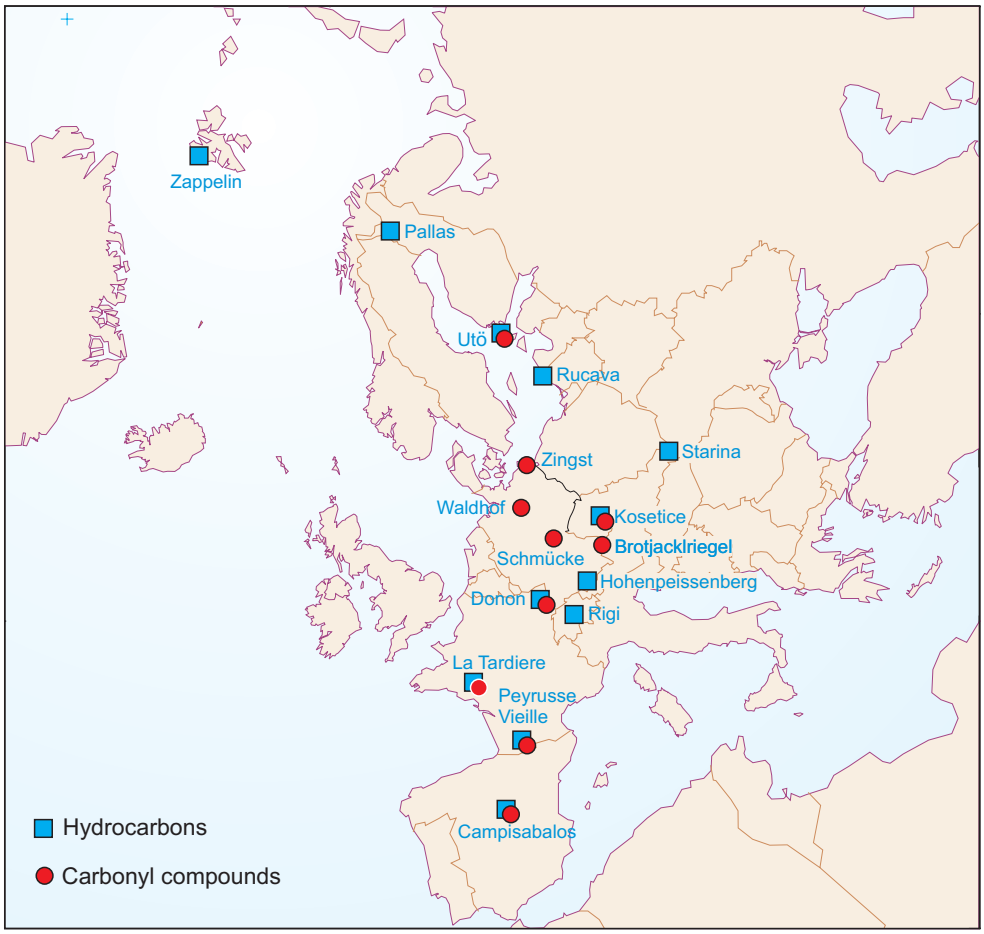
EMEP/CCC-Report 8/2006

EMEP Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

VOC measurements 2004

Sverre Solberg



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Summary

This report presents measurements of VOC carried out during 2004 at EMEP monitoring sites. VOC measurements are reported for a total of 14 sites and 10 of these with carbonyls. All the VOC measurements are made by grab samples of light hydrocarbons in canisters and 8-h samples of carbonyls by DNPH adsorption tubes.

The carbonyl samples from Germany, France and Spain were analysed by the national laboratories. For the light hydrocarbons the national laboratories in the respective countries carried out their own chemical analyses.

The 10 year's changes in the winter medians of hydrocarbons indicate a mixed picture during 1995 to 2004. Some compounds, like e.g. butane, indicate a reduction in the general concentration level, while for other components there is no clear trend, or even indications of a levelling-off or increase in the last few years. To what extent these effects are explained by changes in European, anthropogenic emissions or by changes in meteorological conditions are not possible to quantify without long-term detailed transport model calculations.

For the summer medians in carbonyls the trends are less clear, presumably reflecting that inter-annual variations in photo-oxidation are controlling these species.

VOC measurements 2004

1. Introduction

The Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes was adopted in November 1991. It entered into force on 29 September 1997. Three options for emission reduction targets are specified by the Protocol:

(i) 30% reduction in emissions of VOC by 1999 using a year between 1984 and 1990 as a basis;
(ii) The same reduction as for (i) within a Tropospheric Ozone Management Area (TOMA) and ensuring that by 1999 total national emissions do not exceed 1988 levels;
(iii) Finally, where emissions in 1988 did not exceed certain specified levels, Parties may opt for a stabilization at that level of emission by 1999.

In 1999 the Gothenburg protocol to Abate Acidification, Eutrophication and Ground-level Ozone was adopted by the Executive Body of UN-ECE, and on the 17th May 2005 the Protocol entered into force. The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, NO_x, VOCs and ammonia. These ceilings were negotiated on the basis of scientific assessments of pollution effects and abatement options. Parties whose emissions have a more severe environmental or health impact and whose emissions are relatively cheap to reduce will have to make the biggest cuts. According to the Protocol, Europe's sulphur emissions should be cut by at least 63%, its NO_x emissions by 41%, its VOC emissions by 40% and its ammonia emissions by 17% compared to 1990. The Protocol also sets tight limit values for specific emission sources (e.g. combustion plant, electricity production, dry cleaning, cars and lorries) and requires best available techniques to be used to keep emissions down. VOC emissions from such products as paints or aerosols will also have to be cut.

The EMEP VOC monitoring programme was initiated at the EMEP Workshop on Measurements of Hydrocarbons/VOC in Lindau, 1989 (EMEP/CCC, 1990). A three-fold objective of the measurement programme was defined at the workshop:

- Establishing the current ambient concentrations
- Compliance monitoring ("Do the emission control programme lead to a reduction of atmospheric concentrations?")
- Support to the transboundary oxidant modelling (prognostic and diagnostic)

The Workshop recommended that as a first step it would be sufficient with VOC monitoring at 10-15 rural sampling sites and taking two samples per week at each station centred at 12 noon GMT. Collection in stainless steel canisters and analyses by high resolution gas chromatography was recommended for the detection of light hydrocarbons, whereas impregnated adsorbent tubes sampling combined with high performance liquid chromatography (HPLC) was

recommended for the detection of carbonyls. A list of required and desirable compounds was defined and is shown in Table 1.

Certain additional remarks at the Workshop were underlined in the proceedings report (EMEP/CCC, 1990). The need for more information on VOC concentrations close to the emission sources for modelling purposes was raised. Harmonisation with national urban measurement programmes was recommended as well as the assembling of VOC emission inventories. Furthermore, the importance of concurrent measurements of oxides of nitrogen was strongly emphasised.

At the Lindau Workshop it was also recommended that during the starting period the analyses of the VOC samples should be made by the CCC and that other laboratories should be included later on.

Table 1: List of volatile organic compounds that are "required" or "desirable" to measure within the EMEP programme as defined at the EMEP Workshop in Lindau, 1989 (EMEP/CCC, 1990).

	required	**desirable**
Alkanes	ethane	hexane
	propane	branched hexanes
	i-butane	heptane
	n-butane	branched heptanes
	i-pentane	octane
	n-pentane	
Alkenes	ethene	butenes
	propene	pentenes
	isoprene	
Alkynes	acetylene	
Aromatics	benzene	styrene
	toluene	propylbenzenes
	o-xylene	ethyltoluenes
	m,p-xylene	
	ethylbenzene	
	trimethylbenzenes	
Aldehydes	formaldehyde	propionaldehyde
	acetaldehyde	
Ketones	acetone	methylethylketone
		methylvinylketone

The measurements of VOC within EMEP started with the collection of grab samples of light hydrocarbons in the middle of 1992, whereas measurements of carbonyls started in 1993. In the beginning five stations were included in the monitoring programme, Rucava (LV10), Košetice (CZ03), Waldhof (Langenbrügge) (DE02), Tänikon (CH32) and Donon (FR08). Since then the number and selection of VOC measurement sites have changed several times.

The first laboratory intercomparison of light hydrocarbons in EMEP was organised already in 1993 (Romero, 1995). The variation or relative deviation

among the laboratories was in a range ±25% from the median. The exercise showed that the majority of the participating laboratories had the required analytical technique to correctly analyse a wide range of NMHC within an accuracy of ±10–15%. Furthermore, the results showed no substantial differences whether the air samples were analysed immediately after collection or after a period up to 2 months (for C_2–C_5 hydrocarbons).

The measurements are reported annually, and officially made public by the Steering Body of EMEP. Previous results from the EMEP VOC programme have been presented in annual reports (e.g. Solberg, 2005). An EMEP expert meeting on VOC measurements was organised in Berlin, 1994 (EMEP/CCC, 1995), and an evaluation of the measurement programme was made in 1995 (Solberg et al., 1995). Highlights and findings from the EMEP VOC programme have also been presented in a number of scientific papers (Lindskog et al., 1995; Solberg et al., 1996; Hov et al., 1997; Solberg et al., 2001).

Lately, an initiative has been taken to increase the cooperation and exchange of VOC data between GAW (Global Atmospheric Watch) and EMEP. At the EMEP TFMM workshop in Oslo in November 2004, on the implementation of the EMEP monitoring strategy, a closer harmonisation between the VOC monitoring in EMEP and GAW was discussed. Minutes and conclusions from the workshop is given elsewhere (EMEP/CCC, 2005). Harmonisation of data quality objectives (DQOs) and using a common audit questionnaire was recommended, and it is also a wish to arrange common GAW/EMEP training course and to further increase the exchange of VOC monitoring data between EMEP, GAW and WDCGG (World Data Centre of Greenhouse Gases).

A revision and extension of the species recommended to measure was also discussed at the Oslo TFMM workshop. One starting point for such a revision is the VOC speciated emissions provided by UK's National Atmospheric Emissions Inventory (NAEI) as reported by Dore et al. (2004). Table 2, adopted from Dore et al. (2004), shows the photochemical ozone creation potential (POCP) for the top 50 VOCs (with respect to POCP) for the UK. The POCP identifies, on a relative basis, the ozone creation potential for each NMVOC compound through modelling studies. The creation potentials are then normalised by defining ethene as a creation potential of 1. Many of the components in Table 2 are not measured by the present EMEP VOC program due to limitations by the methods presently used, as e.g. alcohols, chlorinated compounds and long-chained alkanes. An extension to include these compounds in the monitoring program will require additional sampling devices as e.g. adsorption tubes.

Table 2: POCP Weighted NMVOC emissions (adopted from UK's NAEI emissions reported by Dore et al., 2004).

	POCP	code	Stationary Combustion	Production Processes	Extraction and Distrib_ Fossil Fuels	Solvent Use	Road Transport	Other Transport	Waste Treatment	TOTAL (Mass Emission)	TOTAL (POCP Weighted)	TOTAL (POCP Weighted %)
butane	35.2	a	4.37	4.52	70.21	19.61	13.30	0.47	0.02	112	40	7.2%
ethanol	39.9	a	1.39	53.56		40.27			0.27	95	38	6.9%
ethylene	100.0	a	3.29	5.65	0.03		14.22	3.55	1.07	28	28	5.0%
toluene	63.7	a	2.03	4.06	0.24	11.44	16.95	3.10	0.16	38	24	4.4%
m-xylene	110.8	a	0.75	2.14	0.09	10.90	5.04	0.70	0.07	20	22	3.9%
propylene	112.3	a	1.65	6.01	0.02	0.00	6.80	1.37	0.06	16	18	3.2%
pentane	39.5	a	2.66	2.00	28.93	0.41	8.64	0.29	0.02	43	17	3.1%
hexane	48.2	a	0.51	4.39	14.93	2.32	7.92	0.20	0.10	30	15	2.7%
1,2,4-trimethylbenzene	127.8	a	0.00	0.52	0.01	5.44	4.69	0.51		11	14	2.6%
2-methylbutane	40.5	a	3.48	1.08	11.11	0.04	17.74	0.77	0.01	34	14	2.5%
formaldehyde	51.9	a	9.05	0.38	0.21	0.03	6.26	1.50	3.40	21	11	2.0%
o-xylene	105.3	a	0.25	0.75	0.04	2.74	5.05	0.80	0.04	10	10	1.8%
heptane	49.4	a	0.77	0.30	15.07	1.26	1.61	0.09		19	9	1.7%
propane	17.6	a	3.22	2.26	36.90	3.81	1.18	0.38	5.11	53	9	1.7%
ethylbenzene	73.0	a	0.24	1.75	0.03	4.17	4.93	0.77	0.12	12	9	1.6%
p-xylene	101.0	a	0.19	0.92	0.02	2.92	3.90	0.54	0.06	9	9	1.6%
ethane	12.3	a	5.84	1.46	49.57	0.00	3.15	0.57	5.44	66	8	1.5%
octane	45.3	a	0.06	0.18	13.27	1.10	0.77	0.09		15	7	1.3%
2-methylpropane	30.7	a	1.01	0.24	13.24	0.89	5.96	0.22	0.01	22	7	1.2%
trichloroethene	32.5	a		0.87		18.97			0.06	20	6	1.2%
1,3,5-trimethylbenzene	138.1	a	0.00	0.19		1.82	1.85	0.24		4	6	1.0%
2-butene	113.9	a	0.60	0.14	0.81		2.67	0.21	0.02	4	5	0.9%
2-methylpropene	62.7	a	0.15	0.68	0.26		5.23	1.03	0.00	7	5	0.8%
2-butanone	37.3	a		0.68		11.38	0.24	0.02	0.01	12	5	0.8%
1,2,3-trimethylbenzene	126.7	a	0.00	0.18		1.84	1.07	0.15		3	4	0.7%
methanol	14.0	a		2.01	0.00	26.09			0.07	28	4	0.7%
2-pentene	111.9	a	0.34	0.01	1.41		1.57	0.04	0.00	3	4	0.7%
decane	38.4	a	0.03	0.84	0.03	7.38	0.92	0.47		10	4	0.7%
1,3-butadiene	85.1	a	0.00	0.29	0.01		2.74	0.61	0.01	4	3	0.6%
butyl acetate	26.9	a		0.19		11.19			0.02	11	3	0.6%
1-butanol	62.0	a		0.23		4.58			0.01	5	3	0.5%
methylethylbenzene	94.1	c		0.23		2.91				3	3	0.5%
benzene	21.8	a	3.88	1.41	0.84	0.00	5.06	1.44	0.89	14	3	0.5%
4-methyl-2-pentanone	49.0	a		0.65		5.07				6	3	0.5%
acetaldehyde	64.1	a	0.00	0.75			2.86	0.67		4	3	0.5%
ethyldimethylbenzene	132.0	c		0.11		1.98				2	3	0.5%
1-butene	107.9	a	0.34	0.62	0.23	0.00	1.21	0.12	0.01	3	3	0.5%
naphthalene	97.7	b	0.48	0.02		1.43		0.01		2	2	0.3%
nonane	41.4	a	0.05	0.52	0.08	4.44	0.21	0.11		5	2	0.4%
2-butoxyethanol	48.3	a		0.10		4.48				5	2	0.4%
dipentene	74.5	b		0.01		2.84				3	2	0.4%
1-propanol	56.1	a		0.06		3.29			0.04	3	2	0.3%
acetone	9.4	a	0.19	1.93		17.04	0.81	0.08	0.00	20	2	0.3%
2-methylpentane	42.0	a	0.03	0.99	2.17	1.09		0.01	0.05	4	2	0.3%
2-propanol	18.8	a	0.01	0.73		8.92			0.02	10	2	0.3%
ethyl acetate	20.9	a		1.31		6.98			0.02	8	2	0.3%
undecane	38.4	a	0.00	0.44		3.85		0.19		4	2	0.3%
1-pentene	97.7	a	0.14	0.06	0.29		0.93	0.04	0.00	1	1	0.3%
3-methylpentane	47.9	a	0.02	0.67	1.21	0.86			0.03	3	1	0.2%
1,2,3,5-tetramethylbenzene	136.0	b		0.06		0.84				1	1	0.2%
Total Top 50 (POCP)			**47**	**109**	**261**	**257**	**155**	**21**	**17**	**868**	**399**	**72.3%**
unspeciated	51.3	c	1.86	32.11	1.20	7.06	1.22	0.36	0.01	44	22	4.1%
other grouped species			0.72	23.31	9.51	6.69	34.54	32.53	1.13	108	68	12.3%
other VOC			1.50	29.87	1.80	106.06	19.80	4.44	1.78	165	62	11.3%
Total VOC			**51**	**194**	**274**	**376**	**211**	**59**	**20**	**1186**	**552**	**100%**

2. Status of the measurement programme in 2004

2.1 The station network

The location of the monitoring sites for VOC presented in this report is shown in Figure 1 and an overview of the measurement programme and the responsible laboratories in 2004 is given in Table 3. Totally 14 measurement sites reported VOC data to CCC in 2004, 10 of these with carbonyls and 10 with light hydrocarbons. Due to technical problems with the instrumentation the hydrocarbon samples from the four German sites DE02, DE05, DE08 and DE09 could not be analysed.

Table 4 gives the number of valid (daily) samples of hydrocarbons and carbonyls (after inspection and removal of outliers). According to EMEP's recommendations, the samples should be taken twice a week, implying that 104 samples per year correspond to 100% data cover.

A 90% data completeness, i.e. 94 samples pr year, of daily values is given as data quality objective according to the EMEP manual (EMEP/CCC, 1996). The data capture was lower than this for several sites in 2004. Carbonyls are only measured once per week in France. In addition the number of hydrocarbon samples was slightly below the data quality objective at several of the sites.

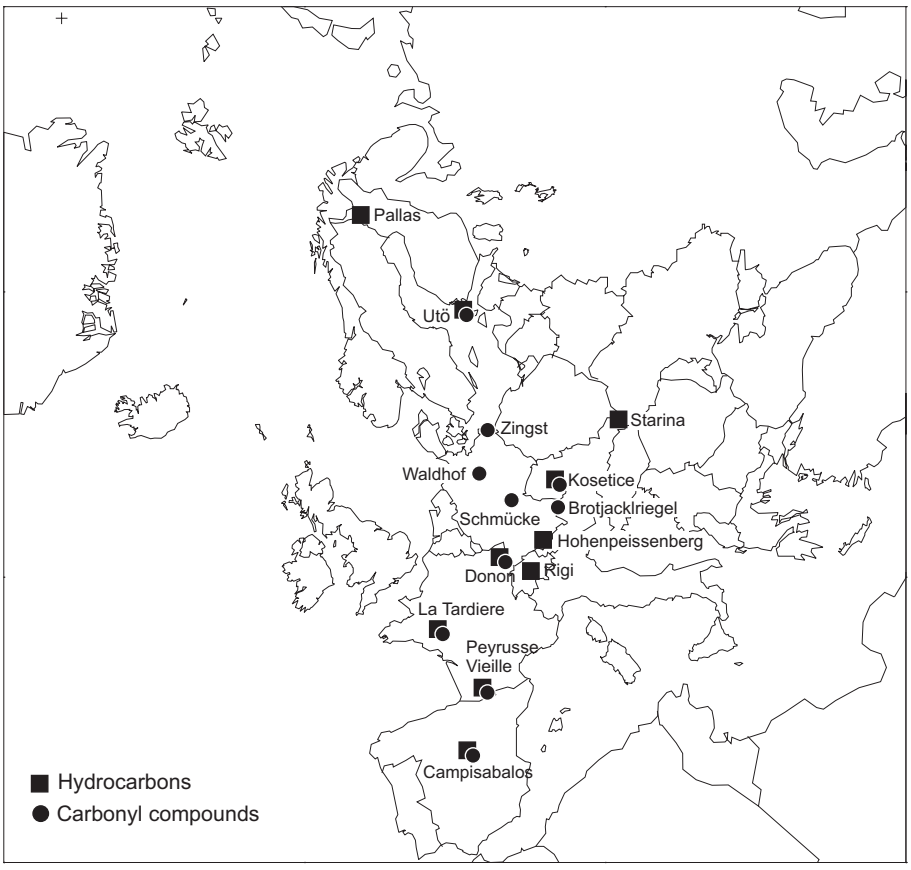

Figure 1: Monitoring sites for VOC in 2004.

Table 3: Status of the VOC monitoring programme in 2004. The columns give the station names, site code, and the sampling frequencies for hydrocarbons (HC) and carbonyl compounds (Carb). The laboratory responsible for the chemical analyses is also given.

Station	Code	HC[1)]	Lab.[2)]	Carb[1)]	Lab.[2)]	Comments
Pallas	FI96	Reg.	FMI	n.m.	-	
Utö	FI09	Reg.	FMI	Reg.	NILU	
Waldhof	DE02	-	-	Reg.	UBA	Grab samples of hydrocarbons not reported at the German sites due to technical problems.
Schmücke	DE08	-	-	Reg.	UBA	
Zingst	DE09	-	-	Reg.	UBA	
Brotjacklriegel	DE05	-	-	Reg.	UBA	
Hohenpeissenberg	DE43	Daily	DWD	n.m.	-	GAW station
Košetice	CZ03	Reg.	CHMI	Reg.	NILU	
Starina	SK06	Reg.	SHMI	n.m.	-	
Rigi	CH05	Cont.	EMPA	n.m.	-	
Donon	FR08	Reg.	EMD	Reg.	EMD	
Peyrusse Vieille	FR13	Reg.	EMD	Reg.	EMD	
La Tardiere	FR15	Reg.	EMD	Reg.	EMD	
Campisábalos	ES09	Reg.	MMA	Reg.	MMA	Monitoring of carbonyls started in May 2004.

1) Reg. = regularly, Scat. = scattered, n.m. = not measured., cont. = Continuous
2) CHMI = Czech Hydrometeorological Institute
DWD = Deutscher Wetterdienst
EMD = Ecole des Mines de Douai (France)
EMPA = Swiss Federal Lab. for Materials Testing and Research
FMI = Finnish Meteorological Institute
MMA = Ministerio de Medio Ambiente (Spain)
NILU = Norwegian Institute for Air Research
SHMI = Hydrometeorological Institute in Slovakia
UBA = Umweltbundesamt (Germany)

Table 4: The number of samples of hydrocarbons (HC) and carbonyls (Carb) in 2004.

Station	Number of samples	
	HC	Carb
Pallas	93	-
Utö	100	91
Zingst	-	95
Waldhof	-	95
Schmücke	-	97
Brotjacklriegel	-	42
Hohenpeissenberg[1)]	340	-
Košetice	91	98
Starina	86	-
Rigi[1)]	301	-
Donon	103	51
Peyrusse Vieille	80	48
La Tardiere	84	52
Campisábalos	99	102

[1)] Refer to days with monitoring data

2.2 Analytical procedures and quality control

The procedures for sampling and chemical analyses were similar in 2004 as in previous years, and are not discussed in this report. A detailed description of the procedures used by NILU is given in the EMEP manual (EMEP/CCC, 1996). The technical procedures for the sampling and analysis of hydrocarbons by FMI at the two Finnish stations, as well as a site description and data interpretation, are given by Laurila and Hakola (1996). A presentation of the sampling and analyses performed by the laboratories at EMD (France), EMPA (Switzerland), CHMI (Czech Republic), MMA (Spain), SHMI (Slovakia) and UBA (Germany) has been given in previous annual reports and by Solberg et al. (1996) and is not repeated here. The instrumentation and methods applied by DWD at Hohenpeissenberg have been successfully tested in two international intercomparison experiments (NOMHICE, AMOHA) and have been documented by Plass-Dülmer et al. (2002).

