





Google Earth
Landsat / Copernicus, Data SIO, NOAA



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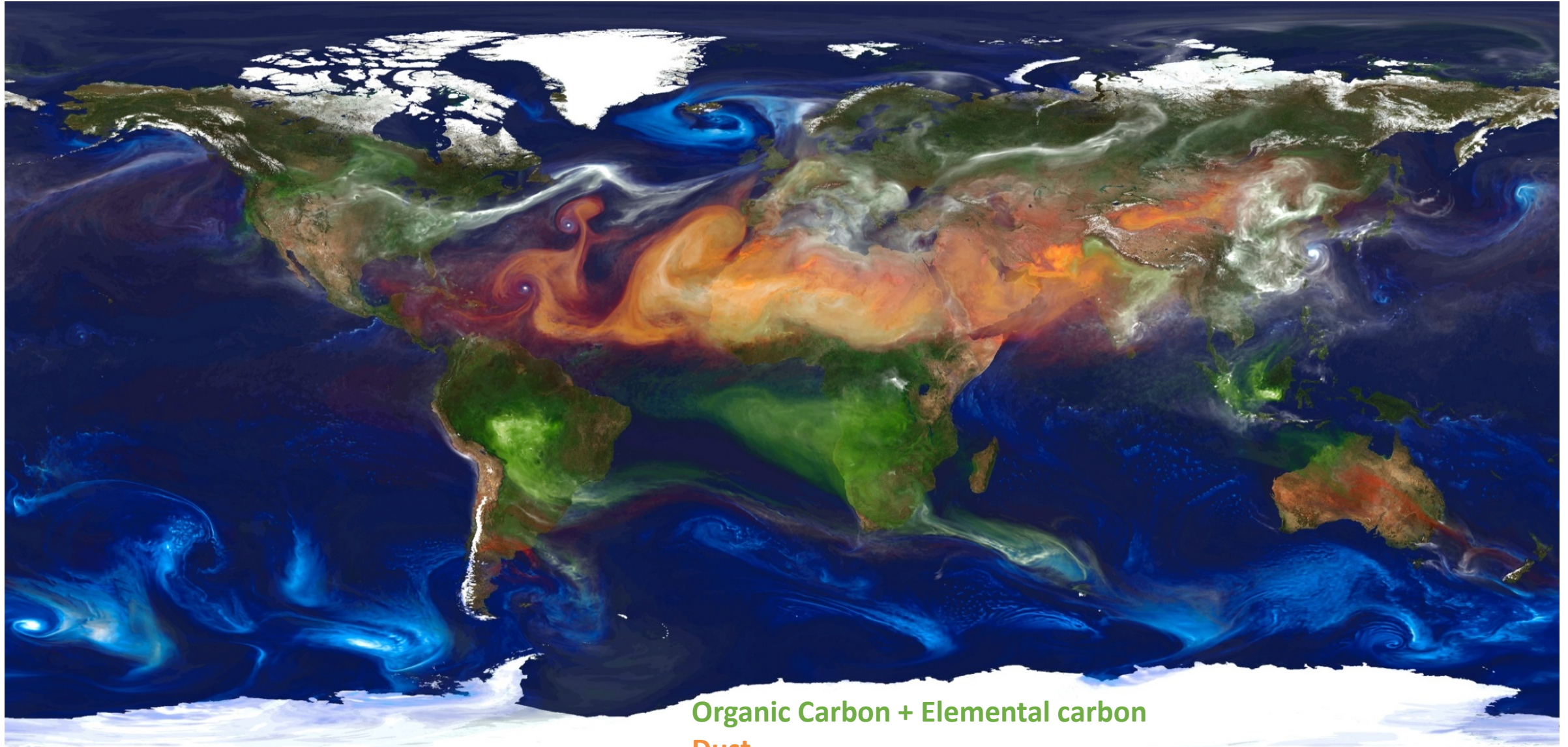
Google Earth
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28/02/2019

Simulating air quality in cities:

CALIOPE-Urban current state and perspectives

Computational simulations



Organic Carbon + Elemental carbon

Dust

Sulfate

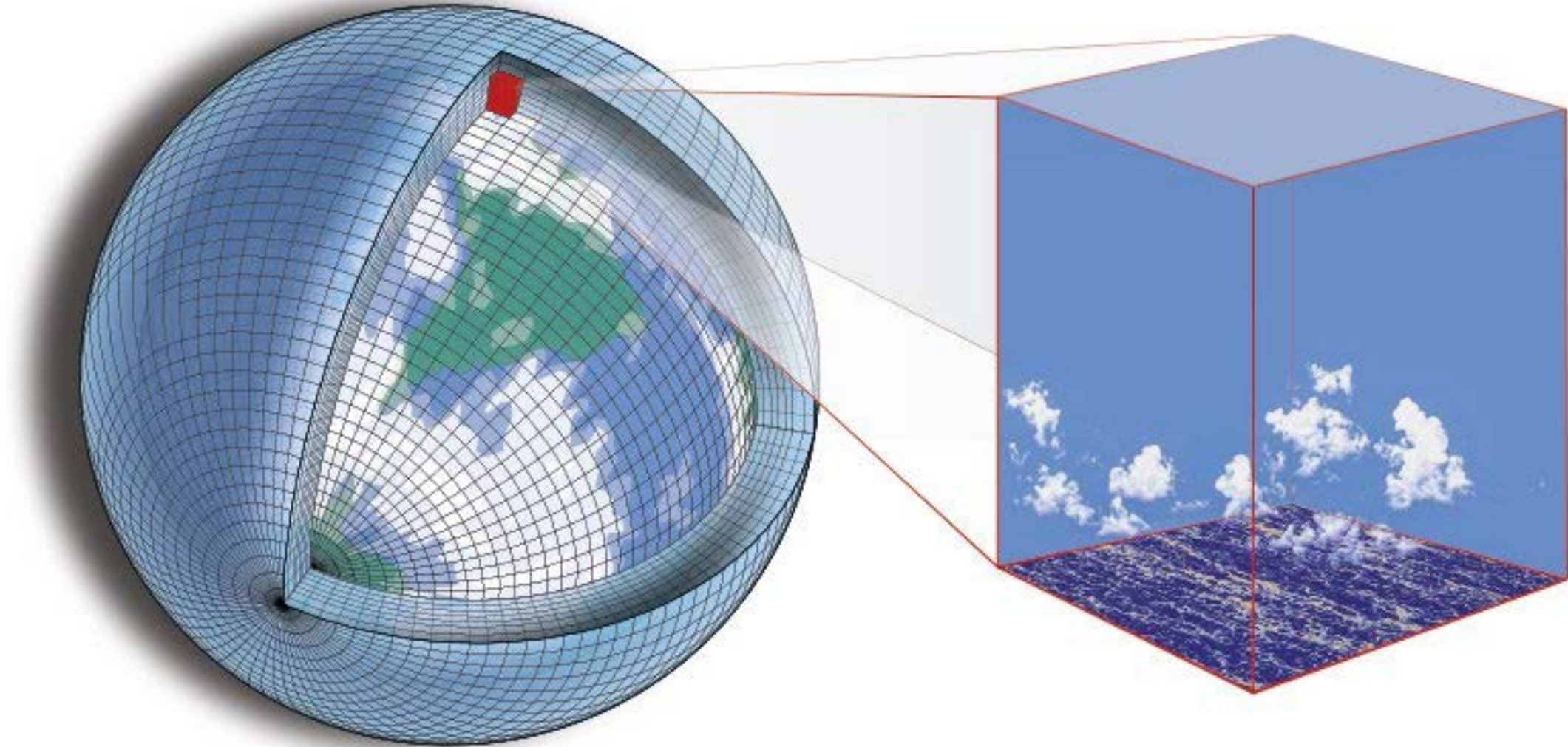
Sea salt



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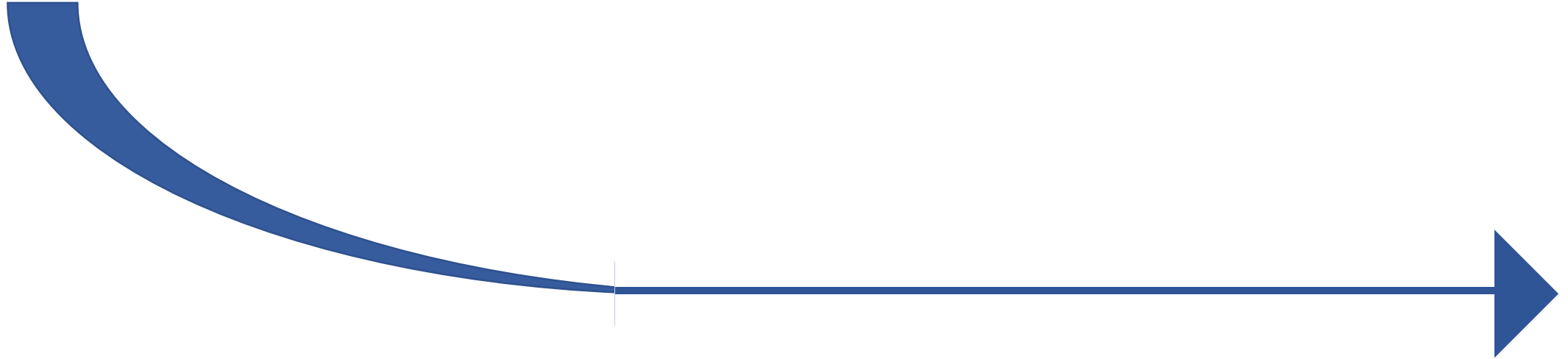
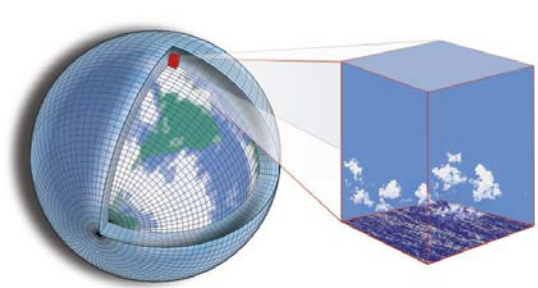
Credit NASA | GEOS-5 Aerosols

Computational cell

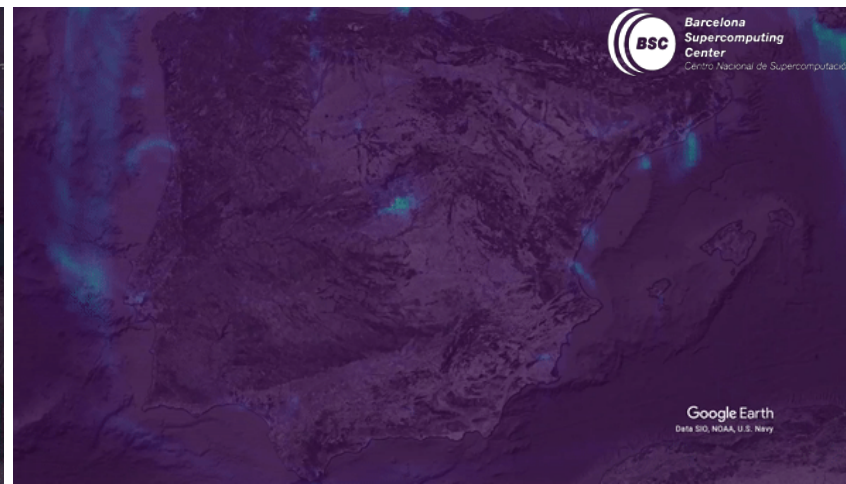
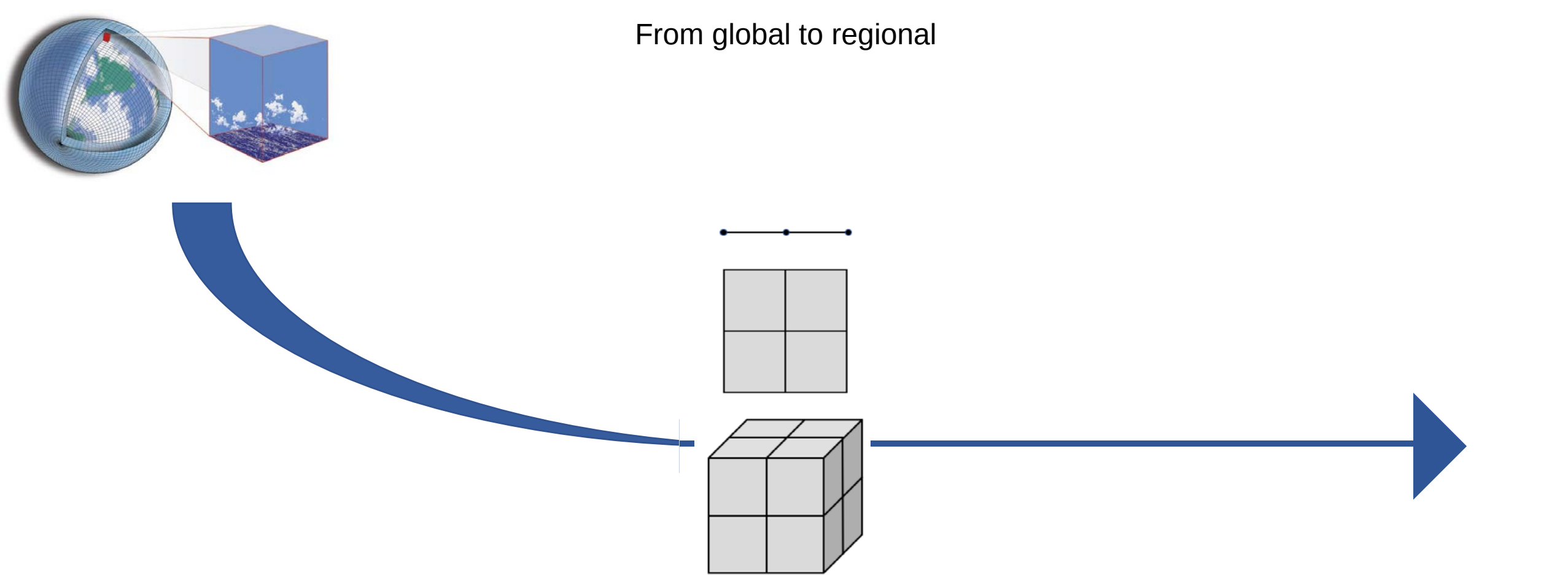


