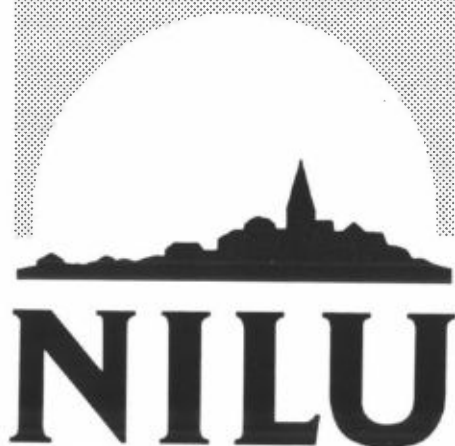


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User's guide for "KILDER" supporting programmes 1995

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Summary

The KILDER model system is developed at NILU during the last 20 years. The central part of the system is the dispersion models POI-KILD and ARE-KILD, which calculates long-term averaged concentration distribution for different source categories. The dispersion models POI-KILD and ARE-KILD are described in a separate report (NILU TR 5/92). In addition to this, and as least as important, there is a series of small programs for calculating emissions and exposure and for operating with binary data fields.

This report contains a revised description of the PC-versions of several different supporting computer programs in the KILDER system. The programs may be divided into four groups:

- programs for input/output etc. of fields and for field handling,
- programs for preparing area code fields and distribution of data
- programs for calculating emissions from traffic and heating
- program for exposure calculations.

As the operating system DOS only accepts 8-character file names, the program names has to be abbreviated in order to remind about what they are doing.

The programs are, the program packages will not always include all of them:

READ-FIE	reads a field with values,
INP-FIE	reads input values to specified squares of a field ,
PRIN-FIE	makes a print -out map of a field ,
READ-PRN	reads a .PRN -file,
SUM-FIE	makes the sum of several fields ,
LOOK-FIE	looks at a binary file and displays values around a specified point,
CONT-FIE	gives the content of a .FLD file (sum, min., max. for each field),
PRES-FIE	presents a field map to the screen,
CONS-FIE	calculates fields with consumption of fuels as oil, coal or wood,
CONS-EMI	calculates emission fields from consumption fields and emission factors,
TRA-WORK	calculates fields with traffic work from road net data,
TRA-EMIS	calculates emission fields from fields with traffic work and emission factors,
CONV-FIE	converts old .FLD files to a new structure,
POP-FIE	distributes population to fields ,
POP-DIST	calculates population distribution within districts

GRP-FIE generates **group**-codes from for instance population distribution,
EXPO-FIE calculates **exposure** from concentration fields, population fields and road data.

User's guide for "KILDER" supporting programmes 1995

1. Introduction

The KILDER dispersion modelling system has been in use at the Norwegian Institute for Air Research (NILU) for more almost 20 years. It has been gradually developed by active use at NILU, and the most commonly used programmes are included in this report. The programs have been transferred into English PC-versions for planning use for Central Pollution Control Board (CPCB) in Dehli, India, and are now all revised according to their comments. The basic units are two Gaussian dispersion models, POI-KILD and ARE-KILD for calculating long-term ground-level concentrations over an area from point and area sources, respectively. These are described separately in another report (NILU TR 5/92). The system also includes 3 programs for statistical evaluation of meteorological and air quality data: WINDFREC, STABFREC and METFREC (NILU TR 4/92).

The KILDER modelling system is, however, more than two dispersion models. Today there is in use at NILU about 30 different supporting programs (some of them only in Norwegian). 8 of these were transferred into English PC-versions for CPCB in May 1992 (NILU TR 6/92). Scientists from NILU introduced the programs in a seminar in Delhi for personell from CPCB and several State Pollution Control Boards. The programs have been in use in 5 regions in India, and the results from the air pollution modelling studies were presented at a seminar at NILU in May, 1994. During the seminar, some minor changes in the programs were suggested, mainly the lack of examples in the User's Guide, which now is included. There has been made a minor change in the file structure, but a program, CONV-FIE converts old files to the new structure. The KILDER system has also been used in air pollution modelling for URBAIR in the mega-cities Bombay, Jakarta, Manila and Kathmandu.

One major feature in the KILDER system is that the file structure is based upon **binary** files with data fields. The data fields are matrixes with different types of values and they may be read into the computer or calculated in different programs. As the files are binary we can not use an editor to look at them, and it is very difficult to change values, which means that this is a **safe** file structure. The programs are originally written to serve different purposes, so one might in some cases get questions that may seem to be irrelevant for the actual case. For model calculations you want to prepare an hourly emission field, whereas an emission survey report may need yearly emission fields.

Another advantage is that the system consists of a series of programs which are making small steps. In an emission survey the input data may be very deficient, and we have to use other data instead. We may for instance have an estimate of the total consumption of fuels for the area, but will distribute this according to the population distribution. It will then be possible to have a different weight (consumption per capita) for different regions.

The examples to the programs are not real; some are taken from different studies, adjusted to fit the format of this report better, some are just examples. It would be nice if we could follow the calculations for one region through all the programs, but the cities and the data sources are all so different that this has not been possible. This is at the same time the strength of the KILDER system, it is so flexible that the programs may utilize the data that are available for the preparation of the fields.

Figure 1 shows some elements of the "KILDER" air pollution modelling system.

The "KILDER" air pollution modelling system

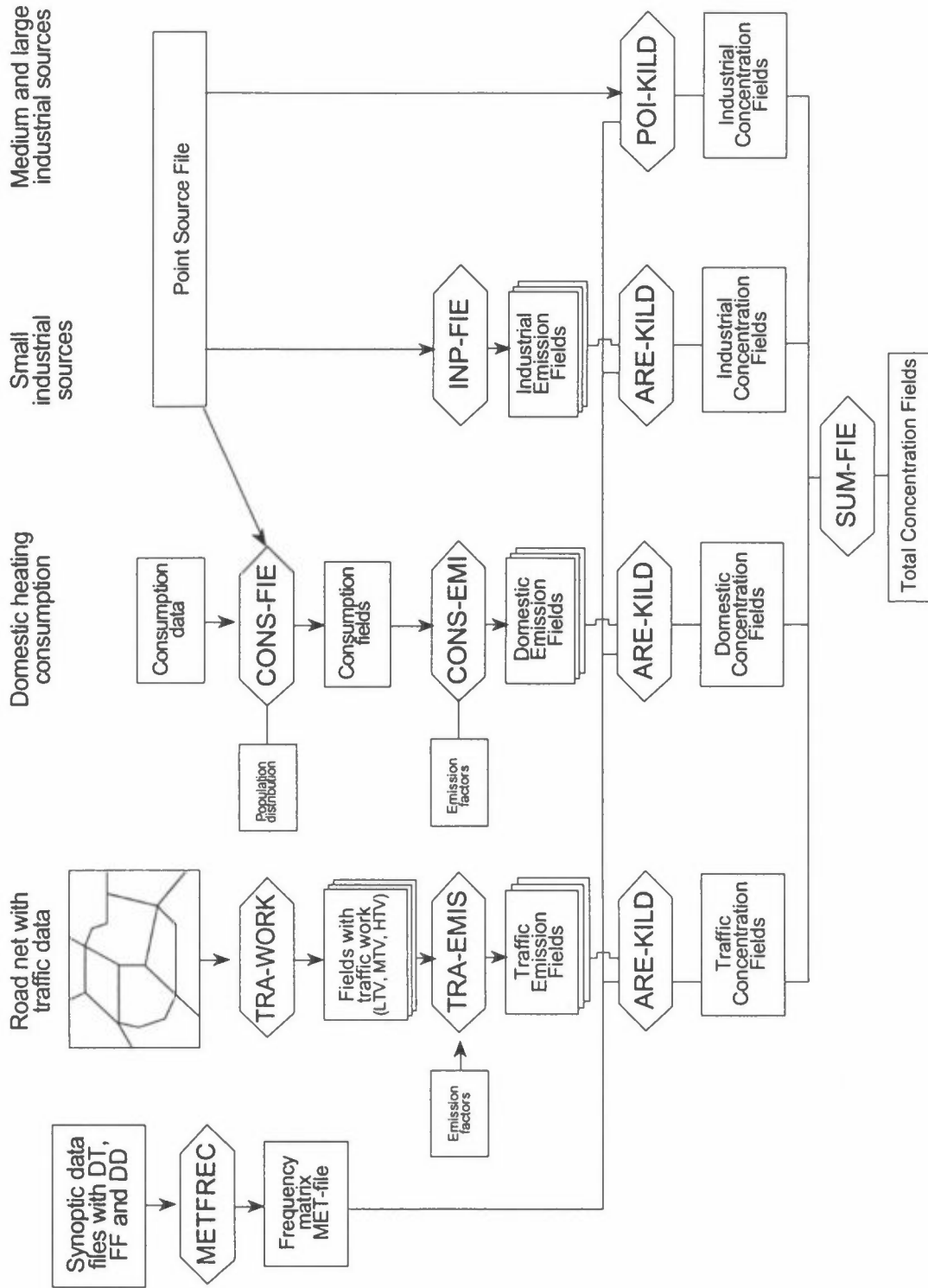


Figure 1: The "KILDER" air pollution modelling system

2. About data fields and the program structure

The main data communication between the different programs is made through files with data fields. A data field consists of values in a gridded network together with some “around-information”. In the data fields the following data are written **unformatted** and stored as **binary** data:

COMPOUND, UNIT, PERIOD, PLACE, SOURCE, DATE, KX, KY, ISIZE, X(KX,KY)

The first 6 character variables has been introduced in order to keep the “around-information” together with the data. This is safer than to write on the data listing the background for the data.

- COMPOUND = Name of the compound (16 characters). This will normally be 'SO₂', 'NO_x' or 'CO', but may also be variables such as 'INHABITANTS', 'HEIGHT' or 'TRAFFIC',
- UNIT = Unit of the field (16 characters). This will for concentrations be 'UG/M³', for emission fields 'KG/H', but may also be 'PERSONS', 'M' or 'DIESEL-KM',
- PERIOD = Period for the data (16 characters). This may be 'WINTER 92/93', '1993', 'Morning traffic',
- PLACE = Place for the data (16 characters). Normally one might study only one area at the time, and the data may be stored at directories with the name of the place, but it is useful to have the place in connection with the rest of the data,
- SOURCE = Source type (16 characters). 'WOOD CONS.', 'TRAFFIC', 'OIL', 'SMALL INDUSTRY'
- DATE = Date when the file was written (16 characters), '1994/08/24 14.15',
- ISIZE = Grid size in meter,
- KX, KY = Number of points in the east direction and the north direction, respectively.
- X[KX,KY] = Data field with values of the real-variable array X in a KX • KY-matrix.

File types

As the DOS file system only allows 8 characters in the file names we have to use reserved extension codes in order to keep related **file families**:

- .FLD binary data fields. These are not readable by a normal editor, but PRIN-FIE makes a listing of the file, and by LOOK-FIE you get displayed values around a specific point. Some of the -KILD and -FIE programs create several different fields which are written to the same .FLD file, and the programs sometimes have to ask for **which** field that should be read.
- .PRN output file. The routine MAP makes a map of the field which is written to the .PRN-file. Normally a program creates both a .FLD file and a .PRN file.
- .DAT input data file. These files may be combined to a file family, with input data at FILE.DAT as input and FILE.FLD and FILE.PRN as result files.
- .RUN input data to a program may be saved and may be used as input for a later run. Ex.: 'TRAF-NOX.RUN', 'HIMALTSP.RUN'
- .MET file with meteorological data for use in the KILDER programmes.

When we are performing calculations for an area we will have both emission and concentration fields for many source groups. It is essential to follow an uniform system in the file names:

Emission fields	Compound-source	Ex.: 'NOX-TRAF', 'TSPBRICK'
Concentration fields	Source-compound	Ex.: 'TRAF-NOX', 'BRICKTSP'

You have to keep order of the files and file types yourself, the programs does not check that you use a correct file (except when you read a field it should be read from a .FLD file).

Library routines

All programs use a set of KILDER library routines:

- INFE for reading and OUTFE for writing of binary unformatted files, GETFE to fetch a data field.

WHEN gives the date for the creation of a field: 1995/08/15 11.08.

- MAP gives a print-out of the data fields.
The MAP routine scales automatic the figures to give four ciphers for the maximum value of the field. For a line printer with 10 characters/inch and 6 lines/inch this will give a map with 1/2"x1/2" squares. When using a postscript printer this is prepared to make nice letters or reports with

different size of the different characters. In the examples in this report we have used Courier, which gives each character the same size.

The routine finds maximum (and minimum if this is negative) of the field, and the sum of the values of the field. When it is an emission field, the sum is the total emission of that source group. For concentration fields, the sum is just the sum of the concentration values.

The routine also calculates the decimal part of the sum. If this is zero, it assumes that it is a map of integers. If the integers are higher than 9999, they are written as reals with a scale factor.

When performing calculation for an area, it is recommended to make a transparent sketch of a map of the area in the same scale (1 inch to 2000 meter for a km-grid, 1"=1 mile for a 1/2-mile grid), as shown in figure 1. This fits to the output of a normal line printer, and may be used as an overlay together with the print-out.

