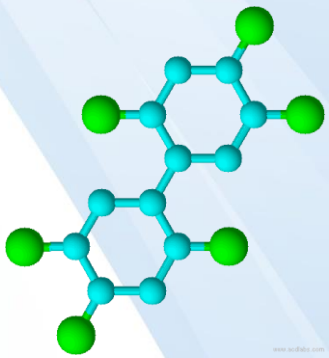
30 years of integrated POPs monitoring at background observatory Kosetice

Roman Prokeš

Petra Přibylová, Jana Borůvková, Petr Kukučka, Ondřej Audy, Jan Kuta, Jakub Martiník, Jana Klánová and Ivan Holoubek



Kosetice observatory$_{est.1988}$ – station CZ01

N 49° 35´ E 15° 05´

534 m a.s.l.

mean air temperature:

7.1°C (36.4°C/-23.5°C)

anual precipitation:

621 mm

catchment area:

0.285 km^2

mean hour of sunschine:

1800 h.y^{-1}

ortography:

Kremesnicka Highlands

western winds

Kosetice observatory

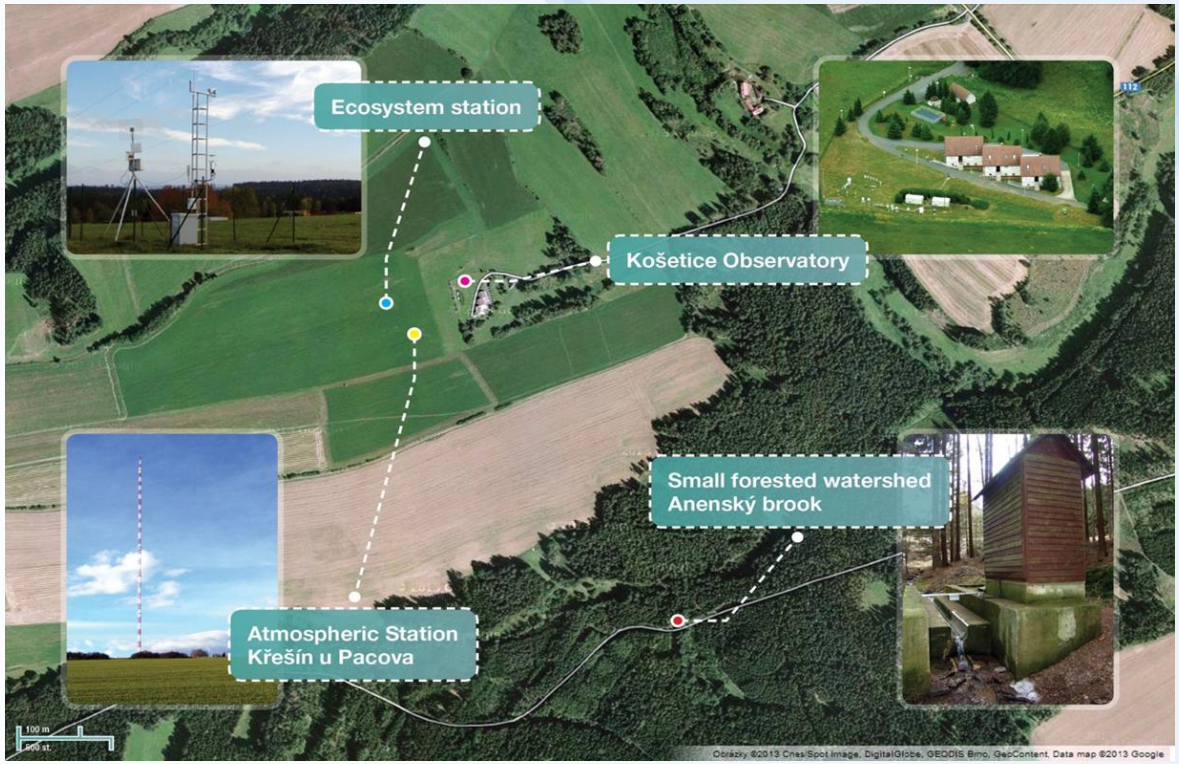
CHMI - Czech Hydrometeorological Institute - meteorological and air quality measurements

CVGZ - Global Change Research Centre of the Czech Academy of Sciences operates the Atmospheric and Ecosystem Stations - GHGs at tall tower (250 m) measurements, selected aerosol measurements

ICPF - Institute of Chemical Process Fundamentals - special aerosol measurements

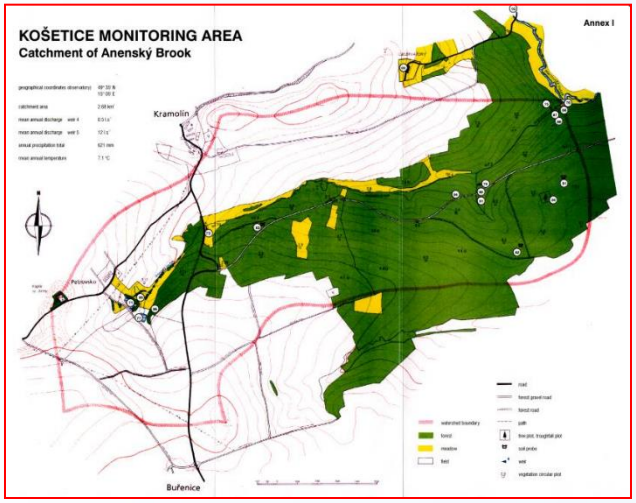
RECETOX - Research Centre for Toxic Compounds in the Environment - focused on persistent organic pollutants (POPs)

- agricultural landscape outside of settlement – no major sources of air pollution
- mobile sources and local residential heating within a radius of 50 km



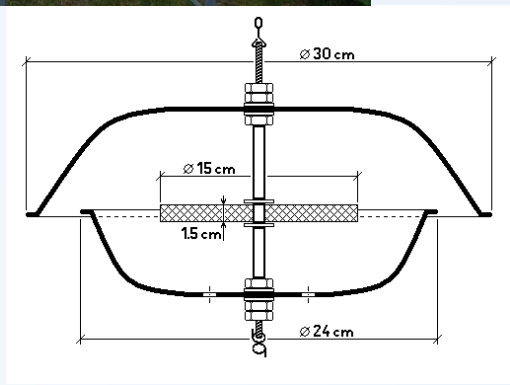
Integrated POPs monitoring from 1988

Matrices	Number of sampling sites	Frequency of sampling
Ambient air	01	Weekly/Monthly
Wet deposition	01	Evently
Surface waters	02, 04, 10, 12a, 12b, 14	Yearly
Sediments	02, 04, 10, 12a, 12b, 14	Yearly
Soils	01, 03, 05, 07, 08, 09, 11, 13, 15	Yearly
Litter	09	Yearly
Spruce and pine needles	05, 07, 08, 09, 13, 15, 16	Yearly
Mosses	05, 07, 08, 09, 13, 15, 16	Yearly



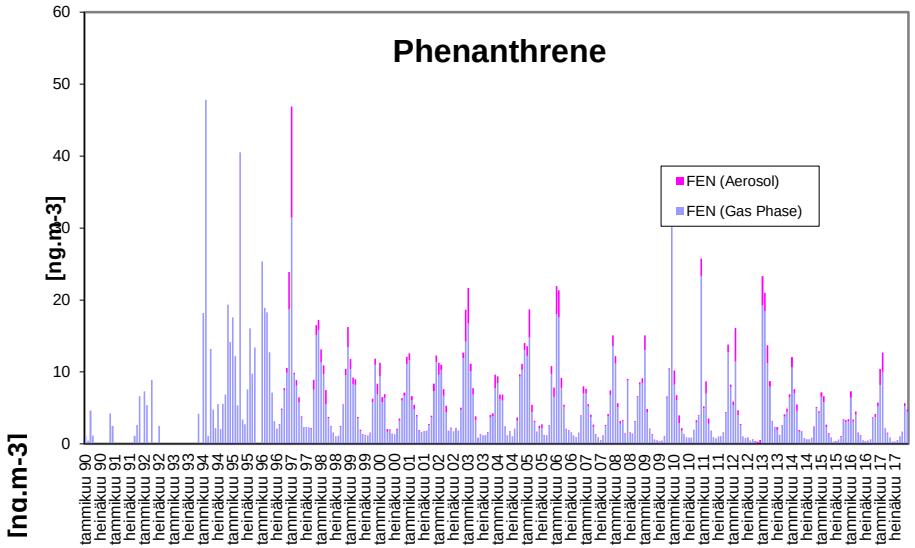
Ambient Air

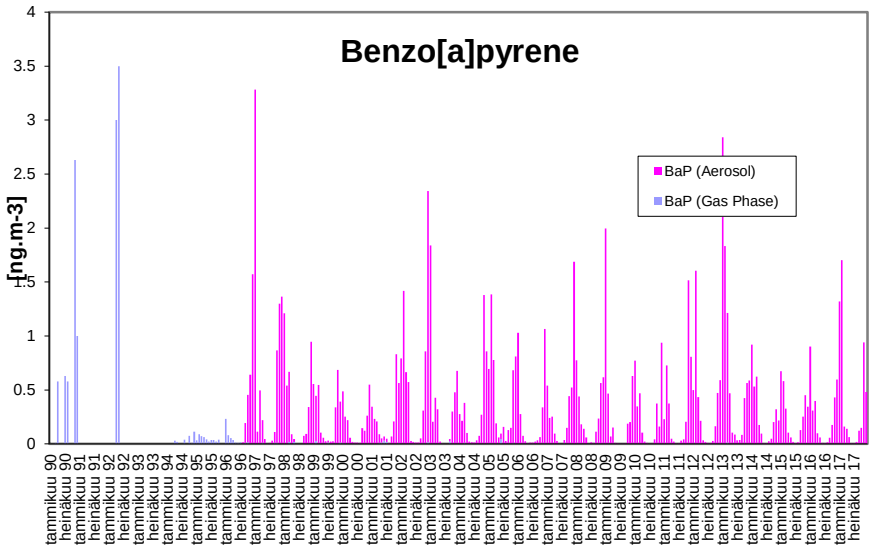
- Active air sampling (1988) – PAHs, PCBs, OCPs: 3475 samples
- Passive air sampling (2003) – PAHs, PCBs, OCPs: 190 monthly samples
- ➢ 2011 – PCDDs/Fs, dl-PCBs, PBDEs, CUPs, PFCs, HBCDDs

