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Preliminary Assessment and Zones in Finland

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Air Quality Improvement
Study Tour to Finland, August 2007

31.8.2007





Background

- **Framework Directive on ambient air quality assessment and management (96/62/EC)**
 - Monitoring of ambient air quality with standardized measurement techniques and common criteria in EU member states
- **4 Daughter directives**
 - To establish limit/target values and assessment thresholds for concentrations of air impurities
 - To harmonize measurement techniques in order to obtain reliable data throughout the Community



The preliminary assessments of ambient air quality

- **2001: Sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter (PM₁₀) and lead**
- **2002: Carbon monoxide and benzene**
- **2003: Ozone**
- **2006 June: Heavy metals and polycyclic aromatic hydrocarbons (=PAH-compounds)**
- **Ongoing 2007-2008: fine particles (PM_{2,5})**



Aims of preliminary assessments

- **To define the concentration levels with respect to limit/target values and assessment thresholds**
 - zones and agglomerations for AQ assessment and management
 - methods and level of continuous AQ assessment
 - continuous monitoring of ambient air quality
- **To present assessment methods and data used:**
 - Air quality measurements
 - Dispersion modelling
 - Emission inventories
- **Reporting to the Ministry of Environment in Finland**
 - **Finnish local and regional environmental authorities & public**
 - **EU Commission**



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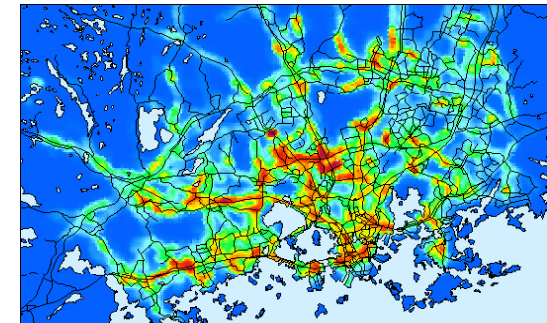
Assessment thresholds and related ongoing assessment methods



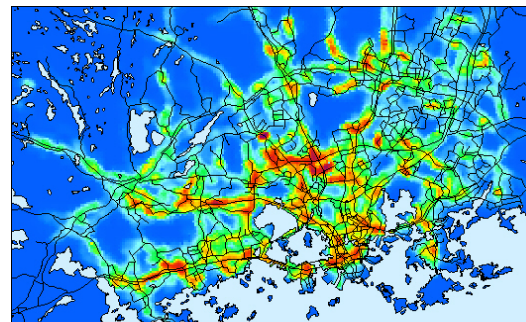
Upper assessment threshold



&



Lower assessment threshold

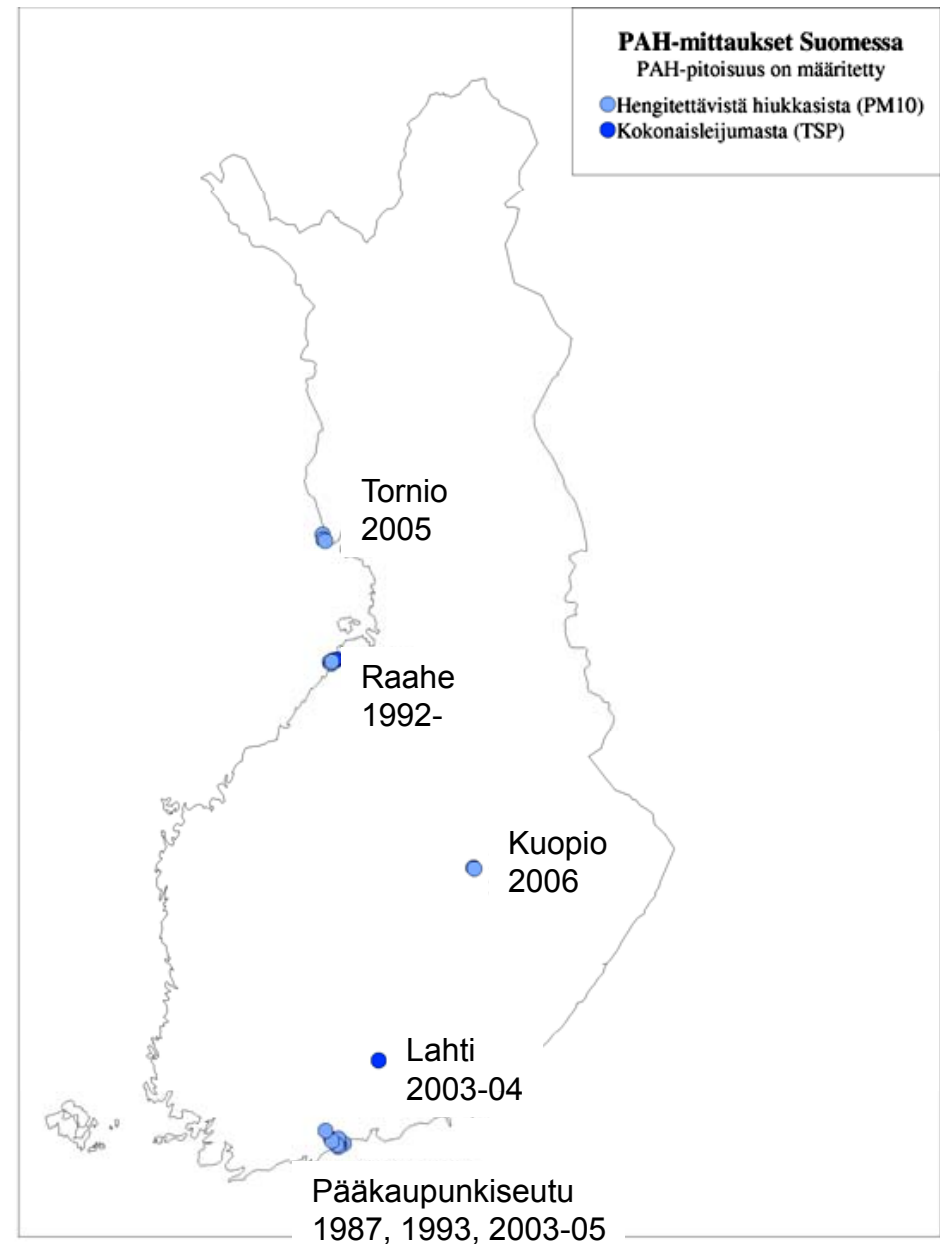


& objective assessment



Some examples:

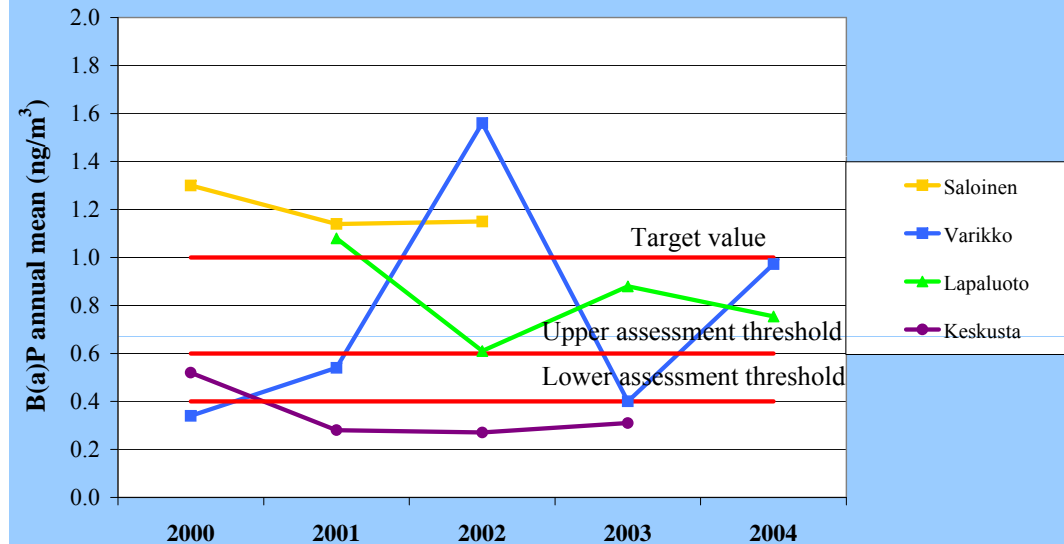
Measurement of
ambient air
PAH-compounds
in Finland 1992-2006



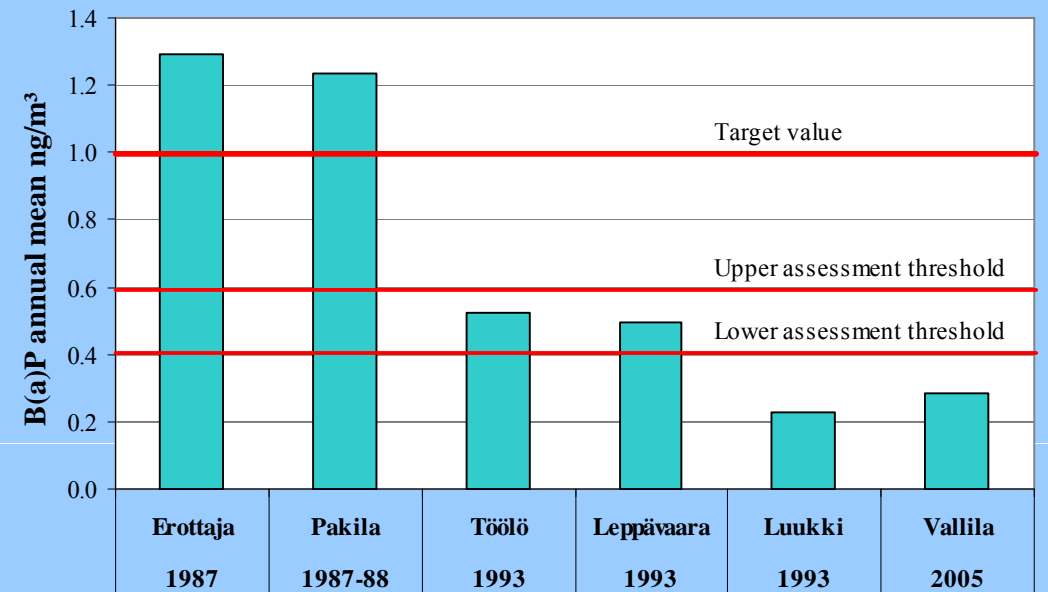


Bentso(a)pyrene concentrations

In the city of Raahe:

