

Generating Climate Data for AnnAGNPS

Description

A file containing daily climatic data is required for the AnnAGNPS mode of continuous simulation. It is not required for the AGNPS mode of single day simulation. Climate data used with AnnAGNPS may be historically recorded data, synthetically generated data, or a combination of the two. Daily precipitation, maximum and minimum temperature, dew point temperature, sky cover, and wind speed are the data requirements of AnnAGNPS (wind direction is currently not used). Careful consideration needs to be given to the source of climate data and how many years are analyzed. Climatic data are of great importance in AnnAGNPS. Daily precipitation is the prime driver of the hydrologic cycle, temperatures are used to define frozen conditions, and with remaining climate elements are used in computing potential evapotranspiration. The following steps are recommended for generating synthetic climate data for use in AnnAGNPS (within the United States).

Run GEM

Description

GEM (climate generator) is a program that generates synthetic climatic data for locations in the United States. It can be downloaded from the web site. **GEM** generates daily precipitation, maximum and minimum temperature, and solar radiation. AnnAGNPS requires six climatic elements for each day which are precipitation, maximum and minimum temperature, sky cover, average daily dew point temperature, and average daily wind speed (wind direction is currently not used). **GEM** is recommended to be run whether or not historical climatic records are available for use. Detailed instructions for running **GEM** can be downloaded from the web site.

Example Usage

An example will be presented which illustrates application of GEM for a location in the US. The basic data needed to run this model are the latitude and longitude of the location. There are several options in running GEM. We will focus on the option which will generate synthetic climate data intended for use with AnnAGNPS.

Data Entry

Using Windows Explorer open the directory AGNPS98\DataPrep\Weather\GEM\Execute. Double click on the file name GEM.exe. A series of questions will be asked.

Do you want to know the name list of available stations? Press Enter (default is no).

Latitude For this example, enter 35. (latitude of Memphis, TN)

Longitude For this example, enter 90. (longitude of Memphis, TN).

Station Name. Press Enter (default will list stations within 100 miles).

Is there any station you wish not to have included in the calculation? Select stations from the displayed list which are not to be considered. For this example, exclude stations 2 and 3. Enter 2 3

Do you want to calculate average annual precipitation? Press Enter (default is no).

Do you want to estimate the probability of X or less inches of precipitation over N days? Press Enter (default is no).

Would you like to generate a time series of weather data, or terminate this program? Press Enter (default will generate a time series).

How many years would you like to generate? For this example, enter 6

Please give the seed for the random process. Press Enter (default is zero).

Default output is in English units. Would you like the output in SI (metric) instead ? For this example, enter Y to select SI units.

Write to file ? Output to screen ? Press Enter (default is to write to file).

Output automatically written to the file name: GEM_output.inp.

Would you like to generate a time series of weather data for another location or terminate this program ? Press Enter (default will exit GEM).

Open the file **AGNPS98\DataPrep\Weather\GEM\execute\GEM_output.inp**. The file will contain daily precipitation, maximum and minimum temperatures and solar radiation. This information is not in the format needed for input to AnnAGNPS nor is the information complete. The format of data needed by AnnAGNPS is contained in the Input Data Specifications. AnnAGNPS does not require solar radiation. Daily dew point temperature, sky cover, and wind speed are needed to complete the climate series for use with AnnAGNPS. These steps will be covered next.

Build MonClim.inp File

Description

An interim program named **Complete_Climate** was written to generate the missing climate elements and format the climatic data for input to AnnAGNPS. Input to **Complete_Climate** includes the GEM output file generated previously and a file created by the user containing monthly average sky cover, dew point temperature, and wind speed. These three remaining climate elements are generated for each day based on the monthly averages. These averages are available from a climatic data atlas or climatic summary for the desired location. The output file of **Complete_Climate** then contains all six climatic elements (three generated by GEM and three generated by **Complete_Climate**).