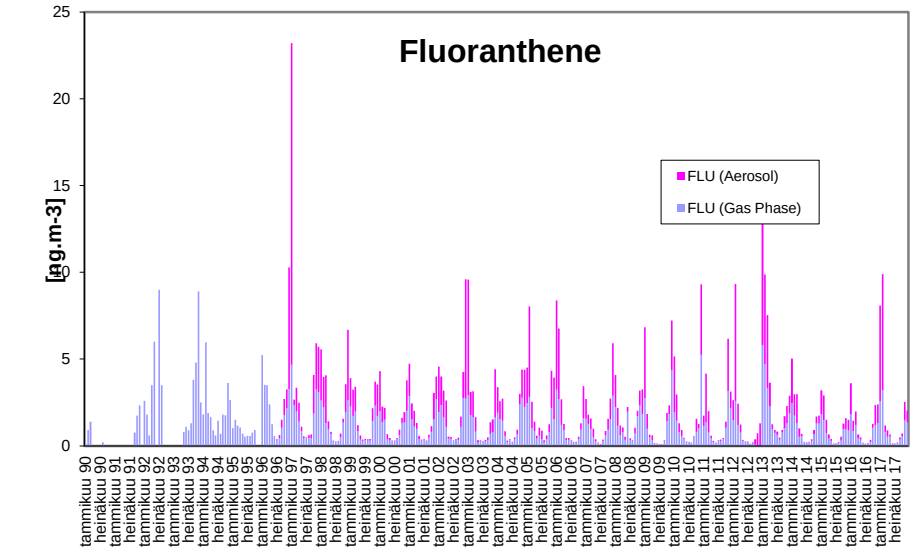


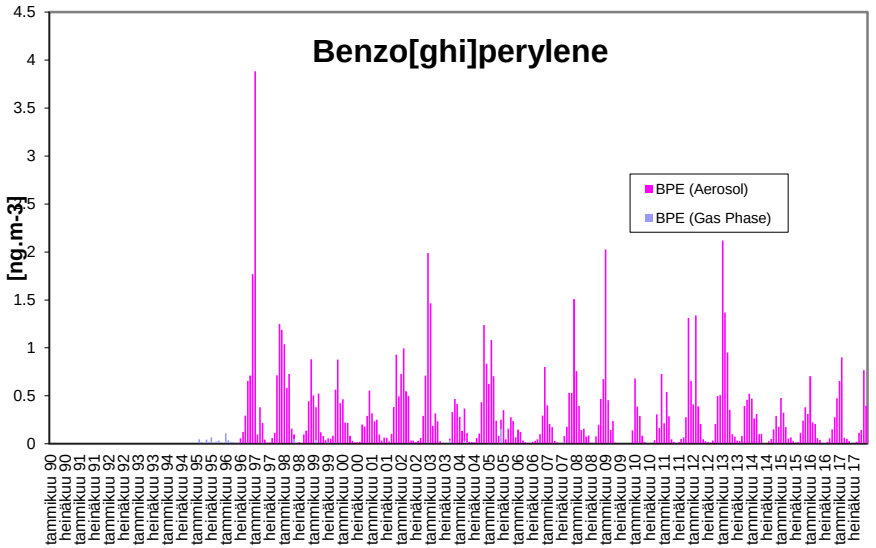
Ambient Air – active sampling

Distribution of PAHs between Gas Phase and Aerosol (1990 – 2017) - month average

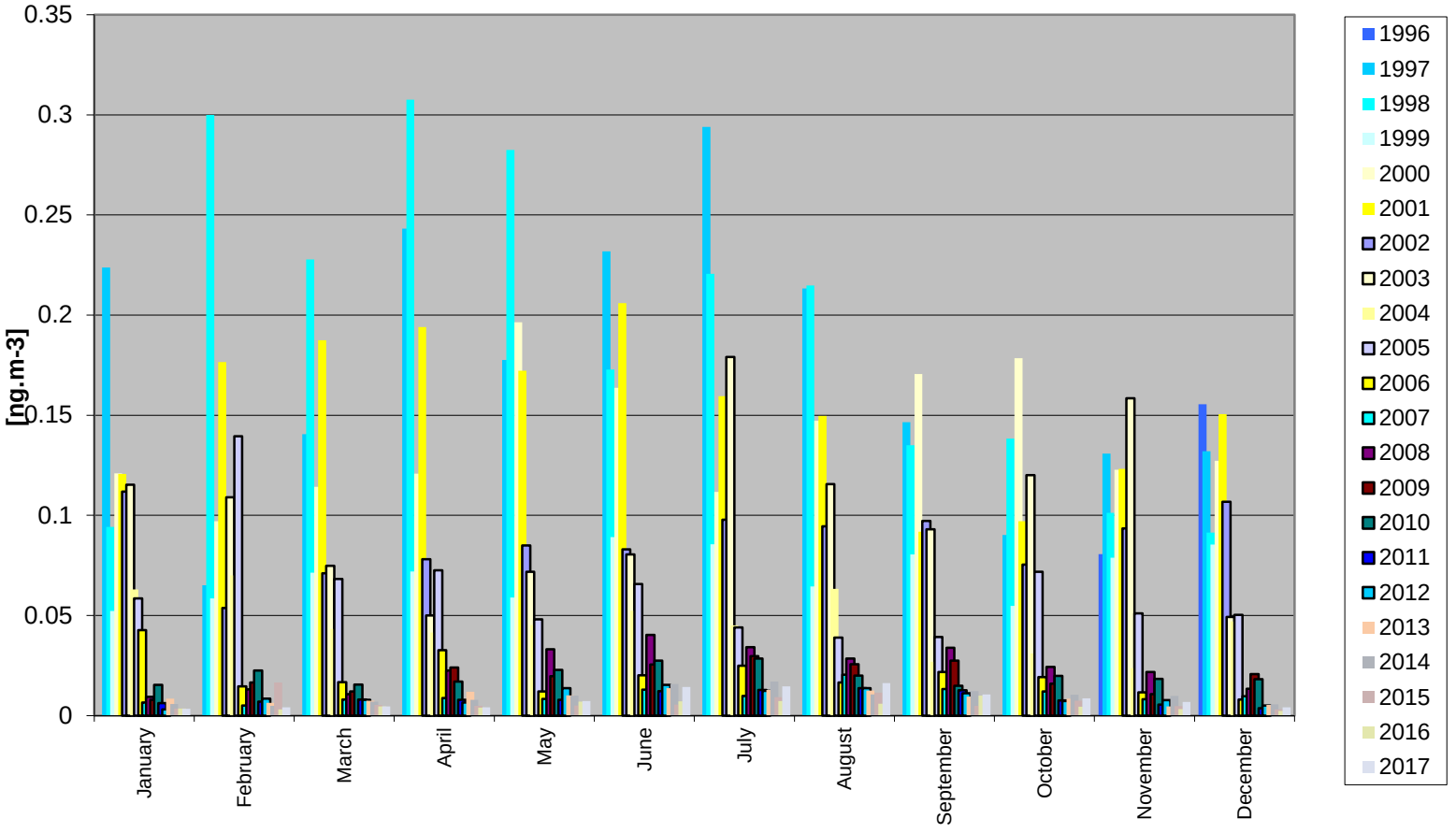




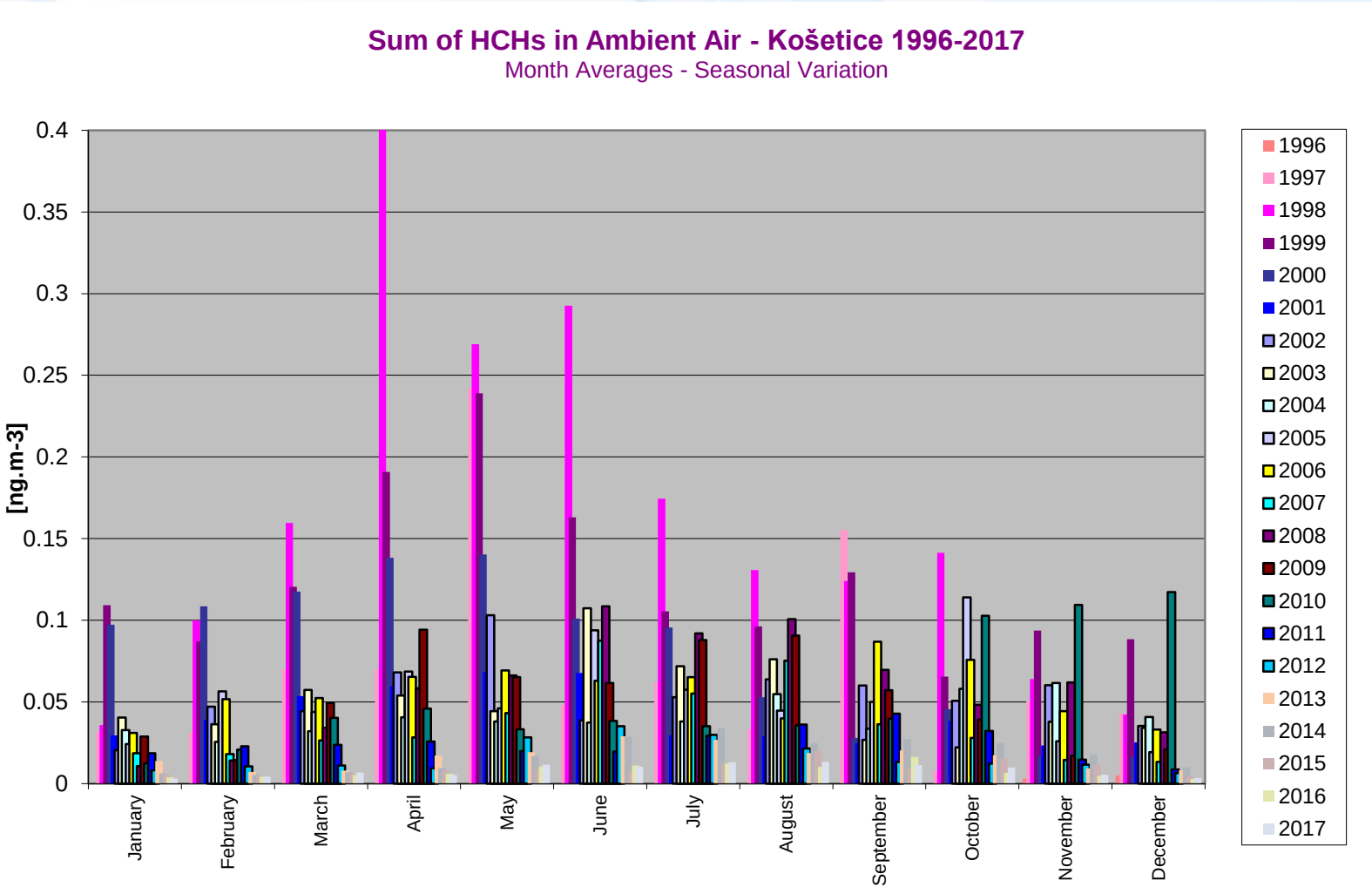




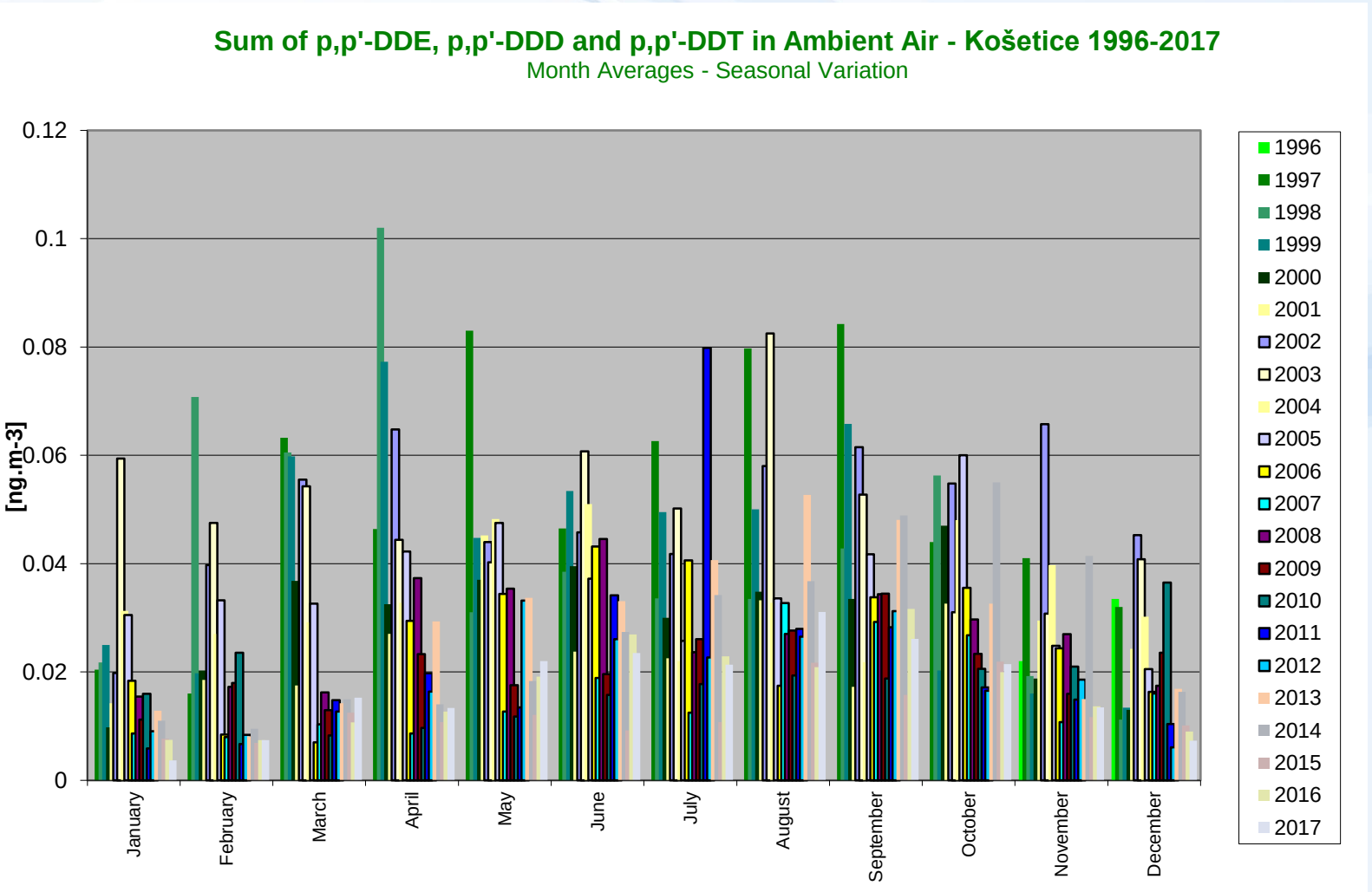
Ambient Air – active sampling



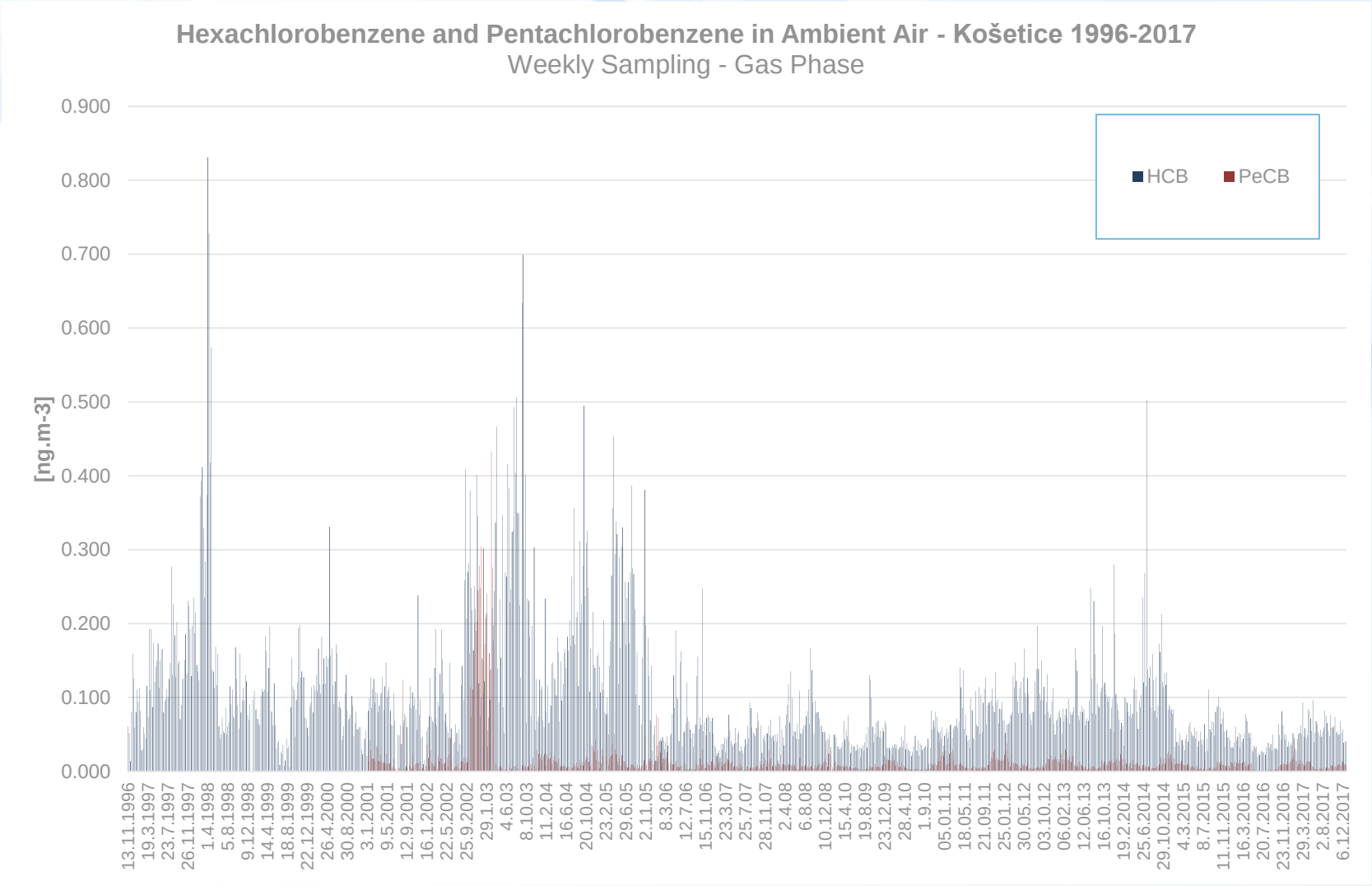
Ambient Air – active sampling



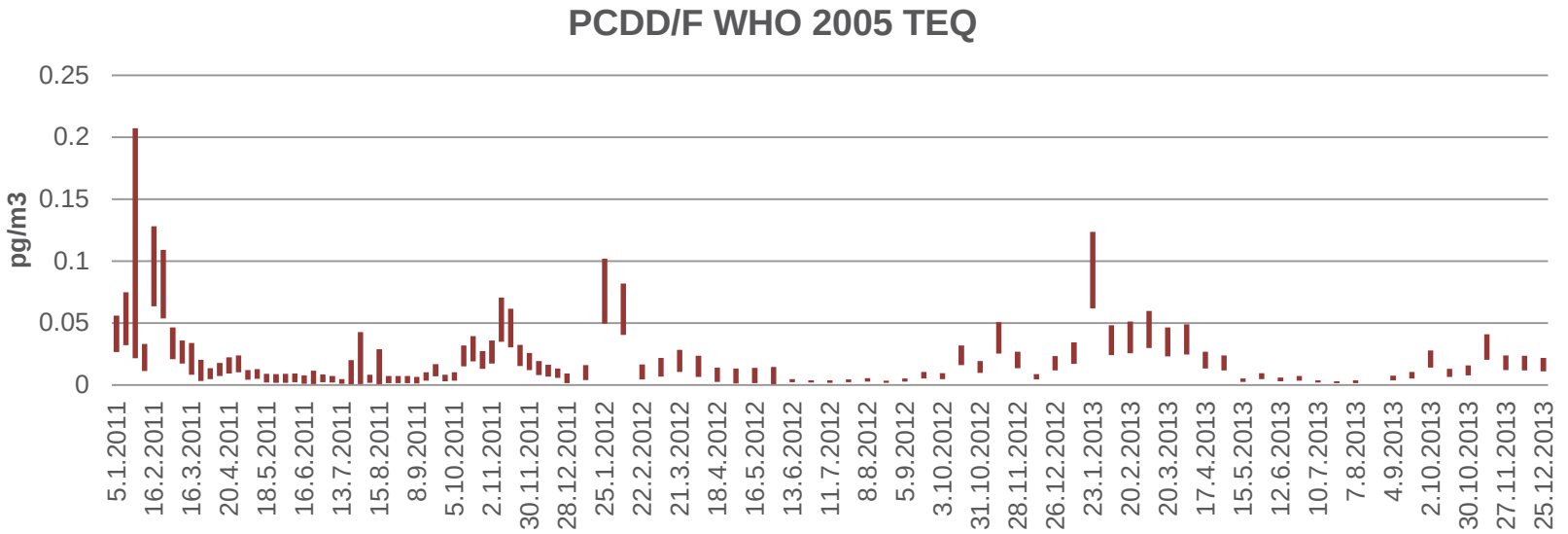
Ambient Air – active sampling

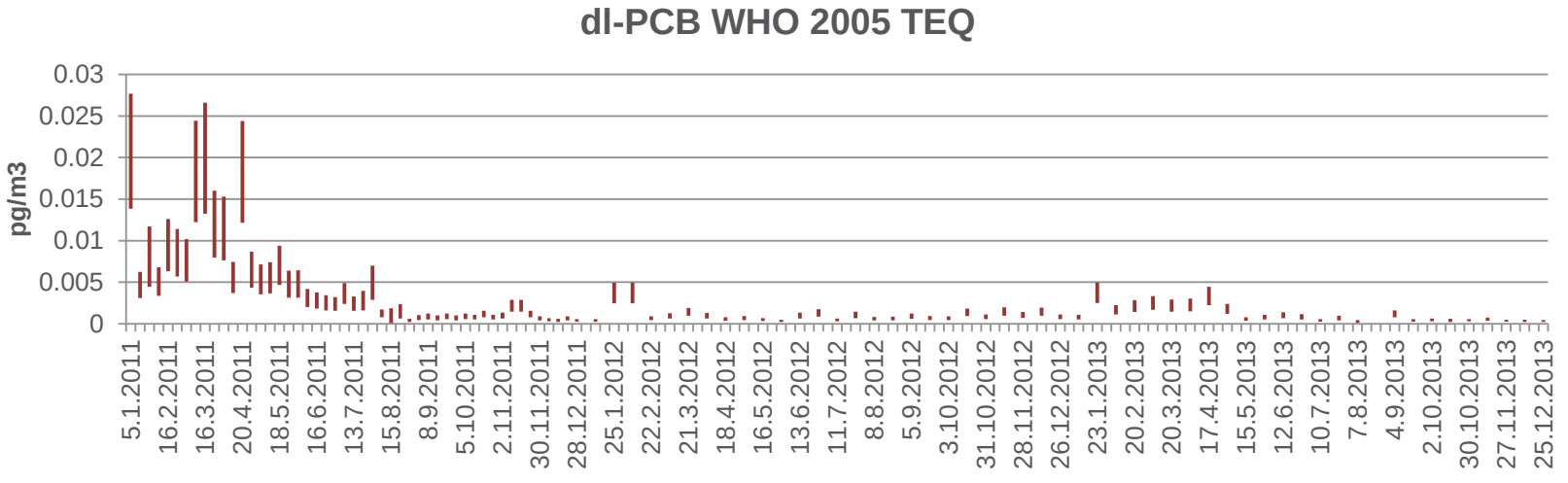


Ambient Air – active sampling

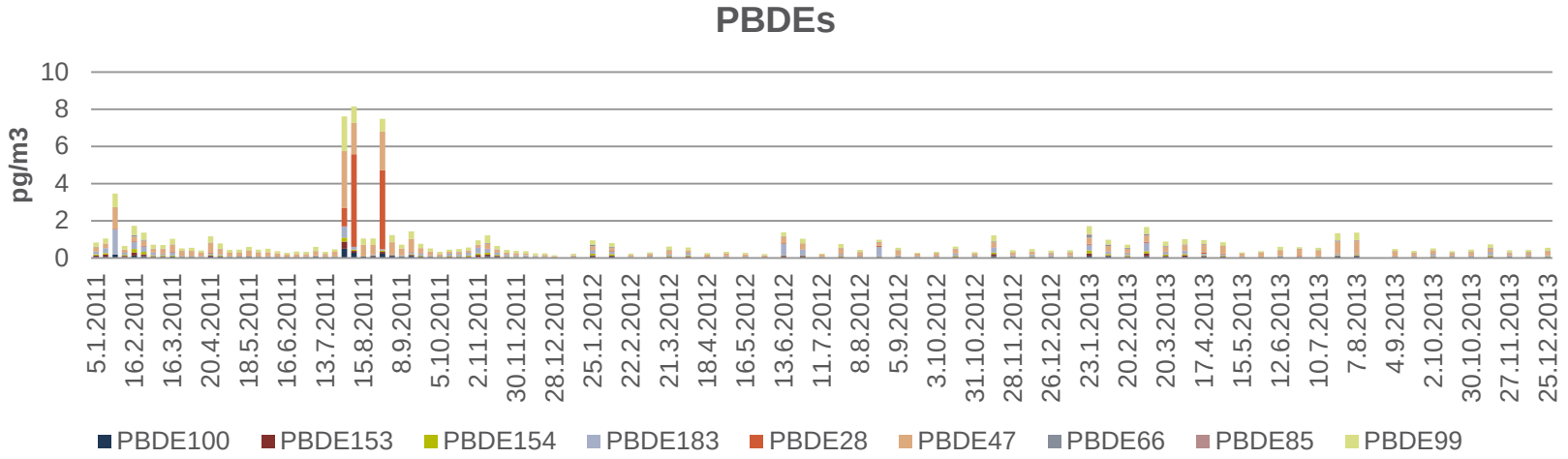