Credit: Tapio Schneider/Kyle Pressel/Momme Hell/Caltech

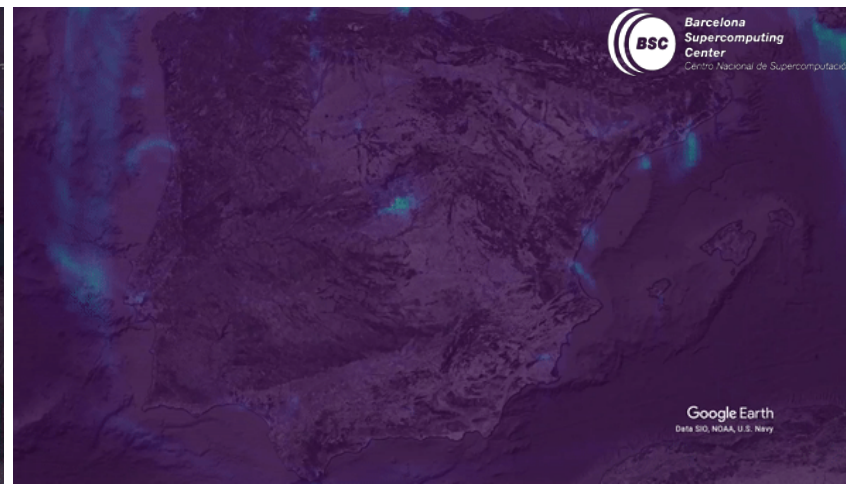
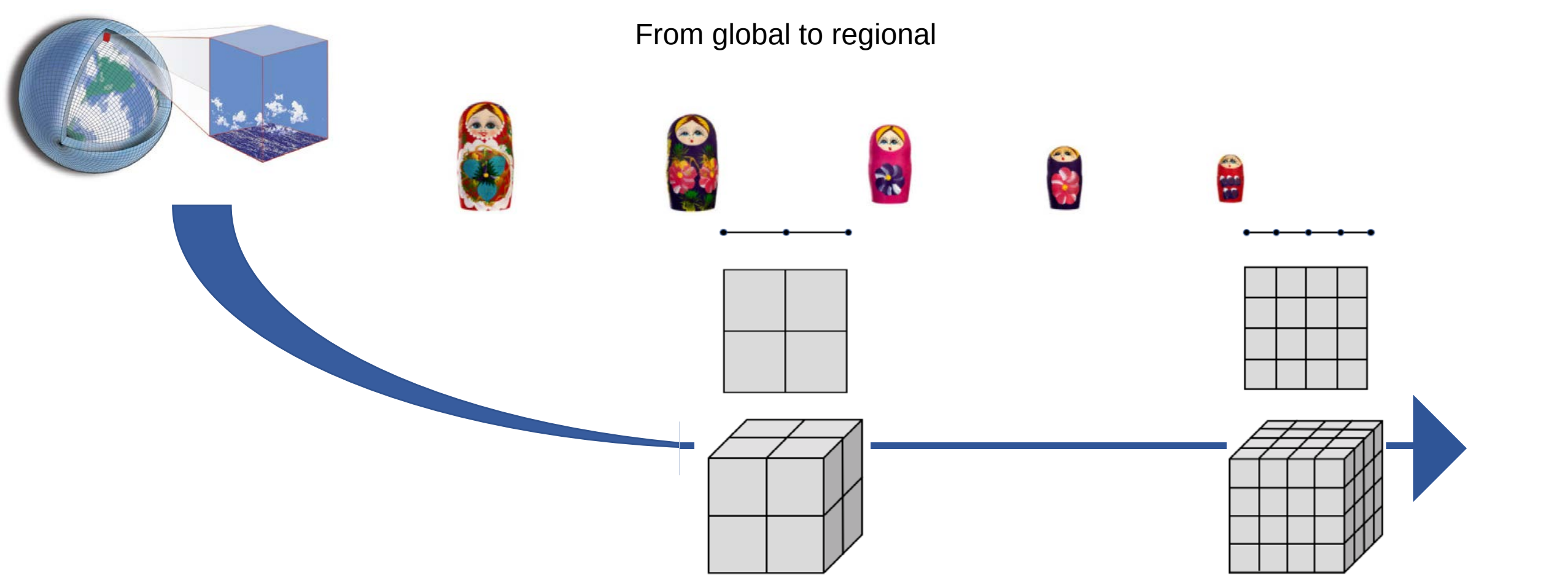
From global to regional



From global to regional



From global to regional



... and in the cities?

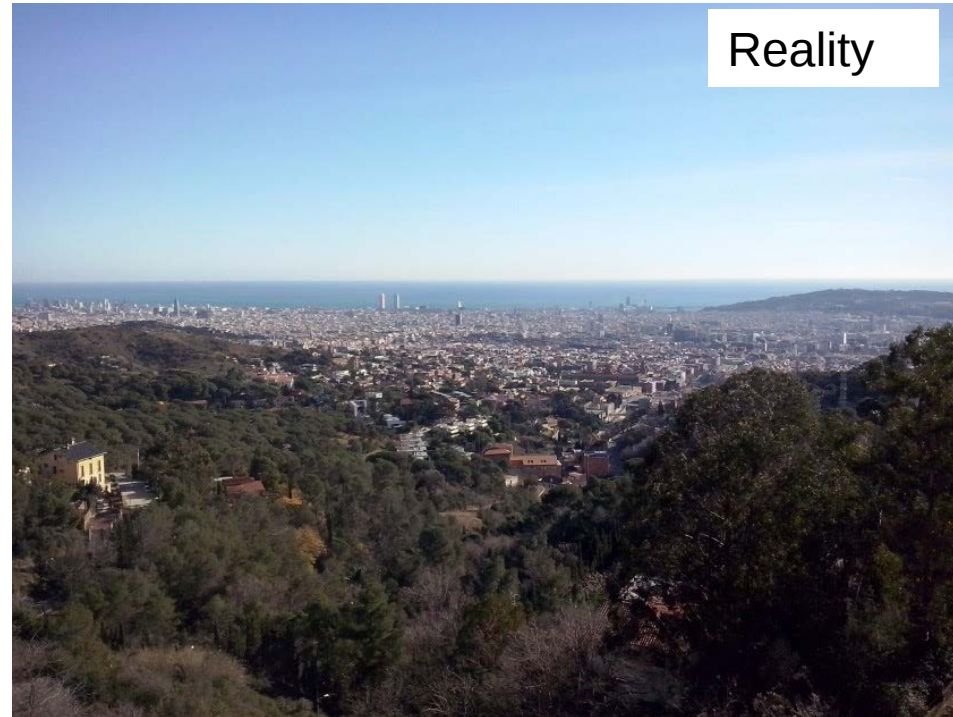
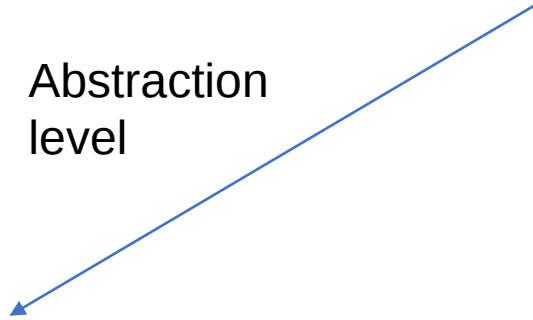


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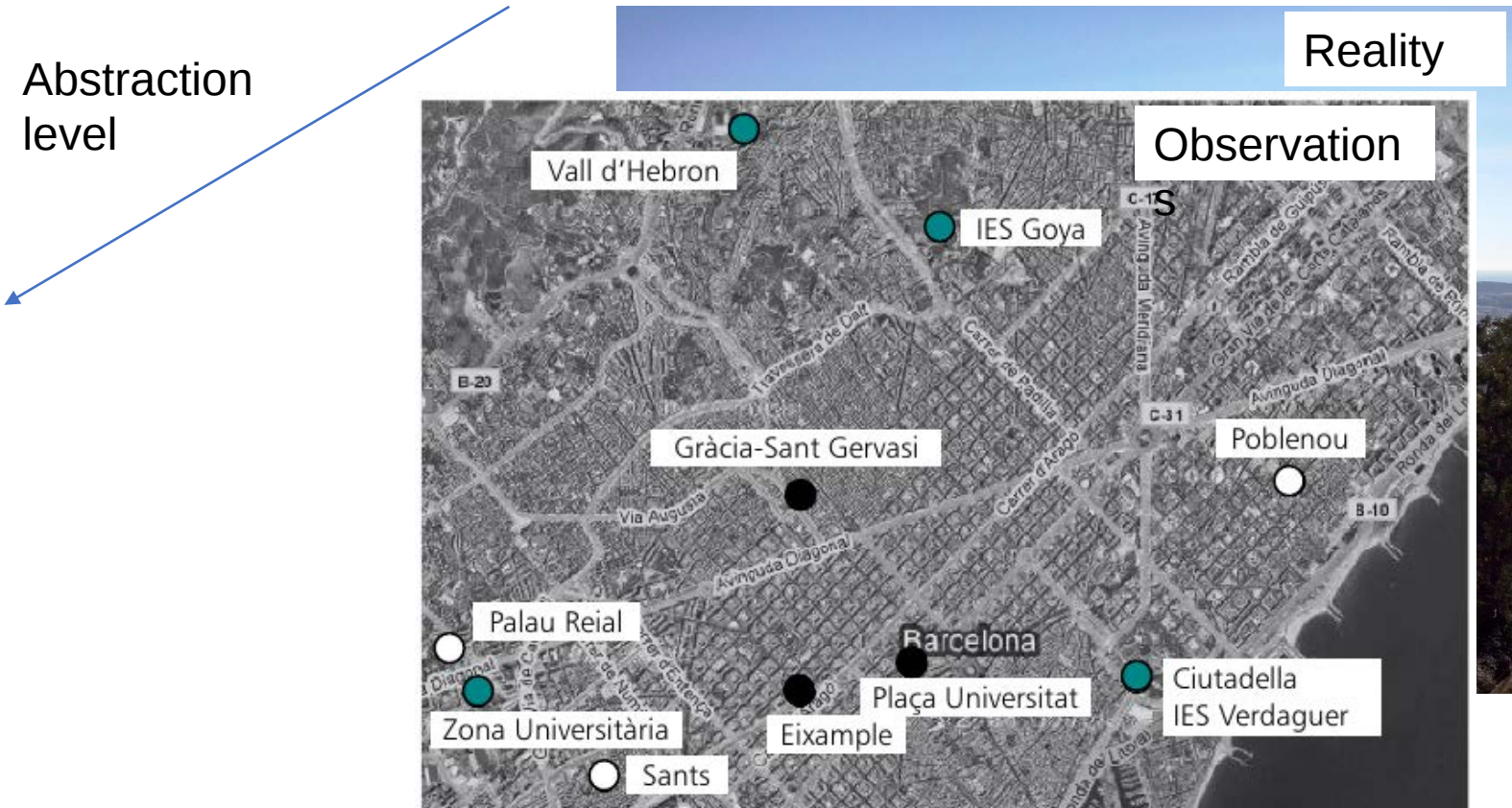
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Modelling at the urban scale

