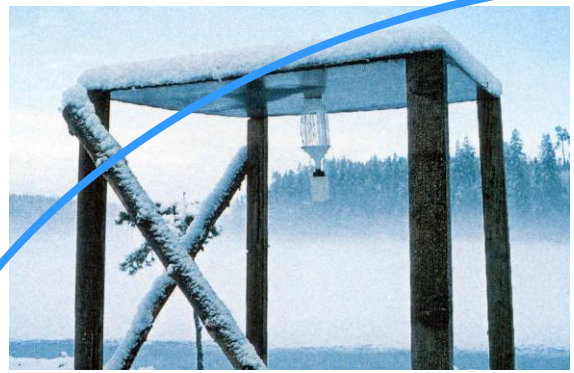
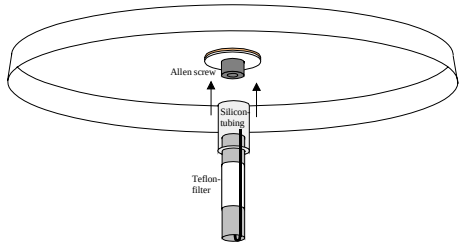
Diffusive samplers

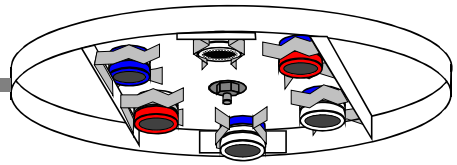
PASSIVE SAMPLERS



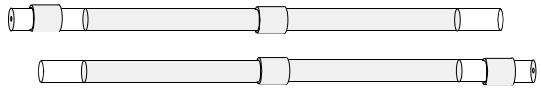


surrogate surfaces

bulk collectors



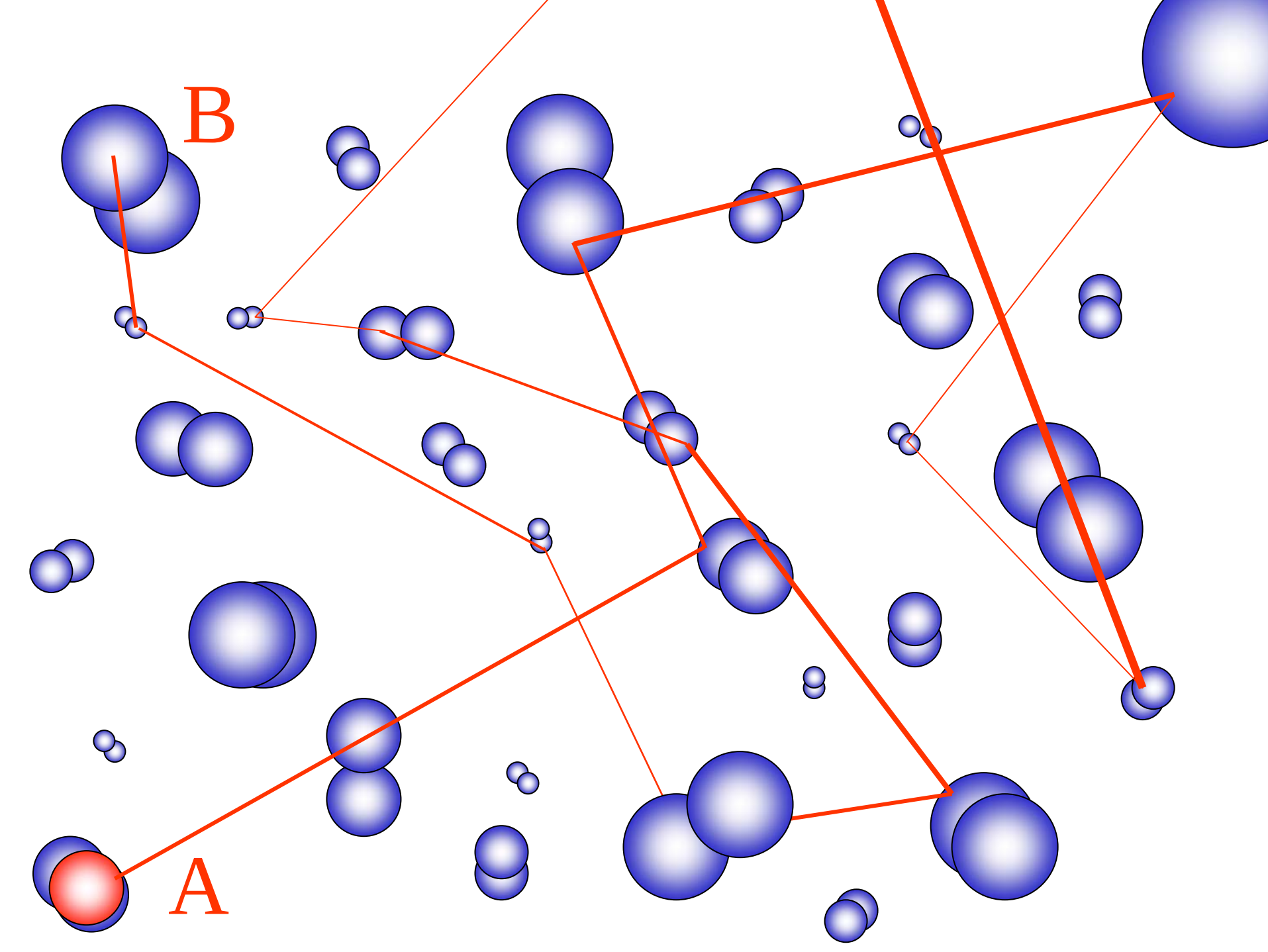
diffusive samplers



flux samplers

throughfall collectors

IVL


B
A

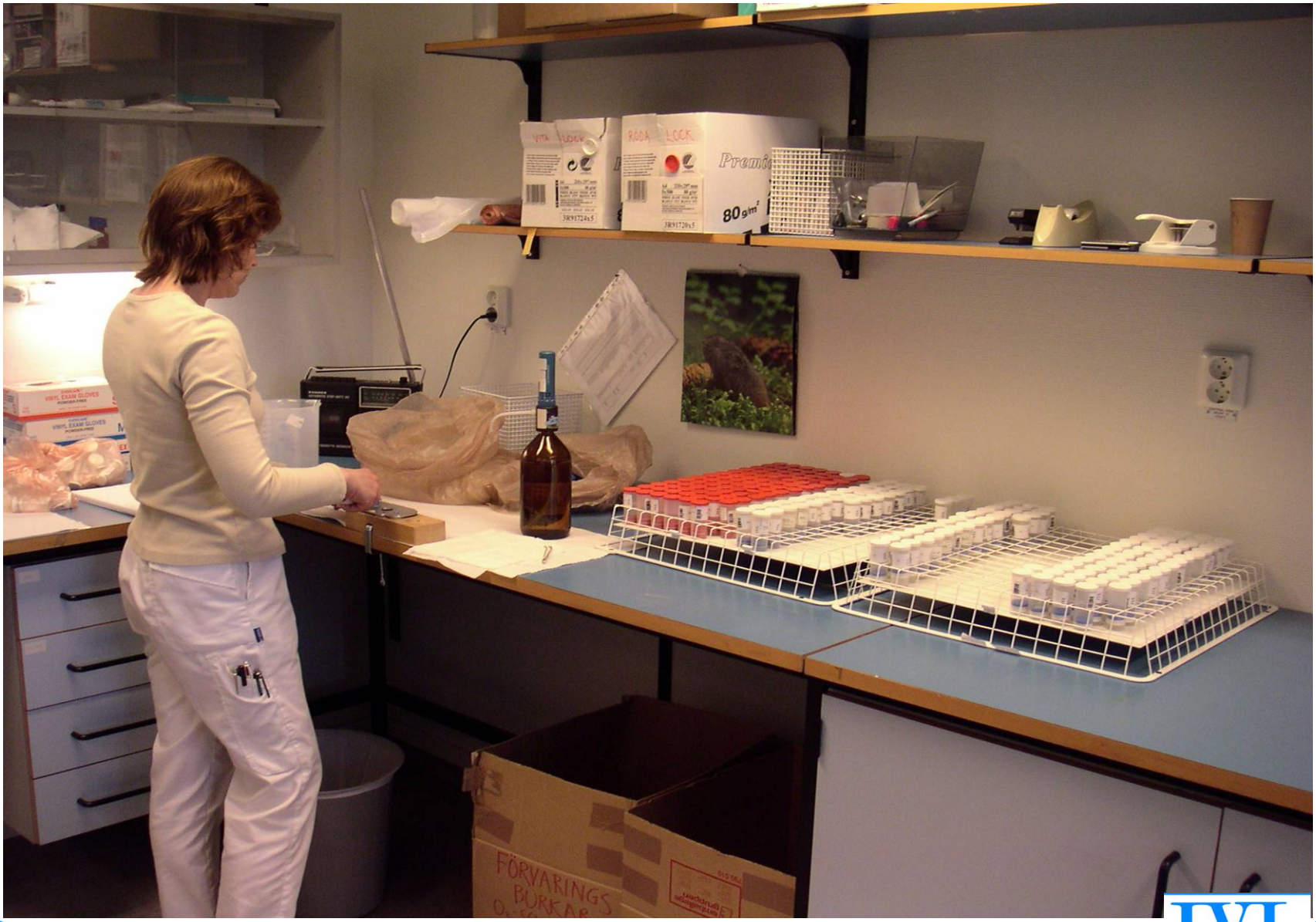
Advantages with diffusive sampling

- Samplers are small, light weight
- Silent
- Don’t need electricity (mains power)
