

Use of SHERPA tool in Spain

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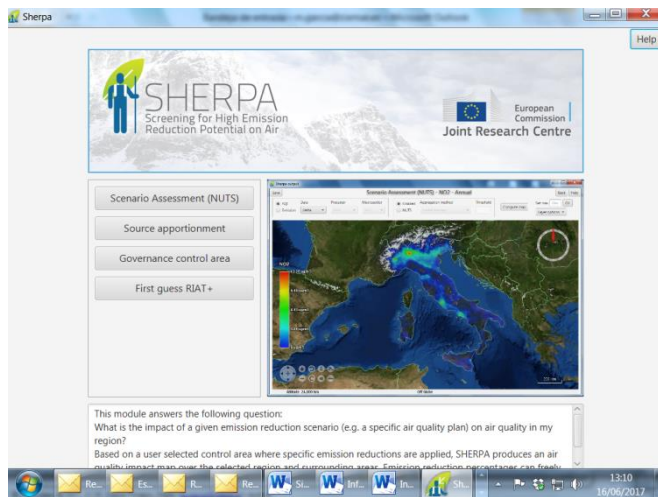
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Purpose of using SHERPA

- Assess air quality (NO_2) in Spain for different emission reductions
- Assess scenarios with emission reductions that comply with the National Emissions Ceiling (NEC) Directive
- Supported by Environmental Ministry of Spain.

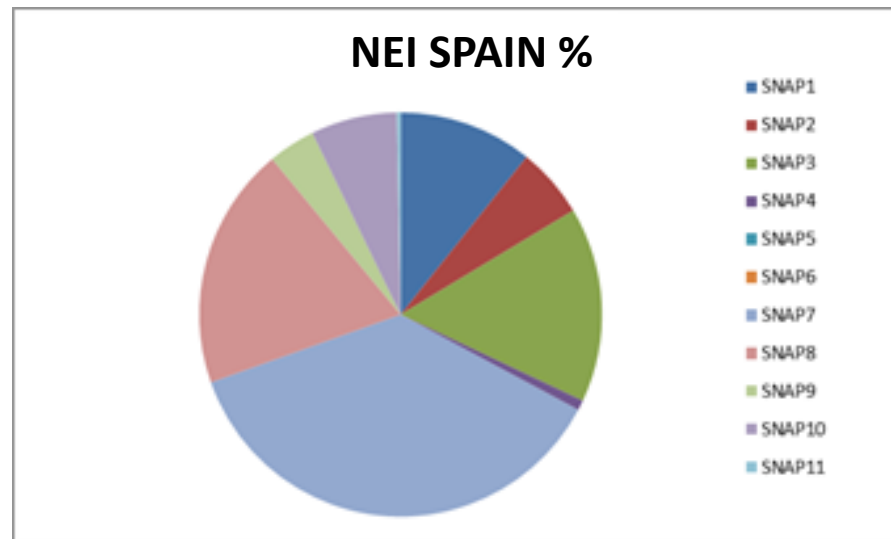
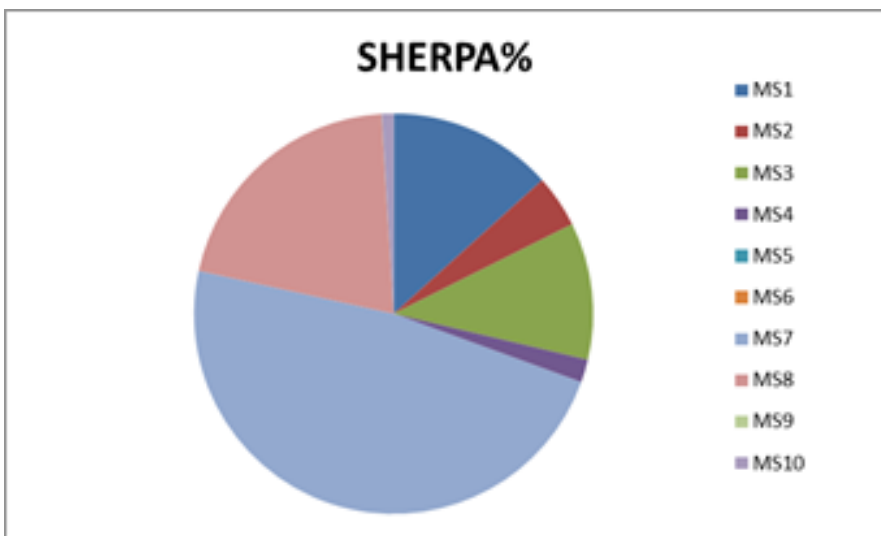
Description of the exercise

- We calculated the NOx reductions required to comply with the NEC Directive.
- SHERPA with reductions applied to all sectors (SNAPS)
- SHERPA with reductions for specific SNAPs (starting task)
- First problems:
 - Different sector shares for SHERPA and National Emission Inventory
 - Base year for SHERPA is 2010 while for NEC directive is 2005

Comparing SHERPA emissions (2010) vs National Emission Inventory (NEI) of Spain (2010) for NOx Sector Shares.

