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2.0 Courses

You will find courses of the year as well as its averages and extremes. Furthermore it allows the output of degree- and gram-day numbers.

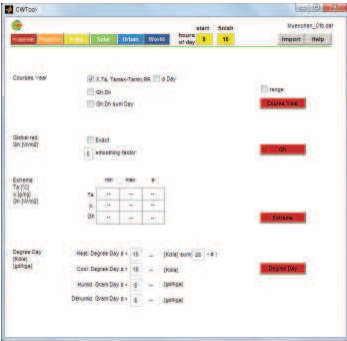


Fig. 2.0.1 Menu item Course.

2.1 Courses Year

Diagram of various specifications throughout the year.

By selecting a checkbox for each climatic parameter a diagram is generated by clicking on the 'Course Year' button.

The diagrams use 8,760 hourly data for the whole year. Choose 'ø Day' for data based on 365 average daily values.

2.1.1. X, Ta, Ta_{max} - Ta_{min}, RR



Fig. 2.1.1.1 Selection climate data (8,760 hour data).

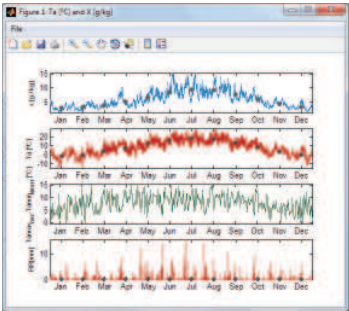


Fig. 2.1.1.2 Example of output X, Ta, Ta_{max}-Ta_{min} and RR with 8,760 hour data.
Order of graphs:
-Absolute humidity x [g/kg] with monthly averages
-Outside air temperature Ta [°C] with monthly averages
-Temperature difference Ta_{max}-Ta_{min} [°C]
-Precipitation RR [mm] with monthly averages.

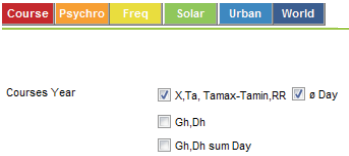


Fig. 2.1.1.3 Selection climate data (365 daily average values).

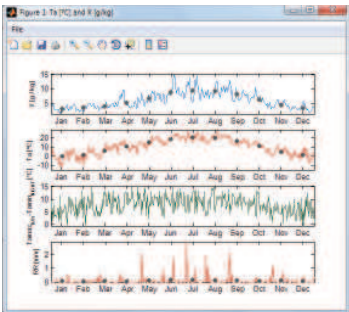


Fig. 2.1.1.4 Example output X, Ta, Ta_{max}-Ta_{min}, RR with 365 daily average values.
Same order of graphs as in Fig. 2.1.1.2

2.1.2 Gh, Dh

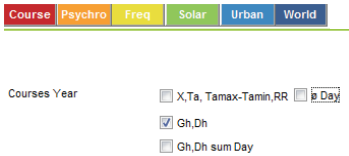


Fig. 2.1.2.1 Selection solar radiation (8,760 hour data).

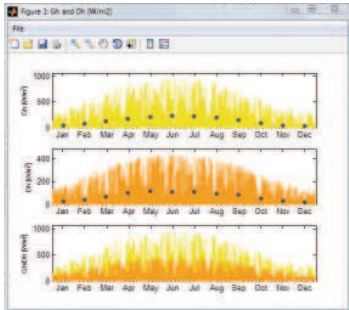


Fig. 2.1.2.2 Example output Gh, Dh with 8,760 hour data.
Order of graphs:
-Global radiation Gh [W/m²] with monthly averages
-Diffuse radiation Dh [W/m²] with monthly averages
-Global and Diffuse radiation Gh/Dh [W/m²]

2.1.3 Gh, Dh sum Day

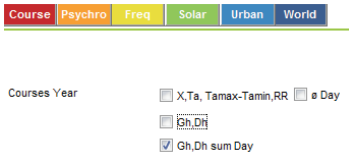


Fig. 2.1.3.1 Selection solar radiation (365 average values).

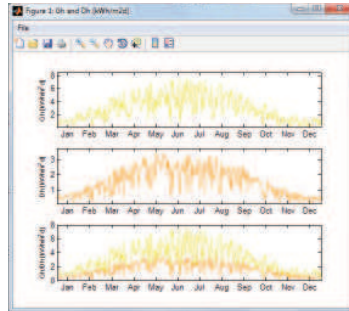


Fig. 2.1.3.2 Example output Gh, Dh with 365 daily average values.
-Order of graphs:
-Global radiation Gh [kWh/m²d],
-Diffuse radiation Dh [kWh/m²d],
-Global and Diffuse radiation Gh/Dh [kWh/m²d] with the received amount of solar energy per day.

2.2.1 Global rad.:

Displays the predominant global radiation [W/m²] and level of illumination [klux] for any particular hour during the course of the year. Depending on the filter peaks can be smoothed.

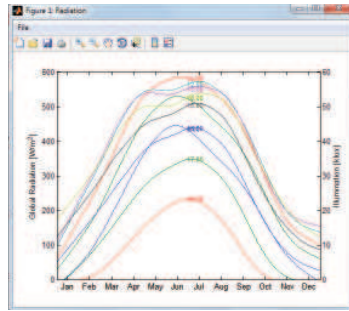


Fig. 2.2.1.1 Example output Global rad., 8:00 to 18:00h, 9am to 6pm, with filter.



Significance of resulting data:
Heating degree days [Kd/a]
Product of the number of heating days and the difference between average indoor air temperature (e.g. 20 °C) and the average outdoor air temperature over the course of one day.

