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The LEO model

combining a plume and grid model for the Netherlands

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RIVM[1] and TNO[2] collaboration

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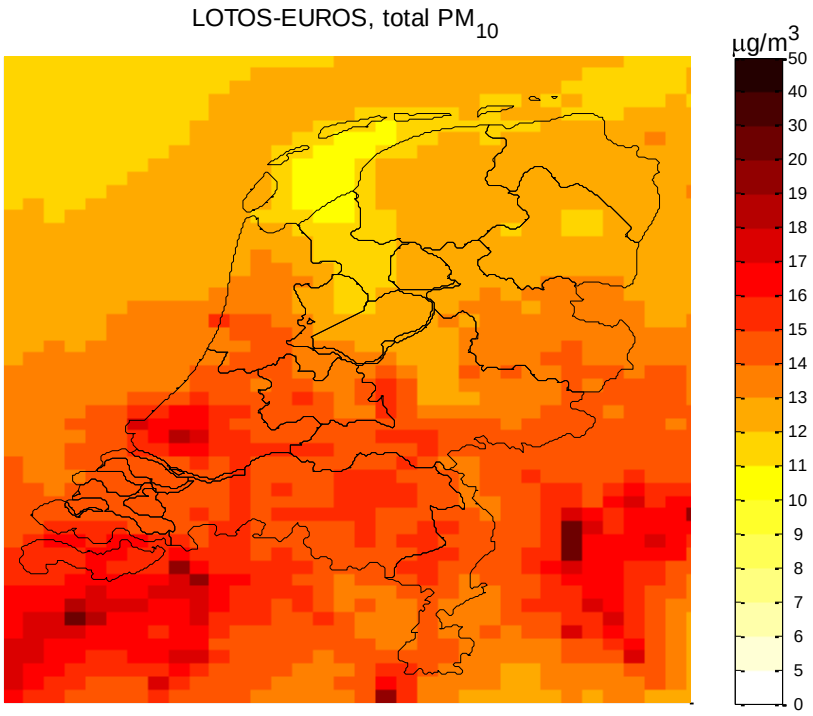

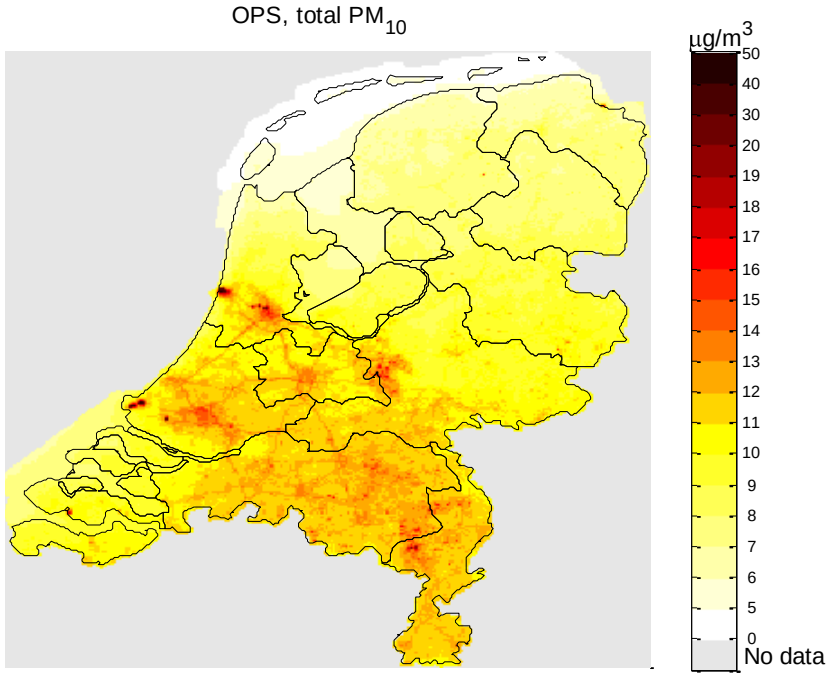

LEO = combination of **L**otos-**E**uros and **O**PS calculations

This talk: LE and OPS calculations are performed separately

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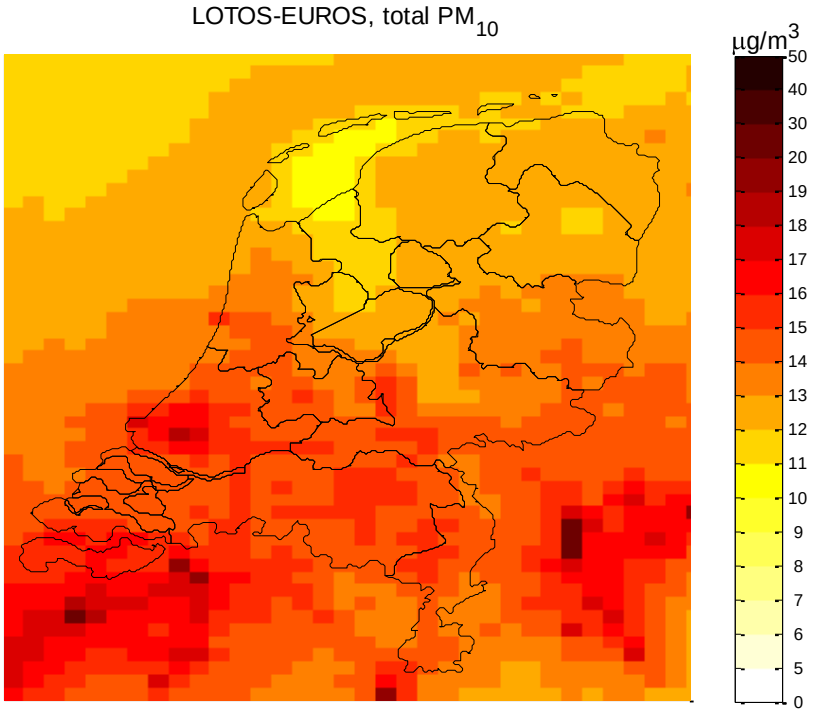

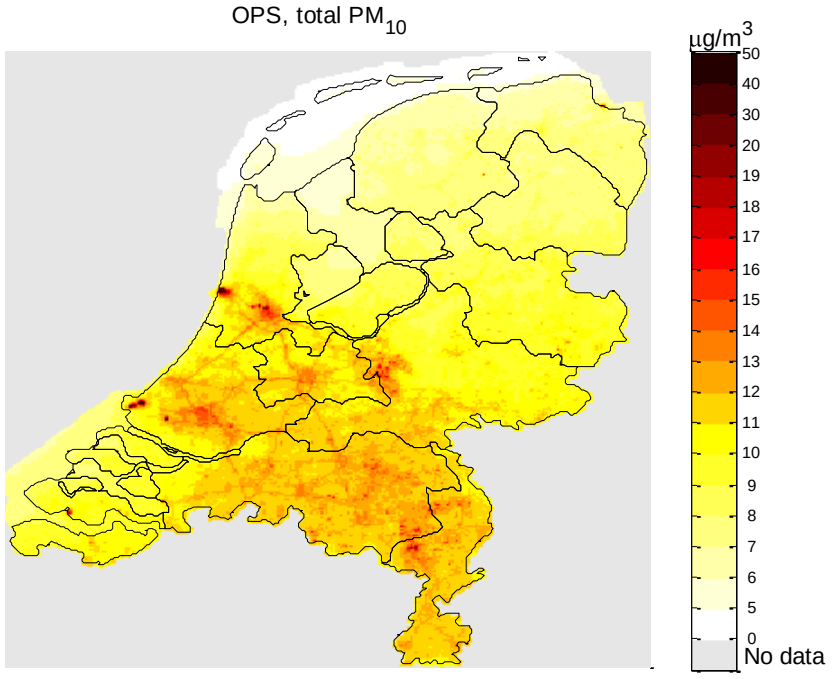

LEO = combination of **L**otos-**E**uros and **O**PS calculations

PinG = **P**lume **in** **G**rid

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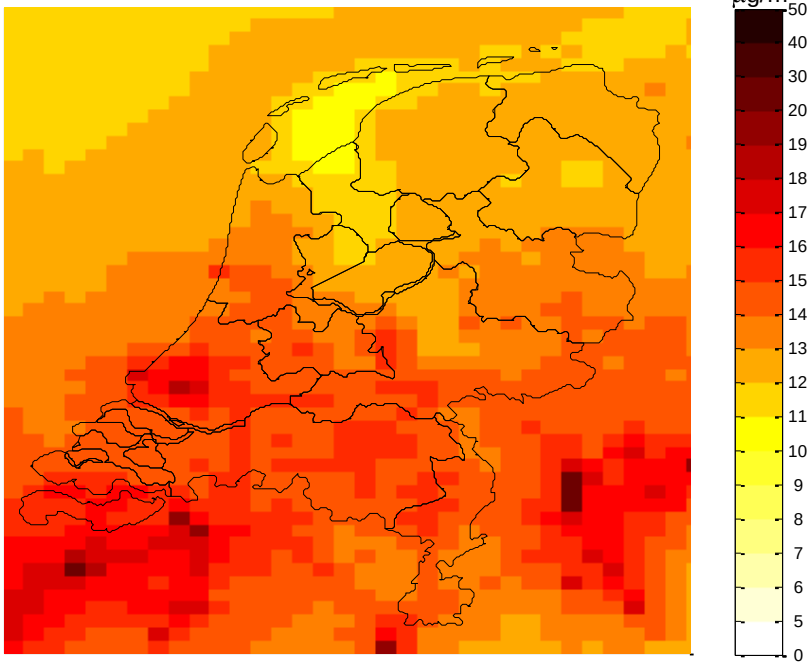
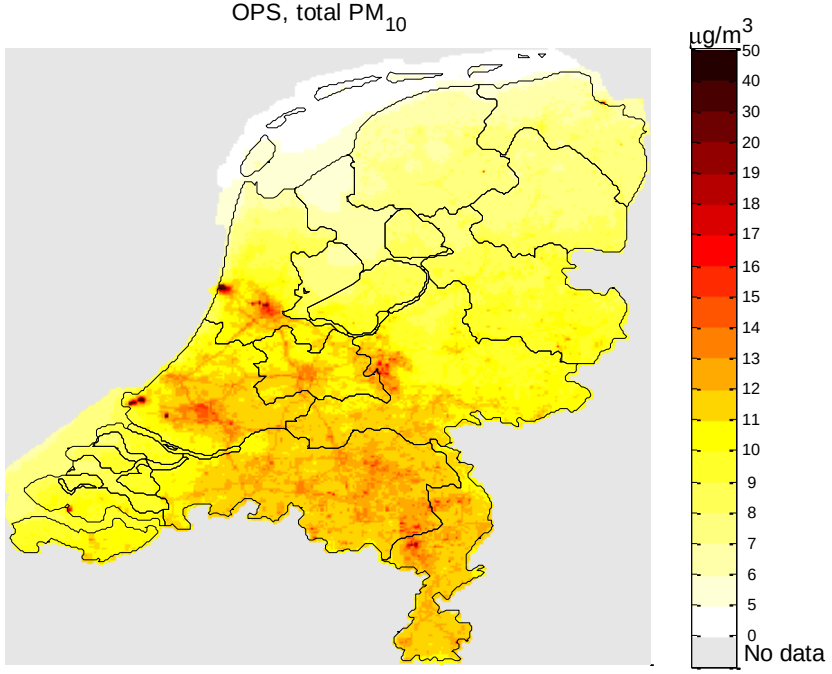
LOTOS-EUROS, total PM_{10}



