Air pollution Measurements in Mediterranean Port Cities

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Germany

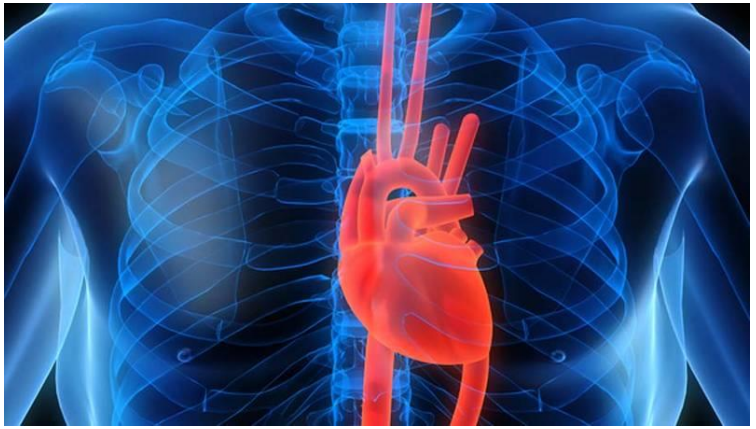
Reducing air pollution from ships in the Mediterranean Sea
Paris, Tuesday May, 15th 2018

What is the problem?

- Sulfur content of fuel for marine sea ships can be about 3,500times as high as on shore (cars, trucks)
- Sulfur content of fuel for marine sea ships on average it is 2,700 times higher
- From 2020 sulfur content will be limited
- To 0.5 %, in ECA and EU harbors: S- max 0.1 %
- Toxic emissions:
  1. Particulate Matter (PM) and
  2. Black Carbon (BC)
  3. Sulfur Dioxides (SO_2)
  4. Poly Aromatic Hydrocarbons (PAH)
  5. Heavy Metal Oxides
  6. Nitrogen Oxides (NO_x)

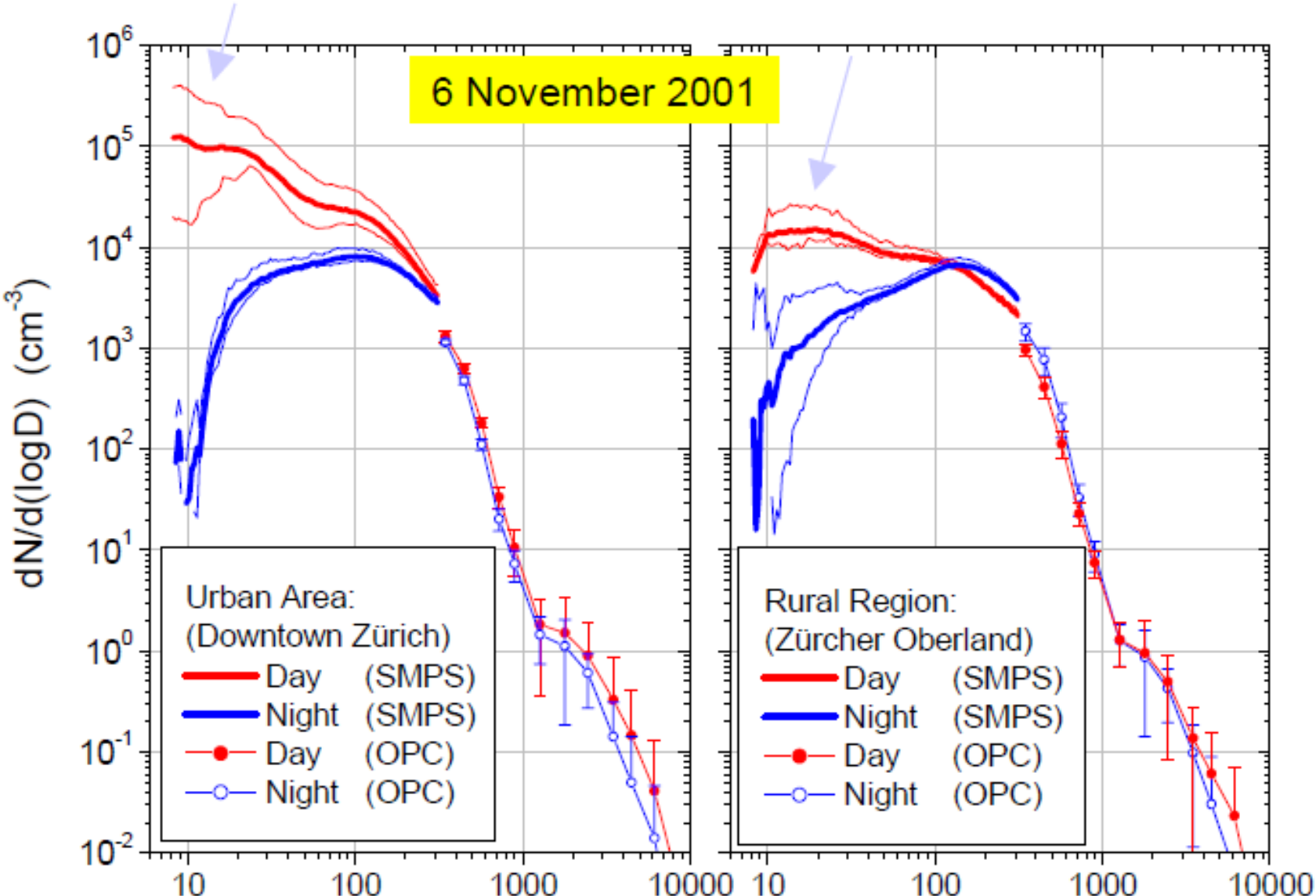
Problem: BlackCarbon(1)

- results from the incomplete burning of fossil fuels and biomass
- component of PM
- shortens life expectancy
- causes respiratory and cardiovascular diseases
- can cause lung-cancer