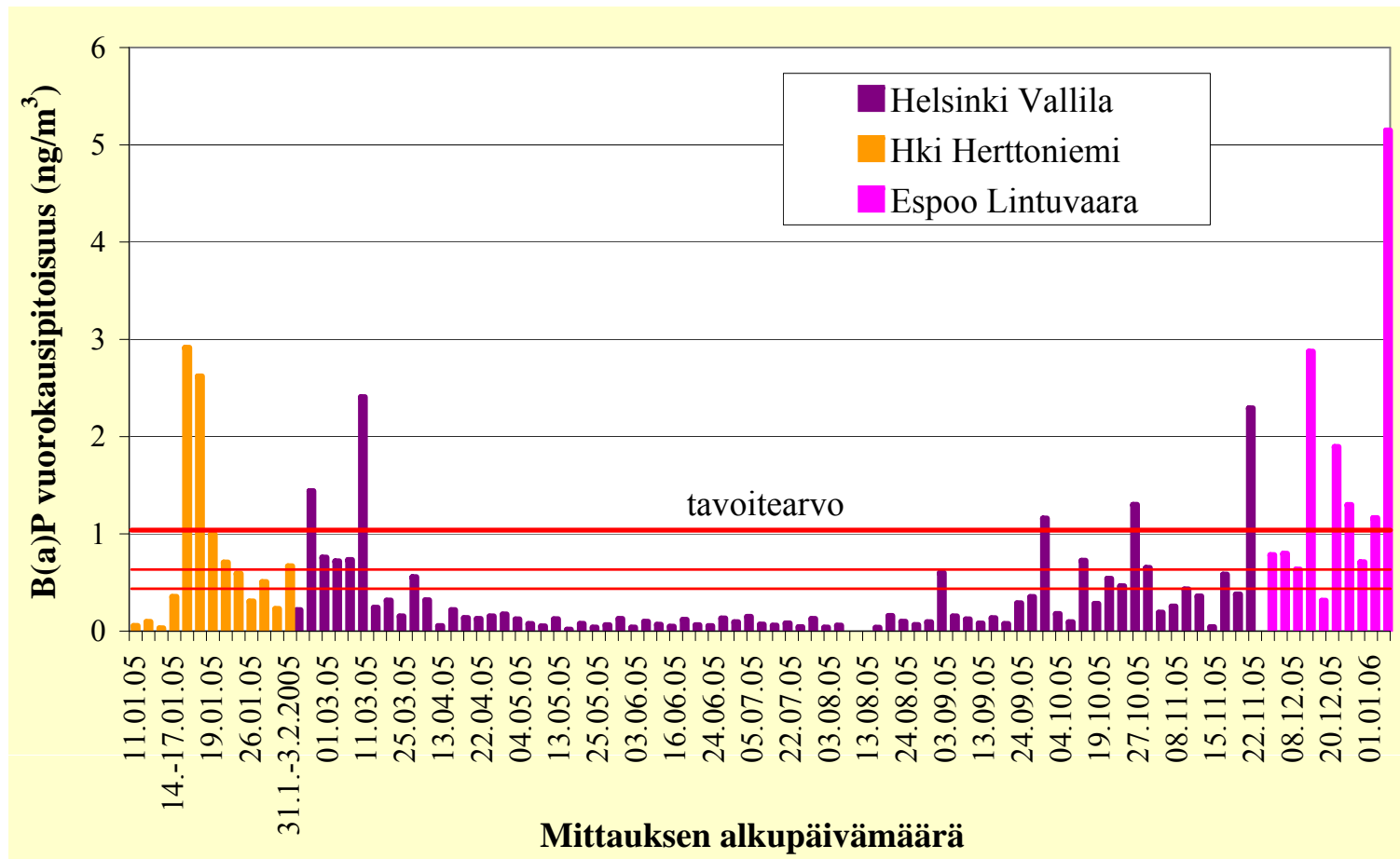


In Helsinki Metropolitan Area:



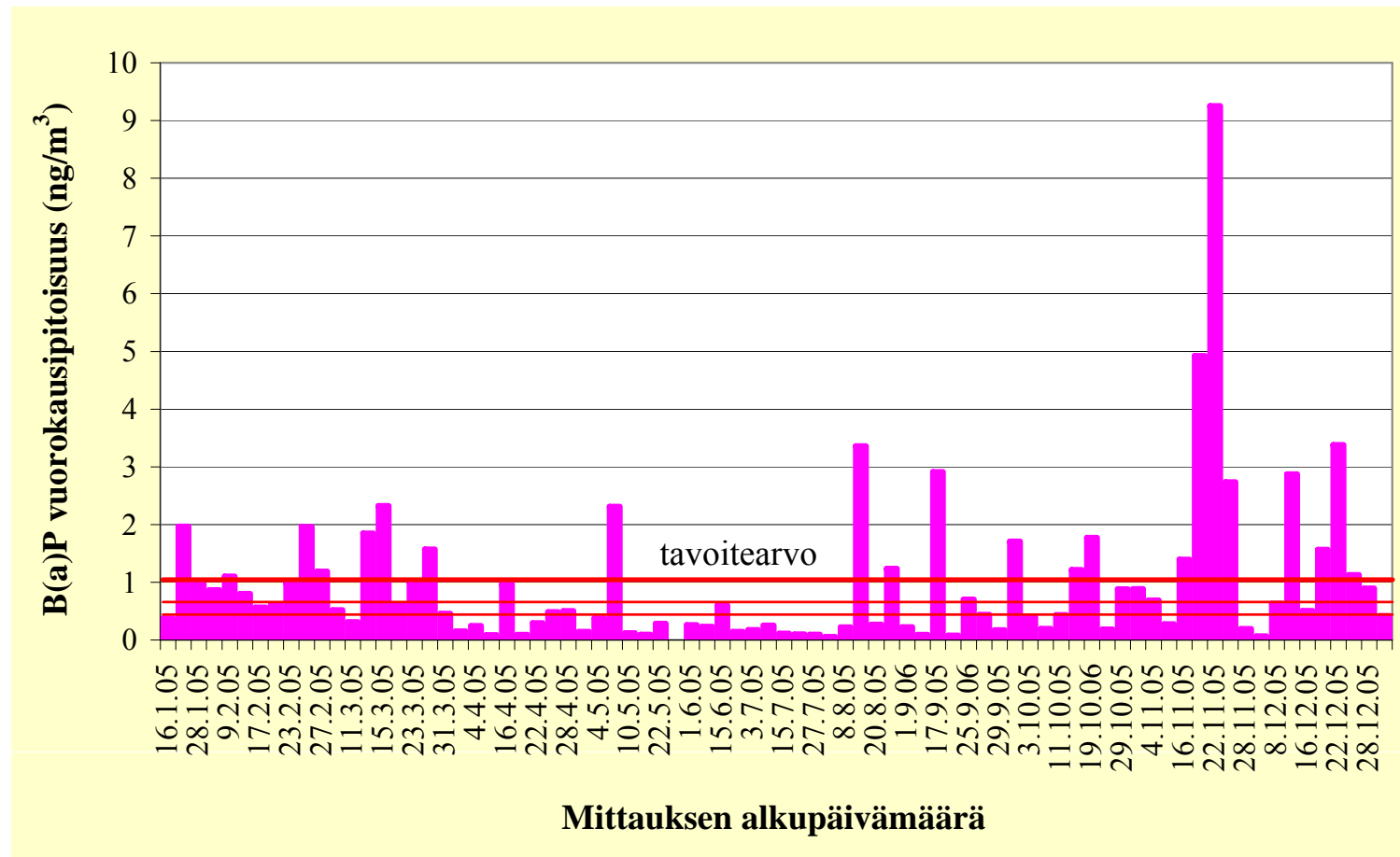


BaP concentrations In the Helsinki Metropolitan Area, traffic and wood burning



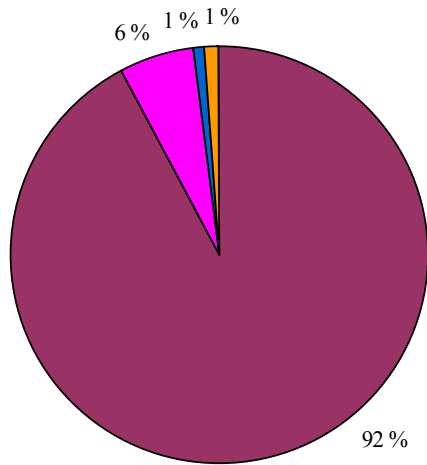


BaP concentrations In the Helsinki Metropolitan Area, wood burning

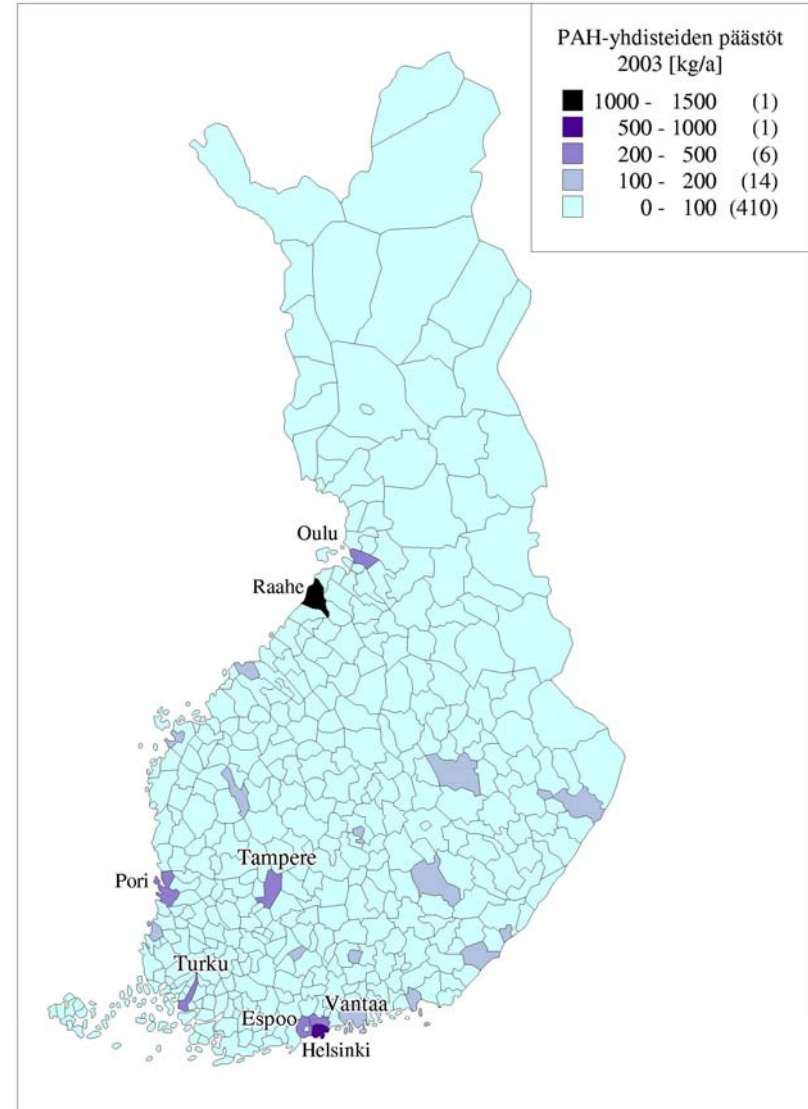
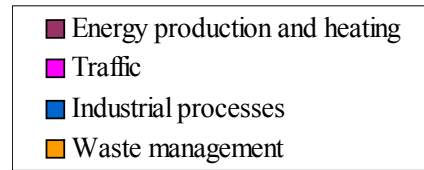