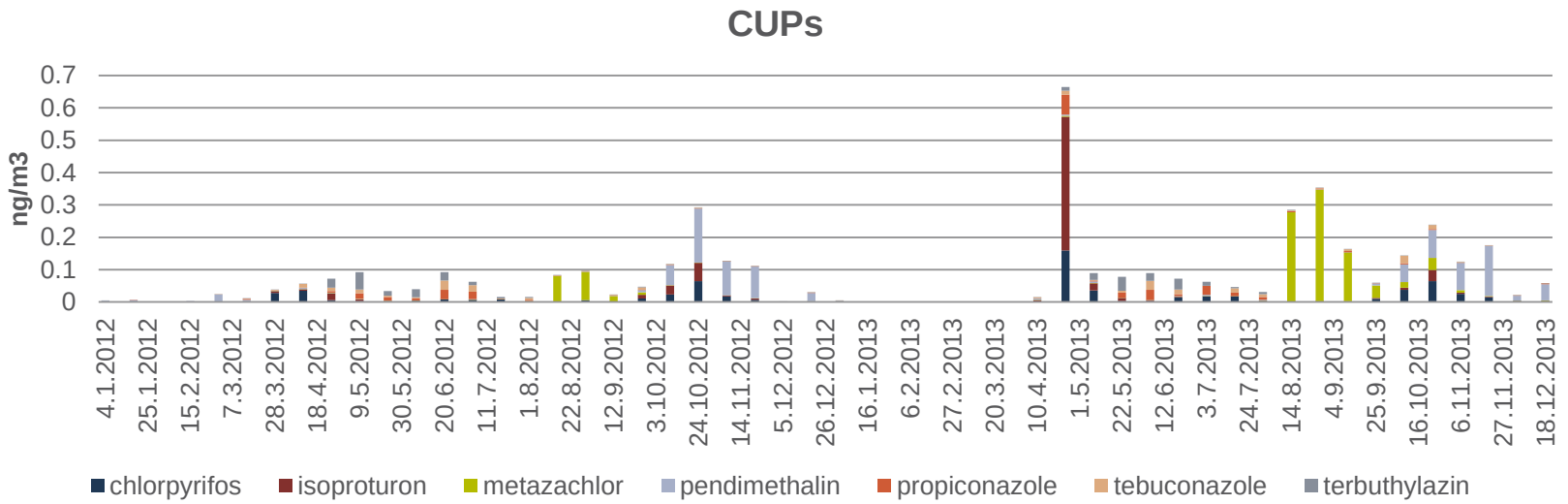
Ambient Air – active sampling





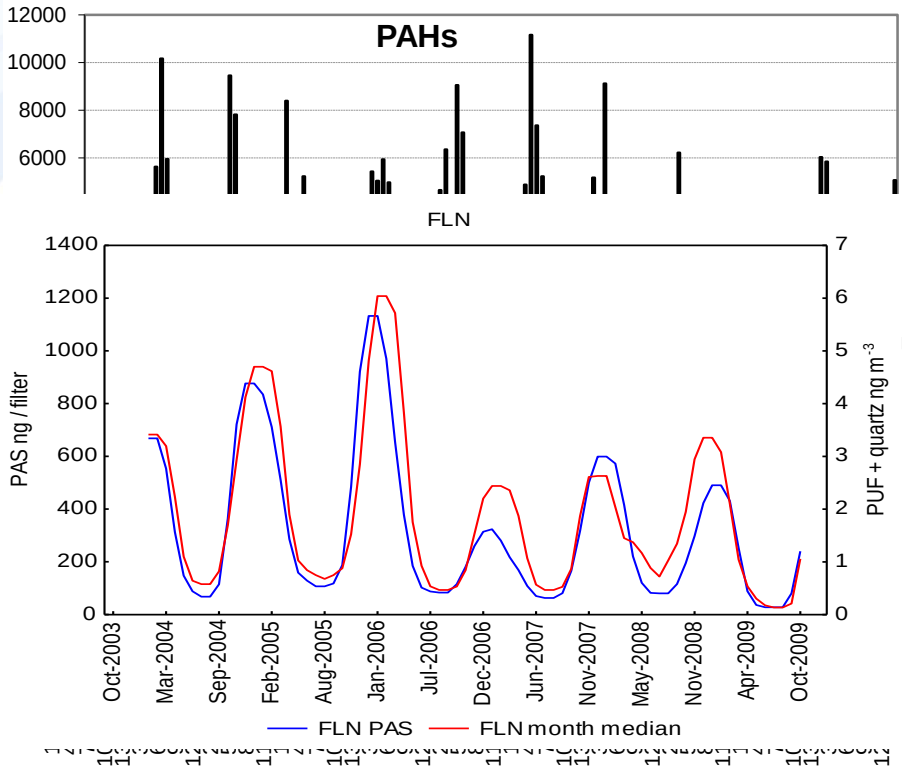
Ambient Air – active sampling

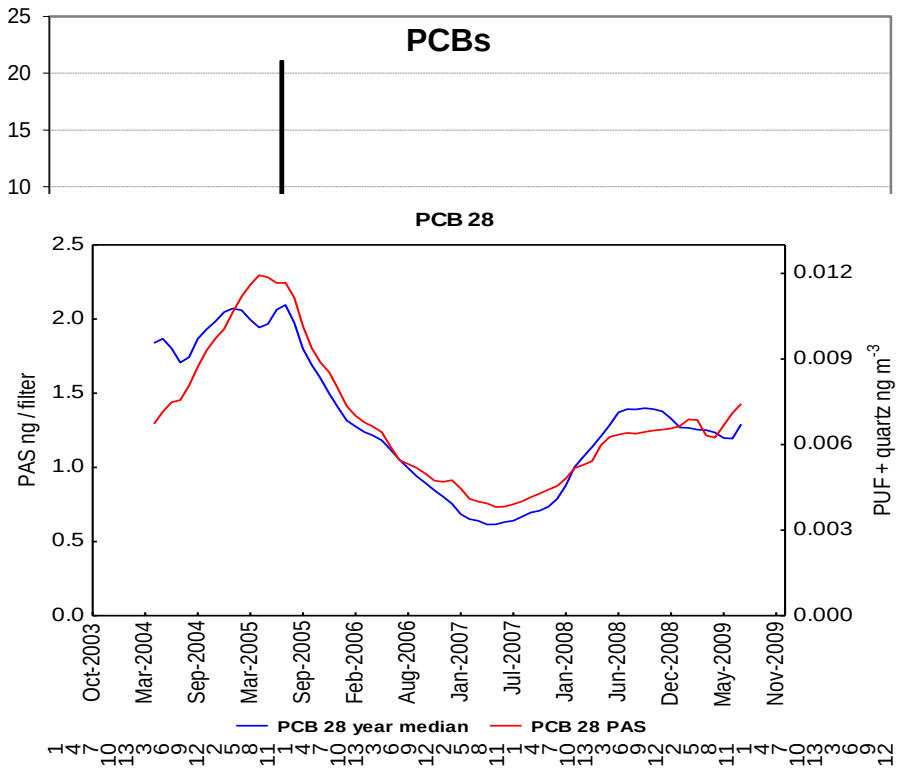


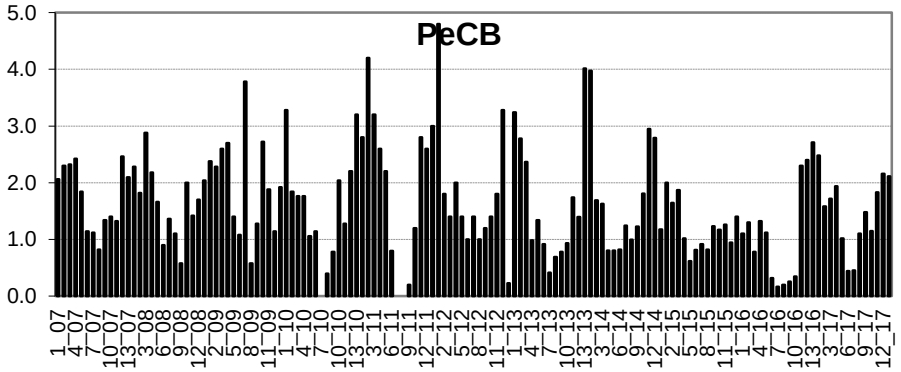


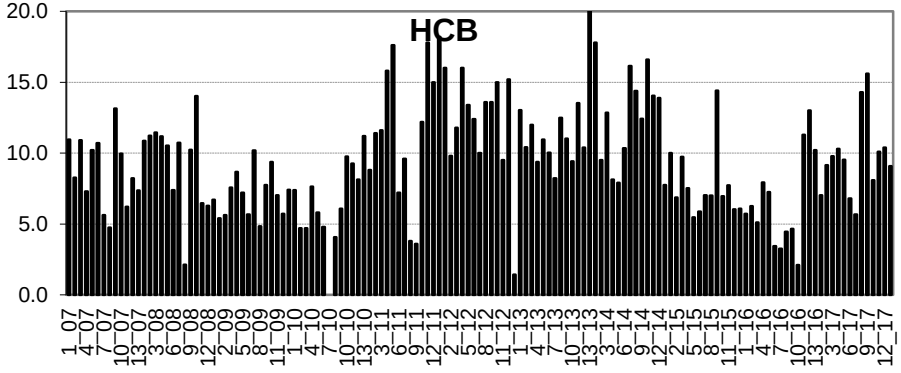
Ambient Air – passive sampling

Concentration in ng/PUF disk

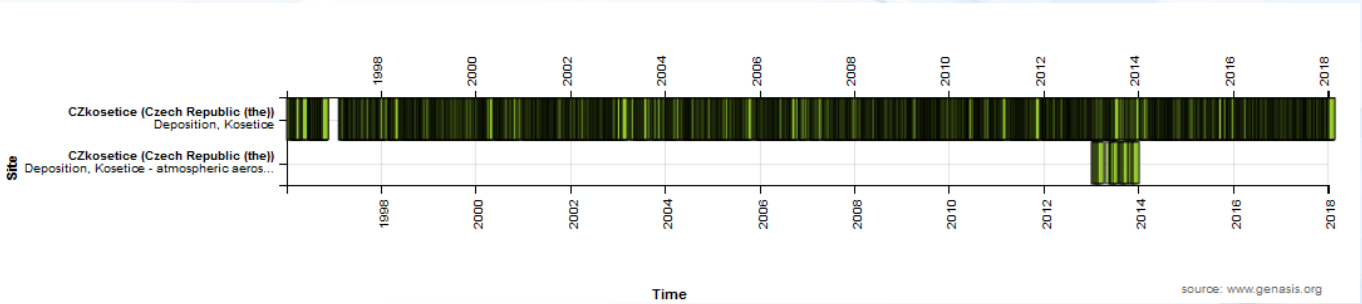


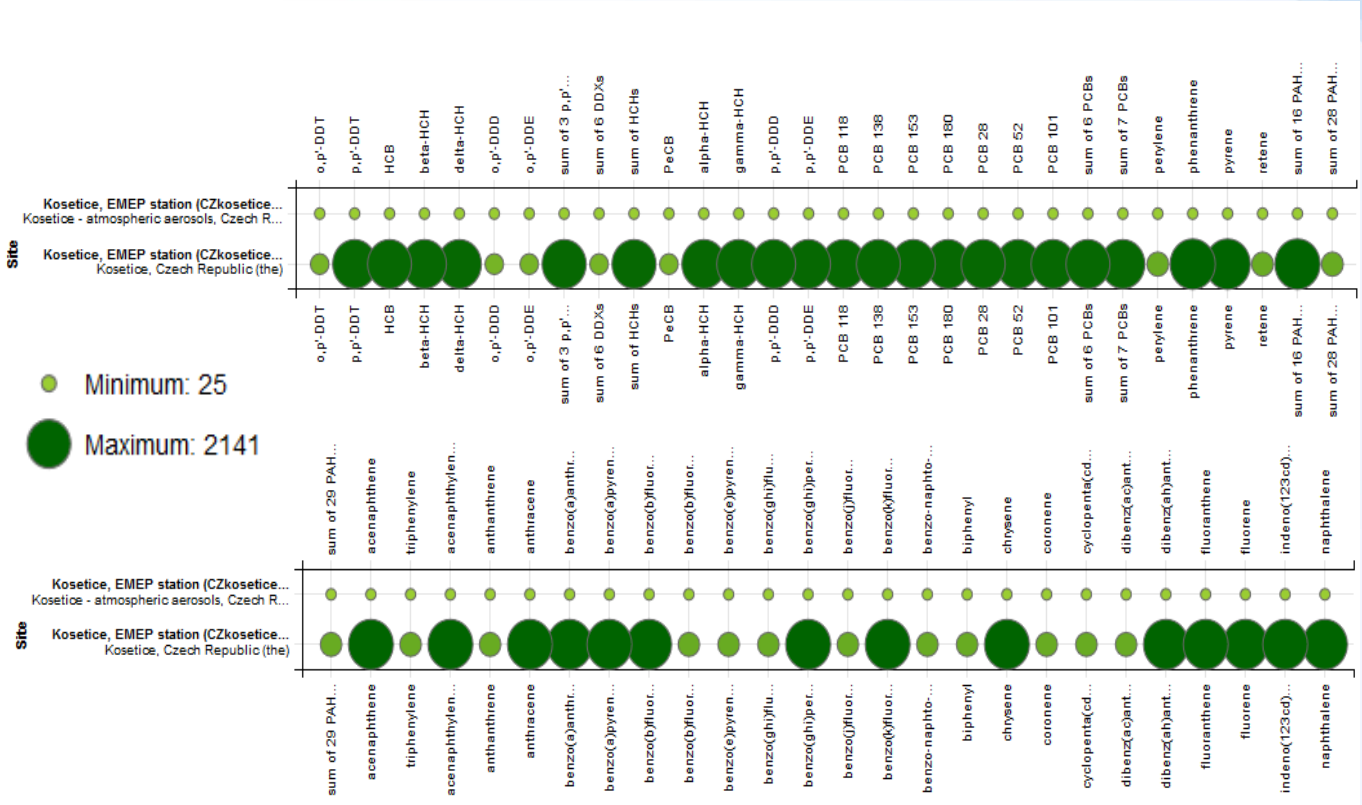


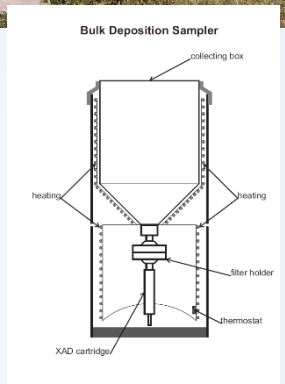




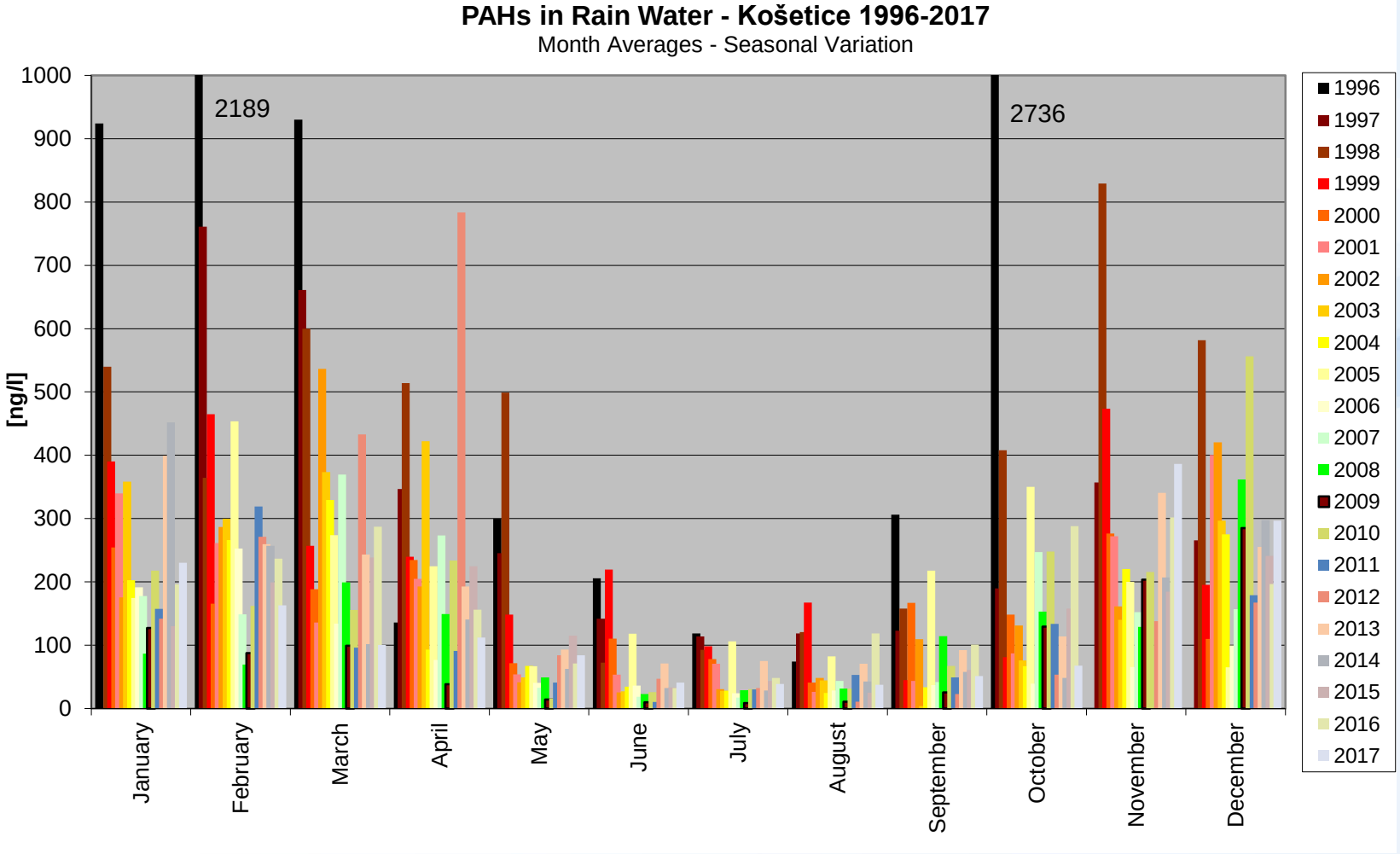
Atmospheric Deposition



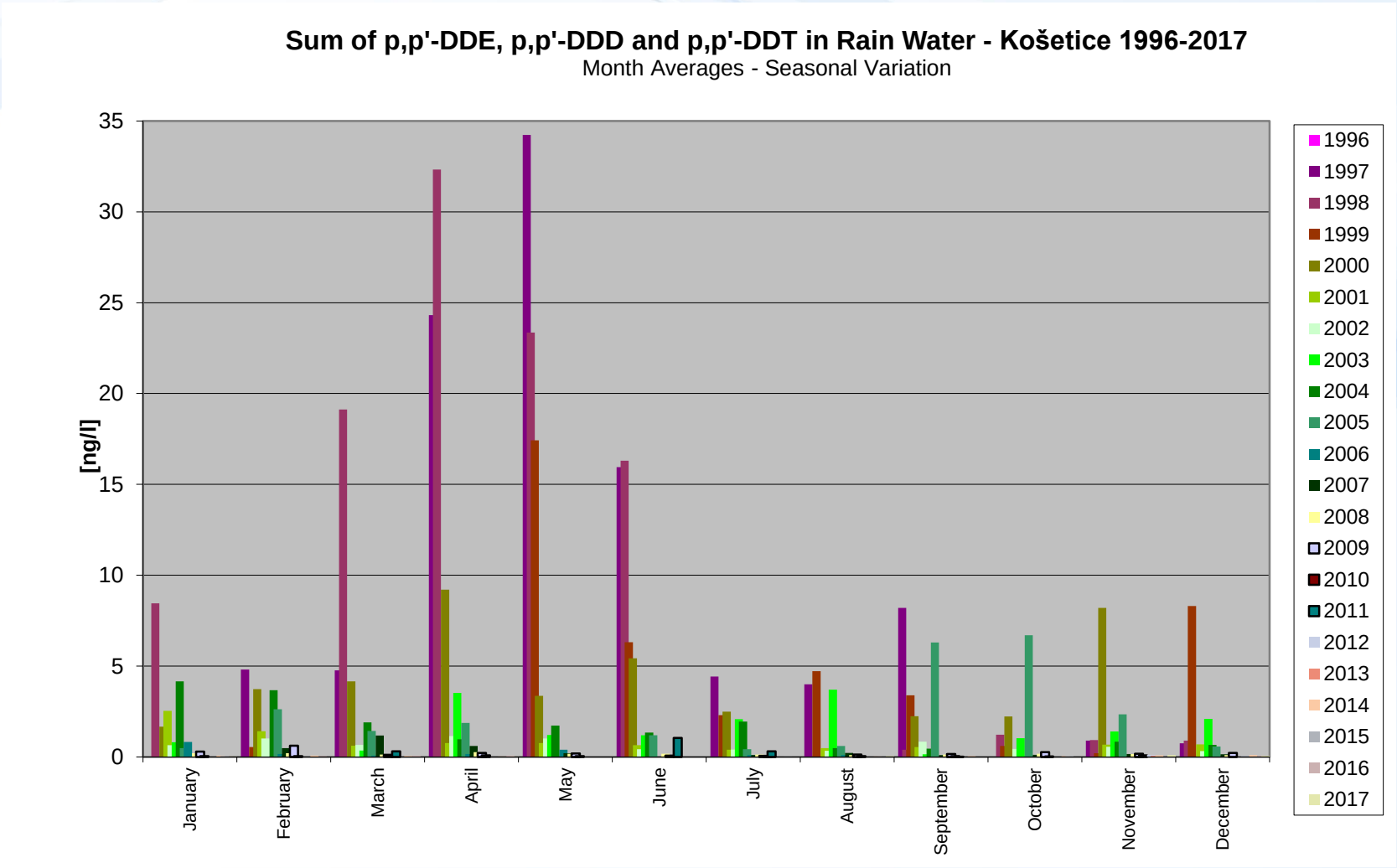




Atmospheric Deposition



