ClimGen - Climatic Data Generator User's Manual

by Roger Nelson

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Abstract

For more information about this model, comments or help in using the material presented here or the software package, contact Claudio O. Stöckle or Roger L. Nelson at the Biological Systems Engineering Dept., Washington State University, Pullman WA 99164-6120. Phone: (509)335-1578, FAX: (509)335-2722. (stockle@mail.wsu.edu or rnelson@mail.wsu.edu)

Using the software

ClimGen now runs under MS-Windows 95 or MS-Windows NT.

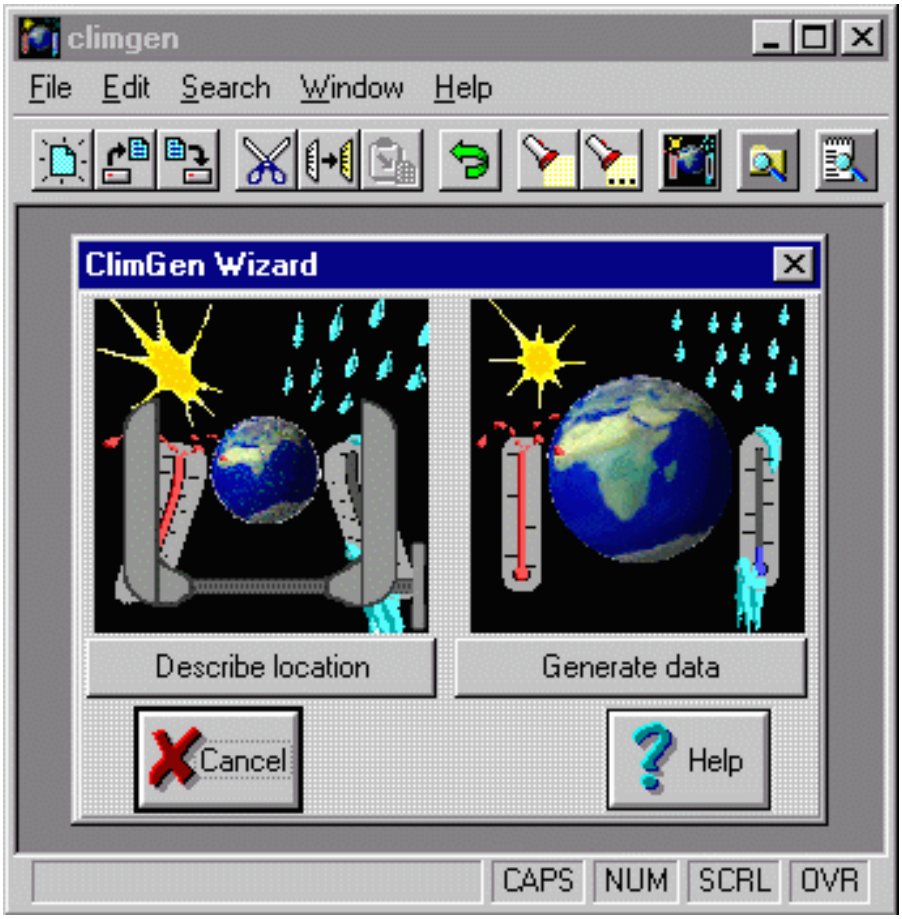
A version **ClimGen** for DOS is available, but it is not actively supported and not all the features of the Windows version are available in the DOS version. Generating weather data in **ClimGen** consists of two

steps: Preparing the location parameters and generating the data. The **ClimGen** parameter editor offers two editing modes for preparing the parameter files: The default editor in the **ClimGen** Wizard . This is a step-by-step procedure in which the program presents "input dialog boxes" and given data provided will determine what additional data will need to be provided or what additional data might be estimated to provide the optimal set of parameters for data generation.

The other Quick editing mode can be used when you need to quickly edit an existing parameter file. *Note that you can edit existing parameter location files using the Wizard, simply click on the [Describe location] button and select and existing file. You will get a warning saying that the existing data may be replaced.*

Using the ClimGen Wizard

The Wizard dialog box is open when the program starts.

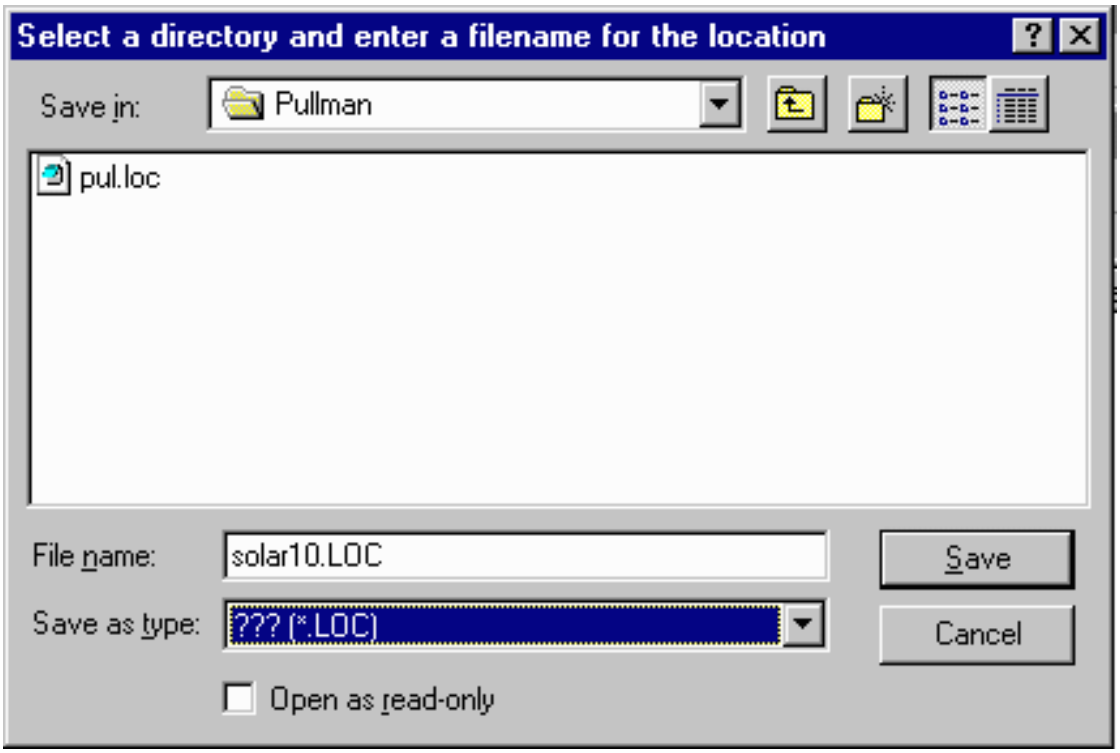


If you close the Wizard dialog, you can restart the Wizard by clicking on the tool bar Wizard button .

If you already have an existing ClimGen location parameter file you can go directly to generating weather data; otherwise, you will need to create a location file and provide some parameters.

To create or edit a location parameter file click on the [Describe location] button. The following information will be displayed indicating that you will be given a file requestor to select a file name for the location parameter file:

Click  to display the file requestor:



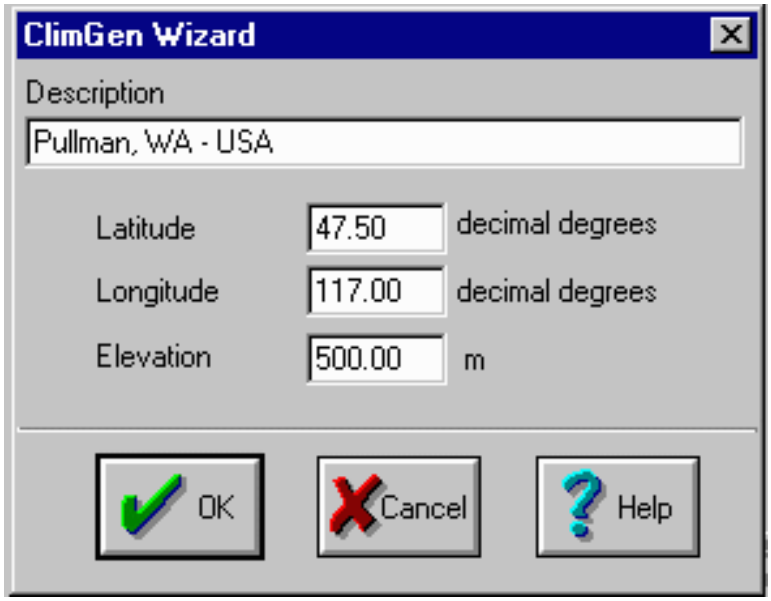
If you have daily weather data file, it is recommended that you put the location file in a directory where you want your generated weather file to be stored. You can safely store your output weather files in the same directory as the input data files, because ClimGen uses different file name extensions for the input and the output files.

