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Report on ozone, nitrogen dioxide and peroxyacetyl nitrate, April-September 1985

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SUMMARY

OXIDATE is a joint project of European OECD countries to collect and distribute regional data on ozone, nitrogen dioxide and PAN. These data can be of interest to those involved in assessing effects of oxidants, modelling the temporal and spatial distribution of oxidants, and to others who are interested in photochemical oxidants.

Each country has nominated a contact person and an institution responsible of collecting data. The data have been sent in a specified format to the project secretariat. The data are then redistributed on magnetic tape to all the participating countries. A summary report is made for each year giving a brief overview of the project organisation and the concentration levels.

The OXIDATE project was started in 1985 under the OECD programme "Control of Major Air Pollutants (MAP)". In the first year of the project, data have been received from 25 measurement stations in these nine countries: Austria, Belgium, Denmark, Federal Republic of Germany, Finland, Netherlands, Norway, Sweden and United Kingdom. Ozone was reported from 24 stations, nitrogen dioxide from six and PAN from one station. There has been no centrally organised intercalibration or other data control activity. The measurement methods used are chemiluminescence or UV absorbtion for ozone, chemiluminescence for nitrogen dioxide and gas chromatography with electron capture detection for PAN.

The highest ozone concentrations were measured in the eastern part of Austria and in the Federal Republic of Germany. The concentrations in eastern Austria were indeed much higher than elsewhere, with hourly concentrations approaching 450 $\mu g/m^3$. The ozone data have indicated a gradient in episodic high concentrations with lower levels in the north-western part and higher levels towards the central and south-eastern part of Europe. It is not clear whether this is a general result or representative for 1985 only.

The days with high ozone concentrations were distributed according to the air trajectory sectors. The distribution of sector directions for which high ozone concentrations were measured was in many cases significantly different from the distribution over the total half-year period.

There is a need to include more countries and measurement stations in the project in order to improve the understanding of the oxidant phenomenon. Regional oxidant data from the other European OECD countries are of interest, particularly from France and Switzerland in which regional ozone monitoring is being carried out. There is also a strong need to include oxidant data from East Europe in future European joint measurement programmes.

CONTENTS

OXIDANT DATA COLLECTION IN OECD-EUROPE 1985-87 (OXIDATE)

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1 INTRODUCTION

Episodes of high concentrations of ozone occur over north-western Europe every summer (Cox et al., 1975, Guicherit and van Dop, 1977, Schjoldager et al, 1981, Grennfelt and Schjoldager, 1984). During these episodes the ozone concentrations can reach values above ambient air quality standards over large regions.

The large scale oxidant phenomenon in Europe was first observed from measurements in southern England 1971 (Atkins et al., 1972). During an episode in June/July 1971 ozone concentrations in excess of 200 $\mu g/m^3$ were observed in connection with high concentrations of particulate sulphate. The observations were made in a high pressure situation with light easterly winds. They suggested that the pollutants originated in continental Europe. The first assessment of ozone data from several stations in Europe was made by Guicherit and van Dop (1977). They examined four ozone episodes between 1971 and 1975 using data from the Federal Republic of Germany, France, Italy, Netherlands, Sweden and United Kingdom. A study of ozone episodes in north-western Europe was done for the years 1976-79 by Schjoldager et al. (1981). Data from 24 monitoring stations in 8 countries were collected and evaluated. The relations between photochemical oxidant episodes, large scale weather and air trajectories were analysed.

For data after 1980 one report is published describing episodes with data from several countries (Lübkert et al., 1984). The report was a result of an OECD workshop in Schauinsland, Federal Republic of Germany, in October 1984. Three episodes were described, one from 1980 and two from 1982. The objective was to provide data for model validations. Besides these reports with data from several countries, a number of publications have appeared presenting and evaluating data from smaller regions.

Because of the regional scale of the photochemical oxidant phenomenon, a successful control of the oxidant problem will only be reached by joint efforts in several countries. At present, several research institutions are involved in modelling work on large scale oxidant formation and transport. Of particular interest is the Dutch-German PHOXA project (Photochemical Oxidant and Acid Deposition Model Application), and the work carried out in Norway within the framework of the European Monitoring and Evaluation Programme (EMEP) (Stern and Builtjes, 1986; Hov et al., 1985).

International bodies, e.g., ECE, EC and OECD, are concerned with abatement strategies. The OECD is currently carrying out a programme on "Control of Major Air Pollutants (MAP)" on an international scale.The programme is concerned with long-range transport of air pollutants and large-scale formation of secondary atmospheric pollutants, particulary photochemical oxidants and their precursors. The programme involves several acitivities; emission inventories, assessment of ambient photochemical concentrations and their effects, implementation and refinement of models for formation and transport of oxidants, and compilation of data on techniques and costs for the control of emissions of nitrogen oxides and volatile organic compounds.

For the assessment of effects and for the model refinement and validation, a comprehensive data base on ambient air concentrations is necessary. Since no permanent or long term (i.e. several years) network yet exists in Europe for the monitoring of photochemical oxidants, Norway and Sweden offered, during the OECD workshop in 1984, to collect data on ozone, NO_2 and PAN from the European OECD countries, and redistribute the data to the participating countries. The project was presented for the Air Management Policy Group (AMPG) at OECD in March 1985 and received general support. It was agreed to include the OXIDATE project in the OECD MAP programme.

The project is being carried out by the Swedish Environmental Research Institute (IVL) and the Norwegian Institute for Air Research (NILU). In 1985 and 1986, the project has been financed by the Swedish Environmental Protection Board (SNV) and the Norwegian State Pollution Control Authority (SFT). In 1987, economic support is given by the Nordic Council of Ministers (NMR).

2 ORGANISATION

Each country nominates an institution responsible for collecting national data and submitting them to the project secretariat. For measurements from the summer half year (April-September), the deadline for data submission is the end of December. For measurements from the winter half year (October-March), the deadline is the end of June. The costs of national data handling are covered by the individual countries.

All data will be redistributed to the participating institutions at the end of March and September, respectively. The data will thus be redistributed six months after the end of the measurement periods.

At the end of March each year, IVL and NILU will prepare a short project report with information on status of stations and measurements, and a summary of the most important episodes during the preceding year.

In the first year, it was not possible to keep the time schedule given above. The reason for this has partly been limited resources at the responsible institutes, and partly that the data were not always received according to the specifications. It is believed that this delay is temporary and will not last throughout the project.

The list of contact persons and institutions is given in Table 1.

Data from April-September 1985 have been received from these nine countries: Austria, Belgium, Denmark, Federal Republic of Germany, Finland, Netherlands, Norway, Sweden and United Kingdom.

3 MONITORING STATIONS

The total number of monitoring stations was 25. The stations are given in Tables 2 and 3, and on the map in Figure 1. 24 stations have reported ozone, six have reported nitrogen dioxide, and one station has reported PAN data.

Table 1: Oxidant data collection in OECD-Europe 1985-87 (OXIDATE). List of contact persons and institutions, 1985.

COUNTRY	NAME, INSTITUTION	TELEPHONE
Austria	Dr. Ruth Baumann Umwltbundesamt Wien Abteilung für Lufthygiene Biberstrasse 11 A-1010 WIEN	43-222-43 2504
Belgium	Dr. J. Beyloos Institute d´Hygiène et d´Epidèmiologie 14, Rue Juliette Wytsman B-1050 BRUXELLES	32-2-642 5111
Denmark	Dr. Finn Palmgren Jensen Miljøstyrelsen, Luftforureningslaboratoriet Forsøgsanlæg Risø DK-4000 ROSKILDE	45-2-37 1137
Federal Republic of Germany	Dr. Rolf Sartorius Umweltbundesamt Bismarckplatz 1 D-1000 BERLIN	49-30-8903 511
	Dr. Wolfgang Grosch Umweltbundesamt, Pilotstation Frankfurt Frankfurter Str. 135 D-6050 OFFENBACH	49-69-88 80 38
Finland	Mr. Heikki Lättilä Finnish Meteorological Institute (FMI) P.O.Box 50 SF-00810 HELSINKI	358-0-119 22
Netherlands	Dr. W.F. Blom Air Research Laboratory Rijksinstituut vor Volksgezondheid en Milienuhygiene Postbus 1 NL-3720 BA BILTHOVEN	31-30-74 91 11
Norway	Mr. Jørgen Schjoldager Norwegian Institute for Air Research (NILU) P.O.Box 64 N-2001 LILLESTRØM	47-6-81 41 70
Sweden	Mr. Peringe Grennfelt Swedish Environmental Research Institute (IVL) P.O.Box 5207 S-402 24 GOTEBORG	46-31-46 00 80
United Kingdom	Dr. B. Sweeney Air Pollution Division Warren Spring Laboratory Gunnels Wood Road, Stevenage Herts SG1 2BX, ENGLAND	44-438-31 33 88

Table 2: Oxidant data collection in OECD-Europe 1985-87 (OXIDATE). List of countries, stations and compounds, 1985.

COUNTRY/STATION	COMPOUNDS O_3	NO_2	PAN	PERIOD
AUSTRIA				
Illmitz	x			1 April-30 September
BELGIUM				
Gent, St.Kruiswinkel	x	x		1 April-30 September
DENMARK				
Risø	x			8 May -30 September
FED.REP. OF GERMANY				
Brotjacklriegel	x			1 April-30 September
Deuselbach	x			" "
Langenbrügge-Waldhof	x			" "
Schauinsland	x			" "
Westerland	x			" "
FINLAND				
Utö	x	x		4 July -30 September
NETHERLANDS				
Delft			x	1 April-30 September
Eibergen	x	x		" "
Witteveen	x	x		" "
NORWAY				
Birkenes	x			1 July -30 September
Jeløya	x			1 April-30 September
Langesund	x			1 April-30 July
SWEDEN				
Aspvreten	x			1 April-30 September
Norra Kvill	x			23 June -30 September
Ringamåla	x			1 April-30 September
Rörvik	x			1 April-30 September
Vavihill	x			2 May -30 September
Vindeln	x			3 July -30 September
UNITED KINGDOM				
Bottesford	x	x		1 April-30 September
Harwell	x			" "
Wray	x	x		" "
Sibton	x			" "

The monitoring stations in the project have been selected by the countries. All countries report that they have used either chemiluminescence or UV absorption for ozone monitoring, chemiluminescence for NO_2, and gas chromatography with electron capture detection for PAN.

10

There have been substantial improvements in both monitoring and calibration techniques for ozone during the last 5-7 years. Most of the ozone data are probably of good quality.

Table 3: List of latitude, longitude and altitude of the OXIDATE stations, 1985. The station codes refer to Figure 1 only, and are not equivalent to the EMEP station codes.

STATION NAME		LATITUDE	LONGITUDE	ALTITUDE (m)
A1	Illmitz	47 46 N	16 46 E	117
B1	Gent, St. Kruiswink.	51 9 N	3 49 E	5
DK1	Risø	55 42 N	12 6 E	13
D1	Brotjacklriegel	48 49 10 N	13 13 9 E	1016
D2	Deuselbach	49 45 53 N	7 3 7 E	480
D3	Langenbrügge-Waldhof	52 48 8 N	10 45 34 E	73
D4	Schauinsland	47 54 53 N	7 54 31 E	1205
D5	Westerland	54 55 32 N	8 18 35 E	12
SF1	Utö	59 47 N	21 23 E	10
NL1	Delft	52 0 N	4 23 E	-2
NL2	Eibergen	52 6 N	6 36 E	20
NL3	Witteveen	52 49 N	6 40 E	16
N1	Langesund	59 1 N	9 45 E	5
N2	Jeløya	59 26 N	10 36 E	3
N3	Birkenes	58 23 N	8 15 E	190
S1	Aspvreten	58 48 N	17 23 E	20
S2	Norra Kvill	57 49 N	15 34 E	261
S3	Ringamåla	56 19 N	14 92 E	103
S4	Rörvik	57 25 N	11 56 E	10
S5	Vavihill	56 1 N	13 9 E	175
S6	Vindeln	64 15 N	19 46 E	225
UK1	Bottesford	52 56 N	0 49 W	32
UK2	Harwell	51 25 N	1 19 W	137
UK3	Wray (Lancaster)	54 6 N	2 35 W	75
UK4	Sibton	52 18 N	1 28 E	46

With regard to NO_2 commercially avaliable chemiluminescence instruments have a detection limit in the lower ppb level. PAN instruments need a quite careful inspection and maintenance. This may explain that only one station has reported PAN.

In the project, no general intercalibration has been performed, nor has there been a general evaluation of the representativity of the stations for the purpose of the project, i.e., to study the regional extent of photochemical oxidants.

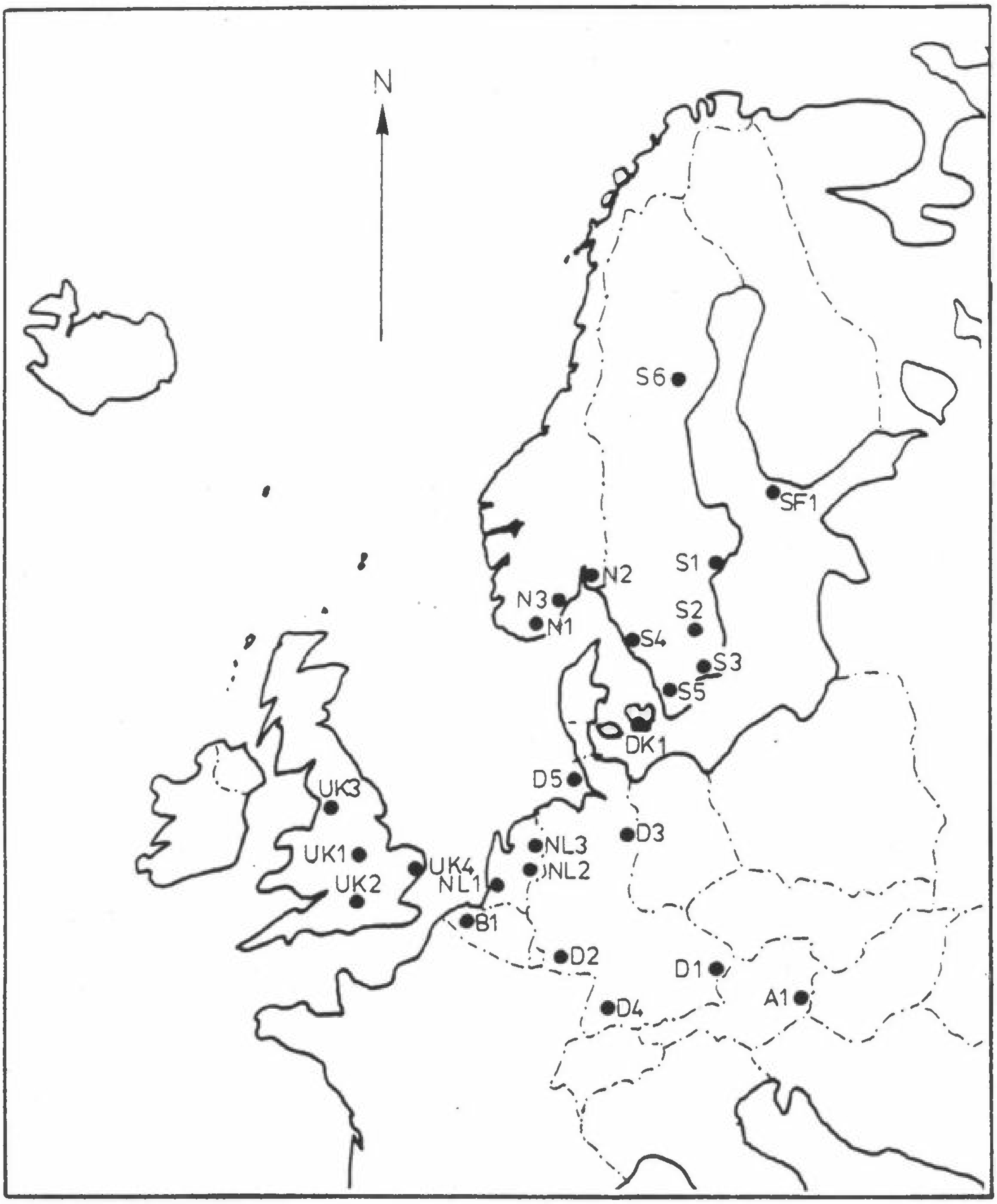


Figure 1: Map of measurement stations in project OXIDATE 1985.
(Station codes refer to Table 1 only.)

4 SUMMARY OF RESULTS

4.1 EXTREME CONCENTRATIONS AND EXCEEDING OF CONCENTRATION LIMITS

Tables of the dates and the number of days and hours with hourly concentrations above certain limits are given in Appendix A-C, for ozone, nitrogen dioxide and PAN.

Table 4 gives the number of hours and days with hourly ozone concentrations exceeding the concentration limits of 120, 160, 200, 240 and 280 $\mu g/m^3$. Two stations, Birkenes (Norway) and Vindeln (Sweden) had no hourly concentrations exceeding 120 $\mu g/m^3$. Four stations had hourly concentrations above 240 $\mu g/m^3$. These were Illmitz (Austria), Gent St. Kruiswinkel (Belgium), Langenbrügge-Waldhof (Federal Republic of Germany) and Jeløya (Norway).

During the half-year period, the highest hourly ozone concentration was 446 $\mu g/m^3$, and the highest daily concentration was 197 $\mu g/m^3$, both measured at Illmitz (Austria) on 16 August 1985.

The highest hourly NO_2 concentration was 261 $\mu g/m^3$, and the highest daily concentration was 150 $\mu g/m^3$, both measured at Gent St. Kruiswinkel (Belgium) on 29 August 1985 and 6 September 1985, respectively.

The highest hourly PAN concentration was 39.8 $\mu g/m^3$, and the highest daily concentration was 11.6 $\mu g/m^3$, measured on 29 and 30 August 1985, respectively. Delft (Netherlands) is the only station that has reported PAN.

4.2 MONTHLY MEAN CONCENTRATIONS

The monthly mean ozone concentrations are given in Table 5. Illmitz (Austria) had monthly mean concentrations above 110 $\mu g/m^3$ for all the months and above 130 $\mu g/m^3$ for the months May-September. The monthly mean concentrations at Schauinsland (Federal Republic of Germany) were

Table 4: Number of hours (h) and days (d) with hourly ozone concentrations exceeding 120, 160, 200, 240 and 280 $\mu g/m^3$, and maximum hourly and daily ozone concentration ($\mu g/m^3$), April-September 1985.

STATION	Number of hours and days												Maximum ozone concentrations ($\mu g/m^3$)	
	Total		>120		>160		>200		>240		>280			
	h	d	h	d	h	d	h	d	h	d	h	d	h	d
Illmitz	4044	172	2226	168	994	123	405	65	152	32	46	13	446	197
Gent St. Kruiswinkel	3695	161	77	15	38	7	17	4	1	1			253	120
Risø	2875	122	107	22	19	4	3	1					210	146
Brotjacklriegel	3609	152	314	41	8	3							174	109
Deuselbach	4003	170	264	38	31	6							196	109
Langenbrügge-Waldhof	4198	183	473	67	149	23	76	15	15	7	1	1	286	138
Schauinsland	4281	183	1170	91	99	20	4	2					202	127
Westerland	4329	183	101	19	4	2							166	105
Utö	1415	58	26	7	1	1							198	120
Eibergen	3841	165	81	17	18	7							181	99
Witteveen	2582	87	88	16	17	6	3	1					217	112
Birkenes	1401	61											115	70
Jeløya	4306	181	53	12	22	5	14	5	1	1			266	118
Langesund	2648	110	29	5									133	113
Aspvreten	2928	121	272	30	62	6							198	173
Norra Kvill	1830	77	13	2	3	1							194	100
Ringamåla	3300	138	207	28	17	5	1	1					202	130
Rörvik	3954	172	233	39	35	8	5	1					214	127
Vavihill	3447	144	255	32	44	7	2	1					212	141
Vindeln	1808	78											120	65
Bottesford	4375	183	84	12	22	2	9	1					220	133
Harwell	3805	160	121	23	16	4	1	1					206	136
Wray	4223	181	51	11	4	1							176	113
Sibton	2228	99	50	11	5	1							192	125

also relatively high, between 97 $\mu g/m^3$ and 110 $\mu g/m^3$ for all the months.

Many of the Nordic stations had their highest monthly mean concentrations in May, which is in agreement with earlier observations (Grennfelt and Schjoldager, 1984).

The monthly mean NO_2 concentrations are given in Table 6. The highest concentrations were generally measured in Belgium. High NO_2 concentrations may indicate influence from nearby sources.

Table 5: Monthly mean ozone concentrations (µg/m^3), April-September 1985.

STATION	April	May	June	July	Aug.	Sept.
Illmitz	114	130	131	155	147	132
Gent St.Kruiswinkel	33	37	33	56	37	38
Risø		87	80	64	58	50
Brotajacklriegel	76	95	86	94		88
Deuselbach	67	74	69	79	80	73
Langenbrügge-Waldhof	74	79	59	83	78	54
Schauinsland	97	109	98	110	98	104
Westerland	68	85	83	76	75	75
Utö				80	86	73
Eibergen	54	61	49	51	37	32
Witteveen	23		68	57	46	38
Birkenes				53	51	44
Jeløya	71	78	63	60	58	41
Langesund	63	68	69	42		
Aspvreten	92	97	53	62	41	36
Norra Kvill				57	60	53
Ringamåla	80	95	70	60	41	29
Rörvik	78	96	87	83	83	67
Vavihill		106	75	68	65	74
Vindeln				44	39	41
Bottesford	56	60	44	53	58	39
Harwell	86	78	64	66	59	67
Wray	70	72	63	57	59	51
Sibton	53	54	73		59	42

Table 6: Monthly mean NO_2 concentrations (µg/m^3), April-September 1985.