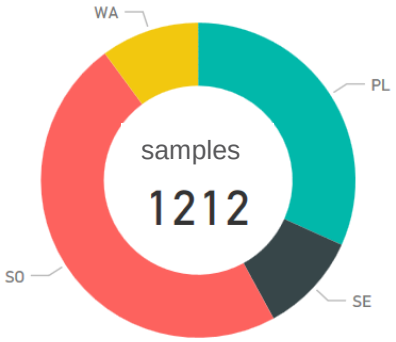
Atmospheric Deposition



Other matrices

- water
- sediment
- plants (moss, needles)
- soil

➢ 23 sampling sites



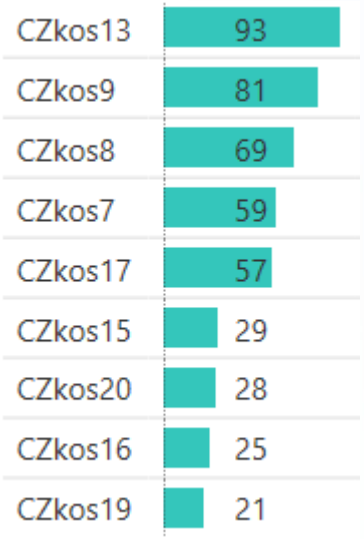
CZkos9	136	1988	2017
CZkos13	121	a 1989	2017
CZkos8	101	1988	2017
CZkos7	88	1988	2017
CZkos15	76	1991	2017
CZkos10	57	a 1989	2017
CZkos17	57	1988	2017
CZkos6	57	1988	2017
CZkos12a	56	1989	2017
CZkos20	55	2008	2017
CZkos14	53	1989	2017
CZkos5	52	1988	2017
CZkos12b	49	1990	2017
CZkos19	47	a 2009	2017
CZkos4	47	1988	2017
CZkos2	40	1988	2010
CZkos11	29	1989	2017
CZkosetice	29	1991	2017
CZkos16	25	1989	2017
CZkos3	20	1988	008
