Institute for advanced architecture of Catalonia | BARCELONA

MASTER IN CITY & TECHNOLOGY
DIGITAL TOOLS AND BIG DATA
2019/2020

FACULTY DIEGO PAJARITO

Environmental Monitoring

Methods, devices and indicators

Institute for advanced architecture of Catalonia

Environmental Stations

Source:
https://ajuntament.barcelona.cat/qualitataire/es/qualitat-de-laire/com-es-lluita-contra-la-contaminacio/la-red-de-vigilancia-y-prevision-de-la

Contaminant	Mètode de mostreig i mesura - norma
Diòxid de sofre (SO_2)	Fluorescència ultraviolada **(Ref.)** - EN 14212
Diòxid de nitrogen i òxids de nitrogen (NO_2 i NO_x)	Quimioluminescència **(Ref.)** - EN 14211
Partícules en suspensió de diàmetre inferior a 10 micres (PM10)	Gravimetria **(Ref.)** - EN 12341 Absorció de radiació beta Microbalança oscil·lant Dispersió ortogonal de llum
Partícules en suspensió de diàmetre inferior a 2.5 micres (PM2.5)	Gravimetria **(Ref.)** - EN 14907 Dispersió ortogonal de llum
Plom (Pb)	Mostreig amb el filtre PM10 (EN 12341) i espectrometria d'absorció atòmica **(Ref.)** - EN 14902
Monòxid de carboni (CO)	Espectrometria infraroja no dispersiva (IRND) **(Ref.)** - EN 14626
Ozó (O_3)	Fotometria ultraviolada **(Ref.)** - EN 14625
Benzè (C_6H_6)	Aspiració amb cartutx adsorbent i determinació per cromatografia de gasos **(Ref.)** - EN 14662 parts 1, 2 i 3
Metalls pesants (As, Cd, Ni)	Mostreig amb el filtre PM10 (EN 12341) i determinació per digestió àcida i espectrometria **(Ref.)** - EN 14902
Benzo(a)Pirè (BaP)	Mostreig amb el filtre PM10 (EN 12341) extracció i determinació per cromatografia **(Ref.)** – UNE15549
Sulfur d'hidrogen (H_2S)	Fluorescència ultraviolada
Clor (Cl_2)	Captació per dissolució adsorbent i colorimetria
Clorur d'hidrogen (HCl)	Captació per dissolució adsorbent i cromatografia iònica
Mercuri (Hg)	Mètodes espectrofotomètrics **(Ref.)** - EN 15852

Used to compare emissions from various greenhouse gases based upon their global warming potential. E.g., GW potential for methane over 100 years is 21.

1M metric tons methane = emissions of 21M metric tons of CO.

Table 1 Lifetimes and Global Warming Potentials (GWP) Relative to CO_2 for Selected Greenhouse Gases (GHG)

Industrial or Common Name	Chemical Formula	Lifetime (Years)	GWP for Given Time Period	
			20-Years	100-Years
Carbon Dioxide	CO_2	N/A	1	1
Methane	CH_4	12	72	25
Nitrous Oxide	NO_2	114	289	298
CFC-11	CCl_3F	45	6,730	4,750
Halon-1301	$CBrF_3$	65	8,480	7,140
HFC-23	CHF_3	270	12,000	14,800
Sulfur Hexafluoride	SF_6	3,200	16,300	22,800
Nitrogen Trifluoride	NF_3	740	12,300	17,200
HFE-125	CHF_2OCF_3	136	13,800	14,900

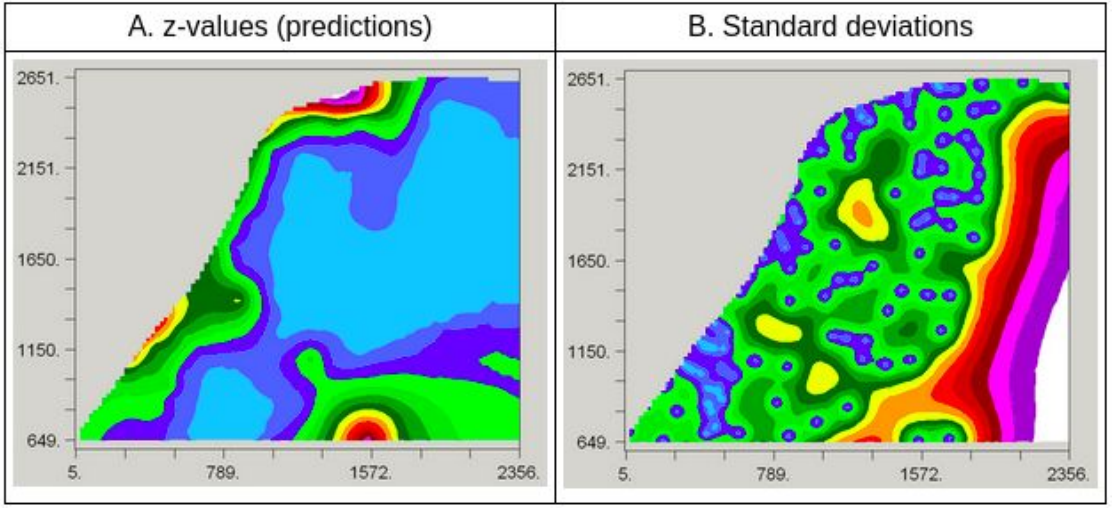
Source: Adapted from Table 2.14, IPCC, 2007.