- 100% time coverage (without data losses)
- Technical personnel is not needed at sampling site
- No field calibration is needed
- *In Situ* measurements (inlet tubing is not used)
- Very large measuring range
- Cost efficient measurements
- A geographical concentration distribution can be obtained

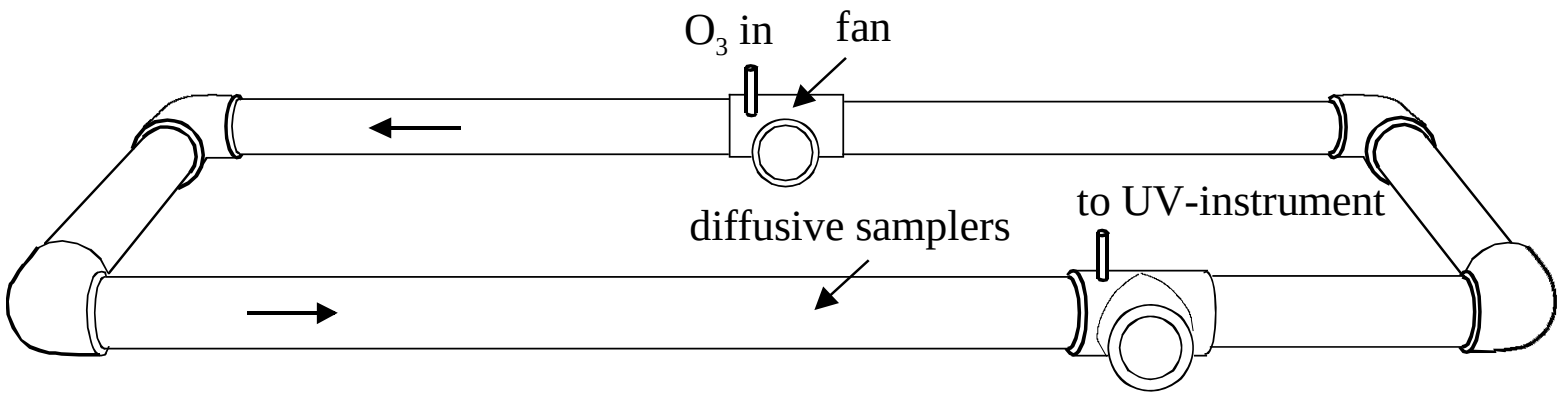
Drawbacks

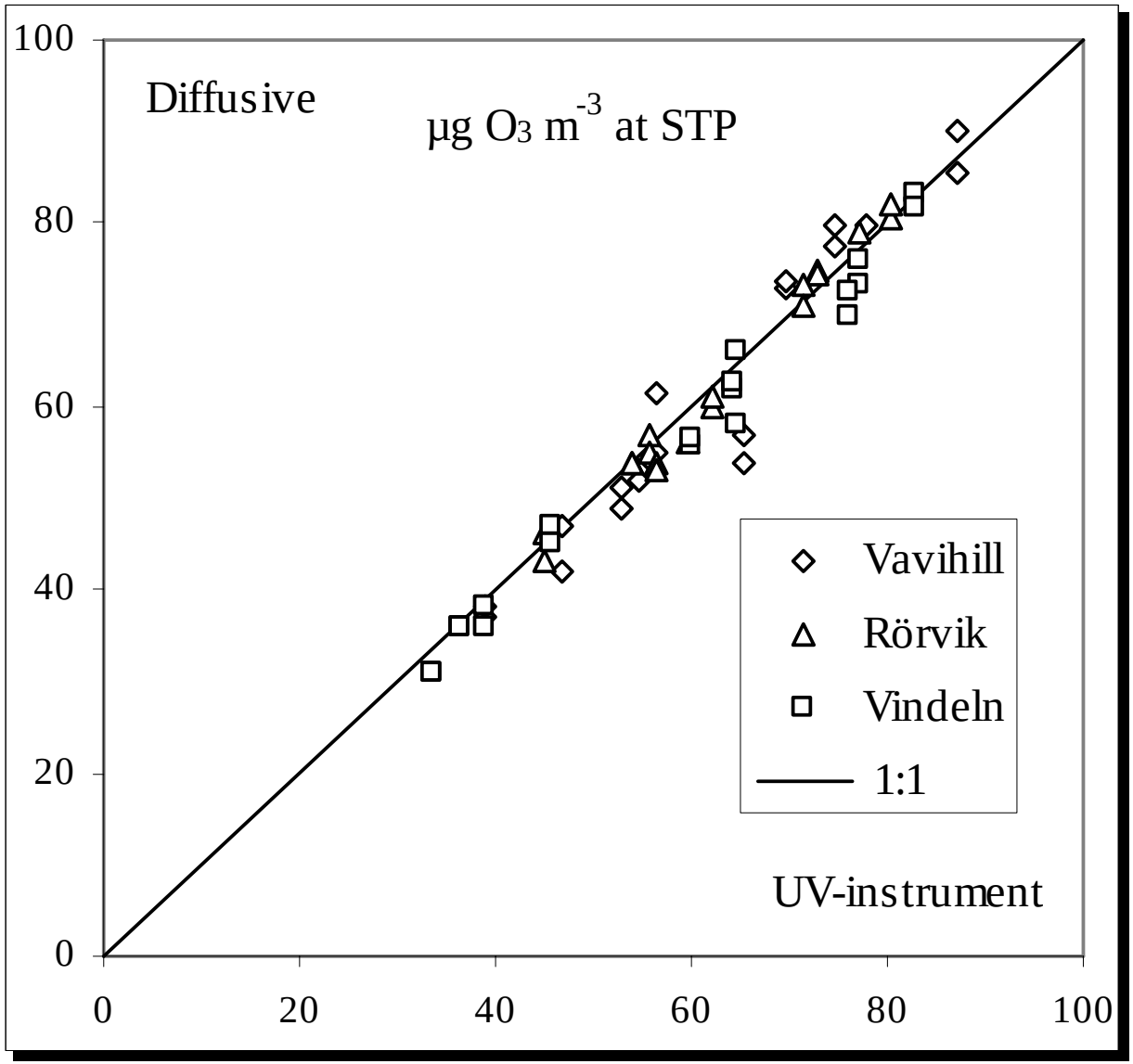
- Real-time measurements not yet possible
- The results are not obtained immediately
- Particulate concentrations can not be measured


