Air Quality and Airports - Recent Developments

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NSCA Workshop

Air Quality Management - from Reviews into Action and Beyond

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Examples of Throughput at Major Airports

Airport	ATMs (thousands)	Passengers (millions)
Heathrow	372	53
Amsterdam	363	34
Paris CGD	360	34
Frankfurt	311	34

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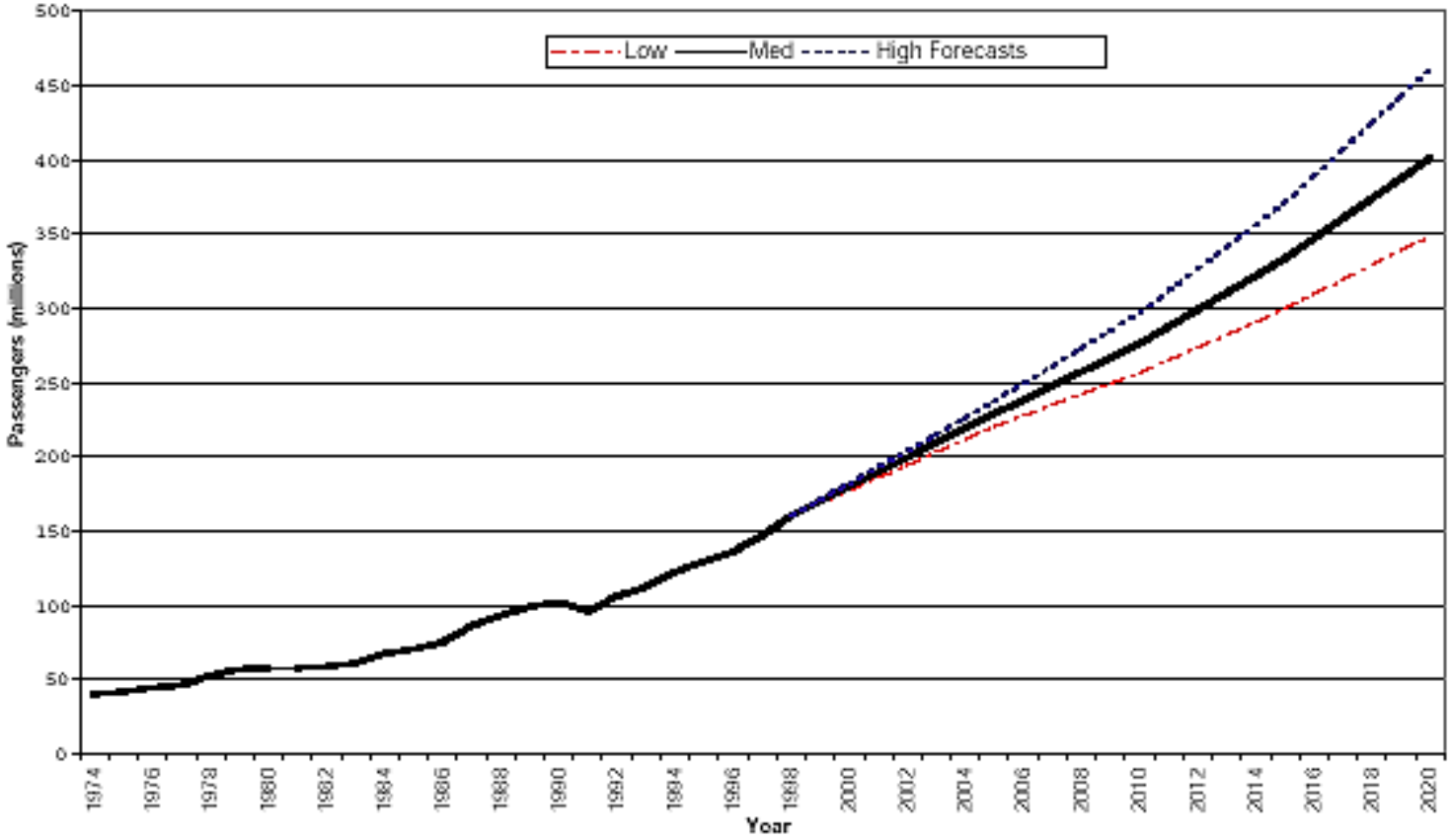
Actual and forecast passenger numbers at UK airports, 1974 to 2020



