Air Traffic Management and the ENVIRONMENT

ALAQS
Airport Local Air Quality Studies
An EEC project

ALAQS-TRANS verification – part 1

- Objectives:
  1. Verify the gridsource approach developed in ALAQS-AV
  2. Verify the use of “smooth and shift approach” for accounting for initial source dynamics

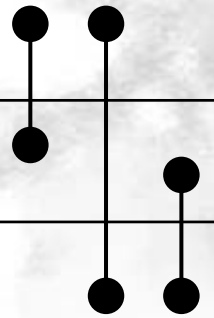
- One line-source modelled which represented a single runway
- Only the take off considered
- Simple terrain, simple meteorology
- Dispersion calculations over 36 hours and using an iso-tropic wind rose
- Lagrangian particle model LASAT was chosen as the dispersion model in ALAQS.
- ALAQS-AV/LASAT output with Shift-and-Smooth compared to the output of LASPORT for common test scenarios.

ALAQS-TRANS verification – part 1

The emission line source was modelled in the ALAQS-AV using the following approach:

1. ALAQS-AV + ALAQS-TRANS + LASAT
2. LASAT line sources + smooth and shift
3. LASAT + detailed source dynamics

The dispersion maps resulting from those three approaches have been compared.

	Model used	Plume dynamics description	Comparisons
Case A	ALAQS May06 LASAT	"smooth and shift" parameters applied onto ALAQS-AV 3D passive grid source	
Case B	LASAT	"smooth and shift" parameters for passive line sources	
Case C	LASAT	sources with LASPORT dynamics	

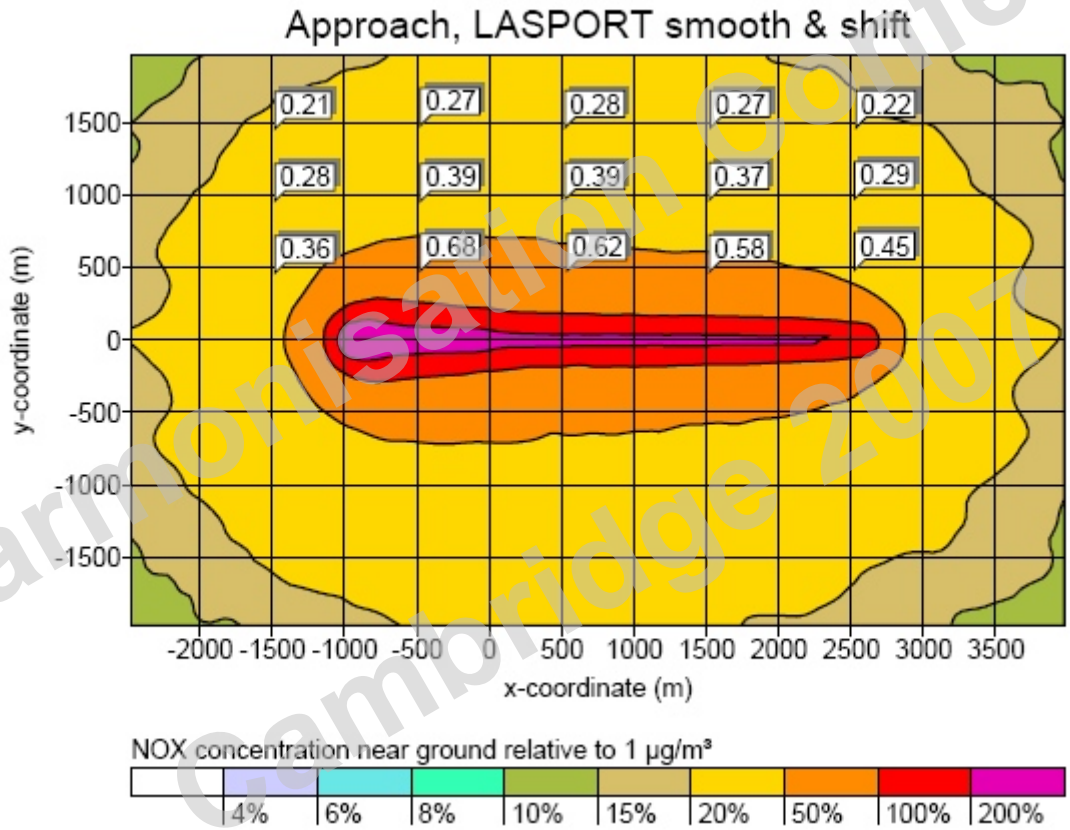
Summary of the three cases modelled and their comparisons

