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INTER-COMPARISON BETWEEN HERMESv2.0 AND TNO-MACC-II TRAFFIC EMISSION DATA (Analysis of Madrid and Barcelona greater areas)

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FAIRMODE technical meeting
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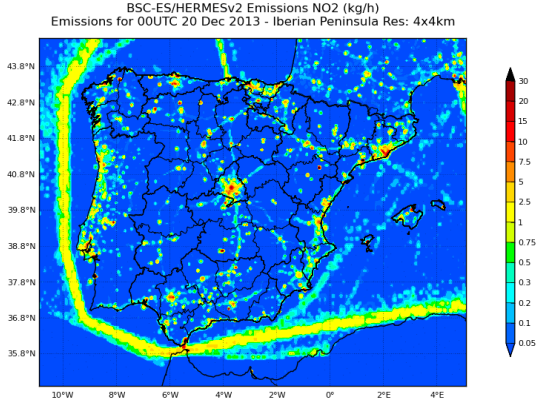
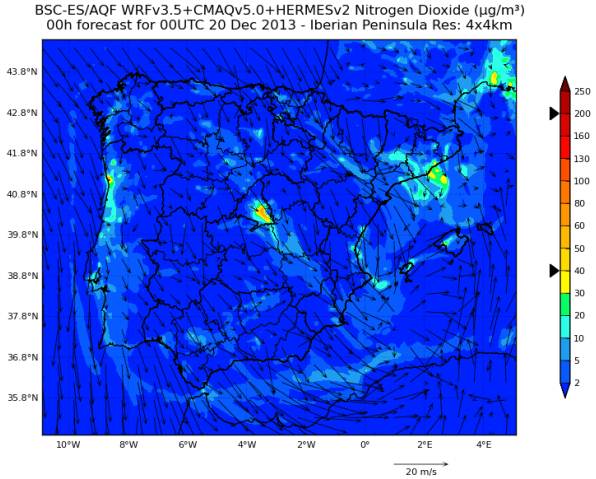
Introduction

HERMESv2.0
(Guevara et al., 2013)



TNO-MACC-II
(Kuener et al., 2014)



- Year basis: 2009
- Up to 1km^2, 1hour
- Mainly bottom-up approaches (EEA, 2009)
- SNAP categories
- Chemical species-based emissions (CB-05)

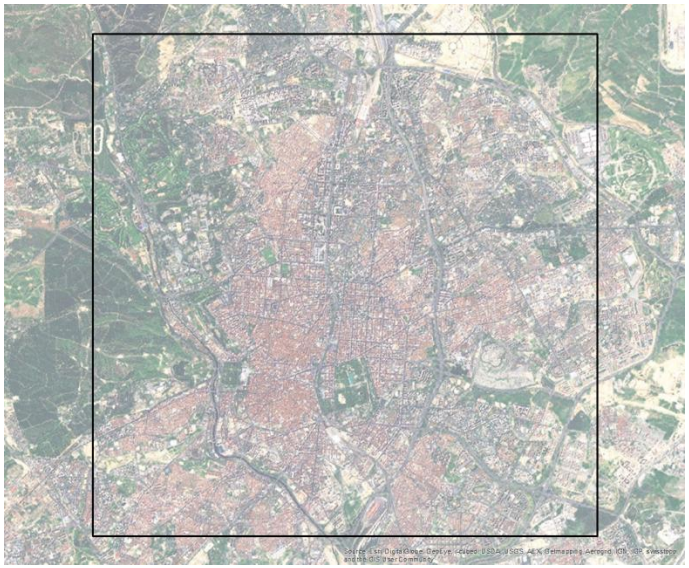
- Year basis: 2009
- ~ 7kmx7km, anual
- Down-scaling of official reported emissions
- SNAP categories
- Primary pollutants (e.g., NOx, SOx)

CALIOPE air quality forecast system

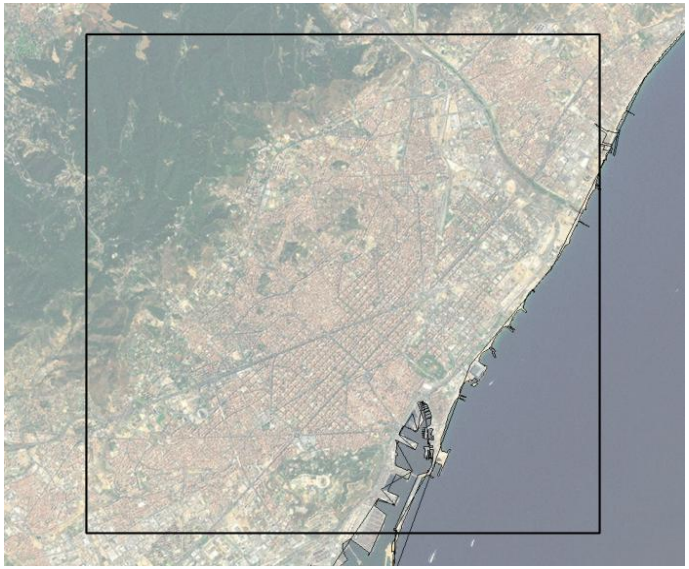
http://www.bsc.es/caliope/

Domains of analysis

1 - Madrid



2 - Barcelona



Methodology – On-road traffic (SNAP07)

Methodologies used for the emission estimation

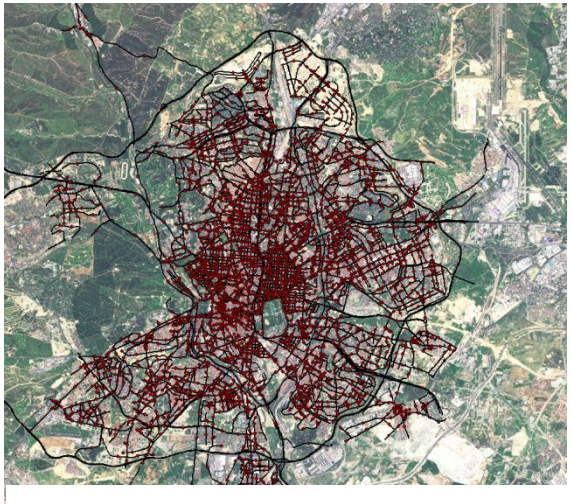
- **EEA (2009) - COPERT IV** → Exhaust (TIER3), evaporative (TIER2) and tyre/break/road wear (TIER3) emissions
- **Pay et al. (2011)** → Paved road dust resuspension emissions

Specific information associate to each road stretch

- Type of stretch (urban, motorway, road,…)
- IMD (Flow traffic data → number of vehicles per day)
- Speed data
- Stretch lenght
- % general vehicle type (light vehicle, heavyduty vehicle, motorcycle)
- Fleet composition → Over **60 profiles** (per province, type of road…)
- Temporal profile (hourly, weekly, monthly) → Over **27.000 profiles**

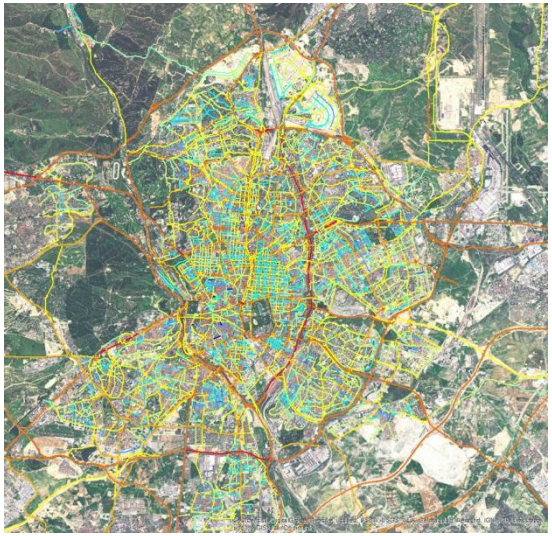
Methodology – On-road traffic (SNAP07)

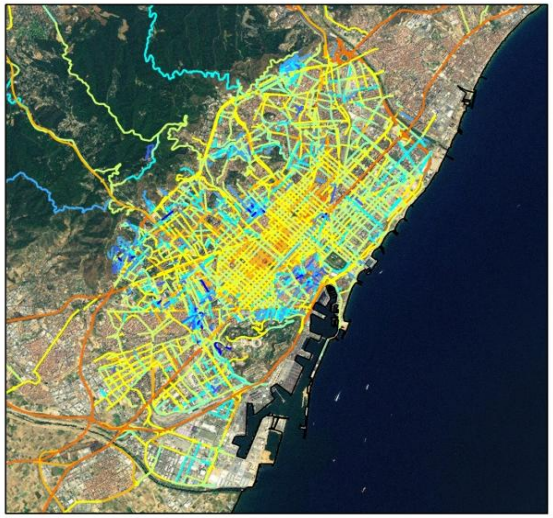
- **A complete digital road map with traffic flow information**