PAH-emissions 2003



In total 16,7 tons

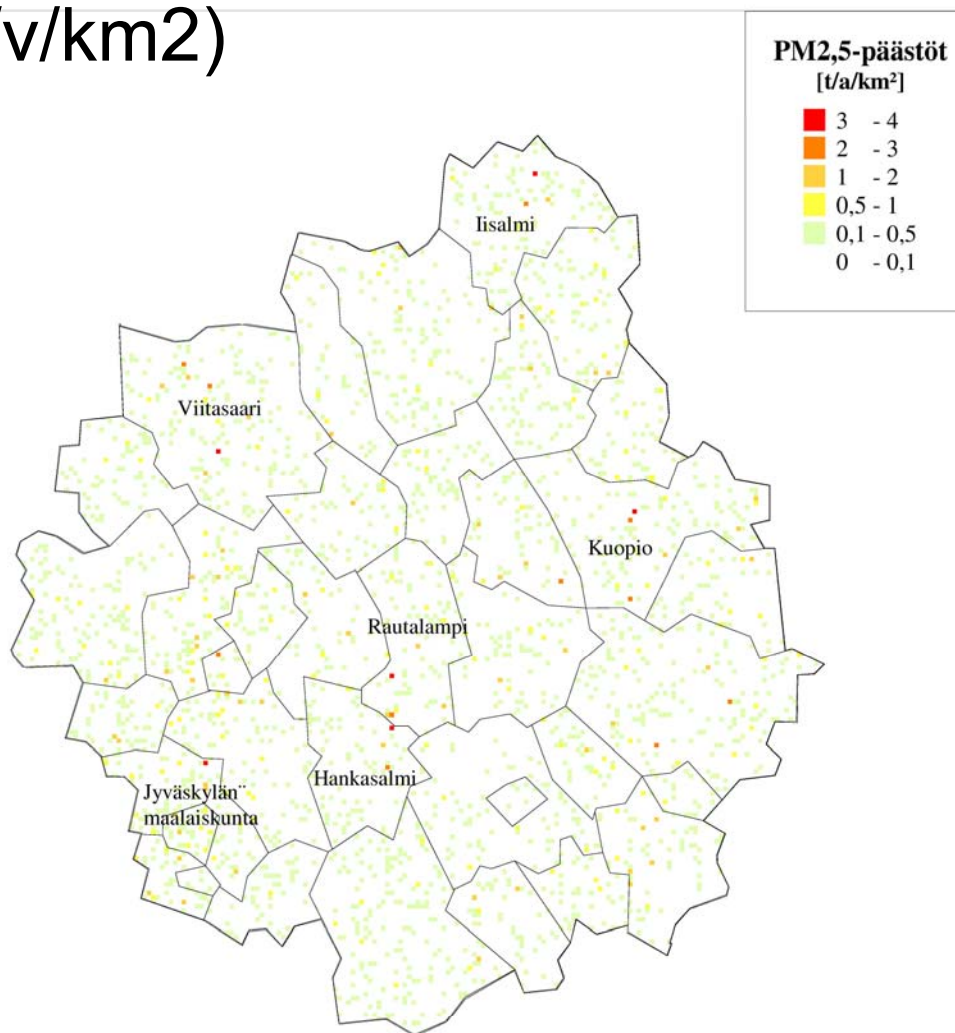


Reference: Finnish Environmental Institute



Emissions from small scale wood burning (PM_{2,5})

(t/v/km²)

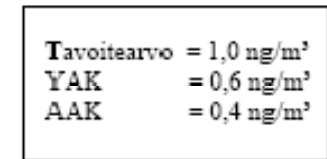
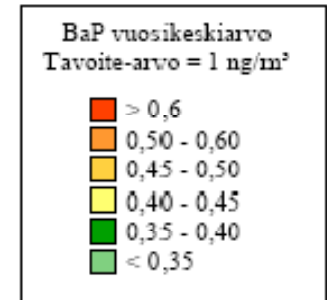
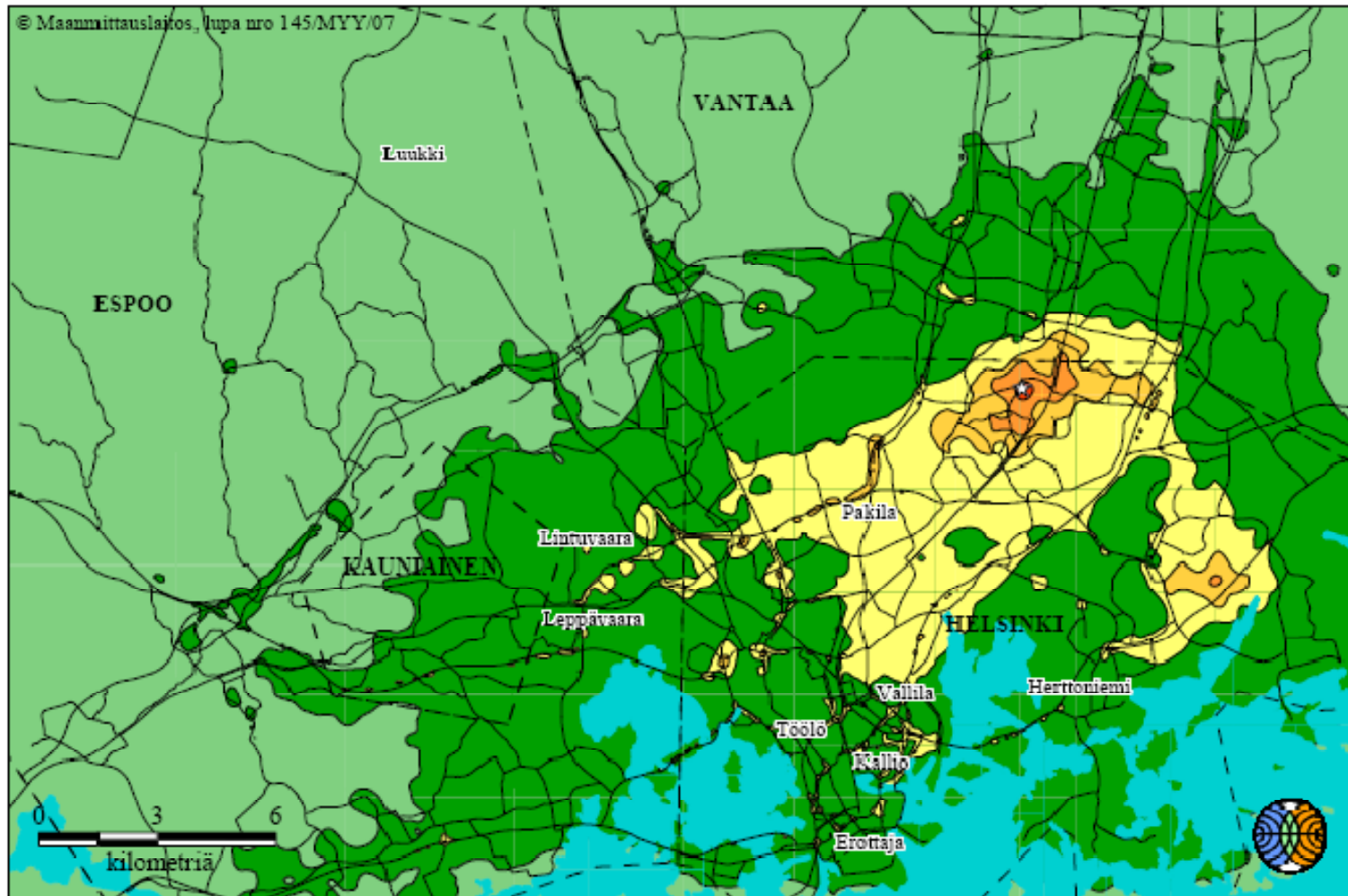


Kunta	PM _{2,5} -päästö (t/a/km ²)
Vesilahti	6,9
Suomussalmi	4,8
Hausjärvi	4,3
Lehtimäki	4,2
Saari	4,1
Viitasaari	3,9
Köyliö	3,8
Ikaalinen	3,7
Rautalampi	3,7
Hankasalmi	3,5
Kuopio	3,5
Pattijoki	3,5
Enontekiö	3,4
Iisalmi	3,4
Virrat	3,3
Ilmajoki	3,1
Mäntyharju	3,1
Iitti	3,1
Pernaja	3,1
Koski Tl	3,1
Jyväskylän mlk	3,1





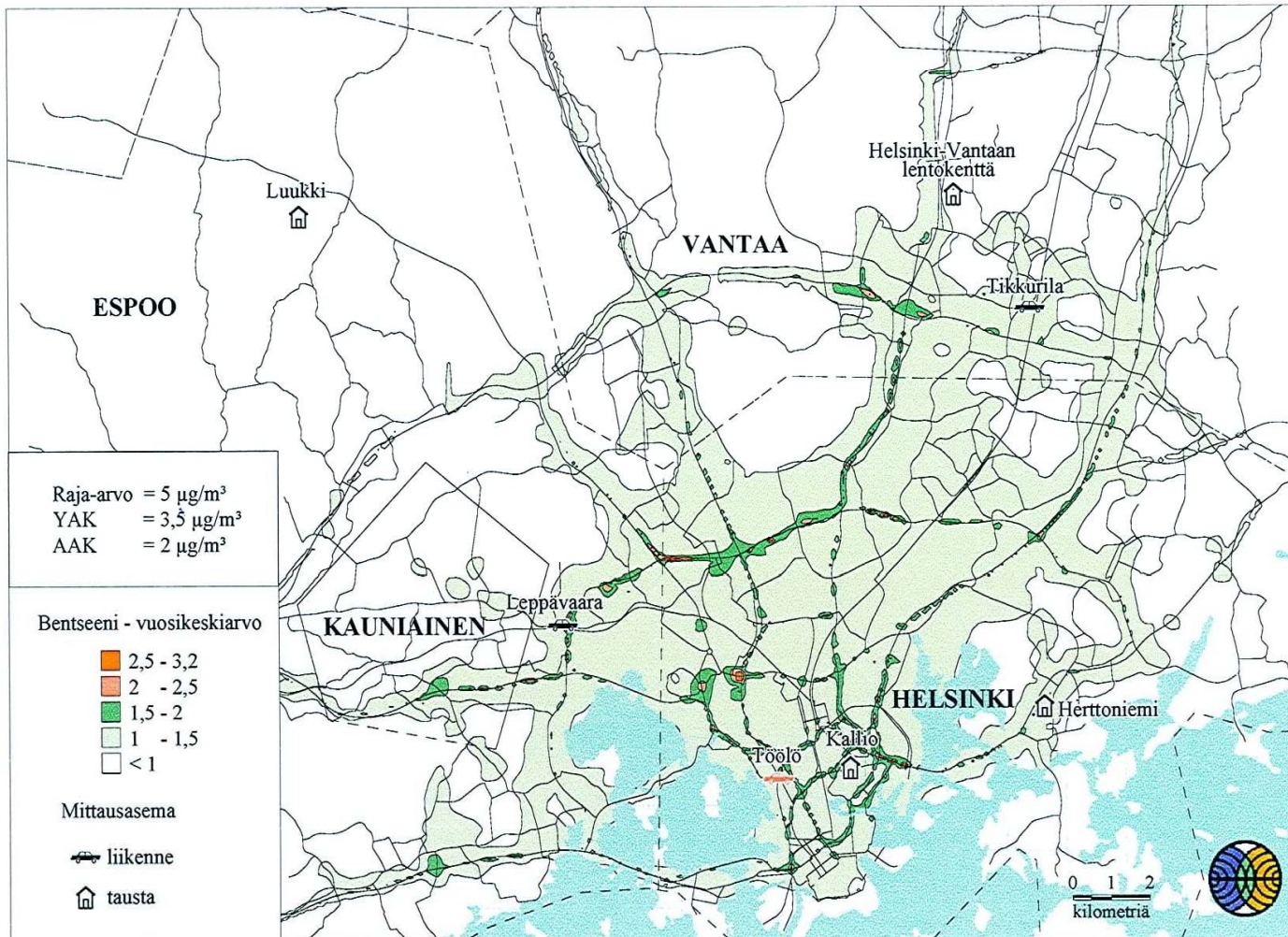
Dispersion modelling, BaP concentration Helsinki Metropolitan Area



