NILU TR: 8/96

NILU : TR 8/96
REFERENCE : O-94048
DATE : APRIL 1996
ISBN : 82-425-0761-9

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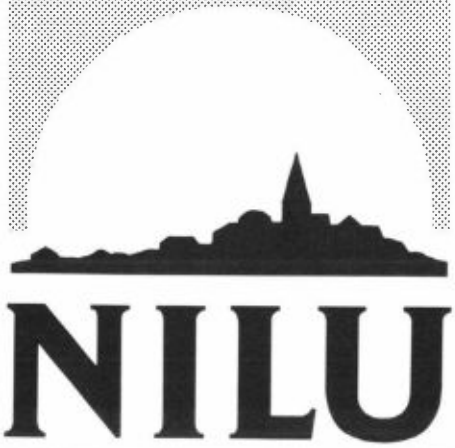
Meteorological programs WINDFREC, STABFREC and METFREC User's Guide

Frederick Gram



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Summary

The KILDER model system is a set of PC-programs for calculating emissions, dispersion and exposure to air pollution from several source groups. The system may be divided into three parts, which are described in separate reports:

- The dispersion models **POI-KILD** and **ARE-KILD**, for calculating long-term concentrations from point and area sources, respectively (NILU TR 5/92);

- **WINDFREC**, **STABFREC** and **METFREC** for analyzing meteorological and air quality data (this report);

- **KILDER supporting** programs for calculating emission and exposure, and for operating with binary data fields (NILU TR 7/95).

This report consists of user's guides for a set of the three computer programs for statistical evaluation of meteorological and air quality data.

- **WINDFREC**

  This program presents standard statistics for wind speed and direction for four wind speed classes and up to 36 wind sectors (wind rose).

- **STABFREC**

  This program presents diurnal distribution in four classes of stability for a stability parameter.

- **METFREC**

  This program presents joint frequency distribution of wind speed, wind direction, stability and air quality for four wind classes, twelve wind sectors and four stability classes for a given period. The output from METFREC is used as input to the dispersion models POI-KILD and ARE-KILD.

All the programs may be run interactive or as a batch job, and the input data are synoptic monthly data files.

KILDER model system:

Meteorological programs WINDFREC, STABFREC and METFREC
User's Guide

1. Introduction

NILU has developed several programs for statistical evaluation of meteorological and air quality data. Three of these are converted to PC-versions and forms a part of the KILDER model system. This report consists of user's guides for the following programs:

- WINDFREC

  This program presents standard statistics for wind speed and direction for four wind speed classes and up to 36 wind sectors (wind rose).

- STABFREC

  This program presents diurnal distribution in four classes of stability for a stability parameter.

- METFREC

  This program presents joint frequency distribution of wind speed, wind direction, stability and air quality for four wind classes, twelve wind sectors and four stability classes for a given period. The output from METFREC is used as input to the dispersion models POI-KILD and ARE-KILD.

The user's guide consists of four parts: a general description of the synoptic data file, and for each program all input variables together with test-examples. The programs are written in FORTRAN for a 386 MS-DOS PC or higher, and needs about 100 kB space.

The programs uses many files, and as we have only 8 characters for the file name, we have to use the same file name for several file types. A synoptic data file shall be a .SYN-file. A file with input data to a program should be a .RUN-file, while the corresponding output should be to a .PRN-file.

2. Synoptic monthly data files

The three programs analyzes meteorological and air quality data. The data are read from a common synoptic data file with one line for each observation set. The file includes stability data, wind data and concentration data. In METFREC synoptic data (one line for each observation set) for 5 (4) variables are read:

1. T upper, Delta T or another stability parameter
2. T lower
3. Wind direction DD (degrees), the wind is blowing from direction DD
4. Wind speed (m/s)
5. Concentration variable (optional)

Data for the first 4 variables must be all present at the file. If they are not used, insert dummy data or put the value -99.0. We may have additional data for up to 8 concentration variables, and we may select from the program which concentration variable we want to study. The observations are normally hourly, but the programs can also read half-hourly data, with two lines for each hour. The data are read unformatted, but it is recommended to have the data in separate columns. Missing or erroneous data are given a code value, -99.0, or other.

The synoptic data file is prepared in an editor or from Microsoft Excel or equivalent. If the data are prepared in or imported to Excel the file should be arranged so that all columns are left justified, with the same number of decimals within each column. The file should be saved as Formatted Text (Space delimited).

A synoptic file shall be of the type .SYN. When identifying a .SYN-file, only 8 characters are available for the file name. It is recommended to use a combination of the place and the month name: 'MAV95APR.SYN', 'JAN-MUK.SYN', 'HUNSEP91.SYN'.