Abstraction
level

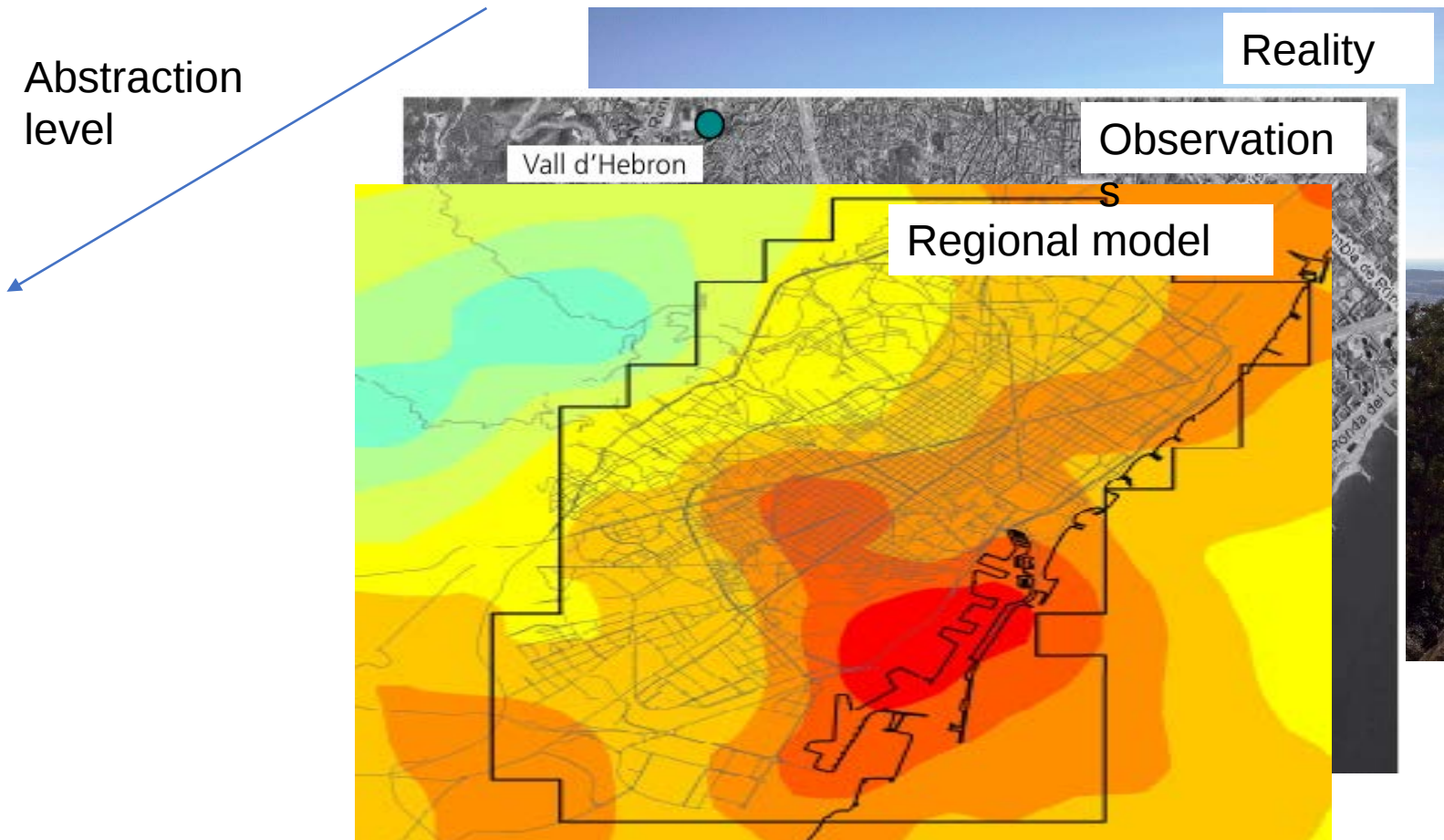


Modelling at the urban scale



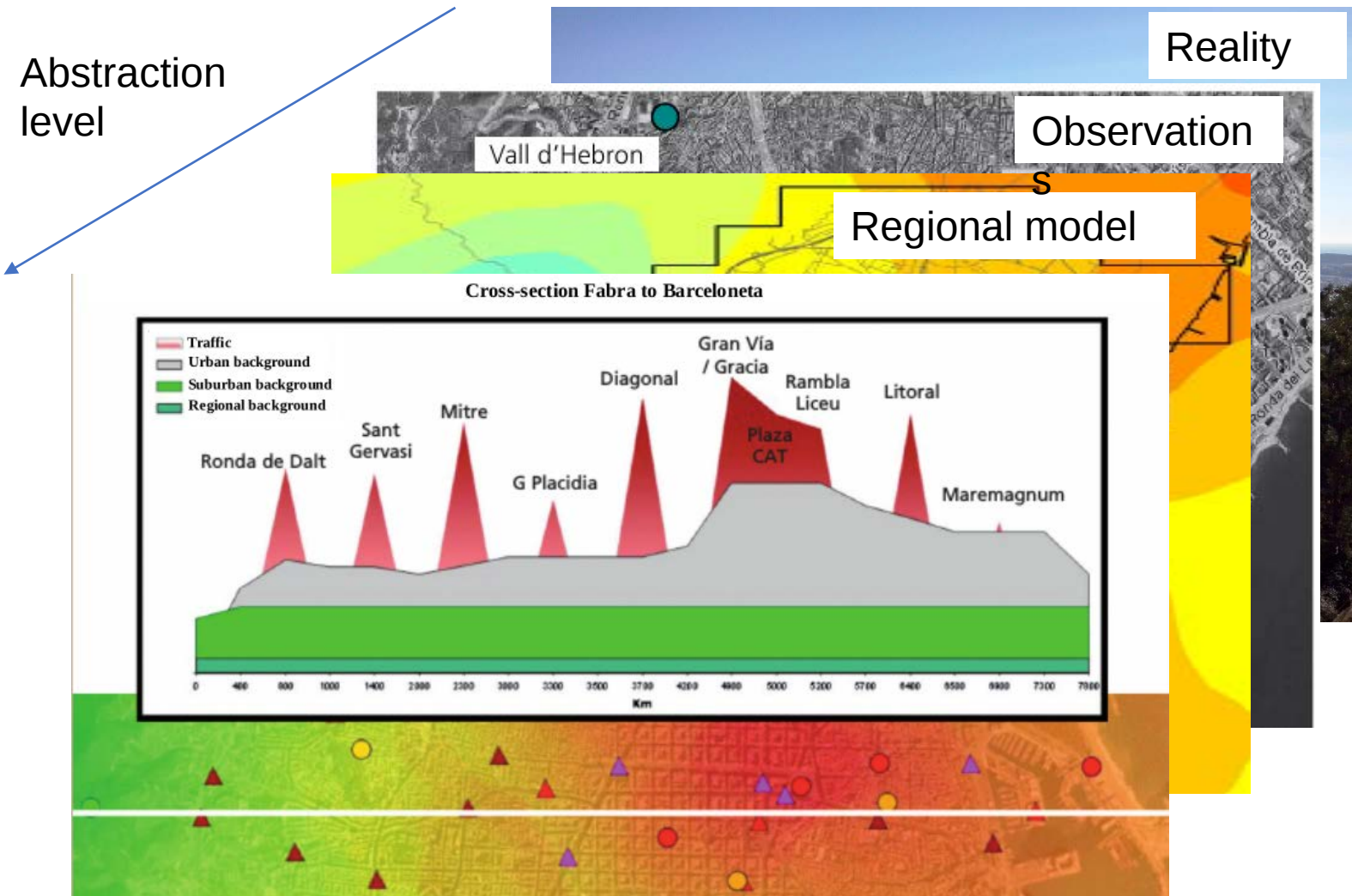
[1] Benavides et al. (2019)

Modelling at the urban scale



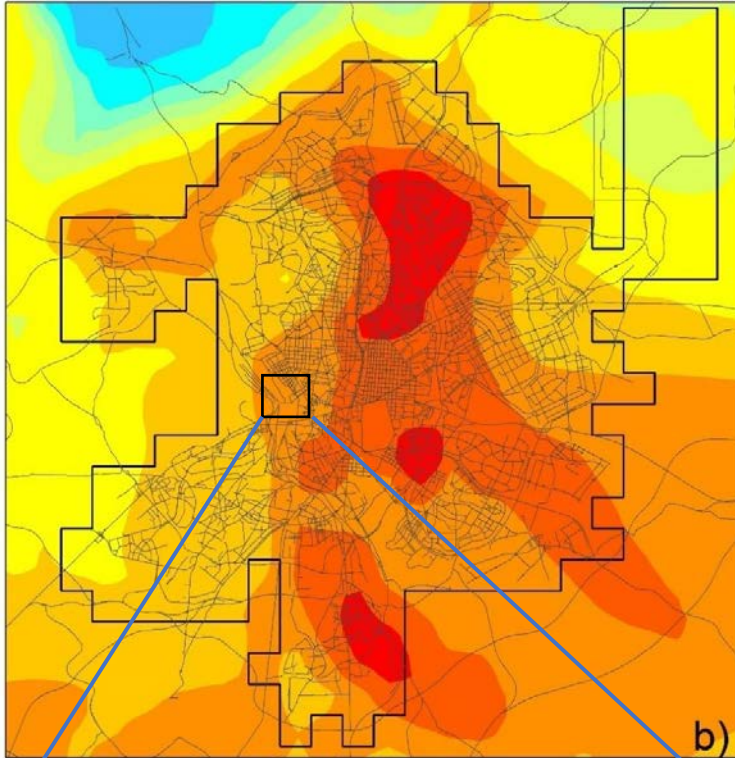
[2] Soret et al. (2014)

Modelling at the urban scale



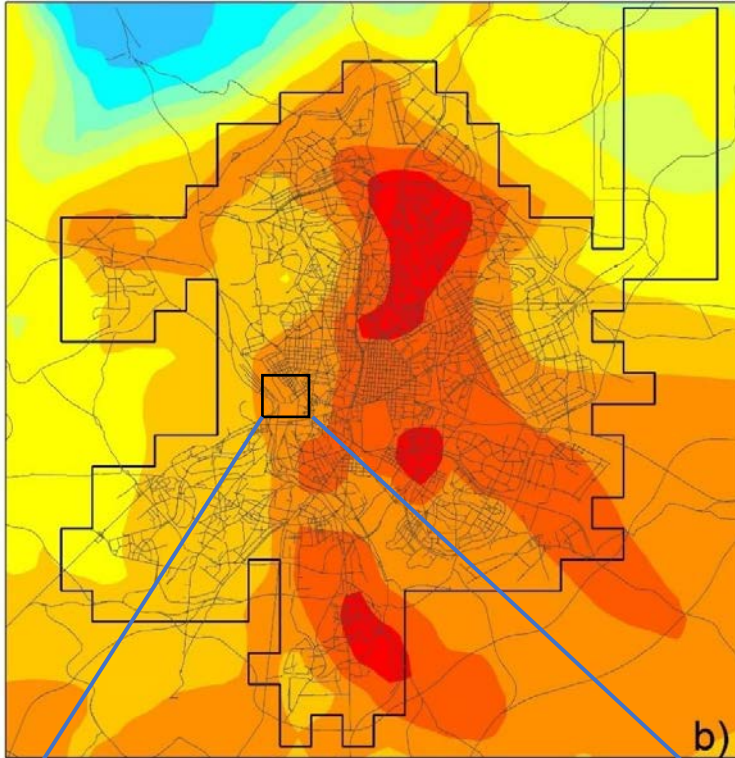
Modelling at the urban scale

NO₂ (ug m⁻³) Max h
Base case; Madrid



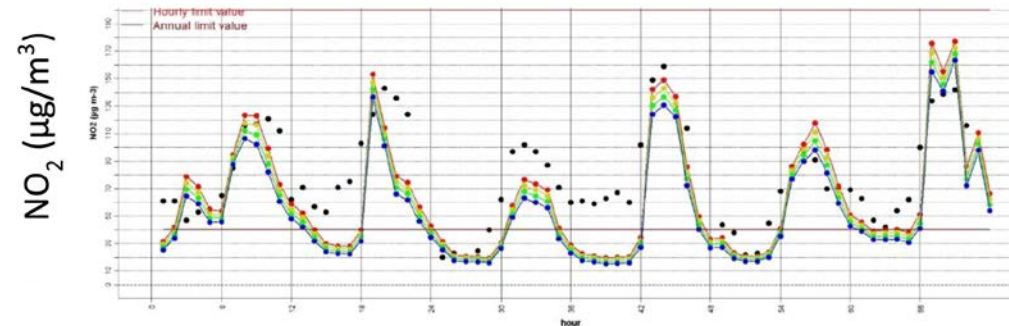
Modelling at the urban scale

NO₂ (ug m⁻³) Max h
Base case; Madrid



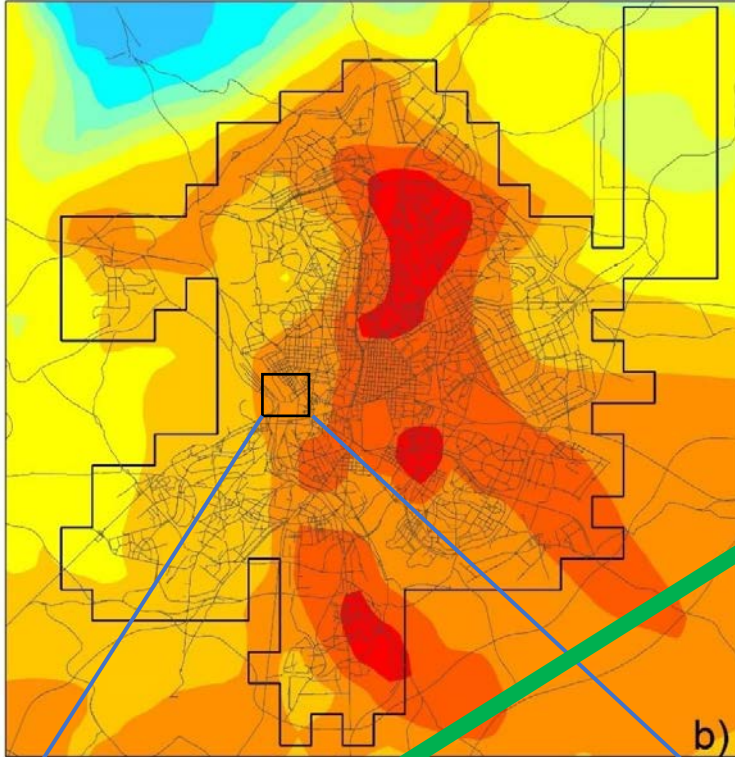
NO₂ hourly concentration. Plaza del Carmen station (background)

● Observations CALIOPE simulations



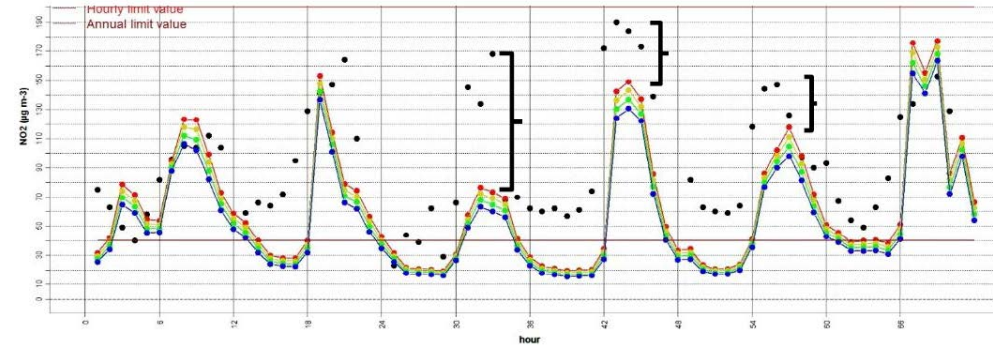
Modelling at the urban scale

NO₂ (ug m⁻³) Max h
Base case; Madrid



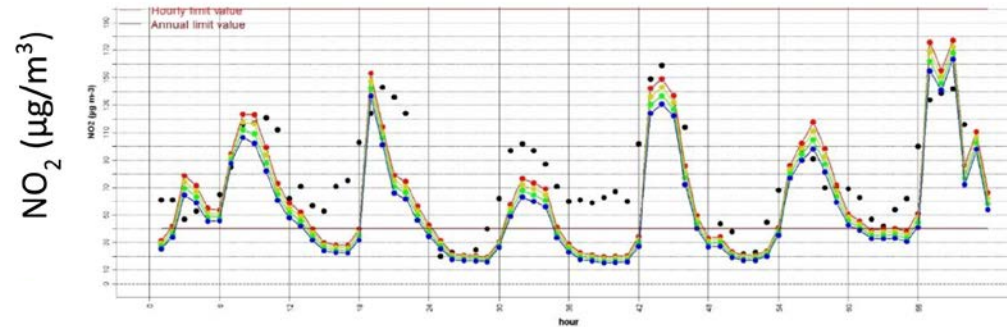
NO₂ hourly concentration. Plaza de España station (traffic)