Smooth and shift Parameters

Parameter	Unit	Idle	Approach	Climb-out	Take-off
Width	m	81.0	165.0	278.0	301.0
Height	m	49.0	100.0	167.0	181.0
Vertical shift	m	0.0	-137.5	-171.0	0.0
Horizontal shift	m	0.0	0.0	360.0	360.0

Aircraft "smooth & shift parameters" derived from LASPORT 1.6 default settings

Source Dynamics



ALAQS-TRANS verification – part 1

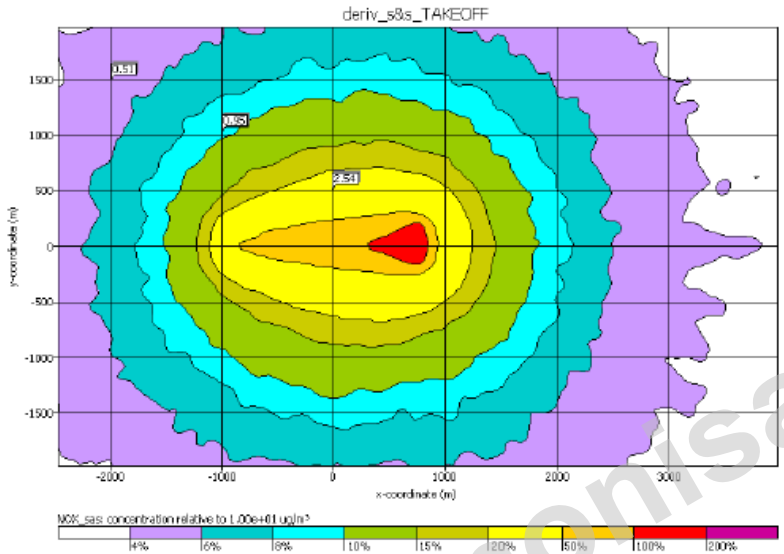


Figure 2: ALAQS-AV gridsource concentration results at ground level.
Uncertainty range 0.6% to 8.2%

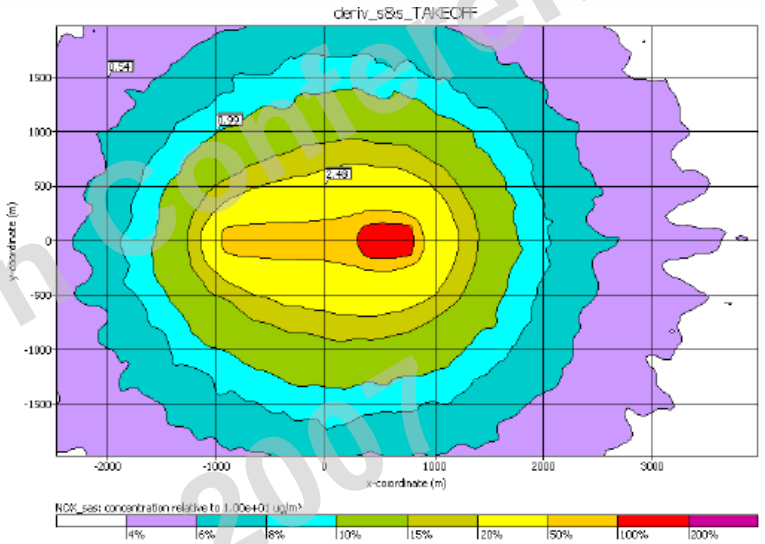


Figure 3: LASAT 2 line-sources "smooth and shift" concentration results at ground level.
Uncertainty range = 0.9 to 11.4%

Results comparison:

