DEPOSITION PATTERNS AND
TRANSPORT SECTOR ANALYSES
FOR A FOUR-YEAR PERIOD

BY

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1. Introduction.

The following figures are based on calculations with the MSC-W routine model for sulphur transport, covering 58 months and previously presented in (1). An accurate description of the model is given in (2) or (3). The area covered by the model calculations is shown in the first Figure.

The sulphur deposition maps presented in Section 2 cover a four-year period starting 1 October 1978, and imply the country-by-country sulphur budget given as Table 1 in (1) and also reproduced here as Table 1. Deposition and concentration patterns from all European emissions are obtained by adding the contributions from individual countries. Such patterns are presented in Section 3. The national sulphur emissions assumed are given in Table 2.

The transport sector analyses of calculated and observed sulphur dioxide and particulate sulphate show that, although there are exceptions, the model generally predicts the average directional variation of these quantities reasonably well. This gives increased confidence to the sulphur budget of Table 1. Corresponding analyses for sulphate in precipitation will be presented later.
Area covered by the model calculations. Trajectories are followed within the entire grid, but their arrival points, and hence the calculated concentrations and deposition patterns, are within the full heavy lines.
Table 1: Calculated European sulphur budget for a 4-year period starting 1 October 1978.

Unit: 10^3 tonnes of sulphur per annum. Assumed emissions are given in Table 2.

Depositions from emitter countries are given in vertical columns, depositions to receiver countries in horizontal rows. IND signifies indeterminate wet depositions.

Total estimated deposition is given as SUM in the right-hand column.
<table>
<thead>
<tr>
<th>Country</th>
<th>Area ((10^3\text{km}^2))</th>
<th>Q1</th>
<th>Q2 ((10^3\text{tonnes S}))</th>
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<tbody>
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<td>50</td>
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<td>Germany, Federal Rep.</td>
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<td>76</td>
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<td>Poland</td>
<td>312.7</td>
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<td>Romania</td>
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<td>1000</td>
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<td>Turkey</td>
<td>460.8</td>
<td>500</td>
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<td>USSR (within grid)</td>
<td>3363.4</td>
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<td>United Kingdom</td>
<td>244.0</td>
<td>2560</td>
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<td>Yugoslavia</td>
<td>255.8</td>
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</table>

Table 2: Assumed national annual sulphur emissions. Unit: \(10^3\text{tonnes S}\). The data are taken from the EMEP emission inventory, which gave estimates for 1978. In three cases, official corrections were received during the model calculations. These were effected from 1 April 1980 and are given under Q2. Information received after completion of the calculations show that the emissions in some other countries have undergone significant changes during the period of calculation (1978-1982). In such cases, the calculated depositions from the countries can be proportionally adjusted.
2. Calculated deposition patterns from emissions in individual countries.

The data are averages over four years, from 1 October 1978. The following four patterns are given

a) Mean annual dry deposition of sulphur, assuming deposition velocities of 0.8 cm$^{-1}$ for sulphur dioxide and 0.2 cm$^{-1}$ for particulate sulphate.

b) Mean annual wet deposition, using 6-hourly precipitation data and model estimates of the sulphate concentration in precipitation.

c) Mean annual wet plus dry deposition.

d) Mean annual wet plus dry deposition, in per cent of the total deposition from all sources, including the indeterminate "background" wet deposition.

Isolines for patterns a), b) and c) are 8, 16, 32, 64, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 mg/m$^2$ annually, in S-units. Start counting from the lowest (outer) line. Maximum values are shown as numbers.

Isolines for pattern d) are 2, 4, 8, 16, 32 and 64%. Maximum values are shown as numbers.
MEAN ANNUAL TOT DEP FROM A IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM A IN % OF MEAN ANNUAL TOT DEP EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM B6
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM B6
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM F IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM F IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM DDR
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM DDR
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL TOT DEP FROM DDR
IN (MG-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM DDR
IN % OF MEAN ANNUAL TOT DEP
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM GR IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM GR IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM H IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM H IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM 1 IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM 1 IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL TOT DEP FROM 1 IN (M6-S/H2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM 1 IN % OF MEAN ANNUAL TOT DEP EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL TOT DEP FROM L IN (M6-S/M2) OCT78-SEP82 EMEP/SC-M ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM L IN % OF MEAN ANNUAL TOT DEP EMEP/SC-M ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM NL IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM NL IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL TOT DEP FROM NL IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM NL IN % OF MEAN ANNUAL TOT DEP
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM P
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM P
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM R IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM R IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM E IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM E IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM S IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM S IN (M6-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM CH
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM CH
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL TOT DEP FROM TR IN (MG-S/M2) OCT78-SEP82 EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL TOT DEP FROM TR IN % OF MEAN ANNUAL TOT DEP EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP FROM UK IN (MG-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP FROM UK IN (MG-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
3. Calculated sulphur deposition and concentration patterns from all European emissions.