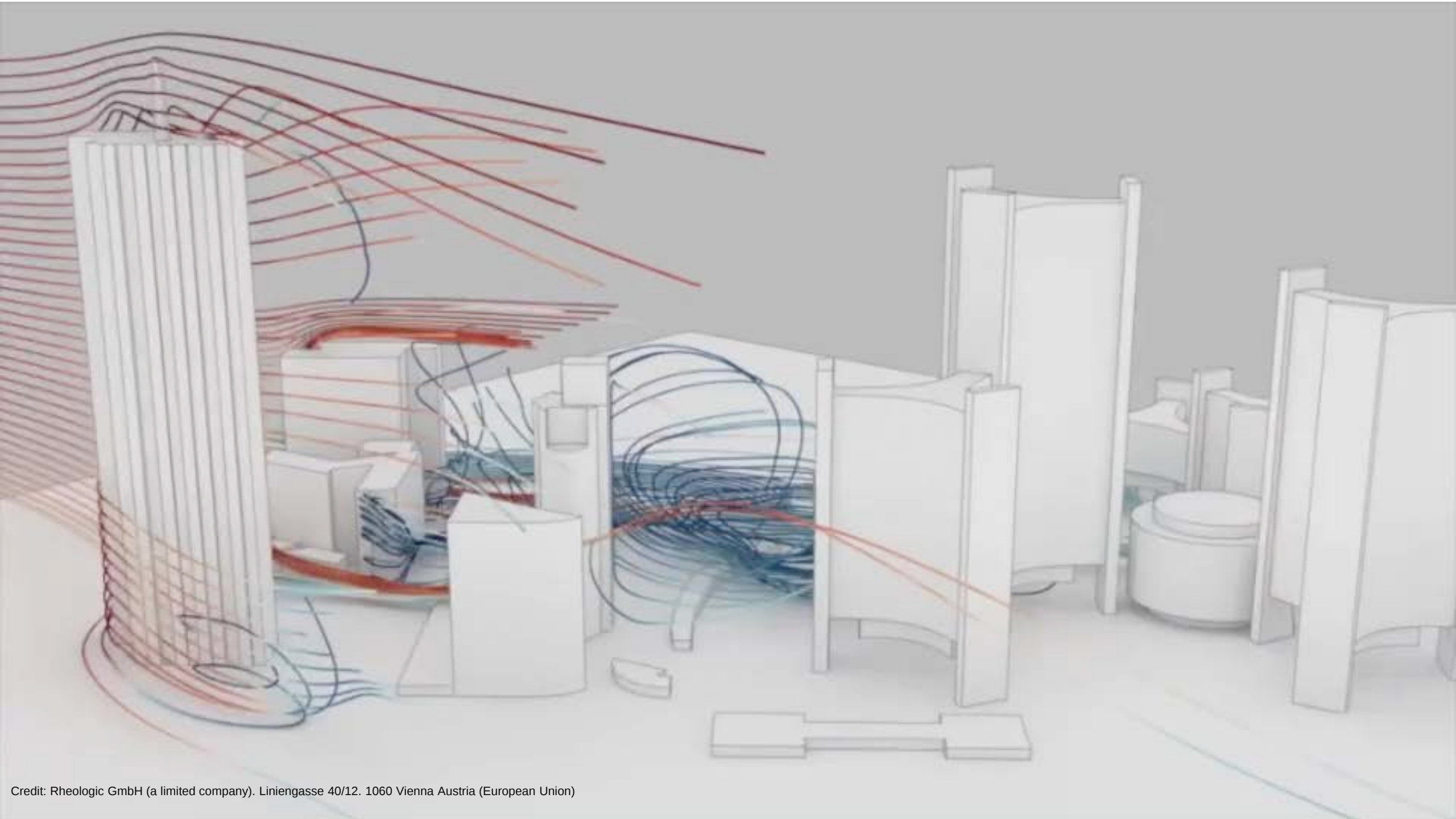
● Observations  CALIOPE simulations

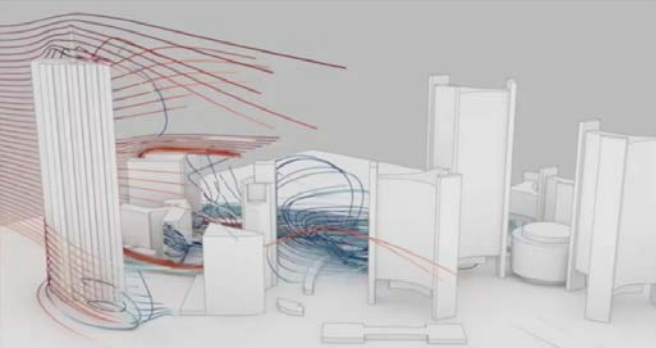


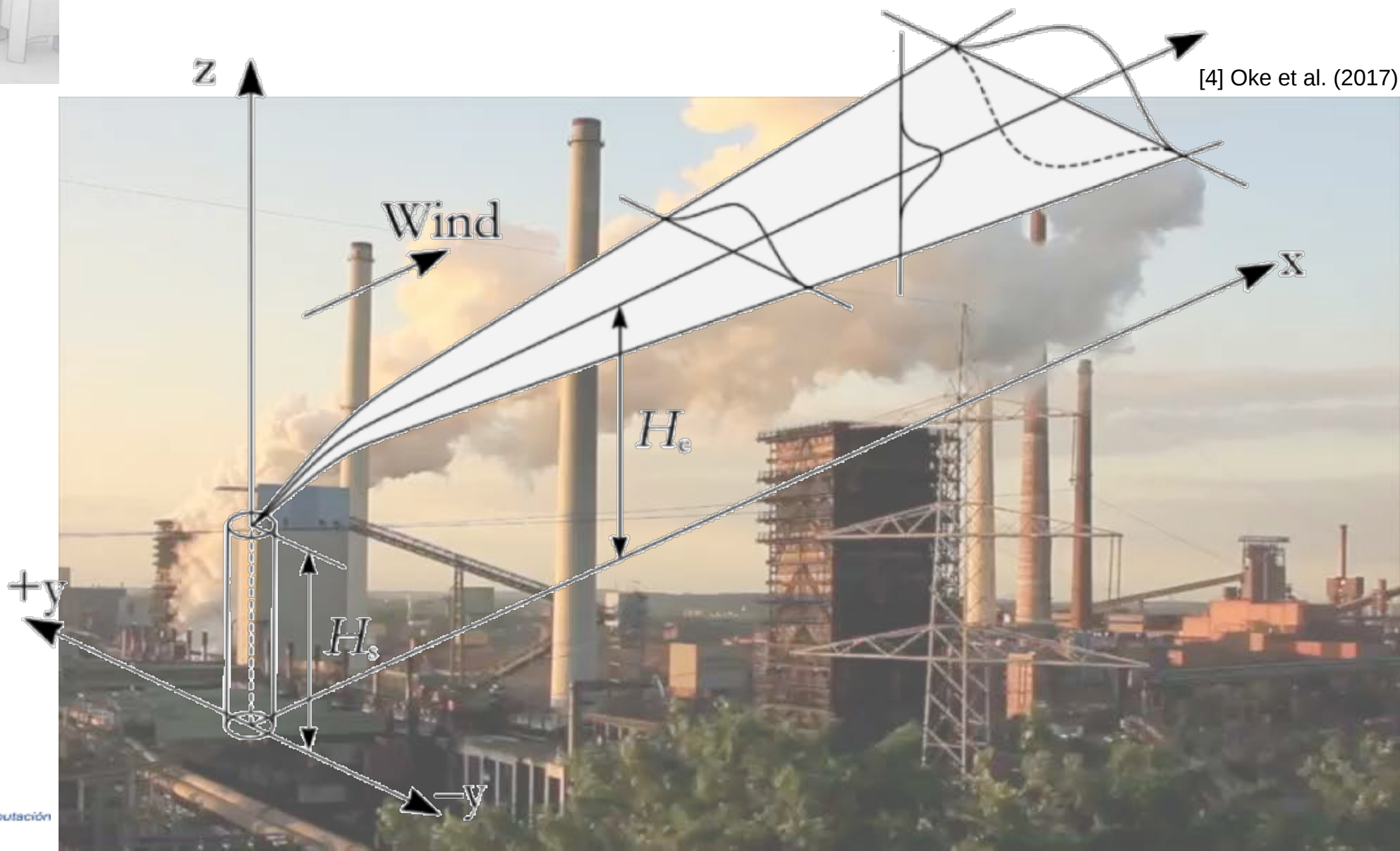
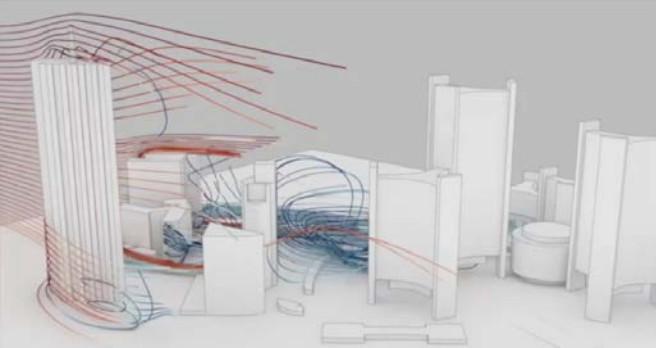
NO₂ hourly concentration. Plaza del Carmen station (background)

● Observations  CALIOPE simulations



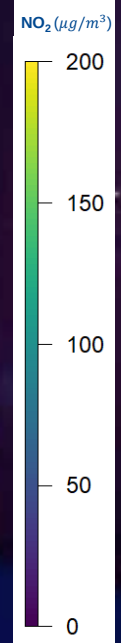








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Google Earth
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28/02/2019

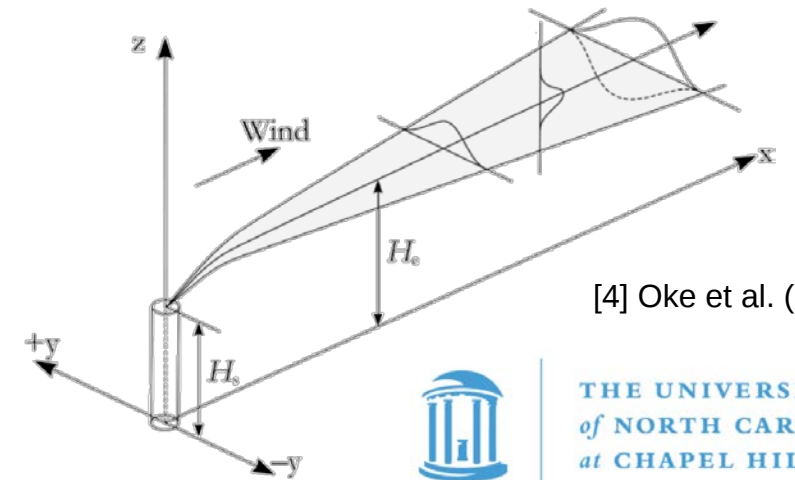
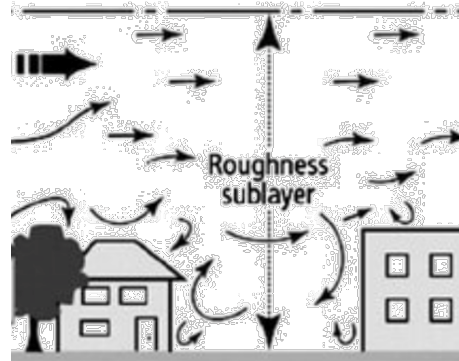
CALIOPE-Urban



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CALIOPE-Urban: street-scale air quality model

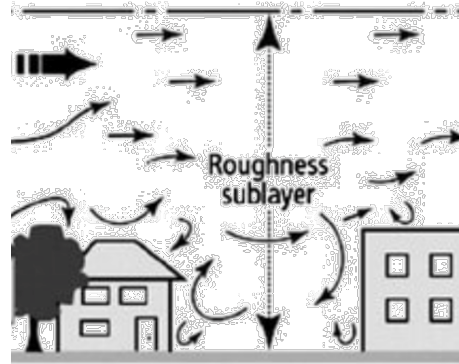


[4] Oke et al. (2017)

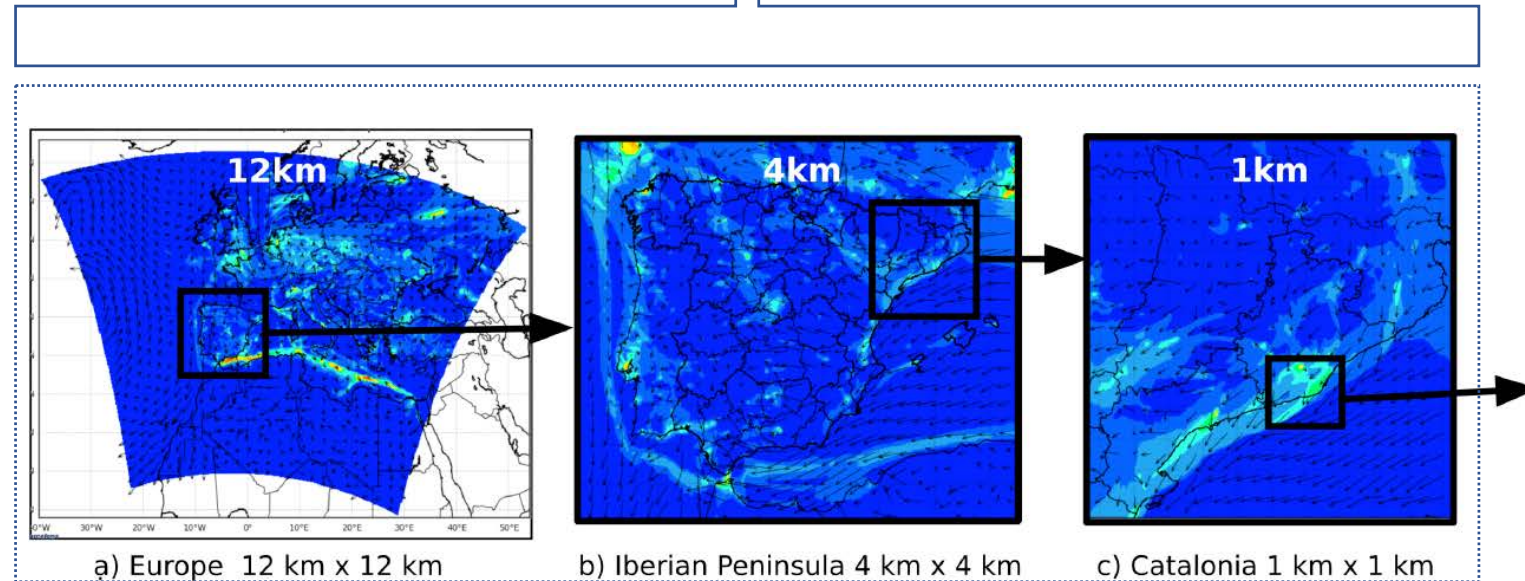


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of NORTH CAROLINA
at CHAPEL HILL