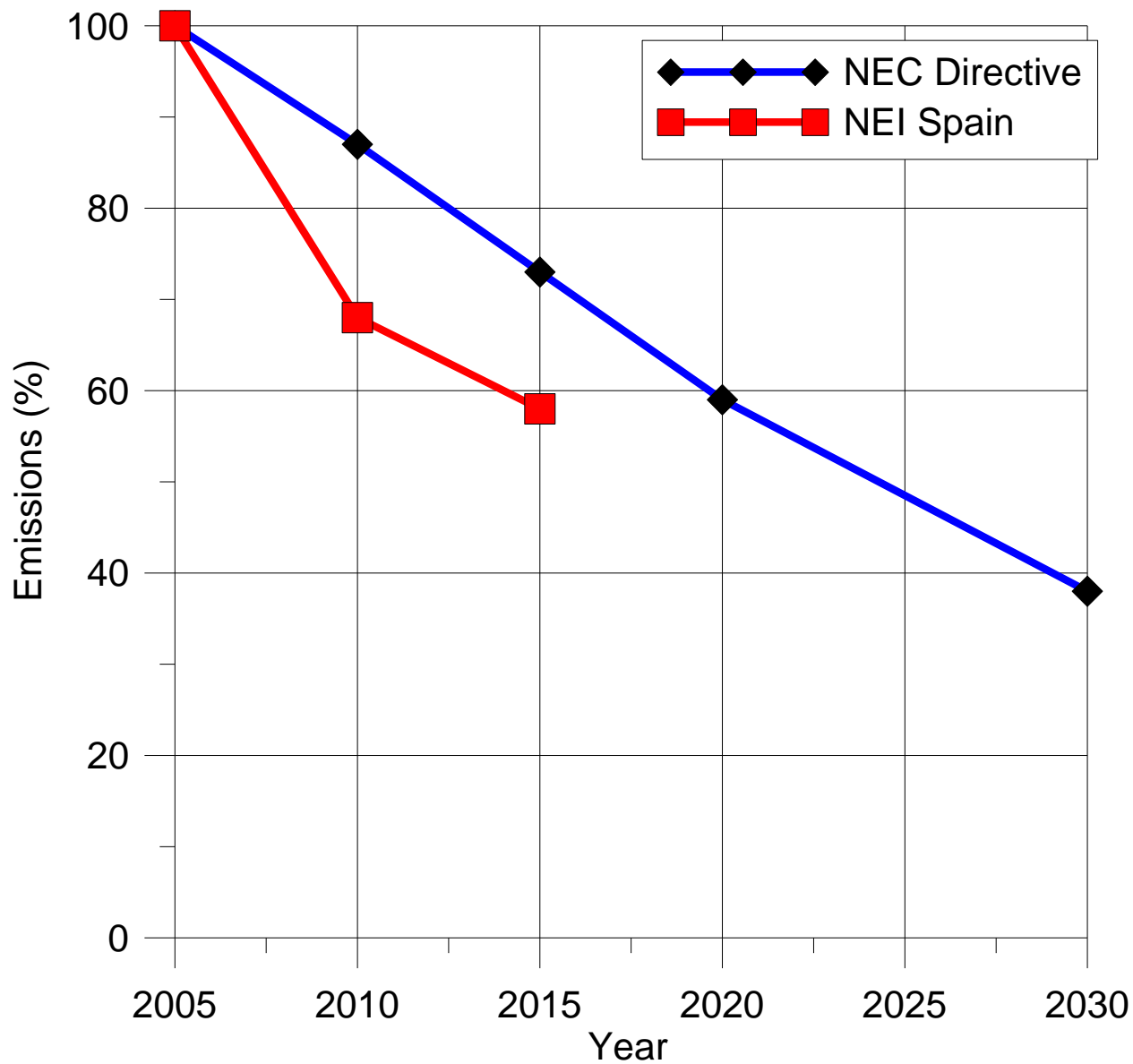
Sector Shares.

- There are discrepancies between SHERPA 2010 and NEI Spain 2010
- Main sectors contributing are traffic, other transports, power generation, industry and commercial-residential.



- Some differences due to recent changes in emission-calculating methodology.
- New methodology for NEI Spain.
- Currently studying SNAP 7 in depth (to see if there are differences that cannot be explained by the change in methodology)

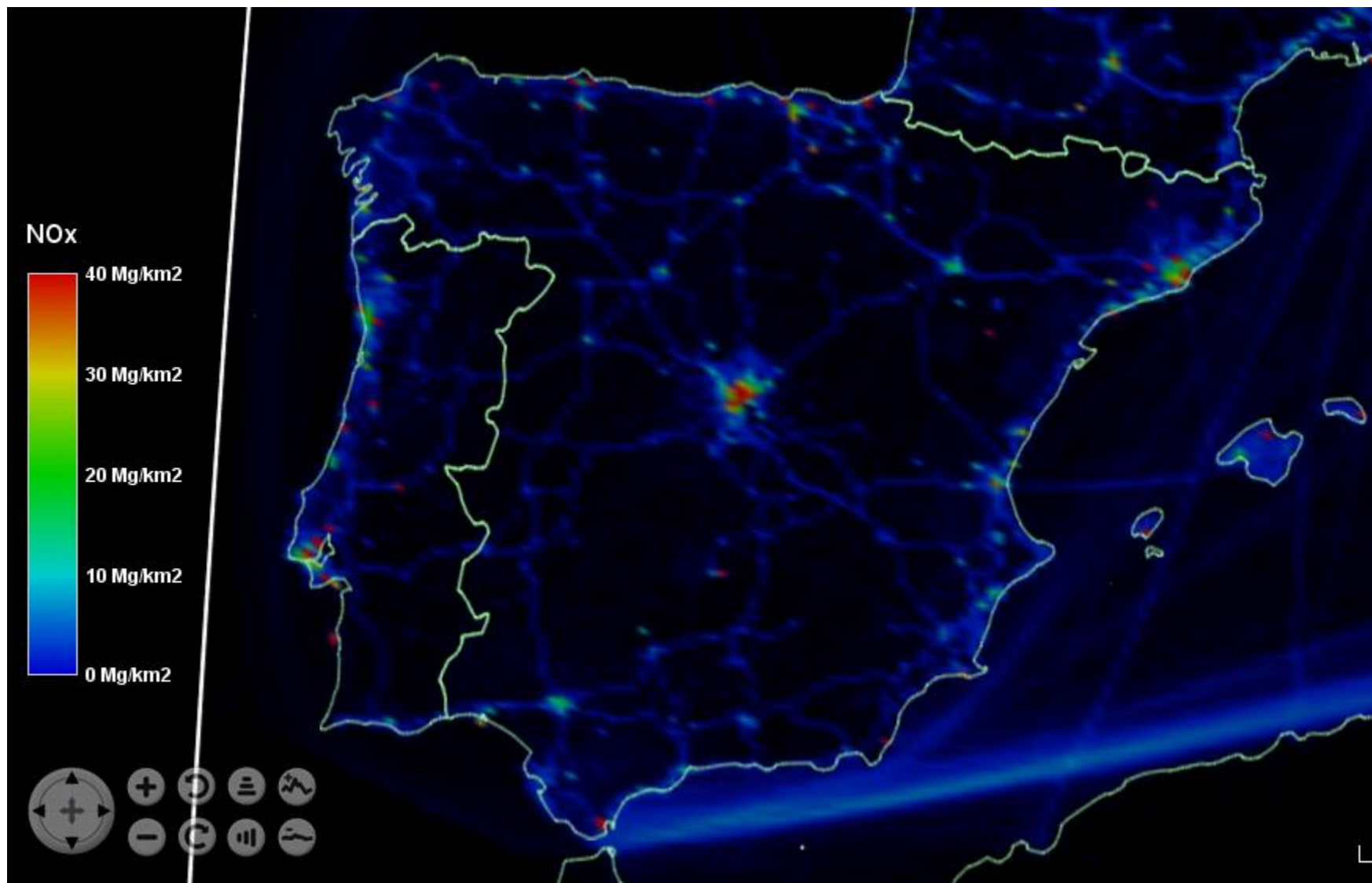
Total emission evolution



Total emission evolution

- No reductions (with 2015 data) required for NO_x in Spain to comply with ceilings for period 2020-2029
- NO_x reductions required to comply NEC directive for 2030:
 - ✓ 44% respect to 2010 emissions
 - ✓ 34% respect to 2015 emissions