ClimGen parameter files have a .LOC extension. These file are 100% compatible with **CropSyst** location parameter files, so you can use **ClimGen** parameter files as **CropSyst** location files and vica versa. Note, however, that both **ClimGen** and **CropSyst** have parameters not used by the other application; thus, if you use a **ClimGen** parameter file for a **CropSyst** location, you will need to edit the .LOC file with the **CropSyst** location parameter editor and fill in the remaining fields (and vica versa). You can use this file

requestor to create the data directory.

You can select an existing file. In this case the file will be edited and the following prompts will display the existing data values.

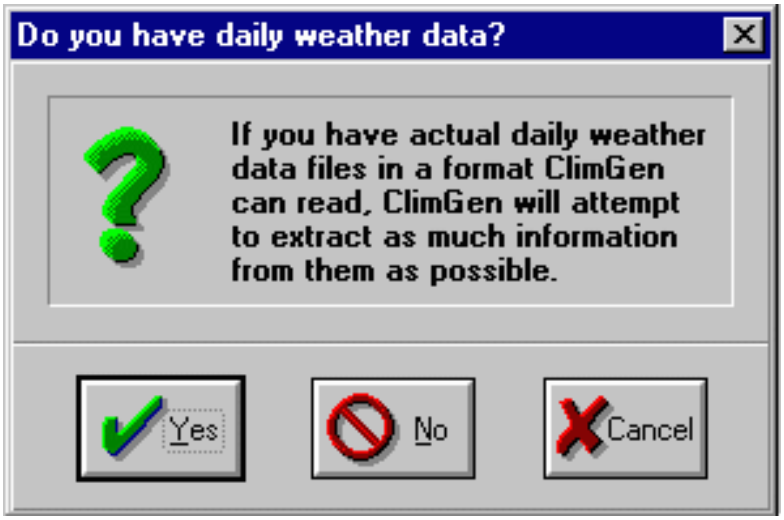
Once the location parameter file name has been entered, the following dialog box will be displayed:



Provide the specified location specific parameters and press 

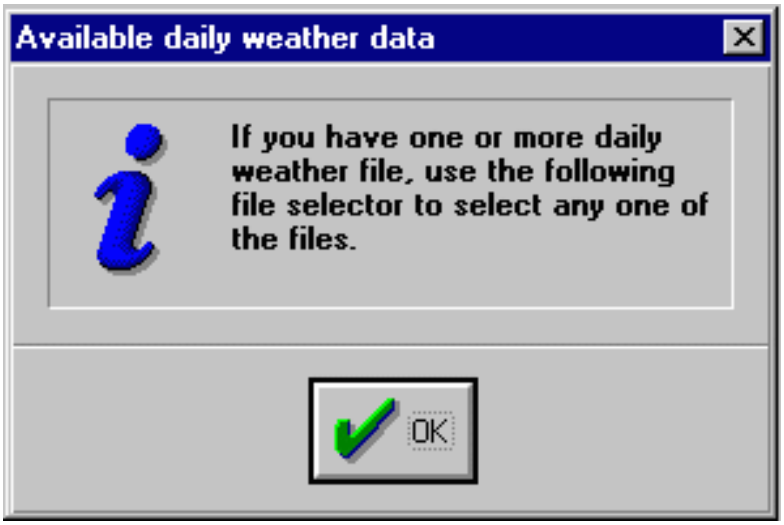
.

The following prompt dialog box will be displayed:

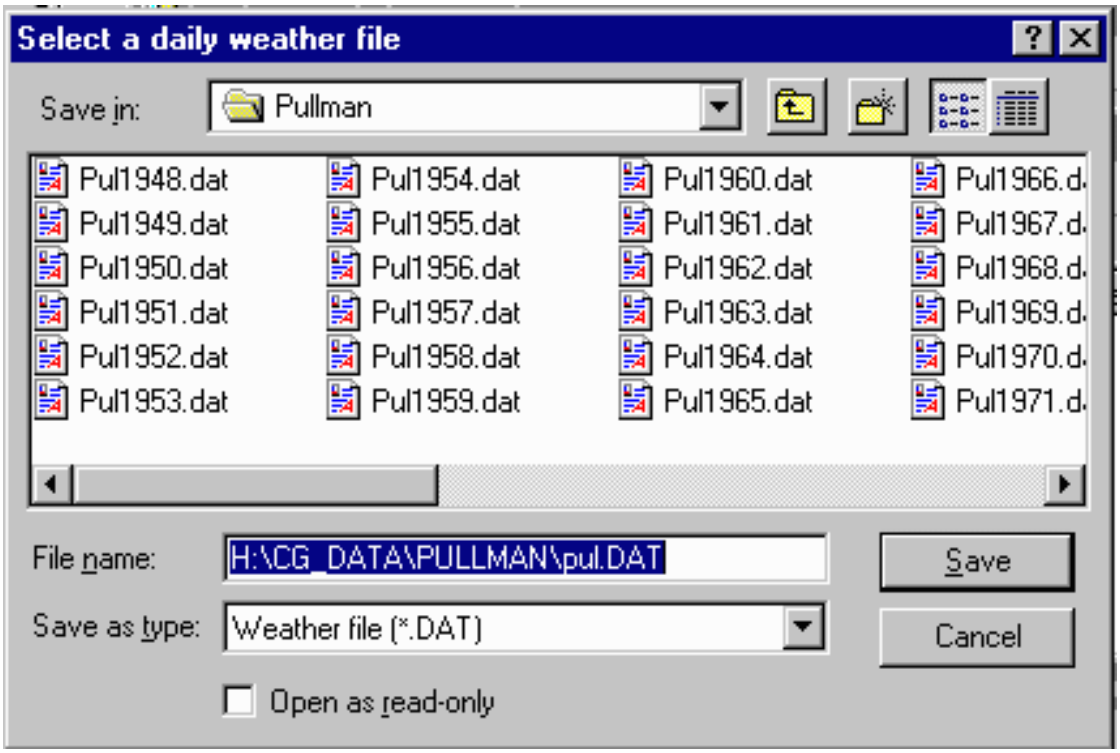


At this point the dialog boxes presented will be different depending if daily weather data exists with which to estimate generation parameters.

If you select daily weather data available the following dialog boxes are displayed

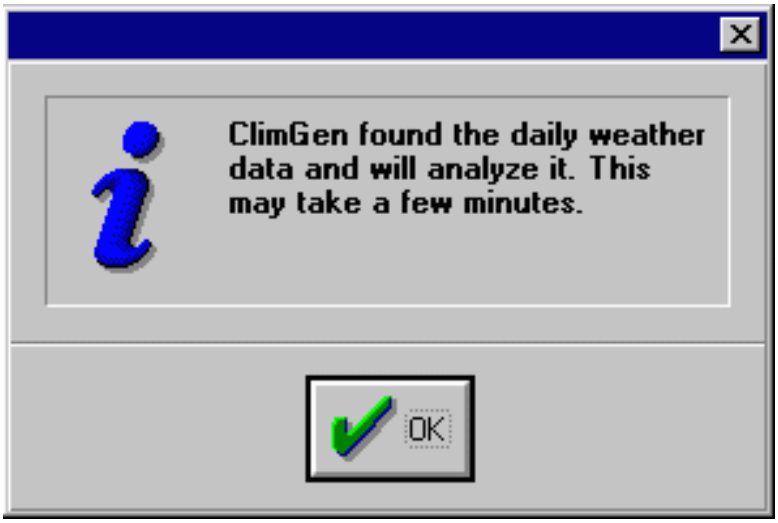


Before continuing you should make sure your daily weather data files are correctly formatted and available for selection



Note that there will usually be more that one one daily file (one for each year). **You only need to select one daily weather file**, ClimGen will use this filename to find the other files in the set.

