



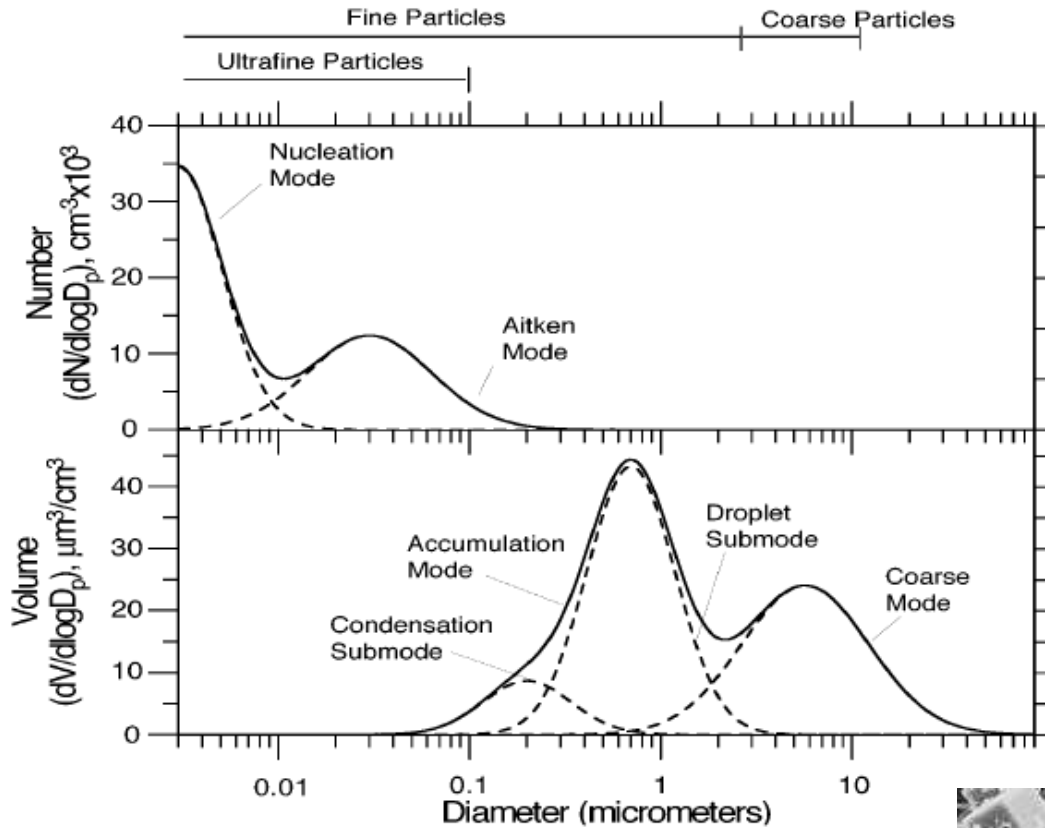
Characterisation of urban aerosol

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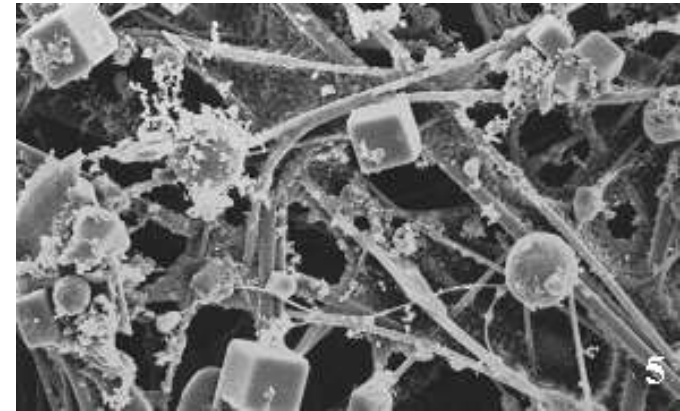


