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# Air Quality Measurements at the Finnish Meteorological Institute

Finnish Meteorological Institute is responsible for the national background air quality monitoring.

Our monitoring network consists of about twenty measurement stations in different parts of the country. Most of our measurements are part of the international measurement programmes:

**GAW** (Global Atmosphere Watch): The world-wide programme of the WMO, Pallas-Sodankylä.
**EMEP** Co-operative programme for monitoring and evaluating the long-range transmssion of air pollutants in Europe, co-ordinated by the United Nations Economic Commision for Europe (UN/ECE), five stations (Oulanka, Pallas, Virolahti, Ähtäri, Utö).
**AMAP** Arctic Monitoring and assessment programme, co-ordinated by the Arctic Council (Pallas-Sodankylä).
**HELCOM** Helsinki Commision co-ordinated by the Baltic Marine Environment Protection Commission
**Integrated monitoring** (UN/ECE) simultaneous measurements of physical, chemical and biological properties of an ecosystem, Kotinen and Hietajärvi

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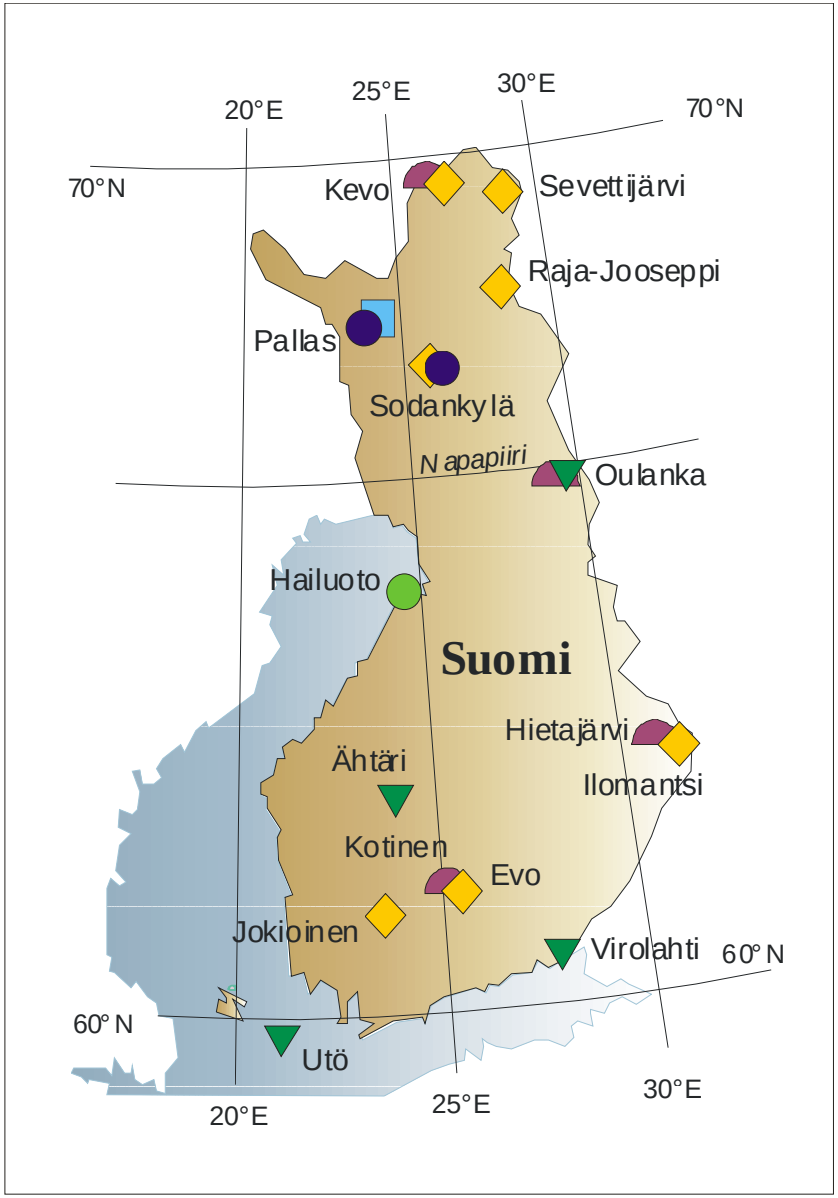
# Air Quality measurement stations