☆ = maksimi = 0,61 ng/m³



Example: dispersion modelling of benzene

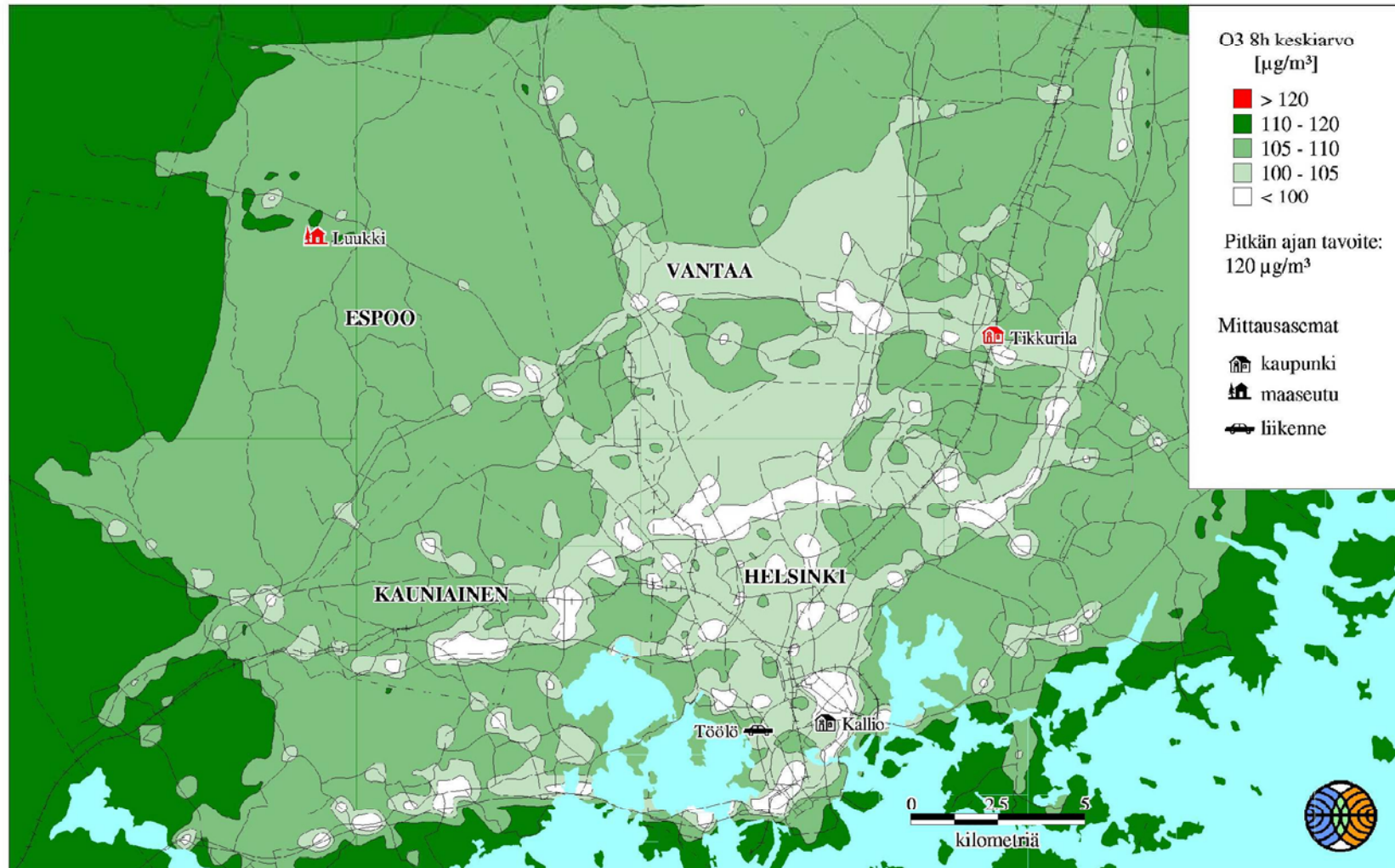


LIITEKUVA 10. Bentseenipitoisuuden vuosikeskiarvo ($\mu\text{g}/\text{m}^3$) pääkaupunkiseudulla vuonna 2000.

YAK=ylempi arviointikynnys, AAK=alempi arviointikynnys.



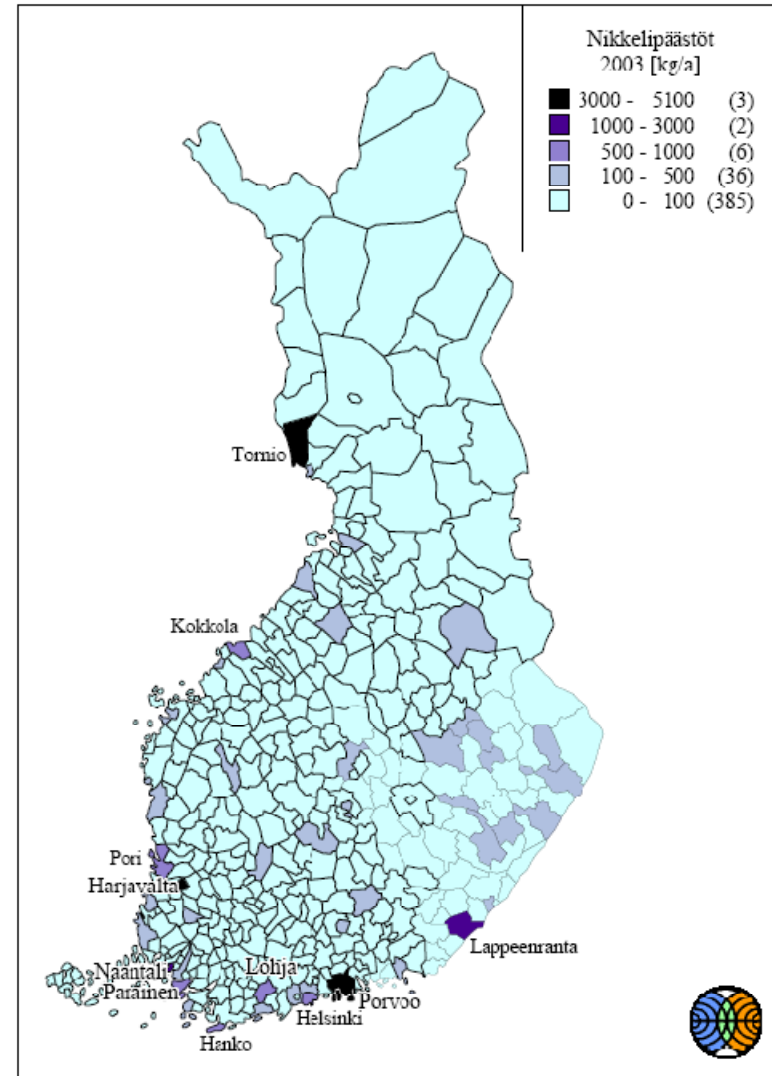
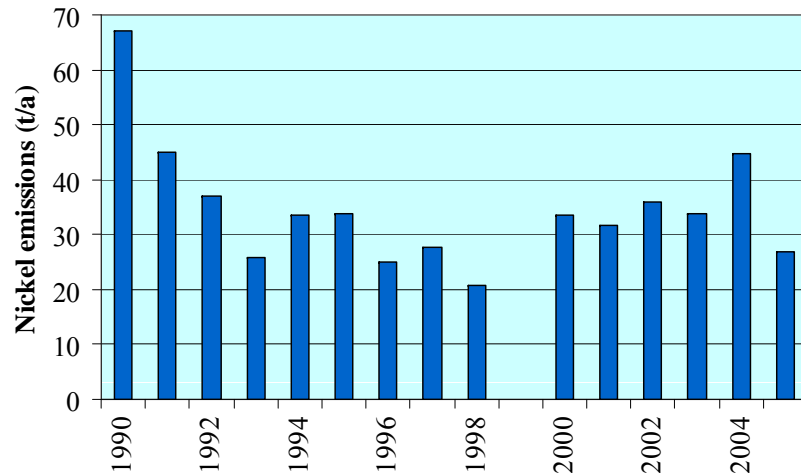
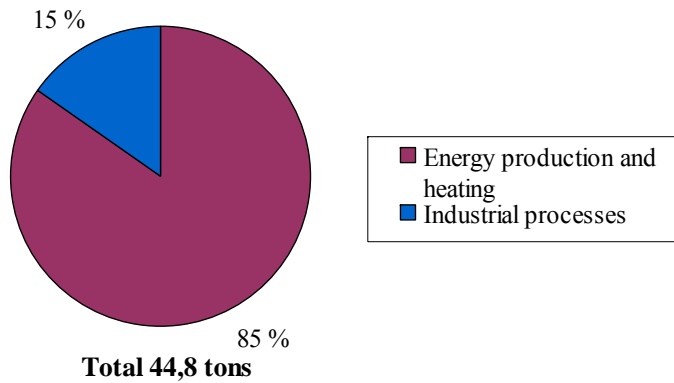
Example: dispersion modelling of ozone



LIITEKUVA 14. Otsonin korkein 8 tunnin keskiarvopitoisuus (µg/m³) pääkaupunkiseudulla vuonna 2000.