The file may start with an information label which contains information about the data, the stations, the variables etc. The information label ends with a line which begins with 'START' or 'Start'. The program reads then:

ISA 1 all the data are from the same station
     2 data from different stations

If ISA=1, read:

STATION Name of the station (with apostrophes)

If ISA=2, read:

STDELTA, STUPPER, STLOWER, STWIND, STCONC
Names of the different stations (with apostrophes)

Then the program reads 2 dummy lines, which may contain additional information about the data (see example in Figure 1).

```
                    1     2     3     4     5     6     7     8     9     10    11    12
START
1
'MAV'
                  BIT   DEG   deg   m/s   m/s   % R   BIT   ug/m3 ug/m3 ug/m3 ug/m3 ug/m3
 YY  MM DD HH  DT 33- Temp  WD    WS    WG    Hum   DT33- O3    NO    NO2   SO2   POR
1995 04 01 01  508.1   2.0 323.3   4.2   7.7  73.5  507.5 61.69  4.96 14.25  2.65 17.50
1995 04 01 02  509.3   2.2 326.9   4.4   7.5  71.0  508.1 59.70  4.96 14.25  1.33 23.00
1995 04 01 03  508.0   2.2 281.8   5.1   8.4  69.9  507.8 58.71  4.96 14.25  1.33 29.50
1995 04 01 04  508.1   2.2 332.0   4.8   8.1  70.4  507.8 57.71  8.06 14.25  1.33 17.50
1995 04 01 05  507.8   2.2 329.8   4.5   7.1  70.0  507.1 56.72  3.72 13.30  1.33 16.50
1995 04 01 06  508.3   2.2 334.9   4.3   7.1  69.7  507.3 55.72  4.34 13.30  1.33 29.00
1995 04 01 07  508.1   2.1 285.0   3.7   6.0  70.0  507.8 54.73  3.72 13.30  2.65 13.00
1995 04 01 08  508.8   2.1 331.7   3.1   4.8  70.2  507.6 53.73  3.72 14.25  1.33 20.50
1995 04 01 09  509.5   2.2 327.2   2.8   4.8  69.1  508.0 52.74  3.72 14.25  1.33 35.00
1995 04 01 10  509.8   2.2 262.4   2.6   4.7  68.6  508.8 50.75  9.30 19.00  2.65 23.50
1995 04 01 11  509.8   2.3 304.1   3.2   4.1  66.9  508.3 45.77  9.92 22.80  2.65 36.50
1995 04 01 12  507.1   2.3 301.5   2.7   3.6  67.4  507.3 45.77  9.92 21.85  2.65 28.00
1995 04 01 13  504.6   2.5 281.6   3.2   4.5  65.4  506.1 41.79  9.30 22.80  2.65 34.00
1995 04 01 14  503.0   3.1 284.0   3.0   4.3  60.3  505.8 38.81 11.78 26.60  1.33 30.00
1995 04 01 15  -99.0 -99.0 -99.0 -99.0 -99.0 -99.0 -99.0 30.85 22.94 38.00  5.30 28.50
1995 04 01 16  500.1   2.5 250.8   4.0   5.0  62.9  505.3 29.85 35.96 41.80 11.93 45.50
1995 04 01 17  502.5   2.5 260.3   4.4   5.8  64.6  505.6 36.82 29.14 38.00 10.60 32.00
1995 04 01 18  503.1   2.3 292.5   2.7   3.9  68.3  506.5 41.79 24.18 31.35  7.95 38.00
1995 04 01 19  500.5   2.1 266.1   2.5   3.9  71.9  506.0 29.85 37.82 44.65  5.30 49.50
1995 04 01 20  501.0   2.2 266.5   4.6   6.6  74.9  505.5 30.85 42.78 43.70  6.63 44.50
1995 04 01 21  500.0   2.6 259.1   4.7   6.6  70.8  504.5 29.85 60.14 51.30  3.98 57.00
1995 04 01 22  495.6   3.2 245.4   3.8   5.3  68.5  502.1 34.83 37.20 46.55  5.30 45.00
1995 04 01 23  494.6   4.4 263.2   5.1   7.7  61.5  503.8 37.81 32.86 39.90  2.65 58.00
1995 04 01 24  494.6   5.0 266.6   6.4   9.4  57.4  503.5 44.78 27.28 36.10  3.98 29.00
1995 04 02 01  498.0   5.4 262.1   6.3   9.0  55.0  504.3 45.77 29.76 33.25  7.95 43.50
1995 04 02 02  499.0   5.4 270.9   5.7   8.5  56.5  504.0 55.72 26.04 29.45  7.95 33.50
1995 04 02 03  499.5   5.5 272.9   5.8   8.2  58.4  504.5 63.68 18.60 34.20  5.30 29.50
1995 04 02 04  499.0   5.3 273.0   5.6   8.1  60.3  505.0 63.68 21.70 29.45  6.63 30.00
1995 04 02 03  503.5   5.2 274.7   5.5   7.8  65.4  506.1 60.70 21.08 31.35  7.95 31.50
1995 04 02 04  503.0   5.7 262.8   5.4   8.1  63.6  505.0 62.69 20.46 32.30  7.95 31.00
```

Figure 1: Synoptic data-file for the KILDER system.

Now follows the data, 4 meteorological variables and up to 8 other variables:
YY, MM, DD, HH, (Y(I), I=1,12)

One line for each observation, NDAY*24 lines for hourly values, NDAY*48 lines for half-hour values. If there are too many or too few lines, the programs will give error messages and stop.

3. Program WINDFREC

General description of the program.

This program presents standard statistics for wind direction and wind speed for four wind speed classes and up to 36 wind sectors (wind rose). The following data are input for the program:

- Wind direction (variable 3), degrees
- Wind speed (variable 4), m/s.