CZkos18	14	a 2011	2017
CZkos14a	2	a 2010	2010
CZkos12c	1	a 2010	2010

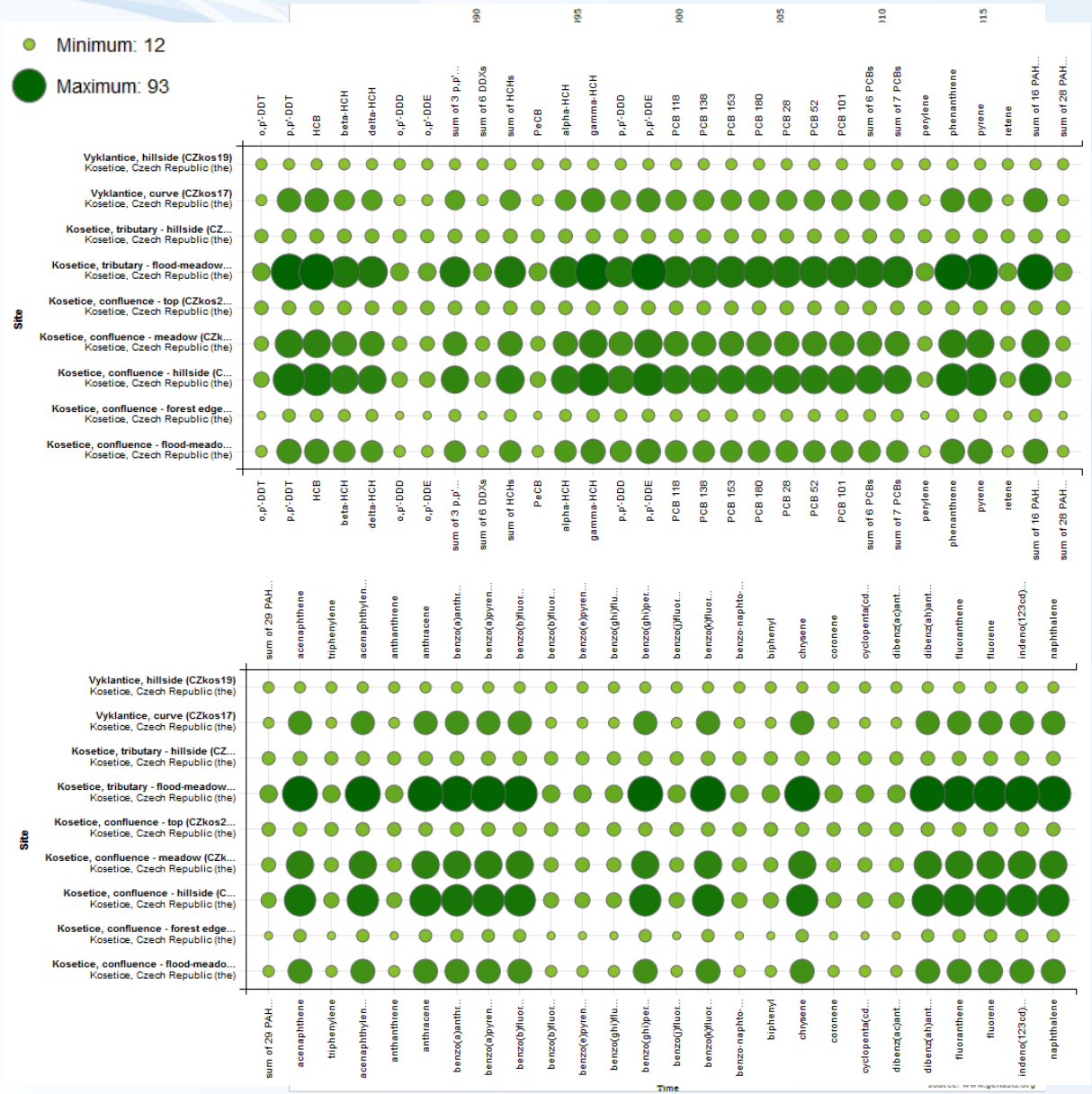
Plants

462 samples

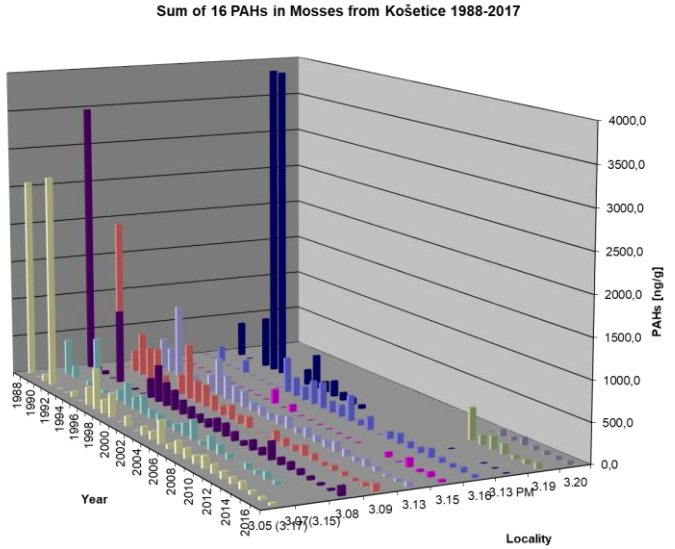
- moss
- needle

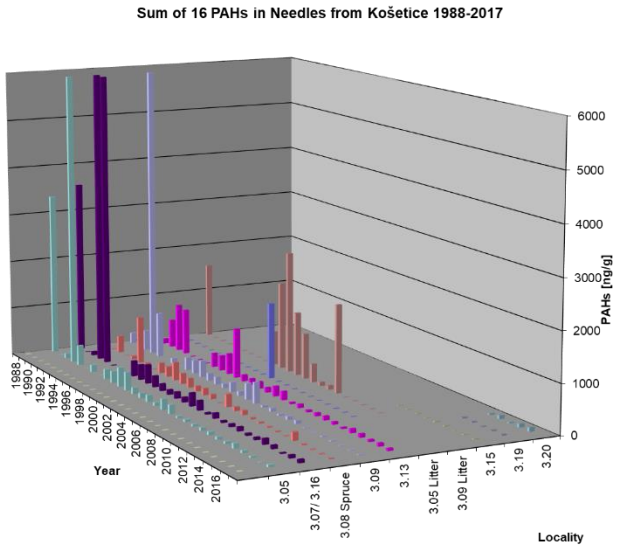
9 sites

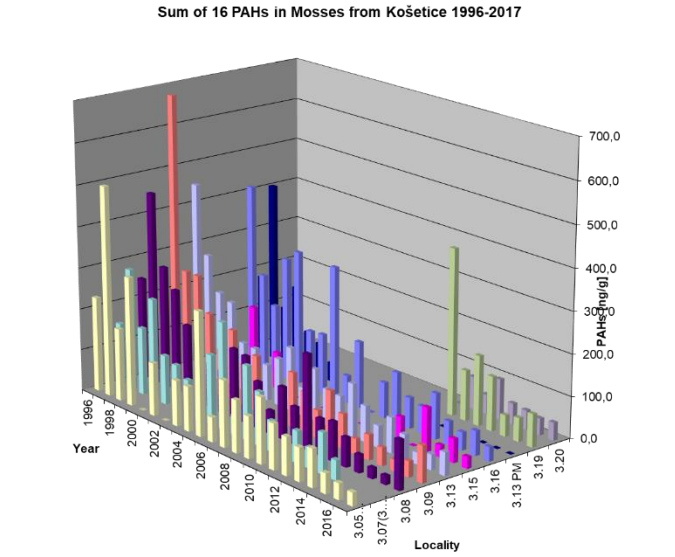


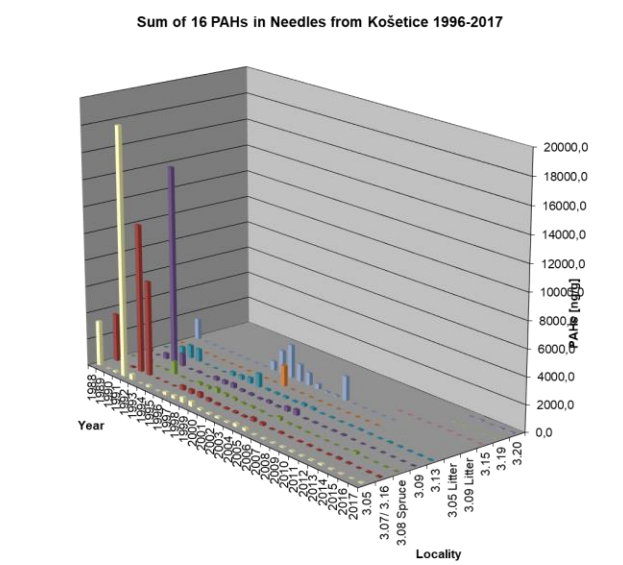


Plants

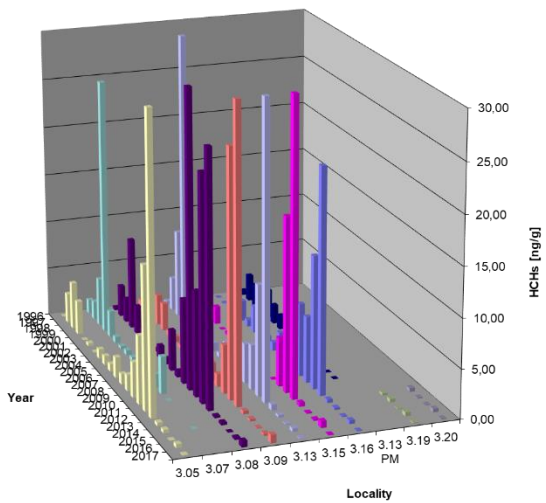

Sum of 16 PAHs in Mosses from Košetice 1988-2017
PAHs [ng/g]
4000,0
3500,0
3000,0
2500,0
2000,0
1500,0
1000,0
500,0
0,0
Year
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Locality
3.05 (3.17)
3.07(3.15)
3.08
3.09
3.13
3.15
3.16
3.13 PM
3.19
3.20

