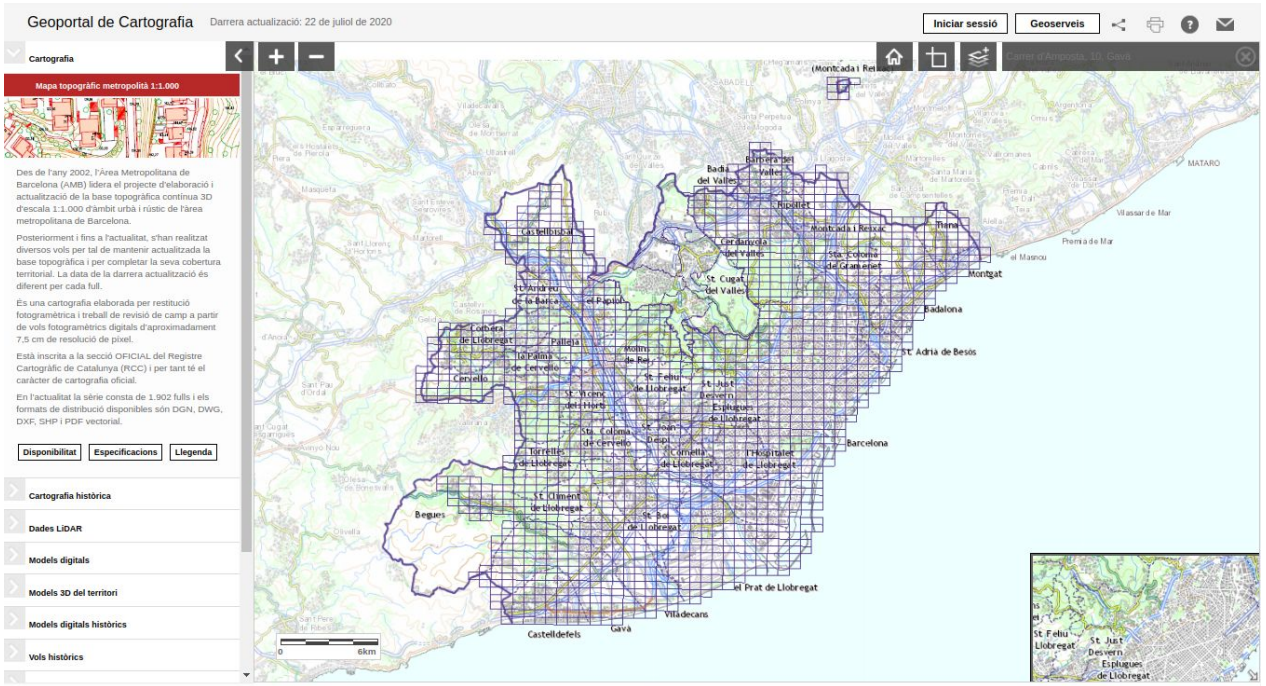
Source: https://www.researchgate.net/publication/261871322_Analysis_of_human_space-time_behavior_Geovisualization_and_geocomputational_approaches

Spatial Domain

Defining Areas of Interest

Understanding environmental dimensions of Barcelona's environment

Source: http://www3.amb.cat/repositori/ESPAIPUBLIC/Pla_millora_biodiversitat.pdf



Barcelona Metropolitan Area

Source geoportal cartografía AMB: https://geoportalcartografia.amb.cat/AppGeoportalCartografia2/index.html
Open data AMB: https://www.amb.cat/en/web/area-metropolitana/dades-obertes/cataleg-opendata
Statistical Office Catalunya: https://www.idescat.cat/

Large scale data, 1:10m

Cultural | Physical | Raster

The most detailed. Suitable for making zoomed-in maps of countries and regions. Show the world on a large wall poster.

1:10,000,000
1″ = 158 miles
1 cm = 100 km

Medium scale data, 1:50m

Cultural | Physical | Raster

Suitable for making zoomed-out maps of countries and regions. Show the world on a tabloid size page.