Station	April	May	June	July	Aug.	Sep.
Gent, St. Kruiswinkel	34	35	31	16	32	53
Utö				7	7	6
Eibergen	23	23	21	23	27	24
Witteveen	14	12	9	9	12	14
Bottesford	26	23	19	26	19	41
Wray	9	11	6	9	6	10

4.3 CUMULATIVE FREQUENCY DISTRIBUTIONS

The cumulative frequency distributions are given in Figures 2 and 3. Many stations show a near log-normal distribution in the higher range of the concentrations indicated by near straight lines in the graphs.

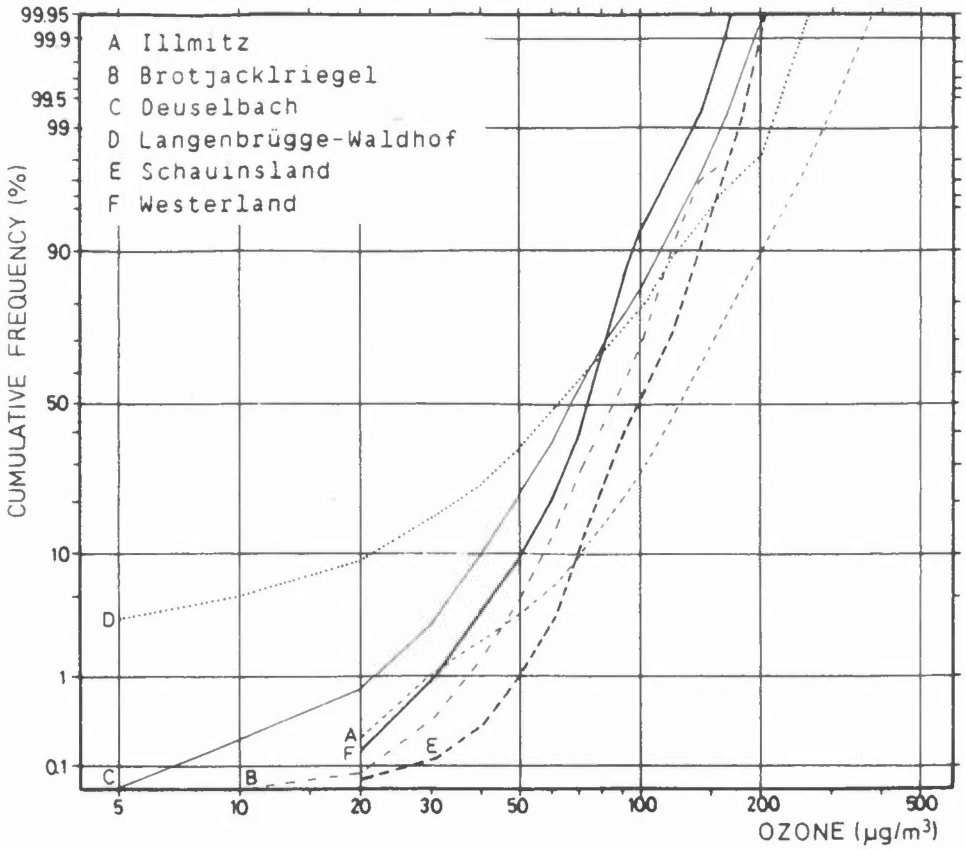
The 90, 95 and 98 percentiles of the ozone concentrations are given in Figures 4-6 for the different stations.

The highest concentrations were again experienced at Illmitz (Austria). Other stations with high concentrations were Schauinsland and Langenbrügge-Waldhof (Federal Republic of Germany).

Some "percentile isopleths" are indicated on the maps. These are extremely uncertain, partly because of the limited number of stations. Further, Illmitz and Langenbrügge-Waldhof which are among the most easterly located stations in continental Europe included in the project, show high concentrations making it impossible to determine the east end of the isopleths. Brotjacklriegel is another "anomaly" with considerably lower concentrations than the three surrounding stations.

In addition, not all the stations were in operation at the same time. For example, the Swedish station Norra Kvill was not operating until 23 June 1985, i.e. after many of the other Nordic stations had experienced their periods with maximum concentrations (see paragraph 4.2). The same was the case for Birkenes (Norway), Vindeln (Sweden) and Utö (Finland), which were not in operation until the beginning of July, 1985.

It should also be noted that the Finnish station Utö had a concentration cut-off of 40 $\mu g/m^3$, i.e. much higher than the other stations. This will have influence on the high percentile concentrations.



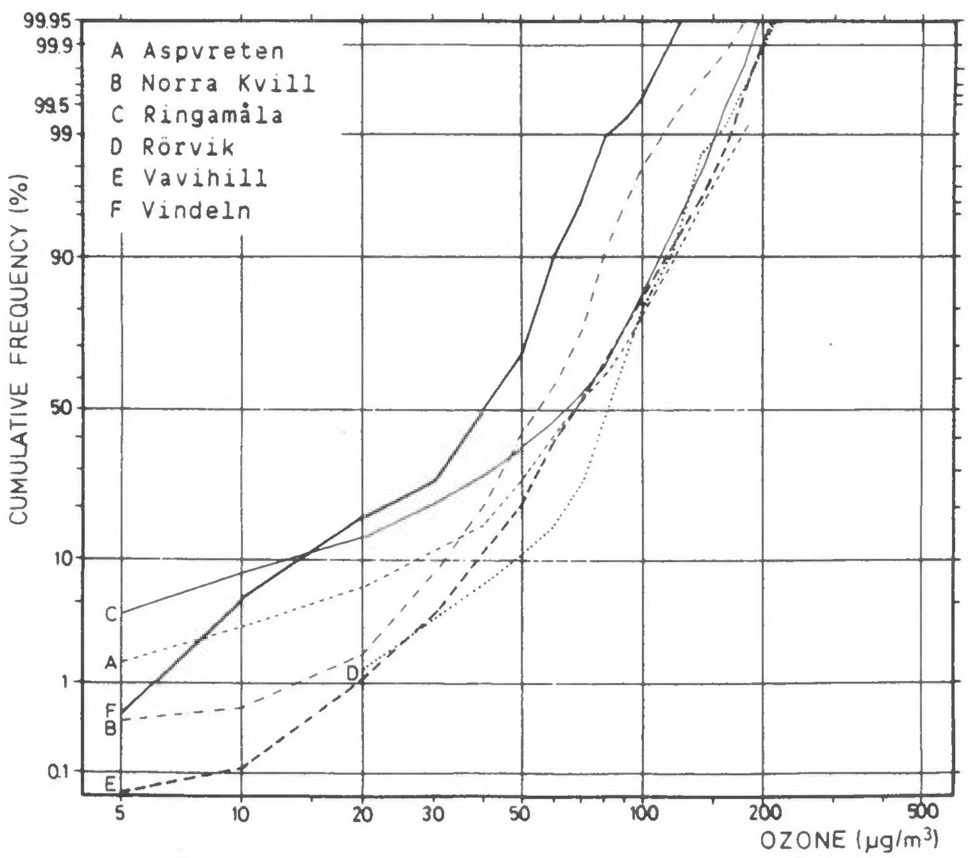
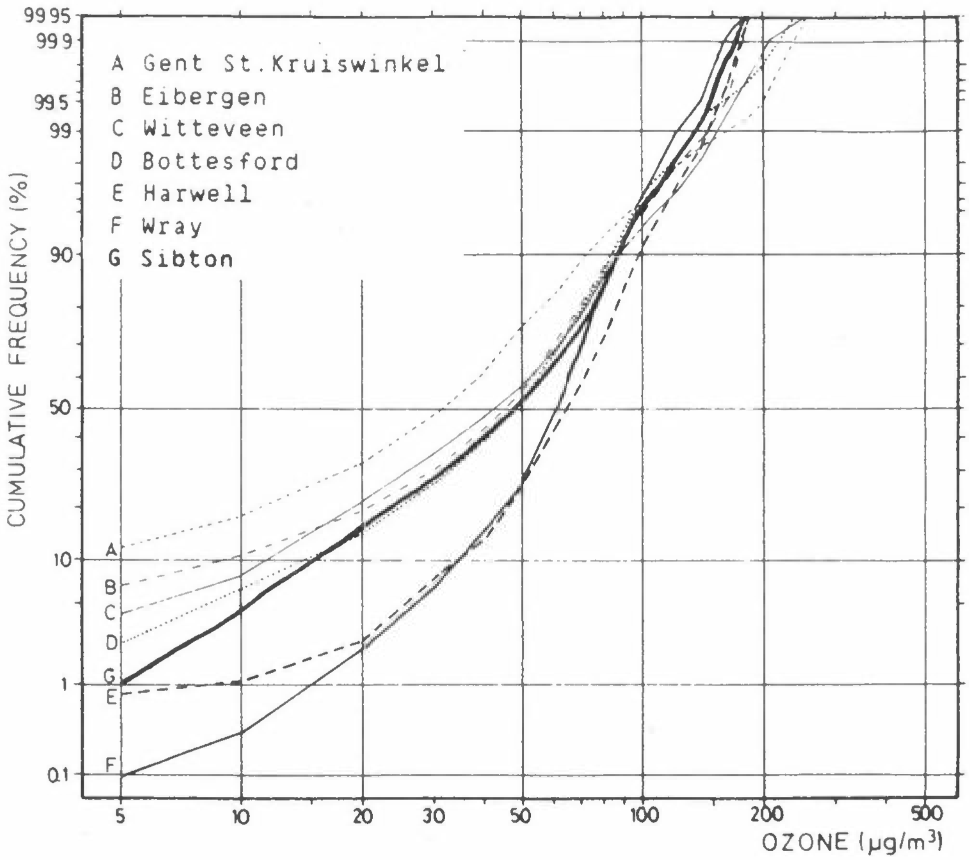


Figure 2: Cumulative frequency distributions of ozone concentrations, April-September 1985.



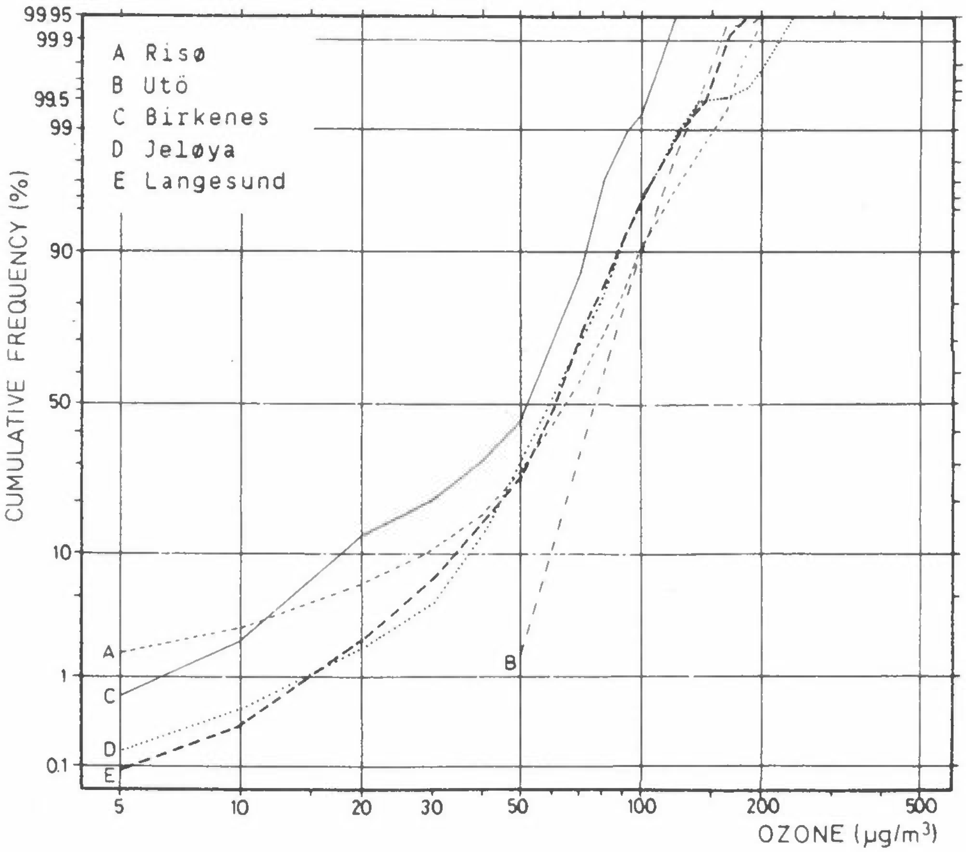


Figure 2 cont.

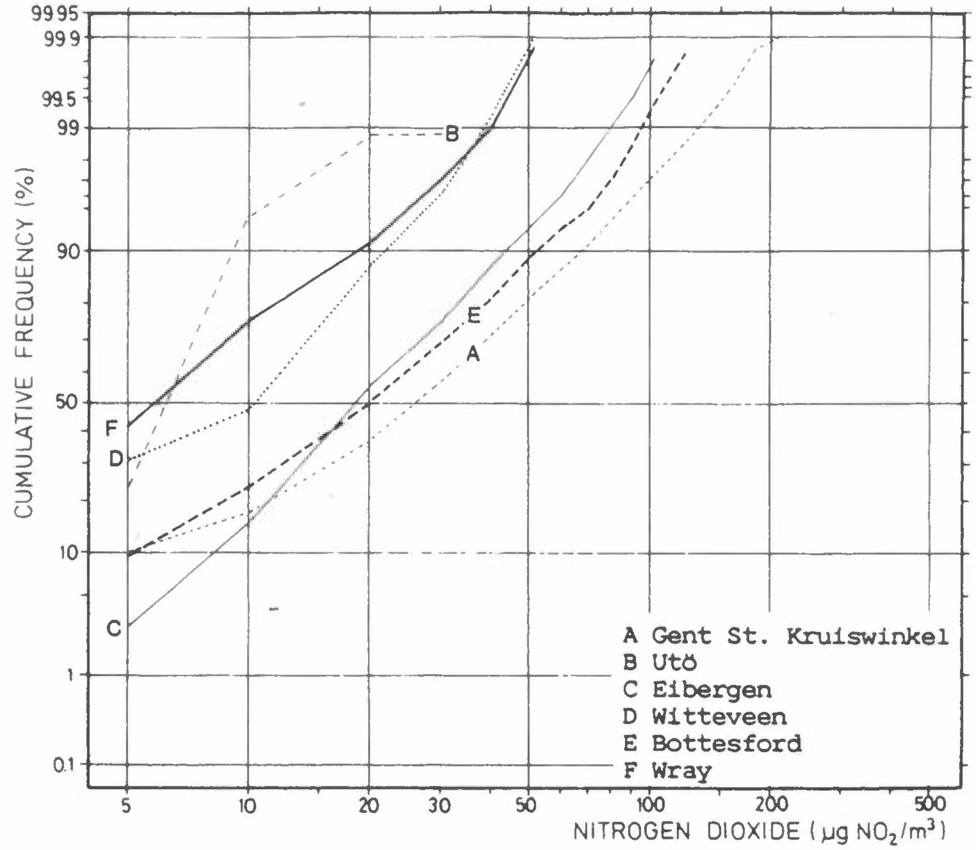


Figure 3: Cumulative frequency distributions of NO_2 concentrations, April-September 1985.

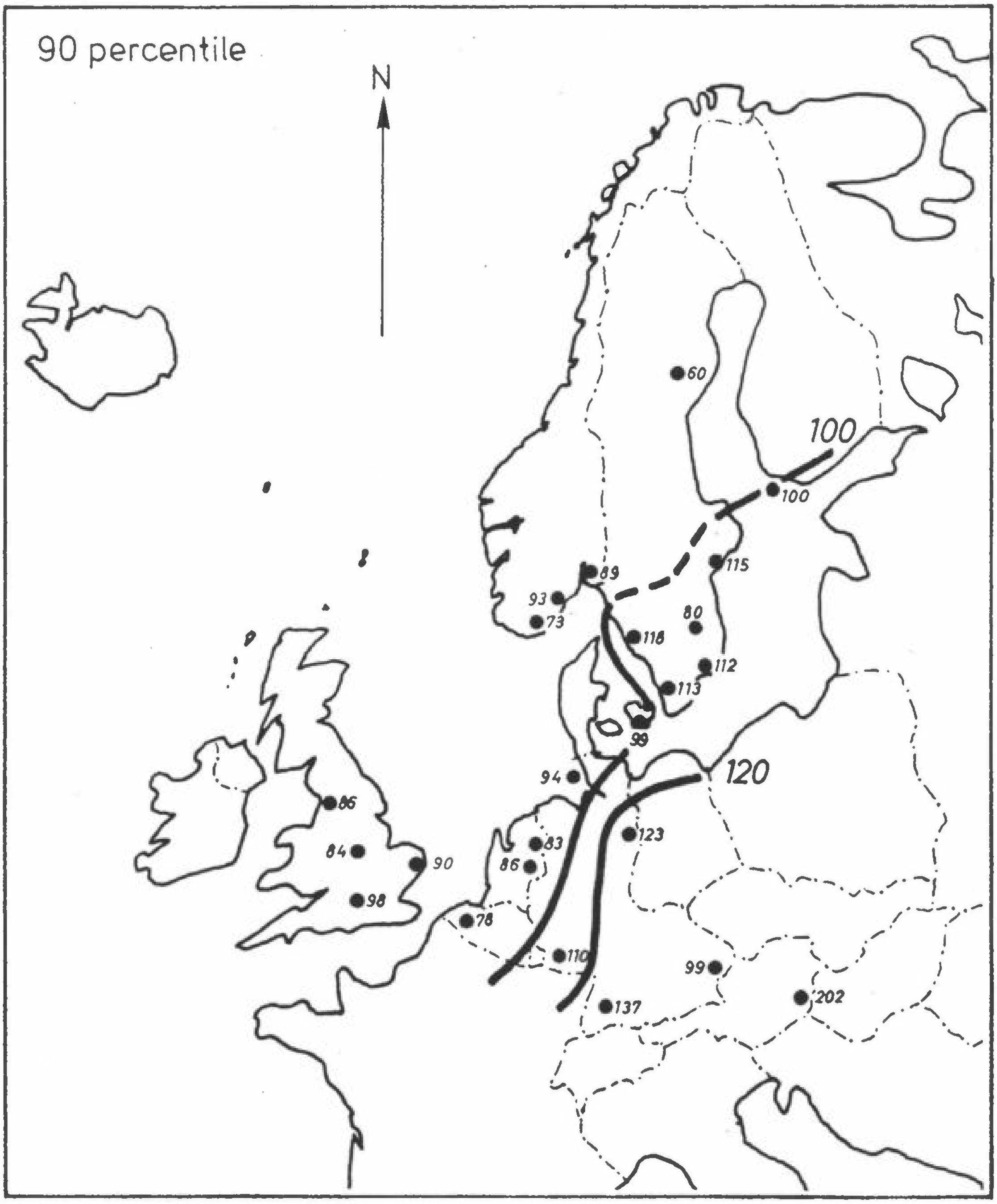


Figure 4: 90 percentile of ozone concentrations (μg/m^3), April - September 1985.

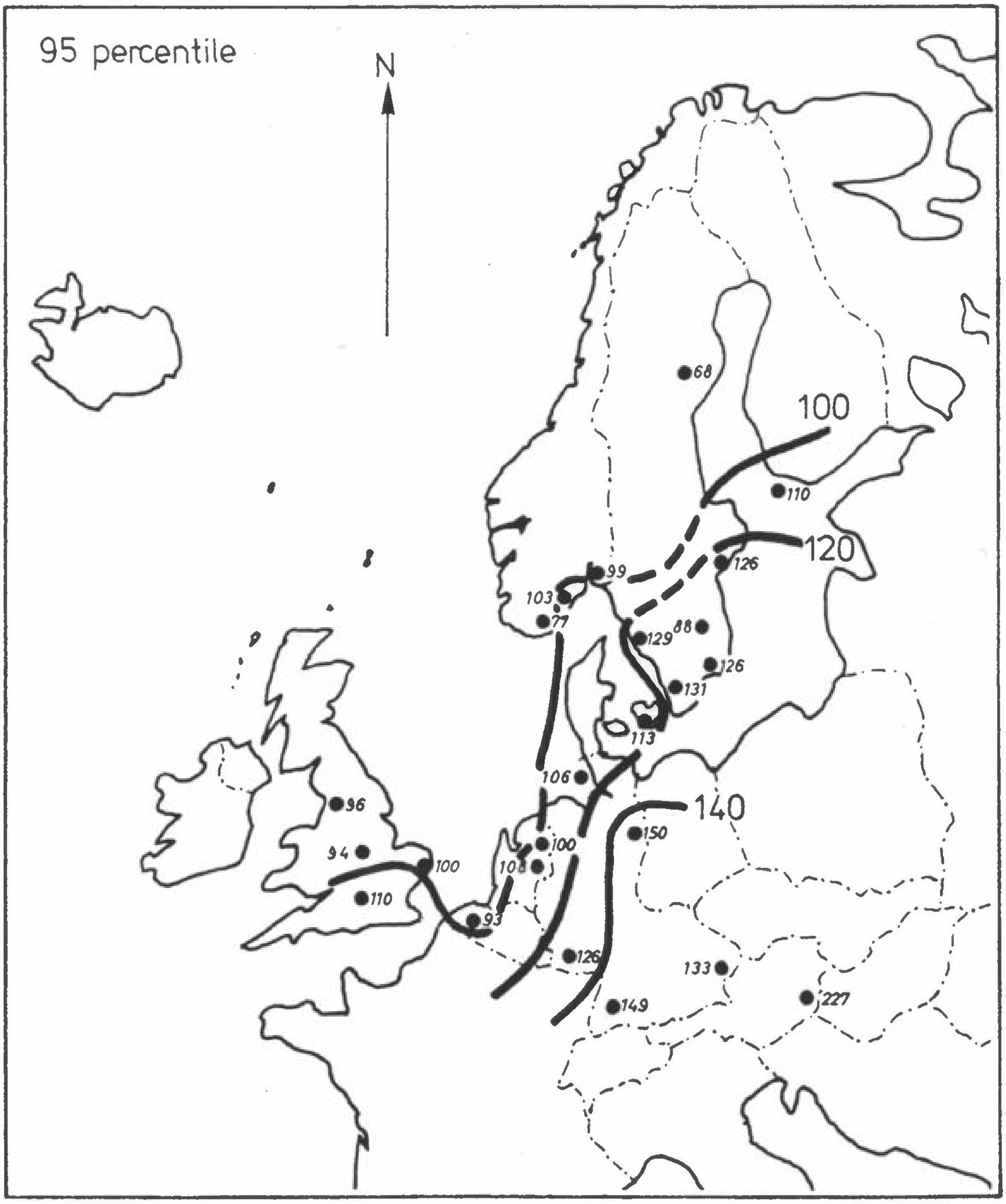


Figure 5: 95 percentile of ozone concentrations ($\mu g/m^3$), April - September 1985.

