jNSM 1.6.0 - Java Newhall Simulation Model

User Guide – Part I

United States Department of Agriculture
Natural Resources Conservation Service

Contents

Java Newhall Simulation Model (jNSM)

The Java Newhall Simulation Model, or **jNSM**, is **a desktop client application** that employs Java 5 (Oracle Corporation) and Adobe Flex. The Flex and the Java are integrated into an **Adobe AIR** executable application.

Flex is used to manage the model input and the formatting of the output products of the application.

The jNSM application takes **batch input** in the form of a **CSV** file, and also allows **interactive input** of data comprising a single model run.

Output products are displayed on the user's monitor, and can be saved and printed in PDF format.

Model run results are stored in **XML** format. (Multiple **XML** files can be converted to a single CSV file by using the **XML2CSV** tool.)

Background of the Newhall Simulation Model (NSM)

The Newhall Simulation Model (NSM), Franklin Newhall's model for soil temperature and moisture regime determination (Newhall and Berdanier, 1994), was originally written in COBAL then reimplemented in GW-BASIC by Van Wambeke (Van Wambeke et al., 1986 and 1992; Van Wambeke, 2000). The GW-BASIC version of the Newhall Simulation Model, known as Van Wambeke 1.0, was ported to the **Java** programming language for the current **jNSM** application. This Java implementation comprises the main computational engine of the jNSM application.

The original NSM functions by taking temperature and precipitation data from a point location, interpreted as monthly averages, and simulates the behavior of the moisture profile. The model algorithm is based on the concept of horizontal moisture recharge and vertical discharge within the moisture profile. See the *User Guide – Part II* for original Newhall Simulation Model description. (Newhall and Berdanier, 1994; Van Wambeke et al., 1986 and 1992; Van Wambeke, 2000)

The Java simulation core of the jNSM is an effective 1:1 port of the original model, behaving identically given the same dataset and assumptions. However, jNSM goes further to incorporate additional features, such as annual and summer water balances.

The water balances are defined as the sum of precipitation minus the sum of evapotranspiration over a year for one figure, and only three months of the summer for the other. AWB is the end total for the entire 12 month duration a dataset covers, while SWB will cover only the three summer months. The summer months are conditional on the location of the dataset, whether it is in the northern or southern hemisphere. “Summer” is considered June through August for the northern hemisphere, and December through February in the southern hemisphere.

Installation of jNSM

Currently jNSM runs only under MS Windows XP and 7 operating systems.

MS Windows (XP or 7) Installation

Extract the files from the **jNSM.zip** file. The jNSM.zip archive file contains 14 files:

- **jNSM_v1.6.0_installer.exe** An Adobe AIR installation executable
- **jNSM_UserGuide_.pdf**
- **Template Batch Metric.xlsx** An empty Excel template file for preparing batch input data in metric units
- **Template Batch English.xlsx** An empty Excel template file for preparing batch input data in English units
- **All PA jNSM Example Batch Metric.xlsx** Sample Excel batch data prep file containing 30-year Normal data in metric units
- **All PA jNSM Example Batch Metric.csv** The CSV version of the above file ready for input to the jNSM application
- **NWSCOOP 1971-2000 jNSM Batch ENGLISH.xlsx** Sample Excel batch data prep file containing 30-year Normal data in English units
- **NWSCOOP 1971-2000 jNSM Batch ENGLISH.csv** The CSV version of the above file ready for input to the jNSM application
- **Williamsport PA jNSM Example Batch English.xlsx** Sample Excel batch data prep file containing data for multiple years for a single site in English units
- **Williamsport PA jNSM Example Batch English.csv** The CSV version of the above file ready for input to the jNSM application
- **WILLIAMSPORT_1930_1930.xml** A sample output XML file from one of the runs included in the Williamsport PA jNSM Example Batch English.csv file
- **XML2CSV.zip** Contains a Java application that enables you to consolidate several output XML files into a single CSV file
- **NewhallPhase2Proposal_2011-03-21.doc** Proposed future work
- **READ_ME_jNSM.txt** A text file with some brief notes pertaining to the above files

You must have administrative privileges in order for the application to install. Install the jNSM application by double-clicking on the **jNSM_v1.6.0_installer.exe** file name.

The installation program does not include a digital signature (or Digital Signing Certificate), so you may see a Security Warning window informing you that the Publisher is Unknown. The jNSM application was developed by the Center for Environmental Informatics in the College of Earth and Mineral Sciences at The Pennsylvania State University, under the auspices of the USDA/NRCS. You can hit the **Run** button in response to the warning.

The jNSM is a Flex application that calls a Java application. This requires you to have both **Adobe AIR** and **Java Runtime** installed. You may, therefore, need to allow the installation of Adobe AIR during the installation.

If your computer alerts you that it does not recognize a **.jar** file when try to run the jNSM, you need to install Java Runtime.

Installing Adobe AIR and Java Runtime on MS Windows

Adobe AIR is packaged with the installation executable. You simply need to allow it to be installed when you execute the installation of jNSM. The most recent version available will be installed.

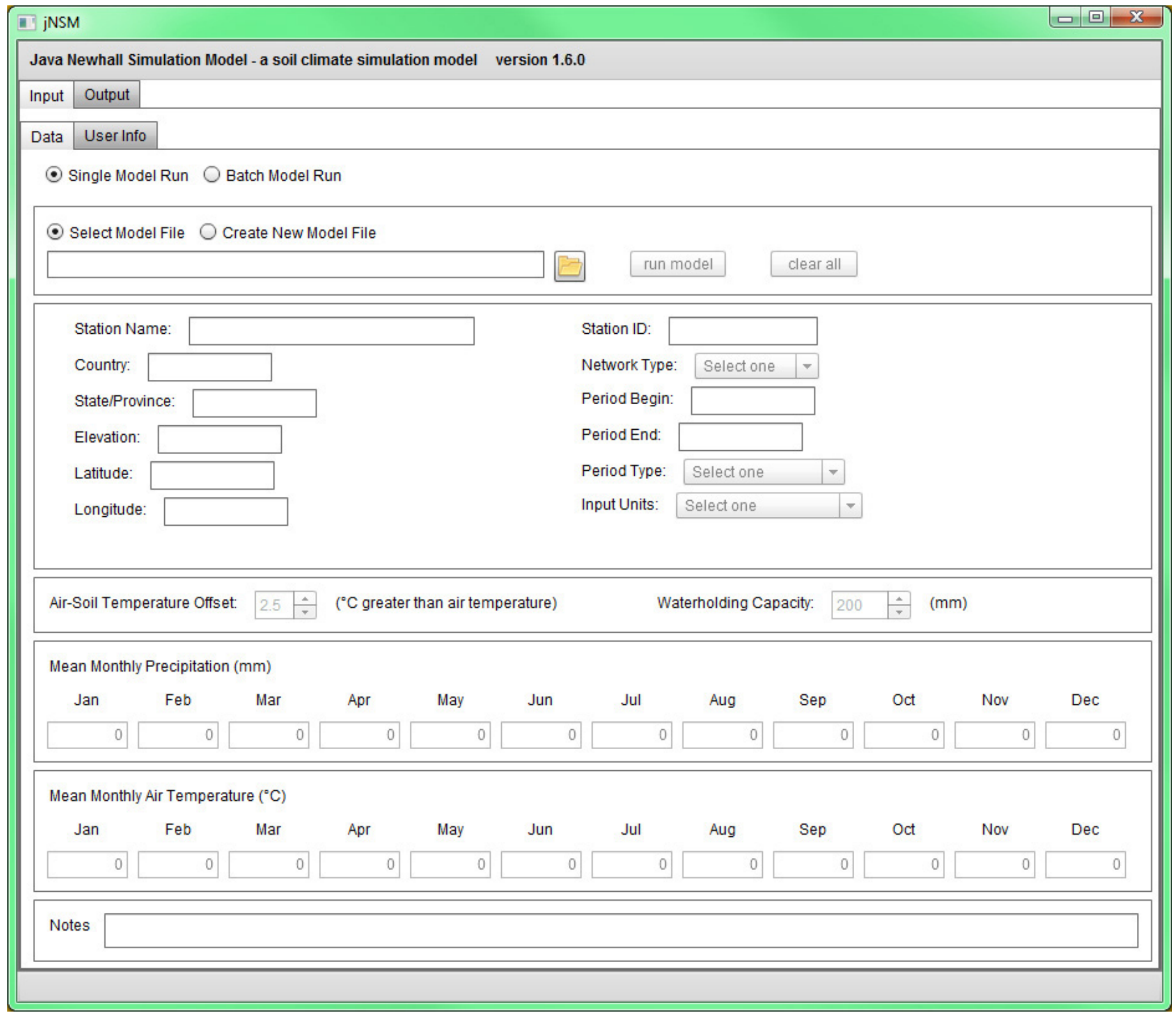
If the machine already has an older version of AIR installed, the option to “Start application after installation” should be selected during installation by the Administrator because there is apt to be a lag of several seconds before the installer alerts you to the fact that a new version needs to be installed which requires Administrator permission.