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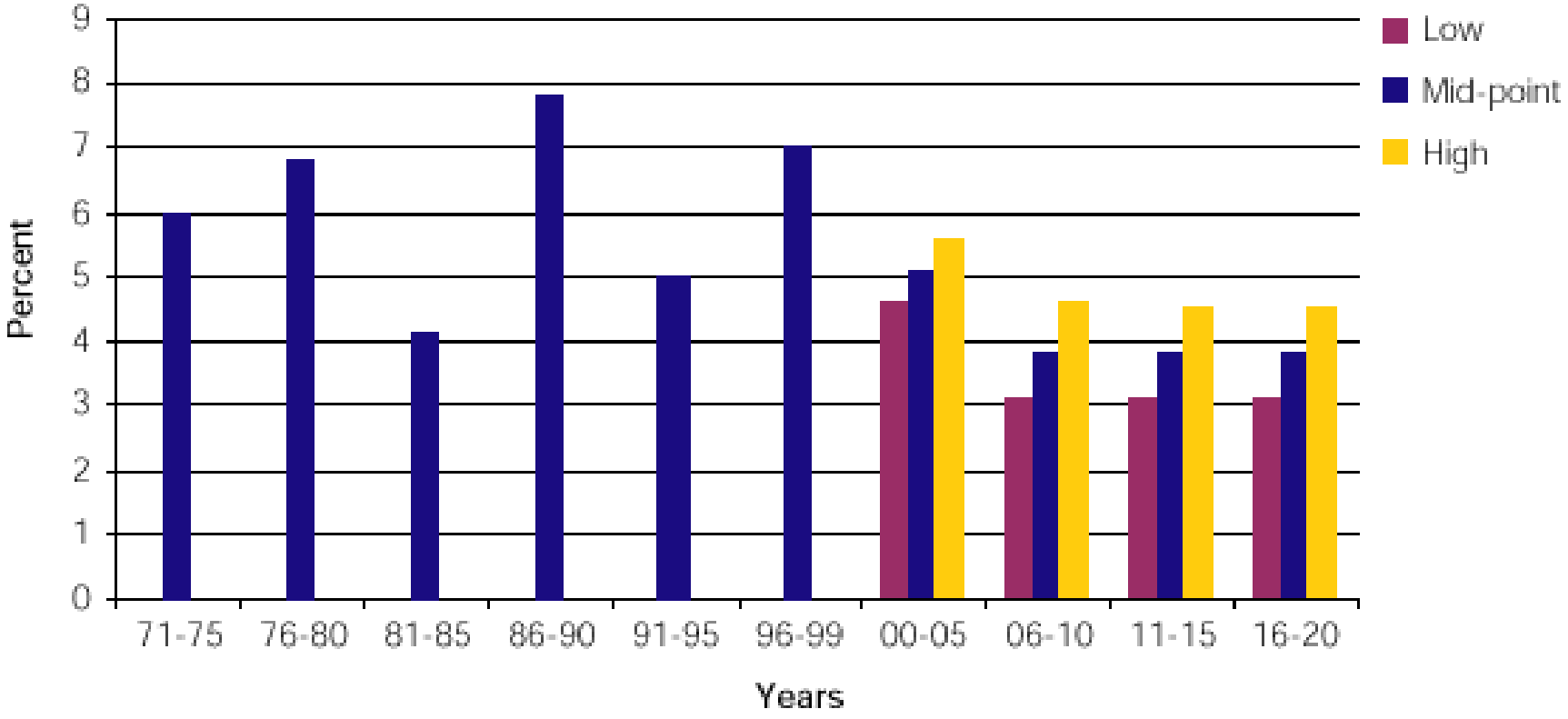
Average annual growth rates, actual and forecast, 1971 to 2020



