



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

Monthly NO_x emission estimates from space

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Important satellites with which KNMI works:

OMI
2004
NASA/KNMI
Measures ozone and air pollution

MetOp
2006
ESA/EUMETSAT
Ozone, wind and air pollution

TROPOMI
2017
ESA/KNMI
Air pollution, ozone and climate change

Aeolus
2018
ESA/KNMI
Wind profiles

EarthCARE 2019
ESA/JAXA/KNMI
Clouds, aerosols and climate change

Earth Science from Space

KNMI plays an important role in developing earth observation satellites and in processing and interpreting their data. Forecasts for weather and climate, air pollution and solar radiation are largely made with data from these satellites.

Formulating requirements



Planning



Design



Calibration



Launch



Data processing



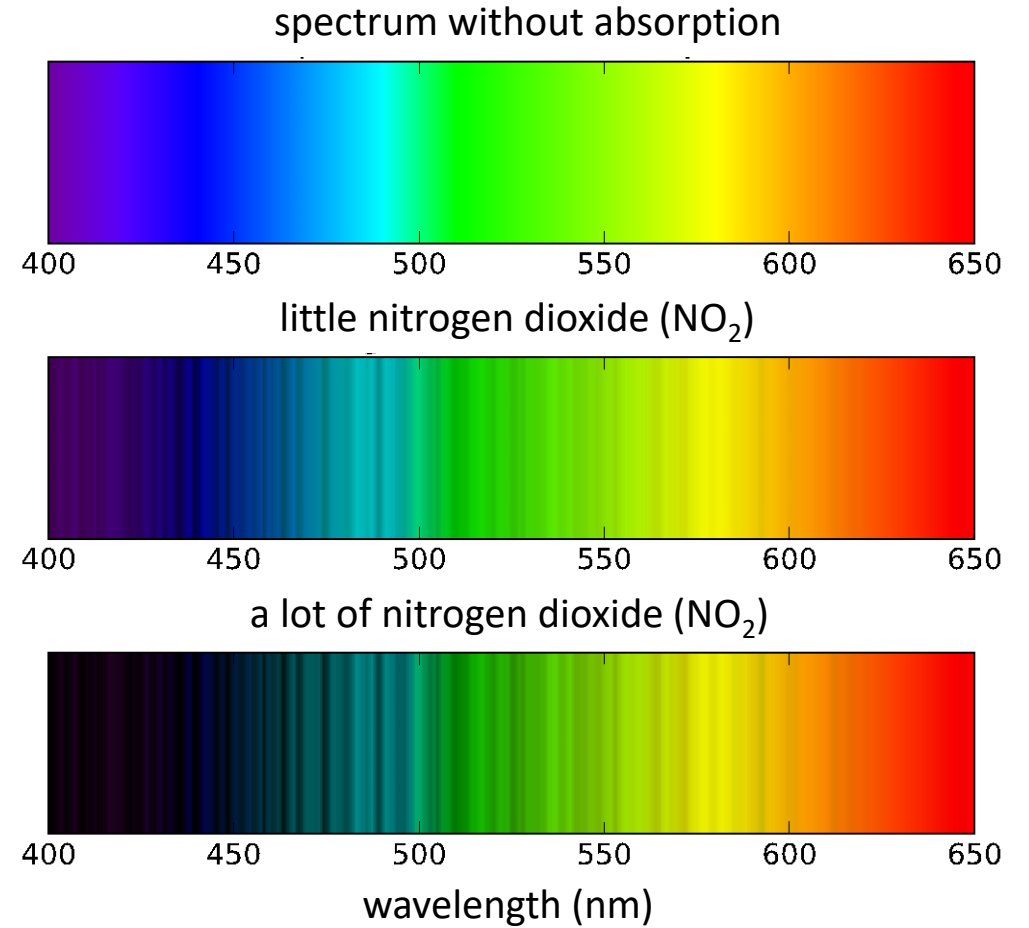
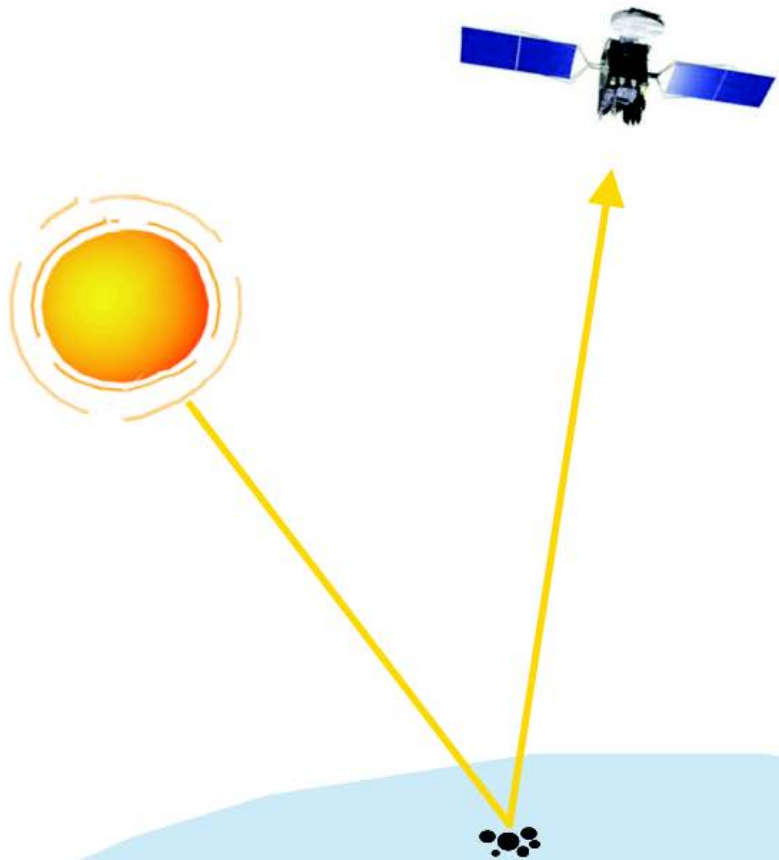
Data interpretation