The following patterns are shown:

a) Mean annual dry deposition
b) Mean annual wet deposition
c) Mean annual "indeterminate" background wet deposition
d) Mean annual total deposition, i.e. the sum of a), b) and c)
e) Mean annual dry deposition in % of total deposition
f) Mean annual wet deposition in % of total deposition
g) Mean annual "indeterminate" wet deposition in % of total deposition
h) Mean concentration of sulphur dioxide
i) Mean concentration of particulate sulphate
j) Precipitation-weighted mean concentration of sulphate in precipitation

The isoline of a), b), c) and d) are 250, 500, 1000, 2000, 4000 and 8000 mg/m² annually in S-units. Maxima are shown with numbers.

The isolines of e), f) and g) are 15, 30, 45, 60 and 75%. Maxima are shown as numbers.

The isolines of h) and i) are 0.25, 0.5, 1, 2, 4, 8 and 16 in μg/m³ as S.

The isolines of j) are 0.5, 1.0, 1.5, 2.0 and 2.5 in mg/l as S.
MEAN ANNUAL DRY DEP
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP
IN (M6-S/M2) OCT78-SEP82
EMEP/MSC-W ROUTINE MODEL
MEAN ANNUAL DRY DEP
IN % OF MEAN ANNUAL TOT DEP
EMEP/HSC-W ROUTINE MODEL

MEAN ANNUAL WET DEP
IN % OF MEAN ANNUAL TOT DEP
EMEP/HSC-W ROUTINE MODEL
MEAN ANNUAL IND WET DEP
IN % OF MEAN ANNUAL TOT DEP
EMEP/MSCE-W ROUTINE MODEL
MEAN ANNUAL SULPHUR IN PREC IN (MB-S/L) OCT78-SEP82
EMEP/HSC-W ROUTINE MODEL
4. **Transport sector analyses of calculated and observed concentrations of sulphur dioxide and particulate sulphate.**

The observed and calculated data may be grouped into sectors according to the direction of origin of the air as determined by trajectories. The dependence of concentrations on transport direction should reflect the position of major source areas.

The MSC-W allocates a transport sector each day at all EMEP monitoring stations. The sector allocation is based on the four 96-hour 850 mb trajectories calculated to arrive at the stations each day. Eight transport sectors have been defined (north, northeast, east, ...., northwest). The trajectories are identified by their positions every second hour. If more than half of the positions of the four trajectories are within a certain sector, the measured data from the day concerned are allocated to that sector. If this is not the case, the data are grouped in a ninth "indeterminate" sector. Only trajectory positions between 150 and 1500 km from the station are used in the sector allocation procedure.

In the following figures, the calculated and observed mean concentrations for each transport sector are shown for all EMEP stations. Data are given for sulphur dioxide and particulate sulphate. Similar data for sulphate in precipitation will be given later.

If available, the analyses are based on data for the complete 58-month period (Jan. 78 - Oct. 82). For many stations data are only available for a shorter period, see the table that follows subsequently. The positions of the stations are shown on a map following directly after the table. The number of days allocated to each sector is shown as numbers around the concentration roses. Data for the indeterminate sector are shown separately.