- EMEP
- GAW (WMO)
- Integrated monitoring
- HELCOM
- AMAP
- Muut asemat

Ähtäri EMEP station



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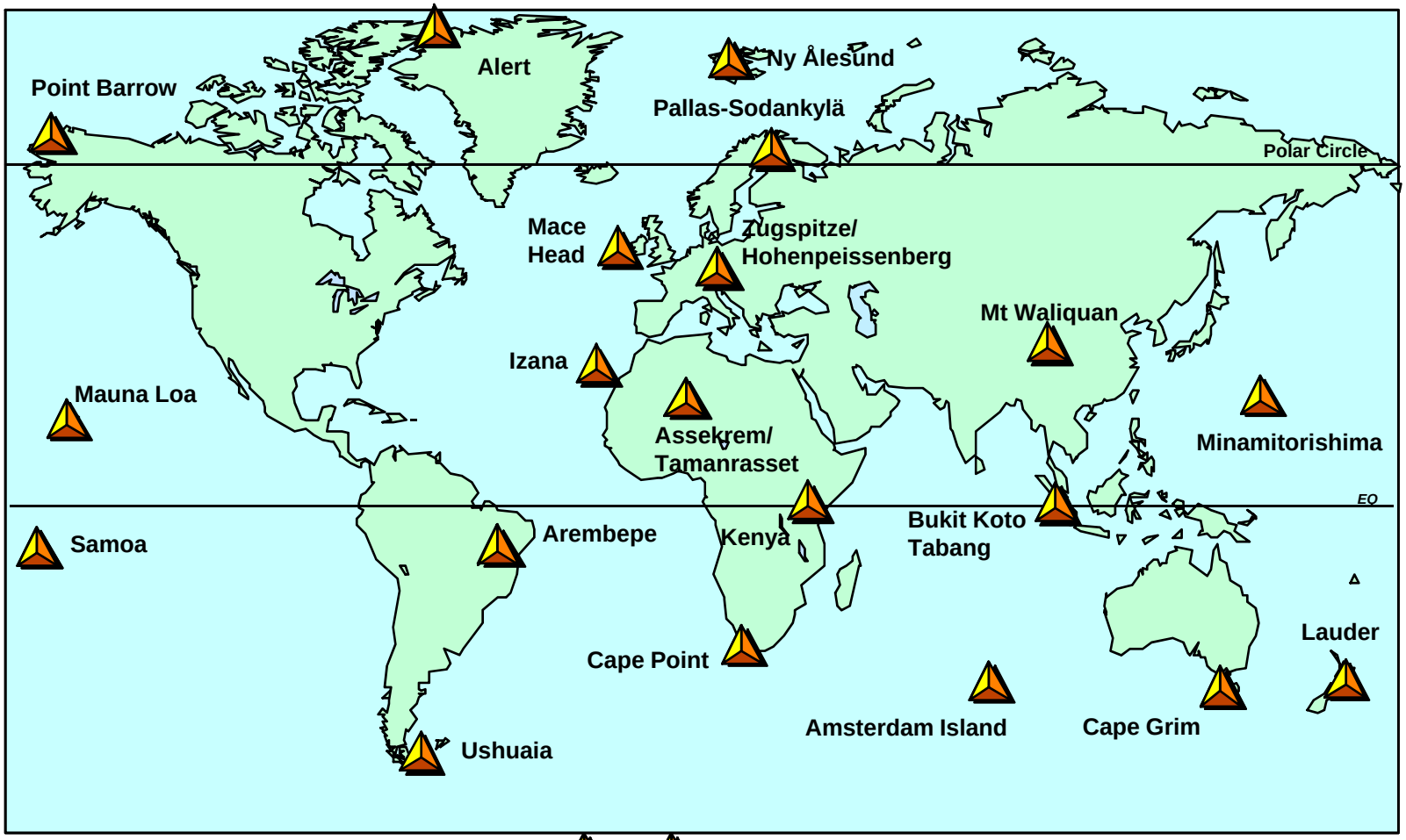
# WORLD METEOROLOGICAL ORGANIZATION

## GLOBAL ATMOSPHERE WATCH




GAW_Map.ppt Oct/2000

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At the background stations the gas and particle samples are collected as daily or weekly samples and precipitation samples as weekly or monthly samples.

In the laboratory the following ions are analyzed from gas- and particle samples:
SO2, SO4, NH4, (HNO3+NO3), (NH3+NH4), Na, K, Ca ja Mg.

and from precipitation samples:
Cl, NO3, SO4, Na, K, Ca, Mg, Ca, NH4, Al, As, Cd, Cu, Fe, Mn, Ni, Pb, V, Zn, Co ja Cr also acidity (pH) and conductivity are measured.

Starting from 2007 trace metals will be measured from particles (PM10) at three stations

Packing the filters for air sampling at the laboratory

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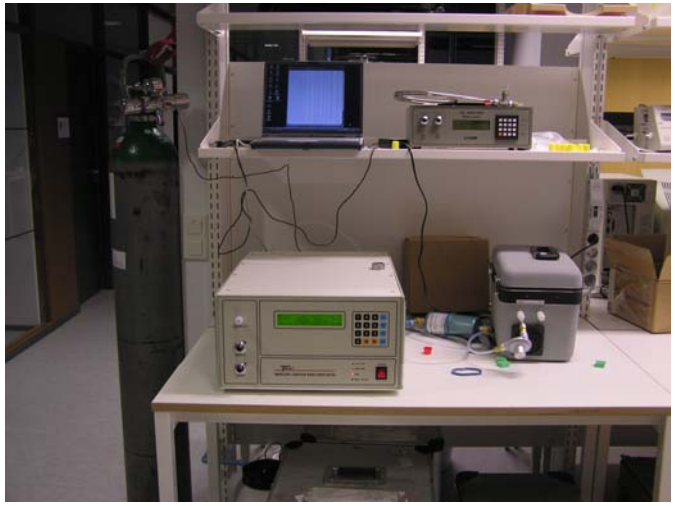
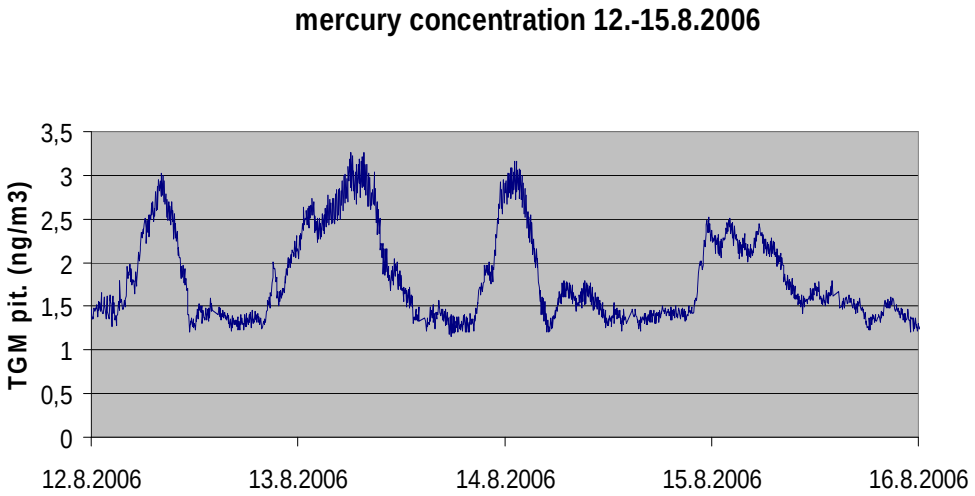
Mercury concentrations in air and in precipitation will also be measured at three background stations starting from 2007.