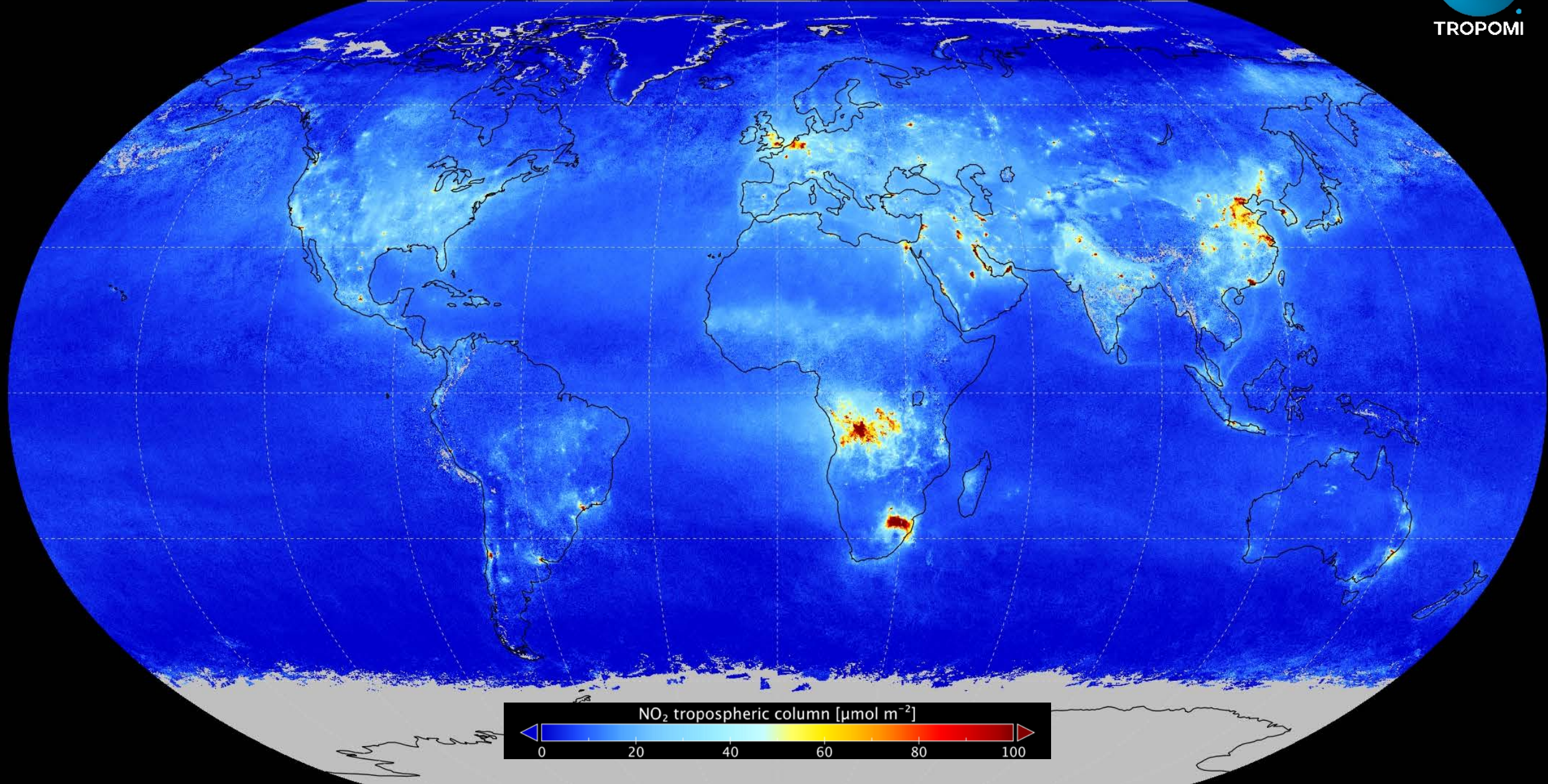
To customers

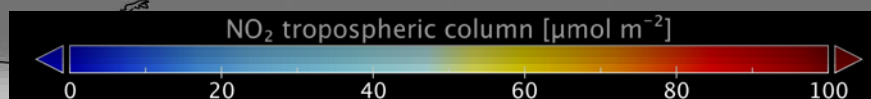
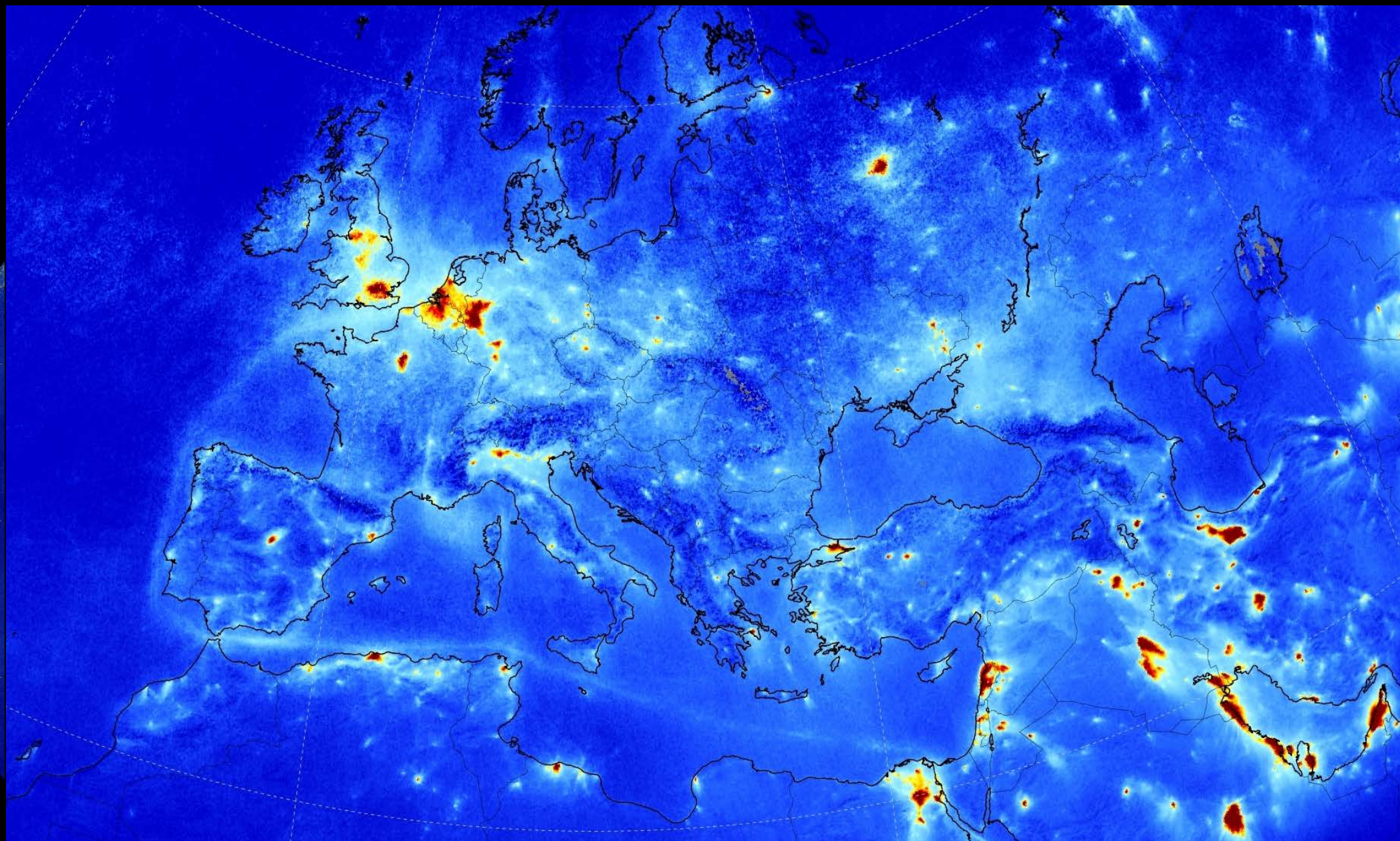
Universities	Aviation
	Government
Meteorologists	Citizens