Tillhör Posten


VITA LOCK
RÖDA LOCK
80 g/m²
FÖRVARINGS
BURKAR

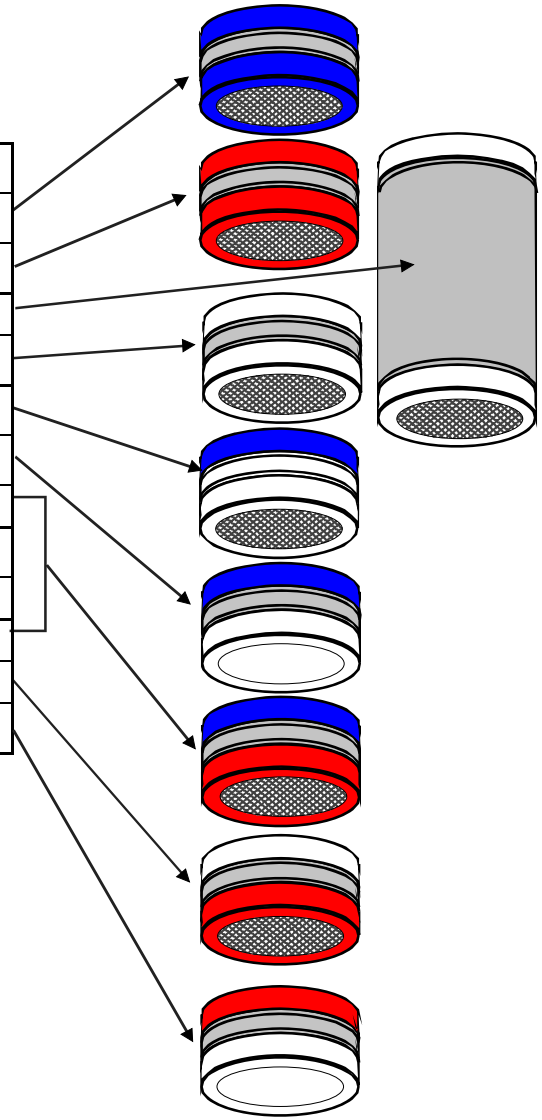
Validation of a diffusive sampler for ozone in workplace atmospheres according to EN 838