To download and install the most recent version of **Java Runtime** (Java 5 or later is required), go to http://www.java.com/en/download/manual.jsp and find the options for Microsoft Windows. Select either the online or offline installer, either will work. Run the program you download, follow the instructions. *It is recommended that you opt-out of any software or toolbar offers the installer provides you, these programs are generally not worth the effort of installing them.*

Run the jNSM Application

To run the jNSM application simply double-click the desktop icon that was placed on your desktop, or go to the Start | All Programs menu and click the jNSM icon (Windows).

The application will open to this view.



Model Input

The user must provide **serially-complete dataset(s)** of climate data for the desired period of record, and specify the **unit system** used. **Serially-complete** implies that the input includes average temperature and total precipitation values for all months (based on all days of each month or at least 20-25 days of each month) over the time period in question, which is a minimum of one calendar year or 12 consecutive months (January through December).

Input parameters for **air-soil temperature relationship** and for **available water capacity** will also be specified by the user. Default values of 2.5°C or 4.5°F, and 200 mm or 7.874 inches, respectively, can be accepted by not specifying values for those input parameters.

Station/Site metadata is also supplied by the user.

jNSM Input Mode

Data is input into the jNSM application as:

- a **CSV** (Comma Separated by Value; **.csv**) batch file, or
- **interactively** via a data input form.

A CSV file is easily created from an Excel (.xls or .xlsx) file by performing a **File | Save As | CSV (Comma delimited) (*.csv)** in the Microsoft Excel application.

The format of the CSV file required by the jNSM application is different from the format of the legacy CSV format used by the BASIC version of the Newhall Simulation Model. See Appendix A for an explanation of the CSV format for jNSM, and Appendix D for a description of the CSV file format used in the BASIC version.

When the jNSM application is run, the interface opens in **Input** mode, expecting the user to:

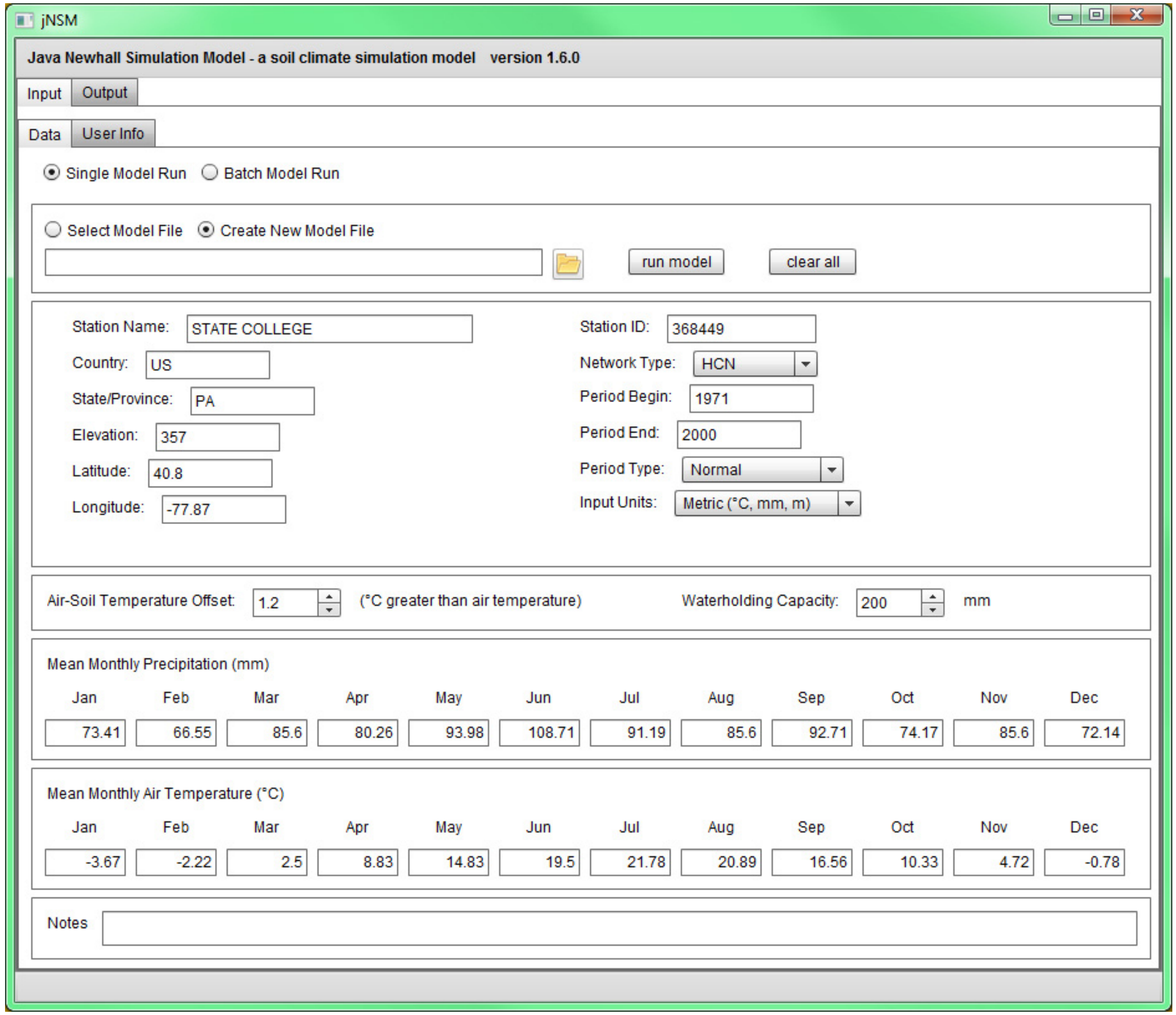
1. **supply input data** in one of **two ways**: 1) either interactively or 2) in batch mode (via CSV file),
   OR
2. **review** an existing output **XML** file from a previous model run.