1:50,000,000
1″ = 790 miles
1 cm = 500 km

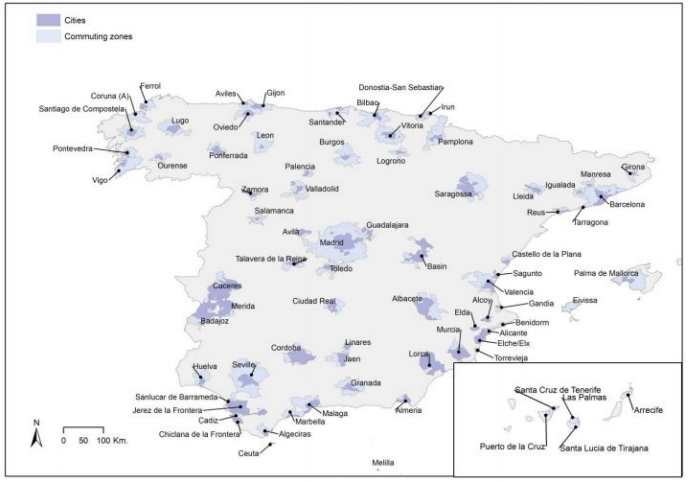
Small scale data, 1:110m

Cultural | Physical

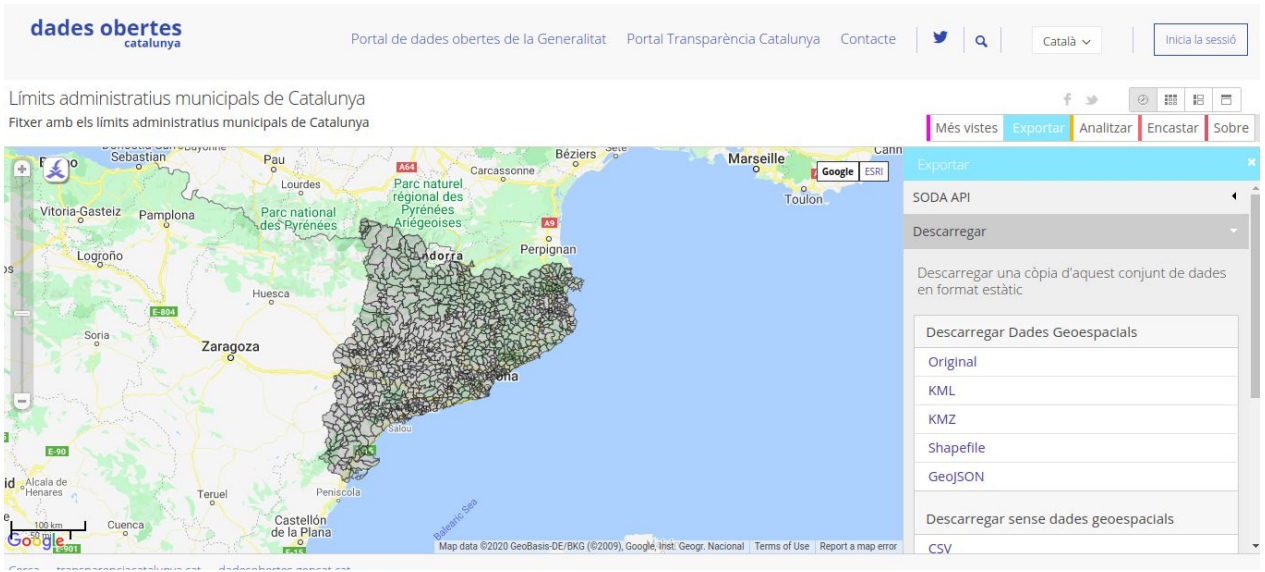
Suitable for schematic maps of the world on a postcard or as a small locator globe.

1:110,000,000
1″ = 1,736 miles
1 cm = 1,100 km

Barcelona Metropolitan Area



Natural Earth: https://www.naturalearthdata.com/downloads/
OECD: Functional Areas: https://www.oecd.org/regional/regional-statistics/functional-urban-areas.htm



Barcelona Metropolitan Area

Spain SDI: https://www.idee.es/web/guest/centros-de-descarga
Open Data Catalunya: https://analisi.transparenciacatalunya.cat/browse
Catalunya's Cartographic institute: http://www.icc.cat/vissir3

a) Build and Share a layer for AMB limits

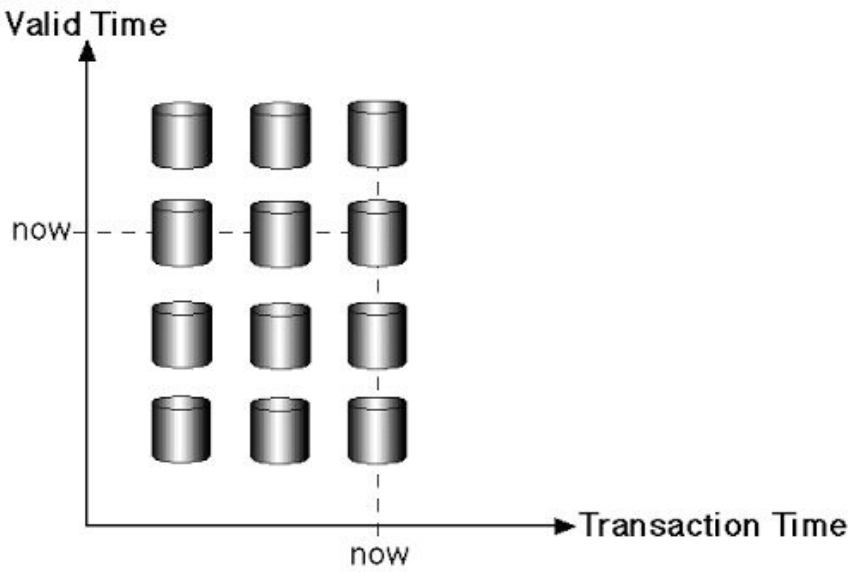
b) Search and share complementary layers:
Rivers, roads, urban areas, water bodies, etc.

c) Create a QGIS project with basemap and customised layer styles

d) Explore a second city having a similar AOI to validate this process

Temporal

How computer systems handle time?