TEKRAN 2537A Mercury Analyser

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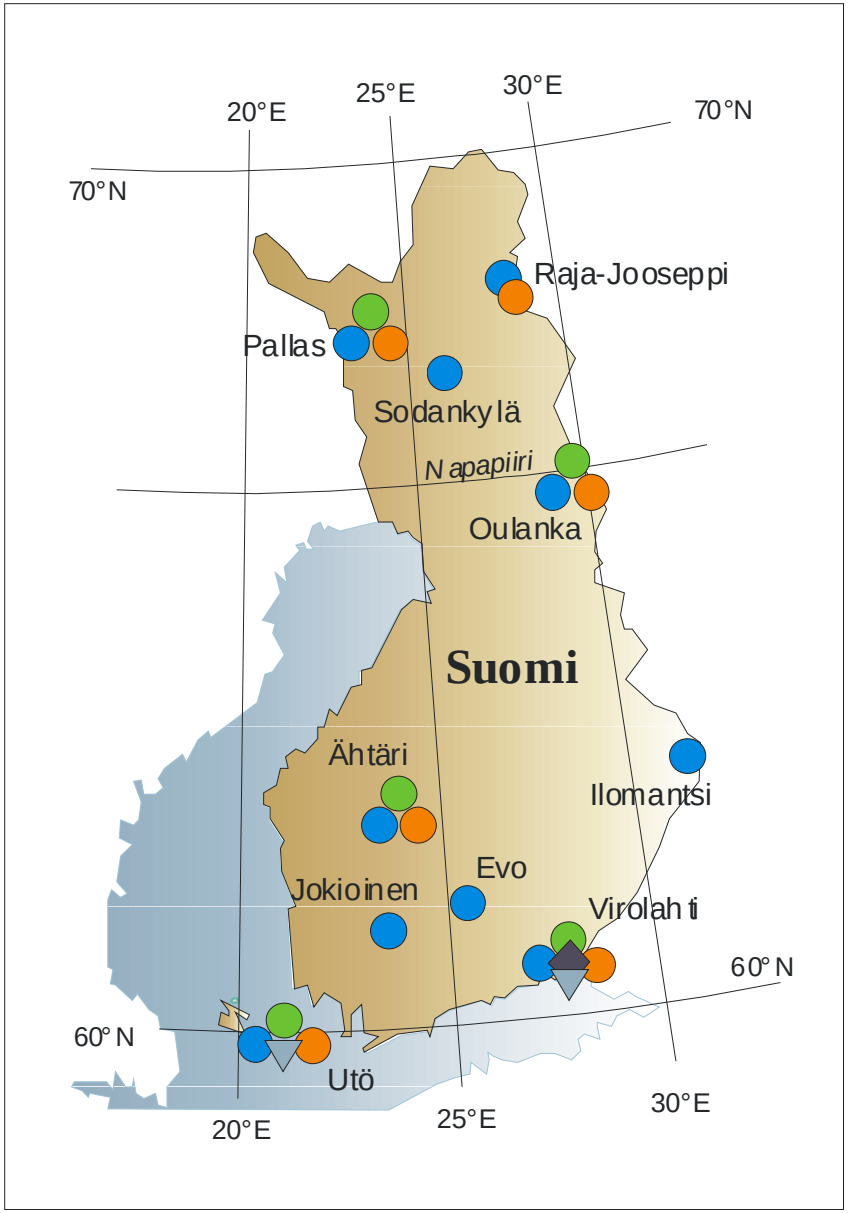
# Continuous measurements:

The following gases and particles are monitored continuosly at the background stations:

- ozone ($O_3$)
- nitrogen dioxide ($NO_2$)
- sulphur dioxide ($SO_2$)
- $PM_{10}$
- $PM_{2.5}$



## Air quality measurements are used:

- The reasearch of air chemistry and to detect the changes in air quality
- To verify the air chemistry models
- To follow the effects of the emission reduction agreements
- To evaluate the loads air pollutants have on terrestrial and sea ecosystems.

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# The results of air quality measurements:

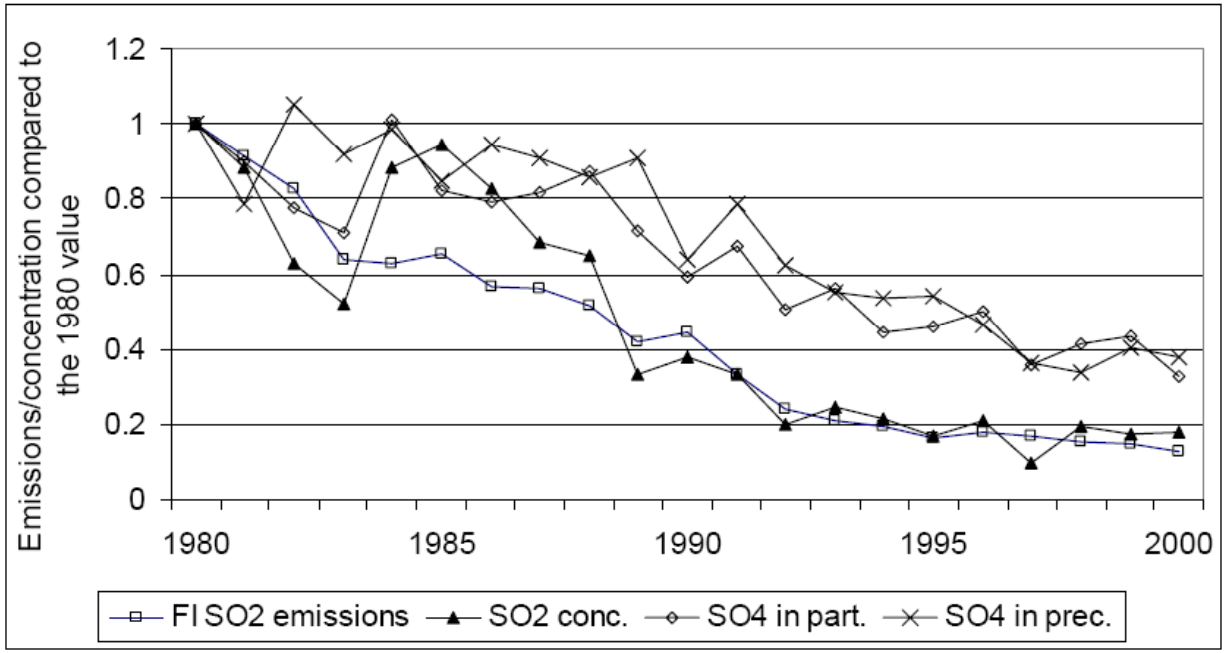
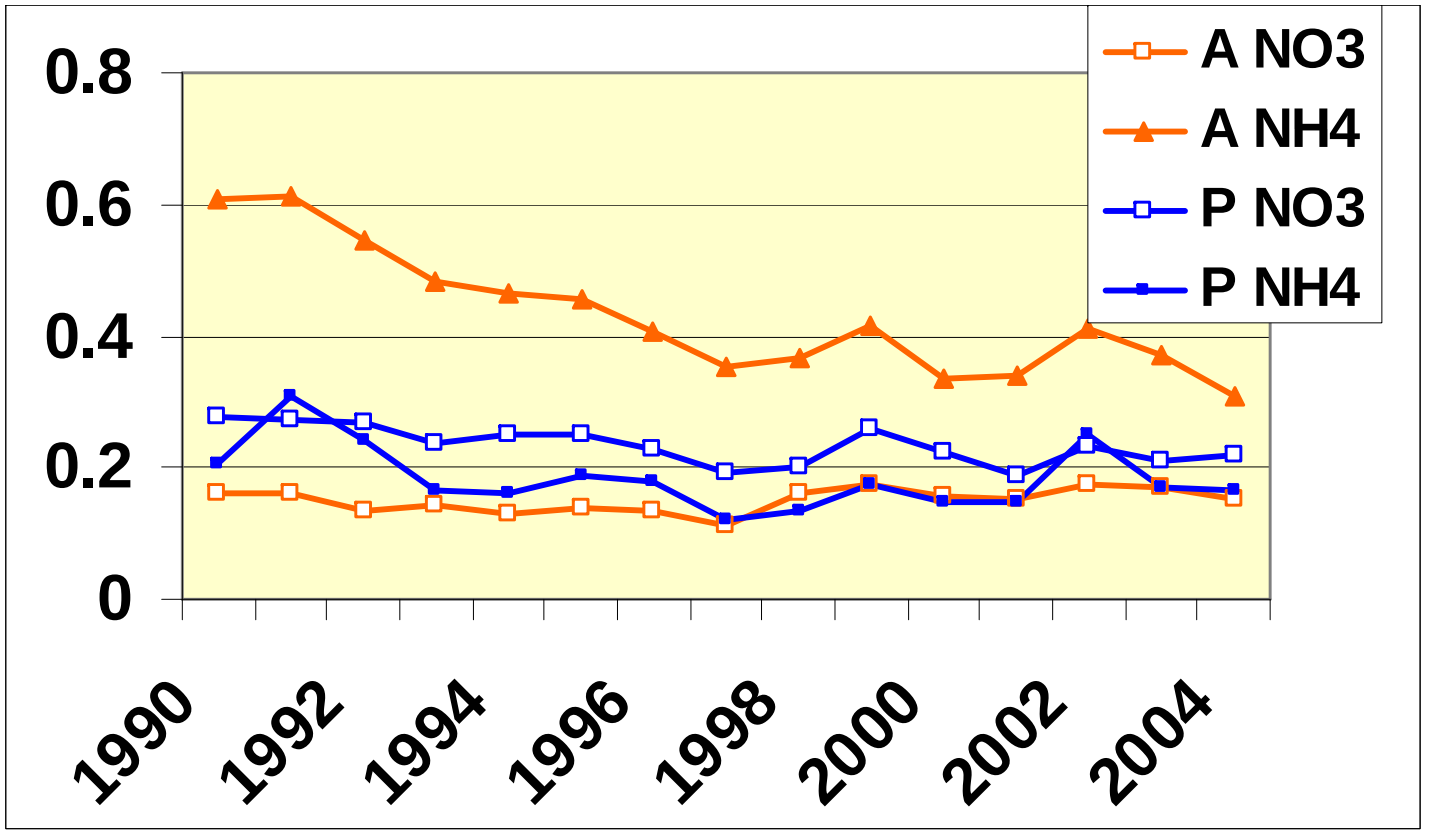



Figure 7. Decline of the Finnish $SO_2$ emissions, the $SO_2$ concentration in air and the $SO_4^{2-}$ concentration in particles and precipitation in Ähtäri. The annual values are compared to the 1980 value.

