

Cod: 8.3011

MONITORING OF PCDD/F AND PCB IN AMBIENT AIR AND DEPOSITION AT ALPINE SUMMITS

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Introduction:

Ambient air and deposition measurements for PCDD/F and PCB have been carried out at the three Alpine summits Sonnblick, Weißfluhjoch and Zugspitze from 2005 to 2013 (from 2005 to 2008 in the frame of the EU funded Alpine Space project MONARPOP, since 2008 on basis of a cooperation of the responsible authorities of Austria, Bavaria and Switzerland). The aim of this monitoring program was to investigate if the Alps are a barrier for POP and if there is a source region, which causes a higher impact of POP.

Material and Methods:

A special sampling scheme has been developed to enable the continuous and specific sampling of the ambient air according to the origin of the air masses¹. For this purpose three source regions (NW-European industrial region, NE-European industrial region, S-Po Basin) have been selected. At the sites three filter cartridges are sampled according to these source regions and a fourth filter cartridge was used for air masses with undefined (due to the selecting rules) origin (see picture 1). The aim of this sampling scheme was to study, if one of these source regions has a significant higher contribution to the input of POPs into the Alpine region.

For analysis the GF-filters and PU-foams or deposition cartridges have been extracted with toluene in a soxhlet extractor. After a three step liquid column clean up the extracts are analysed by GC-HRMS according to VDI 3498².

Results and Discussion:

The results of this eight year monitoring program did not show a general picture. Concerning the input from the selected source regions significant higher air concentrations could only be found for a few congeners, mainly from the NE region. However, it should be noted that air masses from the NE region are significantly less frequent at the summits than air masses from the other selected source regions.

Significant concentration differences between the three sampling sites could only be found for few congeners, the same situation for the seasonality of the concentrations.

A significant decreasing trend could be observed for PCDD/F and PCB for the period from 2005 to 2010. During the following sampling periods again higher concentrations could be found, similar to those at the beginning of the monitoring program (see figure 1). This means that over the whole period from 2005 to 2013 no significant trend could be observed.

The concentrations measured in the ambient air samples from the alpine summits were as expected by one to two magnitudes lower than in ambient air samples from the vicinity of conurbations. But contrary to this, the most surprising finding was that the measurements of the deposition samples from the alpine summits showed similar concentrations as deposition samples from the vicinity of conurbations³ (see table 1). The reason for this is currently unknown, maybe the lower temperatures combined with higher precipitation, and pollutant scavenging effects of frequent snowfall at these sites, could be an explanation.

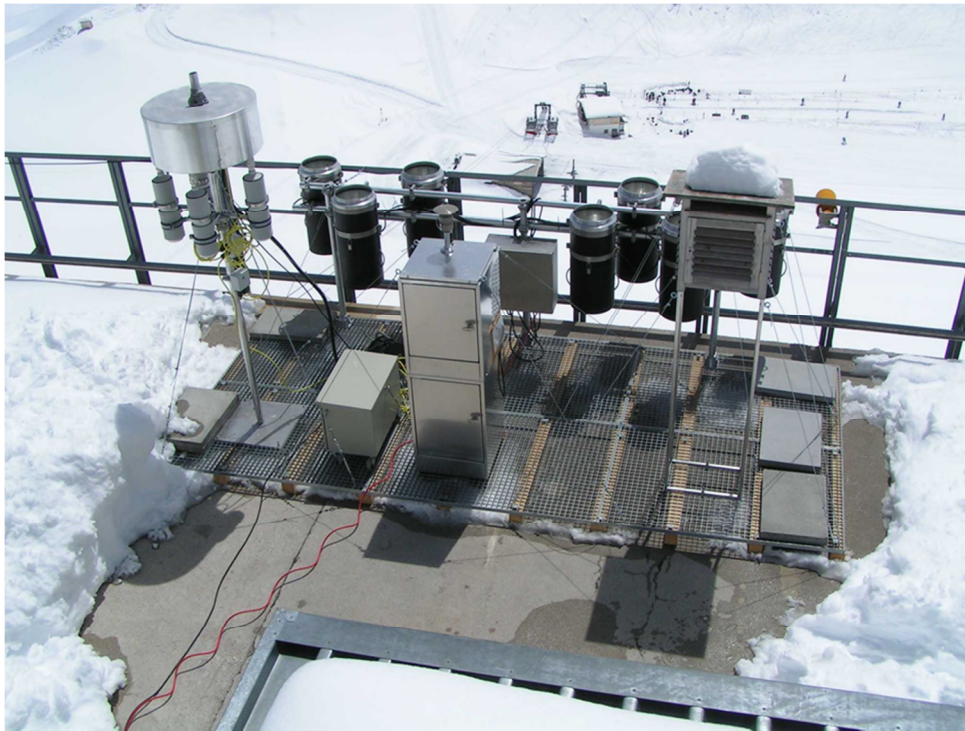
This finding raises the question if ambient air concentrations are the best choice to evaluate the POP input especially at very remote sites as it is foreseen in the Global Monitoring Plan of the Stockholm Convention or if deposition measurements would give a more realistic picture.