OPS, total PM_{10}



<u>Concentrations of pollutants in the Netherlands:</u>

Lotos-Euros: concentrations from emissions abroad

OPS: concentrations from emissions in the Netherlands

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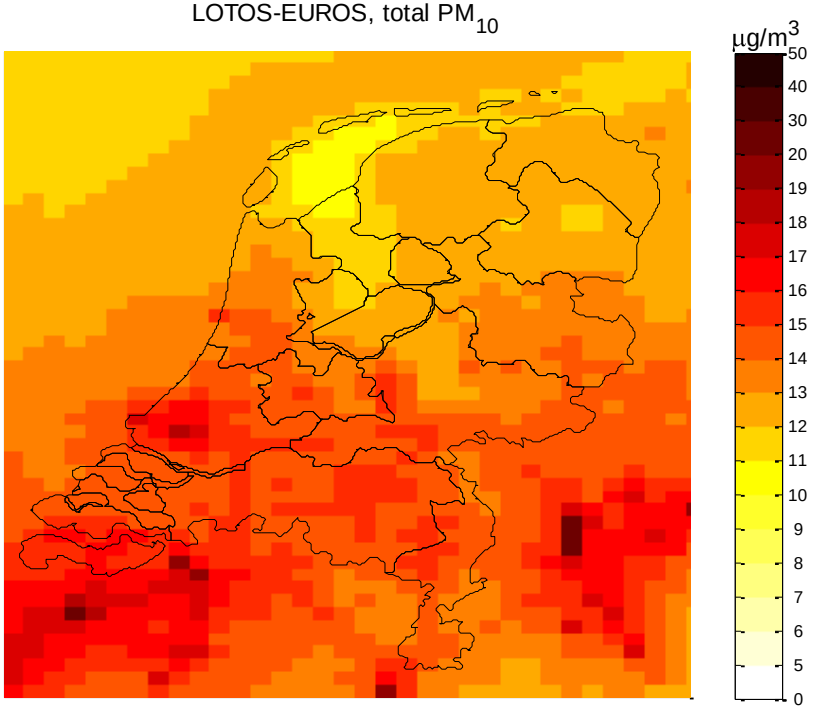
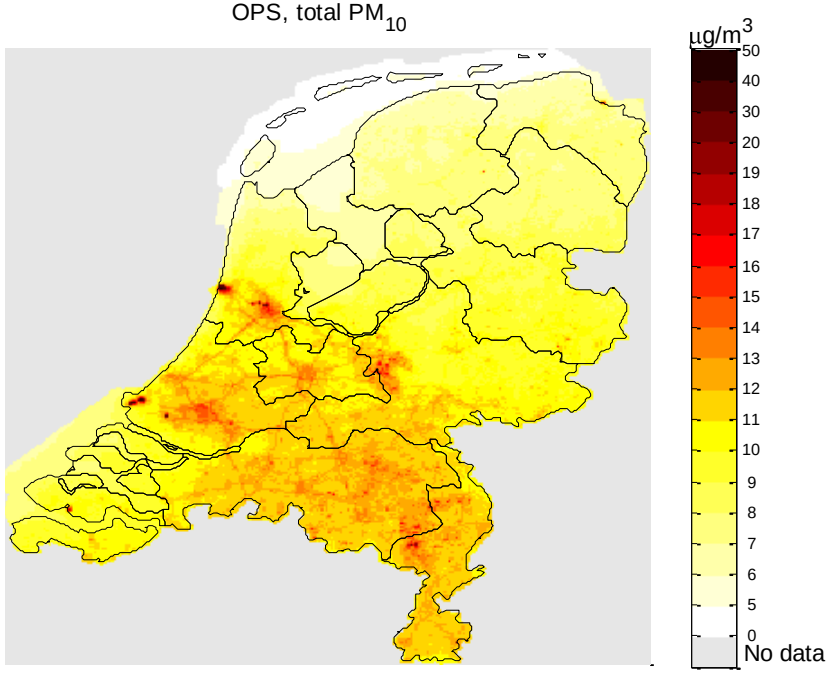
LOTOS-EUROS, total PM_{10}



OPS, total PM_{10}



WHY???

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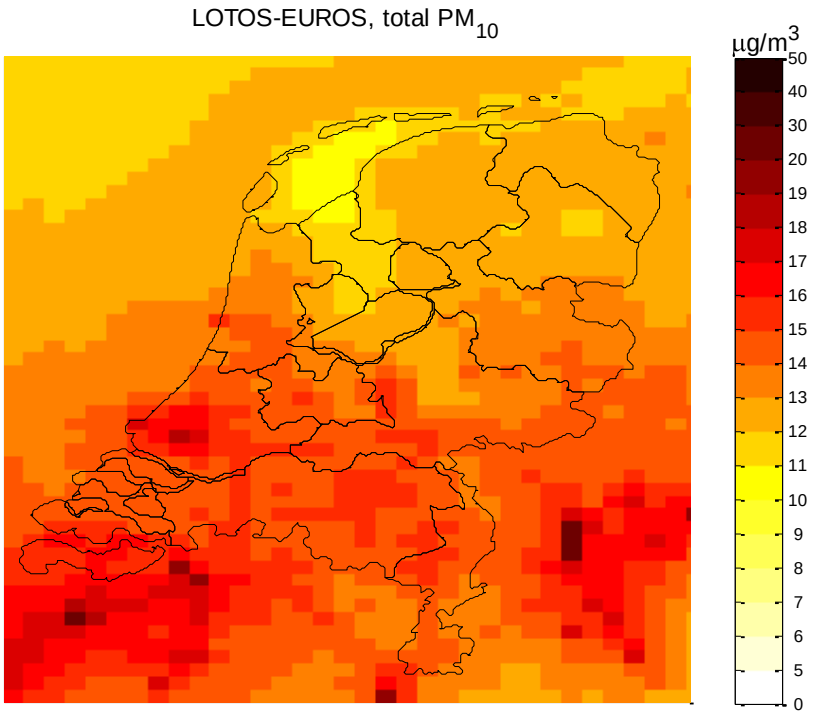

Contribution to the concentration in the Netherlands from emissions abroad is taken from the *LOTOS-EUROS* model:

- state-of-the-art chemistry scheme
- representative large scale transport
- 9 x 7 km^2

WHY???

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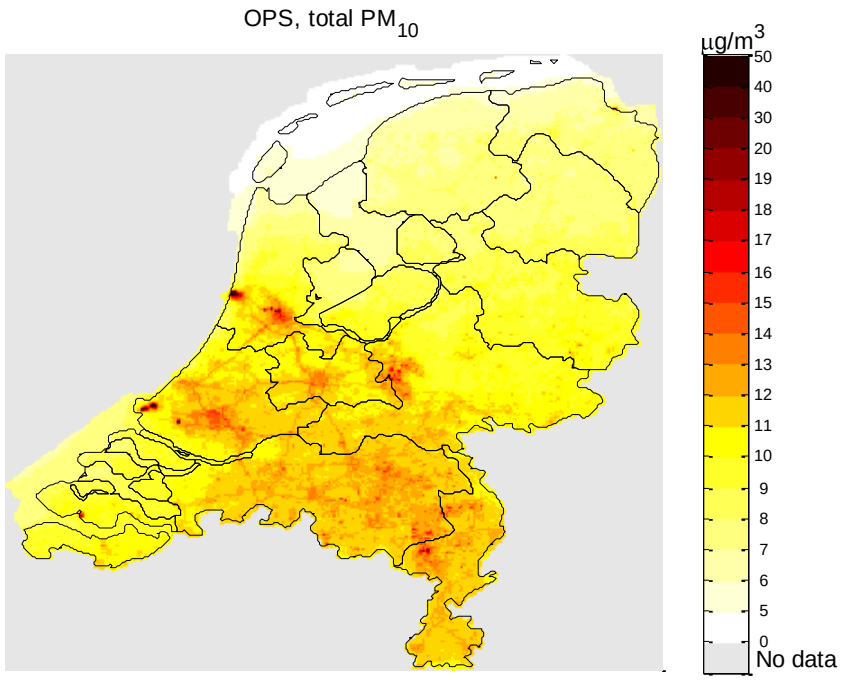
Contribution to the concentration in the Netherlands from Dutch emissions is taken from the *OPS* model:

- high resolution near sources

- 1 x 1 km^2



WHY???

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Contribution to the concentration in the Netherlands from Dutch emissions is taken from the *OPS* model:

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WHY???

HOW???