Source: https://stats.oecd.org/glossary/detail.asp?ID=285
http://sk.sagepub.com/reference/greenenergy/n85.xml

Although environmental variables are continues in space, they are measured using punctual locations.

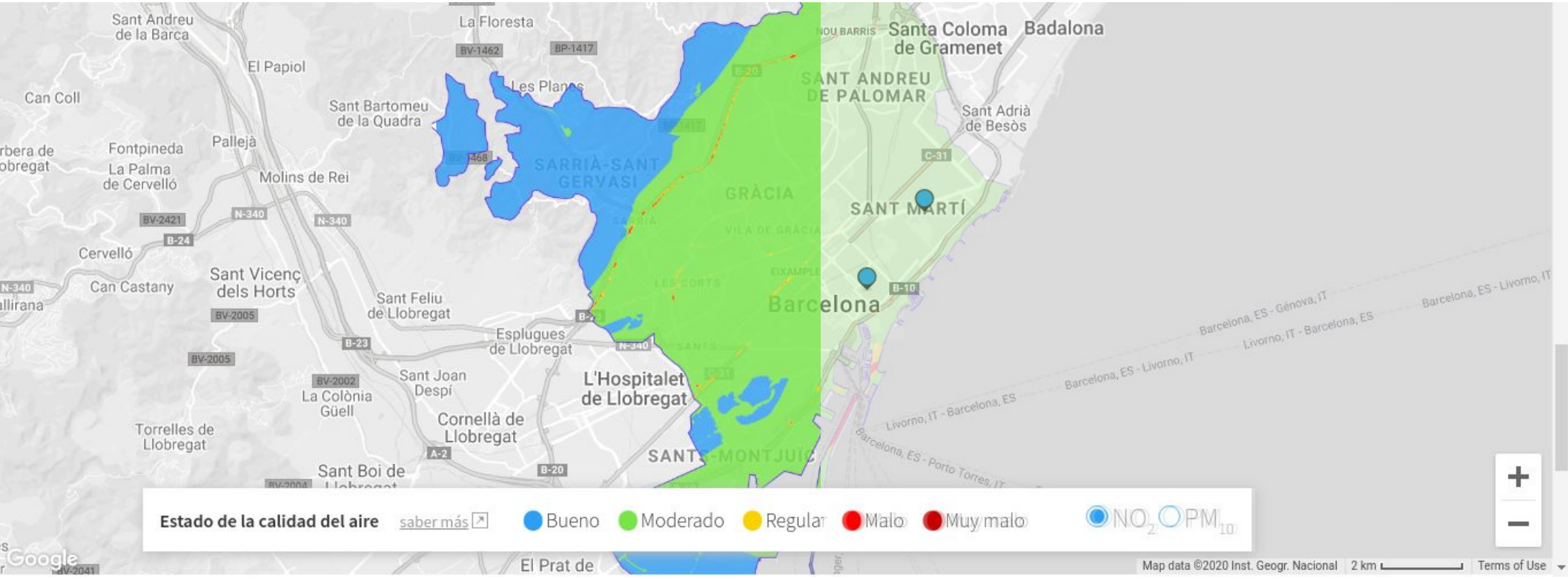
"*Everything is related to everything else, but near things are more related than distant things.*" in ***Tobler's First Law and Spatial Analysis*** (Miller J., 2005)

Interpolation: Voronoi, IDW, Kriging, etc.



Tobler's first law of geography: https://en.wikipedia.org/wiki/Tobler%27s_first_law_of_geography
Interpolation: https://www.spatialanalysisonline.com/HTML/index.html?geostatistical_interpolation_m.htm
Kriging:https://www.spatialanalysisonline.com/HTML/index.html?kriging_interpolation.htm

A diverse set of (complex) mathematical methods used to identify behavioural patterns, infer future changes and interpolate results



Air quality BCN: https://www.apple.com/covid19/mobility
Caliope BSC: http://www.bsc.es/caliope/en/forecasts

Smart Citizen Kit

team ISCAPE_A #7DC1 100 %

LAST DATA RECEIVED:MAY 21, 2020 - 18:05

0 Lux	49.4 dBA	19 °C	82.6 %	102.1 K Pa	49 ug/m3	52 ug/m3	36 ug/m3
light	noise	air temperature	humidity	barometric pressure	PM 2.5	PM 10	PM 1