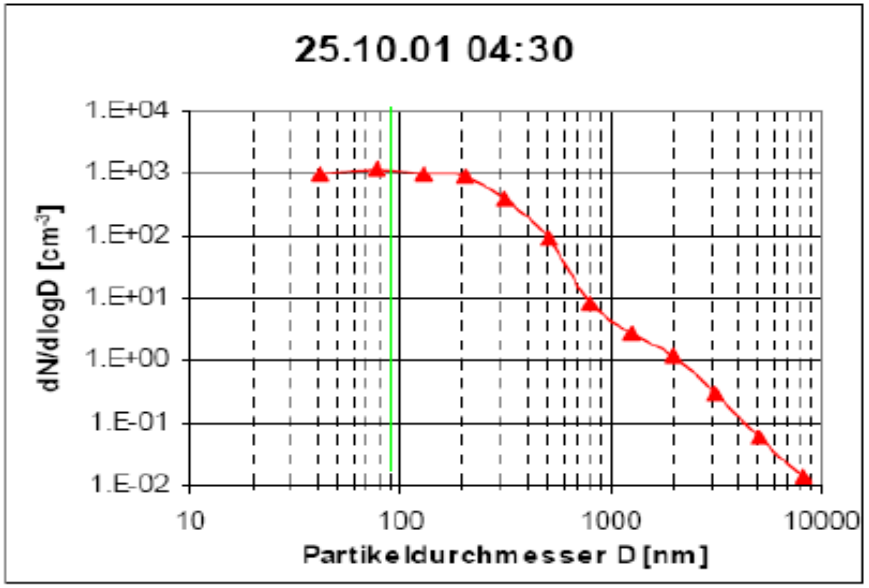


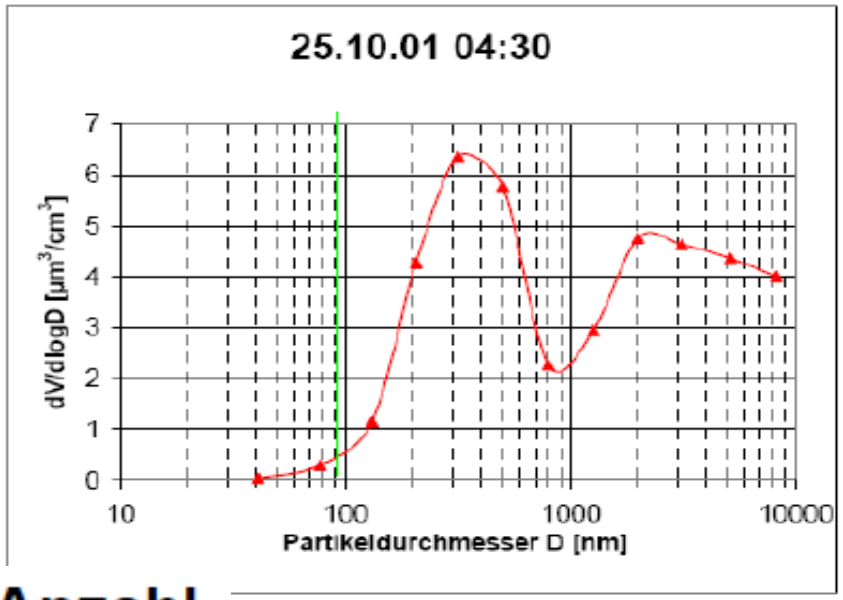
Sources

Aerosol Number/Size – Distribution
City (Zürich) and Coutry (Zürcher Oberland)



Number- and Mass-Distribution





Anzahl

PSI, UVEK 2003

- Number

- **Particle mass are dominated by particles greater than 200nm, particle number by ultrafine particles**

- Volume
  Mass

Ultrafine Particle

P-TRAK™ ULTRAFINE PARTICLE COUNTERS (CPC)

Model 8525

+ Counts ultrafine particles less than 1 micron diameter in real time
+ Tracks particles to the source
+ Portable, battery operated
+ Data logs to document results

Model 8525

SPECIFICATIONS

P-TRAK ULTRAFINE PARTICLE COUNTER MODELS 8525

Concentration Range
0 to 5 x 10^5 particles/cm^3

Particle Size Range
0.02 to 1 micrometer

Temperature Range

Operation	32 to 100°F (0 to 38°C)
Storage	-40 to 160°F (-40 to 70°C)

Flow Rate

Sample	100 cm^3/min
Total	700 cm^3/min (nominal)

Black Carbon Measurements

microAeth® / AE51

Measurement Principle
Real-time analysis by measuring the rate of change in absorption of transmitted light due to continuous collection of aerosol deposit on filter. Measurement at 880 nm interpreted as concentration of Black Carbon ('BC').