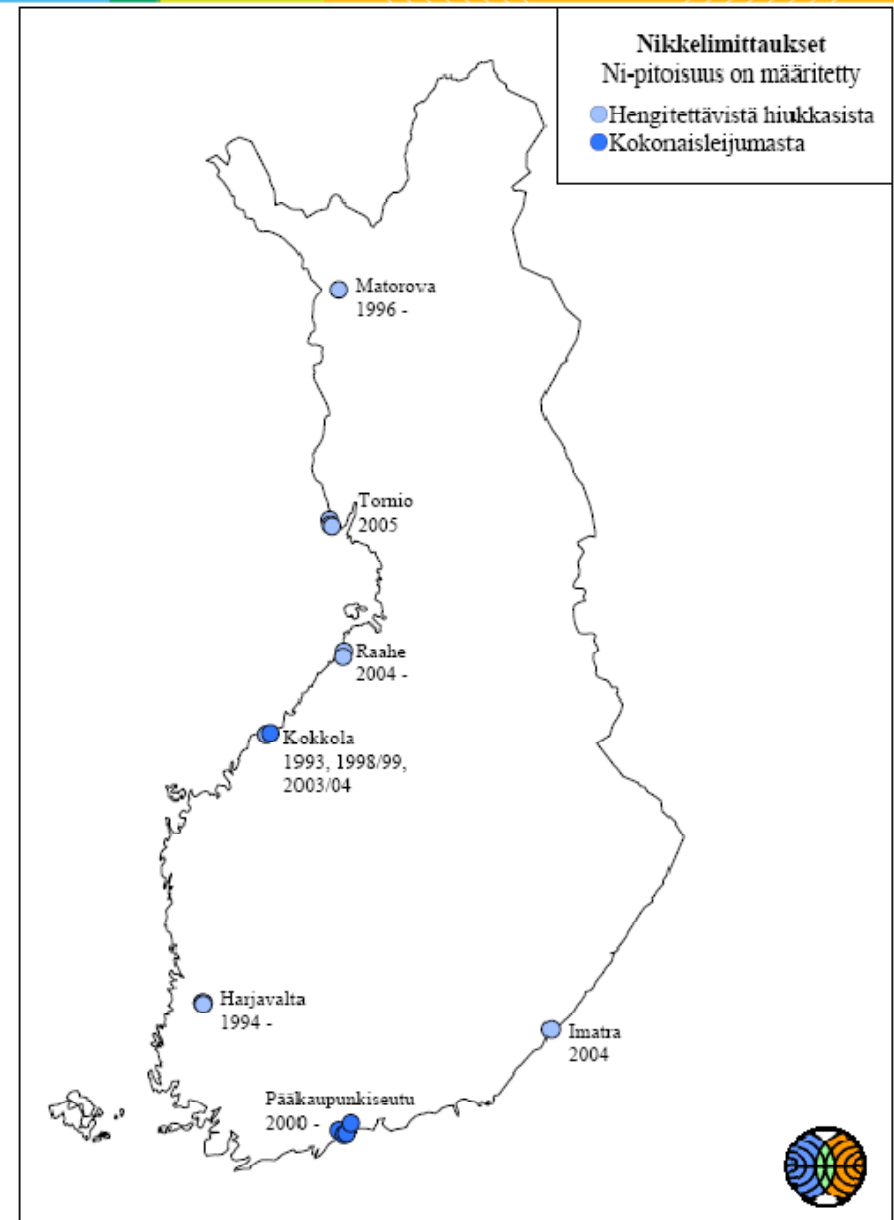


Nickel emission 2003



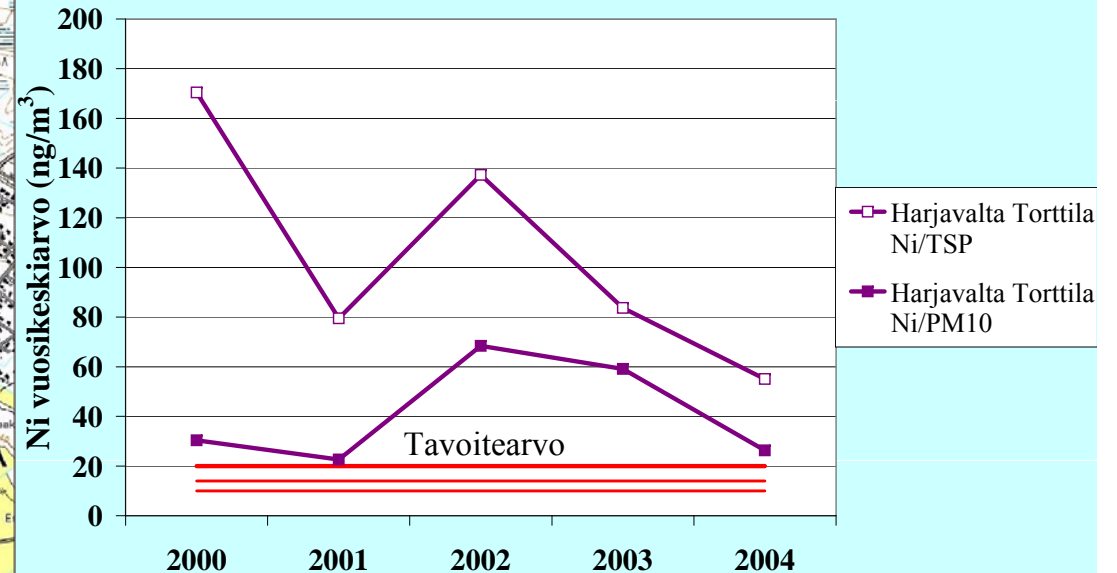
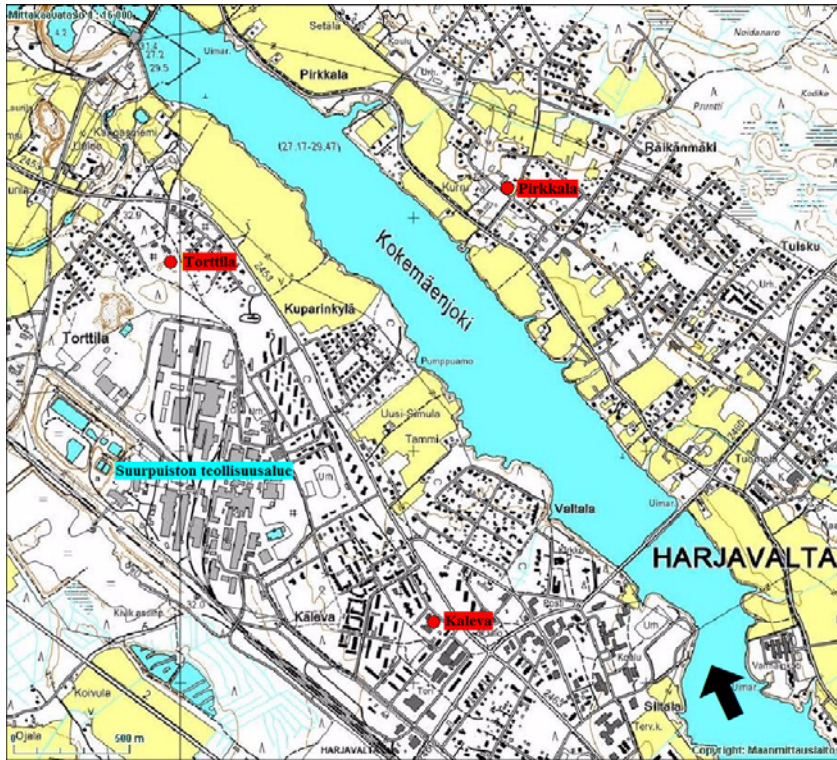


Measurement of Nickel concentration in ambient air in Finland 1993-2006





Nickel concentrations In the city of Harjavalta, industrial source

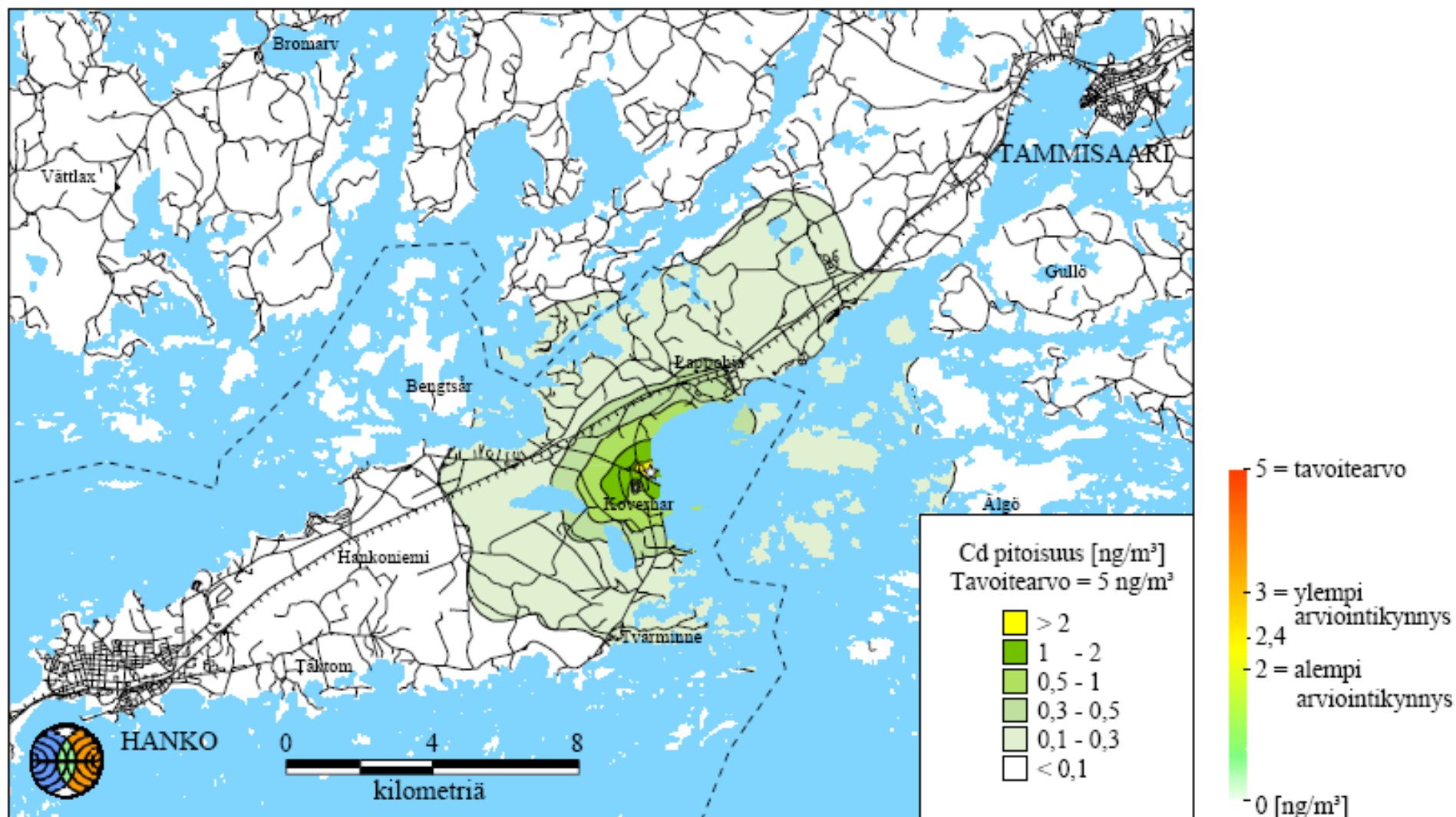




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Dispersion modelling - Cadmium concentration

