

JAVA Newhall Simulation Model
(jNSM)
and
*Traditional Soil Climate Simulation
Modeling in a Digital Geospatial World*

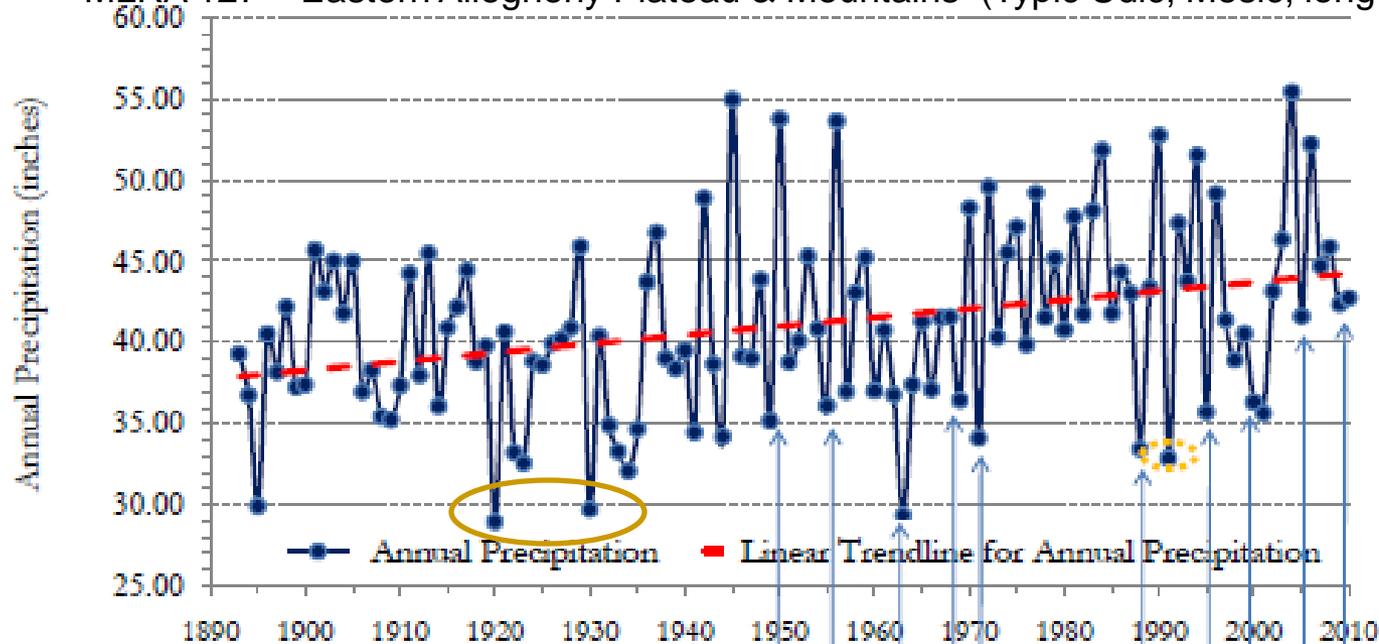
2011 NCSS National Conference
New Technology and Research Agenda Forums
Asheville, NC May 23, 2011



Soil climate simulation models allow the study of soils in the 4th dimension – *Time*.....

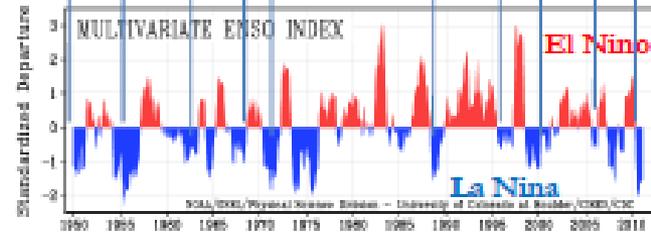
Annual Precipitation of Ridgway, PA (1893-2010)

MLRA 127 – Eastern Allegheny Plateau & Mountains (Typic Udic, Mesic, long term record)



- ◆ MAP increasing through time
- ◆ Drought years associated with La Nina episodes; weak ENSO signature
- ◆ La Nina episodes receive 1.71 inches less on a calendar year basis over the past 60 years
- ◆ Note the “Dust Bowl” episodes
- ◆ Long-term mean = 41.06 in

Normals:	PPT
1901-1930	39.44
1911-1940	38.73
1921-1950	39.51
1931-1960	40.72
1941-1970	40.99
1951-1980	41.35
1961-1990	42.39
1971-2000	43.29
1981-2010	43.85



ENSO or El Niño Southern Oscillation

Growing wetter

Java Newhall Simulation Model (jNSM)

Douglas A. Miller and Brian Bills

**CESU 68-7482-9-527
Enhanced Newhall
Simulation Model Project
\$20,000 FY 2010**

presentation by S. W. Waltman

May 23, 2011

Goal

Improve access and usability of the Newhall Simulation Model (NSM; VanWambeke, 1992) to understand soil climate—in particular soil moisture and temperature regimes determined from long-term climate records.