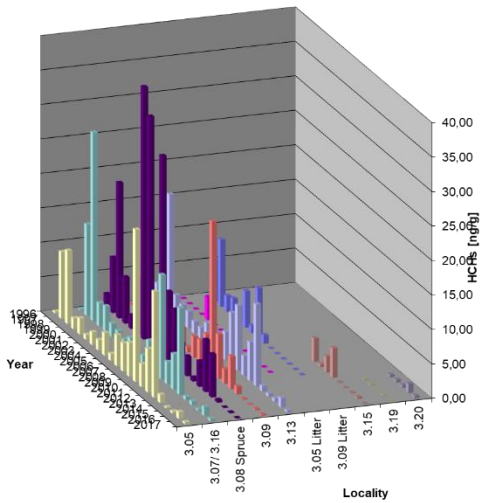

Sum of 16 PAHs in Needles from Košetice 1988-2017
PAHs [ng/g]
6000
5000
4000
3000
2000
1000
0
Year
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Locality
3.05
3.07/ 3.16
3.08 Spruce
3.09
3.13
3.05 Litter
3.09 Litter
3.15
3.19
3.20

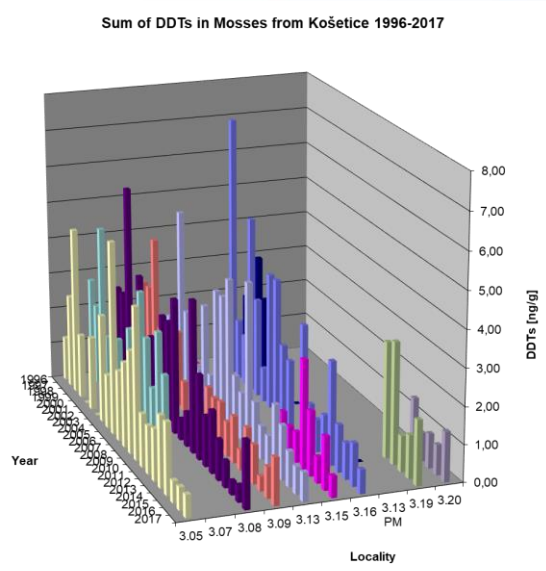

Sum of 16 PAHs in Mosses from Košetice 1996-2017
PAHs [ng/g]
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
Year
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Locality
3.05
3.07(3..
3.08
3.09
3.13
3.15
3.16
3.13 PM
3.19
3.20

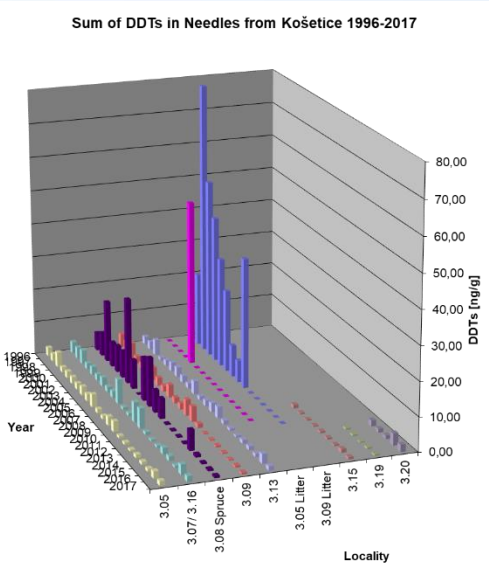

Sum of 16 PAHs in Needles from Košetice 1996-2017
PAHs [ng/g]
20000,0
18000,0
16000,0
14000,0
12000,0
10000,0
8000,0
6000,0
4000,0
2000,0
0,0
Year
Locality
3.05
3.07/ 3.16
3.08 Spruce
3.09
3.13
3.05 Litter
3.09 Litter
3.15
3.19
3.20

Plants


Sum of HCHs in Mosses from Košetice 1996-2017
HCHs [ng/g]
30,00
25,00
20,00
15,00
10,00
5,00
0,00
Year
1996
2017
3.05
3.07
3.08
3.09
3.13
3.15
3.16
3.13
3.19
3.20
PM
Locality


Sum of HCHs in Needles from Košetice 1996-2017
HCHs [ng/g]
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
Year
1996
2017
3.05
3.07/ 3.16
3.08 Spruce
3.09
3.13
3.05 Litter
3.09 Litter
3.15
3.19
3.20
Locality

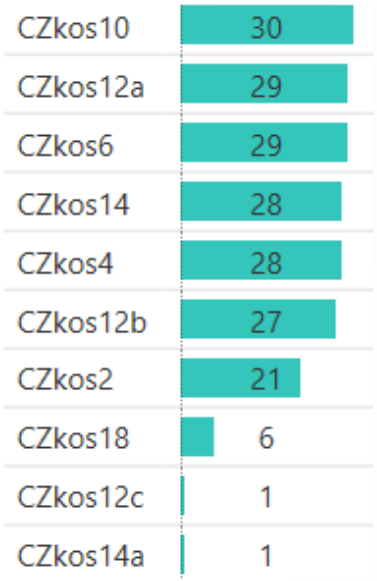

Sum of DDTs in Mosses from Košetice 1996-2017
DDTs [ng/g]
8,00
7,00
6,00
5,00
4,00
3,00
2,00
1,00
0,00
Year
1996
2017
3.05
3.07
3.08
3.09
3.13
3.15
3.16
3.13
3.19
3.20
PM
Locality

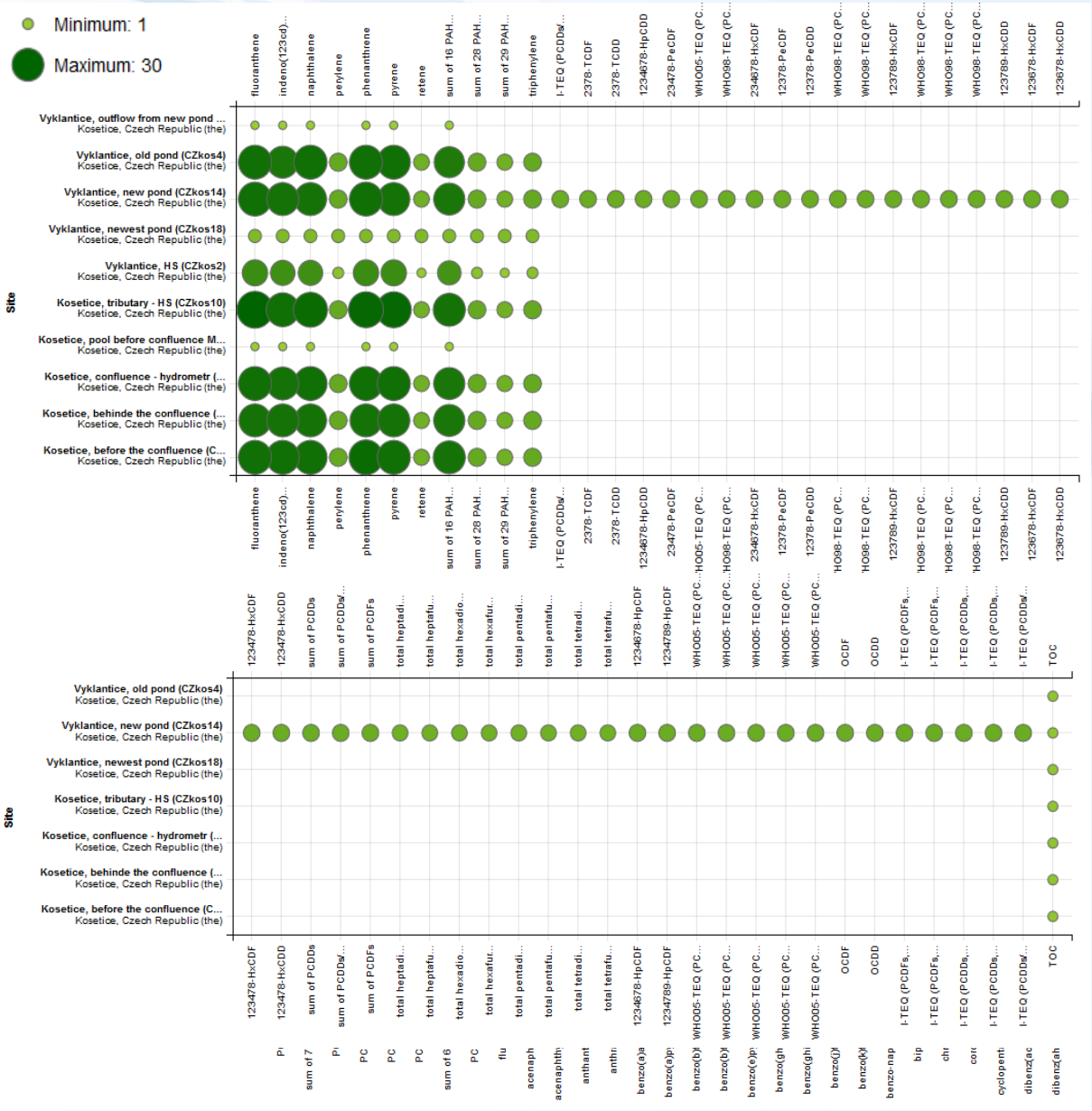

Sum of DDTs in Needles from Košetice 1996-2017
DDTs [ng/g]
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
Year
1996
2017
3.05
3.07/ 3.16
3.08 Spruce
3.09
3.13
3.05 Litter
3.09 Litter
3.15
3.19
3.20
Locality