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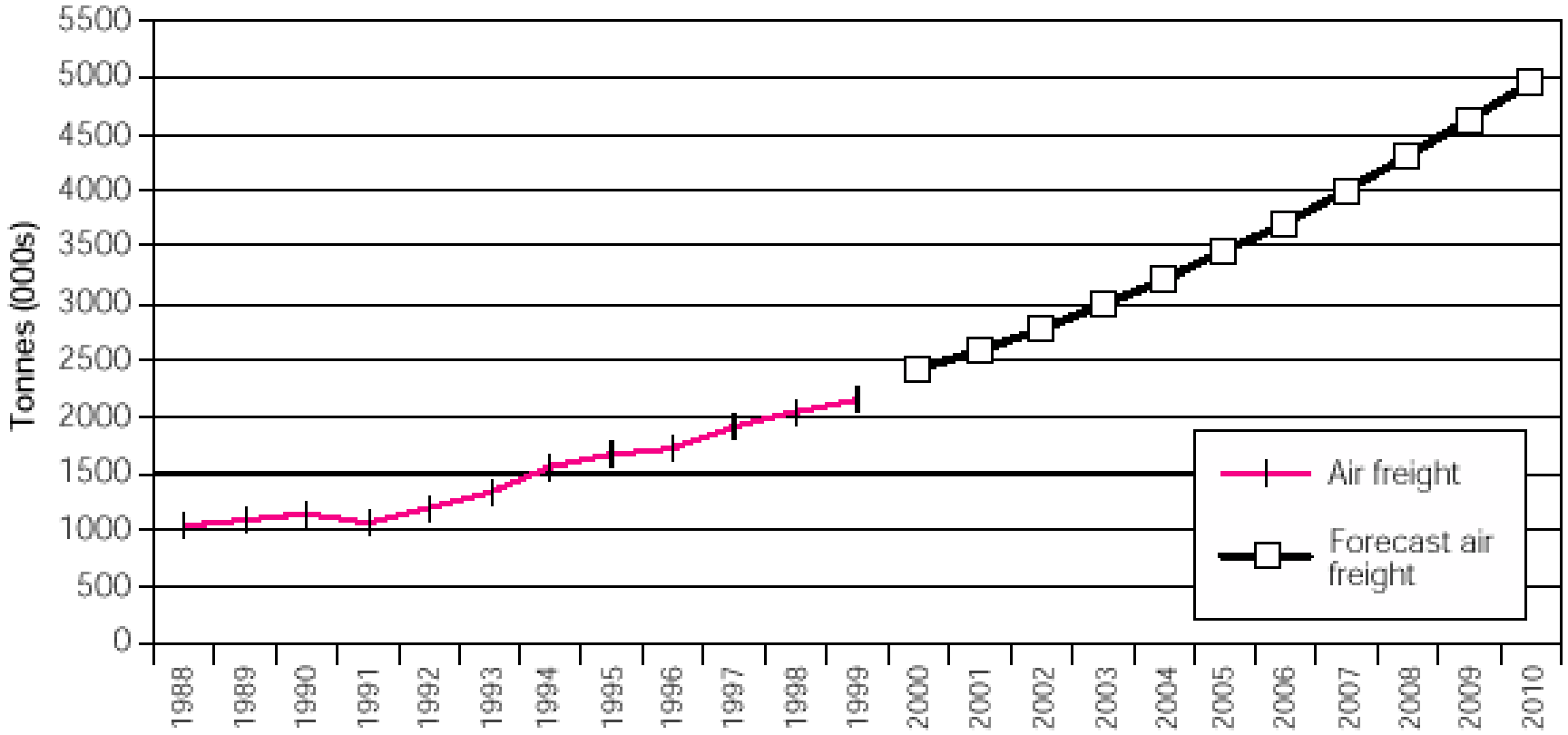
Air freight forecasts



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Environmental Effects

- effects of emissions from aircraft on climate change;
- local air quality effects of emissions from aircraft at airports and of the airport infrastructure which serves them;
- the effect of aircraft noise on people living near airports and under flightpaths;
- noise, emissions and congestion arising from surface access to airports, particularly from road transport;
- land take and urbanisation resulting from airport development; and
- other environmental effects of airports: energy consumption, water quality, contaminated land and waste.