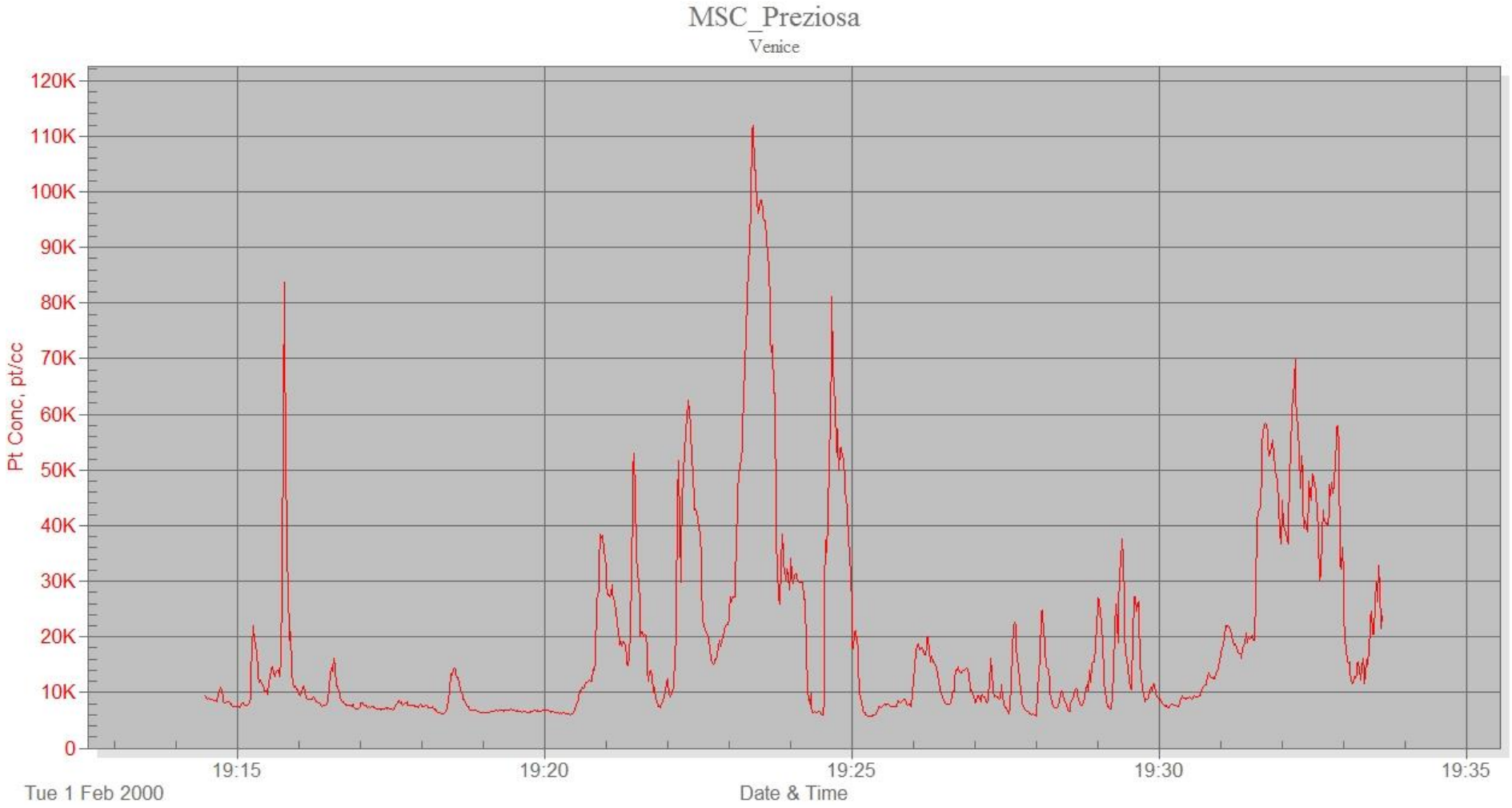
Measurement Range
0-1 mg BC/m^3, filter life time dependent on concentration and flow rate setting:
avg. 5 µg BC/m^3 for 24 hours @ 100 ml/min
avg. 100 µg BC/m^3 for 3 hours @ 50 ml/min
avg. 1 mg BC/m^3 for 15 minutes @ 50 ml/min