The overlay is also useful when you shall prepare other .DAT files. The overlay shown does not fit to the print-outs in this report.

Input data

The programs are normally run interactive with input from the terminal. Some programs needs more input, and data are read from files. The file names and some other variables should be embedded in apostrophes. Some questions asks for short answers, Y/N, without apostrophes.

Input data from the terminal are separated by a comma or a blank.

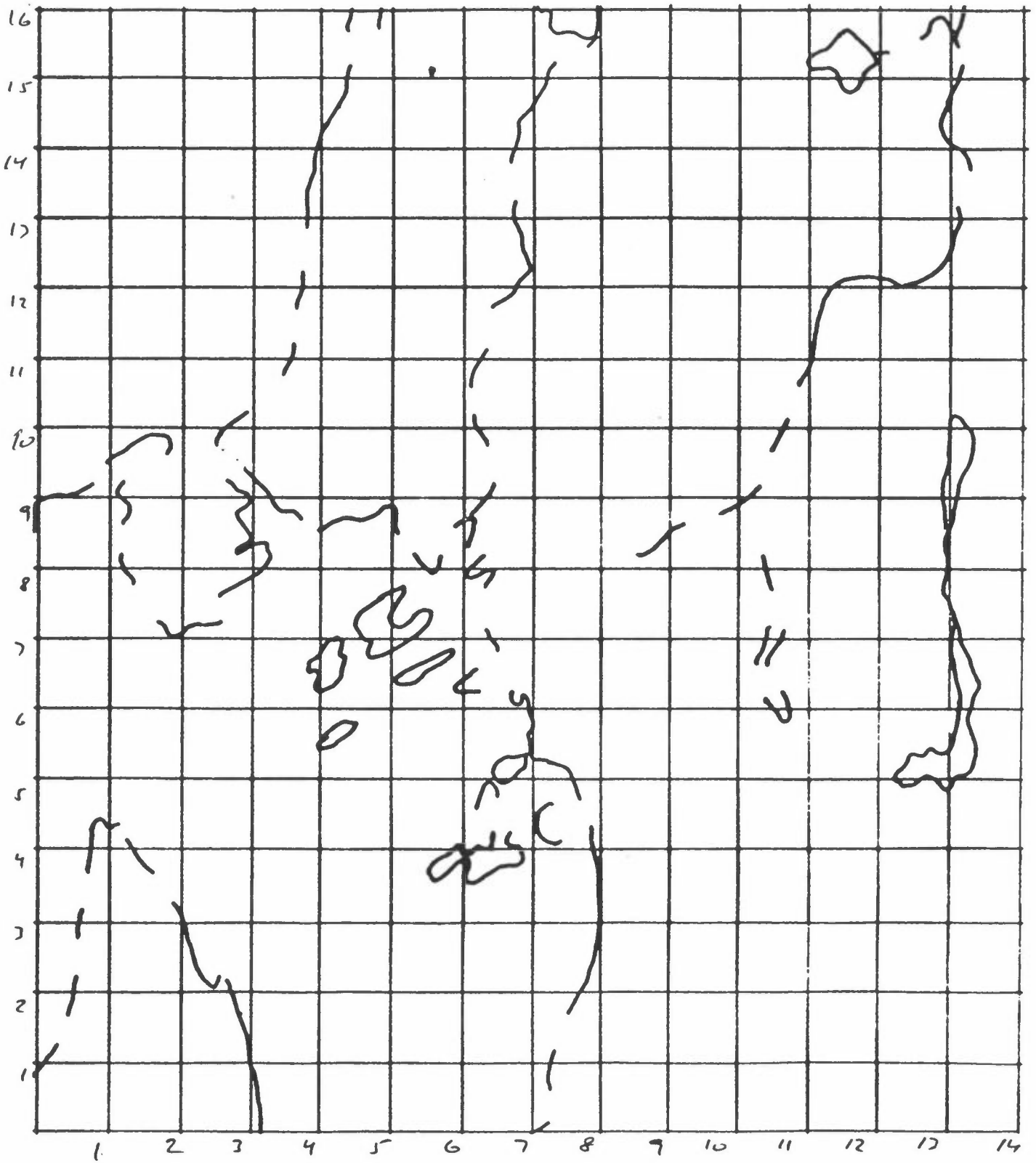


Figure 2: Overlay for print-out.

3. Program READ-FIE

The program is normally run interactive, and it reads one or more data matrixes from an ASCII-file and stores them binary at an .FLD-file.

Input data to READ-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE Name of the input file (with apostrophes and .DAT)

OUTFI Name of the output files (with apostrophes).
The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN

NFIELD Number of fields to be read

INT Output of input data: 0= small integers, 1=reals

The following data are read from INFILE:

INFORM Input format for the data (with parentheses)
Integers are read into the program as reals with format Fx.0.

Before each data field is two lines with heading, which is read **unformatted**:

COMPOUND, UNIT, PERIOD, PLACE, SOURCE
all with apostrophes

LX, LY, ISIZE, FACTOR LX, LY Grid size (should be the same as KX, KY).
ISIZE grid size in meter
FACTOR is a scaling factor to convert the data at the file to the correct unit.

((X(I,K), I=1,KX), K=KY,1,-1) Data field, read according to the format INFORM; KX values at each line. The north-most line is read first, then southwards.
All data are read as reals, but with output according to INT.
The MAP routine scales normally (INT=1) the output map to 4 ciphers for the maximum value.
For small integers we have no scaling (INT=0), otherwise we get values as $200.*1.0E-2$

Example and output from READ-FIE

As an example the program shall read an emission field from a test area. The input data will be:

14,16	Grid size
'TES-READ.DAT'	Input file
'TES-READ'	Result file
1,	Reading one field
1,	Data are reals

The input file 'TES-READ.DAT' will be:

```
(2X,14F3.0)
'SO2','KG/H','WINTER 85','OSLO','OIL HEATING'
  14,16,1000,0.1
16 3 0 0 0 3 1 3 3 3 2 0 0 2 4
15 3 4 5 3 4 9 11 8 3 2 0 1 7 11
14 3 7 10 7 40 22 19 19 7 5 17 14 17 11
13 10 8 10 18 26 37 27 25 24 21 15 12 23 13
12 13 10 11 20 50 31 35 19 29 15 23 12 10 3
11 5 37 18 32 53 33 45 23 34 16 10 5 8 0
10 5 3 19 32125107 35 16 18 14 10 9 1 0
 9 0 2 6 6 25 77 11 40 19 8 10 11 1 0
 8 0 3 3 0 0 0 3 5 8 10 7 19 0 0
 7 0 0 0 0 0 0 5 3 8 5 4 10 0 0
 6 0 0 0 0 0 0 1 3 6 11 9 13 0 0
 5 0 0 0 0 0 0 0 3 7 17 14 4 0 0
 4 0 3 0 0 0 0 0 0 6 8 4 3 0 0
 3 2 4 0 0 0 0 0 1 8 6 3 2 0 0
 2 2 0 2 0 0 0 0 1 2 2 1 1 0 0
 1 1 0 1 0 0 0 0 0 0 3 1 1 0 0
  1 2 3 4 5 6 7 8 9 10 11 12 13 14
```

The figures in the file should be multiplied by 0.1 to give the unit KG/H. The column to the left and the last line will not be read by the programme, but they may be useful.

The data field will be written binary to TES-READ.FLD, whereas the output is written to TES-READ.PRN. The output is very similar to the input file.

Another example: In CONS-FIE we shall distribute some oil consumption according to the population distribution in different regions.

The input will be:

14,16	Grid size
'TESTAREA.DAT'	Input file
'TESTAREA'	Fields at TESTAREA.FLD, output at TESTAREA.PRN.
1,	Reading one field
0,	Data are small integers

The regions are read from the file TESTAREA.DAT:

```
(4X,14F3.0)
'AREA CODE', 'CODE NUMBER', '1994', 'TESTPLACE', 'AREA'
14,16,1000,1.0
 16  3  3  3  3  5  5  5  5  6  6  6  6  6  6
 15  3  3  3  3  5  5  5  6  6  6  6  6  6  6
 14  3  3  3  3  5  5  5  6  6  6  6  6  6  6
 13  3  3  3  3  5  5  2  6  6  6  6  6  6  6
 12  3  3  3  3  5  2  2  6  6  6  6  6  6  7
 11  3  3  3  5  2  2  2  2  6  6  6  7  7  7
 10  3  4  4  2  2  1  1  2  6  6  6  7  7  0
  9  0  4  4  2  2  1  1  2  6  6  7  7  0  0
  8  0  4  4  0  0  0  8  8  8  7  7  7  0  0
  7  0  0  0  0  0  0  8  8  8  7  7  7  0  0
  6  0  0  0  0  0  0  8  8  8  7  7  7  0  0
  5  9  9  0  0  0  0  8  8  8  8  7  7  0  0
  4  9  9  0  0  0  8  8  8  8  8  8  0  0  0
  3  9  9  9  0  0  0  8  8  8  8  8  0  0  0
  2  9  9  9  0  0  0  8  8  8  8  8  0  0  0
  1  9  9  9  0  0  0  8  8  8  8  8  0  0  0
    1  2  3  4  5  6  7  8  9 10 11 12 13 14
```


4. Program INP-FIE

This is a program which may be very useful in many cases, but it has a complex input. The program is normally run as a batch job. In the program values may be given for specified squares or areas of squares. It is possible to read values for 4 fields at the same time.

Input data to INP-FIE

KX, KY, NF Grid size, number of points eastward and northward, and the number of fields (max. 4)

OUTFI Name of the output files (with apostrophes). The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN

ISIZE Grid size in meters

IADD Shall you add the values in a square (Y/N, without apostrophes)

IFO, IFI IFO = 0 reads only background values
 1 reads IX, IY and values
 2 reads UTM-coord. and values
 3 reads rectangles with values
 IFI = 1 reads data from terminal
 2 reads data from file INFILE

If IFI=2, read:

INFILE Name of the input file (with apostrophes and .DAT)

Input continues from file or terminal:

PERIOD, PLACE, SOURCE All with apostrophes

For NF fields is read:

XB(I), COMP(I), UNIT(I) XB = Background value
 COMP = Compound name (with apostrophes)
 UNIT = Unit (with apostrophes)

If IFO=1, read from file or terminal:

IX, IY, (AX(I),I=1,NF) IX, IY indices for the square
 AX values (max. 4)

Date are read until end of the file or a line with -1,,,,,,

If IFO=2, read:

UTMX, UTMY UTM- or local coordinates for lower left corner of the grid

UX, UY, (AX(I),I=1,NF) UTM- or local coordinates coordinates for the square AX values (max. 4)

Data are read until end of the file or a line with -1,,,,,,

IF IFO=3, read:

JX, JY, LX, LY, (AX(I),I=1,NF) All squares within the rectangle with lower left corner (JX, JY) and upper left corner (LX, LY) will have the values AX. A rectangle may cover one single square or many squares,

when I FI=1.

For each rectangle the program asks if we want more rectangles, until the answer is N (without apostrophes).

When the data are read, the program asks:

Do you neEd to re-scale the data? Y/N.

If the answer is Y, a scale factor is requested, and the values read are multiplied by this.

Finally the program asks for scaling oF the output

ISC=1 No scaling

ISC=2 Automative scaling

ISC=3 New scale factor

If ISC=3, a new scale factor is read.

Example for input to INP-FIE:

In TESTPLACE we want to adjust emission fields for 2 planned central heating networks as indicated in the figure below:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=16	3.	3.												
J=15	4.	3.			10.		4.	18.	14.				20.	33.
J=14	6.	11.	11.	9.	14.	31.	19.	17.	17.			13.	37.	41.
J=13	20.	33.	19.	9.	30.	31.	29.	37.	25.	20.	16.	32.	23.	27.
J=12	30.	32.	21.	21.	22.	41.	67.	104.	39.	32.	28.	24.	12.	45.
J=11	22.	17.	17.	28.	51.	60.	92.	55.	20.	28.	8.	1.	43.	23.
J=10	28.	47.	17.	74.	157.	98.	97.	49.	16.	14.	7.	28.	28.	14.
J= 9	19.	6.	20.	83.	48.	48.	64.	80.	22.	33.	34.	20.	25.	
J= 8		1.	10.	2.	7.	1.	15.	54.	20.	26.	45.	25.	5.	
J= 7	4.	6.	10.					1.	20.	23.	28.	19.	45.	
J= 6								4.	11.	18.	33.	18.	33.	
J= 5								2.	15.	22.	39.	18.	25.	9.
J= 4								2.	6.	30.	45.	42.	25.	
J= 3								2.		41.	30.	29.	10.	
J= 2									2.	34.	1.	4.	3.	
J= 1									9.	18.	3.	4.	1.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Program\INP-FIE

14,16,1	grid size, 1 field
'POWER'	output file name
1000	grid size
N	no addition
1,2	reads IX, IY, from file
'POWER.DAT'	input file
N	no re-scaling of data
2	automatic scaling of output.