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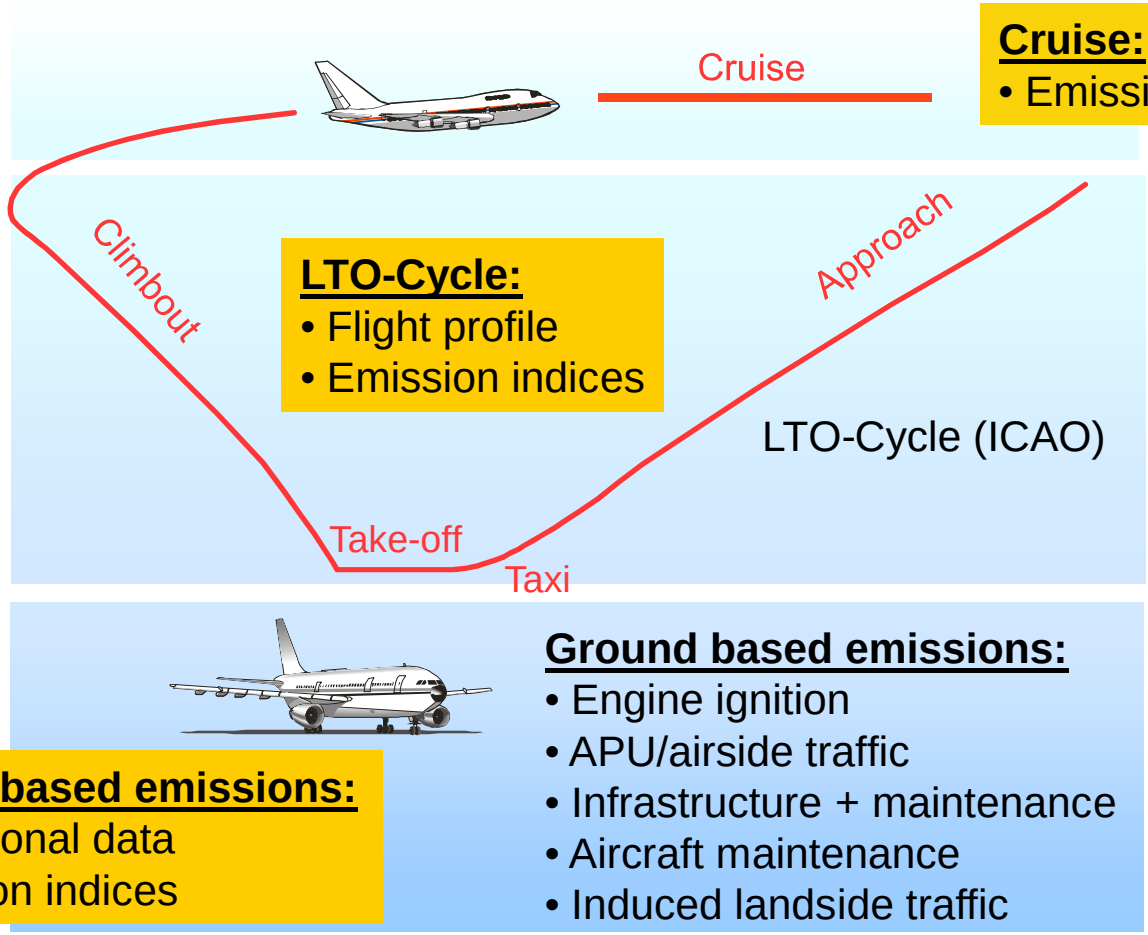
Air Traffic Emissions

Global Scale

Local Scale



Cruise:
- Emission indices

LTO-Cycle:
- Flight profile
- Emission indices

Ground based emissions:
- Operational data
- Emission indices

Ground based emissions:
- Engine ignition
- APU/airside traffic
- Infrastructure + maintenance
- Aircraft maintenance
- Induced landside traffic

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Airport Emission Sources

Emission Source	Emission Data	Comments
Air traffic exhaust	ICAO-EDB for NO_x, VOC , CO no PM_{10} (smoke number only)	Emission factors not available for all aircraft on thrust settings. Individual flight thrust settings available.
Fugitive Emissions	VOC's	
APU Auxiliary Power Units	Limited data available	
Airside support vehicles		
Building emissions	e.g. terminal boiler houses	
Landside road traffic	Standard emission factor for road traffic	Useful to split this between airport induced and other traffic

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Modelling Techniques

- Gaussian
- Particle
- Other

Gaussian Type

- assumed ‘gaussian-type’ concentration distribution dependent on meteorology
- Uses source types e.g. volume, point, line