Measuring trace gases from space

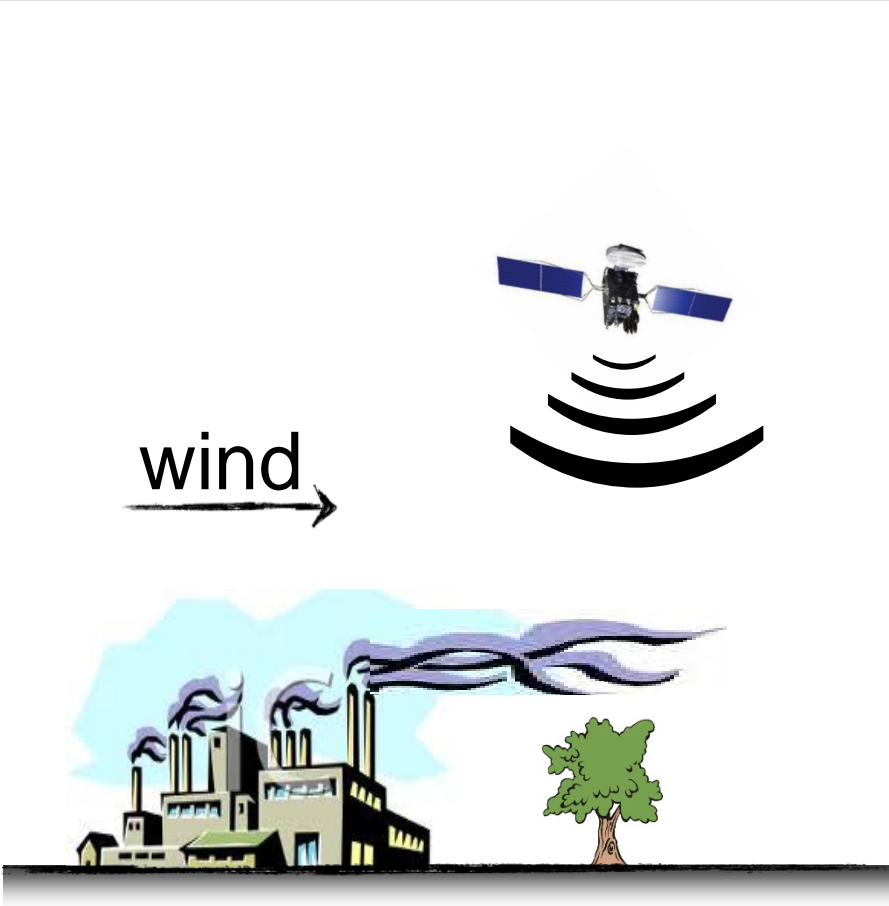


Global NO₂ tropospheric column, July 2018





Emission estimation with the DECSO* algorithm



Calculation of the plume back to its source

Fast updates of regional emission inventories
at relatively high resolution ($\sim 10 \times 10 \text{ km}^2$)