The analyses shows that, although there are exceptions, the model generally predicts the average directional variation of sulphur dioxide and particulate sulphate reasonably well. This gives increased confidence to the sulphur budget of Table 1.
<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Station code and name</th>
<th>Location lat. long.</th>
<th>Height above sea(m)</th>
<th>Sulfur dioxide available</th>
<th>from</th>
<th>to</th>
<th>Sulfate-particle available</th>
<th>from</th>
<th>to</th>
</tr>
</thead>
<tbody>
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<td>Austria</td>
<td>A1 Illmitza</td>
<td>47°46'N 16°46'E</td>
<td>117</td>
<td>Jan 78 - Oct 82</td>
<td>Jan 78 - Oct 82</td>
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<tr>
<td>Belgium</td>
<td>B1 Offagen</td>
<td>49°53'N 5°12'E</td>
<td>420</td>
<td>Feb 79 - Aug 79</td>
<td>Feb 79 - Aug 79</td>
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<td>Czechoslovakia</td>
<td>CS1 Svatouocht</td>
<td>49°44'N 16°02'E</td>
<td>727</td>
<td>Jan 78 - Sep 79</td>
<td>Jan 78 - Sep 79</td>
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<tr>
<td></td>
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<td>48°56'N 19°35'E</td>
<td>2008</td>
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<tr>
<td></td>
<td>DK2 Tunge</td>
<td>54°21'N 9°36'E</td>
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<td>Apr 78 - Oct 82</td>
<td>Apr 78 - Oct 82</td>
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<td>Germany</td>
<td>DE1 Arzona</td>
<td>54°41'N 13°26'E</td>
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<tr>
<td>Republic of</td>
<td>DE1 Wetterland</td>
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<td>Federal Republic</td>
<td>DE3 Schaulinsland</td>
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<td>Republic of</td>
<td>DE4 Deuelbach</td>
<td>49°46'N 7°03'E</td>
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<td>DE6 Bohmenstedt</td>
<td>54°06'N 9°40'E</td>
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<td>DE7 Basum</td>
<td>52°51'N 8°43'E</td>
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<tr>
<td></td>
<td>DE9 Rodenberg</td>
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<td>DE11 Remscheid</td>
<td>51°07'N 7°38'E</td>
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<tr>
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<td>DE13 Ussing</td>
<td>50°20'N 8°32'E</td>
<td>485</td>
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<tr>
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<td>DE17 Alsbach</td>
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<tr>
<td></td>
<td>DE18 Rotenburg</td>
<td>48°29'N 8°56'E</td>
<td>427</td>
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<td>DE19 Sarnberg</td>
<td>48°03'N 11°21'E</td>
<td>729</td>
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<td>Greece</td>
<td>GR1 Alariz</td>
<td>38°13'N 23°00'E</td>
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<td>Hungary</td>
<td>H1 Kaposvárd</td>
<td>46°58'N 19°35'E</td>
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<tr>
<td>Ireland</td>
<td>Z51 Rijspomeed</td>
<td>64°05'N 21°51'E</td>
<td></td>
<td>Oct 78 - Mar 82</td>
<td>Oct 78 - Mar 82</td>
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<tr>
<td></td>
<td>Z52 Iskósa</td>
<td>64°05'N 21°01'E</td>
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<tr>
<td>Ireland</td>
<td>IR1 Valencia Observatory</td>
<td>51°56'N 10°15'E</td>
<td>9</td>
<td>Jan 78 - Oct 82</td>
<td>Jan 78 - Oct 82</td>
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<tr>
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<td>NL2 Mitrevenen</td>
<td>55°48'N 6°40'E</td>
<td>18</td>
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<td>Netherlands</td>
<td>NL5 Reken</td>
<td>57°06'N 6°43'E</td>
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<td>NL6 Appleatha</td>
<td>57°57'N 6°18'E</td>
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<td>Norway</td>
<td>N1 Birkenes</td>
<td>58°23'N 8°15'E</td>
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<td>NB Skredalen</td>
<td>58°47'N 6°43'E</td>
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<td>NS Tustervatn</td>
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<td>NS5 Nordwalde</td>
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<td>COUNTRY</td>
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<td>Location lat.</td>
<td>Location long.</td>
<td>Height above sea (m)</td>
<td>SO₂-in-air available from to</td>
<td>SO₄-particulate available from to</td>
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<td>Poland</td>
<td>PL1 Suwałki</td>
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<td>184</td>
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<td>PI1 Bragança</td>
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<td>6°46'W</td>
<td>691</td>
<td>Aug 79 - -</td>
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<td>RO1 Râșca</td>
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<td>25°37'E</td>
<td>1526</td>
<td>Sep 78 - -</td>
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<td>140</td>
<td>Jul 79 - Oct 82</td>
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<td>Switzerland</td>
<td>CH1 Jungfraujoch</td>
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<td>7°57'E</td>
<td>1573</td>
<td>Jul 79 - Oct 82</td>
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<td>Union of Soviet Socialist Republics</td>
<td>SU1 Kayakskoy</td>
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<td>118</td>
<td>Jan 78 - -</td>
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<td>United Kingdom</td>
<td>UK1 Glasgow</td>
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<td>Yugoslavia</td>
<td>YU1 Sarajevo N.F.</td>
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<td>Jan 78 - Oct 82</td>
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<td>45°55'N</td>
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<td>445</td>
<td>Aug 79 - -</td>
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<td>YU4 Zagorje</td>
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<td>1594</td>
<td>Aug 79 - -</td>
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<td>YU5 Crni Vrh</td>
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<td>834</td>
<td>Aug 79 - -</td>
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<td>YU6 Cemerno</td>
<td>41°14'N</td>
<td>19°36'E</td>
<td>1305</td>
<td>May 78 - -</td>
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<td>YU7 Lazaropolje</td>
<td>41°32'N</td>
<td>20°47'E</td>
<td>1312</td>
<td>May 78 - -</td>
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</table>
Location of EMEP stations.
A 2
SO 2 CONC IN AIR
1 CM=4μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1655
MEASURED MEAN 9.7
CALCULATED MEAN 12.1