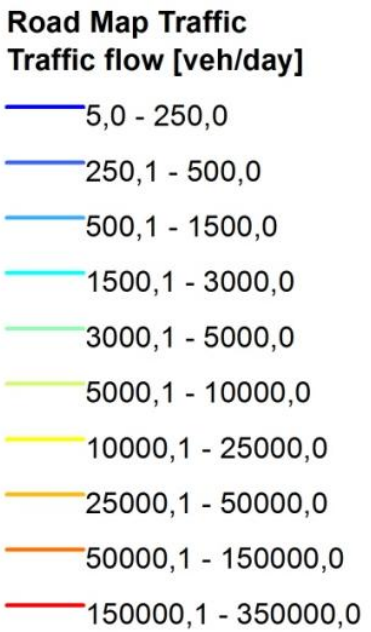


3,198 Traffic Stations

2,575 Traffic Stations

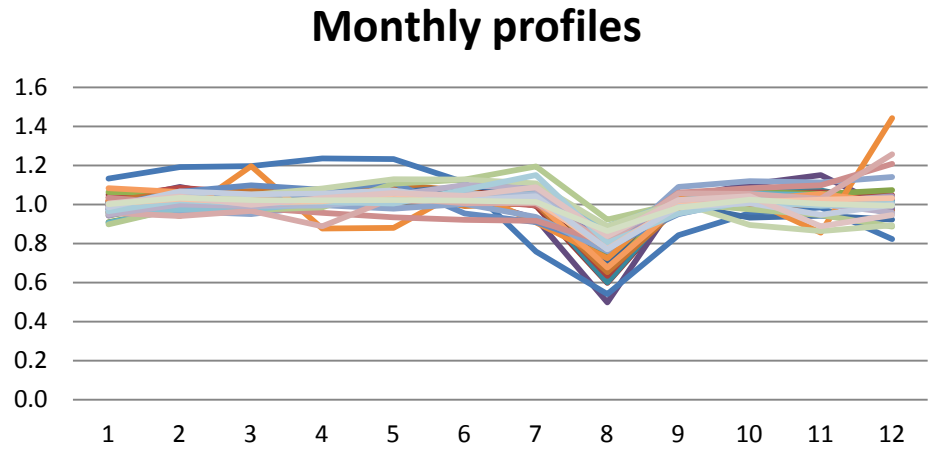


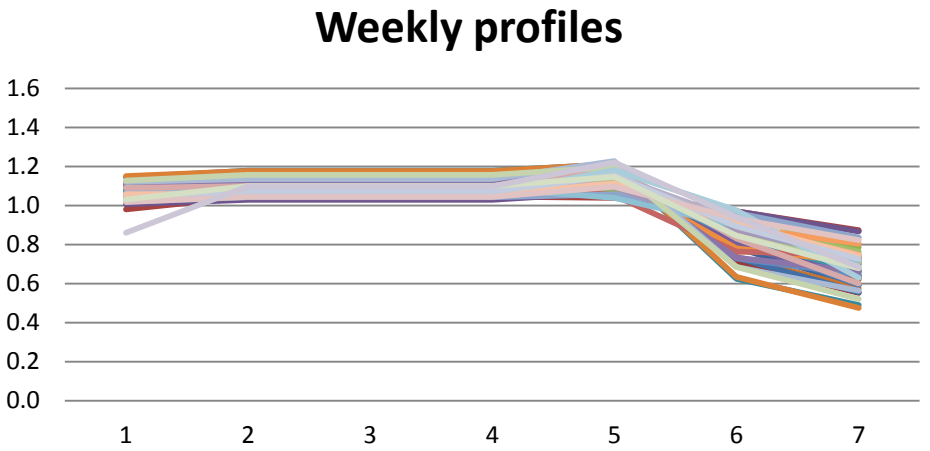


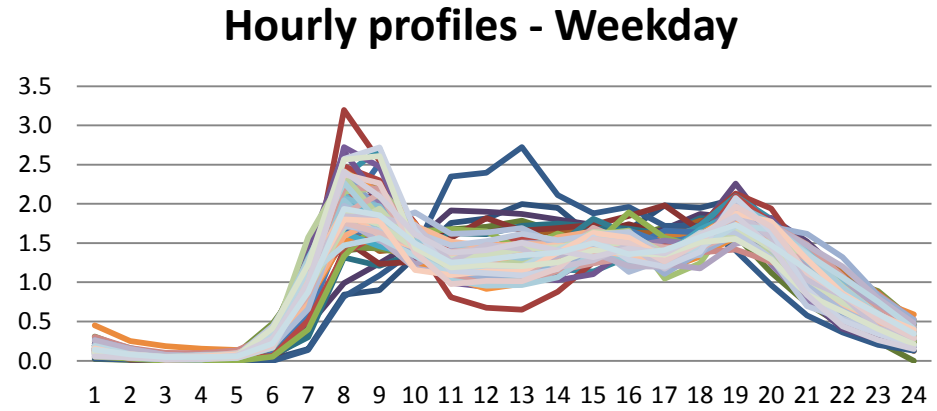


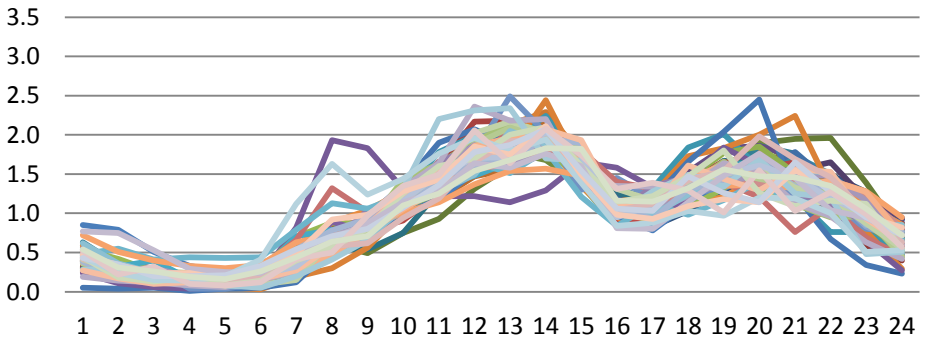
Methodology – On-road traffic (SNAP07)

- Used > 1,000 temporal profiles (including monthly, weekly, hourly)









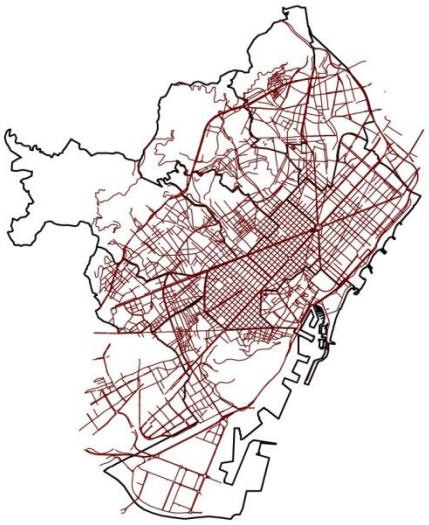
Methodology – On-road traffic (SNAP07)

- **Different composition fleets per district (256 vehicle categories)**

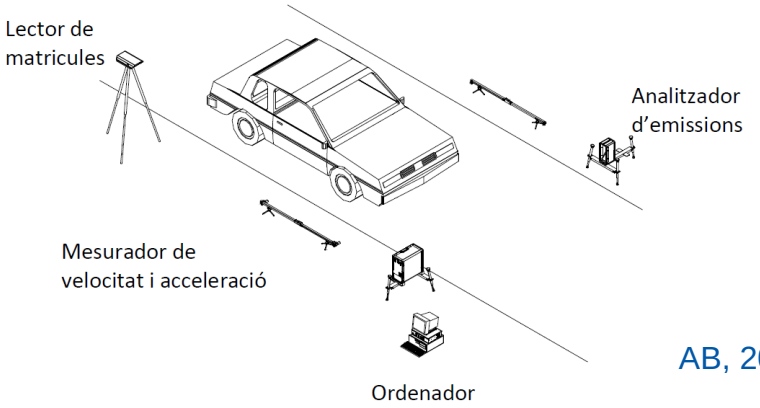
7 fleet composition profiles obtained from statistics

Zone	Buses	HDV	Taxis	Motocycles	PC
1	3,4%	8,6%	17,4%	7,1%	63,5%
2	2,2%	6,7%	14,3%	4,4%	72,3%
3	2,3%	6,3%	15,3%	5,9%	70,2%
4	2,1%	5,4%	9,2%	4,7%	78,5%
5	2,4%	6,4%	10,6%	4,6%	76,1%
6	1,4%	6,2%	3,7%	1,6%	87,1%
7	2,6%	7,6%	4,7%	2,6%	82,5%
TOTAL	2,5%	6,9%	9,1%	4,0%	77,5%