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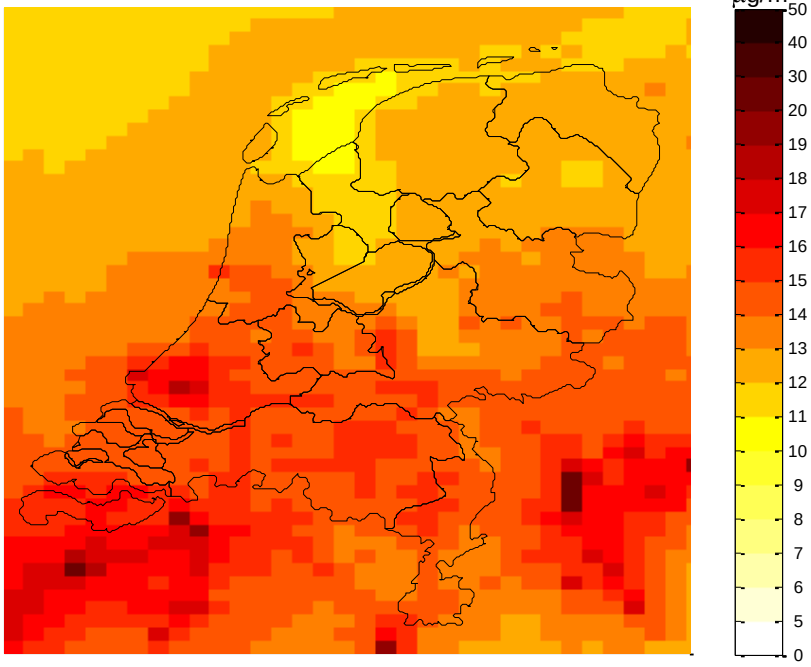
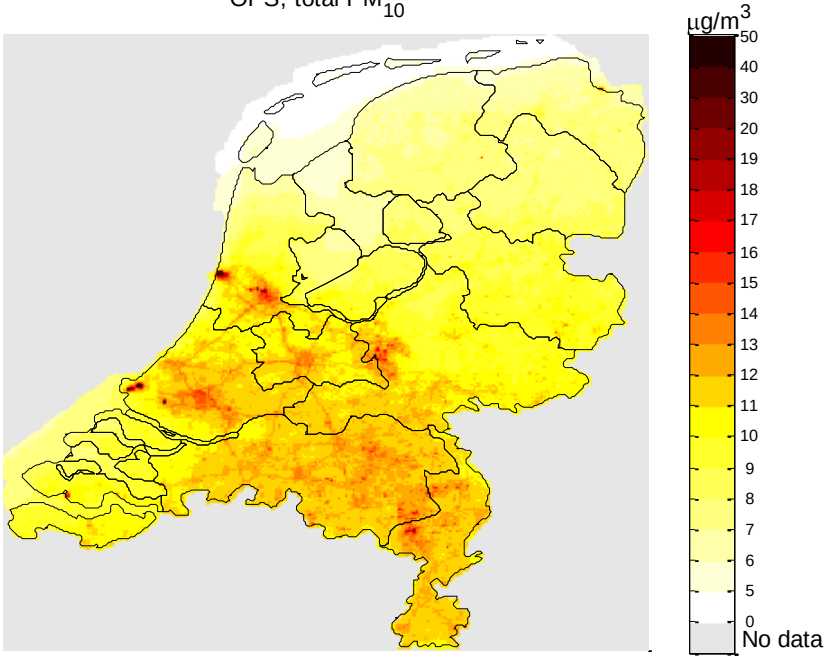
LOTOS-EUROS, total PM_{10}



OPS, total PM_{10}



<u>Concentrations of pollutants in the Netherlands:</u>

Lotos-Euros: concentrations from emissions abroad

OPS: concentrations from emissions in the Netherlands

HOW???

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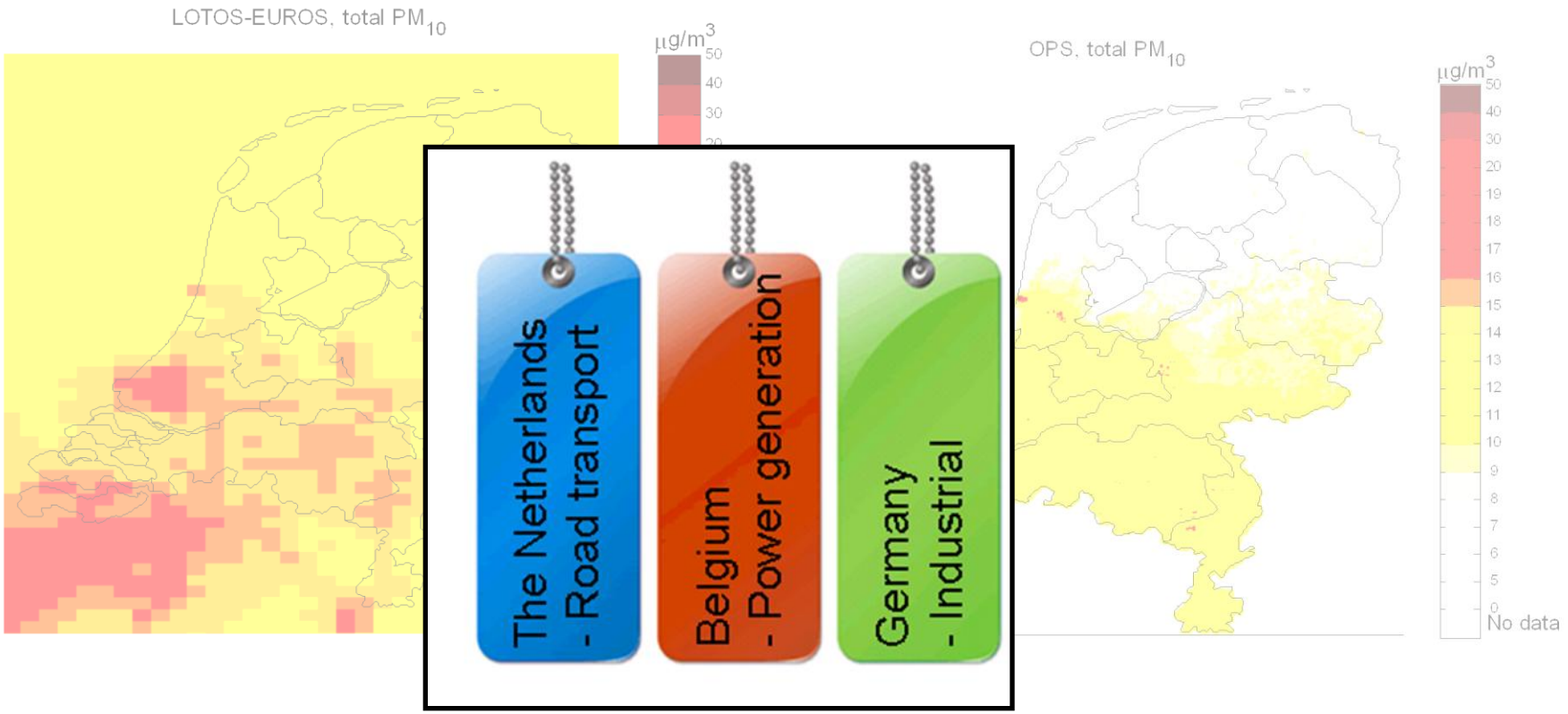

Both models have a source apportionment module, so we can perform simulations in which the Dutch emissions and the emissions from abroad are tagged.