From 'POWER.DAT' is read:

'2000', 'TESTPLACE', 'CENTRAL HEATING'
0, 'PLANT', 'INTEGER'

2,10,1
2,11,1
3,10,1
3,11,1
3,12,1
9,8,2
10,6,2
10,7,2
10,8,2

10,9,2
11,6,2
11,7,2
11,8,2
11,9,2
12,7,2
-1, , ,

The data might also be read interactive (IFI=1) as a combination of rectangles:

2,10,3,11,1
Y
3,12,3,12,1
Y
10,6,11,9,2
Y
9,8,9,8,2
Y
12,7,12,7,2
N

5. Program PRIN-FIE

Normally the results from a programme will be as corresponding .FLD and .PRN files. Sometimes the .PRN file may have been deleted, or you want it presented in another way.

Input data to PRIN-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE Name of the file that shall be printed (with apostrophes and .FLD)

OUTFILE Name of the output file (with apostrophes and .PRN)
Normally, INFILE and OUTFILE will be the same family.

NFIE, Number of fields to be printed. If you do not know how many fields you have, say 0 and you get all.

If NFIE > 0, read: IFIE (I),I=1,NFIE Number of the fields to be printed

ISC Scaling:
ISC=1 No scaling (small integers)
ISC=2 Automatic scaling
ISC=3 New unit for some fields
ISC=4 Separate scale factor for each field
ISC=5 Common scale factor for all fields

If ISC=3 or higher, enter for each field:

CII New scale factor

If CII is different from 1.0, then:

UNIT New unit (with apostrophes). If you want the same unit, put ''.

Example and output from PRIN-FIE:

```
PROGRAM\PRIN-FIE
14,16            Grid size
'TESTZONE.FLD' Output field
'TESTZONE.PRN' Print-file
1                1 field
1                Field no. 1
1                ISC=1 (small integers)
```

The result is:

Field for ZONE CODE is put on file testzone.FLD

MAP OF: ZONE CODE UNIT: CODE NUMBER PERIOD: 1994 PLACE: TESTPLACE

MAXIMUM VALUE IS 4.0000E+00, IN (8, 6)
SUM= 3.17000E+02 SCALE FACTOR: 1.0E+00

GRID SIZE: 1000 METER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=16	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
J=15	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
J=14	1.	1.	1.	1.	1.	1.	1.	1.	2.	2.	2.	2.	1.	1.
J=13	1.	1.	1.	1.	1.	2.	1.	2.	3.	3.	2.	2.	1.	1.
J=12	1.	1.	1.	2.	2.	2.	2.	2.	3.	3.	3.	2.	1.	1.
J=11	1.	1.	2.	2.	2.	3.	3.	3.	4.	4.	1.	1.	1.	1.
J=10	1.	1.	2.	2.	2.	4.	4.	2.	4.	3.	2.	1.	1.	1.
J= 9	1.	2.	2.	2.	1.	1.	1.	2.	3.	2.	1.	1.	1.	1.
J= 8	1.	2.	2.	2.	1.	1.	1.	2.	3.	1.	1.	1.	1.	1.
J= 7	1.	1.	1.	1.	1.	1.	1.	3.	3.	2.	1.	1.	1.	1.
J= 6	1.	1.	1.	1.	1.	1.	1.	4.	4.	3.	1.	1.	1.	1.
J= 5	1.	1.	1.	1.	1.	1.	1.	3.	3.	2.	1.	1.	1.	1.
J= 4	1.	1.	1.	1.	1.	1.	1.	3.	2.	2.	1.	1.	1.	1.
J= 3	1.	2.	1.	1.	1.	1.	1.	1.	2.	2.	1.	1.	1.	1.
J= 2	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
J= 1	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Another example:

PROGRAM\PRIN-FIE	
22,18	Grid size
'POP-OSLO.FLD'	Output field
'POP-OSLO.PRN'	Print-file
1	1 field
1	Field no. 1
2	ISC=2 (automatic scaling)

In many cases it would be useful to take the .PRN-file into an editor and substitute 'blank-zero-period' by 'blank-blank-period'. In this way the zeros from all the grids with no activity or emissions are suppressed and the map is easier to read:

6. Program READ-PRN

This program is the opposite to PRIN-FIE. It is similar to READ-FIE, but it gets its input from an old .PRN-file. It is useful when a .FLD file has been deleted, but you still have the .PRN file. The program is normally run interactive.

Input data to READ-PRN

KX, KY	Grid size, number of points eastwards and northward
INFILE	Name of the input file (with apostrophes and .PRN)
OUTFI	Name of the output files (with apostrophes) The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN If INFILE is equal to OUTFI, you will get an error message. In such cases it is better to rename INFILE.PRN to a temporary name.
PERIOD, PLACE, SOURCE	all with apostrophes
NFIELD	Number of fields to be read. If 0, you should get all.
INT	Output of input data: 0= small integers, 1=reals

Example and output from READ-PRN

As an example the program shall read the .PRN-file from the example 1 in READ-FIE. The input data will be:

14,16	Grid size
'TEST-REA.PRN'	Input file, TES-READ.PRN is re named
'TES-READ'	Result file
'WINTER 85','OSLO','OIL HEATING'	Period, place and source
1,	Reading one field
1,	Data are reals

The output should be the same as for example 1 in READ-FIE.

7. Program SUM-FIE

In the program SUM-FIE we may calculate a sum of different fields. It is normally run interactive.

Input data to SUM-FIE

KX, KY Grid size, number of points eastwards and northward

NFIELD, NCOMP It is possible to make the sum of NFIELD fields, each with NCOMP components

IPR, ISF IPR=0 No output of single fields
 IPR=1 Print-out of single fields before scaling
 IPR=2 Print-out of single fields after scaling
 ISF=1 makes a new .FLD file

For NFIELDs we read for component no. 1:

KFILE, KREC, FAK Record number KREC at the file KFILE (with apostrophes and .FLD). If this is the same as previous, put 'SAME' as the file name. The data should be multiplied by FAK.

BACKGR Background value for component no. 1

COMPS, UNIS COMPS = compound for the sum field (with apostrophes)
 UNIS = unit of the sum (with apostrophes)
 If you enter 'SAME' you will get the same as for the **last** field

SUMSO SUMSO = source for the sum (with apostrophes), Ex.: 'SUM NOX', 'SUM SO2 OIL'

OUTFILE Name of the output files (with apostrophes)
 Output is written to the file OUTFI.PRN
 If ISF=1 data fields will be written binary to the file OUTFI.FLD,

For the following components (J= 2 to NCOMP) we read:

KREC(N), N=1, NFIELD Record numbers for component J at the different files

FAK(N), N=1, NFIELD New scale factors

BACKGR Background value for component no. J

COMPS, UNIS COMPS = compound for the sum field (with apostrophes)
 UNIS = unit of the sum (with apostrophes)
 If you enter 'SAME' you will get the same as for the **last** field

A new notation for PERIOD and PLACE will be taken from the last field.

Example 1:

We want to calculate the sum of NO_x- and TSP-emissions from different sources in Testplace.

NO_x- and TSP-emissions from gasoline and diesel traffic are field 8-9 and 13-14 respectively at the file TRAFFIC.FLD, emissions from oil heating field 2 and 4 at UT-FY-85.FLD, and emissions from solid fuels (wood and coal) as field 3 and 4 at SOLID.FLD. The consumption of solid fuels is increased by 20%. This gives the following input:

PROGRAM\SUM-FIE	
14,16	Area dimension
4,2	4 fields, two components
0,1	No print-out of fields, creates a .FLD-file (ISF=1)
'TRAFFIC.FLD',8,1.0	traffic, field 8, gasoline cars
'SAME',9,1.0	same file, field 9, diesel cars
'UT-FY-85.FLD',2,1.0	oil, field 2
'SOLID.FLD',3,1.2	field 3, increased by 20%
0.0	No background value
'SUM NOX','KG/H'	Sum, unit
'ALL SOURCES'	Source
'SUM-EMIS'	Output file. Results at SUM-EMIS.PRN, and SUM.FLD
13,14,4,4	Field numbers for TSP
1.,1.,1.,1.2	New factors
'SUM TSP','KG/H'	Sum, unit

Example 2:

We have calculated TSP-concentrations in Kathmandu, but want an estimate of PM₁₀-levels. The different sources have a different proportion PM₁₀/TSP.

```

PROGRAM\SUM-FIE
27,21          Area dimension
7,1           7 fields, one component
0,0          No print-out of fields, no .FLD-file
'traf-tsp.fld',1,1.    Traffic          all as PM10
'resu-tsp.fld',1,0.25  Resuspension,    25% as PM10
'dom-tsp.fld',1,.5    Domestic,        50% as PM10
'bricktsp.fld',1,.25  Brick factories, 25% as PM10
'hoff-tsp.fld',1,.25  Hoffman kilns,   25% as PM10
'himalpoi.fld',1,.42  Himal cement,    42% as PM10
'himal2.fld',1,.25    Himal diffuse,   25% as PM10
10.0          Background 10 ug/m3
'SUM PM10','ug/m3'    Sum, unit
'ALL SOURCES'        Source
'SUM-EMIS'          Results at SUM-EMIS.PRN, but no .FLD-
                    file

```

Output from Example 2:

```

Field no. 1 at file traf-tsp.fld, TSP TRAF,    unit UG/M3    Sum= 1.3973E+03
Field no. 1 at file resu-tsp.fld, TSP RESUSP, unit UG/M3
is multiplied by 2.500E-01 to give unit ug/m3    Sum= 9.2766E+02
Field no. 1 at file dom-tsp.fld , ASS. FUELS, unit UG/M3
is multiplied by 5.000E-01 to give unit ug/m3    Sum= 3.7140E+03
Field no. 1 at file bricktsp.fld, TSP-BRICK,   unit UG/M3
is multiplied by 2.500E-01 to give unit ug/m3    Sum= 5.2707E+03
Field no. 1 at file hoff-tsp.fld, TSP-HOFF,    unit UG/M3
is multiplied by 2.500E-01 to give unit ug/m3    Sum= 2.4260E+02
Field no. 1 at file himalpoi.fld, TSP,         unit UG/M3
is multiplied by 4.200E-01 to give unit ug/m3    Sum= 7.1557E+02
Field no. 1 at file himal2.fld , TSP,         unit UG/M3
is multiplied by 2.500E-01 to give unit ug/m3    Sum= 1.9493E+03
                                                    SUM= 1.9887E+04

A background value of 10.000 ug/m3            is added

```

The sum of the field values gives 14217.13, plus 10 $\mu\text{g}/\text{m}^3$ in 27x21 grids = 5670, with a total of 19887.13.

MAP OF: SUM PM10 UNIT: ug/m3 SOURCE: ALL SOURCES
 PERIOD: Winter average PLACE: KATHMANDU GRID SIZE: 1000 METER
 CREATED: 1995/03/14 09.19

MAXIMUM VALUE IS 1.5028E+02, IN (8, 8)
 SUM= 1.98872E+04 SCALE FACTOR: 1.0E-01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=21	194.	207.	222.	236.	248.	266.	287.	309.	327.	337.	343.	332.	329.	325.
J=20	202.	219.	235.	252.	265.	284.	308.	333.	353.	371.	379.	368.	366.	361.
J=19	210.	230.	250.	268.	287.	305.	330.	364.	395.	421.	431.	418.	409.	399.
J=18	219.	241.	265.	286.	309.	329.	357.	397.	450.	498.	501.	491.	475.	443.
J=17	229.	252.	279.	304.	331.	356.	390.	431.	501.	567.	595.	588.	549.	493.
J=16	238.	268.	296.	322.	352.	387.	427.	469.	544.	629.	687.	676.	633.	551.
J=15	226.	286.	322.	352.	381.	433.	486.	529.	605.	694.	764.	739.	688.	595.
J=14	228.	277.	348.	390.	427.	465.	528.	578.	677.	794.	816.	789.	715.	618.

and so on.

8. Program LOOK-FIE

In the program LOOK-FIE we may look at the values around a point in a field, and change some values. It is normally run interactive.

Input data to LOOK-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE, NFIE Name of the file (with apostrophes and .FLD), and the number of fields in the file

Now the program asks if we want to save a new .FLD file:

YN Y / N

If the answer is Y or y, then:

OUTFILE Name of the new file (with apostrophes. but **not** .FLD !)

The program asks: Where do you want the output?

IOUT IOUT = 1 SCREEN,
 2 SCREEN + file

If the answer to YN above was N or n, then:

OUTFILE Name of the new file (with apostrophes. but **not** .PRN !)

If the answer to YN above was Y or y, then:

FACT Scale factor

IX, IY Indices for the point
 If IX= -1, go to next field

The values around (IX, IY) is displayed on the screen, and the program asks if any value should be changed:

YC Y / N

If the answer is Y or y, then:

IX, IY, X(IX,IY) Indices and new value

The program asks: Change more values? until N. Then the program asks for another point to be displayed, new values for (IX,IY) is read until IX= -1.

If the answer to YN above was Y or y, then we may change the heading:

YH Y / N

If the answer is Y or y, then:

NCOMP, NUNIT New compound and unit (with apostrophes)
 PERIOD and PLACE will be the same as before, and DATE
 will be the current date.

If the answer to YN above was Y or y, then the field shall be written to file. But you have a last opportunity to change your mind:

YF Y / N

After this the program will go to the next field or end.