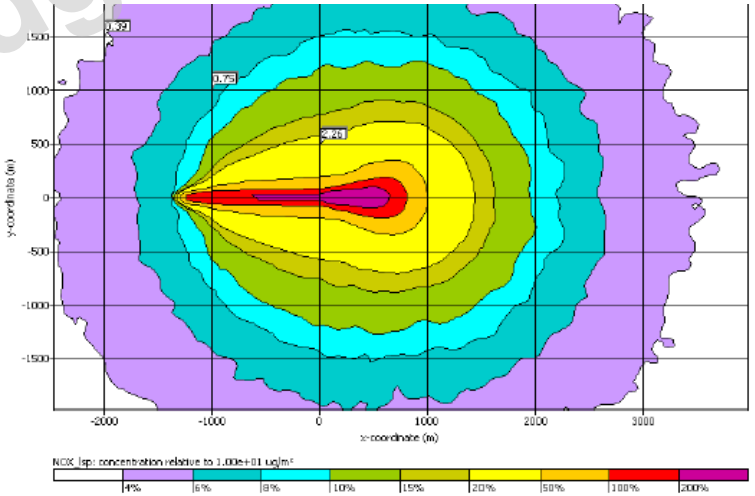


Figure 5: LASAT source dynamics concentration results at ground level.
Uncertainty range = 0.2% to 11.2%

ALAQS-TRANS verification – part 1

Figure 12: Comparison of concentrations (ug/m^3) at point 3 for the four source dynamics approaches and for all vertical layers.