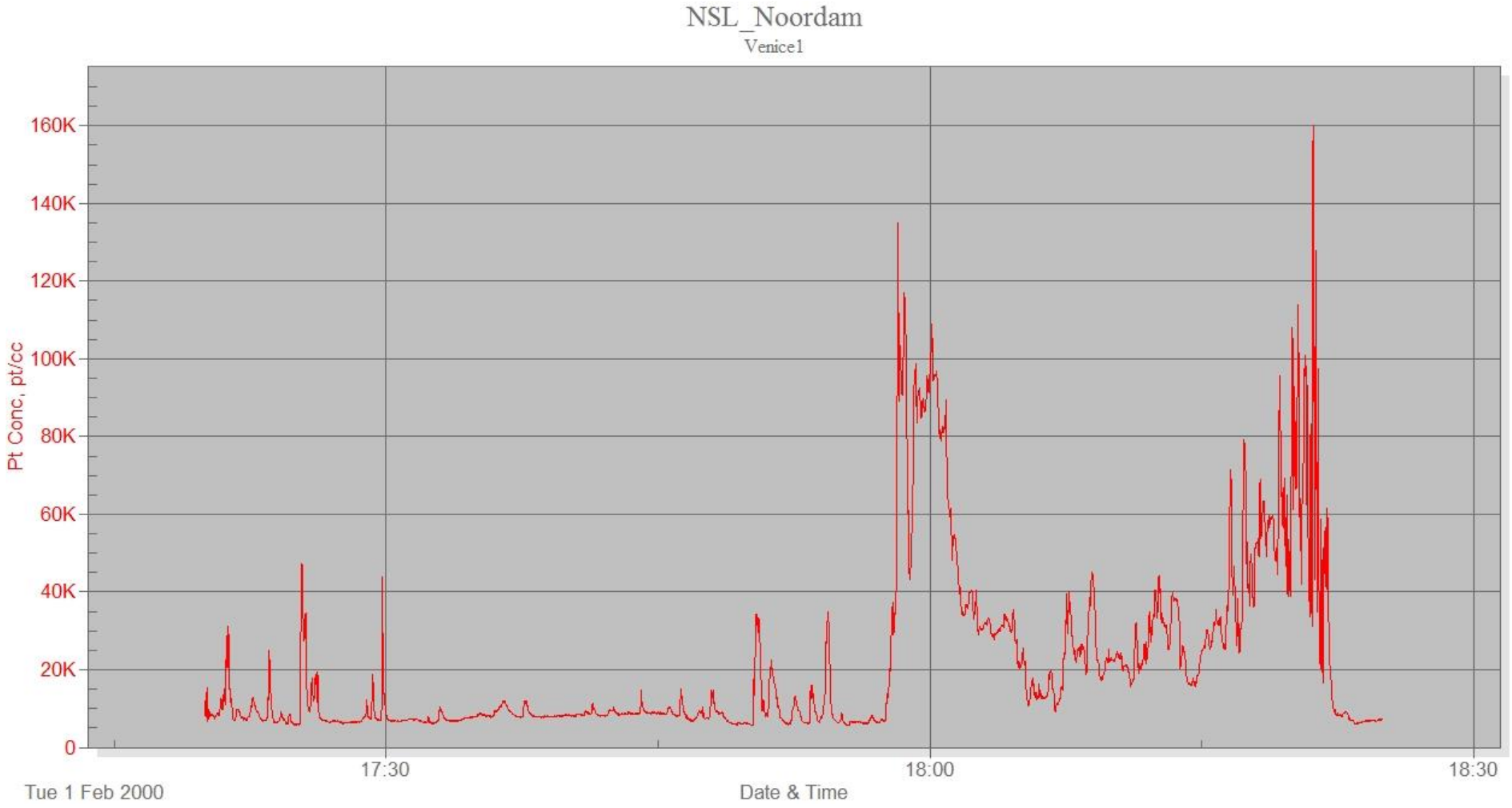
Measurement Resolution
0.001 µg BC/m^3

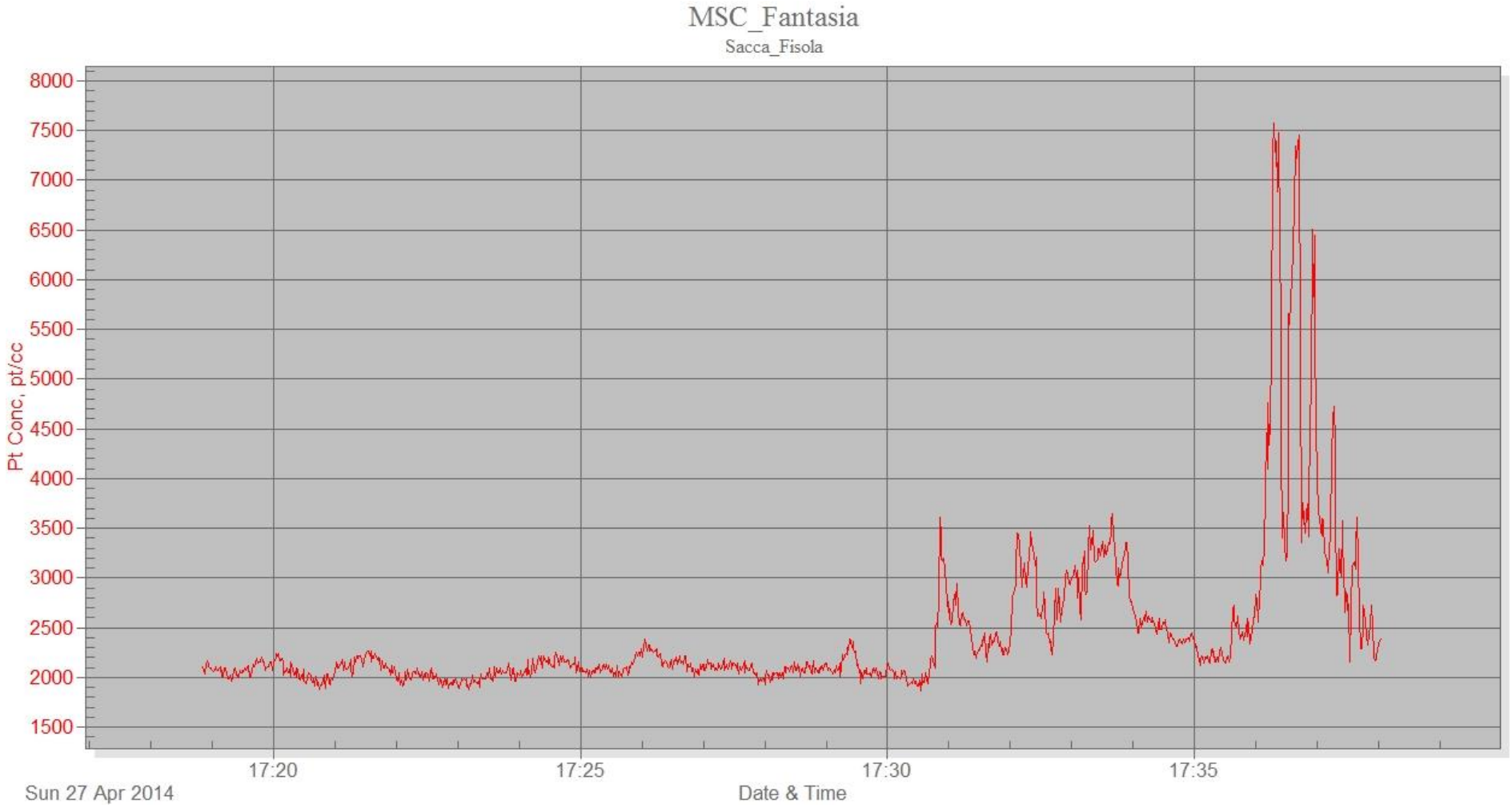
Measurement Precision
±0.1 µg BC/m^3, 1 min avg., 150 ml/min flow rate