AM, 2009

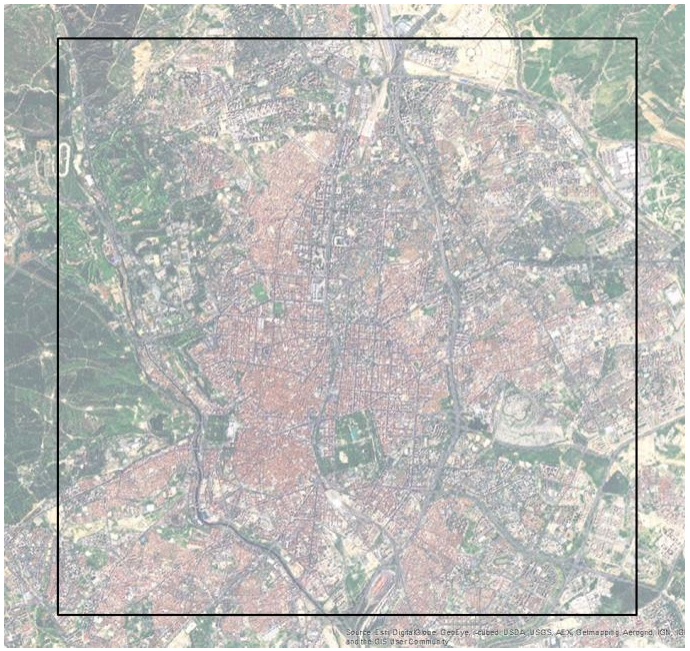


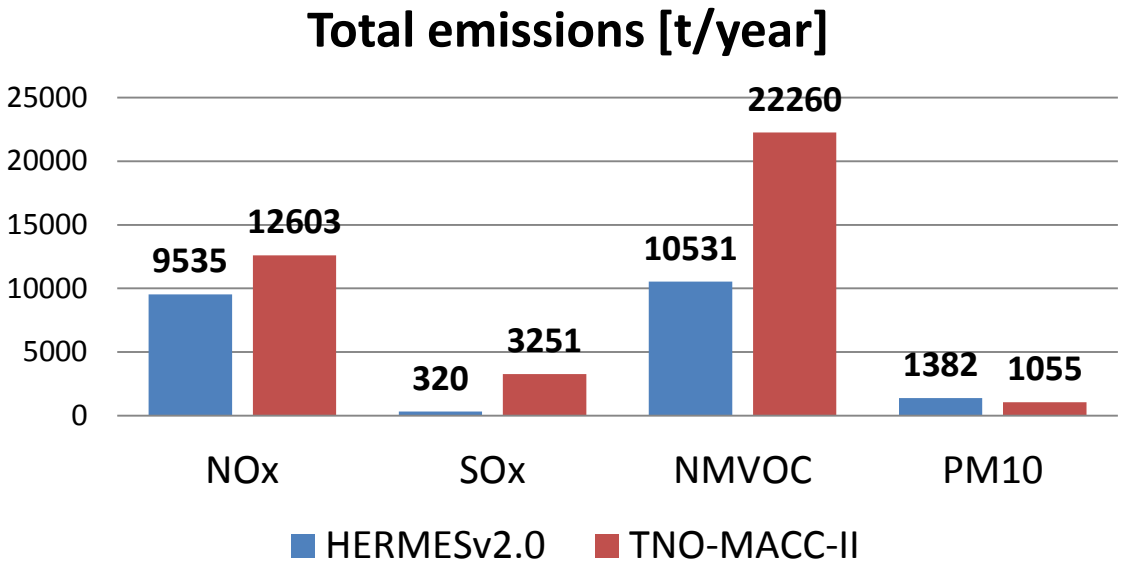
12 fleet composition profiles obtained from Remote Sensign Device (RSD) data