A 2
SO 4 CONC IN AIR
1 CM=2μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1662
MEASURED MEAN 3.6
CALCULATED MEAN 3.8
B 1
SO₂ CONC IN AIR
1 CM = 4 µG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 584
MEASURED MEAN 11.3
CALCULATED MEAN 10.9

B 1
SO₄ CONC IN AIR
1 CM = 2 µG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1359
MEASURED MEAN 4.2
CALCULATED MEAN 2.6
CS 1
SO2 CONC IN AIR
1 CM = 4 μG/MMX3 AS S
MEAS
CALC
TOT NO. OF DAYS 1700
MEASURED MEAN 8.1
CALCULATED MEAN 16.3

CS 1
SO4 CONC IN AIR
1 CM = 2 μG/MMX3 AS S
MEAS
CALC
TOT NO. OF DAYS 1717
MEASURED MEAN 4.9
CALCULATED MEAN 4.0
CS2
SO2 CONC IN AIR
1 CM = 4 μG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1641
MEASURED MEAN 2.2
CALCULATED MEAN 14.2

C5S2
SO4 CONC IN AIR
1 CM = 2 μG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1656
MEASURED MEAN 1.6
CALCULATED MEAN 3.9
**DK 3**

**SO₂ CONC IN AIR**

1 CM = 4μG/M³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1601

**MEASURED MEAN** 4.2

**CALCULATED MEAN** 3.5

---

**DK 3**

**SO₄ CONC IN AIR**

1 CM = 2μG/M³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1610

**MEASURED MEAN** 2.5

**CALCULATED MEAN** 1.5
**DK5**

**SO2 CONC IN AIR**
1 CM=4 µG/M××3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1495
**MEASURED MEAN** 5.3
**CALCULATED MEAN** 5.7

---

**DK5**

**SO4 CONC IN AIR**
1 CM=2 µG/M××3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1531
**MEASURED MEAN** 3.0
**CALCULATED MEAN** 2.0
DK 7
SO 2 CONC IN AIR
1 CM=4µG/MMX3 AS S
MEAS
CALC
TOT NO. OF DAYS 1280
MEASURED MEAN 0.5
CALCULATED MEAN 0.5

DK 7
SO 4 CONC IN AIR
1 CM=2µG/MMX3 AS S
MEAS
CALC
TOT NO. OF DAYS 1284
MEASURED MEAN 1.3
CALCULATED MEAN 0.4
SF 4
SO 2 CONC IN AIR
1 CM = \frac{mg}{M\times3} AS S
MEAS
CALC
TOT NO. OF DAYS 1745
MEASURED MEAN 3.7
CALCULATED MEAN 1.3

SF 4
SO 4 CONC IN AIR
1 CM = \frac{mg}{M\times3} AS S
MEAS
CALC
TOT NO. OF DAYS 1747
MEASURED MEAN 1.2
CALCULATED MEAN 0.8
SF 6
SO 2 CONC IN AIR
1 CM = 2 \mu G/M \times 3 AS S

**MEAS**
- TOT NO. OF DAYS: 617
- MEASURED MEAN: 4.8
- CALCULATED MEAN: 1.2

**IND**

SF 6
SO 4 CONC IN AIR
1 CM = 2 \mu G/M \times 3 AS S

**MEAS**
- TOT NO. OF DAYS: 616
- MEASURED MEAN: 1.3
- CALCULATED MEAN: 0.9
SF 7
SO₂ CONC IN AIR
1 CM=4 µG/M₃×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 1740
MEASURED MEAN 5.4
CALCULATED MEAN 2.3

SF 7
SO₄ CONC IN AIR
1 CM=2 µG/M₃×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 1732
MEASURED MEAN 1.7
CALCULATED MEAN 1.0
SF 9
SO₂ CONC IN AIR
1 CM = 4 µG/M³ x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1001
MEASURED MEAN 5.1
CALCULATED MEAN 1.4

SF 9
SO₄ CONC IN AIR
1 CM = 2 µG/M³ x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 999
MEASURED MEAN 1.5
CALCULATED MEAN 1.0
F 1
SO₂ CONC IN AIR
1 CM = 4 μg/m³ X 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1751
MEASURED MEAN 5.1
CALCULATED MEAN 8.5