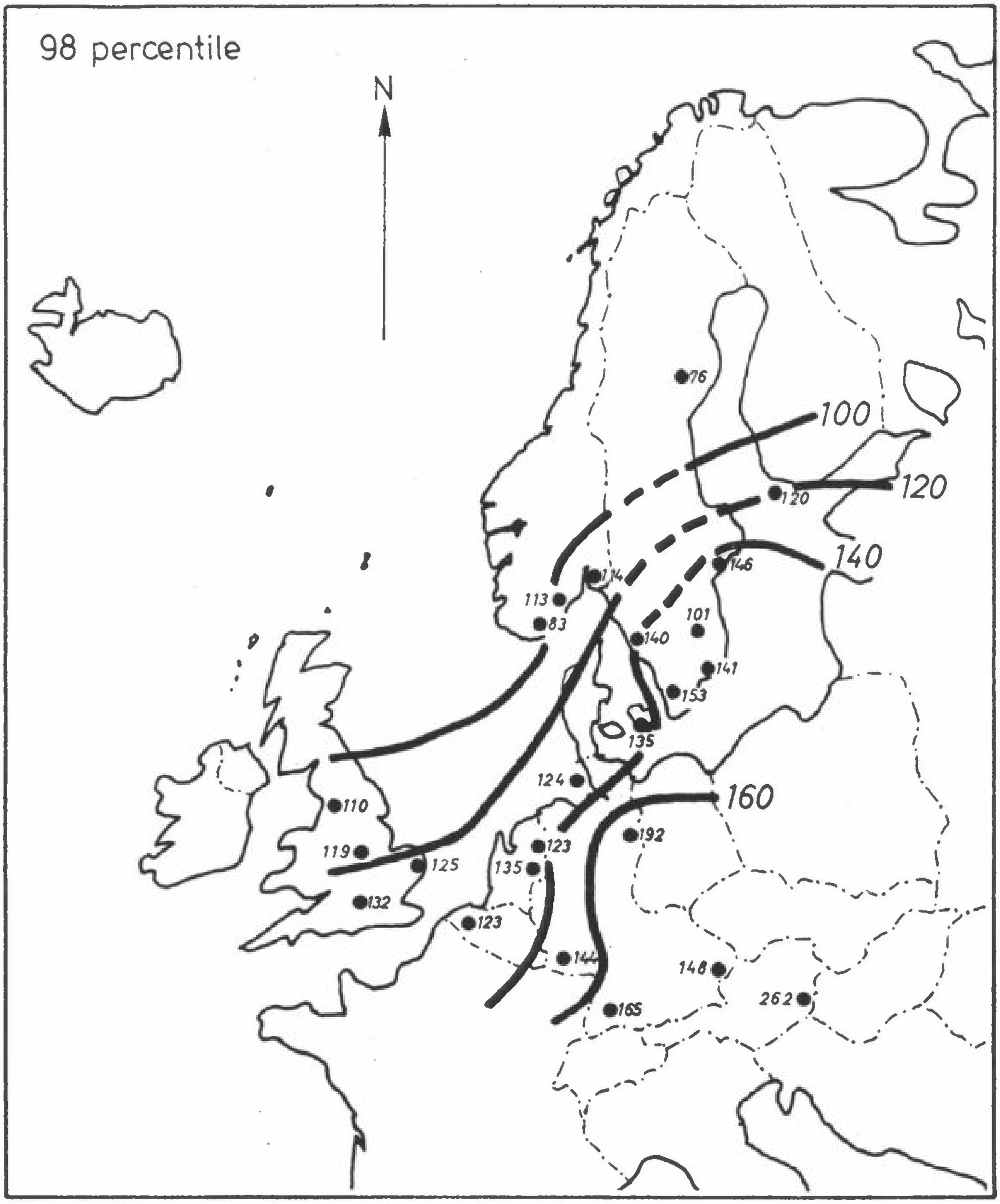


Figure 6: 98 percentile of ozone concentrations (µg/m^3), April - September 1985.

4.4 MEAN DIURNAL CONCENTRATION VARIATIONS

The mean diurnal ozone concentrations are given in Figure 7. Most stations exhibited the well-documented diurnal variation with lowest concentrations during the night and highest concentrations during the afternoon hours. The highest concentrations occurred at Illmitz, Austria, where the average afternoon concentrations exceeded 180 $\mu g/m^3$.

There seemed to be smaller diurnal variations for coastal stations, e.g., Westerland (Federal Republic of Germany) and Utö (Finland) and for hilltop stations, e.g., Schauinsland, than for some other stations.

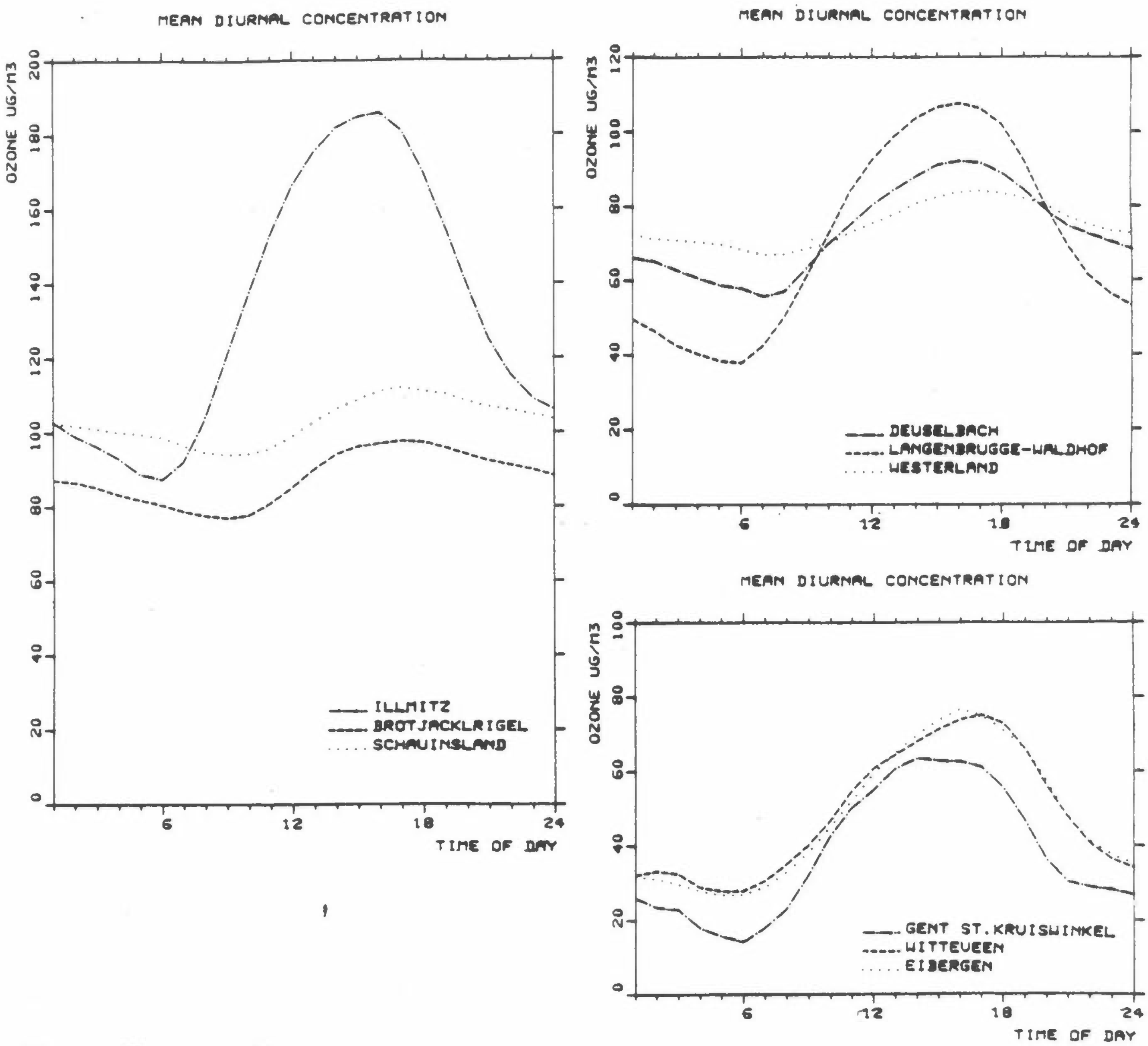


Figure 7: Mean diurnal concentration variations of ozone, April - September 1985.

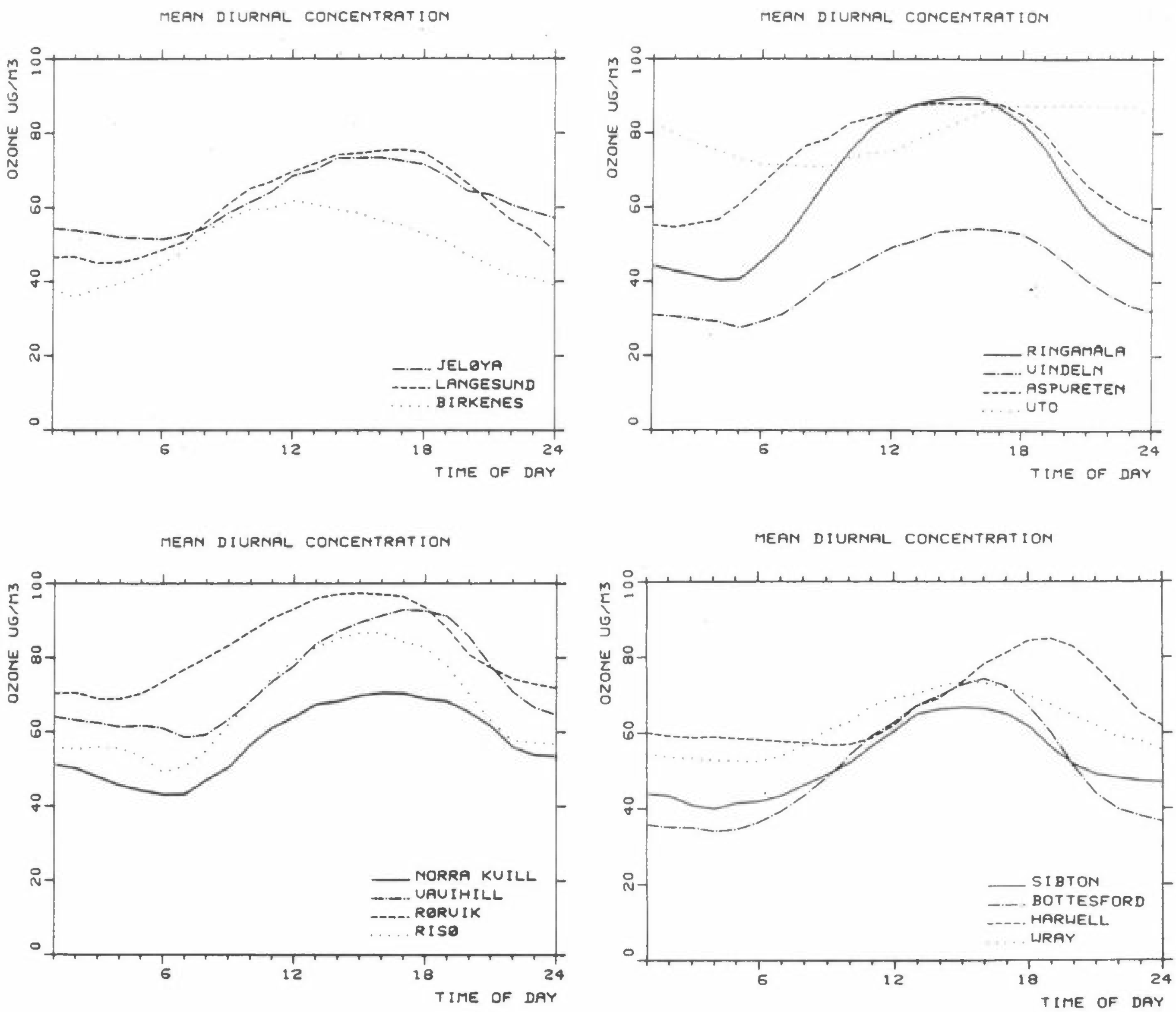


Figure 7 cont.

The diurnal concentration variations of nitrogen dioxide and PAN are given in Figure 8. The pronounced "bimodal" concentration variation for NO_2 shown for Gent St.Kruiswinkel (Belgium) and partly for Eibergen (Netherlands) and Bottesford (United Kingdom) may indicate influence from local sources associated with automobile traffic.

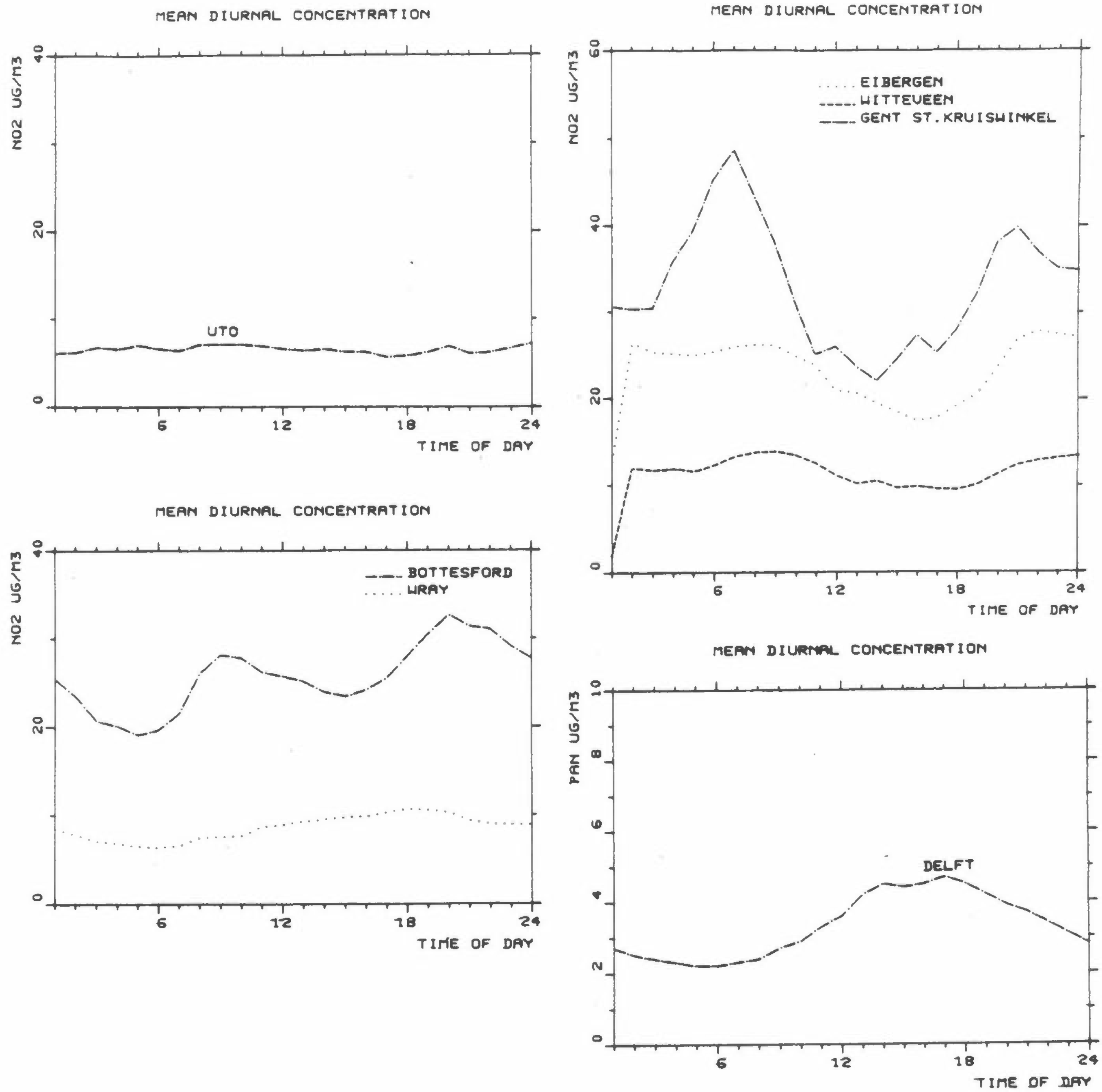


Figure 8: Mean diurnal concentration variations of nitrogen dioxide and peroxyacetyl nitrate, April-September 1985.

4.5 TRAJECTORY SECTOR DISTRIBUTIONS

The days of the half-year period are distributed according to the trajectory sectors. For a certain receptor point, one day is allocated to a 45^0 sector if the positions of the 96-h back trajectories at the 1000-hPa level arriving on that day are within the sector at least 50% of the time. Only trajectory positions between 150 km and 1500 km from the receptor point are considered. If this criterion is not satisfied for any of the eight 45^0 sectors, the day is called "undetermined".

The results are given in Appendix D. "Trajectory roses" are made both for all the days in the half-year period, and for the days on which the maximum 1-h concentration exceeded given limits. The distributions are given as per cent (%) of the number of days meeting the given conditions. For ozone, the concentration limit is 120 $\mu g/m^3$ for all the stations. For Illmitz, Langenbrügge-Waldhof and Schauinsland, similar trajectory roses are made with the ozone concentration limit of 160 $\mu g/m^3$, and for Illmitz also with the ozone concentration limit of 240 $\mu g/m^3$. For most of the stations, there was not a sufficient number of days with high concentrations to use higher limits than 120 $\mu g/m^3$ (see Appendix A).

For NO_2 the concentration limits of 40 $\mu g/m^3$, 80 $\mu g/m^3$ and 120 $\mu g/m^3$ are used. For PAN the concentration limit is 10 $\mu g/m^3$.

It should be noted, that trajectory sector calculations are associated with many uncertainties, and great caution should be used when trying to indicate emission source areas. This is especially the case for high pressure situations often associated with high oxidant concentrations. Many of these days will have "undertermined" trajectory sectors.

The distributions for five stations are shown in Figure 9. For Langenbrügge-Waldhof and Schauinsland the total half-year distribution of all trajectories show a dominant transport from southwest, west and northwest. There were more "undetermined" days at Schauinsland than at Waldhof.

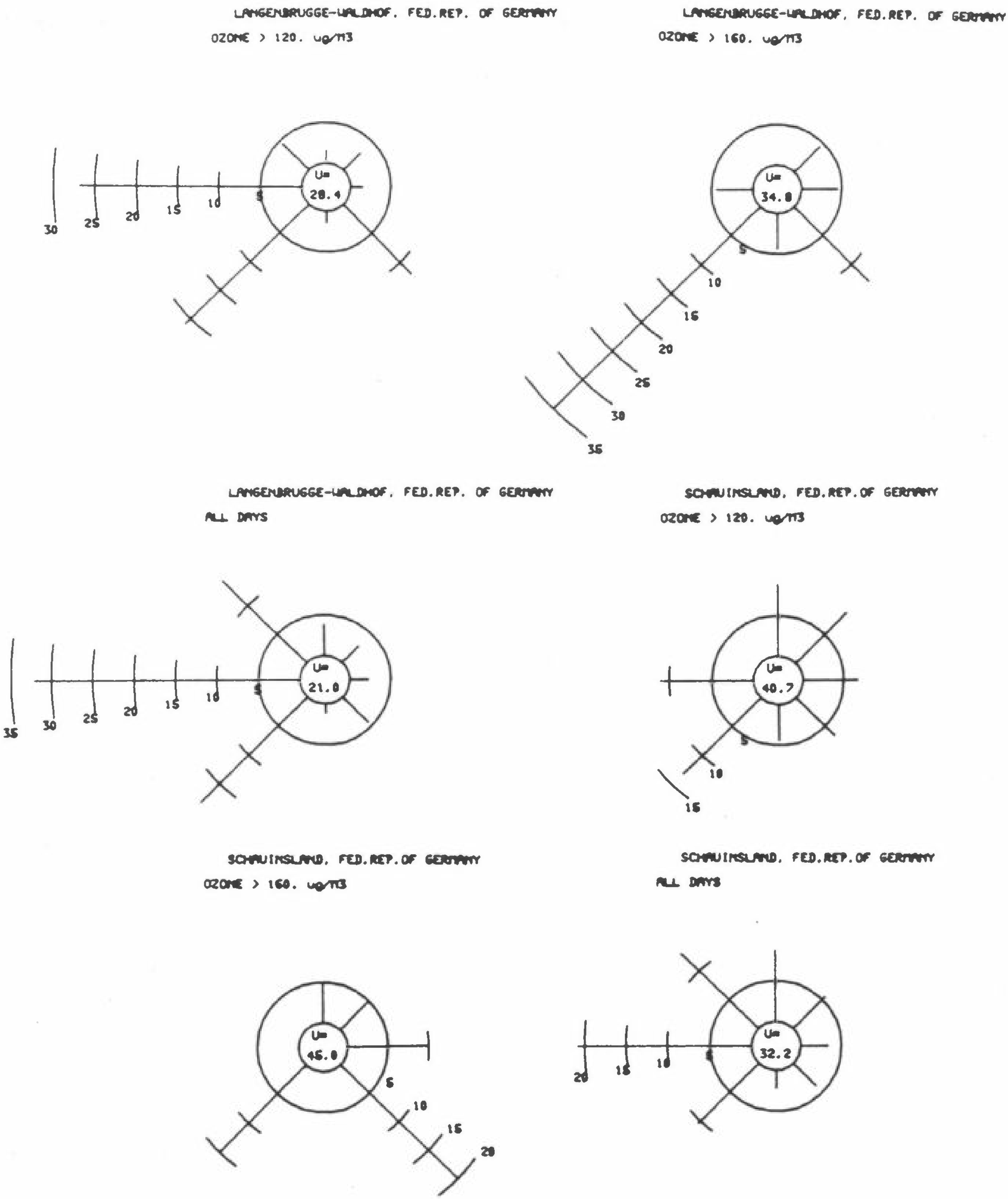


Figure 9a: Back trajectory sector distributions (%) for Langenbrügge-Waldhof and Schauinsland (Federal Republic of Germany), see Appendix D.