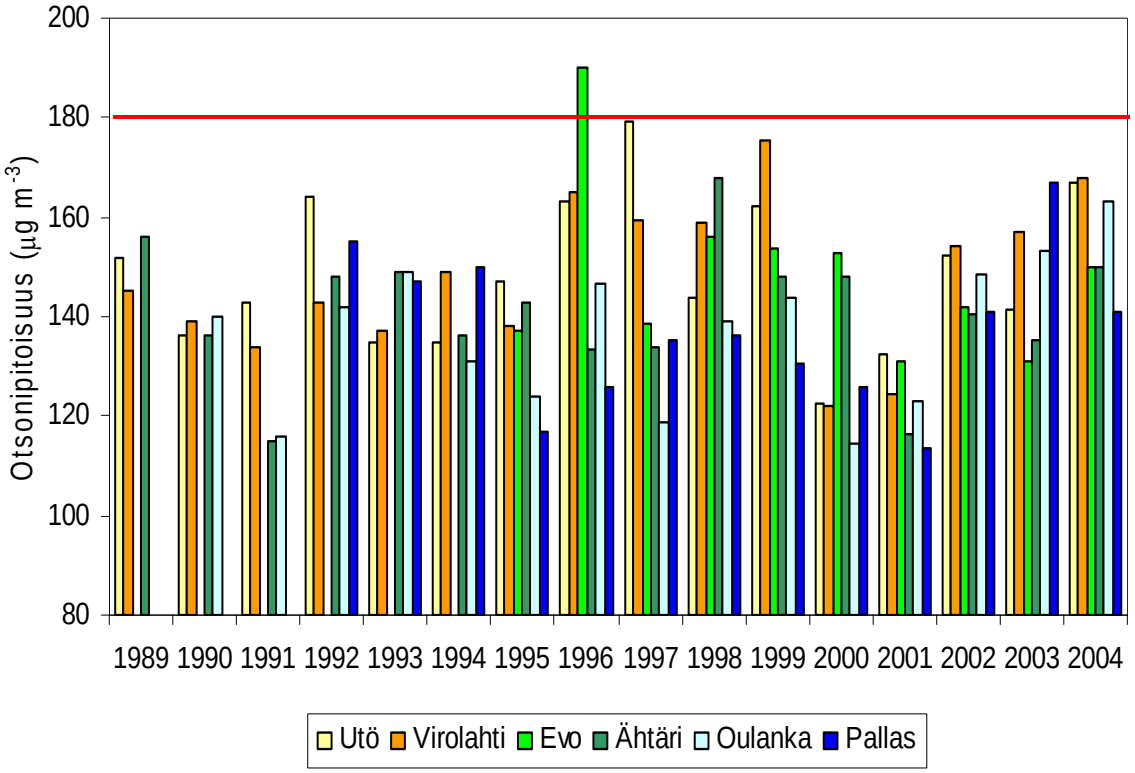
**Ruoho-Airola, T., 2004. Dissertation.**
**Finnish Meteorological Institute Contributions No. 44**

LRTAP 25th Anniversary
Long-range Transboundary Air Pollution




Nitrogen compounds in air (A) and in precipitation (P) annual mean in Ähtäri, unit μg N/m3 in concentrations in air ja mg N/l in concentrations in precipitation

T. Ruoho-Airola




Tiedotuskynnys

The increased ozone concentrations are a major air quality problem in Europe during spring and summer caused mainly by traffic exhaust. According to the ozone directive the public has to be informed when the ozone concentrations reach 180 µg $m^{-3}$.

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# Organic compounds in the ambient air

Air contains lots of organic compounds. Some of them (aromatic and light hydrocarbons C2-C6) are emitted as a result of fossil fuel burning, but also due to wood burning,  some are emitted naturally by trees and other plants (terpenes).

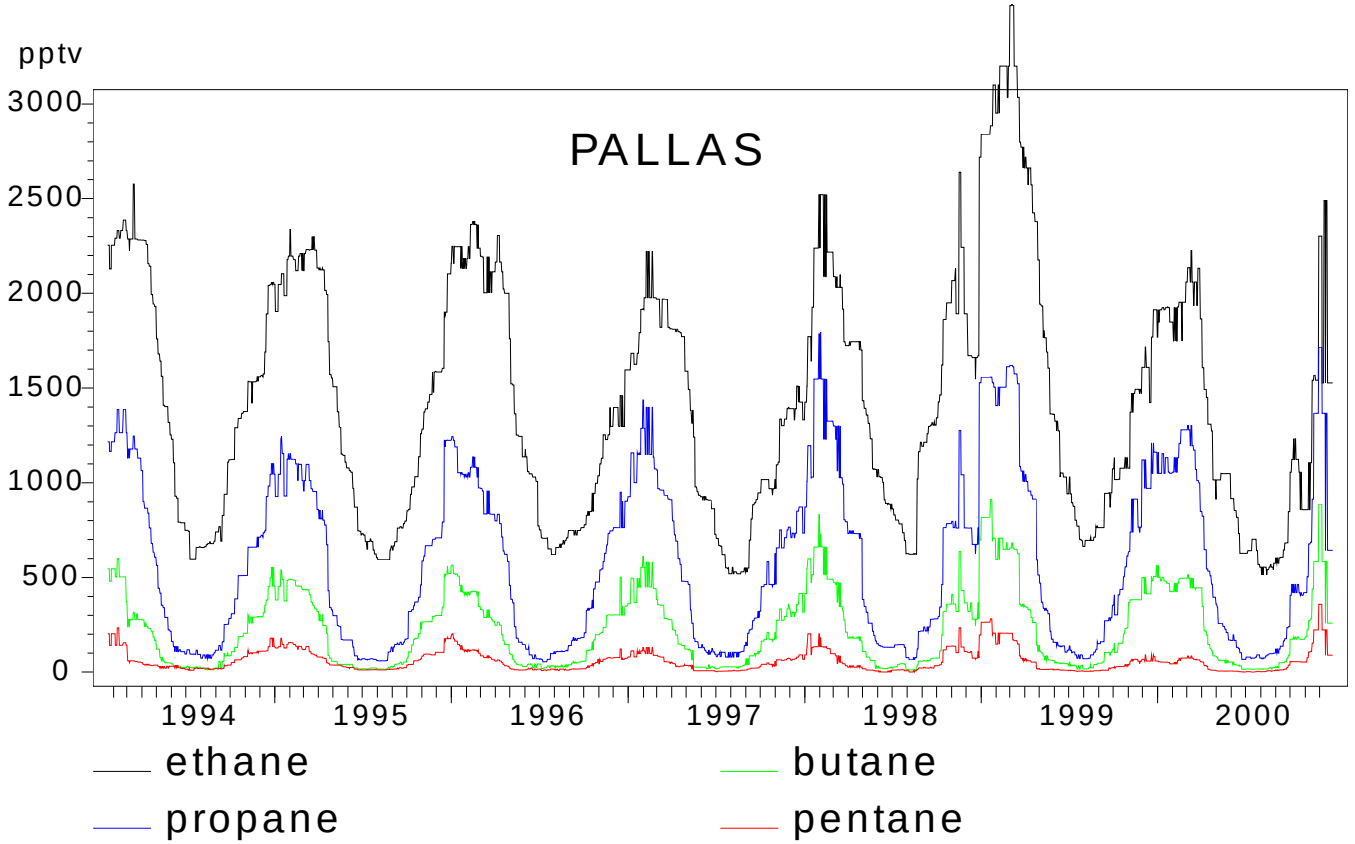
Organic compounds react in the air causing ozone formation, EU requires the member states to measure ozone forming compounds.

