Newhall Simulation Model -- Users Manual

Contents

1. Introduction

The Newhall program was translated to C from a BASIC program and several modifications were made. This Newhall program is run on a time-sequence of monthly climate data, and approximates the daily soil moisture condition (dry, moist/dry, and moist in the control section) and biologically significant temperature thresholds (at 50mm depth). The time-series of moisture and temperature class are summarized according to the criteria of Soil Taxonomy (USDA NRCS Soil Survey Staff, 1999), thereby classifying the site. A description of how to use the program is given in the **Usage** and **Usage Examples** sections. The necessary input files are explained in the **Input Files** section and the **Output Files** section explains what files the program writes to and where they are.

2. Usage

This section outlines the different command line arguments that can by used with the Newhall program.

usage	Newhall <WHC> <Directory>
<WHC>	Water Holding Capacity in mm
<Directory>	Local directory where input files can be found

3. Usage Examples

This section gives some examples of how to use the Newhall program.

1. newhall

   The Newhall program runs using the input files in the current directory and outputs the results in the same directory.

2. newhall 100

   The Newhall program runs using the input files in the current directory and outputs the results in the same directory, but using a water holding capacity of 100 mm.

3. newhall 100 \newhall\test (or /usr/xxx/newhall/test)

   The Newhall program runs using the input files in the specified directory and outputs the results in that directory, using a water holding capacity of 100 mm. Note that you may need to use different directory format for Windows or Unix environment.

4. Input Files

Currently, the program requires several specifically named input files. These three input files are:
monthly_T, **monthly_P**, and **parameter**.

monthly_T

These files hold the temperature data (in degree F) for a station. Each line starts with the year followed by 12 temperature entries. The temperature is the average monthly temperature. The example shown is from monthly_T.

```
1893 14.371 14.000 26.435 44.250 54.645 70.683 73.355 69.323 63.600 48.806 32.867 19.161
1894 12.705 14.979 37.984 49.700 61.209 71.463 77.935 74.312 65.283 51.516 34.767 29.548
1895 12.519 17.964 33.994 54.506 60.411 66.172 70.548 69.622 65.288 44.795 32.433 23.333
1896 23.258 27.397 26.425 48.833 62.790 68.054 71.365 70.677 57.991 46.355 21.154 28.597
```

monthly_P

These files hold the precipitation data (in Inch) for a station. Each line starts with the year followed by 12 precipitation entries. The precipitation is the total monthly precipitation. The example shown is from monthly_P.

```
1893  0.610  1.500  1.730  4.050  1.950  0.790  3.020  2.570  1.430  0.850  1.260  2.350
1894  0.700  0.550  0.580  4.240  2.430  1.150  0.580  1.480  0.550  1.760  0.050  1.000
1895  0.650  0.540  0.520  3.980  2.380  6.240  2.320  3.920  4.770  0.060  1.040  0.000
1896  0.250  0.270  1.670  5.680  6.240  7.740  5.550  1.660  1.810  3.230  3.850  0.230
```

parameter

The parameter file contains seven parameters that are needed to run the Newhall model. The first entry in the file is the latitude in degree (Warning: Do not use latitude as Degree.Minute). The second entry is the north (N) or south (S) hemisphere. The third entry is the water holding capacity in inches (Note that if you use commandline arguments to specify the water holding capacity, the WHC in the input file is not going to be used. But you need to include that in the parameter file). The fourth entry is the difference between the average annual air temperature and soil temperature at 50 mm depth. The fifth entry is the amplitude change of soil temperature at 50 m depth versus air temperature. The sixth entry is the phase shift of soil temperature at 50 mm depth versus air temperature. The values the fourth, fifth and sixth parameters can be found in Table 1. If you could not find the parameter values related to your state, try using either the default values or values of those states having similar climate conditions. The last entry is the station name.

```
41.57  N  2.33  2.5  0.9  10  ARTHUR
```

State	CC (degC)	CD	Lag (day)	Available Years
AR	2.29	0.90	7	2000 - 2001
AZ	3.60	0.85	9	2001
CO	4.47	1.10	17	1998-2001
FL	2.56	1.15	20	1997, 1999 - 2001
GA	1.16	1.00	15	1998 - 2001
ID	6.50	0.90	5	2000 - 2001
IL	2.43	1.00	14	1998 - 2001
KY	1.48	1.00	14	1998 - 2001
MN	3.24	1.00	11	1998
MS	2.78	1.05	13	1998 -2000
MT	3.20	1.05	16	1999 -2000
NC	2.95	1.10	15	1998
ND	2.54	0.90	15	1998 -2000
NV	3.41	1.20	15	1997 - 1999
NY	2.63	1.00	15	1998 - 2000
OH	2.12	1.00	15	1998, 2001
PA01	1.36	0.85	4	2001
SC01	2.81	0.90	5	2000 - 2001
TX	1.72	0.95	12	1997 - 2001
VA	1.48	0.87	3	2001
VT	2.45	0.50	6	2001
WA	2.61	1.20	18	1997, 1998, 2000, 2001
WI	2.71	1.10	17	1998 - 2000
WY	3.18	0.90	10	1998 - 2001
AVG	2.74	0.98	12	
Default	2.50	0.988	12.5	

CC: Average soil temperature = Average air temperature + CC
CD: Amplitude of soil temperature = Amplitude of air temperature * CD
Both CC and CD are the symbols used in the original Newhall Model

Table 1. Best fit parameters used to estimate soil temperature at 50 mm depth from monthly air temperature

5. Output files

There are four different output files that contain the simulation results of the Newhall program. They are *year* (actual year), *summary*, *SMR* and *SMRS*.

year

The file *year*, for example 1990, contains the complete simulation results in a format same as the original Newhall program.

summary

The file *summary* contains the summary of simulation results.

SMR

The file *SMR* contains the probability analysis of soil moisture regimes.

SMRS

The file *SMRS* contains the probability analysis of subdivisions of soil moisture regimes.

6. Bugs

Please send bug reports to dgov@rcf.unl.edu