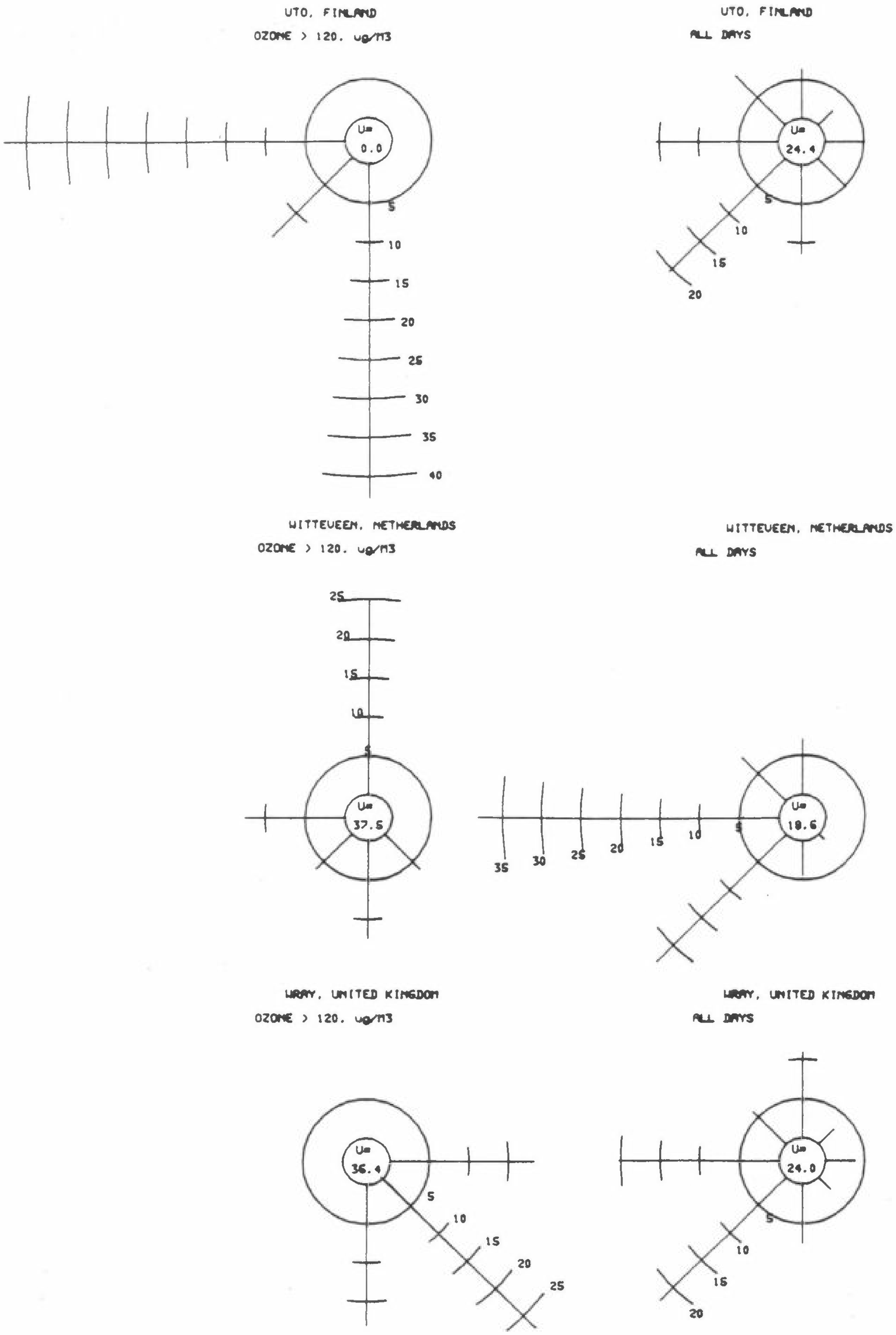


Figure 9b: Back trajectory sector distributions (%) for Utö (Finland), Witteveen (Netherlands) and Wray (United Kingdom), see Appendix D.

For days with high ozone concentrations the dominant trajectory direction for Langenbrügge-Waldhof was from the southwest and to a smaller degree from the southeast. For Schauinsland the high ozone concentrations occurred with trajectory directions from southeast and to a smaller degree from southwest and east.

The trajectory distribution from Utö (Finland) showed two main directions, south and west, for ozone concentrations above 120 $\mu g/m^3$, and no "undetermined" days, while the distribution for all days in the half-year period was dominated by directions from southwest, south and west and with ca 25% undetermined days.

The distributions from Witteveen (Netherlands) and Wray (United Kingdom) showed main directions from southwest and west for the whole half-year period. The main "ozone directions", however, were from the north at Witteveen and from south, southeast and east at Wray.

4.6 OZONE EPISODES

The ozone data were analysed for episodes with high ozone concentrations occurring at several monitoring stations during the same period. If we define an "episode day" as a day when four or more stations have recorded a maximum 1-h ozone concentration above 160 $\mu g/m^3$, six episodes were found in the summer of 1985 (Table 7).

Table 7: Ozone episodes in north-western Europe, April-September 1985.

Time period	No. of days	Number of stations with ozone conc. $\geq$160 $\mu g/m^3$	$\geq$200 $\mu g/m^3$	Maximum ozone conc. $\mu g/m^3$
26-28 May	3	9	3	242
3- 5 June	3	9	1	278
3- 6 July	4	8	3	242
12-14 July	3	11	4	322
24-26 July	3	7	3	330
29 Aug-1 Sept	4	10	3	320

In this paragraph the six episodes are briefly discussed. The discussion is based on the synoptic weather situation (Weather Log, 1985), back trajectories at the 1000 hPa level, and the air quality data.

4.6.1 26-28 May 1985, Figure 10, Table 8

A high pressure was formed over central and east Europe on 24 May and it remained on 25 May. From 26 May, it slowly moved eastward. Low pressure systems prevailed west of the Continent and moved later over the British Isles. On 26 May trajectory analysis indicated transport from the south and south-east to the stations on the Continent, and from south-west to the stations in Scandinavia. On 27 May, all trajectories to the stations on the European Continent were coming from south, while the air transport to Great Britain came from south west. On 28 May, most west European stations had transport from south-west.

High ozone concentrations were recorded in Austria, Federal Republic of Germany, Netherlands and Sweden. The highest ozone concentration was reported from Illmitz (Austria) with an hourly maximum of 242 $\mu g/m^3$ (29 May). Concentrations above 200 $\mu g/m^3$ were also measured on 26 May at Ringamåla, Sweden (202 $\mu g/m^3$) and Vavihill, Sweden (200 $\mu g/m^3$). The monitoring stations in United Kingdom showed almost no increase in the ozone concentrations, indicating that the episode did not cover the British Isles.

4.6.2 3-5 June 1985, Figure 11, Table 8

The weather situation was characterized by small pressure variations and weak winds over the west and central Europe. On 3 June, a high pressure area over southern Scandinavia moved south and south-east. Trajectories indicate air transport from the north for 3 June. For 4 and 5 June, there was a pronounced clockwise circulation around the North Sea, and for 5 June, also over central Europe.

This episode included all the investigated countries, and ozone concentrations above 160 $\mu g/m^3$ were measured in Austria, Belgium, Denmark, Federal Republic of Germany, Netherlands, Sweden and United

Kingdom. The episode started already on 2 June, with ozone concentrations up to 140-150 $\mu g/m^3$ in United Kingdom and Federal Republic of Germany. On 3 June, the ozone concentration continued to increase and two stations reported values above 160 $\mu g/m^3$ (Schauinsland and Harwell). The highest concentrations were measured at Illmitz (Austria), at the end of the episode (278 $\mu g/m^3$, on 6 June).

4.6.3 3-6 July 1985, Figure 12, Table 9

A high pressure area over Germany, northern France and the British Isles expanded to cover the whole north-western Europe on 3 July, and moved eastward on 4 and 5 July. Trajectories indicated a clockwise circulation of air over northwest Europe, and later over central Europe.

The episode covered essentially the European Continent and the British Isles. The highest hourly concentration was reported from Langenbrügge-Waldorf, Federal Republic of Germany, (242 $\mu g/m^3$), at the end of the episode (6 July). Concentrations above 160 $\mu g/m^3$ were reported from Austria, Federal Republic of Germany, Netherlands, Sweden and United Kingdom.

4.6.4 12-14 July 1985, Figure 13, Table 9

The weather was characterized by a high pressure area over the whole central Europe except the British Isles. Southern Scandinavia was at the northern border of the high pressure area. The high pressure area moved to the east at the end of the episode. Trajectory analyses for 13 July indicated transport from south-west to all stations except Illmitz. For 14 and 15 July the trajectories were clockwise with a main direction of between south and west.

The episode started on 12 July with high ozone concentrations at most of the stations on the European Continent and in southern Scandinavia. High ozone concentrations were measured at Illmitz, Austria (322 $\mu g/m^3$), Langenbrügge-Waldhof, Federal Republic of Germany, (242 $\mu g/m^3$), Rörvik, Sweden (214 $\mu g/m^3$) and Vavihill, Sweden (212 $\mu g/m^3$).

4.6.5 24-26 July 1985, Figure 14, Table 10

A high pressure area moved from the Atlantic and the English Channel to Central Europe.

The episode started in Germany and Netherlands on 24 July and was extended to the British Isles on 25 July. The episode covered the European Continent and the British Isles. High concentrations were observed at Illmitz, Austria (330 $\mu g/m^3$), Schaunisland, Federal Republic of Germany (202 $\mu g/m^3$), Bottesford, United Kingdom (218 $\mu g/m^3$) and Harwell, United Kingdom (206 $\mu g/m^3$).

4.6.6 29 August - 1 September, Figure 15, Table 10

A high pressure area prevailed over the north western part of the European Continent. The high pressure area expanded on 28 and 29 August and moved eastward on 30 and 31 August. The trajectories show a clockwise circulation over central Europe.

Ozone concentration above 160 $\mu g/m^3$ were recorded on the European Continent and in southern Scandinavia. The highest concentrations occured at Illmitz, Austria (320 $\mu g/m^3$), Langenbrügge-Waldhof, Federal Republic of Germany (286 $\mu g/m^3$), Gent, St. Kruiswinkel, Belgium (253 $\mu g/m^3$) and Norra Kvill, Sweden (194 $\mu g/m^3$). No high ozone concentrations were recorded in the British Isles.

High concentrations of NO_2 and PAN were also measured during this episode. The maximum 1-h concentrations of NO_2 and PAN in the total half year period were measured on 29 August at Gent St. Kruiswinkel and Delft (261 $\mu g/m^3$ and 39.8 $\mu g/m^3$ respectively). On 30 August the highest daily PAN concentration was measured at Delft (11.6 $\mu g/m^3$).

Table 8: Maximum hourly ozone concentrations ($\mu g/m^3$) for the episodes 26-28 May and 3-5 June 1985.

Stations	May 26	May 27	May 28	June 3	June 4	June 5
Illmitz	232	214	216	120	176	196
Gent St.Kruiswinkel	116	75	47	139	184	
Risø	154	128				188
Brotjacklriegel	124	128	64	96	120	136
Deuselbach	148	124	76	148	162	108
Langenbrügge	124	128	64	112	116	84
Schauinsland	192	162	108	196	156	150
Westerland	164	160	114	84	138	99
Utö						
Eibergen	178	144	75	139		104
Witteveen				142	217	150
Birkenes						
Jeløya	126	140	110	84	101	70
Langesund	86	129	93	103	107	120
Aspvreten	162	196	168	62	76	86
Norra Kvill						
Ringamåla	202	172	164	116	124	172
Rörvik	193	187	147			162
Vavihill	200	180	188	120	160	188
Vindeln						
Bottesford	84	62	98	94	80	76
Harwell	89	90	115	160	105	103
Wray	76	74	86	148	110	80
Sibton	44	30	26		122	128

Table 9: Maximum hourly ozone concentrations ($\mu g/m^3$) for the episodes 3-6 July and 12-14 July 1985.

Stations	July 3	4	5	6	12	13	14
Illmitz	218	210	224	212	250	322	262
Gent St.Kruiswinkel			153	123	85	187	
Risø	90	80	90	102	146	116	
Brotjacklriegel	106	114	122	132	150	158	144
Deuselbach	132	146	126	124	158	196	170
Langenbrügge	130	218	202	242	208	234	242
Schauinsland	202	184	126	146	176	194	166
Westerland	82	108	104	124	94	100	166
Utö			108		104	125	89
Eibergen					102	173	181
Witteveen	101	155	168	93	86	130	193
Birkenes	80	88	115				
Jeløya	86	83	103	103	83	73	60
Langesund	72	68	101	90	86	68	72
Aspvreten	186	198		66	80	72	112
Norra Kvill	74	86	74	68	108	101	133
Ringamåla	86	104	96	102			160
Rörvik	103	110	105	140	150	117	214
Vavihill	104	84	108	104	144	124	212
Vindeln	64	68	60	60	96	64	52
Bottesford	132	196	208	78	88	98	68
Harwell	164	157	157	62	98	132	107
Wray	176	152	122	66	60	60	58
Sibton							

Table 10: Maximum hourly ozone concentrations (μg/m^3) for the episodes 24-26 July and 29 August-1 September 1985.

Stations	July			August			Sept.
	24	25	26	29	30	31	1
Illmitz	262	292	330	160	228	266	320
Gent St.Kruiswinkel	148	225	99	253	207	85	83
Risø	70	80	98	82	94		106
Brotjacklriegel	118	124	126				
Deuselbach	146	190	194	156	156	146	92
Langenbrügge	150	118	184	206	250	286	126
Schauinsland	186	202	176	134	168	162	150
Westerland	92	80	86	94	160	130	82
Utö							
Eibergen	169	161	86	157	157	41	70
Witteveen				117	163	68	75
Birkenes	64	68	68	68	88	80	72
Jeløya	67	67	70	71	67	77	77
Langesund	43	43	43				
Aspvreten			58				
Norra Kvill	58	72	65		78	194	112
Ringamåla	76	80	78	68	68	112	80
Rörvik	90	91	88	96	100	165	145
Vavihill	72	76	84	100	104	192	112
Vindeln	68	60	60	60	60	52	56
Bottesford	56	218	136	100	122	70	56
Harwell	98	206	145	111	96	88	86
Wray	42	148	102	54	104	80	78
Sibton							

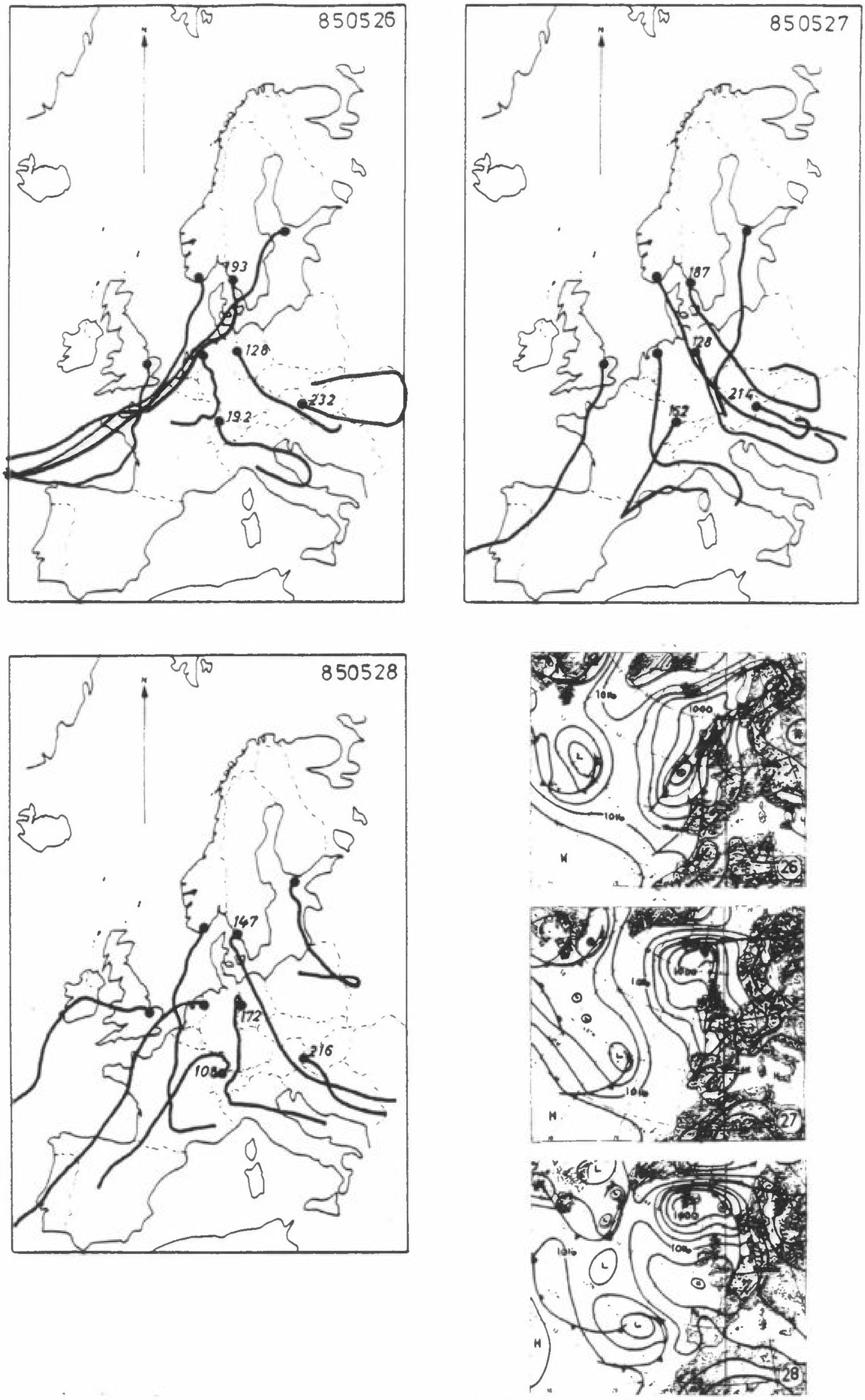


Figure 10: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios (µg/m^3), and weather maps (Weather Log, 1985), 26-28 May 1985.

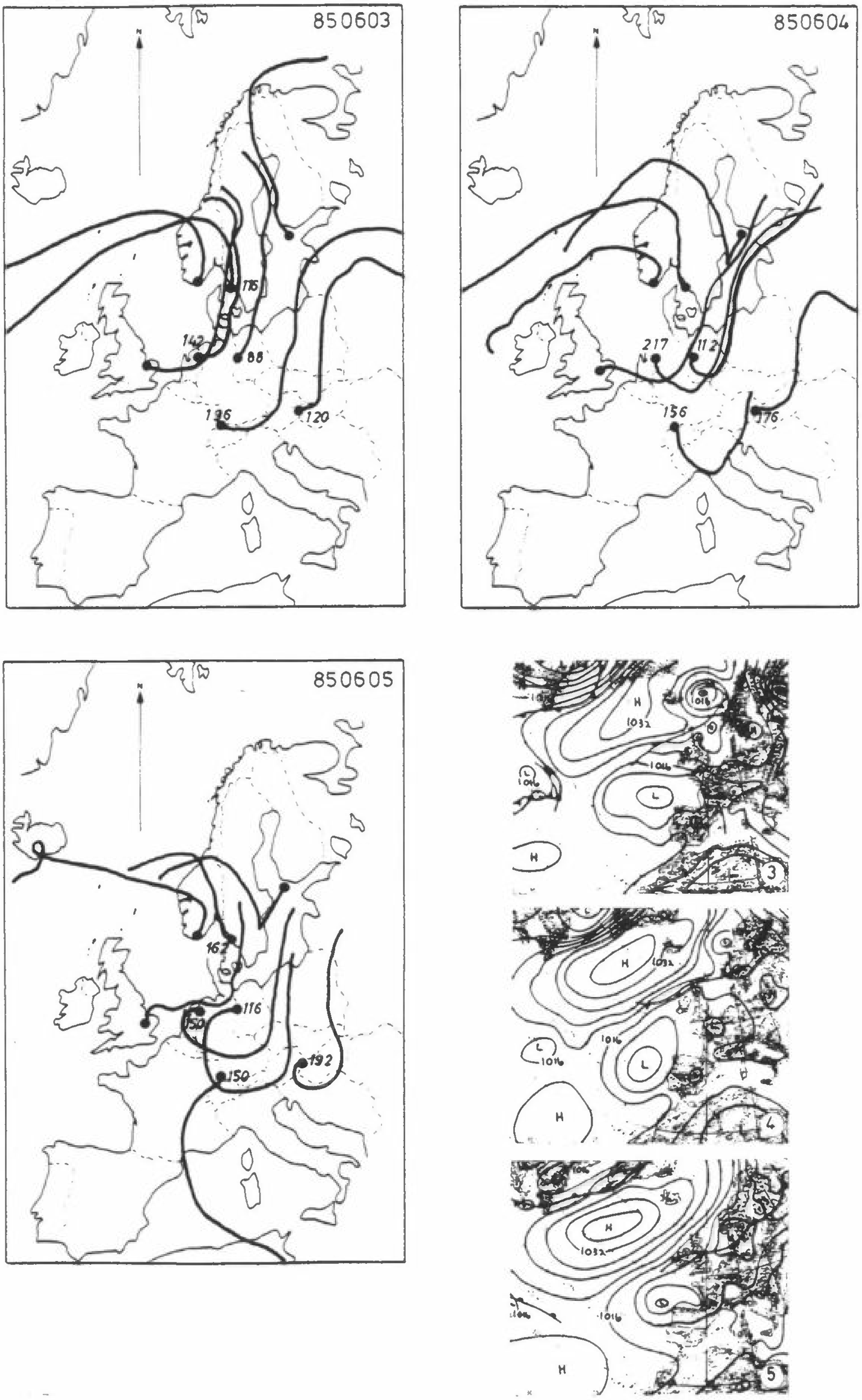


Figure 11: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios ($\mu g/m^3$), and weather maps (Weather Log, 1985), 3-5 June 1985.