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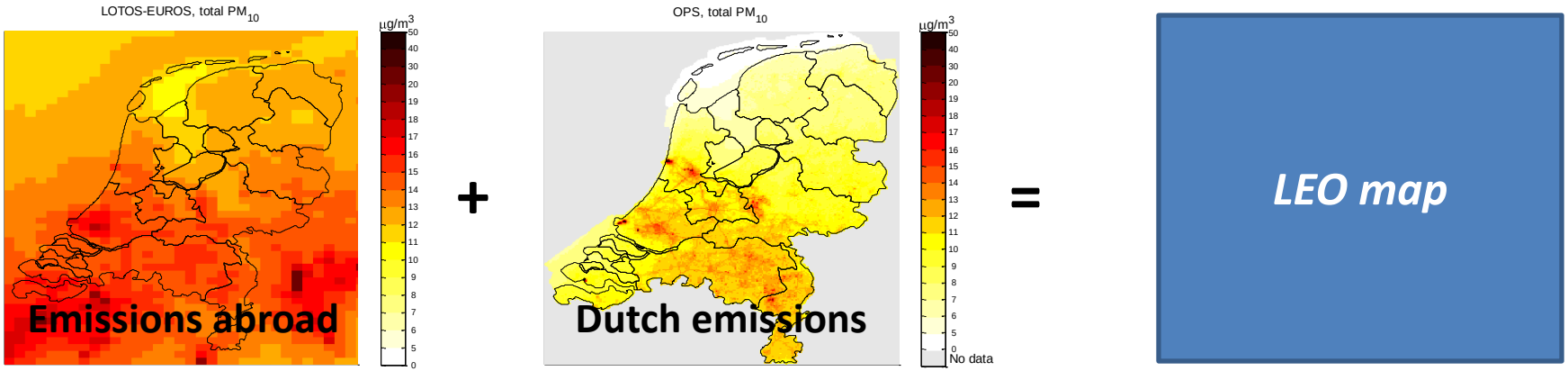
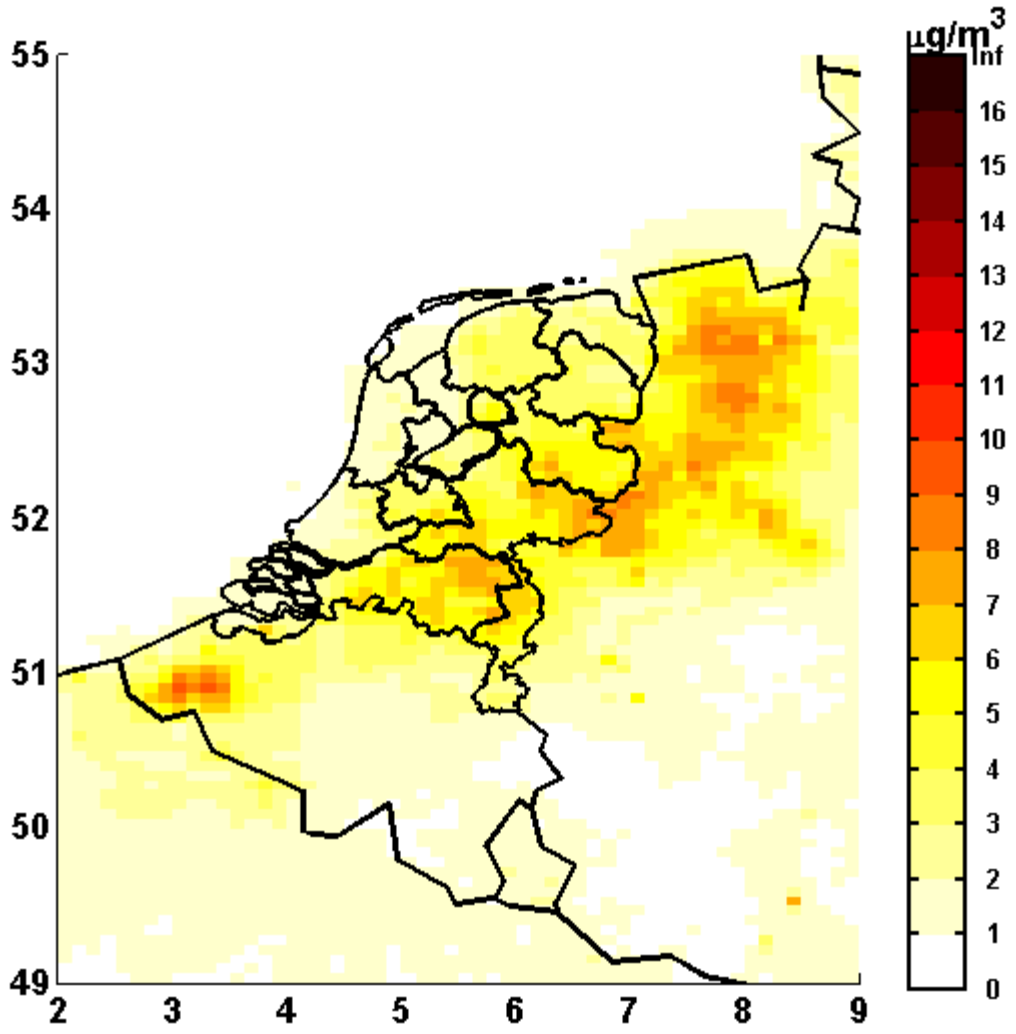
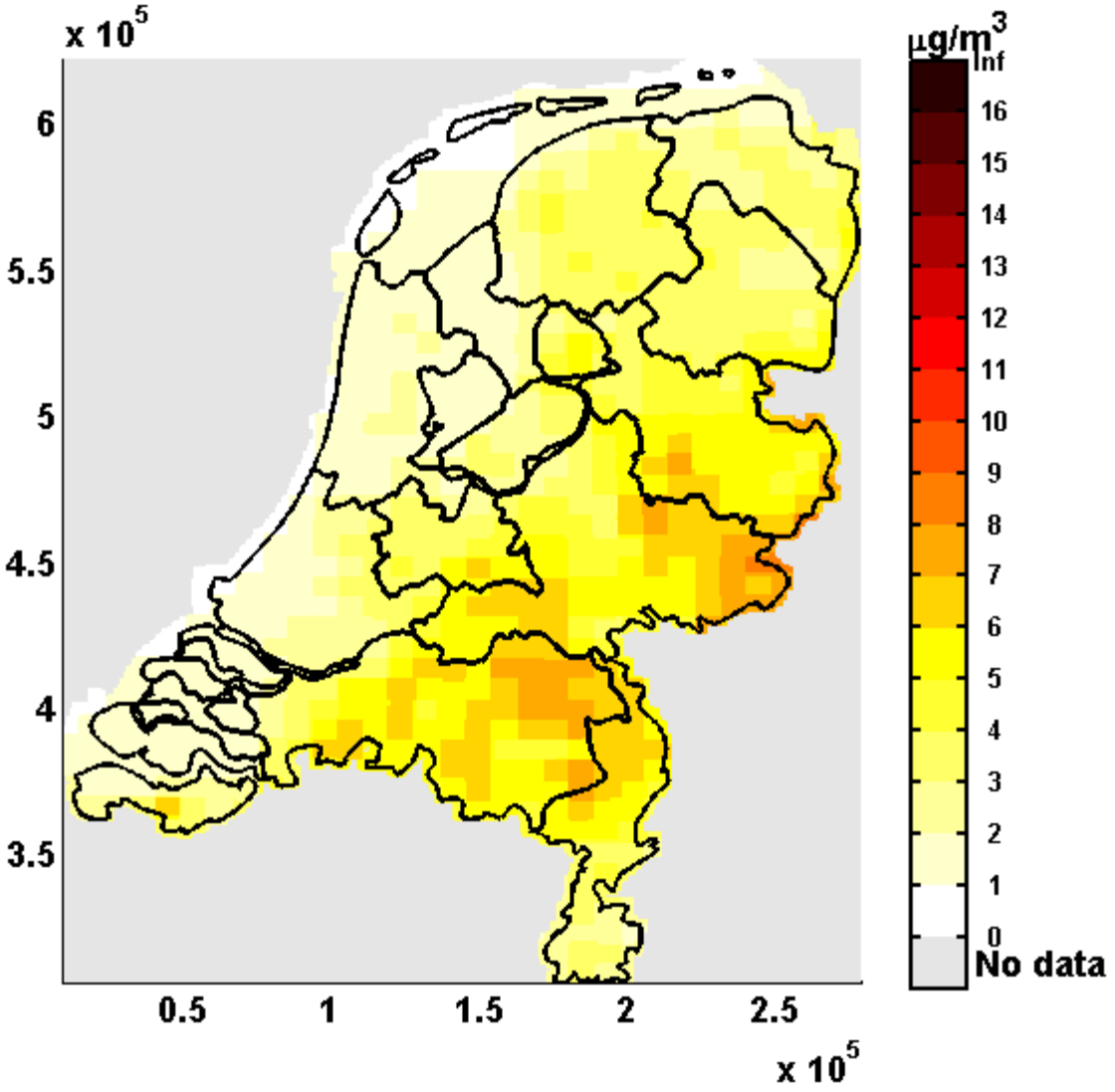


- Model calculations for 2007-2011 (same emissions)
- Results from Lotos-Euros, OPS and LEO
- Components NO_x, NO_2, PM_{10}, $PM_{2.5}$, EC, NH_3, SO_2
- Validation with measurements