For the EMEP VOC measurements in general, the quality control of the VOC measurements includes QA procedures at all stages from sampling to chemical analyses and integration. The QA procedures are described in the EMEP manual (EMEP/CCC, 1996) and are the laboratories' responsibility to follow up. In addition, data received from the individual laboratories are inspected before classified as valid or invalid by the EMEP/CCC.

A few notes about the measurements are given in the following. The concentrations of 3-buten-2-one, 2-methylpropenal, 2-butanone and butanal have for many years been difficult to interpret. No systematic and explainable pattern has been found and inter-laboratory comparisons between EMD, UBA and NILU have indicated analytical problems. Laboratory studies at CCC indicate that unsaturated carbonyl compounds are not chemical stable in the prepared sample solution. Furthermore, LC/MS studies indicate possibilities of chromatographic interference in the C_4 carbonyl compound range. Thus, a revision of the monitoring procedures for carbonyls is needed.

3. VOC concentrations in 2004

3.1 General

Monthly mean and median concentrations of the individual hydrocarbons and carbonyls for 2004 are tabulated in Appendix A. The monthly statistics were not calculated for sample numbers less than 4. Time series of all compounds during 2004 are given in Appendix B. For the continuous monitor data from CH05 Rigi the average of two 2-hourly values around noon were used in the calculations whilst the sample taken around noon at Hohenpeissenberg were used (samples from noon and midnight were reported). Based on previous experience there is not much difference in the anthropogenic HC concentrations at noon and at midnight at Hohenpeissenberg (pers. comm., Christian Plass-Dülmer). For isoprene the difference is substantial as this is a reactive biogenic compound, emitted during daytime, with low concentrations during night.

A comparison of the seasonal mean and percentile concentrations of hydrocarbons in winter (Jan., Feb., Nov., Dec.) and carbonyls in summer (May, June, July, Aug.) measured at the different stations is given in Figure 2 and Figure 3.

Considering that the sites span a wide area from south to the most northern part of Europe, the hydrocarbon winter mean levels are fairly uniform for the alkanes with a few exceptions. The concentration level of the most low-weight hydrocarbons at Campisábalos were lower than expected which need to be investigated further. Furthermore, the concentration level of butane and pentane at Starina were considerably higher than at the other sites. Larger regional differences are seen for the alkenes, partly explained by the chemical reaction with O_3, making these compounds less stable in winter, even in absence of an effective OH oxidation at that time of year.

The summer seasonal means and percentiles for four selected carbonyls, formaldehyde, acetaldehyde, acetone and butanone, are given in Figure 3. This shows a marked north-south difference in concentration level of formaldehyde (methanal) and acetone (propanone) with low concentrations in the north and higher in the south. Acetaldehyde on the other hand show highest concentrations at Košetice. One explanation for this is that formaldehyde is controlled by degradation of the biogenic emitted compound isoprene whereas acetaldehyde, on the other hand is to a larger extent a primary or secondary product of anthropogenic emissions.

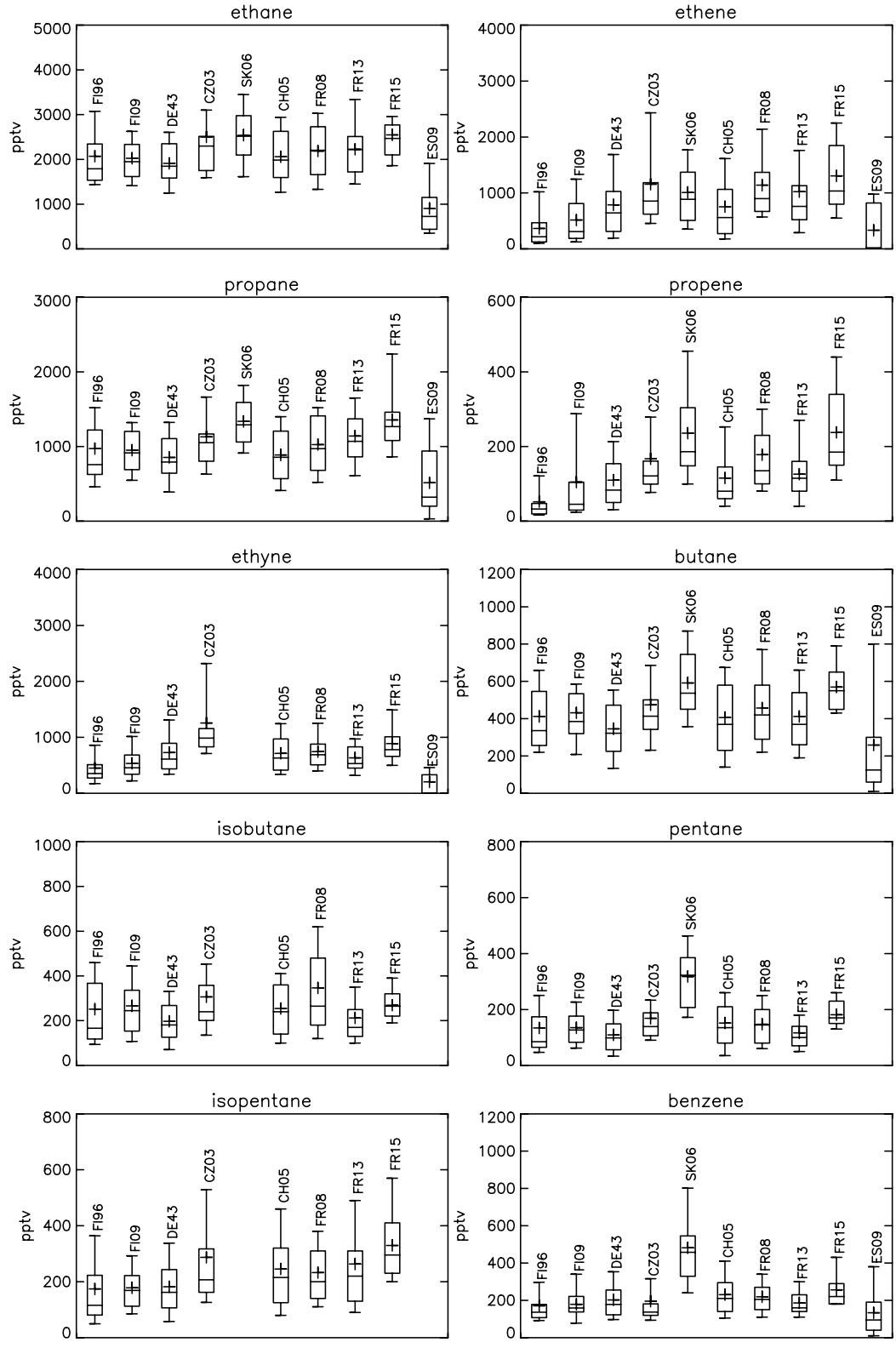

Figure 2: Box- and whisker-diagrams for hydrocarbons during winter 2004 (Jan., Feb., Nov., Dec.). The markers indicate the 10-, 25-, 50-, 75- and 90-percentiles. Mean values are indicated by a cross.

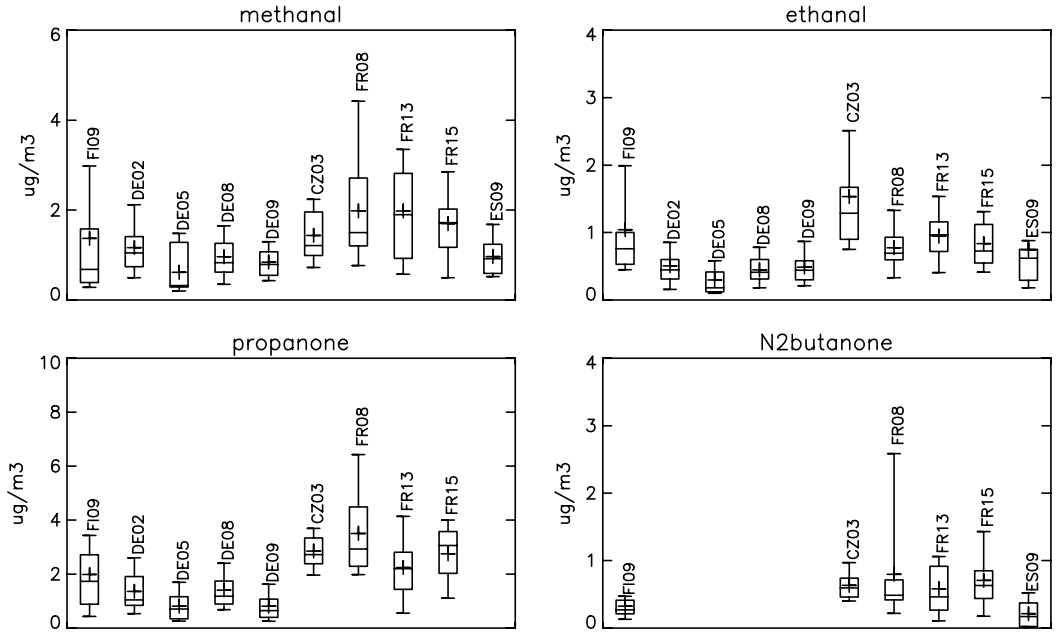

Figure 3: Box- and whisker-diagrams for carbonyls during summer 2004 (May, June, July, August). The markers indicate the 10-, 25-, 50-, 75- and 90-percentiles. Mean values are indicated by a cross.

3.2 Regional distribution of VOC

Figure 4–Figure 13 shows maps with the stations' median concentrations of 10 light hydrocarbons for the winter months January, February, November and December in 2004 taken together. These medians are based on the average of the two 2-hourly values around noon at Rigi and on the day-time values at Hohenpeissenberg.

Although the number of sites obviously is too low to give a clear picture of the regional background distribution of hydrocarbons in Europe, some characteristics are indicated by these results. Similar figures for three carbonyls for the summer months May-August 2004 are given in Figure 14–Figure 16.

As noted in previous reports, the measurements indicate that hydrocarbons become fairly well mixed in Europe in winter. Components indicative of natural gas emissions, ethane and propane, normally show less geographical variations and with higher concentrations in north and east, whereas e.g. ethene, propene and acetylene normally are higher in central and eastern parts of the continent. However, the results from the winter months in 2004 show larger differences between central European sites with higher concentrations compared to lower levels in the north for all compounds.

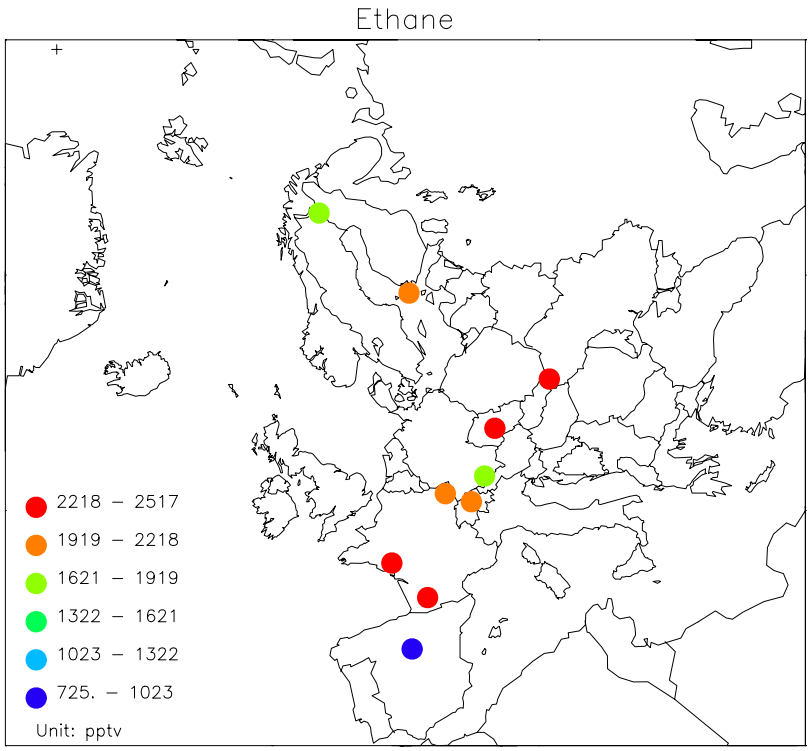

Figure 4: Median concentration of ethane at EMEP sites in the winter months November, December, January and February 2004 taken together.

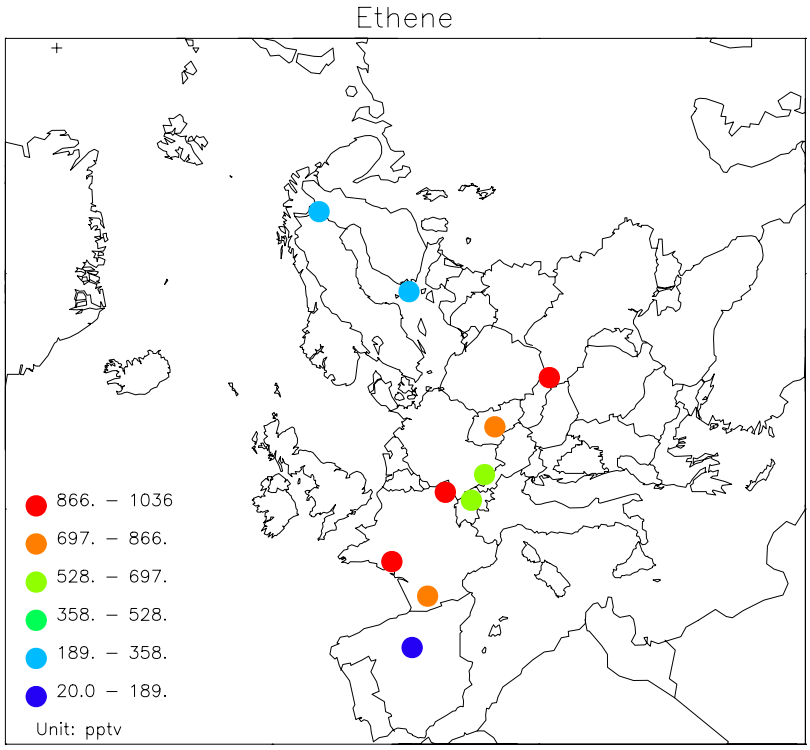

Figure 5: Median concentration of ethene at EMEP sites in the winter months November, December, January and February 2004 taken together.

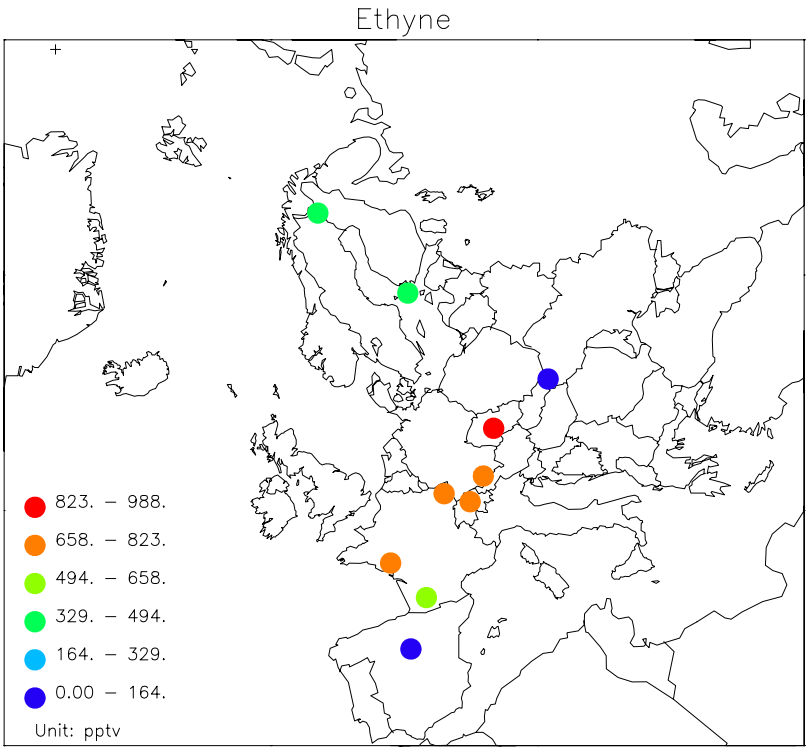

Figure 6: Median concentration of acetylene at EMEP sites in the winter months November, December, January and February 2004 taken together.

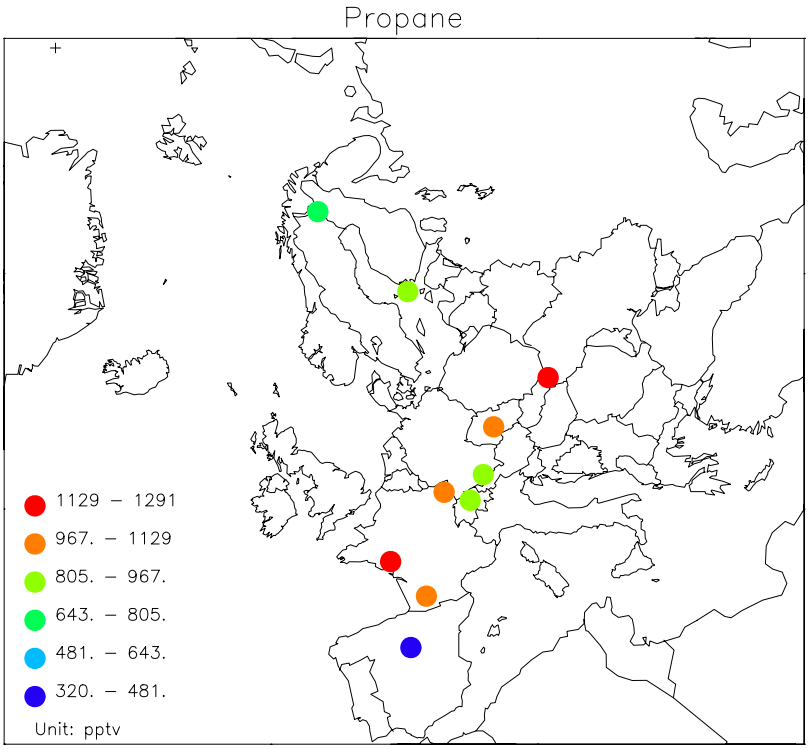

Figure 7: Median concentration of propane at EMEP sites in the winter months November, December, January and February 2004 taken together.

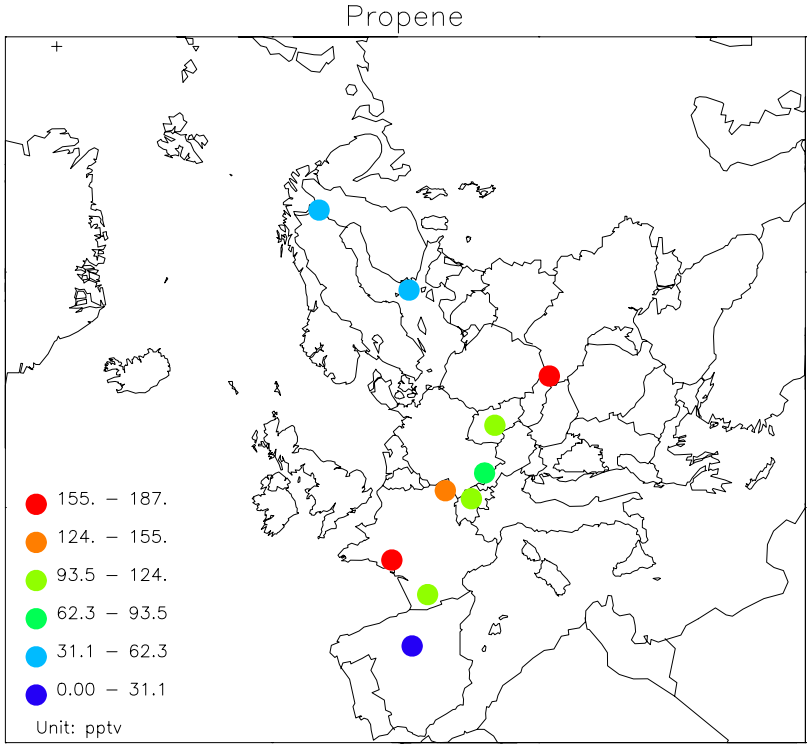

Figure 8: Median concentration of propene at EMEP sites in the winter months November, December, January and February 2004 taken together.

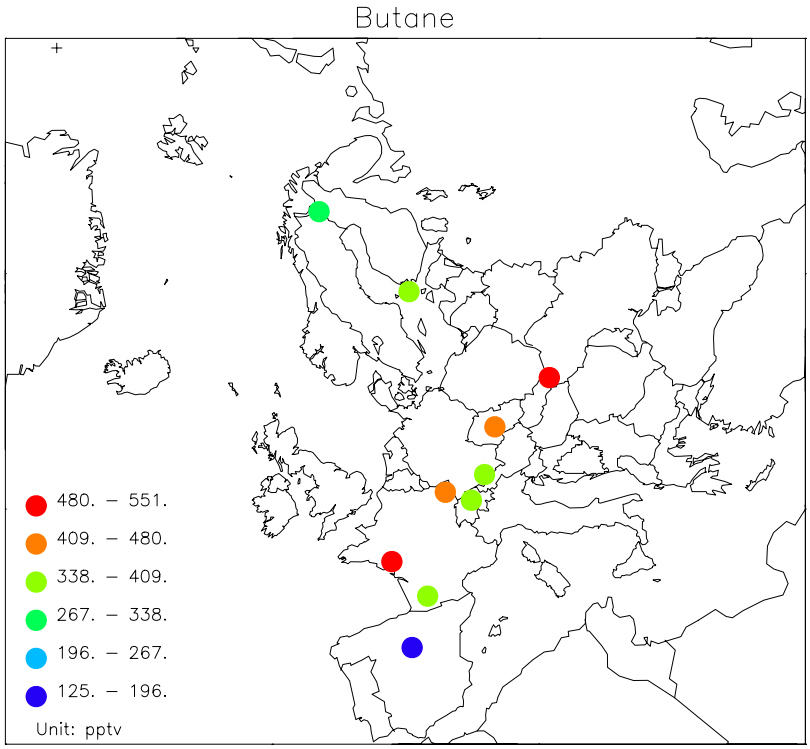

Figure 9: Median concentration of n-butane at EMEP sites in the winter months November, December, January and February 2004 taken together.

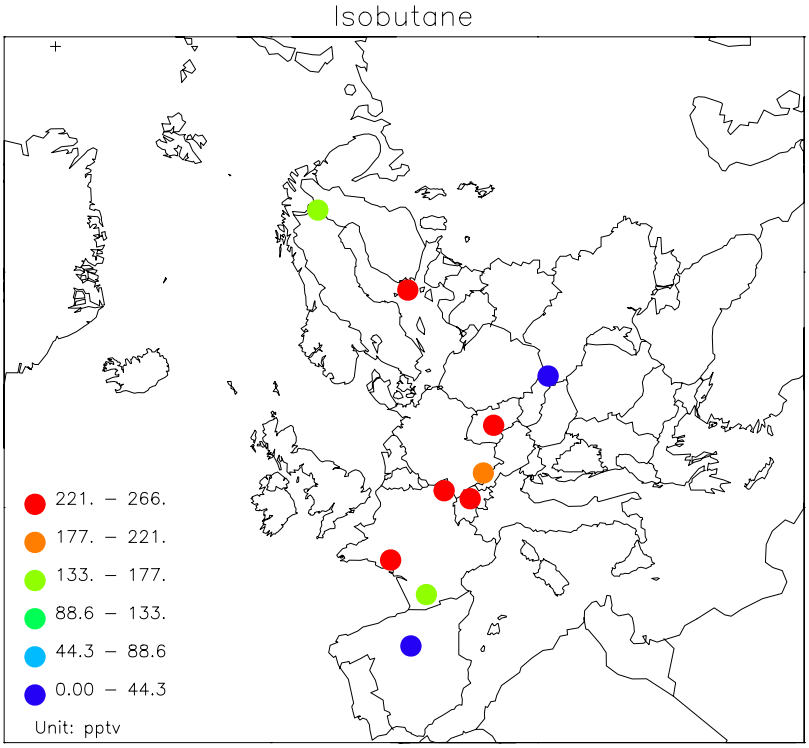

Figure 10: Median concentration of i-butane at EMEP sites in the winter months November, December, January and February 2004 taken together.