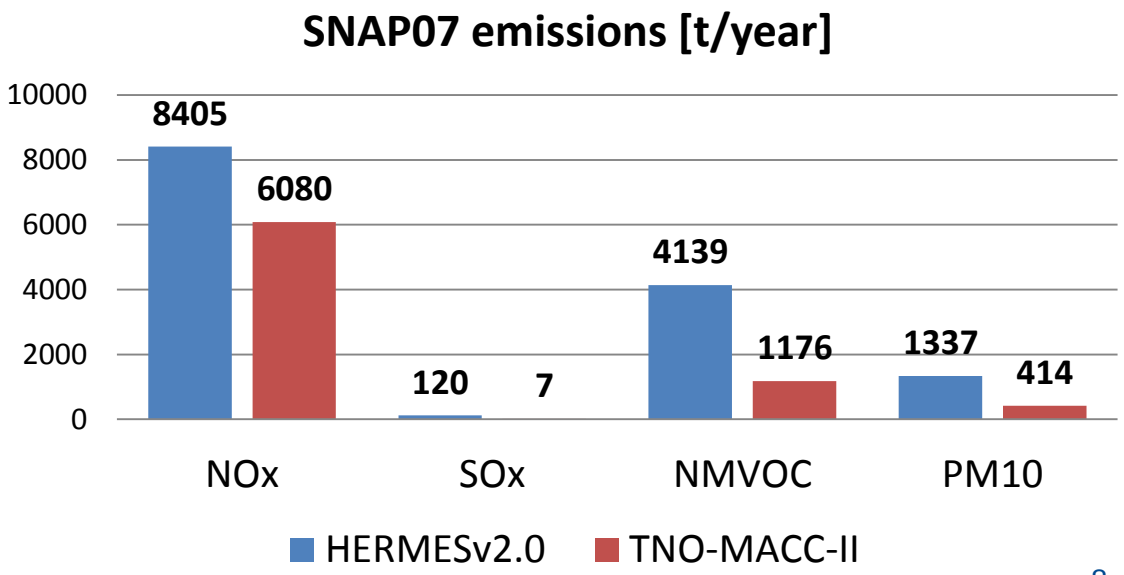


AB, 2010a

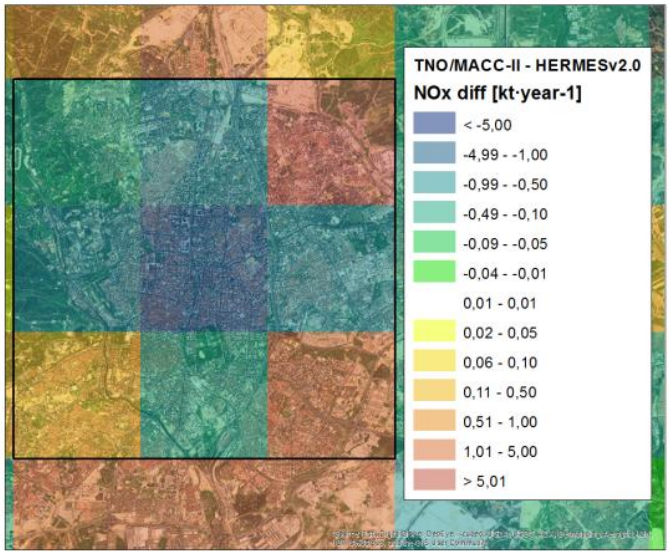
Emission results – Madrid greater area

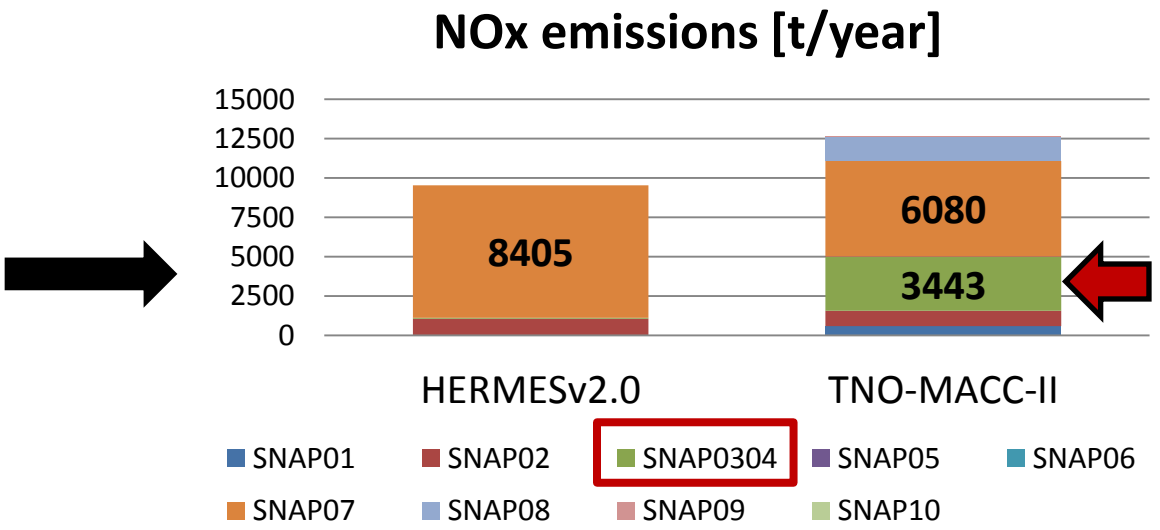


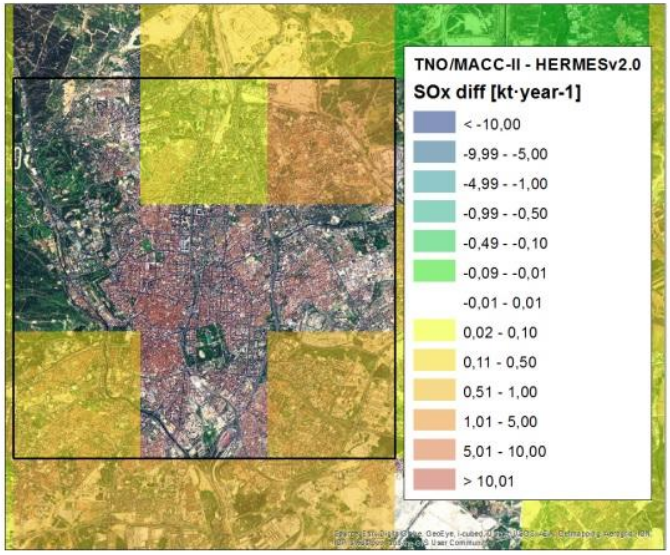


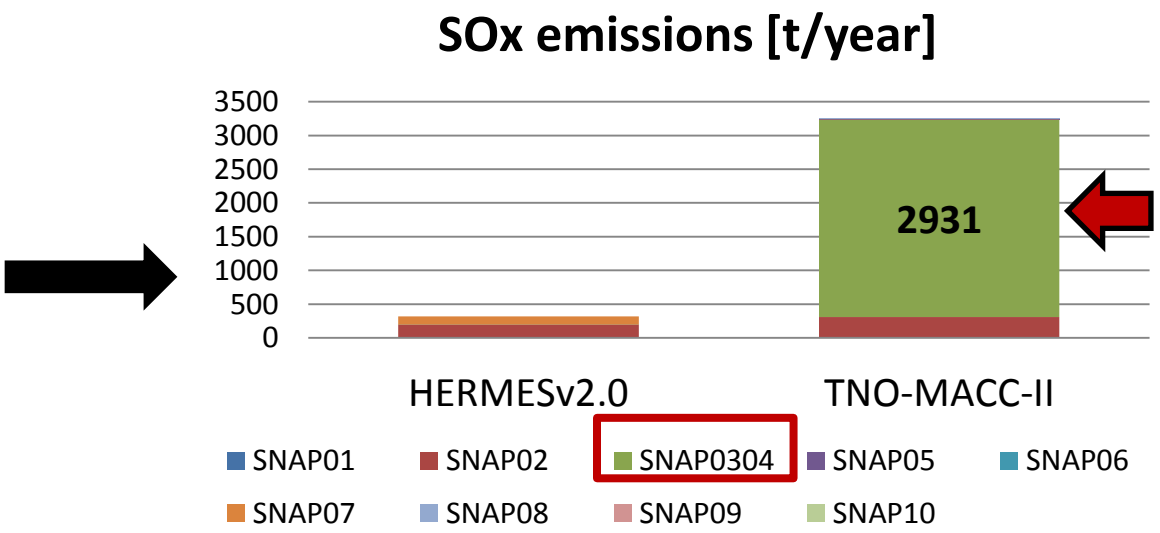


Emission results – Madrid greater area









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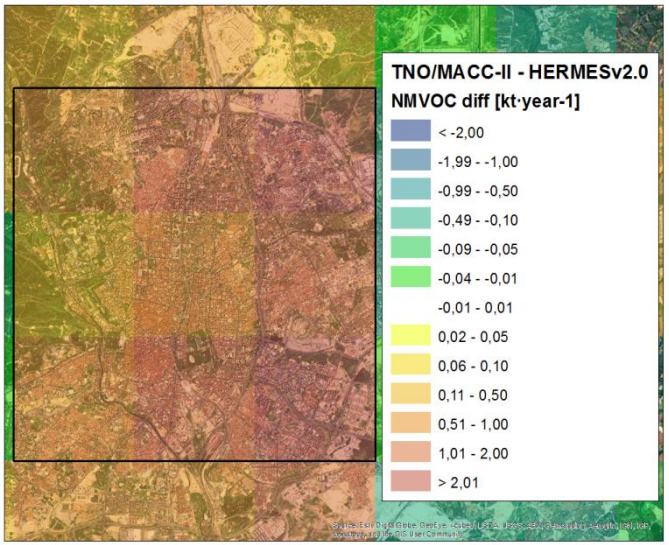