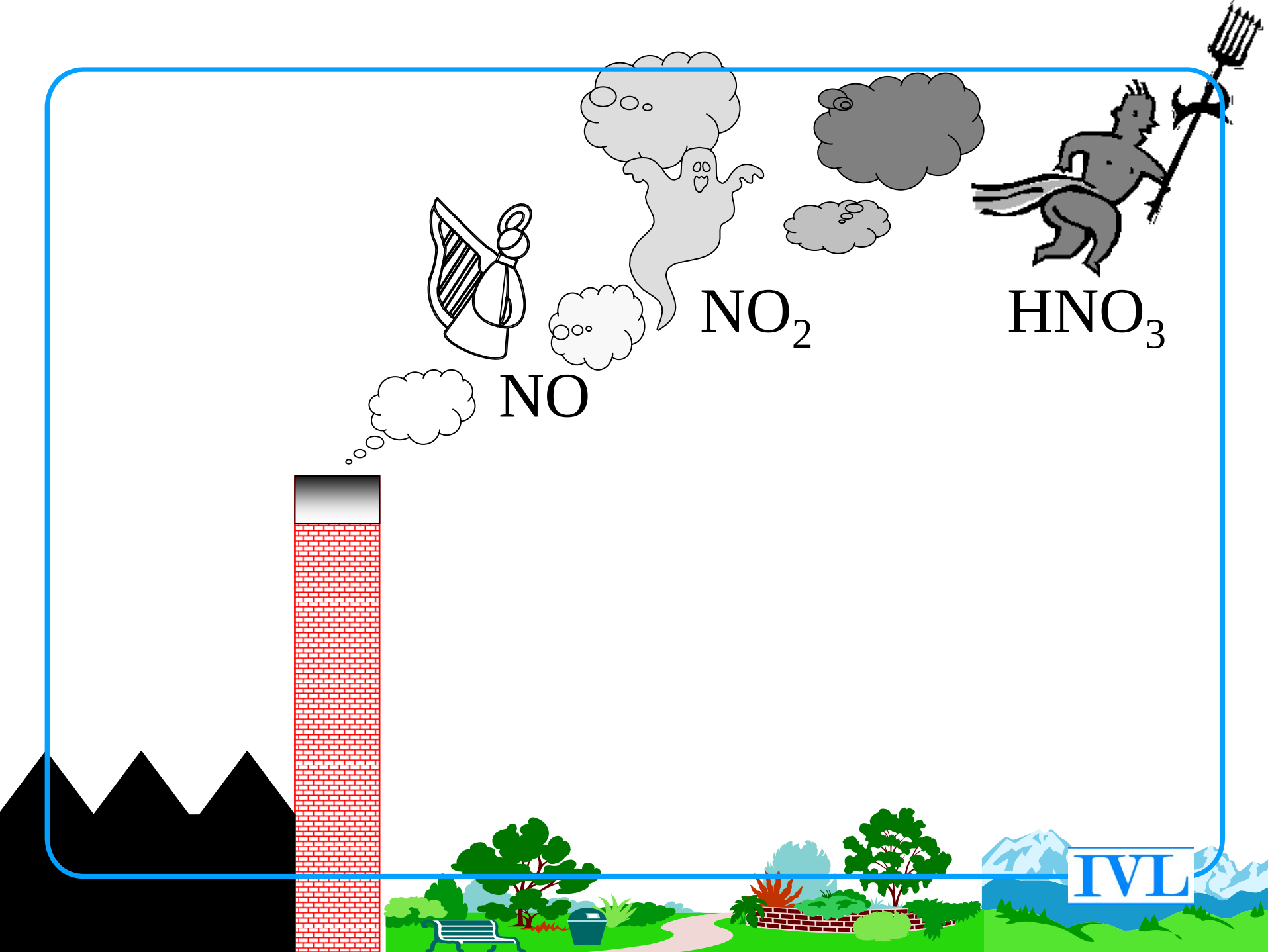


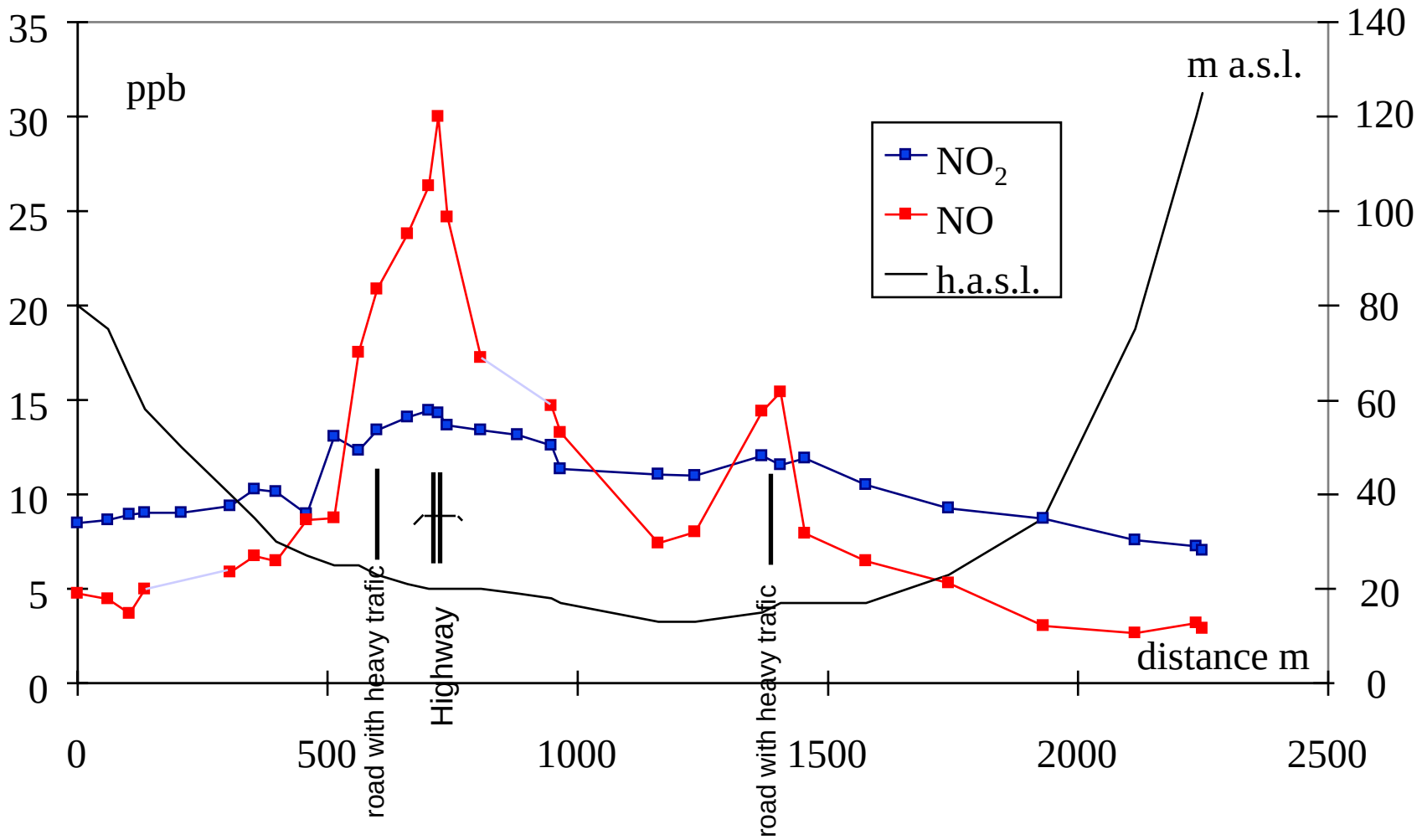

Diffusive
µg O3 m-3 at STP
100
80
60
40
20
0
0
20
40
60
80
100
Vavihill
Rörvik
Vindeln
1:1
UV-instrument

gas	µg m^{-3}	ppb
sulphur dioxide, SO_2	0.2-100	0.1-35
nitrogen dioxide, NO_2	0.1-100	0.05-50
nitric oxide, NO*	2-150	2-150
ammonia, NH_3	0.2-30	0.3-40
ozone, O_3	1-100	0.5-50
nitric acid, HNO_3	0.02-10	0.01-4
formic acid, HCOOH	0.7-150	0.4-70
acetic acid, CH_3COOH	1-250	0.4-100
hydrogen fluoride, HF	0.2-70	0.2-80
hydrogen chloride, HCl	0.7-100	0.5-60
formaldehyde, HCHO	0.2-20	0.2-20
mercury, Hg^0	0.01-	