The program WINDFREC gives the following results:

Diurnal variation of wind directions
Distribution of wind speed with wind directions
Average and maximum wind speed for each wind sector
- Average wind speed for selected wind speed classes.

The program dialogue and results.

The program WINDFREC is an interactive program with a dialogue to the users terminal, but the input may also be read from a batch file. The questions are written in Courier, the answers written in **bold.**The results are written to a user specified result-file. The example below is a typical input sequence for the program. The program uses all the wind data available, but in the example the print-out is restricted to every 3. hour.

PROGRAM WINDFREC

The program will always begin to ask where it will find the input data:

```
Enter the name of input file or 'TERM'.............: 'TERM'
```

If the answer is 'TERM', the rest of the data is read from the terminal (interactive), otherwise the data are read from the input file, which must be a .RUN-file.

```
Enter the name of the result-file (with apostrophes
 and .PRN) ....................................: 'WIND4-6.PRN'
Enter number of months..........................: 3
Wind distribution for each I. hour, enter I.....: 3
Enter hour for the first distribution...........: 1
```

If the number of months are more than 1, the following question is given:

```
Do you want a separate output for each month? Y/N).: N
```

Further:

```
Enter number of wind sectors (12, 16, 32).......: 12
```

A wind direction=0 may be interpreted in three ways:

1. Data not available
2. Calm
3. Wind direction = 360

```
Enter 1, 2 or 3.................................: 3
Enter lower wind speed for not-calm.............: 0.3
Enter number of limits for windspeed classes
 (Max 6)........................................: 5
Enter 5 limits for windspeed classes............: 1,2,4,6,8
Enter number of observations per hour (1 or 2).....: 2
Enter code for missing data (-99.0 or other).....: -99.0
```

For each month is read:

```
Enter number of days in the month.............. .: 30
Enter name of input file.(with apostrophes
and .SYN)..................................... ..:'METK0495.SYN'
```

Figure 2 shows a batch-file 'WIND4-6.RUN', and Figure 3 shows the corresponding output from 'WIND4-6.PRN'.

```
'WIND4-6.PRN'          , Output
3                      , Months
3                      , Wind rose every 3. hour
1                      , First rose at 01
N                      , Total output
0.3                    , Calm limit
5                      , 5 wind groups
1,2,4,6,8              , Limits
12                     , Sectors
3                      , 0 is north
2                      , 2 data per hour (30 min.)
-99.0                  , Missing code
30                     , Days in April
'METK0495.SYN'         , Data file
31                     , Days in May
'METK0595.SYN'         , Data file
30                     , Days in June
'METK0695.SYN'         , Data file
```

Figure 2: Batch-file WIND4-6.RUN

With regard to Figure 3, there also exists wind roses for the hours 02, 03, 05, 06 etc., but we have only asked for print-out for 01, 04, 07 etc.

Station : MAV
Period : 95. 4. 1 - 95. 6.30
Wind direction 0 = 360 deg
Calm: .3 m/s or less

DIURNAL VARIATION OF WIND DIRECTIONS (%)

*) Wind-direction	Hours 01	04	07	10	13	16	19	22	Wind-rose
30	2.3	1.7	3.9	.0	2.3	2.8	5.7	5.6	3.2
60	10.3	7.3	4.5	6.4	4.6	4.0	7.4	7.3	5.7
90	25.7	19.1	15.1	3.5	7.5	7.9	9.7	14.7	13.6
120	8.6	11.8	15.6	12.8	9.8	6.8	6.3	11.9	10.1
150	4.0	2.2	3.4	11.6	15.5	12.4	6.9	4.5	7.1
180	4.6	5.6	5.6	7.0	8.0	15.3	6.3	2.8	6.3
210	4.0	1.7	4.5	9.9	8.0	9.6	2.3	2.8	5.5
240	7.4	14.6	14.0	16.9	12.6	10.2	14.9	10.2	13.3
270	14.3	16.3	18.4	23.8	23.0	20.9	21.1	16.4	19.1
300	4.6	6.7	4.5	5.8	3.4	4.5	10.3	4.0	5.9
330	5.1	2.8	2.2	2.3	5.2	5.1	5.1	2.3	3.9
360	.6	.0	.0	.0	.0	.0	1.1	.6	.2
Calm	8.6	10.1	8.4	.0	.0	.6	2.9	16.9	6.2
Nobs	(175)	(178)	(179)	(172)	(174)	(177)	(175)	(177)	(4209)
Average wind m/s	1.9	2.2	2.6	3.5	3.8	3.4	2.4	1.9	2.7

DISTRIBUTION OF WINDSPEED WITH WIND DIRECTIONS (%)

Class I : Wind speed .3 - 1.0 m/s
Class II : Wind speed 1.1 - 2.0 m/s
Class II : Wind speed 2.1 - 4.0 m/s
Class IV : Wind speed 4.1 - 6.0 m/s
Class V : Wind speed 6.1 - 8.0 m/s
Class VI : Wind speed > 8.0 m/s

