Measurement programme of the Large research infrastructure ACTRIS-CZ



NAOK

Aerosol particles

Automatic measurement

Parameter	Instrument	Frequency of measurement
PM_{10}	Environnement S.A. MP101M	continually
$PM_{2.5}$	Environnement S.A. MP101M	continually
Vertical profille of atmospheric composition	LIDAR LR211-D300 (Raymetrics)	continually
Particle number size distribution (10–800 nm)	aerosol spectrometer MPSS (TROPOS)	5 min
Particle number size distribution (0.7–10 mm)	aerosol spectrometer APSS 3321 (TSI)	5 min
Total particle number concentration (d50 @ 10 nm)	condensation particle counter CPC 3750 (TSI)	1 s
Total particle number concentration (d50 @ 4 nm), at ground, in 230 m	condensation particle counter CPC 3775 (TSI)	1 s
Particle number size distribution (> 1 nm; 1–4 nm)	nano-aerosol spectrometer MPSS 3938E57 (TSI)	5 min

Parameter	Instrument	Frequency of measurement
Size distribution of ion electrical mobility (0.8–40.0 nm) and particle number size distribution (2.0–40.0 nm)	ion and aerosol spectrometer NAIS (Airel)	1 s – 5 min
Total nuclei concentration and nuclei size distribution ranging from 0.75 to 20.00 μm, both depending on supersaturation from 0.1 to 1.0%	dual Cloud Condensation Nuclei Counter CCNC-2000 (DMT)	total measurement cycle through all 5 supersaturations 1 hour, data collection 1/s
Chemical composition of aerosol particles	Aerosol Mass Spectrometer ToF-ACSM (Aerodyne)	10 min
PM_{10} - elemental composition	Xact X-ray Elemental Analyzer (Cooper Environmental)	4 hour
Light absorption	Aethalometer (Magee AE33)	1 min
Light scattering	Nephelometer (Aurora-3000)	1 min
Organic and Elemental carbon	Semi-Continuous OC/EC Field Analyzer 4G (Sunset)	4 hour
PM_{10} - elemental composition	Horiba PX 375	4 hour
Drop size /rainfall types intensity)	Disdrometer 5.4110 (Thies CLIMA)	1 min
Cloud-particle spectrometer	Fog Monitor, FM_120, 4.03.01 (DMT)	1 s

Manual measurement		
Parameter	**Instrument**	**Frequency of measurement**
TSP chemical composition (1)	Sven Leckel, MVS6	daily
PM_{10}	Sven Leckel, SEQ 47/50	1 × per 2 days
Heavy metals in PM_{10} (2)	Sven Leckel, SEQ 47/50	1 × per 2 days
PM_{10}/$PM_{2,5}$/ PM_1 (accorting to need)	Umwelttechnik MCZ GmbH, μPNS1	accorting to need
PM_{10}	Sven Leckel, SEQ 47/50	1 × per 2 days
$PM_{2.5}$	Sven Leckel, SEQ 47/50	1 × per 2 days
Heavy metals in $PM_{2.5}$ (2)	Sven Leckel, SEQ 47/50	1 × per 2 days
PM_1	Sven Leckel, SEQ 47/50	1 × per 2 days
Heavy metals in PM_1 (2)	Sven Leckel, SEQ 47/50	1 × per 2 days
ECOC	Sven Leckel, MVS6	1 × per 2 days
Base cationts (3)	Sven Leckel, SEQ 47/50	7 days

(1) SO_4, NH_4, NO_3

(2) As, Cd, Pb; + since 2004 Mn, Cu, Ni; + since 2011 V, Cr, Fe, Co, Zn, Se

(3) Ca, K, Mg, Na

Gaseous pollutants		
Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
SO_2	Teledyne API T100	continually
CO	Teledyne API T300	continually
$NO\text{-}NO_2\text{-}NO_X$	Teledyne API T200UP Teledyne API T500U	continually
O_3	Teledyne API T400	continually
Hg (4)	Tekran 2537X	5 min
Manual measurement		
Parameter	**Instrument**	**Frequency of measurement**
VOCs (5)	sampling into canisters	twice a week (Mo + Th)
PAHs (6)	Sven Leckel, SEQ 47/50	1 × per 3 days