Benzene is a carcinogenic aromatic hydrocarbon, that is contained in crude oil. European Union (EU, 2002) has set limit values and upper and lower assessment thresholds for concentrations in ambient air. The annual average concentration may not exceed 5 µg m-3, upper and lower assessment thresholds are 3,5 and 2 µg m-3, respectively.

Starting from 2007, the EU member states also have to measure polycyclic aromatic hydrocarbons in PM10.

The biogenic hydrocarbons also affect ozone concentrations and they also can cause new particle formation and growth of the particles.

# The concentrations of ozone forming compounds are measured at Pallas and on Utö




The concentrations are small in summer due to reactions in sunlight

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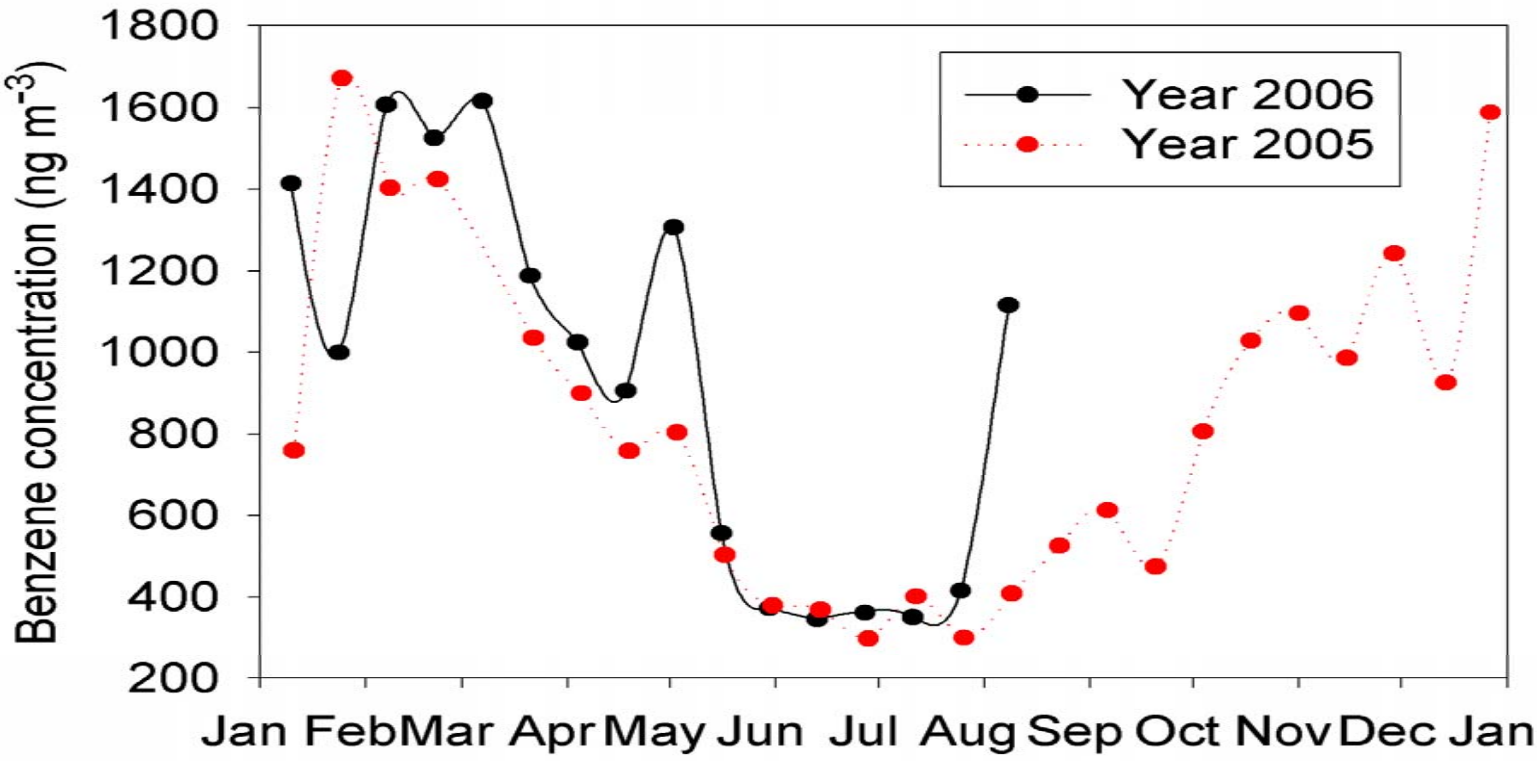
# Benzene concentrations in Helsinki at the urban background station of Kallio