F 1
SO₄ CONC IN AIR
1 CM = 2 μg/m³ X 3 AS S
MEAS
CALC
TOT NO. OF DAYS 762
MEASURED MEAN 1.9
CALCULATED MEAN 1.9
**F 3**

SO₂ CONC IN AIR
1 CM = 4μG/M³ x 3 AS S

**MEAS**

**CALC**

TOT NO. OF DAYS 1386
MEASURED MEAN 1.2
CALCULATED MEAN 3.1

---

**F 3**

SO₄ CONC IN AIR
1 CM = 2μG/M³ x 3 AS S

**MEAS**

**CALC**

TOT NO. OF DAYS 623
MEASURED MEAN 1.3
CALCULATED MEAN 1.2
SO₂ CONC IN AIR
1 CM = 4 μG/M×M×3 AS S

MEAS

CALC

TOT NO. OF DAYS 1314
MEASURED MEAN 6.9
CALCULATED MEAN 3.3

SO₄ CONC IN AIR
1 CM = 2 μG/M×M×3 AS S

MEAS

CALC

TOT NO. OF DAYS 550
MEASURED MEAN 2.2
CALCULATED MEAN 1.2
F 6
SO₂ CONC IN AIR
1 CM=4 µG/M×3 AS S

MEAS  
CALC

TOT NO. OF DAYS 1614
MEASURED MEAN 2.8
CALCULATED MEAN 5.3

F 6
SO₄ CONC IN AIR
1 CM=2 µG/M×3 AS S

MEAS  
CALC

TOT NO. OF DAYS 718
MEASURED MEAN 2.4
CALCULATED MEAN 1.9
**F 7**

**SO₂ CONC IN AIR**

1 CM = 4 μG/M×3 AS S

<table>
<thead>
<tr>
<th>MEAS</th>
<th>CALC</th>
</tr>
</thead>
</table>

| TOT NO. OF DAYS | 1583 |
| MEASURED MEAN   | 2.2  |
| CALCULATED MEAN | 3.4  |

**F 7**

**SO₄ CONC IN AIR**

1 CM = 2 μG/M×3 AS S

<table>
<thead>
<tr>
<th>MEAS</th>
<th>CALC</th>
</tr>
</thead>
</table>

| TOT NO. OF DAYS | 700  |
| MEASURED MEAN   | 1.9  |
| CALCULATED MEAN | 1.4  |
DD 1
SO2 CONC IN AIR
1 cm=4 μg/m³×3 AS S
MEAS
CALC
TOT NO. OF DAYS 666
MEASURED MEAN 5.4
CALCULATED MEAN 6.2

DD 1
SO4 CONC IN AIR
1 cm=2 μg/m³×3 AS S
MEAS
CALC
TOT NO. OF DAYS 653
MEASURED MEAN 2.2
CALCULATED MEAN 2.3
DD 2
SO₂ CONC IN AIR
1 CM=4 µG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 666
MEASURED MEAN 9.5
CALCULATED MEAN 13.0

162
175
107

40

DD 2
SO₄ CONC IN AIR
1 CM=2 µG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 659
MEASURED MEAN 2.7
CALCULATED MEAN 3.2

159
173
107

39

D 1
SO 2 CONC IN AIR
1 CM = 4 µG/M3 × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1707
MEASURED MEAN 3.7
CALCULATED MEAN 4.2

D 1
SO 4 CONC IN AIR
1 CM = 2 µG/M3 × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1687
MEASURED MEAN 2.5
CALCULATED MEAN 1.8
D 2
SO 2 CONC IN AIR
1 CM=4μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1727
MEASURED MEAN 11.3
CALCULATED MEAN 10.9

D 2
SO 4 CONC IN AIR
1 CM=2μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1688
MEASURED MEAN 3.1
CALCULATED MEAN 2.9
**SO₂ CONC IN AIR**

1 cm = 4 μg/m³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1657

**MEASURED MEAN** 2.8

**CALCULATED MEAN** 6.4

---

**SO₄ CONC IN AIR**

1 cm = 2 μg/m³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1692

**MEASURED MEAN** 1.5

**CALCULATED MEAN** 2.4
D 4
SO 2 CONC IN AIR
1 CM = 2 μG/M×M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1758
MEASURED MEAN 9.0
CALCULATED MEAN 11.6

D 4
SO 4 CONC IN AIR
1 CM = 2 μG/M×M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1689
MEASURED MEAN 2.4
CALCULATED MEAN 2.8
**SO₂ CONC IN AIR**