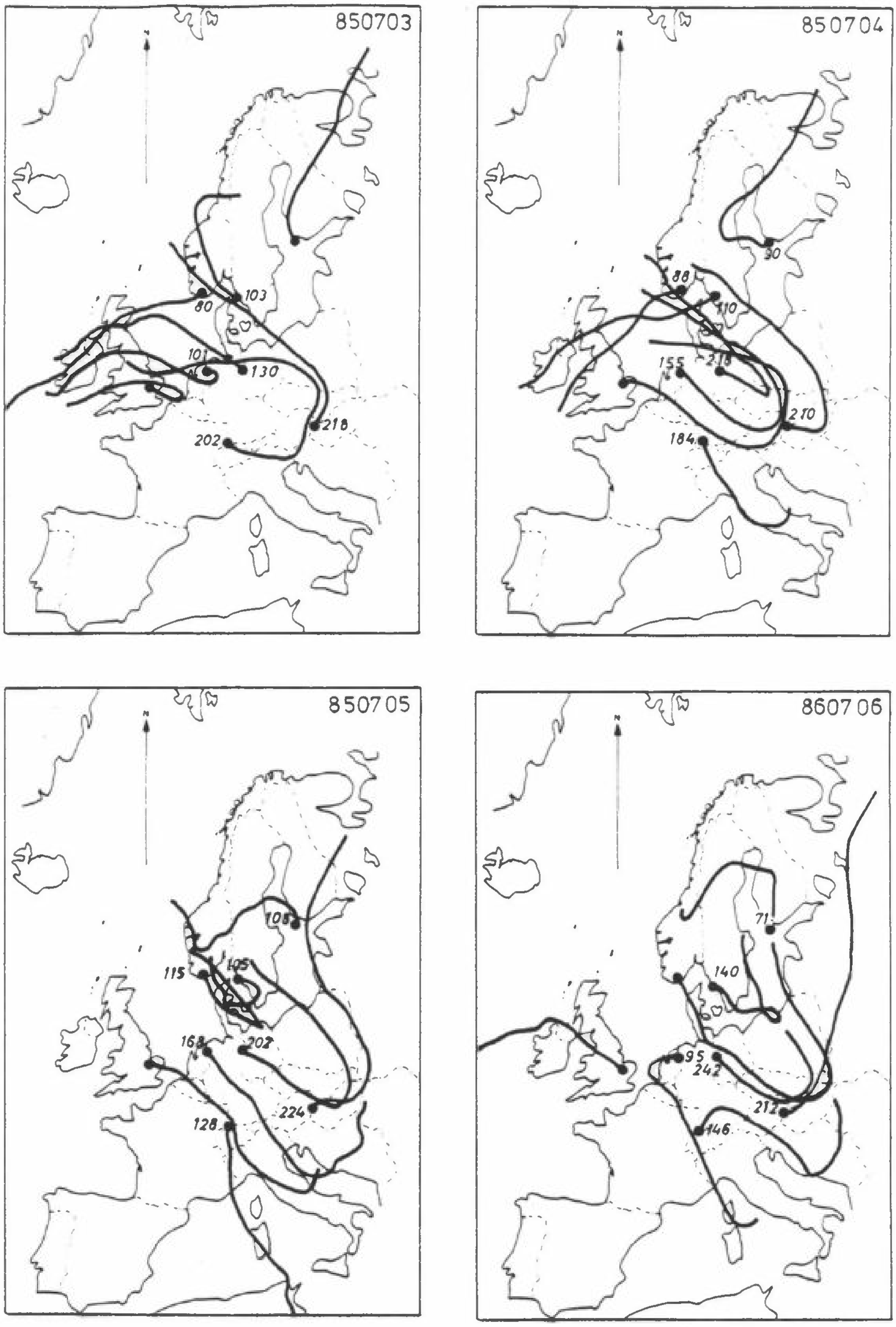


Figure 12: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios ($\mu g/m^3$), and weather maps (Weather Log, 1985), 3-6 July 1985.

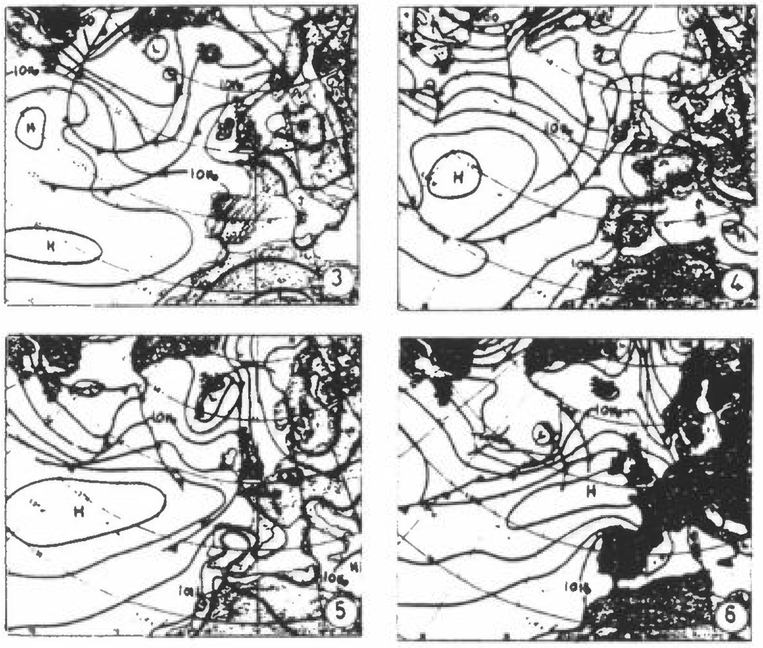


Figure 12 cont.

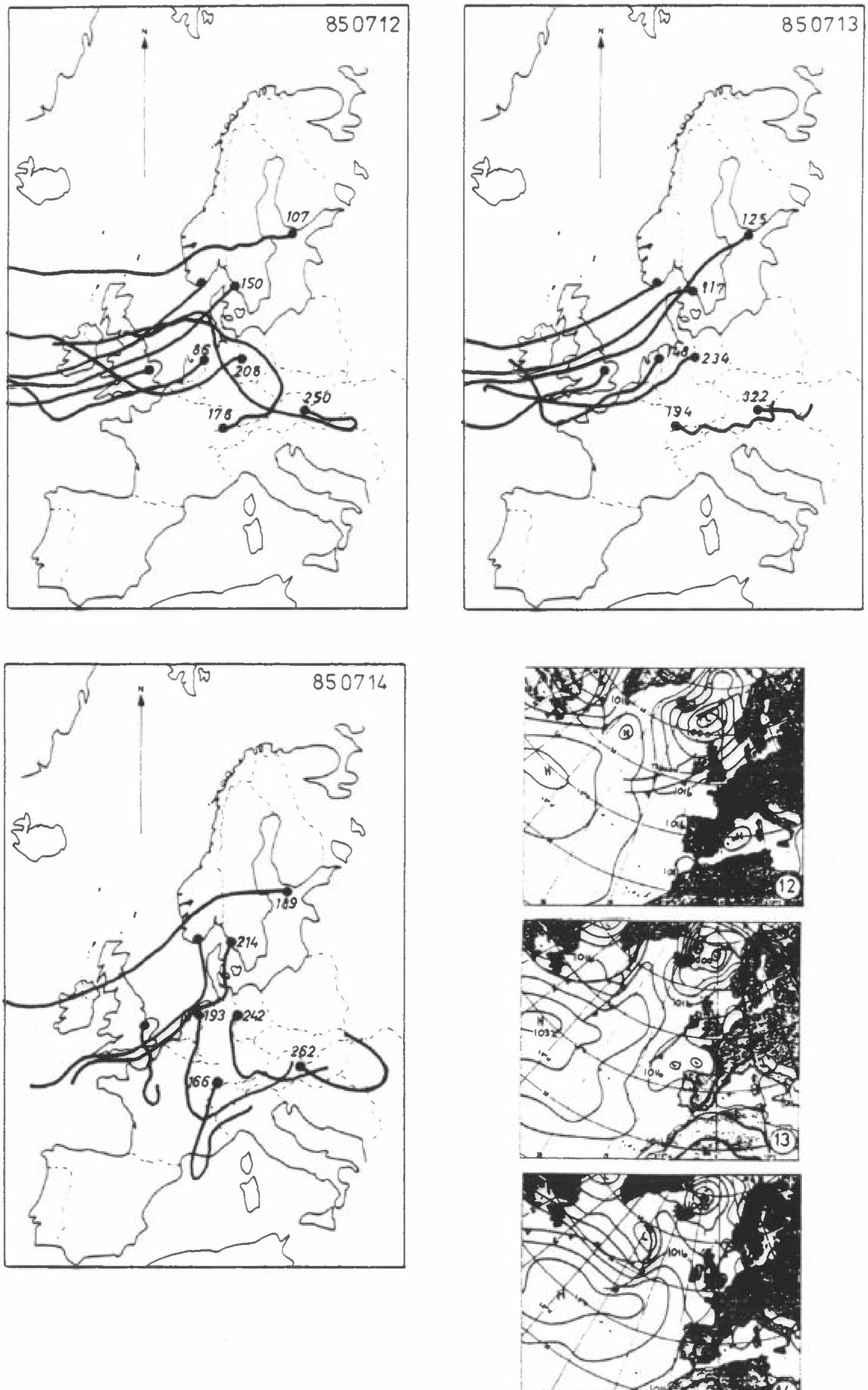


Figure 13: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios ($\mu g/m^3$), and weather maps (Weather Log, 1985), 12-14 July 1985.

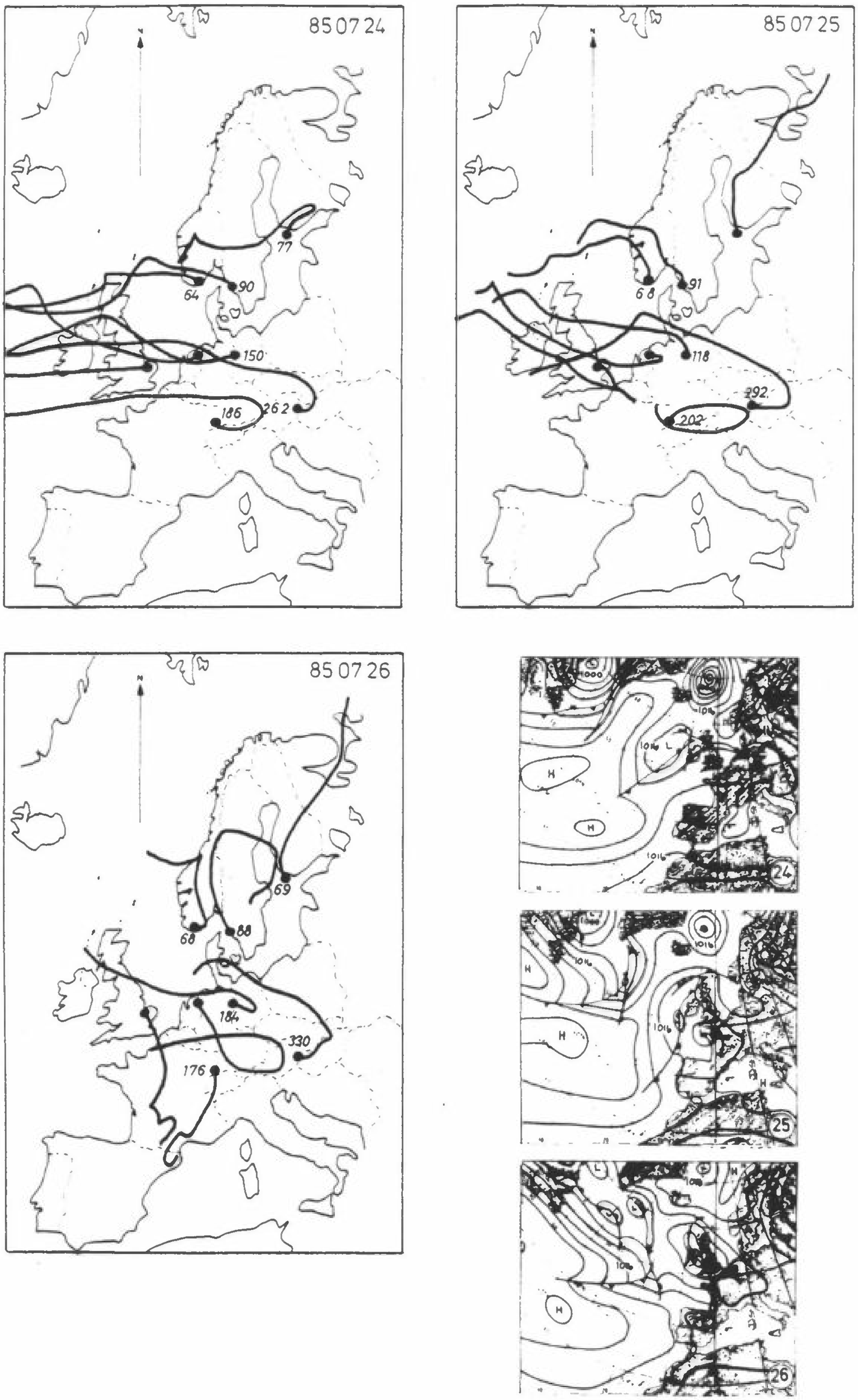


Figure 14: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios ($\mu g/m^3$), and weather maps (Weather Log, 1985), 24-26 July 1985.

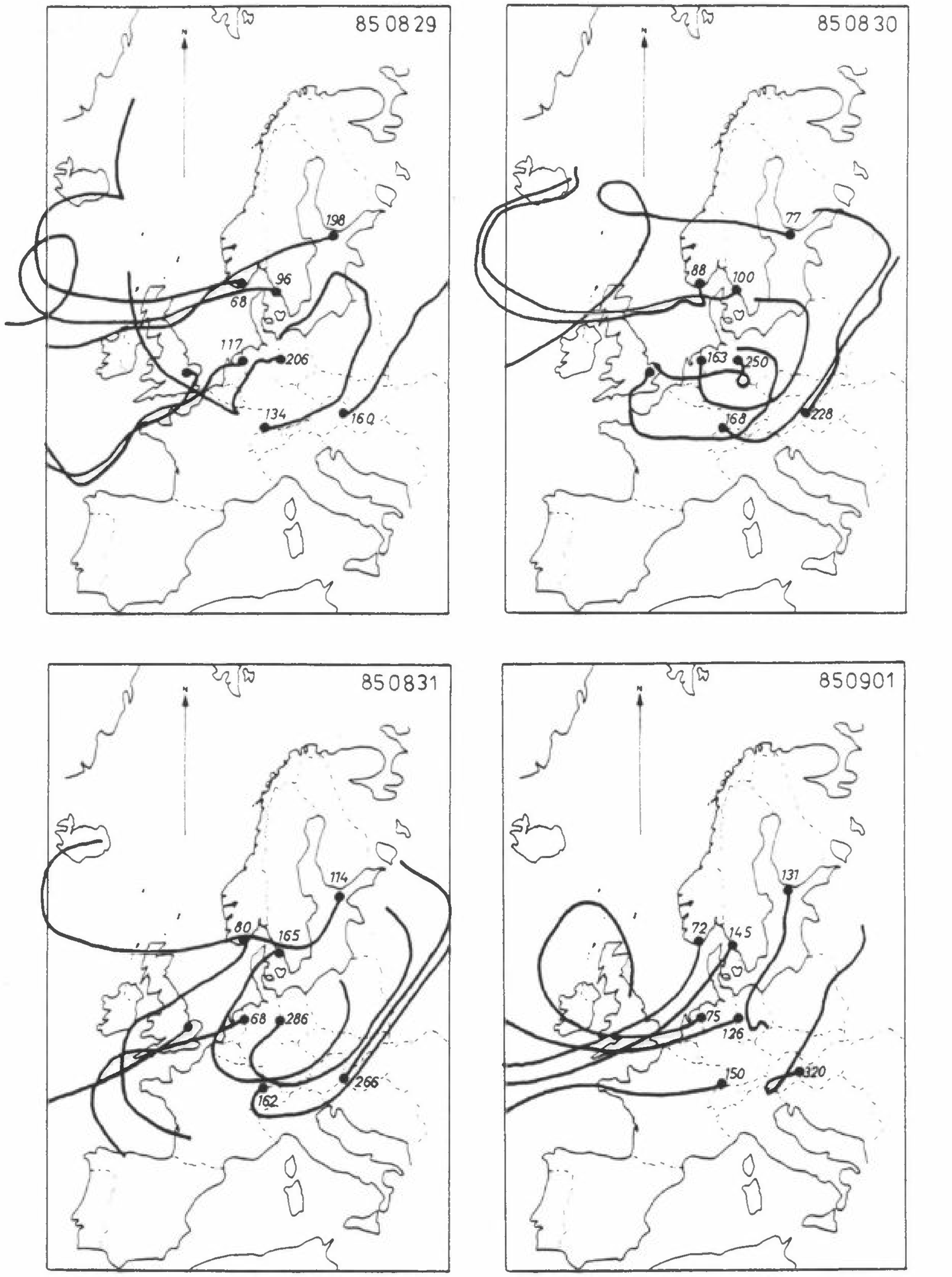


Figure 15: Back trajectories at the 1000 hPa level, maximum 1-h ozone concentratios ($\mu g/m^3$), and weather maps (Weather Log, 1985), 29 August- 1 September 1985.

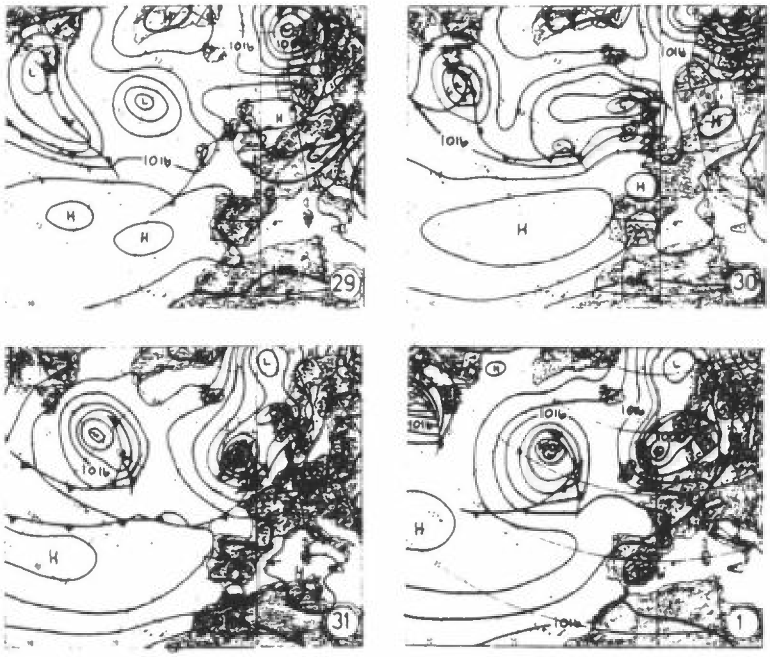


Figure 15 cont.

5 CONCLUSION

Hourly data on photochemical oxidants from April-September 1985 are presented from 25 regional stations in Europe. These nine countries are represented: Austria, Belgium, Denmark, Federal Republic of Germany, Finland, Netherlands, Norway, Sweden and United Kingdom.

24 stations have reported ozone, six have reported nitrogen dioxide and one station has reported PAN.

The individual countries have selected the monitoring stations, and they have also been responsible for the quality assurance of the data. No centralised intercalibration or other data quality control has been carried out.

The highest ozone concentrations were measured at Illmitz (Austria) with maximum levels of 446 $\mu g/m^3$ (hourly mean) and 197 $\mu g/m^3$ (daily mean). The highest concentrations of nitrogen dioxide were measured at Gent St. Kruiswinkel (Belgium) with maximum levels of 261 $\mu g/m^3$ (hourly mean) and 150 $\mu g/m^3$ (daily mean). The highest PAN concentrations were 39.8 $\mu g/m^3$ (hourly mean) and 11.6 $\mu g/m^3$ (daily mean) measured at Delft (Netherlands). A complete set of data have been submitted on magnetic tapes to all the participating countries.

The magnitude and extension of the episodes with high ozone concentrations are not clear from the data. Illmitz (Austria), and Langenbrügge-Waldhof and Shauinsland (Federal Republic of Germany), which generally had the highest ozone concentrations, are located at the eastern and southern end of the monitoring area.

The highest ozone concentrations have been recorded in the eastern part of Austria and in the Federal Republic of Germany. The concentrations in Norway, United Kingdom and the western part of continental Europe were generally lower than in central continental Europe. Whether this is a general gradient or a more specific result from the summer of 1985, remains to be seen.

The air trajectory sector distributions showed that certain trajectory directions in many cases were strongly associated with high ozone concentrations. These directions varied considerably between different regions in Europe and were generally not the same as the main directions for the whole half-year period.

The examination of the data reveals in many cases large variations of concentration levels and patterns between the stations. Further work is needed in order to explain these variations. Local and mesoscale concentration variations of oxidant concentrations are well known and must be taken into account when data from different stations are compared.

There is a definite need to include more countries and measurement stations, in order to improve the understanding of the oxidant phenomenon. In particular, regional data from other European OECD countries are of interest, particularly France and Switzweland in which regional ozone monitoring is being carried out. Data from East Europe are also of great interest in future joint European measurement programmes.