Examples: ADMS – all pollutants including chemistry

EDMS – FAA model; passive pollutants

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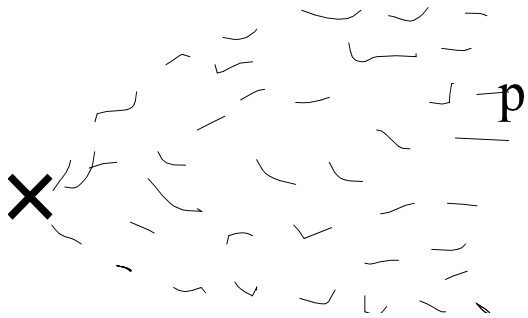
Particle Model

- tracks particles released from sources to build up concentration distribution
- tested at Zurich and 0ther European airports



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Current Activities

AERONET - European Research Forum looking at environmental impact of airports

FAA/EUROCONTROL - Cooperative Effort on Models for Evaluation ATM Environmental Impact

DETR

LOCAL AUTHORITIES with airports in or adjacent to their borough/district

BAA, other airport authorities - environmental impacts

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Role of AERONET

- Improve methodology for emission calculation including
  - aircraft LTO profile, thrust setting, time in mode
  - PM10 / 2.5
  - APU
  - Start up
- Modelling
- Monitoring
- Workshop April 4 Manchester

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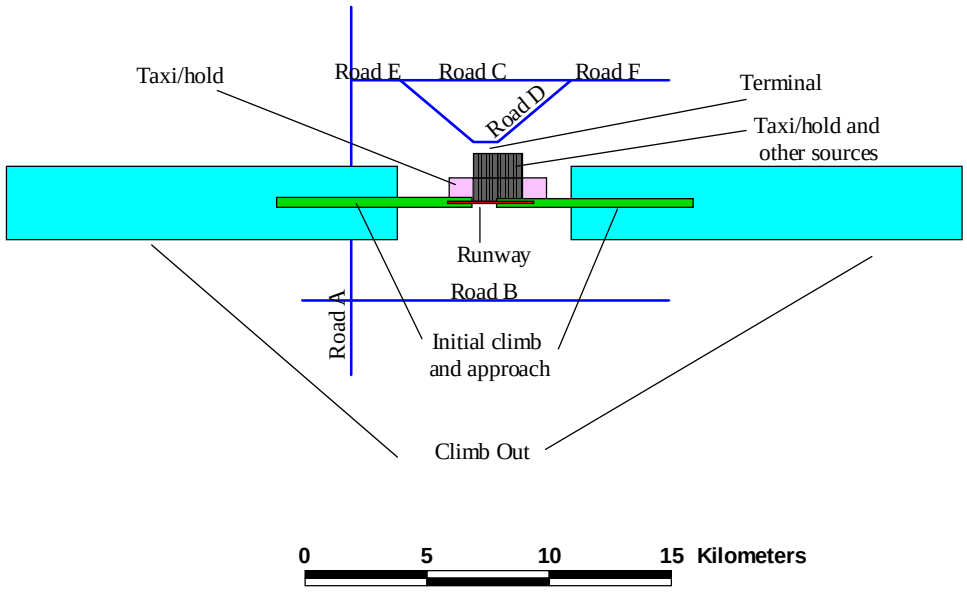
Example of Impact on Air Quality of Airport

Airport Layout



Road network
Runway (Take off and landing)
Climb Out
Initial Climb and approach
Taxi/hold
Other sources

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Table 1 Road source NO_x emissions

	A g/km/s	B g/km/s	C g/km/s	D g/km/s	E g/km/s	F g/km/s	Total emission T/yr	Total road length km
Airport related	0.55	0.55	0	1.1	0.55	0.55	940	45
Non-airport related	3.0	3.0	1.0	0	1.0	1.0	3200	43