52 ug/m3

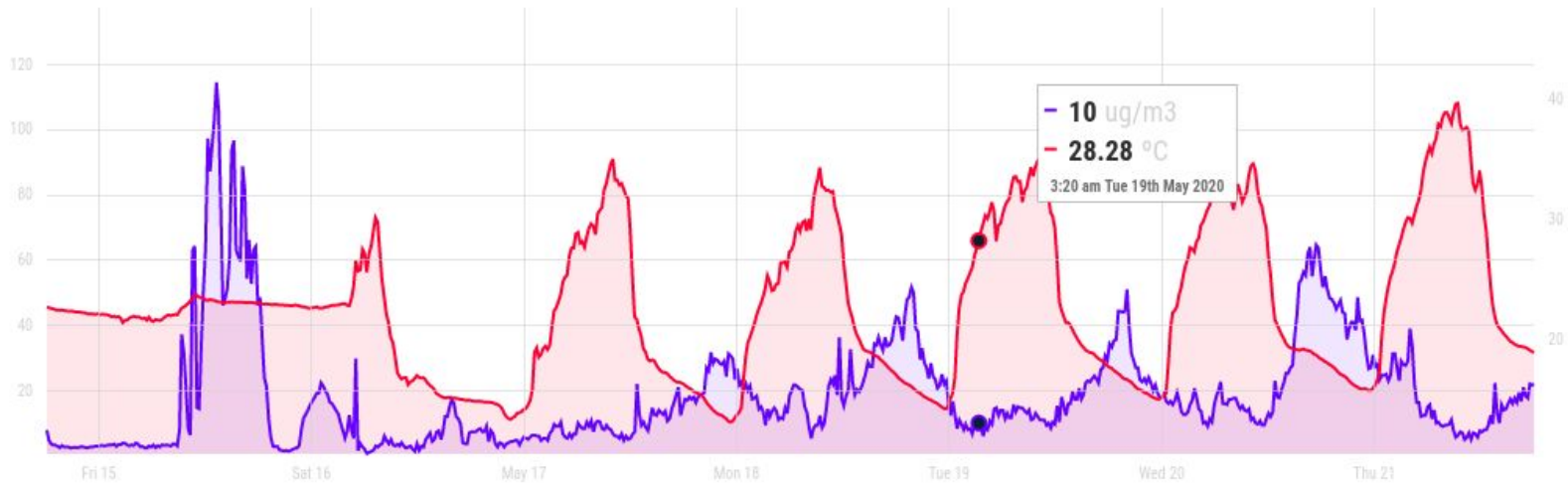
LAST DATA RECEIVED From: 14 May, 2020 To: 21 May, 2020

PM 10

PM 10

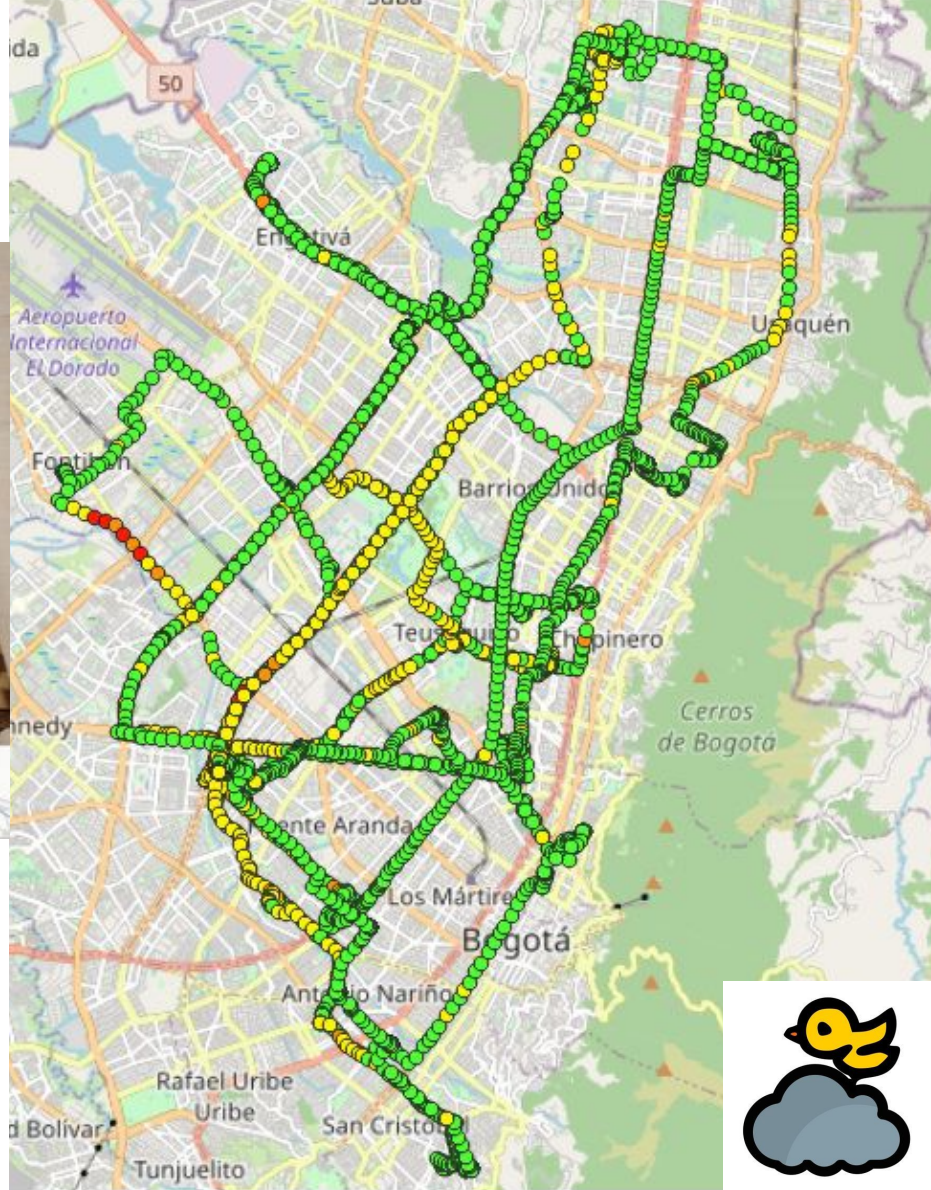
PM stands for particulate matter: the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as du ... More info

Compare with AIR TEMP...