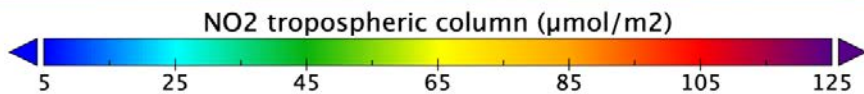
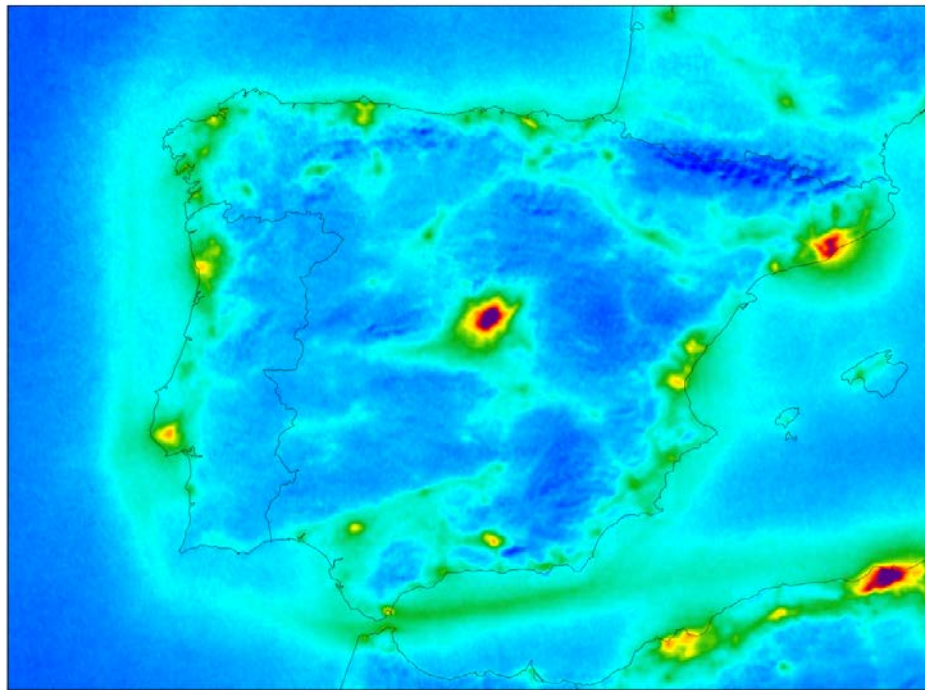
**Algorithm can detect new hotspots /
relocating existing hotspots**

* Daily Emission estimates Constrained by Satellite Observations

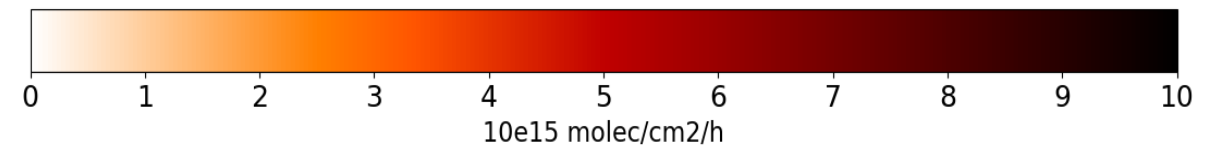
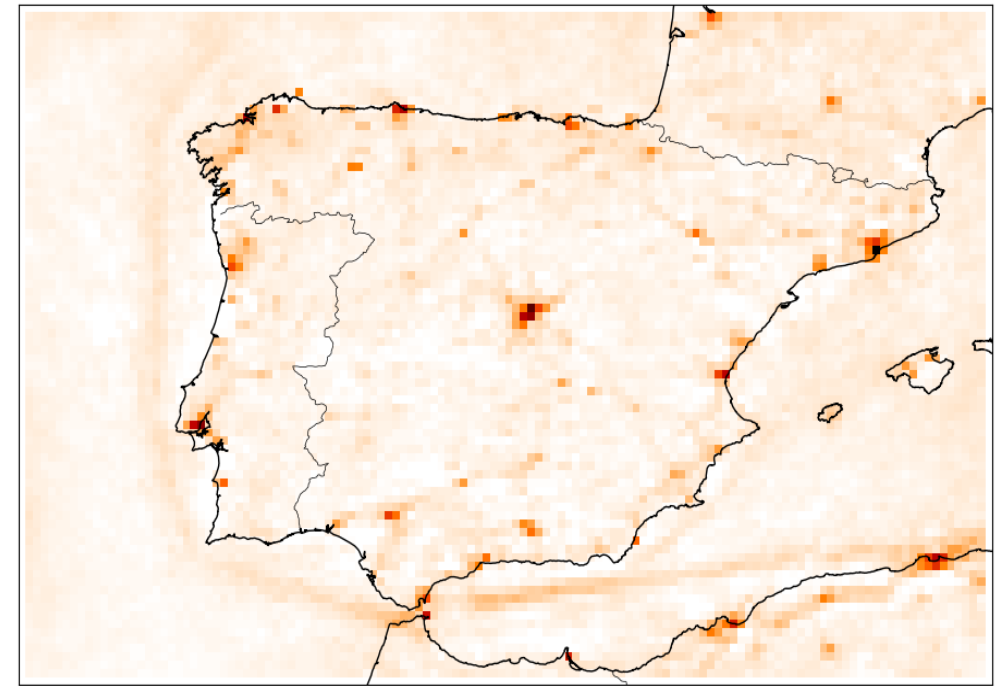