Cooling degree days [Kd/a]
Product of the number of cooling days within the whole year (outdoor air temperature 18 °C) and the temperature difference between the outdoor temperature of the cooling day and the supply air temperature (e.g. 18 °C).

Humidification gram days [gd/kg]
Product of the number of humidification hours (hours < 8g/kg) and the difference between the water content of the indoor air (8 g/kg) and the absolute water content of the outdoor air (during the humidification hour)
The humidification gram days result from the operating hours per day and the operating days per year.

Dehumidification gram days [gd/kg]
Product of the number of dehumidification hours within the whole year (hours > 8g/kg) and the difference between the absolute water content of the outdoor air (during the dehumidification hour) and the water content of the indoor air (8 g/kg). The dehumidification gram days result from the operating hours per day and the using days per year.

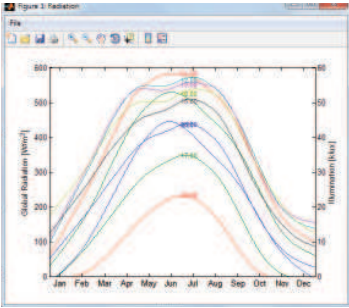


Fig. 2.2.1.1 Example output Global rad., 8:00 to 18:00h, 9am to 6pm, without filter.

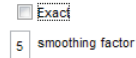


Fig. 2.2.1.2 Filter options for displaying the graphs

2.2 Extrema

By clicking on the button 'Extrema' a summary table is displayed, showing the extremes
Ta[°C] Outside air temperature,
x[g/kg] Absolute humidity and
Gh[W/m²] Global radiation
each with yearly maxima, yearly minima and the annual average.

Extrema	min	max	a
Ta [°C]	-13.5	28.7	10.3
x [g/kg]	1.3	15.2	5.9
Gh [W/m²]	0.0	970.0	289.9

Fig. 2.2.1 Example output extrema

2.3 Degree-day and gram-day

In order to assess the demand for heating or cooling it helps to determine the number of degree days [Kd/a]. Both heating days and cooling days can be calculated, adjusting the heating level (e.g. 15°C) and the cooling level (e.g. 18°C) and the average indoor air temperature individually.

By obtaining the number of gramdays [gd/kg] you can decide whether humidification or dehumidification is needed. The maximum water content of the air (e.g. 8 g/kg) can be adapted.

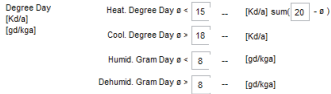


Fig. 2.3.1 Example output degree- days and gram-days.

3.0 Psychrometric chart

The menu option 'Psychro' displays and combines outdoor air temperature and absolute humidity, or precipitation. You can create both the psychrometric diagram and the hx-diagram (chart year) which allows assignment to the climate zones, concerning building climatology and room conditioning.
The 'Climate Diagram' (according to Walter, Lieth 1967) displays temperature and distribution of precipitation to compare the results.

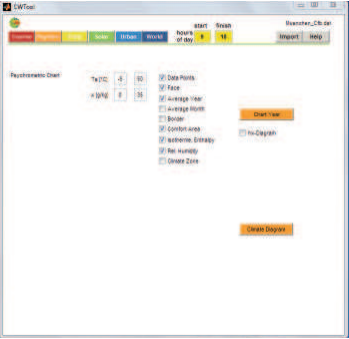


Fig. 3.0.1 Menu item psychro.

3.1 Psychrometric Chart

The psychrometric chart is a correlation between temperature [°C] and fresh air humidity, absolute [g/kg] and relative [%]. By clicking on the button 'Chart Year' three different time scales are displayed: 24 hours, times of day and night(8.00 am to 6.00 pm and 6.00 pm to 8.00 am). The daytime and nighttime area can be set individually by clicking on the button 'hours 9/18' (yellow).

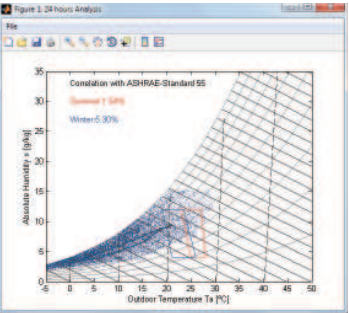


Fig. 3.1.1 Example output psychrometric chart.

The diagram helps to assign a location to a specific climate zone, demonstrates the possible need for conditioning measures, and shows the different possibilities of conditioning. Relevant design information for passive cooling systems is the dew point temperature and the wet-bulb temperature (risk of condensation, or evaporation)

The Psychrometric Chart features numerous options of configuration as follows:

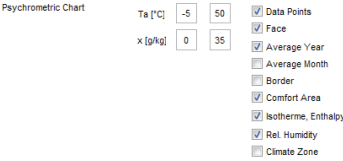


Fig.3.1.2 Various setting options of the psychro menu.

Ta [°C] and x [g/kg]:
the scale of the X-axis or the Y-axis can be individually set. the display values are set in steps of 5.

Data Points:
You can display or hide the 8,760 data points.

Face:
The area of the hourly data (light blue) can either be displayed or blended out.



Average Year:
monthly average values are shown (dark grey points), connected by the thicker dark blue line.

Average Month:
all of the daily average values are displayed.

Border:
You can display or hide the contour line for the hourly data.

Comfort Area:
the comfort zone (summer and winter) according to the ASHRAE Standard 55 is displayed. The diagram also shows the percentage of hourly data in the comfort zone.

Isotherme, Enthalpy:
isotherm and enthalpy lines can either be displayed or blended out.