Characterisation of urban aerosol

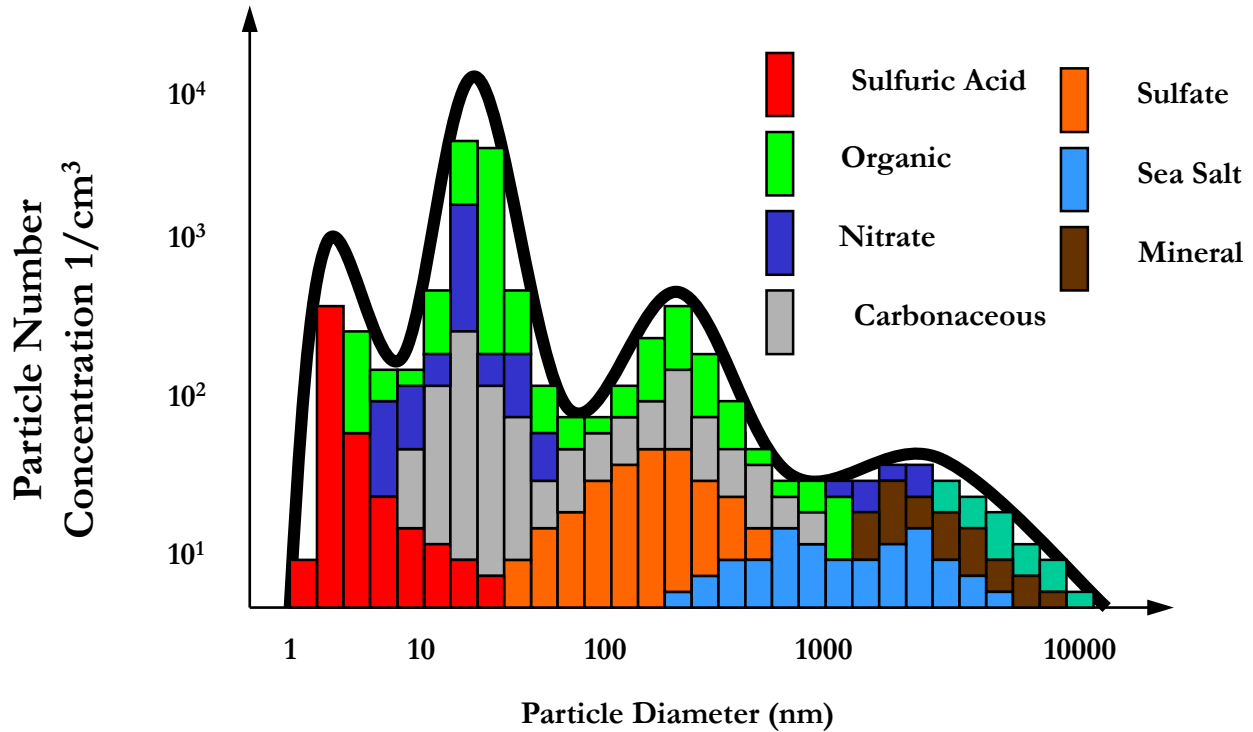


Size (number) distribution

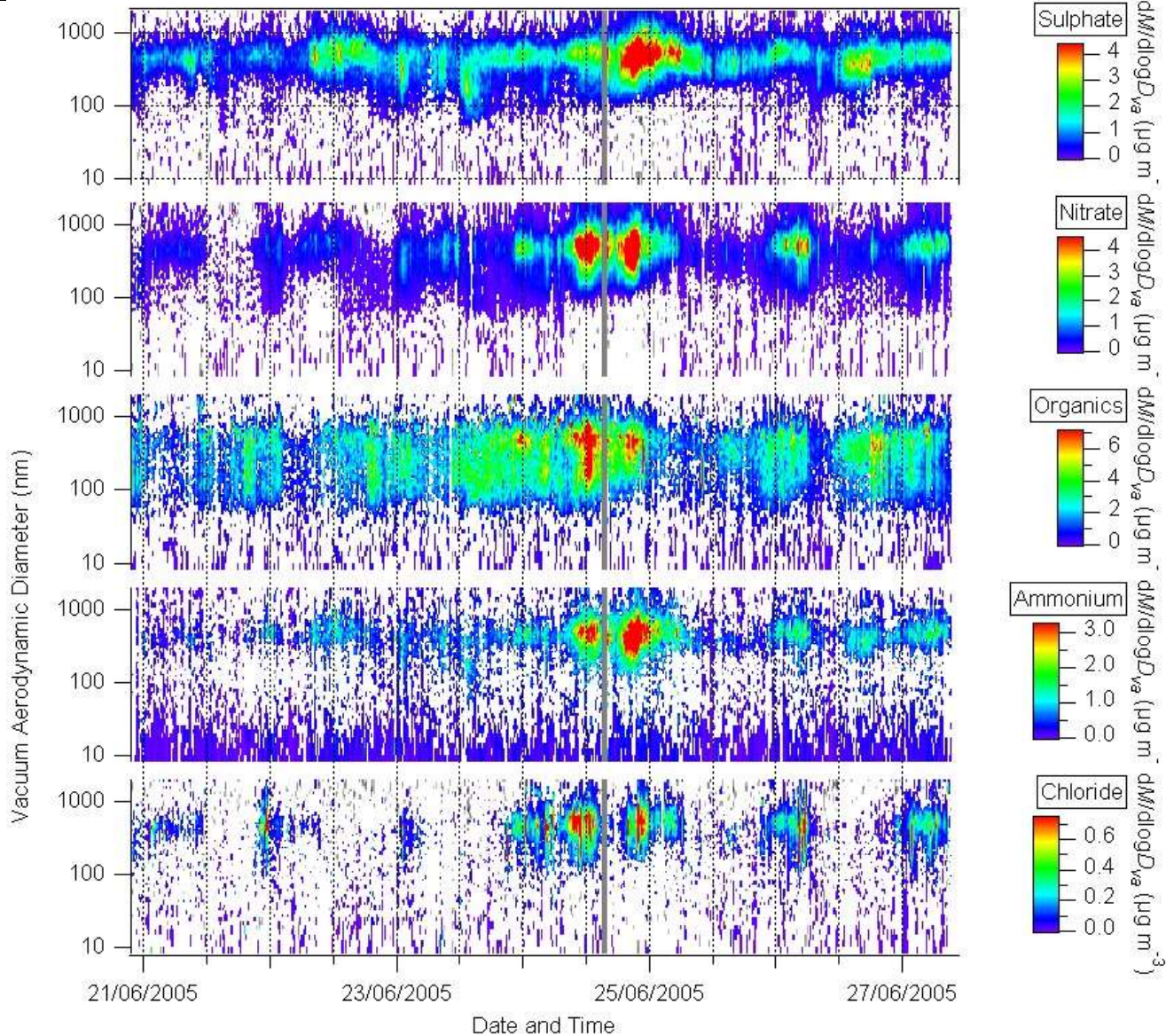
Size (mass) distribution



Characterisation of urban aerosol

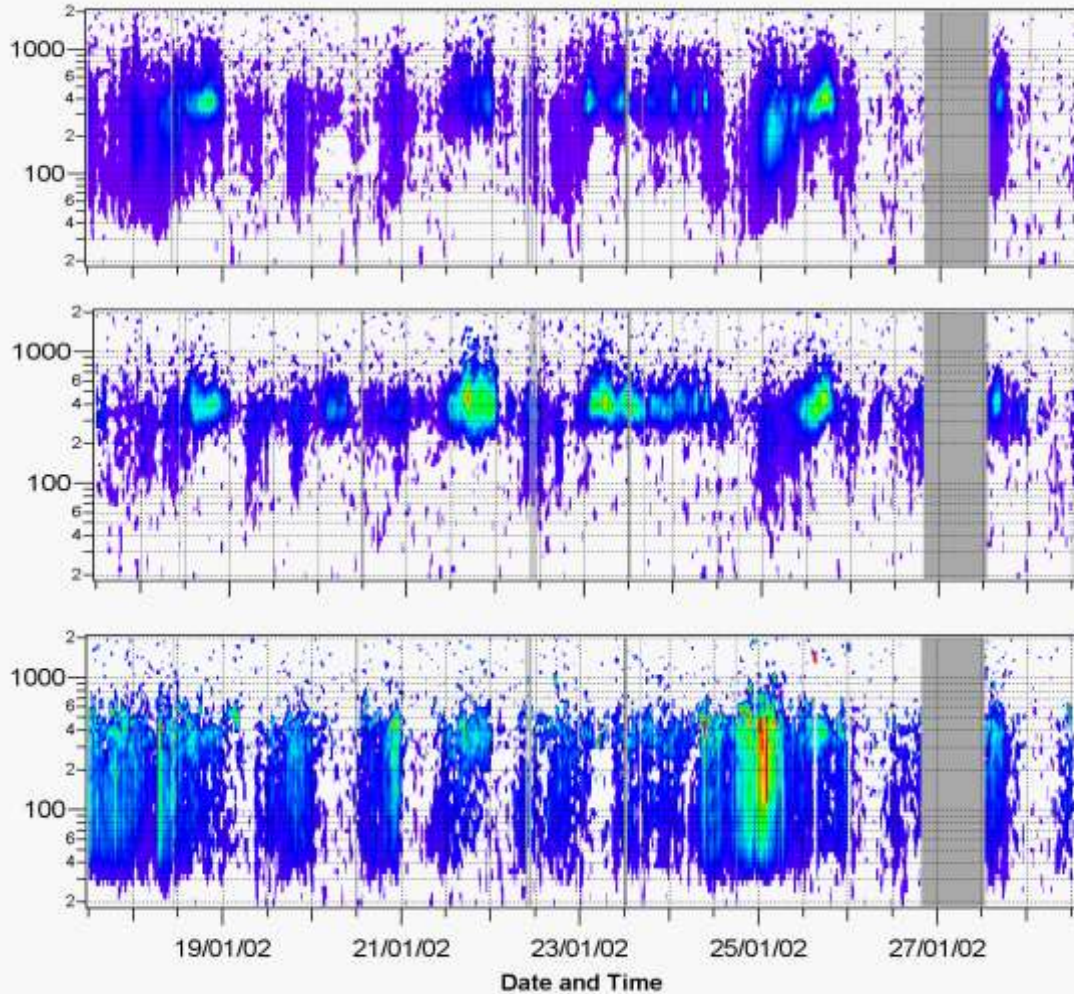


Characterisation of urban aerosol



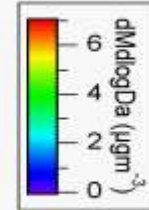
Characterisation of urban aerosol

Manchester in winter..



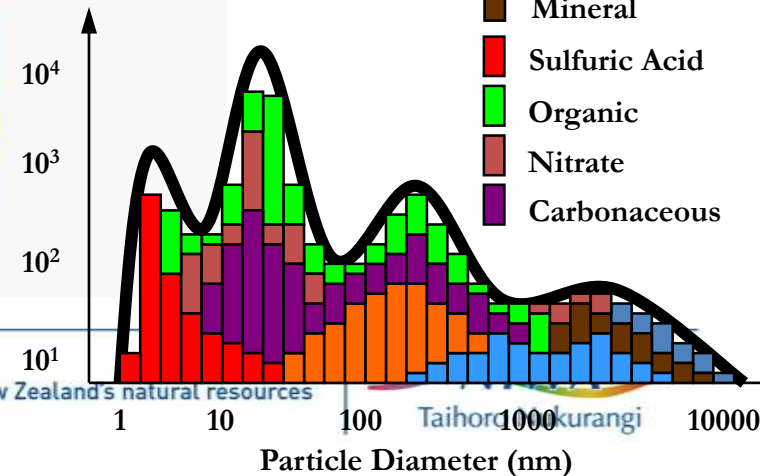
Nitrate

Sulphate



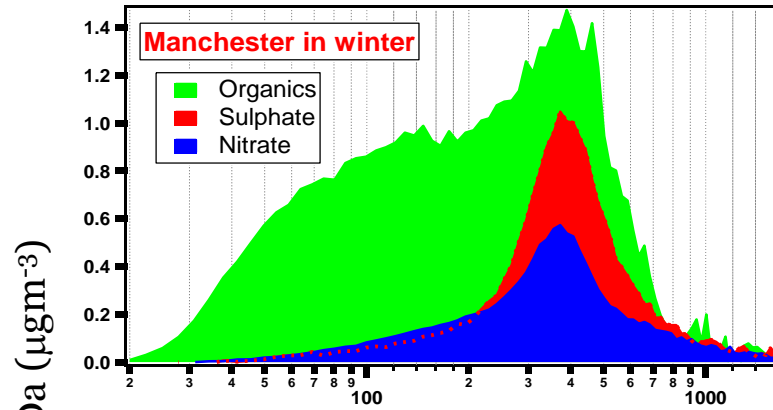
Organics

- Sulfate
- Sea Salt
- Mineral
- Sulfuric Acid
- Organic
- Nitrate
- Carbonaceous

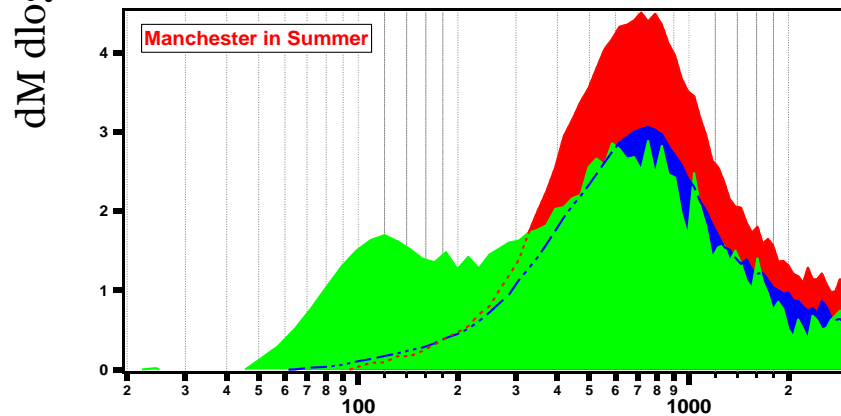
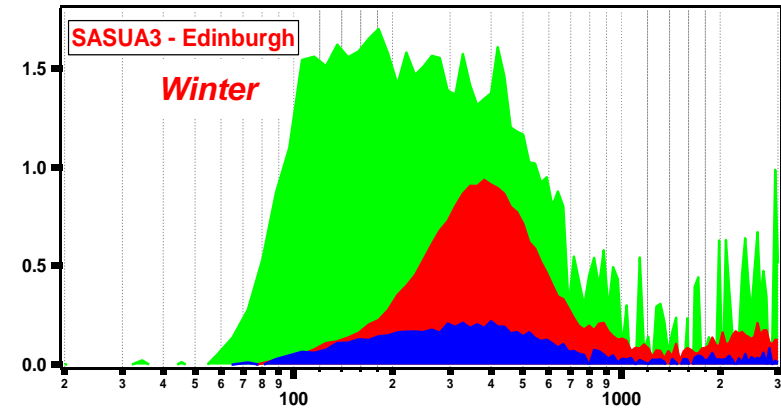