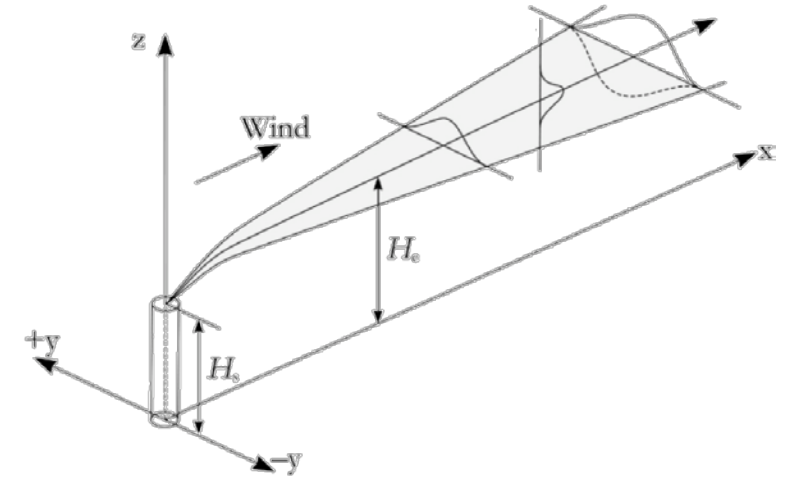
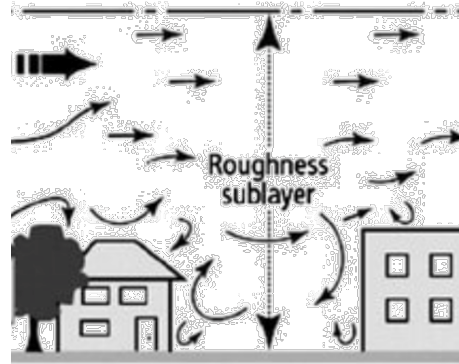
CALIOPE-Urban: street-scale air quality model



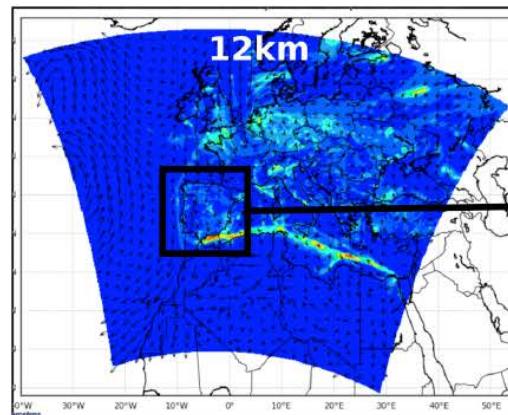
Regional model



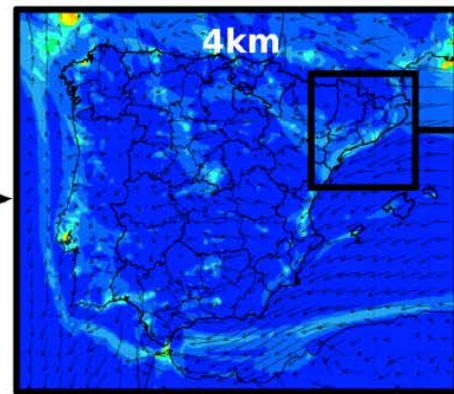
CALIOPE-Urban: street-scale air quality model



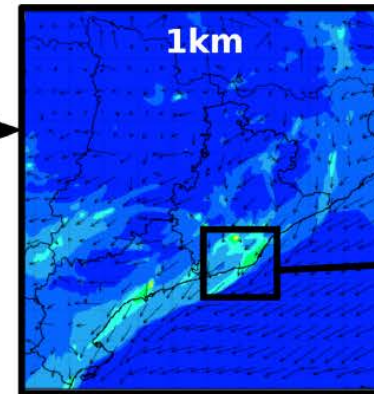
Regional model



a) Europe 12 km x 12 km

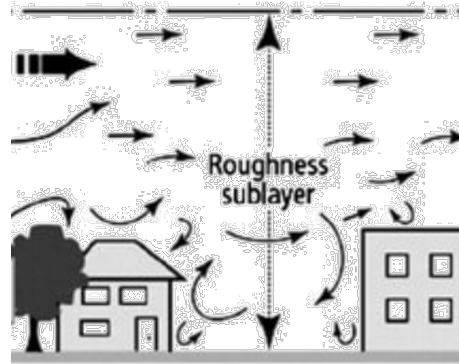


b) Iberian Peninsula 4 km x 4 km

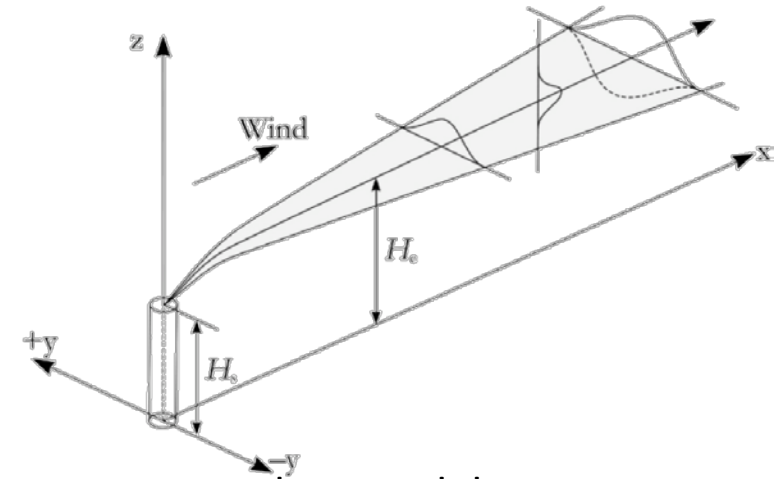


c) Catalonia 1 km x 1 km

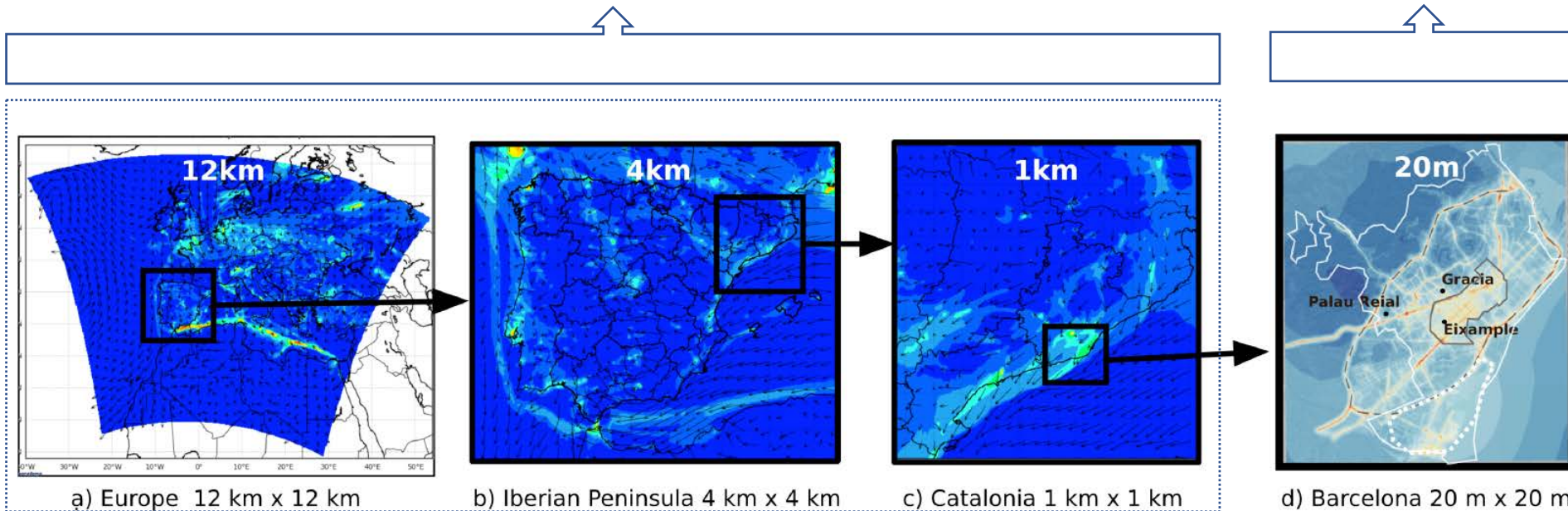
CALIOPE-Urban: street-scale air quality model



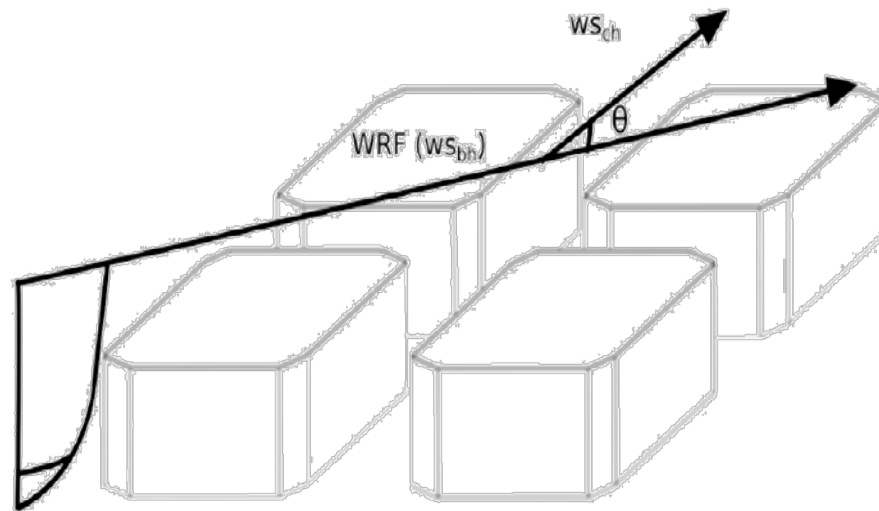
Regional model



Urban model



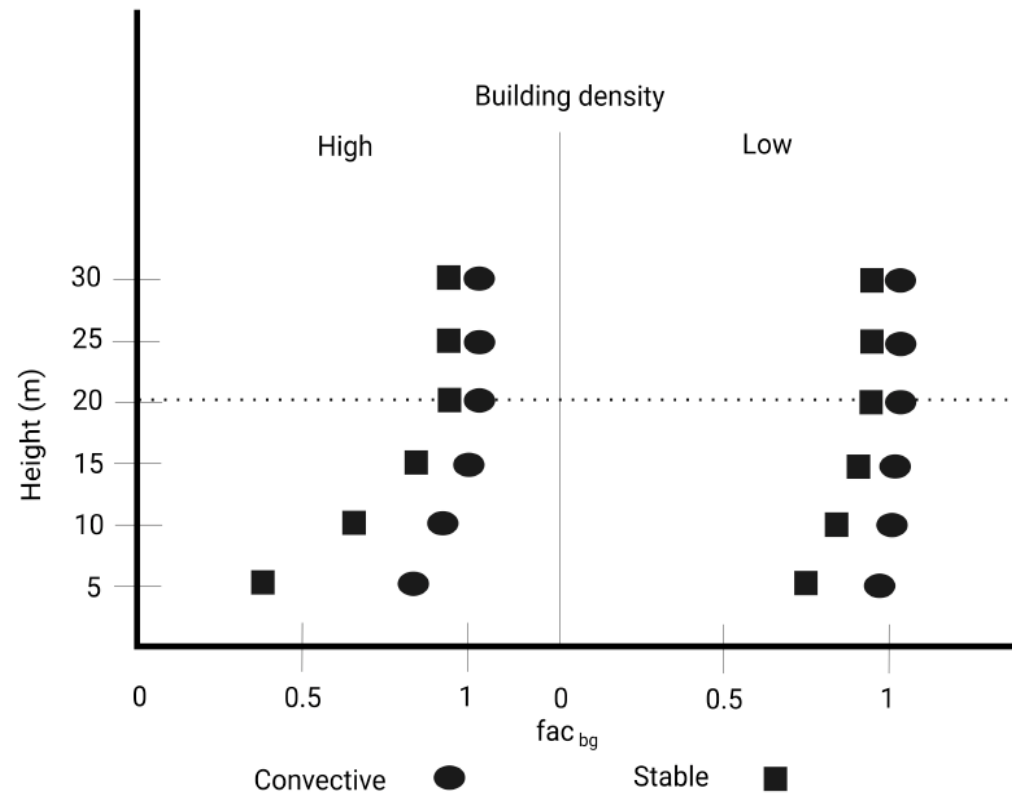
CALIOPE-Urban: street-scale air quality model