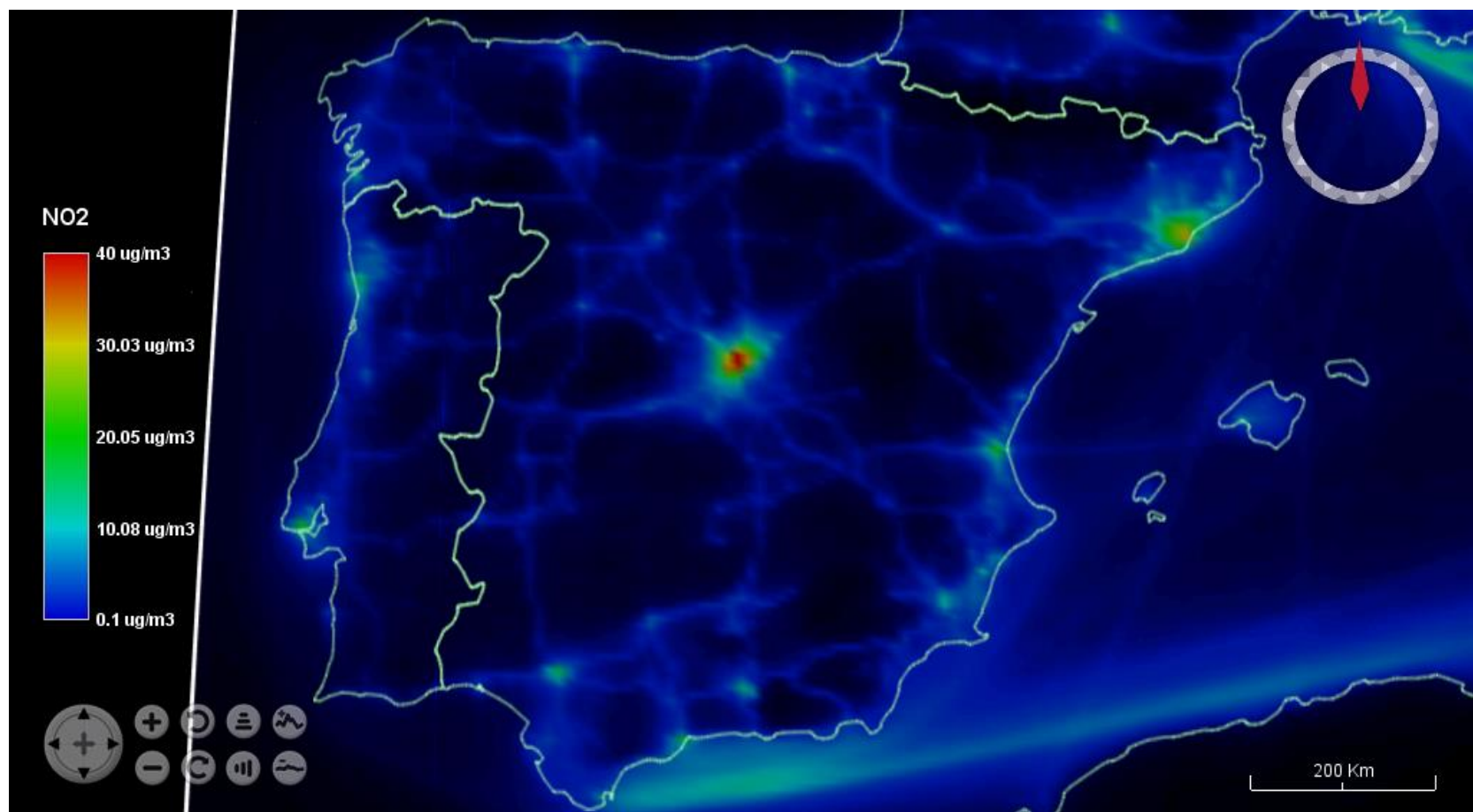
NOx emission map for 2010



NO₂ concentration (annual mean) in 2010

SHERPA

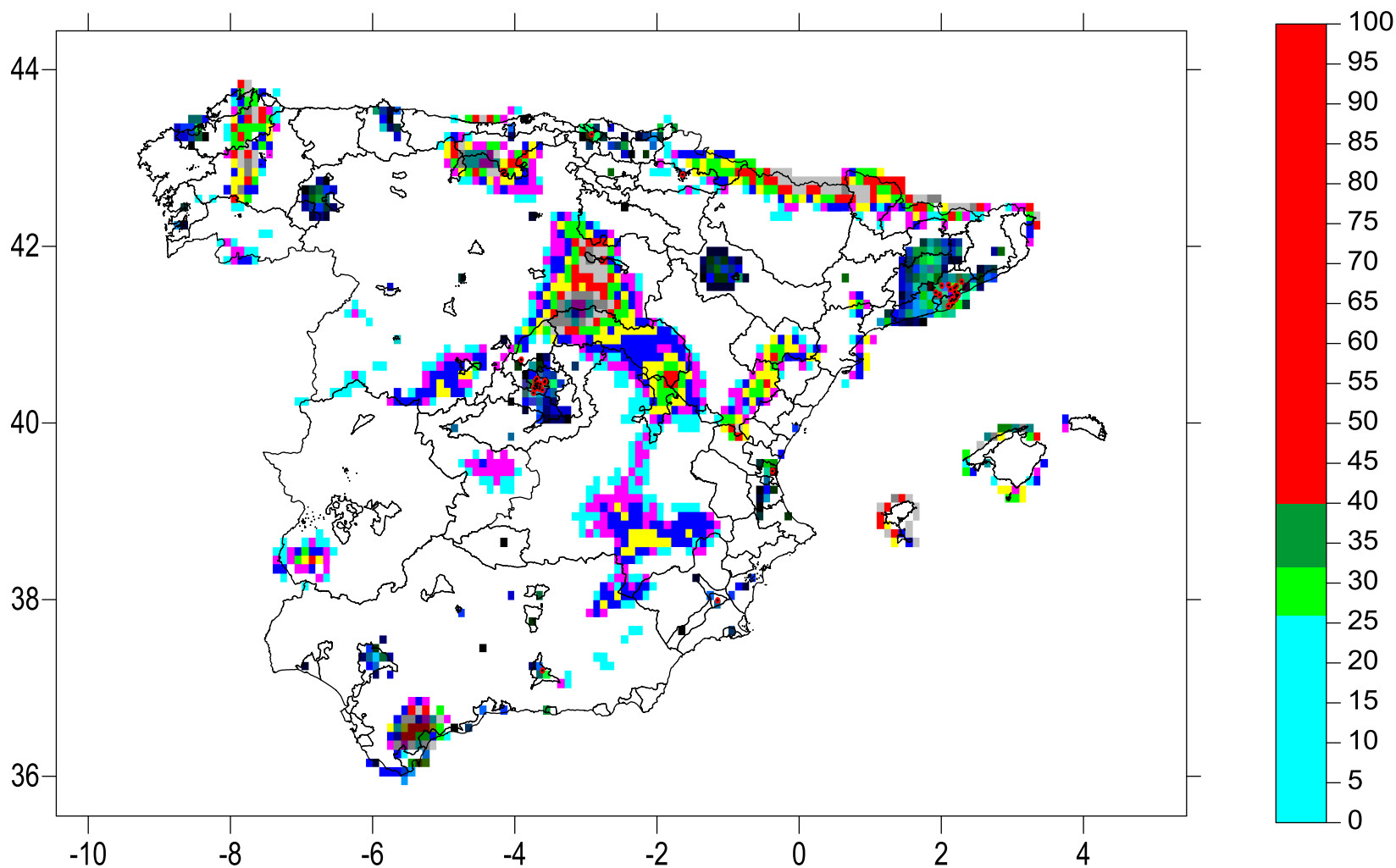
- Exceedances of limit value (40 µg/m³) in large cities.