Characterisation of urban aerosol

Manchester

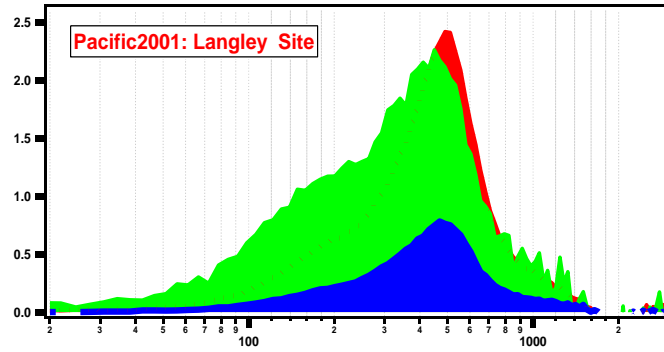


Edinburgh

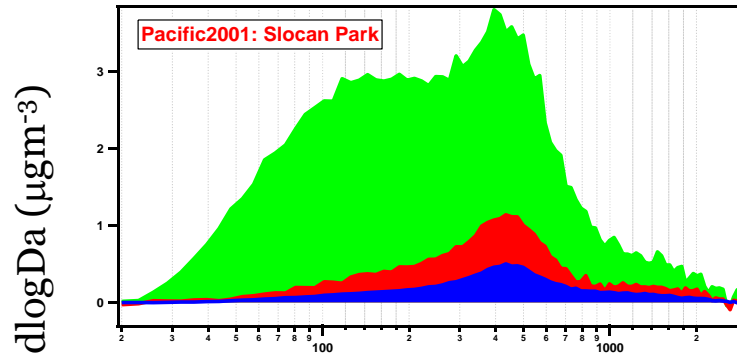


Characterisation of urban aerosol

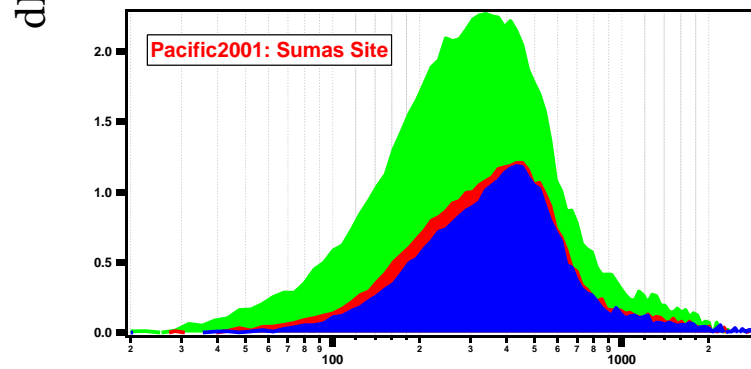
Vancouver



Urban

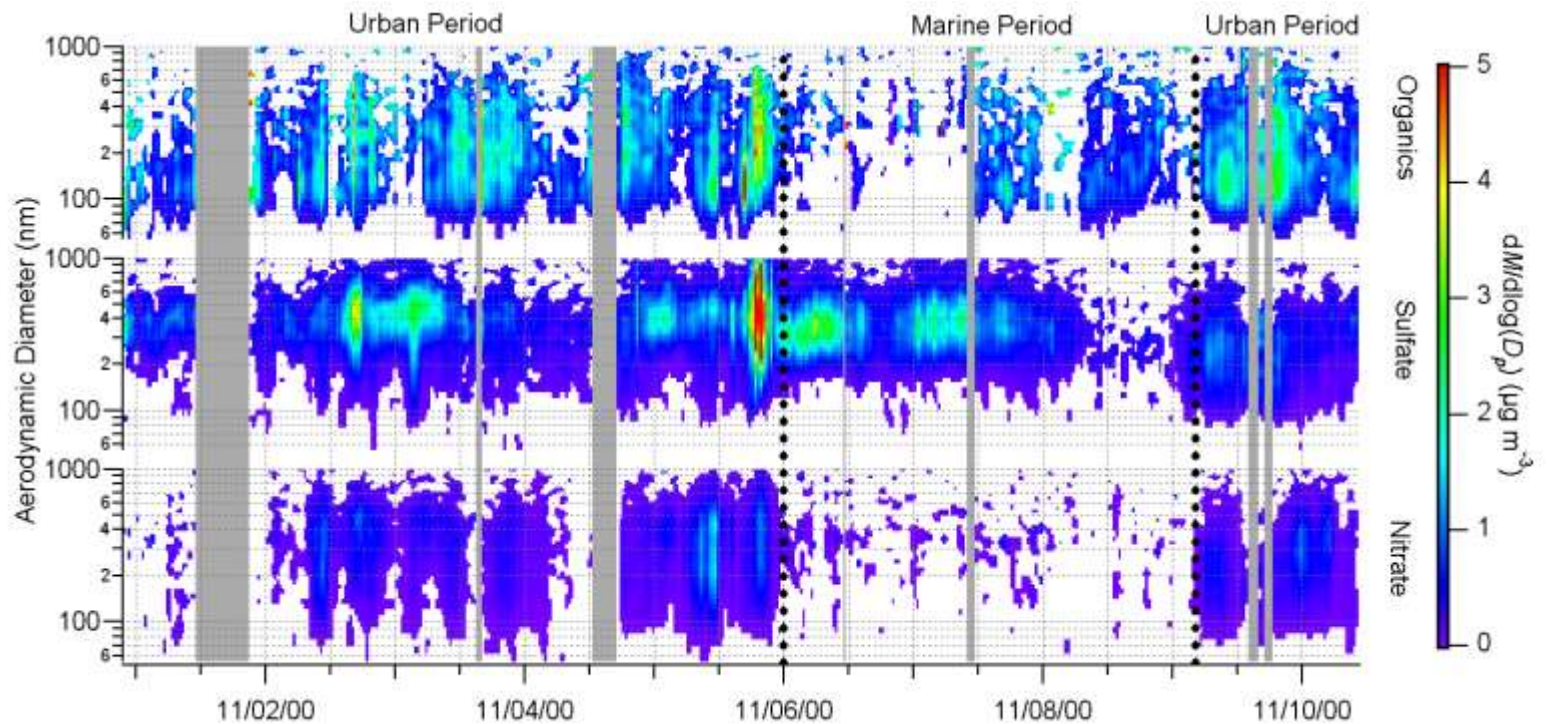


Semi Rural

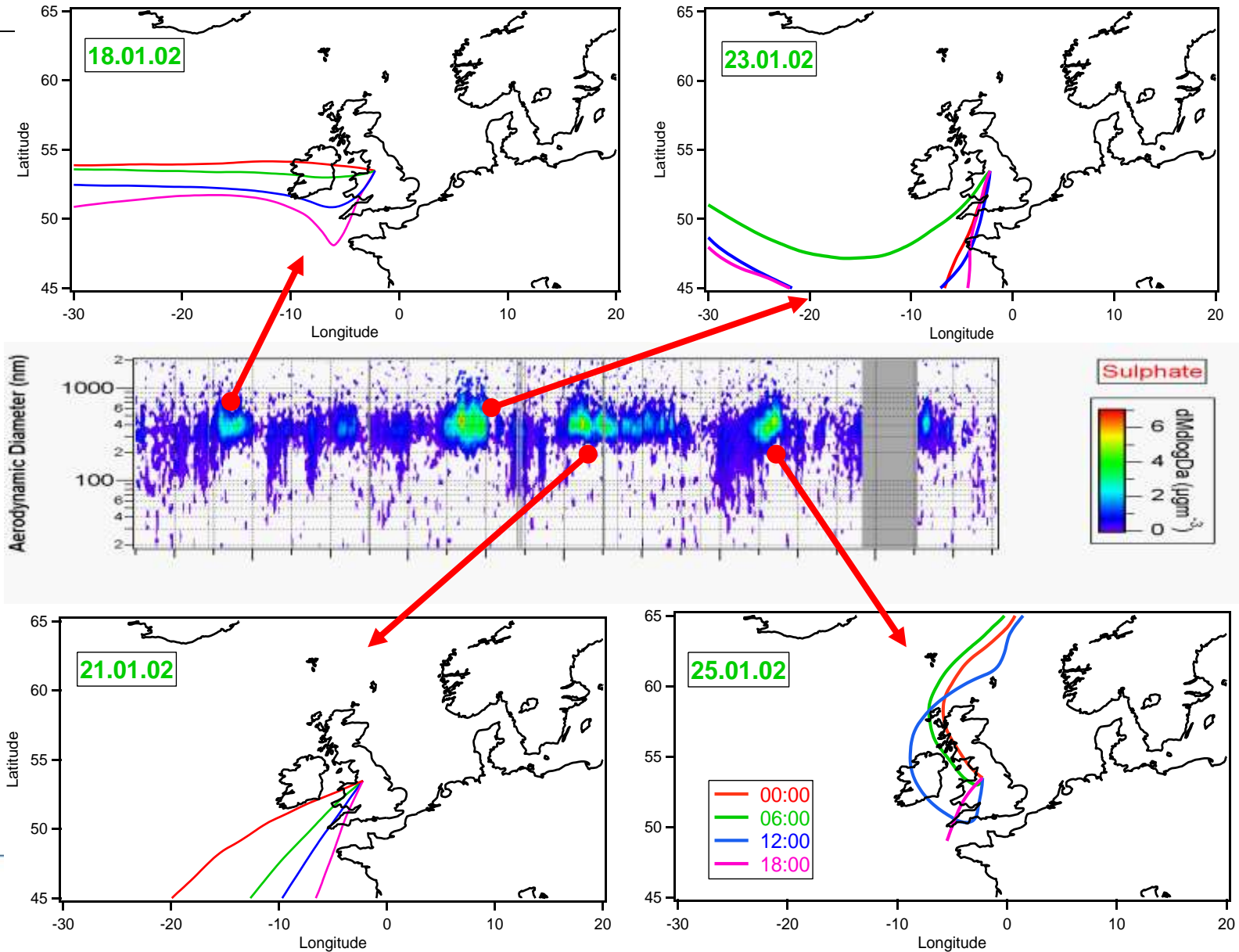