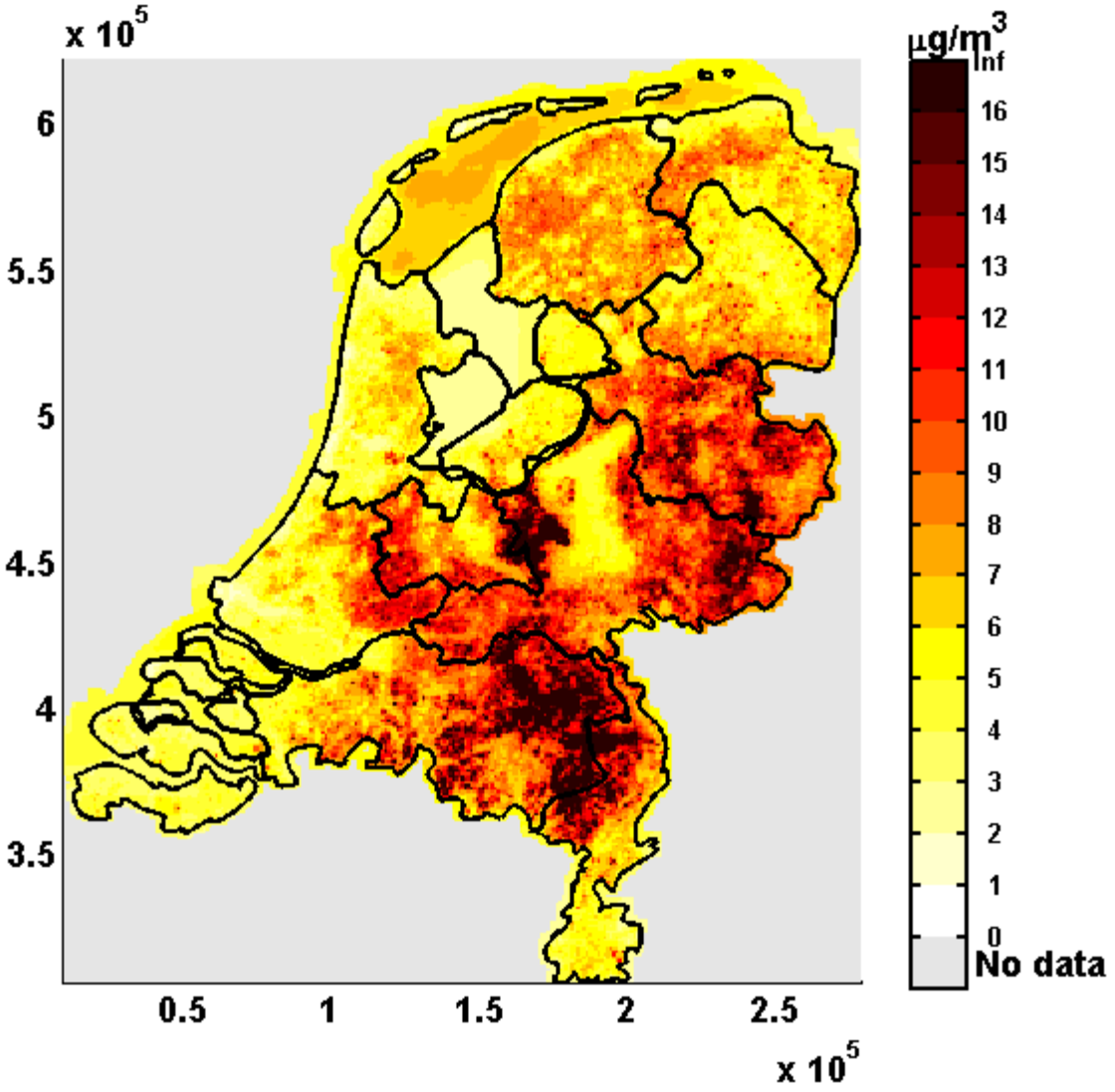
LOTOS
EUROS

Annual averaged NH_3 concentration for year 2009



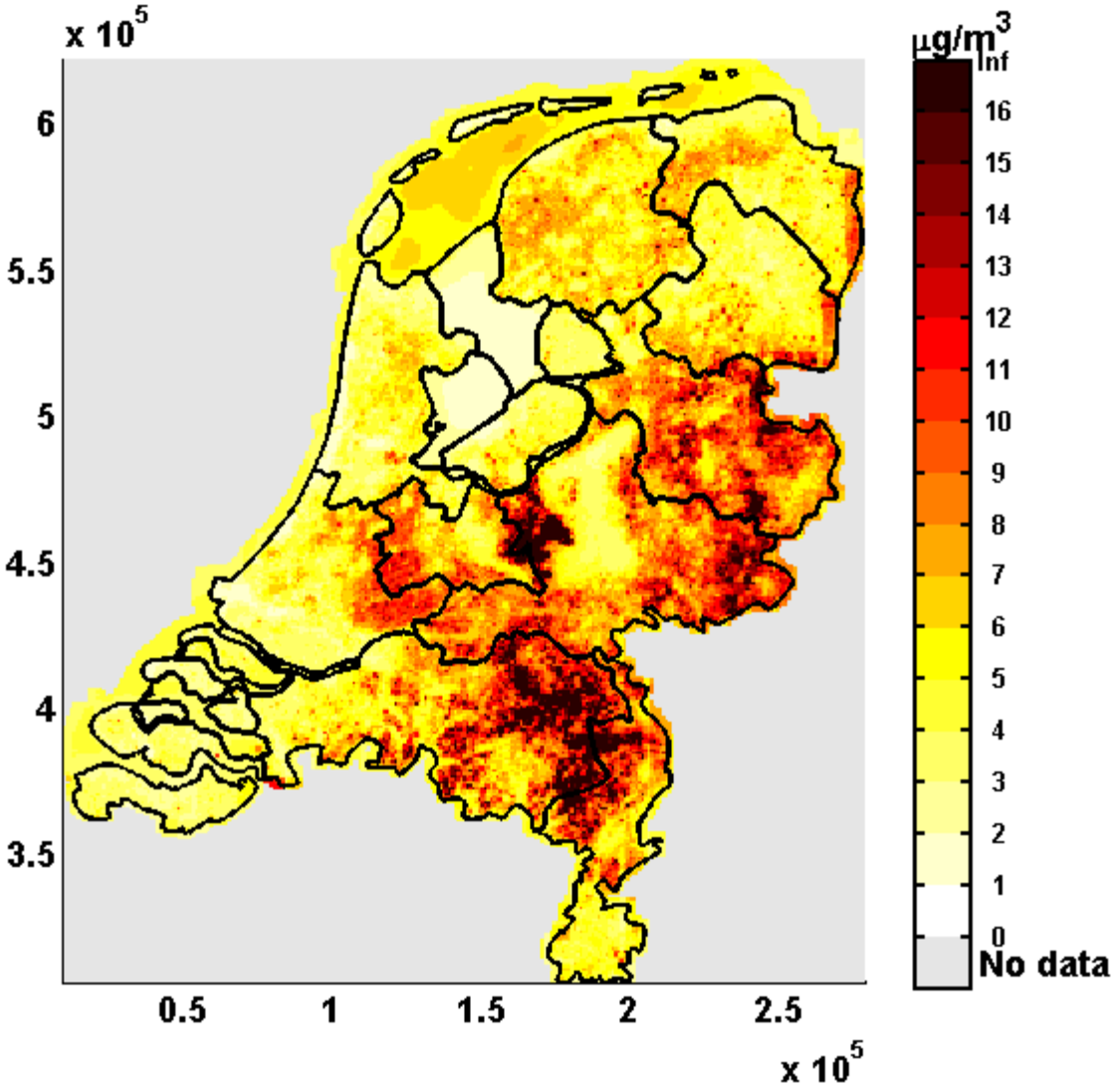
LOTOS
EUROS

Annual averaged NH_3 concentration for year 2009



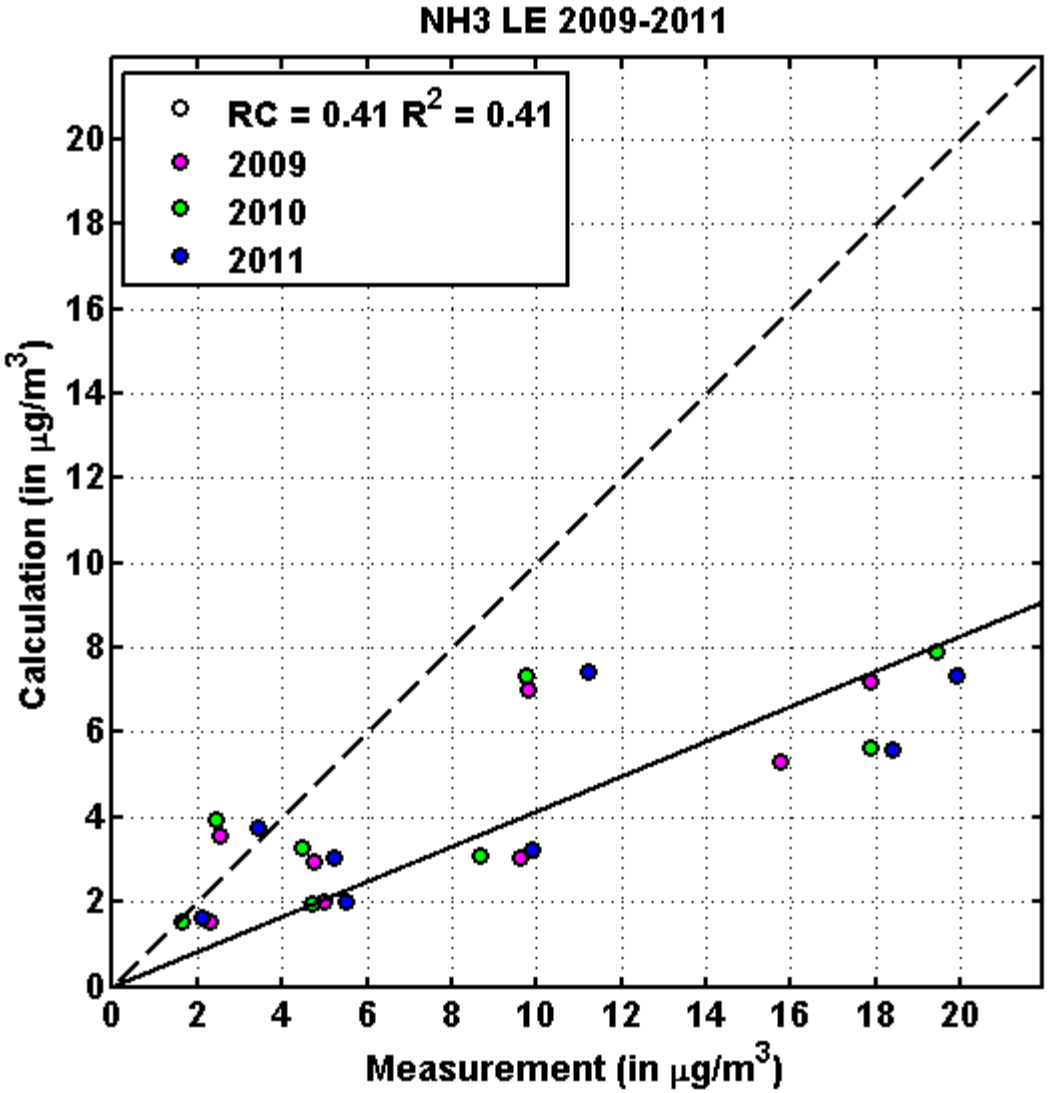
LEO

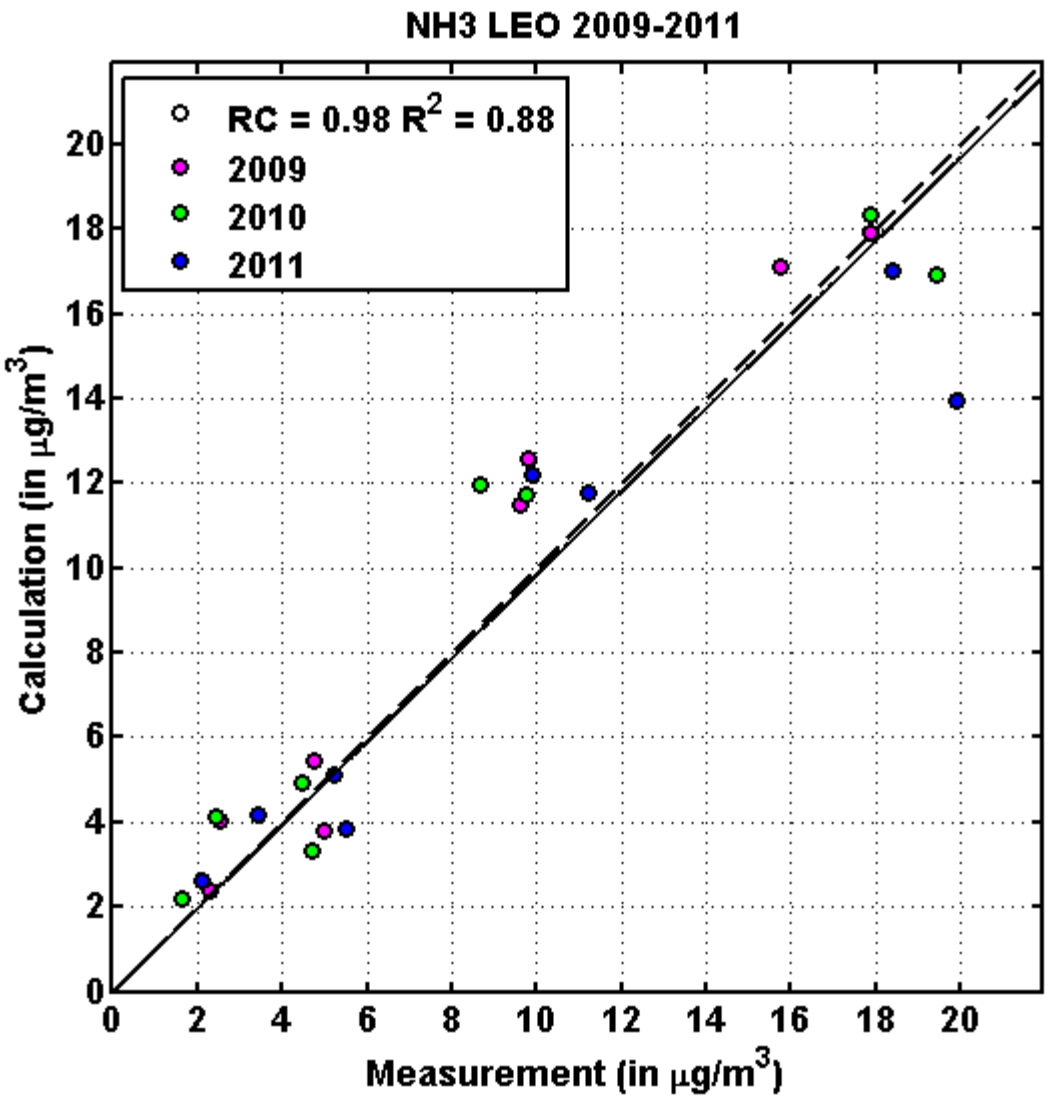
Annual averaged NH_3 concentration for year 2009