If you are editing an existing location parameter file, the data file will already have been selected so you will only get the following message.

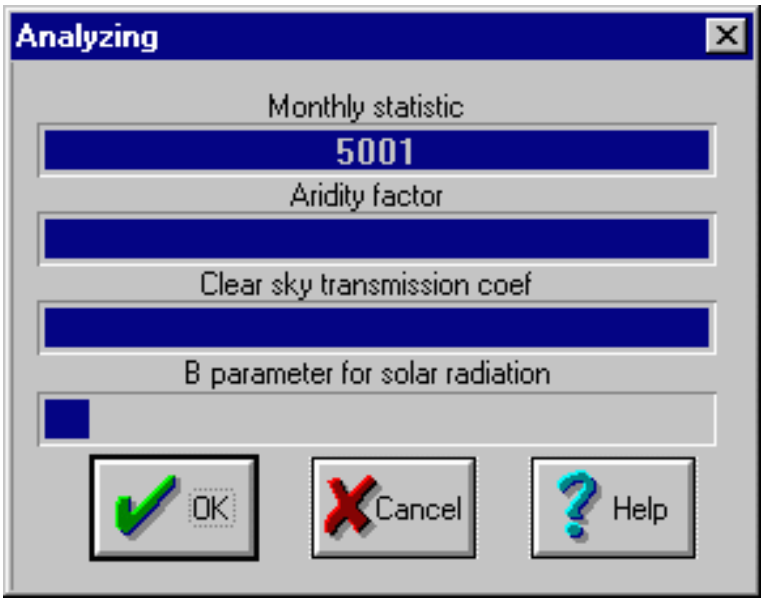


Next, ClimGen will perform some analysis on the daily weather data.

The analysis performed will depend on the data that is available in the daily weather files.

For example, Clear sky transmission coefficient and B parameter for solar radation will not be calculated if solar radiation data is not in the weather files or if there are a not sufficient number of days of solar radiation to give reliable parameters for estimating solar radation.

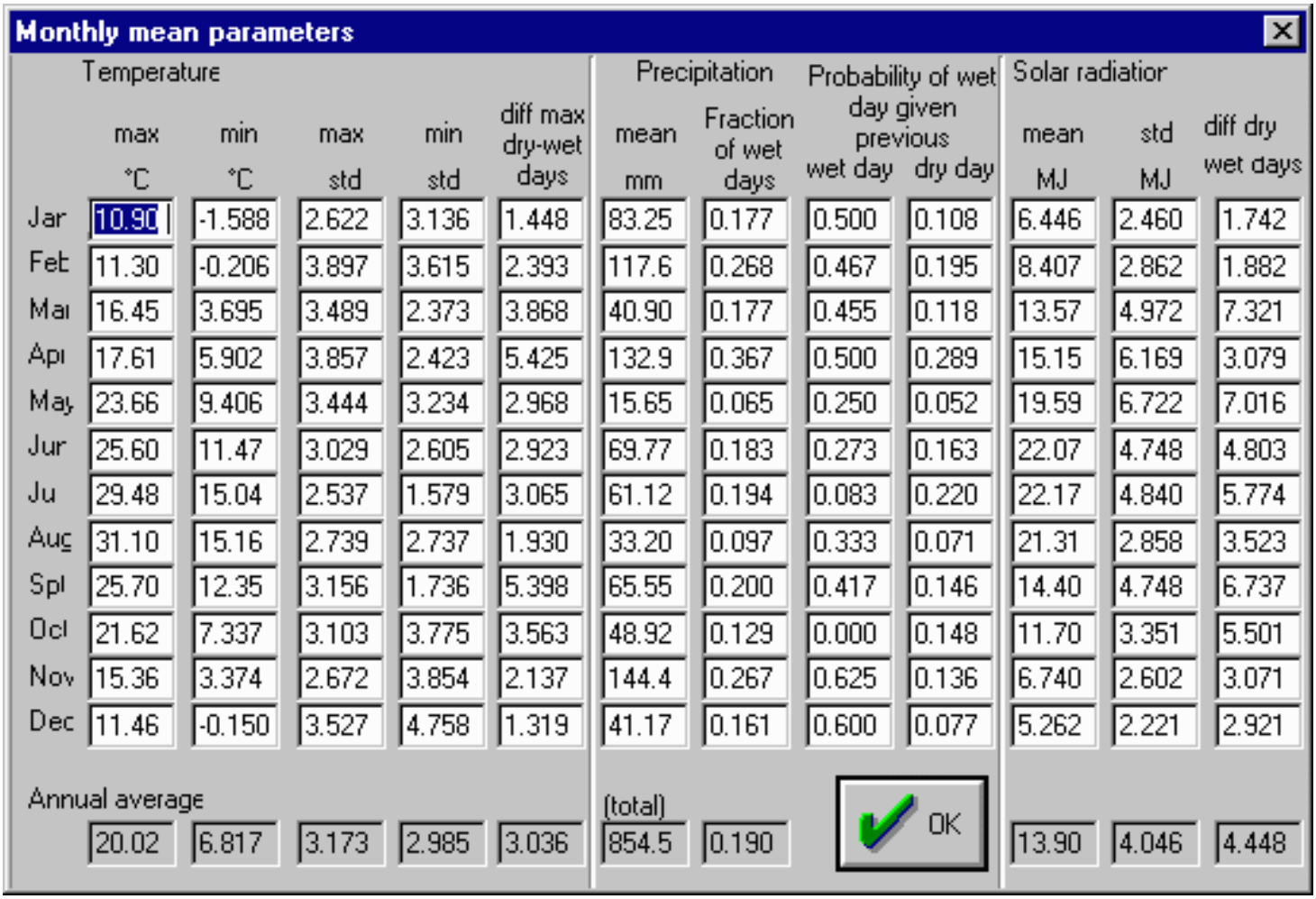
Similarly, Aridity factor will not be computed if there are not sufficient days of valid relative humidity data.



If you are editing an existing location parameter file and ClimGen had completed this analysis phase or you do not intend to generate solar radiation and/or relative humidity; ffter the monthly statistics have be computed you can press 

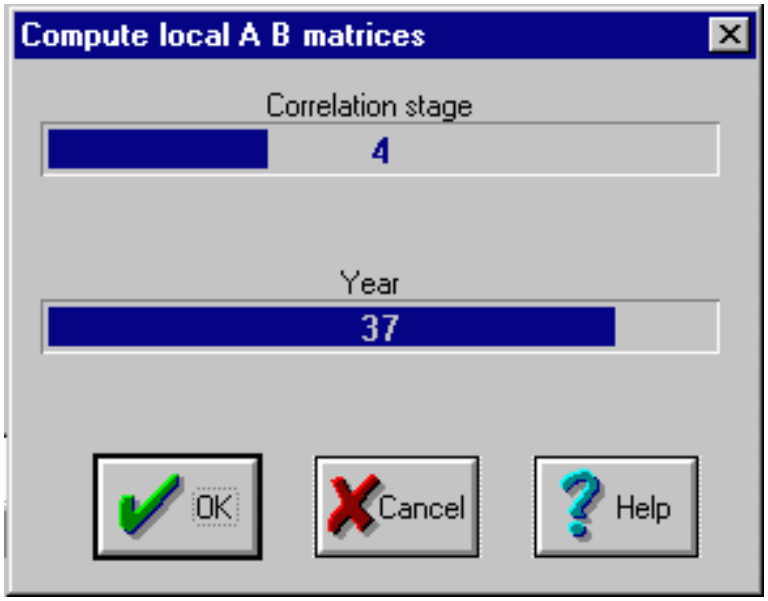
to skip the Aridity, Clear Sky and B parameter analysis.