Rural

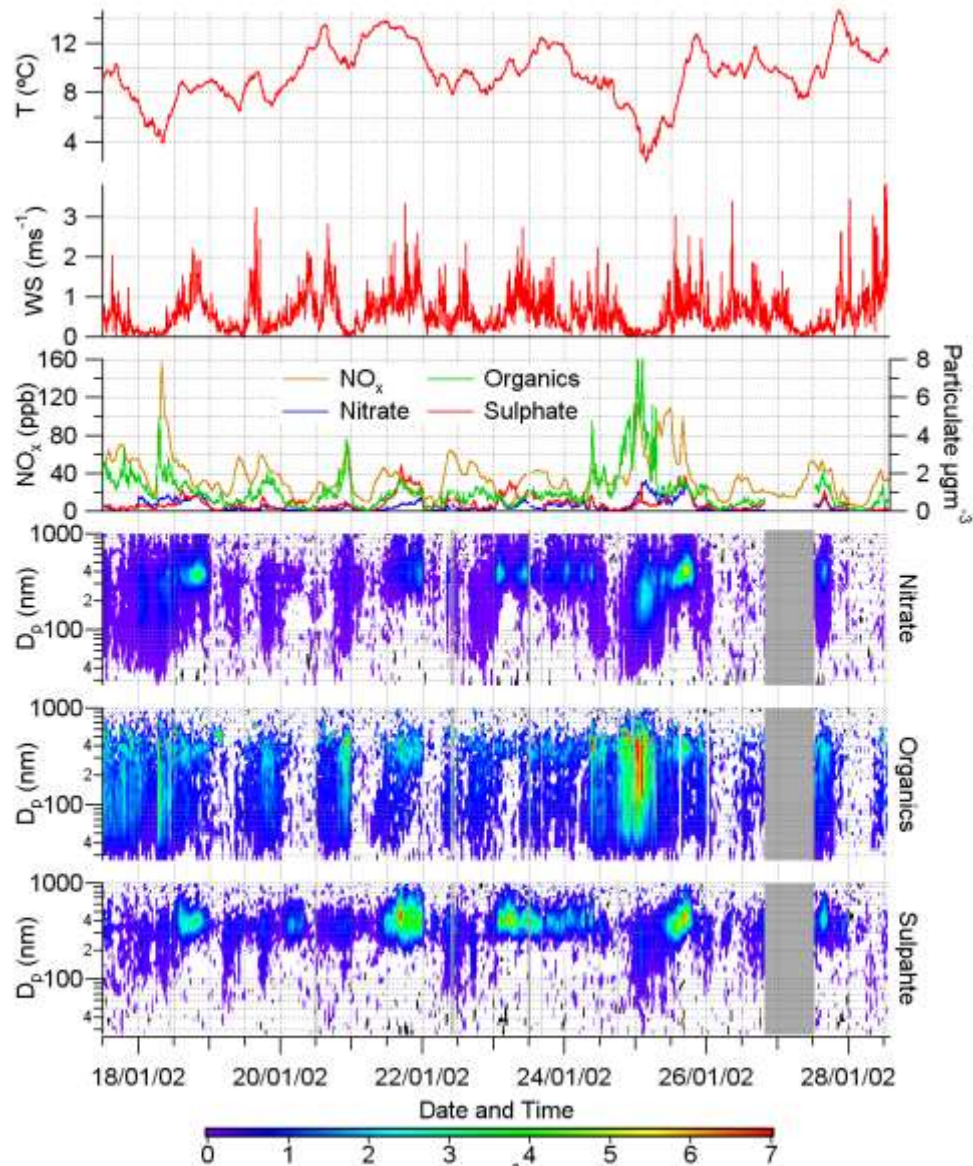
Characterisation of urban aerosol



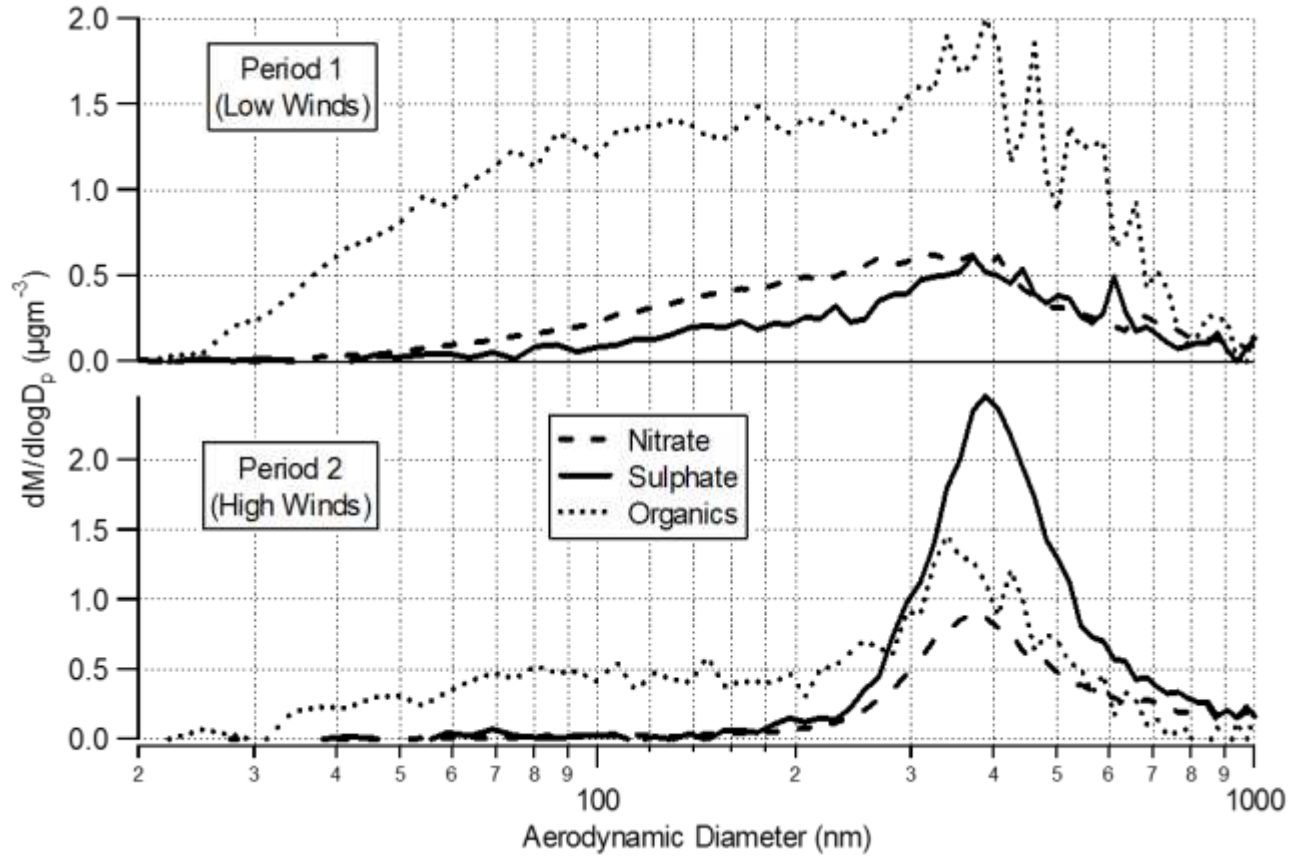
Characterisation of urban aerosol



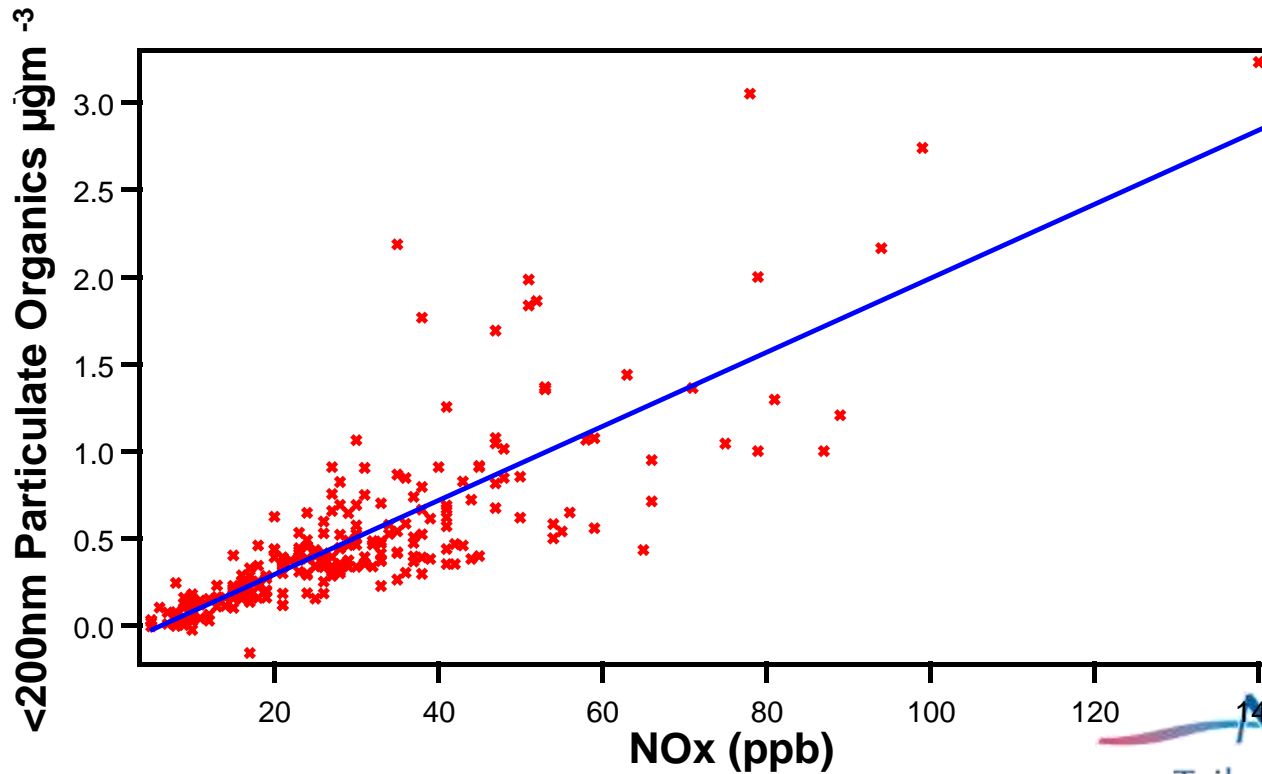
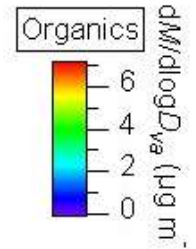
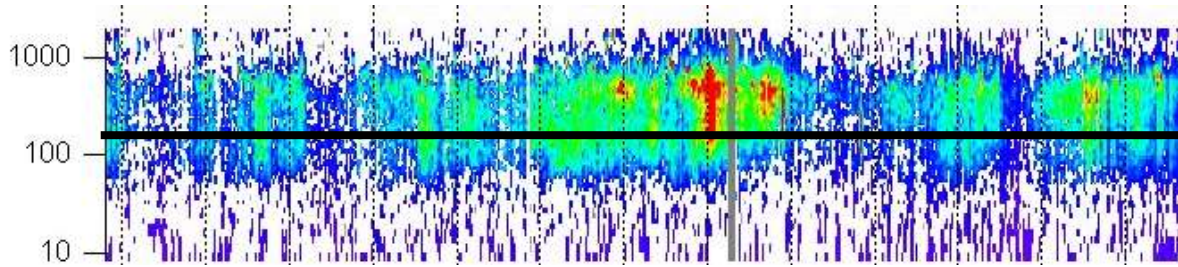
Characterisation of urban aerosol