Example and output from LOOK-FIE

```
FIELD 1  GWH/PERS          GWH/PERS          1985
OSLO      POPULATION      1995/04/26 11.06
```

Enter indices (IX,IY) for the point (IX=-1, end of this session):

```
      10      9
    9,10    10,10    11,10
1.06843E-03 8.04243E-03 2.49520E-02

    9, 9    10, 9    11, 9
0.00000E+00 0.00000E+00 0.00000E+00

    9, 8    10, 8    11, 8
-1.00000E+00 -1.00000E+00 -1.00000E+00
```

Do you want to change some values? Y/N: Y

Enter IX,IY and new value for the point (IX,IY):

```
      11      9    1.000000E-03
The value in (11, 9) is changed from .000E+00 to .100E-02
```

Change more values? Y/N: Y

Enter IX,IY and new value for the point (IX,IY):

```
      10      9    7.000000E-04
The value in (10, 9) is changed from .000E+00 to .700E-03
```

Change more values? Y/N: N

Enter indices (IX,IY) for the point (IX=-1, end of this session):

```
      7      9
    6,10    7,10    8,10
0.00000E+00 5.78474E-03 4.65967E-03

    6, 9    7, 9    8, 9
-1.00000E+00 3.21623E-02 4.59461E-03

    6, 8    7, 8    8, 8
0.00000E+00 0.00000E+00 0.00000E+00
```

Do you want to change some values? Y/N: Y

Enter IX,IY and new value for the point (IX,IY):

```
      6      10    1.000000E-03
The value in ( 6,10) is changed from .000E+00 to .100E-02
```

Change more values? Y/N: Y

Enter IX,IY and new value for the point (IX,IY):

```
      6      8    5.000000E-04
The value in ( 6, 8) is changed from .000E+00 to .500E-03
```

Change more values? Y/N: N

Enter indices (IX,IY) for the point (IX=-1, end of this session):

```
     -1      0
PRINT-OUT WRITTEN TO GWH-LOOK.PRN
```

9. Program CONT-FIE

The program CONT-FIE gives a list of the **content** of the fields on a file. It is normally run interactive.

Input data to CONT-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE, Name of the file (with apostrophes and .FLD)

OUTFILE Name of the output file (with apostrophes and .PRN) or 'TERM'

The program writes the heading, max., min. and the sum for each field.

Example and output from CONT-FIE

From the program ROAD-EMI we have calculated traffic work and emissions from a road network to the file TRAFBRU.FLD. We want a condensed content of this file:

PROGRAM\CONT-FIE

16,23 Grid size
'TRAFBRU.FLD' File name
'BRUTRAF.PRN' Output file

This gives the following print-out:

```
Print-out for the file: TRAFBRU.FLD
Field no.  1, TR.AR.LIGHT  Unit: CARKM/HOUR  Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  1.5979E+03, IN ( 7,21)
      SUM= 3.95922E+04

Field no.  2, TR.AR.HEAVY  Unit: CARKM/HOUR  Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  9.7810E+01, IN ( 7,21)
      SUM= 3.25745E+03

Field no.  3, GASOLINE     Unit: L/HOUR      Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  1.2809E+02, IN ( 7,21)
      SUM= 2.70614E+03

Field no.  4, DIESEL       Unit: L/HOUR      Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  3.9773E+01, IN ( 7,21)
      SUM= 1.19067E+03

Field no.  5, ROAD LENGTH  Unit: KM VEI     Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  6.8818E+00, IN ( 7,21)
      SUM= 1.98256E+02

Field no.  6, CO LIGHT     Unit: KG/H       Period: 1994  Place: GREENLAND
Source: CAR TRAFFIC      Date:1995/04/12 12.47
      MAXIMUM VALUE IS  2.7732E+01, IN ( 7,21)
      SUM= 5.73392E+02
```


Field no. 7, CO HEAVY Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 6.4376E-01, IN (7,21)
SUM= 1.67966E+01

Field no. 8, NOx LIGHT Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 2.7655E+00, IN (7,21)
SUM= 7.74638E+01

Field no. 9, NOx HEAVY Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 1.1216E+00, IN (7,21)
SUM= 3.55133E+01

Field no. 10, NO2 LIGHT Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 1.0409E-01, IN (7,21)
SUM= 2.86942E+00

Field no. 11, NO2 HEAVY Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 1.6824E-01, IN (7,21)
SUM= 5.32699E+00

Field no. 12, Ep LIGHT Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 8.3124E-02, IN (7,21)
SUM= 2.02593E+00

Field no. 13, Ep HEAVY Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 9.7235E-02, IN (7,21)
SUM= 3.24216E+00

Field no. 14, SO2 LIGHT Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 7.6109E-02, IN (7,21)
SUM= 1.62861E+00

Field no. 15, SO2 HEAVY Unit: KG/H Period: 1994 Place: GREENLAND
Source: CAR TRAFFIC Date:1995/04/12 12.47
MAXIMUM VALUE IS 9.3770E-02, IN (7,21)
SUM= 2.94921E+00

10. Program PRES-FIE

Sometimes it is useful to have a look at the fields without a full listing, therefore PRES-FIE. If you want a listing of a field, use PRIN-FIE.

Input data to PRES-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE Name of the file (with apostrophes and .FLD)

ISC Scaling:
 ISC=1 No scaling (small integers)
 ISC=2 Automatic scaling

The program prints the heading and the first 20 lines of the first field to the screen. To continue, type CR. Then the program asks: NEXT? YES / JUMP / END:

If the answer is YES, the next field is displayed.

If the answer is JUMP, the program will have:

JUMP The program reads JUMP fields, and displays the last.

Example of output from PRES-FIE.

```
MAP OF:  TR.WORK LIGHT      UNIT:  CAR/KM/HOUR  SOURCE:  CAR TRAFFIC
PERIOD:  1994                PLACE:  GREENLAND   GRID SIZE: 1000 METER
CREATED: 1995/04/12 12.47
      SUM: 3.95922E+04      SCALE: 1.0E+00
      1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
J=23  0  0  0  0  2  8 31  0  5  0  0  0  0  0  0
J=22  0  0  8  1 19  9 92 15  1  0  0  0  0  0  0
J=21  0  0  1 17 60 70159 55  0  0  0  0  0  0  0  0
J=20  0  0  2 10  6 98 98 66 16  0  0  0  0  0  0
J=19 17  3 15 23 32 57 68 73 27  0  0  0  0  0  0
J=18  0 14  2  0 30 27 26 68 53 14  0  0  0  0  0
J=17  0  0  0  0 10  2 11 21 84 39  0  0  0  0  0
J=16  0  0  0  7  1  0 12  0 46 66  0  0  0  0  0
J=15  0  0  3  5  0  0  5 15 53 49  0  0  0  0  0
J=14  0  0  8  0  0  0  0  7 77 75  0  0  0  0  0
J=13  0  0  9  0  0  0  0  9101124 76  5  0  0  0  0
J=12  5 21  6  7  7  8  9  5 53 51  0 63 29  0  0
J=11  0  2 11  1  0  0  0  0  3 85 35 22 57 53  0
J=10  0  0  0 10  4  0  0  0  0 37 41 18 39 13 42 43
J= 9  0  0  0  0  6  4  0  0  0  0 25 88  4  0  0
J= 8  0  0  0  0  0  7  3  0  0  0  0 76  0  0  0
J= 7  0  0  0  0  0  0  9  1  0  0  0 73  0  0  0
J= 6  0  0  0  0  0  0  0 13  0  0  0 64  0  0  0
J= 5  0  0  0  0  0  0  0  4  9  0  0 67  1  0  0
J= 4  0  0  0  0  0  0  0  0 12  1  0 60 10  0  0
J= 3  0  0  0  0  0  0  0  0  0 18 15 82 13  0  0
J= 2  0  0  0  0  0  0  0  0  0  0 39  0 25  3  0
J= 1  0  0  0  0  0  0  0  0  0  0 32  2 13 20  0
      1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
```

NEXT? YES/JUMP/END: yes

MAP OF: TR.WORK HEAVY UNIT: CARKM/HOUR SOURCE: CAR TRAFFIC
 PERIOD: 1994 PLACE: GRENLAND GRID SIZE: 1000 METER
 CREATED: 1995/04/12 12.47

SUM: 3.25745E+03 SCALE: 1.0E-02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
J=23	0	0	0	0	14	46164	0	26	0	0	0	0	0	0	0	0	
J=22	0	0	45	5101	49506	79	9	0	0	0	0	0	0	0	0	0	
J=21	0	0	6	91319410978289	0	0	0	0	0	0	0	0	0	0	0	0	
J=20	0	0	21	79	35602772354	89	0	0	0	0	0	0	0	0	0	0	
J=19	175	35148213317502744633148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J=18	0141	20	0313241256699298	74	0	0	0	0	0	0	0	0	0	0	0	0	
J=17	0	3	0	0115	13	75289845234	0	0	0	0	0	0	0	0	0	0	
J=16	0	2	1	78	11	0	76	0517351	0	0	0	0	0	0	0	0	
J=15	0	0	36	57	0	0	38	85546262	0	0	0	0	0	0	0	0	
J=14	0	0	90	0	0	0	0	42853409	0	0	0	0	0	0	0	0	
J=13	0	0	97	0	0	0	0	0149781786698	49	0	0	0	0	0	0	0	
J=12	49185	59	69	69	76106	97407300	0638361	0	0	0	0	0	0	0	0	0	
J=11	0	19	99	10	0	0	0	0	33551187117636755	0	0	0	0	0	0	0	
J=10	0	0	0	88	37	0	0	0	0281243180434190631643	0	0	0	0	0	0	0	
J= 9	0	0	0	0	51	34	0	0	0	0194808	43	0	0	0	0	0	
J= 8	0	0	0	0	0	59	23	0	0	0	0486	0	0	0	0	0	
J= 7	0	0	0	0	0	0	70	12	0	0	0626	0	0	0	0	0	
J= 6	0	0	0	0	0	0	0	0101	0	0	0641	0	0	0	0	0	
J= 5	0	0	0	0	0	0	0	0	33	70	0	0669	13	0	0	0	
J= 4	0	0	0	0	0	0	0	0	0	91	12	0574	57	0	0	0	
J= 3	0	0	0	0	0	0	0	0	0	0141130896103	0	0	0	0	0	0	
J= 2	0	0	0	0	0	0	0	0	0	0	0473	0200	27	0	0	0	
J= 1	0	0	0	0	0	0	0	0	0	0	0403	15102162	4	0	0	0	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

NEXT? YES/JUMP/END: END

11. Program CONS-FIE

This program reads data about the **consumption** of fuels as oil, coal, wood or other, mainly for domestic use, and makes consumption fields. In the program CONS-EMI these data are multiplied by emission factors to make **emission** fields. Originally CONS-FIE was written to give maps for an emission survey. Consumption data for a list of point sources was read, and the consumption for a large number of consumers was combined to area sources. In addition to this, there was a rest-consumption which had to be distributed in different ways, mainly according to the population distribution. In most cases detailed consumption figures are not available, and this part is taken out of this version of the programme CONS-FIE. If consumption data for point or area sources are available, these may be read to fields by INP-FIE.

The consumption may be given as a total for the whole area, as separate data for different regions, or as *pro capita* consumption figures. In a region the different zones may have a varying social standard with unlike specific consumption. As domestic heating may be the dominant source of air pollution in many regions, it is important to have a realistic model for the consumption. The more local knowledge that is the basis for the estimates, the better will the result be.

The program is normally run interactive. It may be necessary to run it twice or more, because it asks for data that may be not are available in advance, but are calculated by the programme.

Input data to CONS-FIE

KX, KY Grid size, number of points eastwards and northward

OUTFI Name of the output files (with apostrophes)
The data fields will be written binary to the file OUTFI.FLD,
the output is written to the file OUTFI.PRN

PERIOD, PLACE, SOURCE All with apostrophes

NFUEL Number of fuel types (max. 8)

For each fuel type is read (with apostrophes):

TYPE, UNIT TYPE = fuel type (COAL, WOOD, KEROSENE, FUEL OIL
etc.)
UNIT = unit (tons/year, m³/year etc.)

NZO Number of zones for distribution of the consumption (max. 9)

POPFILE, ZONEFILE

Names of the files with population and zone codes (with apostrophes and 'FLD', or 'NONE')

If POPFILE = 'NONE', all squares are given weight = 1

If ZONEFILE = 'NONE', then NZO **must** be 1

Only one file name can be 'NONE'

The programme counts the number of squares in each zone group if POPFILE = 'NONE', otherwise the number of inhabitants in each zone group, IPOPU. Here we may proceed in two ways:

- | | | |
|------|--------|--|
| IDIS | IDIS=1 | Total consumption is distributed according to a weighted population distribution |
| | IDIS=2 | Total consumption is calculated from consumption pro capita in different zones |

If IDIS = 1, for each fuel type K is read:

ALL(K,L), L=1,IZO

Total annual amount of fuel type K consumed in each zone

The consumption in square (I,J), which belongs to zone L is calculated as

$$\text{CONS}(I,J,K)=\text{ALL}(K,L)*\text{POP}(I,J)/\text{IPOP}(L)$$

If IDIS = 2, for each fuel type K is read:

CAP(K,L), L=1,IZO

Annual pro capita consumption of fuel type K in each zone

The consumption in square (I,J), which belongs to zone L is calculated as

$$\text{CONS}(I,J,K)=\text{CAP}(K,L)*\text{POP}(I,J)$$

Example:

In example 2 to READ-FIE we have read a field with zone codes called TESTAREA.FLD. We want to distribute consumption figures according to the population, which is at the file POPU85.FLD. (The figures are not real.)