When time “started”
the Unix epoch at 1 January 1970 00:00:00 UT

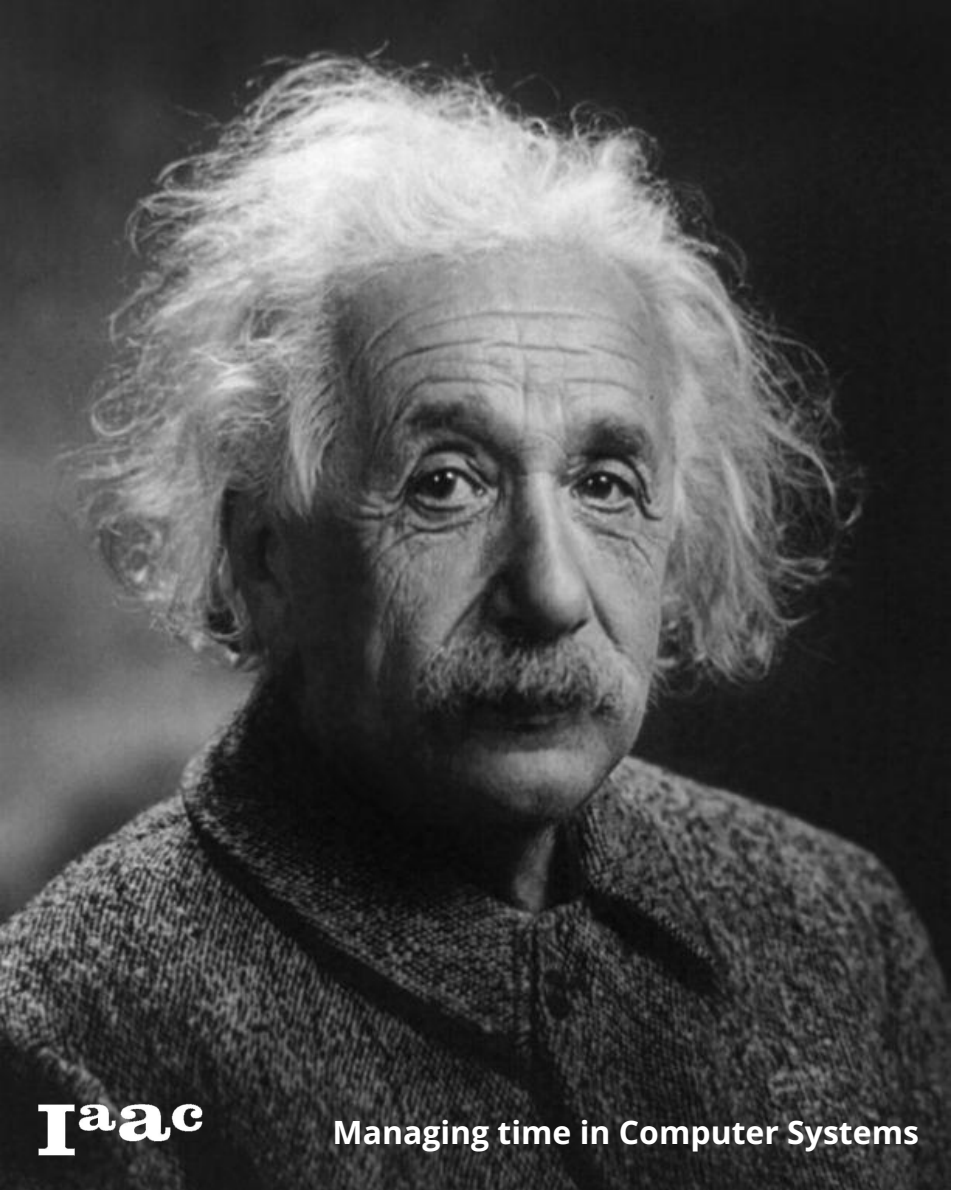
Computational units
Milliseconds, Seconds, Minutes, Hours, Day, Month, Year, Time Zone

Source: https://link.springer.com/chapter/10.1007/3-540-55966-3_2
System Time: https://en.wikipedia.org/wiki/System_time

Time instant: a particular point in time that can be associated to a particular event.

12h
12h:23m:05.35s
11/10/2020 12h:23m:05.35s
11/10/2020 12h:23m:05.35s GMT

Time period or time interval: the time between two instants (start - end) that can be associated to a specific event or series of events.



Although there is no limit:

Step 1: Setting versions

Step 2: building spatio-temporal models

Step 3: dealing with real time data

Spatial Analysis

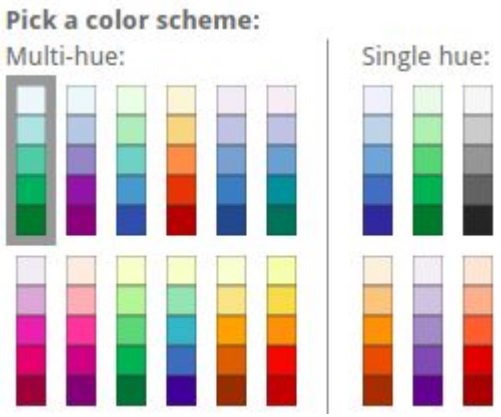
How to make spatial data more useful?