NO₂ concentration (annual mean) in 2010

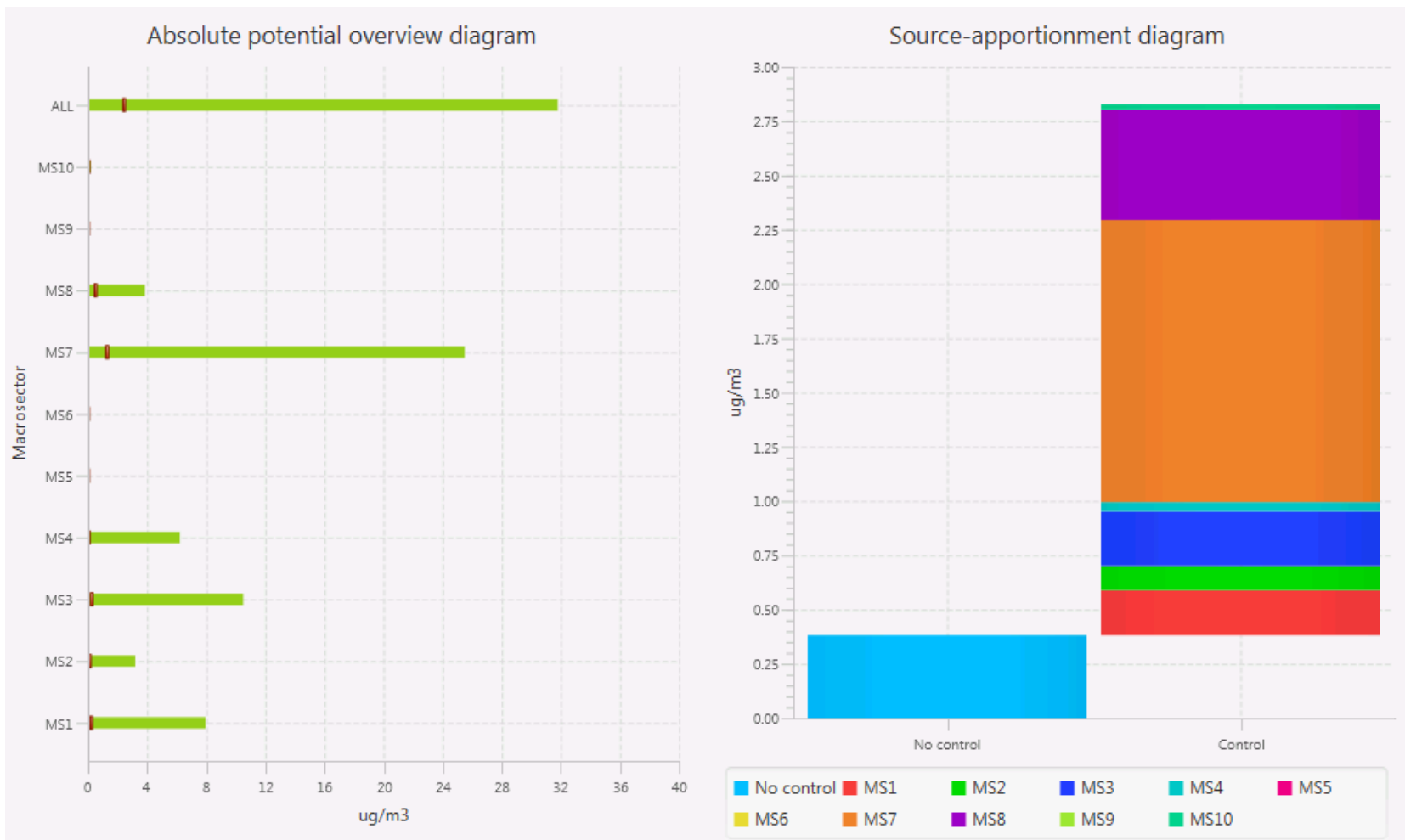
CHIMERE+Observations

Air quality assessment map done by CIEMAT for Spanish Environment Ministry



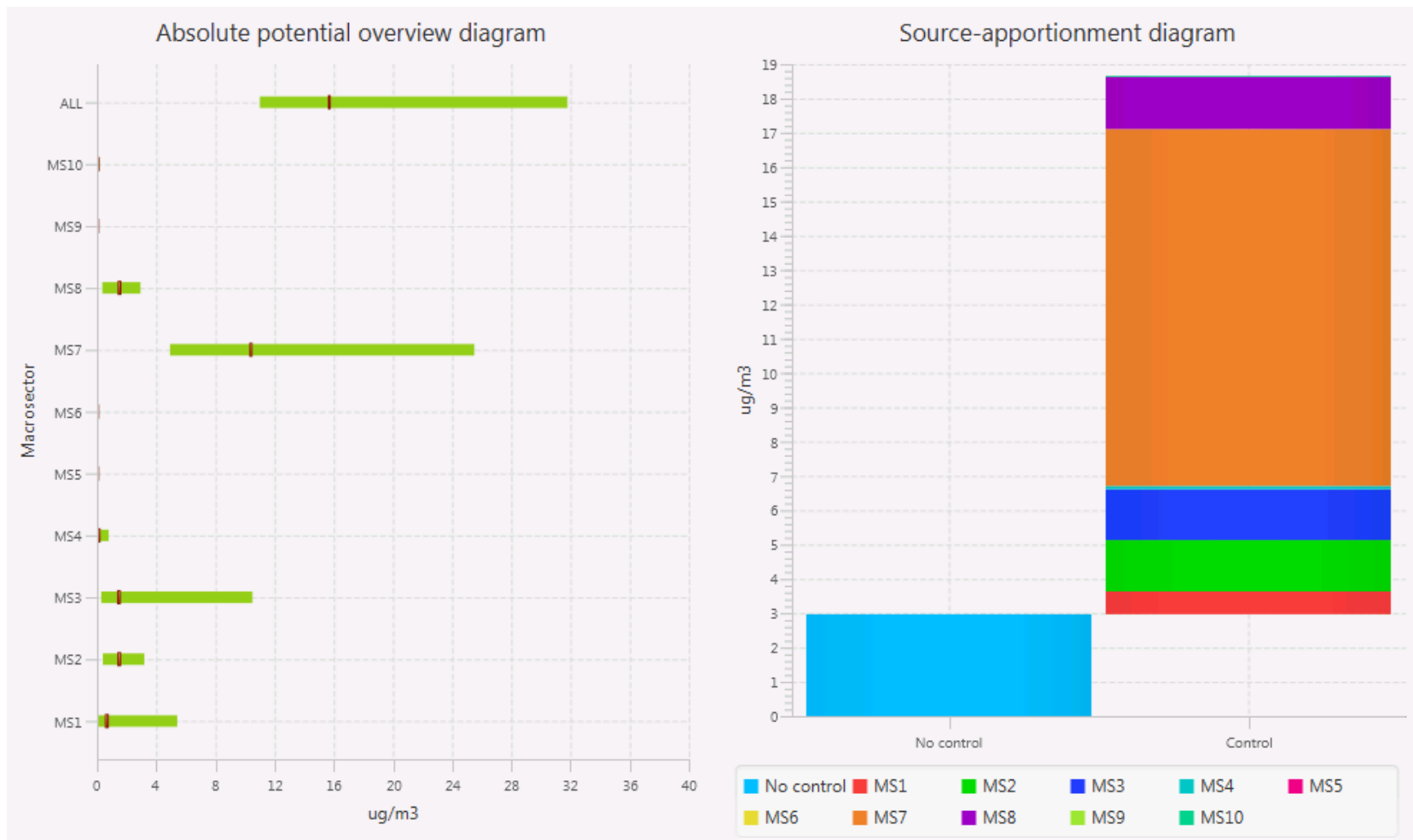
SHERPA: NOx source apportionment