FUNDIA WIRE OY AB, KOVERHARIN TERÄSTEHDAS





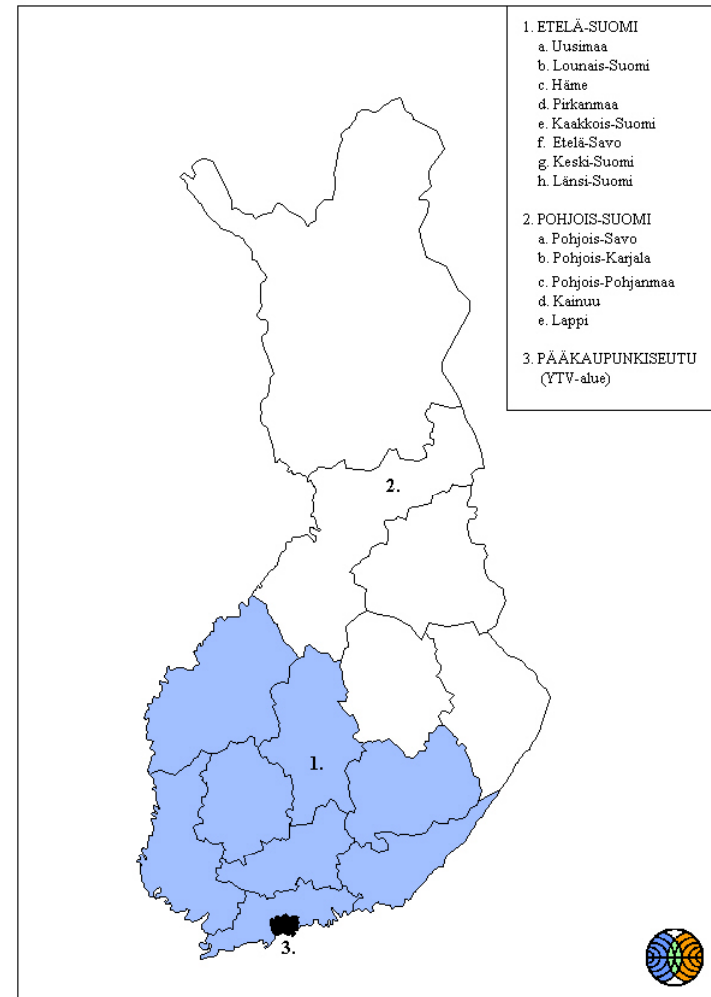
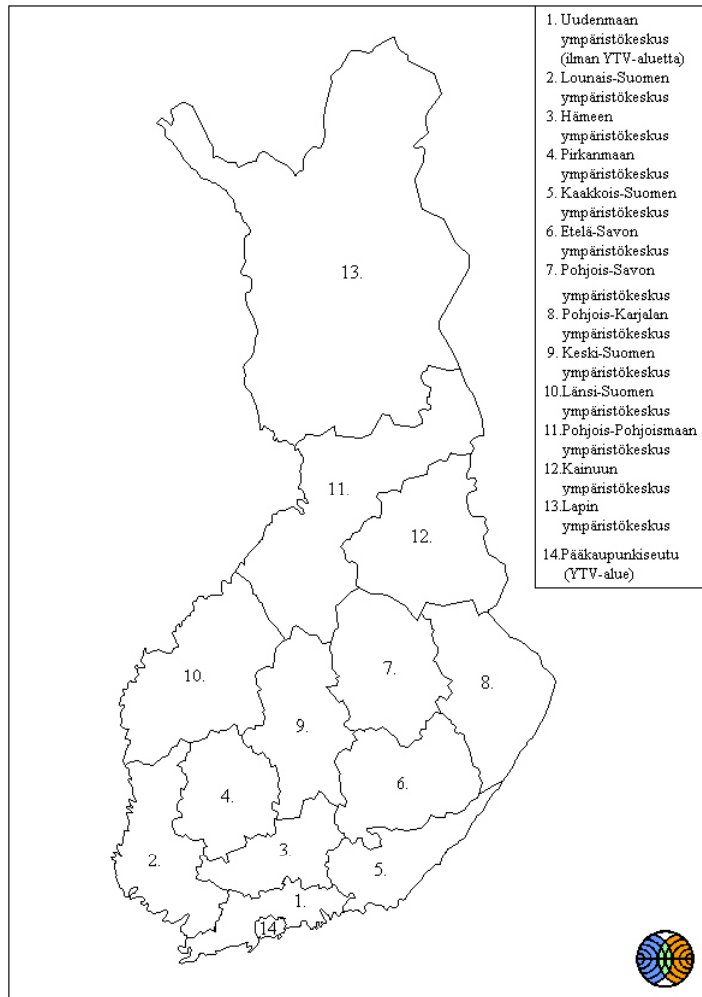
Zones and agglomerations in Finland

- **One agglomeration : Helsinki Metropolitan Area, 1 milj. inhabitants**
- **Zones based on Regional Environmental Centers (13)**
- **Different zoning for different pollutants**
 - based on concentration levels and sources of pollution
 - to optimize assessment burden
- **SO₂, NO₂, PM₁₀, Pb, CO : 1 aggl. + 13 zones**
- **Benzene : 1 aggl. + 2 zones**
- **SO₂&NO_x nature, O₃, BaP, HMs : 1 aggl. + 1 zone**



Zones and agglomerations in Finland: SO₂, NO₂, PM₁₀, Pb, CO

benzene





Required measurement stations

Zone	Area (km ²)	Population	Number of stations
HMs			
Helsinki Metropolitan	743	971 947	0
Rest of Finland	118 110	4 264 664	0
Point sources (Harjavalta)			2
Background	303 070		3
PAH			
Helsinki Metropolitan	743	971 947	1 ^{1/2} ²
Rest of Finland	302 327	4 264 664	2 ^{1/4} ²
Point Sources (Raahe)			2
Background	303 070		3

1) LAT < conc. < UAT

2) conc. > UAT



PM10 and PM2.5 measurements in Finland

November 2006:

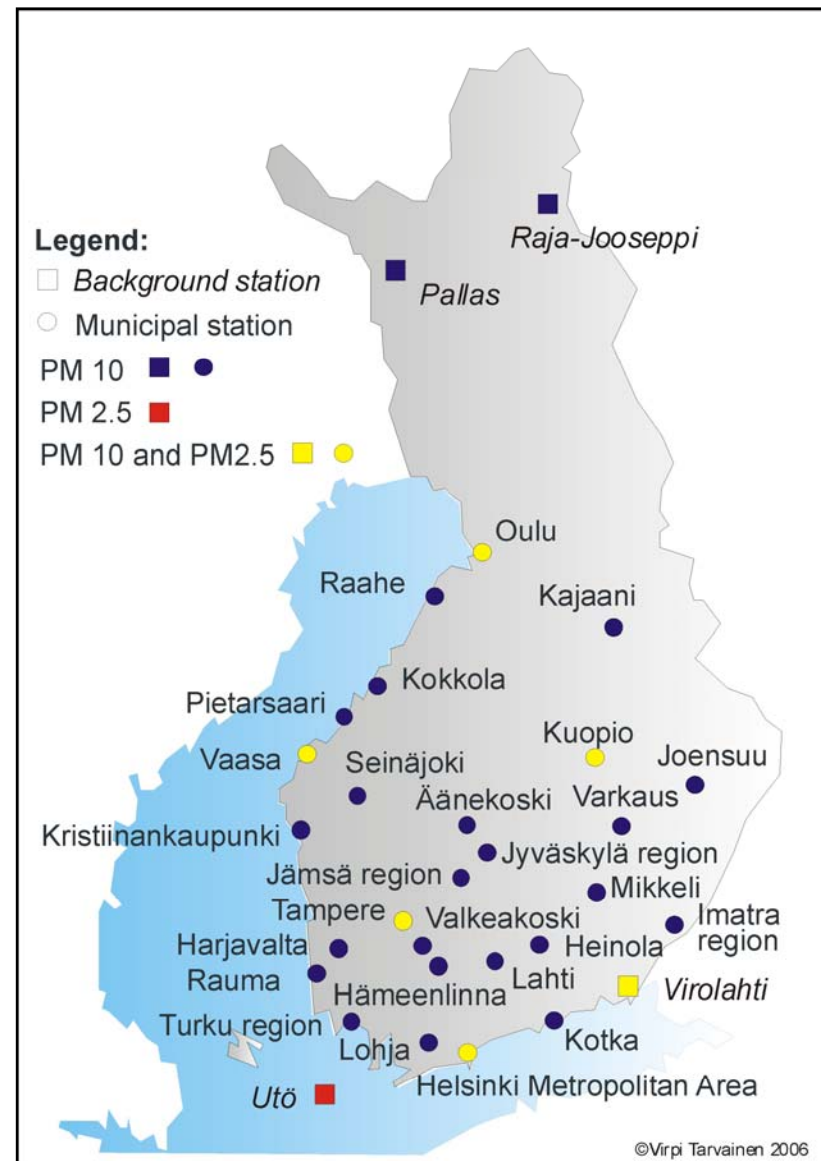
PM10 60 measurement stations

PM2.5 9 measurement stations

Background measurements carried out by FMI.

Municipal stations operated by local environmental authorities.

Source: Finnish National Air Quality Data Base (ILSE),
Finnish Meteorological Institute.