The following summary of the computed parameters will be displayed.

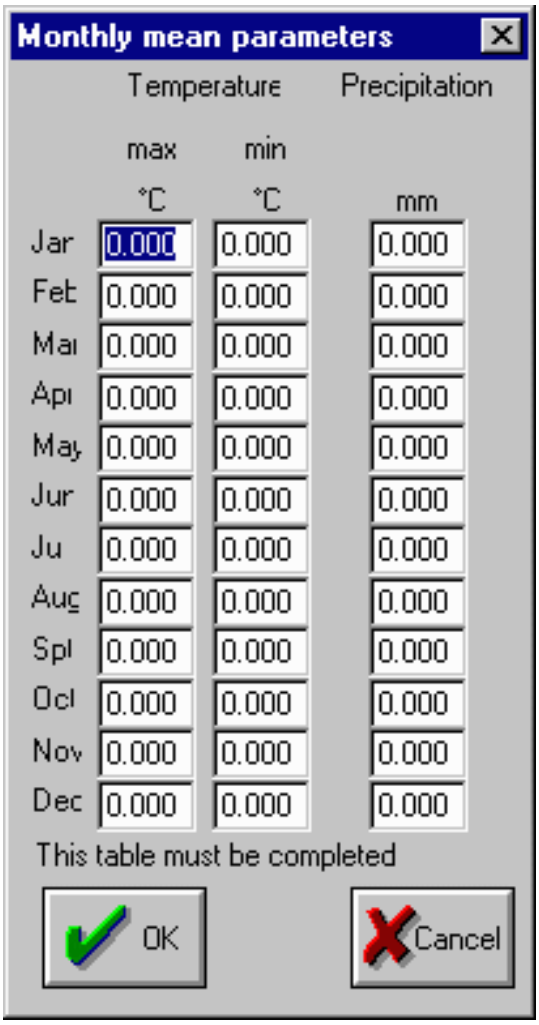


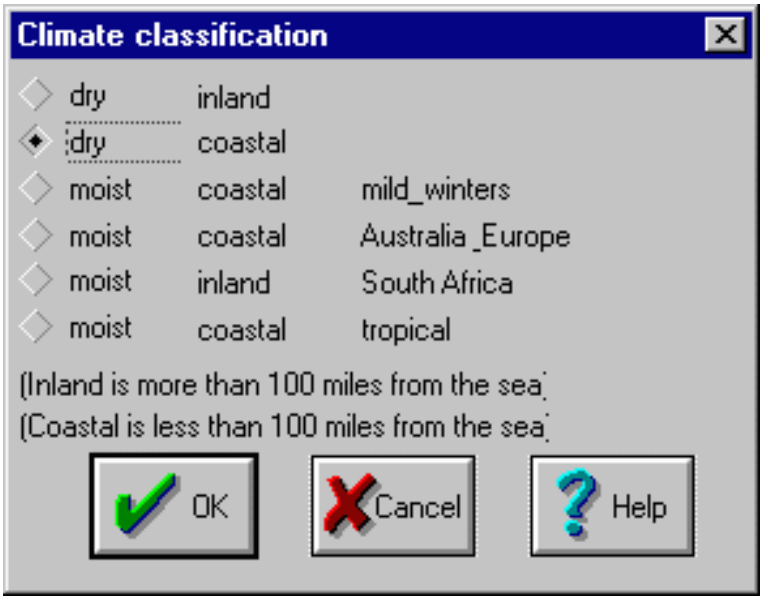
The annual totals listed along the bottom of the window are the means of the monthly values except Precipitation which is the annual total.

A/B correlations will be computed next.
Correlations for Solar Radiation will only be done if there are 5 year of contiguous valid solar radition data.



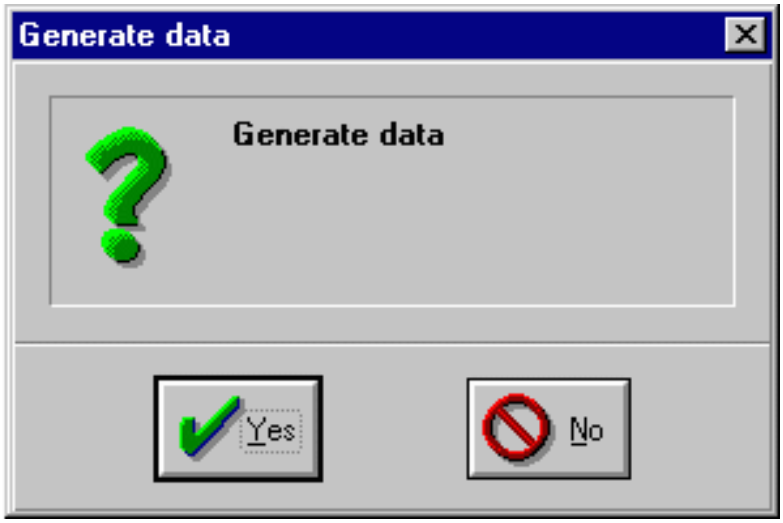
If no daily weather data is available you will need to provide a climatic zone classification and supply a minimal set of monthly mean parameters for precipitation and temperature.





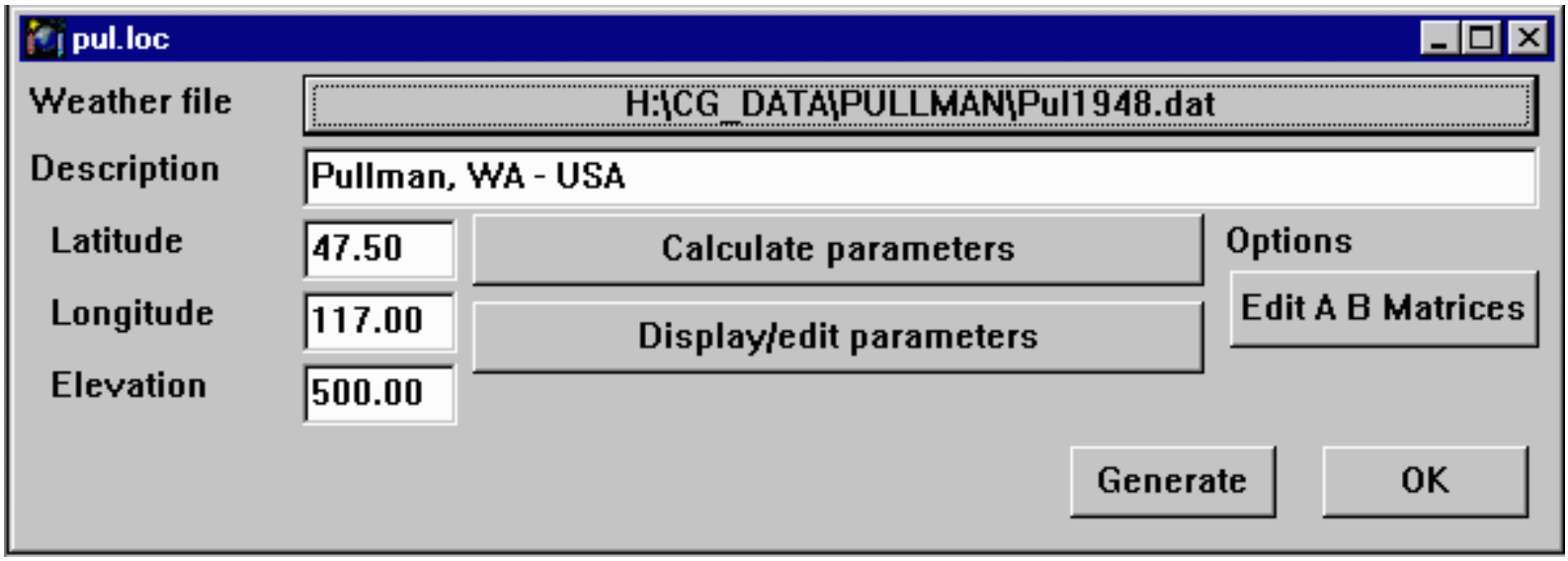
Without daily weather data it is not possible to reliably generate or estimate solar radiation. Solar radiation estimation/generation will not be available in this case.