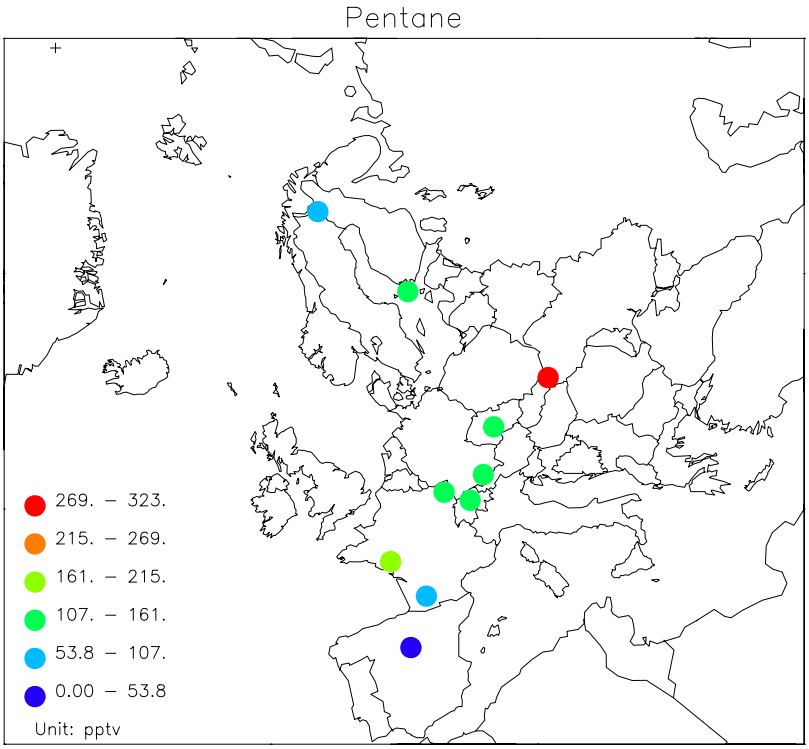

Figure 11: Median concentration of n-pentane at EMEP sites in the winter months November, December, January and February 2004 taken together.

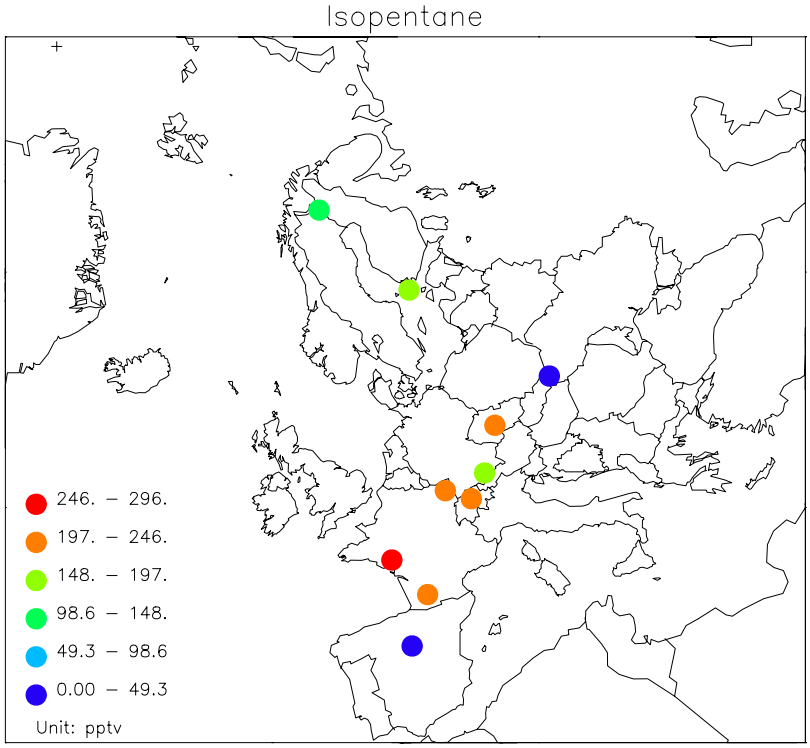

Figure 12: Median concentration of i-pentane at EMEP sites in the winter months November, December, January and February 2004 taken together.

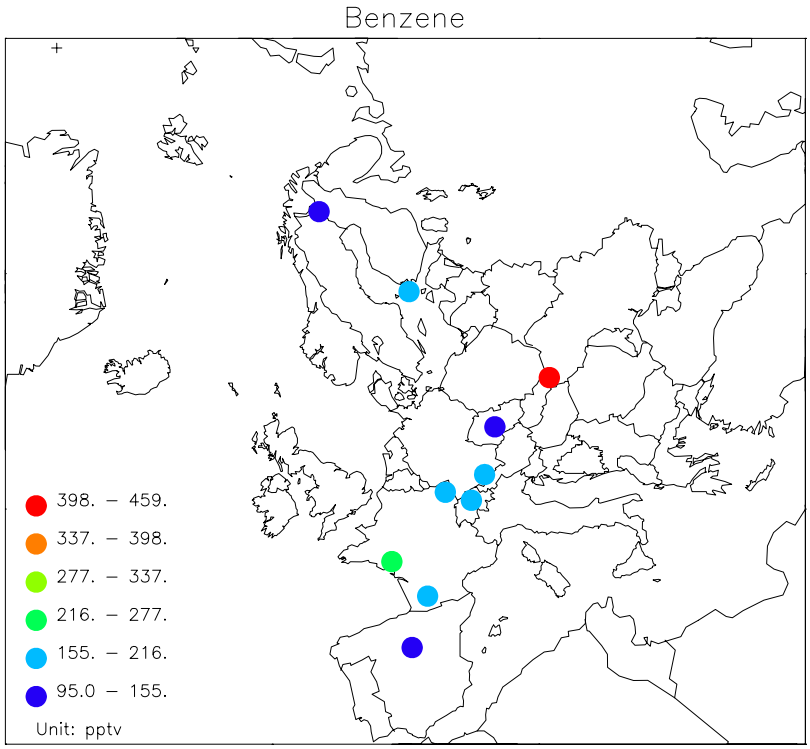

Figure 13: Median concentration of benzene at EMEP sites in the winter months November, December, January and February 2004 taken together.

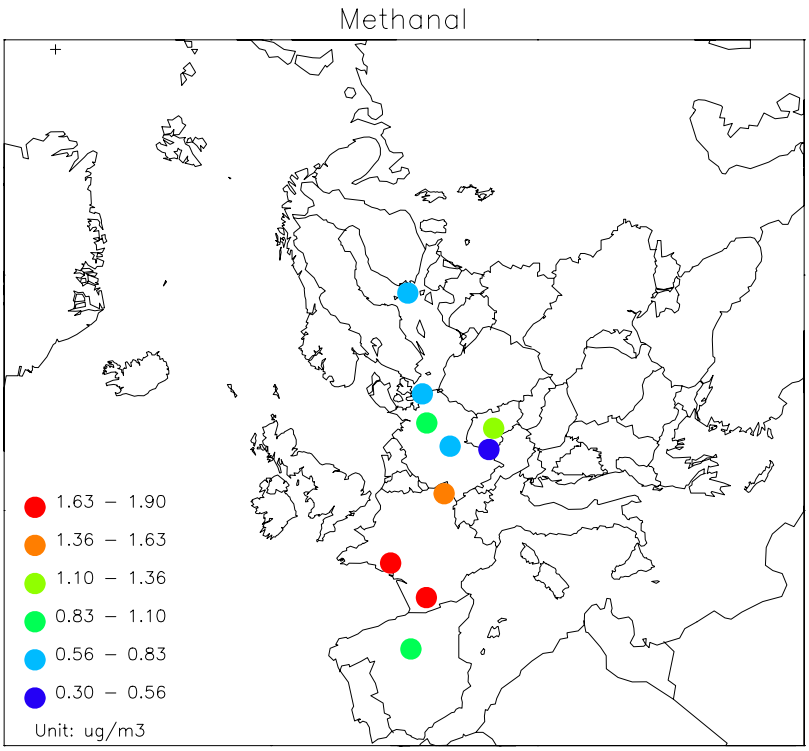

Figure 14: Median concentration of formaldehyde at EMEP sites in the summer months May, June, July and August 2004 taken together.

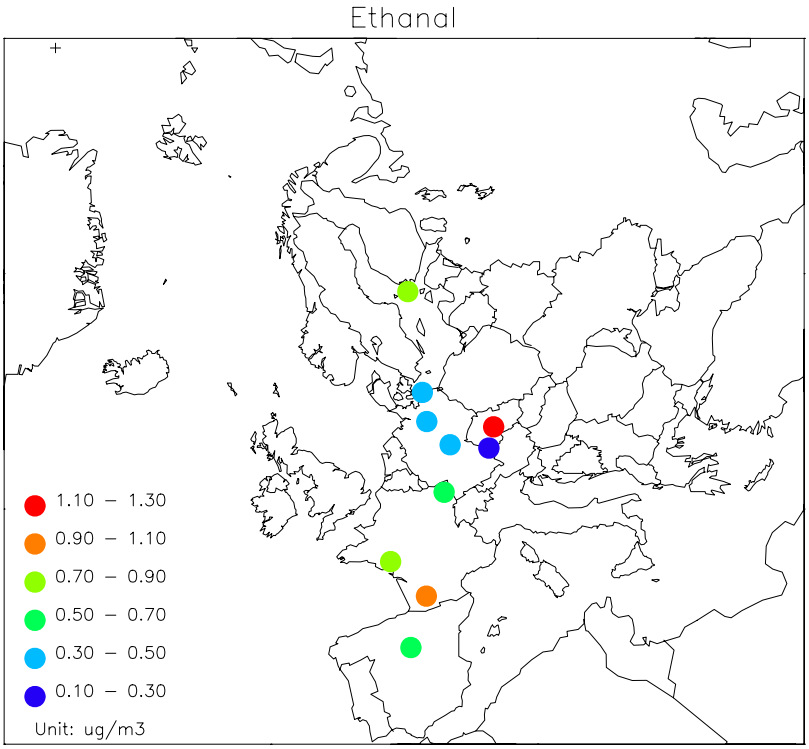

Figure 15: Median concentration of acetaldehyde at EMEP sites in the summer months May, June, July and August 2004 taken together.

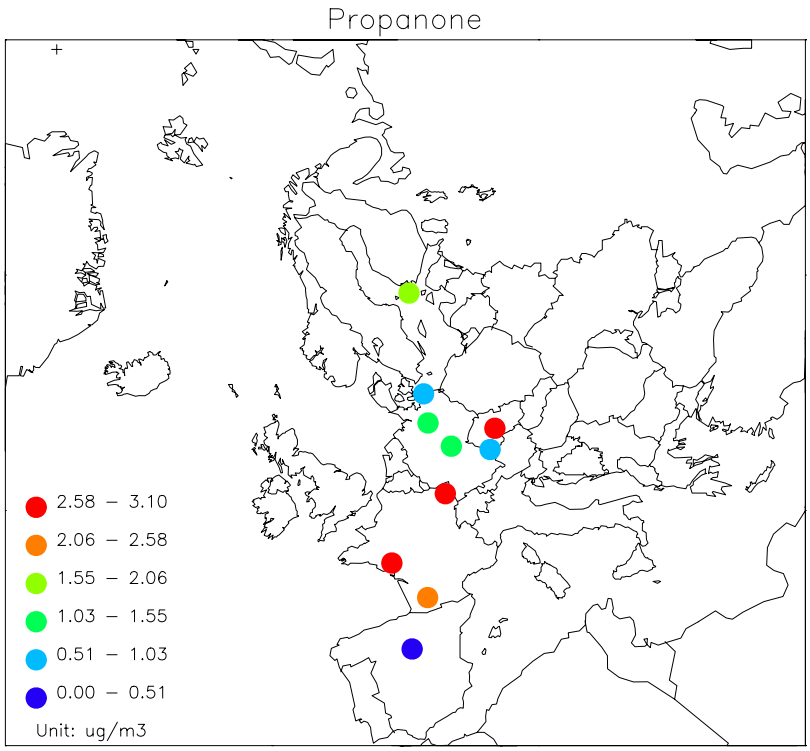

Figure 16: Median concentration of acetone at EMEP sites in the summer months May, June, July and August 2004 taken together.

4. Long-term trends in VOC

The 10 year's trend in the measured VOC from 1995 is indicated in Figure 17 showing the winter medians at Košetice (CZ03), Utö (FI09), Pallas (FI96), Donon (FR08), Peyrusse Vieille (FR13) of selected hydrocarbons.

In addition to the emission source strength, these long-term trends or variations will be largely controlled by inter-annual changes in weather conditions and atmospheric stability. Furthermore, the changes in chemical analysing laboratory may also have a significant impact on the median concentrations and this is marked in the Figures. Note that the parallel sampling and analyses has not necessarily been carried out during the whole season. Thus, large differences between two laboratories for the same year may give a false impression of the laboratory differences.

The 10 year's trend, or variations, in the winter medians clearly varies for the various hydrocarbons as indicated by Figure 17 and no overall picture is seen. For some compounds, like butane, the results do indicate a long-term reduction in the winter median concentration level, whereas for other compounds, there are signs of a concentration levelling off or even increasing during the last few years. However, to separate the sole effect of changes in European VOC emissions on the observed concentrations trends in Figure 17 requires a number of detailed model calculations. Furthermore, due to the large scatter in data values from year to year, a linear trend is of little value to assign.

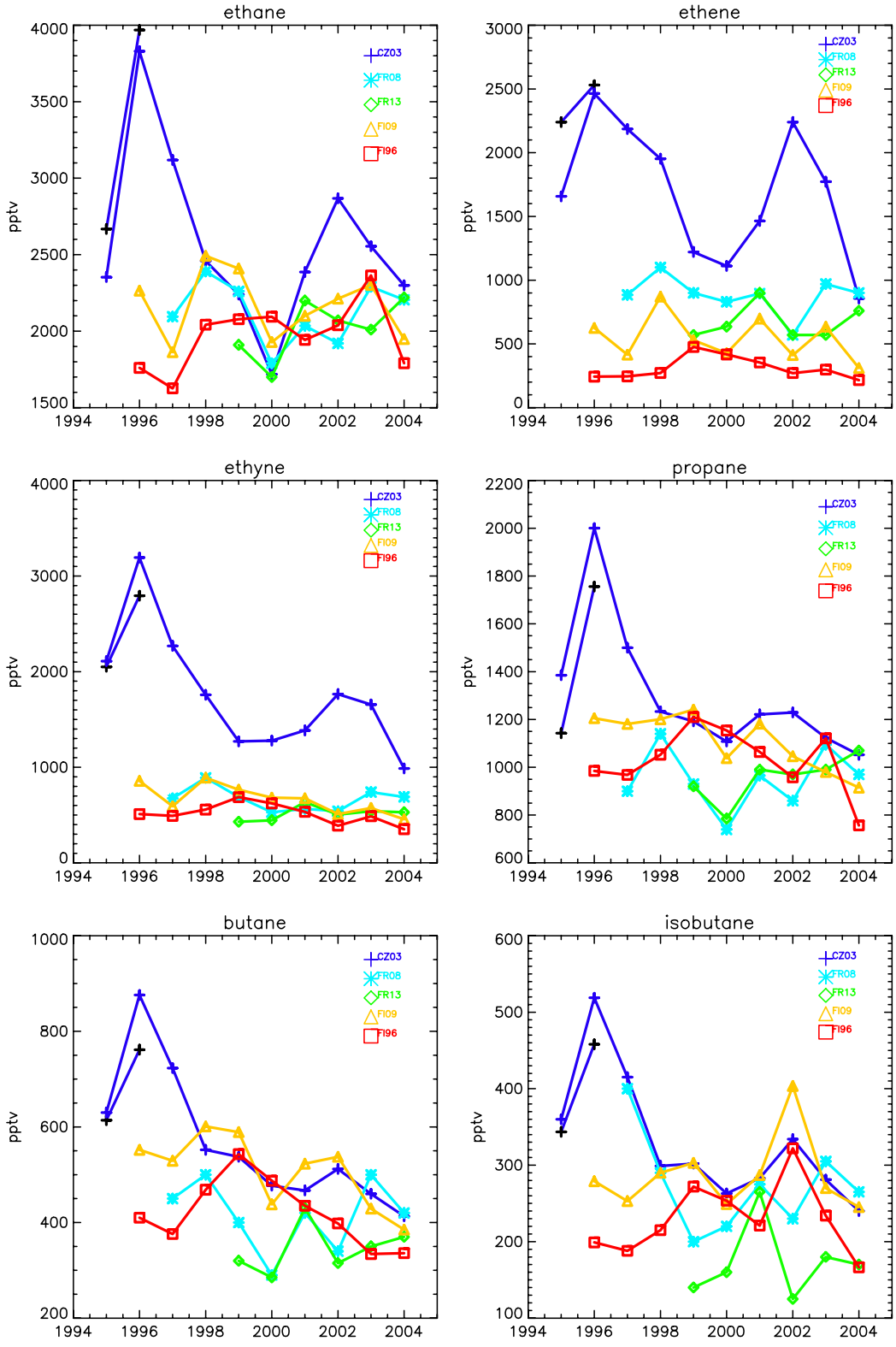

Figure 17: Annual winter (Jan., Feb., Nov., Dec.) median concentrations of hydrocarbons at Košetice (CZ03), Waldhof (DE02), Donon (FR08), Peyrusse Vieille (FR13), Utö (FI09) and Pallas (FI96). Black symbols mark analyses from NILU's lab., coloured symbols mark the national lab.

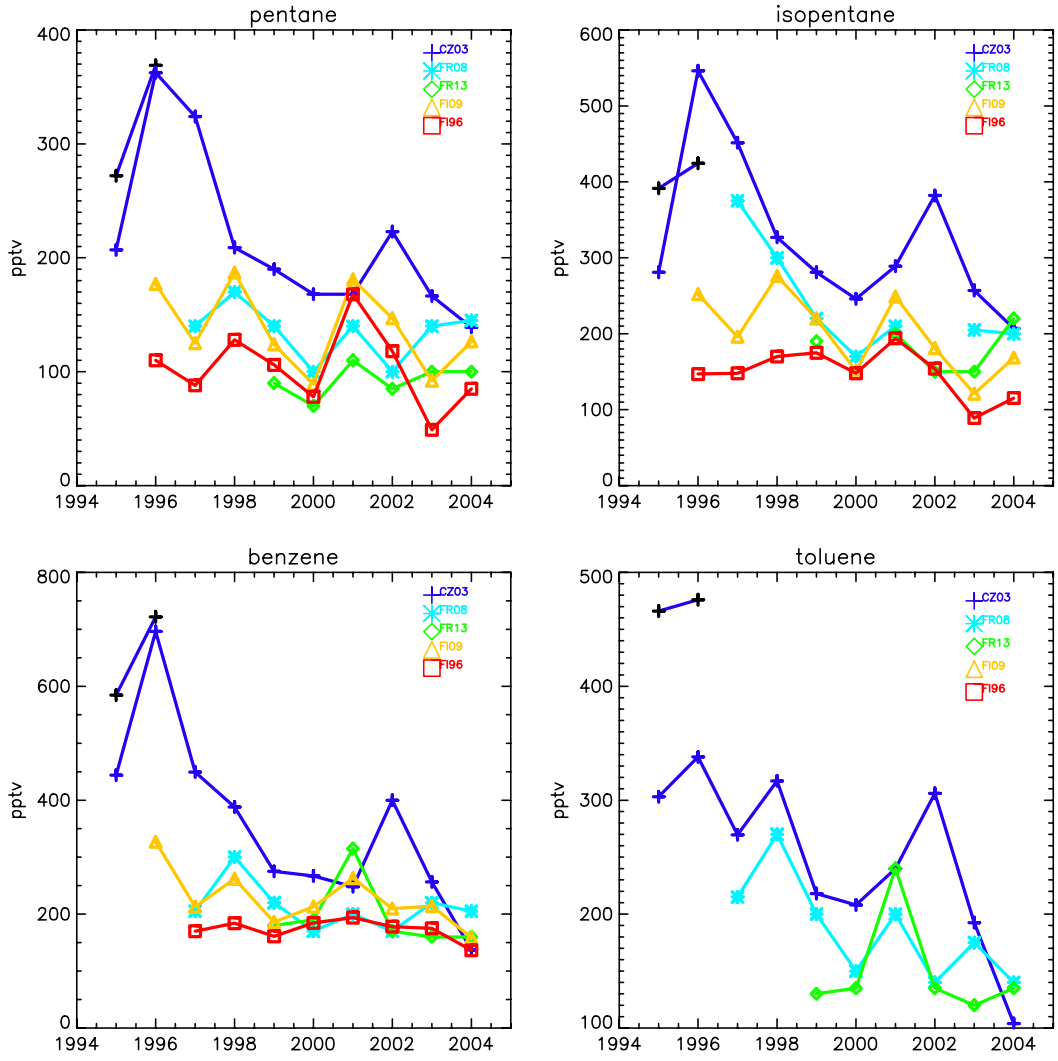

Figure 17, cont.

5. Acknowledgement

We would like to thank all people involved in the sampling and handling of hydrocarbon canisters and DNPH tubes. We are very grateful for the VOC measurement data provided by Patrice Coddeville (EMD), Christian Dye (NILU), Hannele Hakola (FMI), Radek Pokorny (CHMI), Marta Mitosinkova (SHMI), Alberto Gonzalez Ortiz (MMA), Karin Uhse (UBA), Christian Plass-Dülmer (DWD) and Stefan Reimann (EMPA).