Wind channelling estimation

CALIOPE-Urban: street-scale air quality model

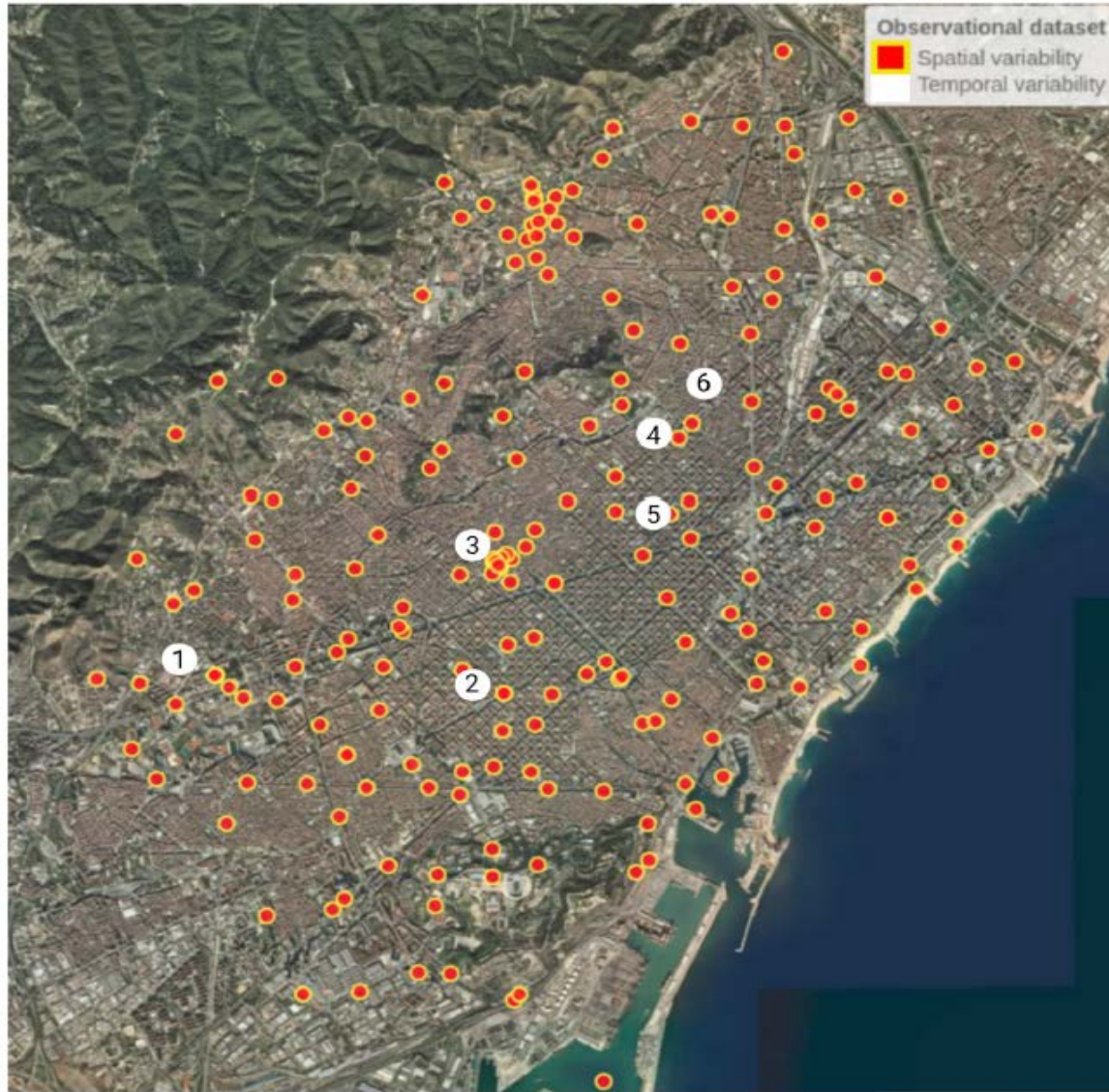
Parametrization of the vertical mixing



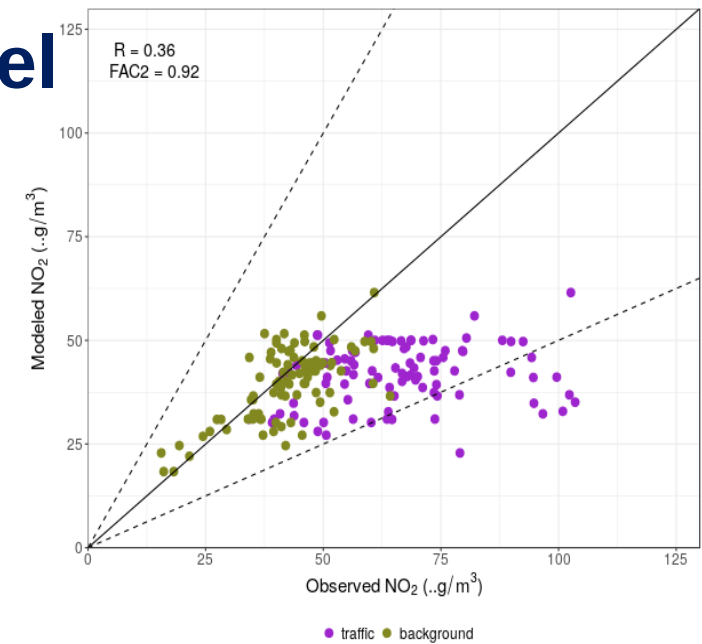
CALIOPE-Urban: street-scale air quality model



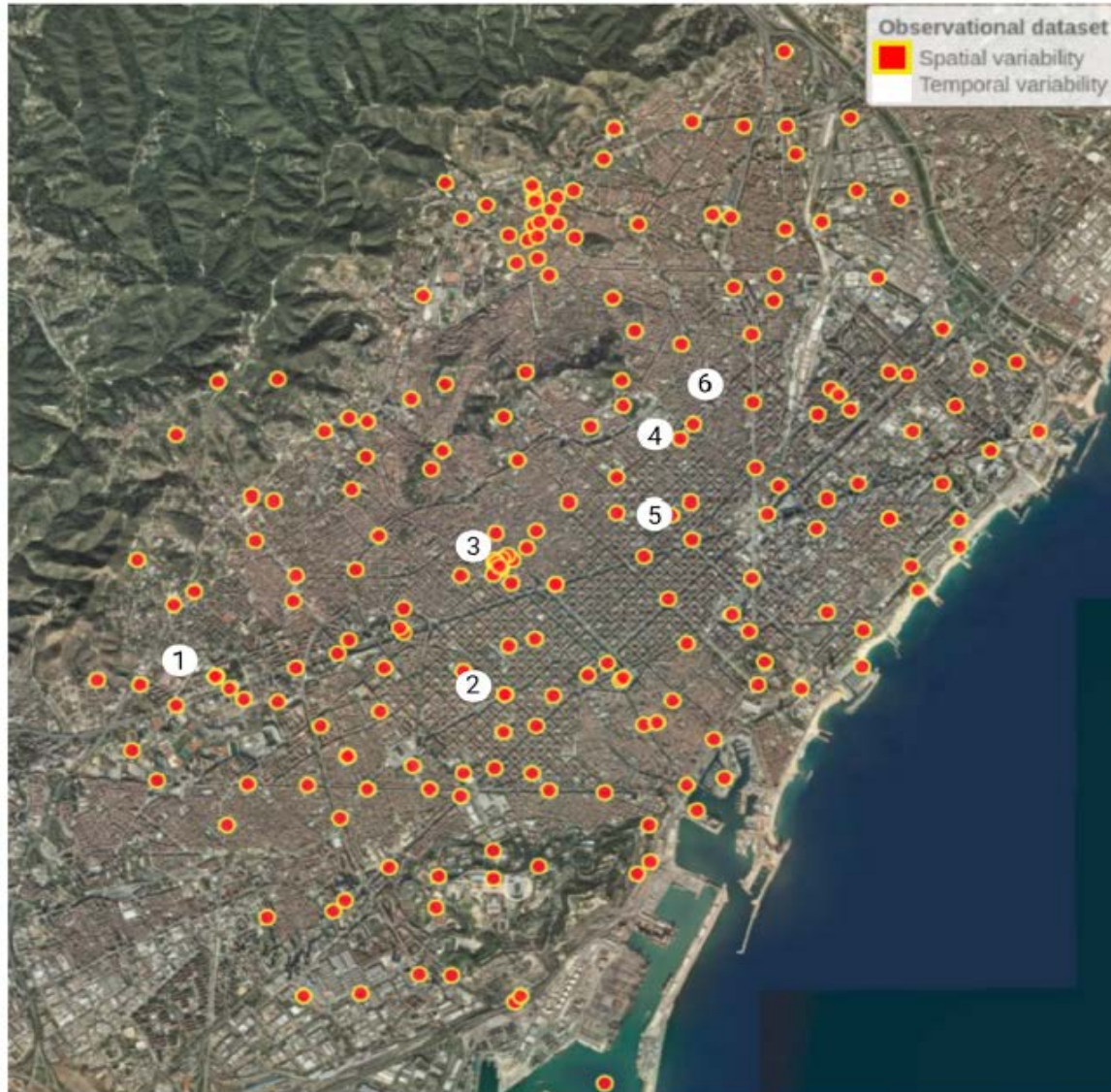
CALIOPE-Urban: street-scale air quality model



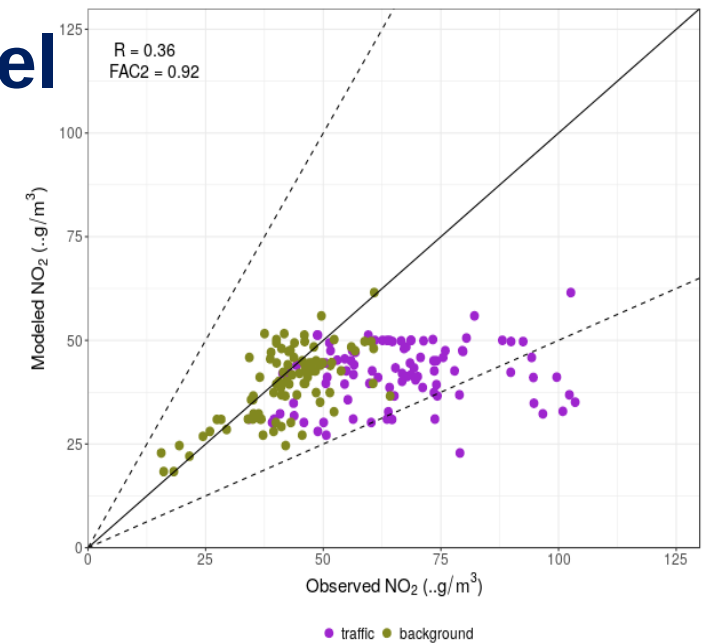
*Regional
Model
CALIOPE
1km x 1km*



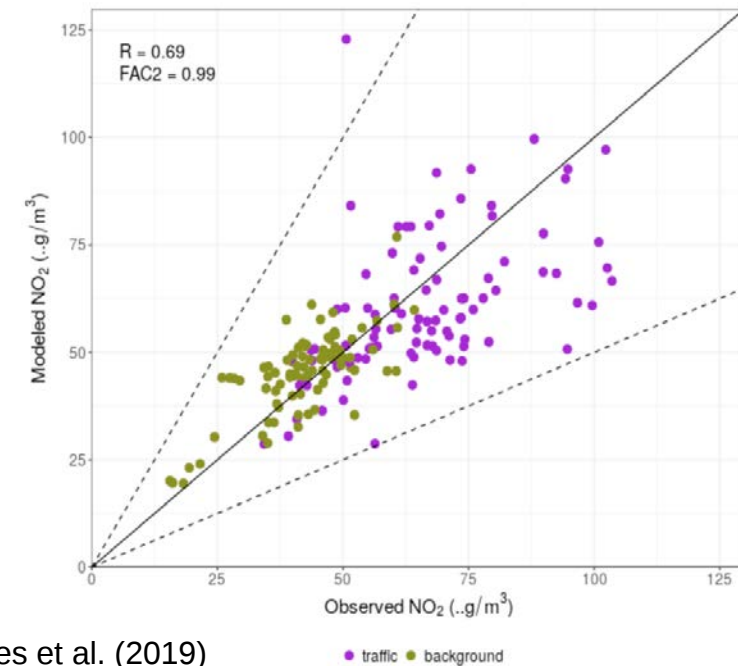
CALIOPE-Urban: street-scale air quality model



*Regional
Model
CALIOPE
1km x 1km*



*Urban Model
CALIOPE-
Urban 20m x
20m*



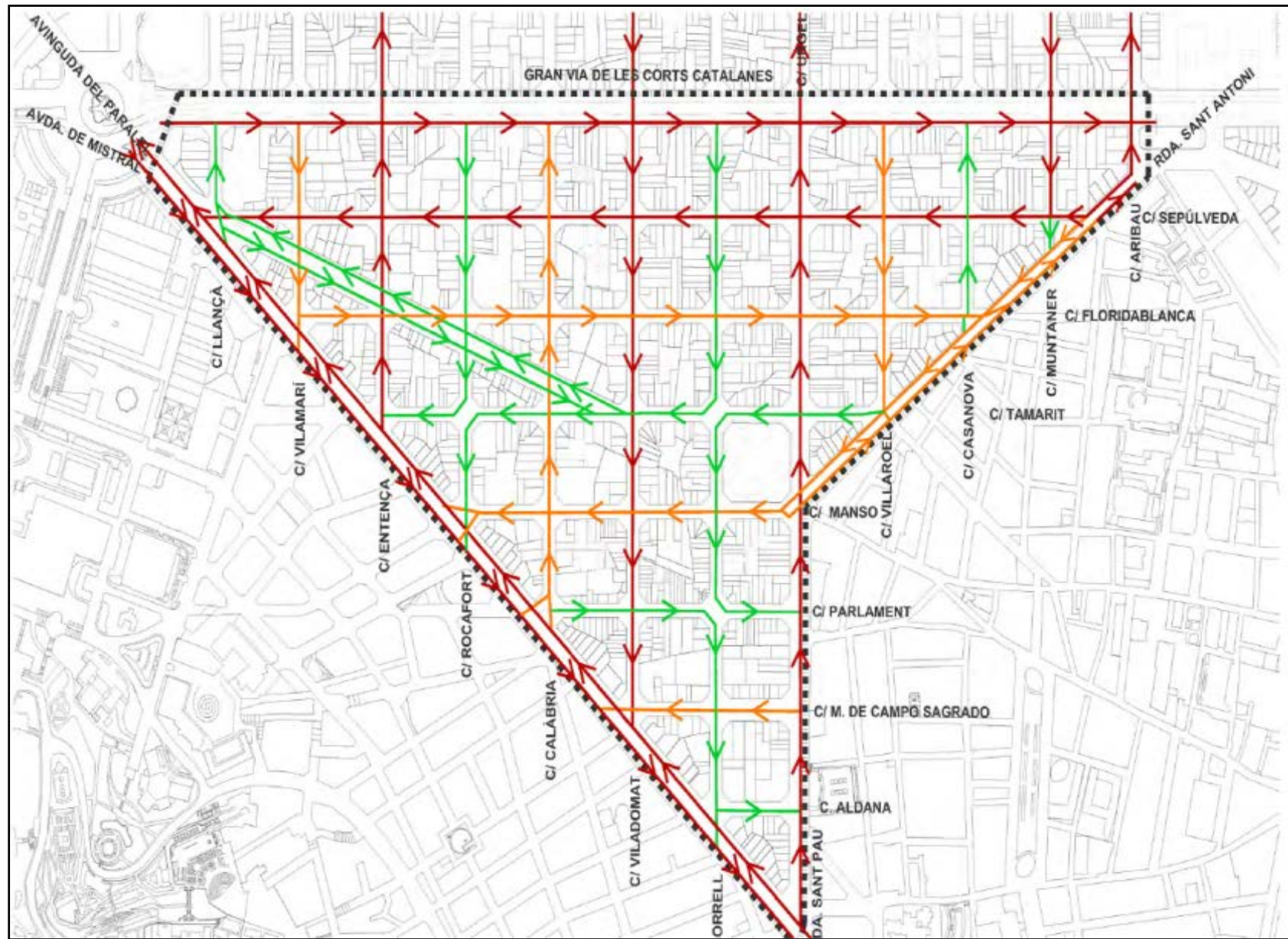
1. Urban planning
2. Diagnosis
3. Forecast