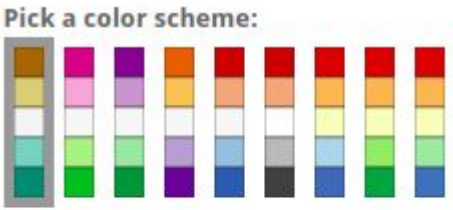
Continuous
Discrete
Categorical
Ordinal
Nominal
Reference/key *

Sequential
Diverging
Qualitative
*

Always check if **0** / **cero** / **NaN** / **No value** mean something for the analysis

An example from: https://soa.utexas.edu/work/2014-gis-and-visual-communication-student-work





Secuencial:

0-10 units
10-20 units
20-30 units
>30 units

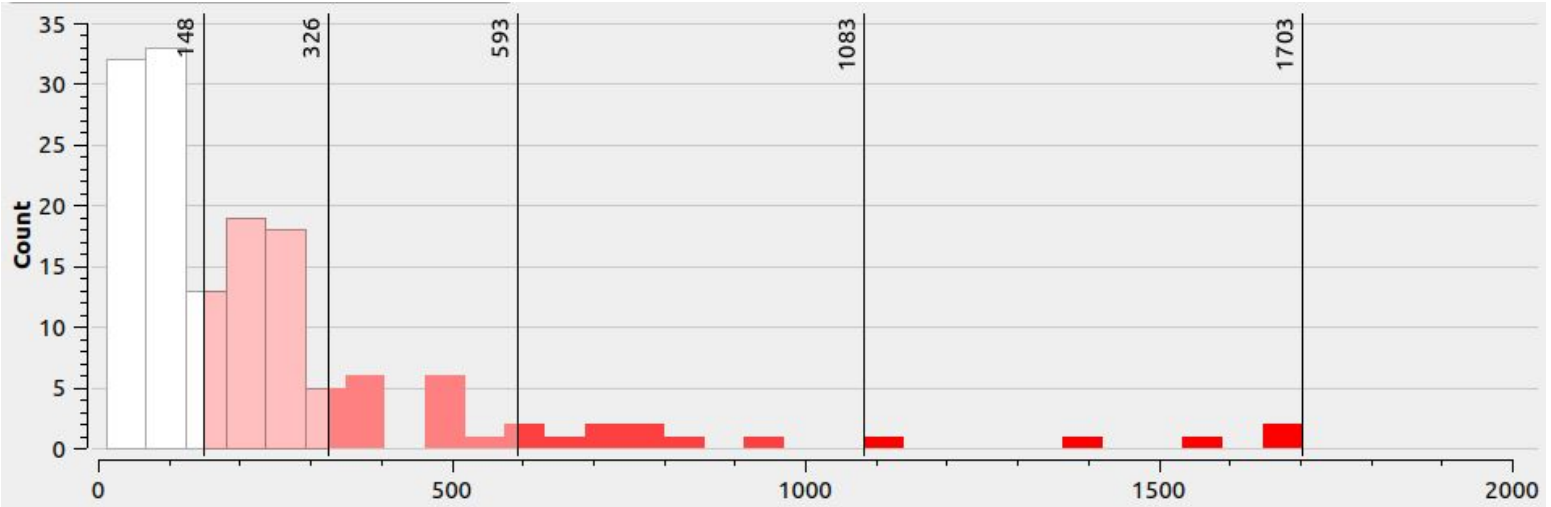
Divergent:

> +10	very good
-3 - +10	good
-3 - +3	neutral
-10 - -3	bad
< -10	very bad

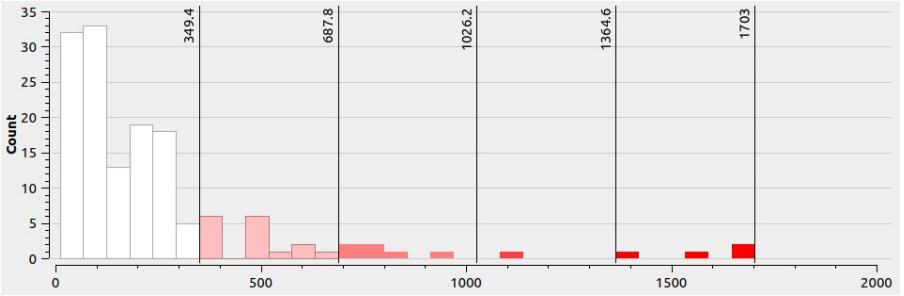
Qualitative:

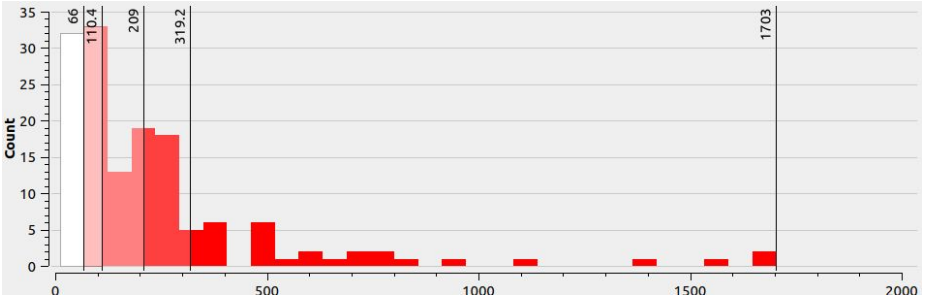
Category X
Category J
Category U
Category L
Category E