Once all parameters have been estimated, you can begin generating weather data.



Using the Quick editor

The Quick editing mode is accessed from the File/New or File/Open menu options, or by clicking on the New or Open toolbar buttons  . The Quick mode editor allows you to quickly get to a data entry dialog box without stepping through the ClimGen Wizard dialog boxes one at a time. While you can use the Quick mode editor to create location files. It is recommened that you create location files using the Wizard to insure that all parameters that can be computed or estimated are done.



Here you can change the name of the input daily weather file.

The **[Calculate parameters]** button will perform the daily weather data analysis if the daily weather file exists.
Note: *In order for the* **[Calculate parameters]** *button to be available you must first specify a daily weather data file.* If there is no daily weather file, or the specified filename does not exists, this button will change to say **[Climate Classification].**

The **[Display/Edit parameters]** button will display the monthly mean parameters dialog box used by the

Wizard

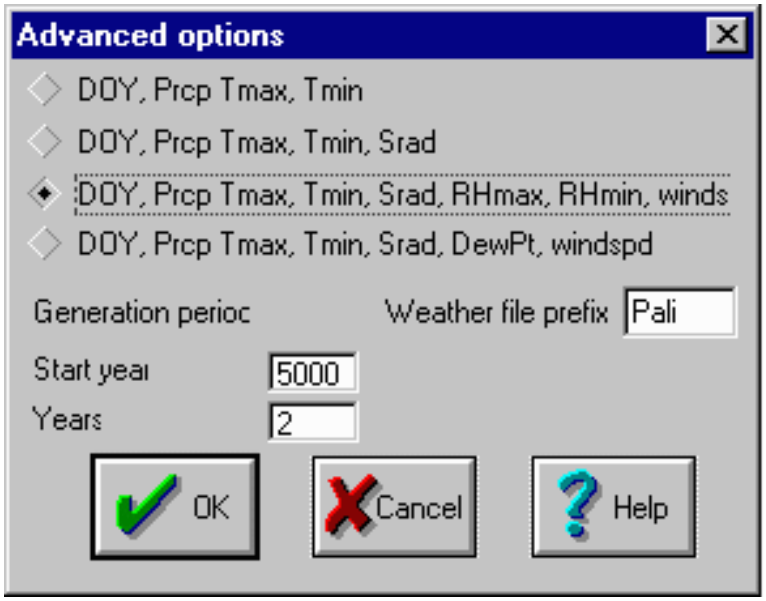
You can only edit the minimal monthly mean parameters when the daily weather data doesn't exist, otherwise the calculated monthly means should be used and not modified.

The **[Edit A B matrices]** button allows researches to view and modify the A B correlations matrices or recompute them. It is for researcher and developer use only and will not be further documented here.

Generating weather data

Currently there are four output file formats.

The format of the generated output files is the same as the input files.



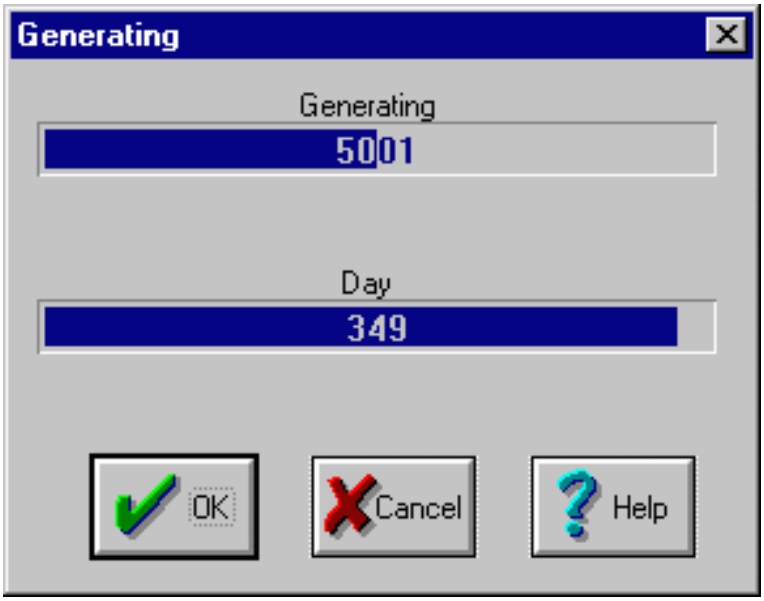
You can select any of the available formats; however, formats with solar radiation, Relative humidity Dew Point and wind speed may be disabled if there was insufficient input data for parameters to be computed or estimated from existing real data.

You must specify a one to four character **weather file prefix** this is used to construct the generated weather file names. The output weather filenames will have this prefix followed by a four digit year and a .GEN extension.

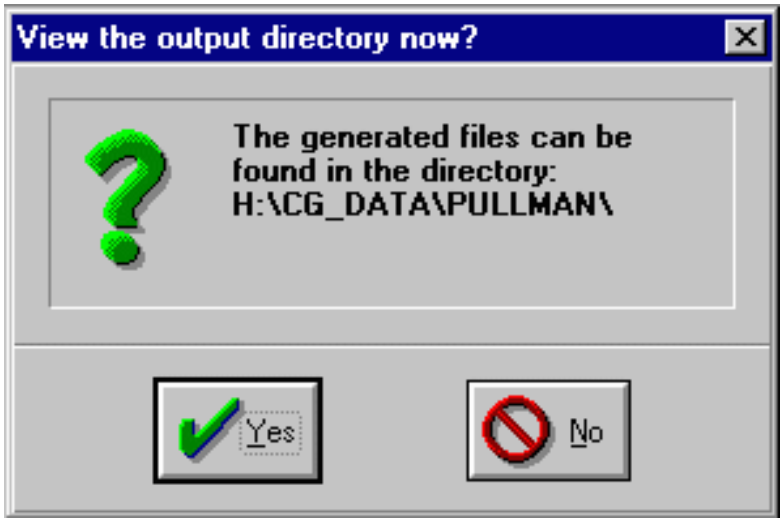
The generation period specifies the years to be generated.
Any existing .GEN files for the period will be overwritten, (.DAT file are not overwritten).
If the generation period overlaps any years for which there was existing .DAT input files,
the data from the .DAT files will be copied to the output files, and any values needed to complete the output format will be (Estimated rather than generated).

For example: If you select to generate DOY, Prcp, Tmax, Tmin, and Srad for the years 1990 and 1991, and there is an input daily weather file for 1990 with the format DOY, Prcp, Tmax and Tmin; then the generated 1990 output file will contain the same data as the input 1990 data file with the additional column of estimated solar radiation. The 1991 output file will all contain generated data.

As the data files are generated, the following progress dialog box will be displayed:



When generation is complete the following prompt will be displayed:



If you select [Yes], a Windows Explorer window will be opened to the directory containing the generated output files.
You can view the output file(s) by dragging the file icon(s) from the Windows Explore window and droppting them on to the ClimGen window.

Weather file data preparation

Various options for parameter calculation or estimation are available depending on the data available. The main option is having available actual daily measured data weather files. With daily measured data, average monthly mean parameters can be calculated by the program, without daily weather data, the available options for generated output data is more limited since ClimGen cannot as reliably estimate generation parameters.

The data must be formatted using the format described in section "Weather files".

While the description of the weather file format indicates that missing values can be identified, this version

of **ClimGen** can tolerate some missing values only for the statistical analysis of precipitation, and temperature, because the values totalled by month is over the total period of years for which data is available. However, any missing values will disable the calculation of A-B correlation matrices for local conditions: a complete data set is required because the matrix generation performs daily correlations.