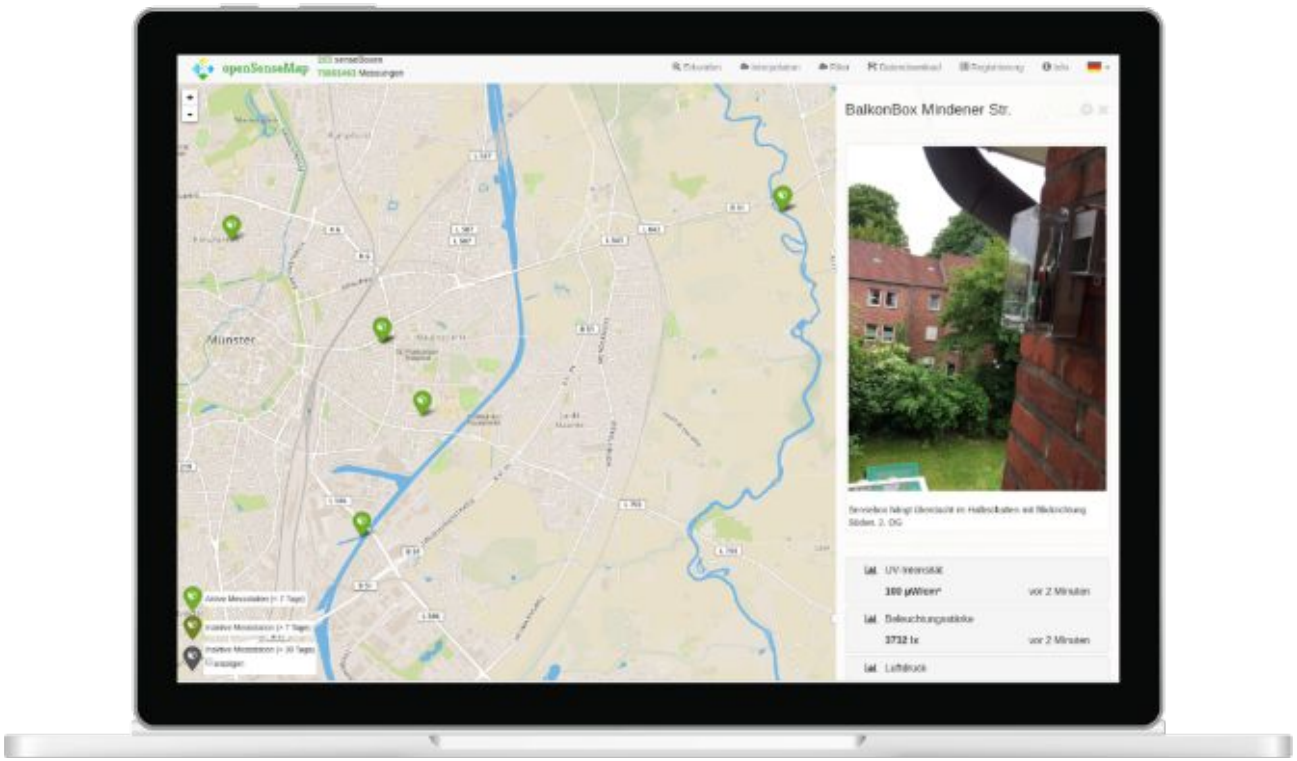
Details of one of IAAC's kit: https://smartcitizen.me/kits/10917