station run by Helsinki Metropolitan Area Council

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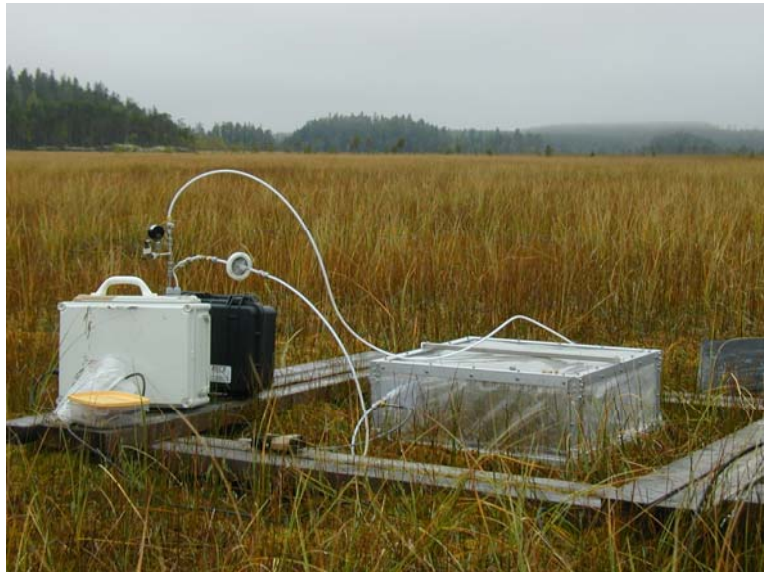
Air chemistry laboratory studies also the biogenic organic compounds. The research is connected to new particle formation and growth processes.



Emission rate measurements of volatile organic compounds from wetland and pine trees.

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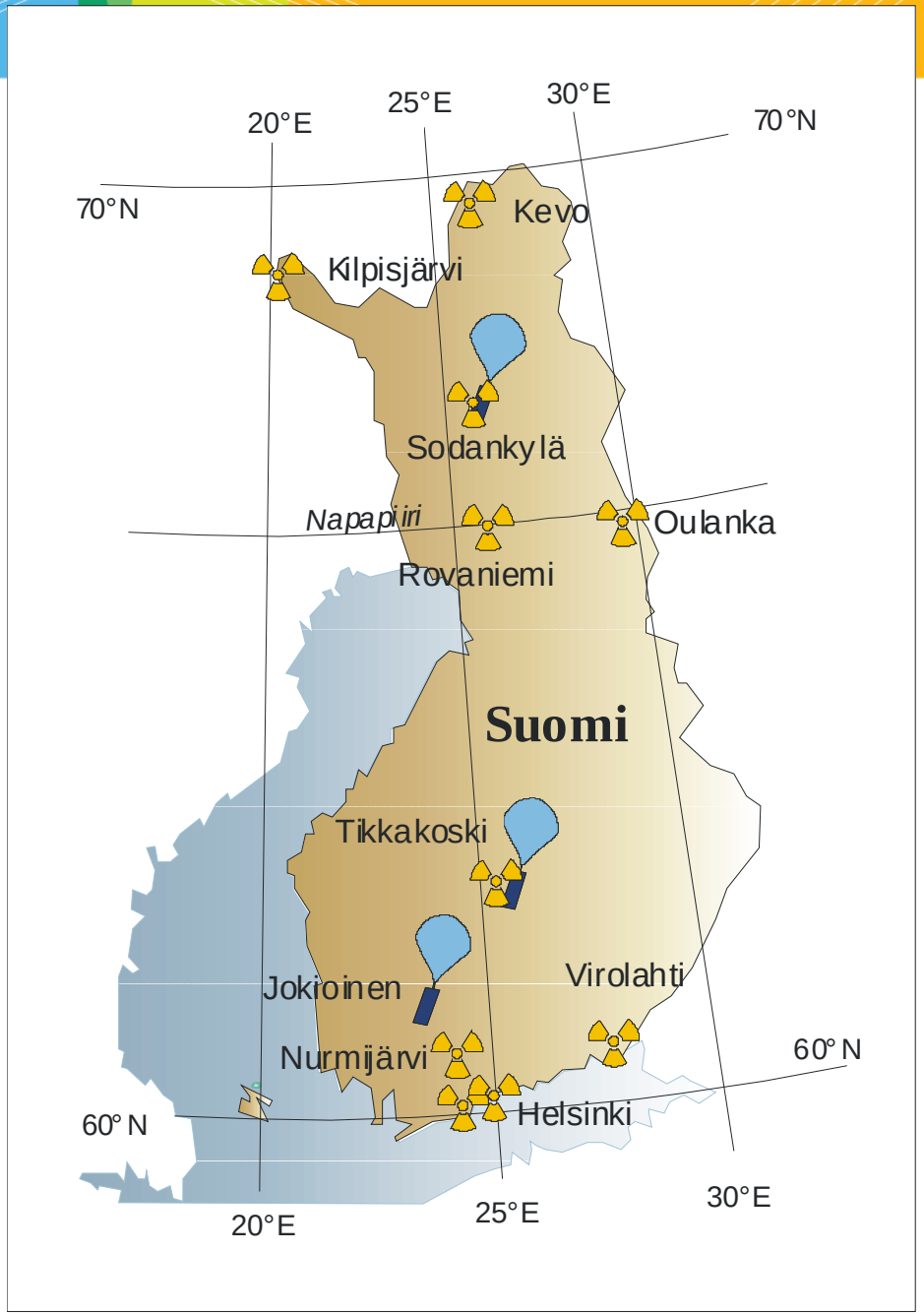
The radioactivity of the atmosphere is measured

In surface air

and in sounding stations ionizing radiation of upper atmosphere is measured

The beta-activity of aerosol particles is measured continuously on background stations and aerosol samples collected on stations are sent to laboratory for the analysis of lead-210 and beryllium-7.



