USE OF NATIONAL EMISSION INVENTORIES FOR AIR QUALITY MODELLING AND DEVELOPMENT OF EMISSION REDUCTION PLANS

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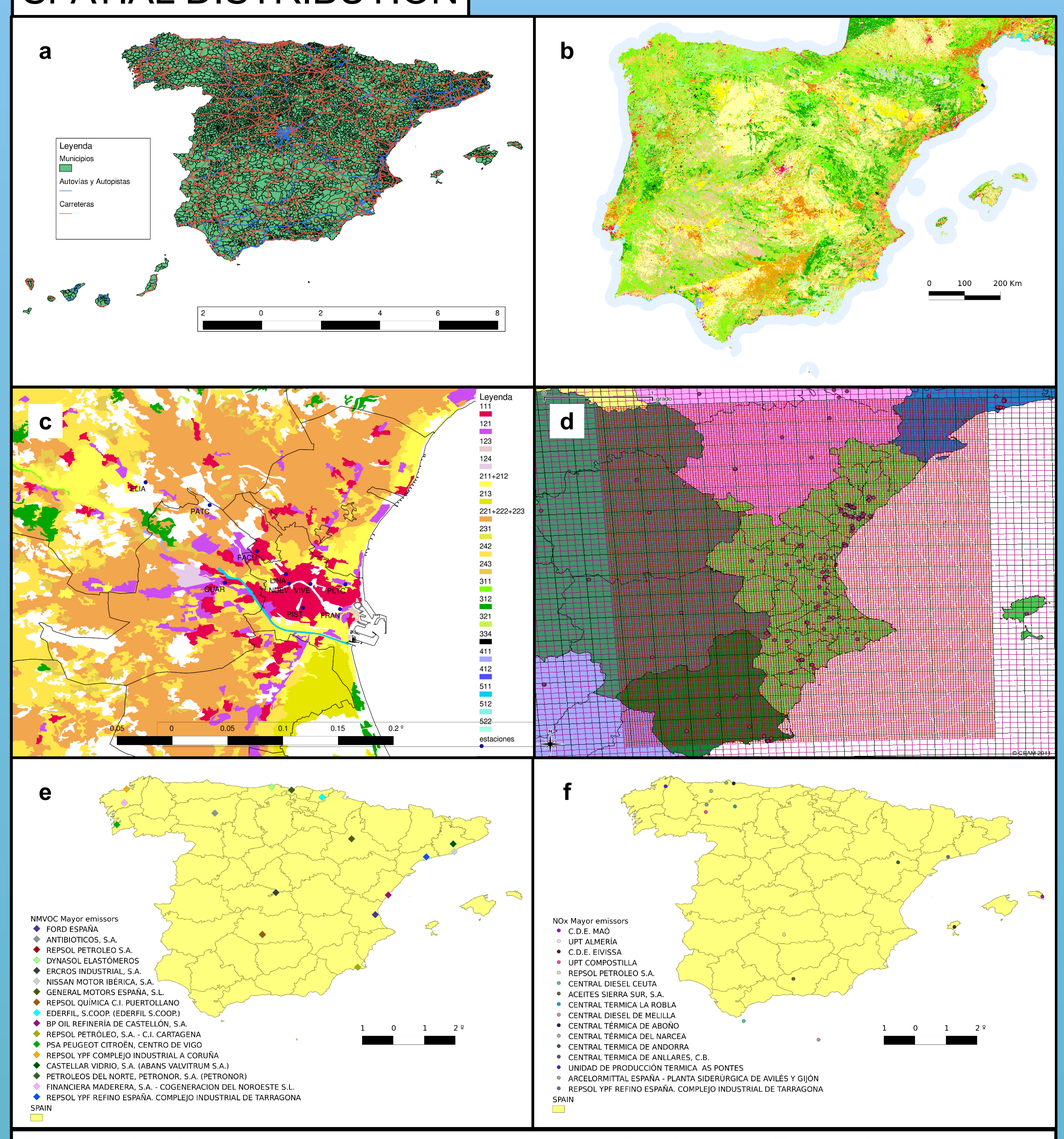
Air quality is considered a basic requirement for human health and comfort. However, air pollution still poses a severe threat to human health around the world. European directive 2008/50/CE defines objectives to ensure clean air, urging responsible authorities to establish policies and procedures to maintain or improve air quality.
Air quality models are fundamental tools in modern air quality management, especially for secondary pollutants, because they allow us to link the atmospheric emissions with pollutant concentrations. Air quality models require high-resolution emission input data, both spatially and temporally. Emissions are a critical part of air quality modelling because they represent the raw material for physical and chemical processes. Nevertheless, most of the uncertainty managed in the development of air quality plans comes form the estimation of anthropogenic and biogenic emissions.
In this work we present a methodology based on the joint use of National Emission Inventories with low spatial (values aggregated for a country) and temporal resolution (annual values), and high-resolution land use maps, to estimate gridded, hourly, and speciated emissions to be used in air quality modelling.
The advantages of using National Inventories for estimating anthropogenic emissions are that they are easily accessible, they are subject to revisions and quality controls, and they are annually up-dated. Moreover, this methodology enables the implementation of a modelling system for air quality management based on official emission data.