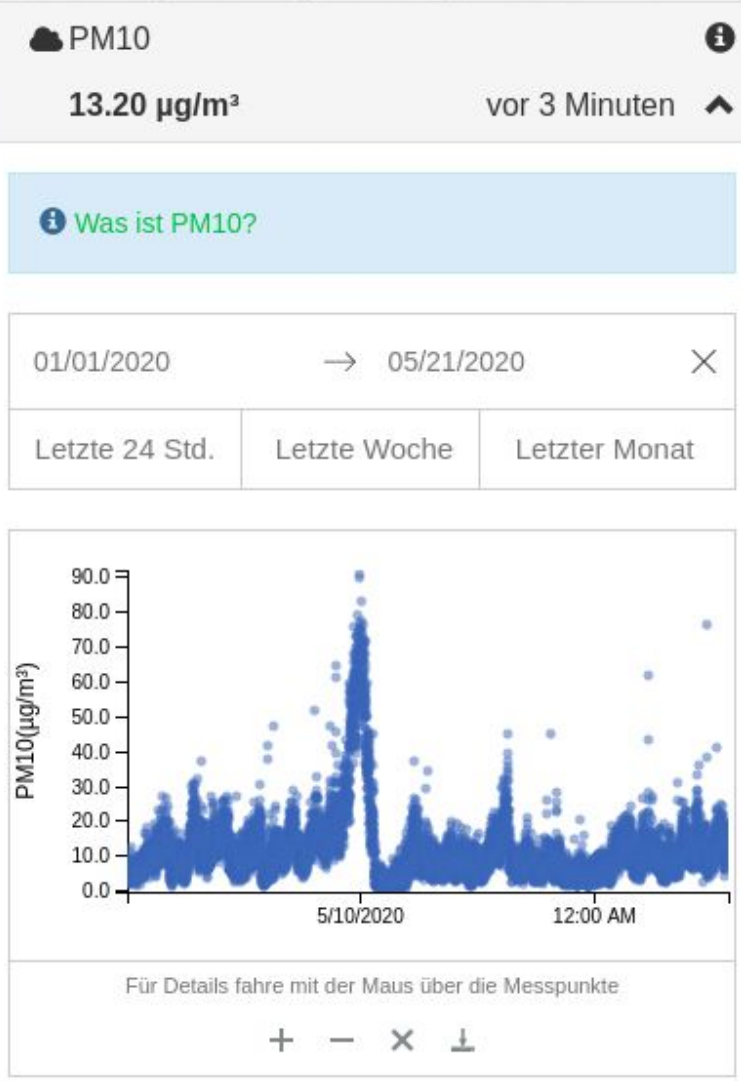
CanAir.io



Source: https://canair.io/#talleres

Sensebox





Get some data for Barcelona: https://opensensemap.org/explore/5d87f4ea5f3de0001aca3475

Hands-on

Let’s get some environmental data for Barcelona?

Let’s see what we are thinking

http://etc.ch/AgVd

https://www.directpoll.com/

** This survey is designed only for the live session*

Exploring air quality data for Barcelona

Goal: to access and to manipulate data about historical measurements for air quality.

1. Get access to historical data about air quality in Barcelona
2. Navigate and download data from environmental stations
3. Run the python script and create basic plots for historical records
4. Open geospatial layers for environmental stations in QGIS
5. [optional] Explore interpolation options in QGIS

Using curated maps to complement visualisations

Goal: To use the WMS (map service) for environmental data of Barcelona as an additional (visual) analysis layer.

1. Navigate the Barcelona's web application for environmental data maps
2. Get the WMS url
3. Configure access to WMS using QGIS
4. Create a geospatial visualisation that combines your project data sources

Scrapping Barcelona's air pollution predictions

Goal: To access and visualise air pollution predictions for PM10 and NO2 in Barcelona

1. Navigate the web portal "air quality, metropolitan area of Barcelona"
2. Scrap web app resources to find the raster image displaying model results
3. Scrap web app resources to find the spatial parametres (coordinates) for georeferencing the image.
4. Add model images to QGIS
5. Use the georeferencing tool in QGIS to generate geospatial layers

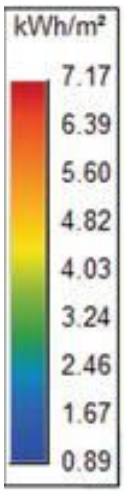
Give some examples of potential uses of the data source identified:

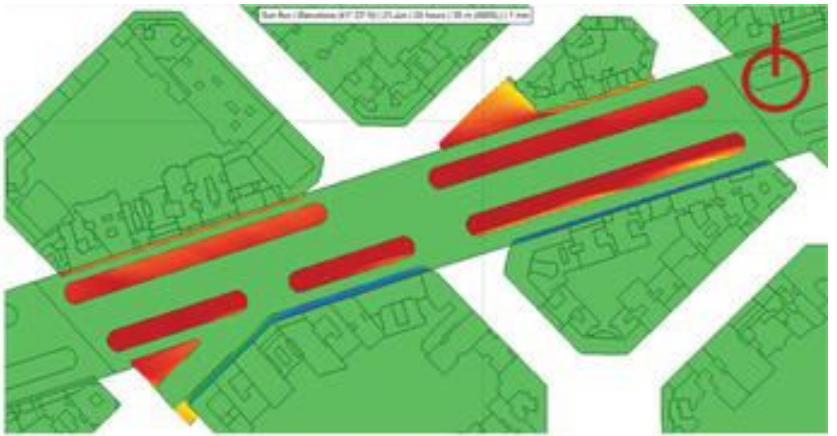
How do you see the integration of these datasets and the analysis for the studio project?