NO_x emission estimates from TROPOMI

Sentinel-5P NO₂, April 2018 – March 2019



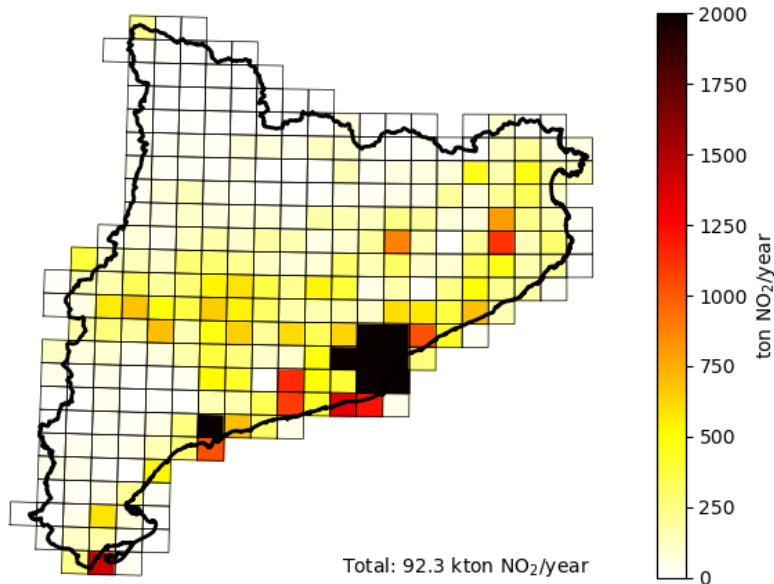
Emissions September 2018 (old algorithm)



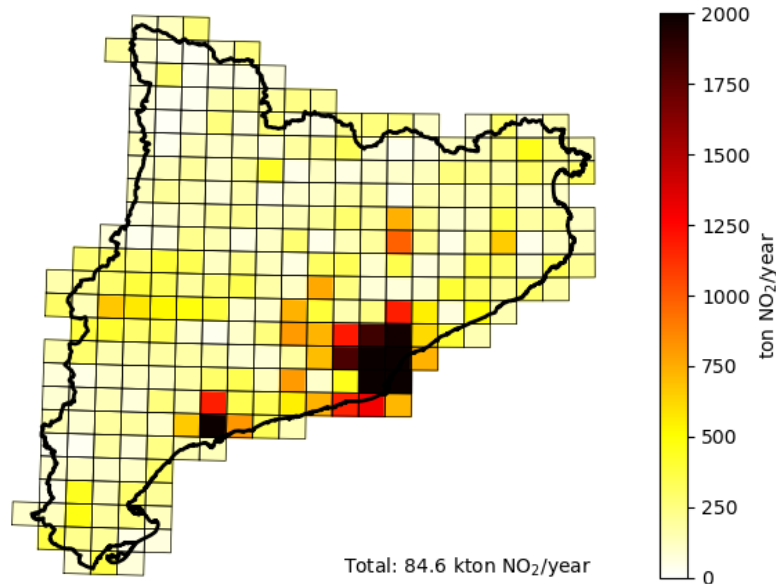


Total NO_x emissions Catalonia, 2019

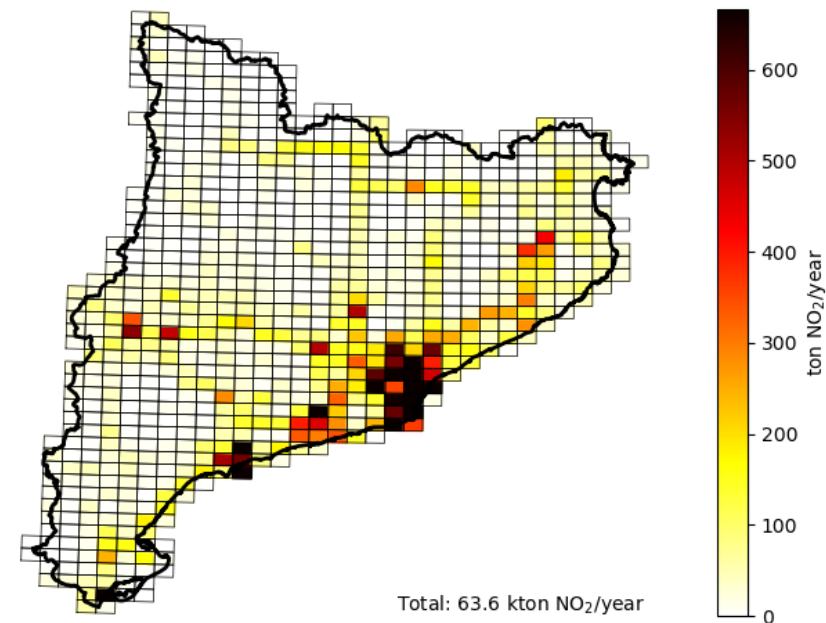
NO_x Emissions Catalunya 2019 (HERMES v3)