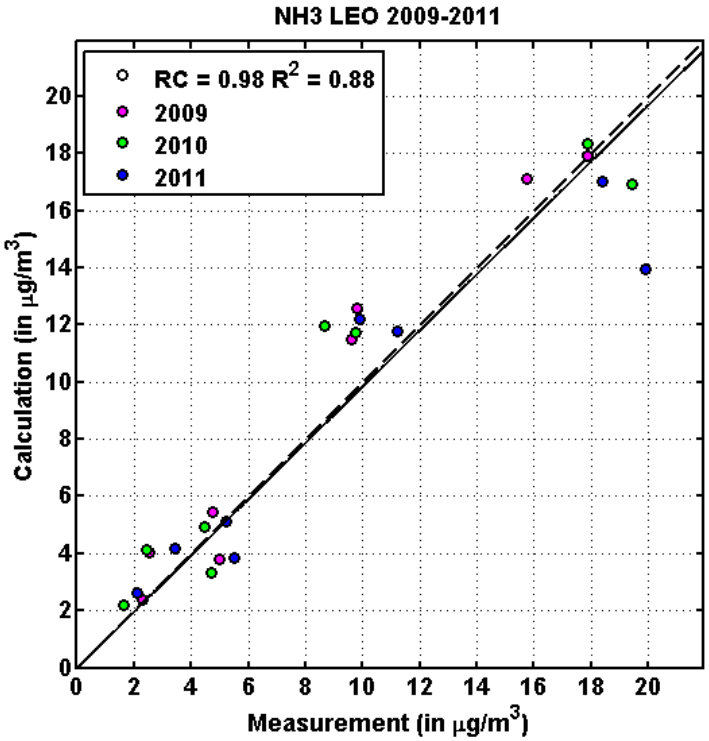


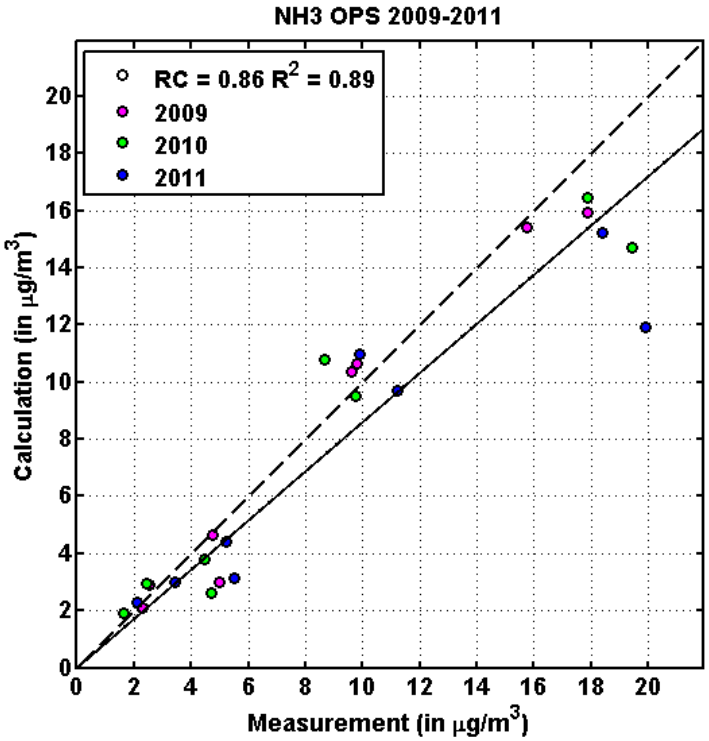
OPS

Annual averaged NH_3 concentration for year 2009


NH3 LE 2009-2011
RC = 0.41 R2 = 0.41
2009
2010
2011
Calculation (in µg/m3)
Measurement (in µg/m3)
0
2
4
6
8
10
12
14
16
18
20

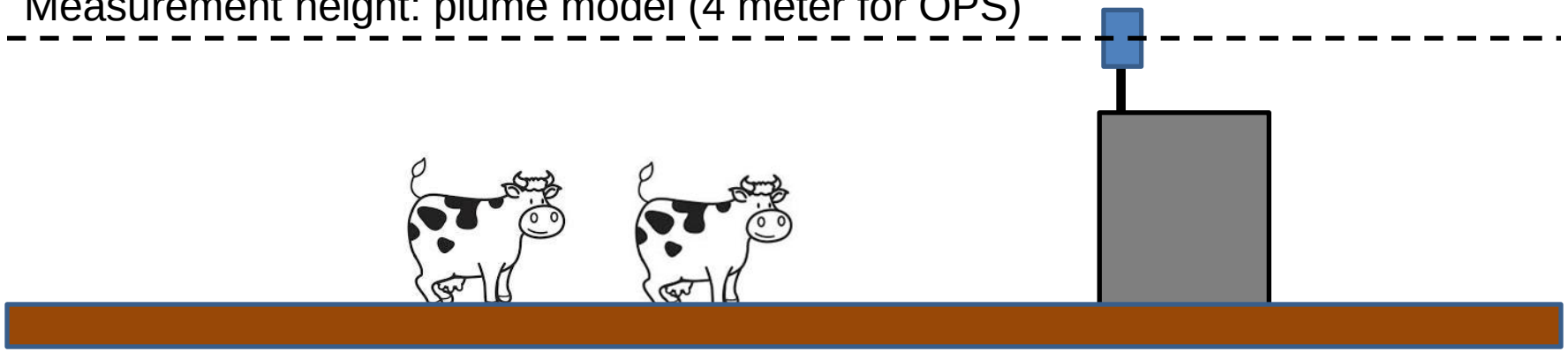

NH3 LEO 2009-2011
RC = 0.98 R2 = 0.88
2009
2010
2011
Calculation (in μg/m3)
Measurement (in μg/m3)
0
2
4
6
8
10
12
14
16
18
20





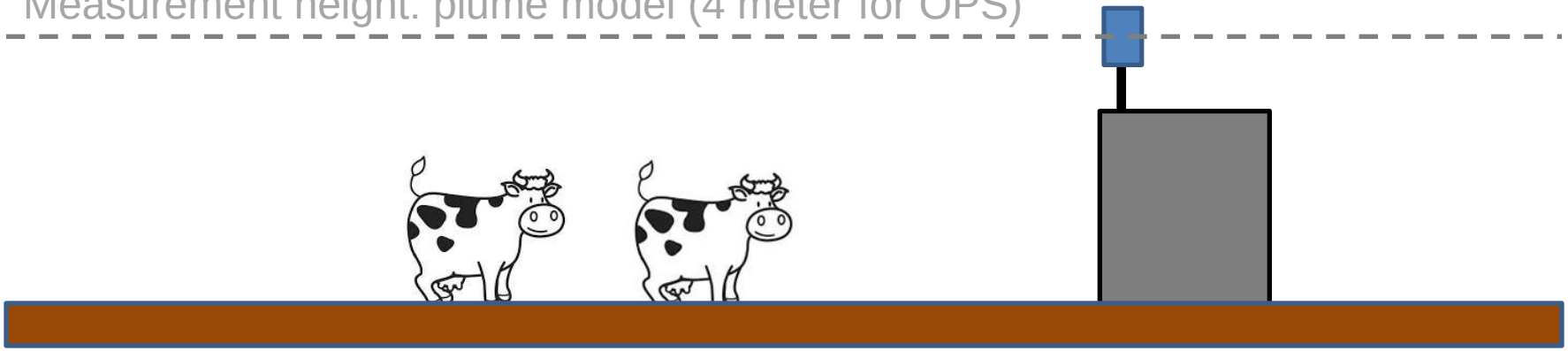
NH_3 is a component which has a very local scale so OPS is contributing most to the NH_3 concentration in the LEO model

Measurement height: plume model (4 meter for OPS)



First layer of Eulerian model (25 meter for LOTOS-EUROS)

Measurement height: plume model (4 meter for OPS)



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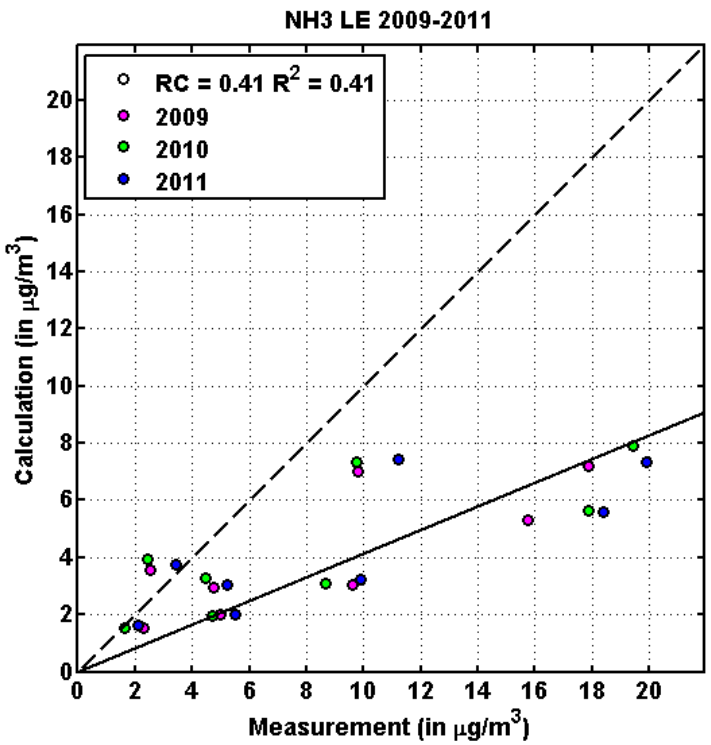

