

# RESPIRE AIR

## A SPATIAL COMPARATIVE ANALYSIS BETWEEN THREE GRIDDED ATMOSPHERIC EMISSION INVENTORIES FOR SPAIN

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### INTRODUCTION

We present the new downscaling module of the High-Elective Resolution Modelling Emission System version Delta (HERMES\_Δ), which performs a spatial mapping of the Spanish official emission inventory.

We compare the HERMES\_Δ results against two state-of-the-art gridded inventories: EMEP and CAMS-REG.

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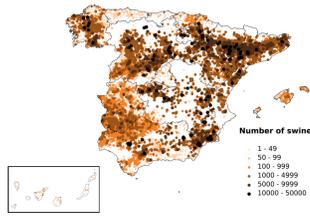
### METHODOLOGY

The spatial distribution of the national emissions is determined using around **140 spatial proxies** and activity data developed and collected at a fine spatial scale.

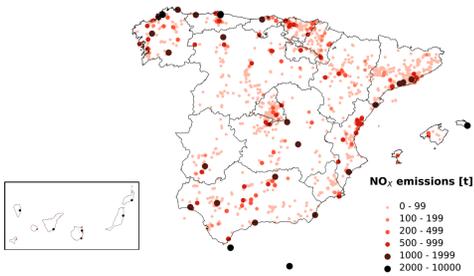
Annual Average Daily Traffic (AADT) data for interurban-rural roads



Number of swine per farm



NO<sub>x</sub> emissions per PRTR-Spain and LPS point source

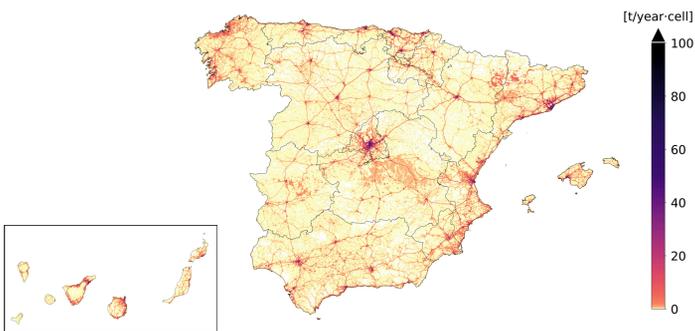


Emission source	Main proxies used
Energy industries	- PRTR-Spain and LPS - CORINE land cover 2018 (industrial or commercial units) - Our own point source database (e.g., public power plants)
Non-industrial combustion plants	- Global Human Settlement Layer - Population density map (GHSL-POP) - Global Human Settlement Layer - Degree of urbanisation map (GHSL-SMOD) - Register of Livestock holdings provided by MAPA - Energy consumption per capita for heating purposes, natural gas availability and biomass combustion capacity installed per capita at NUTS3 level - CORINE land cover 2018 (e.g., sport and leisure facilities, agro-forestry areas)
Industrial combustion plants	- PRTR-Spain and LPS - CORINE land cover 2018 (e.g., mineral extraction sites) - Our own point source database (e.g., plaster furnaces, paper mill plants)
Industrial processes without combustion	- PRTR-Spain and LPS - CORINE land cover 2018 (e.g., extraction sites, industrial or commercial units) - Global Human Settlement Layer - Population density map (GHSL-POP) - Our own point source database (e.g., titanium dioxide and calcium industries)
Fugitives	- LPS - Global Human Settlement Layer - Population density map (GHSL-POP) - CORINE land cover 2018 (industrial or commercial units) - Our own polygon, line and point source database (e.g., marine terminals, refineries) - Service stations (MITECO, 2021)
Solvents	- PRTR-Spain and LPS - CORINE land cover 2018 (e.g., construction sites) - Our own point source database (e.g., inks manufacturing plants)
Road transport	- Interurban and rural road network - Population by municipality (MITECO, 2023) - OSM urban road network combined with Mu et al. (2022) road type weight factors
Other mobile sources and machinery	- Spanish transport network (Centro Nacional de Información Geográfica, 2024) - CORINE land cover 2018 (e.g., non-irrigated arable land) - Total agricultural machinery power (MAPA, 2022) and volume of harvested trees (MITECO, 2022) per province - Our own polygon and line source database (e.g., military facilities, airports)
Waste	- PRTR-Spain and LPS - Distribution of residential population (GHSL-POP) - CORINE land cover 2018 (e.g., dump sites, green urban areas) - Our own polygon, line and point source database (e.g., controlled landfills) - Urban Waste Water Treatment Plants (WWTP) database (EEA, 2023b) - Agricultural plots for WWTP sludge application (MITECO, 2020)
Agriculture	- European Union Crop type Map (EUCROPMAP; d'Andrimont et al., 2021) - Register of Livestock holdings provided by MAPA - CORINE land cover 2018 (e.g., vineyards, olive groves, pastures)