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Appendix A

Monthly mean and median concentrations of hydrocarbons and carbonyls in 2004

Monthly mean and median concentrations (first and second line, respectively) of hydrocarbons (pptv)

ETHANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	3035	2353	2317	1862	1320	1002	808	841	929	1081	1451	1753
	2435	2471	2290	1765	1303	994	768	799	909	1043	1504	1715
Utö	2612	2241	2388	2033	1444	1086	898	850	993	1281	1489	1783
	2420	2242	2352	2075	1373	1075	838	841	983	1129	1538	1788
Hohenpeissenberg	2139	2302	2398	1921	1487	963	824	901	941	1058	1598	1707
	2123	2351	2424	1878	1441	957	809	894	921	1036	1626	1692
Starina	3364	2521	2274	2283	1444	1133	1082	1074	1358	1550	2188	2443
	3082	2251	2207	2279	1477	1081	1045	1078	1374	1518	2188	2629
Košetice	2494	2269	2374	1962	1494	964	887	733	877	1337	2738	-
	2377	2321	2458	1932	1462	898	795	777	826	1296	1657	-
Rigi	2359	2495	2641	2300	1643	1321	1107	1014	1254	1417	1629	1566
	2285	2640	2650	2270	1610	1320	1110	980	1260	1370	1620	1560
La Tardière	2400	2664	2531	2014	1700	1335	843	803	876	-	2620	-
	2320	2670	2510	2020	1440	1165	820	780	850	-	2155	-
Donon	2471	2608	2559	2106	1562	995	841	919	1008	1196	1536	2106
	2670	2610	2675	2100	1550	955	880	940	1000	1160	1540	2060
Peyrusse Vieille	1920	2984	2303	1813	1410	1077	926	720	-	1075	1723	-
	1790	3180	2120	1780	1410	1140	860	715	-	1110	1615	-
Campisábalos	916	1745	1768	1074	709	442	482	740	748	417	429	585
	910	1880	1735	1050	690	445	435	770	635	420	400	480

ETHENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	785	333	225	151	52	64	83	89	80	101	163	265
	872	180	114	132	54	59	83	79	66	89	113	227
Utö	748	596	405	382	223	338	202	164	205	272	276	451
	446	650	365	242	193	190	185	164	176	157	151	292
Hohenpeissenberg	807	685	724	356	256	200	220	214	268	498	869	896
	566	625	645	306	223	172	192	196	241	334	673	634
Starina	1543	867	561	323	183	131	206	159	304	386	829	1019
	1351	698	550	290	183	117	203	170	279	369	498	1151
Košetice	1264	645	1458	354	288	233	229	112	162	768	1547	-
	1041	603	798	240	187	181	212	106	134	696	1026	-
Rigi	880	748	880	505	534	328	283	237	226	419	822	550
	610	635	830	460	310	290	250	210	170	280	640	360
La Tardière	1276	1100	736	394	286	318	310	250	242	-	1250	-
	1020	925	700	370	260	340	250	230	250	-	1090	-
Donon	1296	886	771	446	387	291	293	377	411	525	835	1482
	1370	830	770	410	350	290	280	320	350	455	675	1320
Peyrusse Vieille	544	1625	420	300	267	244	171	343	-	309	850	-
	440	970	410	290	270	230	165	275	-	325	755	-
Campisábalos	361	996	866	117	67	40	55	103	89	14	8	6
	150	925	870	30	30	20	35	89	90	8	5	5

PROPANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	1598	1121	1028	559	229	115	152	155	221	348	549	808
	1221	1286	909	480	223	120	125	133	207	344	591	757
Utö	1224	1053	1090	753	332	257	226	196	293	455	632	904
	1285	1093	1183	731	248	206	210	208	292	385	603	883
Hohenpeissenberg	990	1055	1025	589	366	228	217	276	330	406	711	746
	942	1082	1033	564	334	212	194	262	311	382	735	735
Starina	1722	1305	1872	1100	501	398	445	431	539	743	1139	1350
	1591	1251	1583	830	457	355	427	442	514	687	1118	1260
Košetice	1189	1014	970	624	381	232	245	180	254	619	1180	-
	1137	1062	903	576	399	212	167	165	278	600	663	-
Rigi	1065	1109	1003	699	398	316	338	299	418	472	671	651
	980	1170	975	680	410	280	340	280	400	430	640	610
La Tardière	1270	1304	1061	636	463	372	246	217	298	-	1555	-
	1200	1295	1035	600	330	285	260	220	270	-	1315	-
Donon	1209	1219	1045	663	360	205	192	284	396	451	663	996
	1370	1230	1150	650	340	185	190	240	360	325	660	970
Peyrusse Vieille	909	1461	880	504	331	259	234	-	-	479	966	-
	800	1515	780	480	320	270	195	-	-	445	920	-
Campisábalos	452	1183	1110	357	219	122	138	204	173	68	122	355
	290	1265	1100	280	165	115	110	190	110	45	100	360

PROPENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	105	49	30	35	26	30	32	32	25	26	24	40
	77	32	27	35	26	31	32	30	23	27	21	39
Utö	128	198	93	77	70	142	84	53	59	45	39	64
	47	120	69	63	54	57	65	50	48	37	30	46
Hohenpeissenberg	103	93	87	61	50	51	62	51	43	69	129	122
	78	77	75	50	45	45	62	45	40	48	90	91
Starina	300	177	193	74	58	405	223	57	71	103	188	307
	245	179	131	67	57	441	73	56	67	74	148	329
Košetice	149	90	152	48	46	40	35	23	26	115	264	-
	131	84	100	33	32	32	33	24	25	121	141	-
Rigi	125	112	115	80	88	141	55	41	65	95	146	86
	80	90	110	70	70	130	50	40	50	70	110	70
La Tardière	221	171	123	71	56	67	92	86	71	-	287	-
	170	165	120	60	50	65	80	70	70	-	220	-
Donon	184	118	94	68	66	58	67	89	92	100	138	261
	170	110	95	70	60	55	60	80	70	85	125	230
Peyrusse Vieille	77	156	47	43	47	54	53	98	-	74	145	-
	80	125	50	40	50	60	45	95	-	80	120	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

ETHYNE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	769	532	512	436	172	77	74	76	115	173	272	325
	800	477	430	371	167	75	77	59	103	172	275	340
Utö	730	572	649	506	118	140	138	131	173	271	383	454
	625	485	646	437	70	123	123	126	125	206	297	390
Hohenpeissenberg	816	758	942	549	324	191	182	223	-	-	676	733
	727	751	896	503	305	183	165	215	-	-	533	601
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	1384	896	2409	732	398	239	247	188	220	706	1468	-
	1155	897	1317	610	371	203	200	170	196	689	941	-
Rigi	726	740	1449	1313	461	501	393	477	444	530	858	631
	610	720	1310	1130	480	450	360	440	420	440	745	510
La Tardière	933	890	708	463	262	153	234	149	152	-	677	-
	750	735	685	470	210	150	120	140	150	-	600	-
Donon	877	715	791	513	292	170	162	236	254	306	531	831
	800	675	705	490	310	155	150	240	250	250	440	770
Peyrusse Vieille	549	824	600	343	280	137	109	143	-	250	478	-
	510	775	610	310	220	120	105	130	-	210	420	-
Campisábalos	149	671	450	19	5	5	5	33	11	5	5	19
	5	415	390	5	5	5	5	5	5	5	5	5

BUTANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	637	487	351	134	40	28	36	40	60	93	217	382
	629	529	367	109	41	29	29	30	51	96	244	414
Utö	458	473	352	250	144	107	78	65	92	160	266	533
	442	489	353	237	113	72	65	64	92	123	262	402
Hohenpeissenberg	396	404	362	162	111	92	87	100	-	-	321	299
	392	424	334	151	99	86	80	96	-	-	284	296
Starina	721	524	864	442	199	178	198	224	237	337	542	634
	713	493	749	280	172	159	184	197	234	276	539	558
Košetice	497	412	596	200	139	170	107	58	91	255	511	-
	454	405	372	168	136	125	67	55	88	228	253	-
Rigi	460	474	433	236	206	153	170	138	190	242	367	302
	410	500	410	220	200	150	160	110	180	190	320	280
La Tardière	543	583	380	229	178	177	120	114	141	-	572	-
	510	550	375	220	130	135	120	90	140	-	555	-
Donon	556	511	395	236	194	84	116	149	198	200	289	460
	570	450	415	190	110	70	120	130	200	130	270	470
Peyrusse Vieille	321	570	269	149	124	94	118	-	-	190	302	-
	260	595	220	130	120	100	85	-	-	180	300	-
Campisábalos	179	698	589	122	110	37	59	87	65	12	29	168
	120	790	605	70	40	35	40	90	40	5	20	165

ISOBUTANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	488	335	221	95	23	15	23	27	35	58	100	163
	458	368	189	82	22	16	18	23	34	53	105	149
Utö	337	325	283	165	91	65	66	43	57	95	132	276
	320	335	266	164	30	37	49	42	59	75	117	205
Hohenpeissenberg	219	235	221	103	69	58	55	61	80	100	190	179
	210	240	211	98	60	53	50	58	75	86	163	166
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	312	263	395	159	84	91	72	39	54	163	344	-
	276	232	266	118	76	66	40	45	58	150	146	-
Rigi	297	323	326	192	106	82	89	79	107	135	209	166
	275	340	320	190	110	80	80	60	100	110	180	150
La Tardière	251	279	209	106	70	55	67	37	55	-	250	-
	230	270	205	100	50	45	50	30	60	-	235	-
Donon	354	309	243	129	81	52	66	84	144	130	250	457
	310	260	225	110	70	40	50	70	130	75	210	380
Peyrusse Vieille	167	285	149	70	43	39	28	95	-	96	160	-
	130	255	120	60	40	40	25	40	-	85	130	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

BUTENES

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Starina	135	91	75	43	45	37	48	36	36	47	60	69
	132	80	60	39	44	40	46	36	35	32	52	71
Košetice	228	267	160	62	64	148	136	32	28	39	98	-
	67	180	72	56	49	91	40	33	22	42	93	-
Rigi	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
La Tardière	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Donon	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Peyrusse Vieille	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Campisabalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

BUT-1-ENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	27	16	12	13	10	12	14	11	13	12	10	11
	16	11	11	12	10	14	14	9	13	11	10	10
Utö	40	67	32	23	23	42	26	18	18	14	12	17
	14	31	23	18	21	18	22	18	17	15	11	15
Hohenpeissenberg	20	17	17	10	8	7	9	8	8	14	25	22
	15	14	15	8	7	7	8	7	7	10	18	16
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Rigi	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
La Tardière	44	39	28	21	16	25	28	33	29	-	58	-
	40	35	20	20	10	25	30	30	30	-	55	-
Donon	37	25	23	18	22	15	23	22	20	25	28	47
	30	20	20	20	20	20	20	20	20	20	25	40
Peyrusse Vieille	13	29	11	6	12	15	12	38	-	17	27	-
	20	30	10	5	10	10	10	35	-	15	30	-
Campisábalos	42	139	98	18	18	8	8	15	13	5	5	5
	20	140	90	5	5	5	5	10	10	5	5	5

TRANS-2-BUTENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	23	25	22	22	18	12	13	12	7	8	9	5
	24	24	22	22	18	12	13	13	8	9	10	3
Utö	27	31	24	24	23	16	15	11	10	5	9	6
	25	28	26	23	22	14	14	11	10	3	8	6
Hohenpeissenberg	9	8	9	8	7	7	9	-	6	7	11	9
	7	7	8	7	7	6	8	-	6	7	8	7
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Rigi	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
La Tardière	14	11	7	7	5	5	7	5	6	-	10	-
	10	5	5	5	5	5	5	5	5	-	5	-
Donon	7	5	7	5	9	6	5	6	5	8	5	11
	5	5	5	5	5	5	5	5	5	5	5	5
Peyrusse Vieille	7	6	5	6	5	5	5	5	-	5	5	-
	5	5	5	5	5	5	5	5	-	5	5	-
Campisábalos	16	63	36	11	29	5	6	7	5	5	5	5
	10	60	35	5	5	5	5	5	5	5	5	5

CIS-2-BUTENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	8	5	6	3	3	3	3	4	3	3	3	3
	9	3	3	3	3	3	3	3	3	3	3	3
Utö	15	11	8	8	4	6	7	5	3	3	3	4
	11	6	3	8	3	3	3	3	3	3	3	3
Hohenpeissenberg	7	7	7	5	4	3	4	4	4	4	8	6
	7	6	6	4	4	3	3	4	4	4	6	5
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Rigi	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
La Tardière	12	9	7	7	5	5	7	6	5	-	8	-
	5	5	5	5	5	5	5	5	5	-	5	-
Donon	7	5	6	5	9	5	5	5	5	5	5	7
	5	5	5	5	5	5	5	5	5	5	5	5
Peyrusse Vieille	5	5	5	6	5	5	6	5	-	5	5	-
	5	5	5	5	5	5	5	5	-	5	5	-
Campisábalos	110	723	536	120	19	84	66	90	93	-	22	26
	50	820	590	40	10	10	25	30	80	-	30	5

PENTANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	269	155	122	46	13	12	17	18	24	38	57	91
	177	180	113	38	13	12	14	15	18	37	62	85
Utö	208	150	173	122	60	89	53	53	61	69	80	103
	199	154	165	97	43	37	50	49	62	58	70	100
Hohenpeissenberg	113	134	121	58	57	56	45	51	51	80	120	97
	106	129	113	55	47	45	34	44	46	49	96	77
Starina	397	273	625	252	153	121	165	180	174	189	324	306
	386	237	530	138	148	124	143	185	184	165	301	323
Košetice	177	125	205	71	65	133	52	28	41	120	203	-
	172	124	119	64	67	83	36	28	36	125	97	-
Rigi	153	163	161	110	164	108	130	104	170	164	201	112
	130	150	140	80	125	90	100	80	120	110	160	90
La Tardière	163	171	168	86	104	133	93	186	252	-	212	-
	160	160	125	70	70	105	90	160	210	-	210	-
Donon	166	160	130	96	53	44	42	62	81	70	99	161
	190	145	140	80	40	35	40	70	80	55	85	150
Peyrusse Vieille	87	166	67	74	82	51	46	-	-	91	80	-
	70	150	50	50	40	50	20	-	-	80	70	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

ISOPENTANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	332	220	146	52	17	18	22	26	29	47	73	121
	337	218	127	48	17	19	20	23	20	46	74	112
Utö	246	218	177	156	84	103	64	72	127	95	111	149
	229	198	172	127	58	51	47	85	102	79	96	143
Hohenpeissenberg	196	196	206	122	113	110	112	120	140	159	221	173
	185	189	184	104	108	100	94	117	130	128	158	150
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	305	209	299	126	112	311	139	56	73	208	344	-
	285	176	183	103	108	178	98	54	54	201	160	-
Rigi	229	238	237	182	240	205	241	226	298	287	334	203
	200	240	220	160	220	190	210	190	270	235	280	170
La Tardière	297	320	206	144	121	133	178	171	176	-	340	-
	290	260	190	110	110	135	130	180	200	-	330	-
Donon	254	223	196	154	129	68	97	141	177	144	173	272
	280	190	200	140	110	60	90	120	180	130	155	260
Peyrusse Vieille	143	270	123	224	486	166	164	-	-	290	296	-
	120	265	100	160	200	150	80	-	-	225	280	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

HEXANE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	80	45	31	12	7	6	8	7	9	13	29	34
	55	52	27	10	7	7	8	7	8	13	25	36
Utö	63	44	43	36	22	23	14	13	15	24	42	35
	58	42	44	35	19	11	17	14	16	19	33	33
Hohenpeissenberg	40	39	36	18	17	17	12	12	16	24	40	34
	36	39	31	17	15	16	10	11	14	18	34	30
Starina	114	34	66	40	44	38	48	82	48	92	101	121
	107	9	67	32	19	20	20	92	50	99	102	116
Košetice	55	31	57	19	16	33	17	7	7	29	58	-
	47	32	28	18	12	27	8	7	7	27	22	-
Rigi	45	45	36	28	33	20	23	23	28	31	42	38
	40	40	30	20	30	20	20	20	20	20	40	30
La Tardière	52	51	34	24	28	38	20	31	33	-	82	-
	50	50	35	20	10	25	20	20	30	-	70	-
Donon	62	56	50	39	31	19	26	27	43	27	38	82
	70	50	55	30	30	15	30	30	30	20	40	60
Peyrusse Vieille	30	78	21	21	28	19	39	-	-	31	37	-
	30	65	20	20	10	20	20	-	-	30	30	-
Campisábalos	29	1658	908	266	36	54	112	266	224	6	5	68
	20	815	890	50	8	13	25	100	70	5	5	5

ISOPRENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	5	4	6	4	8	14	88	45	19	18	12	12
	4	4	4	4	8	11	81	35	18	19	10	15
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	4	3	7	10	20	39	65	73	30	16	8	5
	3	3	6	5	13	27	22	22	10	11	5	3
Starina	89	68	66	63	21	49	82	328	52	38	11	-
	63	43	36	19	20	52	78	341	47	37	10	-
Košetice	14	7	12	10	15	50	44	88	21	11	9	-
	10	7	5	4	13	45	48	68	14	11	6	-
Rigi	12	13	19	23	74	66	113	118	64	38	13	21
	10	10	10	10	40	30	60	60	40	20	10	10
La Tardière	10	7	5	6	96	395	382	379	287	-	19	-
	10	5	5	5	70	330	310	340	130	-	20	-
Donon	24	43	82	130	336	908	724	1314	389	225	70	38
	20	35	40	110	220	645	480	920	370	175	45	20
Peyrusse Vieille	5	10	7	64	656	1496	1109	-	-	404	50	-
	5	5	5	30	400	1290	840	-	-	230	40	-
Campisábalos	21	99	64	21	18	93	102	179	155	5	5	5
	10	95	50	10	10	35	60	160	125	5	5	5

BENZENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	289	192	184	131	61	28	37	33	40	53	102	134
	279	172	162	112	66	22	31	31	21	49	98	136
Utö	237	220	225	176	85	58	54	66	80	9	86	175
	213	198	208	150	60	61	63	66	63	7	106	148
Hohenpeissenberg	224	211	254	139	85	56	73	82	89	118	198	202
	203	220	249	127	81	52	69	78	88	89	173	171
Starina	744	441	355	189	134	111	129	181	221	253	401	448
	734	400	349	171	119	93	92	132	179	243	347	494
Košetice	174	132	420	131	69	38	35	39	56	110	283	-
	145	127	184	114	66	34	32	37	55	119	178	-
Rigi	240	245	235	171	253	115	109	122	137	145	253	188
	195	240	220	140	200	110	100	100	130	120	210	160
La Tardière	243	259	208	134	71	50	60	64	79	-	225	-
	210	215	195	130	70	50	50	60	80	-	200	-
Donon	258	210	225	143	84	46	47	70	93	100	156	244
	220	195	215	140	80	45	40	80	90	80	130	240
Peyrusse Vieille	149	246	164	96	97	51	46	63	-	74	162	-
	150	225	150	90	90	50	45	65	-	75	150	-
Campisábalos	63	261	193	69	18	28	52	126	91	24	41	188
	40	250	170	40	10	18	5	110	90	25	40	175

TOLUENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	158	164	175	91	77	73	89	81	101	136	201	149
	146	140	150	75	69	66	69	76	93	98	146	123
Starina	79	22	42	31	19	69	65	133	64	140	136	86
	39	21	37	16	18	26	22	45	25	148	65	34
Košetice	105	101	213	81	62	66	59	29	39	128	227	-
	95	97	124	59	50	43	54	28	40	122	131	-
Rigi	225	255	258	192	360	172	184	204	246	274	332	164
	160	210	230	140	220	140	160	170	200	205	270	100
La Tardière	388	363	291	172	93	105	162	221	244	-	480	-
	280	255	190	100	80	85	90	150	210	-	315	-
Donon	200	154	133	91	73	43	70	94	123	113	140	227
	160	120	155	60	60	40	70	60	90	75	125	220
Peyrusse Vieille	101	250	97	180	166	69	59	-	-	105	205	-
	80	210	90	110	120	70	40	-	-	105	195	-
Campisábalos	193	1349	933	269	99	178	104	166	101	52	58	311
	220	1475	825	190	70	170	90	170	105	50	60	190

ETHYLBENZENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	24	26	24	11	10	10	13	12	15	22	33	25
	22	21	18	9	9	10	12	11	14	19	21	16
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	33	29	43	13	15	12	13	7	8	27	41	-
	29	20	22	11	13	10	10	6	7	26	27	-
Rigi	48	48	44	16	38	20	21	22	22	40	58	37
	40	40	40	10	30	20	20	20	20	30	50	30
La Tardière	60	59	46	28	13	15	28	29	48	-	78	-
	50	35	30	20	10	15	20	30	50	-	70	-
Donon	34	25	24	16	12	8	12	15	19	18	23	37
	30	20	30	10	10	5	10	10	20	15	20	30
Peyrusse Vieille	13	30	11	9	11	9	11	-	-	15	27	-
	10	25	10	5	10	5	5	-	-	15	25	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

m+p-XYLENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	59	57	47	17	18	19	23	22	30	55	87	61
	48	44	31	11	14	14	18	19	23	40	55	30
Starina	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	63	48	48	28	37	21	28	24	18	54	93	-
	64	42	29	22	21	16	24	21	18	55	67	-
Rigi	106	104	97	36	77	46	50	45	52	94	138	79
	70	80	85	30	55	40	40	40	40	60	110	60
La Tardière	193	184	151	83	41	53	87	96	167	-	272	-
	160	90	70	50	40	45	50	70	160	-	215	-
Donon	86	56	38	29	27	15	22	37	38	45	56	97
	60	45	45	20	20	20	20	20	30	35	55	80
Peyrusse Vieille	33	65	16	33	39	19	40	-	-	40	65	-
	30	55	20	20	20	20	20	-	-	40	55	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

o-XYLENE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pallas	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Utö	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Hohenpeissenberg	22	21	19	8	8	9	11	9	12	21	31	25
	19	16	14	7	6	7	9	8	10	16	20	19
Starina	585	369	408	219	207	362	304	480	271	399	460	429
	508	361	384	148	185	299	241	345	228	358	396	380
Košetice	26	18	23	9	11	10	11	11	7	22	31	-
	22	16	15	7	10	6	9	5	6	21	21	-
Rigi	46	46	38	19	32	18	21	25	21	37	47	33
	30	40	40	10	30	10	10	20	20	30	40	30
La Tardière	74	68	59	33	-	-	-	-	-	-	-	-
	70	50	40	30	-	-	-	-	-	-	-	-
Donon	44	36	29	19	-	-	-	-	-	-	-	-
	40	35	30	10	-	-	-	-	-	-	-	-
Peyrusse Vieille	21	34	16	21	-	-	-	-	-	-	-	-
	10	35	20	20	-	-	-	-	-	-	-	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

Monthly mean and median concentrations (first and second line, respectively) of carbonyls ($\mu g\ m^{-3}$)

METHANAL (FORMALDEHYDE)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.643	0.316	0.387	0.694	2.782	0.392	0.650	1.577	-	0.618	0.277	0.386
	0.570	0.300	0.380	0.630	1.640	0.360	0.595	1.390	-	0.635	0.250	0.340
Zingst	0.511	0.588	0.724	0.747	0.924	0.891	0.616	0.953	0.560	0.444	0.607	0.337
	0.520	0.610	0.690	0.625	0.910	0.710	0.500	0.850	0.510	0.350	0.690	0.400
Langenbrügge	0.850	0.497	0.750	1.205	0.995	1.232	0.746	1.764	1.321	0.410	0.622	0.434
	0.490	0.445	0.775	1.030	0.880	1.100	0.625	1.990	1.100	0.350	0.580	0.430
Schmücke	0.534	0.555	0.700	0.950	0.962	0.980	0.760	1.136	0.575	0.415	0.582	0.496
	0.560	0.490	0.730	0.990	0.800	1.040	0.585	1.225	0.490	0.450	0.540	0.540
Brotjacklriegel	0.288	0.302	0.398	0.354	0.297	1.172	-	-	-	-	-	-
	0.270	0.260	0.240	0.350	0.300	1.380	-	-	-	-	-	-
Košetice	0.767	0.777	1.351	1.442	1.087	1.392	1.831	1.391	1.183	1.023	0.934	0.826
	0.645	0.685	1.360	1.490	1.055	1.260	2.050	1.100	1.205	0.945	0.930	0.720
La Tardiére	1.127	1.270	1.528	1.308	1.395	1.768	2.448	1.153	2.004	0.989	0.968	1.351
	0.901	1.294	1.468	1.355	1.531	1.945	2.599	1.122	1.902	1.100	0.984	1.324
Donon	0.441	1.074	1.246	1.269	1.834	2.439	1.404	2.100	1.140	0.872	0.516	-
	0.281	1.117	1.072	1.167	1.678	2.038	1.318	1.201	0.664	0.472	0.538	-
Peyrusse Vieille	0.821	1.476	-	1.673	1.677	2.335	2.327	1.484	-	0.859	1.220	0.992
	0.768	1.494	-	1.332	1.660	2.790	2.372	1.275	-	0.574	1.171	1.121
Campisábalos	0.255	0.460	0.597	0.835	0.874	1.255	1.111	0.658	0.568	0.355	0.145	0.707
	0.240	0.520	0.510	0.750	0.850	1.145	1.040	0.590	0.505	0.240	0.190	0.570