1 cm = 4 μg/m³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1723

**MEASURED MEAN** 5.7

**CALCULATED MEAN** 9.3

---

**SO₄ CONC IN AIR**

1 cm = 2 μg/m³ x 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1729

**MEASURED MEAN** 2.0

**CALCULATED MEAN** 3.3
D11
SO2 CONC IN AIR
1 CM = 4 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 947
MEASURED MEAN 5.1
CALCULATED MEAN 6.4

D11
SO4 CONC IN AIR
1 CM = 2 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1681
MEASURED MEAN 3.2
CALCULATED MEAN 2.2
D 12
SO₂ CONC IN AIR
1 CM = 4 μG/MMx3 AS S
MEAS
CALC
TOT NO. OF DAYS 965
MEASURED MEAN 7.1
CALCULATED MEAN 9.3

D 12
SO₄ CONC IN AIR
1 CM = 2 μG/MMx3 AS S
MEAS
CALC
TOT NO. OF DAYS 1728
MEASURED MEAN 3.6
CALCULATED MEAN 2.6
D 13
SO2 CONC IN AIR
1 CM=4\mu G/M^3 AS S

MEAS

CALC

TOT NO. OF DAYS 996
MEASURED MEAN 9.2
CALCULATED MEAN 12.0

D 13
SO4 CONC IN AIR
1 CM=2\mu G/M^3 AS S

MEAS

CALC

TOT NO. OF DAYS 1749
MEASURED MEAN 3.4
CALCULATED MEAN 3.0
SO \( 2 \) CONC IN AIR
1 CM = 4 \( \mu G/M\times 3 \) AS S

MEAS

CALC

TOT NO. OF DAYS 967
MEASURED MEAN 9.0
CALCULATED MEAN 16.5

SO \( 4 \) CONC IN AIR
1 CM = 2 \( \mu G/M\times 3 \) AS S

MEAS

CALC

TOT NO. OF DAYS 1716
MEASURED MEAN 3.0
CALCULATED MEAN 3.3
SO 2 CONC IN AIR
1 CM = 4 μG/M**3 AS S
MEAS
CALC
TOT NO. OF DAYS 956
MEASURED MEAN 9.2
CALCULATED MEAN 13.5

SO 4 CONC IN AIR
1 CM = 2 μG/M**3 AS S
MEAS
CALC
TOT NO. OF DAYS 1638
MEASURED MEAN 3.4
CALCULATED MEAN 3.2
D 16
SO 2 CONC IN AIR
1 CM = 4 μG/M × 3 AS S

MEAS
CALC

TOT NO. OF DAYS 1005
MEASURED MEAN 9.6
CALCULATED MEAN 12.4

D 16
SO 4 CONC IN AIR
1 CM = 2 μG/M × 3 AS S

MEAS
CALC

TOT NO. OF DAYS 1731
MEASURED MEAN 2.8
CALCULATED MEAN 2.9
D 17
SO₂ CONC IN AIR
1 CM=4 μG/M×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 974
MEASURED MEAN 4.7
CALCULATED MEAN 10.4

D 17
SO₄ CONC IN AIR
1 CM=2 μG/M×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 1745
MEASURED MEAN 3.1
CALCULATED MEAN 3.0
D 18
SO₂ CONC IN AIR
1 CM = 4 µG/M₉×3 AS S
MEAS  ——
CALC ——
TOT NO. OF DAYS 984
MEASURED MEAN 4.3
CALCULATED MEAN 8.2

D 18
SO₄ CONC IN AIR
1 CM = 2 µG/M₉×3 AS S
MEAS  ——
CALC ——
TOT NO. OF DAYS 1721
MEASURED MEAN 2.7
CALCULATED MEAN 2.7
SO2 CONC IN AIR
1 CM=4 μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 965
MEASURED MEAN 3.2
CALCULATED MEAN 7.4

SO4 CONC IN AIR
1 CM=2 μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1707
MEASURED MEAN 2.3
CALCULATED MEAN 2.9
GR 1
SO 2 CONC IN AIR
1 CM=4 G/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 528
MEASURED MEAN 5.1
CALCULATED MEAN 5.1

GR 1
SO 4 CONC IN AIR
1 CM=2 G/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 528
MEASURED MEAN 10.4
CALCULATED MEAN 1.9
H 1
SO 2 CONC IN AIR
1 CM = 4 µG/µM x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1585
MEASURED MEAN 7.3
CALCULATED MEAN 14.4

H 1
SO 4 CONC IN AIR
1 CM = 2 µG/µM x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1677
MEASURED MEAN 5.8
CALCULATED MEAN 3.8
IR 1
SO 2 CONC IN AIR
1 CM=4μG/M×103 AS S
MEAS
CALC
TOT NO. OF DAYS 752
MEASURED MEAN 0.8
CALCULATED MEAN 0.5