(4) sampling is conducted at ground and in 230 m

(5) BZN [benzene], TLN [toluene], EBZN [ethylbenzene], MPXY [m, p-xylene], OXY [o-xylene], ethane [ethane], ethene [ethene], PRPA [propane], PRPE [propene], IBUT [i-butane], NBUT [butane], ACET [acetylene], SBUT [sum butene], IPEN [i-pentane], NPEN [n-pentane], SPTN [sum pentene], MCPT [methylcyclopentane], CHEX [cyclohexane], NHEX [n-hexane], NHEP [n-heptane], ISOP [isoprene], Nonn [nonane], MP23 [2 + 3 methylpentan], MH23 [2 + 3 metylhexan], CP [cyclopentane]; DMB22 [2,2-dimethylbutane], DMB23 [2,3-dimethylbutane], MHP23 [2-methyl heptane 3], I_OKT [i-octane], N_OKT [n-octane], BT13 [1,3 butadien], STMB [sum of trimethylbenzen]

(6) BaP [benzo[a]pyrene] (since y. 2004); BaA [benzo[a]anthracene, BghiPRL [benzo[g,h,i]perylene], DBahA [dibenzo[a,h]anthracene], Chry [chrysene], I123cdP [indeno[1,2,3-cd]pyrene] (since y. 2005); BbF [benzo[b]fluoranthene], BkF [benzo(k)fluoranthene] (since y. 2006); COR [coronen] (since y. 2009); PAHs [polycyclic aromatic hydreocarbons-summ] (2005–2012); BbF_BkF [sum benzo(b)fluoranten a benzo(k)fluoranten] (in y. 2005) BjF [benzo[j]fluoranthene], BeP [benzo(e)pyren], PIC [picene], RET [retene], PRL [perylene]

Greenhouse gases and their precursors		
Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
O_3 (7)	Thermo 49i	1 min
CO (8)	LGR N2O/CO-23d Analyser model 913-0015 EP	< 1 min
CO_2 (8)	Picarro G2301	< 1 min
CH_4 (8)	Picarro G2301	< 1 min
N_2O (8)	LGR N2O/CO-23d Analyser model 913-0015 EP	< 1 min
Manual measurement		
Parameter	**Instrument**	**Frequency of measurement**
^{14}C v CO_2 (9)		1 × per two weeks

(7) at a height of 50, 125 and 230 m (8) at a height of 10, 50, 125 and 250 m (9) at a height of 250 m

Semi-volatile organic compounds

Active sampling		
Parameter	**Instrument**	**Frequency of measurement**
POPs (10) in fraction PM_{10}	Digitel DH77	1 × per week (wed)
POPs (10, 11, 12) in fraction PM_{10}	Digitel DH77	weekly
CUPs, PFAS (13)	Baghirra, directional	biweekly
POPs (10) - wet depozition	Baghirra WS 1m	daily

Passive sampling		
Parameter	**Instrument**	**Frequency of measurement**
POPs (10) and (10, 11)	passive sampler	28 and 84 days

Episodic sampling		
Parameter	**Matrix**	**Frequency of measurement**
POPs (10)	surface water	1 × per year
POPs (10) and metals (14)	sediments	1 × per year
POPs (10) and metals (14)	soils	1 × per year

Active sampling	
Parameter	**Instrument**
POPs (10, 11, 12) and metals (13) - TSP, $PM_{10,}$ $PM_{2.5}$, PM_{1},	Sven Leckel MVS6, Digitel DH77, Baghirra SAM 50 Auto, Baghirra FV 3-12 Solar
POPs (10) - particle size separation	Cascade impactors Tisch-Environmental, Moundi, Sioutas
Parameter	**Instrument**
POPs (10, 11, 12) sampling air by wind direction, source identification	Multi-directional high- and low-volume samplers BaghirraBaghirra HI 30 Auto and Baghirra LV 30 Auto
Automatic particle analyzers	Grimm 11-E, Palas Fidas 200S
POPs (10) - total deposition	Baghirra 314 GL