*) Wind-direction	Classes I	II	III	IV	V	VI	Total	Nobs	Average wind	Max
30	.2	.3	1.3	1.0	.2	.1	3.2	(135)	4.0	27.0
60	.6	1.1	2.5	1.0	.3	.1	5.7	(238)	3.1	10.2
90	2.9	4.1	5.2	1.1	.2	.1	13.6	(572)	2.3	17.4
120	2.3	3.7	2.9	.9	.2	.2	10.1	(424)	2.2	18.7
150	1.2	2.6	3.0	.3	.0	.0	7.1	(299)	2.2	7.2
180	.8	1.9	2.5	.7	.3	.1	6.3	(265)	2.8	18.6
210	1.1	1.4	2.2	.5	.3	.0	5.5	(233)	2.6	8.4
240	1.5	3.3	5.5	2.0	.8	.1	13.3	(561)	3.0	15.4
270	1.3	2.9	8.4	4.4	1.8	.3	19.1	(802)	3.6	34.0
300	.4	1.4	3.1	.8	.1	.2	5.9	(249)	3.1	20.9
330	.1	.4	1.9	1.2	.3	.1	3.9	(164)	3.9	9.4
360	.0	.0	.0	.0	.0	.1	.2	(7)	6.0	9.5
Calm							6.2	(260)		
Total	12.4	23.0	38.5	14.0	4.4	1.4	100.0	(4209)		
Average wind m/s	.7	1.6	3.0	4.9	6.8	10.9			2.7	

*) This number indicates central direction of sector

Figure 3: Output-file WIND4-6.PRN

In the print-out are the values rounded to the nearest 0.1 %. For the hourly wind rose in the first part of Figure 3 one observation will represent 100/175 = 0.57 %. In the total wind rose and in the second part of the figure one observation will

represent 100/4209 = 0.024 observations. In the example a value of 0.1 % corresponds to between 3 and 6 observations. This also gives that the sum of the percentages in a group will not always add up to the Total value. For the sector 150 the maximum wind speed is reported as 7.2 m/s, while the value for wind speed class 6-8 m/s is .0.

4. Program STABFREC

General description of the program.

This program presents diurnal distribution in four classes of stability for a stability parameter: Unstable, Neutral, Light stable and Stable. The following data are input for the program:

- Temperature difference ΔT in degrees or bits (variable 1)
- Temperature difference ΔT as $T_{upper} - T_{lower}$ (variable 1-variable 2)

The stability may also be given from an external stability classification. If the stability is grouped as Pasquill classes A, B...F, these should be changed into 1-6, with the limits 3, 4 and 5. In the KILDER programs, the unstable classes A-C are combined to an unstable class. Such a stability class should be read as variable 1.

The program STABFREC gives the following results:

- Diurnal distribution of four selected stability classes.

The program dialogue and results.

The program STABFREC is an interactive program with a dialogue to the users terminal, but the input may also be read from a batch file. The questions are written in `Courier`, the answers written in **bold.** The results are written to a user specified result-file. The example below is a typical input sequence for the program. The number of variables will vary with the data. Instead of using the temperature difference as a stability parameter you may use another variable, with other limits for the stability classes.

PROGRAM STABFREC

The program will always begin to ask where it will find the input data:

```
Enter the name of input file or 'TERM'.............: 'TERM'
```

If the answer is 'TERM', the rest of the data is read from the terminal (interactive), otherwise the data are read from the input file, which ought be a .RUN-file.

```
Enter the name of the result-file (with apostrophes
 and .PRN)                                        : 'STAB4-6.PRN'
Enter number of months.............................: 3
```

If the number of months are more than 1, the following question is given:

```
Do you want a separate output for each month? (Y/N): Y
```

Stability can be represented in five ways:

1. Temperature difference directly from the file
2. Temperature difference: $100*(T_{upper}-T_{lower})$/Height difference
3. Temperature difference: $(T_{upper}-T_{lower})$
4. Bits
5. Stability class

```
Select option.....................................: 4
```

For option 2 the program will ask:

```
Enter height difference (m) between the upper and
lower  level for the temperature measurements.....: 65.
```

Further:

```
Enter 3 limits for the stability classes..........: 491,512,533
Enter number of observations per hour (1 or 2)....: 2
Enter code for missing data (-99.0 or other)......: -99.0
```

For each month is read:

```
Enter number of days in the month.................: 30
Enter name of input file.(with apostrophes
and .SYN).....................................: 'METK0495.SYN'
```

Figure 4 shows a batch-file 'STAB4-6.RUN', and Figure 5 shows the corresponding output from 'STAB4-6.PRN'.

```
'STAB4-6.PRN'    , Output-file
3                , Months
N                , Output for the whole period
4                , Stability from bits
491,512,533      , Stability limits
2                , Obs. Per hour
-99.0            , Code for missing data
30               , Days in April
'METK0495.SYN'   , Data-file
31               , Days in May
'METK0595.SYN'   , Data-file
30               , Days in June
'METK0695.SYN'   , Data-file
```