SPATIAL DISTRIBUTION

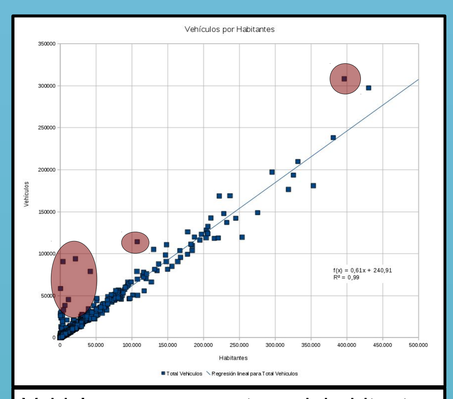


Spatial distribution of emissions. **a**) Highways and road allocation over Spanish towns map, used to allocate Road transport emissions. **b**) CLC land use distribution, included 44 land use types. 22 of them are also used for spatial allocation of gridded emissions. **c**) Detail of the 22 CLC land use distribution around Valencia city with Valencian Air Quality Monitoring and Control Network stations. **d**) 2 Km inner study domain with large emission sources. **e**) Greatest NMVOC (over one million tons per year) point source emissors. **f**) Greatest NOx (over five million tons per year) point source emissors.

METHODOLOGY

EMISSION TYPE		EMISSION DATA	SPATIAL DISTRIBUTION	CHEMICAL SPECIATION	TEMPORAL ALLOCATION
Road transport		National Emission Inventory, Gruop 7	Highways and Roads map with Daily medium traffic intensity. Poblation and vehicle census by towns.	SCC speciation	Weekday/ Weekend
Biogenic		Guenther et al. algorithm[(1)].	Corine Land Cover. All non-artificial surfaces	SCC speciation	Meteorogical Model (WRF)
Soil		National Emission Inventory, Group 11	Corine Land Cover. Land uses asociated with NEI group 11 activities	N/A	Steady State
Urban and Industrial activity	Gridded emision source	National Emission Inventory, Groups 1-6, 10	Corine Land Cover. Land uses asociated with NEI groups 1-6, 10 activities	City Delta Proyect[(2)]	Steady State
	Ports and Airports	National Emission Inventory, Group 8	Corine Land Cover. Land uses asociated with NEI group 8 activities	City Delta Proyect	Steady State
	Large Emission Source	Spanish Pollutants Release and Transfer Register	Spatial Coordinates of point sources stacks	SCC speciation	Steady State
Outside Spain		EMEP-CEIP	Included in EMEP-CEIP data	City Delta Proyect	Steady State