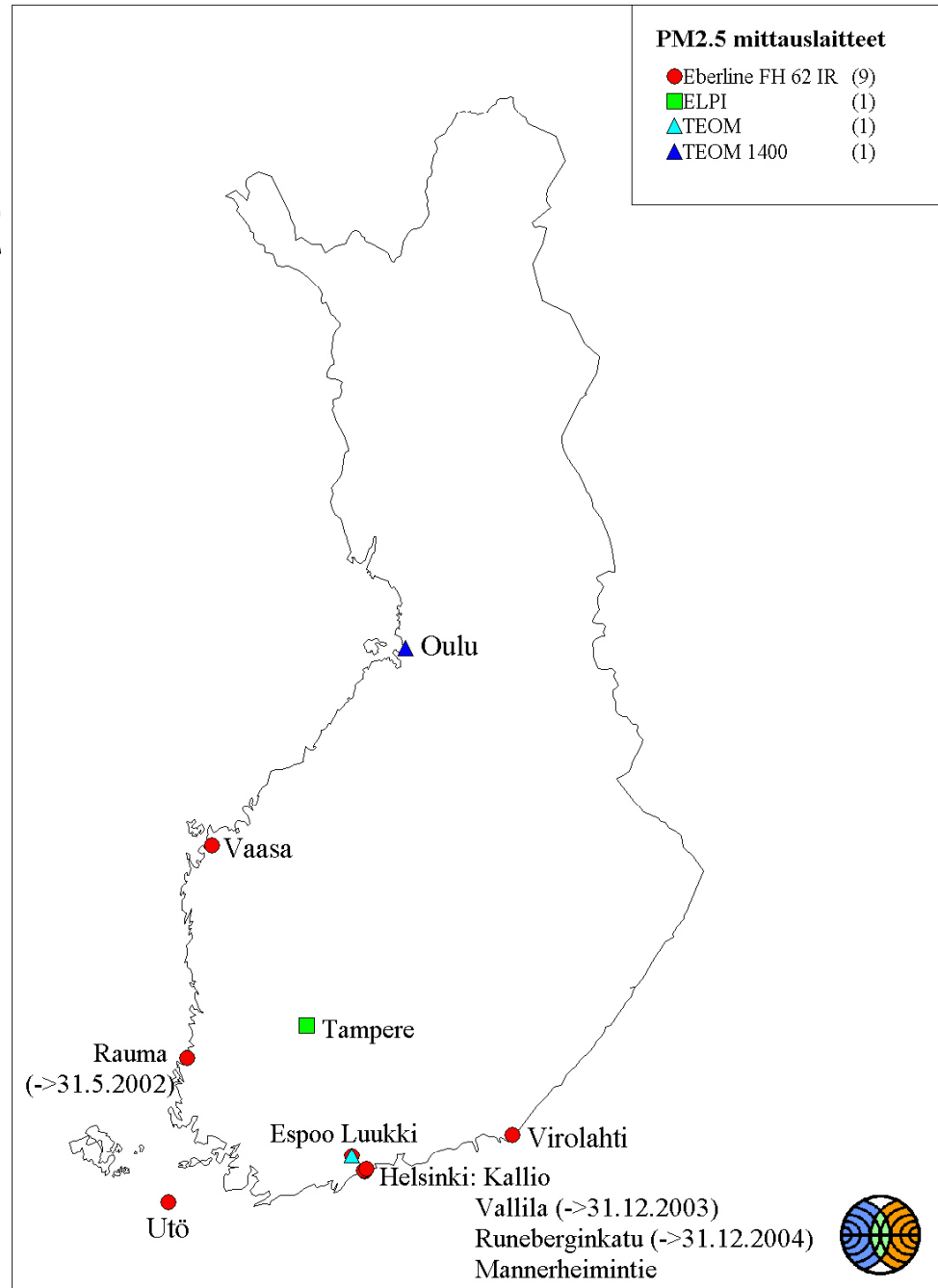




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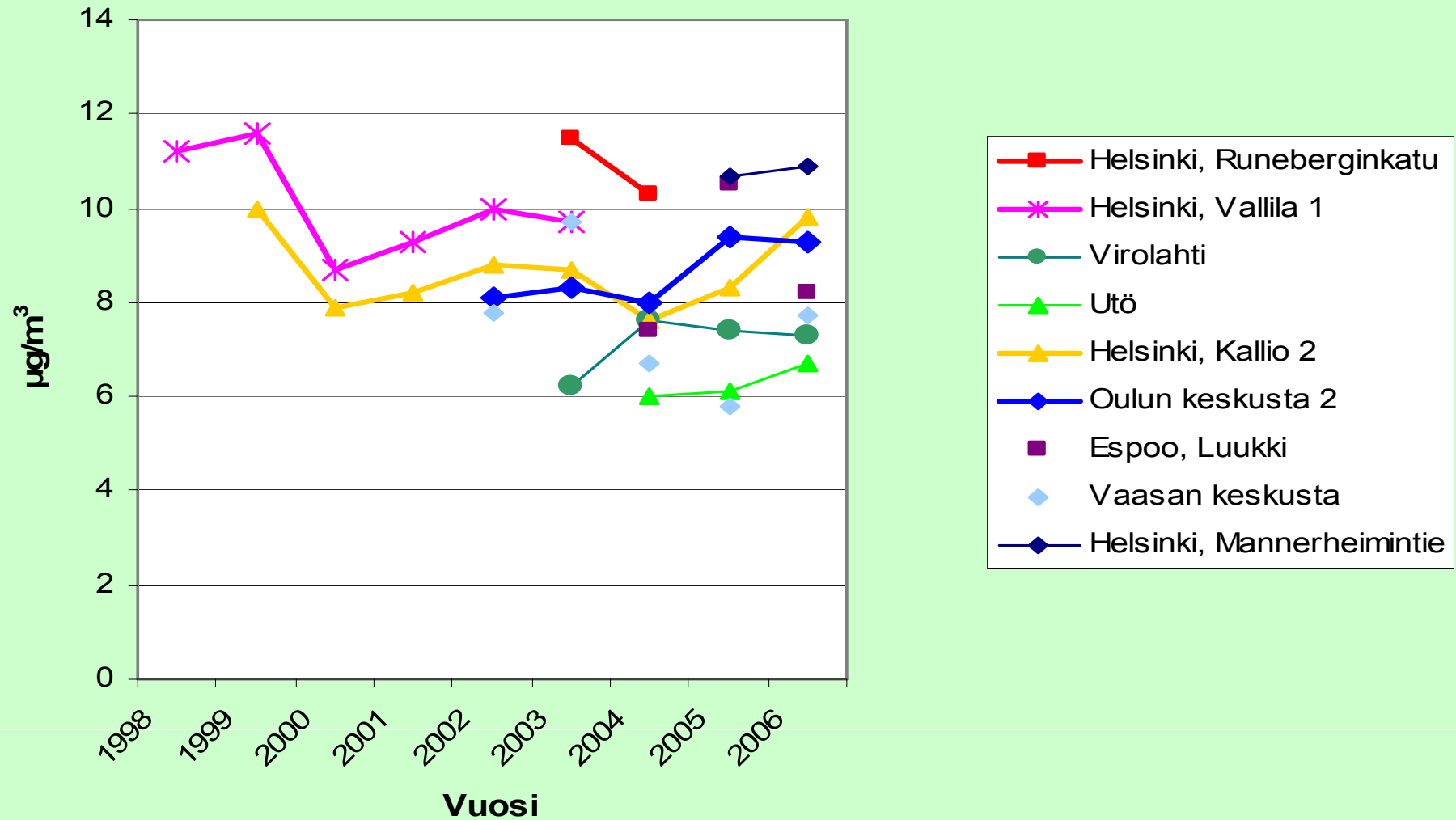