Acknowledgements:

In the framework of the project MONARPOP from 2005 to 2008, the monitoring activities were supported by the European Unions's INTERREG III programme "Alpine Space" and by local authorities the Bavarian State Ministry of the Environment and Public Health, the Austrian Ministry for Agriculture, Forestry, Environment and Water Resources and the Swiss Federal Institute for Forest, Snow and Landscape Research. With the individual financial help of these three Austrian, Swiss and Bavarian ministries, sampling activities could be continued after 2008 and are still continuing.

References:

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Picture 1: Sampling Site at Mount Zugspitze (Germany)

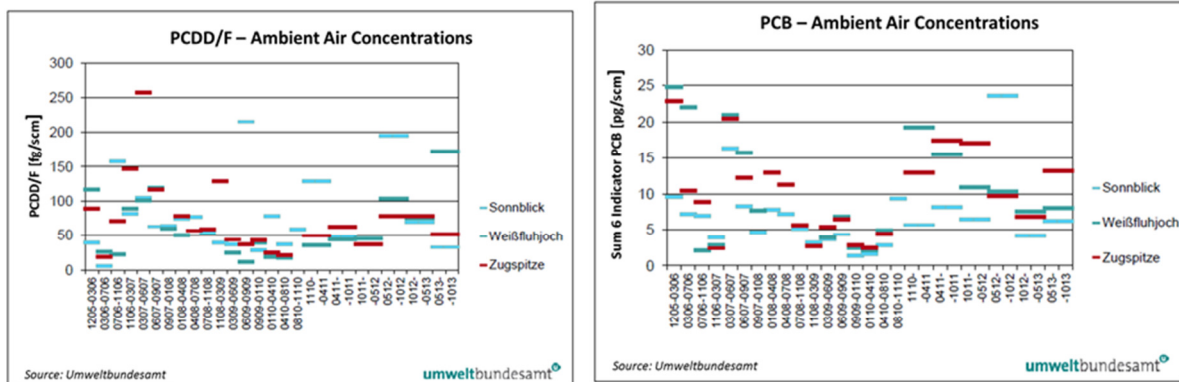


Figure 1: Tendency of results of Ambient Air measurements (weighted means per period for all source regions)

Table 1: Results of Ambient Air and Deposition measurements; median and range (in brackets)

Ambient Air Concentrations:

fg TEQ / Nm ³	Sonnblick	Weißfluhjoch	Zugspitze	Conurbations (Austria) ¹⁾
PCDD/F	0.52 (0.02 – 5.97)	0.51 (0.00 – 2.02)	0.71 (0.04 – 3.09)	6.9 – 42 (summer) 48 – 125 (winter)
PCB	0.13 (0.02 – 0.47)	0.33 (0.09 – 0.65)	0.39 (0.10 – 1.25)	7.1 – 16 (summer) 4.7 – 8.5 (winter)

Deposition:

pg TEQ / m ² .d	Sonnblick	Weißfluhjoch	Zugspitze	Conurbations (Germany) ²⁾
PCDD/F	2.2 (0.22 – 20)	0.16 (0.00 – 0.97)	0.97 (0.00 – 6.72)	2 – 22 (majority < 4)
PCB	0.11 (0.02 – 0.74)	0.05 (0.02 – 0.58)	0.09 (0.01 – 0.92)	0,2 – 3 (majority < 1)

¹⁾ UMWELTBUNDESAMT, 2003

²⁾ LANDESAMT FÜR UMWELTSCHUTZ SACHSEN-ANHALT, 2010