NO_x Emissions Catalunya 2019 (DECSO v5.3)

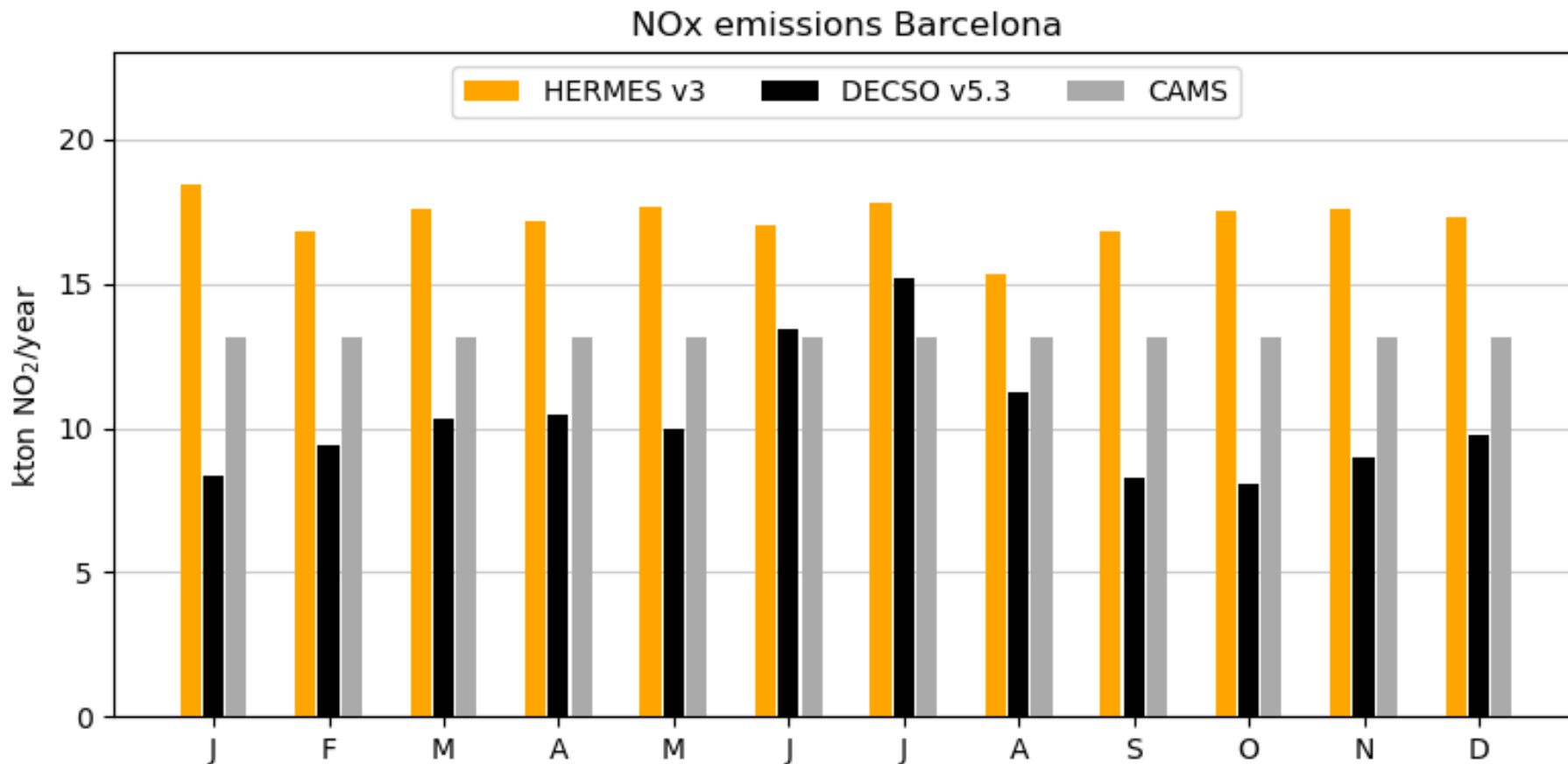


NO_x Emissions Catalunya 2017 (CAMS)