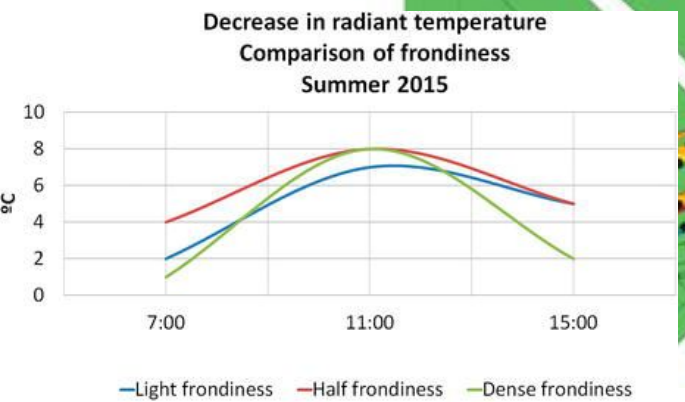
Space-time analysis

Present in most of the environmental analysis

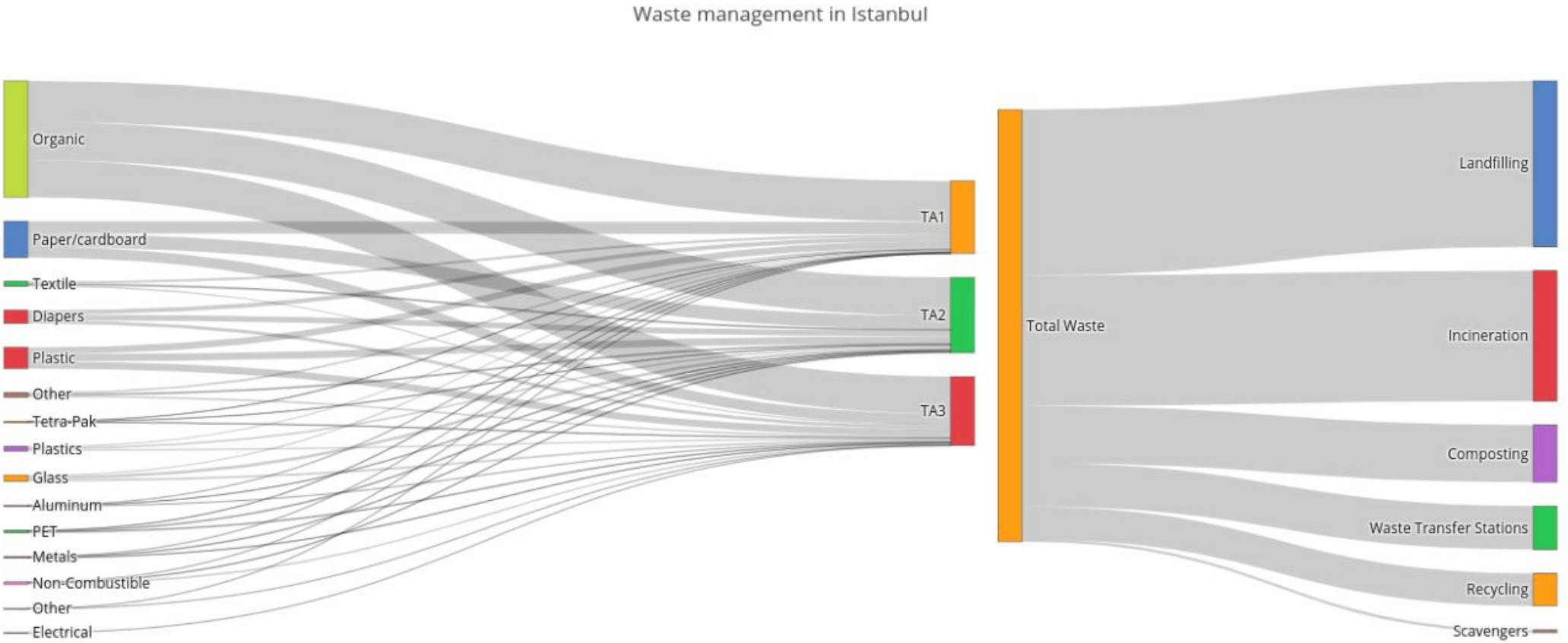
Combination of space, time and environmental variables







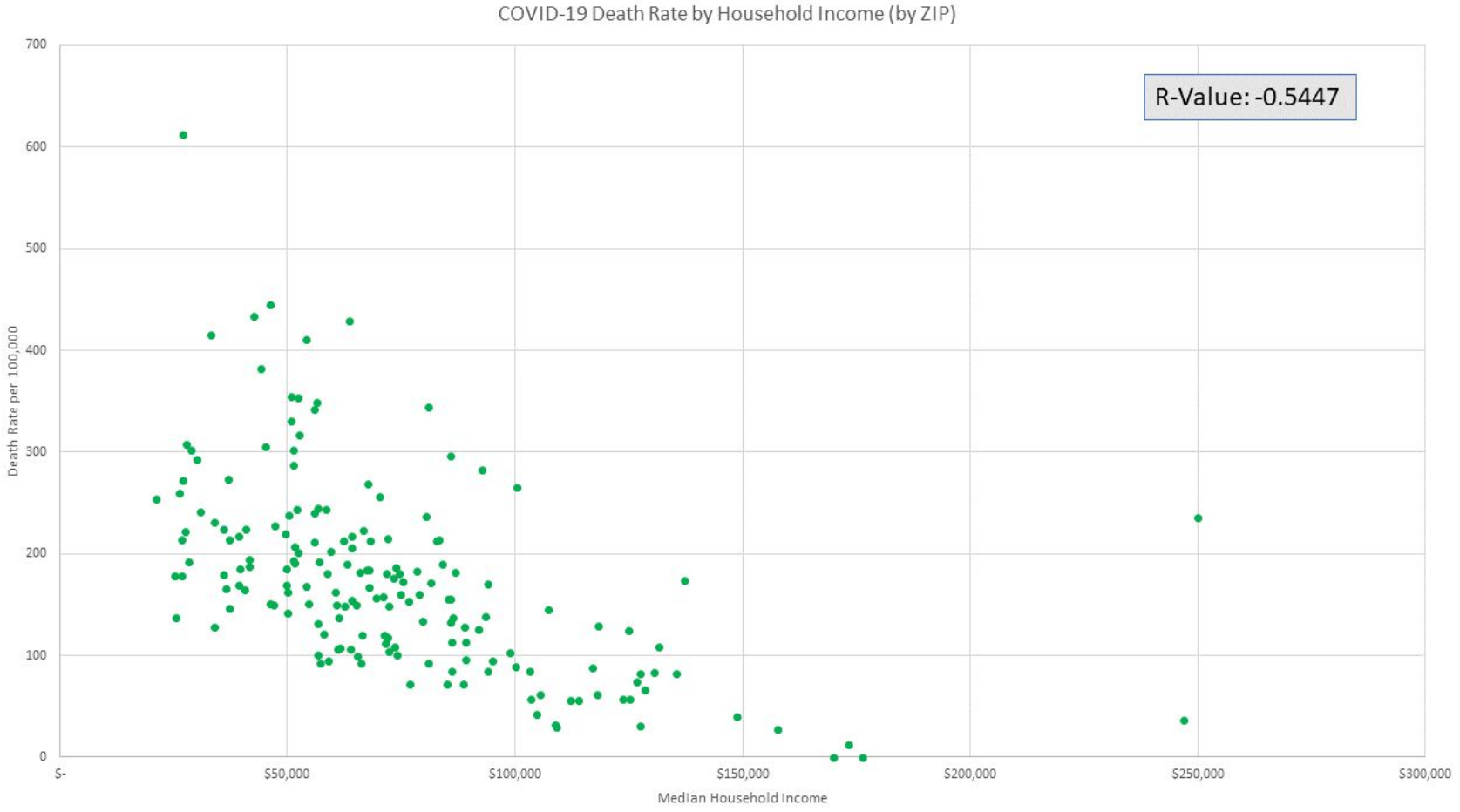
Source:
https://www.intechopen.com/books/mediterranean-identities-environment-society-culture/climate-and-urban-morphology-in-the-city-of-barcelona-the-role-of-vegetation