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Urban planning



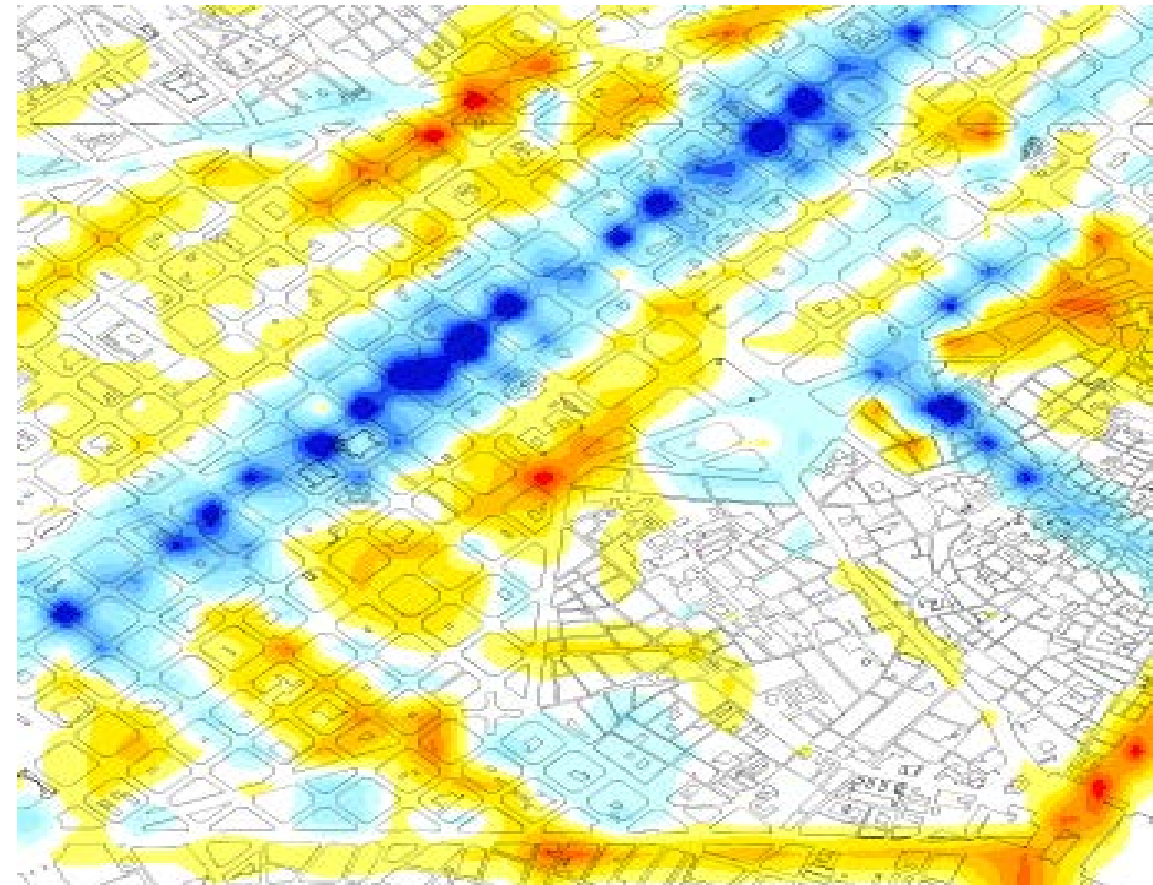
Urban
planning



Traffic model



Emission model



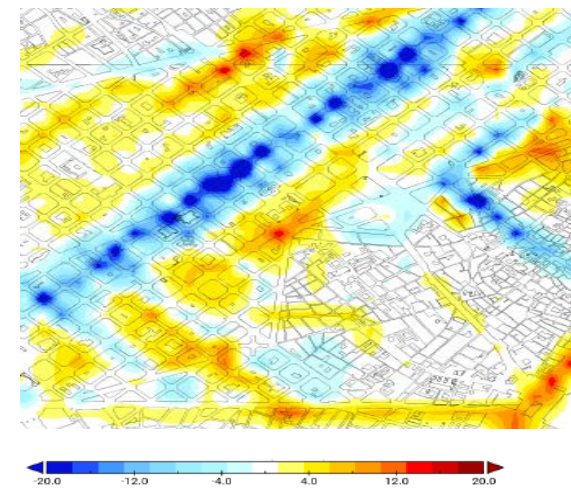
Urban
planning



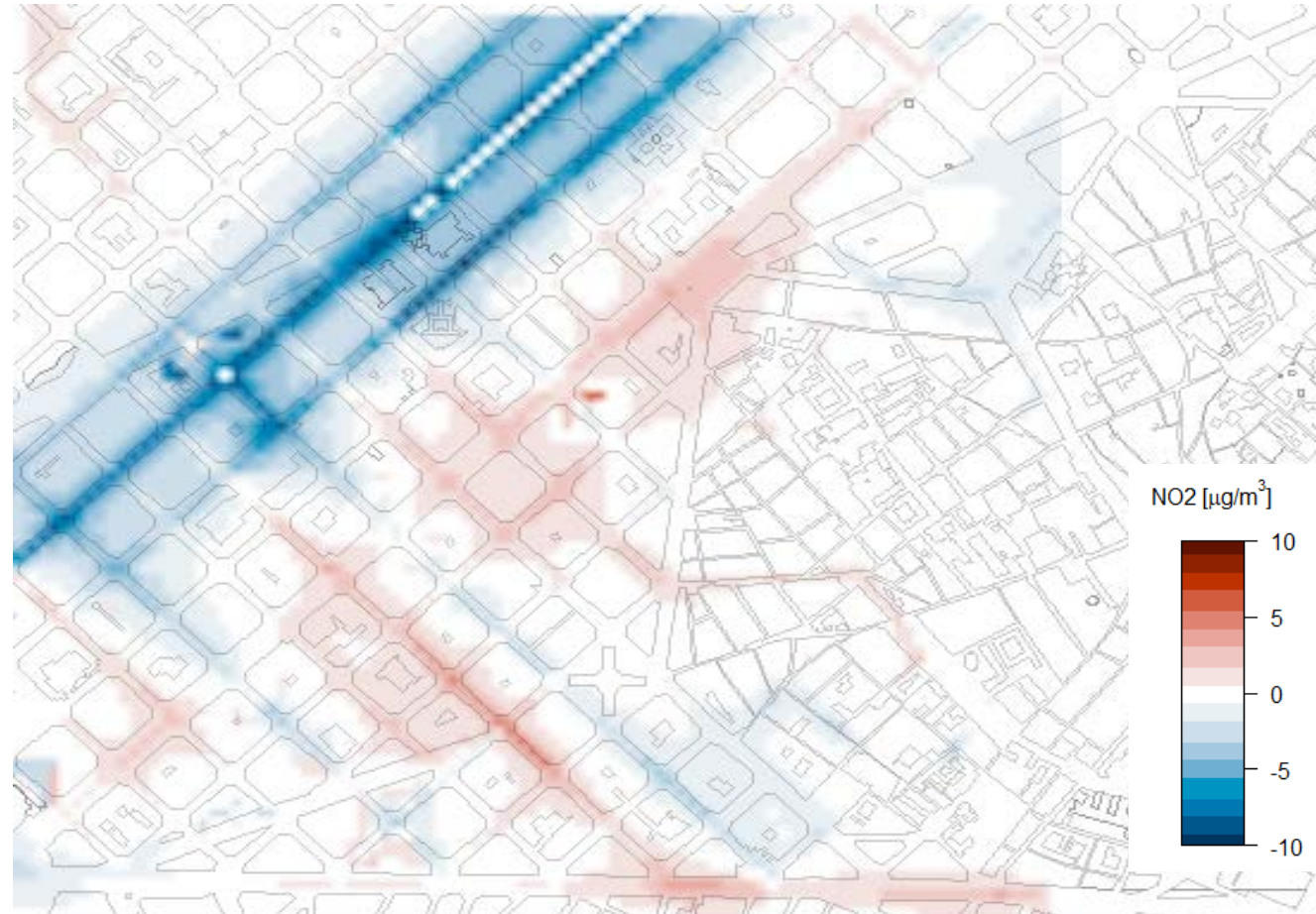
Traffic model



Emission
model



Air quality
model



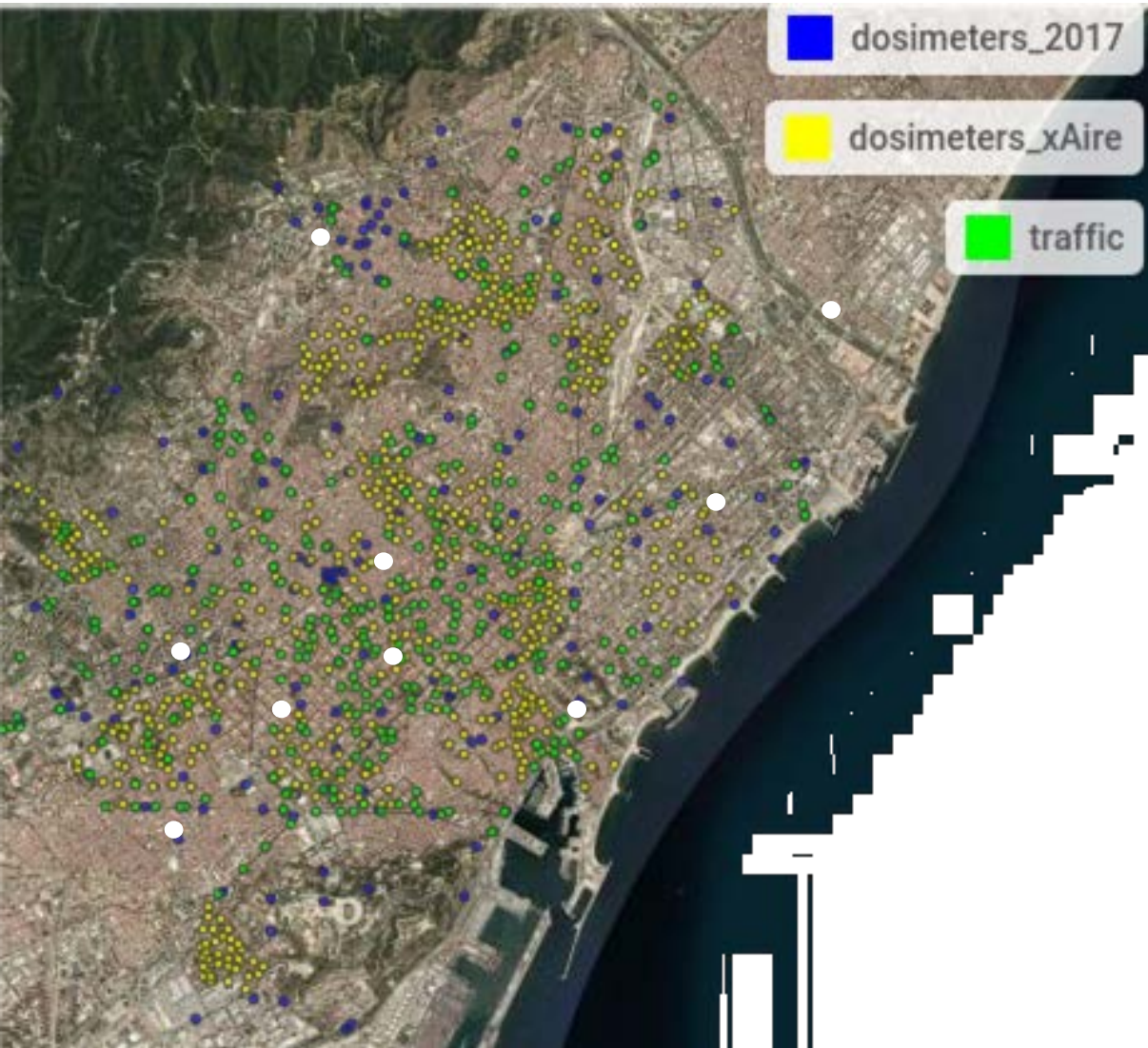
1. Urban planning
- 2. Diagnosis**
3. Forecast



