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User's Guide for the "Kilder" Supporting Programmes

DRAFT REPORT

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CONTENTS

SUMMARY

This report contains a description of ten different computer programs supporting the PC-version of the KILDER model system which is prepared for CPCB in Delhi, India.One major feature in the system is the file structure 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.

The programs may be divided into two groups: programs for input/output etc. and programs for calculation of emissions from traffic and heating.

The programs are:

READ-FIE	reads a field with values.
INP-FIE	reads values to specified squares for a field.
PRIN-FIE	makes a print-out map of a field.
SUM-FIE	makes a sum of different fields.
CONT-FIE	calculates the sum of the values and the maximum and minimum values for all fields on a file.
DIST-FIE	distributes values for a district to field squares.
CONS-FIE	calculates fields with consumption of 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.

USER'S GUIDE FOR "KILDER" SUPPORTING PROGRAMMES

1 INTRODUCTION

The KILDER dispersion modelling system has been in use at the Norwegian Institute for Air Research (NILU) for about 15 years. The basic units are two programs, POI-KILD and ARE-KILD for calculating long-term ground-level concentrations over an area from point and area sources, respectively. The programs have been transferred into English PC-versions for planning use in CPCB in Delhi, India, and is described in another report (NILU TR xx/92).

The KILDER modelling system is, however, more than two dispersion models. Today there is in use at NILU about 40 different supporting programs mainly written in Norwegian (Gram, 1987), of which 10 are transferred into English PC-versions and described in this report.

One major feature in the system is the file structure 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.

All programs use some standard routines:

INFE for reading and OUTFE for writing of binary unformatted files,

MAP for a display of the data fields. The MAP routine scales automatic the figures to give three ciphers for the maximum value of the field.For a printer with 10 characters/inch and 6 lines/inch this will give a map with

1/2"x1/2" squares. When performing calculations 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). It is then possible to make a copy of the print-out together with the transparent map to make it more easy to see where in the area things are.

The programs may be divided into two groups: programs for input/output etc. of data fields and programs for calculation of emissions from traffic and heating.

2 DATA FIELDS

The main data communication between the different programs is made through files with data fields.

In the data fields the following data are written UNFORMATTED and stored as binary data:

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

COMPOUND = Name of the compound which is calculated (16 characters). This will normally be 'SO2', 'NOX' or 'CO', but may also be variables such as 'INHABITANT', 'HEIGHT' or 'TRAFFIC'.

UNIT = Unit of the values which is in 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 = Calculation period (16 characters). PERIOD may be used as a period for emission data, a data period for meteorological data, or a period for calculations. This may be 'WINTER 1991/92', '1990'.

PLACE = Name of the area (16 characters), 'DELHI', 'OSLO'

KX,KY = Dimensions for the data-field X, integers KY↑ └→ KX

ISIZE = Grid size in meters, integer.

X(KX,KY) = Data-field with values of the real-variable array X in a KX*KY-matrix

In the program system the files with data fields are declared with a file type .FLD, to distinguish them from other files. These files are not readable by the text editor. The formatted output from a program is put on a file with the same file name as the data field, but with file type .PRN. Some of the -KILD and -FIE programs create several different fields which are written to the .FLD file. A .FLD file may thus contain several fields, and the programs have to ask for which field to be read.

3 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 a .FLD-file.

3.1 INPUT DATA TO READ-FIE

KX,KY Dimension of the area, number of grid points easterly and northerly

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

OUTFI Name of the input file (with apostrophes).

The data fields are written binary to the file OUTFI.FLD, whereas the output is written to the file OUTFI.PRN

NFIELD Number of data fields to be read

INT Output of input data: 0=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 Fx.0.

Before each data field is a line with heading:

```
COMPOUND,UNIT,PERIOD,PLACE,ISIZE,FACTOR
        FORMAT (4A16,I8,F10.2)
```

FACTOR is a scaling factor to convert the data at the file to the correct unit

For the data fields:

((X(I,K),I=1,KX),K=KY,1,-1) Data field, read according to the format INFORM, KX values at each line. The northerly line is read first, then south-wards.

3.2 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:

```
PROGRAM\READ-FIE
16,16,                      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:

```
(4X,16F4.0)
SO2 OIL HEATING KG/H          WINTER 85      OSLO              1000     0.1
16    0.  3.  0.  0.  0.  3.  1.  3.  3.  3.  2.  0.  0.  2.  4.  3.
15    3.  3.  4.  5.  3.  4.  9. 11.  8.  3.  2.  0.  1.  7. 11.  4.
14    5.  3.  7. 10.  7. 40. 22. 19. 19.  7.  5. 17. 14. 17. 11.  9.
13    4. 10.  8. 10. 18. 26. 37. 27. 25. 24. 21. 15. 12. 23. 13.  5.
12    5. 13. 10. 11. 20. 50. 31. 35. 19. 29. 15. 23. 12. 10.  3.  0.
11    6.  5. 37. 18. 32. 53. 33. 45. 23. 34. 16. 10.  5.  8.  0.  0.
10    7.  5.  3. 19. 32.125.107. 35. 16. 18. 14. 10.  9.  1.  0.  0.
 9    0.  0.  2.  6.  6. 25. 77. 11. 40. 19.  8. 10. 11.  1.  0.  0.
 8    0.  0.  3.  3.  0.  0.  0.  3.  5.  8. 10.  7. 19.  0.  0.  0.
 7    0.  0.  0.  0.  0.  0.  0.  5.  3.  8.  5.  4. 10.  0.  0.  0.
 6    0.  0.  0.  0.  0.  0.  0.  1.  3.  6. 11.  9. 13.  0.  0.  0.
 5    0.  0.  0.  0.  0.  0.  0.  0.  3.  7. 17. 14.  4.  0.  0.  0.
 4    0.  0.  0.  0.  0.  0.  0.  0.  0.  6.  8.  4.  3.  0.  0.  0.
 3    0.  0.  0.  0.  0.  0.  0.  0.  1.  8.  6.  3.  2.  0.  0.  0.
 2    0.  0.  0.  0.  0.  0.  0.  0.  1.  2.  2.  1.  1.  0.  0.  0.
 1    0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  3.  1.  1.  0.  0.  0.
      1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16
```

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

4 INP-FIE

This is a program with a complex input, but it has proved to be very useful in many cases. The program is normally run as a batch job. Values are given for specified squares or areas of squares. It is possible to read values for 4 fields at the same time. The data are stored binary at a .FLD-file.

4.1 Input data to INP-FIE

KX,KY,NF — Dimension of the area, number of grid points easterly and northerly, and the number of fields (max. 4)

OUTFI — Name of the output file (with apostrophes). The data fields are written binary to the file OUTFI.FLD, whereas the output is written to the file OUTFI.PRN

ISIZE — Grid size in meters

PERIOD,PLACE — Name and place for the data period (with apostrophes)

IFO,IFI

IFO=0 reads only a background
1 reads IX, IY and values
2 reads UTM-coord. and values
3 reads rectangles with values

IFI=1 reads data from terminal/batch file
2 reads data from the file INFILE

If IFI=2 then read:

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

JADD It is possible to add the values (JADD=Y) or use the last values that is given to a square (JADD=N)

For each field to be read, we read:

XB,COMP,JUNIT XB= background value
COMP Name of the compound (with apostrophes)
JUNIT Unit (with apostrophes)

The following data are read from terminal/batch if IFI=1, from INFILE if IFI=2:

If IFO=1, read:

IX,IY,(AX(I),I=1,NF) IX,IY indices of the square
AX the values

Data are read until 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 for the square AX the values

Data are read until 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 right corner (LX,LY) will have the values AX. A rectangle may cover one single square or many squares.

For each rectangle the program asks if we want more rectangles until the answer is N.

When all data are read the program asks:

Do you need to re-scale the data? Y/N.
If the answer is Y, read:

SCALE(I),I=1,NF Scale factors for the data fields

Finally the program asks about the output:

ISC ISC=1 No scaling (the values as they are, best for integer values)
ISC=2 Automatic scaling
ISC=3 Read a scale factor for the output

If ISC=3, read:

CII New output scale factor

4.2 EXAMPLE AND OUTPUT FROM INP-FIE

```
PROGRAM\INP-FIE
16,16,1                    Grid size, one field
'ZONE'                     Output file
1000,                      Grid size
'1991','OSLO'              Period, place
1,2                        IFO,IFI
'ZONE.DAT'                 Input file
Y                          Adds the values
1,'ZONES','NAMELESS'
```

From the file 'ZONE.DAT' the program reads:

```
7,8,1
8,8,1
9,8,1
10.8.1
11,8,1
12,8,1
7,9,1
8,9,2
9,9,3
10,9,2
11,9,1
8,10,1
9,19,2
10,10,1
11,10,1
10,11,1
11,11,1
-1,,,,,,
```

The result at the file ZONE.PRN will be:

```
MAP OF: ZONES   UNIT: NAMELESS   PERIOD: 1991   PLACE: OSLO
MAXIMUM VALUE IS  4.0000E+00, IN ( 9, 9)
SUM= 2.78000E+02        SCALE FACTOR:  1.0E+00
GRID SIZE:  1000 METER
```

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