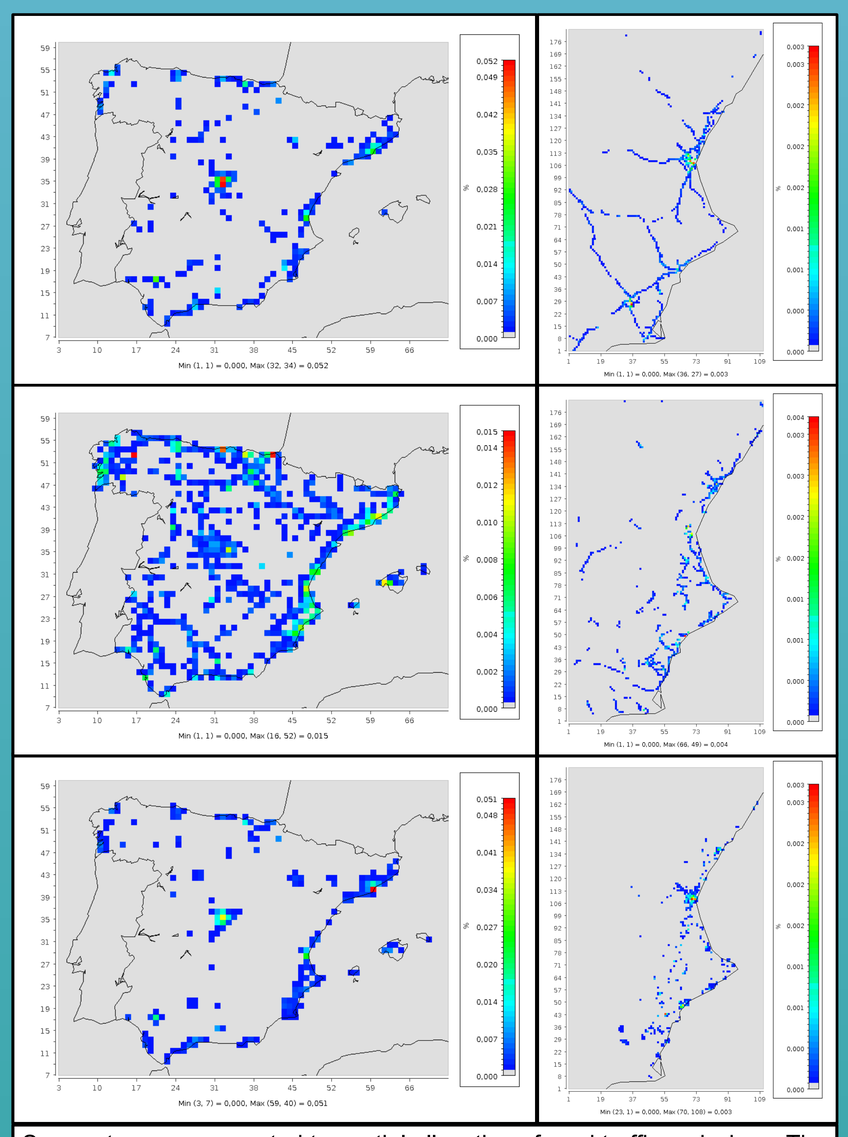
Origin of emission data, spatial distribution, chemical speciation and temporal allocation procedures



Vehicles census vs. town inhabitants. Not adjusted values, marked in red, make necessary to adjust them with a linear regression normalization.

EMISSOR TYPE	ROAD TRANSPORT	BIOGENIC	SOIL	GRIDDED EMISSION SOURCE	PORTS & AIRPORTS	LARGE EMISSION SOURCE	OUTSIDE SPAIN
CHEMICAL SPECIATION	SO2	OLE	SO2	SO2	SO2	SO2	SO2
	NO	PAR	NO	NO	NO	NO	NO
	NO2	ALD2	NO2	NO2	NO2	NO2	NO2
	OLE	ISOP	CH4	OLE	OLE	OLE	OLE
	PAR	TERPB	CO	PAR	PAR	PAR	PAR
	TOL	NR	CO2	TOL	TOL	TOL	TOL
	XYL		N2O	XYL	XYL	XYL	XYL
	FORM		NH3	FORM	FORM	FORM	FORM
	ALD2			ALD2	ALD2	ALD2	ALD2
	ETH			ETH	ETH	ETH	ETH
	NR			MEOH	MGLY	ISOP	MEOH
	CH4			ETOH	CH4	NR	ETOH
	CO			ISOP	CO	N2O	ISOP
	CO2			CH4	CO2	NH3	OLE2
	N2O			CO	N2O		MGLY
	NH3			CO2	NH3		CO
				N2O			NH3
				NH3			

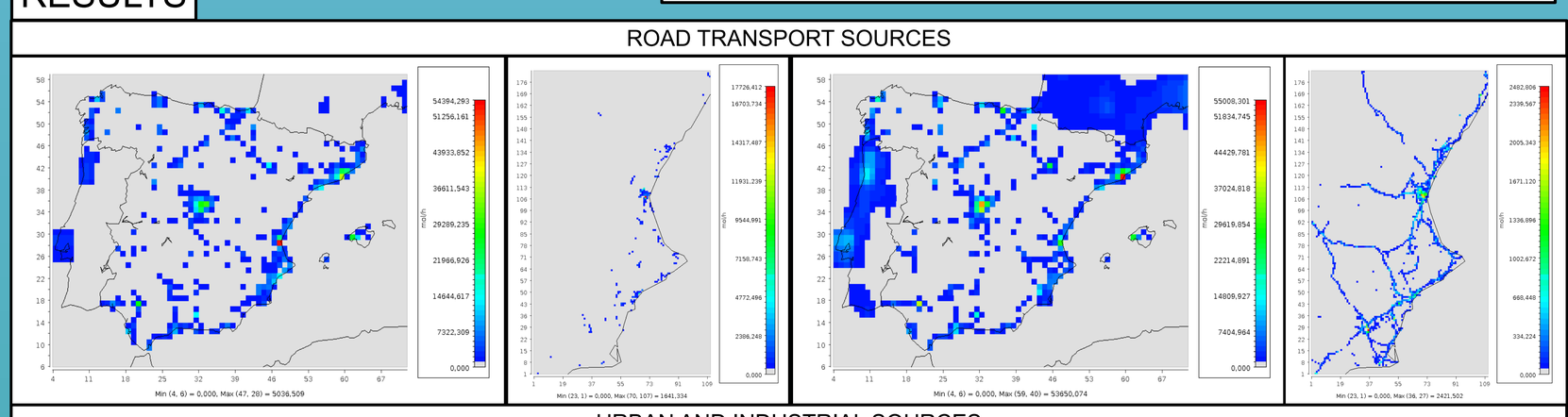
Chemical speciation of pollutant emitted by each emissor type. Note that NMVOC speciation varies by emissor type.