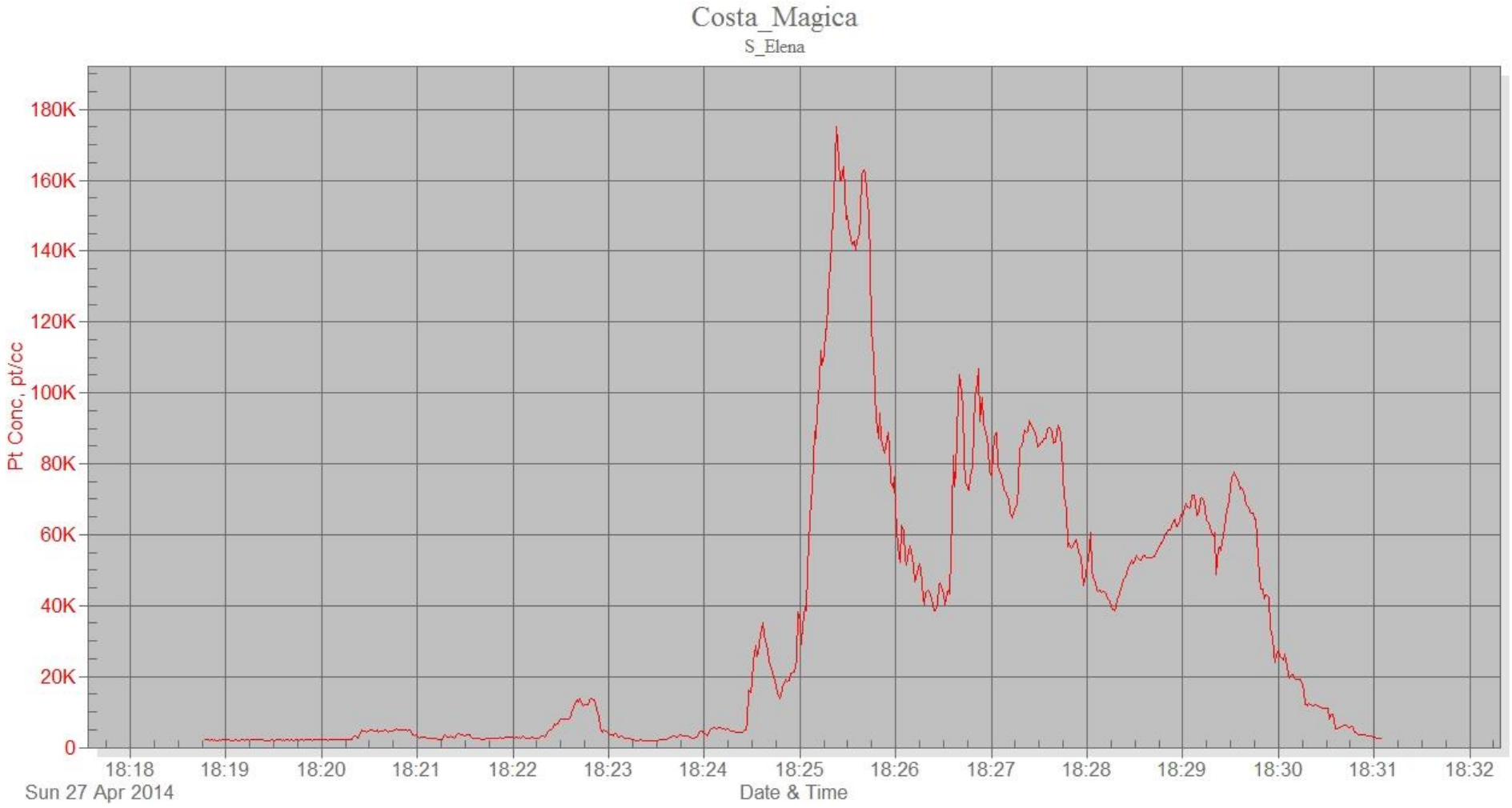
Measurement Timebase (User setting)
1, 10, 30, 60, or 300 seconds