(10) N [naphthalene] Acl [acenaphthylene] Ac [acenaphthene] Fl [fluorene] Fen [phenanthrene], A [anthracene] Flu [fluoranthene] Pyr [pyrene] BaA [benzo [a] anthracene] Chry [chrysene] BbF [benzo [b] fluoranthene] BkF [benzo [k] fluoranthene] BaP [benzo [a] pyrene] I123cdP [indeno [1,2,3-cd] pyrene] DBahA [dibenzo [a, h] anthracene] BghiPRL [benzo [g, h, i] perylene] PAHs [polycyclic aromatic hydrocarbons sum] PCB28 [PCB28] PCB52 [PCB52] PCB101 [PCB101] PCB118 [PCB118], PCB138 [PCB138], PCB153 [PCB153], PCB180 [PCB180], PCBs [polychlorinated biphenyls-sum] alpha_HCH [alpha-HCH], beta_HCH [beta-HCH], gamma_HCH [gamma-HCH], delta_HCH [delta -HCH] HCH [Hexachlorocyclohexane] HCB [hexachlorobenzene] PeCB [pentachlorobenzene] pp_DDE, [p, p-DDE] pp_DDD [p, p'-DDD] pp_DDT [p, p-DDT]

(11) polybrominated diphenyl ethers PBDE [BDE 28, BDE 47, BDE 99, BDE 100, BDE 153, BDE 154, BDE 183, BDE 209], BATE [2-bromoallyl-2,4,6-tribromophenyl ether], DBDPE [decabromodiphenylethane], DPTE [2,3-dibromopropyl-2,4,6-tribromophenyl ether], HBB [hexabrombenzene], HCDBCO [hexachlorocyclopentenyl-dibromocyclooctane], PBEB [pentabromomethylbenzene], PBT [pentabromotoluene], TBBPA [tetrabromobisphenol A], beta TBCO [1,2,5,6-tetrabromocyclooctane], BTBPE [1,2-bis[2,4,6- tribromophenoxy]ethane], beta TBECH [1,2-dibromo-4-[1,2-dibromethyl]-cyclohexane], pTBX [tetrabromo-p-xylene], antiDP [anti-Dechloran Plus], synDP [syn-Dechloran Plus], T23BPIC [Tris[2,3-dibromopropyl] isocyanurate], TBCT [3,4,5,6-Tetrabromo-2-chlorotoluene], alphaTBCO [3,4,5,6-Tetrabromo-2-chlorotoluene], alphaTBECH [α-Tetrabromoethylcyclohexane], PBBZ [1,2,3,4,5-Pentabromobenzene] heptachlor, heptachlorepoxide cis- [= exo, B], heptachlorepoxide trans- [= endo, A], aldrin, dieldrin, endrin, endrin aldehyde , endrin ketone, isodrine, oxychlordane, cis-nonachlor, trans-nonachlor, trans-chlordane [= gamma], cis-chlordane [= alpha], endosulfan I [= alpha], endosulfan II [= beta], endosulfan sulfate, chlordecone , methoxychlor, mirex; 1-nitronaphthalene, 2-nitronaphthalene, 3-nitroacenaphthene, 5-nitroacenaphthene, 2-nitrofluorene, 9-nitroanthracene, 9-nitrophenanthrene, 3-nitrophenanthrene, 2-nitrofluoranthene, 3-nitrofluoranthene, 1-nitropyrene, 2-nitropyrene, 7- nitrobenzoanthrac, 6-nitrochrysene, 1,3-dinitropyrene, 1,6-dinitropyrene, 1,8-dinitropyrene, 6-nitrobenzoapyrene, 1,4-naphthoquinone, naphthalene-1-aldehyde, 9-fluorenone, 9,10-anthraquinone, 1,4-anthraquinone, 9,10-phenanthroquinone, benzo-a-fluoren-11one, benzo-b-fluoren-11one, benzanthrone, benz[a]anthrac-7,12one, 5,12-naphthacenequinone