6 ACKNOWLEDGEMENT

We will thank the contact persons from the different countries, given in Table 1, for their interest in the project and the submission of data. We also thank the secretariat of the OECD Environment Directorate for valuable support. Finally we thank Audun Harstad and Kari Arnesen of the NILU computing department for the necessary and valuable programming work, and the handling of the data.

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APPENDIX A

Summary of ozone data

The tables give number of hours per day, and number of days, with hourly concentrations exceeding given limits.

Site   : ILLMITZ, AUSTRIA
Parameter: OZONE, UG/M3
Period   : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration
exceeding given limits

Date	>120	>160	>200	>240	>280	>320	>360	Maximum 1-h concentration
010485	4							154.
020485	11	2						168.
030485	8							154.
040485	10	6						192.
050485	15	7	2					208.
060485	21	5						176.
070485	17							138.
080485	3							132.
090485	3							132.
110485	10							142.
120485	7							142.
130485	10							144.
140485	12							130.
150485	13							146.
160485	11							142.
170485	6							146.
180485	4							142.
190485	13	8	2					212.
200485	9	7						200.
210485	13	8						180.
220485	13	10						190.
230485	15	8	4	1				246.
240485	2							124.
250485	13	7						170.
260485	5							132.
270485	10							152.
280485	11							146.
290485	12							148.
300485	18	3						174.
010585	15							150.
020585	19							146.
030585	18							158.
040585	15	10						196.
050585	13	9						186.
060585	10	2						168.
070585	3							130.
080585	24	5						166.
090585	14	6						170.
100585	13	8	6					222.
110585	9	7						200.
120585	15	7						190.
130585	10	5						170.
140585	9	7						196.
150585	15	8	3					224.
160585	18	8						194.
170585	6							152.
180585	5							140.
190585	7							138.

Site : ILLMITZ, AUSTRIA
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	>280	>320	>360	Maximum 1-h concentration
200585	9							152.
210585	13	3						172.
220585	16	3						174.
230585	21	6						168.
240585	22	11	1					202.
250585	15	12	5					218.
260585	15	12	8					232.
270585	13	10	6					214.
280585	12	10	7					216.
290585	17	10	4	1				242.
300585	11	1						164.
310585	2							134.
010685	8							146.
040685	12	6						176.
050685	13	7						192.
060685	14	12	7	5				278.
070685	15	7	4					216.
080685	4							134.
090685	21	8						184.
100685	15	6						176.
110685	21	2						162.
120685	17	10						180.
130685	3							128.
140685	14							160.
150685	18	8						180.
160685	24	9						200.
170685	10							152.
180685	17							160.
190685	14	11	8	3				250.
200685	4							130.
210685	21							160.
220685	15	6	1					202.
230685	17							144.
240685	17	1						164.
250685	22	8						178.
260685	23	10	4					206.
270685	17	6						178.
280685	16	6						174.
290685	11	7						192.
300685	17	12	10	1				242.
010785	15	9						196.
020785	19	4						180.
030785	13	9	3					218.
040785	13	10	4					210.
050785	15	11	8					224.
060785	14	8	2					212.
070785	20	14	5	2				250.
080785	24	11	8	3				264.

Site : ILLMITZ, AUSTRIA
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	>280	>320	>360	Maximum 1-h concentration
090785	19	9						196.
100785	17	6						194.
110785	16	12	7					222.
120785	13	10	8	4				250.
130785	14	14	11	10	8	1		322.
140785	15	12	10	8				262.
150785	24	15	12	6				266.
160785	17	12	10	3				250.
170785	17	7						192.
180785	16	11	9	5				258.
190785	17	12	8	6	2			320.
200785	19	13	11	5				260.
210785	18	2						166.
220785	16	8						190.
230785	20	11	3					208.
240785	15	10	8	4				262.
250785	13	12	9	7	2			292.
260785	14	13	12	8	4	1		330.
270785	15	11	7	4				278.
280785	16	12	8					240.
290785	17	16	11	5				258.
300785	17	5						176.
310785	12	2						164.
010885	15	10	6					218.
020885	17	7						174.
030885	14	11	7					222.
040885	19	12						180.
050885	15	9	2					222.
060885	9	8	6	1				242.
080885	1							122.
120885	12	8	5					230.
130885	14	12	9	7	3	2		338.
140885	15	12	10	8	1			282.
150885	17	13	10	8	4			290.
160885	17	10	10	9	7	5	2	446.
170885	23	15	9	7	4			308.
180885	21	1						164.
270885	10	1	1	1	1			300.
280885	8							138.
290885	8							160.
300885	17	10	6					228.
310885	13	8	7	4				266.
010985	13	11	9	6	4			320.
020985	17	5						200.
030985	16	12	8					234.
040985	17							154.
050985	11	4						180.
060985	13	6						180.

Site : ILLMITZ, AUSTRIA
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	>280	>320	>360	Maximum 1-h concentration
070985	17	4						166.
080985	24	12						182.
090985	6							154.
100985	9							152.
110985	9	7						200.
120985	13	6						176.
130985	7	6						188.
140985	9	6						194.
150985	11	7	5					212.
160985	14							156.
170985	4							150.
180985	5							154.
190985	9	6	3					216.
200985	10	7	6	4	3	1		352.
210985	10	9	6	5	3	3		348.
220985	13	11	5					226.
230985	8	5	2	1				248.
240985	8	7	2					226.
250985	12	9	6					234.
260985	7	1						162.
270985	8	4	2					220.
280985	10	7	5					230.
290985	9	6						194.
300985	9	5	2					228.
Total number of hours	2226	994	405	152	46	13	2	
Total number of days	168	123	65	32	13	6	1	

Site : GENT,ST.KRUISWINKEL, BELGIUM
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	Maximum 1-h concentration
030485	1				143.
160585	1				123.
030685	4				139.
040685	3	1			184.
050785	8				153.
060785	1				123.
110785	3				136.
130785	8	6			187.
240785	5				148.
250785	12	9	6		225.
280885	2				131.
290885	10	8	5	1	253.
300885	7	6	2		207.
110985	7	6	4		230.
120985	5	2			171.
Total number of hours	77	38	17	1	
Total number of days	15	7	4	1	

Site : RISØ, DENMARK
Parameter: OZONE, UG/M3
Period : 8 MAY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
080585	16	3		166.
090585	1			124.
110585	2			124.
120585	3			124.
140585	5			150.
170585	8			148.
200585	6			144.
210585	2			122.
220585	4			130.
240585	1			126.
260585	12			154.
270585	3			128.
040685	2			160.
050685	16	8		188.
060685	3	1		168.
190685	1			122.
120785	4			146.
130785	1			136.
150785	3			144.
280885	3			138.
310885	9	7	3	210.
220985	2			150.
Total number of hours	107	19	3	
Total number of days	22	4	1	

Site : BROTJACKLRIEGEL, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
050485	2		126.
200485	3		122.
110585	2		126.
140585	2		126.
160585	11		138.
170585	6		136.
240585	11		144.
250585	24		152.
260585	10		144.
270585	24	5	174.
280585	5		124.
010685	5		130.
050685	12		136.
140685	1		122.
190685	3		126.
210685	3		132.
220685	1		124.
300685	3		128.
010785	5		124.
050785	1		122.
060785	13		132.
070785	1		126.
120785	14		150.
130785	24		158.
140785	22		144.
150785	8		150.
180785	6		136.
190785	2		122.
220785	1		122.
250785	2		124.
260785	7		126.
270785	1		122.
010985	11	1	162.
140985	5		132.
150985	1		126.
190985	9		156.
200985	21	2	170.
210985	22		158.
220985	7		128.
230985	1		124.
240985	2		126.
Total number of hours	314	8	
Total number of days	41	3	

Site : DEUSELBACH, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
040485	3		126.
190485	5		128.
200485	7	1	164.
210485	5		138.
060585	2		126.
160585	6		130.
180585	3		132.
250585	7		142.
260585	13		148.
270585	3		126.
310585	4		122.
010685	1		122.
020685	1		122.
030685	12		148.
040685	13	1	162.
190685	3		124.
030785	6		132.
040785	10		146.
050785	4		126.
060785	1		124.
120785	8		158.
130785	14	9	196.
140785	18	3	170.
160785	1		126.
240785	10		146.
250785	15	11	190.
260785	14	6	194.
280885	11		158.
290885	11		156.
300885	15		156.
310885	10		146.
070985	3		122.
120985	10		148.
130985	1		124.
190985	4		132.
210985	6		134.
220985	2		128.
280985	2		138.
Total number of hours	264	31	
Total number of days	38	6	

Site : LANGENBRUGGE-WALDHOF, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	>280	Maximum 1-h concentration
040485	5					148.
050485	5	2				162.
170485	6					150.
180485	7					156.
190485	12					152.
200485	7					156.
210485	8					138.
220485	9					156.
240485	6					140.
250485	6					144.
260485	1					124.
300485	11					150.
010585	1					124.
020585	5					140.
050585	5					140.
060585	11	2				180.
070585	5					130.
110585	5					136.
130585	6	1				164.
140585	13	10	3			222.
150585	14	11	6	1		244.
160585	11					156.
170585	6	1				172.
260585	7					128.
270585	7					128.
190685	13	6				184.
200685	1					136.
210685	2					126.
220685	2					142.
240685	7					146.
270685	2					132.
030785	5					130.
040785	12	9	3			218.
050785	12	6	1			202.
060785	11	8	5	1		242.
110785	1					122.
120785	9	6	2			208.
130785	10	8	4			234.
140785	19	11	8	1		242.
150785	5					142.
160785	7	5				200.
170785	4					130.
180785	11	10	8	1		244.
190785	6					140.
240785	9					150.
260785	11	4				184.

Site : LANGENBRUGGE-WALDHOF, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	>280	Maximum 1-h concentration
280785	7					156.
010885	4					144.
090885	11	7	3			208.
100885	5					144.
110885	3					140.
130885	4					146.
140885	14	11	10	3		246.
150885	6					152.
160885	2					130.
190885	5	2				168.
210885	2					124.
240885	8					156.
280885	8	3	2			210.
290885	10	8	3			206.
300885	15	14	12	3		250.
310885	13	9	6	5	1	286.
010985	3					126.
130985	5					160.
190985	10					152.
210985	2					122.
270985	3					130.
Total number of hours	478	154	76	15	1	
Total number of days	67	23	15	7	1	

Site : SCHAUINSLAND, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
010485	2			126.
030485	5			128.
040485	21			152.
050485	16			138.
180485	6			128.
190485	12			138.
200485	24			152.
210485	22			148.
220485	10			150.
230485	3			138.
250485	1			122.
050585	3			124.
060585	5			128.
110585	7			126.
130585	5			126.
140585	4			130.
150585	14			134.
160585	23			148.
170585	16			150.
180585	14			140.
190585	14			146.
200585	20			142.
210585	4			132.
230585	7			126.
240585	20			142.
250585	24	10		194.
260585	24	18		192.
270585	17	2		162.
310585	13	6		174.
010685	22			146.
020685	21			140.
030685	19	4		196.
040685	17			156.
050685	11			150.
160685	4			130.
170685	5			132.
180685	9			140.
190685	6			132.
290685	8			138.
300685	12			152.
010785	5			138.
020785	12			150.
030785	18	7	1	202.
040785	17	6		184.
050785	6			128.
060785	3			146.

Site : SCHAUINSLAND, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
070785	8			136.
080785	15			158.
090785	3			130.
100785	9			130.
110785	11			152.
120785	24	5		176.
130785	24	6		194.
140785	24	3		166.
150785	2			128.
170785	10			148.
180785	13			134.
190785	1			124.
240785	12	9		186.
250785	24	6	1	202.
260785	18	1		176.
280785	9			130.
120885	3			138.
130885	12	5		168.
140885	23			156.
150885	9			138.
160885	3			136.
210885	9			156.
220885	21			158.
230885	3			132.
240885	9			136.
280885	6			144.
290885	6			134.
300885	14	5		168.
310885	24	1		162.
010985	3			150.
110985	10			148.
120985	11	4		190.
130985	17	1		172.
190985	18			148.
200985	19			158.
210985	24			144.
220985	21			140.
230985	24	1		162.
240985	22			160.
250985	13			140.
260985	8			140.
270985	11			154.
280985	24	1		162.
290985	24			158.
300985	23			160.
Total number of hours	1172	101	2	
Total number of days	91	20	2	

Site : WESTERLAND, FED.REP. OF GERMANY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
060585	3		128.
070585	3		128.
150585	3		132.
170585	5		134.
210585	4		128.
260585	9	1	164.
270585	10		160.
020685	10		144.
040685	10		138.
210685	3		124.
060785	2		124.
110785	5		128.
140785	13	3	166.
150785	3		144.
180785	5		136.
140885	1		122.
280885	1		126.
300885	8		160.
310885	3		130.
Total number of hours	101	4	
Total number of days	19	2	

Site : UTO, FINLAND
Parameter: OZONE, UG/M3
Period : 4 JULY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
110785	1		129.
130785	4		125.
150785	14		155.
160785	2		130.
120885	1		121.
290885	1	1	198.
010985	3		131.
Total number of hours	26	1	
Total number of days	7	1	

Site : EIBERGEN, NETHERLANDS
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
190485	3		132.
060585	3		125.
160585	4		125.
190585	3		127.
260585	8	5	178.
270585	5		144.
030685	6		139.
130785	8	5	173.
140785	10	3	181.
240785	5	1	169.
250785	9	1	161.
110885	1		122.
140885	4	2	169.
280885	1		123.
290885	6		157.
300885	4	1	171.
190985	1		122.
Total number of hours	81	18	
Total number of days	17	7	

Site : WITTEVEEN, NETHERLANDS
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
310585	6			129.
010685	1			121.
020685	6			127.
030685	8			142.
040685	9	6	3	217.
050685	6			150.
060685	1			122.
040785	10			155.
050785	8	4		168.
130785	3			148.
140785	9	3		193.
150785	1			125.
210785	6	1		184.
140885	5	1		166.
280885	3			135.
300885	6	2		163.
Total number of hours	88	17	3	
Total number of days	16	6	1	

Site   :   BIRKENES, NORWAY
Parameter: OZONE, UG/M3
Period   : 1 JULY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

No hourly values exceeding 120.

Site : JELØYA, NORWAY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	>240	Maximum 1-h concentration
200485	1				122.
140585	6				128.
200585	1				125.
240585	1				131.
260585	3				126.
270585	15				140.
070785	1				123.
220785	6	6	1	1	266.
290785	4	2	2		233.
060885	4	4	4		220.
070885	4	3	1		234.
090885	7	7	6		221.
Total number of hours	53	22	14	1	
Total number of days	12	5	5	1	

Site : LANGESUND, NORWAY
Parameter: OZONE, UG/M3
Period : 1 APRIL - 31 JULY 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	Maximum 1-h concentration
080585	6	126.
090585	11	129.
140585	6	123.
270585	5	133.
120685	1	124.
Total number of hours	29	
Total number of days	5	

Site : ASPVRETEN, SWEDEN
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
110485	7		128.
120485	8		126.
130485	1		122.
140485	3		128.
160485	10		146.
170485	5		126.
180485	2		124.
190485	3		122.
020585	9		134.
060585	9		144.
070585	16		154.
080585	12		136.
090585	8		130.
120585	8		138.
130585	11		150.
140585	14		156.
160585	6		128.
180585	9		132.
190585	13		136.
200585	2		126.
220585	3		124.
240585	3		126.
250585	1		124.
260585	15	1	162.
270585	19	15	196.
280585	19	7	168.
290585	4		142.
020785	7	2	166.
030785	24	18	186.
040785	21	19	198.
Total number of hours	272	62	
Total number of days	30	6	

Site : NORRA KVILL, SWEDEN
Parameter: OZONE, UG/M3
Period : 23 JUNE - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
140785	4		133.
310885	9	3	194.
Total number of hours	13	3	
Total number of days	2	1	

Site : RINGAMÅLA, SWEDEN
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
060585	13			140.
070585	16			150.
080585	18			146.
090585	1			122.
130585	1			122.
140585	11			128.
150585	2			132.
170585	6			130.
180585	3			122.
200585	8			132.
210585	4			126.
220585	5			128.
230585	8			154.
250585	7			140.
260585	11	7	1	202.
270585	14	3		172.
280585	9	3		164.
290585	10	1		162.
020685	4			128.
040685	4			126.
050685	11	3		172.
060685	8			142.
210685	1			124.
230685	7			138.
240685	9			152.
140785	12			160.
150785	3			128.
200785	1			126.
Total number of hours	207	17	1	
Total number of days	28	5	1	

Site : RORVIK, SWEDEN
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
060585	10			138.
070585	12			138.
080585	12			142.
090585	4			126.
110585	2			123.
120585	2			127.
130585	4			124.
140585	7			127.
190585	7			125.
200585	7			125.
210585	4			135.
250585	1			122.
260585	12	6		193.
270585	23	10		187.
280585	14			147.
010685	4			123.
020685	1			121.
050685	6	1		162.
060685	1	1		183.
180685	3			125.
220685	4			133.
230685	8			149.
010785	1			139.
060785	4			140.
070785	2			122.
120785	7			150.
140785	13	11	5	214.
150785	11	2		173.
180785	13	2		164.
190785	2			127.
010885	1			149.
100885	1			127.
130885	2			127.
150885	2			126.
160885	6			134.
240885	2			124.
280885	6			140.
310885	10	2		165.
010985	2			145.
Total number of hours	233	35	5	
Total number of days	39	8	1	

Site : VAVIHILL, SWEDEN
Parameter: OZONE, UG/M3
Period : 2 MAY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
060585	13			148.
070585	16	2		164.
080585	20			160.
090585	1			124.
100585	5			132.
110585	6			132.
120585	10			144.
130585	6			132.
140585	13			160.
150585	2			124.
170585	5			150.
180585	4			126.
190585	9			136.
200585	8			136.
210585	7			136.
220585	7			156.
250585	4			128.
260585	14	12		200.
270585	24	7		180.
280585	18	4		188.
040685	7			160.
050685	8	3		188.
210685	1			122.
120785	6			144.
130785	1			124.
140785	12	9	2	212.
150785	4			144.
180785	4			140.
190785	1			156.
240885	3			128.
280885	6			152.
310885	10	7		192.
Total number of hours	255	44	2	
Total number of days	32	7	1	

Site : VINDELN, SWEDEN
Parameter: OZONE, UG/M3
Period : 3 JULY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

No hourly values exceeding 120.

Site : BOTTESFORD, UNITED KINGDOM
Parameter: OZONE, UG/M3
Period : 8 MAY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
070585	3			136.
160585	7			132.
170585	7			134.
180585	4			144.
290585	2			124.
020785	1			122.
030785	4			132.
040785	8	4		196.
050785	7	4	2	208.
230785	2			128.
250785	14	8	6	218.
260785	2			136.
300885	1			122.
110985	6	1		176.
120985	8	5	1	216.
130985	2			158.
270985	3			124.
280985	3			132.
Total number of hours	84	22	9	
Total number of days	18	5	3	

Site : HARWELL, UNITED KINGDOM
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	>200	Maximum 1-h concentration
180485	6			152.
190485	9	4		167.
260485	1			125.
270485	1			125.
300485	2			124.
160585	8			160.
170585	8			146.
180585	10			147.
290585	3			136.
300585	3			132.
310585	2			121.
010685	7			136.
020685	7			147.
030685	6			160.
030785	6	2		171.
040785	5			157.
050785	7			157.
130785	3			132.
230785	3			126.
250785	11	9	1	206.
260785	3			145.
110985	3			136.
120985	7	1		163.
Total number of hours	121	16	1	
Total number of days	23	4	1	

Site : WRAY, UNITED KINGDOM
Parameter: OZONE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
190485	1		130.
160585	4		126.
170585	6		152.
010685	1		128.
030685	8		148.
030785	8	4	176.
040785	13		152.
050785	1		122.
250785	5		148.
120985	3		128.
280985	1		128.
Total number of hours	51	4	
Total number of days	11	1	

Site   : UK4 SIBTON, UNITED KINGDOM
Parameter: OZONE, UG/M3
Period   : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	>120	>160	Maximum 1-h concentration
190485	1		122.
040685	1		122.
050685	4		128.
140885	2		126.
180885	3		148.
250985	2		134.
260985	4		140.
270985	15	5	192.
280985	14		160.
290985	1		154.
300985	3		138.
Total number of hours	50	5	
Total number of days	11	1	

APPENDIX B

Summary of nitrogen dioxide data

The tables give number of hours per day, and number of days, with hourly concentrations exceeding given limits.

Site : GENT,ST.KRUISWINKEL, BELGIUM
Parameter: NITROGEN DIOXIDE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration
exceeding given limits

Date	> 40	> 80	>120	>160	>200	>240	Maximum 1-h concentration
010485	4						62.
020485	1						50.
030485	1						41.
040485	4						52.
050485	4						78.
060485	3						46.
080485	4						56.
090485	5						57.
100485	5						50.
110485	2						53.
120485	4						65.
130485	8						66.
150485	5						55.
160485	12						59.
170485	22						80.
180485	15						65.
190485	17	4					85.
200485	1						41.
220485	1						41.
240485	5	2	1				139.
250485	16	12	5	3	2		211.
260485	3						45.
290485	18	6					112.
300485	10						80.
060585	13	10	4	1			169.
070585	14	4	1				130.
080585	1						53.
090585	11	1					83.
100585	3						44.
110585	4						59.
140585	3						65.
150585	5	3					108.
160585	13	5					100.
170585	8						64.
180585	7						62.
190585	5						52.
200585	10	3					118.
210585	11	1					94.
220585	8	1					86.
230585	12						63.
240585	4						71.
250585	5						79.
260585	12						76.
270585	7						63.
280585	5						77.
290585	4						58.
020685	10						56.