PM_{2,5} measurement instruments



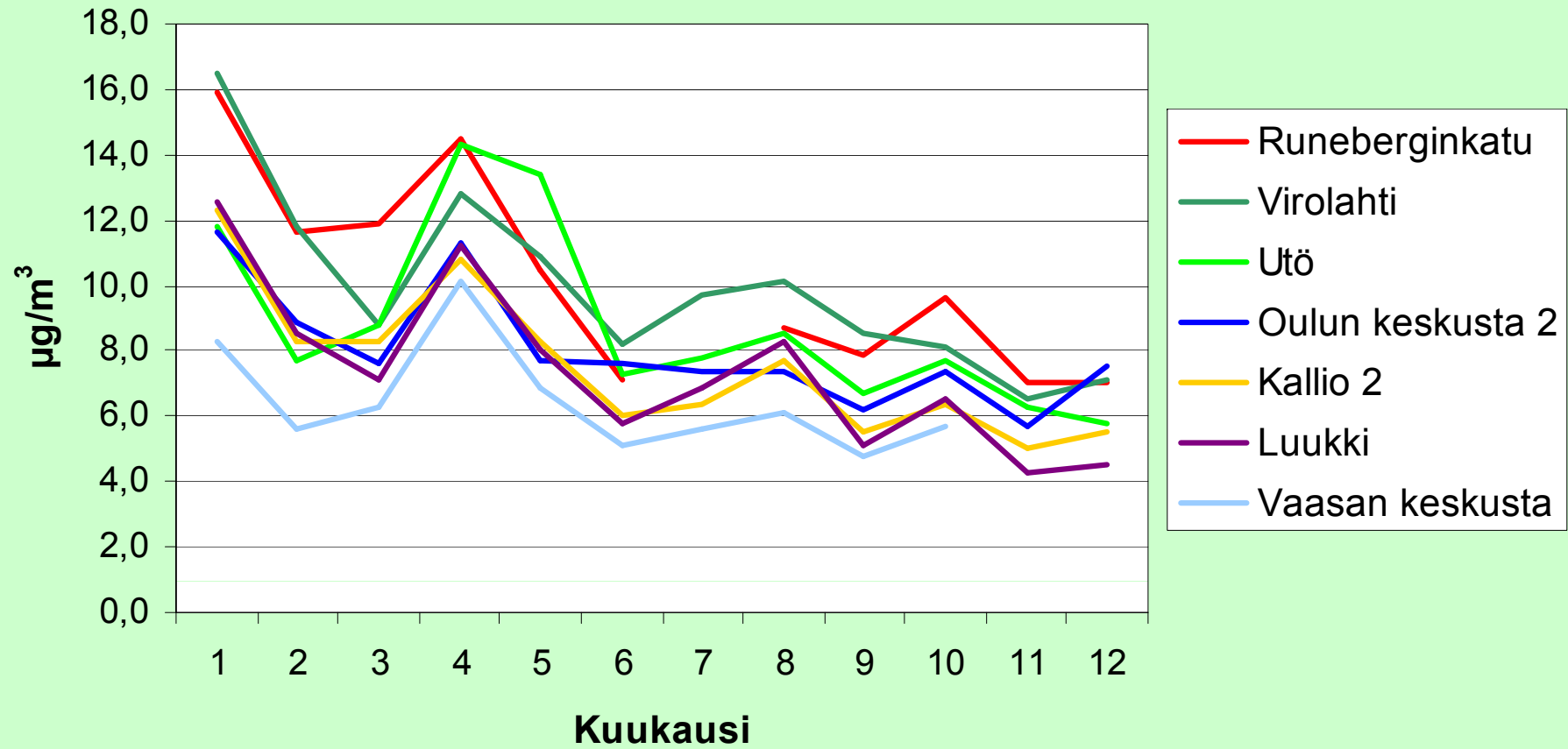


PM_{2.5} annual mean



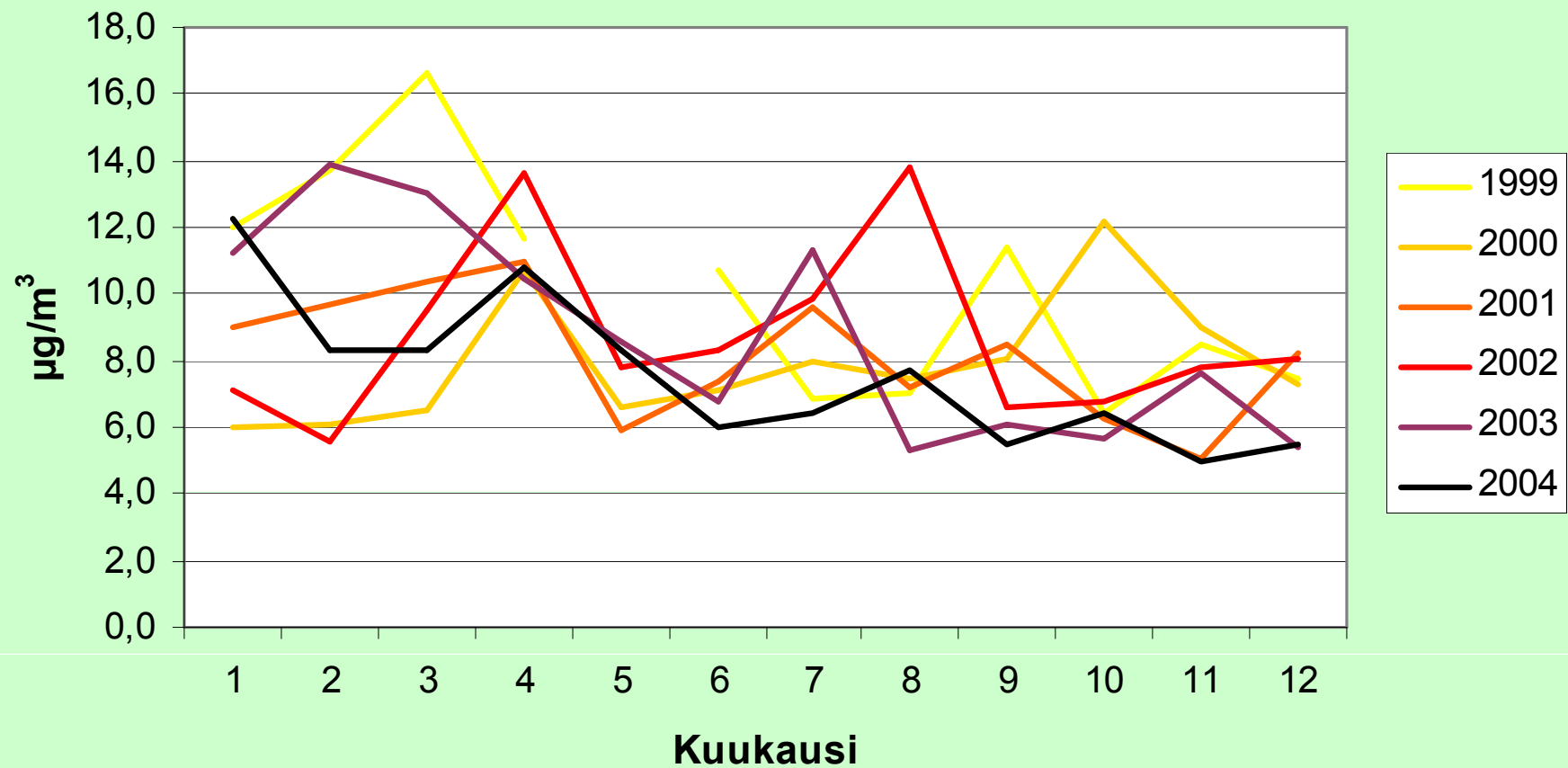


PM_{2.5} monthly averages 2004



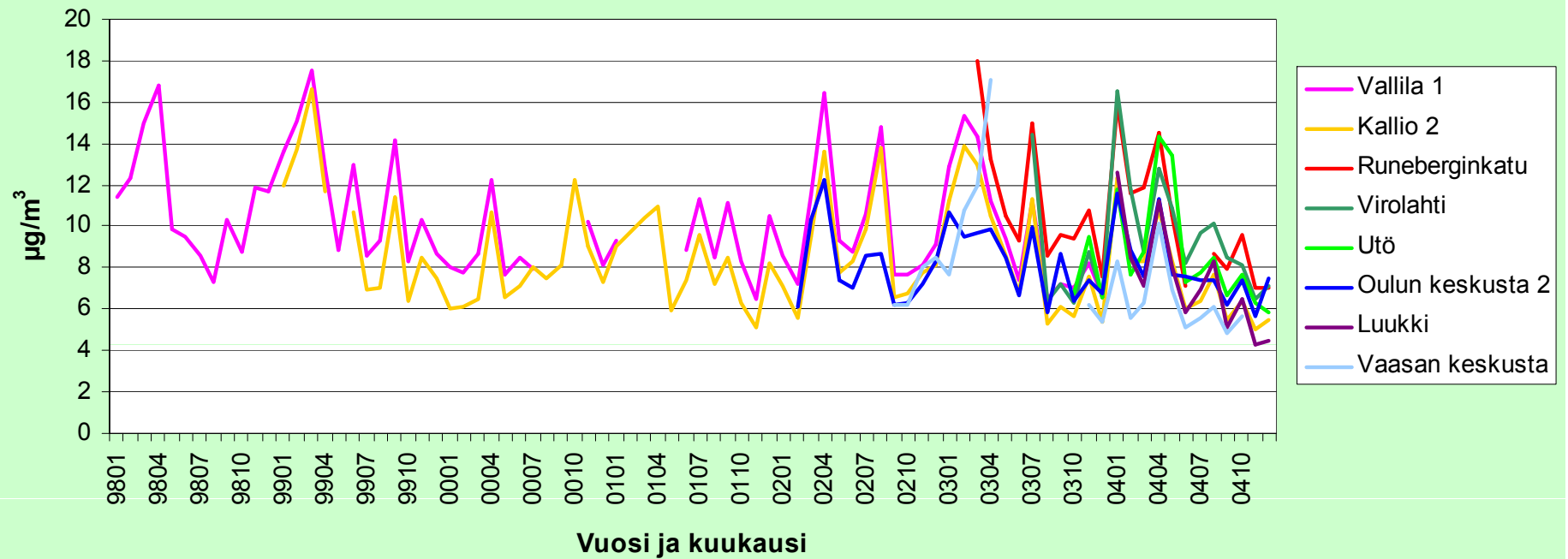


Kallio 2, monthly averages 1999-2004



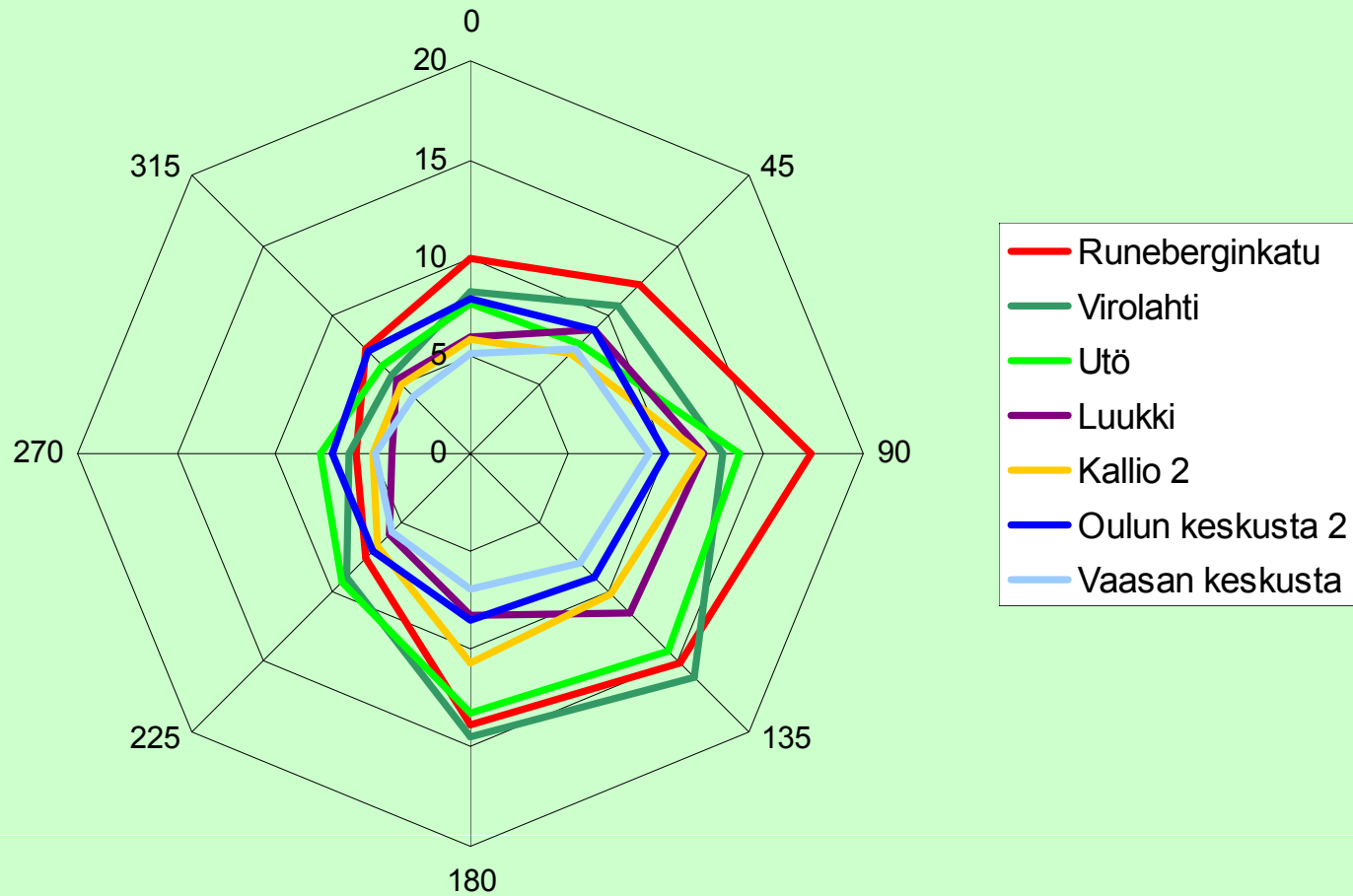


PM2.5 monthly averages





PM2.5 averages ($\mu\text{g}/\text{m}^3$) and wind direction 2004





PM_{2,5} concentrations in Finland – preliminary conclusions

- **PM_{2,5} annual averages are below 15 µg/m³ in all over Finland**
 - **Long range transportation has main contribution to PM_{2,5} levels – both annual averages and episodes (South, South-East and East)**
 - **Major local emission sources: transportation and small scale wood burning, industry in some places**
 - **In Helsinki Metropolitan Area**
 - Long range transportation contribution: about 7 µg/m³
 - Traffic sites about 60 %, background about 90 %
- **It is challenging task to reduce urban background concentration levels in Finland by local or national measures**