ETHANAL (ACETALDEHYDE)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.650	0.547	0.471	0.705	1.740	0.726	0.622	1.033	-	0.823	0.471	0.771
	0.570	0.510	0.480	0.650	1.000	0.690	0.695	0.950	-	0.810	0.440	0.510
Zingst	0.798	0.518	0.331	0.401	0.611	0.531	0.427	0.381	0.332	0.251	0.260	0.196
	0.560	0.565	0.240	0.385	0.490	0.450	0.445	0.415	0.320	0.320	0.320	0.220
Langenbrügge	0.816	0.546	0.498	0.705	0.467	0.634	0.388	0.551	0.651	0.292	0.358	0.348
	0.530	0.535	0.480	0.680	0.420	0.500	0.350	0.600	0.510	0.280	0.375	0.340
Schmücke	0.460	0.377	0.515	0.487	0.428	0.377	0.480	0.510	0.345	0.198	0.385	0.287
	0.440	0.320	0.475	0.470	0.320	0.380	0.500	0.530	0.335	0.210	0.410	0.250
Brotjacklriegel	0.315	0.312	-	0.196	0.125	0.536	-	-	-	-	-	-
	0.310	0.240	-	0.140	0.120	0.460	-	-	-	-	-	-
Košetice	1.131	0.902	1.345	1.067	0.937	1.746	1.502	1.905	1.095	1.111	1.173	1.045
	0.965	0.860	1.040	1.020	0.955	1.575	1.480	1.570	0.950	1.075	0.960	1.030
La Tardiére	0.790	0.814	1.083	0.729	0.754	0.909	1.078	0.583	1.155	0.807	0.842	1.101
	0.717	0.760	1.027	0.705	0.790	0.977	1.138	0.605	0.943	0.772	0.795	1.201
Donon	0.316	0.627	0.813	0.645	0.748	0.861	0.613	0.837	0.572	0.584	0.535	0.781
	0.205	0.580	0.771	0.638	0.733	0.765	0.637	0.613	0.366	0.627	0.587	0.840
Peyrusse Vieille	0.473	0.853	-	0.797	0.928	1.093	1.134	0.594	-	0.748	0.806	0.962
	0.446	0.819	-	0.908	0.938	1.069	1.178	0.590	-	0.765	0.742	1.007
Campisábalos	0.185	0.301	0.373	0.735	0.714	1.372	0.470	0.494	0.626	0.455	0.353	0.517
	0.200	0.345	0.290	0.670	0.690	0.615	0.470	0.620	0.610	0.405	0.370	0.420

PROPANONE (ACETONE)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	1.781	1.785	1.523	1.864	3.705	1.732	0.635	1.708	-	3.048	3.204	4.028
	1.735	1.795	1.530	1.580	2.990	1.730	0.725	1.510	-	2.865	3.280	3.930
Zingst	1.042	0.376	1.103	1.188	0.951	0.522	1.150	0.575	1.197	0.547	1.274	0.390
	0.900	0.390	1.050	0.755	0.810	0.390	1.105	0.540	0.560	0.575	1.330	0.380
Langenbrügge	1.203	0.571	1.387	1.572	1.280	1.344	1.038	1.817	1.588	0.705	0.661	0.882
	1.020	0.525	1.275	1.500	1.125	1.000	0.910	2.270	1.575	0.755	0.700	0.880
Schmücke	0.947	0.705	1.684	1.357	1.328	1.222	1.210	1.840	1.026	0.913	1.212	1.102
	0.920	0.605	1.570	0.760	1.240	1.190	0.915	1.750	0.820	0.900	0.950	0.520
Brotjacklriegel	0.750	0.495	1.005	0.490	0.435	1.332	-	-	-	-	-	-
	0.730	0.435	0.850	0.420	0.380	1.170	-	-	-	-	-	-
Košetice	2.002	2.518	3.416	3.272	2.757	3.158	3.073	2.445	3.976	3.273	3.021	3.077
	1.840	2.365	2.920	3.190	2.630	3.030	2.680	2.190	3.810	3.115	2.880	2.990
La Tardiére	2.189	1.414	2.703	2.270	2.949	2.766	3.242	2.037	3.005	2.733	2.378	1.628
	2.240	1.321	2.314	1.793	3.345	3.164	3.382	2.017	2.396	1.899	2.919	1.560
Donon	0.654	1.464	2.077	2.348	3.412	3.575	2.986	3.932	2.674	1.742	1.134	1.233
	0.468	1.470	1.851	1.681	3.296	2.850	3.157	2.025	1.714	1.110	1.172	1.168
Peyrusse Vieille	1.366	1.990	-	2.598	2.568	1.769	3.204	1.540	-	1.853	1.578	1.373
	1.281	2.034	-	2.588	2.223	1.434	2.628	1.577	-	1.617	1.536	1.346
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

PROPANAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.118	0.072	0.051	0.101	0.640	0.126	0.128	0.348	-	0.132	0.082	0.171
	0.120	0.075	0.050	0.080	0.170	0.100	0.130	0.180	-	0.130	0.080	0.105
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Kosetice	0.170	0.168	0.227	0.177	0.165	0.280	0.261	0.374	0.178	0.170	0.181	0.198
	0.135	0.165	0.180	0.170	0.155	0.230	0.250	0.320	0.160	0.170	0.160	0.210
La Tardiére	0.124	0.149	0.171	0.127	0.142	0.141	0.174	0.086	0.252	0.105	0.122	0.162
	0.121	0.142	0.192	0.133	0.143	0.154	0.173	0.088	0.162	0.113	0.119	0.176
Donon	0.050	0.113	0.137	0.107	0.102	0.113	0.074	0.100	0.078	0.079	0.079	0.111
	0.030	0.113	0.134	0.102	0.104	0.088	0.071	0.079	0.060	0.092	0.076	0.110
Peyrusse Vieille	0.080	0.136	-	0.147	0.162	0.166	0.185	0.078	-	0.100	0.120	0.141
	0.080	0.144	-	0.133	0.166	0.162	0.145	0.071	-	0.093	0.115	0.141
Campisabalos	0.097	0.020	0.020	0.106	0.048	0.032	0.020	0.042	0.306	0.081	0.090	0.050
	0.020	0.020	0.020	0.110	0.020	0.020	0.020	0.020	0.080	0.020	0.110	0.020

2-PROPENAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.032	-	-	0.028	0.188	0.016	0.018	0.071	-	-	-	-
	0.030	-	-	0.020	0.165	0.015	0.020	0.035	-	-	-	-
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.030	0.045	0.061	0.048	0.022	0.022	0.028	0.030	-	0.035	0.044	0.111
	0.030	0.045	0.060	0.050	0.020	0.020	0.020	0.025	-	0.040	0.050	0.095
La Tardiére	0.018	0.016	0.016	0.015	0.016	0.017	0.016	0.017	0.027	0.038	0.015	0.016
	0.018	0.017	0.016	0.016	0.016	0.017	0.016	0.017	0.017	0.034	0.016	0.016
Donon	0.016	0.016	0.017	0.015	0.015	0.019	0.016	0.016	0.082	0.034	0.030	0.016
	0.016	0.016	0.017	0.015	0.015	0.016	0.016	0.017	0.053	0.016	0.016	0.016
Peyrusse Vieille	0.016	0.017	0.024	0.017	0.016	0.024	0.016	0.020	-	0.186	0.016	0.015
	0.016	0.018	0.017	0.016	0.016	0.016	0.016	0.017	-	0.161	0.016	0.016
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

2-BUTANONE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.438	0.508	0.374	0.372	0.534	0.311	0.148	0.262	-	0.422	0.292	0.568
	0.420	0.535	0.340	0.370	0.420	0.320	0.170	0.250	-	0.400	0.300	0.500
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.494	0.741	1.083	0.756	0.513	0.693	0.621	0.694	0.680	0.615	0.482	0.681
	0.520	0.730	0.950	0.760	0.450	0.690	0.520	0.650	0.605	0.560	0.440	0.640
La Tardiére	0.601	0.502	0.716	0.452	0.709	0.718	0.938	0.457	0.728	1.087	0.984	0.482
	0.581	0.468	0.712	0.421	0.616	0.842	0.949	0.461	0.486	0.407	0.744	0.484
Donon	0.199	0.399	0.490	0.464	0.508	0.392	0.716	1.493	0.271	0.238	0.205	0.267
	0.157	0.416	0.490	0.400	0.509	0.427	0.759	0.542	0.182	0.179	0.209	0.254
Peyrusse Vieille	0.231	0.392	-	0.495	0.399	0.322	0.978	0.623	-	0.234	0.324	0.346
	0.237	0.384	-	0.493	0.401	0.299	1.017	0.645	-	0.265	0.339	0.370
Campisábalos	0.138	0.301	0.156	0.163	0.020	0.311	0.352	0.173	0.063	0.078	0.046	0.052
	0.140	0.245	0.110	0.020	0.020	0.330	0.390	0.160	0.020	0.040	0.020	0.020

3-BUTEN2ONE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	-	-	-	-	-	0.292	-	-	-	-	-	-
	-	-	-	-	-	0.290	-	-	-	-	-	-
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
La Tardiére	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Donon	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Peyrusse Vieille	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

2-METHYLPROPENAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	-	-	-	-	-	-	-	-	-	-	0.077	-
	-	-	-	-	-	-	-	-	-	-	0.075	-
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	-	-	0.025	0.047	-	-	-	0.024	-
	-	-	-	-	-	0.020	0.045	-	-	-	0.020	-
La Tardiére	0.022	0.012	0.026	0.021	0.044	0.145	0.130	0.113	0.114	0.012	0.012	0.024
	0.014	0.012	0.029	0.012	0.042	0.121	0.135	0.128	0.073	0.012	0.012	0.022
Donon	0.012	0.022	0.036	0.058	0.188	0.451	0.172	0.493	0.125	0.058	0.014	0.016
	0.012	0.013	0.015	0.044	0.149	0.247	0.200	0.205	0.068	0.012	0.012	0.012
Peyrusse Vieille	0.012	0.013	-	0.016	0.196	0.345	0.306	0.270	-	0.154	0.023	0.016
	0.012	0.013	-	0.013	0.172	0.308	0.351	0.321	-	0.074	0.012	0.012
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

BENZENECARBALDEHYDE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	-	-	-	-	0.151	0.041	0.040	0.046	-	-	-	-
	-	-	-	-	0.090	0.040	0.040	0.040	-	-	-	-
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	-	-	-	0.052	0.051	0.038	0.041	0.042	-	-	0.058	-
	-	-	-	0.050	0.050	0.035	0.040	0.040	-	-	0.050	-
La Tardiére	0.143	0.099	0.121	0.088	0.041	0.074	0.103	0.048	0.156	0.097	0.138	0.091
	0.070	0.080	0.081	0.084	0.042	0.077	0.094	0.053	0.050	0.064	0.063	0.066
Donon	0.016	0.043	0.051	0.059	0.036	0.052	0.044	0.039	0.031	0.032	0.024	0.021
	0.016	0.042	0.047	0.029	0.036	0.049	0.050	0.018	0.016	0.031	0.016	0.016
Peyrusse Vieille	0.016	0.038	-	0.032	0.051	0.096	0.103	0.044	-	0.033	0.044	0.031
	0.016	0.030	-	0.030	0.047	0.083	0.078	0.040	-	0.034	0.041	0.030
Campisábalos	0.041	0.038	0.077	0.110	0.213	0.370	0.354	0.231	0.370	0.153	0.041	0.056
	0.020	0.020	0.020	0.020	0.160	0.285	0.360	0.250	0.315	0.075	0.020	0.020

PENTANAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	-	-	-	0.054	0.311	0.095	0.098	0.091	-	0.078	0.056	0.106
	-	-	-	0.040	0.195	0.110	0.110	0.080	-	0.050	0.045	0.060
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.077	0.062	0.040	0.084	0.062	0.108	0.083	0.197	0.077	0.065	0.061	0.054
	0.055	0.070	0.040	0.070	0.055	0.075	0.060	0.120	0.065	0.055	0.050	0.050
La Tardiére	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Donon	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Peyrusse Vieille	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Campisábalos	0.060	0.163	0.312	0.280	0.341	0.161	0.028	0.130	0.076	0.037	0.020	0.471
	0.020	0.075	0.240	0.220	0.360	0.175	0.020	0.140	0.065	0.020	0.020	0.020

ETHANEDIAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.042	0.064	0.032	0.081	0.305	0.111	0.122	0.280	-	-	-	-
	0.050	0.050	0.030	0.070	0.165	0.120	0.120	0.190	-	-	-	-
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.095	0.040	0.116	0.058	0.040	0.085	0.186	0.153	-	-	0.073	0.137
	0.080	0.030	0.090	0.045	0.030	0.075	0.210	0.135	-	-	0.065	0.140
La Tardiére	0.013	0.012	0.012	0.011	0.022	0.022	0.053	0.042	0.057	0.027	0.033	0.071
	0.013	0.012	0.012	0.012	0.022	0.013	0.047	0.045	0.041	0.020	0.032	0.055
Donon	0.012	0.012	0.013	0.011	0.030	0.056	0.026	0.039	0.033	-	0.029	-
	0.012	0.012	0.013	0.011	0.018	0.051	0.029	0.041	0.025	-	0.034	-
Peyrusse Vieille	0.012	0.013	0.017	0.012	0.012	0.016	0.018	0.038	-	0.022	0.040	0.048
	0.012	0.013	0.013	0.012	0.012	0.012	0.012	0.042	-	0.022	0.043	0.052
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

HEXANAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	0.035	0.044	0.032	0.107	0.753	0.100	0.085	0.213	-	0.091	0.057	0.131
	0.035	0.040	0.030	0.050	0.345	0.100	0.090	0.170	-	0.100	0.060	0.110
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.074	0.076	0.124	0.113	0.091	0.131	0.158	0.277	-	0.083	0.092	0.087
	0.060	0.075	0.070	0.080	0.070	0.115	0.120	0.140	-	0.080	0.080	0.080
La Tardiére	0.025	0.026	0.030	0.042	0.058	0.112	0.113	0.069	0.183	0.126	0.053	0.049
	0.020	0.025	0.016	0.051	0.048	0.101	0.102	0.070	0.063	0.099	0.056	0.046
Donon	0.016	0.045	0.045	0.051	0.074	0.091	0.050	0.087	0.033	0.064	0.040	-
	0.016	0.043	0.038	0.054	0.062	0.096	0.055	0.054	0.016	0.061	0.038	-
Peyrusse Vieille	0.043	0.080	-	0.138	0.156	0.258	0.602	0.089	-	0.089	0.038	0.048
	0.043	0.069	-	0.115	0.117	0.173	0.130	0.080	-	0.078	0.047	0.048
Campisábalos	0.253	0.803	0.820	0.952	1.126	0.661	0.225	0.313	0.335	0.132	0.052	0.073
	0.200	0.730	0.690	0.810	1.320	0.575	0.210	0.240	0.295	0.130	0.020	0.020

2-OXOPROPANAL

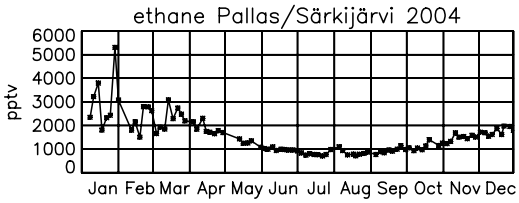
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Utö	-	-	-	0.101	0.283	0.186	0.166	0.246	-	-	-	0.070
	-	-	-	0.060	0.210	0.200	0.160	0.255	-	-	-	0.070
Zingst	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Langenbrügge	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Schmücke	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Brotjacklriegel	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Košetice	0.100	-	0.027	0.026	0.024	0.128	0.281	0.346	-	-	0.047	0.104
	0.090	-	0.020	0.025	0.020	0.130	0.340	0.305	-	-	0.040	0.120
La Tardiére	0.018	0.022	0.028	0.026	0.047	0.051	0.084	0.027	0.076	0.016	0.015	0.078
	0.018	0.017	0.016	0.025	0.046	0.047	0.064	0.019	0.059	0.016	0.016	0.056
Donon	0.016	0.016	0.017	0.015	0.049	0.075	0.037	0.116	0.034	0.026	0.020	0.041
	0.016	0.016	0.017	0.015	0.029	0.080	0.039	0.041	0.016	0.016	0.016	0.016
Peyrusse Vieille	0.034	0.017	0.021	0.017	0.103	0.136	0.095	0.061	-	0.023	0.029	0.087
	0.016	0.018	0.017	0.016	0.055	0.125	0.094	0.044	-	0.017	0.034	0.098
Campisábalos	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-