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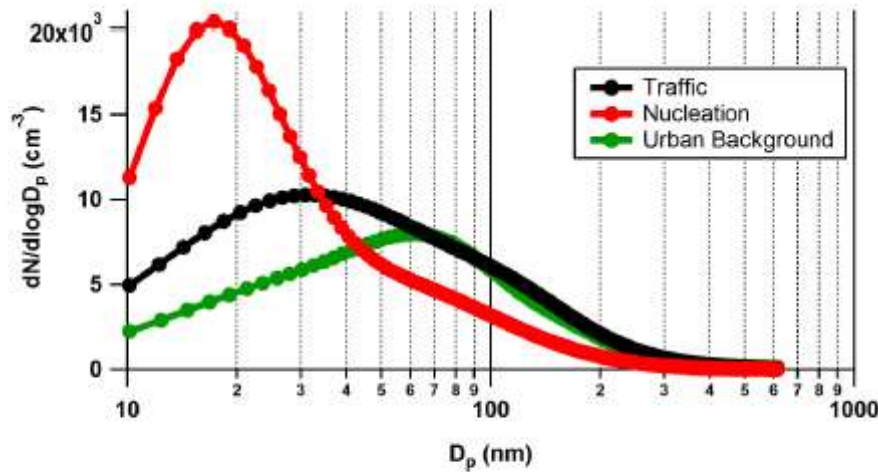


Figure 4. Average aerosol size distributions for the main *k*-means cluster category: Traffic, Nucleation and Urban Background. Only the main cities BCN, MAD and BNE were considered.

Table 4. *k*-means cluster categories average size distribution size mode peaks and corresponding area percentage. Only the main cities BCN, MAD and BNE were considered. Note the two Aitken modes for Urban Background.

Category	Nucleation	Aitken	Accumulation
Traffic	–	31 ± 1 nm (86 %)	120 ± 2 nm (14 %)
Nucleation	17 ± 1 nm (43 %)	53 ± 7 nm (57 %)	–
Urban Background	–	38 ± 3 nm (71 %), 72 ± 2 nm (25 %)	168 ± 14 nm (4 %)

Characterisation of urban aerosol

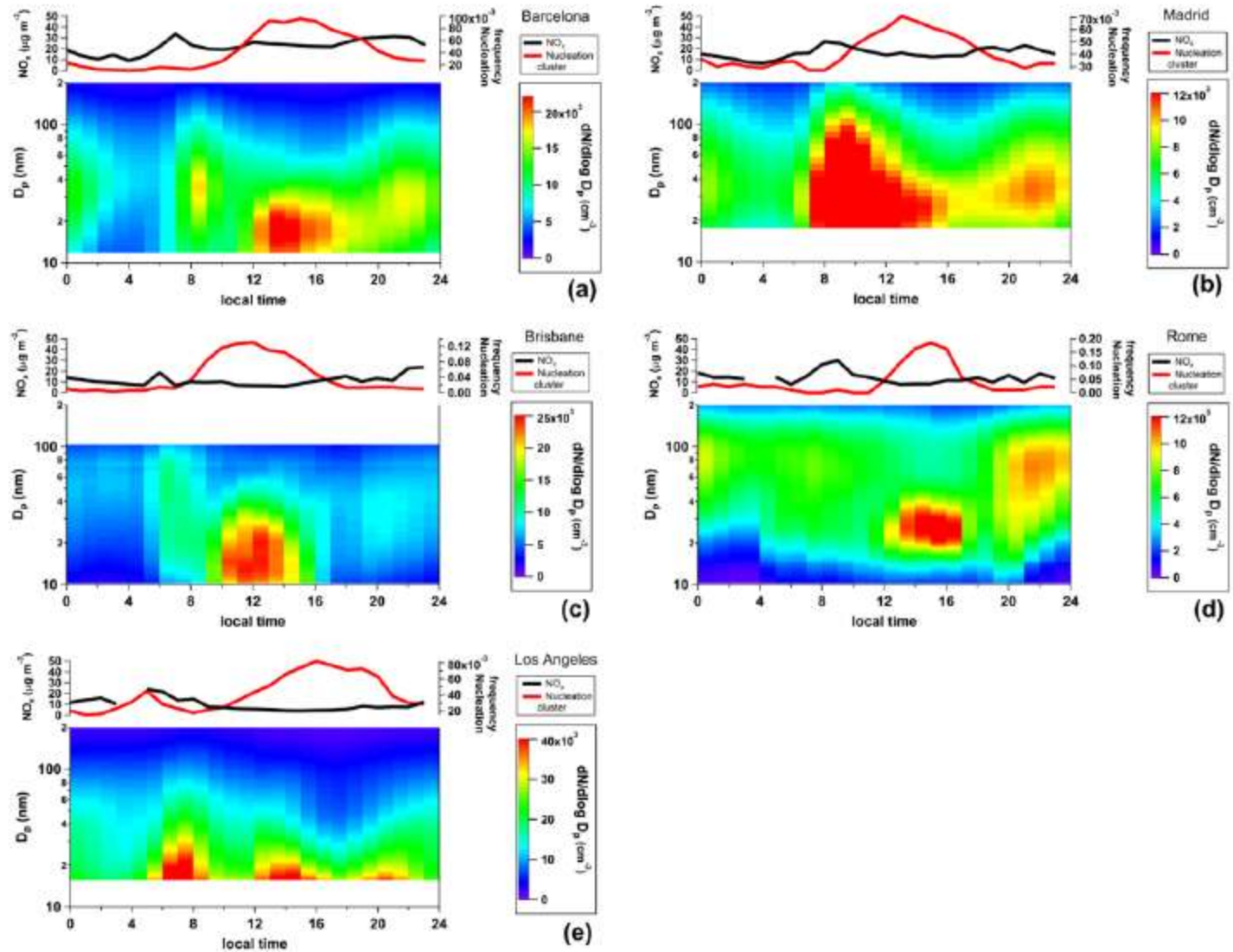
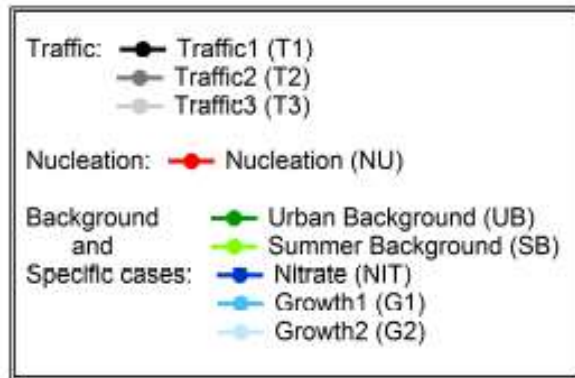
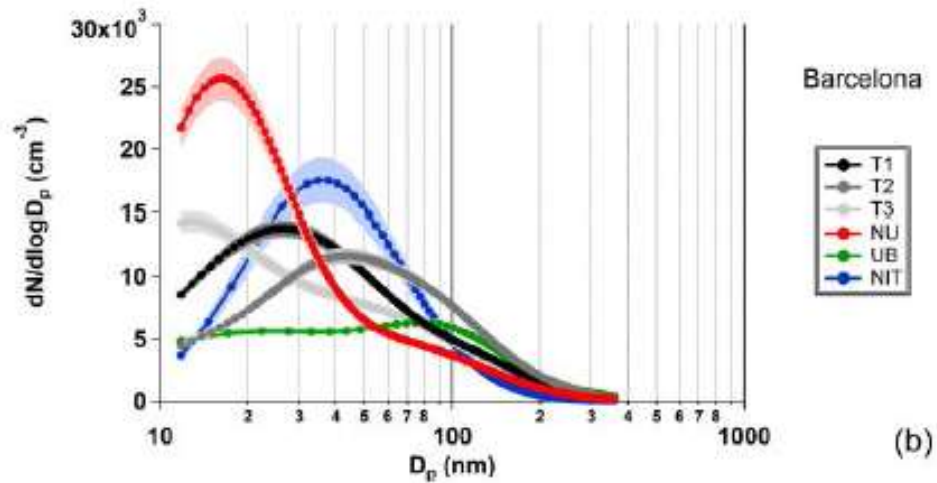


Figure 5. Mean SMPS size distributions on a nucleation day at each selected city, NO_x average concentration and the frequency of occurrence of the Nucleation cluster for: (a) Barcelona, (b) Madrid, (c) Brisbane, (d) Rome and (e) Los Angeles. Please note that NO_x concentrations for Madrid represent $\text{NO}_x/2$ and for Los Angeles $\text{NO}_x/10$. These values are 30–65% lower on nucleation days than the corresponding sampling period average levels.