Site : GENT,ST.KRUISWINKEL, BELGIUM
Parameter: NITROGEN DIOXIDE, UG
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	>120	>160	>200	>240	Maximum 1-h concentration
030685	13	1					89.
040685	9						74.
050685	3						68.
060685	12						67.
070685	3						56.
080685	6						65.
090685	3						43.
100685	7						71.
110685	14						71.
120685	4						50.
140685	6						78.
160685	4						54.
170685	5						74.
180685	11						77.
190685	15						73.
200685	5						69.
210685	8						52.
220685	2						43.
250685	6						69.
280685	4	2					88.
290685	3						54.
050785	3						63.
080785	2	1					87.
090785	2						52.
100785	1						50.
120785	3	1					86.
150785	1						43.
160785	1						52.
260785	2						47.
310785	2						45.
010885	3						54.
020885	2						49.
060885	2						48.
070885	8						77.
080885	2						62.
090885	10	3					115.
100885	3						46.
120885	4						71.
130885	9						77.
140885	5						73.
150885	8	2					105.
190885	3						69.
200885	4	1					86.
210885	11	3					101.
220885	17	6	1				123.
230885	10	2					95.
260885	9	6	5	1			164.
270885	12	3	3				138.

Site : GENT,ST.KRUISWINKEL, BELGIUM
Parameter: NITROGEN DIOXIDE, UG
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	>120	>160	>200	>240	Maximum 1-h concentration
280885	14	4	2				126.
290885	8	2	1	1	1	1	261.
030985	12	5	1				136.
040985	3						61.
050985	7	2	1				129.
060985	8	7	7	3	1		226.
100985	3	2	2	1			172.
110985	4						71.
120985	12	5					93.
130985	11						68.
140985	5						68.
150985	4						69.
160985	7	4	1				141.
170985	2						57.
180985	7						56.
190985	1						64.
200985	18	11	2				152.
210985	1						48.
220985	6						52.
230985	12	2					90.
240985	20	7					104.
250985	17	4	1				131.
260985	18	7					113.
270985	24	16	9	1			162.
280985	16	8	1				122.
290985	21	6					100.
300985	23	7					100.
Total number of hours	911	182	48	11	4	1	
Total number of days	122	41	18	7	3	1	

Site   :   UTO, FINLAND
Parameter: NITROGEN DIOXIDE, UG/M3
Period   : 4 JULY - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

No hourly values exceeding   40.

Site : EIBERGEN, NETHERLANDS
Parameter: NITROGEN DIOXIDE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	Maximum 1-h concentration
010485	8		71.
030485	6		73.
040485	16	8	104.
050485	1		42.
060485	4		52.
070485	2		52.
090485	2		48.
100485	6		49.
110485	6		48.
160485	2		46.
170485	18	1	86.
180485	6		61.
190485	12		78.
200485	3		46.
210485	2		48.
300485	1		43.
010585	2		45.
030585	5		67.
050585	11		69.
090585	6	1	91.
130585	1		43.
140585	5	2	85.
150585	9		62.
200585	7		53.
220585	3		44.
240585	5		74.
250585	3		48.
270585	8		59.
040685	2		46.
060685	2		45.
170685	1		43.
180685	8		56.
190685	12		58.
210685	8	1	88.
220685	4		49.
240685	8		55.
260685	5		58.
280685	2		44.
090785	1		49.
110785	4		47.
120785	8		77.
130785	8		65.
140785	8		53.
160785	3		59.
180785	10	4	93.
210785	1		42.

Site : EIBERGEN, NETHERLANDS
Parameter: NITROGEN DIOXIDE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	Maximum 1-h concentration
260785	6		80.
280785	8		70.
290785	4		53.
080885	2		51.
090885	11		60.
140885	3		49.
150885	4		77.
160885	1		41.
180885	3		52.
190885	10		79.
210885	3		48.
220885	4		74.
240885	7	3	87.
270885	4		61.
280885	11		69.
290885	13	4	106.
300885	21	3	102.
310885	9	5	116.
020985	5		72.
030985	3	1	82.
040985	1		41.
100985	3		47.
110985	11		65.
120985	15		79.
130985	11	5	95.
160985	1		44.
190985	10		63.
200985	4		52.
210985	6		47.
240985	7		64.
Total number of hours	456	38	
Total number of days	76	12	

Site : WITTEVEEN, NETHERLANDS
Parameter: NITROGEN DIOXIDE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	Maximum 1-h concentration
040485	4	44.
040585	2	46.
040685	4	61.
240885	3	50.
100985	3	58.
130985	3	55.
190985	4	46.
Total number of hours	23	
Total number of days	7	

Site   : UK1 BOTTESFORD, UNITED KINGDOM
Parameter: NITROGEN DIOXIDE, UG/M3
Period   : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	>120	Maximum 1-h concentration
020485	10	1		86.
040485	1			54.
060485	1			46.
090485	6			65.
100485	16	6		100.
110485	3			58.
120485	3			65.
150485	16	4		98.
160485	10			65.
170485	10			77.
180485	6			65.
190485	14	7		102.
200485	2	1		84.
240485	10	1		81.
250485	6	4		96.
260485	11	1		83.
270485	6			75.
280485	2			65.
290485	13	3		102.
300485	5			69.
020585	3	1		94.
030585	10			69.
040585	2			44.
050585	4			44.
060585	2			56.
070585	9	2		109.
080585	24	4		109.
090585	9	1		81.
100585	10	3		86.
140585	10	1		81.
150585	1			48.
170585	5			58.
180585	1			42.
220585	14			73.
230585	6			50.
280585	1			44.
310585	2			50.
050685	7	2		100.
070685	7			60.
130685	6			61.
140685	8			67.
150685	2			42.
170685	4			61.
200685	6	1		96.
260685	2			48.
280685	2			44.
300685	1			48.

Site   : UK1 BOTTESFORD, UNITED KINGDOM
Parameter: NITROGEN DIOXIDE, UG/M3
Period   : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	>120	Maximum 1-h concentration
040785	1			44.
050785	13			79.
060785	2			42.
070785	5			46.
080785	10			61.
090785	6			63.
100785	10	1		92.
110785	5			50.
140785	4			46.
150785	14	1		83.
160785	1			44.
180785	1			65.
190785	5			54.
200785	3			54.
210785	1			40.
230785	8			79.
240785	2			56.
270785	2			54.
290785	11	1		83.
300785	15	1		81.
310785	3			48.
010885	1			40.
020885	3	2		86.
100885	3			54.
140885	6			54.
160885	1			42.
170885	2			54.
190885	4			52.
200885	1			42.
220885	3			69.
240885	5			50.
250885	2			52.
260885	2			56.
280885	9			73.
290885	11			69.
300885	7			52.
310885	6			60.
010985	2			67.
020985	1			48.
030985	9			75.
040985	8			73.
050985	4			48.
060985	8	5		100.
070985	15	1		88.
080985	2			44.
090985	12	10	5	144.
100985	24	9		115.
110985	12	4		104.

Site : UK1 BOTTESFORD, UNITED KINGDOM
Parameter: NITROGEN DIOXIDE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	> 80	>120	Maximum 1-h concentration
120985	19	5		104.
130985	11	2		90.
140985	5	2		109.
150985	3			63.
160985	4			65.
170985	8	3	1	125.
180985	21			73.
190985	16	6		98.
200985	20	10		117.
210985	1			48.
220985	8			63.
230985	11	2		90.
240985	15	2		102.
250985	24	4		92.
260985	19	2		102.
270985	17	1		84.
280985	11	1	1	121.
290985	1			40.
300985	13			60.
Total number of hours	821	118	7	
Total number of days	114	39	3	

Site   :   WRAY, UNITED KINGDOM
Parameter: NITROGEN DIOXIDE, UG/M3
Period   : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 40	Maximum 1-h concentration
040485	4	54.
180485	2	42.
190485	1	44.
170585	5	56.
020685	1	44.
040785	4	46.
050785	4	56.
100785	1	40.
250785	1	46.
260785	1	44.
290885	4	46.
300885	1	42.
040985	3	46.
090985	1	40.
110985	1	40.
120985	4	61.
250985	1	40.
290985	4	46.
Total number of hours	43	
Total number of days	18	

APPENDIX C

Summary of peroxyacetyl nitrate data

The table gives number of hours per day, and number of days, with hourly concentrations exceeding given limits.

Site : DELFT, NETHERLANDS
Parameter: PEROXYACETYL NITRATE, UG/M3
Period : 1 APRIL - 30 SEPTEMBER 1985

Number of hours per day with 1-h concentration exceeding given limits

Date	> 10	> 20	> 30	Maximum 1-h concentration
040485	1			10.5
170485	5			14.6
180485	3			11.0
190485	15			19.1
300485	1			10.5
050585	5			12.0
060585	9			16.6
070585	1			11.0
080585	6			13.6
090585	2			12.0
150585	7			14.1
160585	12			17.1
170585	3			11.5
190585	5			18.6
210585	12			14.6
220585	1			11.5
240585	3			14.6
030685	1			11.0
040685	12	1		21.6
060685	6	1		20.1
160685	8			15.1
170685	4			12.6
180685	1			11.5
190685	13			14.6
210685	8			12.6
030785	1			10.5
040785	5			15.1
130785	1			11.0
140785	3			16.6
180785	2			16.6
240785	9			15.1
180885	3			13.6
280885	2			13.1
290885	8	2	1	39.8
300885	12	1		20.6
110985	11			18.6
120985	7			16.6
250985	3	1		23.1
260985	3			12.0
270985	6			18.1
300985	3			13.1
Total number of hours	223	6	1	
Total number of days	41	5	1	

APPENDIX D

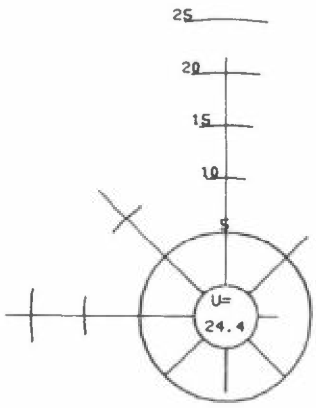
Back trajectory sector distributions. (Unit: Per cent).

Ozone concentration limit: 120 $\mu g/m^3$.
For Illmitz: also 160 $\mu g/m^3$ and 240 $\mu g/m^3$
For Langenbrügge-Waldhof and Schauinsland: also 160 $\mu g/m^3$

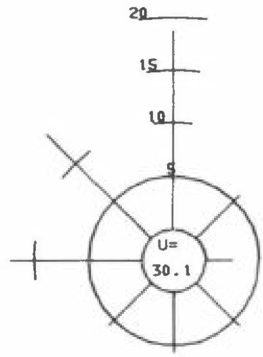
NO_2 concentrations limits: 40 $\mu g/m^3$, 80 $\mu g/m^3$ and 120 $\mu g/m^3$.

PAN concentration limit: 10 $\mu g/m^3$.

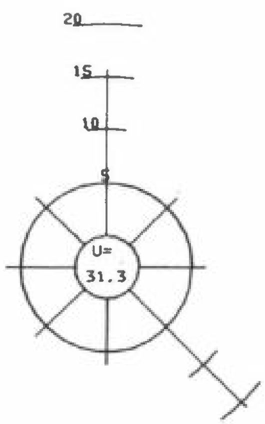
ILLMITZ, AUSTRIA
OZONE > 120. ug/M3



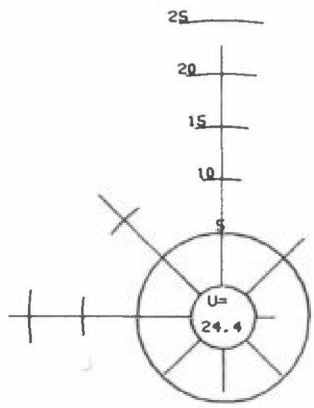
ILLMITZ, AUSTRIA
OZONE > 160. ug/M3



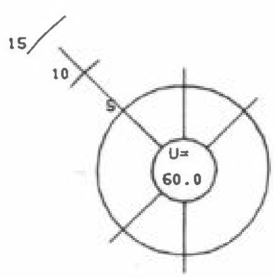
ILLMITZ, AUSTRIA
OZONE > 240. ug/M3



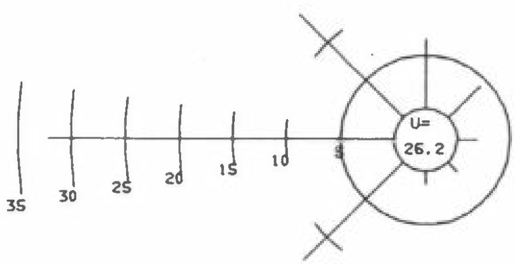
ILLMITZ, AUSTRIA
ALL DAYS



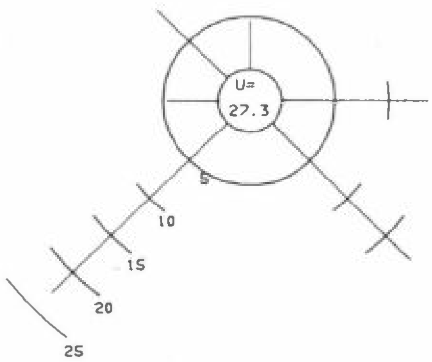
GENT, ST.KRUISWINKEL, BELGIUM
OZONE > 120. ug/M3



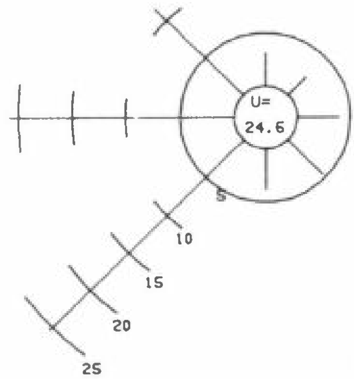
GENT, ST.KRUISWINKEL, BELGIUM
ALL DAYS



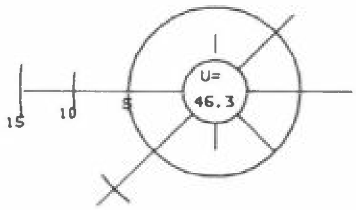
RISØ, DENMARK
OZONE > 120. ug/M3



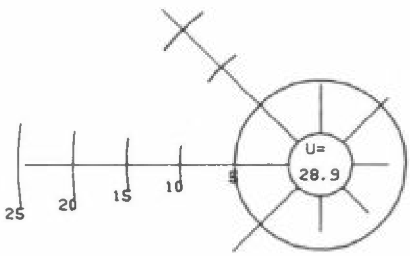
RISØ, DENMARK
ALL DAYS



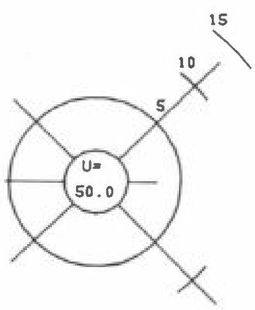
BROTJACKLRIEGEL, FED.REP. OF GERMANY
OZONE > 120. ug/M3



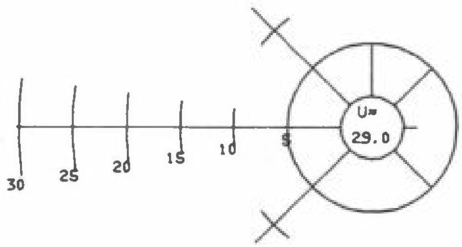
BROTJACKLRIEGEL, FED.REP. OF GERMANY
ALL DAYS



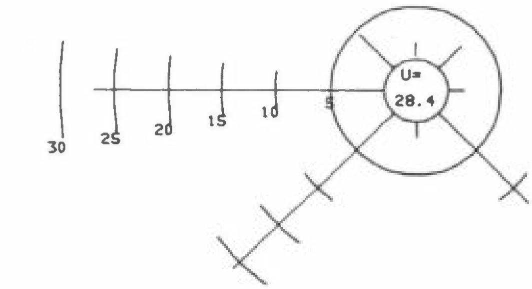
DEUSELBACH, FED.REP. OF GERMANY
OZONE > 120. ug/M3



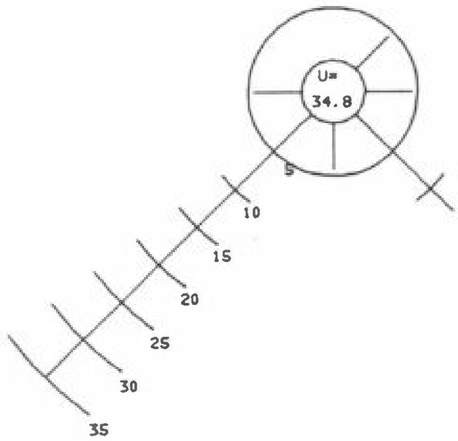
DEUSELBACH, FED.REP. OF GERMANY
ALL DAYS



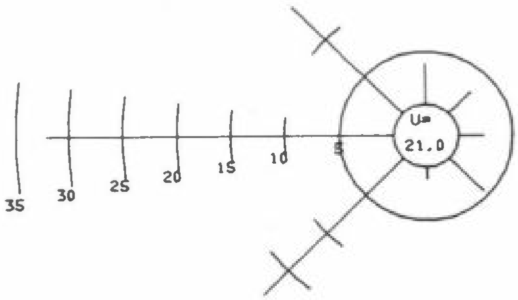
LANGENBRUGGE-WALDHOF, FED.REP. OF GERMANY
OZONE > 120. ug/M3



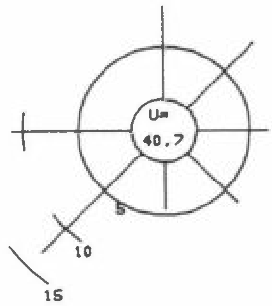
LANGENBRUGGE-WALDHOF, FED.REP. OF GERMANY
OZONE > 160. ug/M3



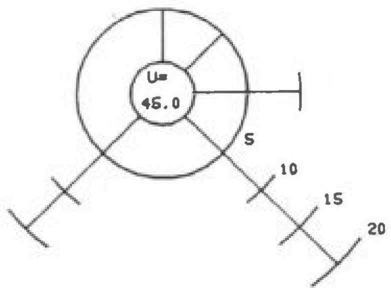
LANGENBRUGGE-WALDHOF, FED.REP. OF GERMANY
ALL DAYS



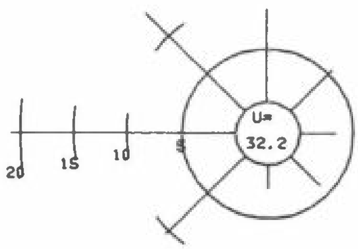
SCHAUINSLAND, FED.REP.OF GERMANY
OZONE > 120. ug/M3



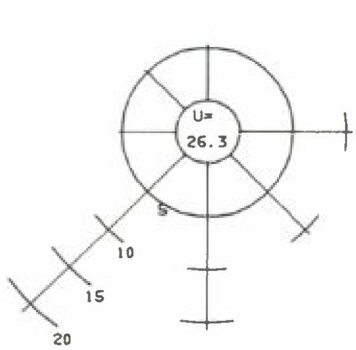
SCHAUINSLAND, FED.REP.OF GERMANY
OZONE > 160. ug/M3



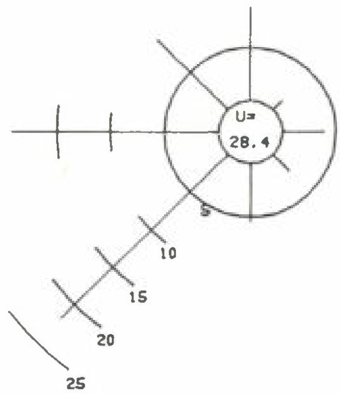
SCHAUINSLAND, FED.REP.OF GERMANY
ALL DAYS



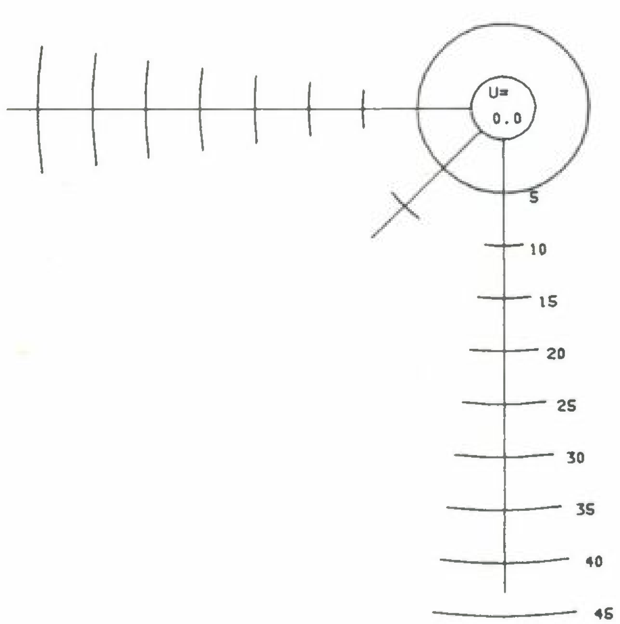
WESTERLAND, FED.REP.OF GERMANY
OZONE > 120. ug/M3



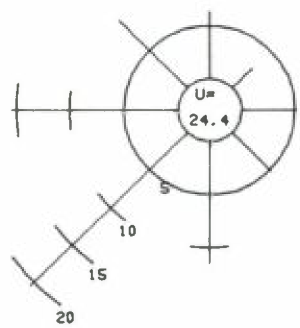
WESTERLAND, FED.REP.OF GERMANY
ALL DAYS



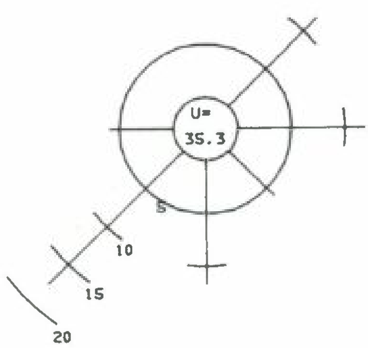
UTO, FINLAND
OZONE > 120. ug/M3



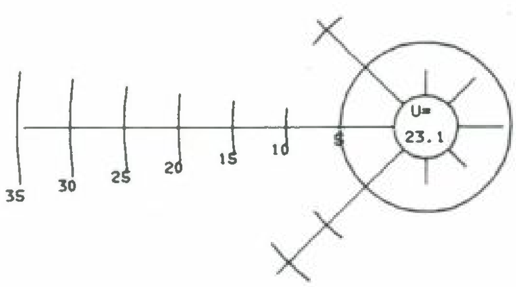
UTO, FINLAND
ALL DAYS



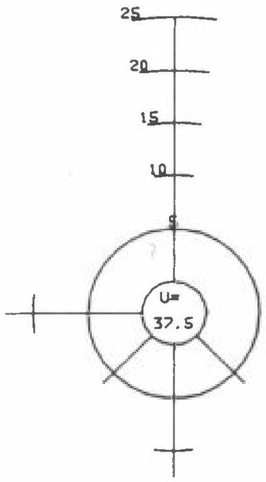
EIBERGEN, NETHERLANDS
OZONE > 120. ug/M3