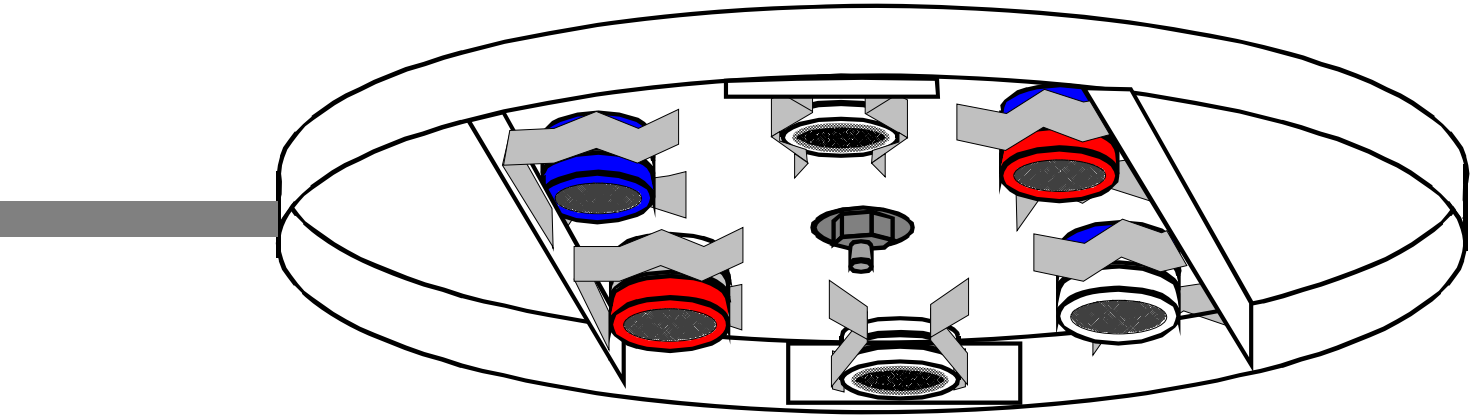
*= max 2 weeks exposure time

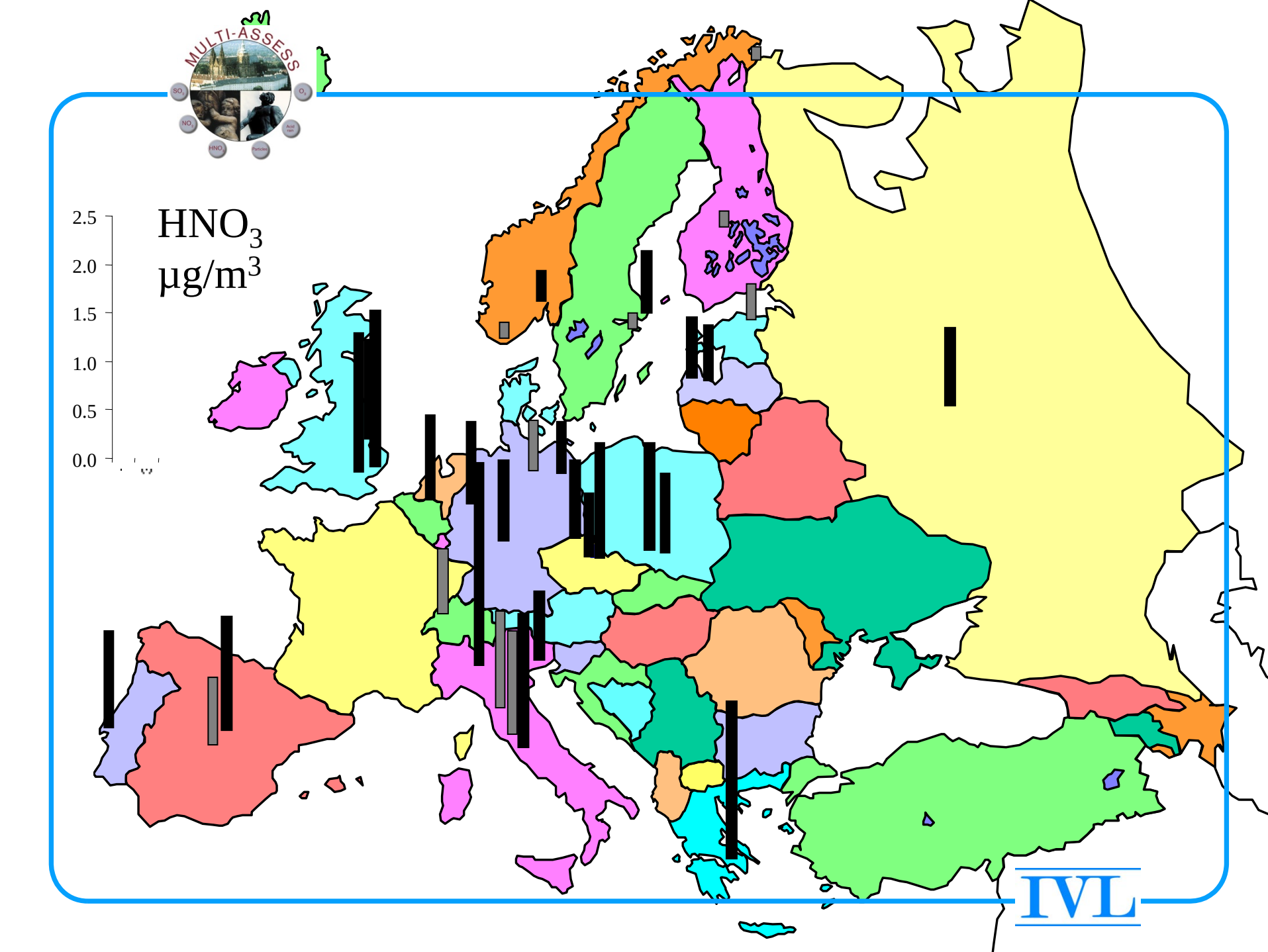



NO
NO_2
HNO_3
IVL


ppb
m a.s.l.
NO2
NO
h.a.s.l.
distance m
road with heavy trafic
Highway
road with heavy trafic
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140
0
500
1000
1500
2000
2500

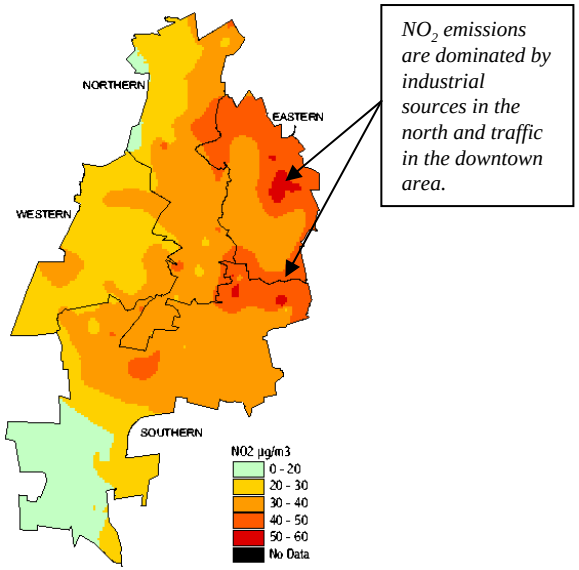
Atmospheric corrosion is a long-term effect. Diffusive sampling is therefore very suitable.




MULTI-ASSESS
2.5
2.0
1.5
1.0
0.5
0.0
HNO3
µg/m3
IVL

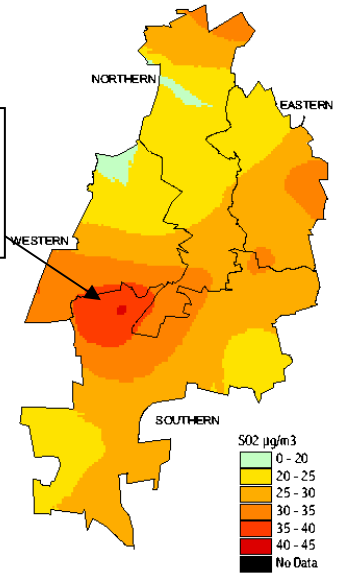
Mapping of Air Pollution in Johannesburg, South Africa

Nitrogen dioxide



NO_2 emissions are dominated by industrial sources in the north and traffic in the downtown area.