This gives the following input to CONS-FIE:

```

14,16          Grid size
TESTCONS      Fields at TESTCONS.FLD, output at
              TESTCONS.PRN
'1985','OSLO','DOM. HEATING' Period, place and source
3            3 fuel types
'WOOD', 'tons/y' Fuel types, unit
'DIST.OIL','m3/y'
'HEAVY OIL','m3/y'
8            8 zones. Population data for zone 9 was not
              included at POPU85.FLD, and no fuel is
              allocated to this area.
'POPU85.FLD','TESTAREA.FLD' Population and zone file
1            IDIS=1, fuel consumption for each zone is
              read

3218,2456,385, zone 1 Consumption of 3 fuel types,
 416,1509, 82, zone 2 8 zones
1796,6958,436, zone 3
2619,5077,562, zone 4
3055,7603,812, zone 5
 812,1285,409, zone 6
2628,3329,756, zone 7
 897,1018,318, zone 8

```

This gives the following output to the file TESTCONS.PRN:

Population in each zone group:

```

1 30650
2 88590
3 31770
4 10220
5 18850
6 77690
7 56690
8 54840

```

Data is put on file TESTCONS.FLD

MAP OF WOOD UNIT: tons/y PERIOD: 1994 PLACE: TESTPLACE

MAXIMUM VALUE IS 1.2019E+03, IN (2,10)
 SUM= 1.54410E+04 SCALE FACTOR: 1.0E+01

GRID SIZE: 1000 METER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=16	2.	2.	.	.	.	.	.	.	.	.	.	.	.	.
J=15	2.	2.	.	.	15.	.	7.	2.	1.	.	.	.	2.	3.
J=14	3.	6.	6.	5.	22.	50.	31.	2.	2.	.	.	1.	4.	4.
J=13	11.	19.	11.	5.	48.	50.	1.	4.	3.	2.	2.	3.	2.	3.
J=12	17.	18.	12.	12.	36.	2.	3.	11.	4.	3.	3.	3.	1.	21.
J=11	12.	9.	9.	45.	2.	3.	4.	3.	2.	3.	1.	.	20.	11.
J=10	16.	120.	44.	3.	7.	103.	102.	2.	2.	2.	1.	13.	13.	.
J= 9	.	16.	52.	4.	2.	50.	68.	4.	2.	3.	16.	9.	.	.
J= 8	.	4.	25.	.	.	.	2.	9.	3.	12.	21.	12.	.	.
J= 7	.	.	.	.	.	.	.	3.	4.	13.	23.	21.	.	.
J= 6	.	.	.	.	.	.	1.	2.	3.	15.	8.	15.	.	.
J= 5	.	.	.	.	.	.	.	2.	4.	6.	8.	11.	.	.
J= 4	.	.	.	.	.	.	.	1.	5.	7.	7.	.	.	.
J= 3	.	.	.	.	.	.	.	.	7.	5.	5.	.	.	.
J= 2	.	.	.	.	.	.	.	.	6.	.	1.	.	.	.
J= 1	.	.	.	.	.	.	.	1.	3.	1.	1.	.	.	.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

and similar fields for Dist. oil and Heavy oil.

Example 2:

From the example above we have data for the consumption and the population within the 8 zones. This enables us to calculate a specific wood consumption factor CAP in tons wood pr. year per person:

Zone	1	2	3	4	5	6	7	8
Cons.	0.1050	0.0047	0.0565	0.2563	0.1621	0.0105	0.0464	0.0164

In the same way we may calculate consumption per person for other fuels. It will perhaps be easier to estimate a consumption in kg or liter per day, but it has to be transformed to consumption per year/person.

12. Program CONS-EMI

From the consumption fields that was created by CONS-FIE, **emission** fields are created by CONS-EMI. The programme is run interactive.

There are some questions by the programme which may seem senseless, but they have their use and their history. Consumption fields will very often tell about the annual consumption of fuels. It is useful to calculate annual emissions, by the use of emission factors. But as an input for model calculations hourly emissions are needed, in kg/h. In Norway most of the fuel is used during winter, and the major pollution problems are due to winter situations with bad dispersion conditions. Therefore we need winter emissions. In hourly model calculations the emissions from heating is adjusted by the hourly temperature and degree-days.

Other places there may also be great seasonal variations in the consumption, and it is necessary to take this into account when preparing hourly emissions.

Input data to CONS-EMI

KX, KY, NCOMP	Grid size, number of points eastwards and northward and number of compounds (max 6)
INFILE	File with annual consumption figures (with apostrophes and .FLD)
INFAK	File with emission factors (with apostrophes and .DAT)
OUTFI	Name of the output files (with apostrophes) The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN
NFU	Number of fuel types/consumption fields (max. 8)
IUV	IUV=0 Yearly emissions IUV=1 Hourly emissions
PALL(J), J=1, NFU	% of the total consumption allocated. This should be 100% from CONS-FIE, but we have the opportunity to adjust this by multiplying the data with 100./PALL(J).
If IUV = 1, then:	
PPER(J), J=1, NFU	% of the total fuel consumption that is used during the period
NDAY	Number of days in the period (365, 182 or other)
PERIOD	New period (with apostrophes) The period for the emission data may be different from the consumption data

PLACE and SOURCE will be taken from INFILE, PERIOD from INFILE if IUV = 0, and DATE is the current date.

Emission factors are read from INFAK.DAT. At the beginning of the file you may put all informations about how this file was created, and all the assumptions the factors are based upon.

The programme starts reading of data when it finds a line starting with START or Start.

Then:

COMP(K), K=1,NCOMP Compounds
 FORMAT (28X, 6A8)

Then for NFU fuel types:

FUELT(J), UNIT(J),DENS(J), (FAK(K,J), K=1,NCOMP)
 FUELT = Fuel type, col. 1-10
 UNIT is not used by the programme, but is
 useful as an information, col 11-18
 DENS = Density of the fuel (see below)
 FAK(K,J) = emission factor, emission of com-
 pound K from consumption of fuel type J
 FORMAT (A10,A8,7F8.2)

DENS will not always be a density, but more a factor for adjustment between the consumption unit and the emission factor unit. For liquid fuels, the consumption unit will be m^3 . If the emission factor is given as kg/m^3 , DENS should be 1.0, but if it is as kg/ton , DENS should be the actual density of the oil. For solid fuels the consumption will normally be given in tons, the emission factor as kg/ton , and DENS = 1.0. UNIT reminds us about the unit for the emission factors. The programme is flexible with respect of the input data, but you must self keep order of the different units.

Example:

Calculation of emissions from fuel consumption in Oslo in 1985, both annual emissions and hourly winter mean emissions.

14,16,4	Grid size, 4 components
'TESTCONS.FLD'	Consumption file
'FUEL-FAK.DAT'	Emission-factor file
'EM-D-WIN'	Emission file, emissions from "domestic", winter
3	3 fuel types
1	IUV = 1, hourly emissions
70.,95.,100.	70% of the wood consumption is allocated, 95% of dist. oil, and 100% of heavy oil
82.0, 75.0, 55.0	82% of the wood is used during the winter season, 75% of the dist. oil, and 55% of the heavy oil
182	Winter season (october-march)
'WINTER 85'	Data for "Winter 85" will actually be used for calculations for the winter 1984/85

The file FUEL-FAK.DAT will be:

Emission factors for Oslo 1985.

Based upon A. Rosland: "Emission Coefficients", SFT 1985

START

			SO2	NOX	CO	PART
Wood	kg/ton	1.00	0.20	0.7	100.0	10.0
Dist. oil	kg/m3	0.83	3.65	2.5	6.5	0.3
Heavy oil	kg/m3	0.95	18.4	4.2	0.4	1.3

The emission factors will vary from place to place, depending on access to "clean" fuels. The SO₂-factor will be $20 * \%S * \rho$, where %S is the sulphur content and ρ is the density.

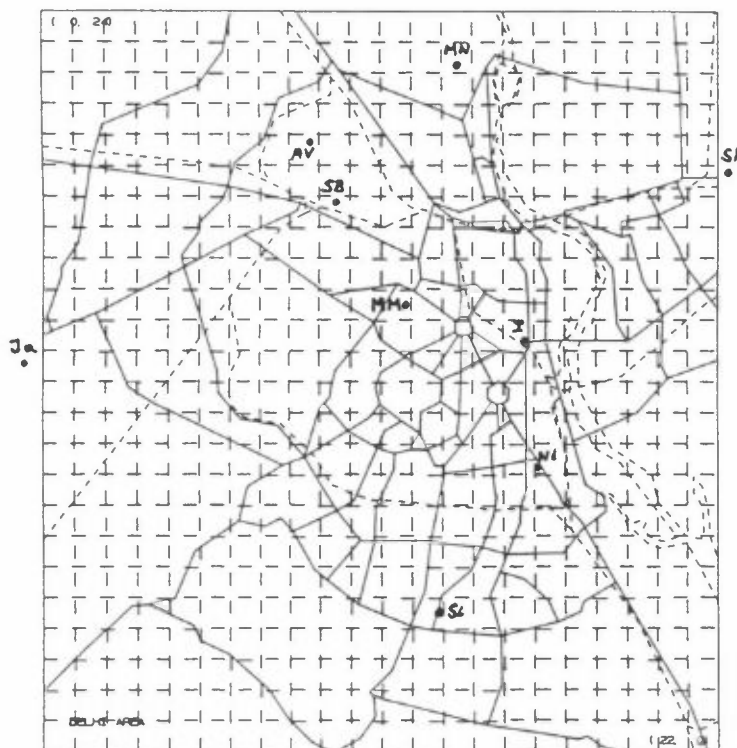
To calculate annual emission fields to file EMIS-DOM, IUV is set to 0, but PPER, NDAY and PERIOD is not read.

13. Program TRA-WORK

For the calculation of area emissions emissions from traffic, this has to be done in two steps, by TRA-WORK and TRA-EMIS. Fields with traffic work is calculated in TRA-WORK, and these are multiplied by emission factors in TRA-EMIS.

First of all it is necessary to define a **main road network**, and perform traffic countings. The more informations that can be collected, the better the results. If detailed data exists (driving conditions, traffic composition etc.) more detailed models for calculating the emissions may be used. It is possible to some extent to use the results of traffic modelling, but these does not always include all traffic groups, and one should be careful to use the results uncritically.

The work starts with a good road map for the area (1:20 000 or better), with a km-grid. All main roads should be registered, all main road crossings (= nodes) numbered, and the coordinates of the nodes should be measured out. If the coordinates exists in a GIS-system, this would be excellent. In this way a road network is built up, and a file with node positions is made. It is possible to transform the coordinates to another system, but the best is to have the node positions in the correct system. This file should be plotted out by the program ROAD-PLO or other, to assure that the network is according to the maps. (This program will be included in the KILDER support programmes package, but it is dependent of the plotter facilities, and needs separate plotter driver routines.) The figure below shows a plot of the main road network in Delhi, together with some measurement stations.



Main road network for Delhi.

The next step is to fill the network file with traffic data. It will also be useful to have the road names in the file. In the beginning we may have data only from a few counting points, but with local knowledge about traffic streams the data may be extended to attached roads. The data may be total traffic, or with separate data sets for different vehicle groups. The example below shows part of a traffic data file from the URBAIR study in Bombay. It is not according to the manual below, but that is reality.

```

Traffic data for BOMBAY
ROAD and NODES is read twice
START
(A10,T1,A10,4F6.2,F7.0,4F6.0)
light heavy bus aadt tot
102 301 1855 6437 1944 6644 5866. 133. 0. 5999.
102 503 1855 6437 2042 6790 11700. 2233. 83. 14016.
301 402 1944 6644 1983 6807 16233. 200. 33. 16466.
301 503 1944 6644 2042 6790 8066. 1133. 50. 9249.
401 402 1888 6866 1983 6807 7333. 616. 0. 7949.
401 702 1888 6866 1923 6956 26133. 516. 0. 26649.
402 501 1983 6807 2000 6800 19183. 2183. 83. 21449.
501 502 2000 6800 2020 6795 11383. 1016. 83. 12482.
501 704 2000 6800 1995 6953 14866. 2000. 166. 17032.
502 503 2020 6795 2042 6790 17233. 2783. 833. 20849.
502 703 2020 6795 2025 6943 5866. 2050. 733. 8649.
503 601 2042 6790 2180 6943 10666. 766. 500. 11932.
601 605 2180 6943 2186 7047 8583. 2333. 816. 11732.
602 603 2066 6943 2042 6790 15966. 1600. 550. 18116.
602 604 2066 6943 2130 7035 7066. 583. 33. 7682.
602 705 2066 6943 2010 6935 13633. 3983. 1016. 18632.
602 706 2045 7000 2066 6943 10333. 1733. 0. 12066.
603 606 2045 7000 2126 7060 6033. 700. 50. 6783.
603 703 2045 7000 1981 7198 7600. 716. 566. 8882.
603 705 2130 7035 2186 7047 5866. 1016. 733. 7615.
603 1301 2130 7035 2126 7060 7633. 150. 33. 7816.
604 605 2186 7047 2195 7240 12983. 900. 233. 14116.
604 801 2045 7000 2126 7060 16. 1000. 0. 1016.
605 1102 1923 6956 1995 6953 45833. 5083. 1383. 52299.
END

```

In TRA-WORK traffic data for the main road network is read, and data fields with road length and with traffic work for the different vehicle groups are written to file. In TRA-EMIS these fields are read and multiplied by emission factors to give emission fields. Normally, traffic data will be as AADT, Annual Average Daily Traffic, but may also be morning traffic, afternoon traffic etc.