(12) acetochlor, alachlor, atrazine, azinphos-methyl, carbaryl, clopyralid, diazinon, dichlofluanid, dimetachlor, dimethoate, disulfoton, diuron, fenitrothion, fenoxaprop ethyl, fenpropimorph, florasulam, fluroxypyr, fonophos, chlorothalonil, chlorpyrifos, chlorsulfuron, chlortoluron, isoproturon, malathion, metamitron, metazachlor, metolachlor, metribuzin, methyl parathion, pendimethalin, phosmet, pirimicarb, prochloraz, propiconazole, pyrazone, simazine, tebuconazole, temefos, terbufos, terbuthylazine, tribenuron methyl, trifluralin, aldicarb, boscalid, cyprodinil, imidacloprid, iprovalicarb, metalaxyl, quizalofop ethyl, thiacloprid, spiroxamine, fenpropidine, omethoate, prosulfocarb, carbofuran, kresoxim-methyl, oxadiazon, phosalone, bifenthrin, deltamethrin, esfenvalerate, fenpropathrin, permethrin, 2,4-D [2,4-dichlorophenoxyacetic acid] , acetamiprid, mercoprop, MCPA [4-chloro-o-tolyloxyacetic acid], carbendazim

(13) Alachlor, Acetochlor, Atrazin, Azinfos-metyl, Carbaryl, Clopyralid, Diazinon, Dichlofluanid, Dimetachlor, Dimetoate, Disulfoton, Diuron, Fenitrothion, Fenoxaprop ethyl, Fenpropimorph, Florasulam, Fluroxypyr, Fonofos, Chlorothalonil, Chlorpyrifos, Chlorsulfuron, Chlortoluron, Isoproturon, Malathion, Metamitron, Metazachlor, Metolachlor, Metribuzin, Methyl, Parathion, Pendimethalin, Phosmet, Pirimicarb, Prochloraz, Propiconazole, Pyrazon, Simazine, Tebuconazole, Temefos, Terbufos, Terbutylazine, Tribenuron methyl, Trifluralin, Aldicarb, Boscalid, Cyprodinil, Imidacloprid, Iprovalicarb, Metalaxyl, Quizalofop ethyl, Thiacloprid, Spiroxamine, Fenpropidin, Omethoate, Prosulfocarb, Carbofuran, Kresoxim-methyl, Oxadiazon, Phosalone, Bifenthrin, Deltamethrin, Esfenvalerate, Fenpropathrin, Permethrin, 2,4-D Acetamiprid, Mercoprop, MCPA, Carbendazim, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFTeDA, PFBS, PFHxS, PFHpS, PFOS, PFDS, MeFOSA, EtFOSA, FOSA, MeFOSE, EtFOSE, PFHpS, PFOS, PFDS, MeFOSA, EtFOSA, FOSA, MeFOSE, EtFOSE

(14) As, V, Cd, Co, Cr, Mo, Cu, Hg, Ni, Pb, Sb, Zn

Meteorological parameters
Measurement within the professional CHMI network according to WMO rules
Climatology (15)
SYNOP (16)
Photon dose equivalent
Solar radiation components (17)
Measurement in vertical profile
Basic meteorological paramaters (18)
Solar radiation components (19)
Measurement in vertical profile
Atmospheric boundary layer height (20)
Total cloud cover (21)
Measurement of sunlight and moonlight (22)

(15) air temperature, air pressure, air humidity, wind speed and direction, amount of precipitation, sunshine duration, visibility, soil temperature (depth of 5, 10, 20, 50 and 100 cm), evaporation

(16) air temperature, air pressure, air humidity, vapor pressure, dew point, wind speed and direction, amount of precipitation, sunshine duration, visibility, soil temperature (depth of 5, 10, 20, 50, 100 cm), soil moisture (depth of 7, 25 and 75 cm), evaporation; maximum, minimum and ground temperature

(17) Global radiation, Diffuse radiation, UV-B radiation

(18) air temperature, air pressure, air humidity, wind speed and direction at heights 10, 50, 125, 230 and 250 m

(19) UV-A and UV-B radiation at heights 10 m and 240 m , Kipp & Zonen SUV-A a SUV-B

(20) Ceilometr Vaisala CL 51, measurement frequency 16 s, measured profile up to 15 km

(21) Sky InSight infrared camera

(22) Multispectral photometer CIMEL CE318 TS9

Precipitation quality

Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
Chemical composition in wet deposition (23)	Eigenbrodt NSA 181	daily
Hg concentration	custom-made	weekly

(23) pH, conductivity, SO4, NO3, NH4 , Ca, Mg, Na, K, Cl, F; + since2005 Fe, Zn, Mn, Pb, Cd, Ni ; since 2010 Cr, As; since 2011 Co, Cu, V, Se