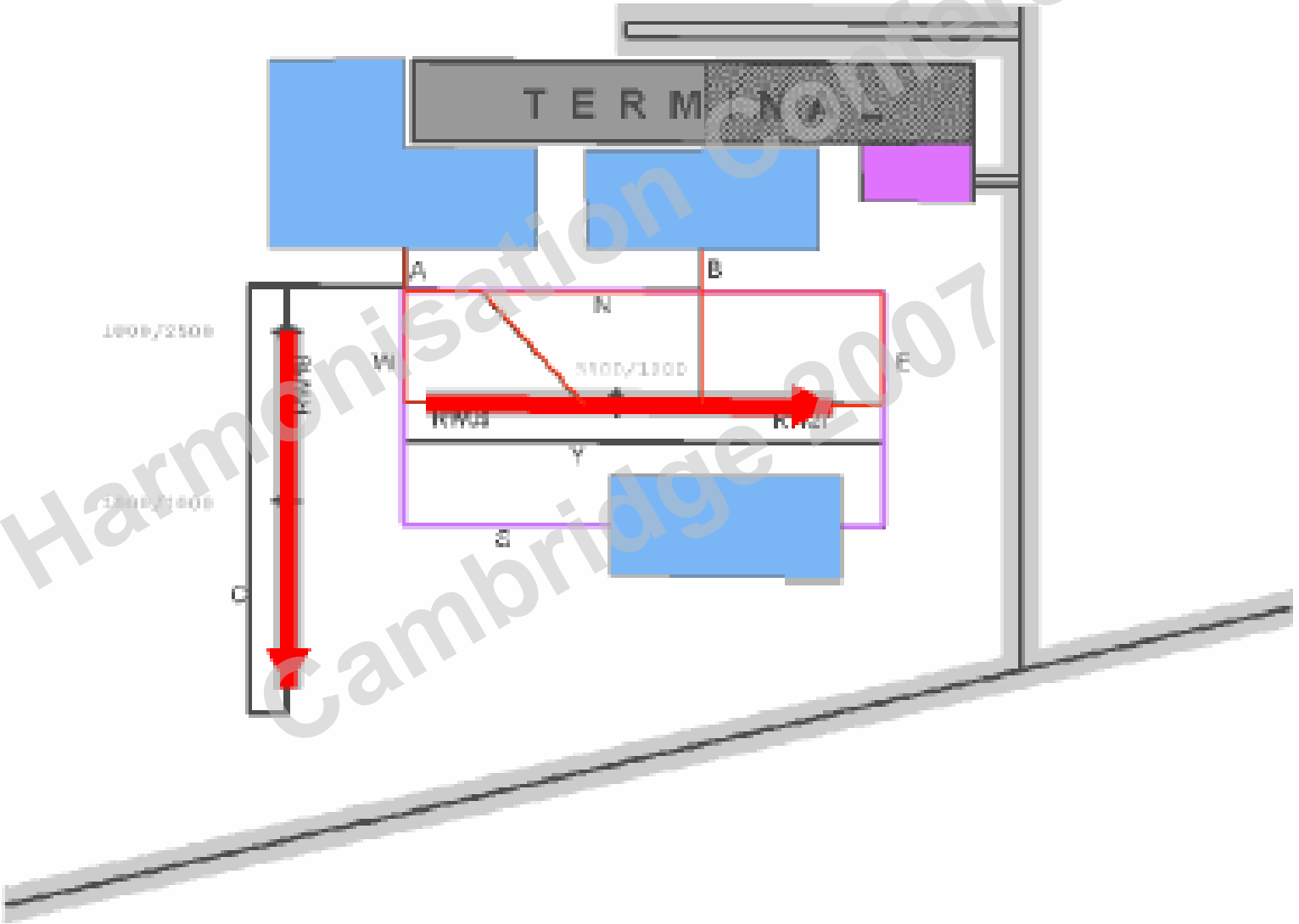
ALAQS-TRANS verification – part 1

- Very similar results between ALAQS-AV gridsource + ALAQS-TRANS and LASAT line sources approach in terms of concentration areas and also when considering the variations in concentration with altitude
- Greatest differences in concentration occurred at ground level and in the close range of the emission source
- Systematic difference of ALAQS-AV + ALAQS-TRANS when compared with LASAT detailed source dynamics
- Main sources of difference: acceleration modelling and source dynamics

ALAQS-TRANS verification – part 2

- Objectives:
  1. Identify the processes that need to be automated so that the use of ALAQS-TRANS doesn't need any pre-processing
  2. Compare dispersion results with LASPORT ones using a simple airport
- The same simple airport (from LASPORT reference manual) was modelled in LASPORT and in ALAQS-AV
- 1 runway, 2 gates, few taxiways and 4 roadways
- Dispersion over a 24 hours period
- Simple terrain, simple meteorology

