

Monitoring Network in the Alpine Region for Persistent and other Organic Pollutants: a multinational approach to investigate the contamination of the Alps with organic compounds

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Introduction:

The Alps are a geographical and meteorological trap for atmospheric pollutants. Barrier effects, high precipitation and low ambient temperature further the deposition of airborne compounds. Pilot studies yielded evidence that this might also be the case for semivolatile organic compounds. Pollution at high altitudes adds another burden to ecosystems already subject to various natural and man-made stressors. It poses a potential threat for drinking water resources, food production and ecosystem health in the affected areas. To assess the current situation, five states within the region of the Alps (Austria, Germany, Italy, Switzerland, and Slovenia) have launched the project MONARPOP (Monitoring Network in the Alpine Region for Persistent and other Organic Pollutants) with support from the European Union.

MONARPOP's goals are

- Identifying the long-range transport and the load with POPs (Persistent Organic Pollutants) and other organic compounds in remote alpine regions.
- Identifying regional differences and altitudinal effects on the load with POPs and other organic compounds.
- Establishing mass inventories of POPs bound in forests in the alpine region (soil and needles).
- Finding indications for sources of the POPs detected in alpine regions.
- Investigating possible reactions and biological impacts of the detected loads.

Material and Methods:

Selected matrices:

Pollutants will be measured in atmosphere, wet and dry deposition, spruce needles and soil from forest sites. Spruce needles have been chosen as a particularly efficient receptor for organic compounds due to their highly absorbing lipophilic cuticles. Forest soils, especially the humus layer, are rich in organic matter and represent a matrix in which the deposited compounds can accumulate over long periods of time. In addition, passive air samplers (SPMD, semipermeable membrane devices) will be exposed. As active air samplers Low Volume and High Volume samplers will trap pollutants depending on their volatility.

Selected Parameters:

MONARPOP's analytical focus rests on:

Polychlorinated dibenzodioxins and -furans (PCDD, PCDF), Polychlorinated biphenyls ("Ballschmitter" and dioxin-like PCB), 5 Hexachlorocyclohexanes (incl. Lindane), Hexachlorobenzene, DDT and metabolites, selected chloropesticides (Aldrin, Chlordan, Dieldrin, Endrin, Heptachlor, Mirex), Polybrominated diphenylethers (PBDEs), Toxaphene, Pentachlorophenol, Polycyclic aromatic hydrocarbons (PAH), Nitrophenols, Chloroform, Tetrachloromethane, 1,1,1-Trichloroethane, Trichloroethylene, Perchloroethylene and Trichloroacetic acid.

Selected Sites

Throughout the largest part of the alpine region, 42 sites have been selected in five countries. In total, 72 needle samples, 53 humus layer samples and 25 mineral soil layer samples will be analysed for the selected parameters.

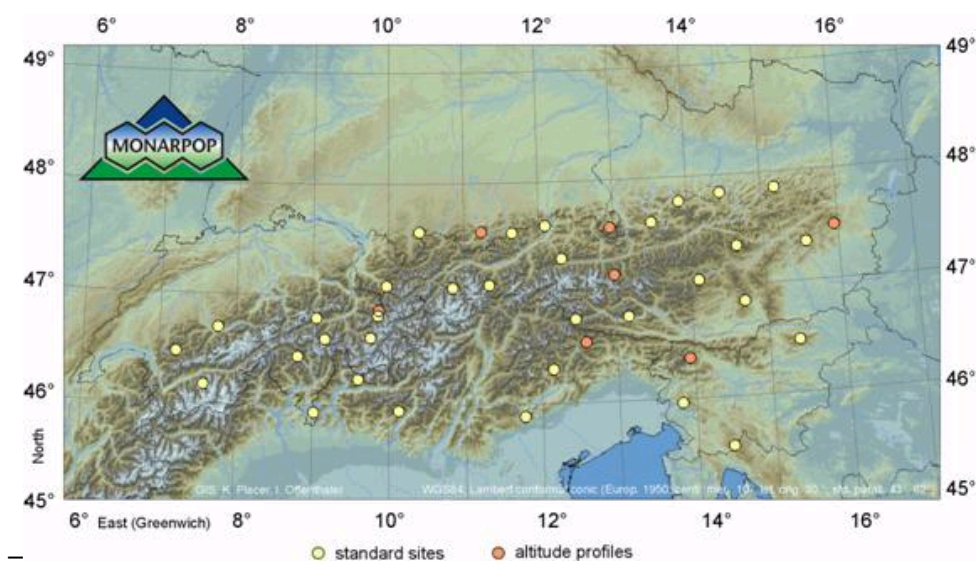


Figure 1: Monarpop sampling sites

Altitude profiles

The vertical component of alpine pollution will be examined with the help of seven local altitude profiles. These profiles combine several sampling sites of increasing elevation.

Bioindication

Possible biological effects of the accumulated POPs are assessed by measuring the glutathion-S-transferases activities, detoxifying enzymes, in Spruce needles and by observing the influence of needle extracts on cell cultures (bioassays).

Air and deposition sampling

Active air samplers at three stations beyond the timberline on top of three altitude profiles, (Austria: Sonnblick, Germany: Zugspitze, Switzerland: Weißfluhjoch) will screen the air for the analysed pollutants. An array of filters is used to distinguish between pollutant imports from different regions. The Austrian Central Institute for Meteorology and Geodynamics determines the travel routes (trajectories) of the incoming air masses. Depending on its origin, the air is loaded onto a corresponding filter. Remote control allows to match filter cartridges and trajectories on a daily basis. (The necessary equipment has been developed by the Austrian Federal Environment Agency and the GSF National Research Center for Environment and Health in co-operation with Dioxin Monitoring Systems, DIGITEL

enviro-sense and Kroneis.)

Low volume samplers are used to detect PAHs and halogenated organopesticides, whereas high volume samplers were installed to detect PCDD/F, PCB, PBDE, and Toxaphene. For the detection of VOC and VHC charcoal cartridges will be used.

Pollutant accumulation in special passive air samplers (SPMD, semipermeable membrane device) will be compared to that occurring in the living needles and air samples from active sampling.

Deposition samplers at the same sites collect wet and dry deposition. All selected chemical parameters will be analysed in deposition samples.



Figure 2: MONARPOP air and deposition sampling station at the Sonnblick, 3106m above sea level (Austria)

Implementation

Selection of 42 remote forest sites across the alpine region, including seven altitude profiles based on existing expertise and on uniform and strict site selection criteria.

The first sampling campaign for spruce needles, humus and mineral soil was successfully performed in autumn 2004. Sample preparation will take place in one selected laboratory for each of the different compartments and samples will then be distributed for analyses. In order to avoid inter laboratory variations, samples from all sites will be analysed by a single laboratory for each specific parameter.

The air sampling activities are scheduled to last one year, starting in spring 2005.

First outcomes and results are expected in 2006.

Outlook:

As a pilot project MONARPOP will assess for the first time the load of the Alps with POPs and will represent a data basis for implementation steps. Target groups for the dissemination of conclusions, for awareness rising and for implementation steps will be local to national authorities, environmental, industrial and agricultural NGOs and international fora under the UN (UNEP-Convention and UN-ECE Protocol on POPs) and the European Union.

It is foreseen to disseminate results among local and regional authorities and to propose measures to contrast this kind of pollution.

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