These choices are elaborated upon in the proceeding sections.

Two Data Input Methods: 1) Single Model Run and 2) Batch Model Run

1. With the **Single Model Run** radio button selected on the **Data** page, the user **interactively** supplies:
   - information about the sample station
   - information about the sampling period and the measurement units
   - air-soil temperature offset and waterholding capacity parameters
   - serially-complete mean monthly precipitation and air temperature values

   When the **run model** button is hit, the user will be prompted to designate the name and the destination for the output XML file.



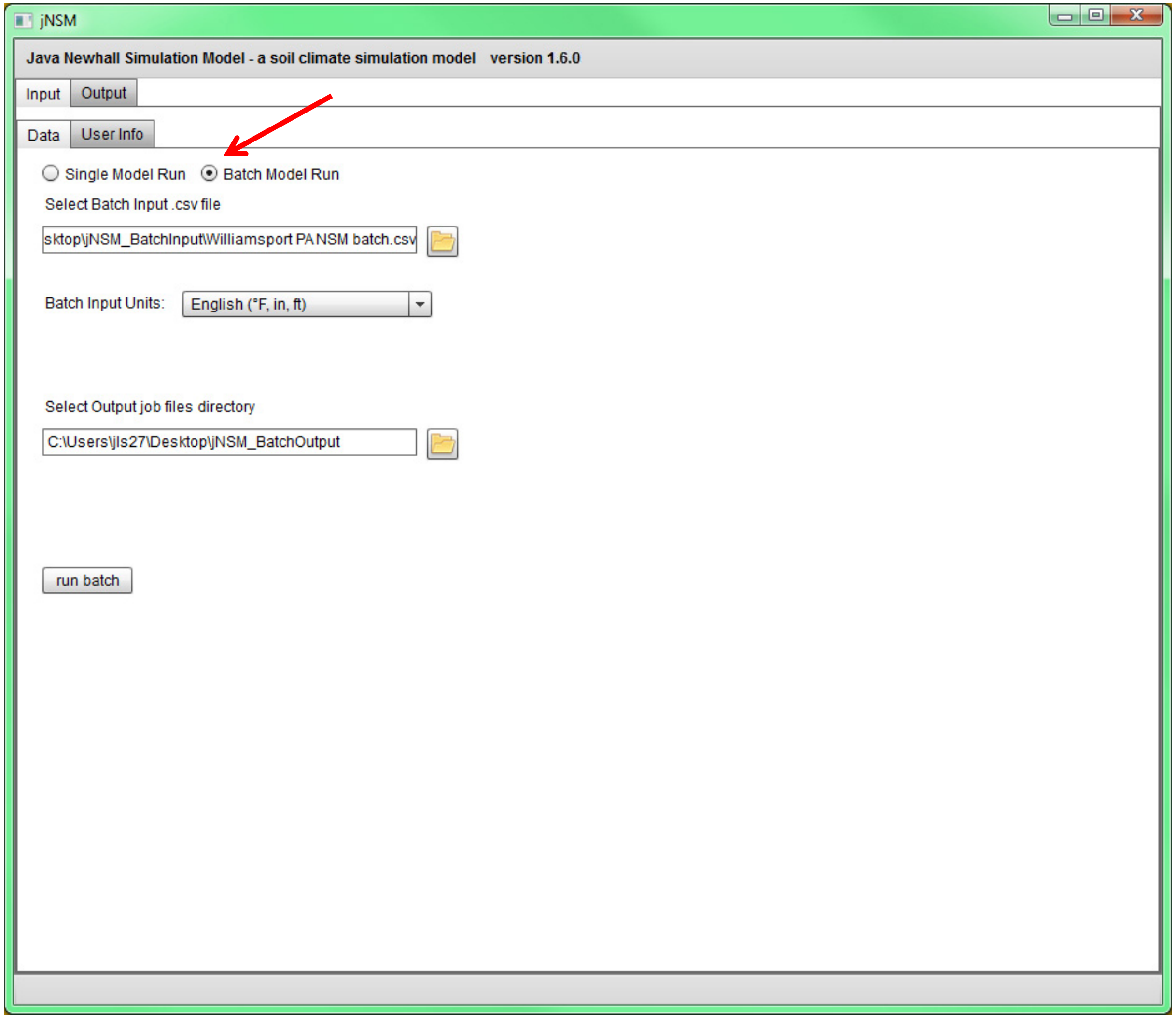
With the **Batch Model Run** radio button selected on the **Data** page, the user supplies:

- the name of a CSV file that contains input data
- the unit system of the data in the batch CSV file
- the name of a destination folder for the model output file

When the **run batch** button is hit, a counter will appear showing the progress of the model run.

The content of a CSV input file is detailed in Appendix A.

A CSV file can be saved from an Excel (.xls or .xlsx) file by performing a **File | Save As | CSV (Comma delimited) (*.csv)** in the Microsoft Excel application.