Figure 4: Batch-file STAB4-6.RUN

```
*********************************************************
*                                                       *
*      Norwegian Institute for Air Research (NILU)      *
*                                                       *
*            P R O G R A M  S T A B F R E C             *
*                                                       *
* Program STABFREC needs following INPUT-data:          *
* - Temperature in two heights, Delta T or DT-bits      *
*                                                       *
* The program calculates the diurnal variation of       *
* stability (%)                                         *
*                                                       *
*             ** RUN 1996/01/17 15.52 **                *
*********************************************************


Stability   : MAV
Parameter   : Temperature difference (DT)
Unit        : Bits
Period      : 95.04.01 - 95.06.30


        DIURNAL VARIATION OF STABILITY (%)

Class   I: Unstable             DT <491.0 Bits
Class  II: Neutral      491.0 < DT <512.0 Bits
Class III: Light stable 512.0 < DT <533.0 Bits
Class  IV: Stable       533.0 < DT        Bits


                        Classes
      Hour        I      II     III      IV
        1        .0    46.3    40.6    13.1
        2        .0    43.4    42.9    13.7
        3        .0    46.2    38.2    15.6
        4        .0    39.3    41.0    19.7
        5        .0    51.7    34.1    14.2
        6        .0    73.4    18.1     8.5
        7       1.7    90.5     6.1     1.7
        8       7.9    91.6      .6      .0
        9      23.9    76.1      .0      .0
       10      42.4    57.6      .0      .0
       11      52.8    47.2      .0      .0
       12      44.1    55.9      .0      .0
       13      44.8    55.2      .0      .0
       14      33.1    66.9      .0      .0
       15      29.1    70.9      .0      .0
       16      20.9    79.1      .0      .0
       17      11.5    88.5      .0      .0
       18       5.2    93.6     1.2      .0
       19        .6    89.1     9.1     1.1
       20        .6    61.5    32.2     5.7
       21        .0    49.1    39.4    11.4
       22        .0    44.1    39.0    16.9
       23        .0    46.6    44.3     9.1
       24        .0    45.9    41.3    12.8

      Total   13.3    62.9    17.8     6.0

      Number of obs.: 4209
      Missing obs.  :  159
```

Figure 5: Output-file STAB4-6.PRN

5. Program METFREC

General description of the program.

This program presents joint frequency distribution of wind speed, wind direction, stability and air quality for four wind classes, twelve wind sectors and four stability classes for a given period. The output from METFREC is used as input to the dispersion models POI-KILD and ARE-KILD. The program also calculates average values for a concentration variable in the same 4x4x12 groups. The following data are input for the program:

- Stability parameter (variable 1 (and 2))
- Wind direction (variable 3)
- Wind speed (variable 4)
- Concentration parameter (optionally variable 5, see later).

The stability parameter and its limits should be the same as in STABFREC.

The results from are METFREC given in two parts:

The first part presents a joint frequency distribution matrix with the occurrence in percent within four classes of wind speed and stability and 12, 16 or 36 wind direction sectors. The values of the line "Total" gives the occurrence in percent of each stability class in each wind class for all wind directions. The values in the column "Rose" gives the occurrence in percent of winds blowing from this sector for all classes of wind speed and stability. If the program is run with 12 sectors, the frequency distribution matrix may be written to a special file which may be prepared as a meteorological input file to the dispersion models POI-KILD and ARE-KILD.

The second part of the program presents in the same way average and maximum values of concentrations or other variables, sorted into boxes of different meteorological conditions related to the wind/stability classification given in the first part. The fifth variable may be a SO_2-concentration, but can also be other variables as turbulence or mixing height.

The program dialogue and results.

The program METFREC is an interactive program with a dialogue to the users terminal, but the input may also be read from a batch file. The questions are written in `Courier`, the answers written in **bold.**The results are written to a user specified result-file. The example below is a typical input sequence for the program. The number of variables will vary with the data. Instead of using the temperature difference as a stability parameter you may use another variable, with other limits for the stability classes.

PROGRAM METFREC

The program will always begin to ask where it will find the input data:

```
Enter the name of input file or 'TERM'.............: 'TERM'
```

If the answer is 'TERM', the rest of the data is read from the terminal (interactive), otherwise the data are read from the input file, which ought be a .RUN-file.

```
Enter the name of the result-file (with apostrophes
 and .PRN)                                        : 'MET-4-6.PRN'
Do you want a separate output-file for frequency
 distribution? (Y/N)...............................: Y
```

If the answer is Y, then:

```
Enter the name of the output-file for frequency
 distribution (with apostrophes and .MET)..........: 'MET-4-6.MET'
```

Further:

```
Enter number of months............................: 3
```

If the number of months are more than 1, the following question is given:

```
Do you want a separate output for each month? (Y/N): Y

Enter number of wind sectors (12, 16, 32).........: 12
```

A wind direction=0 may be interpreted in three ways:

1. Data not available
2. Calm
3. Wind direction = 360

```
Enter 1, 2 or 3...................................: 3
```

- Stability can be represented in five ways:
- Temperature difference directly from the file
- Temperature difference: $100*(T_{upper}-T_{lower})$/Height difference
- Temperature difference: $(T_{upper}-T_{lower})$
- Bits
- Stability class

```
Select option.....................................: 4
Enter 3 limits for the stability classes..........: 491,512,533
Enter 3 limits for windspeed classes..............: 2,4,6
Enter number of hours per day.....................: 24
```

If we want separate daytime and nighttime matrixes, the number will be different from 24, and the following question is given:

```
Enter hours to be included:.......................:
                                  7,8,9,10,11,12,13,14,15,16,16,17
```

Further:

```
Reading of concentration data (variable 5)? (Y/N)..: Y
```

If the answer is Y, then:

```
Enter compound and unit (with apostrophes), number
of decimals (0, 1 or 2), and the column on the data
file.....: 'SO2','ug/m3',1,11
```

Further:

```
Enter number of observations per hour (1 or 2).....: 2
Enter code for missing data (-99.0 or other).......: -99.0
```

For each month is read:

```
Enter number of days in the month..... .: 30
Enter name of input file.(with apostrophes
and .SYN)..... ..:'METK0495.SYN'
```

Figure 6 shows a batch-file 'MET-4-6.RUN', and Figures 7 and 8 shows the corresponding output from 'MET-4-6.PRN' and 'MET-4-6.MET'.

```
'MET-4-6.PRN'              , Output-file
Y                          , Met-file
'MET-4-6.MET'              , Met-file
3                          , Months
N                          , Not monthly output
4                          , Stability from bits
3                          , 0 is north
12                         , Sectors
2,4,6                      , Wind groups
491,512,533                , Bit limits
.3                         , Calm limit
24                         , Hours per day
2                          , Obs. per hour
-99.0                      , Missing code
Y                          , Concentration variable
'SO2','ug/m3',1,11         , Compound, unit, decimals, place
30                         , Days in April
'METK0495.SYN'             , Data file
31                         , Days in May
'METK0595.SYN'             , Data file
30                         , Days in June
'METK0695.SYN'             , Data file
```

Figure 6: Batch-file MET-4-6.RUN

```
************************************************************
*                                                          *
*              P R O G R A M   M E T F R E C               *
*                                                          *
* The program calculates a frequency distribution in percent *
* as a function of wind direction, 4 stability classes and 4 *
* wind speed classes.                                      *
*                                                          *
*                    ** RUN 1996/01/29 14.47 **            *
************************************************************

    Stability : MAV       - BITS
    Wind      : MAV
    Period    : 95.04.01. - 95.06.30.
    Unit      : Percent

JOINT FREQUENCY DISTRIBUTION OF STABILITY, WIND SPEED AND WIND DIRECTION

Class   I: Unstable             DT <491.0 Bits
                                  Class  II: Neutral      491.0 < DT <512.0 Bits
                                  Class III: Light stable 512.0 < DT <533.0 Bits
                                  Class  IV: Stable       533.0 < DT        Bits

                                  Calm: U less or equal  .3 m/s

                .0-  2.0 m/s        2.0-  4.0 m/s        4.0-  6.0 m/s        over 6.0 m/s
    Wind-
  direction    I   II  III   IV     I   II  III   IV     I   II  III   IV     I   II  III   IV   Rose
-------------------------------------------------------------------------------------------------------
         30  .00  .39  .02  .10   .27  .90  .02  .00   .15  .83  .07  .00   .02  .32  .02  .00   3.12
         60  .05  .68  .34  .68   .29 1.64  .15  .34   .07  .83  .07  .00   .02  .27  .02  .00   5.47
         90  .05 2.49 3.71  .81   .39 3.27  .71  .85   .22  .81  .02  .00   .02  .20  .05  .00  13.60
        120  .24 3.54 1.68  .17   .81 2.05  .12  .02   .29  .56  .02  .00   .00  .24  .10  .00   9.86
        150  .66 2.59  .51  .02  1.32 1.51  .15  .00   .22  .10  .00  .00   .00  .02  .02  .00   7.13
        180  .22 2.07  .37  .10  1.03 1.46  .07  .00   .20  .46  .02  .00   .00  .39  .00  .00   6.39
        210  .10 1.68  .61  .05   .68 1.49  .07  .00   .24  .32  .00  .00   .22  .10  .00  .00   5.57
        240  .32 2.95 1.12  .37  1.12 3.47  .66  .27   .44 1.39  .12  .05   .20  .71  .00  .02  13.20
        270  .12 2.83  .85  .34  1.10 5.96 1.15  .29  1.24 2.81  .32  .12   .12 1.90  .12  .00  19.28
        300  .05 1.15  .46  .12   .07 2.93  .12  .02   .10  .66  .05  .00   .02  .27  .00  .00   6.03
        330  .00  .34  .12  .02   .17 1.64  .05  .00   .12 1.07  .00  .00   .02  .39  .00  .00   3.95
        360  .00  .02  .00  .00   .00  .05  .00  .00   .00  .00  .00  .00   .00  .07  .02  .00    .17
       Calm  .02 1.34 3.71 1.15                                                                  6.22
-------------------------------------------------------------------------------------------------------
      Total 1.83 22.09 13.52 3.93  7.25 26.36 3.27 1.81  3.30 9.84  .71  .17   .66 4.88  .37  .02 100.00

Occurrence        41.4 %              38.7 %              14.0 %              5.9 %       100.0 %
Wind speed      1.28 m/s*             3.0 m/s             4.9 m/s             7.8 m/s     2.93 m/s*
*: Calm not included

                                  Frequency of occurrence of the stability classes

                  Class  I          Class  II          Class III          Class  IV

Occurrence        13.0 %              63.2 %              17.9 %              5.9 %       100.0 %
```

Figure 7: Output-file MET-4-6.PRN.

MEAN CONCENTRATION OF SO2 FOR STABILITY, WIND SPEED, WIND DIRECTION

Variable : SO2
Unit : ug/m3
Period : 95.04.01. - 95.06.30.

	.0- 2.0 m/s				2.0- 4.0 m/s				4.0- 6.0 m/s				over 6.0 m/s				
Wind-direction	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	Rose
30	-	12.8	21.2	34.5	21.1	13.9	6.6	-	33.6	14.1	10.6	-	19.9	14.1	13.3	-	16.0
60	31.1	27.8	17.5	36.3	21.8	16.8	7.1	10.8	22.5	16.6	18.1	-	11.9	15.5	15.9	-	20.4
90	33.1	24.4	18.6	27.5	18.6	27.1	22.1	15.4	17.7	14.1	4.0	-	15.9	12.3	18.6	-	21.9
120	44.7	28.8	23.1	9.8	83.8	48.8	23.1	33.1	30.8	40.6	5.3	-	-	13.6	20.5	-	36.7
150	66.2	32.2	26.9	27.8	63.8	27.3	15.2	-	188.2	18.2	-	-	-	.0	15.9	-	43.9
180	37.8	32.0	19.3	29.8	23.6	22.7	27.4	-	21.2	23.2	21.2	-	-	11.3	-	-	25.6
210	33.1	27.1	22.5	13.9	21.3	19.4	6.2	-	19.9	19.3	-	-	13.8	25.5	-	-	22.2
240	42.3	22.1	18.4	8.2	25.6	15.9	11.5	14.1	15.4	17.1	21.2	37.1	2.2	6.4	-	4.0	18.0
270	24.1	22.4	17.3	14.0	30.2	19.8	9.6	16.3	22.7	12.2	8.3	8.8	21.2	6.8	4.2	-	17.4
300	24.5	18.6	17.4	13.3	35.8	18.1	15.6	5.3	25.2	17.4	19.9	-	19.9	9.6	-	-	17.9
330	-	19.4	15.1	25.2	25.2	19.3	10.6	-	23.9	7.7	-	-	1.3	4.6	-	-	14.8
360	-	5.3	-	-	-	11.9	-	-	-	-	-	-	-	19.4	15.9	-	14.8
Calm	21.2	15.6	20.3	12.4													17.8
Average	47.7	25.3	19.9	20.5	38.4	22.4	13.9	14.6	33.5	15.9	12.8	16.9	11.7	9.1	13.4	4.0	22.7
Concentr.		24.1				24.3				19.9				9.6			

Average concentration in selected stability classes

	Class I	Class II	Class III	Class IV
Concentr.	37.1	21.4	18.4	18.5

Figure 7: cont.

MAX. CONCENTRATION OF SO2 FOR STABILITY, WIND SPEED, WIND DIRECTION

Variable : SO2
Unit : ug/m3
Period : 95.04.01. - 95.06.30.

Wind-direction	.0- 2.0 m/s				2.0- 4.0 m/s				4.0- 6.0 m/s				over 6.0 m/s				Rose
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
30	-	29.	21.	99.	32.	54.	7.	-	111.	30.	20.	-	20.	24.	13.	-	
60	32.	225.	36.	156.	50.	233.	28.	70.	34.	30.	25.	-	12.	29.	16.	-	
90	33.	122.	62.	178.	56.	243.	56.	129.	24.	32.	4.	-	16.	24.	20.	-	
120	237.	196.	74.	20.	618.	310.	38.	33.	64.	217.	5.	-	-	32.	30.	-	
150	319.	341.	97.	28.	727.	174.	24.	-	311.	29.	-	-	-	0.	16.	-	
180	93.	343.	25.	69.	72.	119.	37.	-	27.	194.	21.	-	-	29.	-	-	
210	46.	213.	76.	20.	29.	42.	8.	-	37.	41.	-	-	23.	69.	-	-	
240	111.	115.	50.	27.	80.	212.	28.	49.	38.	93.	33.	40.	4.	28.	-	4.	
270	28.	106.	29.	29.	118.	272.	28.	25.	38.	41.	24.	17.	32.	61.	20.	-	
300	29.	64.	27.	21.	53.	93.	23.	5.	38.	32.	20.	-	20.	37.	-	-	
330	-	30.	29.	25.	29.	311.	20.	-	29.	29.	-	-	1.	23.	-	-	
360	-	5.	-	-	-	24.	-	-	-	-	-	-	-	20.	16.	-	
Calm	21.	42.	101.	60.													

Number of obs.: 4097
Missing obs. : 271

Figure 7: cont.

```
Period     : 95.04.01. - 95.06.30.
 1.3, 3.0, 4.9, 7.8,



  30  .00  .39  .02  .10  .27  .90  .02  .00  .15  .83  .07  .00  .02  .32  .02  .00
  60  .05  .68  .34  .68  .29 1.64  .15  .34  .07  .83  .07  .00  .02  .27  .02  .00
  90  .05 2.49 3.71  .81  .39 3.27  .71  .85  .22  .81  .02  .00  .02  .20  .05  .00
 120  .24 3.54 1.68  .17  .81 2.05  .12  .02  .29  .56  .02  .00  .00  .24  .10  .00
 150  .66 2.59  .51  .02 1.32 1.51  .15  .00  .22  .10  .00  .00  .00  .02  .02  .00
 180  .22 2.07  .37  .10 1.03 1.46  .07  .00  .20  .46  .02  .00  .00  .39  .00  .00
 210  .10 1.68  .61  .05  .68 1.49  .07  .00  .24  .32  .00  .00  .22  .10  .00  .00
 240  .32 2.95 1.12  .37 1.12 3.47  .66  .27  .44 1.39  .12  .05  .20  .71  .00  .02
 270  .12 2.83  .85  .34 1.10 5.96 1.15  .29 1.24 2.81  .32  .12  .12 1.90  .12  .00
 300  .05 1.15  .46  .12  .07 2.93  .12  .02  .10  .66  .05  .00  .02  .27  .00  .00
 330  .00  .34  .12  .02  .17 1.64  .05  .00  .12 1.07  .00  .00  .02  .39  .00  .00
 360  .00  .02  .00  .00  .00  .05  .00  .00  .00  .00  .00  .00  .00  .07  .02  .00
      .02 1.34 3.71 1.15                 Calm
```

Figure 8: Output-file MET-4-6.MET

In the examples above the input and output files were given the same "family name" XXX-4-6.RUN and XXX-4-6.PRN, where XXX was WIND, STAB and MET, respectively, and -4-6 was to tell that the period was April-June. When we shall use the file MET-4-6.MET as input to the dispersion models POI-KILD and ARE-KILD, it is renamed to MAV-4-6.MET, to tell that the data was from the station MAV. Some other data should also be added to the file, as shown in Figure 9.

```
APR-JUN-95              , Period
MAV PECS                , Place
20.                     , Tmid
1.3, 3.0, 4.9, 7.8      , Wind speed
10.                     , Height of wind measurements
0.3                     , Starting velocity for wind sensor
Y                       , Standard wind profiles
Y                       , Standard mixing height
  30  .00  .39  .02  .10  .27  .90  .02  .00  .15  .83  .07  .00  .02  .32  .02  .00
  60  .05  .68  .34  .68  .29 1.64  .15  .34  .07  .83  .07  .00  .02  .27  .02  .00
  90  .05 2.49 3.71  .81  .39 3.27  .71  .85  .22  .81  .02  .00  .02  .20  .05  .00
 120  .24 3.54 1.68  .17  .81 2.05  .12  .02  .29  .56  .02  .00  .00  .24  .10  .00
 150  .66 2.59  .51  .02 1.32 1.51  .15  .00  .22  .10  .00  .00  .00  .02  .02  .00
 180  .22 2.07  .37  .10 1.03 1.46  .07  .00  .20  .46  .02  .00  .00  .39  .00  .00
 210  .10 1.68  .61  .05  .68 1.49  .07  .00  .24  .32  .00  .00  .22  .10  .00  .00
 240  .32 2.95 1.12  .37 1.12 3.47  .66  .27  .44 1.39  .12  .05  .20  .71  .00  .02
 270  .12 2.83  .85  .34 1.10 5.96 1.15  .29 1.24 2.81  .32  .12  .12 1.90  .12  .00
 300  .05 1.15  .46  .12  .07 2.93  .12  .02  .10  .66  .05  .00  .02  .27  .00  .00
 330  .00  .34  .12  .02  .17 1.64  .05  .00  .12 1.07  .00  .00  .02  .39  .00  .00
 360  .00  .02  .00  .00  .00  .05  .00  .00  .00  .00  .00  .00  .00  .07  .02  .00
      .02 1.34 3.71 1.15                 , Calm
```

Figure 9: Output-file MAV-4-6.MET

6. References

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Norsk institutt for luftforskning (NILU)
P.O. Box 100, N-2007 Kjeller - Norway

REPORT SERIES	REPORT NO. TR 8/96	ISBN-82-425-0761-9	
TECHNICAL REPORT			
DATE	SIGN.	NO. OF PAGES	PRICE
22 April 1996	Arne Semb	20	NOK 30,-

TITLE	PROJECT LEADER
KILDER model system:	Frederick Gram
Meteorological programs WINDFREC, STABFREC and METFREC User's Guide	NILU PROJECT NO. O-94048
AUTHOR(S) Frederick Gram	CLASSIFICATION * A
	CONTRACT REF.

REPORT PREPARED FOR:
Norwegian Institute for Air Research
P.O. Box 100
2007 KJELLER, NOWAY

ABSTRACT
The report describes three programs in the KILDER system, for analysis of meteorological data.

NORWEGIAN TITLE Modellsystemet KILDER; Meteorologiprogrammene WINDFREC, STABFREC og METFREC. Brukerbeskrivelse

KEYWORDS		
Meteorologi	Statistikk	Brukerbeskrivelse

ABSTRACT (in Norwegian)
Rapporten beskriver tre programmer i KILDER-systemet, til analyse av meteorologiske data.

* *Classification*
- *A Unclassified (can be ordered from NILU)*
- *B Restricted distribution*
- *C Classified (not to be distributed)*