File naming conventions.

ClimGen uses the following naming conventions: A one to four character/digit code (called the station code) is used in constructing the weather file name. Typically this code is an abbreviation or code number for the weather station the data was recorded at. The weather filename consists of these four characters followed by the four digit year with the extension .DAT: I.e. PULL1990.DAT, where PULL is the weather file code.
You can create/edit .DAT files using the File/New or File/Open "All files" menu options or you can use for favorite text editor or output the data from a spread sheet or database as a text file.

The weather data generated by **ClimGen** files follow the same naming conventions as the real data file but with a .GEN extension. The generated weather file records have same the *DOY, precip, Tmax, Tmin,* and *SRad* Weather file format.

Tip: *We strongly encourage you to create subdirectories for each location to contain the real weather (.DAT), generated weather (.GEN) and location parameter (.LOC) files.*

ClimGen *user manual by Roger Nelson*

Precipitation generation

ClimGen generate precipitaton using a similar approach to that in WGEN (Richarson and Wright, 1984). The first step involves generation the occurrence of wet or dry days, which is done using a first-order Markov chain. The probability of rain occuring on a given day is conditioned by the rainfall status of the previous day, i.e., wet or dry. A wet day is defined as a day with 0.25 *mm* or more precipitation. If the probability of a wet day *(i)* given a previous *(i-1)* wet day is *Pi(W/W)*, and Pi*(W/D)* is the probability of a wet day *(i)* given a dry previous (i-1) day then,

$$Pi(D/D) = 1 - Pi(W/D) \quad (5)$$

$$Pi(D/W) = 1 - Pi(W/W) \quad (6)$$

where *Pi(D/W)* and *Pi(D/D)* are the probabilities of a dry day given a wet previous day and probability of a dry day given a dry previous day, respectively. To determine if a particular day is wet or dry, a uniform random deviate *r* on the interval [0 and 1] is generated and compared to *P(W/D)* or *P(W/W)* If *r* is less than or equal to *P(W/D)* (or *P(W/W*), whichever is appropriate, the day is a dry day, otherwise it is classified as a wet day.

The transitional probabilities can be determined directly from daily data if long records (more than 20 years) are available, which is the approach followed in WGEN. They can also be estimated from the fraction of wet days in a month (Geng, Penning De Vries and Supit, 1986). The following simple regression equations were obtained by Geng et al. (1986) for estimating the transitional probabilities and are used in ClimGen:

$$P(W/D) = ß * (fwet) \quad (7)$$

$$P(W/W) = (1 - ß) + ß * (fwet) = (1 - ß) + P(W/D) \quad (8)$$

Where ß is the slope coefficient, which was found to have a value of 0.75. The montly average fraction of wet days if *fwet*. A quadratic spline is then used to interpolate between the monthly probability values obtained using equations 7 and 8, to estimate daily probabilities [Pi(W/W) and Pi(W/D)]. WGEN maintains constant parameter values throughout the month.

If a wet day occurs, ClimGen uses the Weibull distribution to generate precipitation amounts (Selker and Haith, 1990). A Weibull distribution has two parameters but one of the parameters was found by Selker and Haith (1990) to be 0.75 after optimization using data from serveral locations, so only one parameter needs to be determined. The resulting single-parameter Weibull distribtion was shown to yield substantial improvement over other models in fitting historical precipitation probabiliy distributions. If *Xm* is the Mean precipitation amount on wet days in month *m*, the Weibull distribuition is given as (Selker and Haith, 1990):

$$F_{Xm}(x) = 1 - \exp[1(1.191\ x/\mu_m)^{ø}$$

where

$F_{Xm}(x)$ is the cummulative probability distribution for wet day precipitation in month m,
μ_m is the average wet day precipitation for the month,
ø is 0.75.

Random deviates for *x* in the Weibull distribution are easily generated using the transformation method.

Excerpt from WSU Ph.D Thesis:

Weather data generation and its use in estimating evapotranspiration
by
Leonard S. Ndlovu

Bristow, K.L. and Campbell, G.S., 1984

On the Relationship between incoming Solar Radiation and Daily Maximum and Minimum Temperature.
Agricultural and Forest Meteorology 31:159-166.

Geng, S., Penning De Vries, F.W., and Supit, I, 1986

A Simple Method for Generating Daily Rainfall Data.
Agricultural and Forest Hydrology 36:363-376.

Matalas, N.C, 1967

Mathematical assessment of synthetic hydrology.
Water Resources Research 3(4).

Richardson, C.W., 1981

Stochastic simulation of daily precipitation, temperature, and solar radiation.
Water Resources Research 17(1):182-190.

Richardson C.W. and Wright, D.A., 1984

WGEN: A model for generating daily weather variables.
USDA-ARS.

Selker, J.S. and Haither, D.A., 1990

Development and Testing of Singe-Parameter Precipitation Distribuations.
Water Resources Research 26(11):2733-2740.

Swift, L.W., 1976

Algorithm for solar radiation on mountain slopes.
Water Resources Research 12:108-112.

Temperature generation

According to Richardson (1981), weather data such as temperature and solar radiation are not as difficult to model statistically as precipitation, since there is a lower proportion of zero observations and the distribution of these variables is much less skewed than precipitation data. The technique used in **ClimGen** for generating maximum and minimum temperature is similar to that in WGEN, and is based on the assumption that temperature is a weakly stationalry process (Matalas, 1967). This approach considers maximum and minimum temperature to be a continuous multi-variate stochastic process with daily means and standard deviations conditioned by the precipitation status (wet or dry) of the day (Richardson, 1981). Time series of residual elements of the maximum and minimum temperature are obtained through the removal of the periodic means and scaling by the standard deviations; and the elements are analyzed for time dependence and cross correlation. The residual comonents, $X_{p,i}$, for variable *j* (maximum or minimum temperature), are calculated as follows:

$$X_{p,i}(j) = (X_{p,i}(j) - \bar{X}_i^o(j)) / (\acute{o}_i^o) \ , \ Y_{p,i} = 0$$

or

$$X_{p,i}(j) = (X_{p,i}(j) - \bar{X}_i^1(j)) / (\acute{o}_i^1) \ , \ Y_{p,i} > 0$$

where

$\bar{X}_i^o$

is the mean,

$\acute{o}_i^o$

is the standard deviation for a dry day ($Y_{p,i} = 0$).

The same definitions apply to wet days ($Y_{p,i} > 0$), except that a superscript 1 is used instead of 0. The model for generating residual series then becomes:

$$X_i(j) = AX_{i-1}(j) + B \acute{e}_i(j) \quad \text{(eq. 12)}$$

where

$X_i(j)$ and $X_{i-1}(j)$

are (2 × 1) matricies for days *i* and *i-1* respectively, whose elements are residuals of maximum temperature (j=1), and minimum temeprature(j=2),

$\acute{e}_i$

is a 2 × 1 matrix of independent random components thar are normally distributed with mean zero and unity standard deviation,

A and B

are 2 × 2 matrices whose elements are defined such that the new sequences have the desired serial and cross-correlation coefficients.

The matrices aim at preserving the persistence of each variable using the serial correlation element, while the corss correlation element preserves the interdependence in the daily variables (Richardson, 1981). As stated earlier, estimates of daily means are obtained using the quadratic spline interpolation through the monthly parameters.

Finally, the generated value of either daily maximum and minimum temperature are determined by multiplying the generated residual elements (equation 12) by the standard deviation and adding the daily mean as shown in the equation:

$$t_i = X_i * s_i(j) + \mu_i(j) \quad \text{(eq. 13)}$$

where

t_i is the generated value of either maximum temperature(j=1) or minimum temperature(j=2),
$s_i(j)$ is the standard deviation for day *i*,
$\mu_i(j)$ is the mean for the same day.