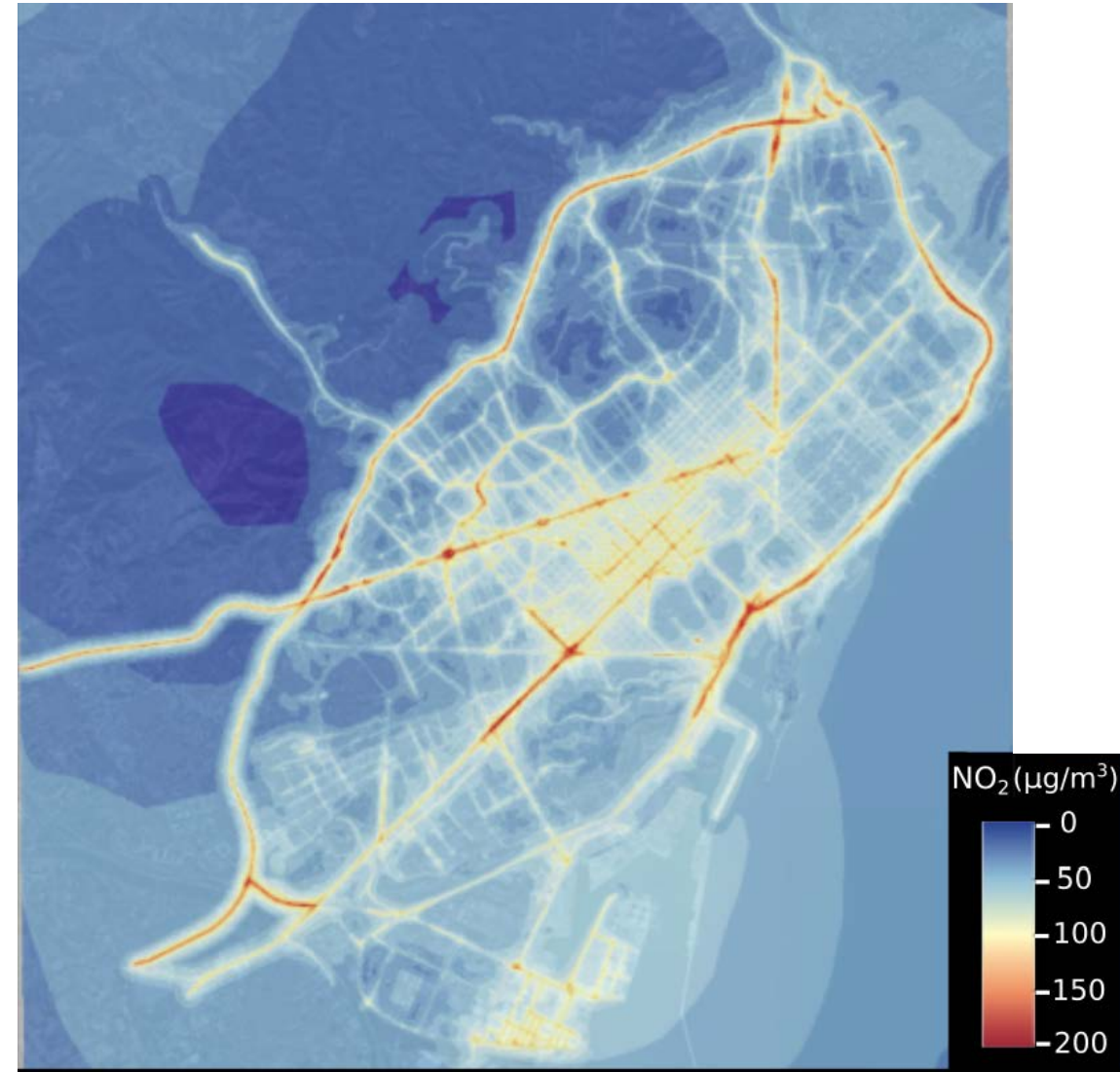
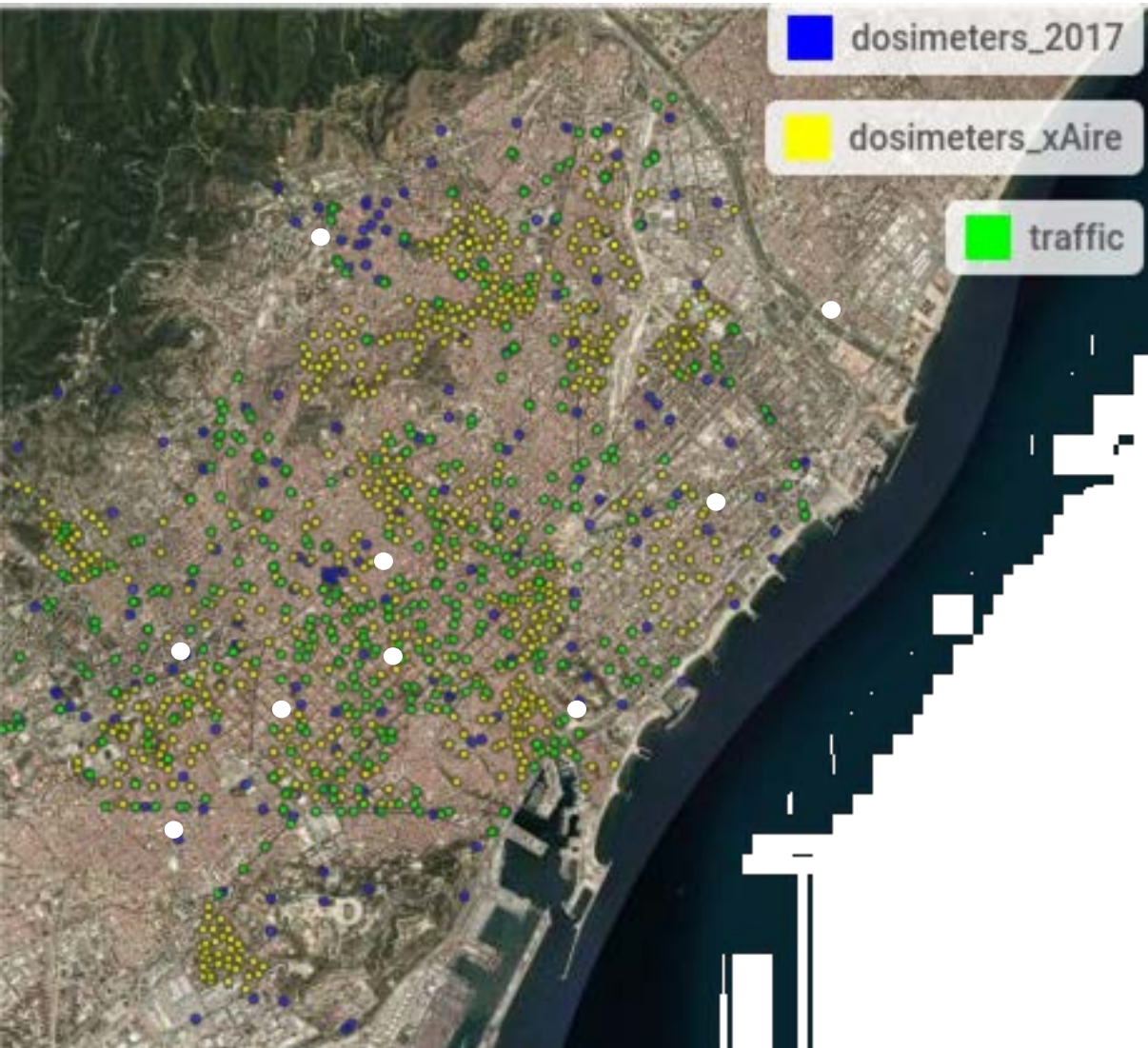
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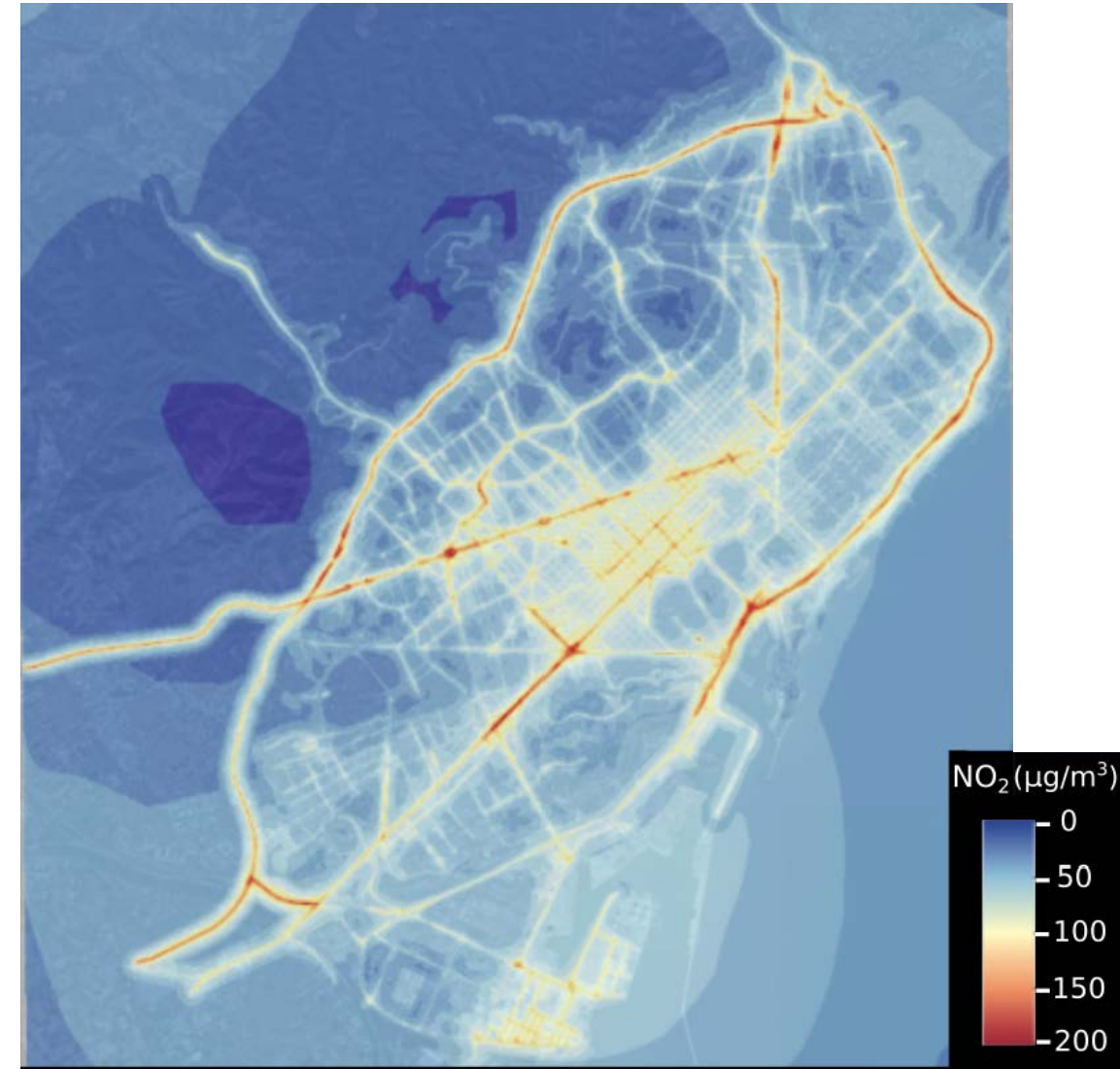
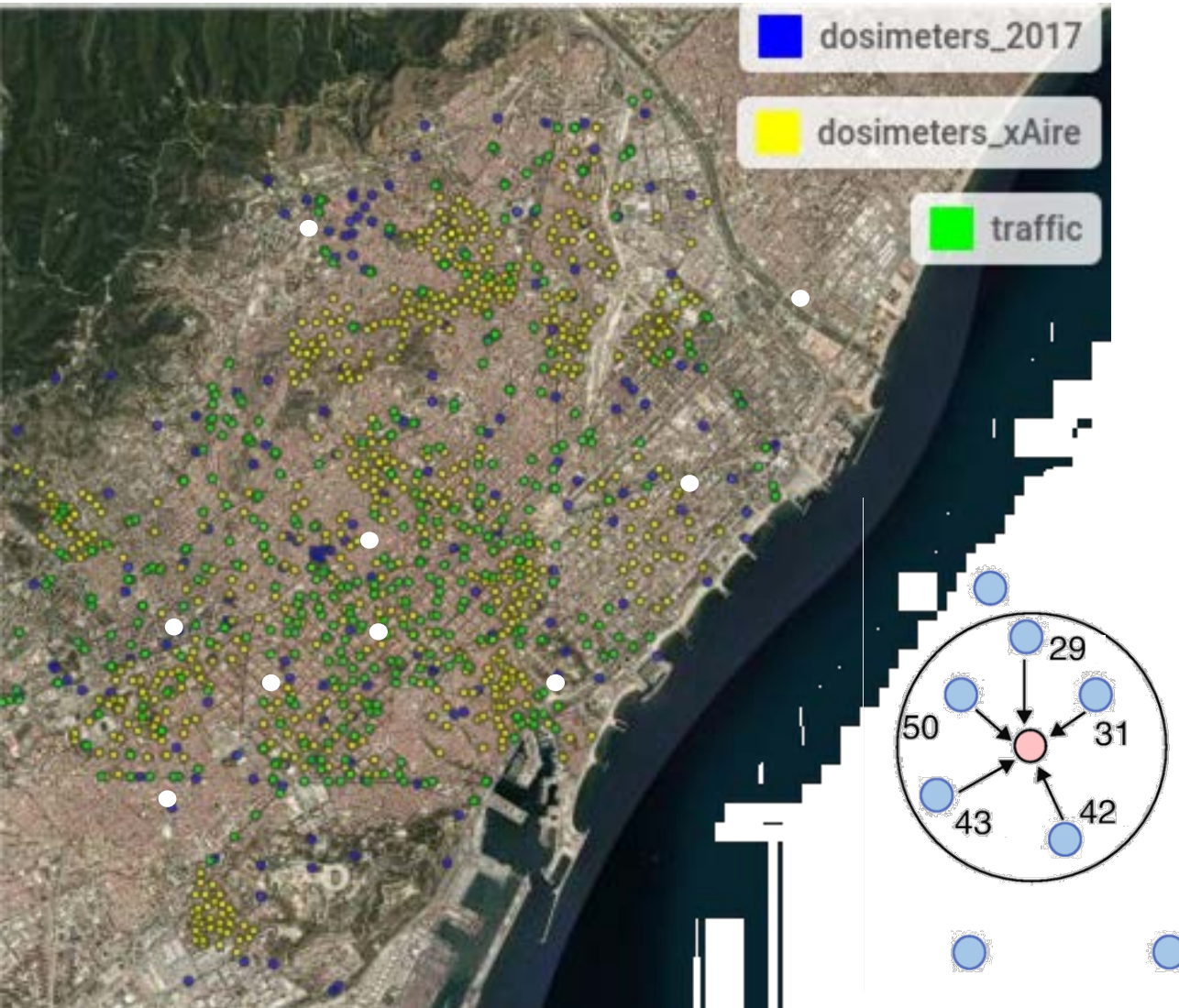
Observations are the cornerstone of robust simulations



Observations are the cornerstone of robust simulations



Observations are the cornerstone of robust simulations



1. Urban planning
2. Diagnosis
3. **Forecast**



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Observations are the cornerstone of robust simulations

Barcelona 2019