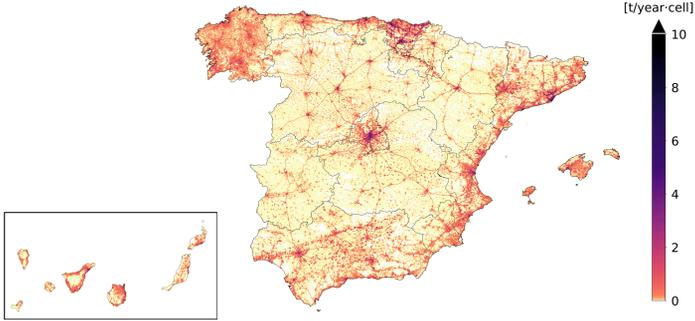
### RESULTS AND DISCUSSION

#### HERMES\_Δ emissions

Total NO<sub>x</sub> gridded emissions for 2021 (0.01 x 0.01 deg)\*



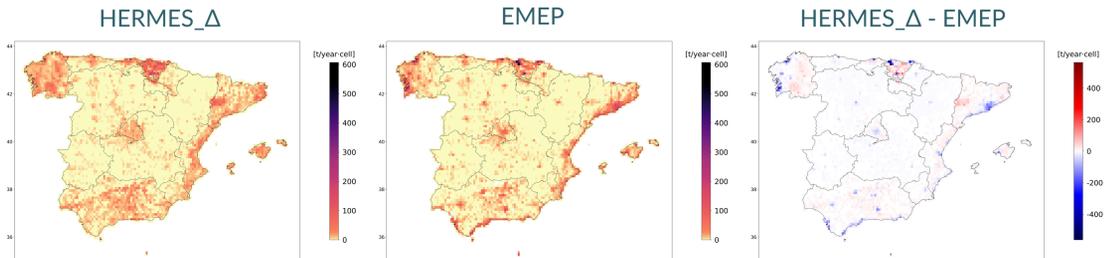
Total PM<sub>2.5</sub> gridded emissions for 2021 (0.01 x 0.01 deg)\*



\* Except for agriculture emissions

#### Comparison to other inventories

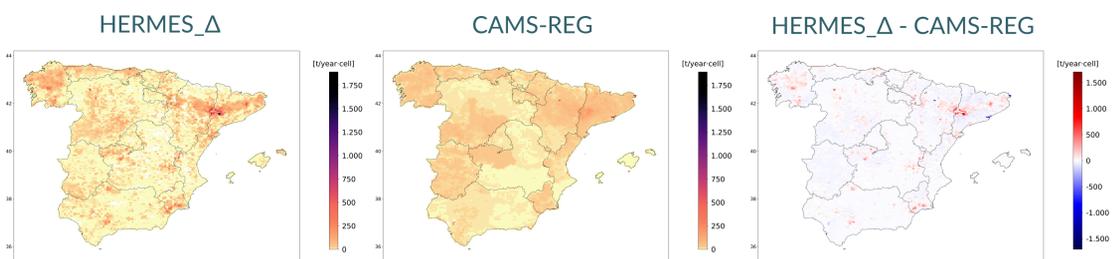
Non-industrial combustion plants PM<sub>2.5</sub> emissions



Road transport NO<sub>x</sub> emissions



Livestock NH<sub>3</sub> emissions



### CONCLUSIONS

- This work presents the downscaling module of the HERMES\_Δ system, developed to process anthropogenic emission inventories for Spain. This system will provide for the first time high-resolution gridded official emissions for the Peninsular Spain and the Canary Islands, and will be integrated into the national air quality forecasting system operated by AEMET.
- Comparison with the EMEP and CAMS-REG gridded emissions reveals significant discrepancies, highlighting the potential benefits of employing highly localised data to develop spatial proxies.
- Future work will focus on assessing the impact of these detailed spatial proxies on the air quality modelling results obtained using the AEMET's air quality system.

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