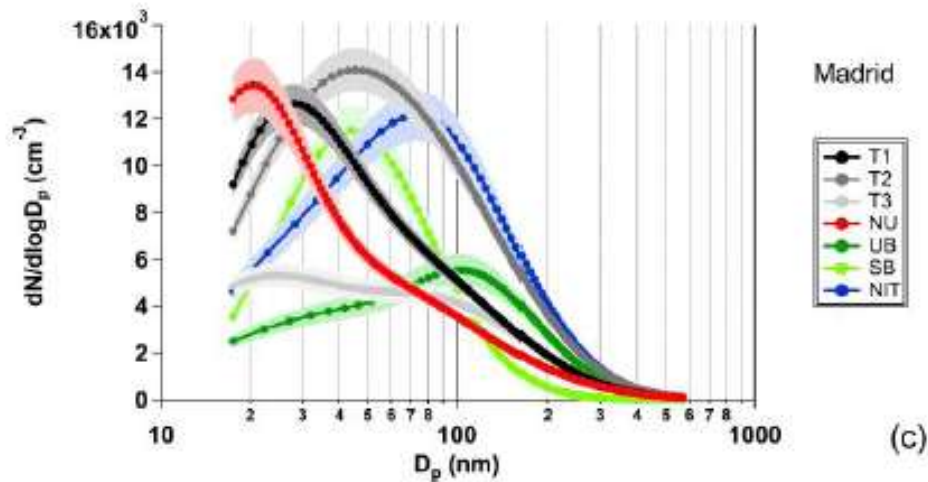
Characterisation of urban aerosol



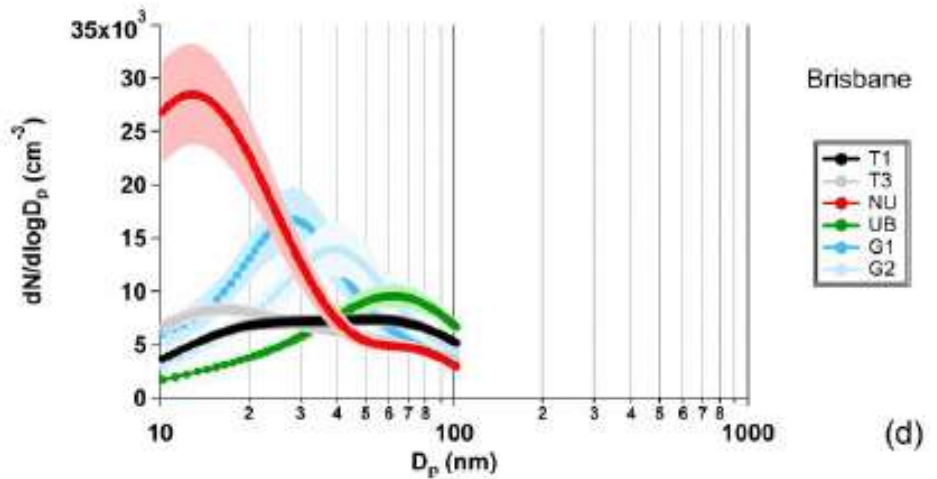
(a)



(b)

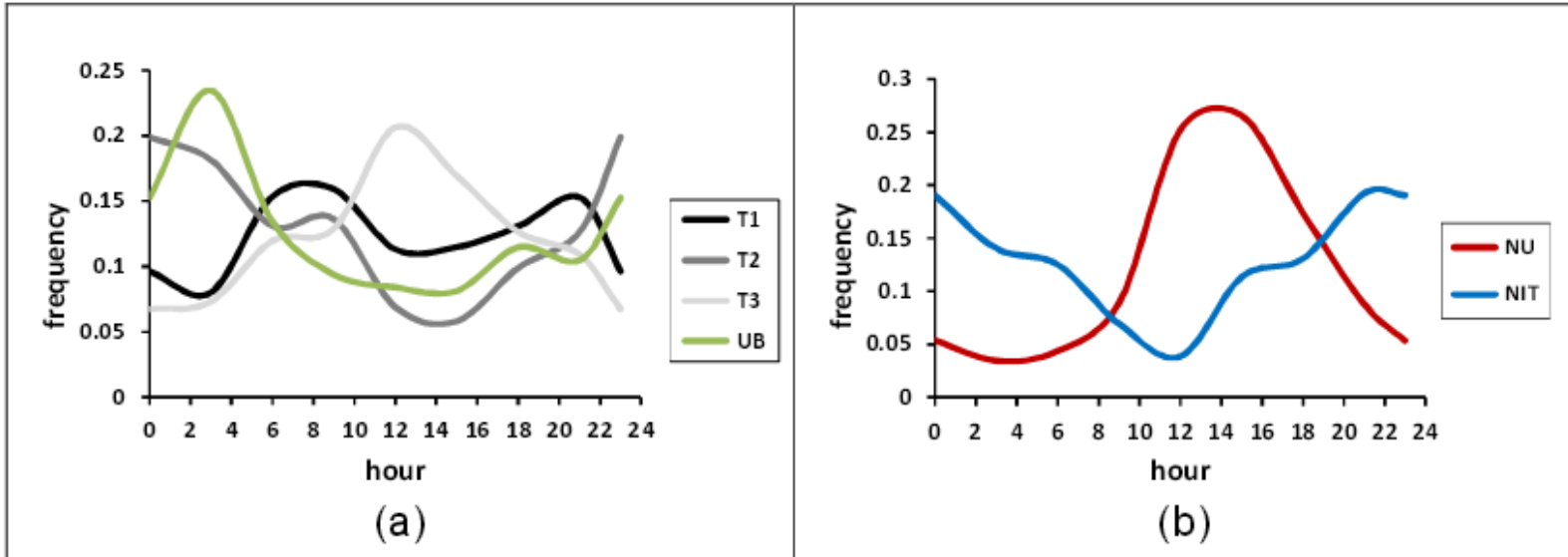


(c)



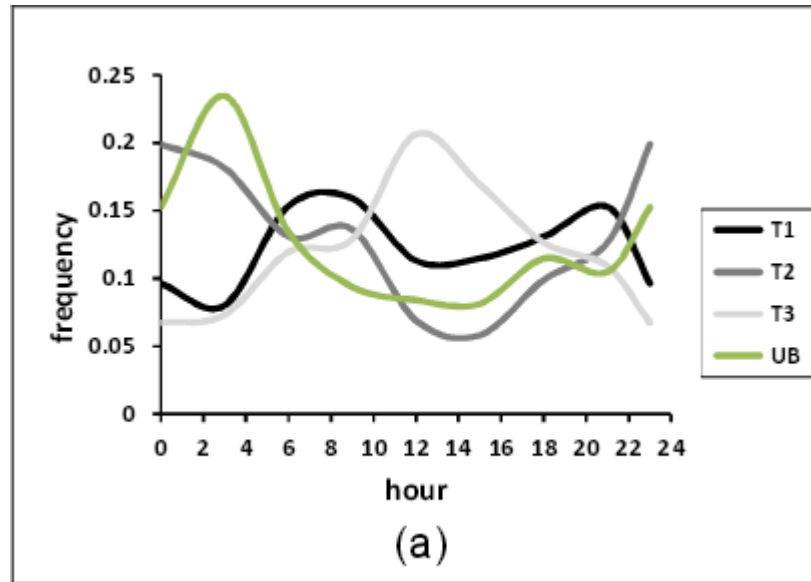
(d)

Characterisation of urban aerosol



How does the diurnal pattern relate to other pollutant measurements, meteorology and size distribution?

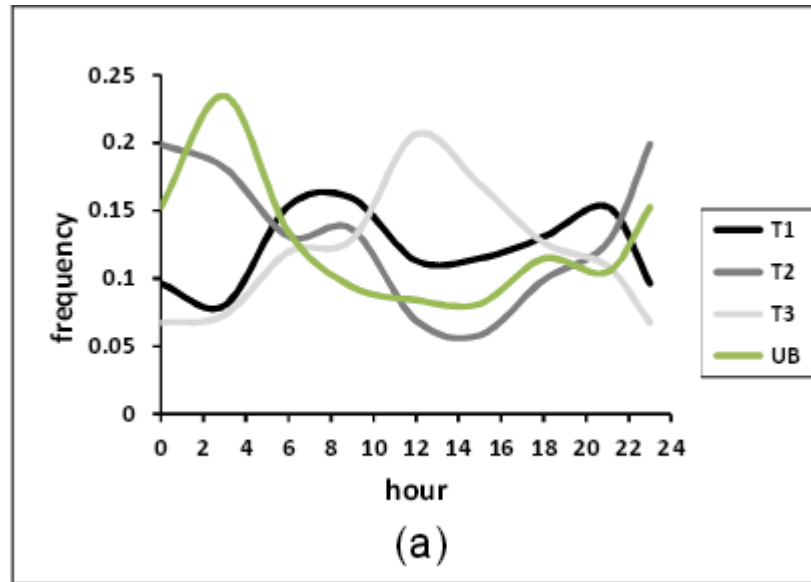
Characterisation of urban aerosol



T1 – freshly emitted traffic particles

- bimodal size distribution, as typically found in vehicle exhausts, with a dominant peak at 20–40 nm (traffic-related nucleated particles) and another at 70–130 nm (soot particles).
- diurnal pattern correlates with traffic rush hours
- Correlated with very high levels of traffic pollutants, such as NO, NO₂, BC and CO