Table 2 Aircraft NO_x emissions

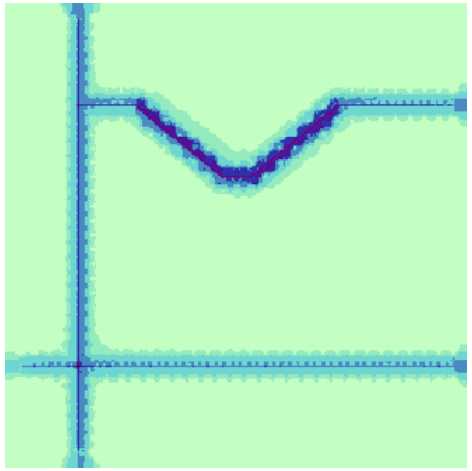
Source	Base height (m)	Depth (m)	Width (m)	Length (m)	Emission (T/yr)	Emission ($g/s/m^{3)}$
Runway (take off and landing)	0	150	100	3500	700	4.22e-7
Initial climb and approach (2 sources)	50	400	400	8000	500×2	1.24e-8
Climb out (2 sources)	450	550	300	16000	1000×2	1.20e-9
Taxi/hold (6 sources)	0	50	1000	1000	45.8×6	2.91e-8

Table 3 Other emissions (APU/airside transport

Source	Base height (m)	Depth (m)	Width (m)	Length (m)	Emission (T/yr)	Emission ($g/s/m^{3)}$
Other sources	0	50	1000	1000	100×4	6.34e-8

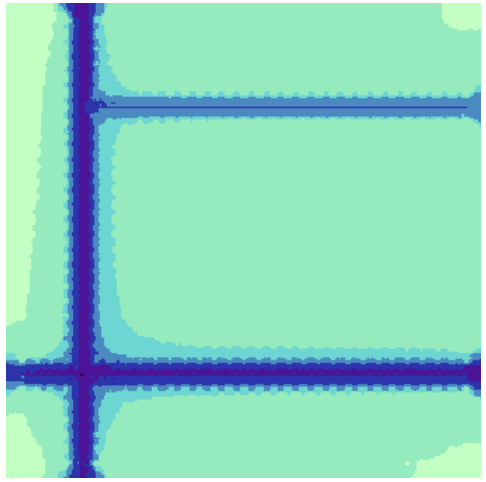
Annual average NOx concentration due to roads

Airport Roads



NOx µg/m³
- 0 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 71

Non-airport roads



NOx µg/m³
- 0 - 5
- 5 - 15
- 15 - 25
- 25 - 50
- 50 - 100
- 100 - 300
- 300 - 383

0 5 10 15 Kilometers

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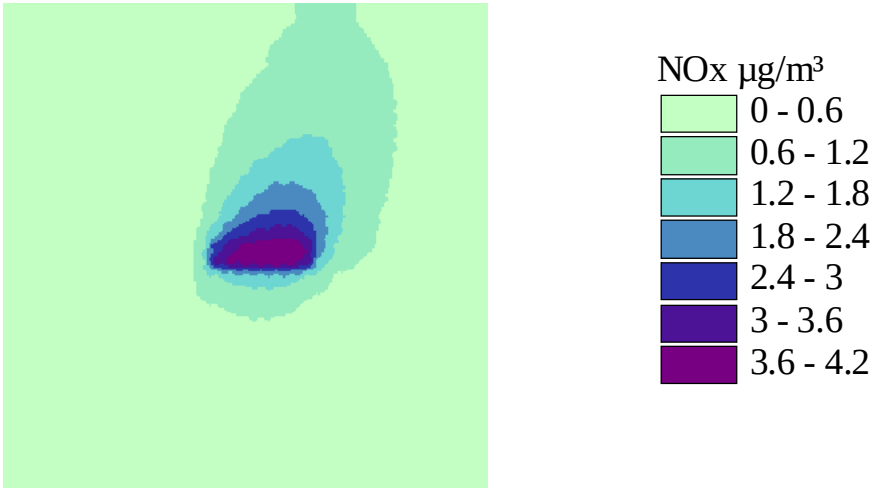
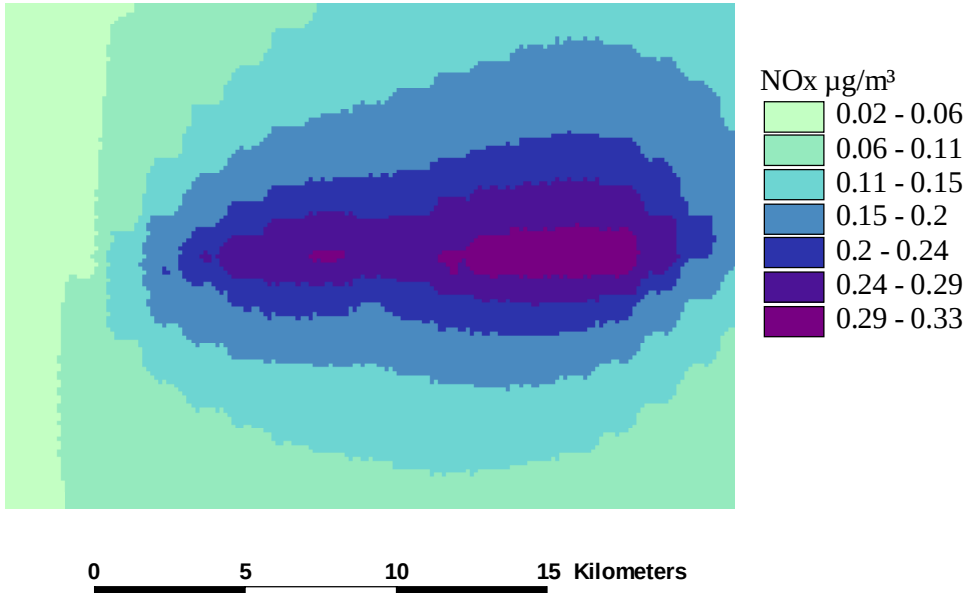
Annual average NOx concentration