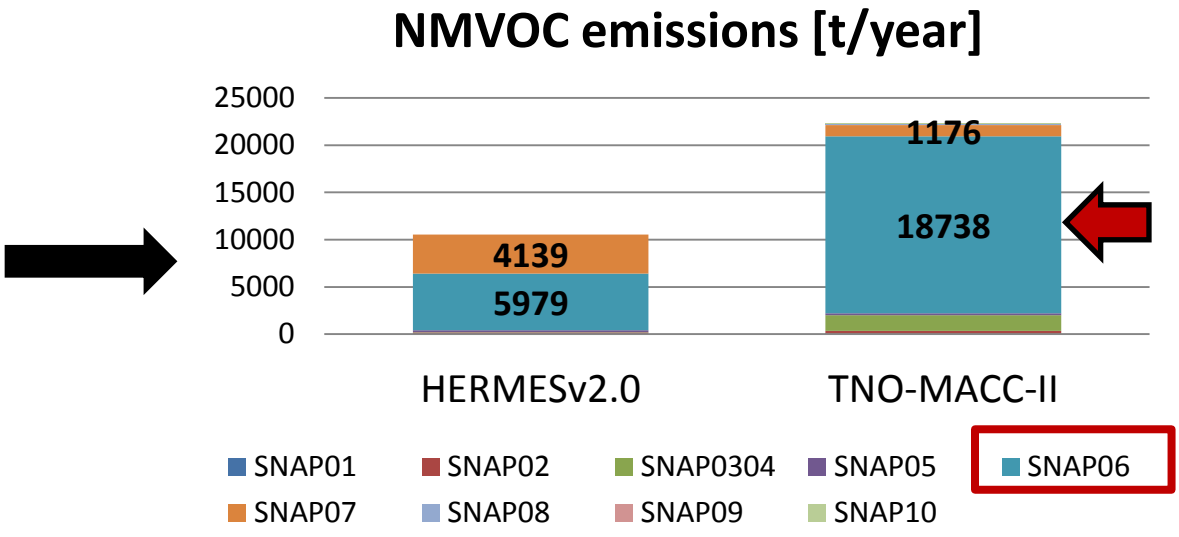

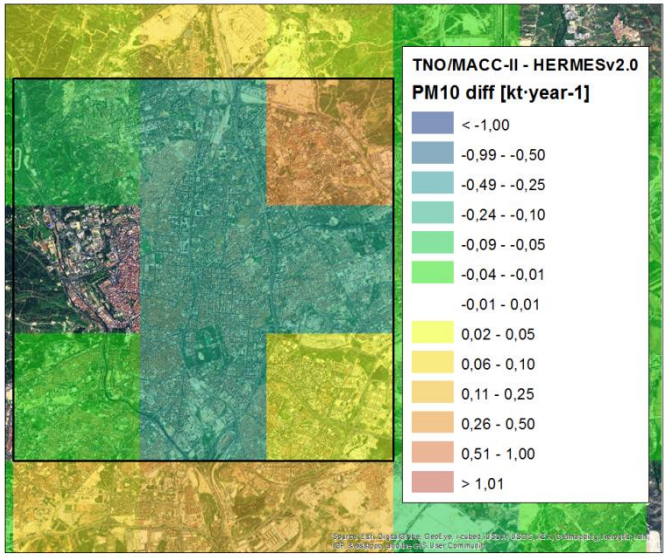

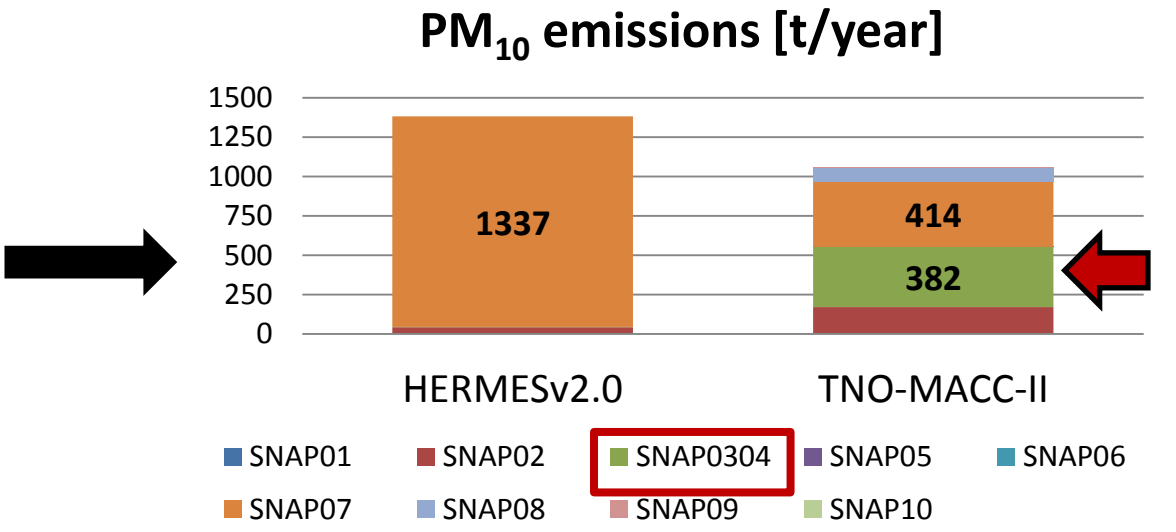

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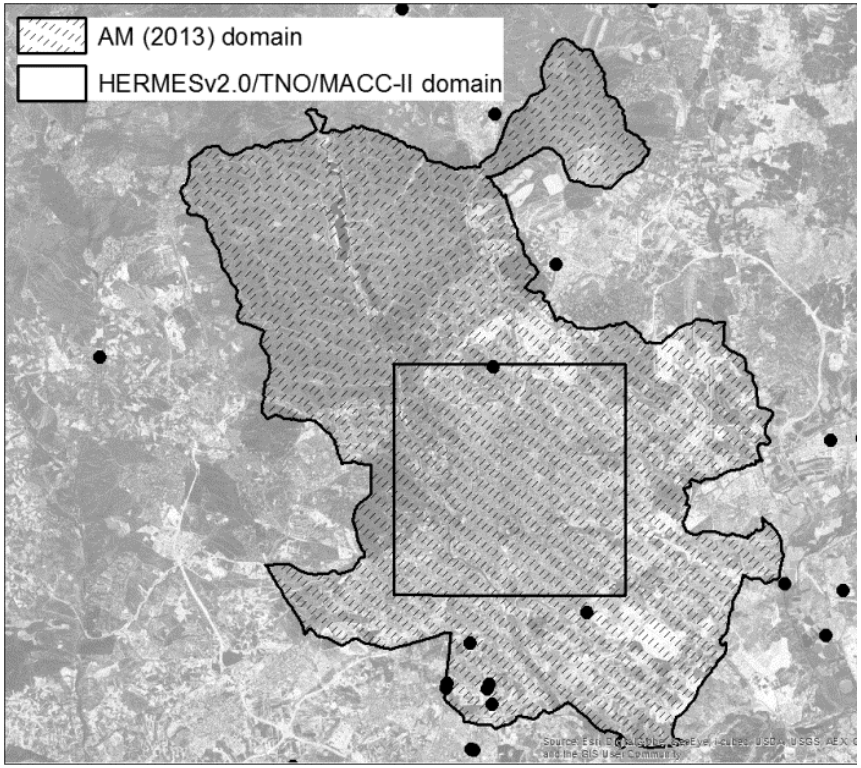
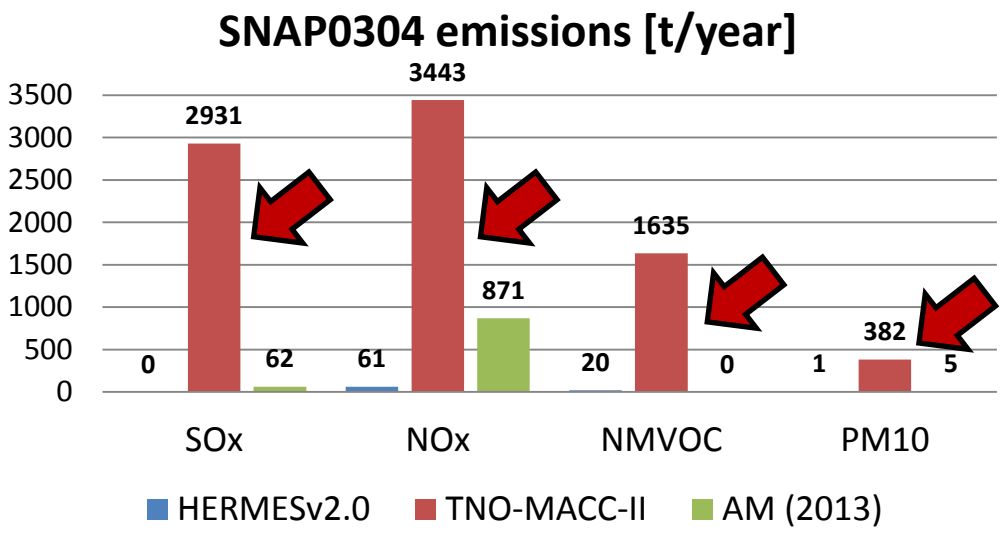
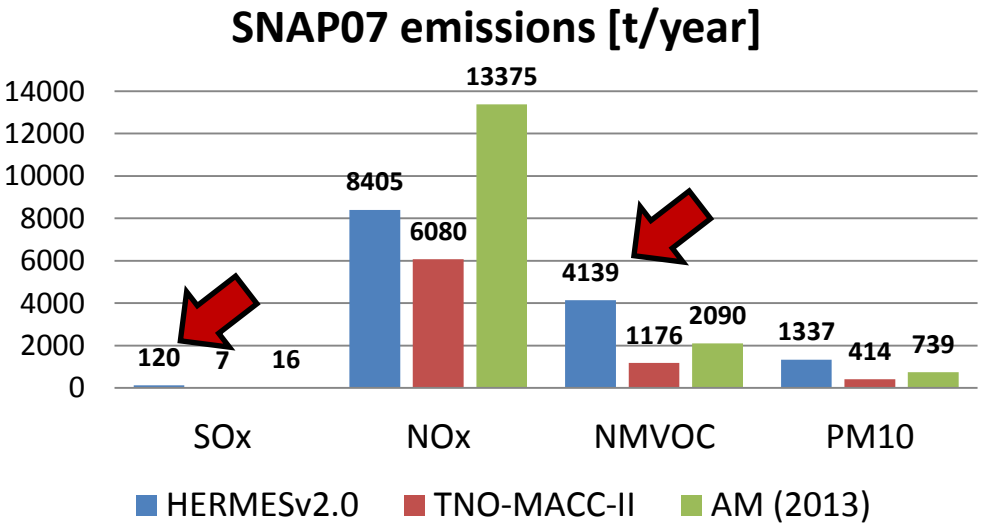


AM, 2013





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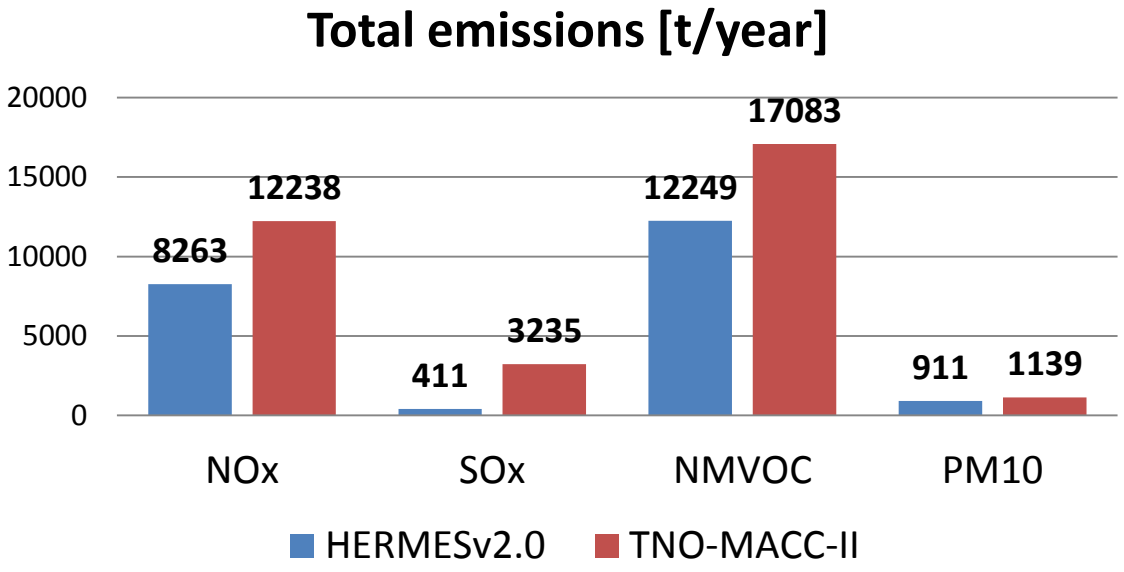