ALAQS-TRANS verification – part 2



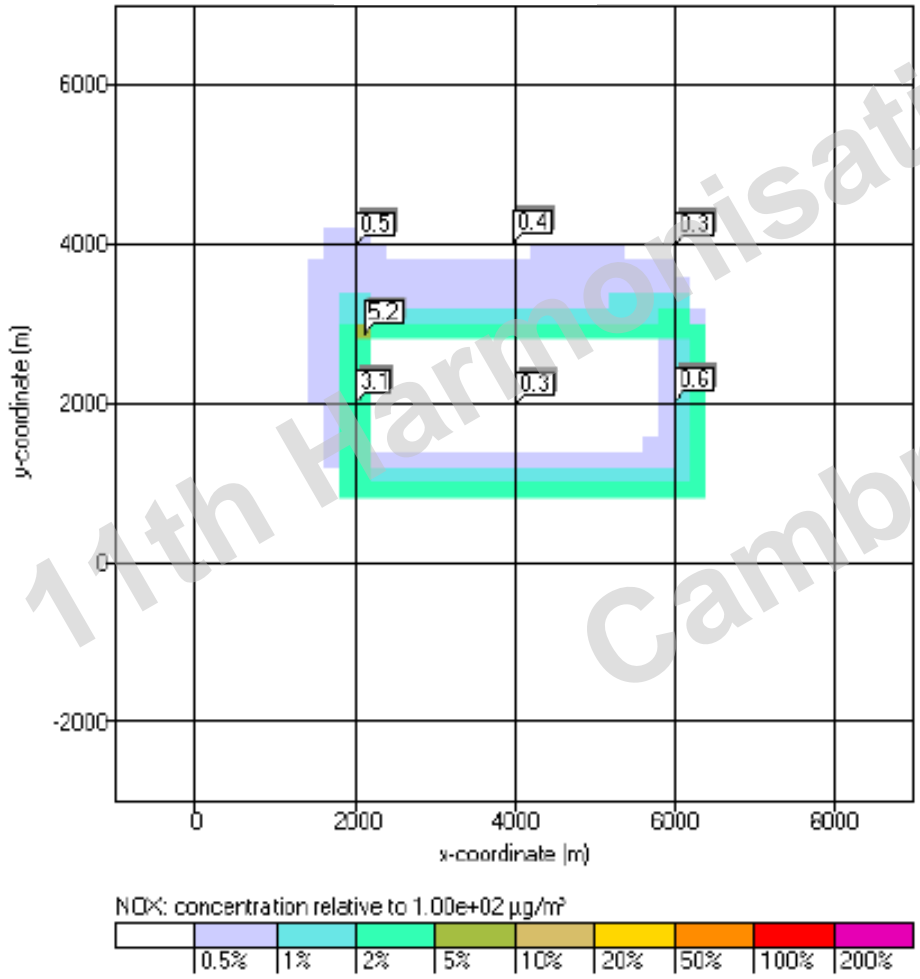
ALAQS-TRANS verification – part 2

- Emission inventory results for roads (NOx):
  - ➔ ALAQS-AV = 41.23 kg
  - ➔ LASPORT = 41.85 kg
- Emission inventory results for aircraft (NOx):
  - ➔ ALAQS-AV = 2041.4 kg
  - ➔ LASPORT = 2051.1 kg