IR 1
SO 4 CONC IN AIR
1 CM=2μG/M×103 AS S
MEAS
CALC
TOT NO. OF DAYS 754
MEASURED MEAN 0.8
CALCULATED MEAN 0.3
NL 2
SO2 CONC IN AIR
1 CM = 4 µg/m³ x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 848
MEASURED MEAN 7.1
CALCULATED MEAN 8.3

NL 2
SO4 CONC IN AIR
1 CM = 2 µg/m³ x 3 AS S
MEAS
CALC
TOT NO. OF DAYS 774
MEASURED MEAN 3.3
CALCULATED MEAN 2.4
**NL 5**

**SO₂ CONC IN AIR**

1 cm = 4 µg/m³ × 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1748

**MEASURED MEAN** 11.6

**CALCULATED MEAN** 11.3

---

**NL 5**

**SO₄ CONC IN AIR**

1 cm = 2 µg/m³ × 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1750

**MEASURED MEAN** 4.4

**CALCULATED MEAN** 2.7
NL 6
SO 2 CONC IN AIR
1 CM=4µG/M×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 1139
MEASURED MEAN 7.5
CALCULATED MEAN 6.6

NL 6
SO 4 CONC IN AIR
1 CM=2µG/M×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 1132
MEASURED MEAN 4.1
CALCULATED MEAN 2.1
N 1
SO 2 CONC IN AIR
1 CM=4 μG/MM×3 AS S
MEAS
CALC
TDT NO. OF DAYS 1700
MEASURED MEAN 1.2
CALCULATED MEAN 1.5

513
IND

N 1
SO 4 CONC IN AIR
1 CM=2 μG/MM×3 AS S
MEAS
CALC
TDT NO. OF DAYS 1716
MEASURED MEAN 1.3
CALCULATED MEAN 1.0
N 8
SO₂ CONC IN AIR
1 cm=4 μg/m³ x 3 as S
MEAS  
CALC  
TOT NO. OF DAYS 1739
MEASURED MEAN 1.1
CALCULATED MEAN 1.3

N 8
SO₄ CONC IN AIR
1 cm=2 μg/m³ x 3 as S
MEAS  
CALC  
TOT NO. OF DAYS 1743
MEASURED MEAN 1.0
CALCULATED MEAN 0.9
440

IND

N 15
SO 2 CONC IN AIR
1 CM = 4 μG/MM × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1534
MEASURED MEAN 0.6
CALCULATED MEAN 0.4

442

IND

N 15
SO 4 CONC IN AIR
1 CM = 2 μG/MM × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 1542
MEASURED MEAN 0.6
CALCULATED MEAN 0.4
SO2 CONC IN AIR
1 CM=4 μG/M×X3 AS S
MEAS
CALC
TOT NO. OF DAYS 1585
MEASURED MEAN 1.2
CALCULATED MEAN 0.2

SO4 CONC IN AIR
1 CM=2 μG/M×X3 AS S
MEAS
CALC
TOT NO. OF DAYS 1589
MEASURED MEAN 0.7
CALCULATED MEAN 0.3
N 36
SO₂ CONC IN AIR
1 cm = 4 µg/m³ x 3 as S
MEAS
CALC
TOT NO. OF DAYS 1643
MEASUR ED MEAN 0.5
CALCULATED MEAN 0.6

498
IND

N 36
SO₄ CONC IN AIR
1 cm = 2 µg/m³ x 3 as S
MEAS
CALC
TOT NO. OF DAYS 1628
MEASURED MEAN 0.5
CALCULATED MEAN 0.6
N 37
SO₂ CONC IN AIR
1 CM=4 µG/M²X3 AS S
MEAS
CALC
TOT NO. OF DAYS 1646
MEASURED MEAN 0.3
CALCULATED MEAN 0.1

N 37
SO₄ CONC IN AIR
1 CM=2 µG/M²X3 AS S
MEAS
CALC
TOT NO. OF DAYS 1648
MEASURED MEAN 0.5
CALCULATED MEAN 0.1
N 39
SO₂ CONC IN AIR
1 CM=4μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1613
MEASURED MEAN 0.4
CALCULATED MEAN 0.6

N 39
SO₄ CONC IN AIR
1 CM=2μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1610
MEASURED MEAN 0.5
CALCULATED MEAN 0.5
PL 1
SO₂ CONC IN AIR
1 CM = 4 µG/M×X3 AS S
MEAS   CALC
TOT NO. OF DAYS 1628
MEASURED  MEAN 3.8
CALCULATED MEAN 4.1