Excerpt from WSU Ph.D Thesis: Weather data generation and its use in estimating evapotranspiration by Leonard S. Ndlovu

Solar radiation generation

The monthly mean and standard deviations entered in the parameter editor (computed from your real solar radiation data), are used only for adjusting the estimated solar radiation to give a daily solar radiation residual used to better approximate the temperature for the next day.

```
Srad_residual
  = daily_solar_rad[DOY]          <- Bristow-Campbell Solar rad estimate.
    - yearly_solar_rad[DOY])      <- Daily values spline interpolated from
    / yearly_std_solar_rad[DOY]   <- the monthly mean/std.dev. input parameters
                                     (computed from your real solar rad. data.
```

The solar radiation residual is only used if column 3 of the A/B matrices are not 0.0.

When the solar radiation residual is computed, it will be used to compute a "better" temperature for the next day, this better temperature is then used to compute the (Bristow-Campbell estimated) solar radiation for the next day, thus the monthly mean/std.dev. solar radiation parameters are only indirectly used for the solar radiation computation only when they are not 0.0 and the A/B matrices have values in column 3.

Normally you should not need to concern yourself with the residual adjustment of solar radiation.

The solar radiation residual adjustment is an optimization feature that Francesc Castellvi is working on.

If you have actual solar radiation, you can try generation with or without the Solar radiation parameters.

To disable the residual adjustment, simply set column 3 of the A/B matrices to 0 and/or set the monthly mean and std for solar radiation to 0. This will disable the solar radiation residual adjustment, so even if you have real solar radiation data in your real data files, it will not be used.

We would certainly be interested in hearing about your results in comparing with/without the residual adjustment.

Solar radiation estimation

Bristow and Campbell (1984) showed the difference between maximum and minimum daily temperatures to be correlated with the amount of solar radiaton recieved. If the amount of solar radiation on the earth"s surface is low (overcast skies), the difference in temperature extremes is also likely to be low. The opposite is true for clear skies. Thus, temperature extremes can be related to the atmospheric transmittance for solar radiation, which, coupled with determination of extraterrestial irradiance, provides an approach to generate solar radiation data from temperature

Based on this concept, Bristow and Campbell (1984) developed a temperature-based approach to estimating daily average solar radiation, S_t, is calculated from:

$$S_t = T_t S_o \text{ (eq. 14)}$$

where

S_o is the estimated daily extraterrestrial solar radiation (MJ/m²/day).
An estimate of T_t is given as function of daily temperatures (maximum and minimum) by Bristow and Campbell (1984) as:

$$T_t = A[1-\exp(-B \Δ T^c)] \text{ (eq. 15)}$$

In the above equation, A, B, and C are emperical coefficients, which can be determined for a particular location from measured solar radiation data. The empirical coefficients do display the physics involved in the relationship. A represents the maximum clear sky T_t of any given area which will vary with elevation and pollution content of the air, B and C are coefficients that determine how rapidly maximum T_t is achieved as Δ T increases. ΔT is the daily range of air temperature, i.e., the difference between maximum and minimum temperatures.

Bristow and Campbell (1984) allowed B to vary seasonally, and used a mean monthly ΔT to compute B. A somewhat simpler version of equation 15 was proposed by Campbell (personal communication, 1993).

$$T_t = A[1-\exp(-B(S_{o30}) (\ΔT)^2)] \text{ (eq. 16)}$$

where

S_{o30} is the extraterrestrial solar radation 30 days previous to the simulation day.

Extraterrestrial solar radation is calculated using (Bristow and Campbell (1984)):

$$S_o = 117.5 [h \sin(\λ) \sin(\δ)+ \cos(\&lambda) \cos(\δ) \sin(h)] / \π \text{ (eq. 17)}$$

where

δ is solar declination angle (radians),
λ is the latitude (radians), *h* is the half-day length (radians) given by the following equation:

$$h = \cos^{-1}(1 \tan(\λ) \tan(\δ)) \text{ (eq. 18)}$$

δ can be calculated as a function of the day of the year (DOY) (Swift, 1976):

δ = $\sin^{-1}$[0.39785 sine (4.689 + 0.0172 * DOY + 0.03345 sin (6.224 + 0.0172 * DOY))] (eq. 19)

Excerpt from WSU Ph.D Thesis: Weather data generation and its use in estimating evapotranspiration by Leonard S. Ndlovu

File Formats

Weather Files

Weather files are text files that are created and manipulated by any text editor that the user may have available (such as the text editor built-in to **ClimGen**). The weather file format is fully compatible with the **CropSyst** simulator.

There must be one file for each year of interest. The convention to name these files is discussed in Data preparation.

The weather text files have the following characteristics:

- Each line represents one day of data.
- There must be either 365 (or 366 for leap year) lines.
- Depending on the format used, all column entries must be provided.
- If data for precipitation or max/min temperature is missing from the original data set for a day, it must be estimated. Missing data can be represented with 999. Maximum or minimum temperature exceeding 50°C are rejected. Precipitation exceeding 400 mm are rejected. Solar radiation exceeding 50 MJ/m²/day are rejected
- The day of year number must be an integer.
- All other numbers may have integer or real number format.
- The file must be sorted by day of year.
- There must be at lease one space or tab between each number.
- **There can be no spaces or other characters after the last number on the line**

The weather files may have one of the following formats depending on available data and evapotranspiration model to be used.

1. Day of year, precipitation (mm), max temperature (°C), min temperature (°C); i.e.

```
1    0   7.3   4.4
2    0     6     4
3    6   9.6     3
:    :     :     :
:    :     :     :
```

2. Day of year, precipitation (mm), max temperature (°C), min temperature (°C), Solar radiation (MJ/m²/day); i.e.

```
1    0   7.3   4.4     2
2    0     6     4   2.1
3    6   9.6     3   2.1
:    :     :     :     :
:    :     :     :     :
```

3. Day of year, precipitation (mm), max temperature (C), min temperature (C), Solar radiation (MJ/m²/day), max relative humidity (%), minimum relative humidity (%), Wind speed (m/s); i.e.

```
1    0   7.3   4.4     2  96   86   1.4
2    0     6     4   2.1  95   84   0.8
3    6   9.6     3   2.1  98   82   3.1
:    :     :     :     :   :    :     :
:    :     :     :     :   :    :     :
```

Parameter files

Normally parameter files are edited using the Parameter editor. The following information is provided in the event you would like to write a program to read/write **ClimGen** parameter files. If you are going to be writing such a program you might like to try my **ClimGen** file class (C++) and/or my windows INI or Variable=Value file classes (C++ or Pascal) (rnelson@mail.wsu.edu).

The parameter file format is similar to Windows .INI files. Note the following:

- When creating the parameter files from scratch with a text editor, be sure that the variable names are spelled correctly. The case of the variable name is significant.
- For the code field, make sure there are no spaces between the equals sign and the code.
- The elevation is in meters.
- Precipitation values are entered in millimeters and temperature in Celcius.
- The latitude and longitude must be specified in decimal degrees. I.e. 10° 30" is entered: `10.5`

The *[solar_rad]* and *[solar_rad_std]* entries are optional.

The following is a sample parameter file:

```
[location]
ET_model=SIMPLE
description=Pullman, WA - USA
weather_directory=H:\CG_DATA\PULLMAN\
weather_filename=H:\CG_DATA\PULLMAN\Pul1948.dat
code=Pul
latitude=47.5000000000 Latitude
ini_cum_freezing_ndx=-30.0000000000 Initial cumulative freezing index
aridity_factor=0.0299999993 Aridity factor for VPD
VPD_slope=0.0000000000
VPD_intercept=0.0000000000
ratio_daily_max_VPD=0.5000000000 Ratio of daily to max. VPD
summer_B_solar_rad=0.3059999943 Summer B parameters for solar radiation generation
winter_B_solar_rad=0.2039999962 Winter B parameters for solar radiation generation
fitted_B_solar_rad=0.0000000000
Tnc_solar_rad=0.0000000000
clear_sky_transmission_coef=0.7500000000
snow_insulation_factor=0.0199999996 Snow insulation factor
PT_constant=1.2599999905 Priestley-Taylor Constant
wind_measurement_height=1.0000000000 Wind measurement height
wind_speed_classification=medium_wind_speed
longitude=117.0000000000
elevation=500.0000000000
country=
state=
county=
[mean_peak_rainfall]
description=Mean peak 1/2 hour fraction of total rainfall
1=0.0000000000 Jan
2=0.0000000000 Feb
3=0.0000000000 Mar
4=0.0000000000 Apr
```

```
5=0.0000000000 May
6=0.0000000000 Jun
7=0.0000000000 Jul
8=0.0000000000 Aug
9=0.0000000000 Spt
10=0.0000000000 Oct
11=0.0000000000 Nov
12=0.0000000000 Dec
[climgen]
start_year=2000
num_years=1
evenly_distributed_precip=0
C_solar_rad=2.0000000000
binary=0
VPD=0
file_format=day_precip_temp
classification=2
[mean_max_temp]
description=Mean maximum temperature
units=
1=1.1619999409
2=4.6069998741
3=8.1370000839
4=13.1499996185
5=17.9050006866
6=22.1040000916
7=27.4990005493
8=27.4769992828
9=22.5750007629
10=15.4409999847
11=6.5890002251
12=1.6990000010
[mean_min_temp]
description=Mean minimum_temperature
units=
1=-5.6199998856
2=-2.7590000629
3=-0.8339999914
4=1.8140000105
5=5.0279998779
6=8.1440000534
7=9.7399997711
8=9.8900003433
9=6.8819999695
10=2.9630000591
11=-0.8299999833
12=-4.4679999352
[mean_precip]
description=Mean precipitation
units=
1=67.4219970703
2=52.7869987488
3=48.4490013123
```

```
4=35.5480003357
5=37.8460006714
6=35.5779991150
7=14.5369997025
8=20.2609996796
9=22.6469993591
10=38.8860015869
11=66.9140014648
12=102.6449966431
[fract_wet_days]
description=Fraction of wet days
units=
1=0.2919999957
2=0.2849999964
3=0.2529999912
4=0.1909999996
5=0.1790000051
6=0.1589999944
7=0.0719999969
8=0.0829999968
9=0.1150000021
10=0.1669999957
11=0.3129999936
12=0.3120000064
[mean_diff_dry_wet_days]
description=Mean of difference of temperature between dry and wet days
units=
1=-3.0079998970
2=-0.5090000033
3=0.7940000296
4=2.6700000763
5=3.1600000858
6=4.0390000343
7=4.5770001411
8=4.6300001144
9=6.1950001717
10=3.6089999676
11=0.0289999992
12=-1.7840000391
[mean_diff_solar_rad_dry_wet_days]
1=0.0000000000
2=0.0000000000
3=0.0000000000
4=0.0000000000
5=0.0000000000
6=0.0000000000
7=0.0000000000
8=0.0000000000
9=0.0000000000
10=0.0000000000
11=0.0000000000
12=0.0000000000
[std_max_temp]
```

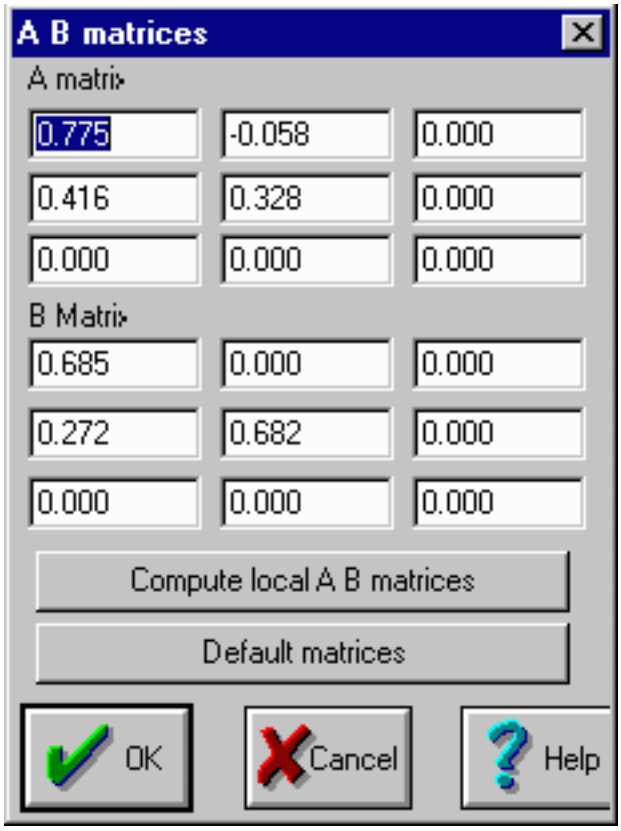
```
description=Standard deviation of mean maximum temperature
1=5.4120001793
2=4.7350001335
3=4.4390001297
4=4.9409999847
5=5.4609999657
6=5.1250000000
7=4.9359998703
8=5.1090002060
9=5.8489999771
10=5.5419998169
11=4.8670001030
12=5.9200000763
[std_min_temp]
description=Standard deviation of mean minimum temperature
1=7.1149997711
2=5.0440001488
3=3.5659999847
4=3.3519999981
5=3.4869999886
6=3.2909998894
7=3.4860000610
8=3.4760000706
9=3.8980000019
10=3.9430000782
11=4.6579999924
12=6.4239997864
[mean_solar_rad]
description=Mean solar radiation
units=MJ/m²/day
1=0.0000000000
2=0.0000000000
3=0.0000000000
4=0.0000000000
5=0.0000000000
6=0.0000000000
7=0.0000000000
8=0.0000000000
9=0.0000000000
10=0.0000000000
11=0.0000000000
12=0.0000000000
[std_solar_rad]
description=Standard deviation of mean solar radiation
1=0.0000000000
2=0.0000000000
3=0.0000000000
4=0.0000000000
5=0.0000000000
6=0.0000000000
7=0.0000000000
8=0.0000000000
9=0.0000000000
```

```
10=0.0000000000
11=0.0000000000
12=0.0000000000
[P(w/w)]
units=
1=0.4580000043
2=0.4600000083
3=0.3560000062
4=0.2790000141
5=0.3100000024
6=0.2980000079
7=0.2290000021
8=0.2160000056
9=0.3310000002
10=0.3779999912
11=0.4359999895
12=0.4379999936
[P(w/d)]
units=
1=0.2240000069
2=0.2150000036
3=0.2179999948
4=0.1710000038
5=0.1509999931
6=0.1330000013
7=0.0599999987
8=0.0710000023
9=0.0869999975
10=0.1239999980
11=0.2569999993
12=0.2549999952
[matgen]
monthly_correlations=0
first_year_continuous_solar_rad=1
num_years_continuous_solar_rad=0
first_year_continuous_temp=1948
num_years_continuous_temp=43
[Amatrix]
1,1=0.7746979594
1,2=-0.0576973110
1,3=0.0000000000
2,1=0.4158574343
2,2=0.3280926049
2,3=0.0000000000
3,1=0.0000000000
3,2=0.0000000000
3,3=0.0000000000
[Bmatrix]
1,1=0.6845726967
1,2=0.0000000000
1,3=0.0000000000
2,1=0.2723201513
2,2=0.6824535728
```

```
2,3=0.0000000000
3,1=0.0000000000
3,2=0.0000000000
3,3=0.0000000000
```

A B correlation matrix editor

The A B correlation matrix editor is not available in Wizard mode.



The **ClimGen** parameter editor now has a built-in A/B Matrices editor/computer. You can enter your own values for the WGEN A/B matrices or use computed or default values. In most situation, the default values should be adequate.

The `[Solar radiation defaults]` button sets default values only for Column 3 of the matricies

The `[Default matrices]` button restores the matrices to the default (WGEN) values.

If you have at least 10 year of complete daily weather data with solar radiation, you can use the `[Compute local A/B matrices]` button.

Note: *If you are using matrix generation for the experimental Excel spreadsheet version of* ***ClimGen****, you will need to edit the .LOC file by hand and set the [matgen] section entry: monthly_correlations=1, in order to get the monthly correlations used by the spreadsheet program.*