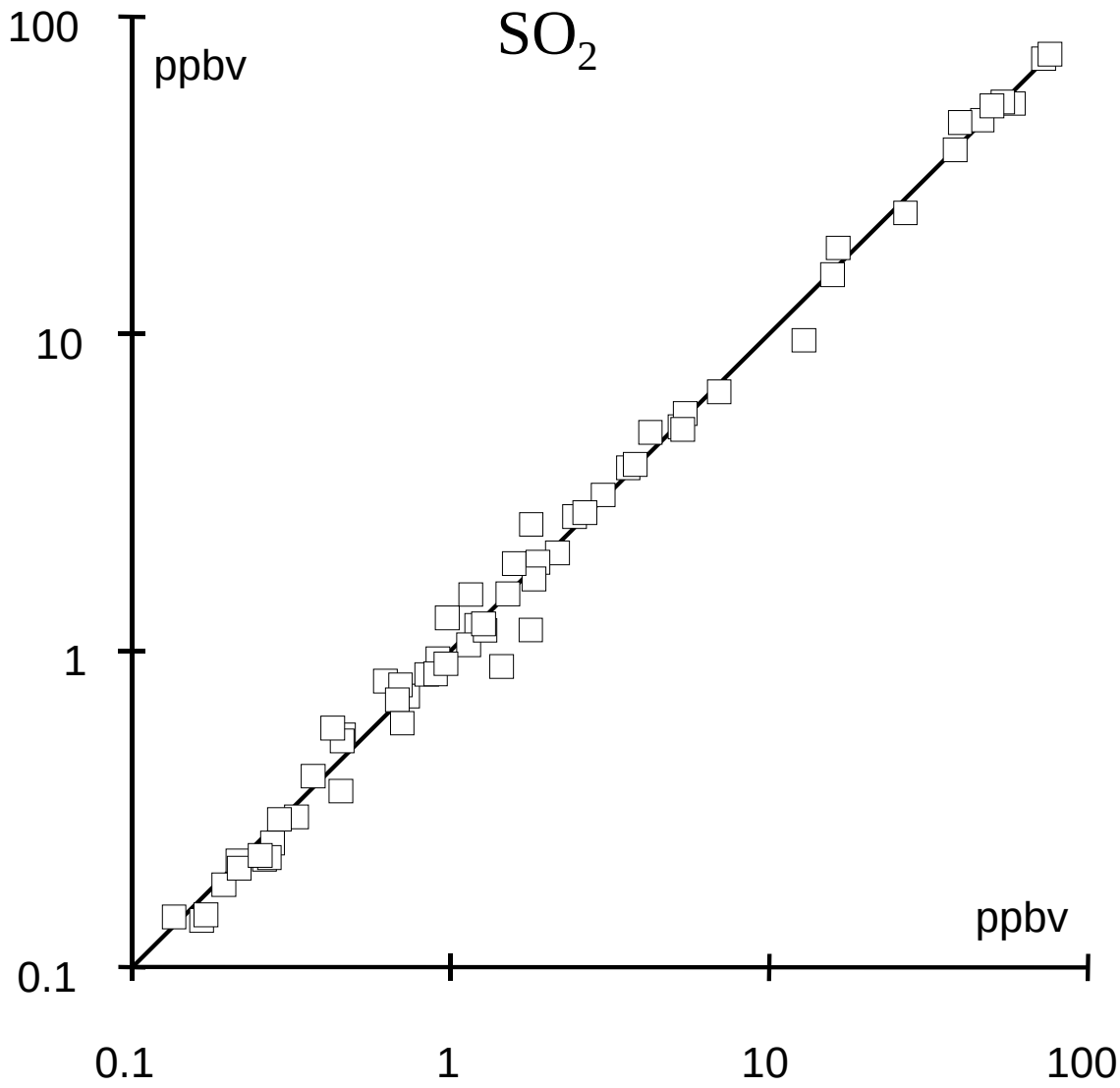
Sulphur dioxide



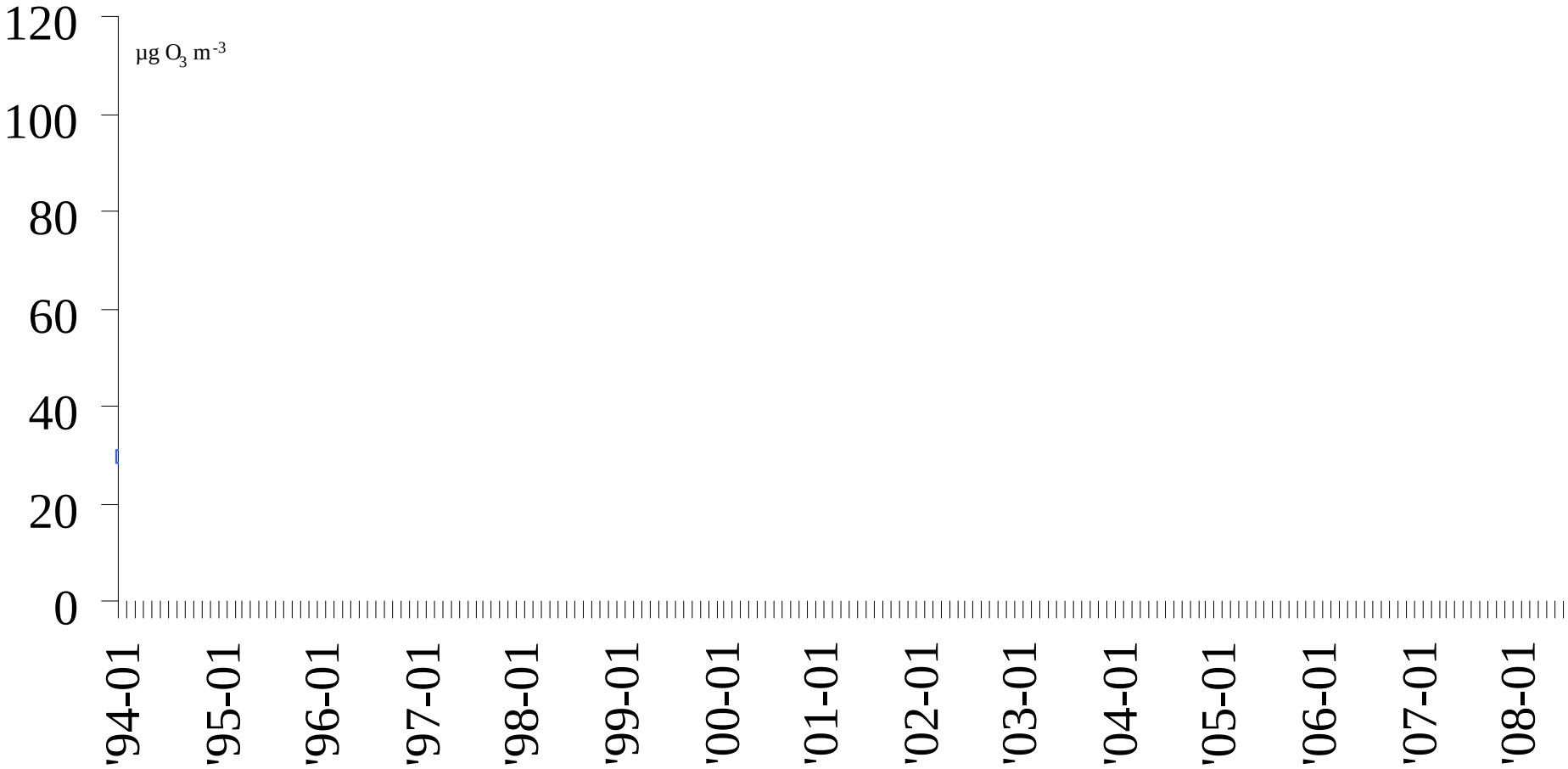
Soweto SO_2 emissions are dominated by domestic use of coal