Rel. Humidity:
the rel. humidity line can either be displayed or blended out.

Climate Zone:
main climate zones according to the building climate classification (Liedl, 2011) are displayed

h,x-Diagram:
instead of the psychrometric-chart the data output is displayed in a hx-diagram.

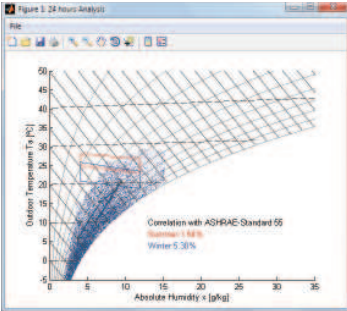


Fig. 3.1.3 Example output h,x-diagram.

3.2 Climate Diagram

By clicking on the button 'Climate Diagram' a diagram with monthly average values of outdoor air temperature and precipitation is displayed (according to Walter, Lieth).

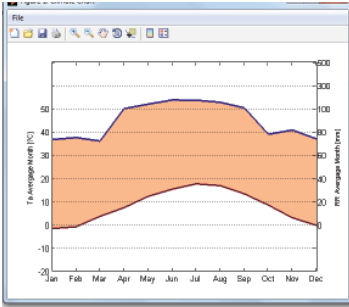


Fig. 3.2.1 Example output climate diagram.

The displayed data facilitate the consideration in the design of seasonal effects on outdoor air temperature and precipitation.

4.0 Frequencies

In the column 'Freq' you can display the cumulative frequency for climatic elements, such as temperature, humidity, solar radiation, light and wind.

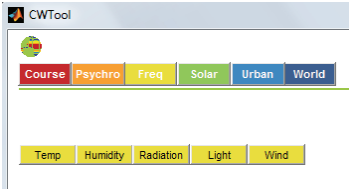


Fig. 4.0.1 Menu Item Freq

The program can output the result both on a monthly view and for the full year (divided into day and night) in different pie charts. These display the generated circles and the pertinent colored legends.

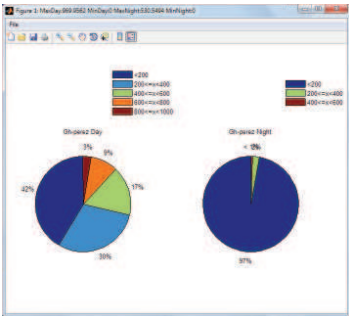


Fig. 4.0.2 Example output Freq.:
Global radiation Gh [w/m²] Year.

The frequency pie charts are therefore an important support in answering different questions in the planning of buildings and in the concepts of room conditioning.

The following explains the different menu items/ output possibilities/ setting options.

The interval size (e.g. 5), the start value (e.g. $x < -10$) and the end value (e.g. $x \geq 40$) of the pie charts can be individually set by clicking on the input field below.

from step to

-10 5 40 ☐ user

Fig. 4.0.3 Setting of interval size and start / end value

The colors (RGB) of the circular segments can be configured individually. There is a separate color file for each menu item in the following folder:
'CWT' folder > 'database' folder > 'user' folder

<input type="checkbox"/> deltaTmaxTcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Fcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Ghcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Lcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Lqcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> sumGh-color	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Tcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Tdcolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> Tpscolor	04.04.2011 00:06	Textdokument	1 KB
<input type="checkbox"/> wettdcolor	17.04.2011 13:06	Textdokument	1 KB
<input type="checkbox"/> Xcolor	04.04.2011 00:06	Textdokument	1 KB

Fig. 4.0.4 Color data of different menu subitems.

In these files you find a list of all color values (RGB) of the segments. The number of colors corresponds to the number of circular segments. You can change the color by entering the RGB values of the desired color.

Datei	Bearbeiten	Format	Ansicht	?
42	77	125		
48	124	180		
140	169	207		
229	233	245		
253	244	171		
239	218	28		
243	151	27		
231	85	21		
228	161	173		
176	28	66		
135	19	37		
69	19	37		

Fig. 4.0.5 Color data of different menu subitems.

To apply the individually set colors on the pie chart, you check the box 'user'.

from step to

-10 5 40 ☒ user

Fig. 4.0.6 Activation of user defined colors.



4.1 Temp

Temp Humidity Radiation Light Wind

Outdoor Air Temp. Ta [°C]
from -10 step 5 to 40 user

Temp. difference Max Day - Min Night [K]
from 5 step 5 to 20 user

Fig. 4.1.1 User interface Temp.

4.1.1 Outdoor Air Temp. Ta [°C]

The distribution of the outdoor air temperature indicates whether a room needs to be cooled or heated.

4.1.2 Temp. difference Delta Ta[K]

For assessing the potential of night cooling, the temperature difference between the daily maximum and minimum are important values.

4.2 Humidity

Temp Humidity Radiation Light Wind

Absolute Humid. x [g/kg]
from 4 step 4 to 12 user

Dewpoint Temp. Td [°C]
from 10 step 2 to 24 user

Cooling Limit Temp. Tp [°C]

Fig. 4.2.1 User interface Humidity.

4.2.1 Absolute Humid. x [g/kg]

The absolute humidity is an important parameter which can help to decide whether natural ventilation or night cooling are possible and whether the cooling systems run without treatment of the incoming air.

4.2.2 Dewpoint Temp. Td [°C] and Cooling Limit Temp. Tp [°C]

The dew point temperature indicates if dehumidification of the supply air is needed (to realize cooling systems). The cooling limit temperature indicates if cooling by evaporation is possible.