Runway



Initial climb and approach and Climb out



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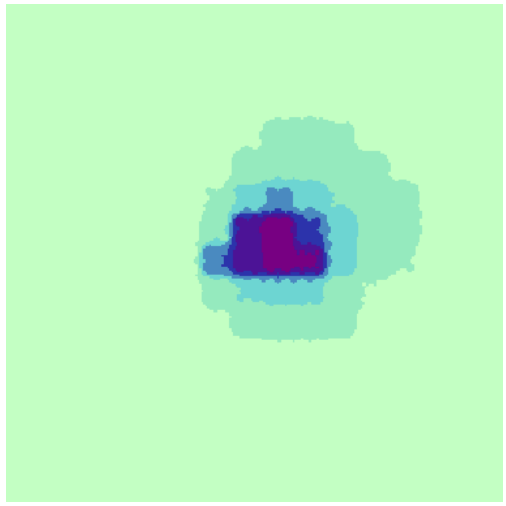
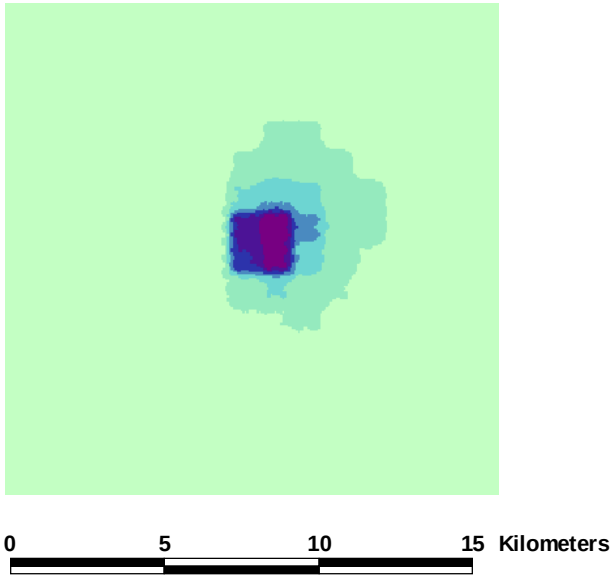
Annual average NOx concentration

Taxi/hold



Other sources (APU/airside transport)



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Summary

- Airport throughput and emissions are increasing.
- Currently the impact of airport emissions on local air quality is relatively small compared to other emissions outside airport e.g. traffic. However relative impacts will change as road traffic emissions decrease.
- Ground level emissions at airports have a much greater impact on local air quality than airborne aircraft emissions – the contribution of aircraft after take-off or before landing being very small.
- Greatest impact on local air quality achieved by reducing ground level emissions.

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