

agGEM and preGEM Implementation within AGNPS

The GEM software provides daily climate data for locations in which statistical parameters have already been developed. At many locations significant climate data exists but statistical parameters have not been developed. The program preGEM allows the user to develop the GEM statistical parameters if the necessary data is available. The user must beware, however, that the validity of the statistical parameters generated depends heavily on the data quality and number of years available. The output of preGEM (example: preGEM_input_template.gm6) becomes the input to agGEM.

The program agGEM produces the same information as GEM, using the previously generated statistical parameters, except that, in addition to output in the original GEM format (example: preGEM_input_template_gem6.out), additional output files are provided with data in the AnnAGNPS fixed format (example: preGEM_input_template_climate.inp) and the AnnAGNPS comma-delimited format (example: 'preGEM_input_template_climate_station.csv' and 'preGEM_input_template_climate_daily.csv') and are based on the same input specifications used within AnnAGNPS for climate. One can run agGEM with statistical data downloaded with the original GEM software, or with the output of preGEM.

Information and datasets for agGEM can be obtained at the following Web site:

<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/?cid=stelprdb1043611>

or the short url:

<http://go.usa.gov/KL0>

More info on agGEM and preGEM

Prior to May 2005 users of AnnAGNPS had been relying on the climate generation software GEM to create years of simulated data for their models. The software GEM and its more recent version GEM6 are unsupported and poorly documented DOS-based Fortran programs. However, their technology is the best available to date for generating statistically valid datastreams.

The software GEM6 reads three input files (with extensions .site, .temp, and .max) and creates an output file with six datatypes (maxT, minT, prec, dewpoint, windspeed, and solar radiation). Although, GEM6 can only be utilized with stations for which the three statistical parameter files have previously been created. The original developers had two utility programs (called AGUA and GENPAR) that created these three files from observed data.

The AGNPS support team has modified GEM6 (now called agGEM) to read data from only one input file (example: preGEM_input_template.gm6) and has

combined the utility programs into one (now called preGEM), which can be used to develop GEM6 statistical parameters from historical values at a climate station.

Procedure for creating the AnnAGNPS Climate input file

Since AnnAGNPS requires all six datatypes from GEM6, the older version of GEM is no longer used. If the user needs climate data generated for a station for which the preliminary statistical files (.site, .temp, and .max) already exist, then only the new program agGEM is needed. If the preliminary statistical files do not exist for a station of interest to the user, then the program preGEM should first be utilized. However, historical data for all six datatypes will need to be assembled as input to preGEM. Details about the two programs preGEM and agGEM are given below.

Details about preGEM

The program requires an input file of historical data in the fixed format or comma-delimited format. Users have the option of specifying the associated format to use when executing preGEM by either indicating an AnnAGNPS station and daily file in the comma-delimited format with a 'csv' extension, or anything other extension when using the fixed format.

Example for fixed format files (Data columns are not of fixed format — simply separate by spaces.):

```
34  22.2022  159.4492  345  Princeville
Mon Day    Year Prec tmax tmin dewp  solar  wind
1    1      1949 0.00  81   69   68   320.95  4.11
1    2      1949 0.00  77   71   68   219.94  4.34
1    3      1949 1.54  77   64   64   343.97  5.64
1    4      1949 0.01  73   69   60   409.61  6.15
etc.
```

The first line data is:

number of years of data in the file, latitude, longitude, elevation (feet), and sitename.

The program has no restriction on the number of years of data. However, a dataset of at least 20 years is preferred, as statistical reliability declines rapidly with fewer. In addition, there can be no missing data. Any missing data in the historic record must be estimated before running preGEM. The input data units should be Fahrenheit for temperatures, inches for precip, langleys for solar, and meters/second for wind. The output file created is given the name of the input file

with the extension .gm6 which is the extension expected by the program agGEM, described below.

The example file, preGEM_input_template.xls, can be used as a template to insert historical data into the fixed format needed to execute preGEM. The parameter fields for 'Prec', 'solar', and 'wind' defaults to two decimal places in their values in order to ensure a space is produced between parameters when saving the file. If the user creates the input information directly into an ASCII file without the template, then there is no limitation in the number of decimal places. Once the information is completely entered in the template, the file should be saved using the "save as" option of "Formatted Text (Space delimited) (*.prn)". Otherwise the preGEM program may not function properly.

Example for comma-delimited files:

Users of preGEM can use comma-delimited formatted input files as specified in the AnnAGNPS input specifications for climate as input files into preGEM. When prompted after executing preGEM for the input file name, the user would enter the comma-delimited AnnAGNPS station file name and then the AnnAGNPS daily file name with the csv extension.

Details about agGEM

The program agGEM requires only the one input file, with a .gm6 extension (example: preGEM_input_template.gm6). agGEM can be utilized for sites that already have GEM6 parameters developed in the three files (.site, .temp, and .max), but these three files must be combined into one, with the data of each file separated from the others by two blank lines, and renamed with a .gm6 extension.

The program agGEM also incorporates the former stand alone program Solar_to_Skycover. Since AnnAGNPS was originally developed to utilize skycover data instead of solar radiation data, this program was used to convert one to the other. Now integrated with agGEM, that extra step can be skipped. The output of agGEM produces four files, one named 'filename_gem6.out' for standard GEM6 data, including solar radiation, another named 'filename_climate.inp' ready for use with AnnAGNPS as the fixed formatted climate file, and comma-delimited files: 'filename_climate_station.csv' and 'filename_climate_daily.csv' ready for use with AnnAGNPS as the comma-delimited climate files. The filename part of the output files is the name of the .gm6 file (generally a station name).