In this approach to calculate traffic emission fields we have no information about parameters as speed, gradient, cold start and catalyst. These have to be included in the emission factors used in TRA-EMIS. Another program, ROAD-EMI, calculates emission fields from detailed traffic data, but is not included here.

In addition to the emissions from the traffic on the main road there will always be a lot of traffic on the smaller roads. The traffic work on these will normally be of the order of 15-25% of the total traffic work, and with emissions of 20-30% of the total. As the amount of information varies from city to city it is very difficult to give a standard procedure for estimating these emissions, but some examples will give an idea about how to proceed.

The program TRA-WORK is normally run interactive, but the traffic data are read from file.

Input data to TRA-WORK

KX, KY	Grid size, number of points eastwards and northward
NT	Number of traffic fields (max. 4)
INFILE	Name of the input file (with apostrophes and .DAT)
OUTFI	Name of the output files (with apostrophes) The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN It is useful to use the same name for INFILE and OUTFILE.
PERIOD, PLACE,	With apostrophes

Traffic data may exist in two ways:

- we may traffic data for NT vehicle types (max. 4), or
- we have total traffic, and distribute this to NT vehicle types, according to the road type.

Select by:

RODI 'a' or 'b' (with apostrophes)

If NT >1, then

CART(I), I=1,NT Car-types (with apostrophes)

If RODI = 'b', then

NRT Number of road types (max 5)

FAD(JR,IV),IV=1,NV

Proportion of the traffic on road type JR by vehicle type IV
One line for each road type

Normally, we have information about the traffic composition for only a few roads. But by systematic counting in representative road types could it is possible to classify the roads into a few groups. For example Toll roads, Main arterial roads, Local arterial roads, Roads in industrial areas and Local roads. Some roads may be prohibited for certain vehicles. This grouping has to be done locally, based upon local knowledge of the traffic.

UTMX, UTM Y	Coordinates of the lower left corner
ISIZE	Grid size in meter (normally 1000)
SCALE	The coordinates must be multiplied by SCALE to get km-coordinates (normally 1.0)
ITR	Transformation of coordinates: ITR=0 No transformation ITR=1 Coordinate system should be rotated and translated ITR=2 The direction of the x-axis should be turned ITR=3 The direction of the y-axis should be turned ITR=4 x- and y-coordinates should be interchanged

If ITR=1, coordinates for two reference points in the two coordinate systems are read:

U1F,V1F	Coordinates for ref. point 1 in the FROM-system
X1T,Y1T	Coordinates for ref. point 1 in the TO-system
U2F,V2F	Coordinates for ref. point 2 in the FROM-system
X2T,Y2T	Coordinates for ref. point 2 in the TO-system

The program will ask for a control

JAD	Distances OK?	Y/N (without apostrophes)
JAX	Zero X OK?	If N, read new reference
JAY	Zero Y OK?	coordinates

As a control, it is useful to print out all road sections within a specified square:

JAP	Y/N (without apostrophes)
-----	---------------------------

If JAP=Y, enter:

IRUX,IRUY	Indices for the square
-----------	------------------------

Input data for the road network is read from INFILE. The file is read until a line with 'START' or 'Start' in column 1-5. The program halts, and you enter CR to continue.

The the program reads a line with input data format FORMIN (with parentheses). From INFILE the data are read, according to FORMIN, until 'END' in column 1-3. The input format is depending of the input data:

If RODI = 'a', then we may read:

ROAD, NODES, (POS(I),I=1,4), (ITRAFN(I),I=1,NT)

ROAD Road name,
 NODES Node numbers (used only for road segment ident.),
 POS 4 node positions,
 ITRAFN NT traffic sets, (integers)

Example FORMIN= (A20,A10,4F8.3,4I8), which gives
 ROAD in column 1-20, NODES in col. 21-30, POS in 31-38,
 39-46,47-54 and 55-62, and ITRAFN in 63-70, 71-78, 79-86
 and 87-94

If RODI = 'b', then we may read:

ROAD, NODES, (POS(I),I=1,4), ITRAFS, JRT

ROAD Road name,
 NODES Node numbers (used only for road segment ident.),
 POS 4 node positions,
 ITRAFS Sum traffic, (integer)
 JRT Road type

Example FORMIN= (A20,A10,4F8.3,I8,I2), which gives
 ROAD in column 1-20, NODES in col. 21-30, POS in 31-38,
 39-46, 47-54 and 55-62, ITRAFS in 63-70 and JRT in col.
 71-72

In addition to the emissions from the traffic on the main road there will always be a lot of traffic on the smaller roads. The traffic work on these will normally be of the order of 15-25% of the total traffic work, and with emissions of 20-30% of the total. As the amount of information varies from city to city it is very difficult to give a standard procedure for estimating these emissions. One approach is to start with the sale of gasoline, assuming that all gasoline is used within the city region.

By using statistical consumption figures for different vehicle types, and their part of the traffic work on the main roads, it is possible to estimate an upper value for the total traffic work. The difference from the main road traffic work may be distributed according to the population, or according to the population, but with different weight in different regions. In the URBAIR study of Jakarta it was calculated a traffic work on the main roads of about $14 \cdot 10^9$ car-km/y, where as the gasoline consumption figures indicates a traffic work of about $17 \cdot 10^9$ car-km. The difference $3 \cdot 10^9$ car-km/y, will be due to traffic on local roads. This may be distributed by multiplying the population field by $3 \cdot 10^9 / 7.1 \cdot 10^6 = 422.5$ car-km/person.

The total traffic work may be calculated by SUM-FIE, as the sum of

'TRAFTOT.FLD' * 1.0, and
'JPOP90.FLD' * 422.5.

This estimate was based upon an average factor for the whole DKI Jakarta. In the densest populated areas the car density is probably lower than in other areas.

Based upon knowledge about the social standard in the regions of the city it should be possible to define zones with different traffic work pro capita.

The average value of 422.5 car-km/person corresponds to about 1.15 km/person * day at local roads. In some zones this could be 0.25 km/day, in other 2.5 km/day and even more.

14. Program TRA-EMIS

The program is normally run interactive, and it reads one or more fields with traffic work from TRA-WORK and calculates emission fields.

Input data to TRA-EMIS

KX, KY, NTR	Grid size, number of points eastwards and northward and the number of traffic fields (max. 4)
INFILE, ITR	Traffic work file (with apostrophes and .FLD).
ITR	field number for the first traffic work field. (Normally 2 for files from TRA-WORK.)
OUTFI	Name of the output files (with apostrophes) The data fields will be written binary to the file OUTFI.FLD, the output is written to the file OUTFI.PRN
INFAK	Emission factor file (with apostrophes and .DAT)
NCOMP	Number of compounds (max. 6)

Emission factors are read from INFAK:

First a line with a heading

```
GROUP(I), I=1, NTR),      Vehicle groups
                          FORMAT (10X, 4A10)
```

Then for NCOMP compounds:

```
COMP(J), (EMIS(J, I), I=1, NTR)
          Compound, emission factors for NTR vehicle groups
          FORMAT (1X, A10, 4F10.3)
```

The emission factors should be based upon measurements of the emissions from the local car population. They may also be a weighted average for several vehicle groups. The table below shows emission factor for vehicles used for calculations in Delhi (CPCB 1982, CUPS/10/1982-83).

Vehicle	MC/TC	Petrol	Diesel	Heavy
SO ₂	0.02	0.08	0.39	1.5
NO _x	0.07	3.20	0.99	21.0
Particles	0.20	0.33	0.45	0.75

15. Program POP-FIE

This program is written as a tool for distributing characteristics when total figures for several districts are given. This will mainly be population, but it has been used to distribute working places and wood consumption.

From official statistics the population within districts/zones is given, and the problem is to distribute this to the grid. The more detailed the information is, the better will the result be. The work starts with a map with the grid, and with the borders of each zone. For each zone it is estimated how many % of the zone that is covered by each square. When it is a homogeneous zone the area distribution may be used, otherwise dense populated parts must be given more weight than the rest of the zone. In some cases we have data for sub-districts and we may calculate by the use of POP-DIST how many % of the population within a district that lives within each sub-district. In this way we prepare a distribution file DISTFILE.DAT, as shown in the example below. We may have several different sets for the population data on POPFILE.DAT (ex. POP1990, POP2000 and POP2010), and we select which we want. We may also have different distribution files according to different area use plans, but such plans will only affect the distribution in special districts.

Example:

We want to make a population map for Oslo, where the data are given for districts and sub-districts. Figure 1 shows a part of the map of Oslo, with borders and a 500 m. grid. The table below shows the population within the districts 12 and 13;

district	pop	% pop.	district	pop	% pop
1201	980	13.62	1301	570	14.85
1202	598	8.31	1302	744	19.38
1203	798	11.09	1303	1389	36.18
1204	725	10.08	1304	780	20.32
1205	533	7.41	1305	356	9.27
1206	685	9.52		3839	100.00
1207	929	12.91			
1208	721	10.02			
1209	899	12.50			
1210	0	.00			
1211	326	4.53			
	7194	100.00			

The 13.63% of the population within sub-district 1 of district 12 is divided to 3.6% in square (15,11) and 10% in (15,12), and the 36.18% within sub-district 3 of district 13 is estimated to 5% in (15,12), 26.2% in (16,12) and 5% in (16,13). Following this procedure, we find that the population of district 12 should be distributed according to:

(14,11) .5%, (14,12) 5.9%, (14,13) 23.4%, (14,14) 5.0%, (15,11) 4.6%, (15,12) 36.8%, (15,13) 20.0% and (15,14) 3.5%,

and district 13:

(15,12) 22.0%, (16,11) 5.0%, (16,12) 45.4%, (16,13) 25.3% and (17,13) 2.3%.

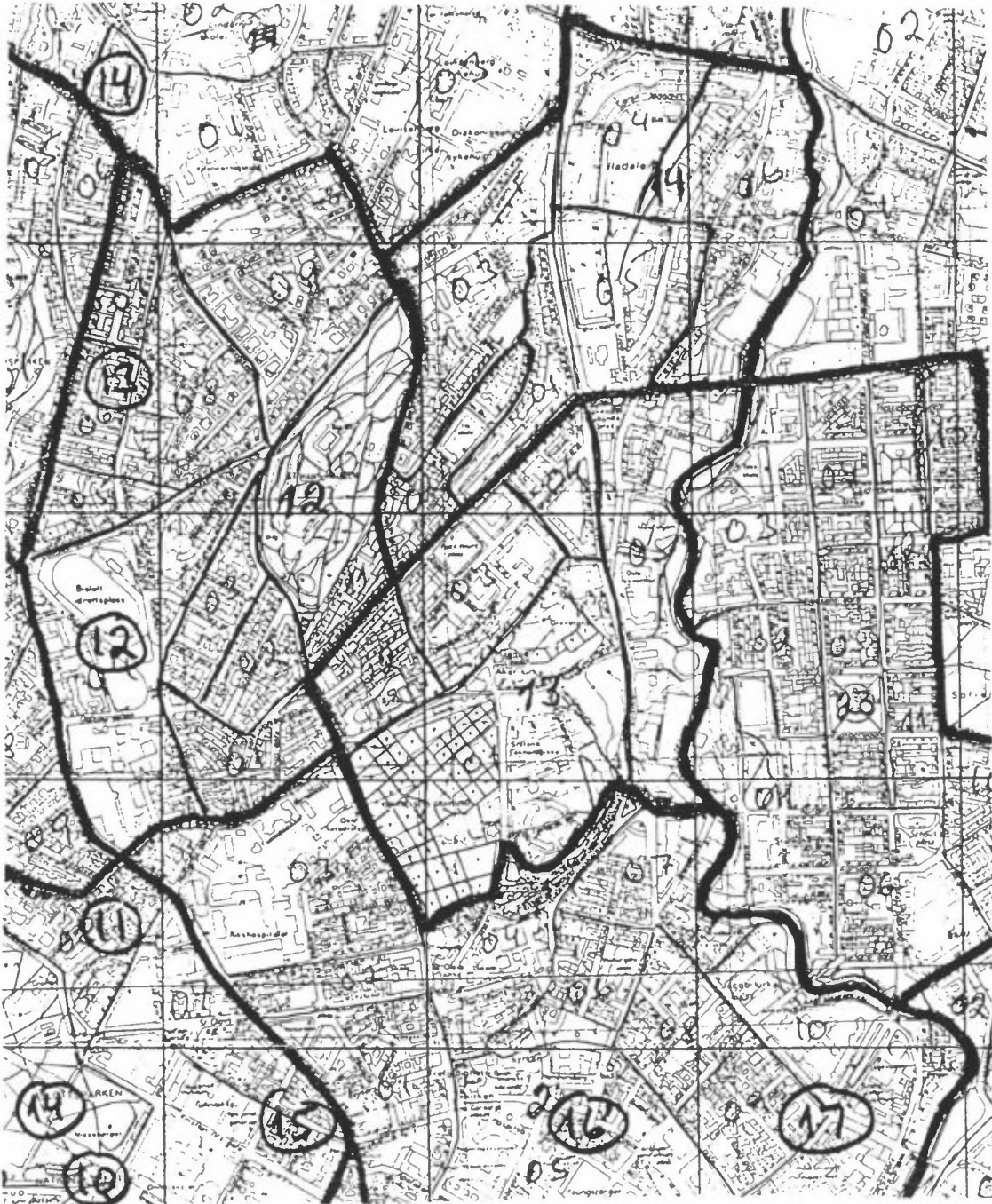


Figure 3: Map of Oslo with districts and sub-districts.