Color Brewer 2: https://colorbrewer2.org/



Natural breaks / Equal intervals / Quantiles





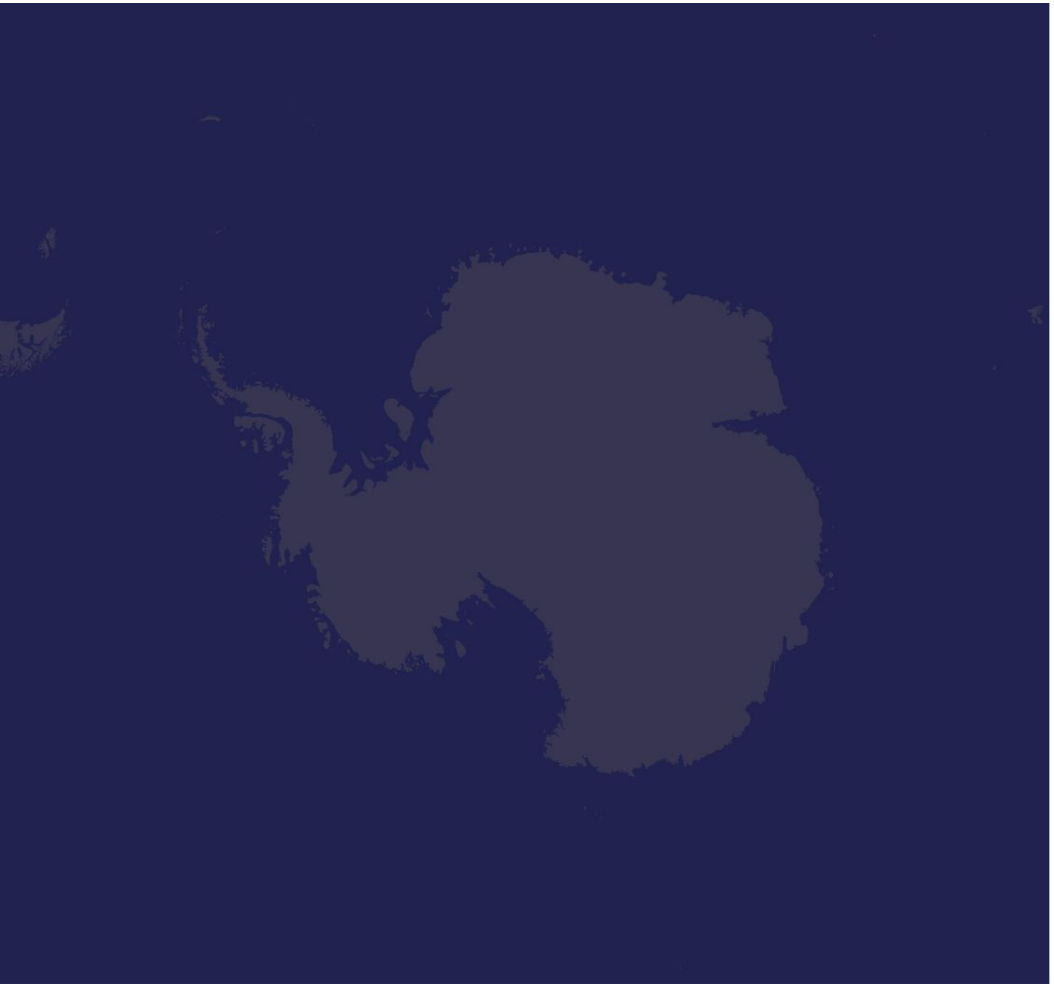
Source: https://en.wikipedia.org/wiki/Jenks_natural_breaks_optimization

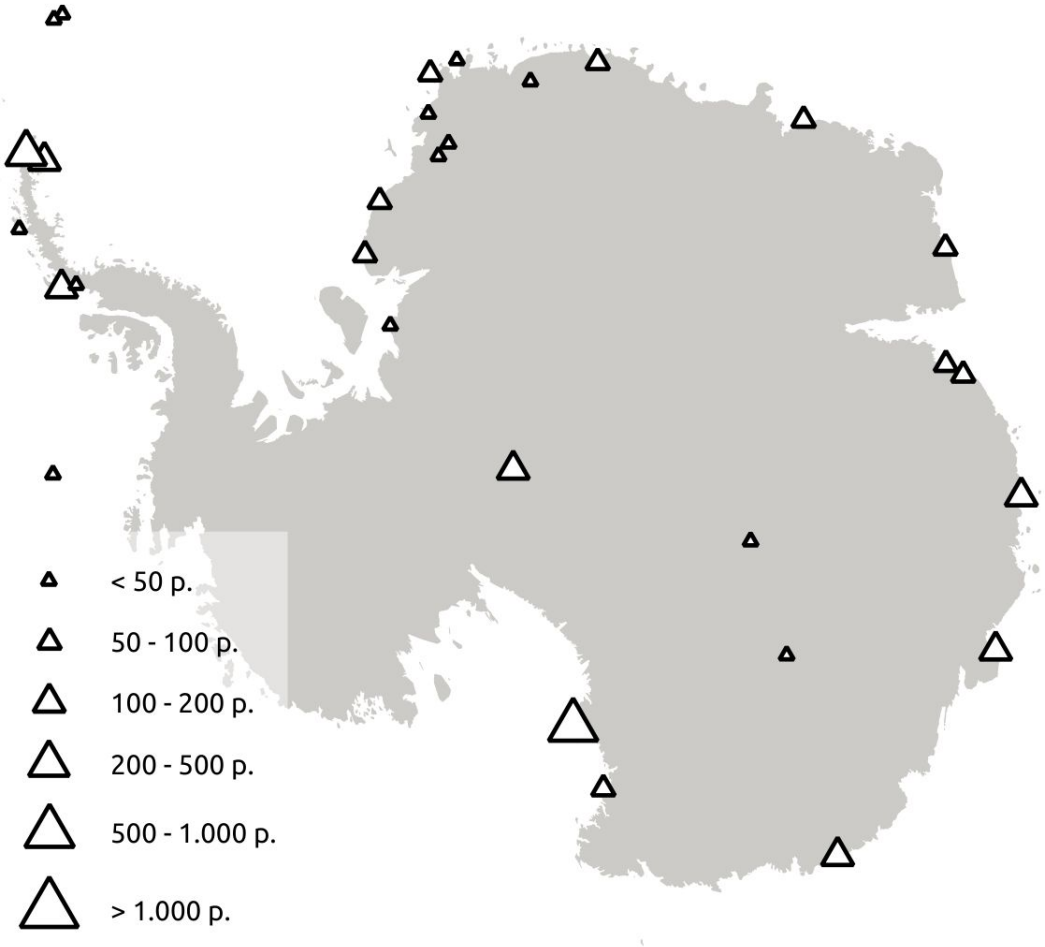
Illustration (general)