Unpublished work for the https://pop-machina.eu / maker academy

Social relationships

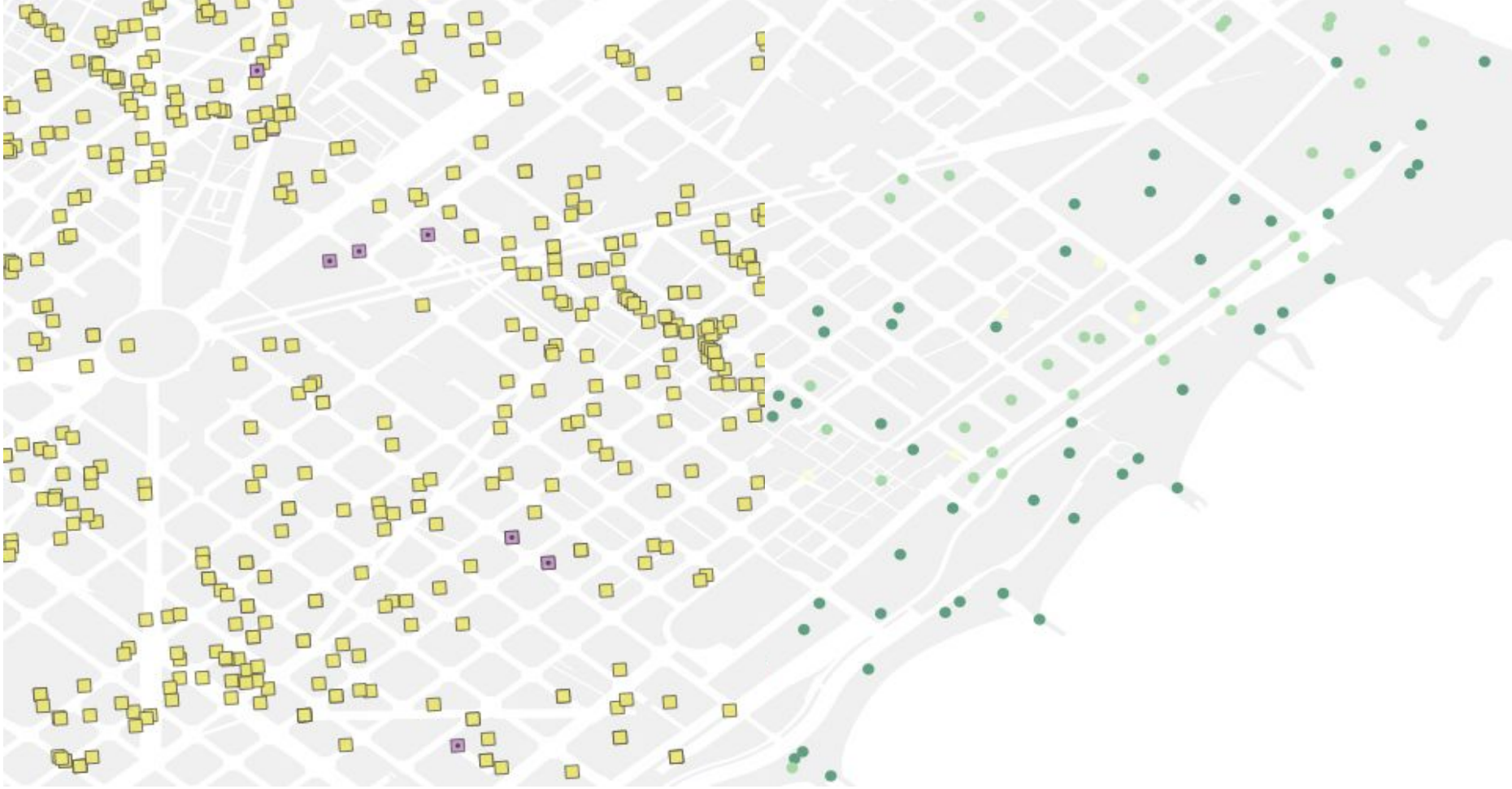
Heavily impacted by environmental conditions