Characterisation of urban aerosol

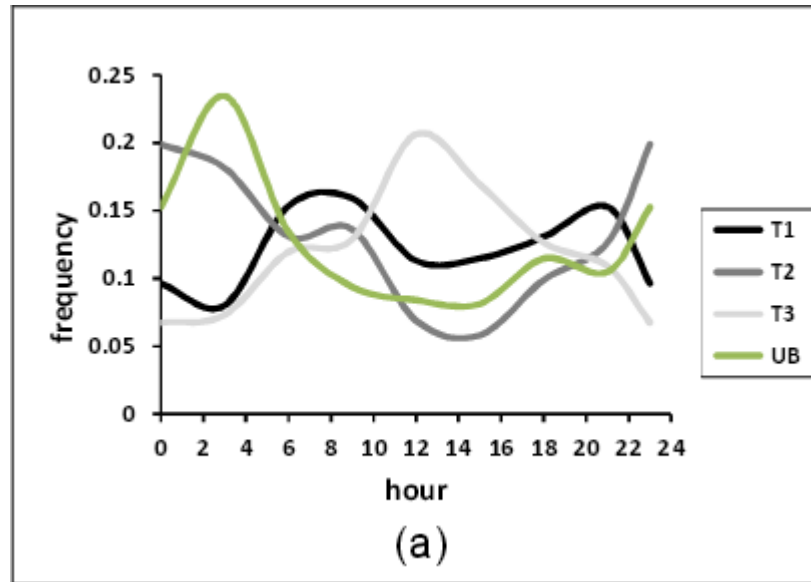


T3 nucleation mode particles of traffic origin

- Bimodal size distribution, with a low peak in the nucleation mode at 10–20 nm and a main peak at 50–90 nm.
- It occurs throughout the day, with a peak during daytime, and it is associated with the lowest pollution levels of all the Traffic clusters
- The shift to smaller sizes of the 20–40 nm peak of T1 and T2 towards the nucleation mode in T3 might indicate particle evaporation in Barcelona, Madrid and Brisbane.

Characterisation of urban aerosol

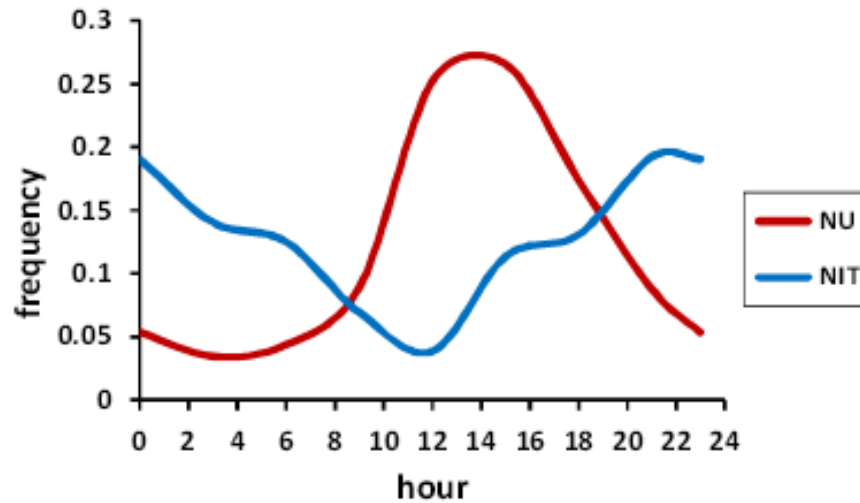
UB/SB Urban Background



- Bimodal peak at 20–40 nm and at 60–120 nm.
- At Barcelona and Madrid – cities highly influenced by road traffic emissions – the dominant peak is the finest one, whereas in Brisbane the larger peak prevails.
- Usually observed during the night time, associated with relatively clean atmospheric conditions in the urban environment
- SB-Madrid summer nights only with a unimodal size distribution peaking in the Aitken mode at 44 nm. It is influenced by clean summer atmospheric conditions

Characterisation of urban aerosol

NU nucleation

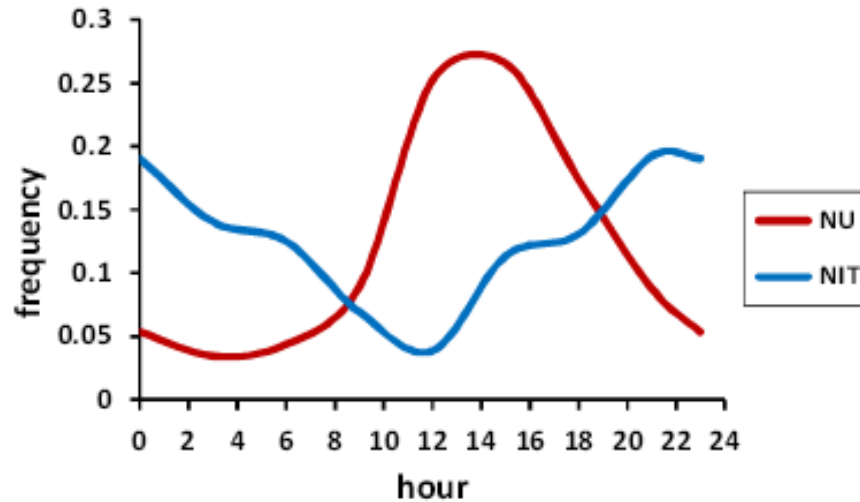


(b)

- Dominant nucleation mode peak in the range 10–20 nm
- A minor size peak in the Aitken mode at 50–80 nm is attributed to background aerosols.
- Observed at midday or early afternoon more intensely during spring and summer
- Characterized by very high solar irradiance, high wind speed and low concentration of traffic pollutants

Characterisation of urban aerosol

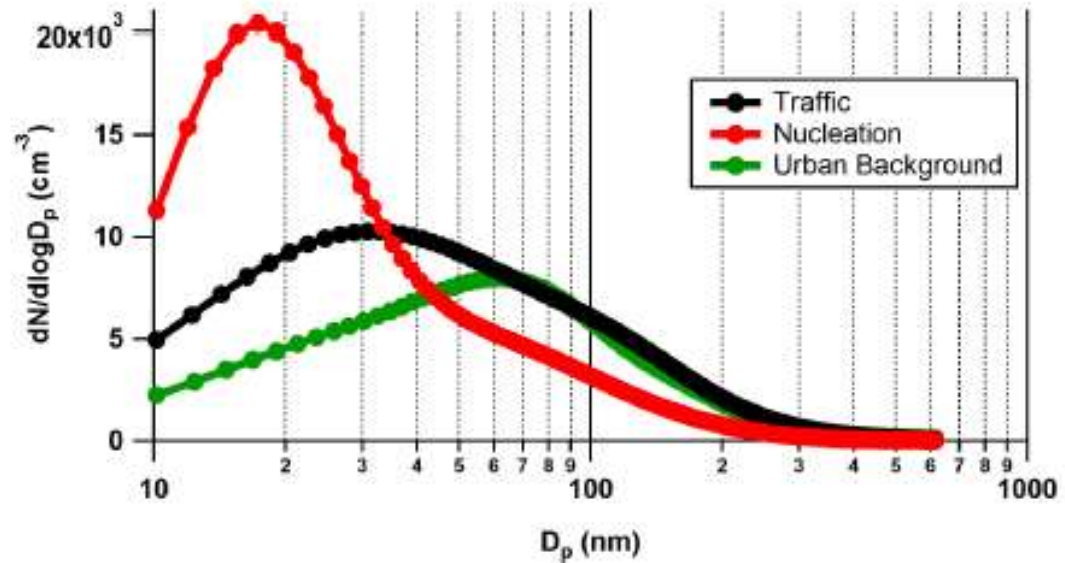
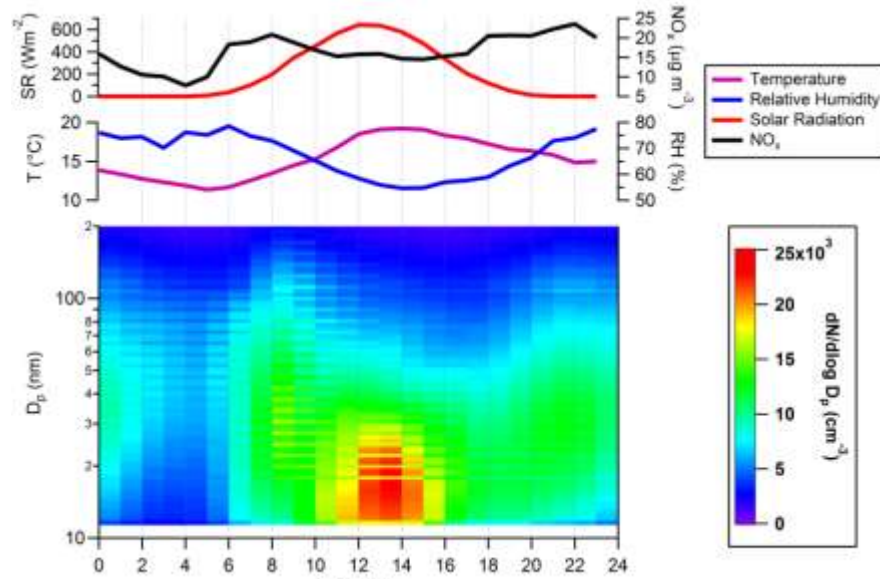
NiT nitrate



(b)