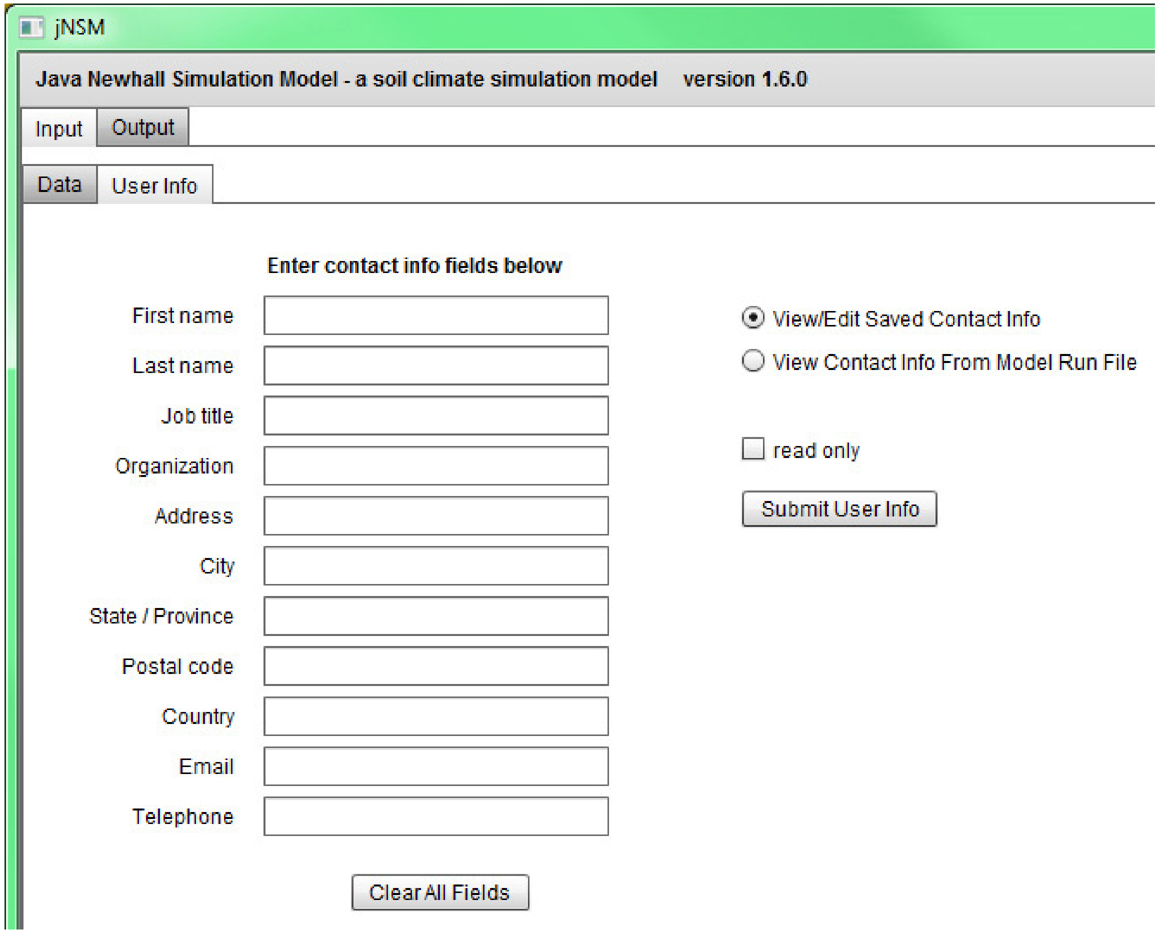
User Information

As part of the metadata for each model run the user must supply contact information via the form pictured here.

The form is accessed via the **User Info** tab, and **must be filled in and submitted** before the user can execute a model run.

After entering User Information the first time you run the model, it will be saved and automatically supplied to subsequent model runs.

You can change it when necessary by resubmitting the form.



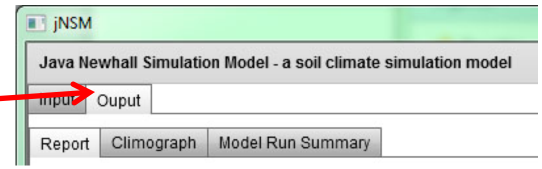
Model Output

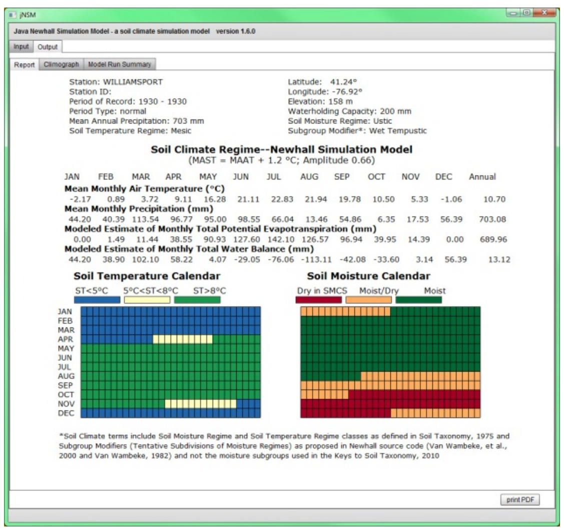
The jNSM application produces three output information products and a machine-readable model run output file in XML format.

The information products produced by the jNSM application are:

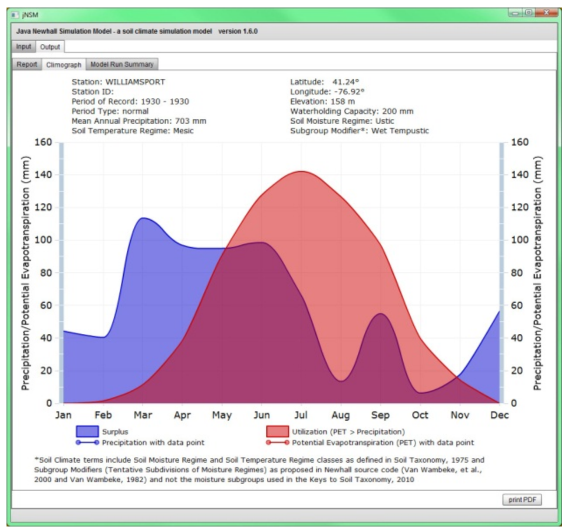
1. a Report page
2. a Climograph page
3. a Model Run Summary page

These are illustrated below. (Larger versions can be viewed in Appendix B.)
They are accessible by selecting the **Output tab** of the jNSM interface.

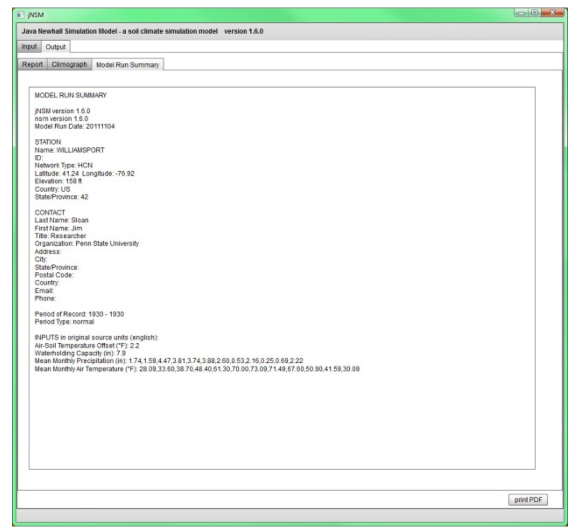




Report



Climograph



Model Run Summary

In addition, the jNSM application **saves an XML (.xml)** file that stores the input parameters and input data as well as the output data in machine-readable XML format. Appendix C shows an example of such a file and provides definitions for each parameter.

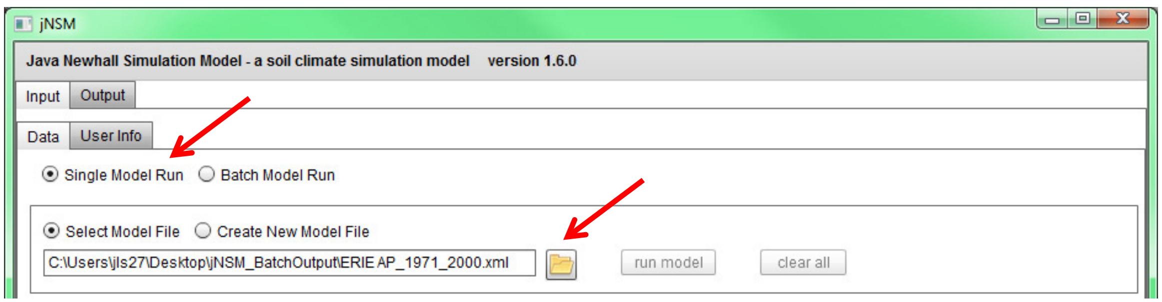
Consolidating multiple output XML files with XML2CSV

The **XML2CSV.zip** file that is included with installation bundle contains a Java application (XML2CSV) that enables you to consolidate several XML files into a single CSV file. The zip archive also includes a user guide. The XML2CSV application can be used, for example, to consolidate the XML files output from a jNSM batch run into a single spreadsheet file for the sake of further analysis.