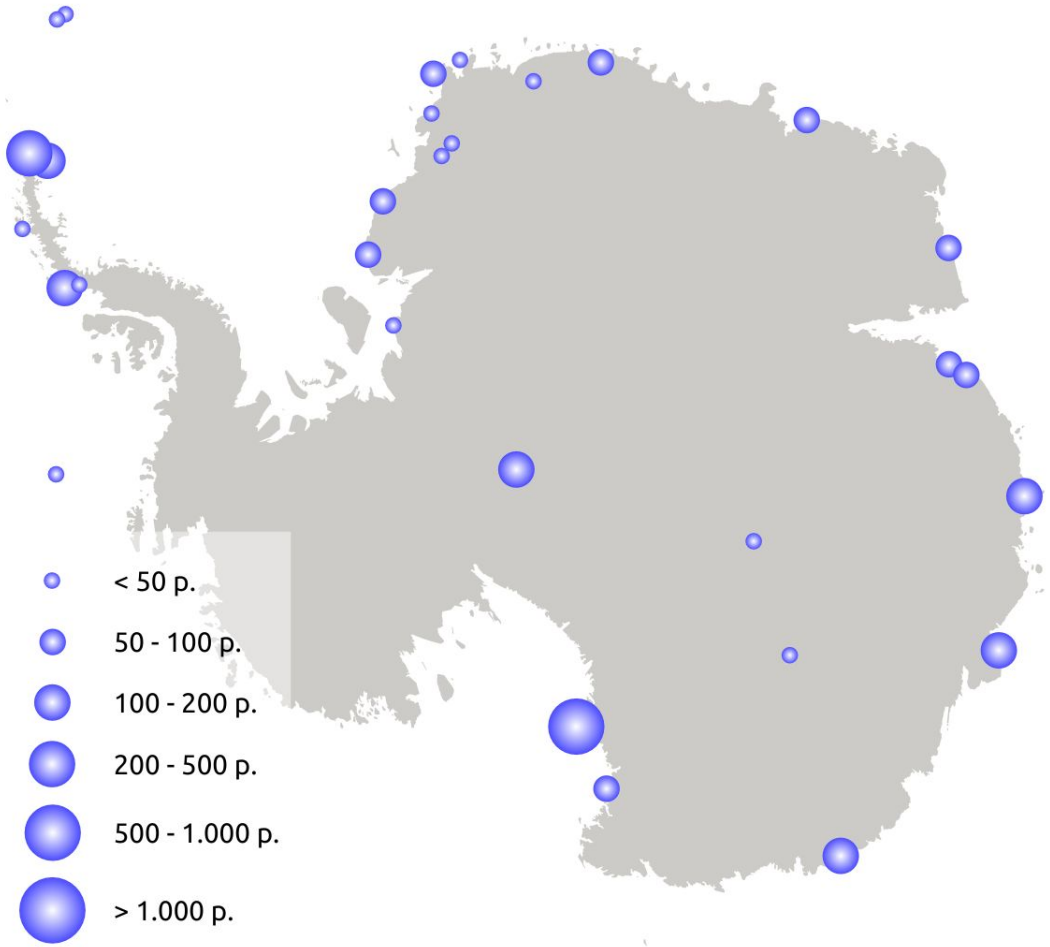
Background
Fill
Shape / icon
Size
Border
Transparency
Color blending
Orientation
Projection