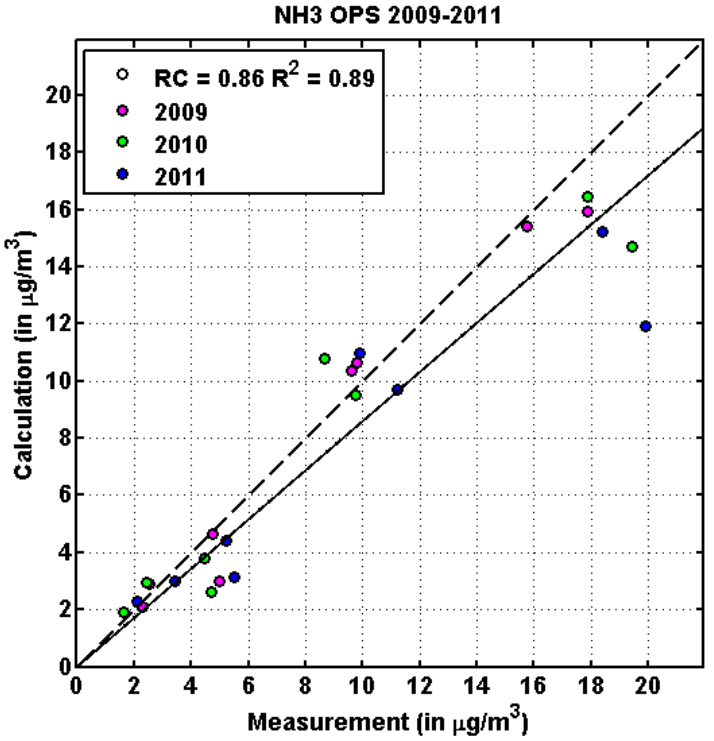

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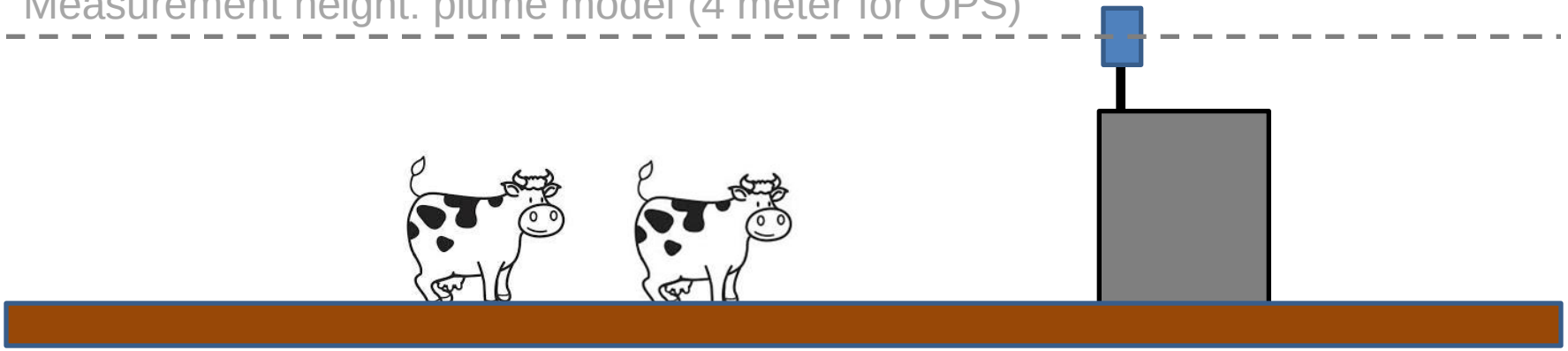
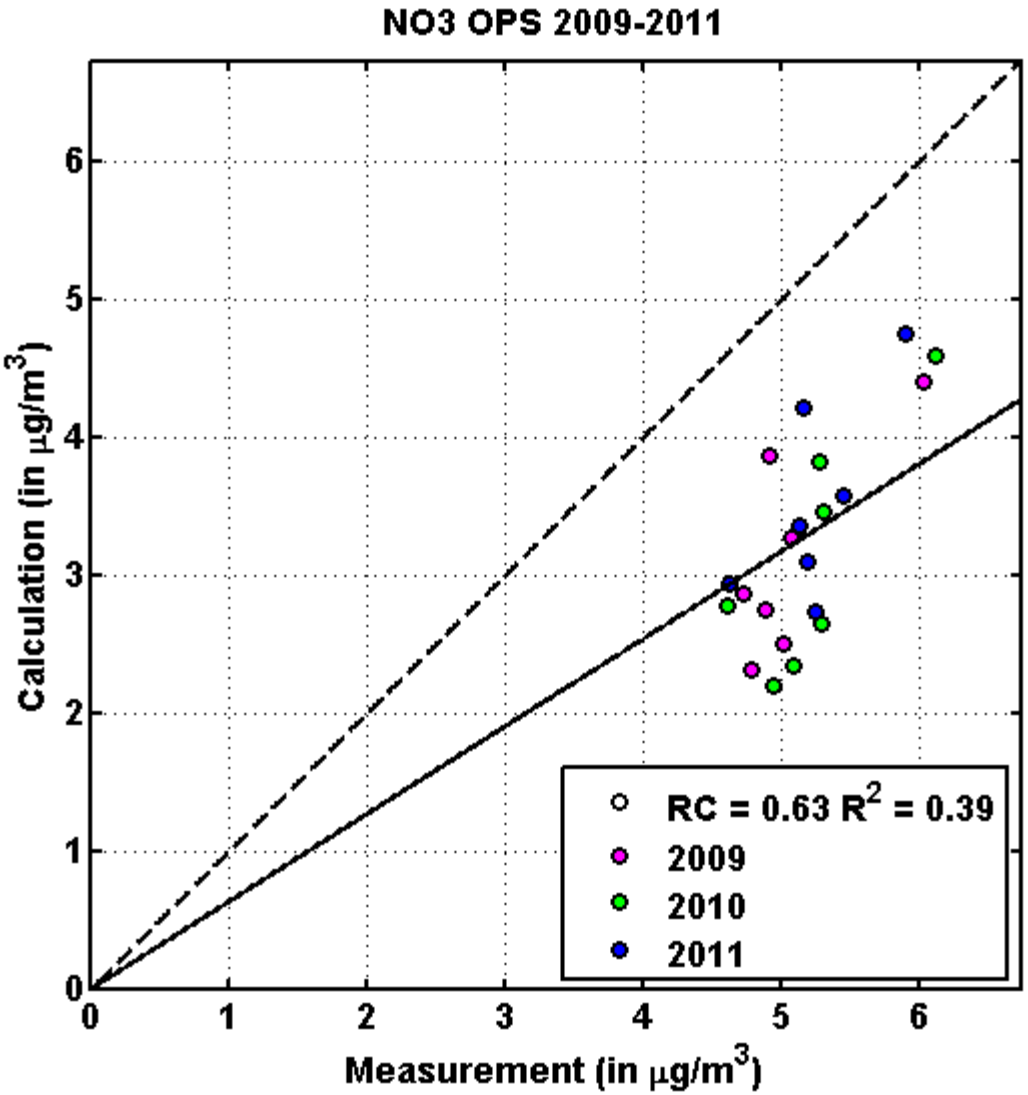
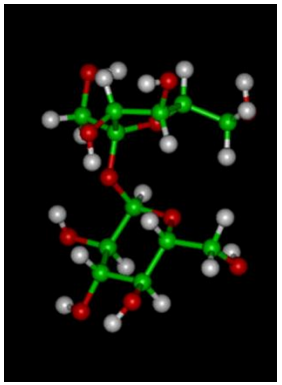
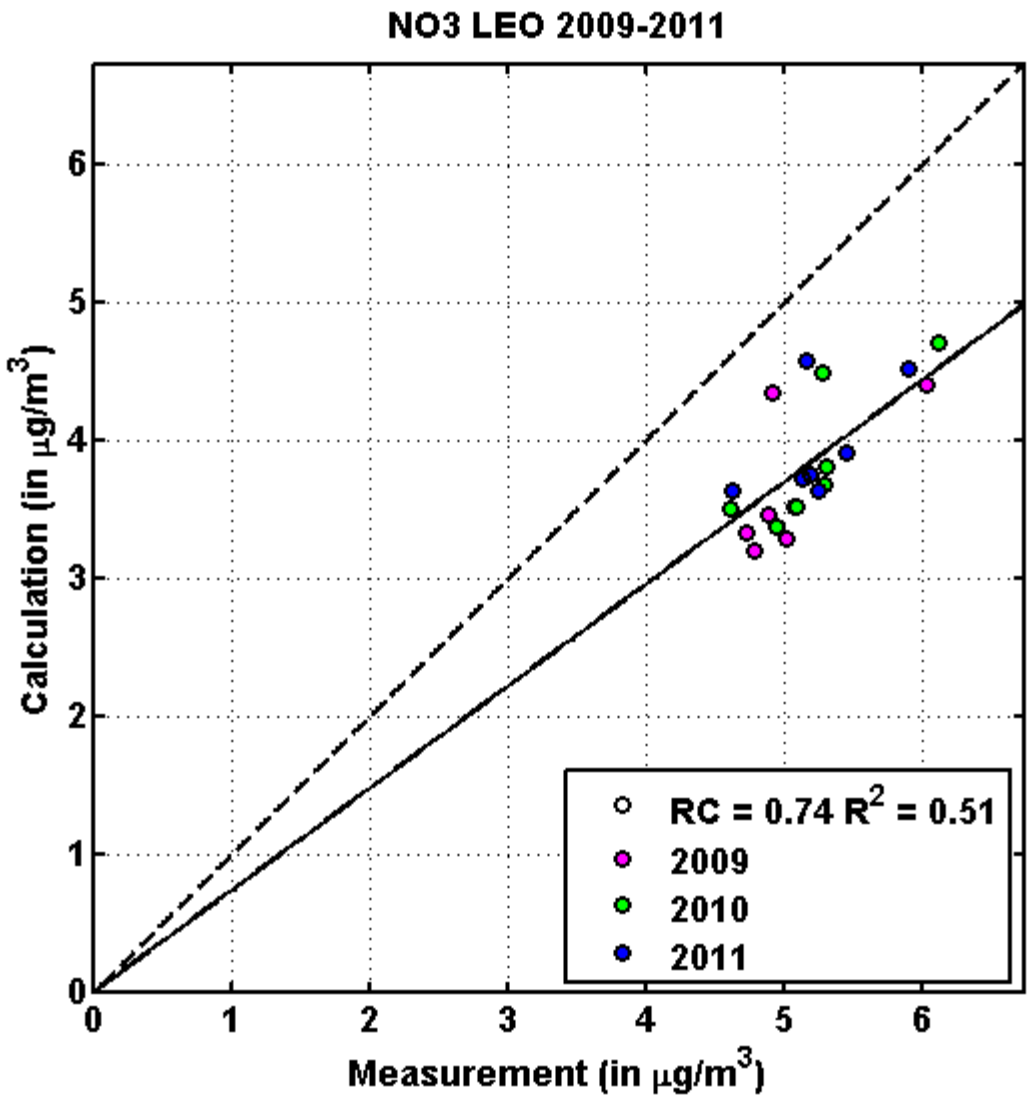
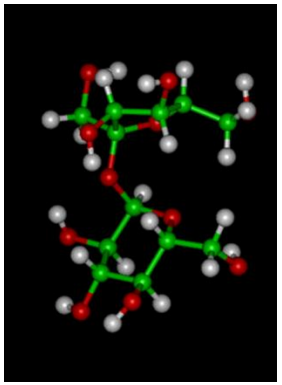