```
 Data for ZONES       is put on file      ZONE
```

5 PRIN-FIE

5.1 INPUT DATA TO PRIN-FIE

The program is run interactive and will ask self-explaining questions.

KX,KY	Dimension of the area, number of grid points easterly and northerly
INFILE	Name of the input file (with apostrophes and .FLD)
OUTFILE	Name of the output file (with apostrophes and .PRN)
NFIELD	Number of fields to be printed If you do not know how many fields you have, say 0 and you get all.
IFIELD(I),I=1,NFIELD	Numbering of the fields for output
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 more, 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 ' '

5.2 EXAMPLE AND OUTPUT FROM PRIN-FIE

The examples are not included yet.

6 SUM-FIE

In the program SUM-FIE we may add the content of different field files.

6.1 Input data to SUM-FIE

KX,KY,	Dimension of the area, number of grid points easterly and northerly
NFIELD,NCOMP	It is possible to make sum of NFIELD fields, each with NCOMP compounds
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 compound no. 1:

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

BACKGR	Background value for compound no. 1
SUMS,UNIS	SUMS name of sum field (with apostrophes) UNIT unit of the sum, ' ' if it is the same as for the last field.
OUTFILE	Name of the output file (with apostrophes) Output is written to OUTFILE.PRN. If ISF=1 are data fields written binary to OUTFILE.FLD

For the following J-1 compounds we read:

KREC(N),N=1,NFIELD	Record numbers for compound J at the different files
FAK(N),N=1,NFIELD	New scale factors
SUMS,UNIS	SUMS name of sum field (with apostrophes) UNIT unit of the sum, ' ' if it is the same as for the last field.

6.2 EXAMPLE AND OUTPUT FROM SUM-FIE

The examples are not included yet.

7 CONT-FIE

The program gives a start list of the content of a .FLD file.

7.1 INPUT DATA TO CONT-FIE

KX,KY	Grid size
INFILE	File name, with apostrophs and .FLD
OUTFILE	File name, with apostrophs and .PRN or 'TERM'

The program writes sum, max and min.

7.2 EXAMPLE AND OUTPUT FROM CONT-FIE

```
22,18
'EMIS-OIL.FLD'
'EM-O.PRN'
```

The output on file EM-O.PRN will be:

```
Field no.   1, SO2 OIL HEATING   Unit: KG/H       Period: WINTER 85       Place: OSLO
    MAXIMUM VALUE IS  1.2500E+01, IN (10,11)
              SUM= 2.08100E+02

Field no.   2, NOx OIL HEATING   Unit: KG/H AS NO  Period: WINTER 85       Place: OSLO
    MAXIMUM VALUE IS  7.2600E+00, IN (10,11)
              SUM= 1.26620E+02

Field no.   3, CO OIL HEATING    Unit: KG/H       Period: WINTER 85       Place: OSLO
    MAXIMUM VALUE IS  3.9800E+01, IN (12,12)
              SUM= 9.78900E+02

Field no.   4, PART OIL HEATING  Unit: KG/H       Period: WINTER 85       Place: OSLO
    MAXIMUM VALUE IS  4.1900E+00, IN (12,12)
              SUM= 9.64300E+01
```

8 DIST-FIE

8.1 INPUT DATA TO DIST-FIE

Distributes population in districts to squares.

KX,KY — Grid size

DISTRFILE, INFILE — Distribution code file, name and file with values (with apostrophs and .DAT)

OUTFILE — Output file (with apostrophs)

ISIZE — Grid size in meters

XB — Background value

COMPOUND,UNIT, PERIOD,PLACE
all with ' '

UTMX,UTMY — Coord. for lower left corner

NT,JT — NT data sets at INFILE, we want no. JT

From DISTRFILE is nead until end:

```
DIS,NRU,(XRJI), YR(I),FOR(I),I=1,7)
               (2X,A4,I4,7(2F3.0,F4.1))
```

DIS = name of the district (A4).
The district covers NRU squares, each with co-ordinates (XR,YR) and FOR% of the value of the district.

From INFILE is read