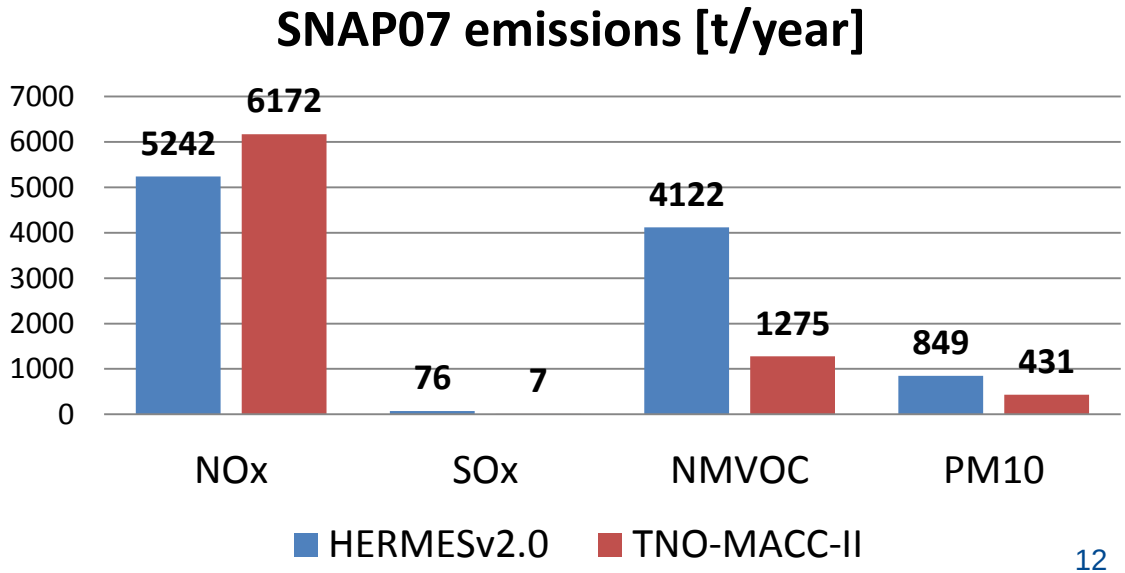

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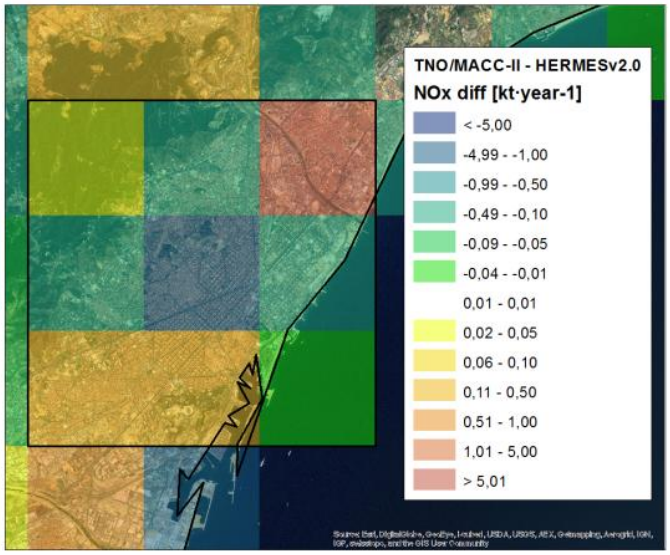

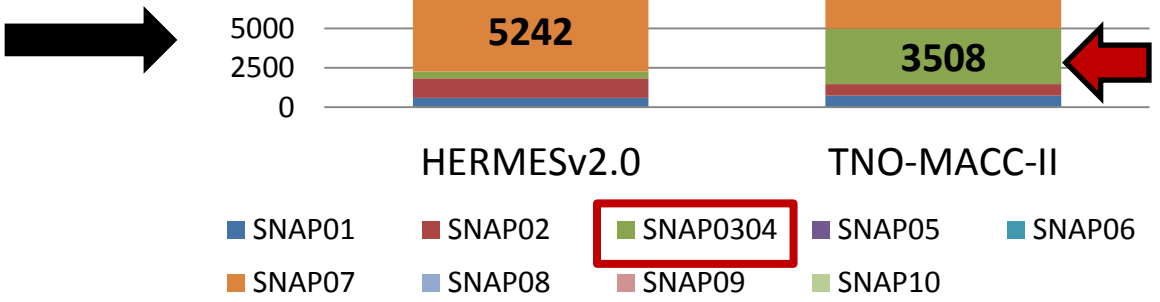

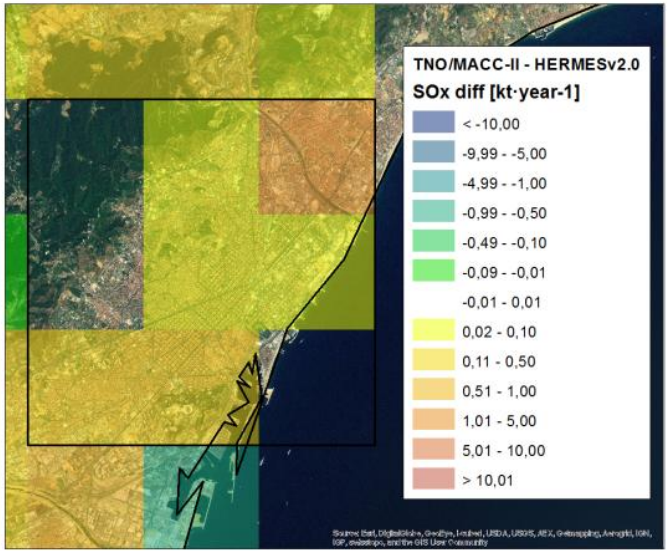

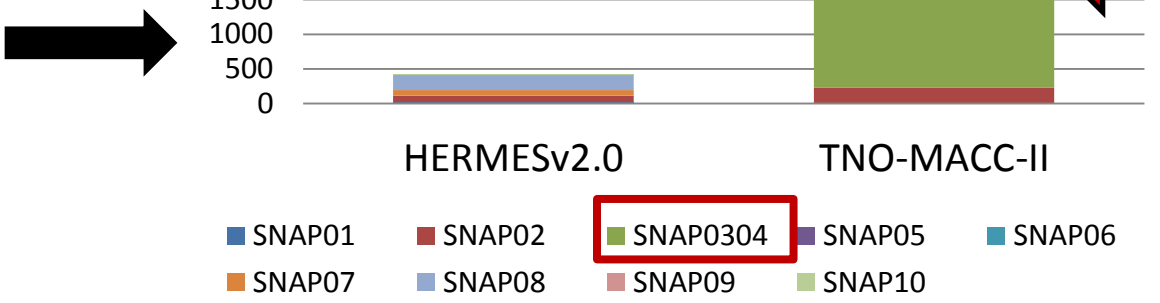

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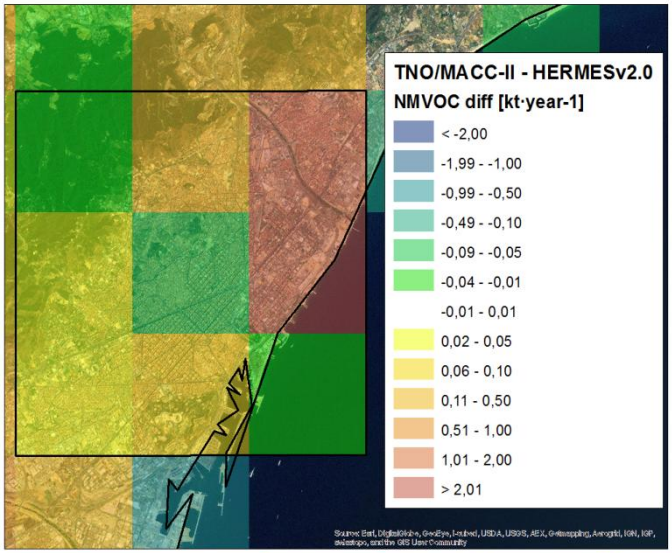