Appendix B

Time series of VOC measured in 2004

Explanations and synonyms to component names

ethyne:	acetylene
butane:	n-butane
isobutane:	i-butane
pentane:	n-pentane
isopentane:	i-pentane
hexane:	n-hexane
methanal:	formaldehyde
ethanal:	acetaldehyde
propanone:	acetone
N2propenal:	2-propenal (acrolein)
N2butanone:	2-butanone (methyl ethyl ketone)
N3buten2one:	3-buten-2-one (methyl vinyl ketone)
N2methylpropenal:	2-methyl propenal (methacrolein)
benzenecarbaldehyde:	benzaldehyde
ethanedial:	glyoxal
N2oxoproanal:	2-oxopropanal (methyl glyoxal)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1000
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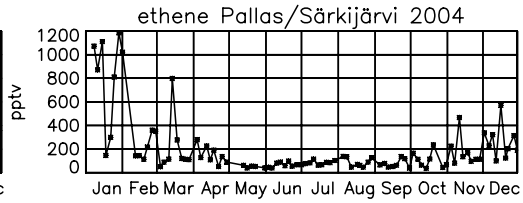
3000
4000
5000
6000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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800
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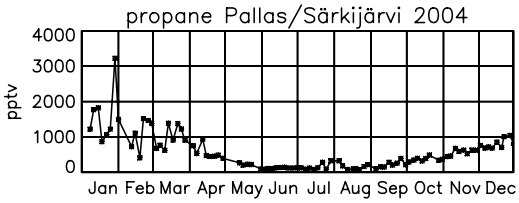
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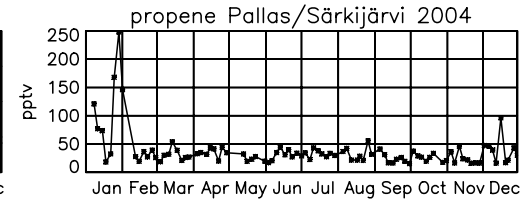
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150
200
250
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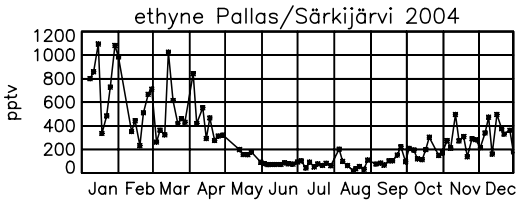
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600
800
1000
1200
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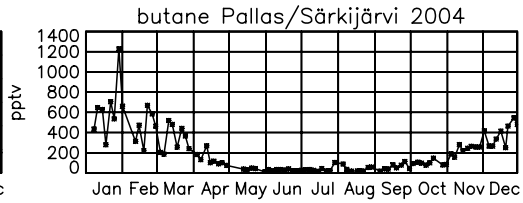
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1000
1200
1400
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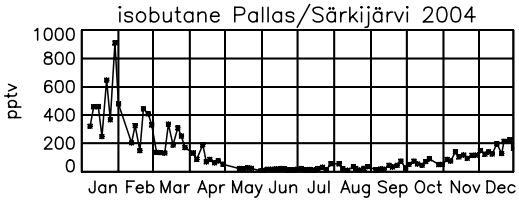
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600
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1000
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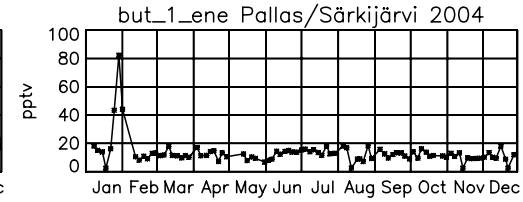
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80
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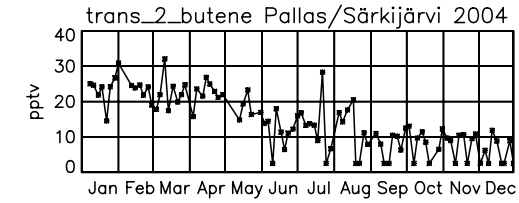
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30
40
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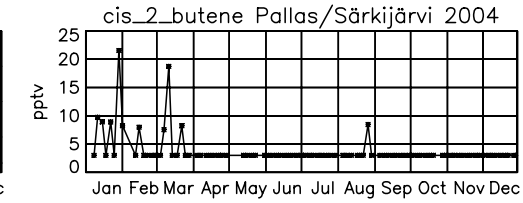
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10
15
20
25
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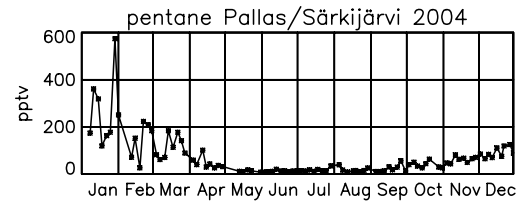
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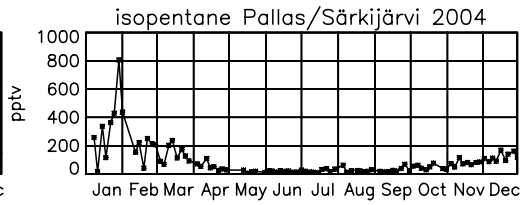
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1000
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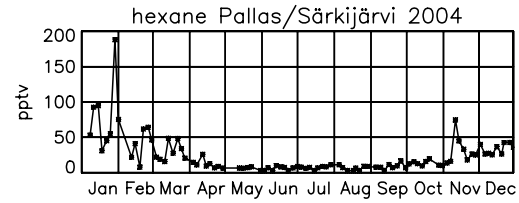
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0
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100
150
200
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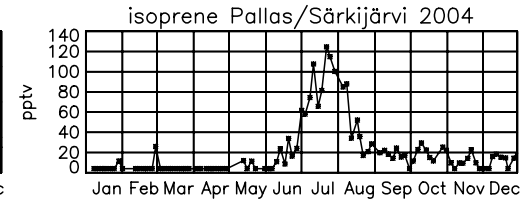
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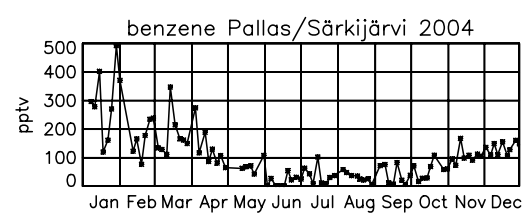
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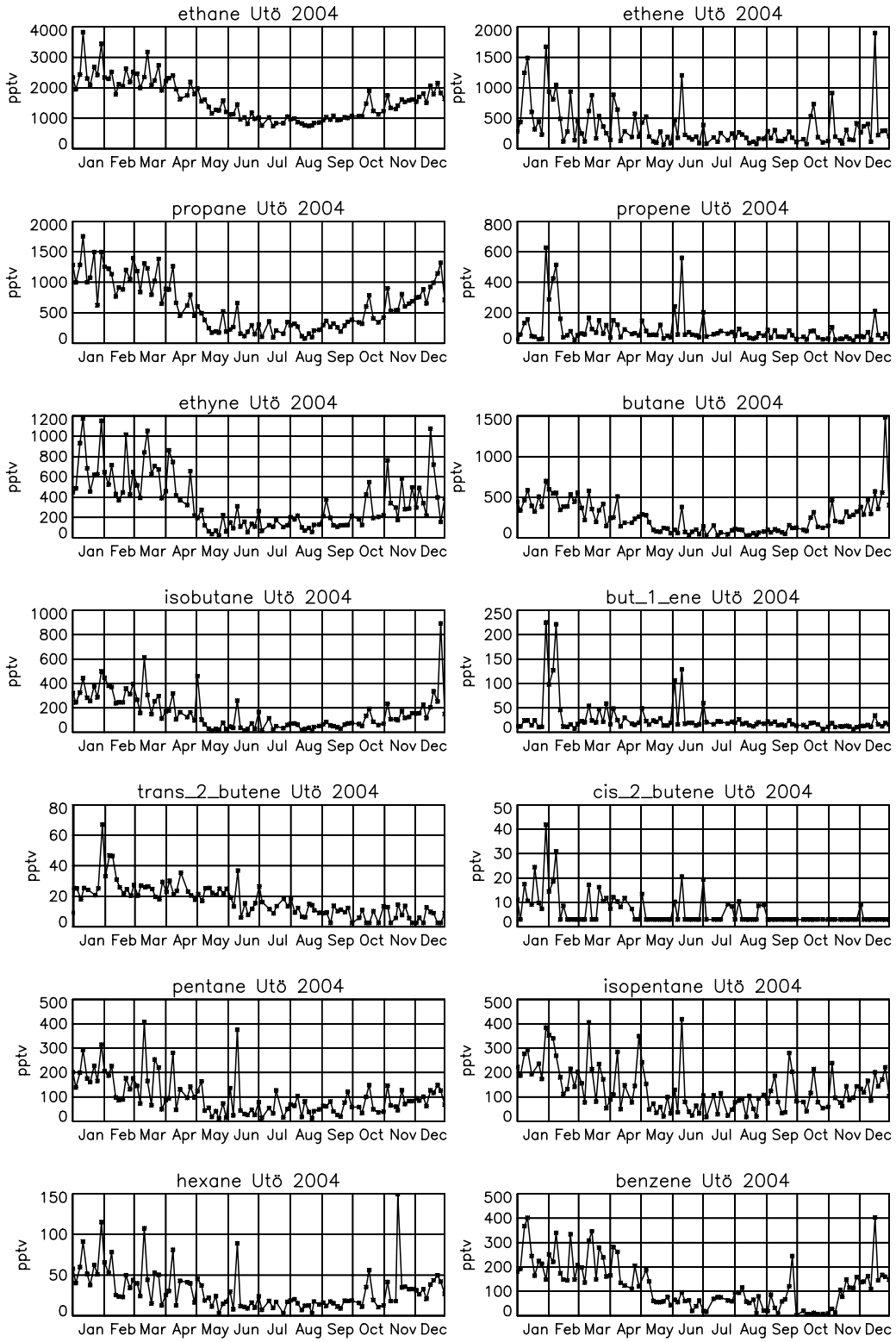
300
400
500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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trans_2_butene Utö 2004
cis_2_butene Utö 2004
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pptv
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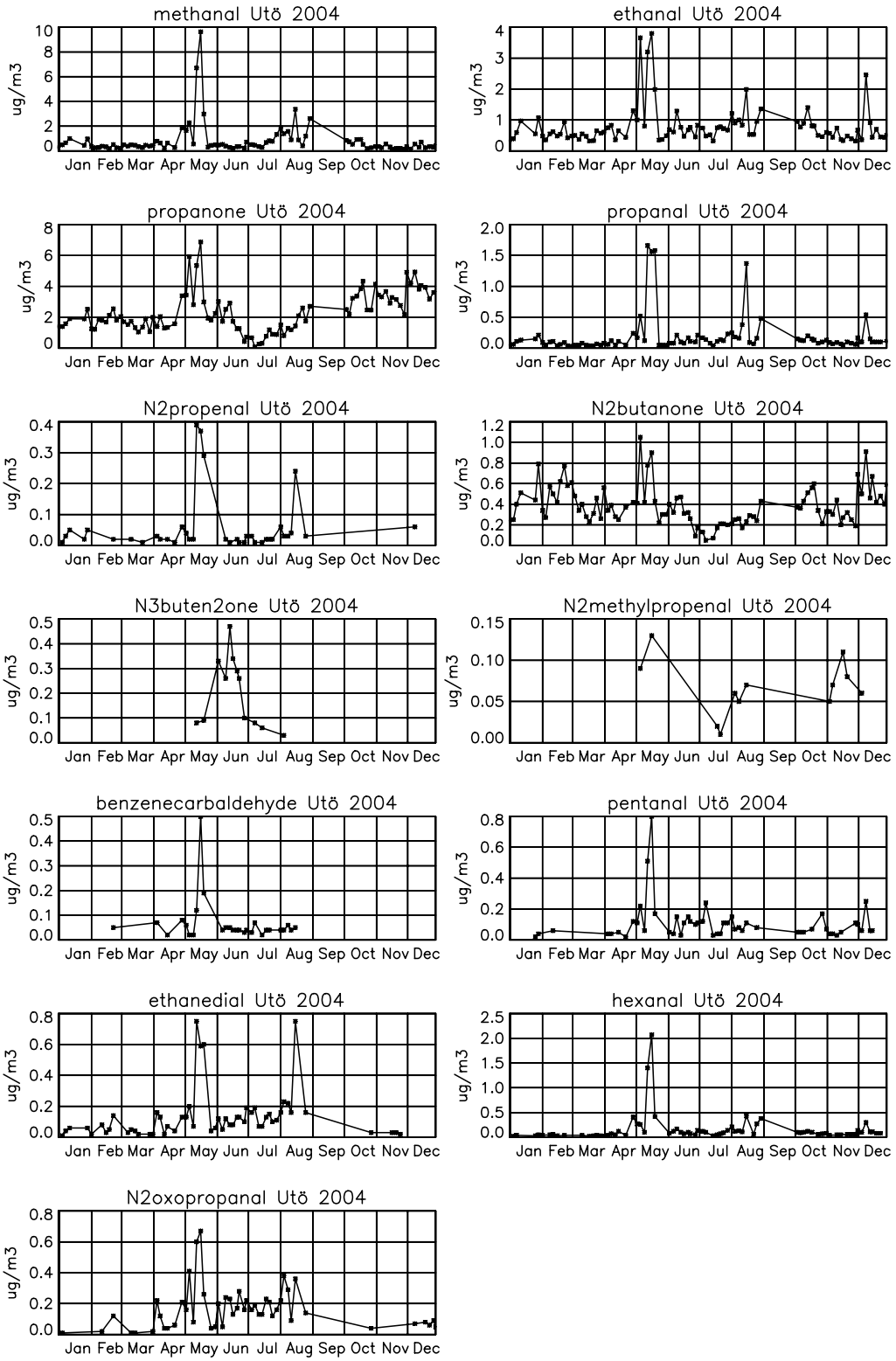
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propanal Utö 2004
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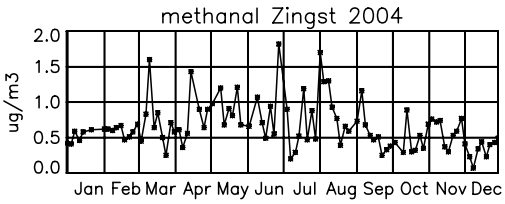
ethanedial Utö 2004
hexanal Utö 2004
N2oxopropanal Utö 2004
ug/m3
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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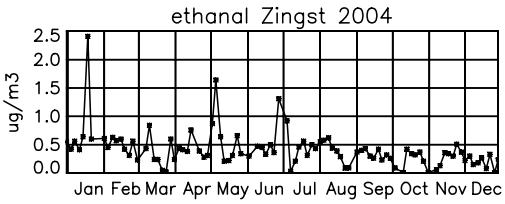
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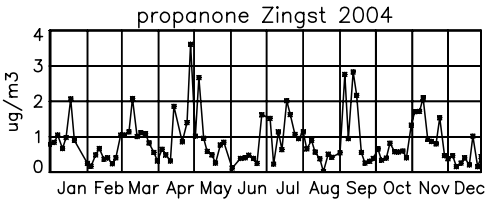
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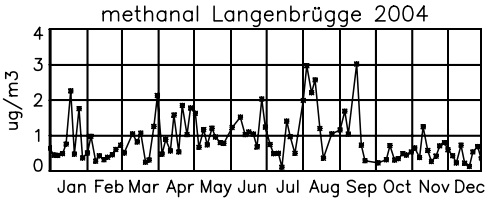
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ug/m3
0
1
2
3
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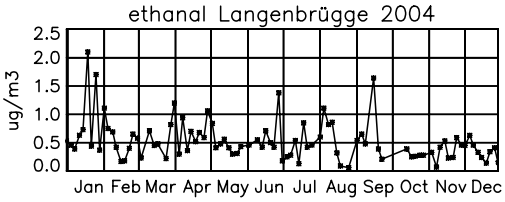
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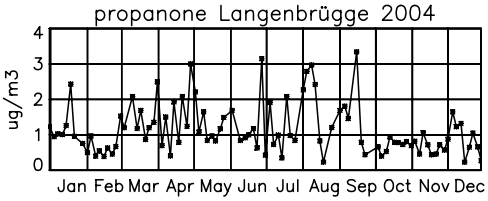
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3
4
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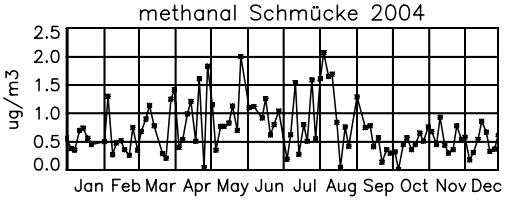
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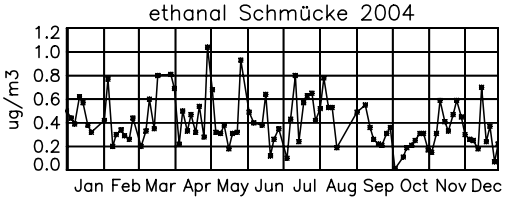
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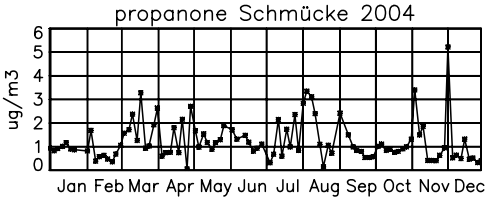
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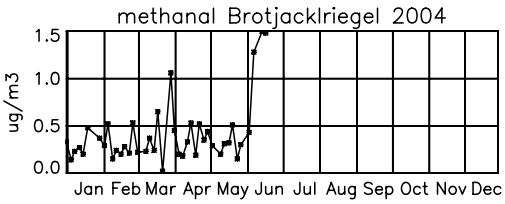
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0.5
1.0
1.5
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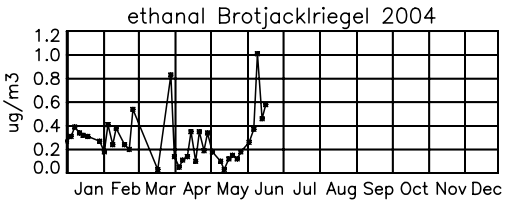
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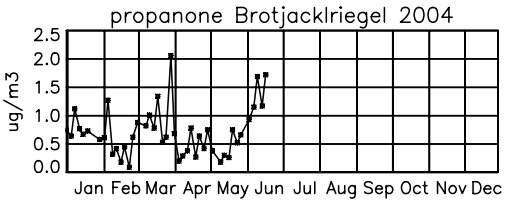
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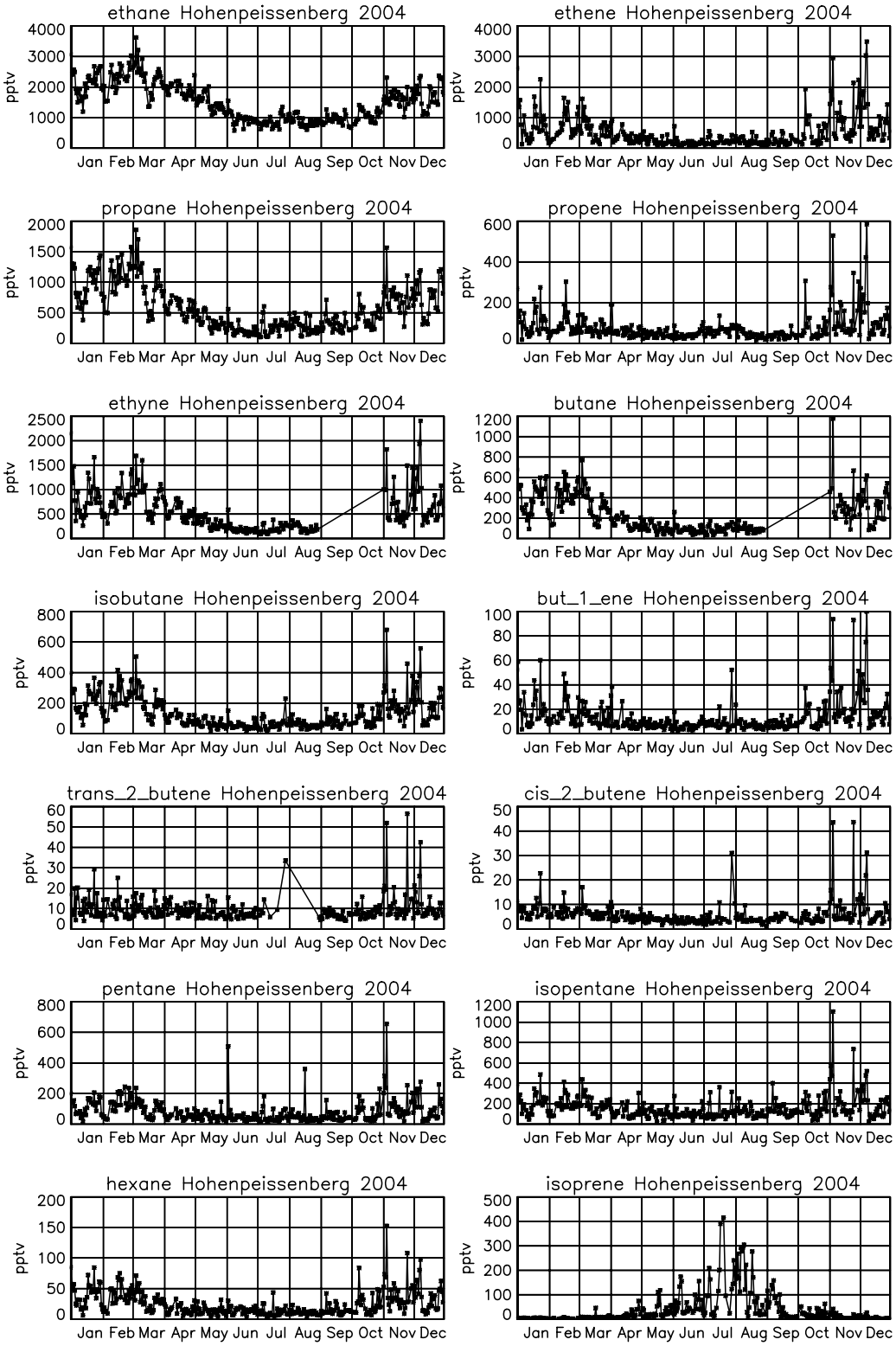
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propane Hohenpeissenberg 2004
propene Hohenpeissenberg 2004
ethyne Hohenpeissenberg 2004
butane Hohenpeissenberg 2004
isobutane Hohenpeissenberg 2004
but_1_ene Hohenpeissenberg 2004
trans_2_butene Hohenpeissenberg 2004
cis_2_butene Hohenpeissenberg 2004
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hexane Hohenpeissenberg 2004
isoprene Hohenpeissenberg 2004
pptv
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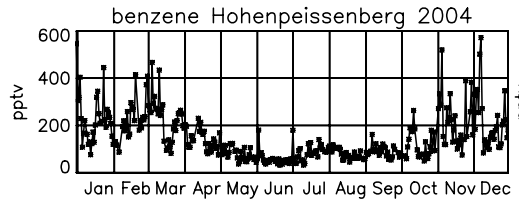
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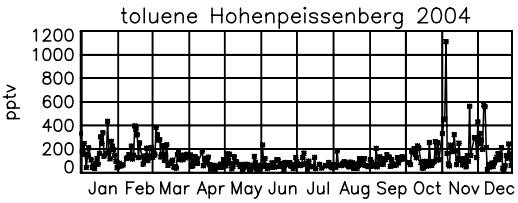
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800
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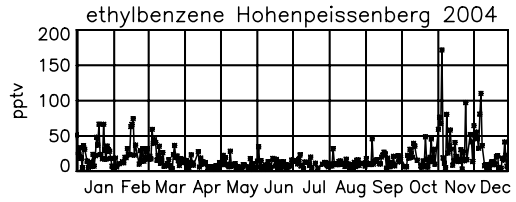
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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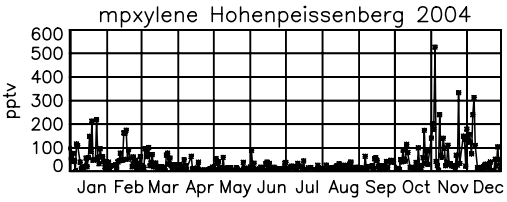
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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400
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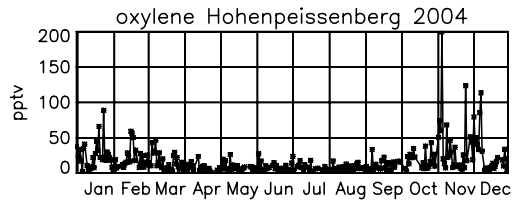
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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150
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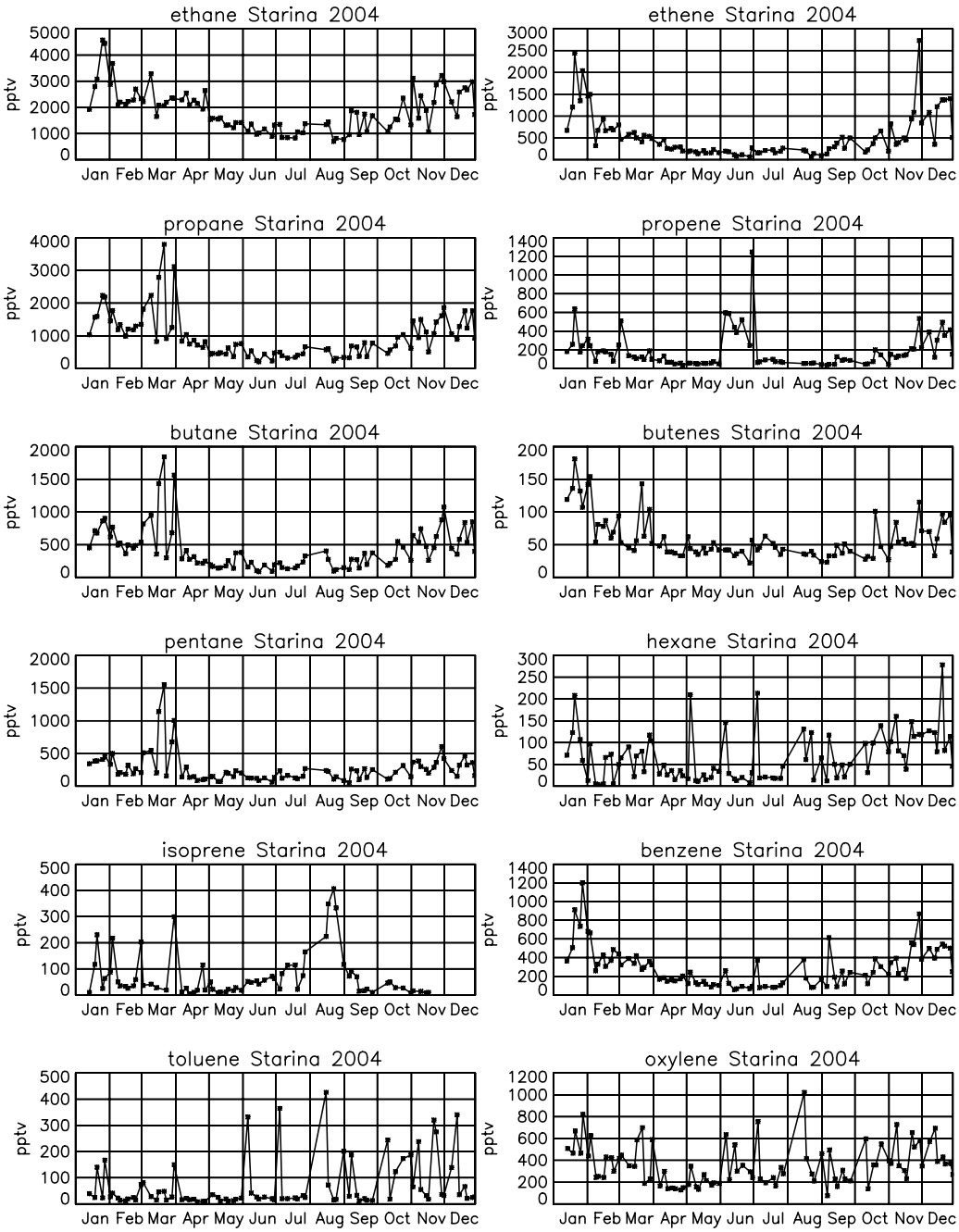
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propane Starina 2004
propene Starina 2004
butane Starina 2004
butenes Starina 2004
pentane Starina 2004
hexane Starina 2004
isoprene Starina 2004
benzene Starina 2004
toluene Starina 2004
oxylene Starina 2004
pptv
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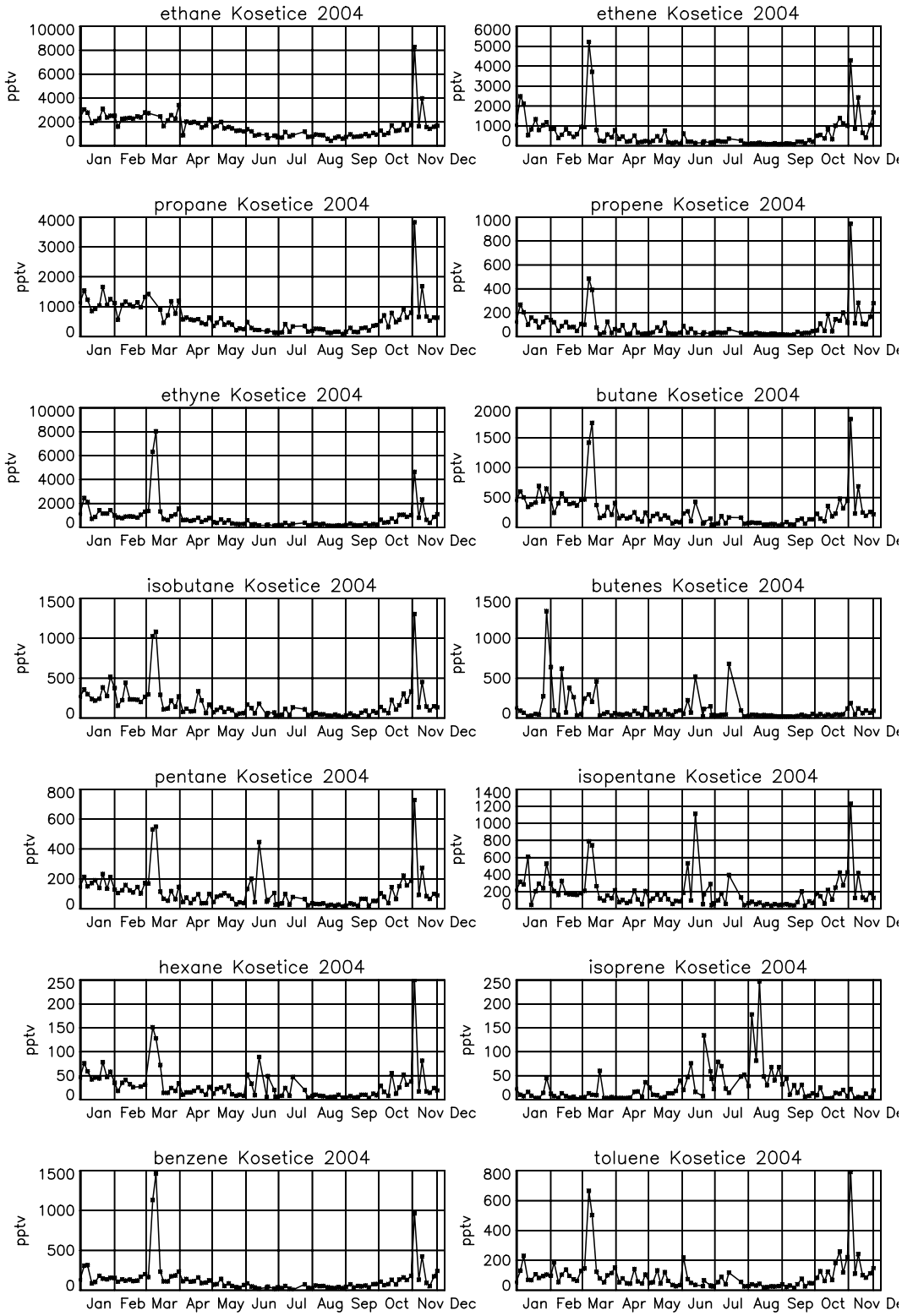
ethane Kosetice 2004
ethene Kosetice 2004
propane Kosetice 2004
propene Kosetice 2004
ethyne Kosetice 2004
butane Kosetice 2004
isobutane Kosetice 2004
butenes Kosetice 2004
pentane Kosetice 2004
isopentane Kosetice 2004
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isoprene Kosetice 2004
benzene Kosetice 2004
toluene Kosetice 2004
pptv
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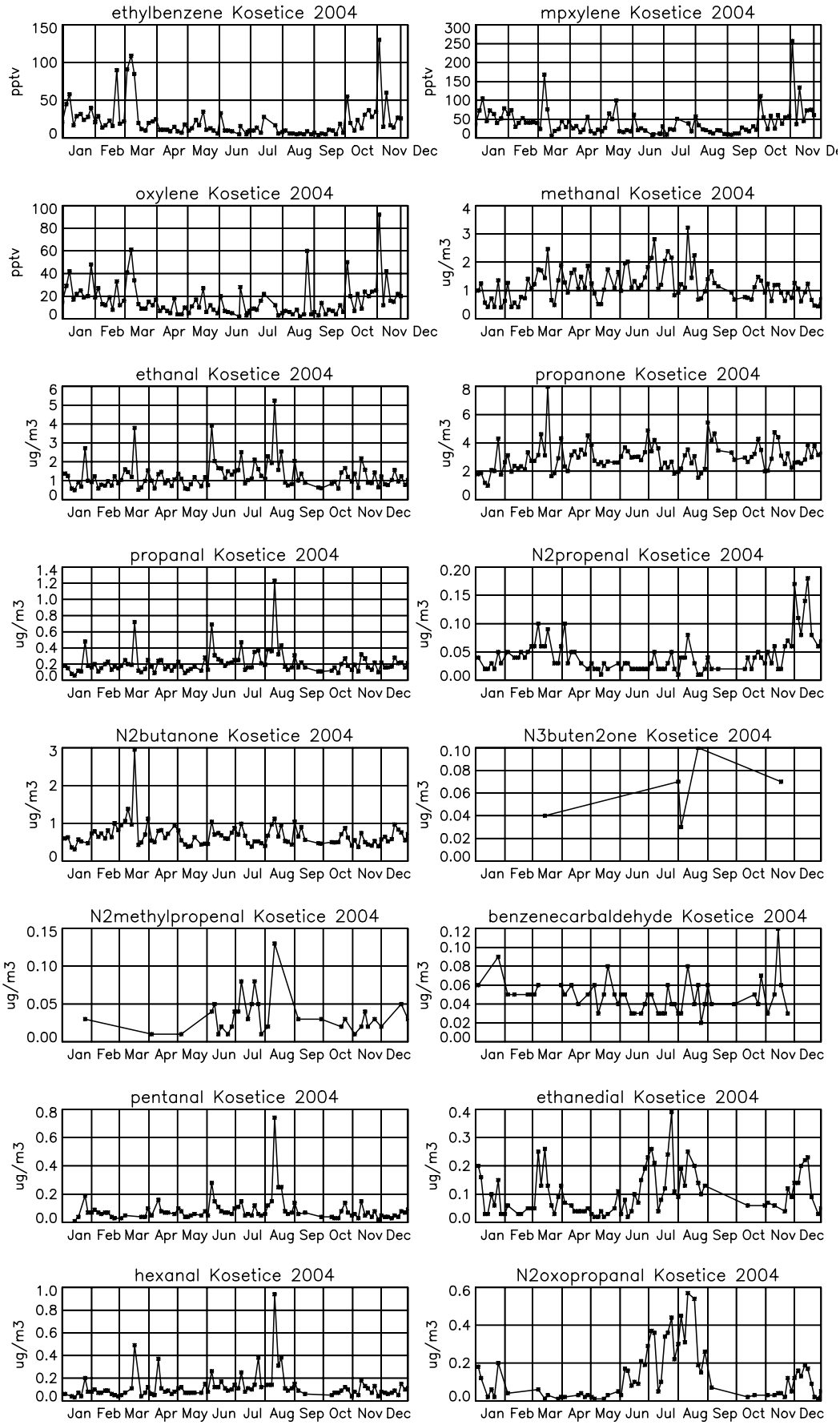
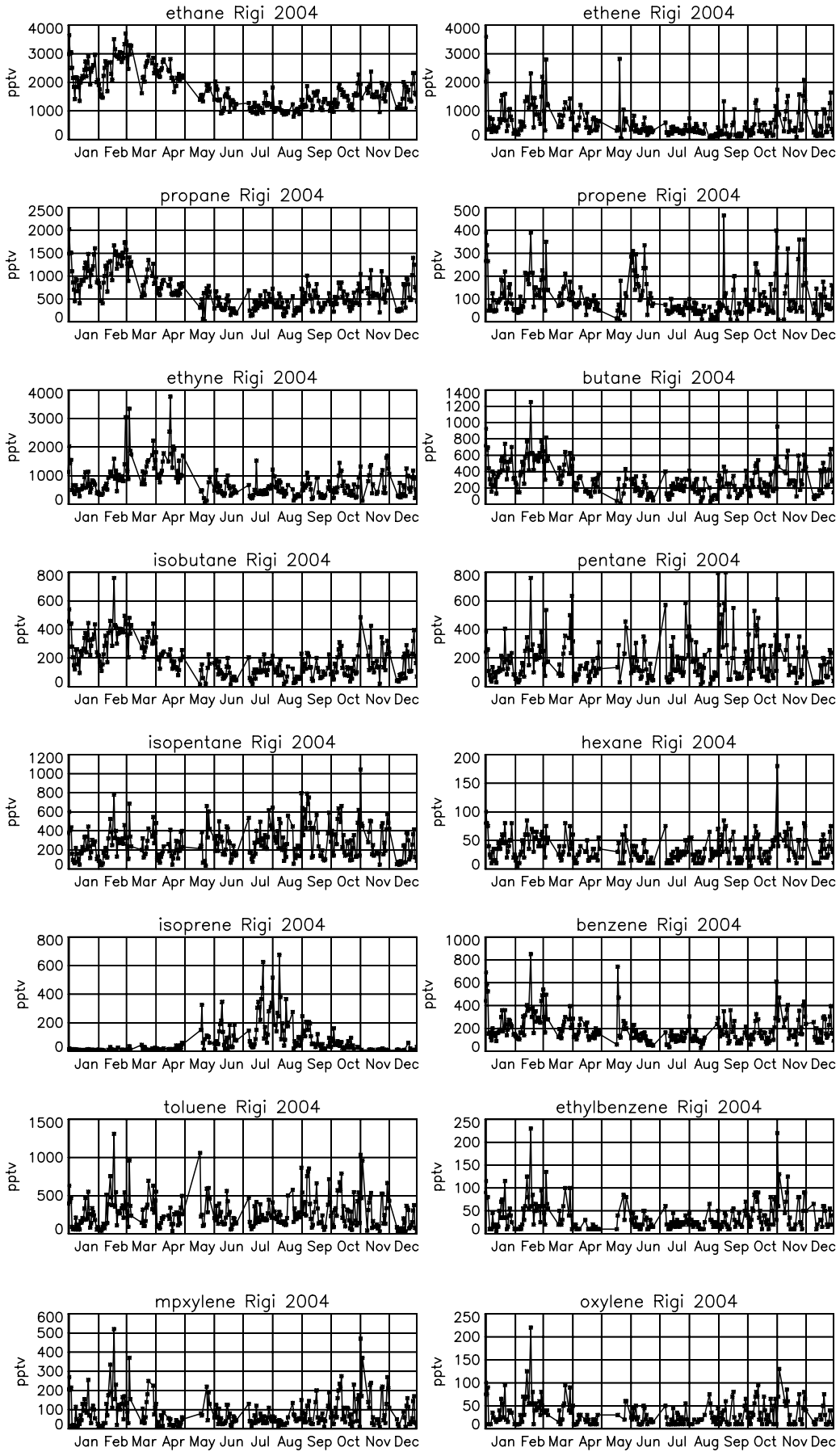
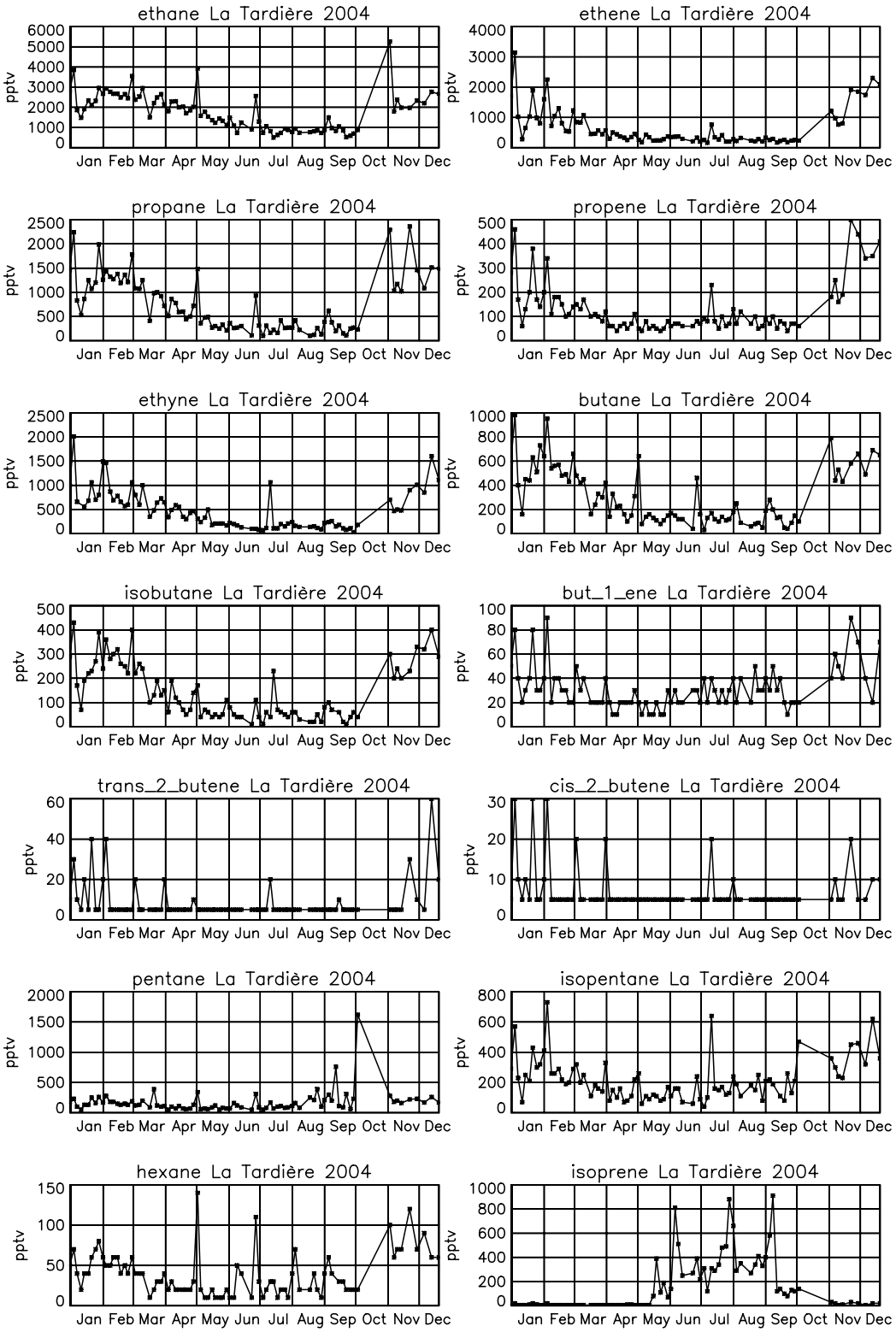
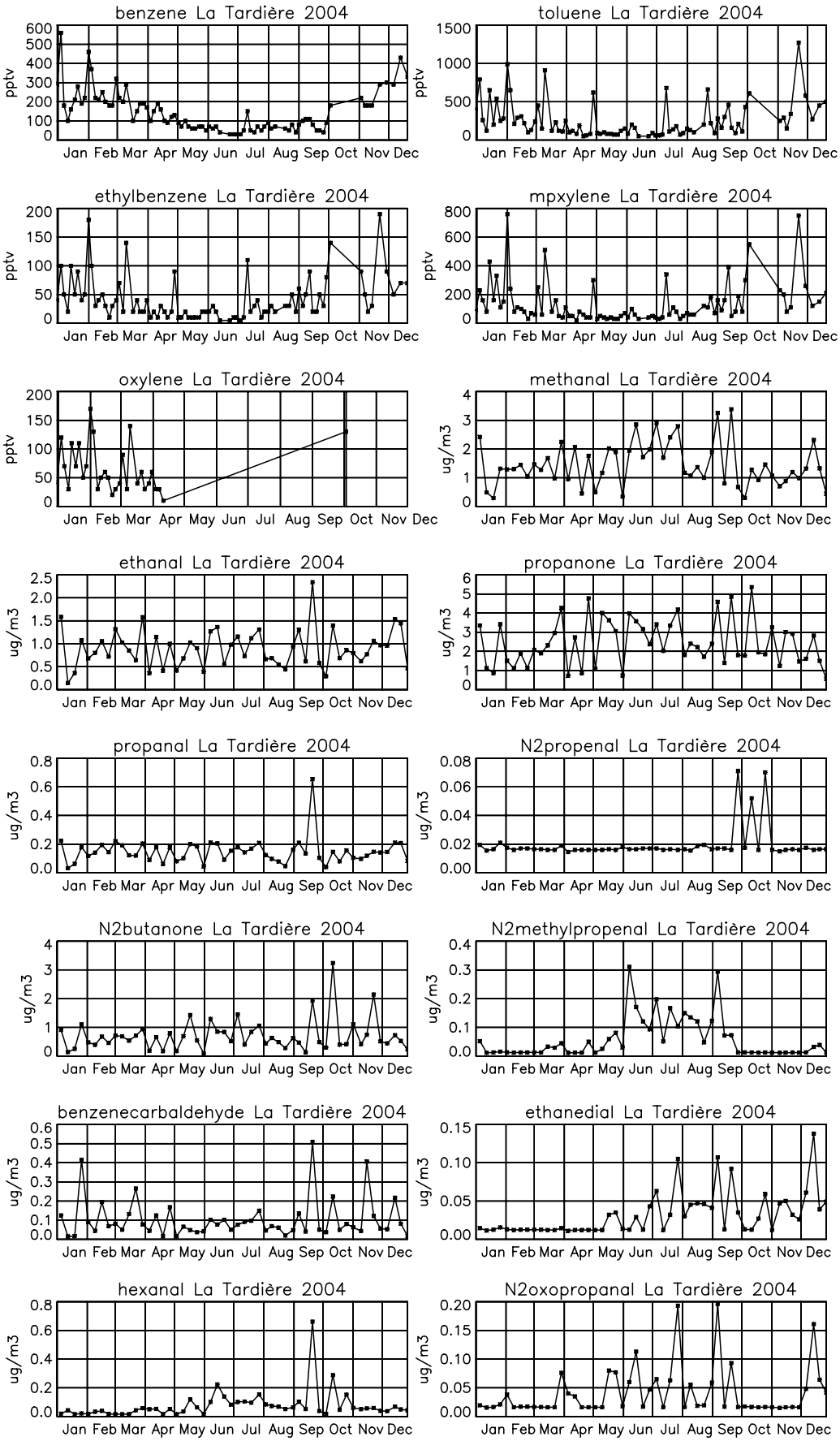
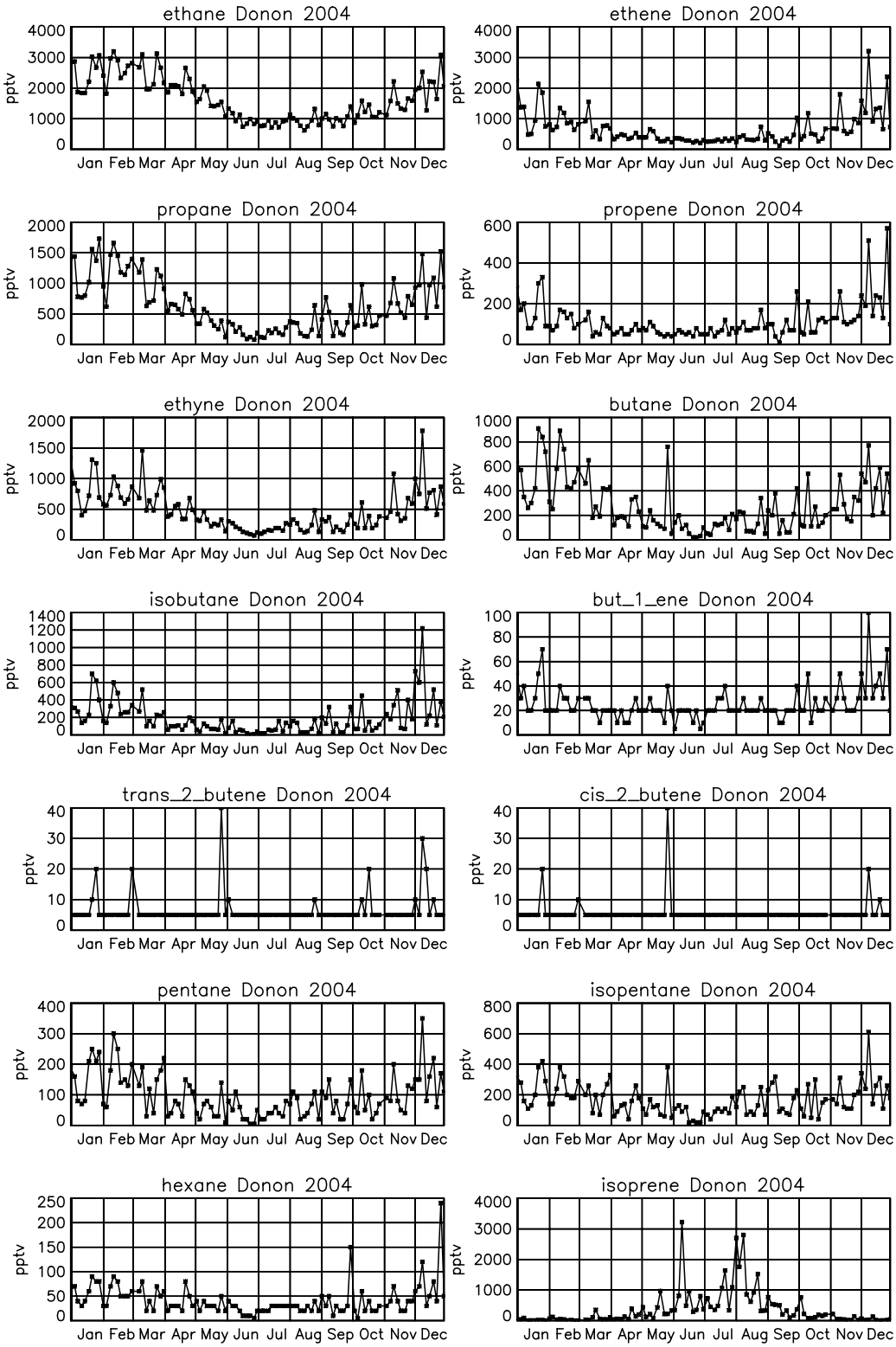