Intensive Campaign Measurements

Automatic measurement	
Parameter	**Instrument**
Aerosol particles chemical composition	cTOF-AMS/lTOF-AMS (Aerodyne)
Hygroscopicity of aerosol particles	HTMDA
Trace VOC Analyzer	PTR-TOF (Ionicon)
Light scattering	Nephelometer (TSI-3653)
Pollen monitoring in real time	Swisens (Poleno-105 Jupiter)
Ice nucleating particles number	PINE (Bilfinger)
Particle number size distribution (> 1 nm; 1–4 nm)	dual condensation particle counter PSM A11 (Airmodus)

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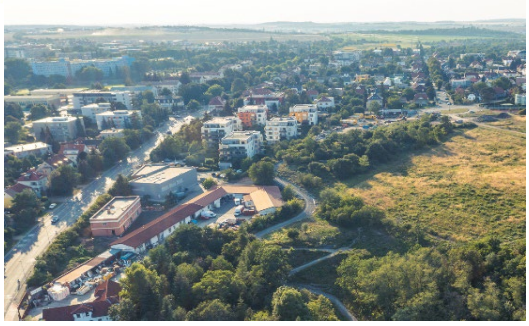


Suchdol

Aerosol particles		
Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
Particle number size distribution (10–800 nm)	aerosol spectrometer MPSS (TROPOS)	5 min
Particle number size distribution (0.7–10 mm)	aerosol spectrometer APSS 3321 (TSI)	5 min
Total particle number concentration (d50 @ 10 nm)	condensation particle counter CPC 3750 (TSI)	1 s
Parameter	**Instrument**	**Frequency of measurement**
Light absorption	Aethalometer (Magee AE33)	
Light scattering	Nephelometer (Aurora-3000)	1 min
Organic and Elemental carbon	Semi-Continuous OC/EC Field Analyzer 4G (Sunset)	4 hour

Measurement programme of the Large research infrastructure ACTRIS-CZ

Lom

Aerosol particles		
Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
Particle number size distribution (10–800 nm)	aerosol spectrometer MPSS (TROPOS)	5 min
Total particle number concentration (d50 @ 10 nm)	condensation particle counter CPC 3750 (TSI)	1 s
Parameter	**Instrument**	**Frequency of measurement**
PM_{10} - elemental composition	Xact X-ray Elemental Analyzer (Cooper Environmental)	4 hour
Light absorption	Aethalometer (Magee AE33)	1 – 5 min
Light scattering	Nephelometer (Aurora-3000)	1 min

Measurement programme of the Large research infrastructure ACTRIS-CZ

Milešovka

Cloud and Precipitation Particles		
Automatic measurement		
Parameter	**Instrument**	**Frequency of measurement**
Cloud liquid water content	PVM-100 (Gerber	1 min
Cloud droplet effective radius	PVM-100 (Gerber Scientific)	1 min
Precipitation types, intensity, spectrum	Disdrometer 5.4110 (Thies CLIMA)	1 min
Vertical profile of cloud and precipitation particles	Cloud Radar MIRA-35C (METEK)	2 s
Volume measurements of precipitation particles	X-band Weather Radar WR2120 (FURUNO)	full scan 3 min

Meteorological parameters
Measurement within the professional CHMI network according to WMO rules
Climatology (1)
SYNOP (2)
Measurement in vertical profile
Wind velocity (3)
Cloud base height (4)

(1) air temperature, air pressure, air humidity, wind speed and direction, amount of precipitation, sunshine duration, visibility, cloud cover, soil temperature (depth of 5, 10, 20, 50 and 100 cm)

(2) air temperature, air pressure, pressure tendency, dew point temperature, wind speed and direction, amount of precipitation, sunshine duration, visibility, cloud cover, lowest cloud base, present weather, past weather; maximum temperature, minimum temperature, ground minimum temperature, state of ground, snow cover depth

(3) WindRanger BL (METEK), profile measurement frequency 10 s, averaging time 30 s, measured profile up to 4.5 km

(4) Ceilometr Vaisala CL 51, measurement frequency 16 s, measured profile up to 15 km