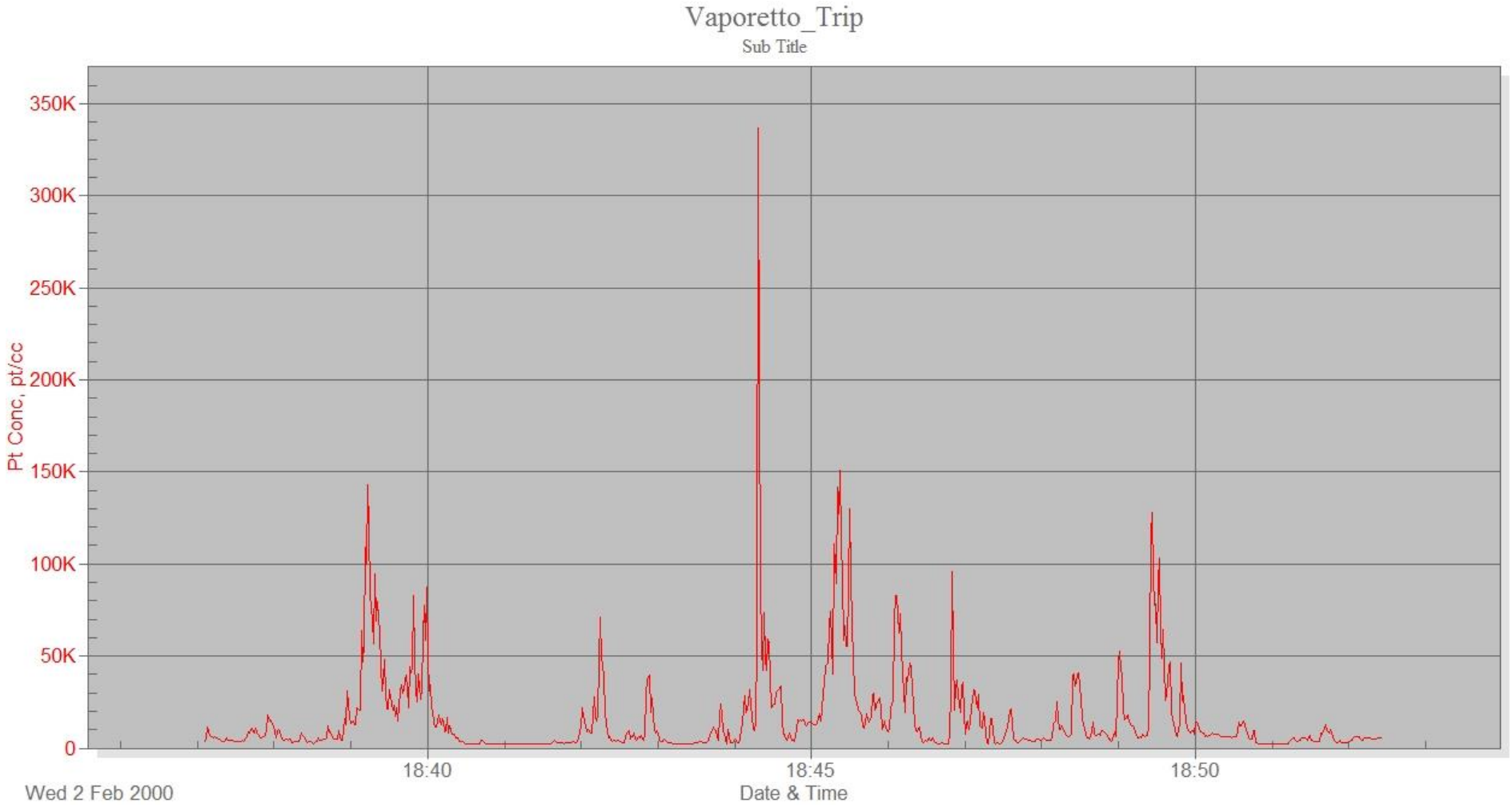
Particle Number Measurements

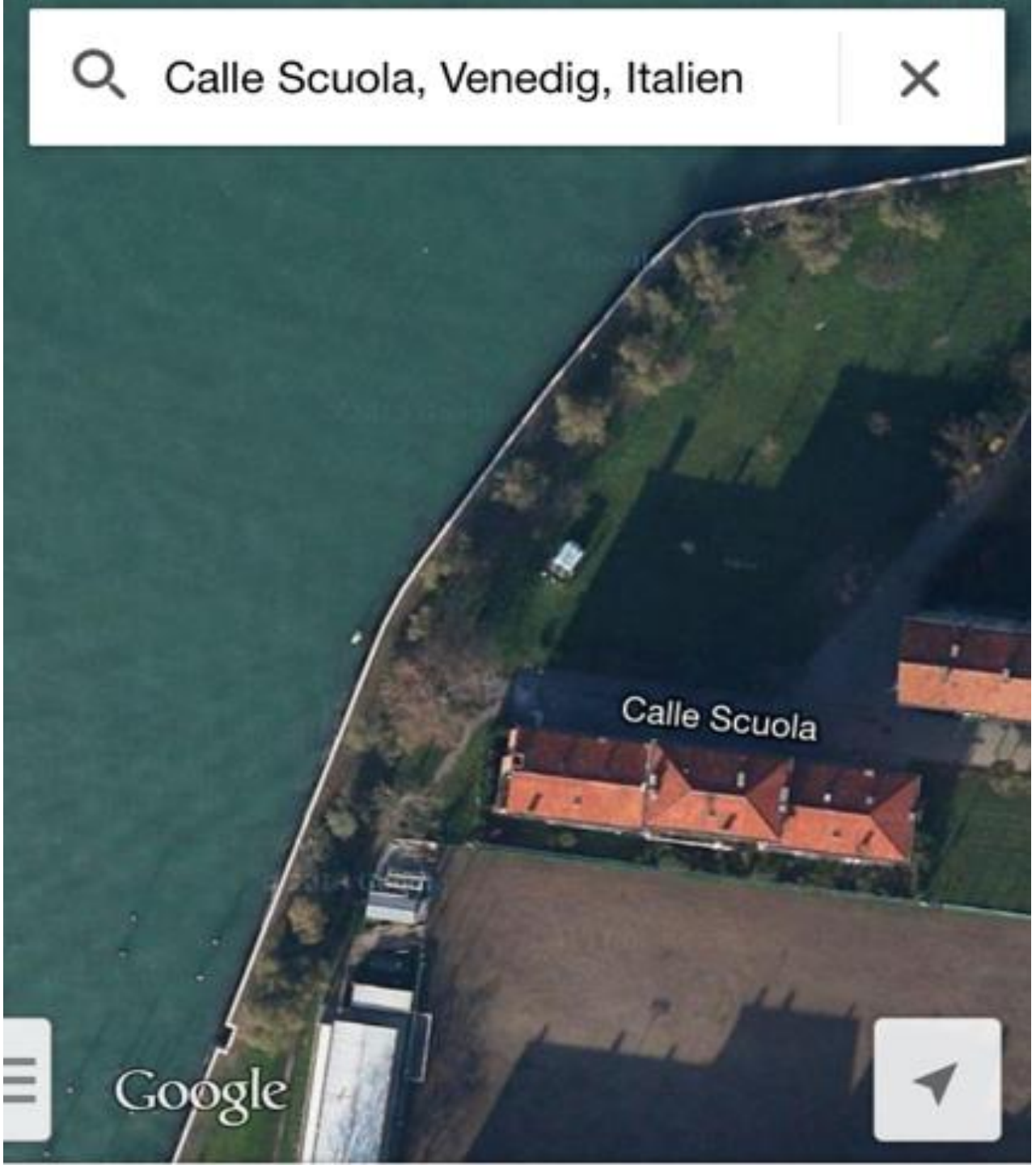

MSC_Preziosa
Venice
120K
110K
100K
90K
80K
70K
60K
50K
40K
30K
20K
10K
0
Pt Conc, pt/cc
19:15
19:20
19:25
19:30
19:35
Tue 1 Feb 2000
Date & Time


NSL_Noordam
Venice1
160K
140K
120K
100K
80K
60K
40K
20K
0
Pt Conc, pt/cc
17:30
18:00
18:30
Tue 1 Feb 2000
Date & Time

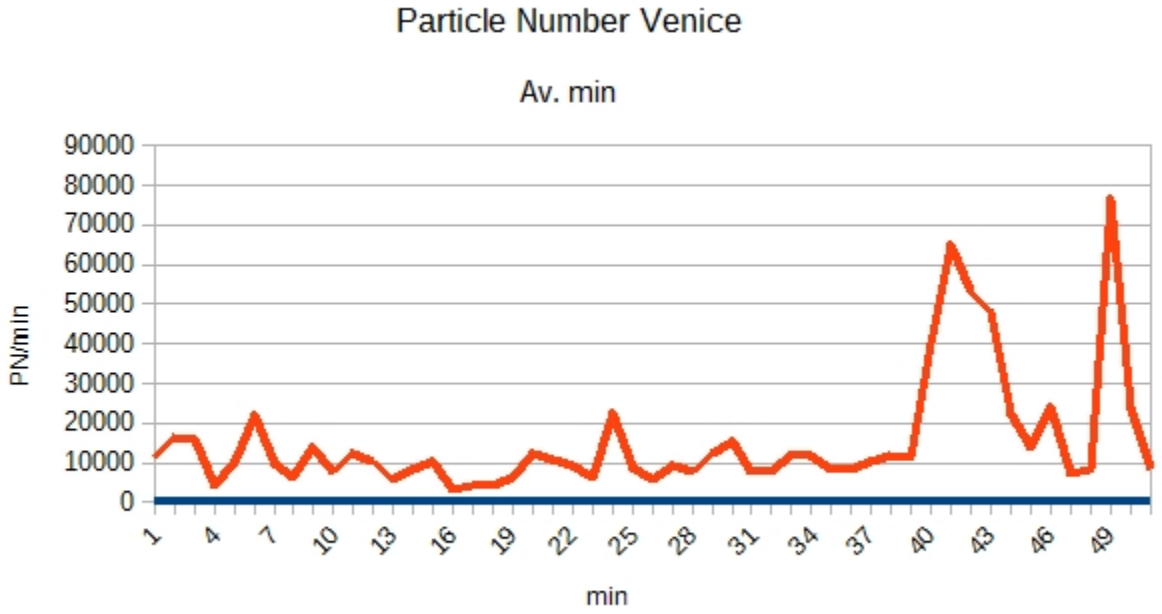

MSC_Fantasia
Sacca_Fisola
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
Pt Conc, pt/cc
17:20
17:25
17:30
17:35
Sun 27 Apr 2014
Date & Time