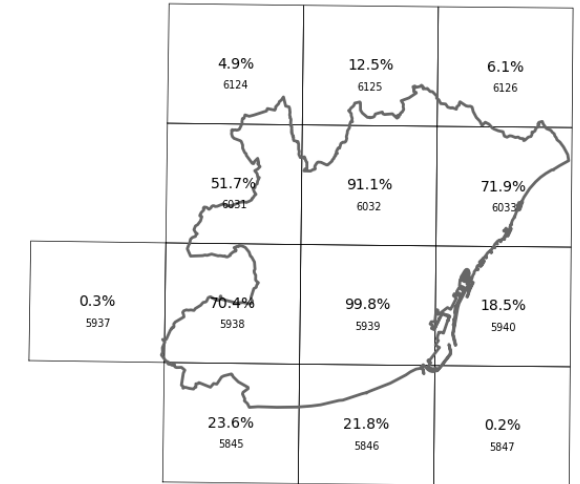




Monthly NO_x emissions Barcelona



Barcelona and DECSO grid



Total emissions

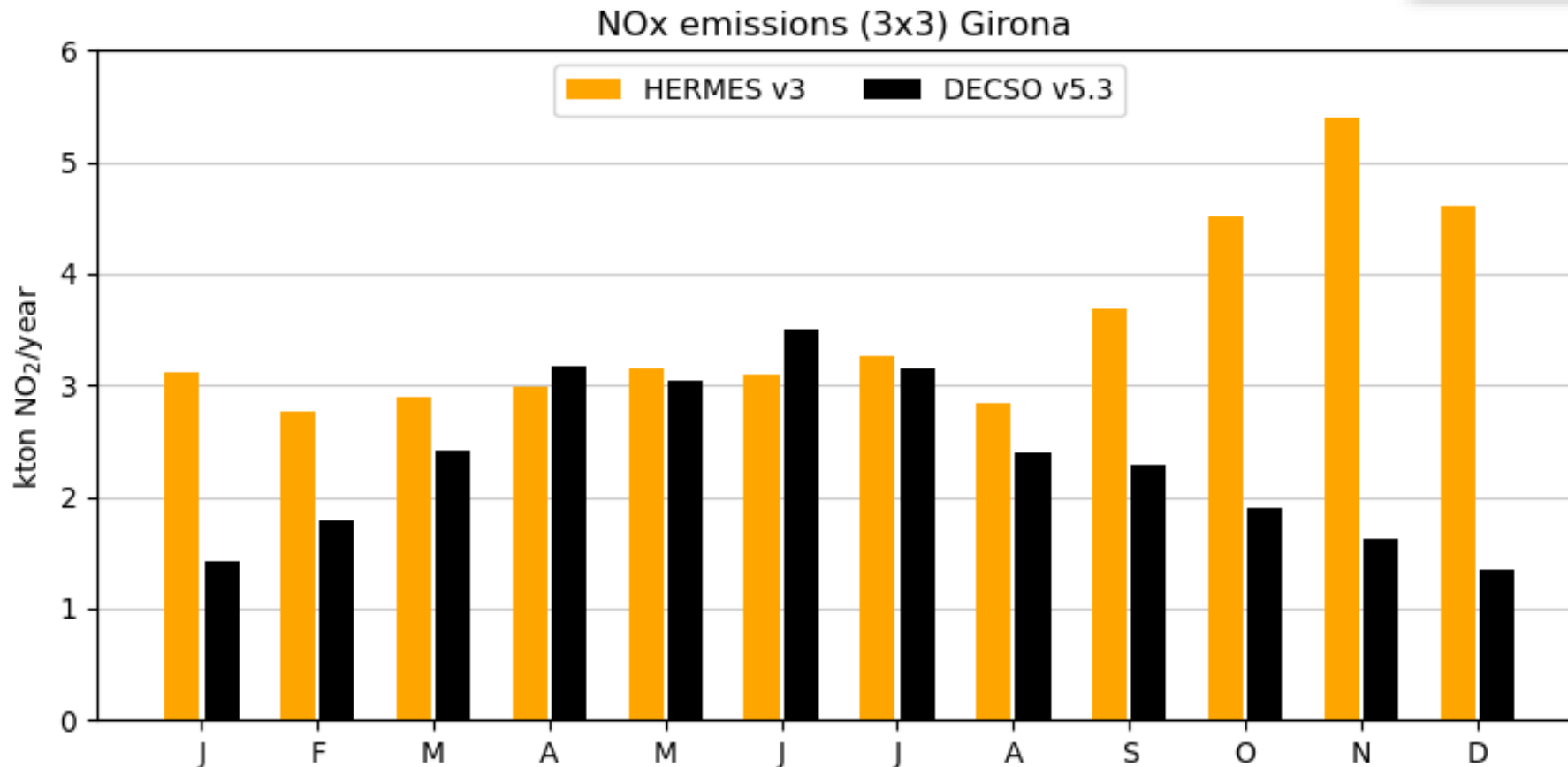
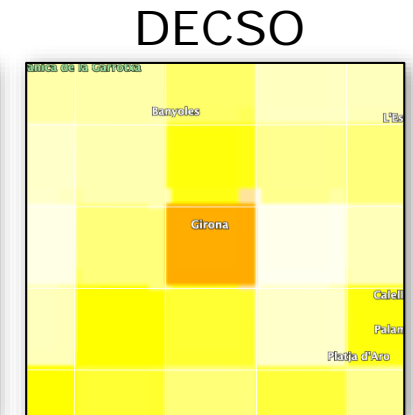
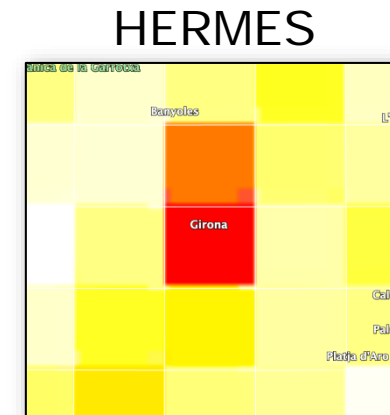
HERMES v3 (2019): 17.3 kton NO₂

DECSO v5.3 (2019): 10.3 kton NO₂

CAMS (2017): 13.2 kton NO₂



Monthly emissions Girona



Total emissions (3x3)