Reviewing Existing Model Runs and Running the Application Based on an Existing Model Run

Reviewing an Existing Model Run

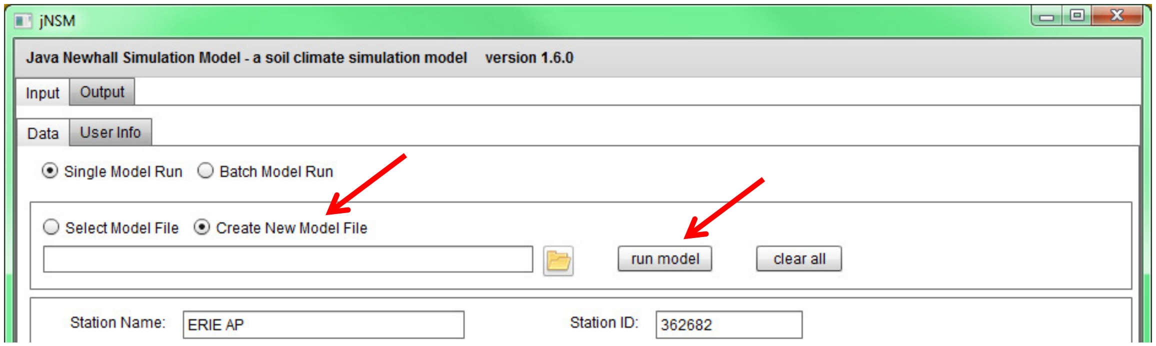
With the **Input** tab of the interface selected, and the **Data** setting set to **Single Model Run**, the user can navigate to and retrieve the results of a single previously-run model. Recall that the output files from previous model runs are XML (.xml) files.



In this mode the interface can be used to simply review the input data for the given model run, which will populate the data form. And, via the **Output** tab, the user can look at the Report, the Climograph and the Model Run Summary for that model run.

Setting up a new model Run Based on an Existing Model Run

With the **Single Model Run** form populated with data from a previous model run, you can select **Create New Model File**, edit the model input, and then hit the **run model** button. You will then be prompted to specify the output destination and file name.



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Appendix A: Input Batch Data File Format

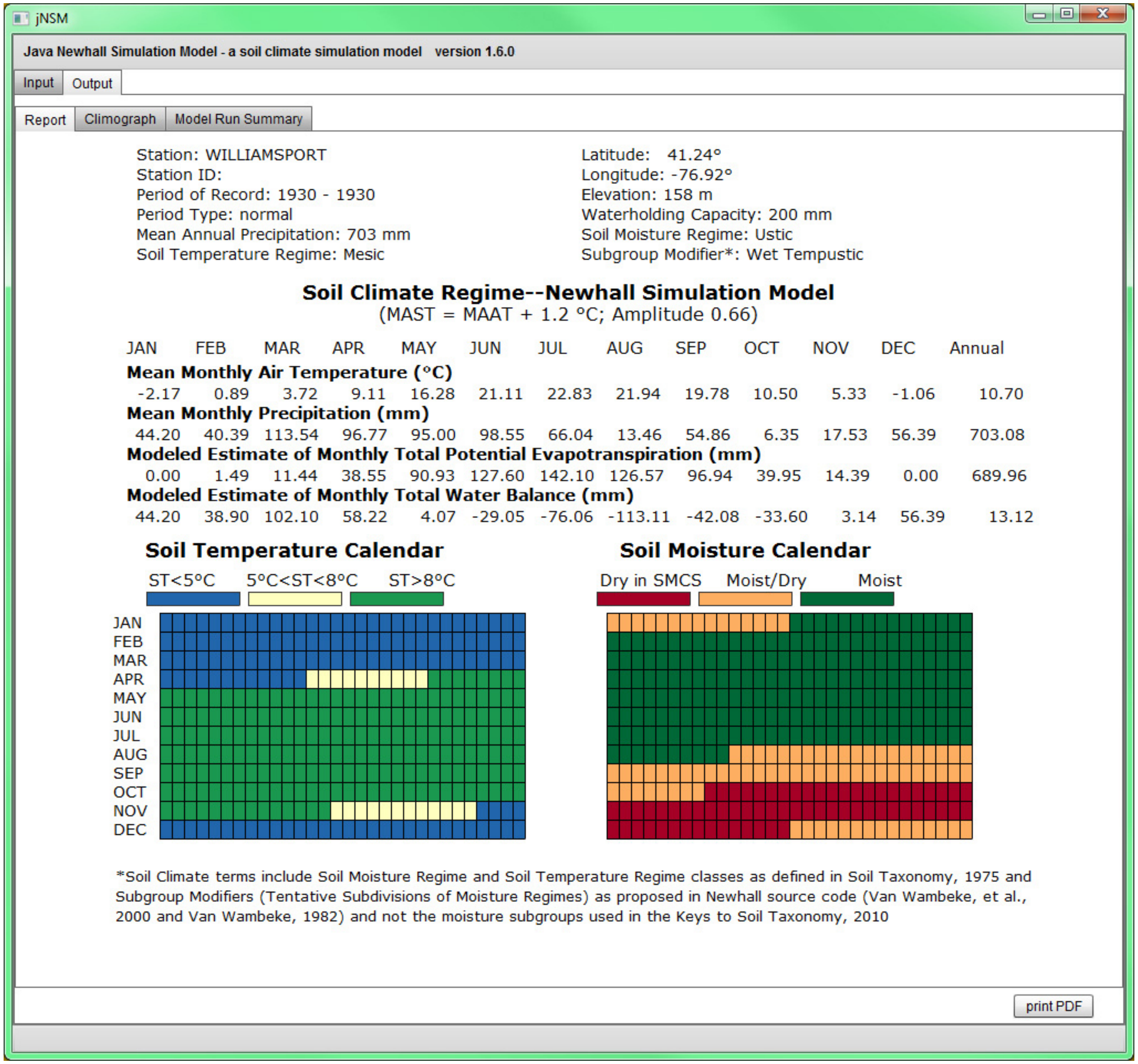
- File Type: comma separated values (CSV)
- File must include required elements
- First line of file must be header of element names from table below
- File must include all element names/columns in the order specified
- Each subsequent line must contain the element data values for a single model run
- File may have only one unit system (i.e. metric and standard units may not be mixed)
- Columns that hold non-required data (N) must either hold valid data values or be left blank

element name	*description*	*required*	*data type*	*units/values*
stationName	station name	Y	text	cannot contain slash
netType	network type	Y	text	SCAN, HCN, SNOTEL, NCSS, other
latDD	station latitude decimal degrees	Y	float	degrees
lonDD	station latitude decimal degrees	Y	float	degrees
elev	station elevation	Y	int	ft, m
tJan	January temperature	Y	float	degrees F, C
tFeb	February temperature	Y	float	degrees F, C
tMar	March temperature	Y	float	degrees F, C
tApr	April temperature	Y	float	degrees F, C
tMay	May temperature	Y	float	degrees F, C
tJun	June temperature	Y	float	degrees F, C
tJul	July temperature	Y	float	degrees F, C
tAug	August temperature	Y	float	degrees F, C
tSep	September temperature	Y	float	degrees F, C
tOct	October temperature	Y	float	degrees F, C
tNov	November temperature	Y	float	degrees F, C
tDec	December temperature	Y	float	degrees F, C
pJan	January precipitation	Y	float	in, mm
pFeb	February precipitation	Y	float	in, mm

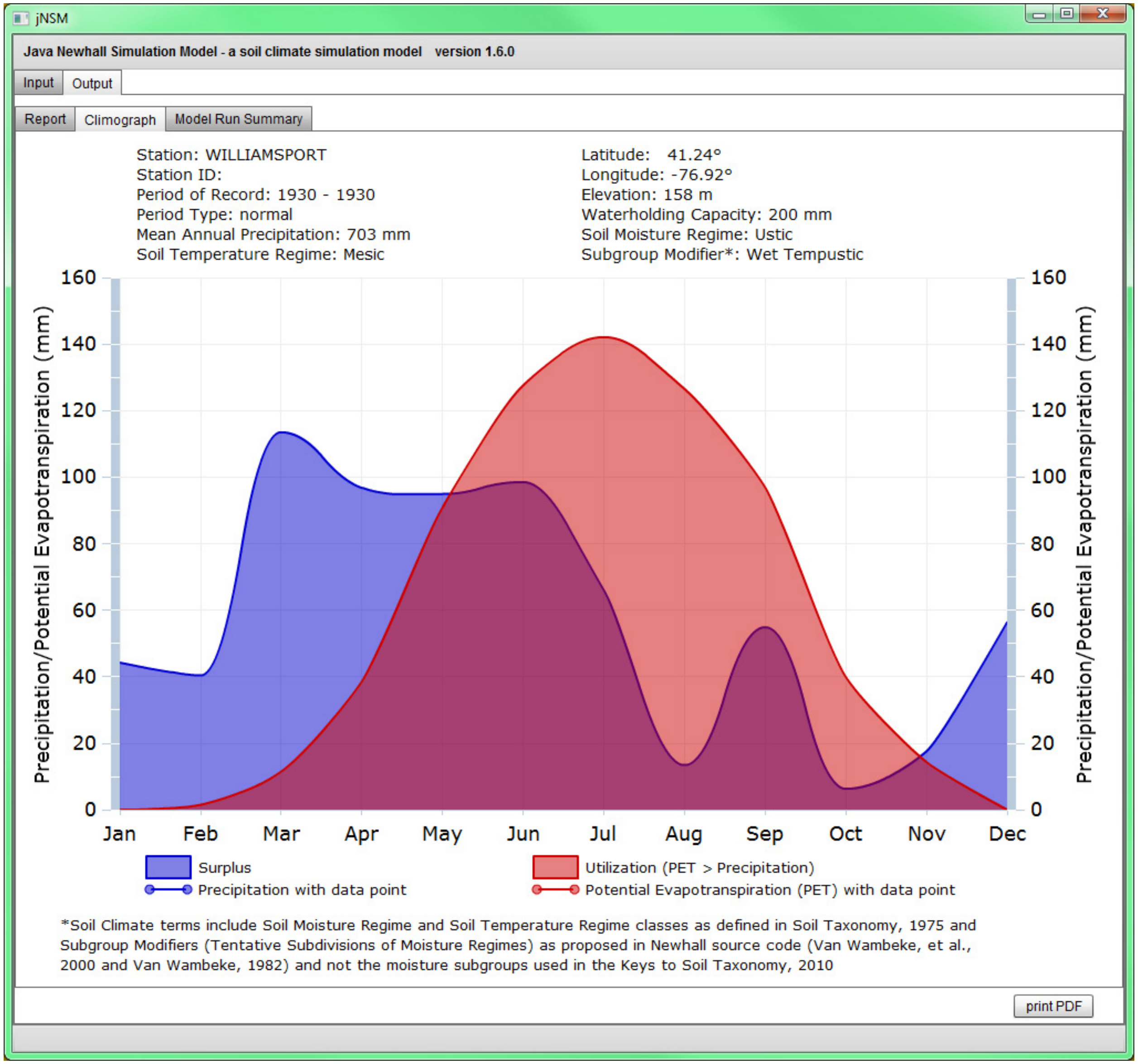
element name	*description*	*required*	*data type*	*units/values*
pMar	March precipitation	Y	float	in, mm
pApr	April precipitation	Y	float	in, mm
pMay	May precipitation	Y	float	in, mm
pJun	June precipitation	Y	float	in, mm
pJul	July precipitation	Y	float	in, mm
pAug	August precipitation	Y	float	in, mm
pSep	September precipitation	Y	float	in, mm
pOct	October precipitation	Y	float	in, mm
pNov	November precipitation	Y	float	in, mm
pDec	December precipitation	Y	float	in, mm
pdType	type of period of record	Y	text	Normal, actual, average
pdStartYr	start year of period represented by data	Y	int	
pdEndYr	end year of period represented by data	Y	int	
awc	available water holding capacity of the soil; if not specified, default of 200 mm (7.874 inches) is used	N	float	in, mm
maatmast	mean annual air temperature to soil temperature offset soil; if not specified, default of 2.5° C (4.5° F) is used	N	float	degrees F, C
cntryCode	country abbreviation	N	text	
stProvCode	state/prov abbreviation	N	text	
mlraID	MLRA ID	N	text	
notes	free-form notes	N	text	
stationID	station ID	N	text	

Appendix B: Larger Versions of Output Product – Report, Climograph, Model Run Summary

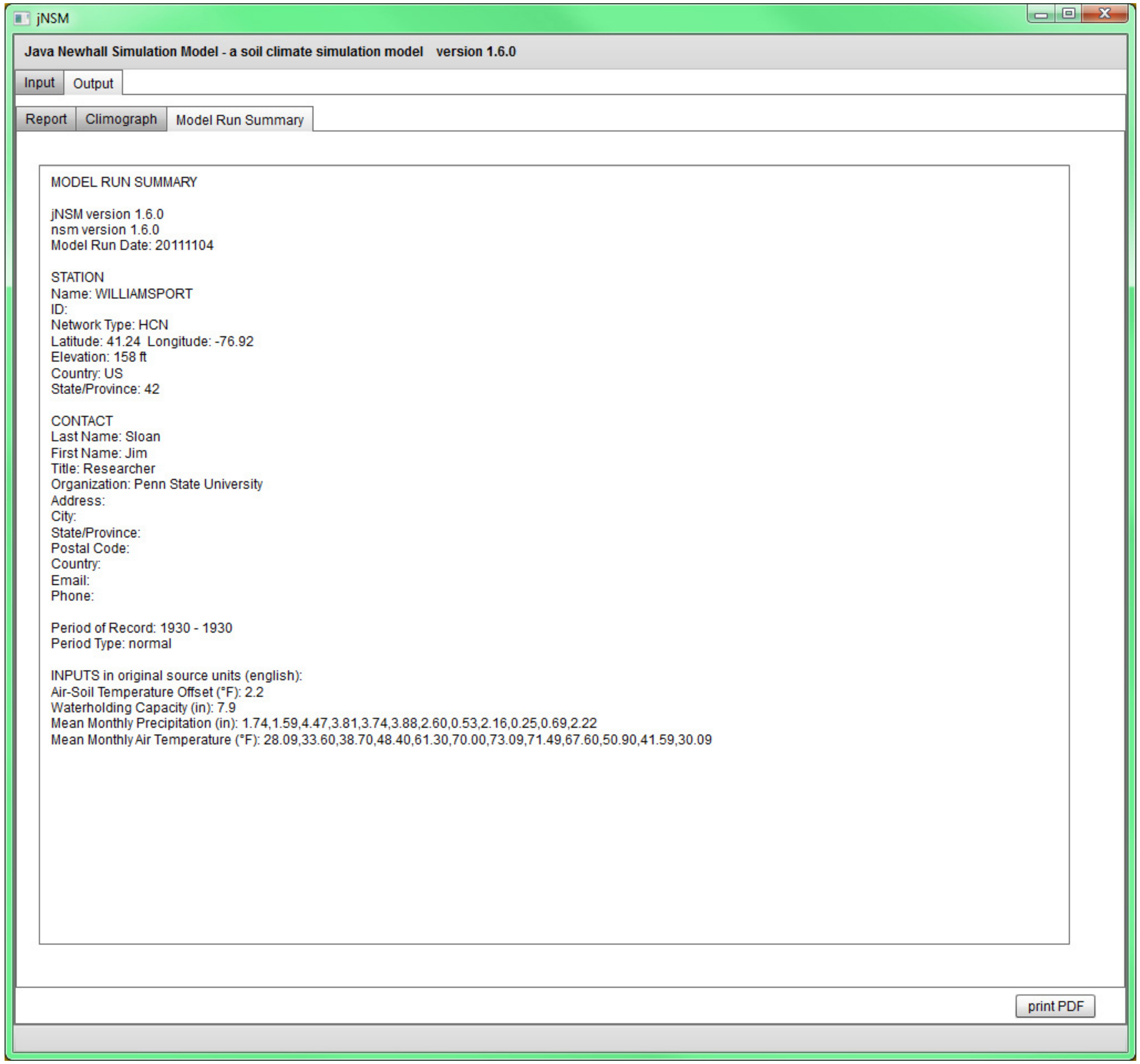
Report



Climograph


jNSM
Java Newhall Simulation Model - a soil climate simulation model version 1.6.0
Input
Output
Report
Climograph
Model Run Summary
Station: WILLIAMSPORT
Station ID:
Period of Record: 1930 - 1930
Period Type: normal
Mean Annual Precipitation: 703 mm
Soil Temperature Regime: Mesic
Latitude: 41.24°
Longitude: -76.92°
Elevation: 158 m
Waterholding Capacity: 200 mm
Soil Moisture Regime: Ustic
Subgroup Modifier*: Wet Tempustic
Precipitation/Potential Evapotranspiration (mm)
0
20
40
60
80
100
120
140
160
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Surplus
Precipitation with data point
Utilization (PET > Precipitation)
Potential Evapotranspiration (PET) with data point
*Soil Climate terms include Soil Moisture Regime and Soil Temperature Regime classes as defined in Soil Taxonomy, 1975 and Subgroup Modifiers (Tentative Subdivisions of Moisture Regimes) as proposed in Newhall source code (Van Wambeke, et al., 2000 and Van Wambeke, 1982) and not the moisture subgroups used in the Keys to Soil Taxonomy, 2010
print PDF

Model Run Summary



Appendix C: Example jNSM XML File & Tag Descriptions

Below is an example model run output file. These files are created and saved to a folder that the user designates when data is run through the jNSM application. Such an output XML file can be brought back in to the jNSM interface in order to review the model run results, or to perform a new model run based on editing the parameters stored from a previous run.


```
<model>
  <metadata>
    <stninfo>
      <nettype>HCN</nettype>
      <stnname>WILLIAMSPORT</stnname>
      <stnid/>
      <stnelev>158.0</stnelev>
      <stateprov>PA</stateprov>
      <country>US</country>
    </stninfo>
    <mlra>
      <mlraname/>
      <mlraid>0</mlraid>
    </mlra>
    <cntinfo>
      <cntper>
        <firstname>Jane</firstname>
        <lastname>Smith</lastname>
        <title>Researcher</title>
      </cntper>
      <cntorg>State University</cntorg>
      <cntaddr>
        <address/>
        <city/>
        <stateprov/>
        <postal/>
        <country/>
      </cntaddr>
      <cntemail/>
      <cntphone/>
    </cntinfo>
```

```
  <notes>
    <note>gaps filled by interpolation of neighboring stations</note>
  </notes>
  <rundate>20111113</rundate>
  <nsmver>1.5.1</nsmver>
  <srcunitsys>english</srcunitsys>
</metadata>
<input>
  <location>
    <lat>41.24</lat>
    <lon>-76.92</lon>
    <usercoordfmt>DD</usercoordfmt>
  </location>
  <recordpd>
    <pdtype>normal</pdtype>
    <pdbegin>1930</pdbegin>
    <pdend>1930</pdend>
  </recordpd>
  <precips>
    <precip id="Jan">44.2</precip>
    <precip id="Feb">40.39</precip>
    <precip id="Mar">113.54</precip>
    <precip id="Apr">96.77</precip>
    <precip id="May">95.0</precip>
    <precip id="Jun">98.55</precip>
    <precip id="Jul">66.04</precip>
    <precip id="Aug">13.46</precip>
    <precip id="Sep">54.86</precip>
    <precip id="Oct">6.35</precip>
    <precip id="Nov">17.53</precip>
    <precip id="Dec">56.39</precip>
  </precips>
  <airtemps>
    <airtemp id="Jan">-2.17</airtemp>
    <airtemp id="Feb">0.89</airtemp>
    <airtemp id="Mar">3.72</airtemp>
    <airtemp id="Apr">9.11</airtemp>
```

```
    <airtemp id="May">16.28</airtemp>
    <airtemp id="Jun">21.11</airtemp>
    <airtemp id="Jul">22.83</airtemp>
    <airtemp id="Aug">21.94</airtemp>
    <airtemp id="Sep">19.78</airtemp>
    <airtemp id="Oct">10.5</airtemp>
    <airtemp id="Nov">5.33</airtemp>
    <airtemp id="Dec">-1.06</airtemp>
  </airtemps>
  <smcsawc>200.0</smcsawc>
  <soilairrel>
    <ampltd>0.66</ampltd>
    <maatmast>1.2</maatmast>
  </soilairrel>
</input>
<output>
  <smrclass>Ustic</smrclass>
  <strclass>Mesic</strclass>
  <subgrpmod>Wet Tempustic</subgrpmod>
  <awb>13.12</awb>
  <swb>-218.22</swb>
  <smcstates>
    <cumdays>
      <yrdry>67</yrdry>
      <yrmd>88</yrmd>
      <yrmst>205</yrmst>
      <bio5dry>48</bio5dry>
      <bio5md>58</bio5md>
      <bio5mst>118</bio5mst>
    </cumdays>
    <consdays>
      <yrmst>293</yrmst>
      <bio8mst>166</bio8mst>
      <smrdry>22</smrdry>
      <wtrmst>105</wtrmst>
    </consdays>
  </smcstates>
```

```
<pets>
  <pet id="Jan">0.0</pet>
  <pet id="Feb">1.49</pet>
  <pet id="Mar">11.44</pet>
  <pet id="Apr">38.55</pet>
  <pet id="May">90.93</pet>
  <pet id="Jun">127.6</pet>
  <pet id="Jul">142.1</pet>
  <pet id="Aug">126.57</pet>
  <pet id="Sep">96.94</pet>
  <pet id="Oct">39.95</pet>
  <pet id="Nov">14.39</pet>
  <pet id="Dec">0.0</pet>
</pets>
<calendars>
  <tempcal>
    <stlt5>
      <beginday>1</beginday>
      <endday>102</endday>
    </stlt5>
    <st5to8>
      <beginday>103</beginday>
      <endday>112</endday>
    </st5to8>
    <stgt8>
      <beginday>113</beginday>
      <endday>314</endday>
    </stgt8>
    <st5to8>
      <beginday>315</beginday>
      <endday>326</endday>
    </st5to8>
    <stlt5>
      <beginday>327</beginday>
      <endday>360</endday>
    </stlt5>
  </tempcal>
```

```
      <moistcal>
        <moistdry>
          <beginday>1</beginday>
          <endday>15</endday>
        </moistdry>
        <moist>
          <beginday>16</beginday>
          <endday>220</endday>
        </moist>
        <moistdry>
          <beginday>221</beginday>
          <endday>278</endday>
        </moistdry>
        <dry>
          <beginday>279</beginday>
          <endday>345</endday>
        </dry>
        <moistdry>
          <beginday>346</beginday>
          <endday>360</endday>
        </moistdry>
      </moistcal>
    </calendars>
  </output>
</model>
```