ethylbenzene Kosetice 2004
pptv
mpxylene Kosetice 2004
pptv
oxylene Kosetice 2004
pptv
methanal Kosetice 2004
ug/m3
ethanal Kosetice 2004
ug/m3
propanone Kosetice 2004
ug/m3
propanal Kosetice 2004
ug/m3
N2propenal Kosetice 2004
ug/m3
N2butanone Kosetice 2004
ug/m3
N3buten2one Kosetice 2004
ug/m3
N2methylpropenal Kosetice 2004
ug/m3
benzenecarbaldehyde Kosetice 2004
ug/m3
pentanal Kosetice 2004
ug/m3
ethanedial Kosetice 2004
ug/m3
hexanal Kosetice 2004
ug/m3
N2oxopropanal Kosetice 2004
ug/m3
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


ethane Rigi 2004
ethene Rigi 2004
propane Rigi 2004
propene Rigi 2004
ethyne Rigi 2004
butane Rigi 2004
isobutane Rigi 2004
pentane Rigi 2004
isopentane Rigi 2004
hexane Rigi 2004
isoprene Rigi 2004
benzene Rigi 2004
toluene Rigi 2004
ethylbenzene Rigi 2004
mpxylene Rigi 2004
oxylene Rigi 2004
pptv
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


ethane La Tardière 2004
ethene La Tardière 2004
propane La Tardière 2004
propene La Tardière 2004
ethyne La Tardière 2004
butane La Tardière 2004
isobutane La Tardière 2004
but_1_ene La Tardière 2004
trans_2_butene La Tardière 2004
cis_2_butene La Tardière 2004
pentane La Tardière 2004
isopentane La Tardière 2004
hexane La Tardière 2004
isoprene La Tardière 2004
pptv
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