- All data

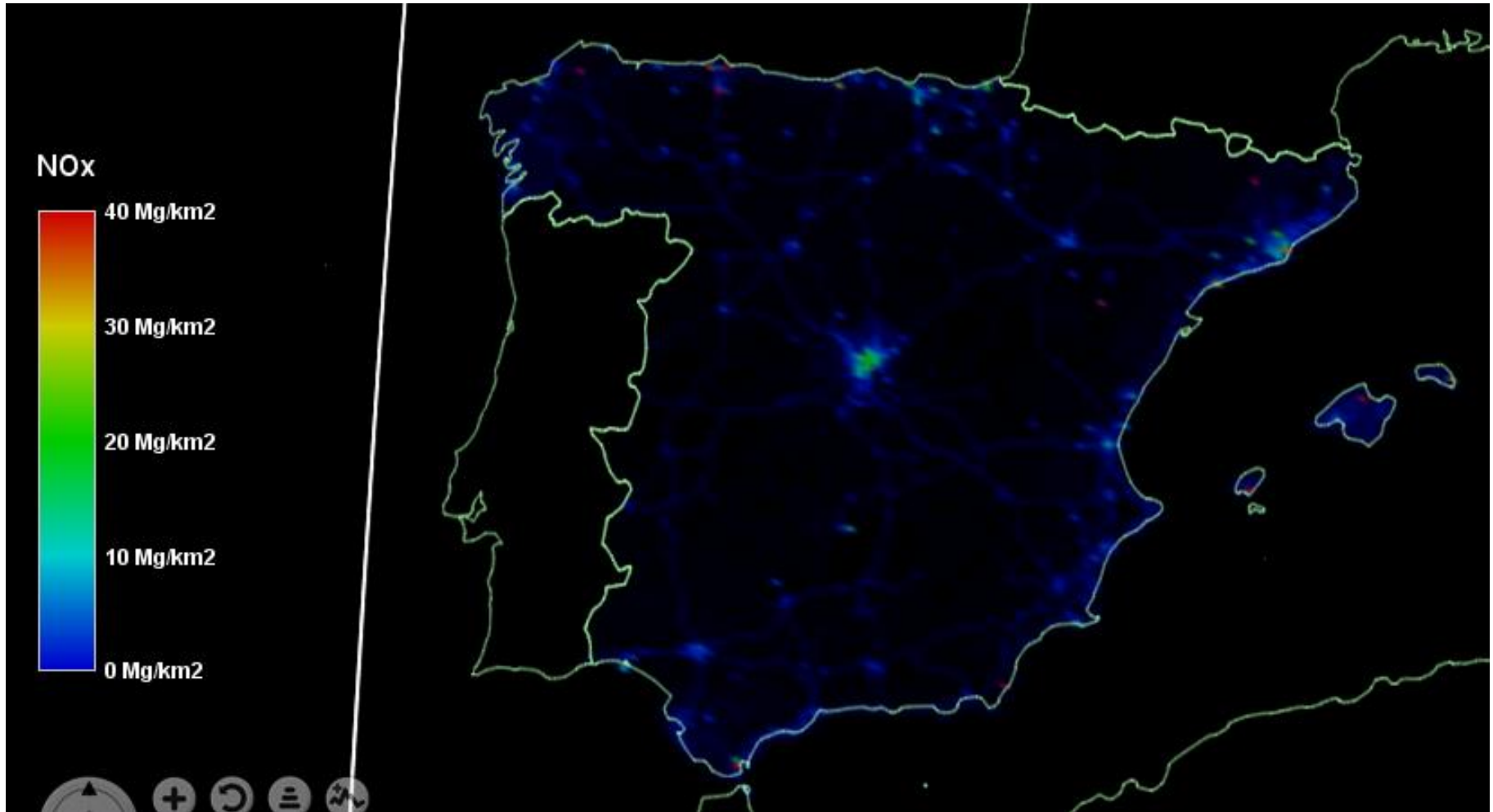


SHERPA: NOx source apportionment

- Percentile 99

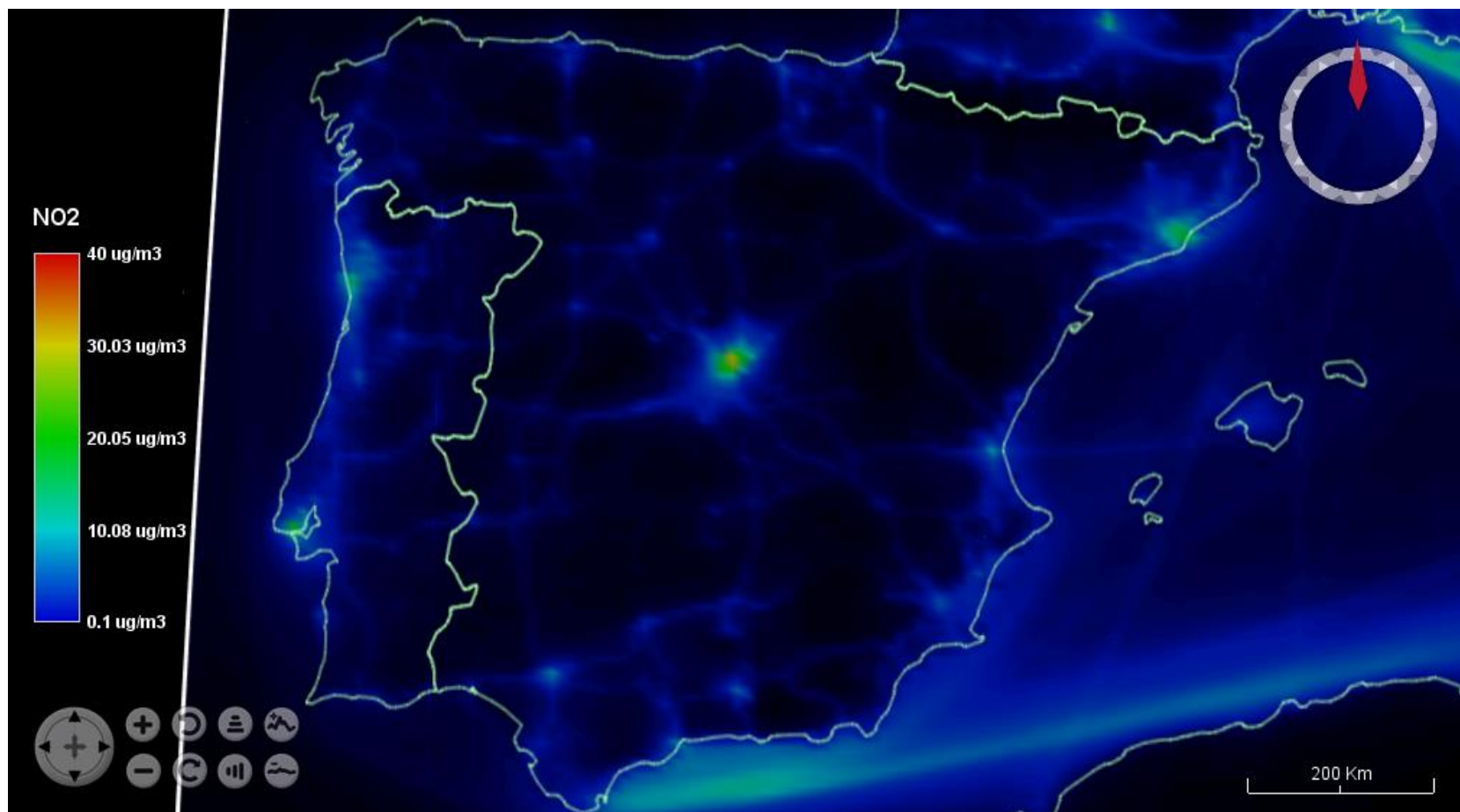


Delta of NOx emissions for 44% reduction for all sectors



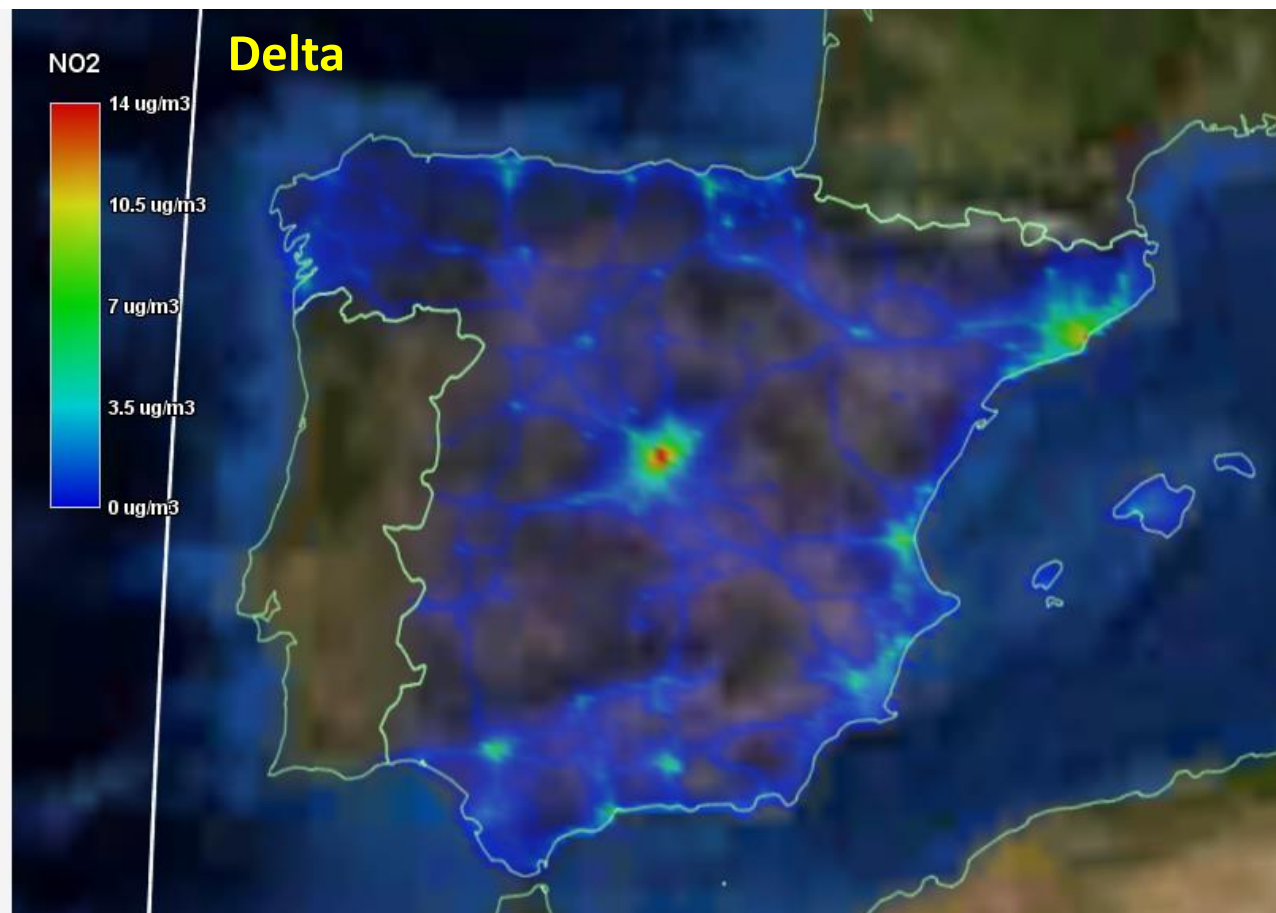
Impact on NO₂ concentrations

- Reduction of annual mean of NO₂ concentration expected for 2030 when reducing NO_x by 44% for all sectors (respect to 2010)
- **Important reduction of areas exceeding the annual limit value for NO₂.**



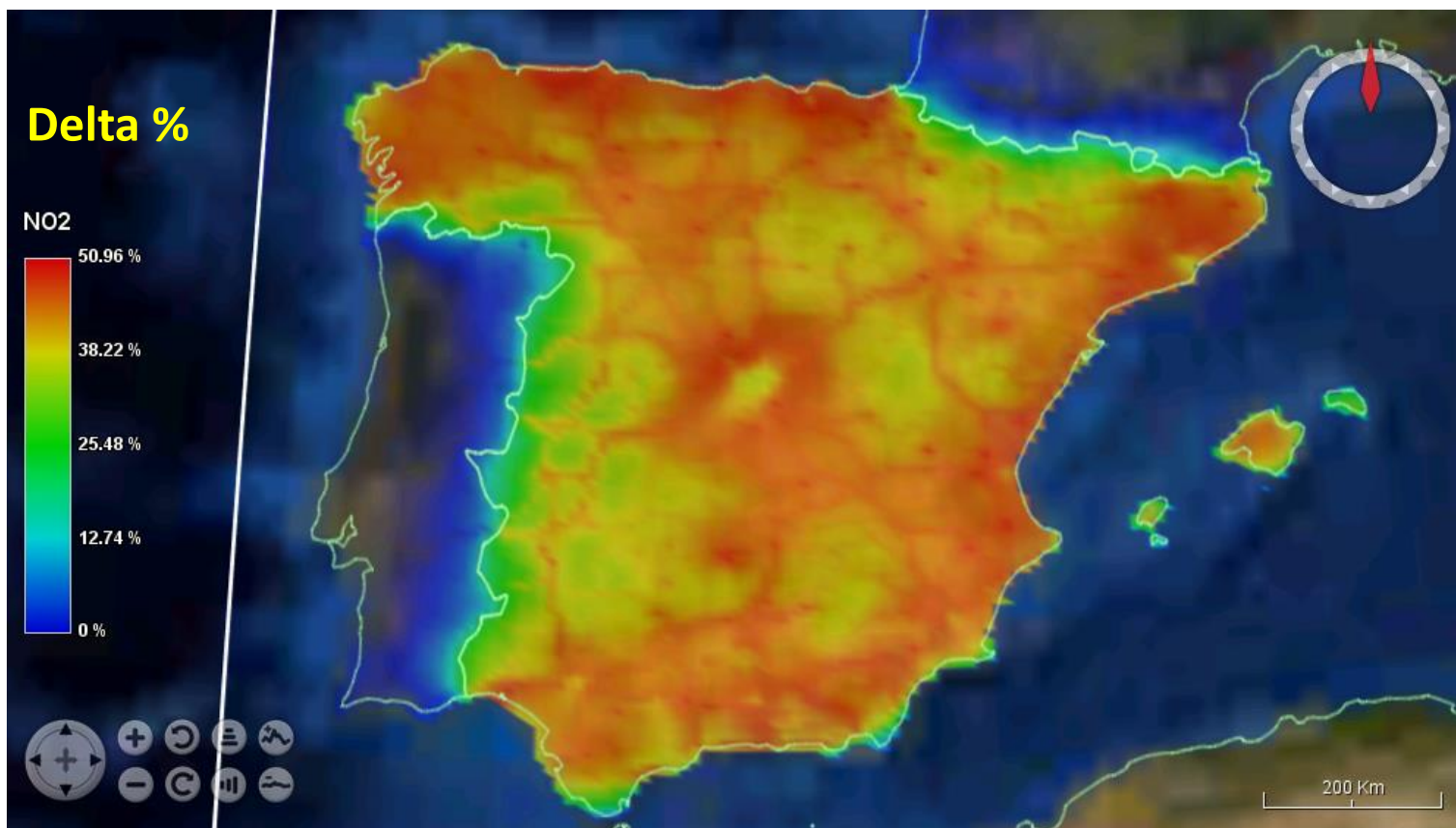
Impact on NO₂ concentrations

- Reduction of annual mean of NO₂ concentration expected for 2030 when reducing NO_x by 44% for all sectors (respect to 2010)
- Maximum delta of annual concentrations **14 μg/m³**



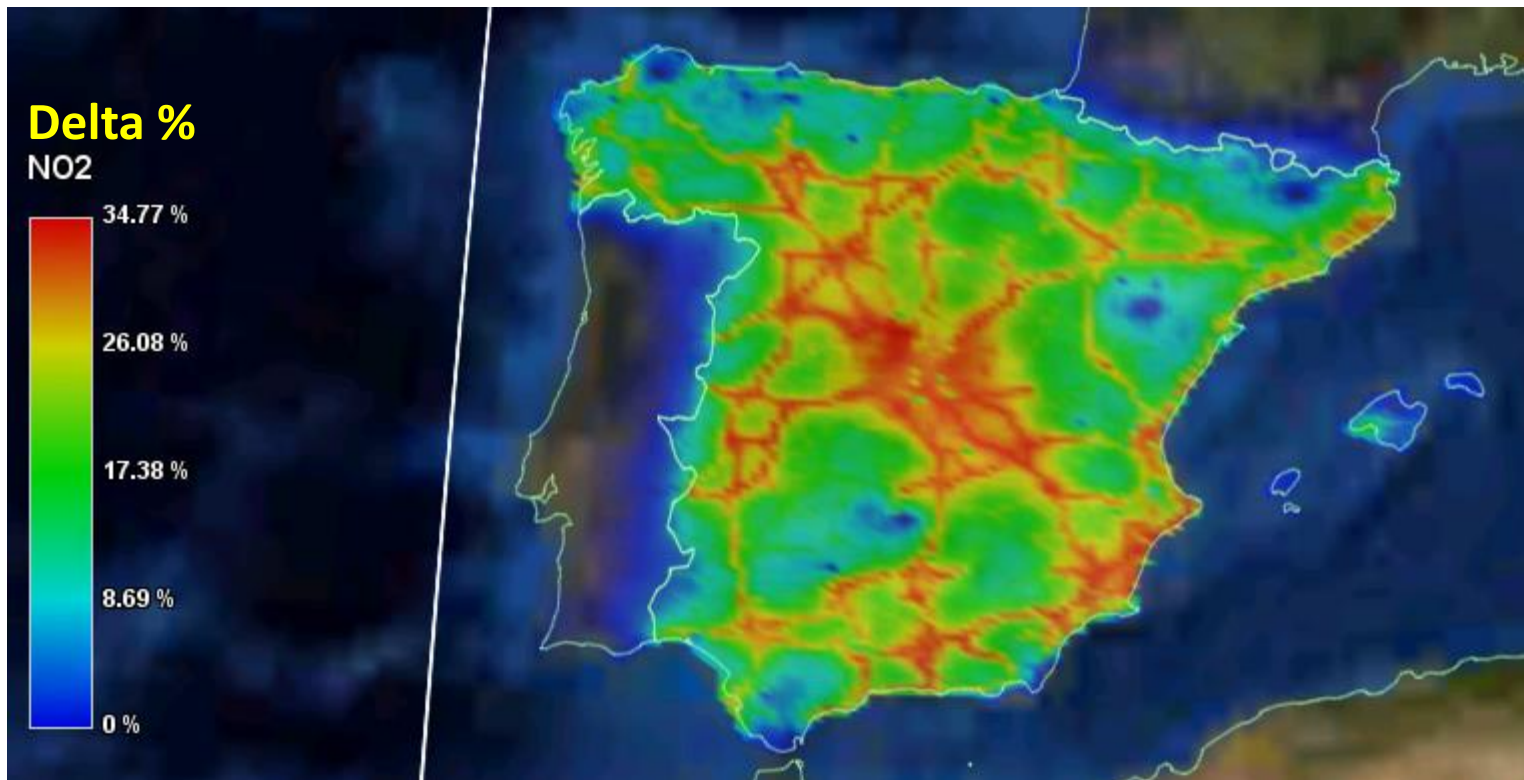
Impact on NO₂ concentrations

- Reduction of anual mean of NO₂ concentration expected for 2030 when reducing NO_x by 44% for all sectors (respect to 2010)
- Maximum concentrations change **50%**



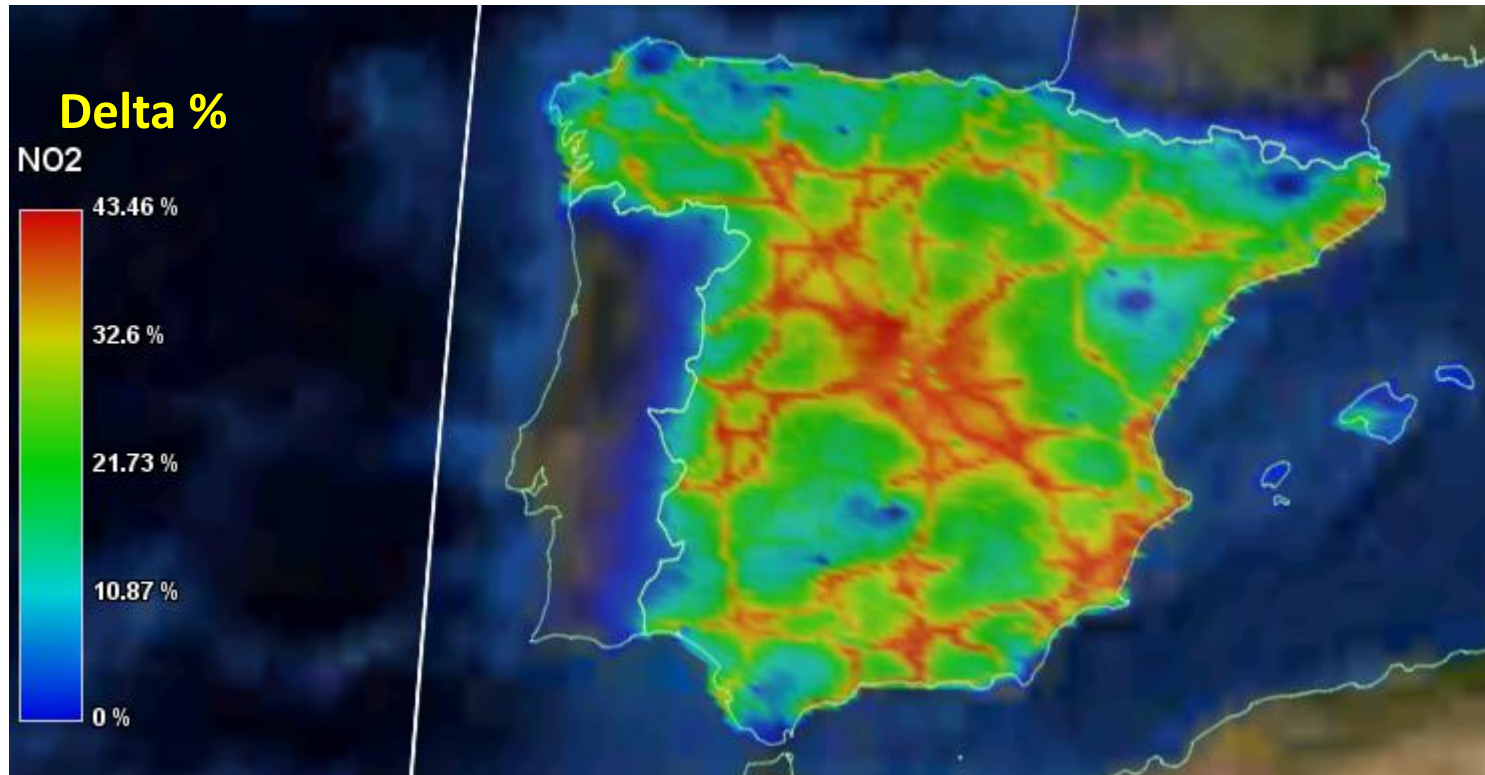
Some results of reductions by sectors

- Applied reduction to single sectors keeping the others without change.
- SNAP 7 (traffic) has the largest impact. Reducing NO_x emission by 44% implies to reduce maxima of annual mean of NO₂ concentration by **11.21 µg/m³**, which is 80% of the reduction when all SNAPs are reduced by 44%.



Some results of reductions by sectors

- If a SNAP 7 (traffic) emission of NO_x is reduced by 55%, the maxima of annual average of NO₂ concentration by **14 µg/m³**, which is the same result when reducing total emissions by 44%.
- Expected result because we are reducing where the maxima concentration are.



Difficulties found and some suggestions

- SHERPA emissions: 2010 while NEC Directive is based on 2005 emissions. It would be easier to study scenarios referred to NEC Directive if SHERPA had the option to use 2005 as a base year.
- It took us a while to find out what the macro sectors used in SHERPA (MS1, MS2..) represented. It turns out they are SNAPS but this is not explained anywhere
- It would help if SHERPA could provide total national emissions in order to check e.g. that the simulation complies with the Directive
- No option of changing the names of the saved output files and some errors in the NetCDF output (e.g. coordinate units in “%”)
- Reduction are given with positive values, so we can't know at first is there is reduction or gain

Next work

- Study scenarios for specific SNAPs
- Study other pollutants of NEC directive, (when available)
- Coupling with RIAT+ to evaluate emission reduction strategies
- Run CHIMERE for a chosen scenario to evaluate SHERPA results
- Run CHIMERE for Spain, $\sim 5 \text{ km}^2$ resolution, for another year (2015) to have a new base (in collaboration with JRC)

Thank you