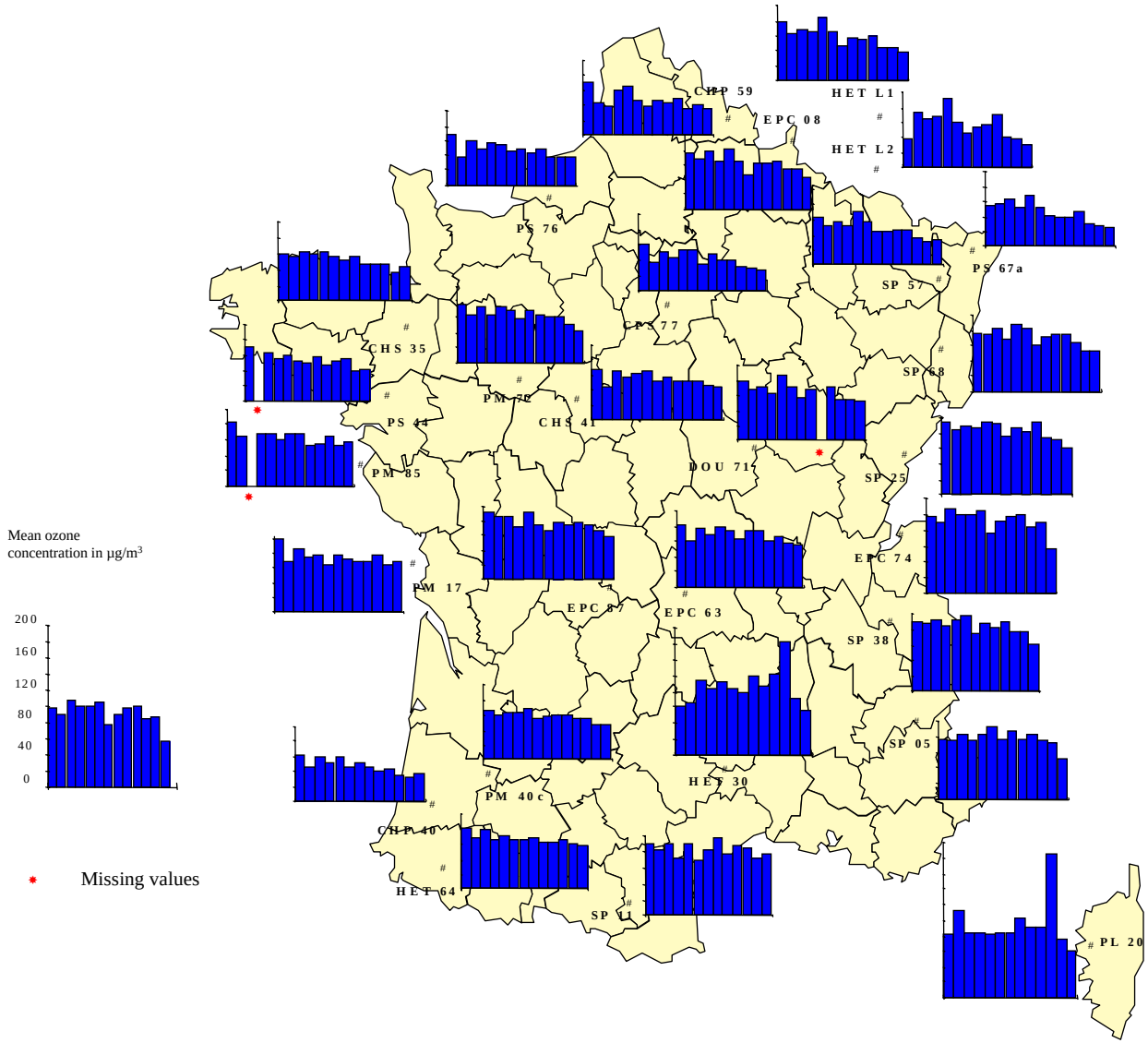

PASSIVE SAMPLING
IN THE TROPICS

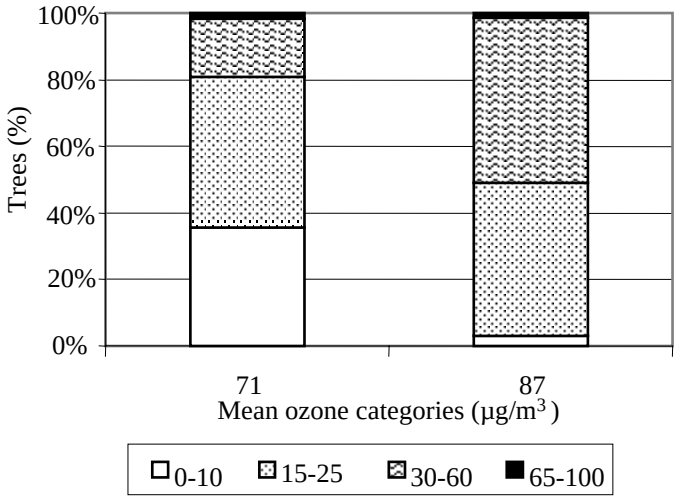

Beijing
Yangyang
Oki
Taean
Cheju
Dhangadi
Kathmandu
Phulchowki
Janakpur
Dingboche
Delhi
Jaipur
Dhankuta
Varanasi
Shillong
Jahangirnagar
Kuhlna
Berhampur
Kashele?
Bombay
Pune
Madras
Cochin
Chongqing
Yueyang
Liuchongguan
Qinzhen
Huitong
Hanoi
Cape D'Aequir
Jiyuehtan
Leiu
Sto Tomas
Chang Rai
Tak
Nam Phong
Phetchabun
Chongburi
Si Chang Island
Kien Thanh
Surat Thani
Lawa Mandau
Tanah Rata
Medan
Mersing
Sibu
Balikpapan
Palembang
Cisaru, Lemban
Qjung Bandung
Jabiru
Motupore


100
ppbv
SO_2
10
1
0.1
ppbv
0.1
1
10
100

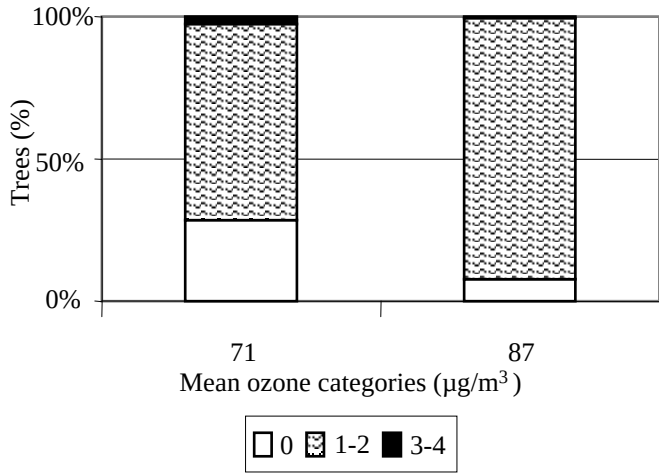

IVL


120
100
80
60
40
20
0
µg O_3 m^{-3}
'94-01
'95-01
'96-01
'97-01
'98-01
'99-01
'00-01
'01-01
'02-01
'03-01
'04-01
'05-01
'06-01
'07-01
'08-01


Mean ozone
concentration in µg/m3
200
160
120
80
40
0
Missing values
CHP 59
HET L1
EPC 08
HET L2
PS 76
PS 67a
SP 57
CPS 77
CHS 35
SP 68
PM 72
PS 44
CHS 41
PM 85
DOU 71
SP 25
EPC 74
PM 17
EPC 87
EPC 63
SP 38
SP 05
HET 30
PM 40c
CHP 40
HET 64
SP 11
PL 20

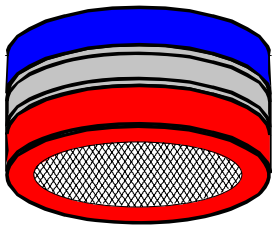


Percentage of Mercantour Arolla pines by defoliation classes and mean ozone categories in 1999.