benzene La Tardière 2004
pptv
0 100 200 300 400 500 600
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
toluene La Tardière 2004
pptv
0 500 1000 1500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethylbenzene La Tardière 2004
pptv
0 50 100 150 200
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
mpxylene La Tardière 2004
pptv
0 200 400 600 800
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
oxylene La Tardière 2004
pptv
0 50 100 150 200
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
methanal La Tardière 2004
ug/m3
0 1 2 3 4
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethanal La Tardière 2004
ug/m3
0.0 0.5 1.0 1.5 2.0 2.5
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
propanone La Tardière 2004
ug/m3
0 1 2 3 4 5 6
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
propanal La Tardière 2004
ug/m3
0.0 0.2 0.4 0.6 0.8
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
N2propenal La Tardière 2004
ug/m3
0.00 0.02 0.04 0.06 0.08
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
N2butanone La Tardière 2004
ug/m3
0 1 2 3 4
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
N2methylpropenal La Tardière 2004
ug/m3
0.0 0.1 0.2 0.3 0.4
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
benzenecarbaldehyde La Tardière 2004
ug/m3
0.0 0.1 0.2 0.3 0.4 0.5 0.6
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethanedial La Tardière 2004
ug/m3
0.00 0.05 0.10 0.15
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
hexanal La Tardière 2004
ug/m3
0.0 0.2 0.4 0.6 0.8
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
N2oxopropanal La Tardière 2004
ug/m3
0.00 0.05 0.10 0.15 0.20
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


ethane Donon 2004
ethene Donon 2004
propane Donon 2004
propene Donon 2004
ethyne Donon 2004
butane Donon 2004
isobutane Donon 2004
but_1_ene Donon 2004
trans_2_butene Donon 2004
cis_2_butene Donon 2004
pentane Donon 2004
isopentane Donon 2004
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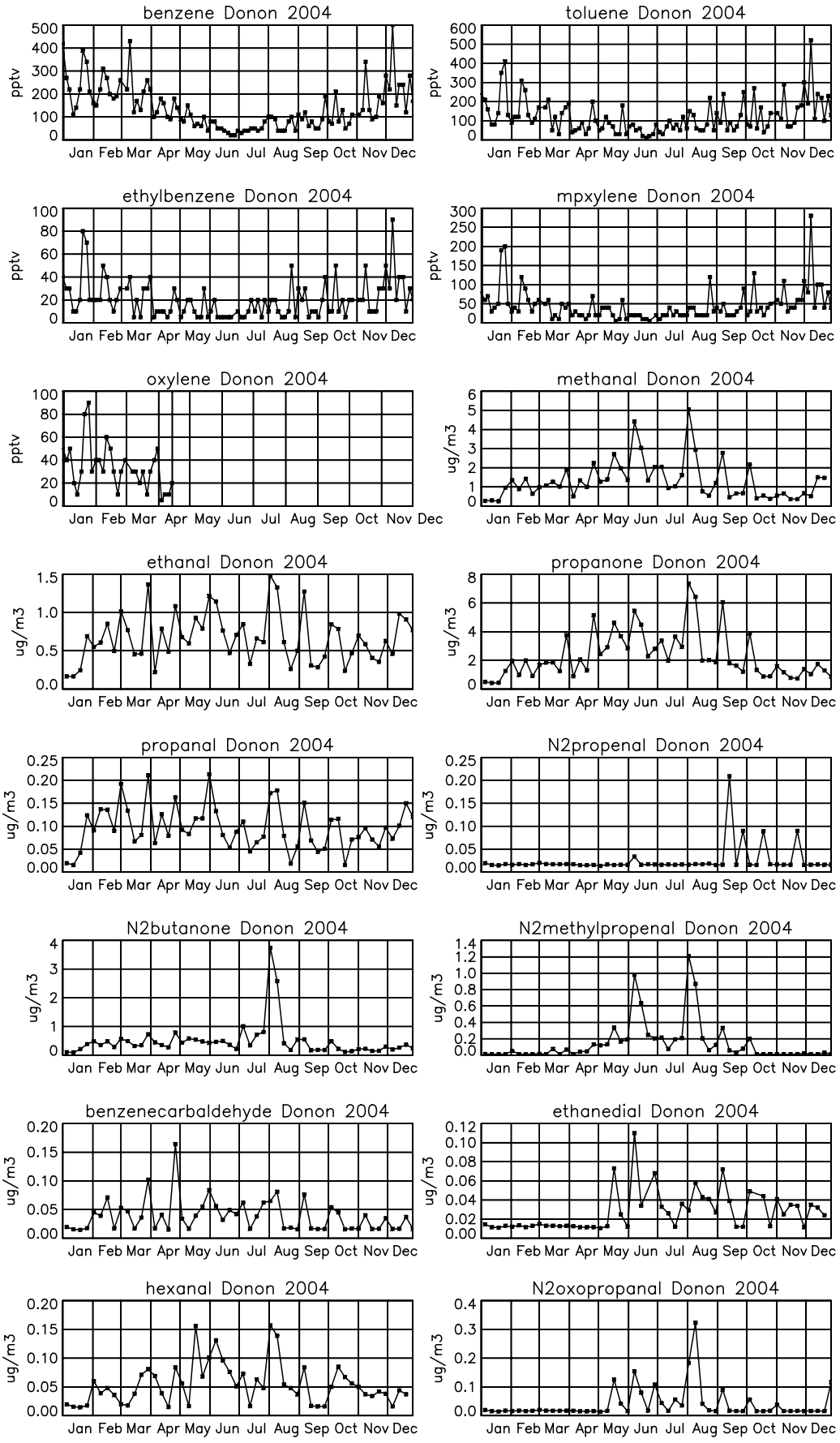
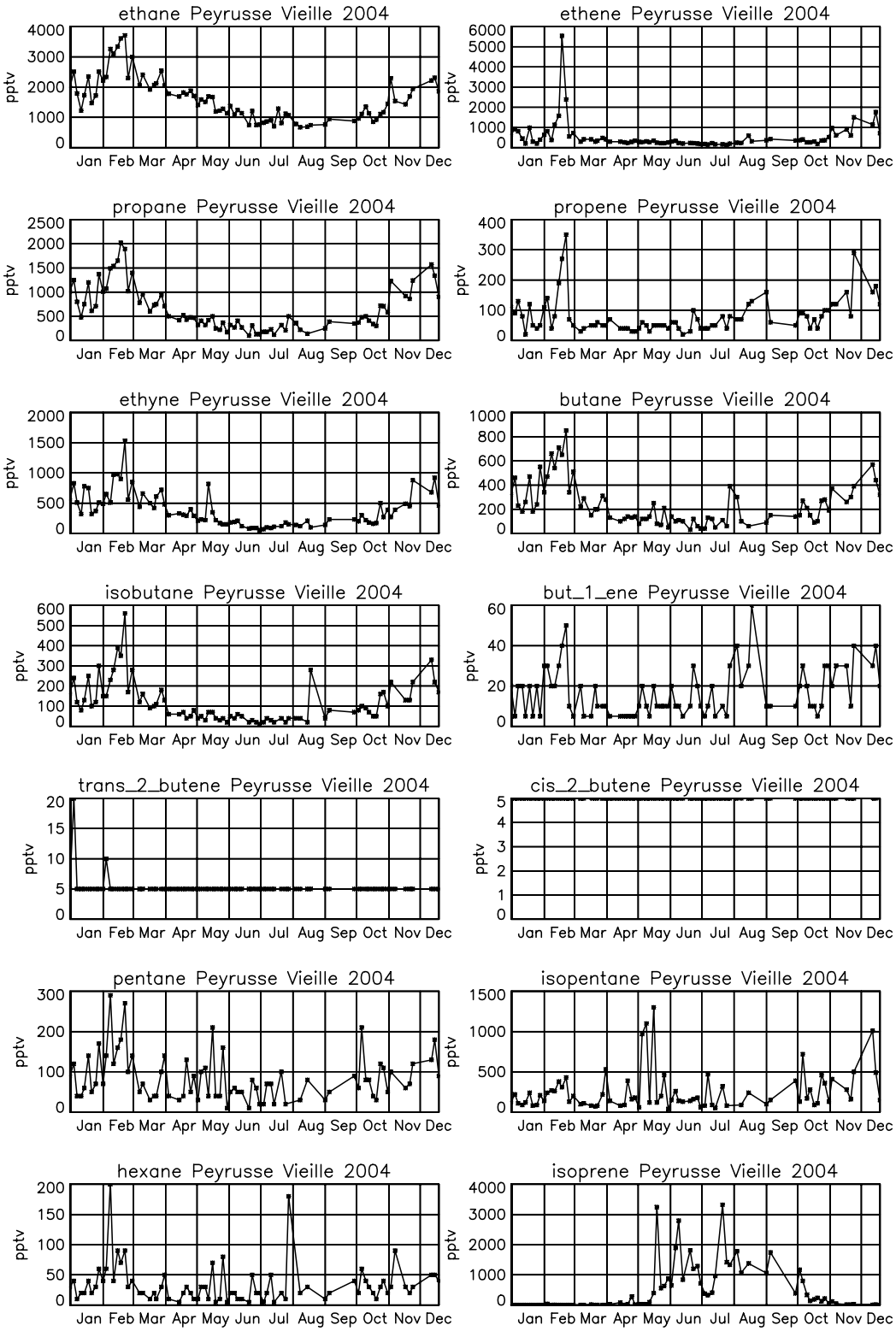
isoprene Donon 2004
pptv
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


benzene Donon 2004
pptv
toluene Donon 2004
pptv
ethylbenzene Donon 2004
pptv
mpxylene Donon 2004
pptv
oxylene Donon 2004
pptv
methanal Donon 2004
ug/m3
ethanal Donon 2004
ug/m3
propanone Donon 2004
ug/m3
propanal Donon 2004
ug/m3
N2propenal Donon 2004
ug/m3
N2butanone Donon 2004
ug/m3
N2methylpropenal Donon 2004
ug/m3
benzenecarbaldehyde Donon 2004
ug/m3
ethanedial Donon 2004
ug/m3
hexanal Donon 2004
ug/m3
N2oxopropanal Donon 2004
ug/m3
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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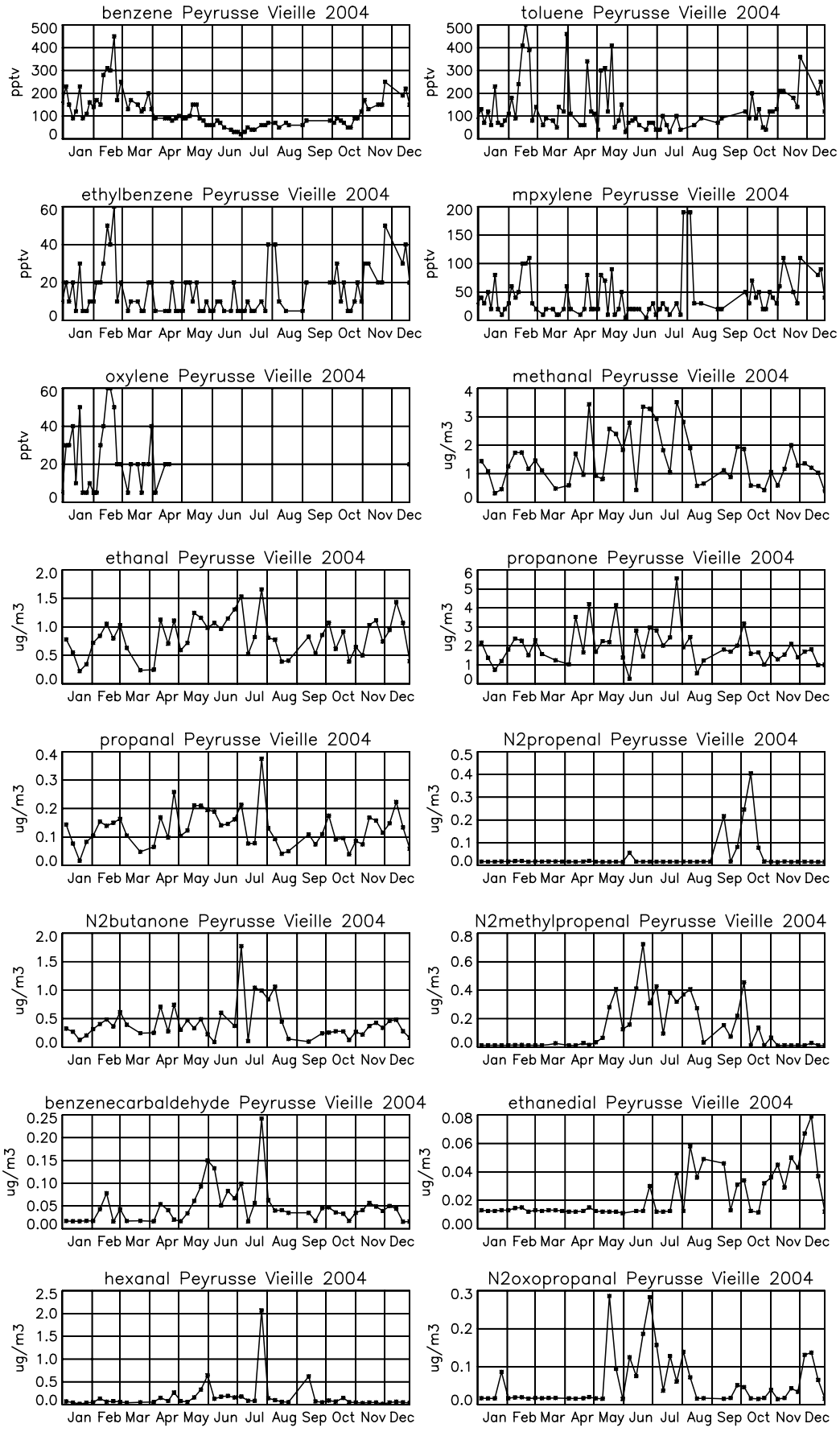
propene Peyrusse Vieille 2004
ethyne Peyrusse Vieille 2004
butane Peyrusse Vieille 2004
isobutane Peyrusse Vieille 2004
but_1_ene Peyrusse Vieille 2004
trans_2_butene Peyrusse Vieille 2004
cis_2_butene Peyrusse Vieille 2004
pentane Peyrusse Vieille 2004
isopentane Peyrusse Vieille 2004
hexane Peyrusse Vieille 2004
isoprene Peyrusse Vieille 2004
pptv
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


benzene Peyrusse Vieille 2004
pptv
toluene Peyrusse Vieille 2004
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ethylbenzene Peyrusse Vieille 2004
pptv
mpxylene Peyrusse Vieille 2004
pptv
oxylene Peyrusse Vieille 2004
pptv
methanal Peyrusse Vieille 2004
ug/m3
ethanal Peyrusse Vieille 2004
ug/m3
propanone Peyrusse Vieille 2004
ug/m3
propanal Peyrusse Vieille 2004
ug/m3
N2propenal Peyrusse Vieille 2004
ug/m3
N2butanone Peyrusse Vieille 2004
ug/m3
N2methylpropenal Peyrusse Vieille 2004
ug/m3
benzenecarbaldehyde Peyrusse Vieille 2004
ug/m3
ethanedial Peyrusse Vieille 2004
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ug/m3
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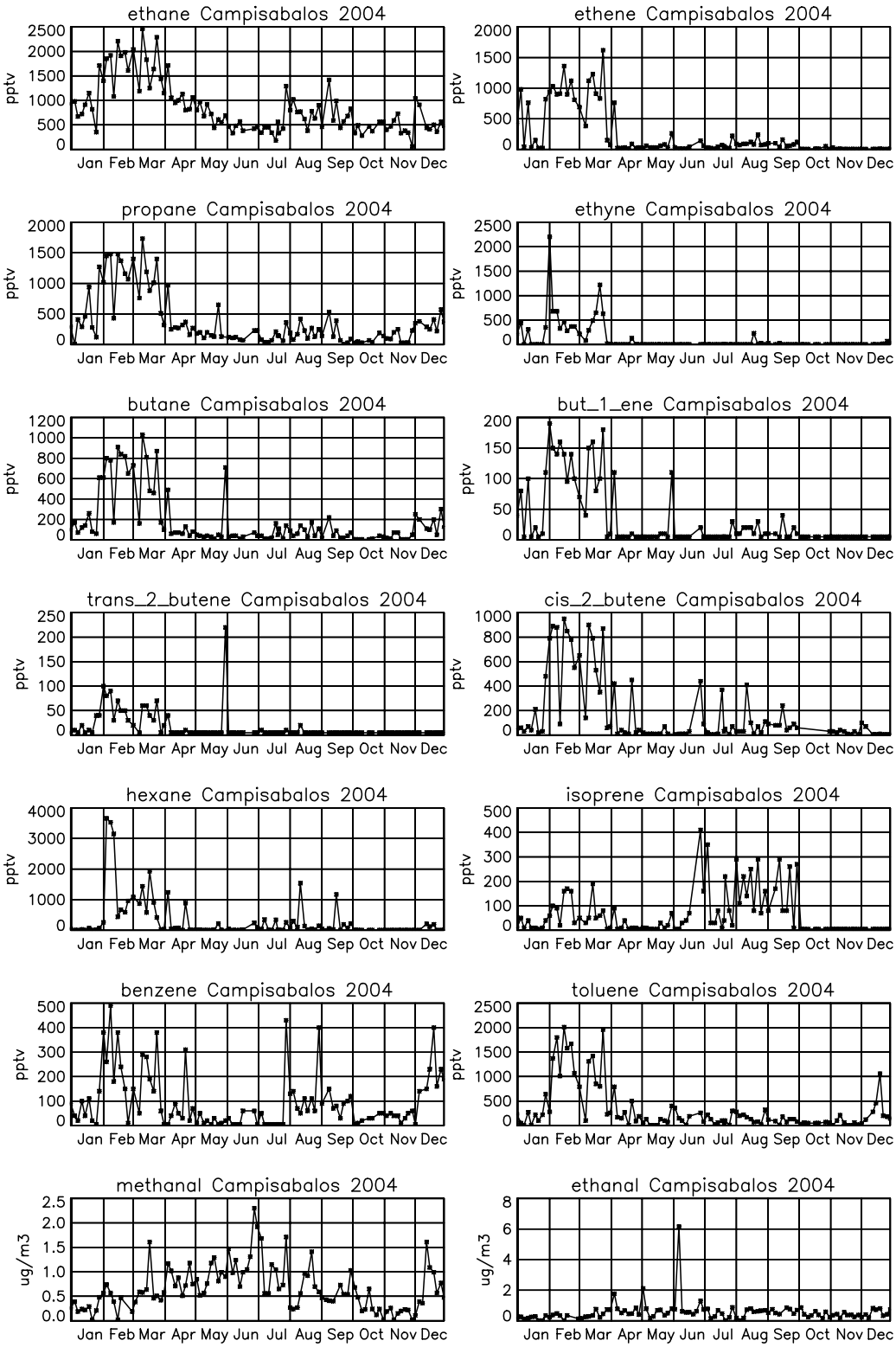
ug/m3
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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pptv
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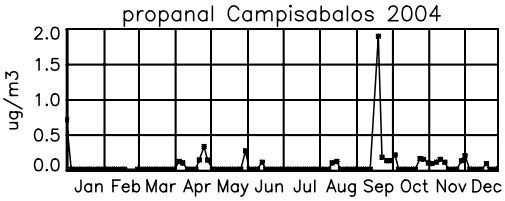
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethene Campisabalos 2004
pptv
0 500 1000 1500 2000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
propane Campisabalos 2004
pptv
0 500 1000 1500 2000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethyne Campisabalos 2004
pptv
0 500 1000 1500 2000 2500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
butane Campisabalos 2004
pptv
0 200 400 600 800 1000 1200
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
but_1_ene Campisabalos 2004
pptv
0 50 100 150 200
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
trans_2_butene Campisabalos 2004
pptv
0 50 100 150 200 250
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
cis_2_butene Campisabalos 2004
pptv
0 200 400 600 800 1000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
hexane Campisabalos 2004
pptv
0 1000 2000 3000 4000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
isoprene Campisabalos 2004
pptv
0 100 200 300 400 500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
benzene Campisabalos 2004
pptv
0 100 200 300 400 500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
toluene Campisabalos 2004
pptv
0 500 1000 1500 2000 2500
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
methanal Campisabalos 2004
ug/m3
0.0 0.5 1.0 1.5 2.0 2.5
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
ethanal Campisabalos 2004
ug/m3
0 2 4 6 8
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec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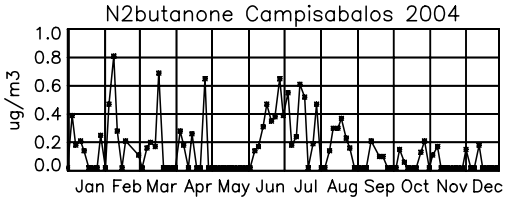
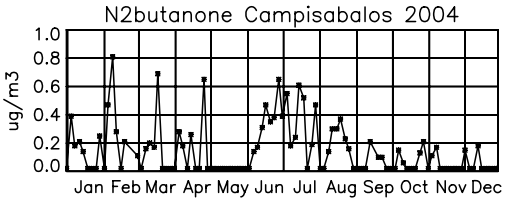
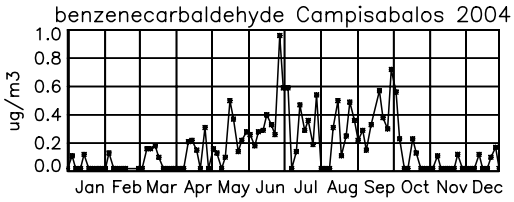
ug/m3
2.0
1.5
1.0
0.5
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


N2butanone Campisabalos 2004
ug/m3
1.0
0.8
0.6
0.4
0.2
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


N2butanone Campisabalos 2004
ug/m3
1.0
0.8
0.6
0.4
0.2
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


benzenecarbaldehyde Campisabalos 2004
ug/m3
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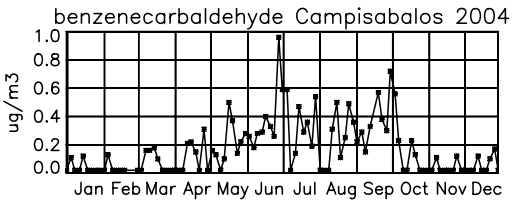
0.6
0.4
0.2
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


benzenecarbaldehyde Campisabalos 2004
ug/m3
1.0
0.8
0.6
0.4
0.2
0.0
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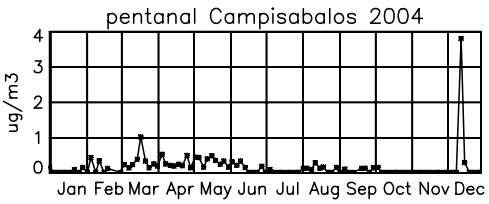
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ug/m3
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3
2
1
0
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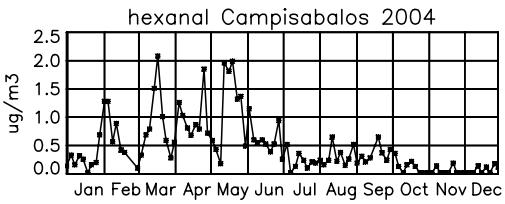
hexanal Campisabalos 2004
ug/m3
2.5
2.0
1.5
1.0
0.5
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec