KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT

WETENSCHAPPELIJK RAPPORT

SCIENTIFIC REPORT

W.R. 82 - 7

W.H. Slob

Climatological values of solar irradiation on the horizontal and several inclined surfaces at De Bilt

De Bilt, 1982

Publikatienummer: K.N.M.I. W.R. 82-7 (F.M.)

Koninklijk Nederlands Meteorologisch Instituut,
Fysisch Meteorologisch Onderzoek,
Postbus 201,
3730 AE De Bilt,
Nederland.

U.D.C.: 551.501.721 :
551.521.1 :
551.582 (492)

Climatological values of solar irradiation on the horizontal and several inclined surfaces at De Bilt.

W.H. Slob

Abstract

Climatological values of the direct and the diffuse solar irradiation on the horizontal surface at De Bilt are calculated.
A data set of about 2½ years on 11 different orientations in Cabauw is used to relate the diffuse solar irradiation on the orientations to the diffuse solar irradiation on the horizontal surface.
These relations were used together with the climatological diffuse solar irradiation on the horizontal surface and sunshine climatology to calculate monthly climatological diffuse irradiations on these orientations. Monthly climatological values of the direct irradiation on each orientation were calculated assuming an even distribution of the sunshine over the day and a constant Linke turbidity factor for each month during sunshine. The groundreflected irradiation on the orientations was calculated for an albedo of 0.2. Tables show halfmonthly climatological values for the global, the direct, the diffuse and the groundreflected daily irradiation on the following orientations at De Bilt:
horizontal, east 90°, south 90°, west 90°, north 90°, east 45°, south-east 45°, south 45°, south-west 45°, west 45°, south 22,5° and south 67,5°.

Climatology of solar irradiance on inclined surfaces IV.

Part III: Climatological values of solar irradiation on the horizontal and several inclined surfaces at De Bilt.

1) Introduction.

2) Mean values of global and direct irradiation on the horizontal surface as a function of relative sunshine duration S/So for each month of the year.

3) Climatology of the sunshine.

4) Calculation of climatological values of the global, the direct and the diffuse irradiation on the horizontal surface.

5) Representativity of the regressian equations (1) derived for De Bilt at other stations.

6) Calculation of the climatological irradiation values for eleven inclined surfaces.
   a) The direct irradiation
   b) The diffuse irradiation
   c) The ground-reflected irradiation
   d) The global irradiation on an inclined surface.

7) Conclusion.

8) References.

1. Introduction

This is one of the final reports of the research work carried out by the Royal Dutch Meteorological Institute (KNMI) under contract No. ESF-006-80 NL (B) for the Commission of the European Communities (DG XII) and for the Dutch Solar Energy Programme under project No. 4.341, job No. 3.1.4. and 3.1.5..

The work has been done in close cooperation with the Institute of Applied Physics TNO-TH (TPD) which, being a subcontractor was responsible for measurements, data handling, presenting of the solar radiation data and comparison of calculation models.

This research work is part of the CEC - Solar Energy - Programme

Project F,

action 4.1; solar radiation data aquisition,

action 4.2; special measurements,

action 3.2; evaluation of irradiation on tilted planes,

action 3.3; statistical analysis of radiation data.

The main aim of this experimental research work was to collect reliable radiation data on inclined surfaces in order to validate and improve the calculation methods which are used to predict the system performance of solar energy installations.

The complete final reporting consists of three separate reports. These are;

Part I Measurements

Part II Validation of calculations models

Part III Climatological values of solar irradiation on the horizontal and several inclined surfaces at De Bilt.

This report describes the results of Part III:

The calculation of climatological values of solar irradiation on the horizontal and several inclined surfaces at De Bilt. Climatological diffuse and direct irradiation values were calculated for the horizontal surface at De Bilt. These values were used to calculate climatological values of global irradiation on the following orientation: east 90°, south 90°, west 90°, north 90°, east 45°, south east 45°, south 45°, south west 45°, west 45°, south 22,5° and south 67,5°.

The measurements in Cabauw were used to derive experimental equations which relate the daily diffuse irradiation on the orientations and

the daily diffuse on the horizontal surface.
These equations were used, together with climatological sunshine data and the climatological irradiation values on the horizontal surface to calculate climatological diffuse irradiation values on the different orientations.
Climatological values of the direct irradiation are calculated assuming a constant monthly value of the Linke Turbidity factor and an even distribution of sunshine during the day. For the groundreflected irradiation an albedo of 0.2 as adapted.
The climatological values of the global irradiation on the 11 orientations and of each of the 3 components namely the direct, the diffuse and the groundreflected are listed in a table.

2. Mean values of global and direct irradiation on the horizontal surface as a function of relative sunshine duration S/S_o for each month of the year.

At De Bilt we have about ten years' hourly data of global and direct irradiation measured with a pyranometer and a pyrheliometer. The diffuse irradiation is calculated by subtracting the direct irradiation on the horizontal surface from the global irradiation on the horizontal surface.

These daily data were assigned to:

a) the 12 months of the year,

b) 11 classes of sunshine duration S/S_o
(0, 0-0.1, 0.1-0.2, ..., 0.9-1.00).

The mean irradiation values in each class of relative sunshine duration were calculated for each month and plotted as a function of S/S_o. Fig. 1 and 2 give examples of these plots for the months of January and July. For each month we calculated the best fit of a quadratic function of S/S_o for the global, the direct and the diffuse irradiation with the least mean square method for the classes unequal to zero according to the following equations:

$$
\begin{aligned}
&\text{for } S/S_o > 0 \rightarrow G_M(S/S_o) = g_1+g_2 \cdot S/S_o + g_3 \cdot (S/S_o)^2 && \text{global irradiation}\\
&\text{for } S/S_o = 0 \rightarrow G_M(0) = g_o\\
&\text{for } S/S_o > 0 \rightarrow I_M(S/S_o) = i_1+i_2\ S/S_o + i_3 \cdot (S/S_o)^2 && \text{direct irradiation} \qquad (1)\\
&\text{for } S/S_o = 0 \rightarrow I_M(0) = i_o\\
&\text{for } S/S_o > 0 \rightarrow D_M(S/S_o) = d_1+d_2\ S/S_o + d_3 \cdot (S/S_o)^2 && \text{diffuse irradiation}\\
&\text{for } S/S_o = 0 \rightarrow D_M(0) = d_o
\end{aligned}
$$

Because $G_M(S/S_o) = I_M(S/S_o) + D_M(S/S_o)$ only a part of these equations are independent.

The correlation coefficients for the regression equation were of the order of 0.99.

The class zero, the totally overcast skies, was calculated seperately because the diffuse irradiation and as a consequence also the global irradiation show a "jump" at the zero point, which is difficult to describe in a smooth curve. The explanation for the "jump" is, that we can have totally overcast skies with very thin clouds and overcast skies with heavy clouds with a corresponding difference in the

diffuse irradiation.

When we extrapolate the curve for the relative sunshine duration greater than zero to zero we get irradiation values which correspond to thin clouds only, while the mean irradiation value corresponding to an average overcast sky is appreciably lower.

Table I shows the monthly average value of the direct, the diffuse and the global irradiation at De Bilt as a function of season and daily relative sunshine duration as derived from about 8 years measurements and the equation (1).

S = 0 gives the average value for overcast skies.

S = +0 gives the extrapolation to zero of the quadratic equation.

The advantage of a quadratic regression over a linear regression here is a much better fit for the direct and the diffuse component.

As a consequence the global irradiation is also described with a quadratic function.

3. Climatology of the sunshine

From eq. (1) we found the direct, the diffuse and the global irradiation on the horizontal surface as a function of relative sunshine duration. For the calculation of climatological values on the horizontal surface we need now the occurrence probability in each class of sunshine for each month.

In our case we determined these probabilities from the cumulative frequency curve based on 30 years of sunshine duration (1930-1960). In table 2 these probabilities are given for each month and each of the 11 classes of sunshine for the 5 main radiation stations: De Bilt, Den Helder, Eelde, Vlissingen and Beek.

The probabilities for month M are $P_M(0)$, $P_M(1)$, ..., $P_{M(10)}$ for the successive classes of relative sunshine duration 0, 0-0.1, ..., 0.9-1.0.

The probabilities will differ a little over the country. In the "Klimaatatlas van Nederland" [1] we can see that lines of equal average sunshine duration are more or less parallel to the coast. Essentially, these probabilities can be calculated for every station with a long set of sunshine data.

4. Calculation of climatological values of the global, the direct and the diffuse irradiation on the horizontal surface.

Combining the regresseion equations from chapter 2 with the sunshine probabilities from chapter 3, we can calculate climatological values of the global, the direct and the diffuse irradiation on the horizontal surface with:

$$\bar{G}_M = \sum_{n=1}^{10} P_M(n) \{g_1 + g_2 S_n + g_3 S_n^2\} + P_M(0) \times g_0$$

$$\bar{I}_M = \sum_{n=1}^{10} P_M(n) \{i_1 + i_2 S_n + i_3 S_n^2\} + P_M(0) \times i_0 \qquad (2)$$

$$\bar{D}_M = \sum_{n=1}^{10} P_M(n) \{d_1 + d_2 S_n + d_3 S_n^2\} + P_M(0) \times d_0$$

S_n is the mid point of relative sunshine class n.
Thus $S_1 = 0.05$, ... $S_{10} = 0.95$.

The results of these calculations are given in table 4 under the column GLOBG, DIRG and DIFG.
These values are representative for the period 1930-1960 because the relative sunshine probabilities are from this period.
To get the long term monthly averages of the global and the direct irradiations as good as possible we used the following procedure. First we calculated from the available measurements the linear relationship with sunshine duration for each month. Then we calculated from the 80 years of sunshine duration measurements (1900-1980) the average sunshine duration for each month. And this average sunshine duration based on 80 years of measurements for a particular month which can deviate from the average sunshine duration for the same month during the measuring period is used in the linear relationship to calculate the longterm average.
This procedure has the advantage that it corrects the values if the average sunshine duration in the measuring period deviates from the long term average sunshine duration. We used this procedure to

calculate long term averages for the global irradiation (20 years of measurements) and the direct irradiation (about 10 years of measurements) on the horizontal surface at De Bilt. The diffuse irradiation is calculated from the difference between the global and the direct irradiation.

Using Fourier analyses we made a smooth interpolation between the monthly long term averages.

Fig. 3 shows the results and in table 4 the half monthly values are given in the columns GLOBH, DIRH and DIFH. These values are used for the calculations of climatological values on the tilted planes of different orientations.

The GLOBG, DIRG, DIFG values are not interpolated and give only the monthly averages. Around the 15th of each month the values of the two should give approximately the same result. Differences are due to the different calculation methods and the differences in sunshine duration from 1900-1980 and 1930-1960.

Differences for the global irradiations are in the order of 5% in winter and 3% in summer. For the direct component the differences are in the order of 10% in winter and 5% in summer. The values indicate approximately the accuracy of the values given in table 4.

5. Representativity of the regression equations (1) derived for De Bilt at other stations.

Only at De Bilt measurements of the direct component are available and this makes it impossible to check the direct and the diffuse component for the other stations.

The sum of these two components, the global irradiation, is measured for about 16 years at the main radiation stations Den Helder, Eelde, Vlissingen and Beek and this opens the possibility to check the equation (1) for the global irradiation at these stations. For each of these stations the sunshine data as given in table 2 were calculated from the cumulative frequency data of sunshine duration (1930-1960). The monthly mean of sunshine duration was calculated for each station and each month according to these data. The monthly average irradiation for each station was calculated with the equation 2. This value calculated from sunshine data only we call the calculated average. The measured monthly average irradiation was calculated too, but this average is based on both sunshine data and measurements at the stations. For each station and each month a linear relation was derived from the 16 years measurements. The relation describes the global irradiation as a linear function of sunshine duration. The average sunshine duration for that month and that station were calculated from table 2 and this value was used in the linear relation to calculate the measured average irradiation. Now we have two average irradiations based on the same set of sunshine data for each station. The measured value is the expected average value at the station and the calculated value is the value we could expect at De Bilt with the same set of relative sunshine data. The ratio of measured and calculated average irradiation shows the differences between the station and De Bilt when we eliminate the influence of relative sunshine duration. The remaining effects are differences in the extra terrestrial irradiation and differences in the atmosphere (turbidity, thickness of the average cloud layer and so on).

Table 3 shows the ratio of the measured and calculated average irradiation (first value) and the ratio of the extra terrestrial irradiation at the main stations and the extra terrestrial irradiation at De Bilt (second value). Table 3A shows the extra

terrestrial irradiations at the main stations and the ratio of the extra terrestrial at the station and the extra terrestrial at De Bilt.

In summer the differences in extra terrestrial irradiations over the country are small, but in winter there are differences of about 10% with respect to De Bilt.

If we compare the ratios in table 3 we find differences in the order of 1 or 2% up to about 10 to 15% due to differences in the atmospheric conditions.

All stations seem to get more radiation than De Bilt in the same sunshine conditions. In summer the differences between the 2 inland stations Beek and De Bilt are small, but the stations Vlissingen, Den Helder and Eelde, which are more or less along the coastline seem to get about 5% more than we expected at De Bilt in the same conditions. In winter the coast stations and the station Beek (the most southern station) show about 10% more than we expected at De Bilt. The first ratio in Table 3 can be used as a correction factor which must be applied in the equations (1) to get the right value of the global irradiation at that station. Of course the correction factor for the direct and the diffuse component in the equations may be different from the factor for the global but as long as we have no measurements of these components the most reasonable assumption is to take the same factor for these components too.

6. Calculation of the climatological irradiation values for eleven inclined surfaces

The global irradiation on an inclined surface is the sum of three components, namely:

a) the direct irradiation on the surface I_s,

b) the diffuse irradiation on the surface D_s,

c) the ground-reflected irradiation on the surface R_s.

Each of these components is calculated separately.

a) The direct irradiation

We know the climatological direct irradiation on the horizontal surface $\overline{I}_M$ for month M, and we want to calculate the climatological value of the direct irradiation on the inclined surface S, $\overline{I}_{MS}$, for month M.

We assume the following relation:

$$\overline{I}_{MS} = f_{MS} \cdot \overline{I}_M \qquad (3)$$

f_{MS} is a multiplication factor for the surface S and the month M. If we assume that the sunshine on the average is evenly distributed over the day (this can be wrong for one day, but is rather realistic for averages over periods of 10 days or longer) and if we assume further that during sunshine over the period the Linke turbidity T is constant, then it is possible to calculate f_{MS}. Under these assumptions f_{MS} is the ratio of the direct irradiation on the tilted surface and the direct irradiation on the horizontal surface for a totaly clear day with a constant Linke turbidity factor T.

Now we could determine f_{MS} for any tilted surface if we know the date, the geographical position and the Linke turbidity factor T. To determine the average monthly turbidity factor we used the regression equation (1) described in chapter 2 for the direct radiation.

For each month M and relative sunshine durations $S_1 = 0.05$, $S_2 = 0.15$ .....$S_{10} = 0.95$ we calculated

$$\frac{I_M(S_n)}{S_n} = \frac{i_1 + i_2 S_n + i_3 S_n^2}{S_n}$$

$I_M(S_n)$ is the average direct irradiation on the horizontal surface when the relative sunshine duration is S_n. $\frac{I_M(S_n)}{S_n}$ represents the direct irradiation for a totally sunny day with the same average direct irradiance during sunshine.
Now we calculated for the 15th of that month at De Bilt the direct irradiation as a function of the Linke turbidity T for a totally clear day.
The value of T where the direct irradiation is equal to $\frac{I_M(S_n)}{S_n}$ we call $T_M(S_n)$ and the average Linke turbidity factor is calculated with

$$T_M = \sum_{n=1}^{10} T_M(S_n) \times P_M(n).$$

$P_M(n)$ is the sunshine probability as defined in chapter 3 at De Bilt. Fig. 4 shows the result of this calculation for De Bilt. The curve corresponds fairly well with the curve Dr. Kasten derived for Hamburg [2].
We found average T-values around 3 for the winter months and values of about 6 in the summer. These T values are used for the calculation of table 5, which gives f_{MS} as a function of different orientations, different inclination angles and the average Linke turbidity factor. From these tables we can obtain the value of f_{MS} (T_M), and the direct irradiation is calculated with eq. (3).
Comparison of measured and calculated values of f_{MS} for the monthly values measured at Cabauw showed differences of a few per cent.
In table 4 the climatological value of the direct component DIRS on the inclined surface is calculated by multiplying f_{MS} with DIRH the climatological value of the direct irradiation on the horizontal surface at De Bilt.

b) The diffuse irradiation

If we assume an isotropic sky, the diffuse irradiation of the inclined surface S with inclination angle α can be written as:

$$D_S = D_H \left(\cos \frac{\alpha}{2}\right)^2 \qquad (4)$$

The problem, however, is that an isotropic sky does not exist. From the measurements at Cabauw (April 1979 - October 1981) on the eleven different orientations a factor f_{DS} was calculated every day for each orientation S with

$$D_S = f_{DS} \cdot D_H \cdot \left(\cos \frac{\alpha_s}{2}\right)^2 \qquad (5)$$

D_S = the measured diffuse irradiation on the inclined surface S.
($D_S = G_S - I_S$).

D_H = the measured diffuse irradiation on the horizontal surface.
($D_H = G_H - I_H$).

α_s = the inclination angle of surface S.

The values of f_{DS} were plotted as a function of S/S_o each month for each of the eleven orientations. Fig. 5A, 5B, 5C as an example shows f_{DS} as a function of relative sunshine duration for each orientation in Nov. 1980. The f_{DS} (M,0.) values were plotted at $S/S_o = -0.17$. A linear regression fits the data very well, and f_{DS} could be written as:

$$f_{DS}(M,S/S_o) = a_{MS} + \frac{b_{MS}\,(S/S_o + 0.17)}{1.17} \quad \text{for } S/S_o > 0 \qquad (6)$$

$$f_{DS}(M,0) = a_{MS} \quad \text{for } S/S_o = 0.$$

The regression coefficients were determined from about two years of measurements. So for each month and each orientation we had about 60 values of f_{DS}.
The "jump" in f_{DS} for $S/S_o = 0$ can be explained in a similar way as the "jump" in the diffuse irradiation for $S/S_o = 0$.
The values of a_{MS} and $(a_{MS} + b_{MS})$ were plotted as a function of season for each orientation. Fig. 6 shows the values for south 45°. As expected the values of a_{MS} were independent of season and only $(a_{MS} + b_{MS})$ showed an annual variation. For the calculations in Table 4 we used the average value of a_{MS} and a best fit value for

($a_{MS}+b_{MS}$). The best fit curve was supposed to give the same value for days with the same maximum altitude of the sun and it was calculated with a least mean square method.

If we now combine the regression equations given in chapter 2, the sunshine probabilities as discussed in chapter 3, and equation (6), we can calculate the climatological value $\overline{D}_{MS}$ for month M and surface S:

$$\overline{D}_{MS} = (\cos \frac{\alpha_s}{2})^2 \times [\sum_{n=1}^{10} P_M(n) \{d_1 + d_2 S_n + d_3 S_n^2\} \times f_{DS}(M,S_n) + P_M(0) \times d_o \times f_{DS}(M,0)] \quad (7)$$

The eleven surfaces for which we have regression coefficients are:
east 90°, south 90°, west 90°, north 90°,
east 45°, south-east 45°, south 45°, south-west 45°,
west 45°, south 67,5° and south 22,5°.

In table 4 the ratio of $\overline{D}_{MS}$ and $(\cos \frac{\alpha_s}{2})^2 \times$ DIFG is given under the column FDIF which shows the average value of f_{DS} for climatological conditions.
The climatological value of the diffuse DIFS is then calculated with

$$DIFS = \overline{D}_{MS} \times \frac{DIFH}{DIFG}$$

DIFH is the climatological value of the diffuse irradiation on the horizontal surface.

c) The ground-reflected irradiation

If we assume diffuse reflection from the ground and a constant albedo ρ, the average climatological ground-reflected irradiation on the surface S with inclination angle α in the month M can be written as:

$$\overline{R}_{MS} = \rho \, \overline{G}_M (\sin \frac{\alpha}{2})^2 \quad (8)$$

In our claculation we have taken $\rho = 0.2$, a value generally observed for grass surfaces. For $\overline{G}_M$ we took GLOBH.
Table 4 shows the results of the calculation for the different orientations under the column REFS.

d) The global irradiation on an inclined surface

The global irradiation is the sum of the direct, the diffuse and the reflected component.
Table 4 shows the expected climatological values at De Bilt for an albedo of 0.20 under the column GLOBS. Fig. 7 and 8 show graphs for some of these orientations. In table 4 the ratio of the climatological values of the global on the inclined and the global on the horizontal surface are listed under the column RATIO.
Fig. 9, 10 and 11 show graphs of this ratio. In the graphs the diffuse was calculated for each orientation on which has been measured in Cabauw. The observed a_{MS} and b_{MS} for each month see eq. (6) were used in the calculation.
In table 4 the value of A is the average value of the a_{MS} values found for each month and a best fit curve was drawn through the monthly values of $(a_{MS} + b_{MS})$. Table 4 also assumes symmetry around the south orientations for the diffuse component as well as for the direct component. In the graphs symmetry is only assumed for the direct component.
Generally west orientations show a little bit higher values of the diffuse component than east orientation especially in winter but the asymmetry in diffuse irradiation seems to be a small effect which causes differences of the order of 5% in the global irradiation and these values are of the order of the expected accuracy.
The asymmetry in the direct component has not been investigated yet, but from the measurements which show symmetry within a few percent this asymmetry seems to be unimportant for Cabauw and probably for the whole country. This seems surprising because some types of weather occur preferently in the morning (fog, low stratus) and others occur preferently in the afternoon (developing convective clouds). With respect to radiation these effects seems to balance more or less against each other and the total effect is symmetry within a few percent. It may be that the effects along the coast in

summer are a little bit larger.

7. Conclusion

From a relatively short data set regression equations can be derived as a function of relative sunshine duration. These regressions functions in combination with a regional small correction factor can be used to calculate climatological values for the irradiation on the horizontal surface and several inclined surfaces from sunshine data only.

8. References

[1] Klimaat atlas van Nederland.
Koninklijk Nederlands Meteorologisch Instituut.
Staatsuitgeverij, Den Haag 1972.

[2] F. Kasten.
Parameterization of radiation fluxes as function of solar elevation, cloudiness and turbidity.
Contractors Meeting Project F, Brussels 1/2 april 1981.
Deutscher Wetterdienst.

Figure and table captions.

Fig. 1 Average global, direct and diffuse irradiation at De Bilt as a function of relative sunshine duration in January.

Fig. 2 Average global, direct and diffuse irradiation at De Bilt as a function of relative sunshine duration in July.

Fig. 3 Annual variation of daily climatological irradiations at the horizontal surface at De Bilt.

Fig. 4 Annual variation of the average Linke Turbidity factor calculated for De Bilt, compared with Hamburg [2].

Fig. 5 Measured values of the diffuse multiplication factor f_{DS} plotted as a function of relative sunshine duration for several orientations in the month Nov. 1980.

Fig. 6 Monthlty values of diffuse regression coefficients a_{MS} and $(a_{MS} + b_{MS})$ for the south 45° orientations as derived from the measurements in Cabauw.

Fig. 7 Annual variation of daily climatological irradiation at north 90° and south 45° at De Bilt.

Fig. 8 Annual variation of daily climatological irradiation at east 90° and south 90° at De Bilt.

Fig. 9 Annual variation of the ratio of the average global irradiation on several south orientations and the average irradiation on the horizontal surface expressed as a percentage.

Fig. 10 Annual variation of the ratio of the average global irradiation at several vertical surfaces and the average global irradiation on the horizontal surface expressed as a percentage.

Fig. 11 Annual variation of the ratio of the average global irradiations at several orientations with an inclination angle of 45° and the average global irradiation on the horizontal surface expressed as a percentage.

Table 1. Average values of the global, direct and diffuse irradiation on the horizontal surface at De Bilt as a function of relative sunshine duration and the month of the year.

Table 2. Occurrence probability for the 11 classes of relative sunshine duration expressed as a percentage for the 5 main radiation stations (1930-1960).

Table 3. The first value shows the ratio of the average of the global irradiation derived from a specific regression for the station and the value of the global irradiation for the station derived from the regression for De Bilt. The second value is the ratio of the extraterrestrial at the station and the extra terrestrial at De Bilt.

Table 3A (The table shows) the annual variation of the extra terrestrial irradiation on the horizontal surface for the 5 main radiation stations and the ratio of these extra terrestrial irradiations on the stations and the extra terrestrial irradiation of De Bilt.

Table 4. (This table shows) climatological values of the global, direct and groundreflected irradiations on the horizontal and several inclined surfaces, as a function of the date. The ratio of the average irradiation on the orientation and the average irradiation on the horizontal is listed too.

Table 5. Multiplication fator of the direct irradiation on the horizontal surface as a function of date (half monthly values), inclination angle of the surface (15°, 30°, 45°, 60°, 75°, 90°) and azimuth of the inclined surface (0° is south, -90° is east, +90° is west, 180° is north)

Fig 1

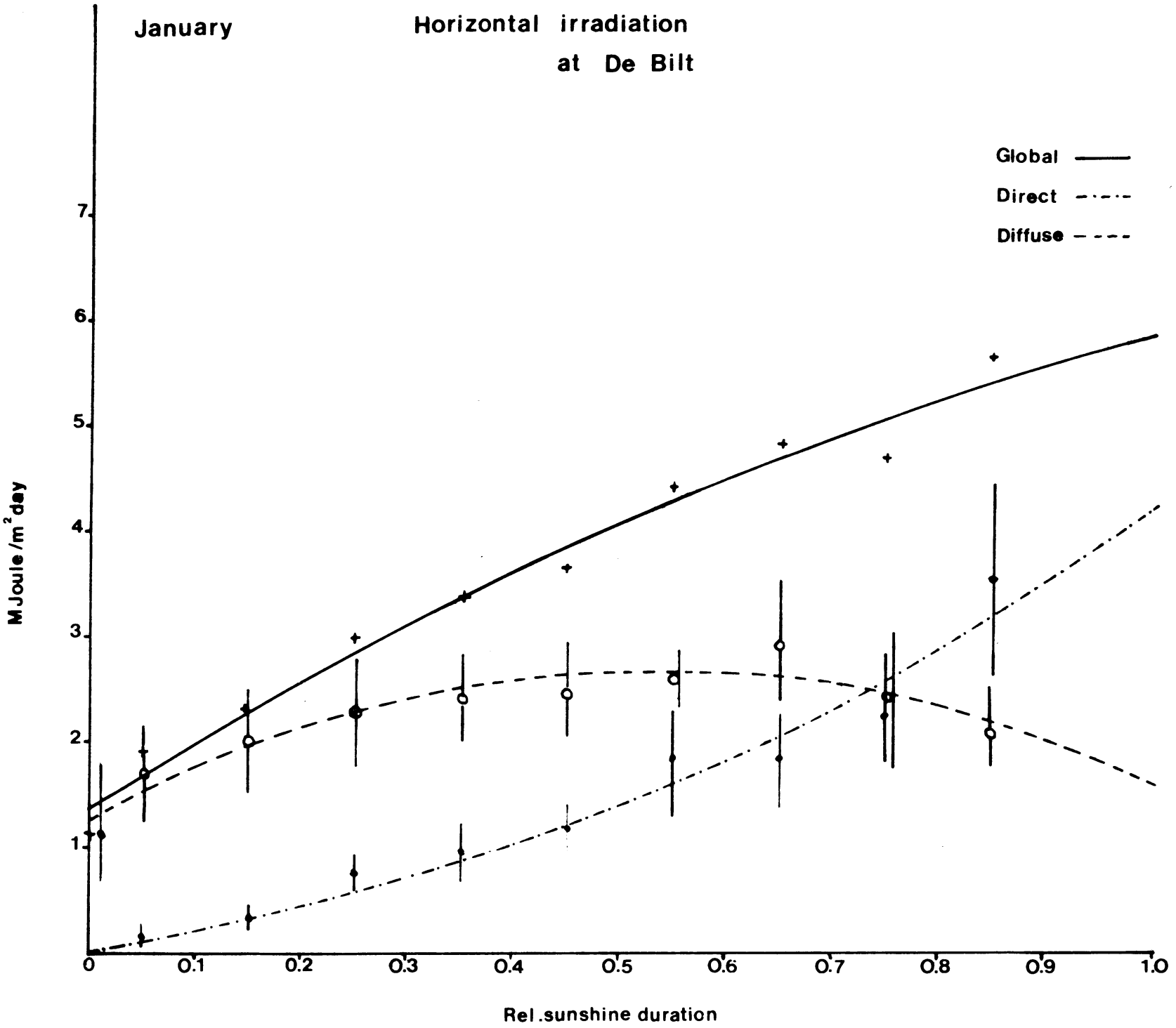

January
Horizontal irradiation
at De Bilt
Global
Direct
Diffuse
MJoule /m² day
7
6
5
4
3
2
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Rel.sunshine duration

Fig 2

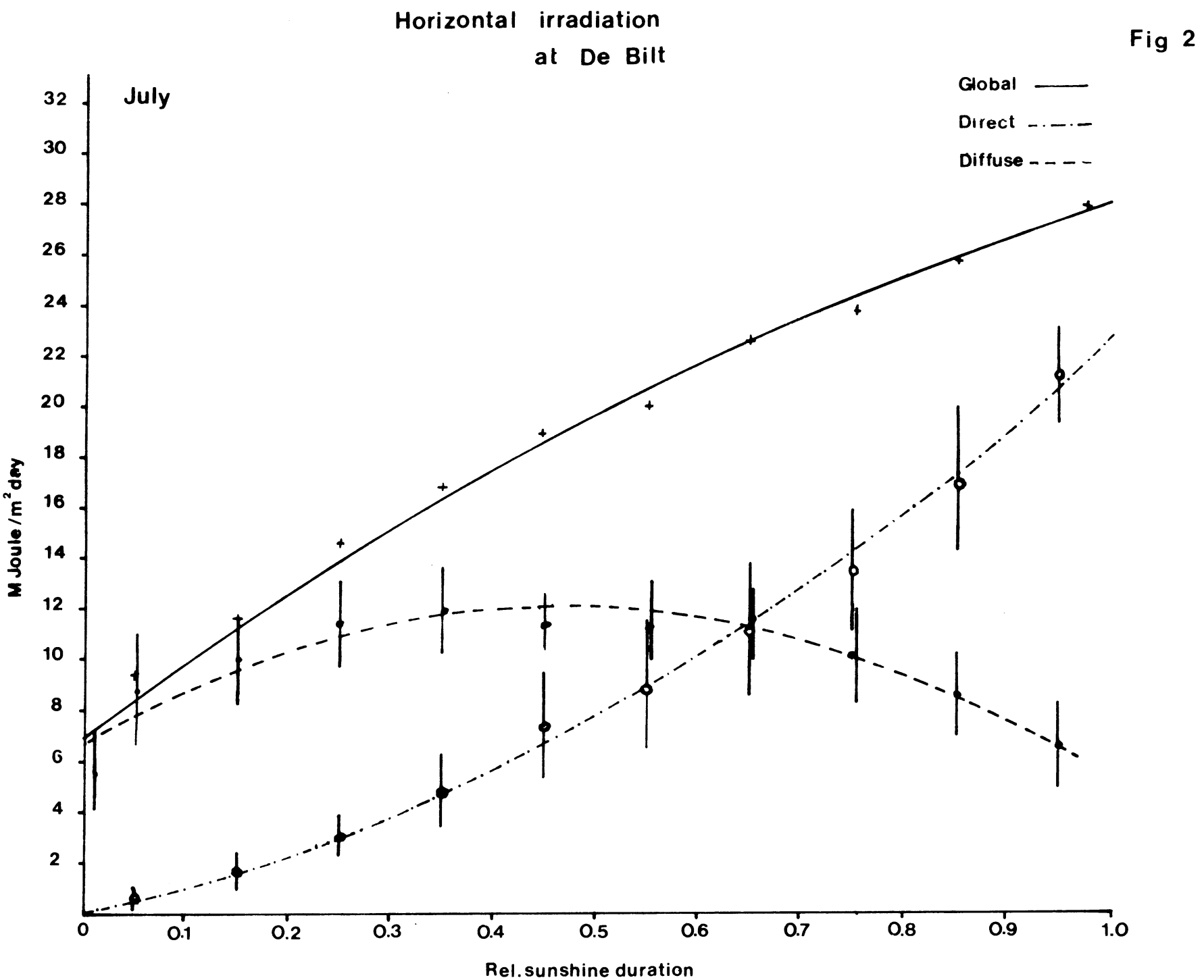

Horizontal irradiation
at De Bilt
July
Global
Direct
Diffuse
M Joule/m² day
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Rel. sunshine duration

Fig 3

Climatological irradiation

at De Bilt

for the horizontal surface

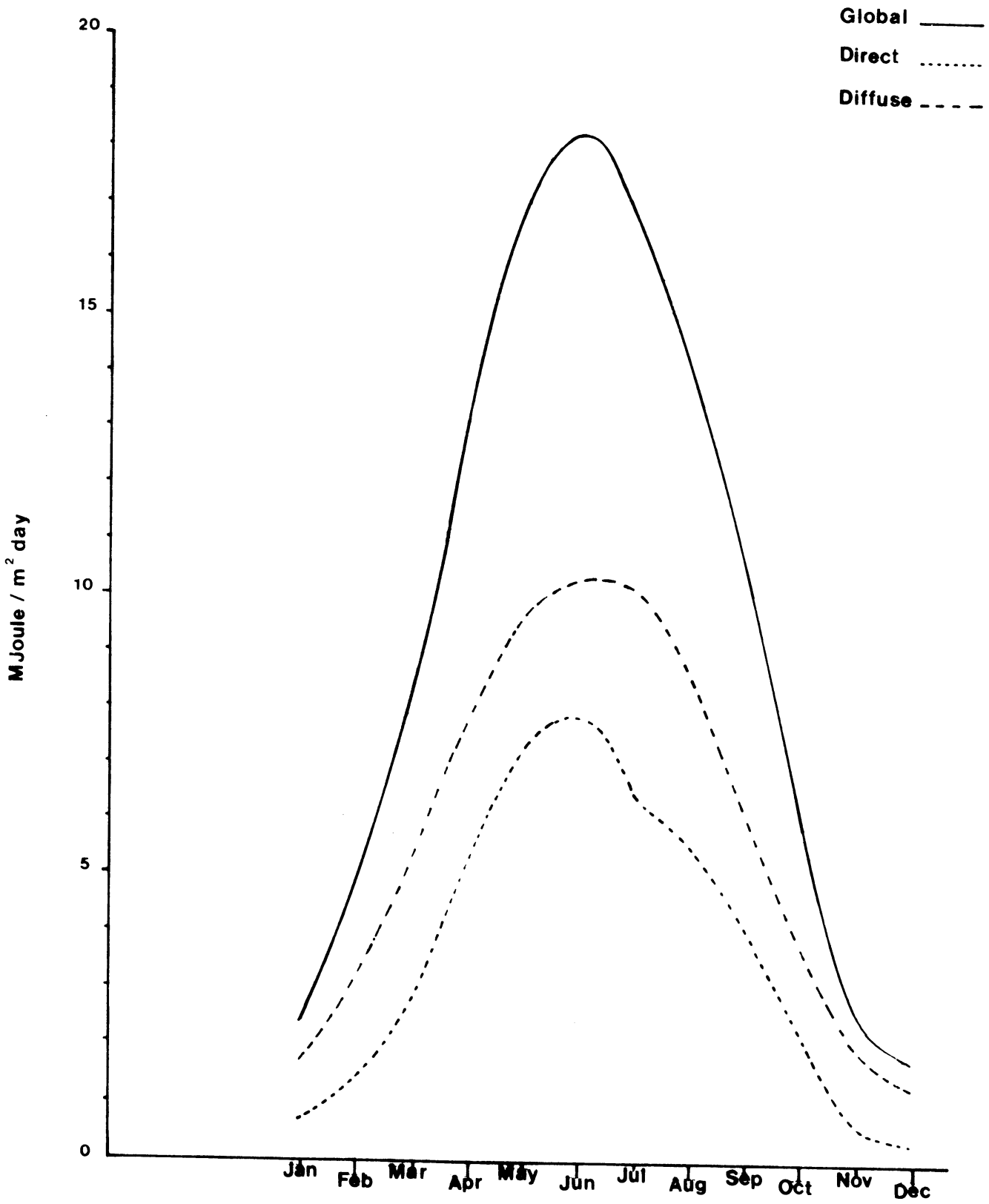


Fig 4

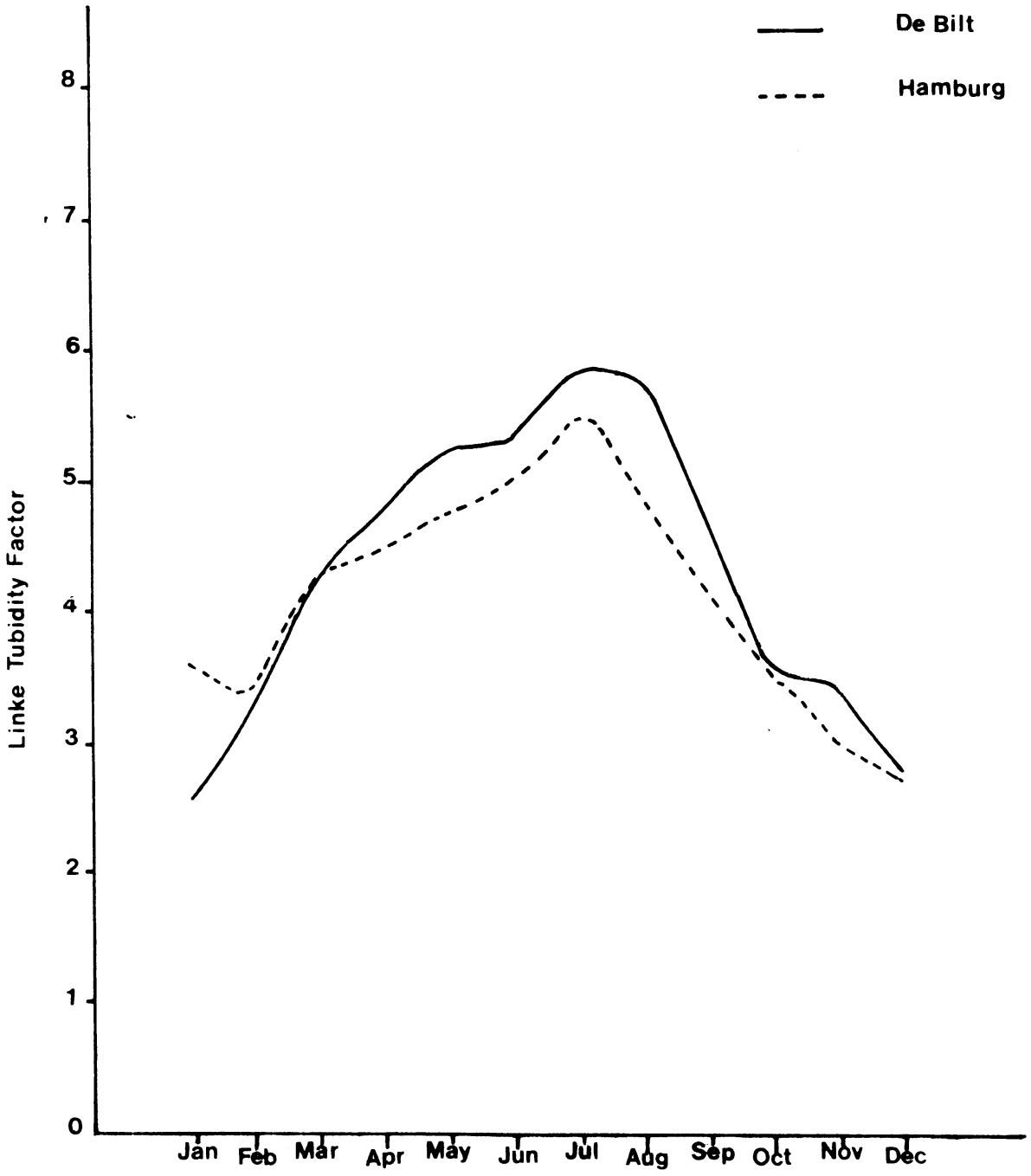
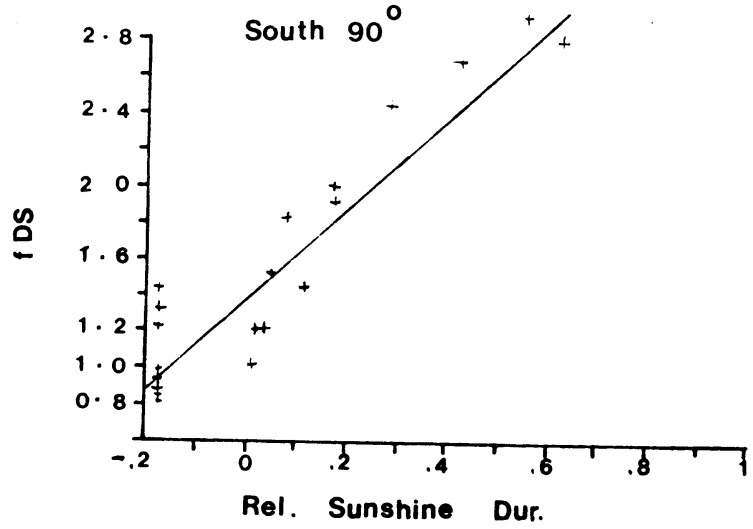
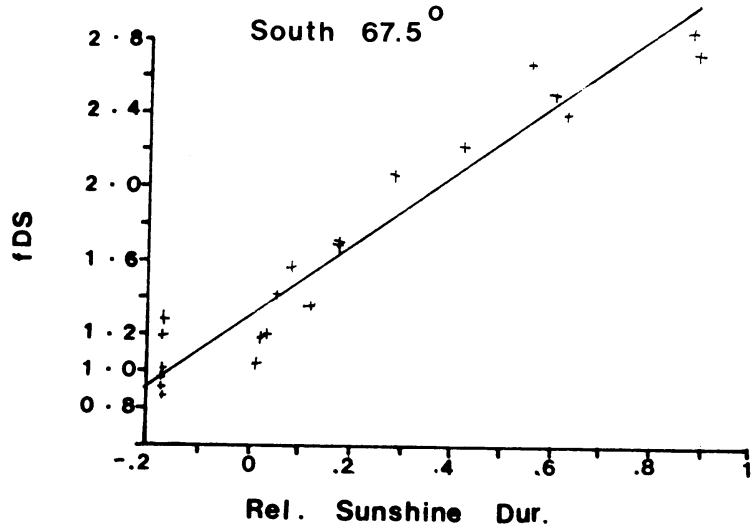
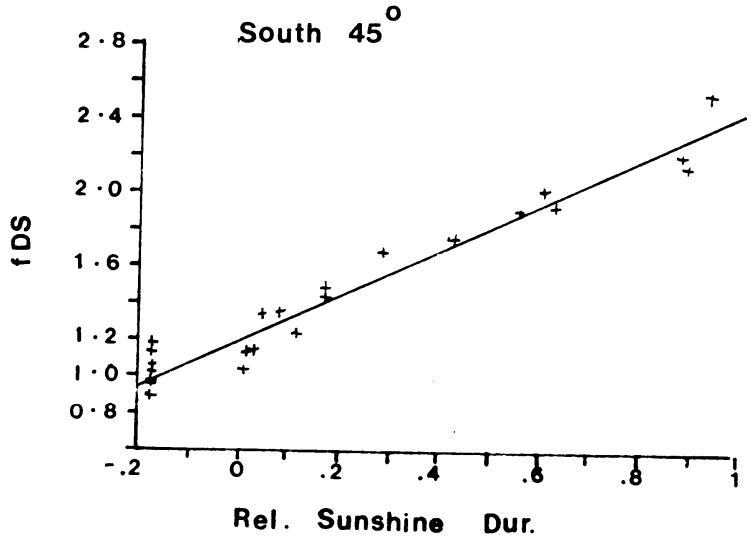
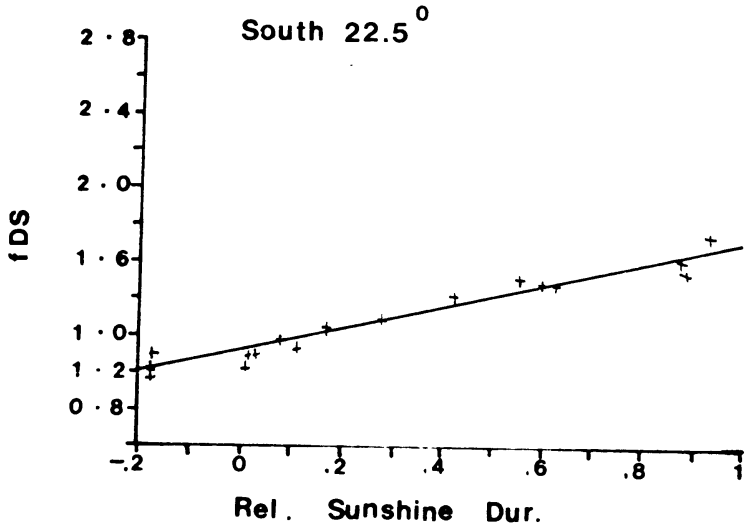

De Bilt
Hamburg
Linke Tubidity Factor
0
1
2
3
4
5
6
7
8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Fig 5a


South 90°
fDS
2·8
2·4
2 0
1·6
1·2
1·0
0·8
-.2
0
.2
.4
.6
.8
1
Rel. Sunshine Dur.

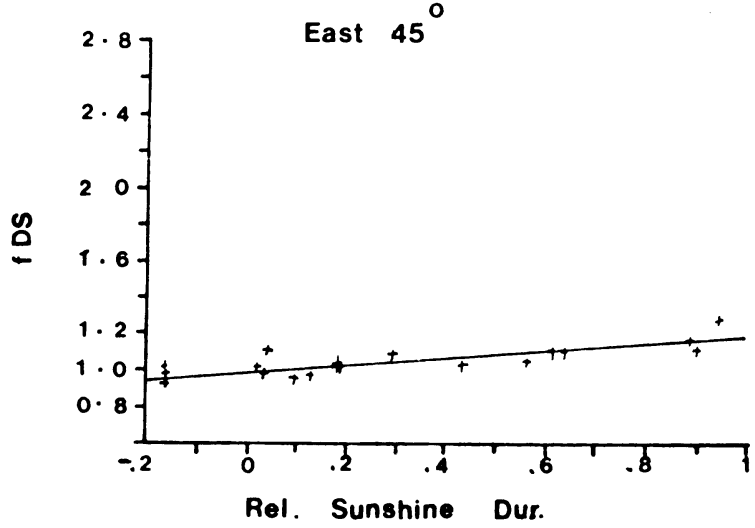

South 67.5°
fDS
2·8
2·4
2·0
1·6
1·2
1·0
0·8
-.2
0
.2
.4
.6
.8
1
Rel. Sunshine Dur.

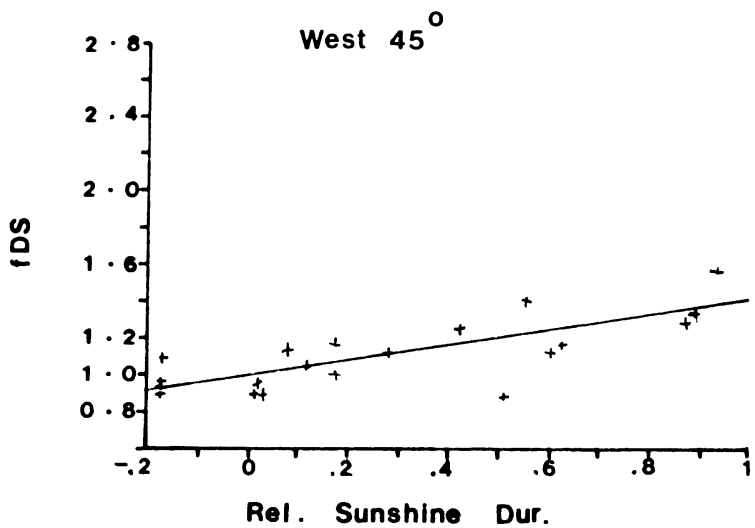

South 45°
fDS
2·8
2·4
2·0
1·6
1·2
1·0
0·8
-.2
0
.2
.4
.6
.8
1
Rel. Sunshine Dur.

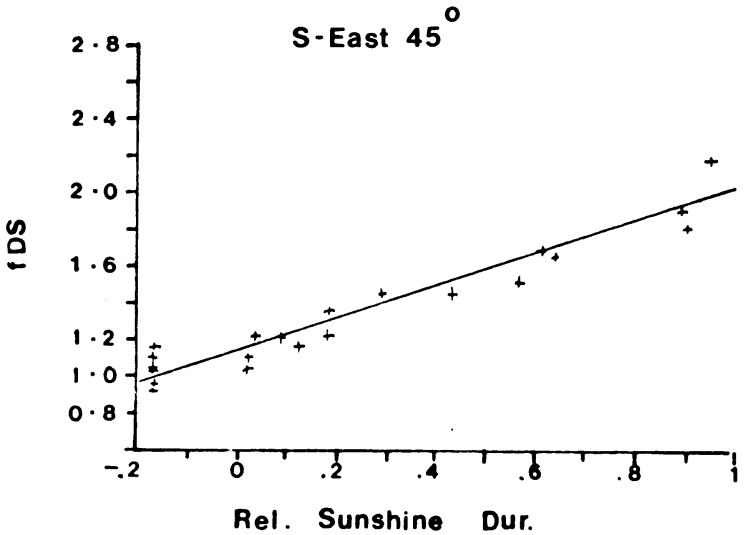

South 22.5°
fDS
2·8
2·4
2·0
1·6
1·0
1·2
0·8
-.2
0
.2
.4
.6
.8
1
Rel. Sunshine Dur.

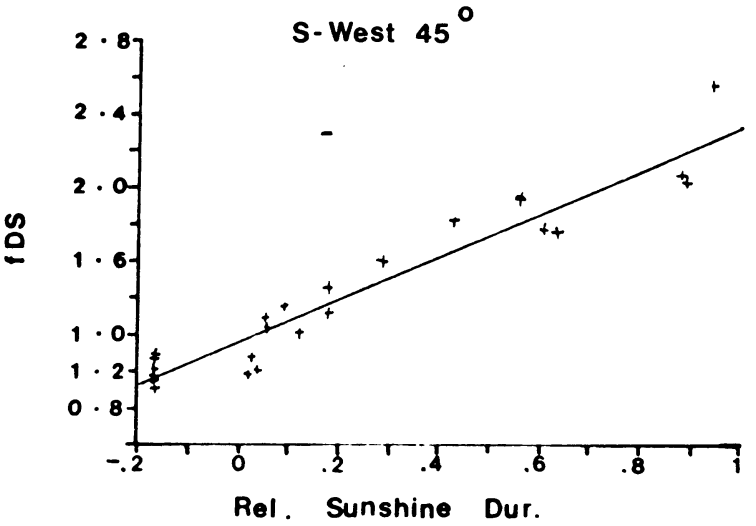
November 1980

Fig 5b



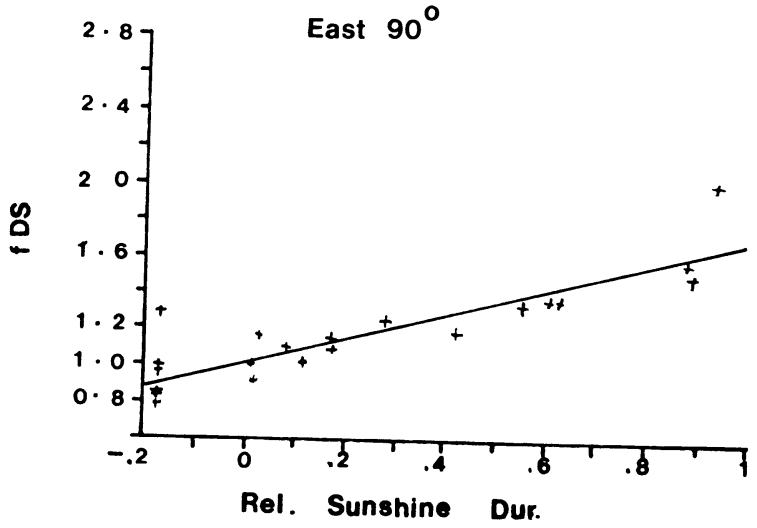


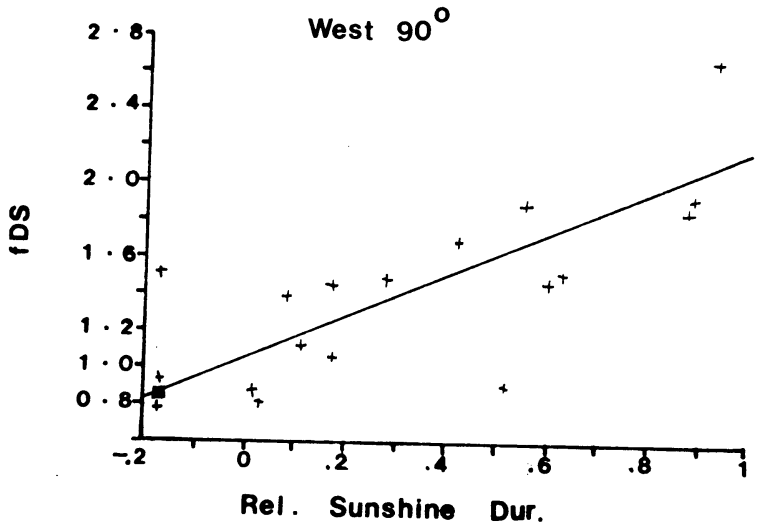


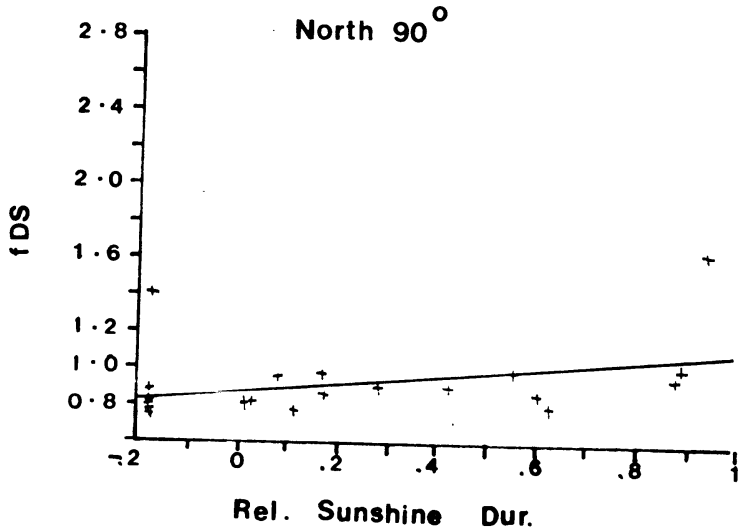


November 1980

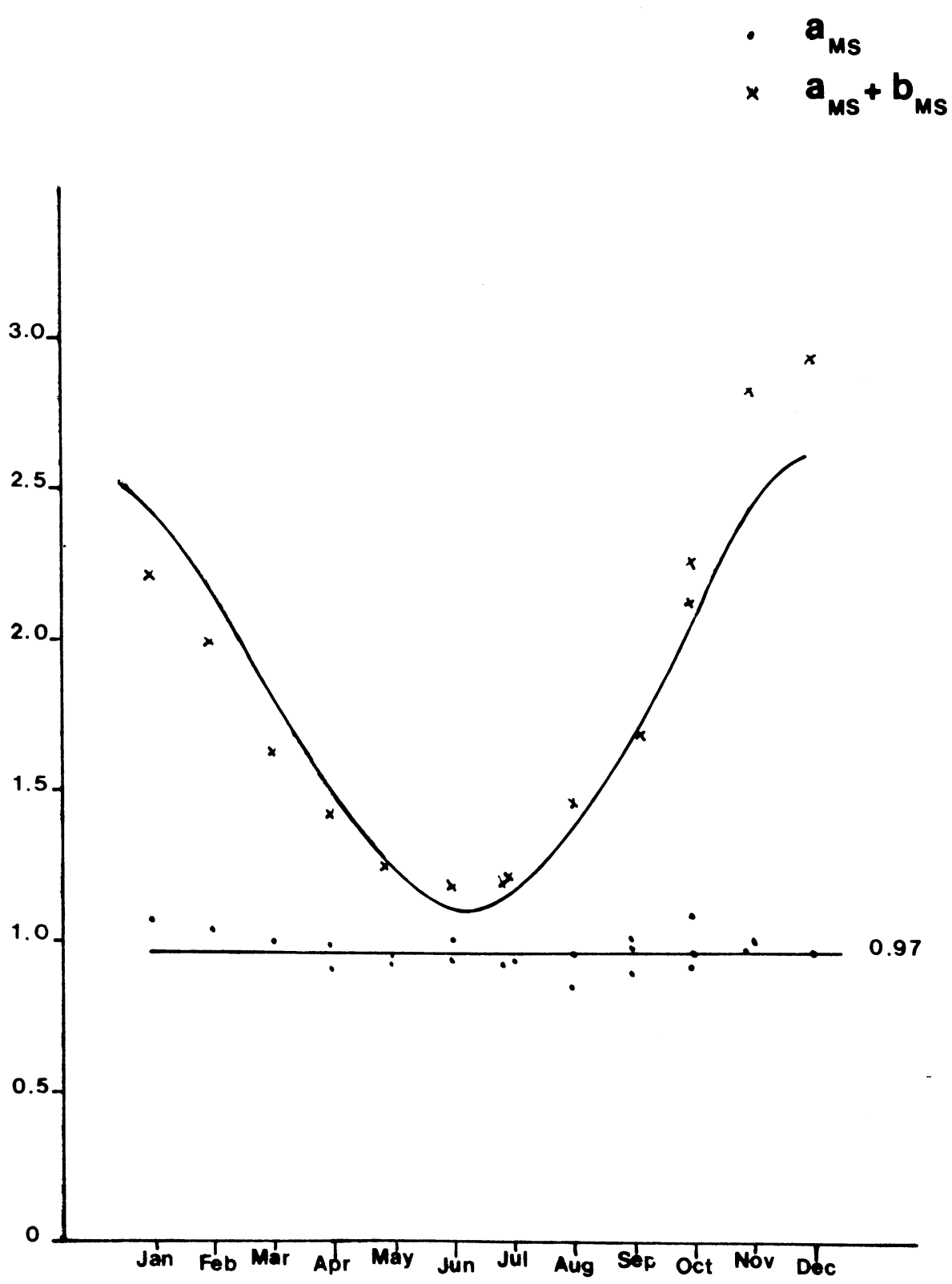
Fig 5c

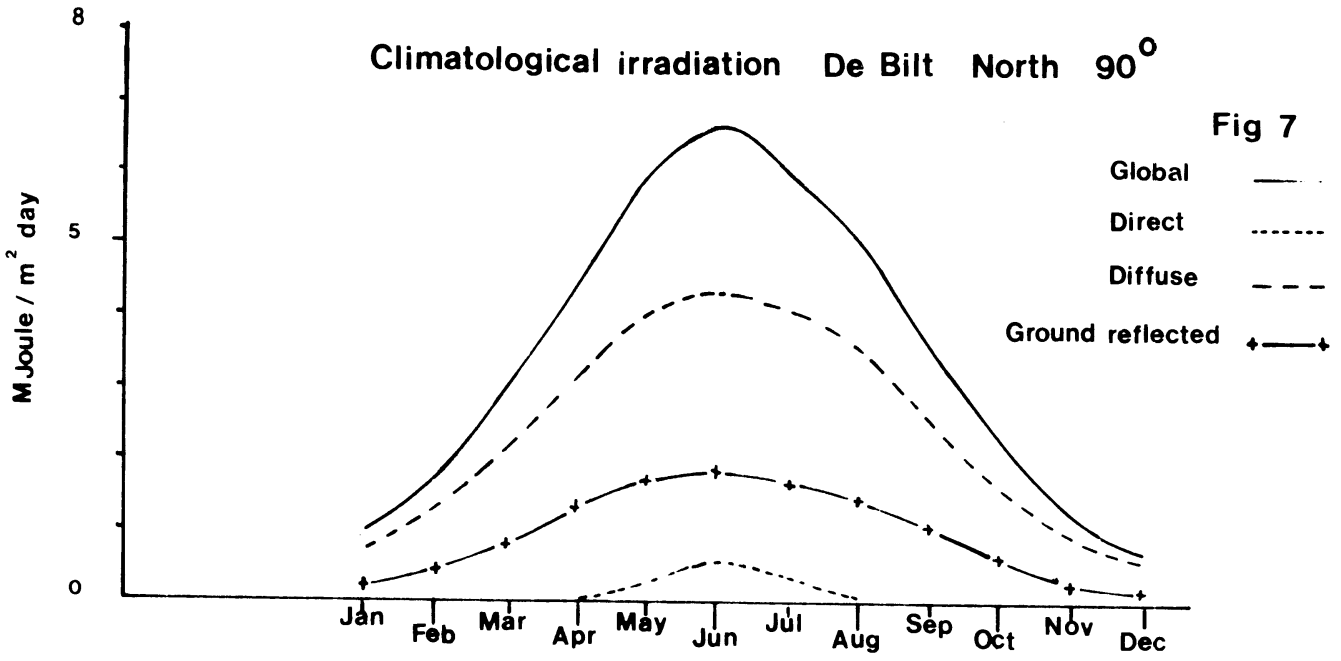






Values of the regression coefficients for South 45°




Climatological irradiation De Bilt North 90°
Fig 7
Global
Direct
Diffuse
Ground reflected
MJoule / m² day
8
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

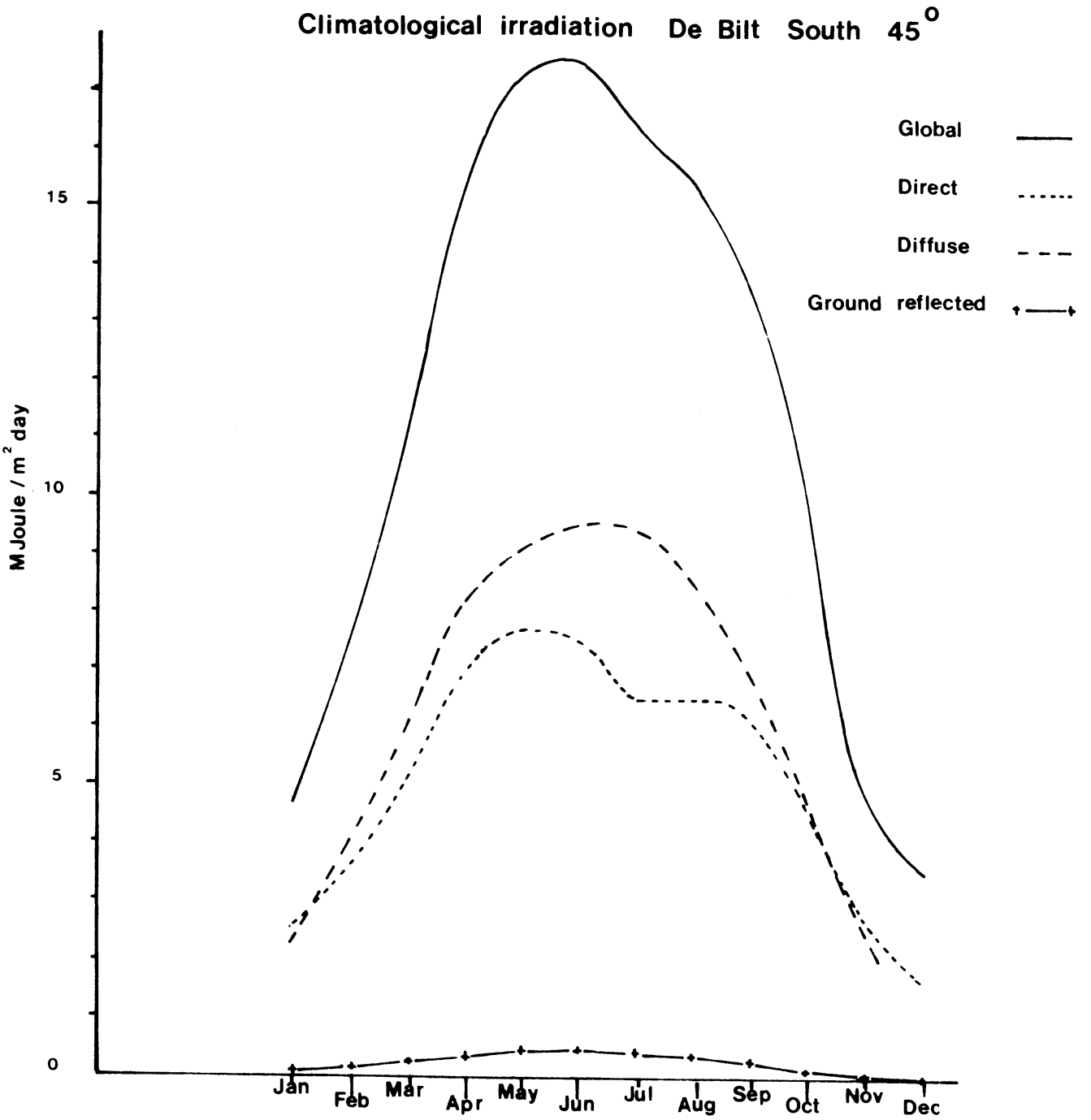
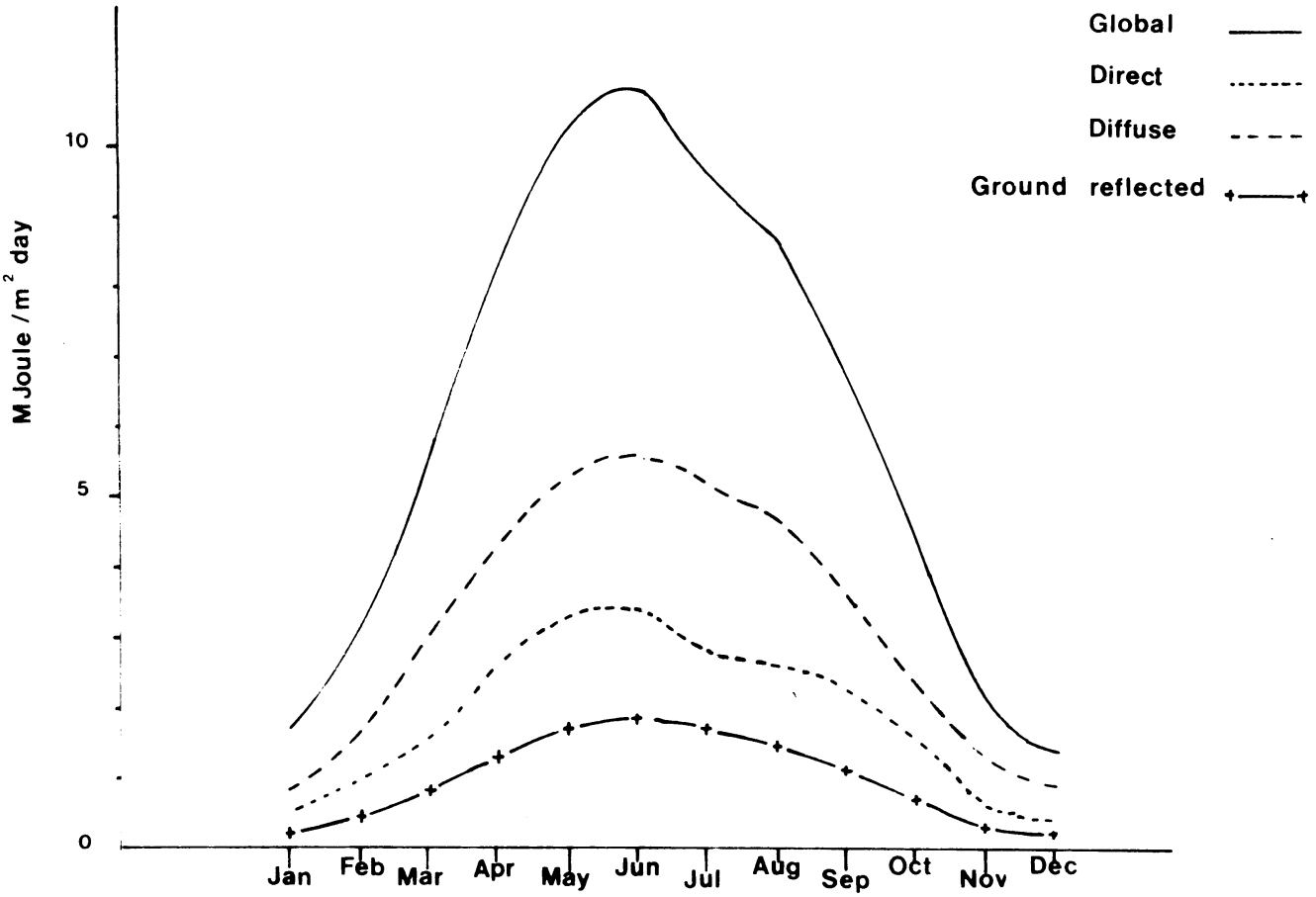

Climatological irradiation De Bilt South 45°
Global
Direct
Diffuse
Ground reflected
MJoule / m² day
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Fig 8


Climatological irradiation De Bilt East 90°
Global
Direct
Diffuse
Ground reflected
MJoule /m² day
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

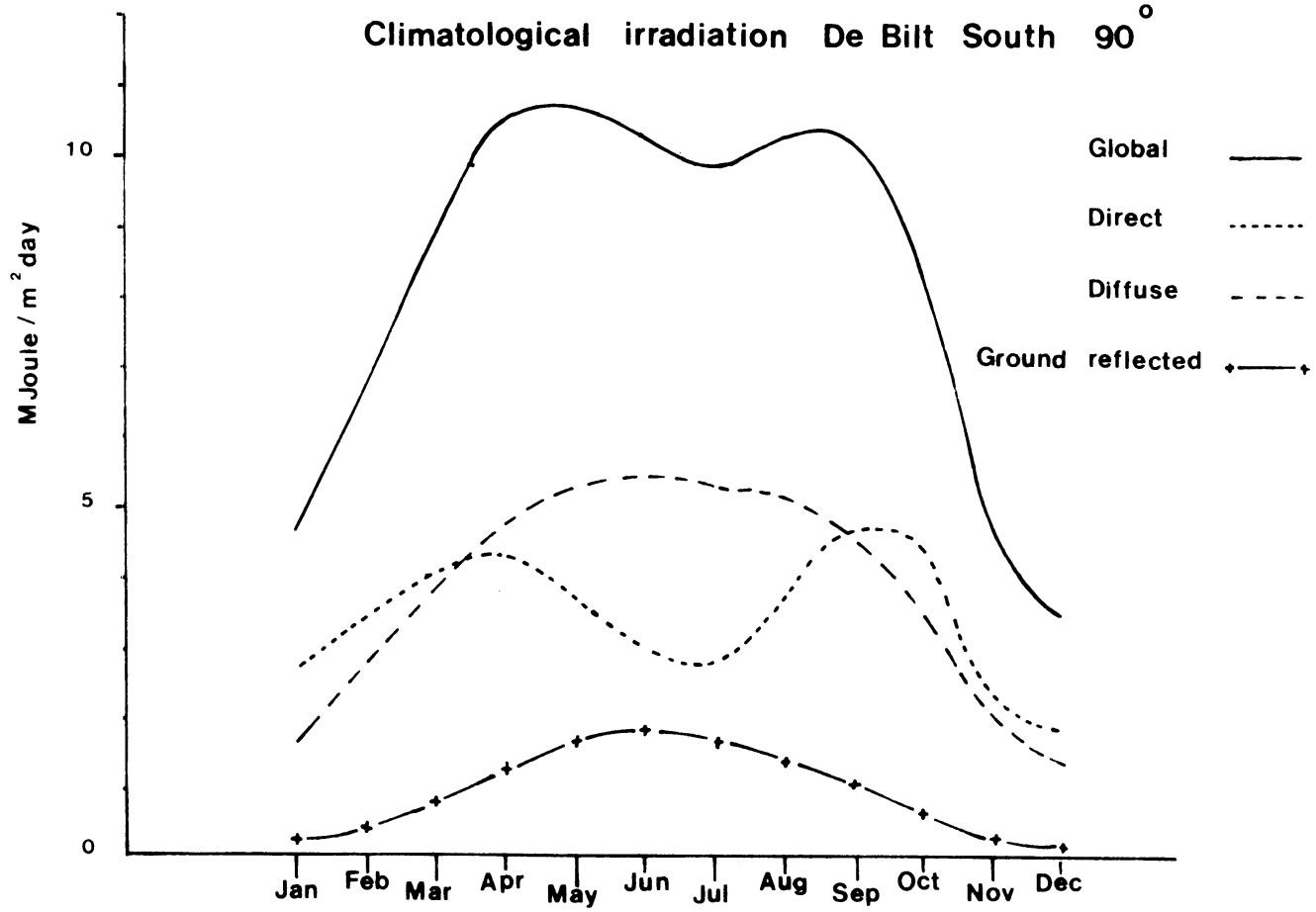

Climatological irradiation De Bilt South 90°
Global
Direct
Diffuse
Ground reflected
MJoule / m² day
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Fig 9

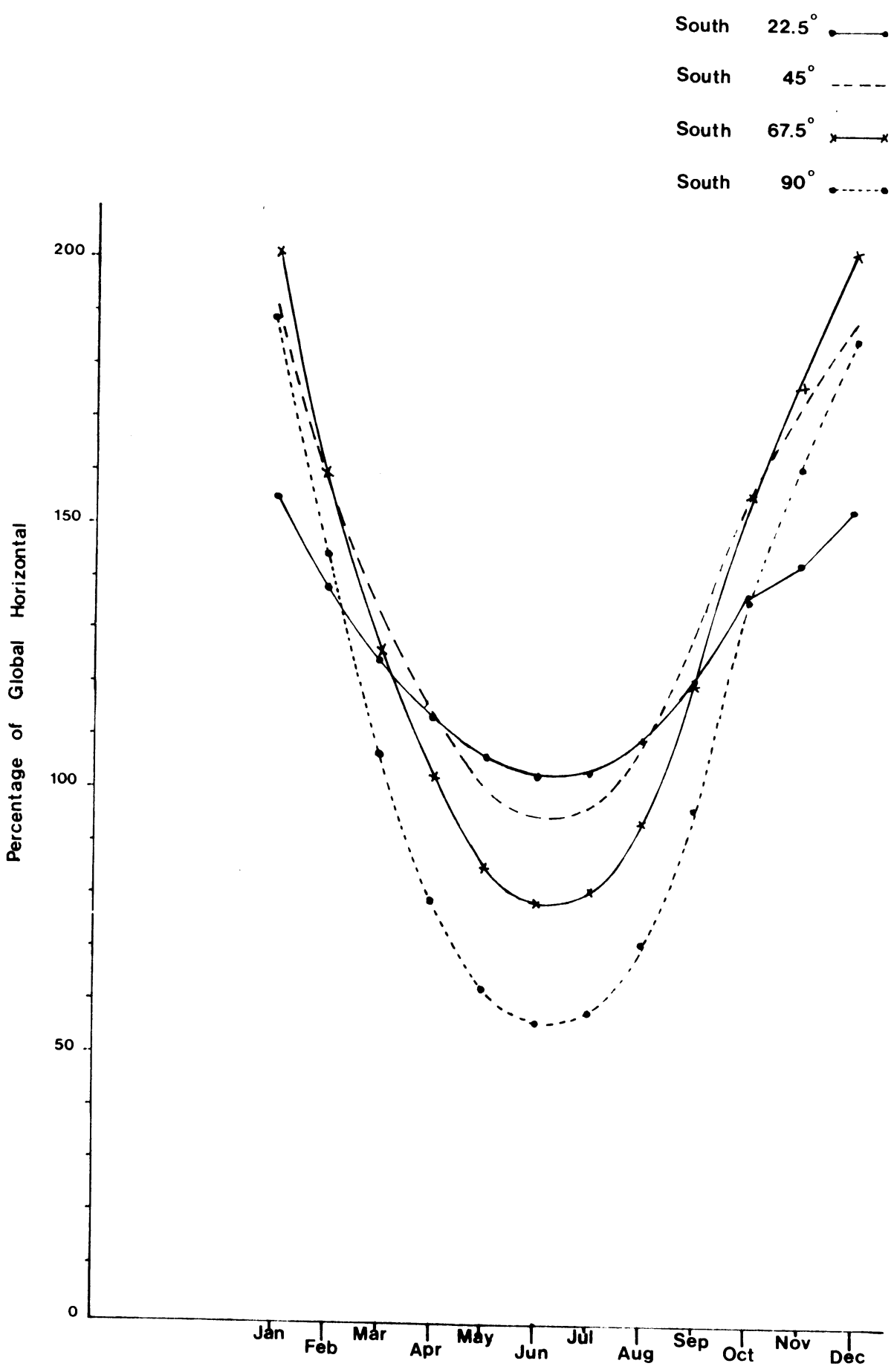

South 22.5°
South 45°
South 67.5°
South 90°
Percentage of Global Horizontal
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Fig 10

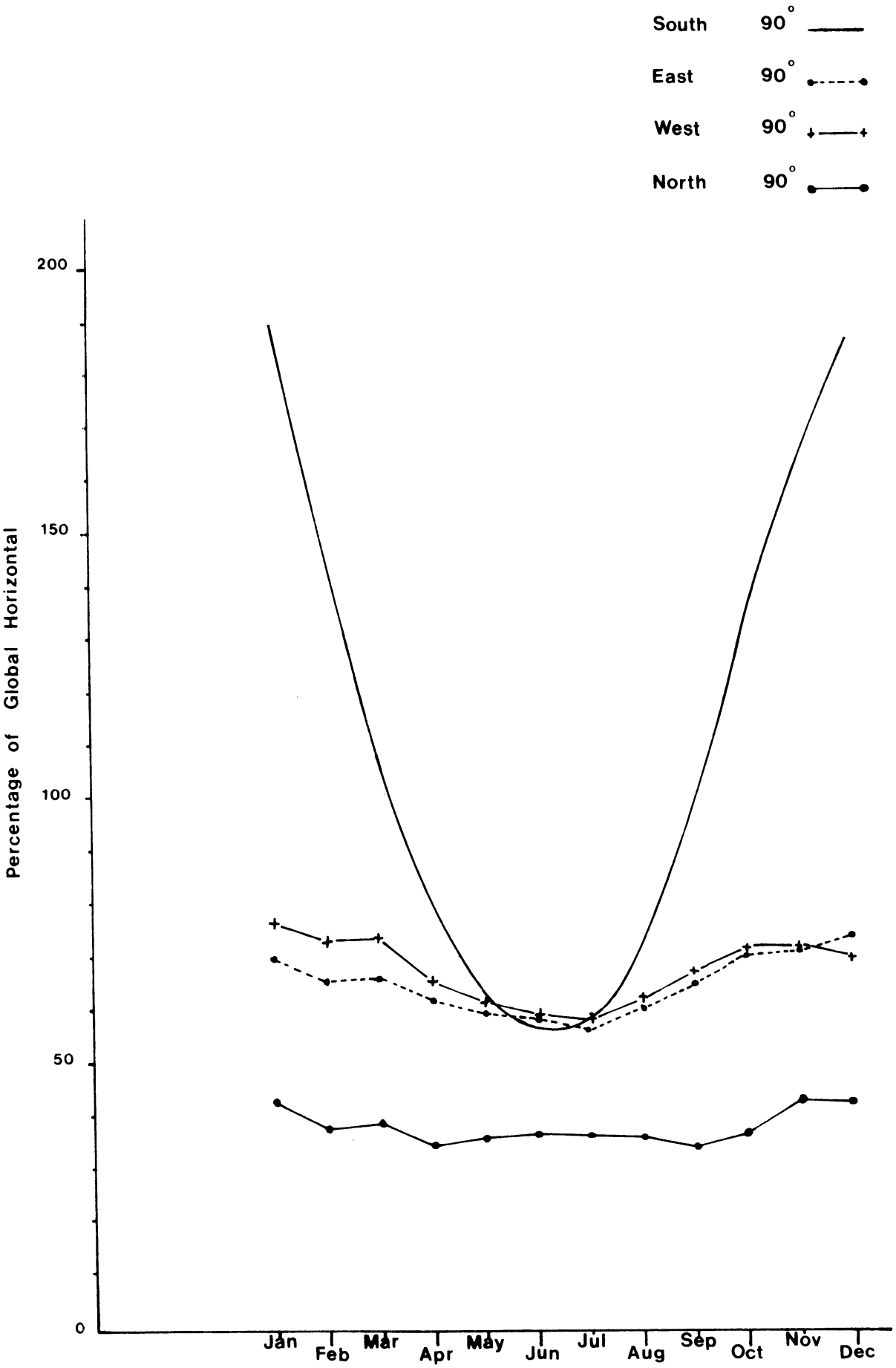

South 90°
East 90°
West 90°
North 90°
Percentage of Global Horizontal
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Fig 11

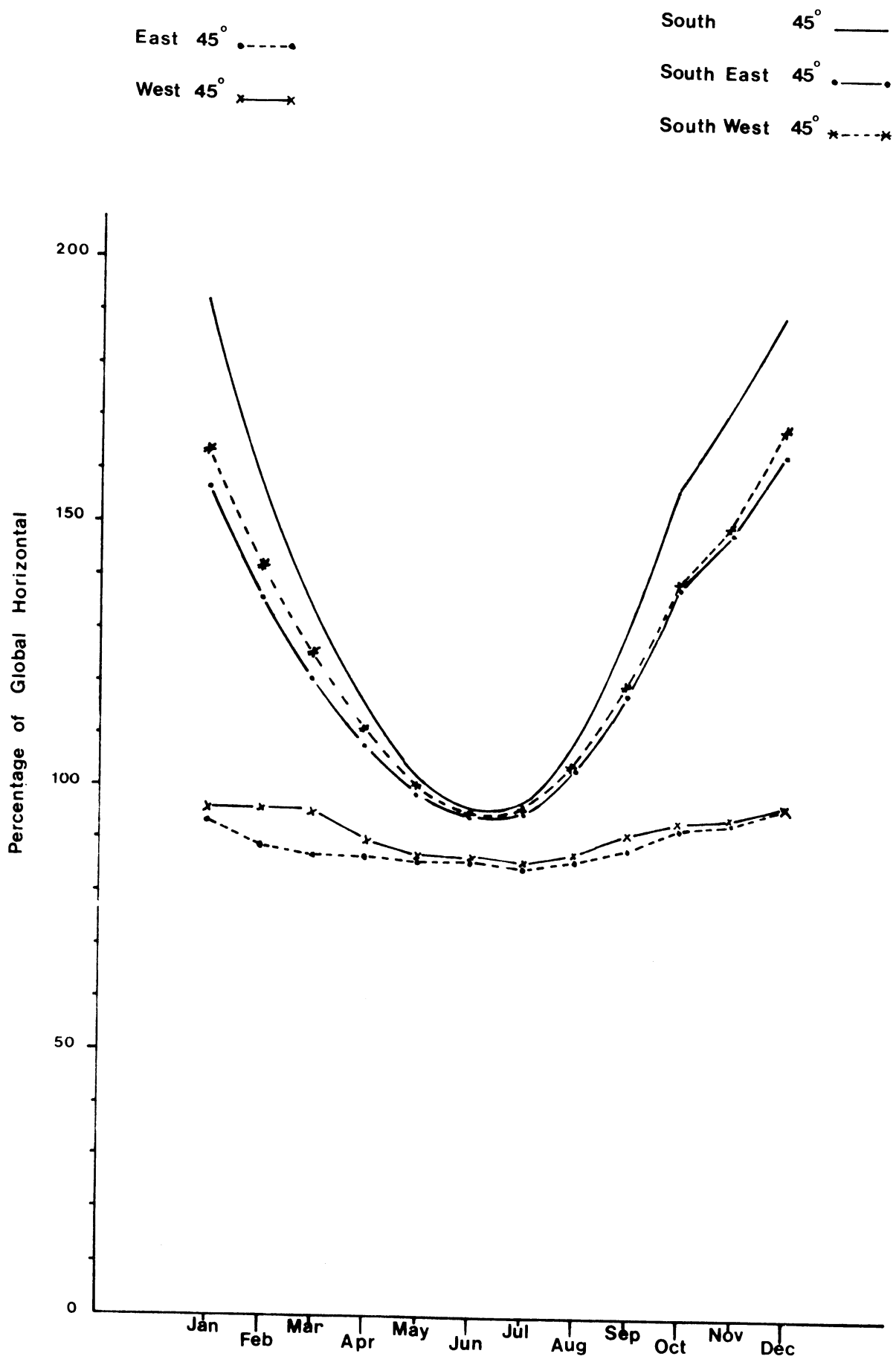

East 45°
West 45°
South 45°
South East 45°
South West 45°
Percentage of Global Horizontal
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

TABLE 1 AVERAGE VALUES OF THE GLOBAL,DIRECT AND DIFFUSE IRRADIATION ON THE HORIZONTAL SURFACE (KJOULE/M2.DAY WRR) AT DE BILT AS A FUNCTION OF THE RELATIVE SUNSHINE DURATION AND THE MONTH OF THE YEAR.

DATE		S=0	S=+0	S=0.1	S=0.2	S=0.3	S=0.4	S=0.5	S=0.6	S=0.7	S=0.8	S=0.9	S=1.0
15- 1	DIR.	9	140	265	456	714	1038	1429	1886	2410	3000	3656	4379
15- 1	DIF.	1124	1486	1896	2223	2465	2623	2696	2686	2591	2413	2150	1803
15- 1	GLOB	1133	1626	2161	2679	3178	3661	4125	4572	5001	5412	5806	6182
15- 2	DIR.	6	146	415	799	1299	1913	2643	3488	4448	5523	6714	8020
15- 2	DIF.	1708	3109	3555	3898	4136	4271	4301	4228	4051	3770	3384	2895
15- 2	GLOB	1714	3255	3970	4697	5435	6184	6944	7716	8499	9293	10098	10915
15- 3	DIR.	15	0	611	1478	2417	3427	4509	5662	6887	8184	9552	10992
15- 3	DIF.	3150	4737	5605	6240	6642	6812	6749	6453	5925	5164	4170	2943
15- 3	GLOB	3165	4737	6216	7718	9059	10239	11258	12116	12812	13348	13722	13935
15- 4	DIR.	26	190	952	1960	3215	4715	6461	8453	10692	13176	15906	18882
15- 4	DIF.	4290	6559	7737	8624	9221	9526	9541	9265	8698	7840	6692	5252
15- 4	GLOB	4316	6749	8690	10585	12436	14241	16002	17718	19390	21016	22598	24135
15- 5	DIR.	27	0	1071	2470	4100	5960	8051	10373	12924	15707	18720	21963
15- 5	DIF.	5735	8414	9666	10593	11197	11476	11431	11061	10368	9350	8008	6342
15- 5	GLOB	5762	8414	10737	13064	15297	17436	19482	21434	23292	25057	26727	28304
15- 6	DIR.	51	149	1365	2852	4612	6643	8946	11520	14366	17485	20875	24536
15- 6	DIF.	6456	8999	10509	11603	12280	12541	12385	11813	10824	9418	7596	5357
15- 6	GLOB	6507	9148	11874	14455	16892	19184	21331	23333	25190	26903	28471	29893
15- 7	DIR.	62	346	1256	2467	3980	5795	7912	10330	13050	16072	19396	23022
15- 7	DIF.	5795	8200	9783	10965	11744	12120	12095	11667	10837	9604	7969	5932
15- 7	GLOB	5857	8546	11039	13432	15724	17915	20006	21997	23887	25676	27365	28953
15- 8	DIR.	11	0	999	2228	3599	5112	6766	8563	10501	12581	14803	17168
15- 8	DIF.	4601	7921	8915	9622	10040	10171	10013	9568	8834	7812	6502	4904
15- 8	GLOB	4612	7921	9914	11850	13639	15282	16779	18130	19335	20393	21305	22071
15- 9	DIR.	53	296	801	1533	2491	3675	5085	6722	8586	10675	12991	15533
15- 9	DIF.	4224	4900	5969	6765	7289	7542	7523	7232	6669	5835	4728	3350
15- 9	GLOB	4277	5197	6770	8298	9780	11217	12608	13954	15255	16510	17719	18883
15-10	DIR.	11	105	564	1140	1833	2643	3570	4615	5777	7056	8452	9966
15-10	DIF.	2326	3761	4216	4554	4773	4875	4858	4724	4471	4101	3612	3006
15-10	GLOB	2337	3866	4780	5694	6606	7518	8429	9339	10248	11157	12064	12971
15-11	DIR.	7	0	278	644	1021	1409	1807	2217	2638	3070	3513	3967
15-11	DIF.	1400	1918	2288	2571	2768	2878	2902	2840	2692	2457	2136	1728
15-11	GLOB	1407	1918	2566	3215	3788	4287	4710	5057	5330	5527	5649	5696
15-12	DIR.	4	37	195	383	599	845	1120	1423	1756	2118	2509	2929
15-12	DIF.	949	1369	1616	1805	1938	2015	2035	1999	1906	1757	1551	1289
15-12	GLOB	954	1406	1811	2188	2538	2860	3155	3422	3662	3875	4060	4218

TABLE 2

RELATIVE SUNSHINE CLIMATOLOGY.
OCCURRENCE PROBABILITY IN PER CENT.

DE BILT

S/S_o	0	0-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0
JAN	47.0	9.5	7.0	6.5	5.5	4.5	3.5	5.0	5.0	5.0	1.5
FEB	33.5	9.5	10.0	12.5	6.0	5.0	8.0	3.5	5.5	5.0	1.5
MAR	24.0	8.5	9.0	9.0	9.0	8.0	7.0	8.0	9.0	8.0	0.5
APR	10.0	12.0	11.5	9.5	10.0	9.5	10.0	8.0	8.5	8.5	2.5
MAY	9.0	9.5	10.0	9.5	10.0	8.5	10.5	9.5	10.5	10.0	3.0
JUN	7.5	6.5	12.0	12.0	10.0	9.0	7.5	10.0	10.5	12.5	2.5
JUL	7.0	13.5	11.0	10.5	11.0	10.5	8.5	9.5	8.5	10.0	1.0
AUG	6.0	11.0	12.0	11.5	10.5	10.5	9.0	10.0	10.0	8.0	1.5
SEP	11.0	11.0	11.0	11.0	9.5	11.0	9.5	9.0	9.0	6.0	2.0
OCT	27.5	10.0	10.0	6.5	10.0	8.5	6.5	7.0	7.0	5.5	1.5
NOV	46.0	10.5	9.0	7.5	6.5	5.5	5.5	3.5	3.5	2.0	0.5
DEC	55.0	8.5	7.5	6.0	4.5	4.0	3.5	3.5	4.0	3.5	0.0

DEN HELDER

S/S_o	0	0-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0
JAN	40.0	10.0	12.5	7.0	6.5	6.0	5.0	5.0	4.0	2.5	1.5
FEB	35.0	9.5	8.5	9.0	7.0	7.0	6.0	6.0	5.5	5.5	1.0
MAR	25.0	8.0	7.5	9.0	10.0	7.0	8.5	8.0	9.5	6.5	1.0
APR	12.5	9.0	8.0	8.0	10.0	8.5	10.0	10.5	11.5	9.5	2.5
MAY	10.0	7.5	7.5	8.0	10.0	8.0	11.0	10.5	11.0	12.5	4.0
JUN	6.0	9.0	10.0	9.0	8.5	9.5	9.0	11.0	13.0	13.0	2.0
JUL	9.0	9.0	10.0	9.0	11.0	11.0	10.5	9.5	10.0	9.0	2.0
AUG	4.0	10.5	10.5	9.5	10.5	9.5	11.5	11.0	11.0	10.0	2.0
SEP	13.0	9.5	10.0	9.0	10.5	10.5	10.0	10.0	9.5	7.0	1.0
OCT	24.5	11.5	10.5	9.5	8.5	7.5	7.5	7.0	7.0	5.5	1.0
NOV	43.0	12.5	10.5	9.0	6.5	6.0	4.5	3.5	2.5	1.5	0.5
DEC	52.0	10.0	8.5	7.0	5.5	5.0	3.5	2.5	3.0	2.5	0.5

VLISSINGEN

S/S_o	0	0-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0
JAN	46.0	9.5	9.0	7.0	5.5	4.5	6.0	4.5	3.5	3.5	1.0
FEB	39.0	10.0	9.0	6.5	7.0	6.5	5.0	6.5	3.5	5.0	2.0
MAR	22.0	10.0	8.0	7.5	8.5	8.5	7.5	10.0	10.0	7.0	1.0
APR	12.5	10.0	10.0	9.5	10.5	9.5	8.5	9.5	8.5	8.5	3.0
MAY	9.5	6.5	8.5	11.5	11.0	11.0	9.5	9.5	9.0	10.0	4.0
JUN	6.0	10.0	10.0	9.0	9.0	9.0	10.0	10.0	11.5	13.0	2.5
JUL	7.5	10.5	10.5	11.5	10.5	10.0	10.5	9.0	9.5	9.5	1.0
AUG	5.0	10.5	10.0	11.0	11.0	11.5	9.5	9.5	10.0	9.5	2.5
SEP	10.5	10.5	11.0	9.5	11.5	11.0	10.0	8.5	9.0	7.0	1.5
OCT	28.5	9.5	8.5	8.5	8.5	9.0	7.0	7.0	6.5	5.0	2.0
NOV	45.0	10.5	11.0	7.5	6.0	6.5	4.0	4.0	3.0	2.0	0.5
DEC	55.0	10.0	7.0	6.0	5.5	4.5	4.0	3.5	2.5	2.0	0.0

TABLE 2

RELATIVE SUNSHINE CLIMATOLOGY.
OCCURRENCE PROBABILITY IN PER CENT.

EELDE

S/S_o	0	0-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0
JAN	52.0	8.0	7.0	6.5	5.5	4.5	3.5	4.0	4.0	3.5	1.5
FEB	41.0	9.0	10.0	6.5	5.0	7.5	5.0	4.0	6.0	4.5	1.5
MAR	26.0	11.0	9.5	9.0	7.0	8.5	7.0	7.5	7.0	5.5	2.0
APR	15.0	9.0	10.0	11.0	10.0	9.0	8.5	7.0	7.5	10.0	3.0
MAY	11.0	9.0	8.5	9.0	9.5	10.5	8.5	8.0	11.0	11.0	4.0
JUN	7.0	12.0	10.5	10.0	10.5	10.0	8.0	8.0	10.0	11.0	3.0
JUL	5.0	16.0	13.0	12.0	8.5	11.0	8.5	9.0	7.5	8.5	1.0
AUG	8.0	11.0	10.5	11.0	10.5	10.5	10.0	10.0	9.5	7.5	1.5
SEP	13.0	10.0	10.0	9.5	13.0	9.0	10.0	9.0	8.5	6.5	1.5
OCT	30.0	11.0	10.0	8.0	6.5	6.5	7.0	7.0	7.0	5.5	1.5
NOV	47.0	10.0	8.5	8.5	7.5	5.0	5.0	3.0	3.5	1.5	0.5
DEC	54.0	9.0	8.5	6.5	4.5	4.0	3.5	3.5	3.0	3.0	0.5

BEEK

S/S_o	0	0-.1	.1-.2	.2-.3	.3-.4	.4-.5	.5-.6	.6-.7	.7-.8	.8-.9	.9-1.0
JAN	54.0	7.5	6.0	6.0	5.5	4.0	4.0	5.0	4.5	2.5	1.0
FEB	40.0	12.0	10.0	7.5	7.0	5.0	4.0	5.5	5.0	3.5	0.5
MAR	21.0	11.0	11.0	10.0	9.5	8.0	9.0	6.0	7.5	6.5	0.5
APR	16.0	10.0	11.5	8.5	11.5	8.5	9.0	8.5	7.5	7.5	1.5
MAY	12.0	8.5	9.5	10.0	11.5	10.0	8.5	8.0	10.0	10.0	2.0
JUN	7.0	10.5	11.5	10.0	10.0	10.0	9.0	8.0	9.0	13.5	1.5
JUL	7.0	11.5	12.0	11.5	10.5	12.0	9.5	7.5	9.0	8.0	1.5
AUG	5.5	11.5	11.5	10.5	12.0	10.5	9.5	10.0	10.5	7.5	1.0
SEP	10.0	12.5	12.0	11.5	9.0	10.5	7.5	9.0	9.5	7.5	1.0
OCT	27.0	9.5	9.0	9.5	8.5	8.5	7.0	7.0	7.5	6.0	0.5
NOV	47.0	10.0	9.0	7.5	6.0	6.0	3.5	4.0	4.5	2.0	0.5
DEC	55.0	8.0	7.5	6.0	5.0	4.5	4.0	3.0	4.0	3.0	0.0

Table 3. The factor, which shows the deviation of the regression for the station from the regression of De Bilt (first value). The ratio of the extraterrestrial at the station and the extraterrestrial at De Bilt (second value). The difference between the first and the second value.

	Eelde	Den Helder	Vlissingen	Beek
Jan	1.02 / 0.91 } +11%	1.09 / 0.93 } +16%	1.18 / 1.04 } +14%	1.22 / 1.08 } +14%
Febr	1.02 / 0.95 } +7%	1.02 / 0.96 } +6%	1.08 / 1.02 } +6%	1.08 / 1.05 } +3%
March	1.03 / 0.97 } +6%	1.08 / 0.98 } +10%	1.09 / 1.01 } +8%	1.06 / 1.03 } 3%
April	1.04 / 0.99 } +5%	1.07 / 0.99 } +8%	1.05 / 1.01 } +4%	1.03 / 1.01 } +2%
May	1.04 / 1.00 } +4%	1.07 / 1.00 } +7%	1.05 / 1.00 } +5%	1.03 / 1.01 } +2%
June	1.03 / 1.00 } +3%	1.06 / 1.00 } +6%	1.04 / 1.00 } +4%	1.01 / 1.00 } +1%
July	1.06 / 1.00 } +6%	1.08 / 1.00 } +8%	1.06 / 1.00 } +6%	1.04 / 1.00 } +4%
Aug	1.04 / 0.99 } +5%	1.04 / 0.99 } +5%	1.04 / 1.00 } +4%	1.02 / 1.01 } +1%
Sept	1.03 / 0.98 } +5%	1.03 / 0.98 } +5%	1.03 / 1.01 } +2%	1.04 / 1.02 } +2%
Oct	1.01 / 0.96 } +5%	1.03 / 0.97 } +6%	1.07 / 1.02 } +5%	1.05 / 1.04 } +1%
Nov	0.97 / 0.93 } +4%	1.00 / 0.94 } +6%	1.11 / 1.03 } +8%	1.17 / 1.07 } +10%
Dec	1.00 / 0.90 } +10%	1.03 / 0.92 } +11%	1.14 / 1.05 } +9%	1.16 / 1.09 } +7%

TABLE 3A

THE ANNUAL VARIATION OF THE EXTRA TERRESTRIAL IRRADIATION (KJOULE/M2.DAY) ON THE HORIZONTAL SURFACE FOR THE 5 MAIN RADIATION STATIONS.

DATE	DE BILT	BEEK	VLISSINGEN	DEN HELDER	EELDE
1- 1	6545	7238	6923	6072	5948
15- 1	7702	8415	8091	7219	7089
1- 2	10366	11100	10770	9864	9731
15- 2	13512	14243	13910	13006	12869
1- 3	17321	18027	17714	16830	16700
15- 3	21563	22215	21922	21102	20981
1- 4	26875	27426	27179	26488	26385
15- 4	31084	31531	31331	30769	30692
1- 5	35383	35708	35559	35166	35099
15- 5	38470	38678	38585	38321	38281
1- 6	41070	41175	41120	40994	40966
15- 6	42091	42150	42132	42055	42044
1- 7	41938	42001	41973	41884	41880
15- 7	40642	40755	40713	40561	40539
1- 8	37818	38028	37939	37654	37612
15- 8	34637	34963	34810	34399	34337
1- 9	30029	30495	30282	29705	29626
15- 9	25867	26426	26175	25476	25377
1-10	21001	21644	21358	20549	20423
15-10	16904	17599	17289	16414	16285
1-11	12514	13239	12912	12013	11877
15-11	9644	10358	10040	9148	9020
1-12	7409	8110	7794	6927	6801
15-12	6432	7122	6809	5963	5841

THE RATIO OF THE EXTRA TERRESTRIAL IRRADIATION ON THE STATION AND THE EXTRA TERRESTRIAL IRRADIATION AT DE BILT.

DE BILT	BEEK	VLISSINGEN	DEN HELDER	EELDE
1.000	1.106	1.058	0.928	0.909
1.000	1.093	1.051	0.937	0.920
1.000	1.071	1.039	0.951	0.939
1.000	1.054	1.029	0.963	0.952
1.000	1.041	1.023	0.972	0.964
1.000	1.030	1.017	0.979	0.973
1.000	1.021	1.011	0.986	0.982
1.000	1.014	1.008	0.990	0.987
1.000	1.009	1.005	0.994	0.992
1.000	1.005	1.003	0.996	0.995
1.000	1.003	1.001	0.998	0.997
1.000	1.001	1.001	0.999	0.999
1.000	1.001	1.001	0.999	0.999
1.000	1.003	1.002	0.998	0.997
1.000	1.006	1.003	0.996	0.995
1.000	1.009	1.005	0.993	0.991
1.000	1.016	1.008	0.989	0.987
1.000	1.022	1.012	0.985	0.981
1.000	1.031	1.017	0.978	0.972
1.000	1.041	1.023	0.971	0.963
1.000	1.058	1.032	0.960	0.949
1.000	1.075	1.041	0.949	0.935
1.000	1.095	1.052	0.935	0.918
1.000	1.107	1.059	0.927	0.908

TABLE 4 CLIMATOLOGICAL VALUES OF THE GLOBAL,DIRECT,DIFFUSE AND GROUNDREFLECTED IRRADIATIONS (KJOULE/M2.DAY)
ON THE HORIZONTAL (GLOBH,DIRH,DIFH) AND THE INCLINED SURFACE (GLOBS,DIRS,DIFS,REFS).
A IS THE DIFFUSE MULTIPLICATION FACTOR FOR OVERCAST SKYS. A+B IS THE SAME FACTOR FOR TOTALLY CLEAR SKYS.
FDIR IS THE MULTIPLICATION FACTOR FOR THE DIRECT IRRADIATION.
FDIF IS THE AVERAGE DIFFUSE MULTIPLICATION FACTOR.
RATIO IS THE RATIO OF THE AVERAGE GLOBAL IRRADIATIONS ON THE INCLINED AND THE HORIZONTAL SURFACE.

SOUTH 45

A=0.9720

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	3702	1840	1807	54	2.5334	3.9033	1.5349	2.0000
15- 1	2333	620	1713	2459	713	1746	4450	2186	2195	68	2.4400	3.5245	1.5012	1.9071
1- 2	3430	974	2456	4662	1496	3166	6054	2829	3124	100	2.2818	2.9035	1.4905	1.7649
15- 2	4743	1405	3338	4662	1496	3166	7583	3380	4064	139	2.1200	2.4051	1.4264	1.5987
1- 3	6515	2069	4446	8487	3162	5326	9639	4114	5334	191	1.9459	1.9881	1.4056	1.4795
15- 3	8366	2948	5418	8487	3162	5326	11520	5075	6199	245	1.8000	1.7214	1.3406	1.3770
1- 4	10863	4231	6632	13660	5581	8080	13830	6201	7311	318	1.6250	1.4656	1.2914	1.2731
15- 4	13188	5296	7892	13660	5581	8080	15377	6769	8222	386	1.4800	1.2782	1.2205	1.1660
1- 5	15657	6304	9353	17403	7519	9884	16851	7099	9293	459	1.3468	1.1261	1.1641	1.0763
15- 5	17409	7153	10256	17403	7519	9884	17732	7466	9756	510	1.2500	1.0437	1.1145	1.0185
1- 6	18619	7969	10650	19302	8686	10616	18030	7611	9674	545	1.1520	0.9802	1.0642	0.9684
15- 6	18746	8099	10646	19302	8686	10616	17615	7638	9429	549	1.1000	0.9430	1.0376	0.9397
1- 7	17973	7458	10515	17466	6987	10480	16842	7002	9313	526	1.1060	0.9389	1.0377	0.9371
15- 7	16988	6755	10232	17466	6987	10480	16402	6610	9294	498	1.1600	0.9785	1.0641	0.9655
1- 8	15893	6327	9565	14667	5776	8891	16258	6704	9089	465	1.2602	1.0594	1.1133	1.0230
15- 8	14768	6020	8748	14667	5776	8891	16116	6932	8751	433	1.3800	1.1516	1.1720	1.0913
1- 9	12903	5207	7696	10663	4277	6386	15265	6755	8132	378	1.5351	1.2974	1.2379	1.1830
15- 9	10802	4169	6633	10663	4277	6386	13824	6166	7342	316	1.6600	1.4791	1.2968	1.2798
1-10	8255	3059	5196	6221	2339	3882	11459	5349	5869	242	1.8093	1.7488	1.3232	1.3682
15-10	6171	2246	3924	6221	2339	3882	9466	4585	4700	181	2.0000	2.0410	1.4032	1.5340
1-11	4155	1378	2777	2697	665	2032	6803	3417	3264	122	2.2846	2.4801	1.3767	1.6371
15-11	2880	765	2115	2697	665	2032	4969	2280	2605	84	2.5000	2.9790	1.4432	1.7255
1-12	2059	438	1620	1725	392	1333	3623	1568	1995	60	2.6099	3.5783	1.4421	1.7599
15-12	1779	409	1371	1725	392	1333	3340	1604	1684	52	2.6000	3.9246	1.4393	1.8772

SOUTH EAST AND SOUTH WEST 45

A=0.9555

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	3137	1400	1682	54	2.2692	2.9689	1.4291	1.6947
15- 1	2333	620	1713	2459	713	1746	3820	1677	2074	68	2.2400	2.7036	1.4186	1.6370
1- 2	3430	974	2456	4662	1496	3166	5393	2212	3081	100	2.2545	2.2700	1.4697	1.5723
15- 2	4743	1405	3338	4662	1496	3166	6967	2702	4126	139	2.2000	1.9227	1.4481	1.4688
1- 3	6515	2069	4446	8487	3162	5326	8948	3379	5377	191	1.9923	1.6330	1.4171	1.3734
15- 3	8366	2948	5418	8487	3162	5326	10594	4274	6075	245	1.7600	1.4496	1.3137	1.2663
1- 4	10863	4231	6632	13660	5581	8080	12826	5401	7107	318	1.5686	1.2764	1.2554	1.1807
15- 4	13188	5296	7892	13660	5581	8080	14641	6090	8165	386	1.4800	1.1499	1.2121	1.1102
1- 5	15657	6304	9353	17403	7519	9884	16443	6589	9395	459	1.3873	1.0452	1.1769	1.0502
15- 5	17409	7153	10256	17403	7519	9884	17390	7060	9820	510	1.2800	0.9870	1.1218	0.9989
1- 6	18619	7969	10650	19302	8686	10616	17791	7511	9735	545	1.1809	0.9425	1.0710	0.9556
15- 6	18746	8099	10646	19302	8686	10616	17613	7430	9635	549	1.1600	0.9173	1.0603	0.9396
1- 7	17973	7458	10515	17466	6987	10480	16945	6821	9597	526	1.1878	0.9145	1.0694	0.9428
15- 7	16988	6755	10232	17466	6987	10480	16331	6356	9477	498	1.2200	0.9409	1.0851	0.9613
1- 8	15893	6327	9565	14667	5776	8891	15876	6296	9115	465	1.2838	0.9950	1.1164	0.9990
15- 8	14768	6020	8748	14667	5776	8891	15558	6364	8762	433	1.4000	1.0572	1.1733	1.0535
1- 9	12903	5207	7696	10663	4277	6386	14578	6026	8174	378	1.5673	1.1573	1.2443	1.1298
15- 9	10802	4169	6633	10663	4277	6386	12961	5352	7292	316	1.6600	1.2838	1.2881	1.1999
1-10	8255	3059	5196	6221	2339	3882	10328	4499	5537	242	1.6806	1.4711	1.2596	1.2512
15-10	6171	2246	3924	6221	2339	3882	8212	3756	4275	181	1.7200	1.6720	1.2762	1.3307
1-11	4155	1378	2777	2697	665	2032	5801	2719	2960	122	1.9060	1.9735	1.2486	1.3960
15-11	2880	765	2115	2697	665	2032	4249	1776	2389	84	2.1500	2.3195	1.3236	1.4754
1-12	2059	438	1620	1725	392	1333	3132	1200	1872	60	2.3416	2.7394	1.3534	1.5217
15-12	1779	409	1371	1725	392	1333	2858	1220	1586	52	2.3500	2.9834	1.3558	1.6061

TABLE 4 CLIMATOLOGICAL VALUES OF THE GLOBAL,DIRECT,DIFFUSE AND GROUNDREFLECTED IRRADIATIONS (KJOULE/M2.DAY)
ON THE HORIZONTAL (GLOBH,DIRH,DIFH) AND THE INCLINED SURFACE (GLOBS,DIRS,DIFS,REFS).
A IS THE DIFFUSE MULTIPLICATION FACTOR FOR OVERCAST SKYS. A+B IS THE SAME FACTOR FOR TOTALLY CLEAR SKYS.
FDIR IS THE MULTIPLICATION FACTOR FOR THE DIRECT IRRADIATION.
FDIF IS THE AVERAGE DIFFUSE MULTIPLICATION FACTOR.
RATIO IS THE RATIO OF THE AVERAGE GLOBAL IRRADIATIONS ON THE INCLINED AND THE HORIZONTAL SURFACE.

EAST AND WEST 45 A=0.9330

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	1811	505	1251	54	1.2932	1.0716	1.0629	0.9784
15- 1	2333	620	1713	2459	713	1746	2265	649	1547	68	1.2800	1.0465	1.0581	0.9705
1- 2	3430	974	2456	4662	1496	3166	3296	965	2231	100	1.2644	0.9900	1.0642	0.9608
15- 2	4743	1405	3338	4662	1496	3166	4473	1318	3016	139	1.2500	0.9381	1.0585	0.9430
1- 3	6515	2069	4446	8487	3162	5326	6076	1848	4037	191	1.2269	0.8929	1.0639	0.9325
15- 3	8366	2948	5418	8487	3162	5326	7665	2556	4864	245	1.2000	0.8670	1.0519	0.9163
1- 4	10863	4231	6632	13660	5581	8080	9833	3578	5937	318	1.1697	0.8455	1.0488	0.9051
15- 4	13188	5296	7892	13660	5581	8080	11774	4388	7000	386	1.1500	0.8285	1.0392	0.8928
1- 5	15657	6304	9353	17403	7519	9884	13833	5116	8259	459	1.1311	0.8115	1.0346	0.8835
15- 5	17409	7153	10256	17403	7519	9884	15206	5735	8962	510	1.1100	0.8017	1.0237	0.8735
1- 6	18619	7969	10650	19302	8686	10616	16069	6343	9181	545	1.0832	0.7959	1.0100	0.8630
15- 6	18746	8099	10646	19302	8686	10616	16082	6417	9116	549	1.0700	0.7923	1.0032	0.8579
1- 7	17973	7458	10515	17466	6987	10480	15409	5885	8997	526	1.0748	0.7891	1.0025	0.8573
15- 7	16988	6755	10232	17466	6987	10480	14654	5336	8821	498	1.0900	0.7899	1.0099	0.8626
1- 8	15893	6327	9565	14667	5776	8891	13826	5036	8325	465	1.1097	0.7959	1.0196	0.8700
15- 8	14768	6020	8748	14667	5776	8891	12961	4841	7688	433	1.1300	0.8042	1.0295	0.8777
1- 9	12903	5207	7696	10663	4277	6386	11482	4268	6836	378	1.1609	0.8197	1.0406	0.8899
15- 9	10802	4169	6633	10663	4277	6386	9800	3515	5969	316	1.1900	0.8431	1.0543	0.9073
1-10	8255	3059	5196	6221	2339	3882	7591	2686	4663	242	1.2152	0.8783	1.0514	0.9196
15-10	6171	2246	3924	6221	2339	3882	5762	2039	3543	181	1.2300	0.9075	1.0576	0.9337
1-11	4155	1378	2777	2697	665	2032	3855	1291	2442	122	1.2485	0.9366	1.0303	0.9277
15-11	2880	765	2115	2697	665	2032	2697	741	1871	84	1.2700	0.9680	1.0369	0.9364
1-12	2059	438	1620	1725	392	1333	1939	446	1433	60	1.2922	1.0170	1.0361	0.9419
15-12	1779	409	1371	1725	392	1333	1699	432	1215	52	1.3000	1.0572	1.0383	0.9548

EAST AND WEST 90 A=0.7742

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	1431	423	823	185	1.9356	0.8967	1.1929	0.7729
15- 1	2333	620	1713	2459	713	1746	1775	532	1011	233	1.9000	0.8570	1.1801	0.7610
1- 2	3430	974	2456	4662	1496	3166	2561	747	1470	343	1.8434	0.7670	1.1974	0.7465
15- 2	4743	1405	3338	4662	1496	3166	3403	959	1970	474	1.8000	0.6827	1.1803	0.7176
1- 3	6515	2069	4446	8487	3162	5326	4599	1256	2691	652	1.7545	0.6070	1.2106	0.7059
15- 3	8366	2948	5418	8487	3162	5326	5708	1657	3214	837	1.7000	0.5621	1.1864	0.6822
1- 4	10863	4231	6632	13660	5581	8080	7237	2217	3934	1086	1.6166	0.5239	1.1863	0.6662
15- 4	13188	5296	7892	13660	5581	8080	8463	2611	4533	1319	1.5400	0.4931	1.1488	0.6418
1- 5	15657	6304	9353	17403	7519	9884	9731	2909	5256	1566	1.4567	0.4615	1.1241	0.6216
15- 5	17409	7153	10256	17403	7519	9884	10472	3169	5562	1741	1.3800	0.4430	1.0847	0.6015
1- 6	18619	7969	10650	19302	8686	10616	10854	3445	5547	1862	1.2965	0.4323	1.0417	0.5829
15- 6	18746	8099	10646	19302	8686	10616	10768	3447	5446	1875	1.2600	0.4256	1.0231	0.5744
1- 7	17973	7458	10515	17466	6987	10480	10313	3125	5391	1797	1.2867	0.4191	1.0254	0.5738
15- 7	16988	6755	10232	17466	6987	10480	9940	2837	5405	1699	1.3500	0.4199	1.0564	0.5851
1- 8	15893	6327	9565	14667	5776	8891	9546	2732	5225	1589	1.4238	0.4317	1.0926	0.6007
15- 8	14768	6020	8748	14667	5776	8891	9079	2703	4899	1477	1.4800	0.4490	1.1201	0.6148
1- 9	12903	5207	7696	10663	4277	6386	8181	2492	4399	1290	1.5557	0.4787	1.1431	0.6341
15- 9	10802	4169	6633	10663	4277	6386	7170	2166	3923	1080	1.6400	0.5197	1.1630	0.6636
1-10	8255	3059	5196	6221	2339	3882	5660	1775	3060	825	1.7364	0.5802	1.1778	0.6857
15-10	6171	2246	3924	6221	2339	3882	4398	1417	2363	617	1.8000	0.6310	1.2045	0.7127
1-11	4155	1378	2777	2697	665	2032	2689	939	1535	416	1.8474	0.6816	1.1051	0.6953
15-11	2880	765	2115	2697	665	2032	2029	561	1179	288	1.8800	0.7335	1.1152	0.7043
1-12	2059	438	1620	1725	392	1333	1454	356	893	206	1.9168	0.8116	1.1022	0.7065
15-12	1779	409	1371	1725	392	1333	1295	358	760	178	1.9400	0.8746	1.1088	0.7280

TABLE 4 CLIMATOLOGICAL VALUES OF THE GLOBAL,DIRECT,DIFFUSE AND GROUNDREFLECTED IRRADIATIONS (KJOULE/M2.DAY) ON THE HORIZONTAL (GLOBH,DIRH,DIFH) AND THE INCLINED SURFACE (GLOBS,DIRS,DIFS,REFS).
A IS THE DIFFUSE MULTIPLICATION FACTOR FOR OVERCAST SKYS. A+B IS THE SAME FACTOR FOR TOTALLY CLEAR SKYS.
FDIR IS THE MULTIPLICATION FACTOR FOR THE DIRECT IRRADIATION.
FDIF IS THE AVERAGE DIFFUSE MULTIPLICATION FACTOR.
RATIO IS THE RATIO OF THE AVERAGE GLOBAL IRRADIATIONS ON THE INCLINED AND THE HORIZONTAL SURFACE.

SOUTH 90

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A=0.8820 A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	3747	2131	1431	185	4.1910	4.5198	2.0749	2.0246
15- 1	2333	620	1713	2459	713	1746	4435	2471	1730	233	4.0400	3.9840	2.0205	1.9009
1- 2	3430	974	2456	4662	1496	3166	5819	3027	2449	343	3.6927	3.1063	1.9946	1.6965
15- 2	4743	1405	3338	4662	1496	3166	6932	3376	3083	474	3.3200	2.4021	1.8471	1.4616
1- 3	6515	2069	4446	8487	3162	5326	8383	3751	3980	652	2.9227	1.8126	1.7905	1.2866
15- 3	8366	2948	5418	8487	3162	5326	9528	4230	4461	837	2.6000	1.4348	1.6469	1.1389
1- 4	10863	4231	6632	13660	5581	8080	10723	4542	5095	1086	2.2196	1.0735	1.5363	0.9871
15- 4	13188	5296	7892	13660	5581	8080	11068	4304	5445	1319	1.9000	0.8126	1.3800	0.8392
1- 5	15657	6304	9353	17403	7519	9884	11262	3831	5865	1566	1.6082	0.6078	1.2542	0.7193
15- 5	17409	7153	10256	17403	7519	9884	11277	3599	5937	1741	1.4200	0.5031	1.1578	0.6478
1- 6	18619	7969	10650	19302	8686	10616	10993	3399	5733	1862	1.2619	0.4265	1.0766	0.5904
15- 6	18746	8099	10646	19302	8686	10616	10504	3095	5535	1875	1.1900	0.3821	1.0398	0.5604
1- 7	17973	7458	10515	17466	6987	10480	10095	2818	5479	1797	1.2089	0.3779	1.0422	0.5617
15- 7	16988	6755	10232	17466	6987	10480	10139	2880	5560	1699	1.3000	0.4263	1.0869	0.5968
1- 8	15893	6327	9565	14667	5776	8891	10514	3319	5605	1589	1.4738	0.5245	1.1720	0.6615
15- 8	14768	6020	8748	14667	5776	8891	10944	3856	5612	1477	1.7000	0.6406	1.2829	0.7411
1- 9	12903	5207	7696	10663	4277	6386	11132	4359	5483	1290	2.0321	0.8371	1.4250	0.8628
15- 9	10802	4169	6633	10663	4277	6386	10839	4551	5208	1080	2.3400	1.0918	1.5703	1.0035
1-10	8255	3059	5196	6221	2339	3882	9599	4506	4268	825	2.6956	1.4732	1.6427	1.1629
15-10	6171	2246	3924	6221	2339	3882	8370	4238	3515	617	3.0500	1.8865	1.7914	1.3564
1-11	4155	1378	2777	2697	665	2032	6217	3455	2347	416	3.5021	2.5073	1.6899	1.4962
15-11	2880	765	2115	2697	665	2032	4648	2459	1900	288	3.8500	3.2130	1.7972	1.6137
1-12	2059	438	1620	1725	392	1333	3448	1779	1463	206	4.1016	4.0606	1.8061	1.6752
15-12	1779	409	1371	1725	392	1333	3295	1860	1257	178	4.2000	4.5502	1.8344	1.8519

NORTH 90

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A=0.8060 A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	798	0	613	185	1.0345	0.0000	0.8884	0.4310
15- 1	2333	620	1713	2459	713	1746	990	0	756	233	1.0200	0.0000	0.8831	0.4242
1- 2	3430	974	2456	4662	1496	3166	1424	0	1081	343	0.9949	0.0000	0.8808	0.4153
15- 2	4743	1405	3338	4662	1496	3166	1928	0	1453	474	0.9700	0.0000	0.8709	0.4064
1- 3	6515	2069	4446	8487	3162	5326	2579	0	1927	652	0.9428	0.0000	0.8669	0.3958
15- 3	8366	2948	5418	8487	3162	5326	3157	0	2321	837	0.9200	0.0000	0.8568	0.3774
1- 4	10863	4231	6632	13660	5581	8080	3900	0	2814	1086	0.8931	0.0000	0.8486	0.3590
15- 4	13188	5296	7892	13660	5581	8080	4623	0	3304	1319	0.8700	0.0000	0.8373	0.3505
1- 5	15657	6304	9353	17403	7519	9884	5538	105	3867	1566	0.8467	0.0167	0.8269	0.3537
15- 5	17409	7153	10256	17403	7519	9884	6209	272	4196	1741	0.8300	0.0380	0.8183	0.3567
1- 6	18619	7969	10650	19302	8686	10616	6652	472	4319	1862	0.8159	0.0592	0.8111	0.3573
15- 6	18746	8099	10646	19302	8686	10616	6719	543	4301	1875	0.8100	0.0670	0.8080	0.3584
1- 7	17973	7458	10515	17466	6987	10480	6512	462	4253	1797	0.8121	0.0620	0.8090	0.3624
15- 7	16988	6755	10232	17466	6987	10480	6188	331	4159	1699	0.8200	0.0490	0.8129	0.3643
1- 8	15893	6327	9565	14667	5776	8891	5703	194	3920	1589	0.8339	0.0306	0.8197	0.3589
15- 8	14768	6020	8748	14667	5776	8891	5193	96	3620	1477	0.8500	0.0160	0.8276	0.3516
1- 9	12903	5207	7696	10663	4277	6386	4534	24	3220	1290	0.8712	0.0046	0.8368	0.3514
15- 9	10802	4169	6633	10663	4277	6386	3885	0	2805	1080	0.8900	0.0000	0.8457	0.3596
1-10	8255	3059	5196	6221	2339	3882	3036	0	2211	825	0.9133	0.0000	0.8510	0.3678
15-10	6171	2246	3924	6221	2339	3882	2309	0	1692	617	0.9400	0.0000	0.8622	0.3742
1-11	4155	1378	2777	2697	665	2032	1609	0	1193	416	0.9782	0.0000	0.8591	0.3871
15-11	2880	765	2115	2697	665	2032	1207	0	919	288	1.0100	0.0000	0.8669	0.4190
1-12	2059	438	1620	1725	392	1333	912	0	706	206	1.0334	0.0000	0.8713	0.4429
15-12	1779	409	1371	1725	392	1333	776	0	598	178	1.0400	0.0000	0.8732	0.4563

TABLE 4 CLIMATOLOGICAL VALUES OF THE GLOBAL,DIRECT,DIFFUSE AND GROUNDREFLECTED IRRADIATIONS (KJOULE/M2.DAY) ON THE HORIZONTAL (GLOBH,DIRH,DIFH) AND THE INCLINED SURFACE (GLOBS,DIRS,DIFS,REFS).
A IS THE DIFFUSE MULTIPLICATION FACTOR FOR OVERCAST SKYS. A+B IS THE SAME FACTOR FOR TOTALLY CLEAR SKYS.
FDIR IS THE MULTIPLICATION FACTOR FOR THE DIRECT IRRADIATION.
FDIF IS THE AVERAGE DIFFUSE MULTIPLICATION FACTOR.
RATIO IS THE RATIO OF THE AVERAGE GLOBAL IRRADIATIONS ON THE INCLINED AND THE HORIZONTAL SURFACE.

SOUTH 67.5 A=0.9260

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	4014	2150	1750	114	3.4479	4.5591	1.8351	2.1687
15- 1	2333	620	1713	2459	713	1746	4792	2521	2127	144	3.3400	4.0640	1.7962	2.0539
1- 2	3430	974	2456	4662	1496	3166	6403	3170	3021	212	3.0816	3.2529	1.7794	1.8665
15- 2	4743	1405	3338	4662	1496	3166	7798	3656	3849	293	2.8000	2.6020	1.6678	1.6440
1- 3	6515	2069	4446	8487	3162	5326	9631	4257	4972	402	2.4793	2.0572	1.6175	1.4782
15- 3	8366	2948	5418	8487	3162	5326	11145	5036	5593	516	2.2000	1.7081	1.4932	1.3322
1- 4	10863	4231	6632	13660	5581	8080	12868	5813	6385	671	1.8797	1.3738	1.3925	1.1846
15- 4	13188	5296	7892	13660	5581	8080	13760	5988	6958	814	1.6400	1.1306	1.2753	1.0434
1- 5	15657	6304	9353	17403	7519	9884	14608	5898	7743	967	1.4558	0.9356	1.1976	0.9330
15- 5	17409	7153	10256	17403	7519	9884	15130	5949	8107	1075	1.3500	0.8317	1.1433	0.8691
1- 6	18619	7969	10650	19302	8686	10616	15171	6000	8022	1149	1.2454	0.7529	1.0896	0.8148
15- 6	18746	8099	10646	19302	8686	10616	14662	5732	7773	1157	1.1800	0.7077	1.0561	0.7822
1- 7	17973	7458	10515	17466	6987	10480	14015	5253	7652	1109	1.1845	0.7044	1.0527	0.7798
15- 7	16988	6755	10232	17466	6987	10480	13851	5094	7708	1049	1.2600	0.7541	1.0897	0.8154
1- 8	15893	6327	9565	14667	5776	8891	13982	5399	7602	981	1.3822	0.8533	1.1496	0.8798
15- 8	14768	6020	8748	14667	5776	8891	14037	5823	7302	912	1.5000	0.9674	1.2073	0.9505
1- 9	12903	5207	7696	10663	4277	6386	13614	6009	6809	797	1.6751	1.1540	1.2797	1.0551
15- 9	10802	4169	6633	10663	4277	6386	12821	5799	6355	667	1.9000	1.3911	1.3858	1.1869
1-10	8255	3059	5196	6221	2339	3882	11164	5334	5321	510	2.2495	1.7439	1.4812	1.3524
15-10	6171	2246	3924	6221	2339	3882	9573	4775	4417	381	2.6000	2.1255	1.6282	1.5513
1-11	4155	1378	2777	2697	665	2032	6962	3719	2986	257	2.9671	2.6989	1.5554	1.6754
15-11	2880	765	2115	2697	665	2032	5122	2565	2379	178	3.2000	3.3510	1.6272	1.7783
1-12	2059	438	1620	1725	392	1333	3759	1812	1821	127	3.3617	4.1346	1.6251	1.8262
15-12	1779	409	1371	1725	392	1333	3546	1675	1561	110	3.4400	4.5872	1.6476	1.9930

SOUTH 22.5 A=0.9850

DATE	GLOBH	DIRH	DIFH	GLOBG	DIRG	DIFG	GLOBS	DIRS	DIFS	REFS	A + B	FDIR	FDIF	RATIO
1- 1	1851	471	1379	2459	713	1746	2951	1251	1686	14	1.7773	2.6535	1.2706	1.5945
15- 1	2333	620	1713	2459	713	1746	3614	1519	2077	18	1.7500	2.4485	1.2608	1.5490
1- 2	3430	974	2456	4662	1496	3166	5065	2059	2980	26	1.6836	2.1127	1.2615	1.4766
15- 2	4743	1405	3338	4662	1496	3166	6570	2590	3944	36	1.6000	1.8431	1.2284	1.3853
1- 3	6515	2069	4446	8487	3162	5326	8574	3347	5177	50	1.4917	1.6173	1.2106	1.3159
15- 3	8366	2948	5418	8487	3162	5326	10502	4342	6096	64	1.4000	1.4727	1.1698	1.2553
1- 4	10863	4231	6632	13660	5581	8080	13029	5645	7301	83	1.3108	1.3342	1.1444	1.1993
15- 4	13188	5296	7892	13660	5581	8080	15091	6529	8462	100	1.2500	1.2328	1.1146	1.1443
1- 5	15657	6304	9353	17403	7519	9884	17196	7248	9828	119	1.1946	1.1498	1.0925	1.0983
15- 5	17409	7153	10256	17403	7519	9884	18578	7893	10552	133	1.1500	1.1035	1.0696	1.0672
1- 6	18619	7969	10650	19302	8686	10616	19360	8505	10713	142	1.1037	1.0672	1.0458	1.0398
15- 6	18746	8099	10646	19302	8686	10616	19207	8479	10586	143	1.0800	1.0468	1.0337	1.0246
1- 7	17973	7458	10515	17466	6987	10480	18407	7803	10468	137	1.0869	1.0462	1.0349	1.0242
15- 7	16988	6755	10232	17466	6987	10480	17700	7224	10346	129	1.1200	1.0694	1.0512	1.0419
1- 8	15893	6327	9565	14667	5776	8891	17077	7050	9906	121	1.1720	1.1142	1.0766	1.0745
15- 8	14768	6020	8748	14667	5776	8891	16377	7007	9258	112	1.2200	1.1640	1.1002	1.1090
1- 9	12903	5207	7696	10663	4277	6386	14897	6471	8328	98	1.2812	1.2428	1.1248	1.1545
15- 9	10802	4169	6633	10663	4277	6386	13058	5592	7384	82	1.3500	1.3414	1.1573	1.2089
1-10	8255	3059	5196	6221	2339	3882	10513	4550	5900	63	1.4509	1.4875	1.1804	1.2735
15-10	6171	2246	3924	6221	2339	3882	8357	3696	4613	47	1.5500	1.6455	1.2220	1.3542
1-11	4155	1378	2777	2697	665	2032	5809	2595	3183	32	1.6538	1.8829	1.1912	1.3979
15-11	2880	765	2115	2697	665	2032	4135	1648	2465	22	1.7200	2.1530	1.2116	1.4356
1-12	2059	438	1620	1725	392	1333	2985	1086	1834	16	1.7636	2.4776	1.2085	1.4500
15-12	1779	409	1371	1725	392	1333	2702	1089	1599	14	1.7800	2.6650	1.2132	1.5188

TABLE 5

DE BILT 52.100 NB 5.1830L

RATIO OF THE DAILY DIRECT IRRADIATIN ON THE INCLINED SURFACE AND THE DAILY DIRECT IRRADIATION ON THE HORIZONTAL SURFACE AS A FUNCTION OF THE DATE, INCLINATION ANGLE OF THE SURFACE AND THE AZIMUTH OF THE INCLINED SURFACE

			0	15	30	45	60	75	90	105	120	135	150	165	180
			SOUTH			S EAST			EAST			N-EAST			NORTH
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 1	15.0	2.2	2.161	2.120	2.001	1.811	1.569	1.296	1.013	0.738	0.487	0.271	0.101	0.012	0.000
1- 1	30.0	2.2	3.175	3.096	2.865	2.500	2.042	1.546	1.058	0.618	0.261	0.031	0.000	0.000	0.000
1- 1	45.0	2.2	3.972	3.861	3.535	3.018	2.383	1.718	1.094	0.567	0.188	0.010	0.000	0.000	0.000
1- 1	60.0	2.2	4.499	4.363	3.963	3.330	2.566	1.792	1.091	0.529	0.157	0.007	0.000	0.000	0.000
1- 1	75.0	2.2	4.719	4.567	4.121	3.416	2.580	1.757	1.037	0.482	0.135	0.006	0.000	0.000	0.000
1- 1	90.0	2.2	4.617	4.460	3.999	3.270	2.423	1.616	0.931	0.420	0.114	0.005	0.000	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 1	15.0	2.5	2.005	1.970	1.866	1.701	1.491	1.253	1.004	0.760	0.535	0.338	0.179	0.076	0.044
15- 1	30.0	2.5	2.874	2.805	2.605	2.288	1.892	1.460	1.030	0.635	0.303	0.067	0.000	0.000	0.000
15- 1	45.0	2.5	3.546	3.449	3.166	2.719	2.172	1.596	1.047	0.574	0.219	0.025	0.000	0.000	0.000
15- 1	60.0	2.5	3.977	3.859	3.511	2.965	2.310	1.642	1.030	0.528	0.180	0.017	0.000	0.000	0.000
15- 1	75.0	2.5	4.137	4.005	3.618	3.010	2.297	1.593	0.968	0.475	0.152	0.013	0.000	0.000	0.000
15- 1	90.0	2.5	4.015	3.878	3.477	2.850	2.134	1.448	0.859	0.409	0.126	0.011	0.000	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 2	15.0	2.9	1.767	1.740	1.660	1.534	1.372	1.187	0.992	0.799	0.617	0.457	0.325	0.232	0.196
1- 2	30.0	2.9	2.414	2.361	2.207	1.965	1.663	1.331	0.993	0.672	0.387	0.156	0.008	0.000	0.000
1- 2	45.0	2.9	2.897	2.822	2.603	2.264	1.853	1.413	0.985	0.598	0.284	0.073	0.000	0.000	0.000
1- 2	60.0	2.9	3.182	3.090	2.822	2.411	1.924	1.422	0.948	0.540	0.230	0.048	0.000	0.000	0.000
1- 2	75.0	2.9	3.250	3.148	2.849	2.395	1.873	1.350	0.872	0.476	0.191	0.036	0.000	0.000	0.000
1- 2	90.0	2.9	3.096	2.991	2.682	2.218	1.703	1.203	0.759	0.402	0.155	0.028	0.000	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 2	15.0	3.3	1.591	1.570	1.508	1.409	1.284	1.139	0.985	0.831	0.685	0.555	0.449	0.376	0.349
15- 2	30.0	3.3	2.074	2.033	1.913	1.727	1.494	1.235	0.966	0.705	0.463	0.252	0.084	0.000	0.000
15- 2	45.0	3.3	2.415	2.357	2.188	1.930	1.616	1.278	0.939	0.621	0.346	0.134	0.014	0.000	0.000
15- 2	60.0	3.3	2.592	2.521	2.314	2.004	1.640	1.257	0.886	0.551	0.278	0.090	0.007	0.000	0.000
15- 2	75.0	3.3	2.592	2.513	2.282	1.946	1.562	1.170	0.800	0.478	0.227	0.067	0.005	0.000	0.000
15- 2	90.0	3.3	2.416	2.334	2.096	1.759	1.389	1.022	0.684	0.397	0.181	0.051	0.003	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 3	15.0	3.9	1.449	1.432	1.384	1.309	1.212	1.099	0.979	0.857	0.742	0.639	0.557	0.503	0.484
1- 3	30.0	3.9	1.799	1.767	1.675	1.534	1.356	1.155	0.943	0.732	0.531	0.349	0.191	0.063	0.000
1- 3	45.0	3.9	2.026	1.981	1.853	1.659	1.423	1.163	0.897	0.638	0.402	0.203	0.058	0.000	0.000
1- 3	60.0	3.9	2.115	2.060	1.905	1.677	1.407	1.118	0.828	0.557	0.320	0.138	0.029	0.000	0.000
1- 3	75.0	3.9	2.061	1.999	1.828	1.587	1.309	1.018	0.734	0.474	0.258	0.102	0.019	0.000	0.000
1- 3	90.0	3.9	1.865	1.802	1.628	1.394	1.134	0.869	0.614	0.386	0.202	0.075	0.013	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 3	15.0	4.3	1.339	1.326	1.290	1.231	1.156	1.069	0.975	0.880	0.789	0.709	0.646	0.606	0.593
15- 3	30.0	4.3	1.587	1.562	1.493	1.386	1.250	1.094	0.927	0.758	0.593	0.439	0.304	0.197	0.146
15- 3	45.0	4.3	1.726	1.692	1.597	1.453	1.276	1.077	0.867	0.657	0.456	0.275	0.123	0.020	0.000
15- 3	60.0	4.3	1.748	1.707	1.594	1.429	1.231	1.013	0.788	0.567	0.363	0.190	0.066	0.006	0.000
15- 3	75.0	4.3	1.651	1.605	1.485	1.316	1.118	0.904	0.686	0.476	0.289	0.140	0.043	0.003	0.000
15- 3	90.0	4.3	1.442	1.395	1.278	1.122	0.945	0.755	0.563	0.381	0.224	0.103	0.029	0.002	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 4	15.0	4.5	1.239	1.229	1.203	1.161	1.106	1.042	0.973	0.902	0.835	0.776	0.731	0.703	0.693
1- 4	30.0	4.5	1.393	1.376	1.327	1.251	1.154	1.040	0.916	0.786	0.657	0.536	0.431	0.359	0.339
1- 4	45.0	4.5	1.452	1.429	1.365	1.267	1.144	1.000	0.844	0.681	0.517	0.360	0.216	0.092	0.013
1- 4	60.0	4.5	1.412	1.386	1.314	1.207	1.074	0.921	0.755	0.583	0.413	0.257	0.125	0.034	0.002
1- 4	75.0	4.5	1.277	1.250	1.179	1.076	0.949	0.804	0.646	0.484	0.328	0.190	0.083	0.020	0.001
1- 4	90.0	4.5	1.054	1.030	0.970	0.885	0.779	0.656	0.521	0.383	0.252	0.140	0.057	0.013	0.001
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 4	15.0	4.7	1.176	1.169	1.149	1.117	1.074	1.025	0.971	0.916	0.864	0.819	0.785	0.763	0.755
15- 4	30.0	4.7	1.272	1.259	1.224	1.167	1.094	1.006	0.908	0.805	0.700	0.602	0.521	0.475	0.461
15- 4	45.0	4.7	1.281	1.266	1.221	1.152	1.061	0.952	0.829	0.696	0.559	0.422	0.292	0.174	0.134
15- 4	60.0	4.7	1.204	1.188	1.142	1.070	0.976	0.862	0.733	0.592	0.447	0.306	0.176	0.071	0.021
15- 4	75.0	4.7	1.046	1.032	0.992	0.929	0.844	0.740	0.620	0.489	0.365	0.227	0.119	0.041	0.011
15- 4	90.0	4.7	0.817	0.810	0.784	0.740	0.676	0.593	0.494	0.383	0.271	0.167	0.083	0.027	0.007

TABLE 5

DE BILT 52.100 NB 5.1830L

RATIO OF THE DAILY DIRECT IRRADIATIN ON THE INCLINED SURFACE AND THE DAILY DIRECT IRRADIATION ON THE HORIZONTAL SURFACE AS A FUNCTION OF THE DATE, INCLINATION ANGLE OF THE SURFACE AND THE AZIMUTH OF THE INCLINED SURFACE

			0	15	30	45	60	75	90	105	120	135	150	165	180
			SOUTH			S EAST			EAST			N-EAST			NORTH
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 5	15.0	5.1	1.122	1.117	1.102	1.078	1.047	1.010	0.970	0.928	0.889	0.856	0.831	0.816	0.810
1- 5	30.0	5.1	1.168	1.160	1.135	1.095	1.041	0.975	0.900	0.820	0.738	0.663	0.606	0.576	0.565
1- 5	45.0	5.1	1.136	1.127	1.099	1.051	0.987	0.907	0.812	0.707	0.594	0.479	0.369	0.296	0.282
1- 5	60.0	5.1	1.029	1.021	0.996	0.951	0.888	0.807	0.709	0.597	0.475	0.350	0.227	0.118	0.068
1- 5	75.0	5.1	0.853	0.850	0.834	0.802	0.751	0.680	0.591	0.488	0.375	0.260	0.154	0.070	0.034
1- 5	90.0	5.1	0.622	0.626	0.628	0.616	0.585	0.534	0.463	0.378	0.284	0.191	0.107	0.046	0.021
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 5	15.0	5.3	1.088	1.084	1.072	1.054	1.030	1.001	0.969	0.936	0.906	0.880	0.861	0.849	0.845
15- 5	30.0	5.3	1.103	1.097	1.079	1.049	1.007	0.955	0.895	0.830	0.764	0.704	0.663	0.640	0.632
15- 5	45.0	5.3	1.046	1.040	1.021	0.988	0.940	0.878	0.802	0.714	0.618	0.519	0.427	0.387	0.376
15- 5	60.0	5.3	0.920	0.916	0.904	0.876	0.832	0.771	0.693	0.600	0.494	0.381	0.266	0.163	0.121
15- 5	75.0	5.3	0.735	0.737	0.735	0.722	0.691	0.641	0.572	0.486	0.388	0.283	0.181	0.096	0.060
15- 5	90.0	5.3	0.506	0.515	0.532	0.538	0.527	0.495	0.443	0.374	0.293	0.207	0.126	0.062	0.037
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 6	15.0	5.3	1.060	1.057	1.048	1.034	1.016	0.993	0.968	0.943	0.920	0.900	0.885	0.876	0.873
1- 6	30.0	5.3	1.050	1.046	1.034	1.012	0.980	0.940	0.892	0.840	0.786	0.740	0.710	0.692	0.686
1- 6	45.0	5.3	0.973	0.970	0.959	0.938	0.904	0.856	0.795	0.722	0.641	0.556	0.486	0.461	0.452
1- 6	60.0	5.3	0.834	0.834	0.831	0.818	0.790	0.745	0.684	0.605	0.513	0.411	0.304	0.215	0.188
1- 6	75.0	5.3	0.643	0.649	0.658	0.660	0.646	0.613	0.561	0.489	0.403	0.307	0.208	0.125	0.092
1- 6	90.0	5.3	0.418	0.430	0.457	0.479	0.484	0.468	0.431	0.375	0.304	0.224	0.145	0.082	0.057
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 6	15.0	5.3	1.049	1.046	1.039	1.027	1.010	0.990	0.968	0.946	0.925	0.908	0.895	0.887	0.884
15- 6	30.0	5.3	1.030	1.026	1.016	0.997	0.970	0.934	0.891	0.843	0.795	0.754	0.728	0.713	0.707
15- 6	45.0	5.3	0.945	0.943	0.935	0.918	0.889	0.847	0.792	0.726	0.650	0.571	0.513	0.490	0.483
15- 6	60.0	5.3	0.801	0.802	0.803	0.795	0.773	0.735	0.680	0.608	0.521	0.423	0.320	0.240	0.225
15- 6	75.0	5.3	0.609	0.615	0.628	0.636	0.628	0.602	0.556	0.490	0.409	0.316	0.219	0.139	0.107
15- 6	90.0	5.3	0.385	0.398	0.429	0.456	0.467	0.457	0.426	0.375	0.308	0.231	0.154	0.091	0.067
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 7	15.0	5.6	1.051	1.048	1.041	1.028	1.011	0.990	0.968	0.945	0.924	0.906	0.893	0.884	0.881
1- 7	30.0	5.6	1.034	1.030	1.019	0.999	0.971	0.934	0.890	0.841	0.792	0.751	0.725	0.708	0.703
1- 7	45.0	5.6	0.950	0.947	0.938	0.920	0.889	0.846	0.790	0.722	0.646	0.566	0.507	0.484	0.476
1- 7	60.0	5.6	0.806	0.807	0.806	0.796	0.772	0.733	0.676	0.603	0.515	0.418	0.315	0.234	0.217
1- 7	75.0	5.6	0.614	0.620	0.631	0.637	0.627	0.599	0.551	0.485	0.403	0.310	0.214	0.133	0.101
1- 7	90.0	5.6	0.389	0.402	0.431	0.456	0.465	0.454	0.421	0.369	0.302	0.226	0.149	0.087	0.063
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 7	15.0	5.9	1.065	1.061	1.052	1.037	1.018	0.994	0.968	0.942	0.917	0.897	0.881	0.871	0.868
15- 7	30.0	5.9	1.059	1.054	1.040	1.016	0.982	0.940	0.890	0.835	0.781	0.733	0.702	0.683	0.676
15- 7	45.0	5.9	0.984	0.980	0.967	0.942	0.904	0.853	0.790	0.715	0.632	0.546	0.475	0.448	0.439
15- 7	60.0	5.9	0.846	0.845	0.839	0.821	0.789	0.741	0.676	0.595	0.502	0.399	0.292	0.202	0.173
15- 7	75.0	5.9	0.656	0.660	0.666	0.663	0.644	0.607	0.551	0.478	0.390	0.294	0.196	0.114	0.081
15- 7	90.0	5.9	0.428	0.440	0.463	0.480	0.481	0.461	0.421	0.363	0.291	0.212	0.135	0.073	0.049
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1- 8	15.0	6.0	1.094	1.090	1.077	1.058	1.032	1.002	0.968	0.934	0.903	0.876	0.855	0.843	0.838
1- 8	30.0	6.0	1.114	1.108	1.087	1.055	1.010	0.955	0.892	0.825	0.757	0.696	0.653	0.628	0.620
1- 8	45.0	6.0	1.061	1.054	1.032	0.994	0.942	0.875	0.795	0.705	0.607	0.507	0.414	0.371	0.359
1- 8	60.0	6.0	0.937	0.932	0.915	0.882	0.833	0.767	0.684	0.587	0.480	0.366	0.252	0.149	0.106
1- 8	75.0	6.0	0.753	0.753	0.746	0.727	0.690	0.635	0.561	0.473	0.373	0.268	0.168	0.085	0.050
1- 8	90.0	6.0	0.523	0.530	0.541	0.541	0.524	0.488	0.432	0.360	0.278	0.193	0.114	0.054	0.030
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 8	15.0	5.8	1.129	1.123	1.106	1.083	1.050	1.011	0.969	0.926	0.886	0.851	0.825	0.809	0.803
15- 8	30.0	5.8	1.181	1.172	1.145	1.101	1.044	0.975	0.897	0.813	0.730	0.653	0.594	0.562	0.552
15- 8	45.0	5.8	1.154	1.143	1.111	1.059	0.989	0.903	0.805	0.696	0.581	0.464	0.354	0.278	0.263
15- 8	60.0	5.8	1.050	1.040	1.009	0.958	0.889	0.801	0.698	0.582	0.459	0.333	0.212	0.106	0.056
15- 8	75.0	5.8	0.875	0.869	0.847	0.807	0.749	0.672	0.578	0.471	0.357	0.243	0.140	0.060	0.026
15- 8	90.0	5.8	0.644	0.645	0.640	0.620	0.581	0.524	0.449	0.362	0.267	0.175	0.095	0.038	0.016

TABLE 5

DE BILT 52.100 NB 5.1830L

RATIO OF THE DAILY DIRECT IRRADIATIN ON THE INCLINED SURFACE AND THE DAILY DIRECT IRRADIATION ON THE HORIZONTAL SURFACE AS A FUNCTION OF THE DATE, INCLINATION ANGLE OF THE SURFACE AND THE AZIMUTH OF THE INCLINED SURFACE

			0	15	30	45	60	75	90	105	120	135	150	165	180
DATE	ANGLE	TURB	SOUTH			S EAST S-WEST			EAST WEST			N-EAST N-WEST			NORTH NORTH
1- 9	15.0	5.4	1.187	1.179	1.158	1.124	1.079	1.027	0.970	0.913	0.858	0.811	0.775	0.753	0.745
1- 9	30.0	5.4	1.293	1.279	1.240	1.180	1.101	1.008	0.905	0.796	0.686	0.587	0.504	0.454	0.440
1- 9	45.0	5.4	1.311	1.293	1.244	1.167	1.068	0.951	0.821	0.683	0.542	0.403	0.272	0.155	0.104
1- 9	60.0	5.4	1.240	1.221	1.168	1.086	0.982	0.860	0.723	0.577	0.429	0.286	0.158	0.059	0.014
1- 9	75.0	5.4	1.085	1.067	1.019	0.945	0.850	0.736	0.608	0.472	0.336	0.209	0.104	0.033	0.007
1- 9	90.0	5.4	0.856	0.844	0.809	0.754	0.680	0.588	0.481	0.367	0.253	0.151	0.071	0.021	0.004
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15- 9	15.0	4.7	1.250	1.240	1.212	1.169	1.111	1.045	0.972	0.899	0.829	0.768	0.721	0.692	0.682
15- 9	30.0	4.7	1.414	1.396	1.345	1.266	1.164	1.045	0.915	0.781	0.648	0.523	0.415	0.339	0.318
15- 9	45.0	4.7	1.483	1.458	1.390	1.286	1.156	1.006	0.843	0.674	0.507	0.347	0.202	0.079	0.006
15- 9	60.0	4.7	1.450	1.421	1.344	1.230	1.088	0.927	0.754	0.576	0.403	0.245	0.115	0.029	0.001
15- 9	75.0	4.7	1.318	1.289	1.211	1.100	0.964	0.810	0.645	0.478	0.319	0.180	0.075	0.016	0.001
15- 9	90.0	4.7	1.097	1.069	1.001	0.907	0.793	0.662	0.521	0.378	0.244	0.132	0.052	0.010	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1-10	15.0	3.9	1.346	1.333	1.296	1.237	1.161	1.072	0.977	0.880	0.787	0.706	0.641	0.600	0.586
1-10	30.0	3.9	1.600	1.575	1.505	1.396	1.259	1.102	0.933	0.761	0.594	0.437	0.299	0.189	0.134
1-10	45.0	3.9	1.745	1.710	1.613	1.469	1.290	1.090	0.878	0.665	0.461	0.277	0.123	0.019	0.000
1-10	60.0	3.9	1.771	1.729	1.615	1.449	1.250	1.030	0.802	0.578	0.371	0.195	0.067	0.006	0.000
1-10	75.0	3.9	1.677	1.630	1.508	1.339	1.139	0.923	0.702	0.489	0.299	0.145	0.045	0.004	0.000
1-10	90.0	3.9	1.468	1.420	1.302	1.146	0.967	0.775	0.580	0.395	0.233	0.108	0.031	0.002	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15-10	15.0	3.5	1.457	1.440	1.391	1.315	1.216	1.103	0.981	0.857	0.740	0.636	0.552	0.497	0.477
15-10	30.0	3.5	1.814	1.782	1.689	1.546	1.366	1.163	0.950	0.736	0.533	0.348	0.188	0.057	0.000
15-10	45.0	3.5	2.048	2.002	1.872	1.677	1.439	1.177	0.908	0.646	0.407	0.205	0.058	0.000	0.000
15-10	60.0	3.5	2.142	2.086	1.928	1.699	1.427	1.136	0.843	0.568	0.328	0.142	0.030	0.000	0.000
15-10	75.0	3.5	2.090	2.028	1.855	1.611	1.332	1.038	0.751	0.488	0.267	0.106	0.020	0.000	0.000
15-10	90.0	3.5	1.896	1.832	1.656	1.420	1.159	0.890	0.632	0.400	0.211	0.080	0.014	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1-11	15.0	3.6	1.629	1.606	1.540	1.436	1.302	1.148	0.984	0.821	0.667	0.530	0.419	0.342	0.313
1-11	30.0	3.6	2.147	2.103	1.975	1.776	1.527	1.250	0.965	0.689	0.438	0.223	0.058	0.000	0.000
1-11	45.0	3.6	2.518	2.456	2.276	1.999	1.661	1.298	0.937	0.603	0.321	0.112	0.007	0.000	0.000
1-11	60.0	3.6	2.718	2.642	2.422	2.088	1.693	1.280	0.884	0.533	0.255	0.073	0.003	0.000	0.000
1-11	75.0	3.6	2.733	2.648	2.402	2.037	1.618	1.194	0.799	0.461	0.207	0.054	0.002	0.000	0.000
1-11	90.0	3.6	2.561	2.474	2.220	1.851	1.444	1.044	0.682	0.381	0.164	0.040	0.002	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15-11	15.0	3.5	1.803	1.775	1.691	1.559	1.388	1.194	0.969	0.786	0.597	0.431	0.295	0.200	0.165
15-11	30.0	3.5	2.484	2.428	2.267	2.012	1.693	1.339	0.983	0.647	0.356	0.127	0.000	0.000	0.000
15-11	45.0	3.5	2.995	2.917	2.688	2.330	1.891	1.422	0.969	0.567	0.251	0.053	0.000	0.000	0.000
15-11	60.0	3.5	3.302	3.206	2.926	2.490	1.968	1.429	0.927	0.505	0.198	0.033	0.000	0.000	0.000
15-11	75.0	3.5	3.384	3.277	2.965	2.482	1.918	1.356	0.849	0.441	0.161	0.024	0.000	0.000	0.000
15-11	90.0	3.5	3.235	3.125	2.802	2.306	1.746	1.206	0.735	0.368	0.128	0.018	0.000	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
1-12	15.0	2.9	2.024	1.987	1.882	1.714	1.499	1.255	1.000	0.751	0.522	0.323	0.163	0.061	0.031
1-12	30.0	2.9	2.909	2.840	2.635	2.312	1.906	1.461	1.020	0.617	0.284	0.055	0.000	0.000	0.000
1-12	45.0	2.9	3.597	3.498	3.209	2.753	2.190	1.595	1.032	0.551	0.199	0.018	0.000	0.000	0.000
1-12	60.0	2.9	4.039	3.918	3.565	3.006	2.330	1.639	1.010	0.502	0.160	0.012	0.000	0.000	0.000
1-12	75.0	2.9	4.206	4.071	3.677	3.056	2.318	1.587	0.945	0.448	0.134	0.009	0.000	0.000	0.000
1-12	90.0	2.9	4.086	3.947	3.539	2.897	2.153	1.441	0.835	0.383	0.110	0.007	0.000	0.000	0.000
DATE	ANGLE	TURB	SOUTH			S-WEST			WEST			N-WEST			NORTH
15-12	15.0	2.3	2.171	2.130	2.010	1.818	1.574	1.298	1.012	0.735	0.461	0.264	0.095	0.008	0.000
15-12	30.0	2.3	3.195	3.115	2.883	2.513	2.051	1.549	1.055	0.611	0.253	0.027	0.000	0.000	0.000
15-12	45.0	2.3	4.000	3.888	3.559	3.037	2.394	1.721	1.089	0.559	0.181	0.008	0.000	0.000	0.000
15-12	60.0	2.3	4.533	4.396	3.993	3.354	2.580	1.794	1.085	0.520	0.150	0.006	0.000	0.000	0.000
15-12	75.0	2.3	4.757	4.604	4.155	3.443	2.594	1.759	1.031	0.473	0.129	0.005	0.000	0.000	0.000
15-12	90.0	2.3	4.657	4.498	4.033	3.297	2.437	1.617	0.924	0.412	0.108	0.004	0.000	0.000	0.000