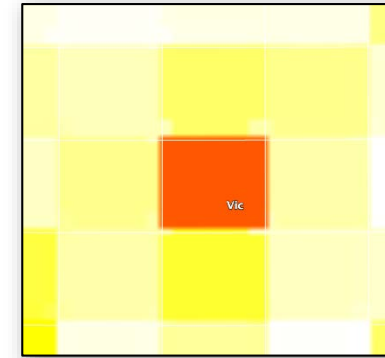
HERMES v3 (2019): 3.5 kton NO₂

DECSO v5.3 (2019): 2.3 kton NO₂

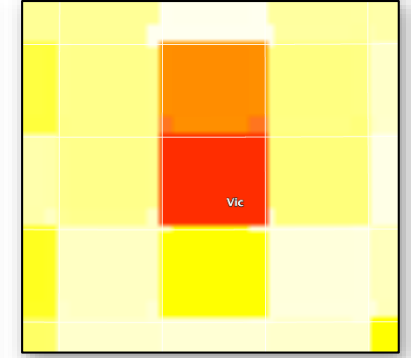


Monthly emissions Vic

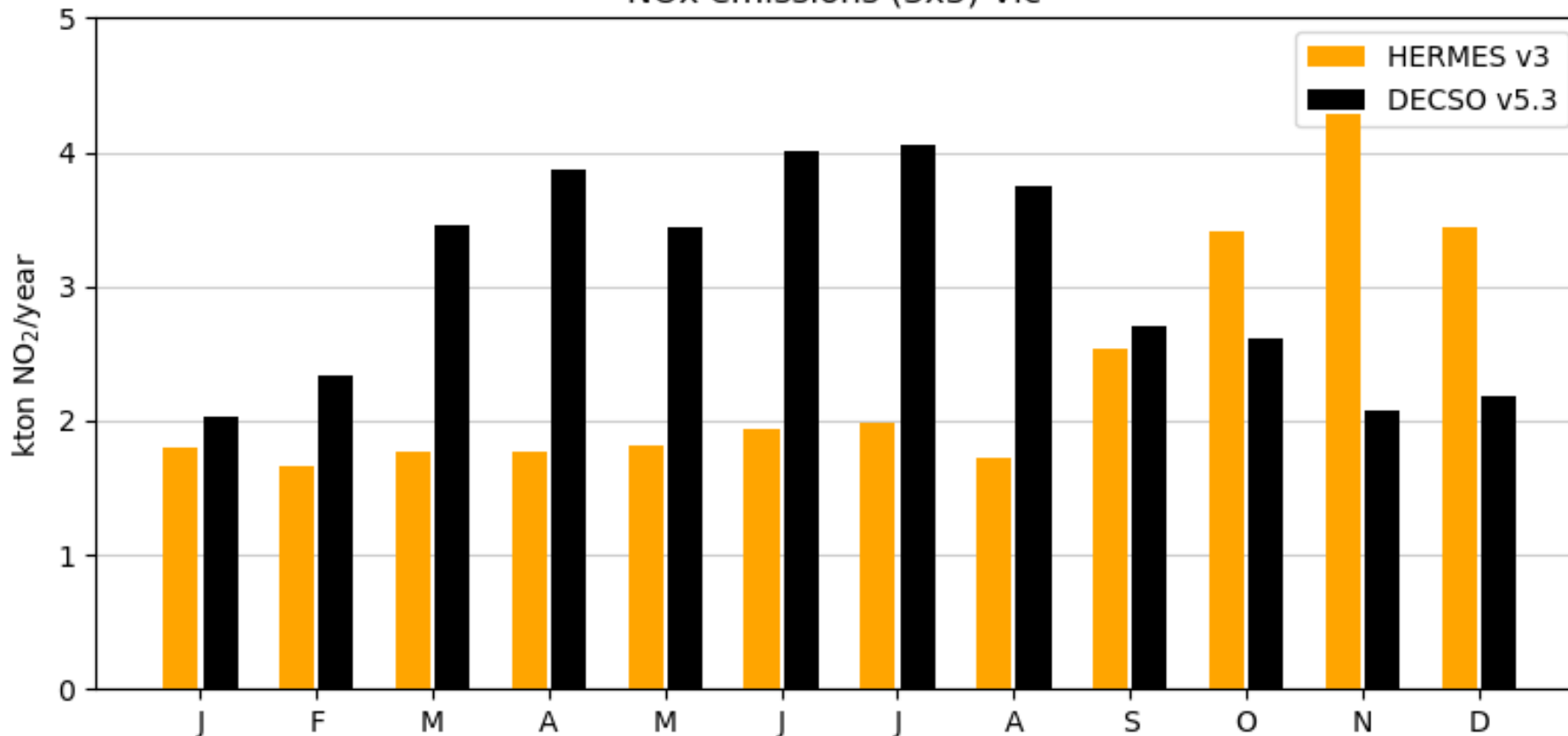
HERMES



DECSO



NOx emissions (3x3) Vic



Total emissions (1x1)

HERMES v3 (2019): 0.88 kton NO₂

DECSO v5.3 (2019): 0.98 kton NO₂

Total emissions (3x3)

HERMES v3 (2019): 2.3 kton NO₂

DECSO v5.3 (2019): 3.1 kton NO₂



Conclusions

- › NO_x emission estimates from space with DECSO algorithm
- › Comparison over Catalonia with HERMES (2019) and CAMS (2017)
- + + Good agreement of spatial locations and absolute regional emissions;
- + At city level we see significant differences between HERMES and CAMS. DECSO is somewhere in the middle;
- Seasonal variability of DECSO needs improvement (probably lifetime issue).