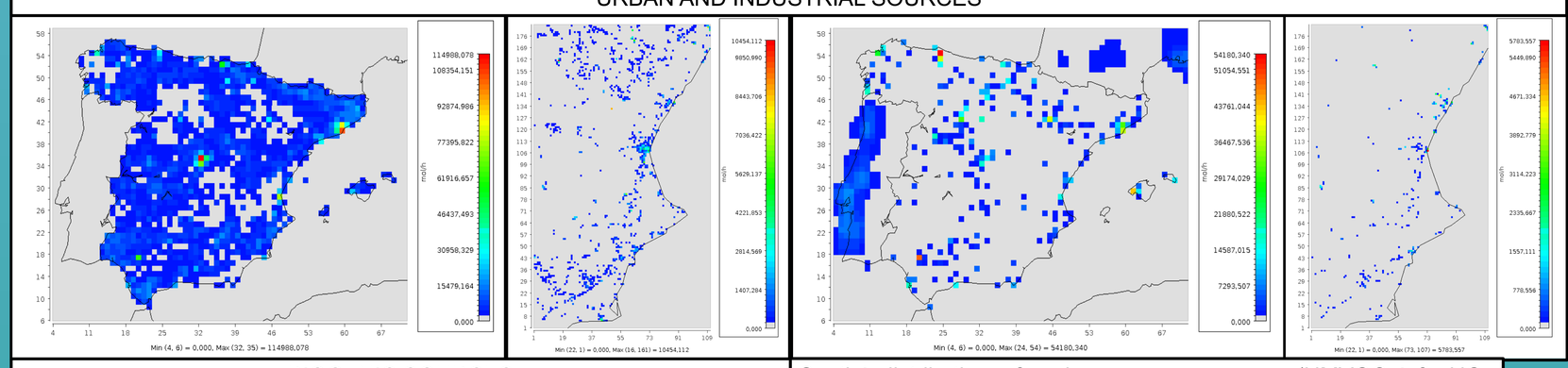
Surrogate maps computed to spatial allocation of road traffic emissions. The Road Traffic Map published by the Spanish Traffic Department (DGT) contains the average daily intensity of vehicles per higway (up), and road (center) sector needed. Town spatial allocation of road traffic (down) was computed with adjusted vehicles census vs. poblation census relationship.

RESULTS

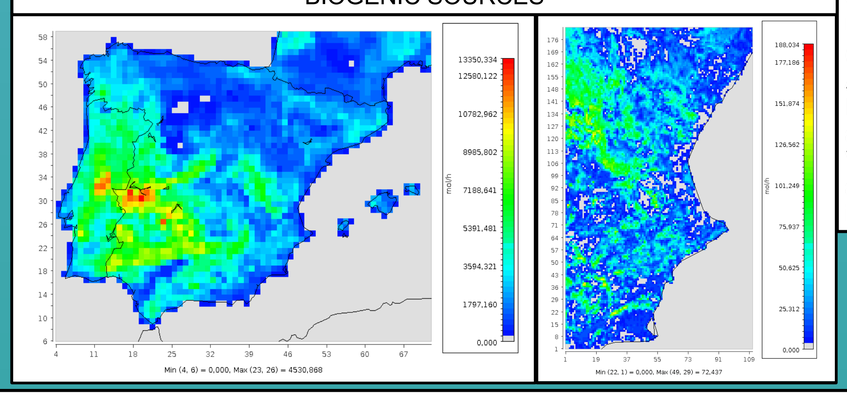
ROAD TRANSPORT SOURCES



URBAN AND INDUSTRIAL SOURCES



BIOGENIC SOURCES



Spatial distribution of major ozone precursors (NMVOC left, NOx right) from road transport source (top), urban and industrial sources (center) and biogenic (bottom) in the mother and inner domains on 1st August 2005 at 17:00 UTC.
Note that the higest values of ozone precursors emissions are placed around greatest cities and industrial parks, like Madrid, Barcelona, Valencia and Huelva. On the other hand, biogenic NMVOC emissions are greater in the SW due to large extensions of grasslands and non-irrigated arable lands.

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