4.3 Radiation

Temp Humidity Radiation Light Wind

Global radiation Gh [W/m²]
from 200 step 200 to 1000 user

Incl. Surface [°]
N E S W N
0

Global radiation Gh [kWh/m²d]
from 2 step 2 to 10 user

Diffuse-/ Direct radiation Dh/Bh [%]

Fig. 4.3.1 Various setting options of the radiation menu.

4.3.1 Global radiation Gh [W/m²]

Global radiation shows the cumulative frequency of global radiation, direct radiation or diffuse radiation, depending on inclination from vertical (90° means a vertical wall) and orientation of the surface.

Both, inclination and orientation can be defined exactly with the help of the cursor. You also can choose between global radiation Gh, direct radiation Dh and diffuse radiation Bh.

Incl. Surface [°] 0

N E S W N

Gh Dh Bh

Fig. 4.3.2 Settings of global radiation Gh [W/m²].

4.3.2 Global radiation Gh [kWh/m²d]

The amount of solar energy every day shows the solar heat load for the respective location. It may indicate the possibilities of energy generation such as photovoltaic systems, solar collectors or solar cooling.

4.3.3 Diffuse / Direct radiation Dh/Bh [%]

To decide which sun protection concept is the best, the amount of diffuse and direct radiation must be taken into account. It also shows the efficiency of solar energy production systems.

4.4 Light

Temp Humidity Radiation Light Wind

Global illum. Lg [lux]
from 5000 step 5000 to 25000 user

Diffuse illum. Ld [lux]

Average illum. [lux]
21 . 3 . 12 Hour -- [lux]
e + 15 Days -- [lux]

Fig. 4.4.1 User interface Light

4.4.1 Global illum. Lg [lux] and Diffuse Ld [lux]

Displays the illumination level, both global and diffuse. The diffuse illumination level during the usage time helps to determine the daylight factor, which provides statements for illumination with daylight.

4.4.2 Average illum. [lux]

Displays the daylight quotient for different kinds of glazing or window surface area, depending on the depth of the room.

To determine the desired time, use the input field. Daily extremes are relativized by the display of the average illumination (e.g. ± 15 days).

21 . 3 . 12 Hour 71039 [lux] Average

e + 15 Days 51945 [lux]

Fig. 4.4.2.1 Setting options Average illum. [lux].

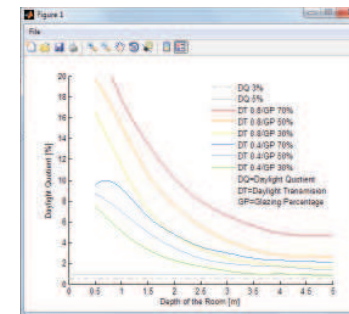


Fig. 4.4.2.2 Example output Average illum. [lux], Average Lg of 3/21/12

4.5 Wind

Temp Humidity Radiation Light Wind

Wind speed FF [m/sec]
from 2 step 2 to 14 user

Wind direction DD [°]
45 ☒ Wind rose ☐ Freq.

Angel in deg has to be a divisor of 300. E.g. 45° = +22.5° around north, with a sequence of +45°

Fig. 4.5.1 User interface Wind

4.5.1 Wind speed FF [m/sec]

The wind speed may influence the heat requirements in winter and the cooling in summer. The wind speed is also important for the feasibility of solar shading or energy production.

4.5.2 Wind direction DD [°]

To avoid pressure differences at the building, and to permit natural ventilation, it is important to take the wind direction into account.

You can define the subdivisions of the wind rose by choosing the angular size for every single section. In order to improve comparability the from-to-value of the legend / of the wind speed can be individually set via the input field shown below.

10

FF min/max 0.0 13.3

DD Month DD Year

Fig. 4.5.2.1 Setting options Wind direction DD [°]

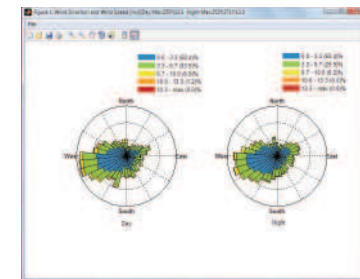


Fig. 4.5.2.2 Example output Wind direction DD [°], DD Year,



5.0 Solar

The ClimateTool enables you to determine the solar radiation on any inclined surface as the power or energy amount for individual days, months or the whole year. Percentages of the diffuse and direct radiation can also be determined.

The course of solar radiation and the amount and type of irradiated solar energy can be analysed for individual days, months, or for the whole year.

The solar diagrams illustrate the influence of orientation and inclination with regard to the amount and kind of solar radiation over the course of a year. They are an important and helpful factor in urban planning, in facade conception, and in planning solar energy systems.



Fig. 5.0.1 Menu item Solar.

Further details on the corresponding menu items are given in the following paragraphs.

5.1 Solar radiation Day [kWh/m²d]

By clicking on the 'Diagram Day' button, the course of the solar radiation on a certain day (as explained below) on differently orientated surfaces can be displayed.

Day: 21
Month: 3

Fig. 5.1.1 Setting option Solar radiation Day [kWh/m²d], Auto.

The displayed graphic chart serves as a tool for orientating the building and for estimating the solar radiation of the room, as all directions and the horizontal level can be set.

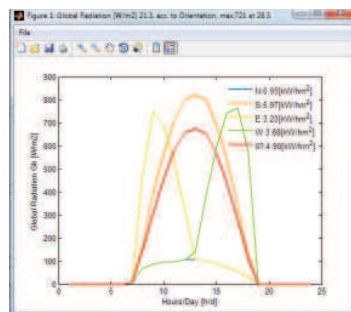



Fig. 5.1.2 Example output Solar radiation Day [kWh/m²d], Diagram Day, 3/21 Auto

By clicking the 'Facade Day' button the program generates two different graphic charts, which display the amount of solar energy received [kWh/m²d], for different orientations. There is a projected cube with differently oriented surfaces that shows the amount of solar energy on the left and on the right is the same cube in 3D. You can rotate the view of this cube by using the button .

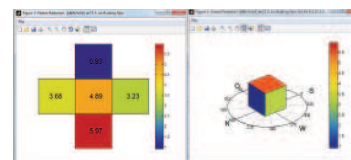


Fig. 5.1.3 Example output Solar radiation Day [kWh/m²d], Facade Day, 3/21 Auto.

Via the setting options shown below, surfaces that are arbitrarily oriented or inclined can be displayed exactly. You also may investigate the global, direct, and diffuse solar radiation.

Incl. Surface [°]
differ from horizontal: 90
N E S W N

Fig. 5.1.4 Setting option Solar radiation Day [kWh/m²d] inclination and orientation.

As an example the radiation on a vertical surface facing west is displayed.

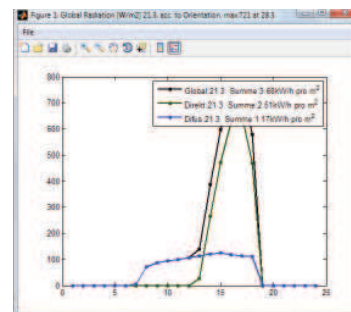


Fig. 5.1.5 Example output Solar radiation Day [kWh/m²d], Diagram Day, 3/21 vertical west facade,

5.2 Solar radiation Month [kWh/m²m]

Via this menu item the program calculates the amount of solar energy [kWh/m²] on both, the surface (facing north, east, south and west) and the horizontal surface (all faces of the cube) for the respective month.



Fig. 5.2.1 Example output Solar radiation Month [kWh/m²m], Global radiation, Facade Month.

By choosing 'Direct' and 'Diffuse' you can determine the share of direct and diffuse part of the total amount of solar radiation.

'Single Months' shows every month of the global radiation separately in a graphic chart.



5.3 Solar radiation Year [kWh/m²a]

This menu item opens up the possibility of calculating the amount of solar energy [kWh/m²a] depending on the orientation and the angle of inclination, for global radiation as well as direct and diffuse radiation.

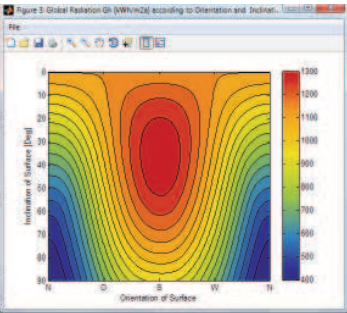


Fig. 5.3.1 Example output Solar radiation Month [kWh/m²a], Facade Month

In addition, the menu item serves to determine the month providing the highest amount of radiation energy [kWh/m²a] and the optimum inclination [°] of the building surface for the respective month.

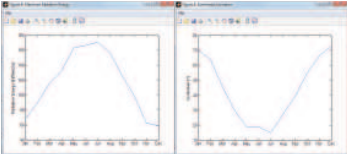


Fig. 5.3.2 Example output Solar radiation Year [kWh/m²a], Maximum Radiation Energy and Optimized Inclination.

Via the option 'Year' you can select the period of time, over a full year or just a single month.

In order to enhance the comparability of different graphic charts, you can create a fixed legend with a from-to-scale under the menu item 'Range'.

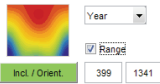


Fig. 5.3.4 Setting example Solar radiation Year [kWh/m²a], Facade Month.

5.4 General views [various]

In 'General views' you can select from an extensive list of climate values (fig. xx). All selected values are displayed in one graphic chart. By assigning values to the abscissa and the ordinate axes the correlation between three parameters can be generated.

Please find details for the meaning of the abbreviations in chapter 'Import'.

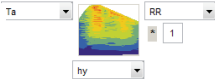


Fig. 5.4.1 Selection example General views [various], Ta and RR with hy.

As an example, outdoor air humidity Ta [°C], precipitation RR [mm] and hours per year hy [h] are selected. The figure below shows the assessment of the correlated values.

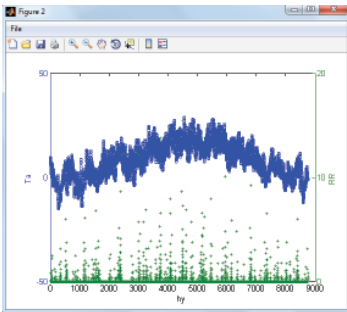


Fig. 5.4.2 Example output General views [various], Ta and RR with hy.

6.0 Urban

Basic questions in urban planning with regard to orientation, height, and distance between buildings, as well as their influence on mutual shading could be clarified with the analysis of menu 'Urban'. You must set a location before using this tool. See 'Import' instructions in section 1.2. (Need to double-check the Bk designation)

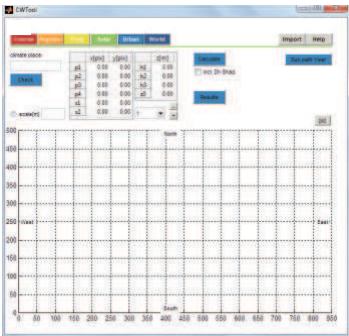


Fig. 6.0.1 Menu item Urban.

6.1 Sun Path

Due to the geographical position of the location you can value altitude and azimuth of the sun from the sun chart, both for a specified month (red lines) and a specified time (green lines). Data concerning sunlight, shading, day length, sun zenith, compass direction and sunrise and sunset can be determined for an entire year.

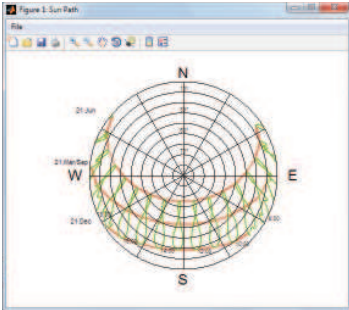


Fig. 6.1.1 Output Sun Path, Year.

6.2 Model

The effect of one building shading another can be precisely calculated. There are two main ways to establish the building's geometry. You may enter values in the table directly or draw them in a clockwise or counterclockwise manner. Each building is defined by four corner points (p1, p2, p3, & p4), the first eave height (h1), a roof ridge height (h2), and the other eave height (h3). You can also specify displacement from the vertical axis using (z0).

	x[m]	y[m]		z[m]
p1	62.30	-55.70	h1	0.00
p2	66.86	-16.97	h2	0.00
p3	54.74	-14.77	h3	0.00
p4	49.54	-54.44	z0	0.00
s1	-82.72	53.53		
s2	-80.64	65.34		

Fig. 6.2.1 Entering and changing building values.

It is also possible to import a jpg image for tracing. Simply click on the 'pic' button, select your image, and it will be inserted. The image below is from a screen capture of Google Maps®. This method is very helpful for non-orthogonal buildings and sites. To scale the building to the image simply enter a known distance next to the 'scale[m]' button, select it, then trace the element in the image with the known length. The roof ridge is always parallel to line segment 1-2.

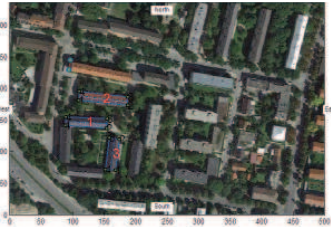


Fig. 6.2.2 Urban overview with loaded image and drawn buildings.

Fig. 5.3.3 Setting option of different climate values.



The box with a '1' adjacent to '+' and '-' indicates which building you are adjusting. To add another building click on the '+'. To remove a building click on the '-'. The large red number on the plan indicates the building.



To see if your buildings have been properly constructed, click on the 'Check' button. This will bring up an image similar to the one below. You may freely rotate the image using the button. You may zoom and save the model using the button above the menu tabs.

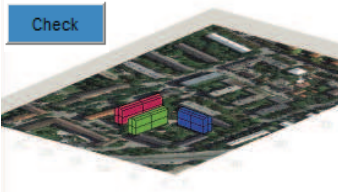


Fig. 6.2.3 Check.

6.2.1 Calculating the results

Once you are sure the geometry is correct, press the 'calculate' button.

You may choose to include diffuse horizontal radiation in the calculations or not by placing a checkmark in the box next to 'incl. Dh Shad.' For further explanation please refer to chapter 'Dh. Shad.'.

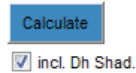


Fig. 6.2.1.1 Calculate incl. Dh Shad.

By clicking on the 'calculate' button a window will be opened where you can define the following parameters of the building envelope:

emission	[-]
absorption	[-]
heat transfer coefficient extern	[W/m ²]
heat transfer coefficient intern	[W/m ²]
temperature (face inside)	[°C]
thermal resistance	[W/m ²]

After adjusting the settings you can click the 'go' button to start the calculation.

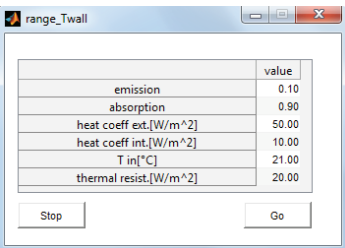


Fig. 6.2.1.2 Definition of walls

The geometry of your building(s) and the results of the calculation will be automatically saved in your installation folder under 'db/sol/Name'

6.2.2 Read and display the results

Once the calculations have completed, you may view the various result options. You can view the results by global horizontal radiation (Gh), direct normal radiation (Bk), and/or diffuse horizontal radiation (Dh), outside temperature of the building faces (Tout), inside temperature of the building faces (Tin), the heat flux density of the building sections can be listed both, individually (q) or collectively (qbuilding). To specify the selected climate data you can choose between the mean, the minimum, the maximum and the sum. You can determine individually the initial and the end value in the table on the right. By clicking on the 'clear' button the program generates suitable values automatically. All results can be calculated for the whole year or by individual month.

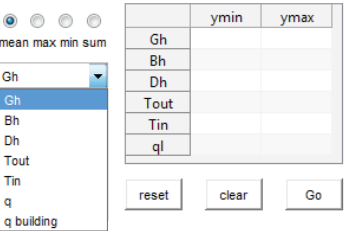


Fig. 6.2.2.1 Options results.

Clicking on the 'Go' button will provide a 3D view of the chosen calculation.

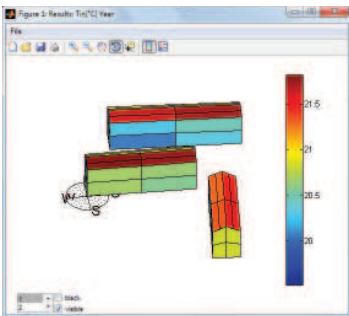


Fig. 6.2.2.2 Example result, Tin Year.

Each face of the building is divided into four quadrants. To display and hide the different buildings choose the corresponding number and click the 'visible' checkbox for presentational purposes. You can also change the color of each building into black.



Fig. 6.2.2.3 Option Display

a detailed analysis for each quadrant can be requested by clicking on it.

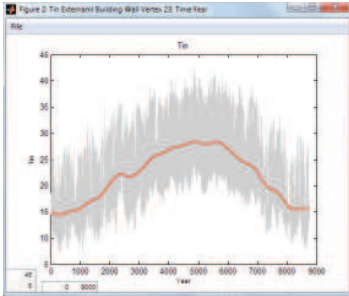


Fig. 6.2.2.4 Result T_{in} of a quadrant.

The diagram shows the hourly data of a year or of the selected month as well as the daily mean value. The generated diagram can be customized. you can change both, the time axis (x-axis) and the range of the chosen climate value (y-axis), by specifying the settings in the boxes. the graph adapts to your selection.

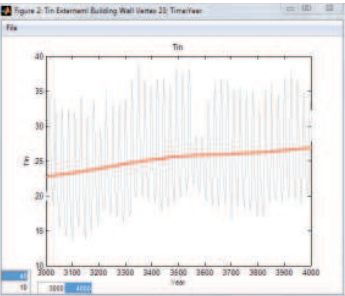


Fig. 6.2.2.5 and Fig. 6.2.2.6 Result quadrant and option display, T_{in} Year.

6.2.3 Load saved results

For reading in data of a former session you enter the file name in the 'climate place' field, press the 'result' button and confirm the query with 'yes'. you can reload the picture via the 'pic' button.

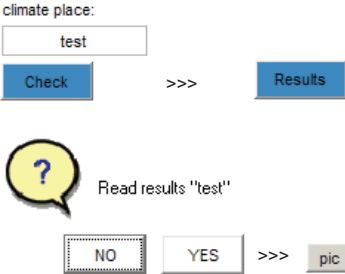


Fig. 6.2.3.1 Steps loading results

6.2.4 Building face resolution

The building face can be divided into more sections by changing the resolution in the following file:

installation folder > db > sol > urban_control

As standard, 1 is setted. by changing the value to 2 the amount of quadrants will rise from four to sixteen. The calculation time will increase.

Resolution: 1 >>> Resolution: 2

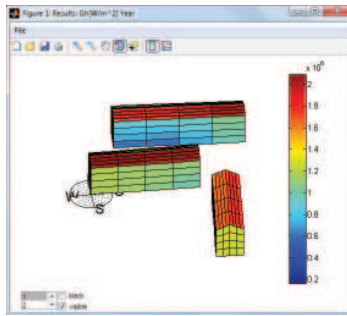


Fig. 6.2.4.1 Fig. 6.2.4.2 Changed Resolution, Gh Year.

6.2.5 Diffuse (Dh) Shade

By activating 'incl. Dh Shad.' the program takes account of the fact that the visible sky and its diffuse radiation may be hidden by another building. The diffuse radiation will be reduced by the percentage of shaded area. For a better understanding see the illustrations below.

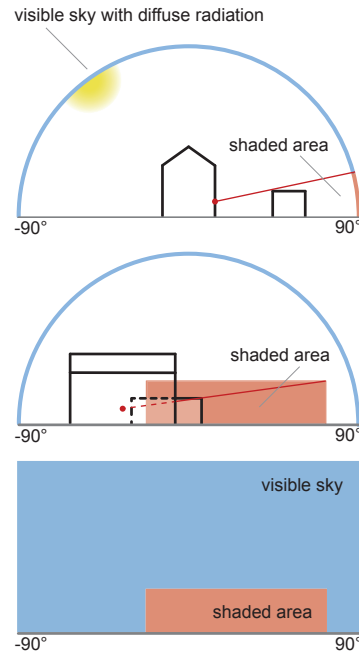


Fig. 6.2.5.1 to 6.2.5.3 Explanation of diffuse shade and its percentage of the visible sky.

6.2.6 Steady State heat transfer

Method of calculation of the walls surface temperatures. It is a simplified calculation that keeps constant outside air temperature and radiation. below you see the corresponding equation and the definition of its parts.

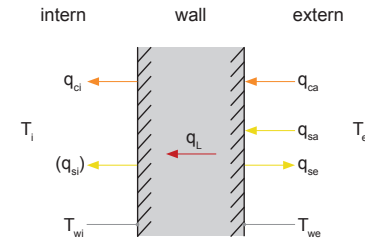


Fig. 6.2.6.2 Heat transfer

α_e = heat transfer coefficient, external

α_i = heat transfer coefficient, internal

R = heat transfer resistance

s = wall thickness

Σ_e = efficiency emission radiation

Σ_a = efficiency absorption radiation

$q_{\text{global wall}} = q_{\text{Bh}} + q_{\text{Dh}}$
(direct and diffuse radiation on the wall)

boltzmann = Stefan-Boltzmann constant

$$q_{\text{in}} = q_L = q_{\text{ca}} + q_{\text{sa}} - q_{\text{se}} = (q_{\text{si}}) + q_{\text{ci}}$$

$$q_{\text{ca}} + q_{\text{sa}} - q_{\text{se}} = q_{\text{ci}} = q_{\text{L}}$$

$$\text{mit: } q_{\text{ce}} = \alpha_e \cdot (T_e - T_{\text{we}})$$

$$q_{\text{se}} = \Sigma_e \cdot \text{boltzmann} \cdot T_{\text{we}}^4$$

$$q_{\text{sa}} = \Sigma_a \cdot q_{\text{global wall}}$$

$$q_{\text{L}} = R/s \cdot (T_{\text{we}} - T_{\text{wi}})$$

$$q_{\text{ci}} = \alpha_i \cdot (T_{\text{wi}} - T_i)$$



8.0 Editing and export of graphic charts

ClimateTool offers extensive opportunities for adaptation or exportation to edit or to insert graphics / datas into other documents. These opportunities are:

File > Export Setup...

There you can customize certain properties as 'Size', 'Rendering', 'Fonts' und 'Lines' and set different options.

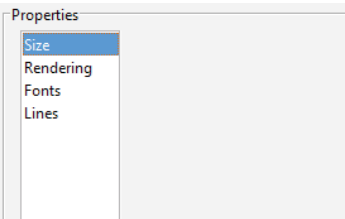


Fig. 7.0.1 Options properties.

In the column 'Size' you can determine width, height and length of the graphic chart.

In the column 'Rendering' you can set the range of colors, the background color, quality and the format of the rendering.

In 'Fonts' you can determine font, size, weight and angle.

The last menu option is 'Lines'. You can adjust and scale the line thickness and width.

You can save the selected settings as styles and apply the style later to other graphics.

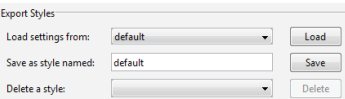


Fig. 7.0.2 Options styles.

Via 'Apply to Figure' the selected settings are displayed as a graphic (can also be seen as a preview).

By clicking on the button 'Restore Figure' you can recover the original graphic chart.

The button 'Export...' is used for saving the figure, forwarding to 'Save As'.

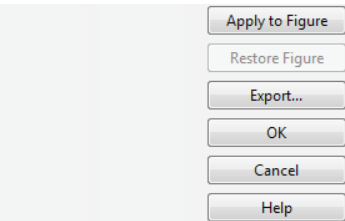



Fig. 7.0.3 Selection possibilities.

You can save the graphic charts as follows:

File > Save As > than select your destination folder > file name > and the desired file format > save

or by using the  icon

The following file types may be selected for saving and exporting.

- MATLAB Figure (*.fig)
- Adobe Illustrator file (*.ai)
- Bitmap file (*.bmp)
- EPS file (*.eps)
- Enhanced metafile (*.emf)
- JPEG image (*.jpg)
- Paintbrush 24-bit file (*.pcx)
- Portable Bitmap file (*.pbm)
- Portable Document Format (*.pdf)
- Portable Graymap file (*.pgm)
- Portable Network Graphics file (*.png)
- Portable Pixmap file (*.ppm)
- Portable inKmap file (*.pkm)
- TIFF image (*.tif)
- TIFF no compression image (*.tif)

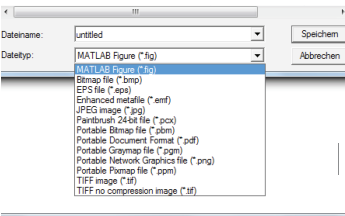


Fig. 7.0.4 Different file types for saving

Afterwards it is possible to edit the saved / exported graphics (e.g. in Illustrator / Gimp / Inkscape / etc...). The data are not restricted.



9.0 Climate Change

ClimateTool offers the chance to compare different climate change scenarios within the years 2020, 2040, 2060, 2080 and 2100. The daily mean data are based on the following:

Experiment: rcp26, rcp45, rcp85
Model: MPI-ESM-MR
Time frequency: day
Version: 20120503
Project: CMIP5
Institute: MPI-M
Long Name: MPI Earth System Model running on medium resolution grid
Funder: Bundesministerium fuer Bildung und Forschung
Principal Investigator: Marco Giorgetta
Source: <http://esgf-data.dkrz.de/>

9.1 Download of data

Click on the button 'Future' to download the data to compare climate change scenarios as described above. Ask for the download key.

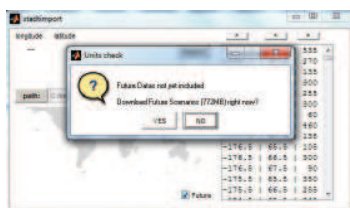


Fig. 9.1.1 Download of data.

9.2 Import climate data

Choose the

- location by clicking on listbox, map, local data or user,
- experiment rcp26, rcp45 or rcp80 and
- year 2020, 2040, 2060, 2080 or 2100.

The following variables will be updated according to your chosen climate change scenario:

- humidity
- temperature

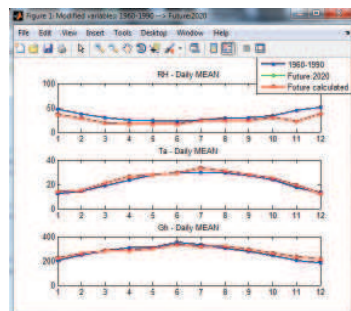


Fig. 9.2.1 Example of a comparison between measured and future climate data.

Blue: measured and interpolated data from weather stations, time period 1960 to 1990. The daily mean values are calculated from hourly data.

Green: daily mean values from model MPI-ESM-MR (see chapter 9.0), year 2020.

Red: daily mean values scaled from measured hourly data, time period 1960 to 1990.

ClimateTool is based on hourly data, the data from the MPI-ESM-MR however are daily mean values. To get hourly data out of these future data the measured data (time period 1960 to 1990) are scaled for each day with a factor so that the scaled mean daily values exactly fit to the data from the MPI-ESM-MR model. The humidity of the MPI-ESM-MR is based on 1 bar. ClimateTool calculates the humidity for every single location based on its pressure