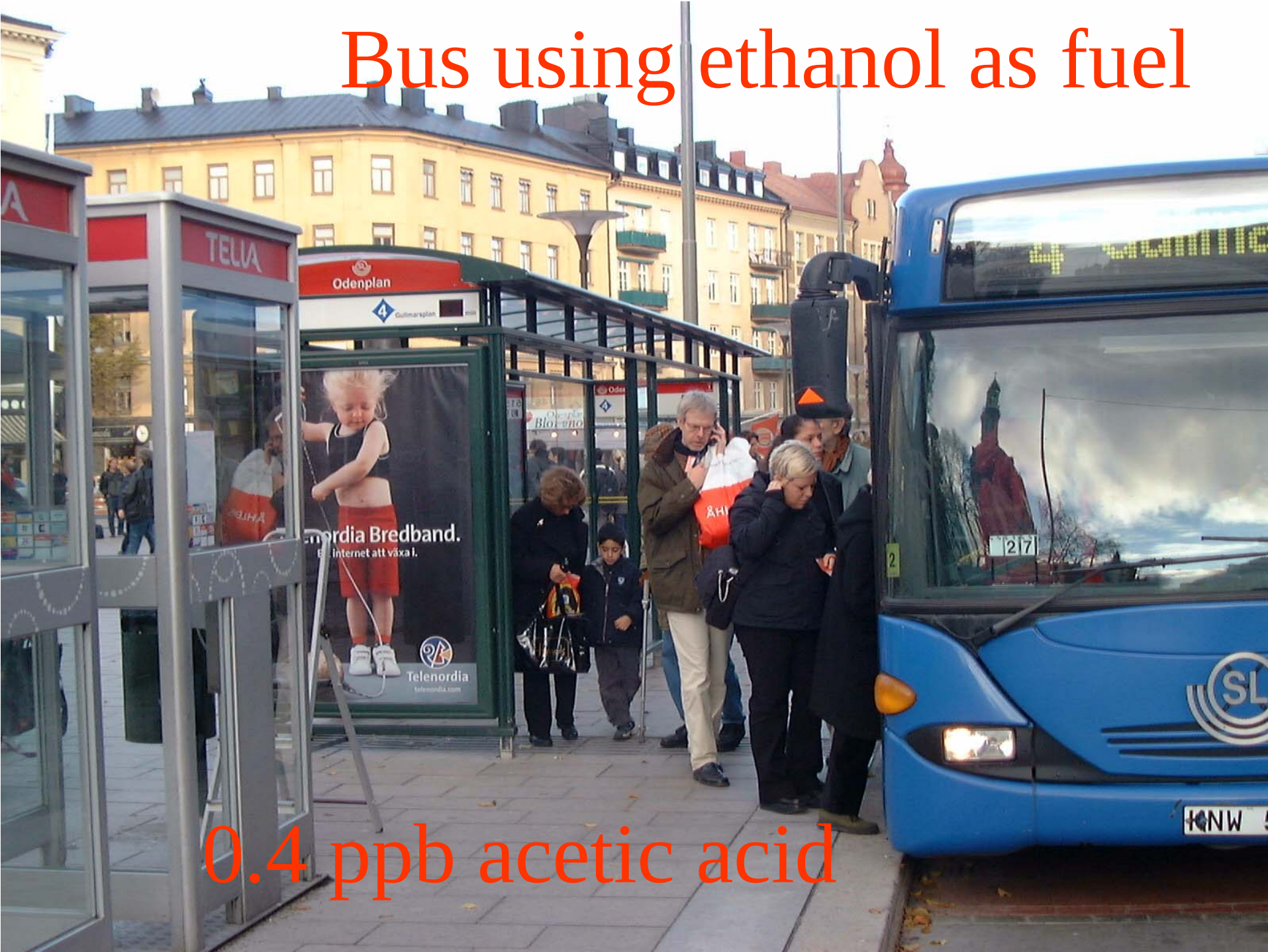


Percentage of Mercantour Arolla pines by discoloration classes and mean ozone categories in 1999.

A multi-component diffusive sampler for acidic gases



HF
HCl
HCOOH
CH_3COOH
SO_2


Bus using ethanol as fuel
0.4 ppb acetic acid
TELIA
Odenplan
Telenordia

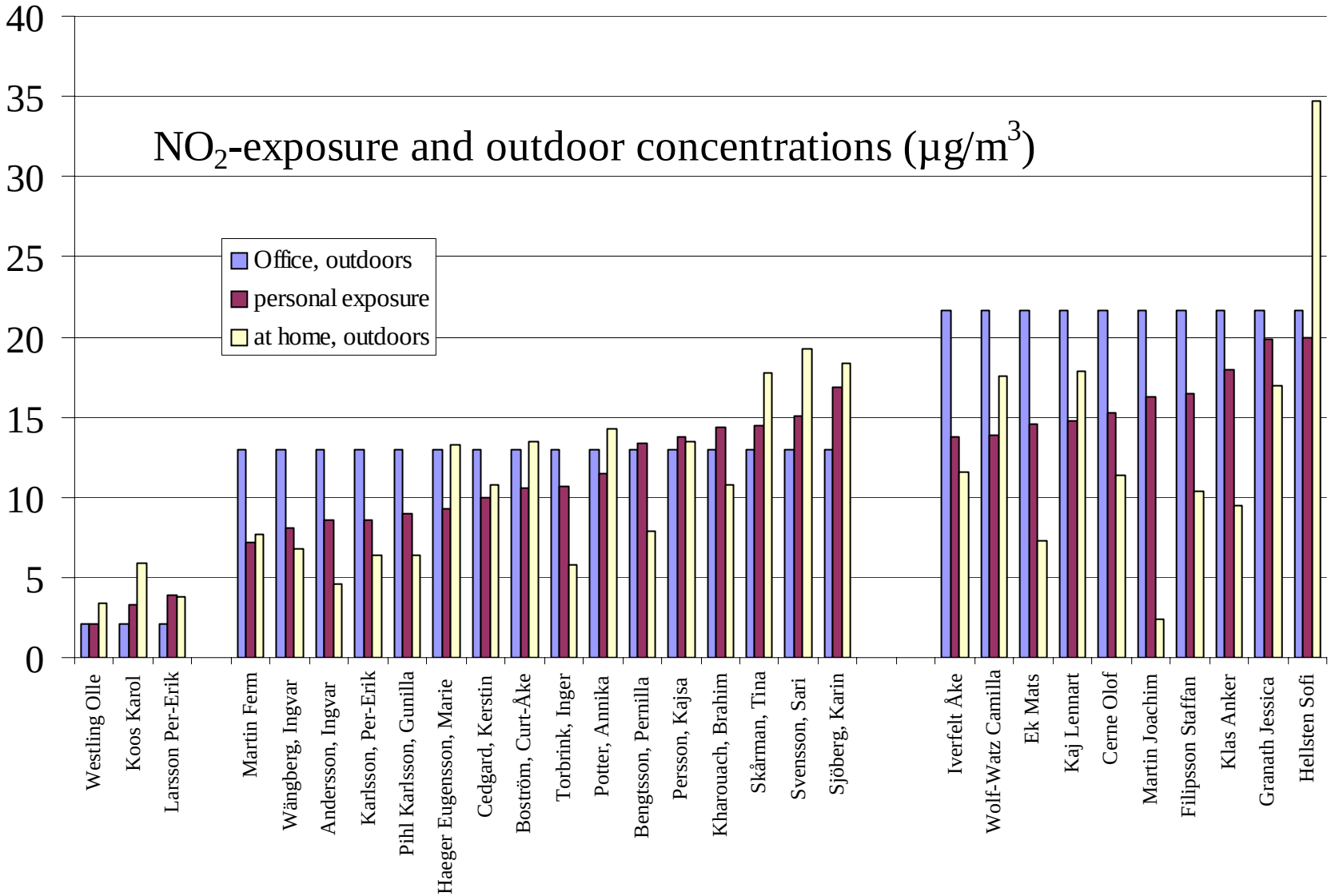

Storage room of museums
0.2 - 58 ppb acetic acid
0.2 - 46 ppb formic acid

Masaya volcano, Nicaragua

2 - 600 ppb HF
2 - 2600 ppb HCl
10 - 7000 ppb SO_2

Mount Etna, Italy


IVL


NO2-exposure and outdoor concentrations (µg/m3)
Office, outdoors
personal exposure
at home, outdoors
40
35
30
25
20
15
10
5
0
Westling Olle
Koos Karol
Larsson Per-Erik
Martin Ferm
Wängberg, Ingvar
Andersson, Ingvar
Karlsson, Per-Erik
Pihl Karlsson, Gunilla
Haeger Eugensson, Marie
Cedgard, Kerstin
Boström, Curt-Åke
Torbrink, Inger
Potter, Annika
Bengtsson, Pernilla
Persson, Kajsa
Kharouach, Brahim
Skårman, Tina
Svensson, Sari
Sjöberg, Karin
Iverfelt Åke
Wolf-Watz Camilla
Ek Mats
Kaj Lennart
Cerne Olof
Martin Joachim
Filipsson Staffan
Klas Anker
Granath Jessica
Hellsten Sofi


Which measurement technique will be most common in the future?
My image is diffuse! I think diffusive sampling will be the most common.