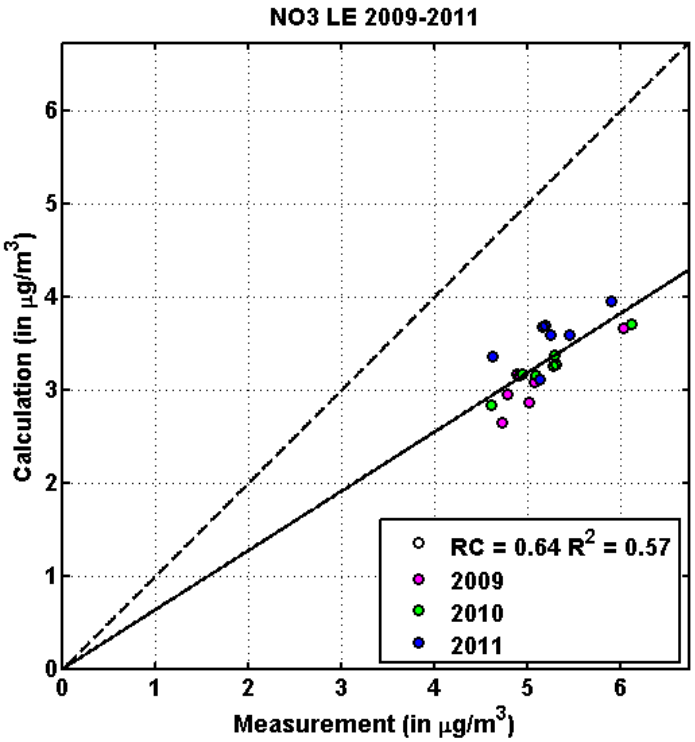


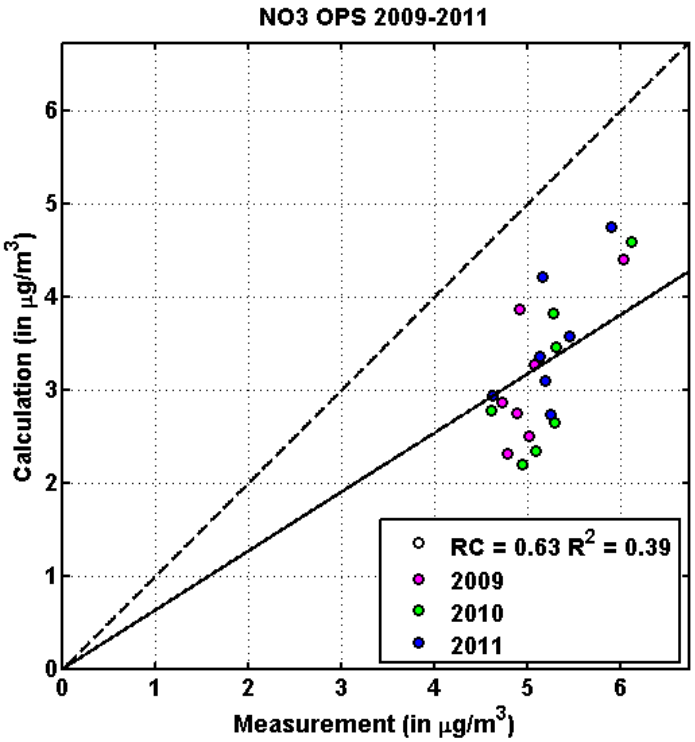
Chemistry Important



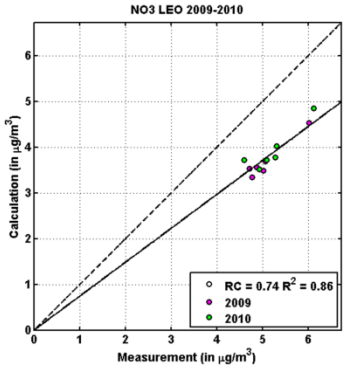


Chemistry Important

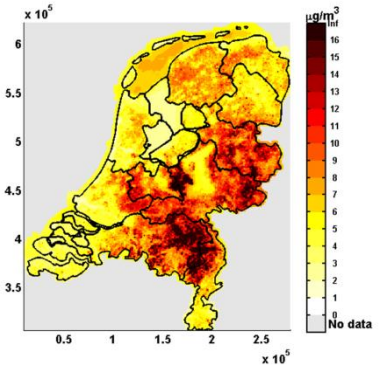




NO_3 is a component for which large scale chemistry is important which is better reproduced by a Eulerian model like LOTOS-EUROS

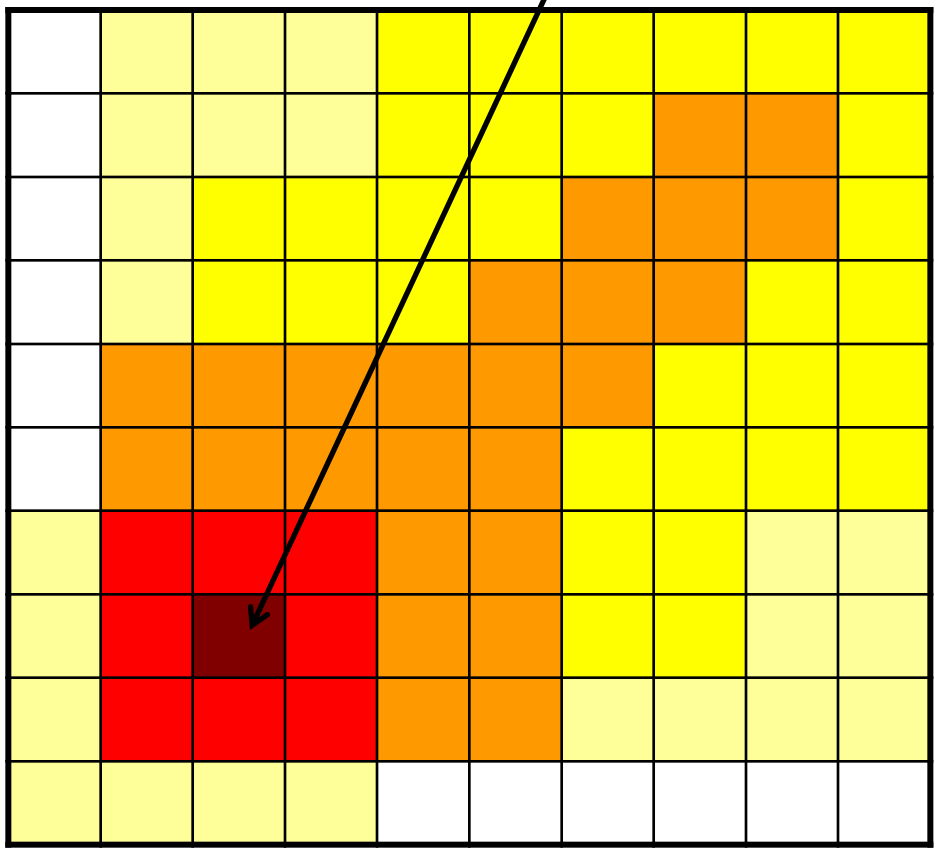


The LEO model

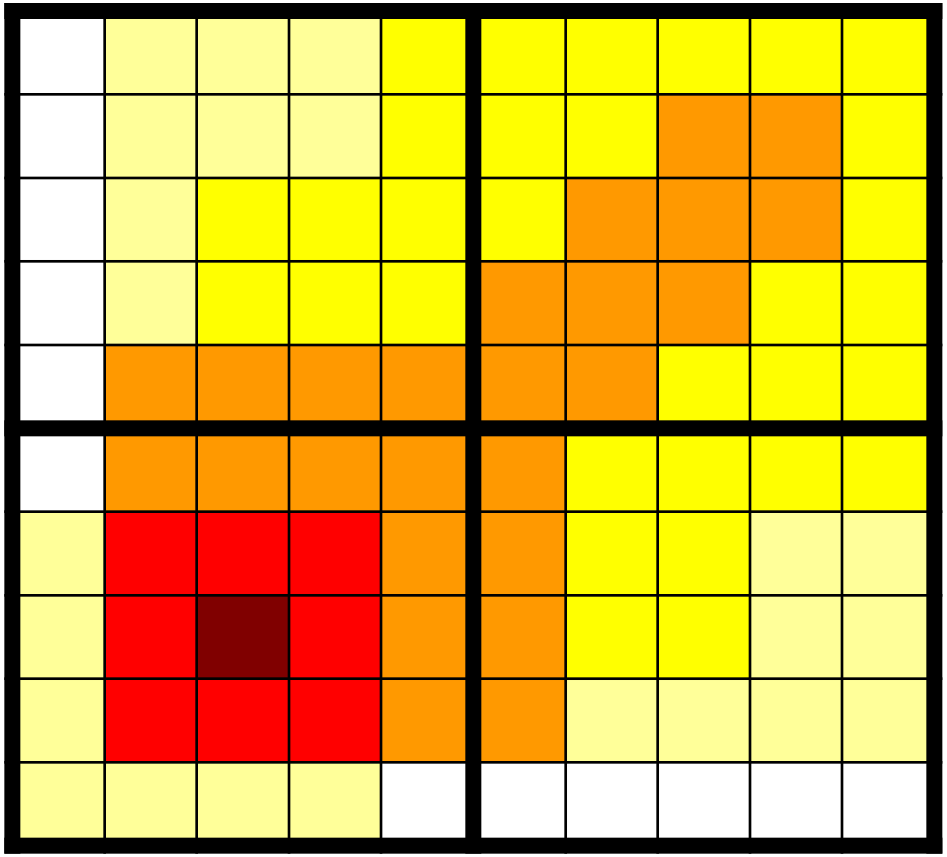


- Combination of plume and grid model
- Best of both ‘worlds’ in one model
- Check consistency emissions
- Work on a PinG version of LEO

OPS calculates sub-grid levels near source



Sub-grid cells are embedded in LOTOS-EUROS grid



Dumping of mass from OPS to LE for advection on large-scale