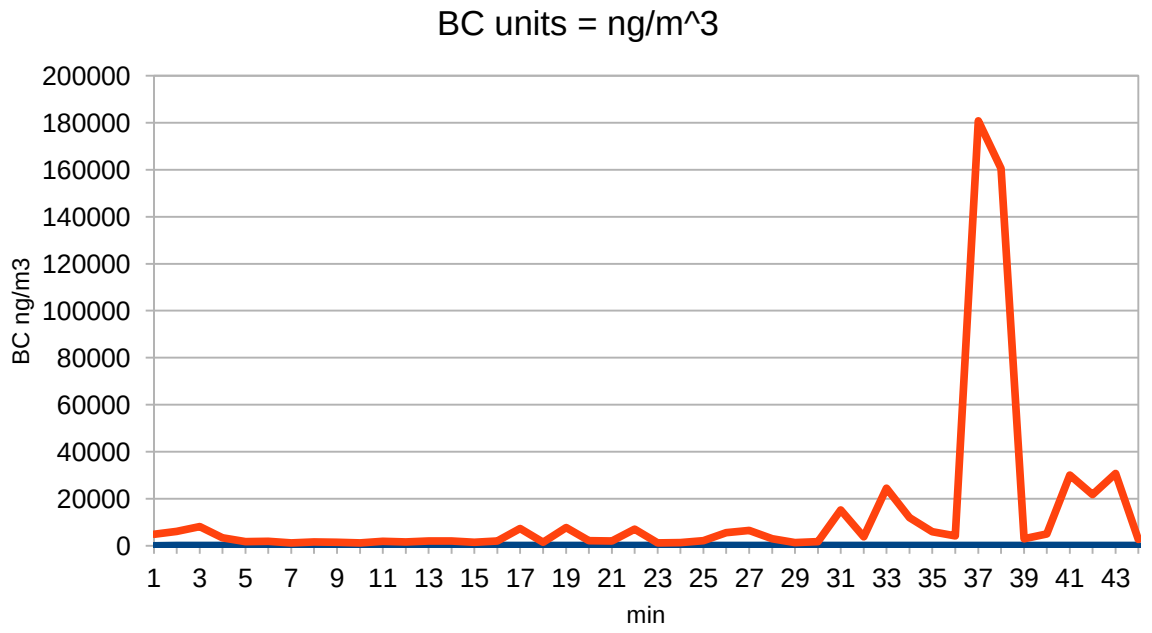

Costa_Magica
S_Elena
180K
160K
140K
120K
100K
80K
60K
40K
20K
0
Pt Conc, pt/cc
18:18
18:19
18:20
18:21
18:22
18:23
18:24
18:25
18:26
18:27
18:28
18:29
18:30
18:31
18:32
Sun 27 Apr 2014
Date & Time


Vaporetto_Trip
Sub Title
350K
300K
250K
200K
150K
100K
50K
0
Pt Conc, pt/cc
18:40
18:45
18:50
Wed 2 Feb 2000
Date & Time