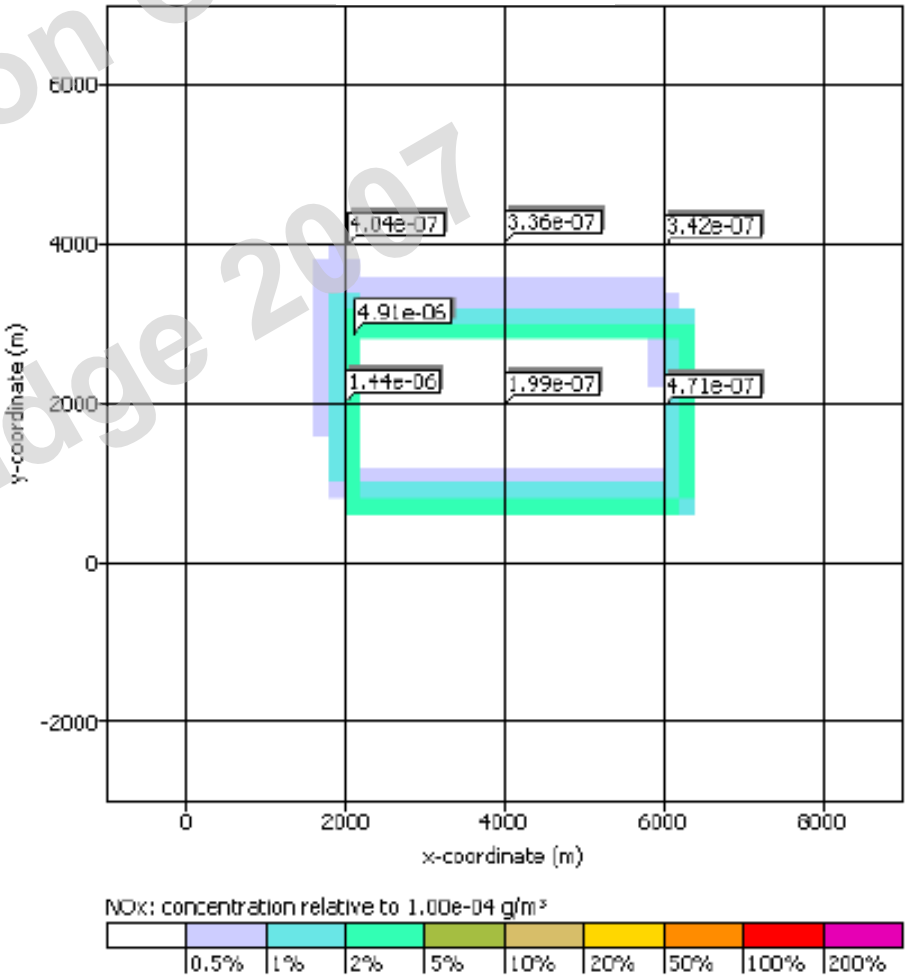
ALAQS-TRANS verification – part 2

- Roadways concentration maps

LASPORT



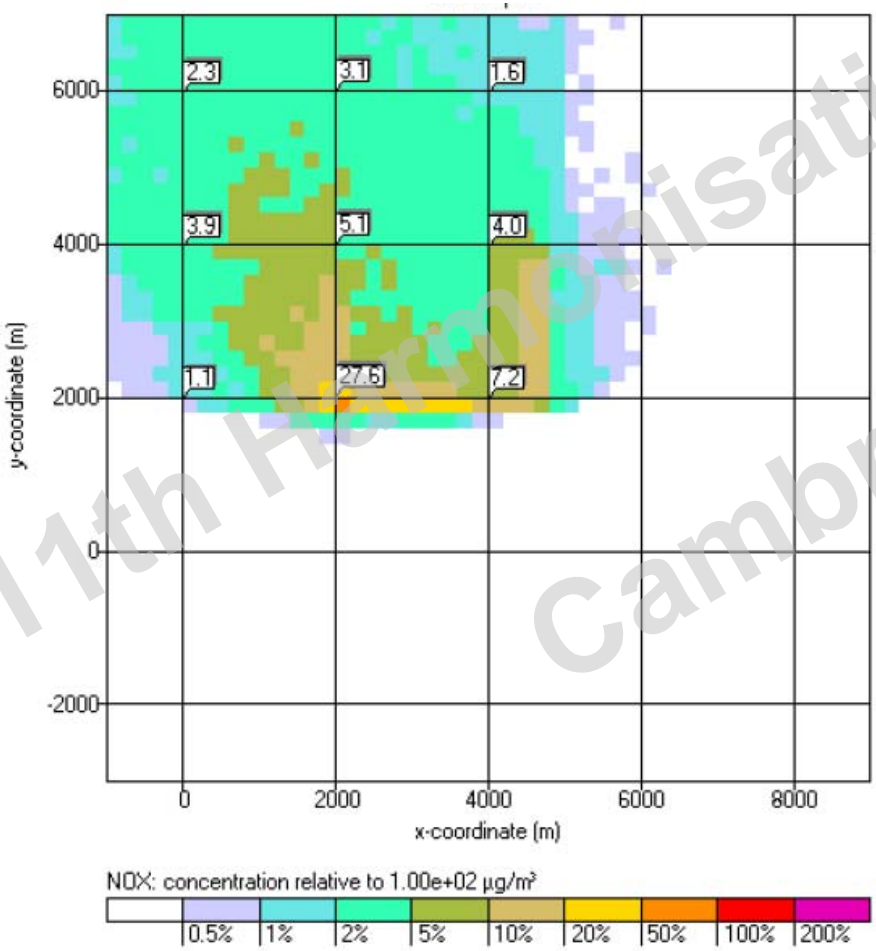
ALAQS-AV



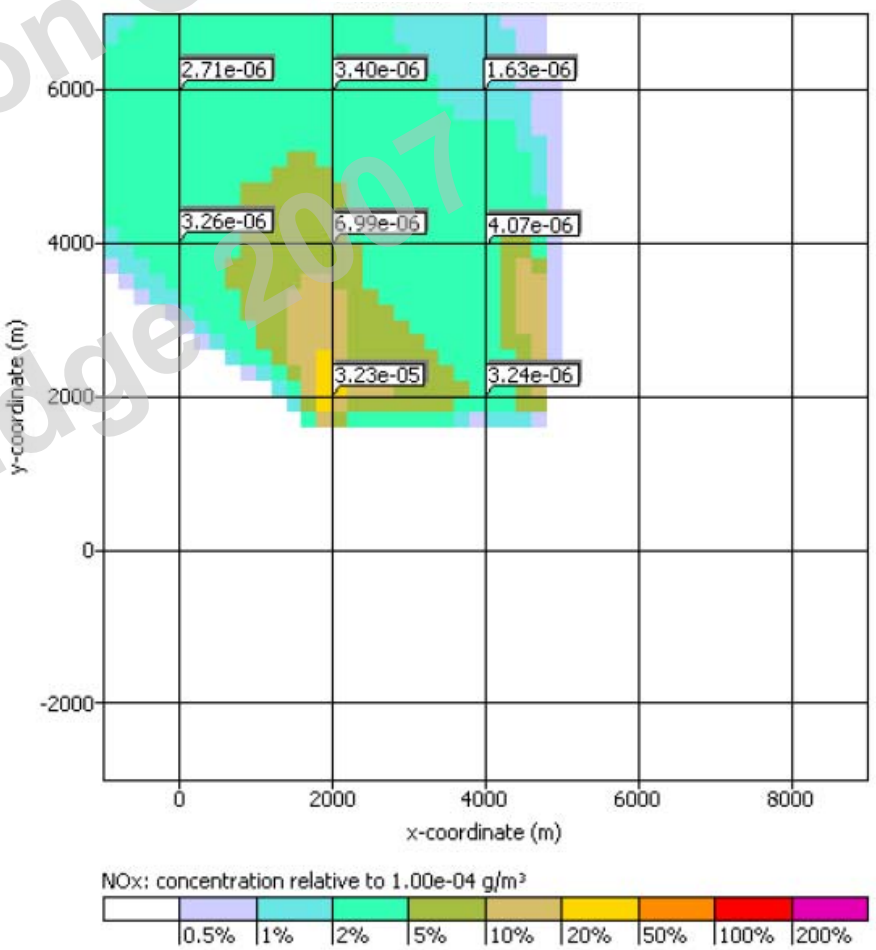
ALAQS-TRANS verification – part 2

- Aircraft concentration maps

LASPORT

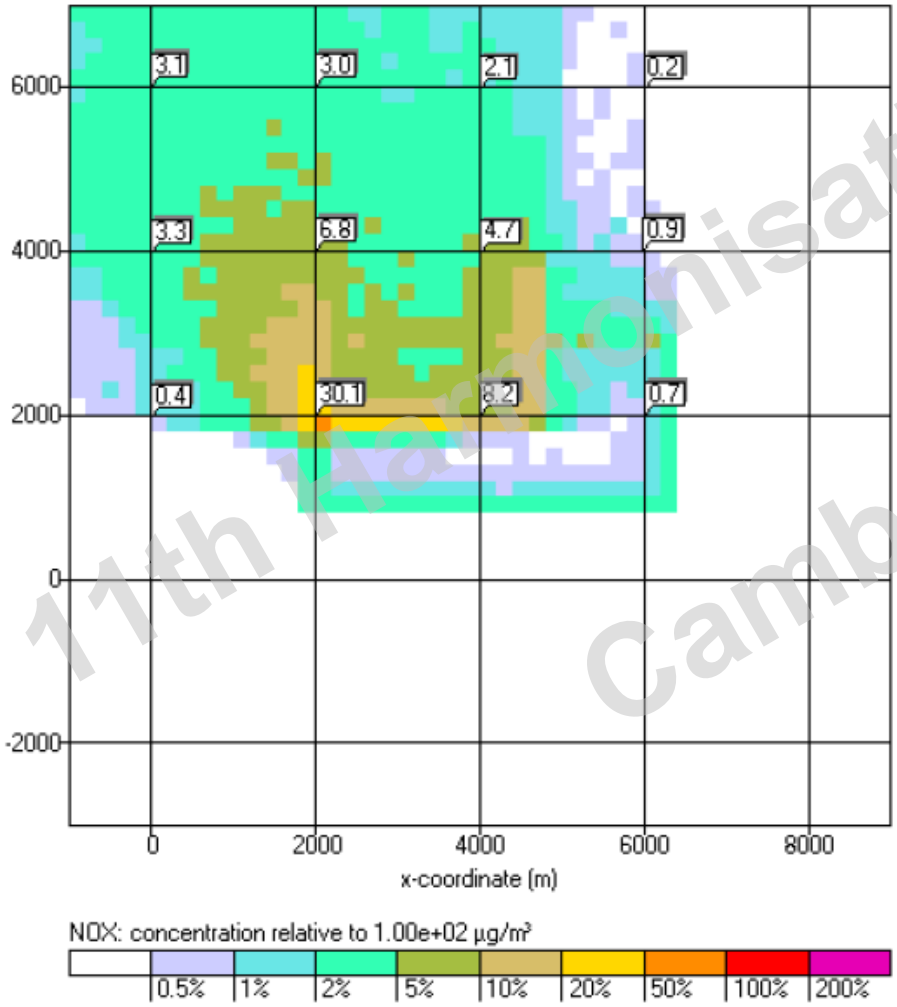


ALAQS-AV

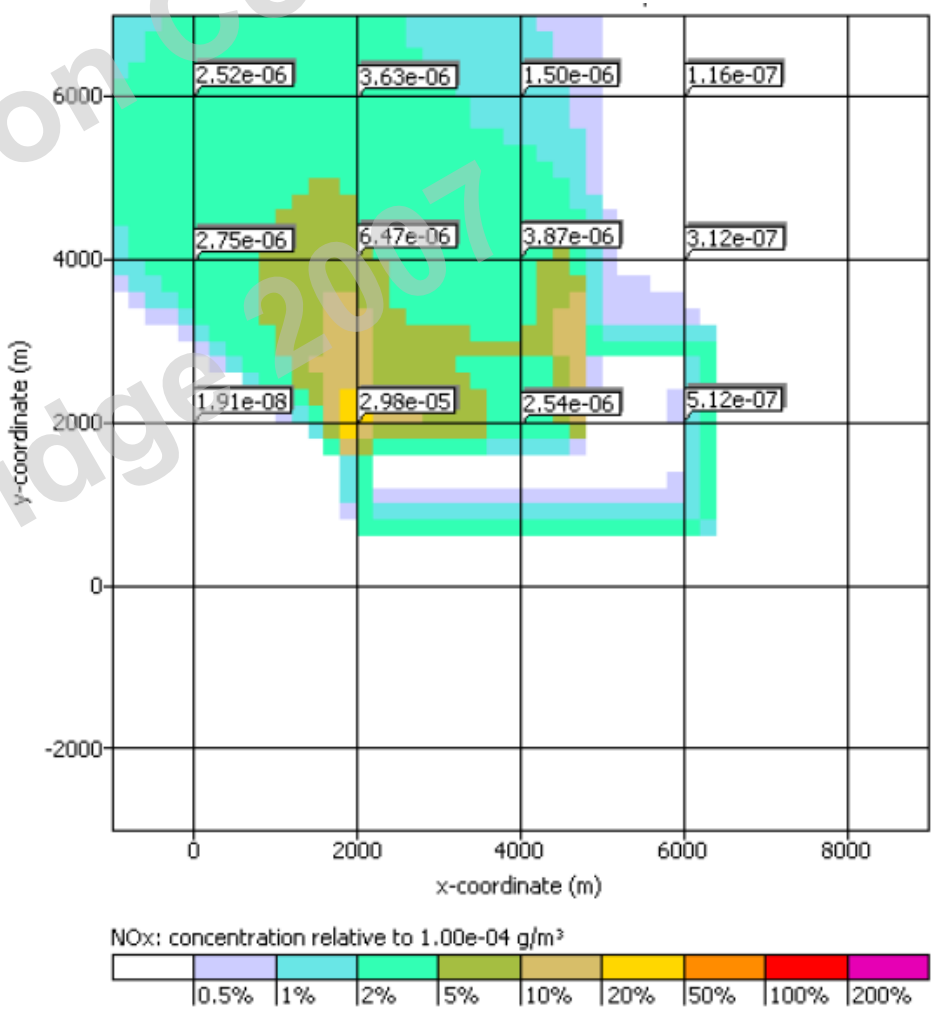


ALAQS-TRANS verification – part 2

LASPORT



ALAQS-AV



ALAQS-TRANS verification – part 2

- ALAQS-TRANS fully automatic
- Comparable dispersion results between ALAQS-AV + LASAT and LASPORT
- Greatest difference around 6 µg/m^3 close to the runway
- In most cases, difference below 2 µg/m^3
- Main differences due to:
  - ➔ Reverse thrust in LASPORT
  - ➔ Detailed source dynamics that take the effect of wind on initial exhaust plume and heat flux

Why modelling aircraft emission ?

Why is it important to model in details aircraft emissions around airports ?

- Compliance with European legislation
- Estimate the impact on the Environment
- Estimate the impact on human health
- Forecast the impact of future operations (for development plans)
- What if scenarios…

QUESTIONS

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