In this way the DISTFILE is prepared:

```

B 12      8 14 11 .5 14 12 5.9 14 1323.4 14 14 5.0 15 11 4.6 15 1236.8 15 1320.0
          15 14 3.5
B 13      5 15 1222.0 16 11 5.0 16 1245.4 16 1325.3 17 13 2.3
B 14      7 15 12 2.0 15 12 8.0 16 12 1.0 16 1338.2 16 1425.8 17 1317.1 17 14 7.9

```

and so on.

POPFILE will normally consist of different sets with population data (for different years, different area strategies etc.), but it may also be other types of data which are given for each district.

This procedure is based upon a steady population distribution. If there are plans for development within one sub-district the population distribution code for that district must be revised, but for the rest of the area the distribution keys may be unchanged.

Example of POPFILE:

	(1994)	(2005)
B 1	141	169
B 2	4463	4428
B 3	2867	3012
B 4	6	5
B 5	3943	4502
B 6	11152	14374
B 7	4773	4694
B 8	6857	7031
B 9	9435	11512
B 10	850	874
B 11	3868	4237
B 12	7194	7384
B 13	3839	4022
B 14	5132	4965
B 15	3090	3175
..

and so on.

Now we can go to the input:

Input data to POP-FIE

KX, KY	Grid size, number of points eastwards and northward
DISTFILE, POPFILE	Distribution code file, population file (with apostrophes and .DAT)
OUTFILE	Name of the output files (with apostrophes)
ISIZE	Grid size in meters
COMPOUND, UNIT, PERIOD, PLACE, SOURCE	all with apostrophes

UTMX, UTMY Coordinates for lower left corner if the grid coordinates are given in the UTM grid.
With a local coordinate system, UTMX = UTM Y = 0

NT, JT NT data sets at INFILE, we want no. JT. (Max. 4 sets.)

From DISTFILE distribution data are read until end, for a maximum of 150 districts. Each district may be covered by max. 21 squares. If this is not sufficient, you have to divide the area or the districts in smaller parts.

If NSQ is 7 or less:

DIS, NSQ, (XR(I),YR(I),VAL(I), I=1,NSQ)
(A4, 2X,I4,7(2I3,F4.1))

DIS Name of the district, an abbreviated name or a number (A4). Must be the same as in POPFILE.
The district covers NSQ squares, each with coordinates (XR,YR) and with VAL % of the value for the district, VALUE.

If NSQ is 8 or more:

DIS, NSQ, (XR(I),YR(I),VAL(I), I=1,7)
(A4, 2X,I4,7(2I3,F4.1))
Distribution for the first 7 squares
(XR(I),YR(I),VAL(I), I=8,NSQ)
(10X,7(2I3,F4.1))
Distribution for the rest, 7 squares per line.

From POPFILE population data are read:

DIS,(VALUE(I), I=1,JT) (A4,4I8)
DIS is the name of the district, which should be the same as in DISTFILE
Data set no. JT is used, with the value VALUE(JT)

When all data are read the program asks if we want to re-scale the data, Y / N.

If the answer is Y or y, then:

SCALE Scale factor

Finally the program asks whether we want a listing of the data for each square, Y/N.

The output of the program will be a population distribution map as shown in Figure 2. This covers 383180 persons, with a maximum of 15730 persons living in grid (5.10).

MAP OF: POPULATION UNIT: PERSONS PERIOD: 1985 PLACE: Oslo
 Source: Population Date: 1987/09/12 15.46

MAXIMUM VALUE IS 1.5730E+04, IN (5,10)
 SUM= 3.83180E+05 SCALE FACTOR: 1.0E+02

GRID SIZE: 1000 METER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=16	3.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	.
J=15	4.	3.	0.	0.	10.	0.	4.	18.	14.	0.	0.	0.	20.	33.
J=14	6.	11.	11.	9.	14.	31.	19.	17.	17.	0.	0.	13.	37.	41.
J=13	20.	33.	19.	9.	30.	31.	29.	37.	25.	20.	16.	32.	23.	27.
J=12	30.	32.	21.	21.	22.	41.	67.	104.	39.	32.	28.	24.	12.	45.
J=11	22.	17.	17.	28.	51.	60.	92.	55.	20.	28.	8.	1.	43.	23.
J=10	28.	47.	17.	74.	157.	98.	97.	49.	16.	14.	7.	28.	28.	14.
J= 9	19.	6.	20.	83.	48.	48.	64.	80.	22.	33.	34.	20.	25.	0.
J= 8	0.	1.	10.	2.	7.	1.	15.	54.	20.	26.	45.	25.	5.	0.
J= 7	4.	6.	10.	0.	0.	0.	1.	20.	23.	28.	49.	45.	0.	0.
J= 6	0.	0.	0.	0.	0.	0.	4.	11.	18.	33.	18.	33.	0.	0.
J= 5	0.	0.	0.	0.	0.	0.	2.	15.	22.	39.	18.	25.	9.	0.
J= 4	0.	0.	0.	0.	0.	0.	2.	6.	30.	45.	42.	25.	0.	0.
J= 3	0.	0.	0.	0.	0.	0.	2.	0.	41.	30.	29.	10.	0.	0.
J= 2	0.	0.	0.	0.	0.	0.	0.	2.	34.	1.	4.	3.	0.	0.
J= 1	0.	0.	0.	0.	0.	0.	0.	9.	18.	3.	4.	1.	0.	0.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Figure 4: Map for population distribution.

16. Program POP-DIST

In the program POP-FIE we are making a population distribution map. As a part of this, we have data for the population within districts and sub-districts. When we shall calculate a distribution-key for a district, is it normally large, and it is very difficult to estimate how the population is distributed. POP-DIST reads data for each sub-district, and calculates how many % of of the population in a district that lives within each sub-district. It is then more easy to distribute this percentage to the grids the sub-district covers.

Input data to POP-DIST

INFILE Population file (with apostrophes and .DAT)

OUTFILE Result-file (with apostrophes and .PRN)

Population data are read from INFILE:

The file is read until Start in col. 1-5. Then:

INFO Input format (with parentheses, but without apostrophes)
NREG Number of regions

For each region:

NDIST Number of districts (kecamatan o.l.)

For each district:

ZONE, RODE, RODENAME, INH
 Zone and rode as A3, rodename as A20, inhabitants as
 integers. One line for each rode (kelurahan) until SUM.

The program gives a message if the population at SUM differs from the SUM for the rodes.

At the end of each region the sum is read, and checked against the sum of the districts, and finally the total population is read and checked against the sum of the regions.

Example:

The population of Jakarta is divided into 5 regions (central, north, west, south and east Jakarta). Each of these are divided into 7-10 kecamatan, and these again into 5-10 kelurahans, to a total of 260 kelurahans. The table below shows the beginning of a file with aera and population within the kelurahans for central Jakarta.

XAAAxaaaXaaaaaaaaAAAAAffff.ffIIIIIIII

Start

(2(1X,A3),1X,A20,7X,I8)

5,number of regions

8,number of districts (kecamatan)

P 1	1	Gelora	2.59	3764
P 1	2	Bendungan Hilir	1.58	28739
P 1	3	Karet Tengsin	1.53	31007
P 1	4	Petamburan	0.90	33486
P 1	5	Kebon Melati	1.26	49809
P 1	6	Kebon Kacang	0.71	27597
P 1	7	Kampung Bali	0.73	17750
P 1	SUM	Tanah Abang	9.30	192152

P 2	1	Menteng	2.44	30806
P 2	2	Pegangsaan	0.98	23857
P 2	3	Cikini	0.82	13451
P 2	4	Gondangdia	1.46	6769
P 2	5	Kebon Sirih	0.83	15891
P 2	SUM	Menteng	6.53	90774

P 3	1	Kenari	0.91	10936
P 3	2	Paseban	0.71	26283
P 3	3	Kramat	0.71	28147
P 3	4	Kwitang	0.45	17005
P 3	5	Senen	0.82	9196
P 3	6	Bungur	0.63	21022
P 3	SUM	Senen	4.23	112589

P 4	1	Rawa Sari	1.25	25604
P 4	2	Cempaka Putih Timur	2.22	28785
P 4	3	Cempaka Putih Barat	1.22	38108
P 4	SUM	Cempaka Putih	4.69	92497

P 5	1	Johar Baru	1.19	39197
P 5	2	Kampung Rawa	0.30	22846
P 5	3	Galur	0.27	19750
P 5	4	Tanah Tinggi	0.62	41073
P 5	SUM	Johar Baru	2.38	122866

P 6	1	Harapan Mulya	0.53	25631
P 6	2	Cempaka Baru	0.99	36862
P 6	3	Sumur Batu	1.15	24096
P 6	4	Serdang	0.82	32045
P 6	5	Utan Panjang	0.54	29167
P 6	6	Kebon Kosong	1.16	30893
P 6	7	Kemayoran	0.53	22995
P 6	8	Gunung Sahari Selat	1.53	24839
P 6	SUM	Kemayoran	7.25	226528

P 7	1	Pasar Baru	1.69	16770
P 7	2	Gunung Sahari Utara	1.86	21850
P 7	3	Kartini	0.55	25650
P 7	4	Karang Anyar	0.51	29559
P 7	5	Manggu Dua Selatan	1.29	30653
P 7	SUM	Sawah Besar	5.92	124482

P 8	1	Cideng	1.26	20670
P 8	2	Petojo Selatan	1.14	20619
P 8	3	Gambir	2.58	4509
P 8	4	Kebon Kelapa	0.78	12530
P 8	5	Petojo Utara	1.12	19696
P 8	6	Duri Pulo	0.72	34840
P 8	SUM	Gambir	7.60	112864

P99	SUM	Jakarta Pusat	47.90	1074752
-----	-----	---------------	-------	---------

B 8	1	Krukut	0.55	22952
B 8	2	Maphar	0.59	18527
B 8	3	Taman Sari	0.68	18863
B 8	4	Keagungan	0.32	20784
B 8	5	Glodok	0.38	9558
B 8	6	Mangga Besar	0.51	10931
B 8	7	Tangki	0.37	14917
B 8	8	Pinangsia	0.96	13794
B 8	SUM	Taman Sari	4.36	130326

B99	SUM	Jakarta Barat	126.15	1815316
-----	-----	---------------	--------	---------

		DKI JAKARTA	666.26	8222515
--	--	-------------	--------	---------

The output gives the corresponding percentage of each kecamatan:

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 "KILDER" program package license for EMC, Jakarta
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Zone	Rode	District	Pop	%
P 1	1	Gelora	3764	1.96
P 1	2	Bendungan Hilir	28739	14.96
P 1	3	Karet Tengsin	31007	16.14
P 1	4	Petamburan	33486	17.43
P 1	5	Kebon Melati	49809	25.92
P 1	6	Kebon Kacang	27597	14.36
P 1	7	Kampung Bali	17750	9.24

P 1		Tanah Abang	192152	100.00

P 2	1	Menteng	30806	33.94
P 2	2	Pegangsaan	23857	26.28
P 2	3	Cikini	13451	14.82
P 2	4	Gondangdia	6769	7.46
P 2	5	Kebon Sirih	15891	17.51

P 2		Menteng	90774	100.00

P 3	1	Kenari	10936	9.71
P 3	2	Paseban	26283	23.34
P 3	3	Kramat	28147	25.00
P 3	4	Kwitang	17005	15.10
P 3	5	Senen	9196	8.17
P 3	6	Bungur	21022	18.67

P 3		Senen	112589	100.00

P 4	1	Rawa Sari	25604	27.68
P 4	2	Cempaka Putih Timur	28785	31.12
P 4	3	Cempaka Putih Barat	38108	41.20

P 4		Cempaka Putih	92497	100.00

P 5	1	Johar Baru	39197	31.90
P 5	2	Kampung Rawa	22846	18.59
P 5	3	Galur	19750	16.07
P 5	4	Tanah Tinggi	41073	33.43

P 5		Johar Baru	122866	100.00

P 6	1	Harapan Mulya	25631	11.31
P 6	2	Cempaka Baru	36862	16.27
P 6	3	Sumur Batu	24096	10.64
P 6	4	Serdang	32045	14.15
P 6	5	Utan Panjang	29167	12.88
P 6	6	Kebon Kosong	30893	13.64
P 6	7	Kemayoran	22995	10.15
P 6	8	Gunung Sahari Selat	24839	10.97

P 6		Kemayoran	226528	100.00

P 7	1	Pasar Baru	16770	13.47
P 7	2	Gunung Sahari Utara	21850	17.55
P 7	3	Kartini	25650	20.61
P 7	4	Karang Anyar	29559	23.75
P 7	5	Manggu Dua Selatan	30653	24.62

P 7		Sawah Besar	124482	100.00
P 8	1	Cideng	20670	18.31
P 8	2	Petojo Selatan	20619	18.27
P 8	3	Gambir	4509	4.00
P 8	4	Kebon Kelapa	12530	11.10
P 8	5	Petojo Utara	19696	17.45
P 8	6	Duri Pulo	34840	30.87

P 8		Gambir	112864	100.00
		region Jakarta Pusat	1074752	

This percentages should be used in preparing of the DISTFILE.DAT.