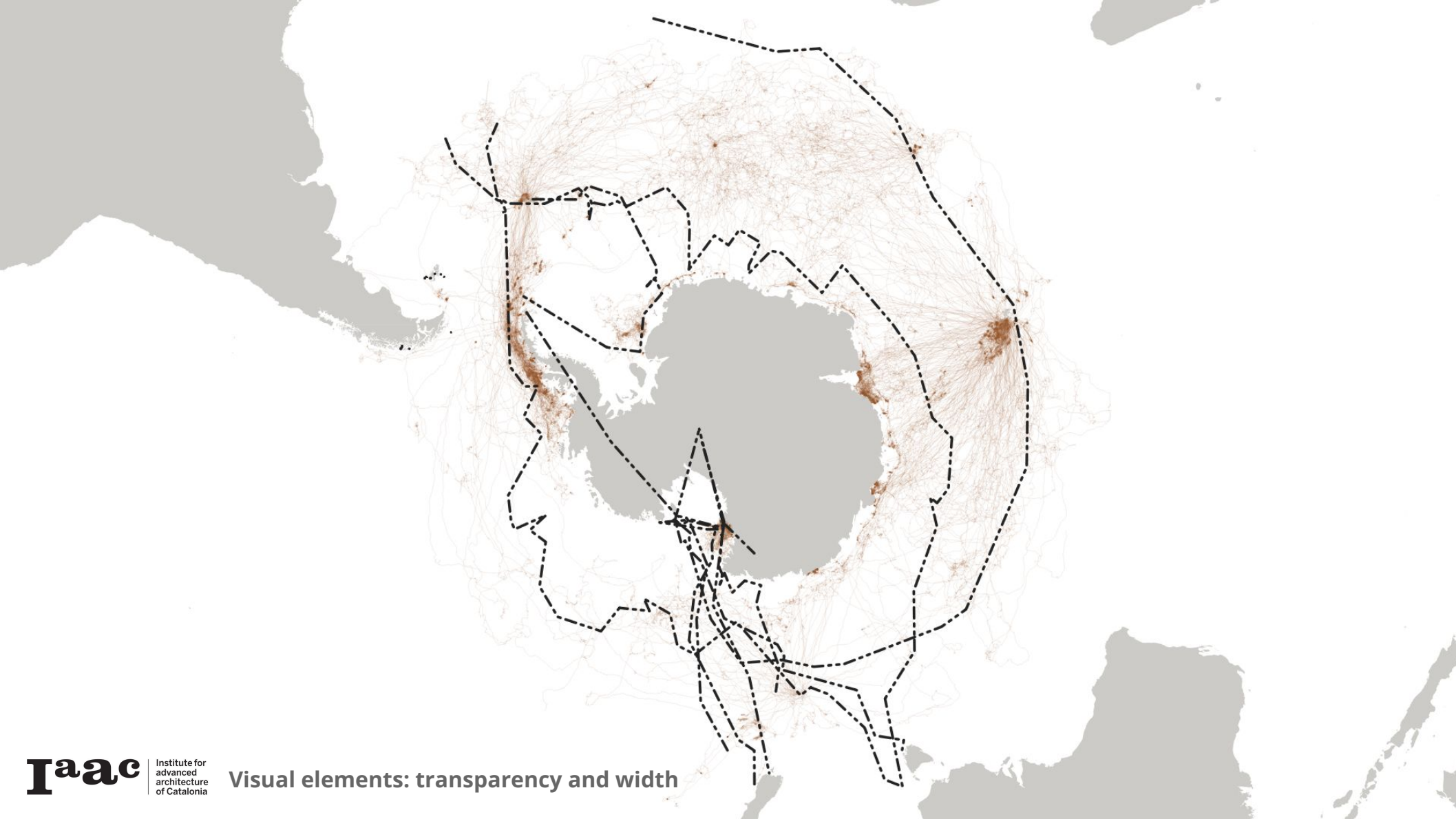
Map (Cartography)

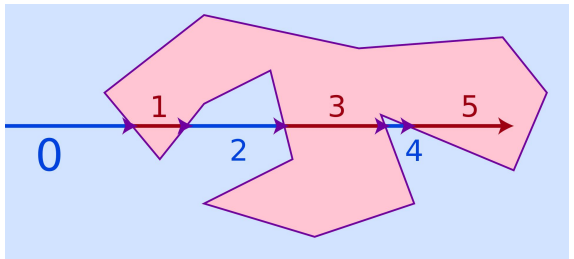
Orientation
Projection
Guidelines and Tics
Axis
Axis labels
Title
Legend
Sources
And lots of rules