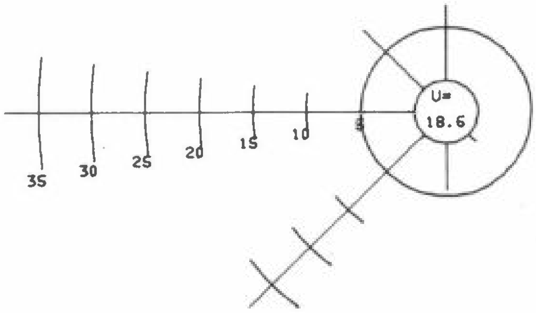
EIBERGEN, NETHERLANDS
ALL DAYS



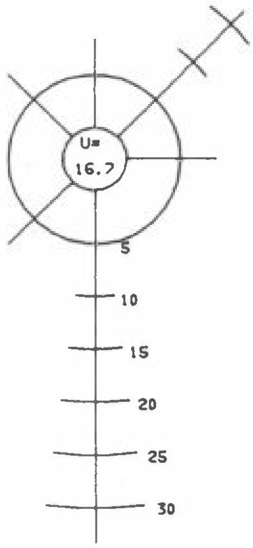
WITTEVEEN, NETHERLANDS
OZONE > 120. ug/M3



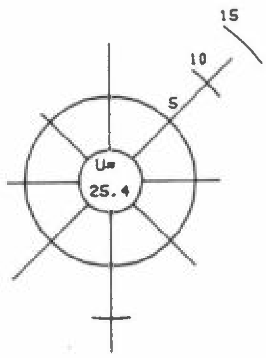
WITTEVEEN, NETHERLANDS
ALL DAYS



JELØYA, NORWAY
OZONE > 120. ug/M3



JELØYA, NORWAY
ALL DAYS



LANGESUND, NORWAY
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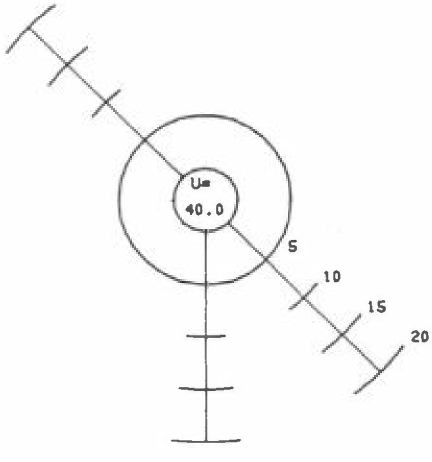
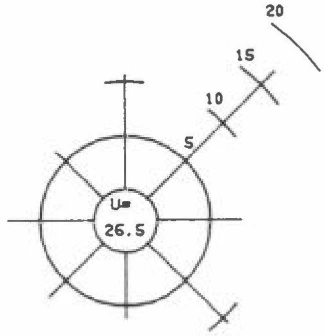


LANGESUND, NORWAY
ALL DAYS



ASPURETEN, SWEDEN
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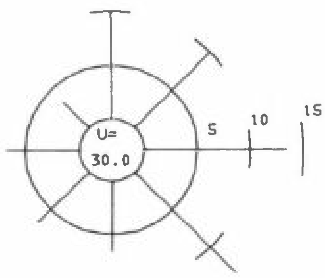
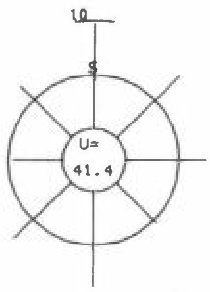
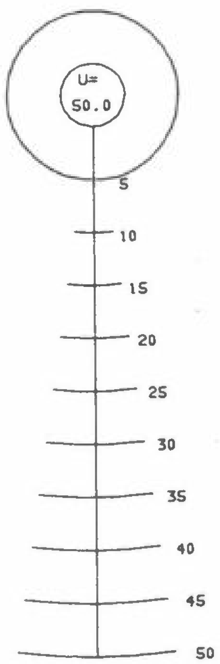


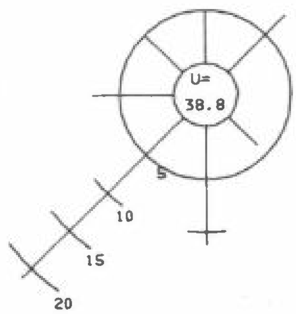
ASPURETEN, SWEDEN
ALL DAYS



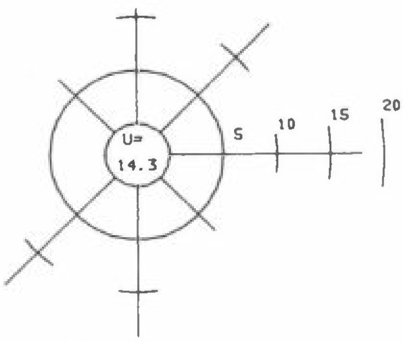
NORRA KVILL, SWEDEN
OZONE > 120. ug/M3



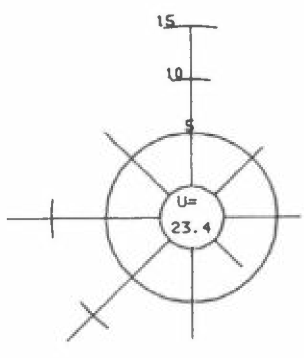
NORRA KVILL, SWEDEN
ALL DAYS



RINGAMALA, SWEDEN
OZONE > 120. ug/M3



RINGAMALA, SWEDEN
ALL DAYS



RORVIK, SWEDEN
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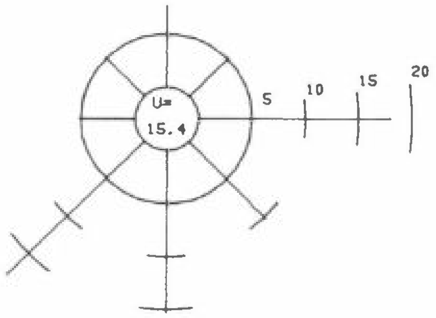
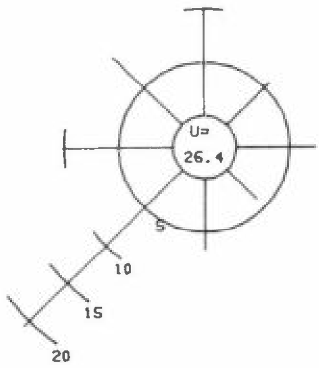
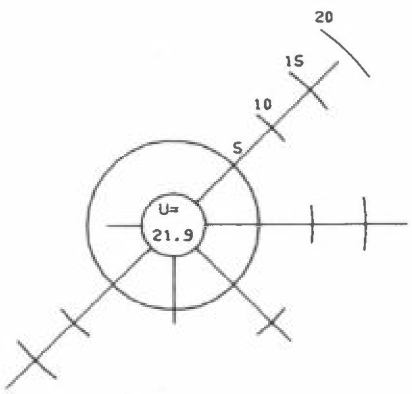


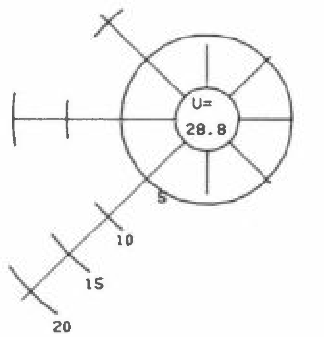
RORVIK, SWEDEN
ALL DAYS



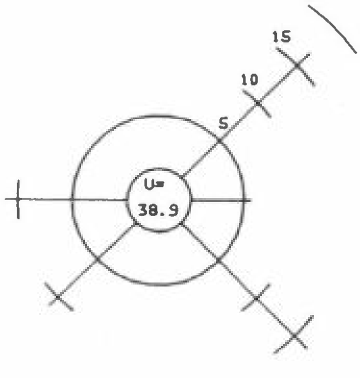
VAVIHILL, SWEDEN
OZONE > 120. ug/M3



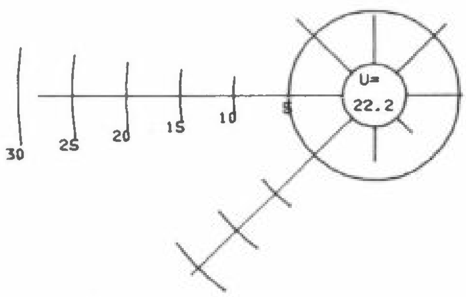
VAVIHILL, SWEDEN
ALL DAYS



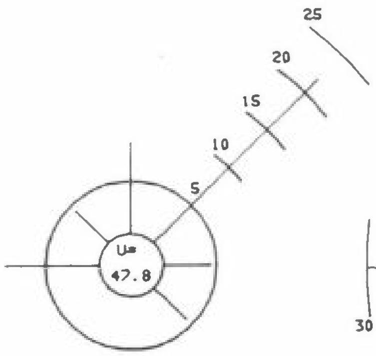
BOTTESFORD, UNITED KINGDOM
OZONE > 120. ug/M3



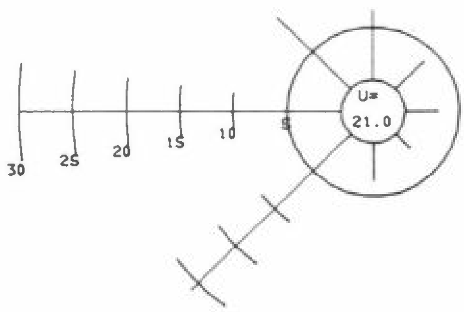
BOTTESFORD, UNITED KINGDOM
ALL DAYS



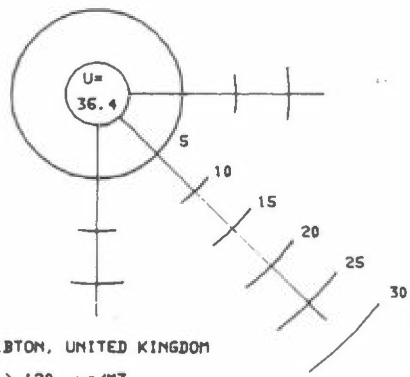
HARWELL, UNITED KINGDOM
OZONE > 120. ug/M3



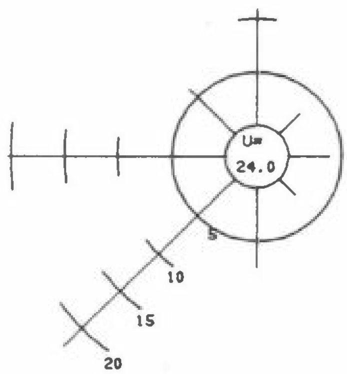
HARWELL, UNITED KINGDOM
ALL DAYS



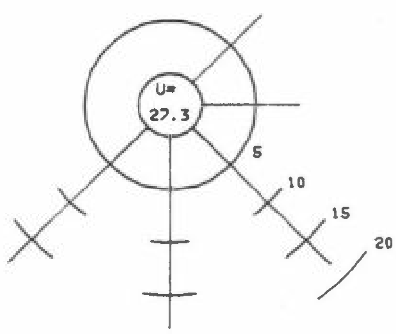
WRAY, UNITED KINGDOM
OZONE > 120. ug/M3



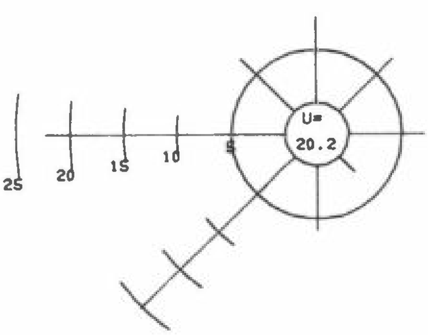
WRAY, UNITED KINGDOM
ALL DAYS



SIBTON, UNITED KINGDOM
OZONE > 120. ug/M3

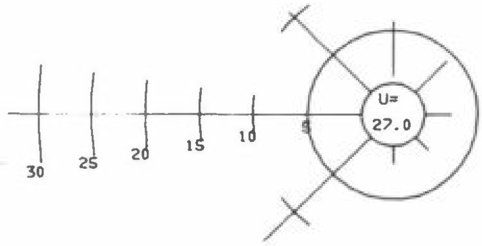


SIBTON, UNITED KINGDOM
ALL DAYS



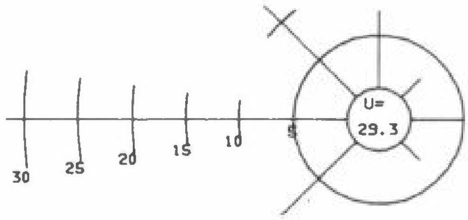
GENT, ST.KRUISWINKEL, BELGIUM

NO2 > 40. ug/M3



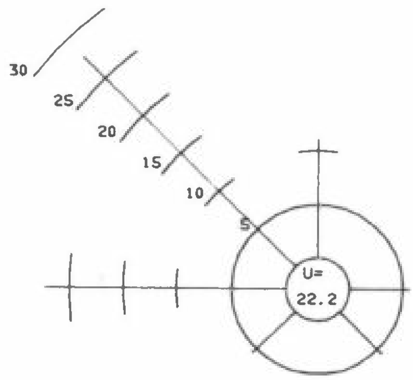
GENT, ST.KRUISWINKEL,

NO2 > 80. ug/M3



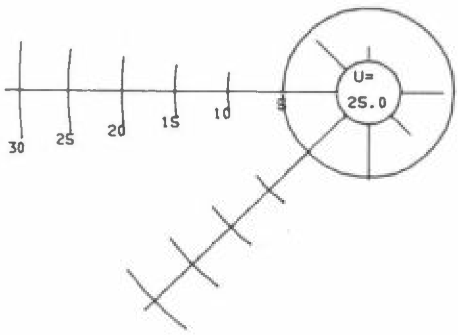
GENT, ST.KRUISWINKEL, BELGIUM

NO2 > 120. ug/M3



EIBERGEN, NETHERLANDS

NO2 > 40. ug/M3



EIBERGEN, NETHERLANDS

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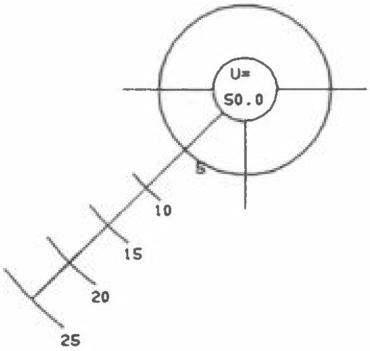
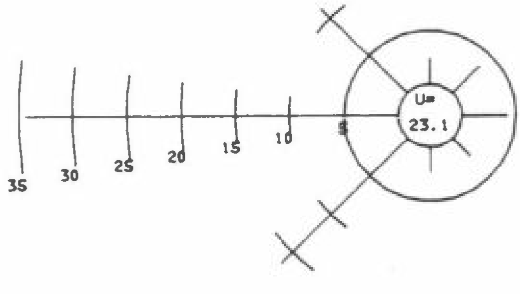
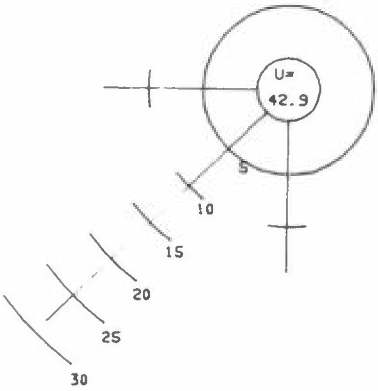


EIBERGEN, NETHERLANDS

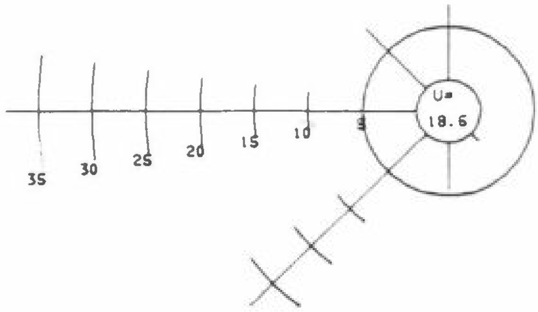
ALL DAYS



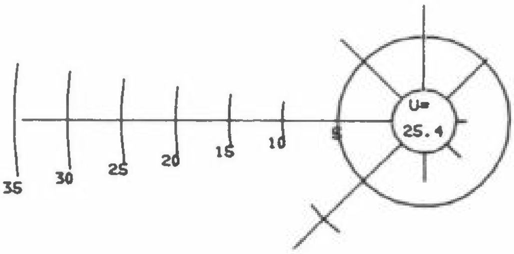
WITTEVEEN, NETHERLANDS
NO2 > 40. ug/M3



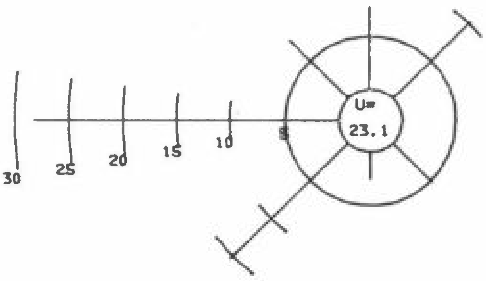
WITTEVEEN, NETHERLANDS
ALL DAYS



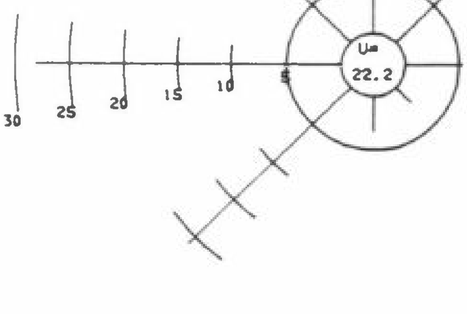
BOTTESFORD, UNITED KINGDOM
NO2 > 40. ug/M3



BOTTESFORD, UNITED KINGDOM
NO2 > 80. ug/M3

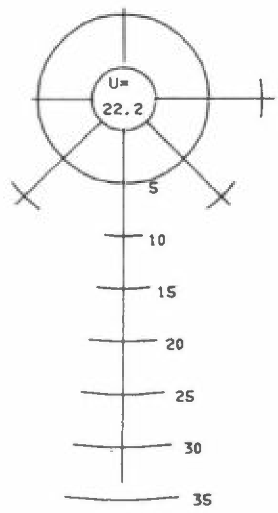


UK1 BOTTESFORD, UNITED KINGDOM
ALL DAYS



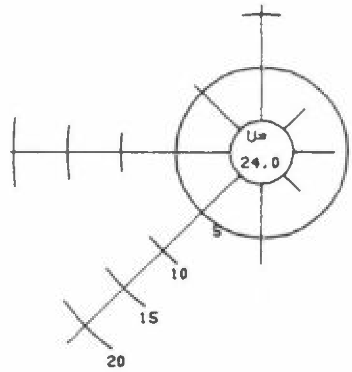
WRAY, UNITED KINGDOM

NO2 > 40. ug/M3



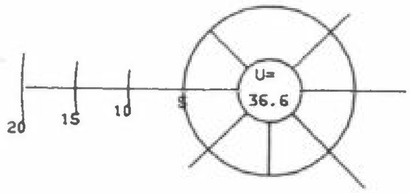
WRAY, UNITED KINGDOM

ALL DAYS



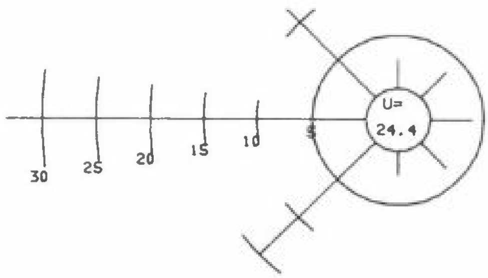
DELFT, NETHERLANDS

PAN > 10. ug/M3



DELFT, NETHERLANDS

ALL DAYS



NORSK INSTITUTT FOR LUFTFORSKNING (NILU)
NORWEGIAN INSTITUTE FOR AIR RESEARCH
POSTBOKS 64, N-2001 LILLESTRØM

RAPPORTTYPE Oppdragsrapport	RAPPORTNR. 22/87	ISBN-82-7247-805-6	
DATO April 1987	ANSV. SIGN. J. Schjoldager	ANT. SIDER 109	PRIS NOK 90.-
TITTEL Oxidant data collection in OECD-Europe 1985-87 (OXIDATE). Report on ozone, nitrogen dioxide and peroxyacetyl nitrate, April-September 1985.		PROSJEKTLEDER J. Schjoldager	
		NILU PROSJEKT NR. O-8535	
FORFATTER(E) Peringe Grennfelt Jørgen Saltbones Jørgen Schjoldager		TILGJENGELIGHET A	
		OPPDRAGSGIVERS REF.	
OPPDRAGSGIVER (NAVN OG ADRESSE) National Swedish Environment Protection Board (SNV) Norwegian State Pollution Control Authority (SFT)			
3 STIKKORD (à maks. 20 anslag)			
Ozone	Nitrogen dioxide	PAN	
REFERAT (maks. 300 anslag, 7 linjer)			

TITLE

ABSTRACT (max. 300 characters, 7 lines)
The report summarizes the data from 25 regional measurement stations in 9 countries. Ozone data is given from 24 stations, NO_2 from six stations and PAN from one station. Frequency distributions, mean diurnal concentration variation, monthly mean values and trajectory sector distributions are given together with a brief discussion of oxidant episodes.

* Kategorier: Åpen - kan bestilles fra NILU A
Må bestilles gjennom oppdragsgiver B
Kan ikke utleveres C