Institute for advanced architecture of Catalonia

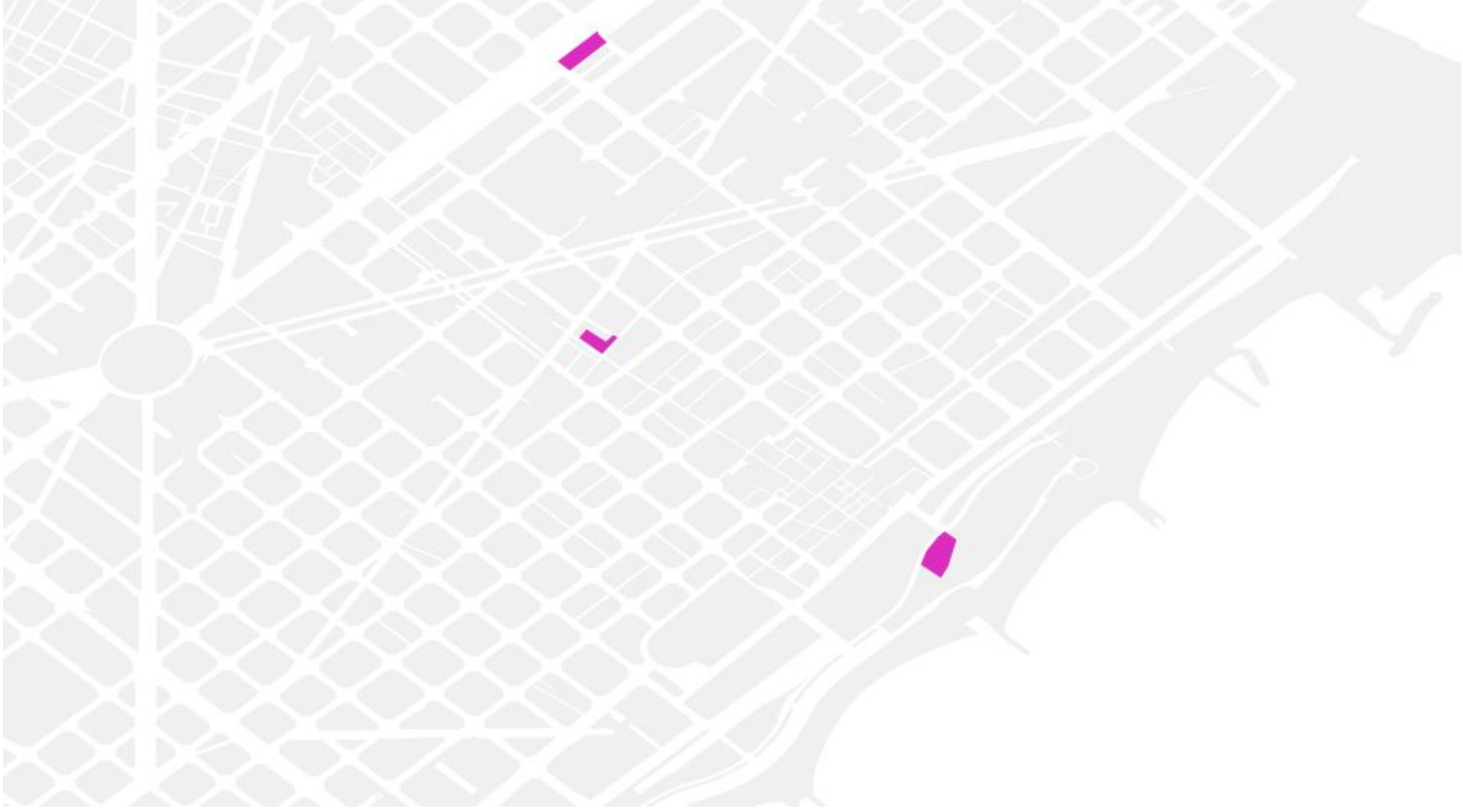
Income and COVID19 cases (Article)

Source: https://www.nytimes.com/interactive/2020/nyregion/new-york-city-coronavirus-cases.html



Source terraces:
https://opendata-ajuntament.barcelona.cat/data/en/dataset/terrasses-comercos-vigents/resource/8808bc24-e14c-45a5-9c24-5e67846f087a

Source: green areas:
https://opendata-ajuntament.barcelona.cat/data/en/dataset?q=public+space



Source: https://opendata-ajuntament.barcelona.cat/data/en/dataset/espais-prioritaris-neteja-barcelona

Merging basic data and tracking

Hands-on

What can we see from these data sets?

Comparing Barcelona's income and social distancing spaces

Goal: To identify if there is correlation between income and available space for social activities in Barcelona

Comparing Barcelona's pollution and social distancing spaces

Goal: To identify if there is correlation between air pollution conditions and COVID-19 cases in Barcelona

Institute for advanced architecture of Catalonia | BARCELONA

MASTER IN CITY & TECHNOLOGY
DIGITAL TOOLS AND BIG DATA
2019/2020

FACULTY DIEGO PAJARITO