```
DIS, (VALUE(J), J=1,NT)                          (2X,A4,4F8.0)
```

The value for district DIS is VALUE(JT)

JAN Rescaling of data? Y/N

If JAN = Y then

SCALE	Scale factor
JAL	JAL = J gives a listing of the data for each square

8.2 EXAMPLE AND OUTPUT FROM DIST-FIE

The example are not included yet.

9 CONS-FIE

The program makes fields with the consumption of oil, coal, wood or other.

9.1 INPUT DATA TO CONS-FIE

KX,KY	Grid size
INFILE	Name of file with consumption figures (with apostrophes and .DAT)
OUTFILE	Output file (with apostrophes)
ISIZE	Grid size
NOIL	Number of oil types (max 8)
OILT	Name of oil types (with apostrophes)

IRU 1 UTM-coord
2 Square-index

UTMK,UTMY 'PERIOD','PLACE'

MED Y all sources included

SCALE Factor to give the input data the unit m^3/year

Which source types (P = point sources, A = area sources) should be included?

HVA P,A or PA

If HVA = P or PA, reading of point source values from INFILE.

FORM Reading format

SOURCE Dummy heading for point sources

If (IRU = 1)

SOURCE,UTK,UTY,NOT,(OIL(J),J=1,NOIL) until END

else

SOURCE,IK,IY,NOT,(OIL(J),J=1,NOIL) until END

If HVA = A, will all points sources be skipped
If (HVA = A or PA), reads all area sources:

FORM Read format

SOURCE Dummy heading for area sources

SOURCE,UTK,UTY,NOT,(OIL(J),J=1,NOIL)

or

SOURCE,IK,IY,NOT,(OIL(J),J=1,NOIL)

ISO — number of zone groups (0-3) for spreading the rest consumption

If (ISO>0)

POPFILE,ZONEFILE — Files with population and zone codes (with apostrophes and .FLD)

Do you want the zone codes added Y/N?

YES — If YES = Y
zone codes are added. This means that
zone 2 includes '1' and '2'
zone 3 includes '1', '2' and '3'

For K=1,ISO

UNALL(L,K),L=1,NOIL
Amount of each oil type that shall be allocated to zone K

ISOF — Zone group where the consumption from sources outside the area shall be allocated

9.2 EXAMPLE AND OUTPUT FROM CONS-FIE

The examples are not included yet.

10 CONS-EMI

The program calculates emission fields from consumption fields.

10.1 INPUT DATA TO CONS-EMI

KX,KY,NCOMP	Grid size, compounds (max 6)
INFILE	File with consumption figures (with apostrophes and .FLD)
INFAK	File with emission factors (with apostrophes and .DAT)
OUTFILE	Output files (with apostrophes)
NOIL	Number of consumption fields/types (max 8)
IUV	IUV=0 Yearly emissions IUV=1 Hourly emissions
PRUN(J),J=1,NOIL	% of the total consumption allocated
PSRAS(J),J=1,NOIL	% of the total consumption is used during the period
ADAY	Number of days in the period

The file INFAK is need until 'START', then:

```
COMPO(K),K=1,COMP    26X,6A 10
                     SO2,NOX,CO,PART---

OLJET(J),DENS(J),(FAK(K,J),K=1,NCOMP)  A10,7F10.2
                  Emission factors for oiltype OLJET(J)
```

10.2 EXAMPLE AND OUTPUT FROM CONS-EMI

The examples are not included yet.

11 TRA-WORK

11.1 INPUT DATA TO TRA-WORK

KX,KY	Grid size
INFILE	Name of input file (with apostrophes and .DAT)
OUTFILE	Output files (with apostrophes)
PERIOD,PLACE	With apostrophes
UTMK,UTMY	Coordinates for lower left corner
ISIZE	Grid size in meters
JAT	Transformation of coordinates? Y/N

If (JAT=Y) then

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

JAD	Distances OK? Y/N	┐ If 'N' read more
JAZ	Zero X OK?	├ coordinates
JAZ	Zero Y OK?	┘

JAD	4 Print out for the roads within a square? Y/N.

If (JAD=Y)

IRUX,IRUY	Indices for the square
IMA	Suppressing of maps Y/N
JAS	Scaling of the traffic data Y/N
SCALE(I),I=1.3	Scale factors

The input file is read until START in column 1-5.
The program reads a dummy line, then

```
ROAD,XPOS1,YPOS1,XPOS2,YPOS2,(TRAFN(I),I=1.3)
                        (A20,2(2F5.2,5X),3F6.0)
```

Road	road name
XPOS	coordinates of the end points
YPOS	coordinates of the road link
TRAFN	yearly mean traffic from light, medium and heavy vehicles

The file is read until END.

11.2 EXAMPLE AND OUTPUT FROM TRA-WORK

The examples are not included yet.

12 TRA-EMIS

12.1 INPUT DATA TO TRA-EMIS

KX,KY,NCOMP	Grid size, number of component
INFILE	Traffic work file (with apostrophes and .FLD)
OUTFILE	Output emission file (with apostrophes)
INFAK	Emission factor file (with apostrophes .DAT)

Emission factors read from INFAK:

First a dummy line, the for NCOMP:
COMP(I),(EMISI,J),J=1.4) compound, factors for LTV, MTV gasoline, MTVdiesel and HTV

Traffic work fields are read from INFILE, multiplied with emission factors and written to OUTFILE.

12.2 EXAMPLE AND OUTPUT FROM TRA-EMIS

The examples are not included yet.

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STIKKORD
Programbeskrivelse | Spredningsberegninger | Modeller

REFERAT
I tilknytning til programsystemet "KILDER" er det laget en rekke hjelpeprogrammer for innlesning, beregning av utslipp og presentasjon av resultater.

TITLE

ABSTRACT
Description of a set of supporting programs for calculating, handling and presentation data in connection to the "KILDER" program system.

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