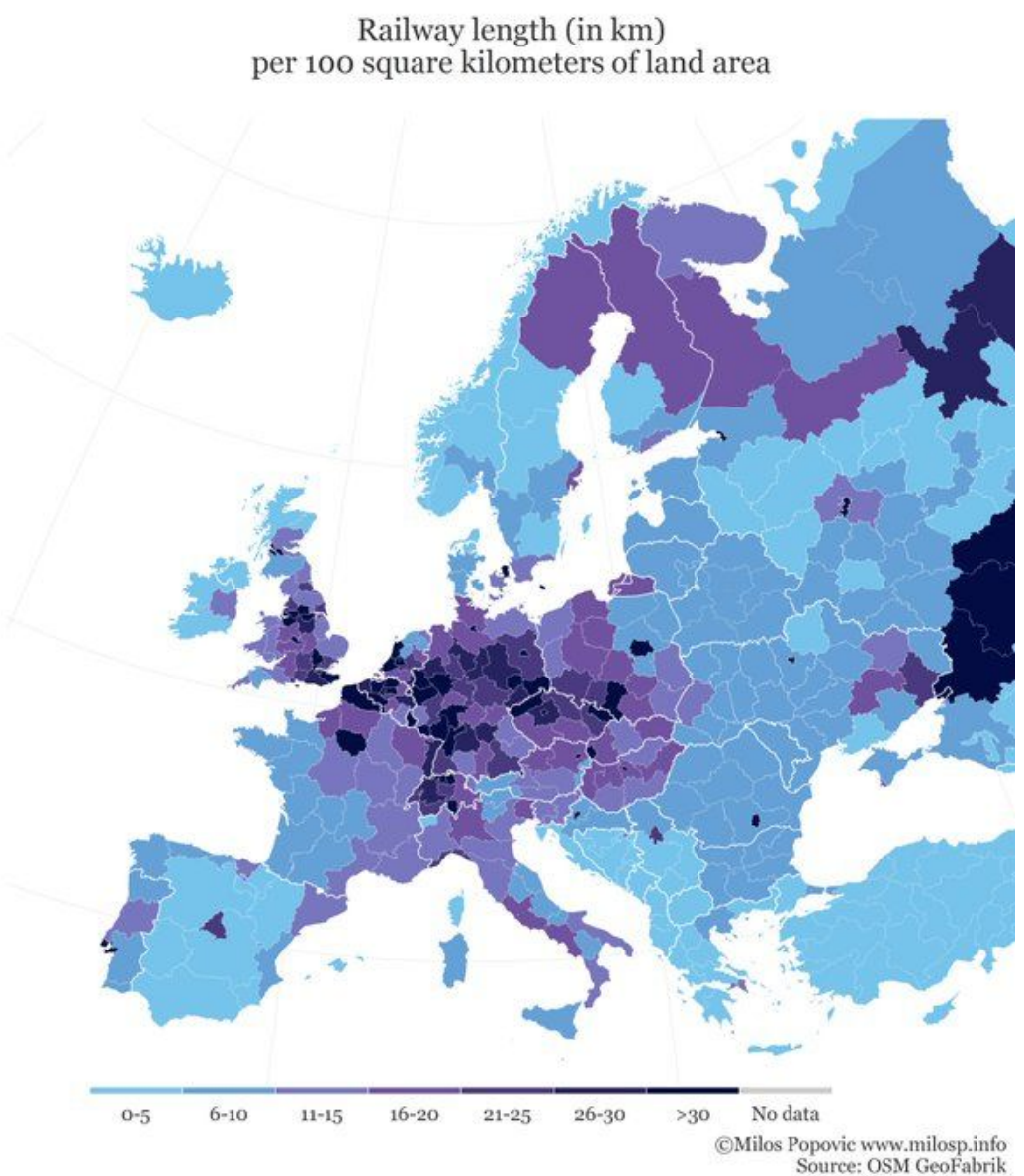



< 50 p.
50 - 100 p.
100 - 200 p.
200 - 500 p.
500 - 1.000 p.
> 1.000 p.

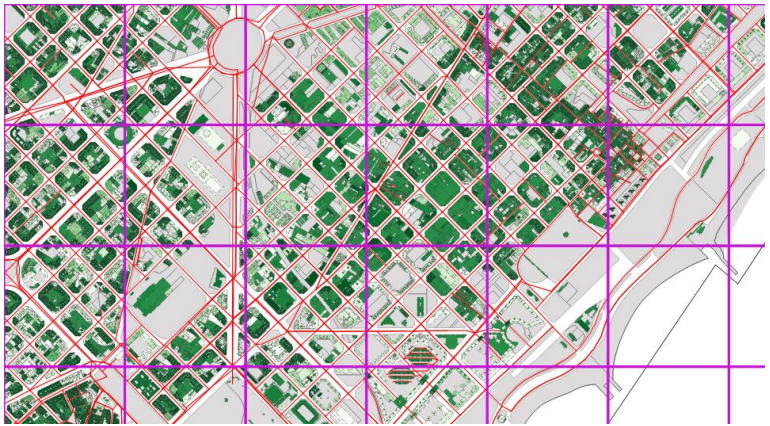

< 50 p.
50 - 100 p.
100 - 200 p.
200 - 500 p.
500 - 1.000 p.
> 1.000 p.

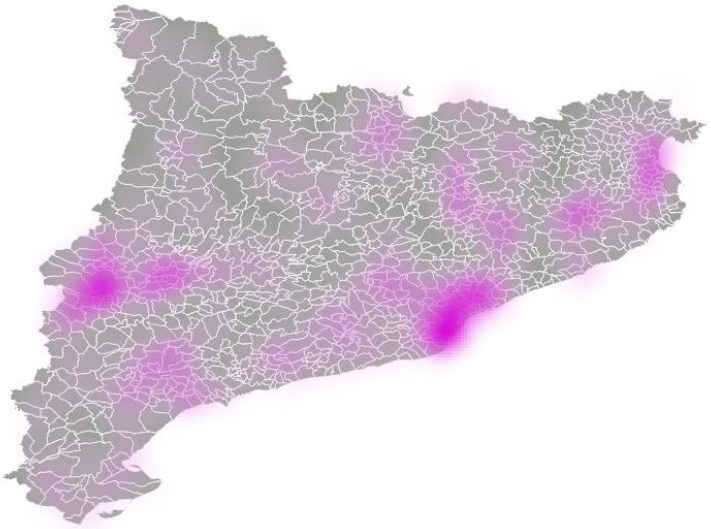






Example from: https://twitter.com/milos_agathon/status/1310879353933357059
Points in polygon: https://en.wikipedia.org/wiki/Point_in_polygon





List of stations available: https://www.meteo.cat/observacions/llistat-xema

a) Find point, line and polygon layers for your AIO(s)

b) Create views overlaying different layers and share them with your peers

c) Plan a point-in-polygon analysis and represent it through a corophlet map

Space-time

Are you sure you want to use the two of them?

Institute for advanced architecture of Catalonia | BARCELONA

MASTER IN CITY & TECHNOLOGY
DIGITAL TOOLS AND BIG DATA
2021/2022

FACULTY DIEGO PAJARITO