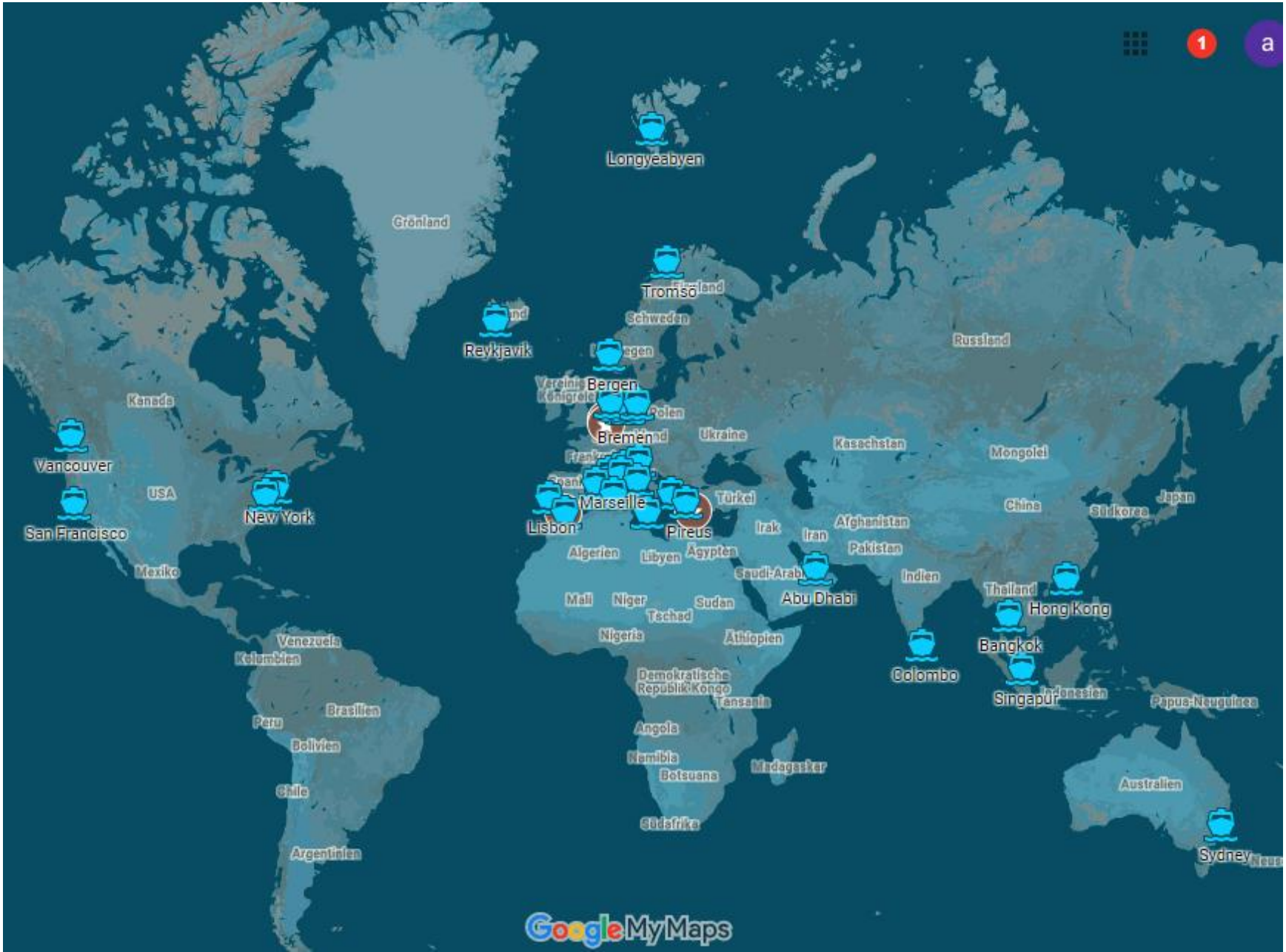

Calle Scuola, Venedig, Italien
Calle Scuola
Google


A.R.P.A.V.
Telefono 041 544135
Monitoraggio della Qualità dell'Aria
Stazione n° 3
Sacca Fisola
P-TRAK
2180

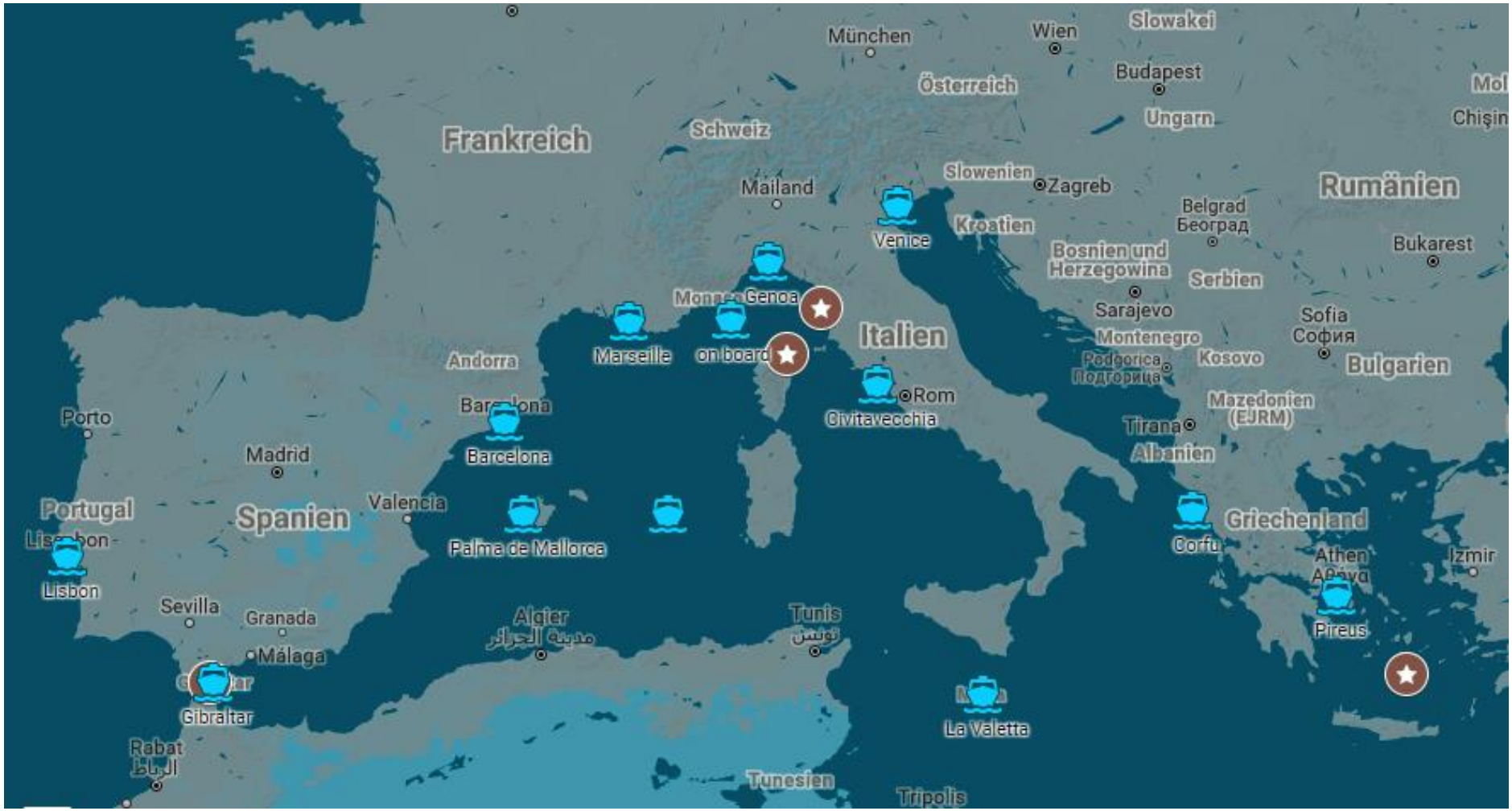

Particle Number Venice
Av. min
PN/mln
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
min


BC units = ng/m^3
BC ng/m3
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
min

Measurements in Ports and on Cruise Ships



Measurements in the Mediterranean Sea



axel.friedrich.berlin@gmail.com

Ratio Cruise ships/Car	
Comparision SOX Emissions	376.030.220
Comparison NOX Emissions	421.154
Comparison Particle emissions	1.052.885
Comparison CO2 Emissions	83.678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