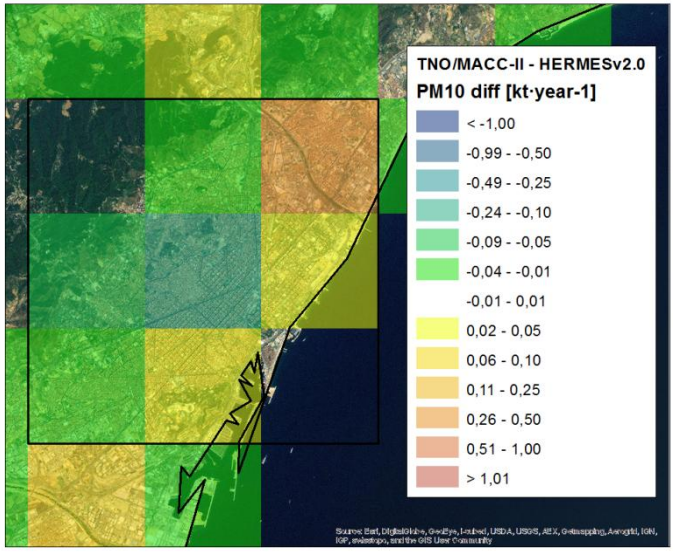

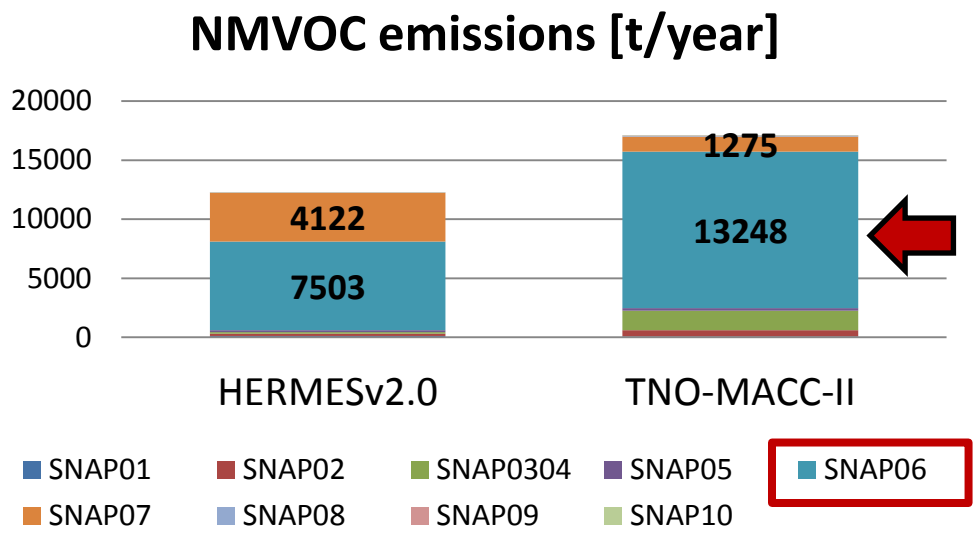

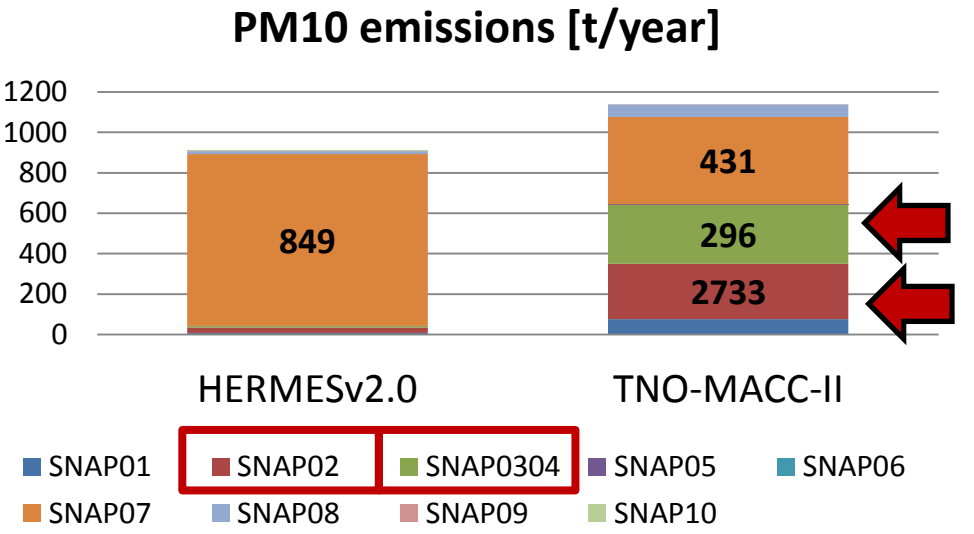

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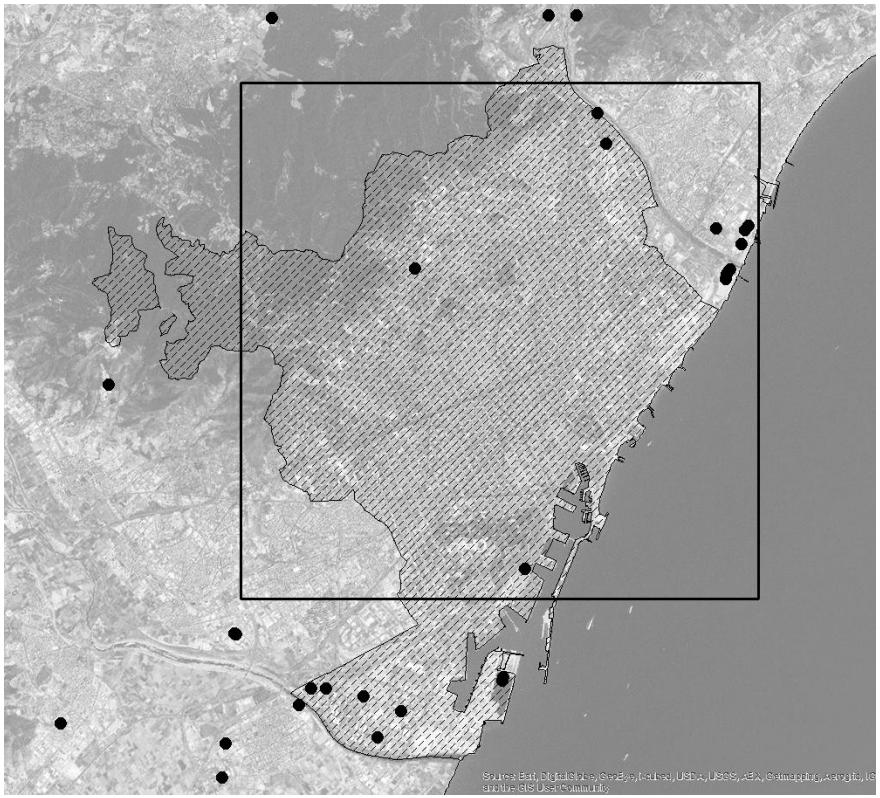
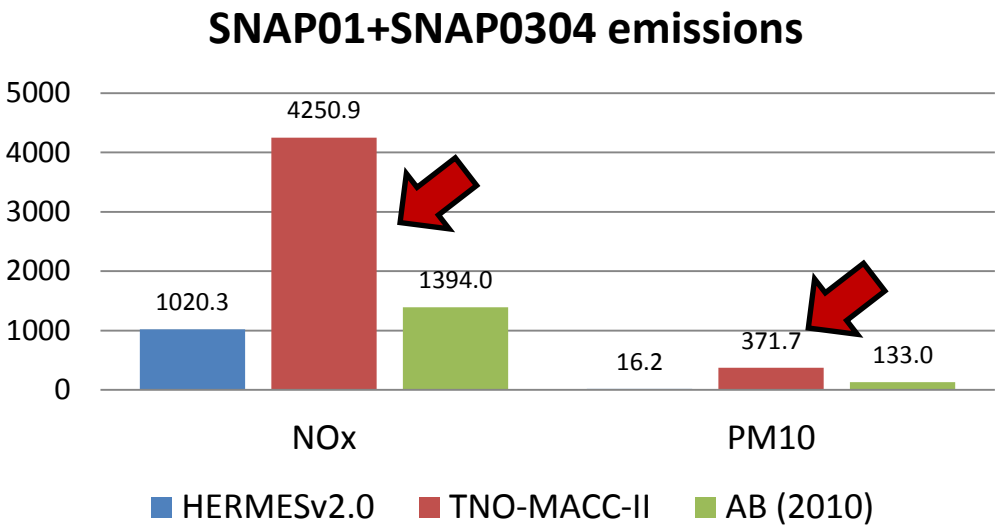
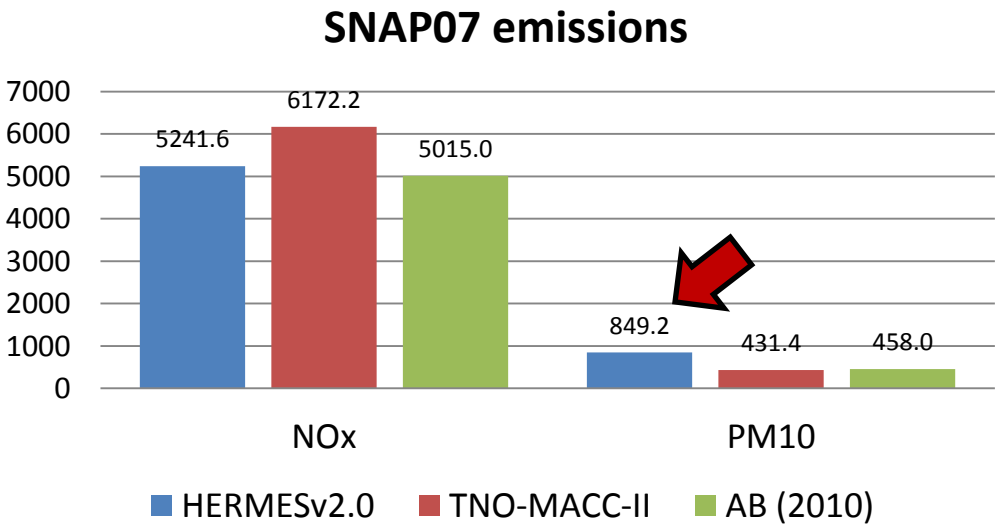