jNSM XML File Tag Descriptions

element name	*description*
nettype	network to which the station belongs (e.g. SCAN, HCN, SNOTEL, NCSS, other)
stnname	station name
stnid	station ID
stnelev	elevation in meters
stateprov	state or province
country	country

element name	*description*
mlraname	MLRA name [Not yet implemented]
mlraid	MLRA ID [Not yet implemented]
firstname	contact person first name
midname	contact person middle name
lastname	contact person last name
title	contact person title
cntorg	contact organization name
address	contact street address
city	contact city
stateprov	contact state or province
postal	contact zip/postal code
country	contact country
cntemail	contact email address
cntphone	contact telephone number
note	free-form note(s)
rundate	time-date stamp of model run (e.g. MM/DD/YYYY HH:MM:SS)
nsmver	version of NSM software
srcunitsys	unit system in which the input data were entered; **important**: all data stored in XML file are in metric units
lat	station latitude in signed decimal degrees
lon	station longitude in signed decimal degrees
~~**usercoordfmt**~~	user preferred coordinate display format; decimal degrees, degrees-decimal minutes, or degrees-minutes-seconds [Deprecation planned]
srccoordfmt	coordinate system (e.g. decimal degrees, degrees-minutes-seconds, or degrees-decimal minutes) in which the input data were entered; **important**: all coordinates stored in XML file are decimal degrees [No yet implemented]
pdtype	period of record type; actual year, normal, or monthly average
pdbegin	period of record begin year
pdend	period of record end year
precip	input precipitation value in millimeters (mm)

element name	*description*
airtemp	input air temperature value in degrees Celsius
smcsawc	input soil moisture control section (SMCS) available water capacity in mm
ampltd	difference in amplitude between soil and air temperature sine waves
maatmast	difference, in degrees Celsius, between mean annual air and soil temperatures
smrclass	soil moisture regime classification computed by model
subgrpmod	soil subgroup modifier
strclass	soil temperature regime classification computed by model
awb	annual water balance in mm [total precip minus PET] jan-dec
swb	summer water balance in mm [total precip minus PET] jun-aug (N hemisphere); dec-feb (S hemisphere)
yrdry	cumulative days the SMCS is dry during the year
yrmd	cumulative days the SMCS is moist/dry during the year
yrmst	cumulative days the SMCS is moist during the year
bio5dry	cumulative days the SMCS is dry when soil temperature >5° C
bio5md	cumulative days the SMCS is moist/dry when soil temperature >5° C
bio5mst	cumulative days the SMCS is moist when soil temperature >5° C
yrmst	consecutive days the SMCS is moist in some part during the year
bio8mst	consecutive days the SMCS is moist in some part when soil temperature >8° C
smrdry	consecutive days the SMCS is dry after summer solstice
wtrmst	consecutive days the SMCS is moist after winter solstice
pet	output potential evapotranspiration value in mm (Thornthwaite, 1948)
stlt5	soil temperature calendar period where soil temperature <5° C
st5to8	soil temperature calendar period where soil temperature is between 5° and 8° C
stgt8	soil temperature calendar period where soil temperature >8° C
dry	soil moisture calendar period where SMCS is dry
moistdry	soil moisture calendar period where SMCS is moist/dry
moist	soil moisture calendar period where SMCS is moist
beginday	soil temperature/moisture calendar period begin day (1-360)
endday	soil temperature/moisture calendar period end day (1-360)

Appendix D: Legacy CSV File Format

The CSV file format used by the **BASIC version** of the Newhall Simulation Model contained two records, or lines. The first line contained a station name, a country, degrees/minutes for a location, hemispheres and elevation. The second line had the unit system, precipitation, temperature, and year(s). Unit system was denoted as either a "E" or "M" for english and metric respectively. The general structure of the legacy format followed the pattern below. (Note the [NEWLINE] indicators.)

The **jNSM** will *not* accept a CSV file that is in the legacy format. The format of the CSV input file for the jNSM application consists of a single record for each model run. See Appendix A for a description of the input CSV format for the jNSM application.

Station Name, Country, Degrees Latitude, Minutes Latitude, N/S
Hemisphere, Degrees Longitude, Minutes Longitude, E/W Hemisphere,
Elevation [NEWLINE]
Pre0, Pre1, Pre2, Pre3, Pre4, Pre5, Pre6, Pre7, Pre8, Pre9, Pre10,
Pre11, Tmp0, Tmp1, Tmp2, Tmp3, Tmp4, Tmp5, Tmp6, Tmp7, Tmp8, Tmp9,
Tmp10, Tmp11, Starting Year, Ending Year, Unit System [NEWLINE]

Example File

"Mead Agronomy Lab","USA",41,10,"N",96,25,"W",1180 [NEWLINE]
. 8,.46,.06,.99,4.08,4.14,3.26,1.62,2.94,.85,.05,.66,32,15,37,55,63,69,
76, 73,63,54,36,17,1989,1989,"E" [NEWLINE]
"Dickinson Expt Station ND","USA",46,53,"N",102,48,"W",2460
[NEWLINE]
.43 , .38 , .68 , 1.42 , 2.38 , 3.67 , 2.16 , 1.79 , 1.36 , .95 , .52
, .39 , 10.8 , 15 , 26.2 , 41.2 , 52.6 , 61.9 , 68.5 , 66.9 , 55.9 ,
44.2 , 28.3 , 16.5 ,1903,1996,"E" [NEWLINE]