Sediments

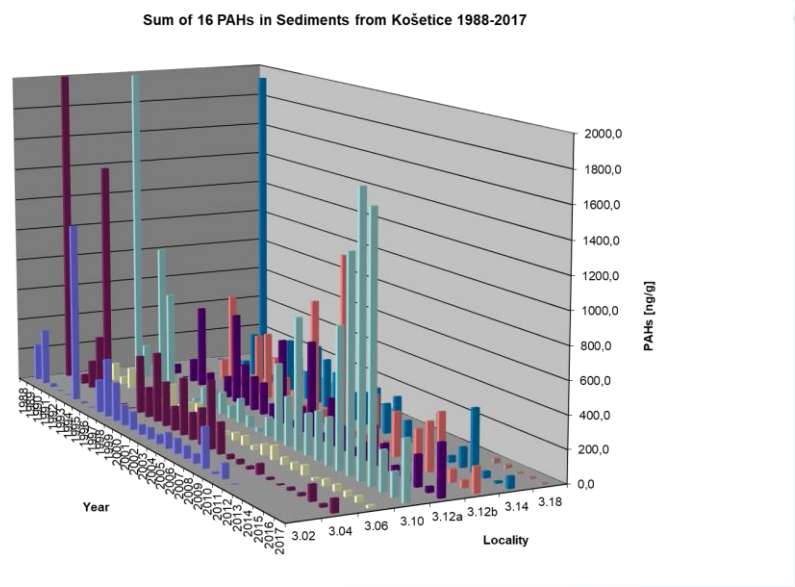
200 samples

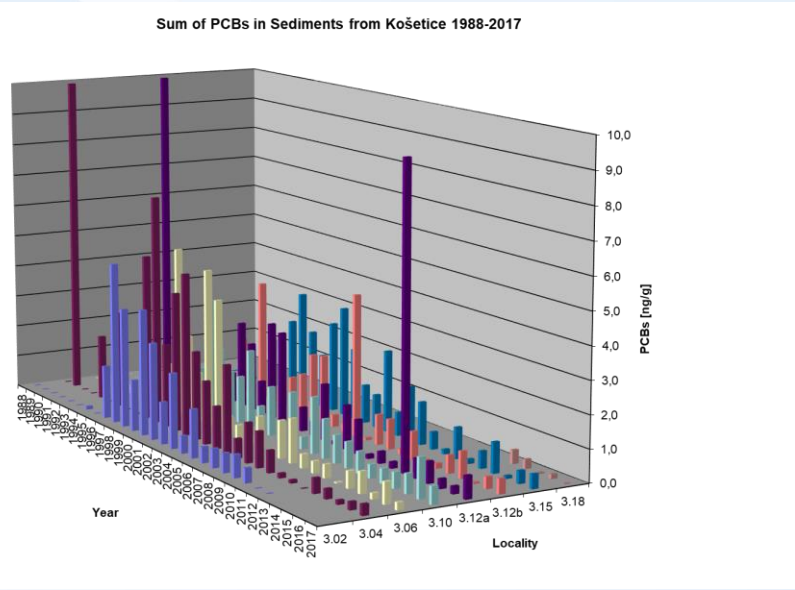
10 sites

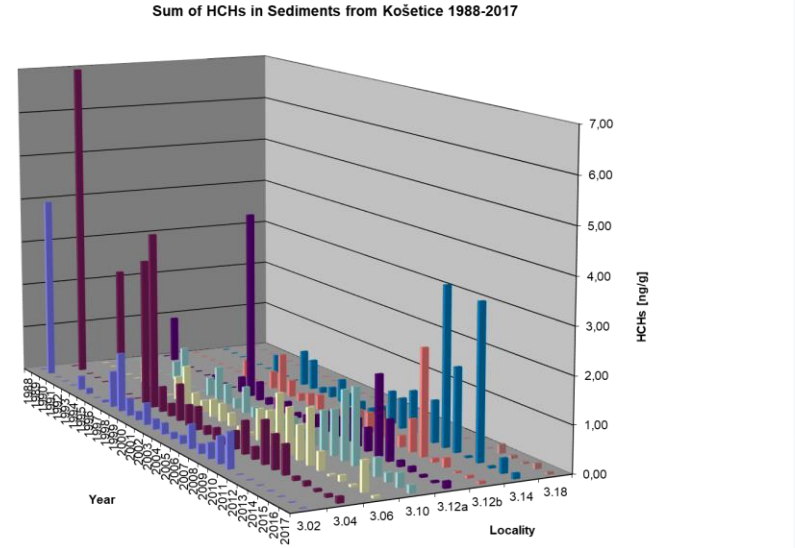


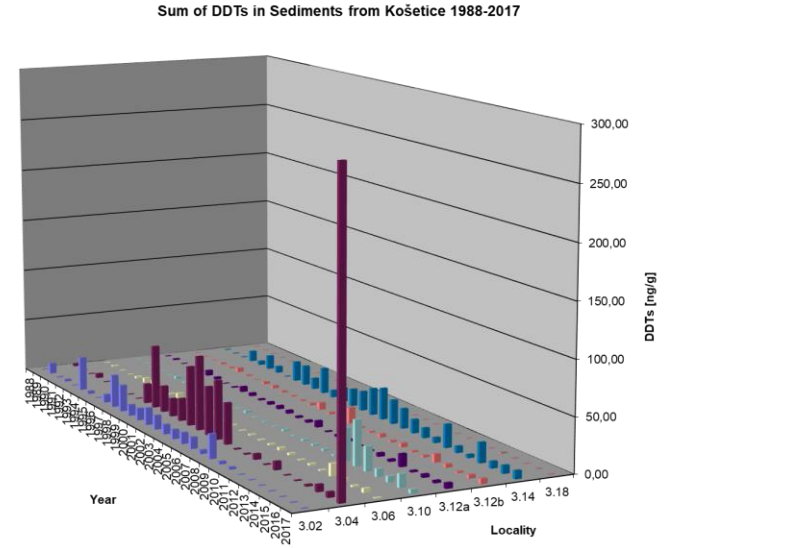


Sediments


Sum of 16 PAHs in Sediments from Košetice 1988-2017
PAHs [ng/g]
2000,0
1800,0
1600,0
1400,0
1200,0
1000,0
800,0
600,0
400,0
200,0
0,0
Year
Locality
3.02
3.04
3.06
3.10
3.12a
3.12b
3.14
3.18


Sum of PCBs in Sediments from Košetice 1988-2017
PCBs [ng/g]
10,0
9,0
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
Year
Locality
3.02
3.04
3.06
3.10
3.12a
3.12b
3.15
3.18

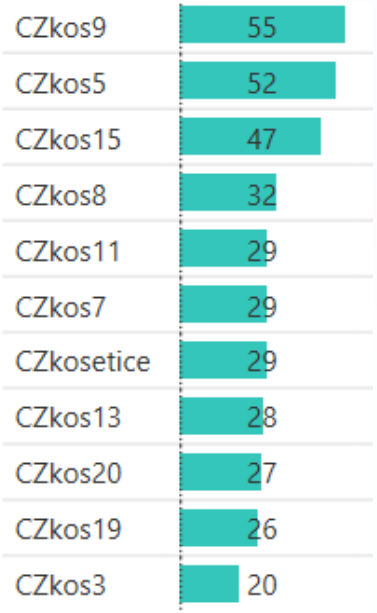

Sum of HCHs in Sediments from Košetice 1988-2017
HCHs [ng/g]
7,00
6,00
5,00
4,00
3,00
2,00
1,00
0,00
Year
Locality
3.02
3.04
3.06
3.10
3.12a
3.12b
3.14
3.18


Sum of DDTs in Sediments from Košetice 1988-2017
DDTs [ng/g]
300,00
250,00
200,00
150,00
100,00
50,00
0,00
Year
Locality
3.02
3.04
3.06
3.10
3.12a
3.12b
3.14
3.18

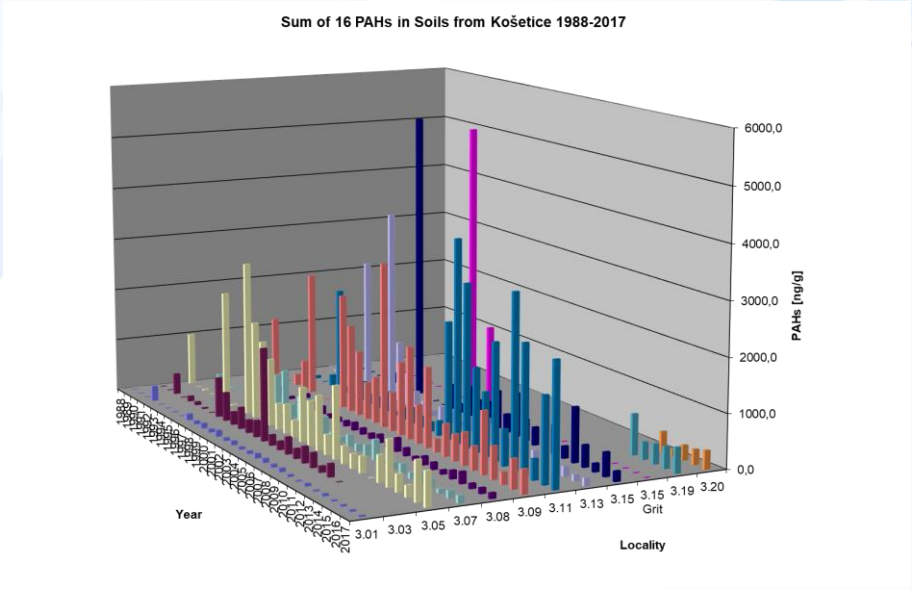
Soils

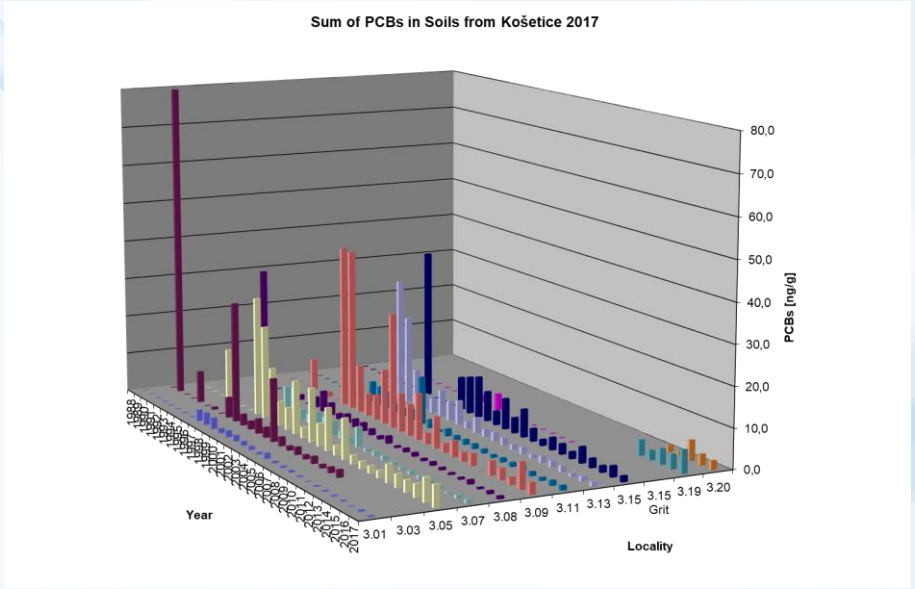
374 samples

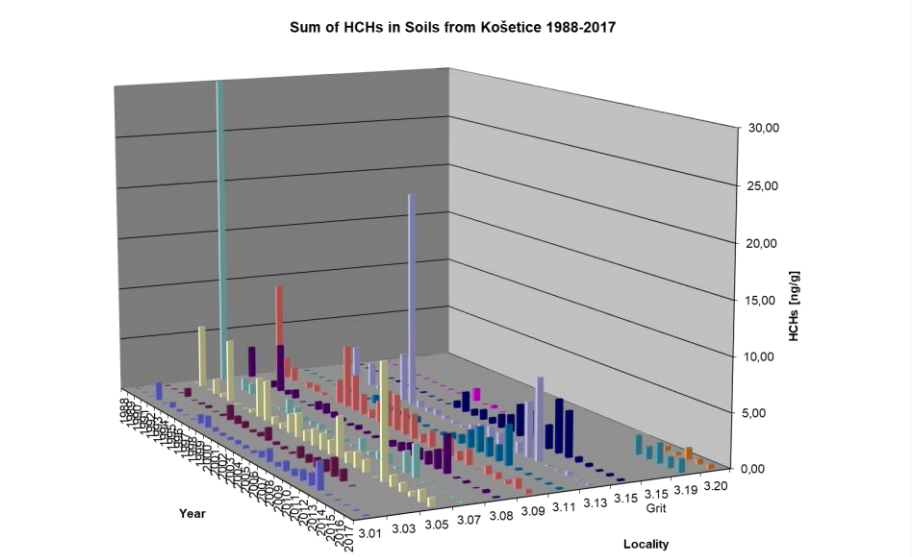
11 sites

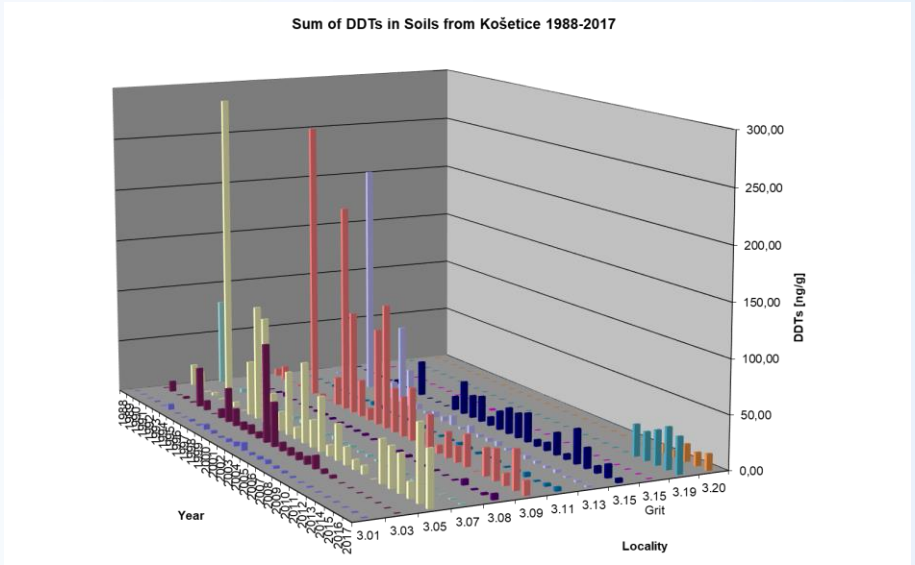


Soils


Sum of 16 PAHs in Soils from Košetice 1988-2017
6000,0
5000,0
4000,0
3000,0
2000,0
1000,0
0,0
PAHs [ng/g]
Year
Locality
Grit
3.01 3.03 3.05 3.07 3.08 3.09 3.11 3.13 3.15 3.15 3.19 3.20


Sum of PCBs in Soils from Košetice 2017
80,0
70,0
60,0
50,0
40,0
30,0
20,0
10,0
0,0
PCBs [ng/g]
Year
Locality
Grit
3.01 3.03 3.05 3.07 3.08 3.09 3.11 3.13 3.15 3.15 3.19 3.20

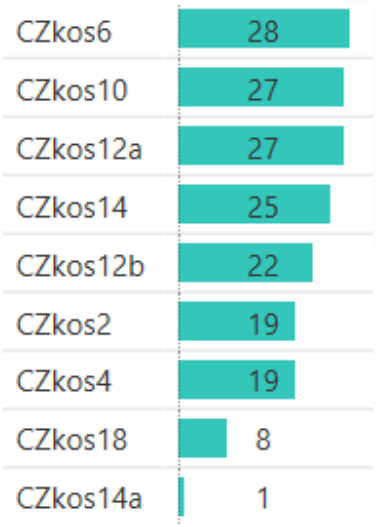

Sum of HCHs in Soils from Košetice 1988-2017
30,00
25,00
20,00
15,00
10,00
5,00
0,00
HCHs [ng/g]
Year
Locality
Grit
3.01 3.03 3.05 3.07 3.08 3.09 3.11 3.13 3.15 3.15 3.19 3.20