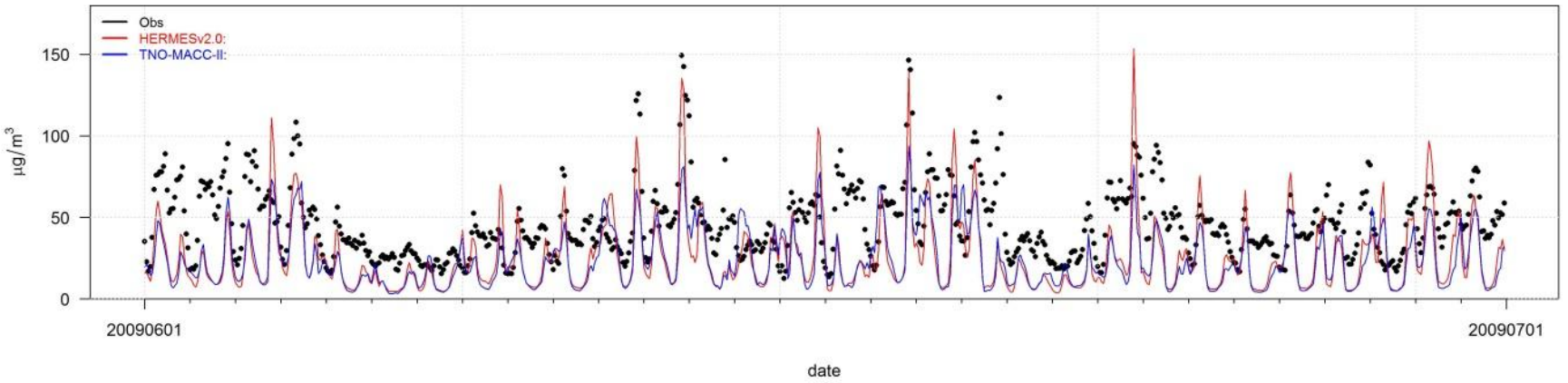
AB, 2010b



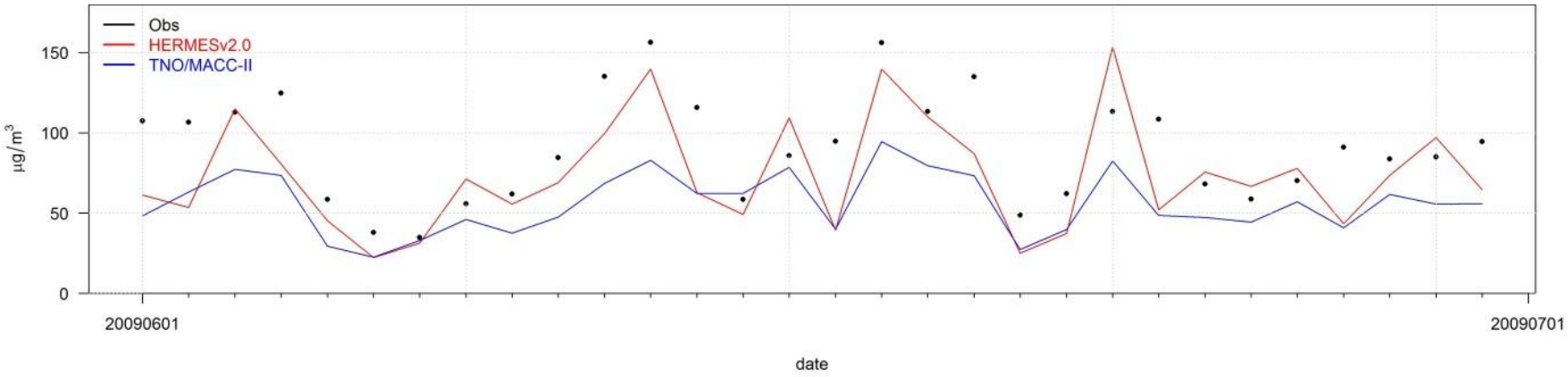


AQ results – Madrid greater area

NO_2 [µg·m^{-3}] mean concentrations MADRID urban stations (Jun-09)

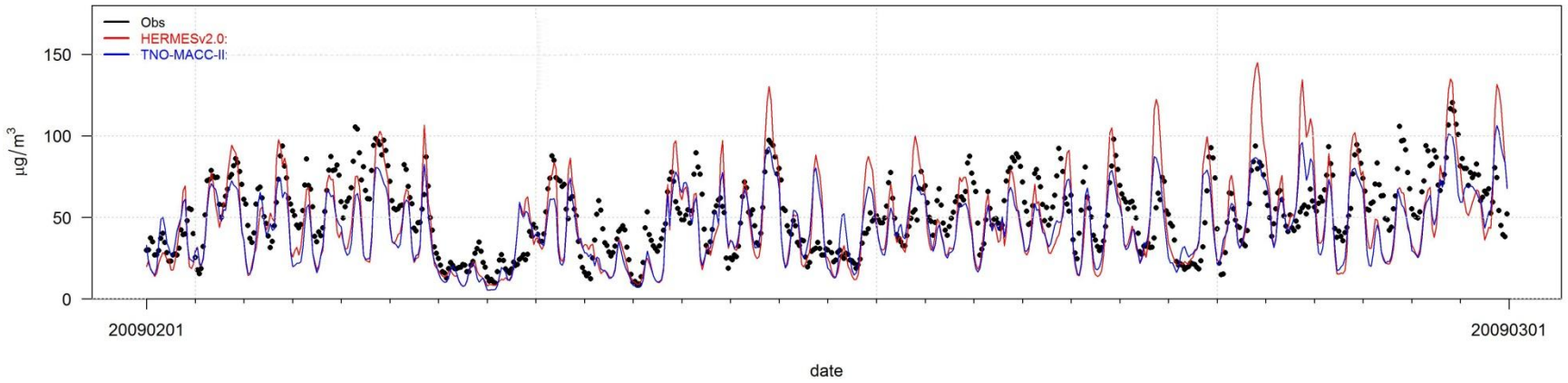


NO_2 [µg·m^{-3}] daily max. concentrations MADRID urban stations (Jun-09)

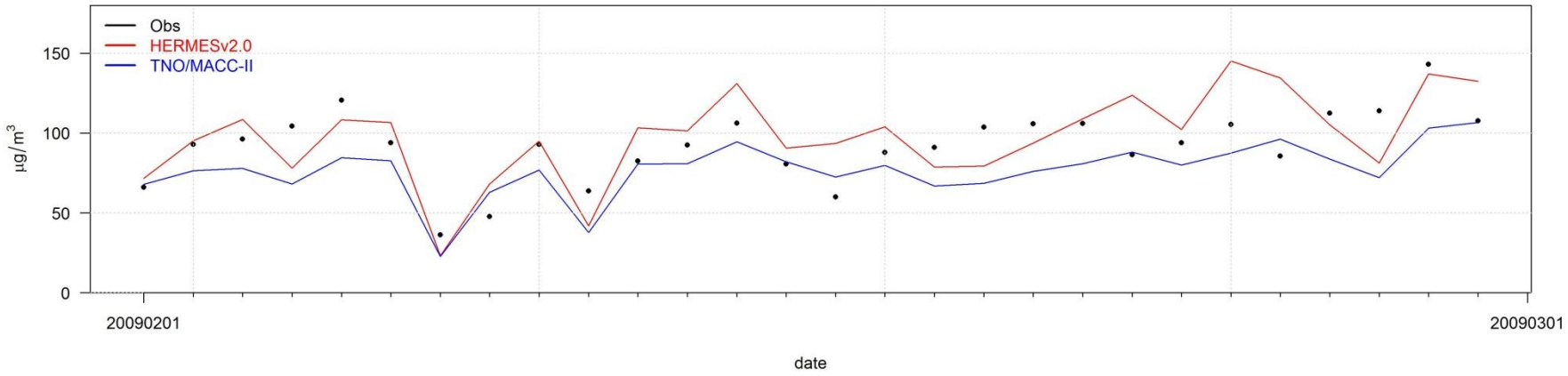


AQ results – Barcelona greater area

NO_2 [µg·m^{-3}] mean concentrations BCN urban stations (Feb-09)



NO_2 [µg·m^{-3}] daily max. concentrations BCN urban stations (Feb-09)



Lessons learned

- Inter-comparisons between down-scaled and (local) bottom-up emission datasets may help to validate emission estimates, confirm distribution patterns and identify gaps
  - Allocation of Spanish industrial area emissions should be reviewed and improved in the present TNO-MACC-II emission inventory (Overestimation)
  - Road dust resuspension plays a key role in the characterization of PM_{10} urban traffic emissions (not included in reported emission national totals)
    - Amato et al. (2012) → EF based on measurements in Barcelona
    - Denby et al. (2013) → The NORTRIP model
  - Revision of evaporative emissions and traffic SO_x EF in HERMESv2.0

Lessons learned

- The uncertainty in the calculation of traffic emissions can depend mostly on the inherent uncertainty of COPERT IV (EF) rather than on the uncertainty of the data provided by the inventory compiler (Kouridis et al., 2010)
  - Comparison of road traffic emission models (Borge et al., 2012)
  - Use of validation techniques (e.g. Remote Sensing Device, RSD). NO_x emissions estimated in Barcelona using the RSD data are 16.2% higher than the ones obtained using CORINAIR EF (AB, 2010a)
  - More complex models (i.e. microscopic traffic models) have the potential to provide more accurate predictions. However, they also require more detailed input data (e.g. instantaneous data on acceleration) which may not be readily available to the model user (Smit et al., 2010)

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Thank you!