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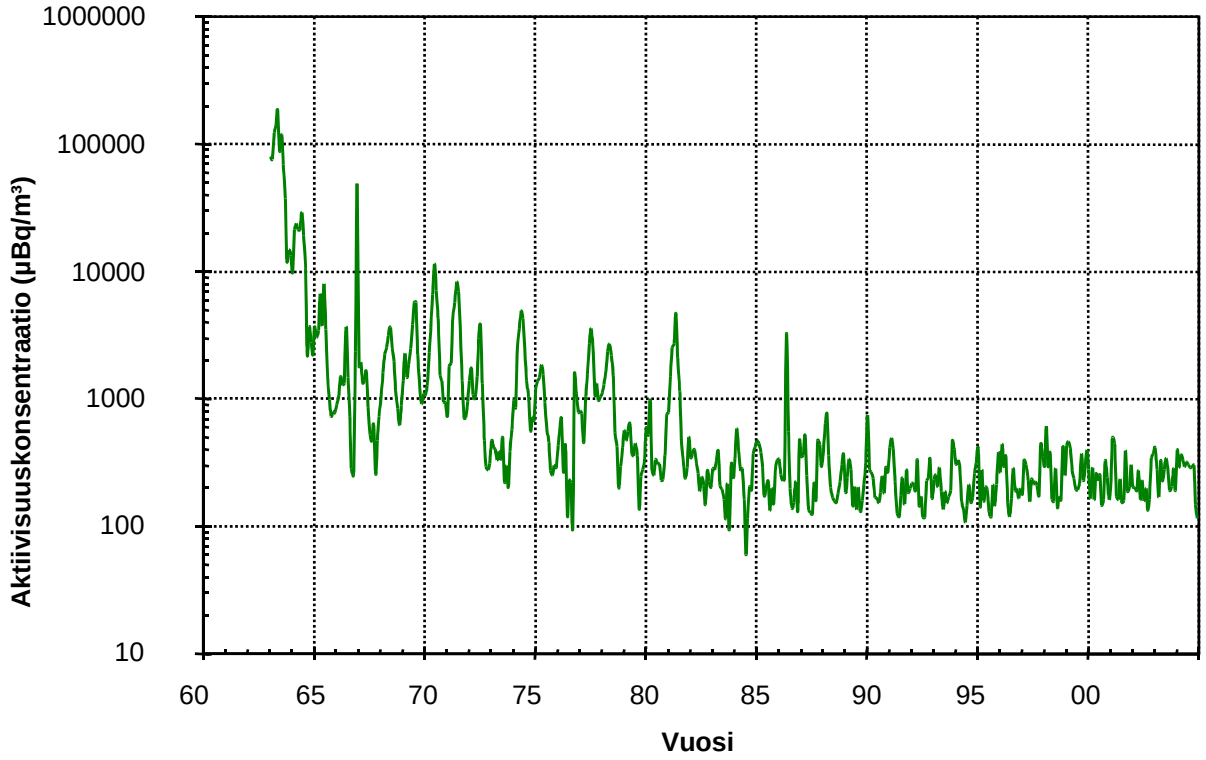
## The measurements of radioactivity are used for:

- nationwide radiation control in normal situations and in states of emergency
- As markers for atmospheric processes such as detecting the origin of air masses
- To study ion-induced nucleation of new particles




Beta-activity of surface air measured at Sodankylä 1963-2004 (monthly means). After the nuclear tests in air have been finished, the beta-activity of air has decreased to natural level, except for Tshernobyl accident in 1986.

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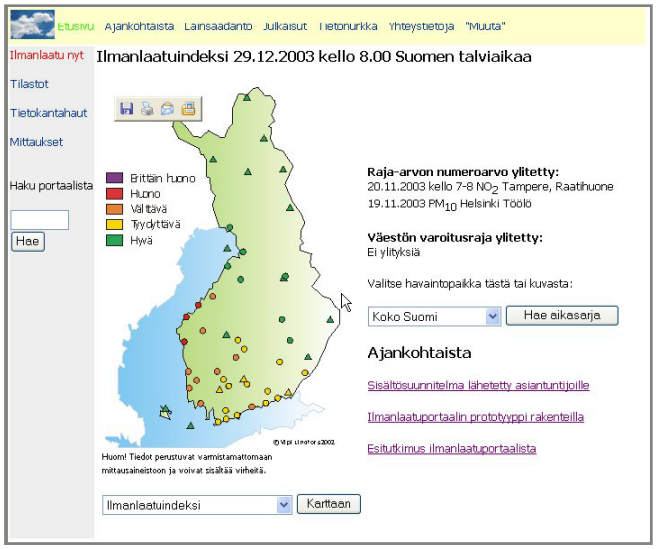
# National air quality internet portal

## 1. Air quality monitoring


**Local air quality authorities**


**Background monitoring stations (FMI)**

## 2. Publication of air quality information in the internet




**www.airquality.fi**

**Developed and maintained by the FMI**