PL 1
SO₄ CONC IN AIR
1 CM = 2 µG/M×X3 AS S
MEAS   CALC
TOT NO. OF DAYS 1628
MEASURED  MEAN 2.4
CALCULATED MEAN 1.9
P 1
SO 2 CONC IN AIR
1 CM = 4 μG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 814
MEASURED MEAN 1.4
CALCULATED MEAN 1.4

P 1
SO 4 CONC IN AIR
1 CM = 2 μG/M × 3 AS S
MEAS
CALC
TOT NO. OF DAYS 803
MEASURED MEAN 1.4
CALCULATED MEAN 0.6
P 2
SO₂ CONC IN AIR
1 CM=μg/m³×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 809
MEASURED MEAN 1.2
CALCULATED MEAN 1.0

P 2
SO₄ CONC IN AIR
1 CM=μg/m³×3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 794
MEASURED MEAN 1.6
CALCULATED MEAN 0.4
S 1
SO2 CONC IN AIR
1 CM=4μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1201
MEASURED MEAN 3.8
CALCULATED MEAN 4.2

S 1
SO4 CONC IN AIR
1 CM=2μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1209
MEASURED MEAN 1.8
CALCULATED MEAN 1.7
SO2 CONC IN AIR
1 CM = 4 μG/M3 AS S
MEAS
CALC
TOT NO. OF DAYS 1715
MEASURED MEAN 4.2
CALCULATED MEAN 2.6

SO4 CONC IN AIR
1 CM = 2 μG/M3 AS S
MEAS
CALC
TOT NO. OF DAYS 1753
MEASURED MEAN 2.0
CALCULATED MEAN 1.3
S 3
SO2 CONC IN AIR
1 CM=4μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1164
MEASURED MEAN 2.4
CALCULATED MEAN 2.1

S 3
SO4 CONC IN AIR
1 CM=2μG/M×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1170
MEASURED MEAN 1.3
CALCULATED MEAN 1.1
S 5
SO 2 CONC IN AIR
1 CM = 4 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1164
MEASURED MEAN 1.5
CALCULATED MEAN 0.6

S 5
SO 4 CONC IN AIR
1 CM = 2 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1168
MEASURED MEAN 0.5
CALCULATED MEAN 0.6
SO₂ CONC IN AIR
1 CM=4μG/M³×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1513
MEASURED MEAN 2.8
CALCULATED MEAN 2.2

SO₄ CONC IN AIR
1 CM=2μG/M³×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1515
MEASURED MEAN 1.3
CALCULATED MEAN 1.3
**CH 2**

SO\textsubscript{2} CONC IN AIR

1 cm=4 \mu G/M\times 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1228

**MEASURED MEAN** 3.5

**CALCULATED MEAN** 5.1

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**CH 2**

SO\textsubscript{4} CONC IN AIR

1 cm=2 \mu G/M\times 3 AS S

**MEAS**

**CALC**

**TOT NO. OF DAYS** 1199

**MEASURED MEAN** 2.0

**CALCULATED MEAN** 2.1
UK 2
SO₂ CONC IN AIR
1 CM=4 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1729
MEASURED MEAN 4.1
CALCULATED MEAN 3.2

UK 2
SO₄ CONC IN AIR
1 CM=2 μG/MM×3 AS S
MEAS
CALC
TOT NO. OF DAYS 1748
MEASURED MEAN 1.1
CALCULATED MEAN 0.9
UK 3
SO₂ CONC IN AIR
1 CM=4μG/M×3 AS SO₂
MEAS
CALC
TOT NO. OF DAYS 774
MEASURED MEAN 3.4
CALCULATED MEAN 1.4

UK 3
SO₄ CONC IN AIR
1 CM=2μG/M×3 AS SO₄
MEAS
CALC
TOT NO. OF DAYS 800
MEASURED MEAN 0.8
CALCULATED MEAN 0.6
UK 4
SO 2 CONC IN AIR
1 CM=4 μG/MMX3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 404
MEASURED MEAN 7.8
CALCULATED MEAN 11.4

UK 4
SO 4 CONC IN AIR
1 CM=2μG/MMX3 AS S
MEAS  
CALC  
TOT NO. OF DAYS 404
MEASURED MEAN 1.4
CALCULATED MEAN 2.0
UK 5
SO\(_4\) CONC IN AIR
1 cm=2\(\mu\)g/m\(^3\) AS S
MEAS
CALC
TOT NO. OF DAYS 321
MEASURED MEAN 1.4
CALCULATED MEAN 1.3
5. Acknowledgement.

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6. References.


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(3) As (2) but in Atmospheric Environment 17, 1457-1473 (1983).