17. Program CONV-FIE

In the program package which was prepared for CPCB in India (NILU TR 6/92) it was used a file heading with Compound, Unit, Period and Place. Since then the elements Source and Date has been introduced, and all .FLD files has to be converted to the new structure by CONV-FIE. It is normally run interactive.

Input data to CONV-FIE

KX, KY Grid size, number of points eastwards and northward

OLDFILE, NEWFILE Name of the old and new file (with apostrophes, but **without** .FLD)

SOURCE Source type (with apostrophes)

New fields are written to NEWFILE.FLD, with print-out at NEWFILE.PRN.
DATE is taken as the current date.

18. Program GRP-FIE

In some cases we want to make calculations where we shall multiply different regions of a field with different scale factors, for instance according to the population density. This program makes a field with group indexes for this use. It is normally run interactive.

Input data to GRP-FIE

KX, KY Grid size, number of points eastwards and northward

INFILE,NF Name of the input file (with apostrophes and .FLD), and field number

OUTFILE Name of the output files (with apostrophes). Fields are written to OUTFILE.FLD, with print-out at OUTFILE.PRN

NGR Number of groups (max. 9)

ALIM(I), I=1,NGR Limits for each group

IR IR=I: Integers, IR=R: Reals

Do you want to change component/unit? Y/N

If the answer is Y or y, then:

COMPOUND,UNIT New compound and unit (with apostrophes)

PERIOD,PLACE New period and place (with apostrophes)

The program calculates first the number of squares with the value 0, then the number of squares and the sum for all squares with a value between the different limits.

Example:

In the program DIST-FIE we have calculated the population of TESTAREA to the file POPFILE as shown in figure 2 in the program description.

This will give the following output at TEST-GRP.PRN, together with maps of POPFILE and TEST-GRP:

```
Data is read from file TESTAREA.FLD
Number of grids with value 0                                78
Number of grids between 1 and 24999                      83 Sum= 98112 PERSONS
Number of grids between 25000 and 49999                 49 Sum= 171536 PERSONS
Number of grids between 50000 and 74999                 7 Sum= 42408 PERSONS
Number of grids between 75000 and 99999                 5 Sum= 45007 PERSONS
Number of grids between 100000 and 124999                1 Sum= 10385 PERSONS
Number of grids between 125000 and 149999                0 Sum= 0 PERSONS
Number of grids between 150000 and 157301                1 Sum= 15730 PERSONS
Total= 383180 PERSONS
```

A field with group indexes from 1 to 7 is written to TEST-GRP.FLD

19. Program EXPO-FIE

This program reads concentration fields from a number of source groups together with a population distribution field. In its first phase the sum of the concentration values is calculated, together with a background value. If the concentration in a square is above certain limits, the corresponding population is counted. In the next phase the concentration from each source group is successively increased and reduced by +/- 10% and 25%, and new exposure figures are calculated.

The program is normally run interactive.

Input data to EXPO-FIE

KX, KY, NF	Grid size, number of concentration fields (max. 8)
POPFILE	Population file name (with apostrophes and .FLD)
OUTFILE	Output file name (with apostrophes). The output will be written to OUTFILE.PRN
IPER	IPER=1: Output as persons, 2: Percentage of the total population
BACKGR	Background concentration ($\mu\text{g}/\text{m}^3$)

For NF fields is read:

KFILE, KREC, FACT	File name (with apostrophes and .FLD), record number and scale factor. If the file is the same as previous, enter 'SAME'
ILI, NLIM	ILI= 1: read start value and increments, 2: read values NLIM: number of limits (max. 20)

If ILI=1, then:

LIM, DLIM	Start value LIM and increment DLIM (may be negative)
-----------	--

If ILI=2, then:

CLIM(I), I=1,NLIM	Limit values
-------------------	--------------

Output example from EXPO-FIE

In Kathmandu TSP concentrations were calculated from 7 source groups. To calculate PM_{10} -exposure the values had to be multiplied by different scale factors. The program changes the source type to 'ALL SOURCES', but does not change the compound name from TSP to PM_{10} . This may be done by an editor.

```
Date 1995/03/10 11.56
Background          10.000000
TRAF-TSP.FLD       1          1.000000
RESU-TSP.FLD       1      2.500000E-01
DOM-TSP.FLD        1      5.000000E-01
BRICKTSP.FLD       1      2.500000E-01
HOFF-TSP.FLD       1      2.500000E-01
HIMALPOI.FLD       1      4.200000E-01
HIMAL2.FLD         1      2.500000E-01

MAP OF : PM10          UNIT: UG/M3          SOURCE: ALL SOURCES
PERIOD : Winter average PLACE: KATHMANDU    GRID SIZE: 1000 METER
CREATED: 1995/03/10 10.28

MAXIMUM VALUE IS 1.5028E+02, IN ( 8, 8)
SUM= 1.98872E+04    SCALE FACTOR: 1.0E-01
```


	1	2	3	4	5	6	7	8	9	10	11	12	13	14
J=21	194.	207.	222.	236.	248.	266.	287.	309.	327.	337.	343.	332.	329.	325.
J=20	202.	219.	235.	252.	265.	284.	308.	333.	353.	371.	379.	368.	366.	361.
J=19	210.	230.	250.	268.	287.	305.	330.	364.	395.	421.	431.	418.	409.	399.
J=18	219.	241.	265.	286.	309.	329.	357.	397.	450.	498.	501.	491.	475.	443.
J=17	229.	252.	279.	304.	331.	356.	390.	431.	501.	567.	595.	588.	549.	493.
J=16	238.	268.	296.	322.	352.	387.	427.	469.	544.	629.	687.	676.	633.	551.
J=15	226.	286.	322.	352.	381.	433.	486.	529.	605.	694.	764.	739.	688.	595.
J=14	228.	277.	348.	390.	427.	465.	528.	578.	677.	794.	816.	789.	715.	618.
J=13	249.	301.	357.	452.	501.	521.	534.	583.	682.	805.	855.	782.	699.	615.
J=12	230.	318.	337.	429.	573.	621.	620.	613.	652.	722.	797.	789.	713.	638.
J=11	209.	234.	281.	318.	423.	653.	667.	651.	648.	692.	744.	755.	727.	629.
J=10	197.	217.	248.	282.	338.	462.	703.	733.	699.	669.	729.	780.	750.	668.
J= 9	190.	209.	237.	272.	321.	397.	906.	1275.	985.	658.	696.	857.	852.	794.
J= 8	185.	203.	227.	263.	315.	402.	619.	1503.	1054.	633.	704.	836.	918.	872.
J= 7	180.	196.	213.	231.	238.	263.	365.	377.	500.	422.	535.	759.	870.	922.
J= 6	156.	161.	170.	185.	204.	227.	257.	275.	322.	323.	360.	440.	606.	696.
J= 5	145.	152.	160.	171.	185.	199.	213.	224.	249.	260.	280.	328.	436.	432.
J= 4	139.	143.	149.	157.	167.	177.	185.	191.	203.	219.	234.	263.	296.	346.
J= 3	132.	136.	140.	146.	153.	160.	166.	172.	178.	192.	202.	217.	224.	224.
J= 2	127.	130.	134.	139.	144.	150.	153.	158.	161.	172.	177.	185.	188.	189.
J= 1	124.	127.	129.	132.	137.	140.	144.	147.	150.	157.	161.	162.	164.	166.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

	14	15	16	17	18	19	20	21	22	23	24	25	26	27
J=21	325.	314.	295.	276.	258.	246.	235.	223.	214.	205.	194.	189.	173.	156.
J=20	361.	342.	323.	302.	281.	265.	255.	244.	232.	222.	212.	201.	187.	165.
J=19	399.	375.	355.	335.	309.	290.	271.	260.	248.	236.	228.	218.	202.	175.
J=18	443.	410.	397.	372.	334.	312.	292.	276.	264.	251.	241.	232.	216.	186.
J=17	493.	439.	417.	383.	346.	326.	310.	296.	280.	261.	248.	234.	219.	194.
J=16	551.	482.	424.	391.	368.	348.	332.	320.	300.	279.	258.	236.	214.	197.
J=15	595.	510.	444.	413.	393.	381.	366.	349.	329.	310.	286.	254.	226.	203.
J=14	618.	524.	460.	414.	408.	417.	422.	396.	367.	356.	333.	286.	244.	213.
J=13	615.	541.	462.	440.	437.	457.	514.	514.	448.	436.	441.	363.	273.	226.
J=12	638.	533.	463.	480.	509.	488.	535.	610.	552.	507.	539.	430.	296.	236.
J=11	629.	536.	476.	461.	519.	474.	447.	473.	516.	504.	475.	357.	271.	231.
J=10	668.	565.	497.	469.	418.	382.	355.	353.	406.	473.	390.	302.	247.	218.
J= 9	794.	675.	539.	474.	411.	348.	316.	306.	332.	399.	381.	287.	232.	205.
J= 8	872.	827.	596.	442.	364.	315.	284.	267.	262.	260.	286.	245.	206.	186.
J= 7	922.	786.	568.	391.	327.	289.	262.	242.	230.	223.	212.	204.	187.	172.
J= 6	696.	521.	390.	321.	283.	260.	239.	221.	209.	201.	192.	184.	174.	163.
J= 5	432.	363.	285.	251.	232.	217.	210.	199.	191.	183.	176.	170.	163.	155.
J= 4	346.	290.	242.	221.	204.	189.	177.	169.	165.	162.	162.	158.	153.	147.
J= 3	224.	226.	207.	194.	182.	173.	165.	158.	153.	148.	144.	141.	139.	139.
J= 2	189.	191.	185.	175.	167.	160.	155.	150.	145.	141.	138.	134.	131.	128.
J= 1	166.	167.	166.	162.	157.	152.	147.	143.	139.	136.	132.	130.	127.	125.
	14	15	16	17	18	19	20	21	22	23	24	25	26	27

Limit	Exposure when source TRAFFIC is adjusted				
	SUM	+25%	+10%	-10%	-25%
20.	1009178	1009424	1009178	1009178	1008174
40.	773083	787345	785233	773083	771521
60.	475645	496939	489285	474670	448781
80.	67809	180878	124406	28903	28903
100.	2209	2209	2209	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source RESUSPENSION is adjusted					
Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1009178	1009178	1009178	1008965
40.	773083	787345	776232	773083	773083
60.	475645	494181	489285	474670	466427
80.	67809	133708	117925	55616	28903
100.	2209	2209	2209	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source DOMESTIC is adjusted					
Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1011186	1010395	1005202	1000559
40.	773083	809971	791128	760417	735991
60.	475645	506274	495748	452444	411336
80.	67809	192143	135417	28903	28903
100.	2209	3149	2209	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source BRICK FACTORIES is adjusted					
Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1012568	1010395	1002425	1000277
40.	773083	808207	792865	766162	724528
60.	475645	521268	490852	465874	420796
80.	67809	182830	138994	54492	8983
100.	2209	14295	3149	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source HOFFMAN KILNS is adjusted

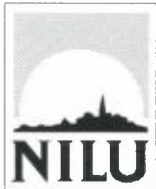
Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1009178	1009178	1009178	1008965
40.	773083	773937	773937	773083	773083
60.	475645	477212	477212	475645	472956
80.	67809	67809	67809	67809	67809
100.	2209	2209	2209	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source HIMAL STACK is adjusted

Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1009424	1009178	1008965	1008293
40.	773083	778247	773083	772568	772568
60.	475645	475645	475645	475645	474670
80.	67809	104635	67809	67809	55616
100.	2209	3149	2209	2209	2209
120.	1476	1476	1476	1476	1476
140.	492	492	492	492	492
160.	0	0	0	0	0
180.	0	0	0	0	0
200.	0	0	0	0	0

Exposure when source HIMAL DIFFUSE is adjusted

Limit	SUM	+25%	+10%	-10%	-25%
20.	1009178	1009424	1009424	1007924	1007555
40.	773083	788751	777040	772568	769705
60.	475645	493610	475645	474301	462850
80.	67809	114839	72994	55616	55370
100.	2209	3395	3149	1476	1476
120.	1476	2209	1476	492	0
140.	492	1476	492	0	0
160.	0	492	492	0	0
180.	0	492	0	0	0
200.	0	0	0	0	0



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ABSTRACT (in Norwegian) I tilknytning til programsystemet KILDER er det laget en rekke hjelpeprogrammer for innlesning, beregning av utslipp og presentasjon av resultater.			

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