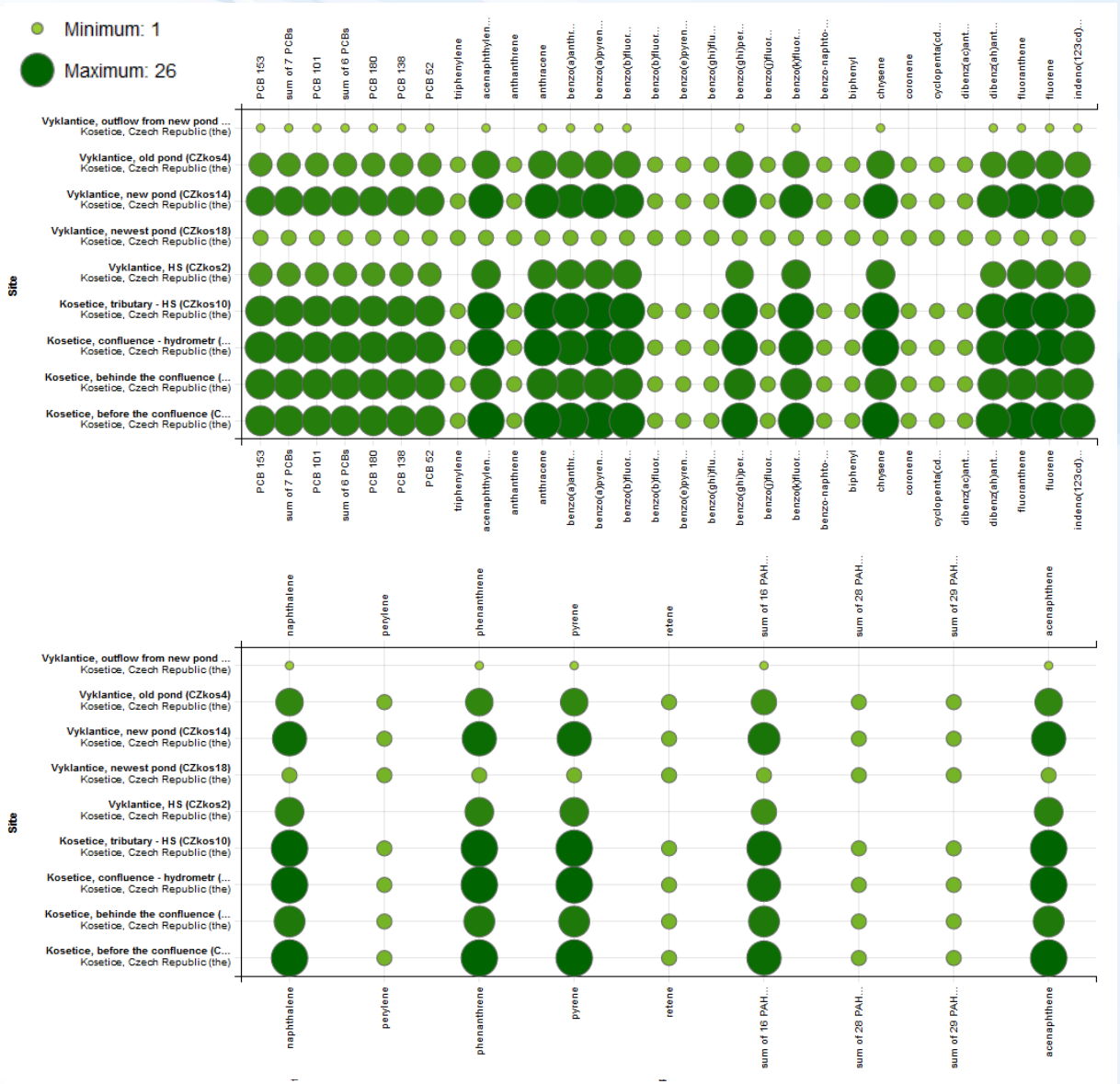

Sum of DDTs in Soils from Košetice 1988-2017
300,00
250,00
200,00
150,00
100,00
50,00
0,00
DDTs [ng/g]
Year
Locality
Grit
3.01 3.03 3.05 3.07 3.08 3.09 3.11 3.13 3.15 3.15 3.19 3.20

Surface Waters

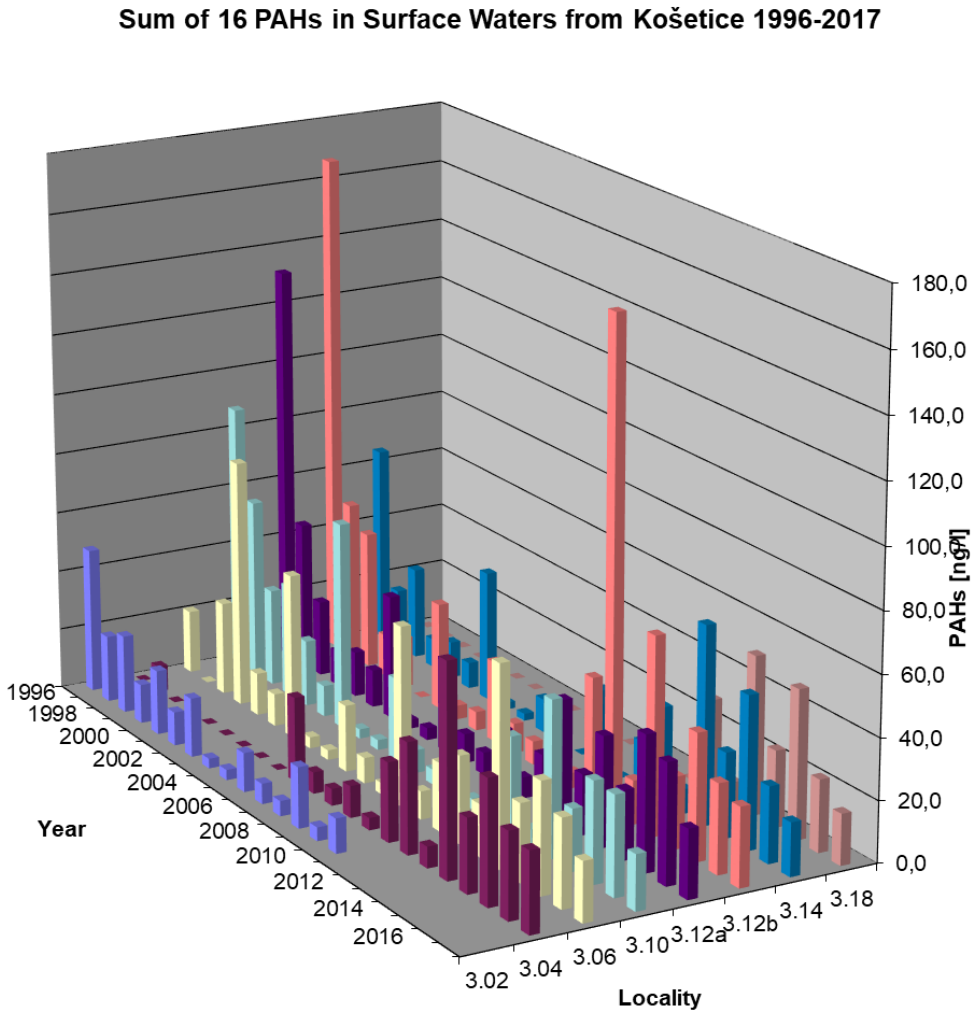
176 samples

9 sites

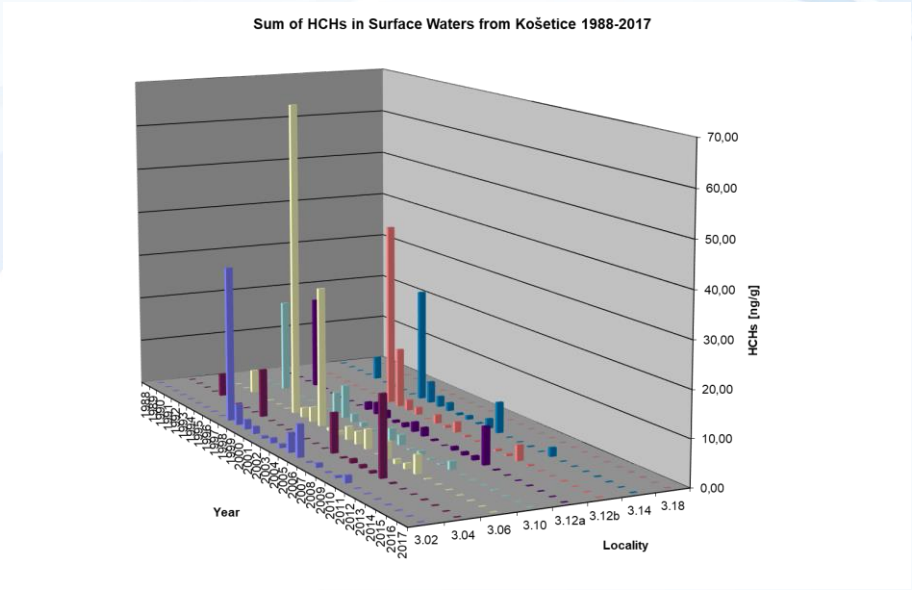


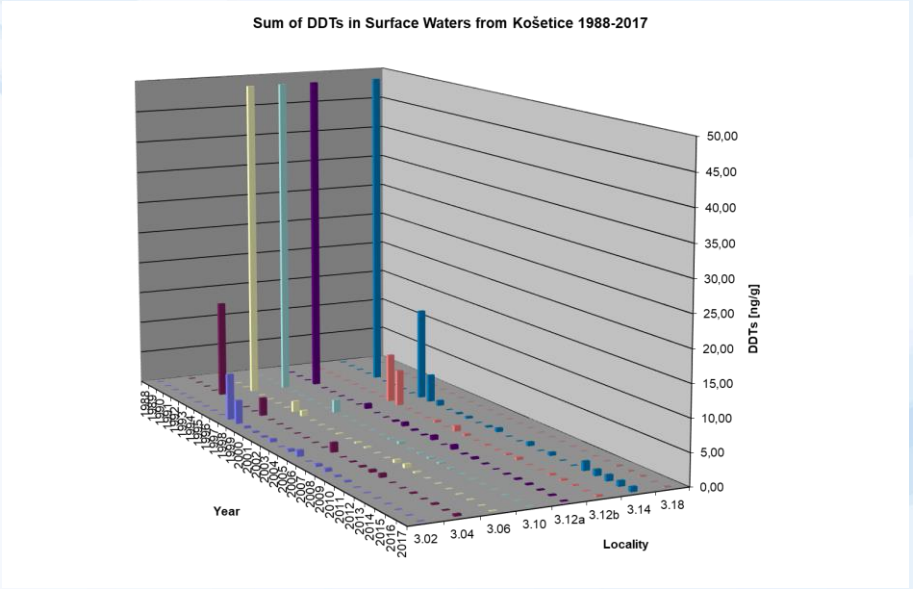


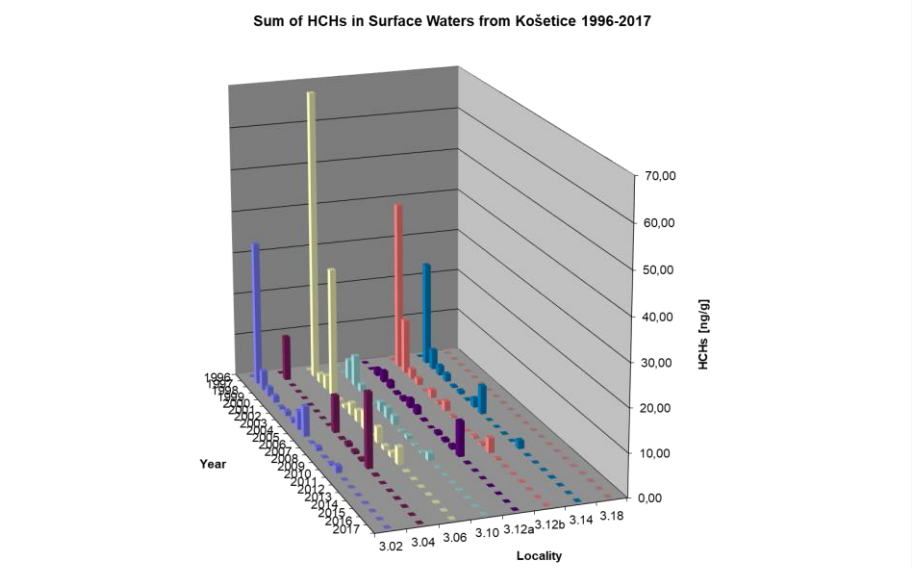
Surface Waters

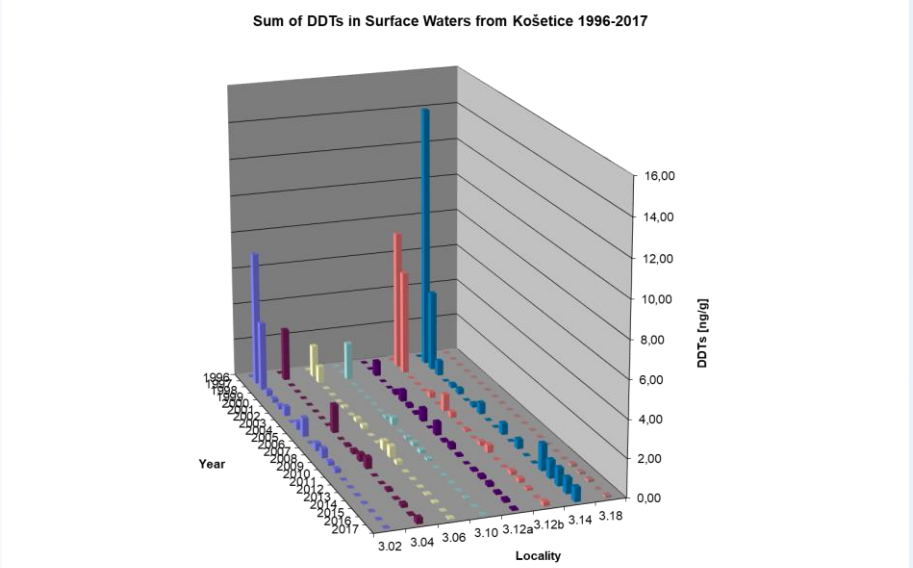


Surface Waters









Conclusions

- Background station - roadmap of the CZ of large infrastructure
- Part of many projects and networks
- Unique data set of POPs from 1988
- Data can be used for long-term POPs monitoring (spatial and temporal) in various matrices, calibration studies, testing/validation of the new sampling method and analytical procedures, data modeling, reporting obligations under the Stockholm convention
- PAHs – similar concentration levels, seasonal behavior
- PCBs, OCPs – decreasing concentration and continuous removal from the environment
- CUPs – seasonal trends depending on crop plants close to the site
- PBDEa, PCDDs/Fs, dl-PCBs – low concentrations, the highest concentration in 2011
- All data are available in GENASIS system (Global Environmental Assessment Information System) – www.genasis.cz

THANK YOU FOR YOUR ATTENTION

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