Currently, the input and output files have fixed file names. The GEM output file name must be GEM_output.inp. The file with the monthly information is named MonClim.inp (an example of file contents and format follows). The output file of **Complete_Climate** is named DayClim.inp (the default climate file name for input to AnnAGNPS). With respect to English and SI (Metric) units, both of the input files to **Complete_Climate** must be in the same units (if not, then an error message is placed in the error file).

Example Usage

In this example, monthly averages for Memphis, TN were read from maps in a climatic atlas. The format of the file is displayed in the following table. It needs to be created through use of a text editor (no input program is available at this time).

The example file is in the directory **AGNPS98\DataPrep\Weather\Climate\Datasets** and named **MonClim.inp**.

The first record must have the word Climate in columns 1-10. The 1 in columns 41-50 signifies SI (Metric) units. A zero indicates monthly averages will be in English units. English units are degrees Fahrenheit for dew point temperature and miles per hour for wind speed. The SI unit for dew point temperature is degrees Celsius and wind speed is meters per second. Units for sky cover are percent (used with both SI and English).

The second record is a title record with any description of location, units, etc.

The third through fourteenth records are monthly averages for dew point temperature, sky cover, and wind speed respectively. The third record is for January and the fourteenth is for December. They are entered in ten column fields (11 - 20, 21 - 30, and 31 - 40). Optional information may be placed in columns 1-10 such as month abbreviation. Columns 1-10 are not read by the program so month can be entered for user reference.

Double click on the file name to display it. Next, the climate data for AnnAGNPS will be completed.

```
Climate                                     1
Memphis, monthly dew point(deg C), sky cover(%), wind speed(M/sec)
Jan           0.0           70.           5.
Feb           1.0           63.           5.
Mar           2.2           62.          5.4
Apr           8.8           60.           5.
May          14.3           60.           4.
Jun          18.9           54.           3.5
Jul          20.5           54.           3.5
Aug          19.4           49.           3.1
Sep          16.0           44.           2.2
Oct          10.0           43.           3.5
Nov           3.9           53.           4.5
Dec           0.0           63.           4.5
```

Run Complete_Climate model

Description

Complete_Climate is the program which generates the daily dew point temperature, sky cover, and wind speed, then formats the six daily climatic elements to be read by AnnAGNPS. The input files to this program must be named GEM_output.inp (GEM generated precipitation and temperatures) and MonClim.inp (monthly average dew point, sky cover, and wind speed). It is an interim procedure developed for use until GEM is completed and generates all climatic data needed for AnnAGNPS.

Example Usage

Complete_Climate will be run to create the climate data file for AnnAGNPS.

Data Entry

Verify that the GEM output file is present and is named GEM_output.inp. Move the file to the directory AGNPS98\DataPrep\Weather\Climate\Datasets. Using Windows Explorer open the directory AGNPS98\DataPrep\Weather\Climate\Datasets. Since the two input files for **Complete_Climate** have been created and are in the proper directory, at this point double click the file name Complete_Climate.bat. This batch file runs the program Complete_Climate.exe which is in the directory AGNPS98\DataPrep\Weather\Climate\Execute. Upon completion of the run, view the file DayClim.inp. The file will contain day, month, year and the six daily climate elements.

The 2-year 24-hour precipitation is computed from the annual maximum daily rainfalls in the generated record from GEM. The value is placed in the DayClim.inp file. The 2-year 24-hour precipitation is used to calculate cell time of concentration for those cells which do not have an entered value of time of concentration. Under the common situation where precipitation at one climate station is representative of the entire watershed, the climate data file is ready for execution with AnnAGNPS. If precipitation varies with elevation across the watershed, factors may be entered to accomplish this. This may be done by importing the climate data file into the AnnAGNPS input editor or referring to the AnnAGNPS Input Specifications and entering the parameters using a text editor.

Import Climate data into AnnAGNPS Input Editor

Description

To complete the data file for use with AnnAGNPS and to do any data editing, it is recommended to import the climate data into the AnnAGNPS Input Editor. Importing climatic data and completing the data will be demonstrated with Example 1.