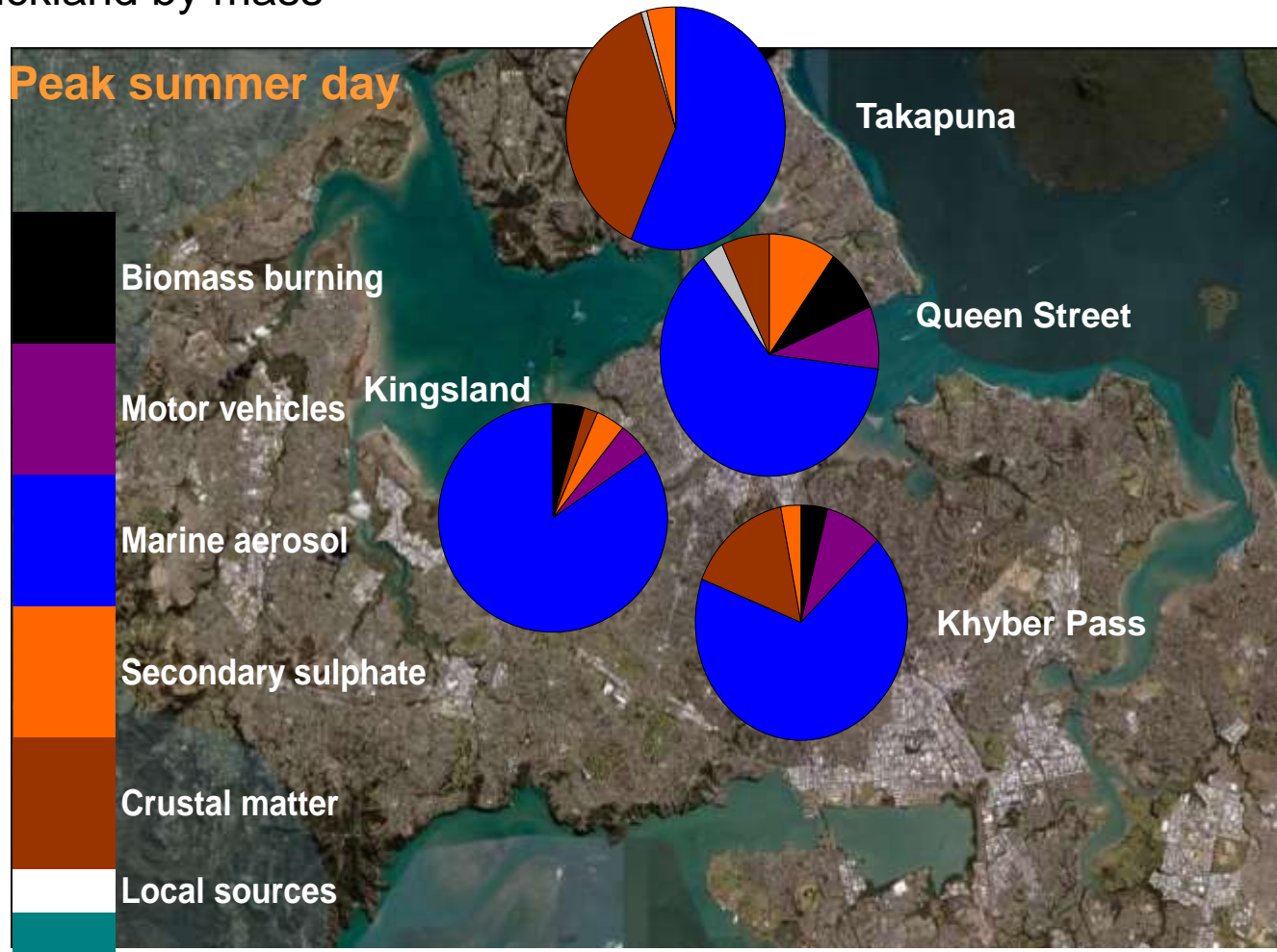
- Prevalence at night during the colder months
- Barcelona and Madrid are unimodal although presenting different modes. BCN_NIT shows a finer mode at 361 nm, whereas MAD_NIT shows a larger size mode at 631 nm.
- In Madrid a minor peak was also seen during midday

Characterisation of urban aerosol



Characterisation of urban aerosol

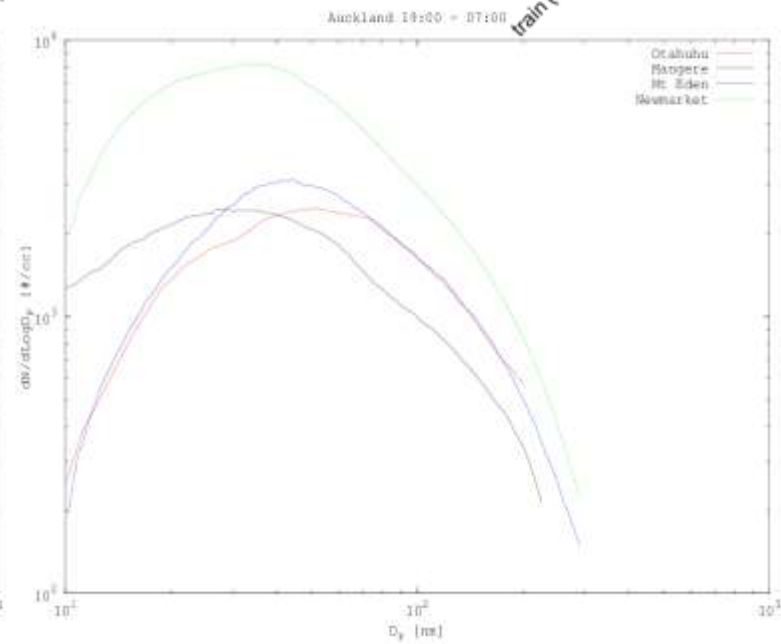
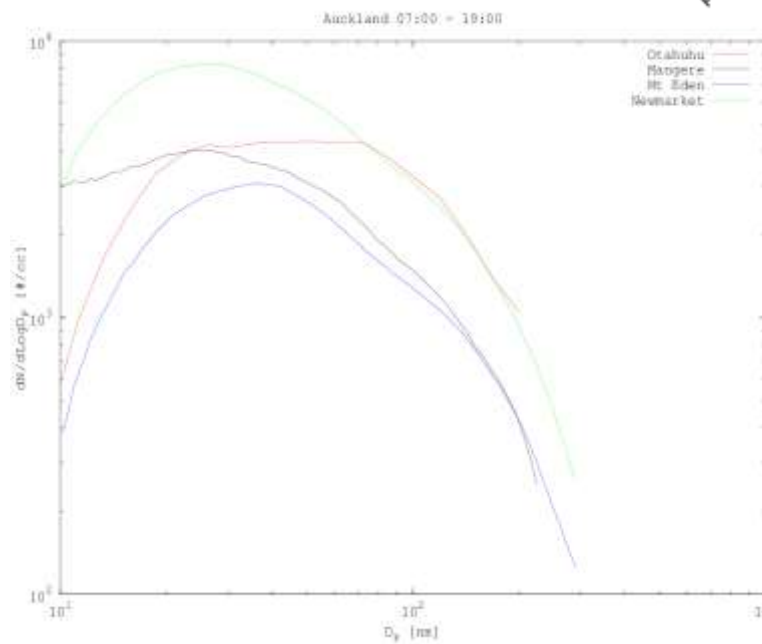
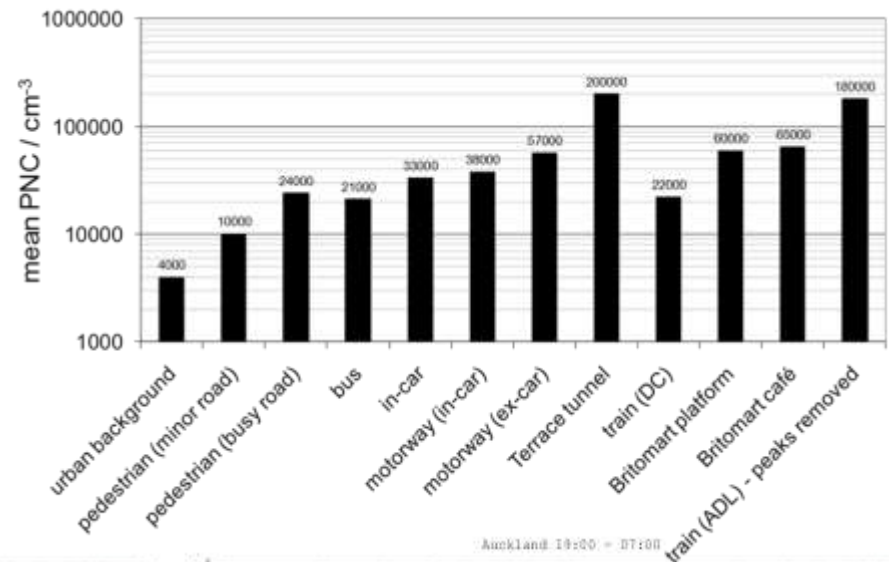
Auckland by mass



Data courtesy of Auckland Regional Council

Characterisation of urban aerosols

Urban aerosols in Auckland

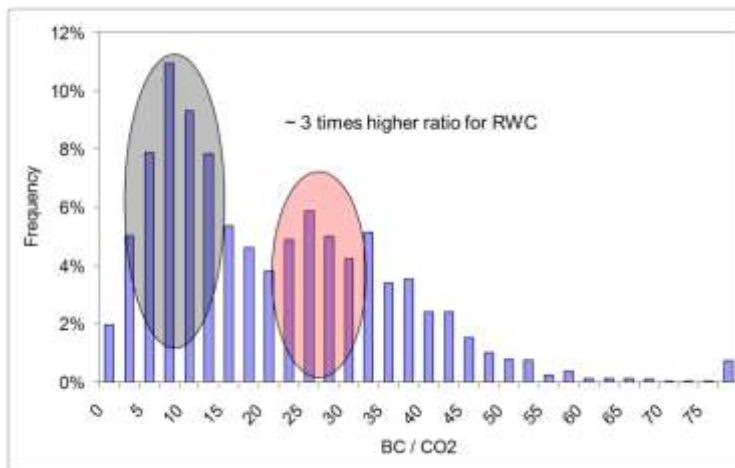


Characterisation of urban aerosol

Differentiate between fossil carbon and biomass carbon from Residential Wood Combustion (RWC)

$$Z \text{ ratio} = \text{BC}/\text{CO}_2$$

Night time mobile measurements in Glen Eden



BC / CO₂
■ RWC
■ mixture
■ Traffic



Characterisation of urban aerosol



Comparisons:

- Other cities
- Urban/Rural
- Season
- Time of day

Correlations with:

- Other pollutant measurements
- Wind regimes
- Climatology
- Back Trajectories