Objectives

- Port NSM program from Basic to modern language (Java)
- Provide intuitive graphical user interface for setting up model runs and visualizing results
- Enable batch processing (input/output)

jNSM Application (2011)

Java Newhall Simulation Model - a soil climate simulation model version 1.4.5

Input Output

Data User Info

Single Model Run Batch Model Run

Select Model File Create New Model File

run model clear all read-only

Station: Network Type:

Country: Period Begin:

State/Province: Period End:

Elevation: Period Type:

Latitude:

Longitude:

Air-Soil Temperature Offset: 1.2 (°C greater than air temp)

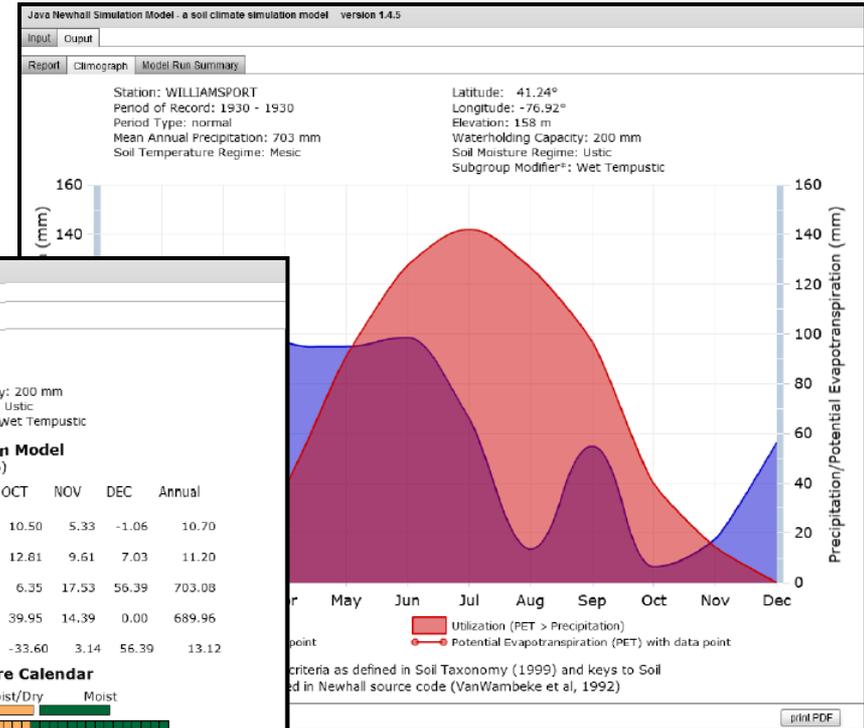
Mean Monthly Precipitation (mm)

Jan	Feb	Mar	Apr	May
<input type="text"/>				

Mean Monthly Air Temperature (°C)

Jan	Feb	Mar	Apr	May
<input type="text"/>				

Notes:



Java Newhall Simulation Model - a soil climate simulation model version 1.4.5

Input Output

Report Climograph Model Run Summary

Station: WILLIAMSPORT Latitude: 41.24°
 Period of Record: 1930 - 1930 Longitude: -76.92°
 Period Type: normal Elevation: 158 m
 Mean Annual Precipitation: 703 mm Waterholding Capacity: 200 mm
 Soil Moisture Regime: Ustic Soil Moisture Regime: Ustic
 Subgroup Modifier*: Wet Tempustic

Soil Climate Regime--Newhall Simulation Model
 (MAST = MAAT + 1.2 °C; Amplitude 0.66)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Mean Monthly Air Temperature (°C)	-2.17	0.89	3.72	9.11	16.28	21.11	22.83	21.94	19.78	10.50	5.33	-1.06	10.70
Mean Monthly Soil Temperature (°C at 50 cm depth)	5.75	5.75	6.60	8.93	12.06	15.14	17.34	17.72	15.75	12.81	9.61	7.03	11.20
Mean Monthly Precipitation (mm)	44.20	40.39	113.54	96.77	95.00	98.55	66.04	13.46	54.86	6.35	17.53	56.39	703.08
Monthly Total Potential Evapotranspiration (mm)	0.00	1.49	11.44	38.55	90.93	127.60	142.10	126.57	96.94	39.95	14.39	0.00	689.96
Monthly Total Water Balance (mm)	44.20	38.90	102.10	58.22	4.07	-29.05	-76.06	-113.11	-42.08	-33.60	3.14	56.39	13.12

Soil Temperature Calendar

	ST<5°C	5°C<ST<8°C	ST>8°C
JAN	█	█	█
FEB	█	█	█
MAR	█	█	█
APR	█	█	█
MAY	█	█	█
JUN	█	█	█
JUL	█	█	█
AUG	█	█	█
SEP	█	█	█
OCT	█	█	█
NOV	█	█	█
DEC	█	█	█

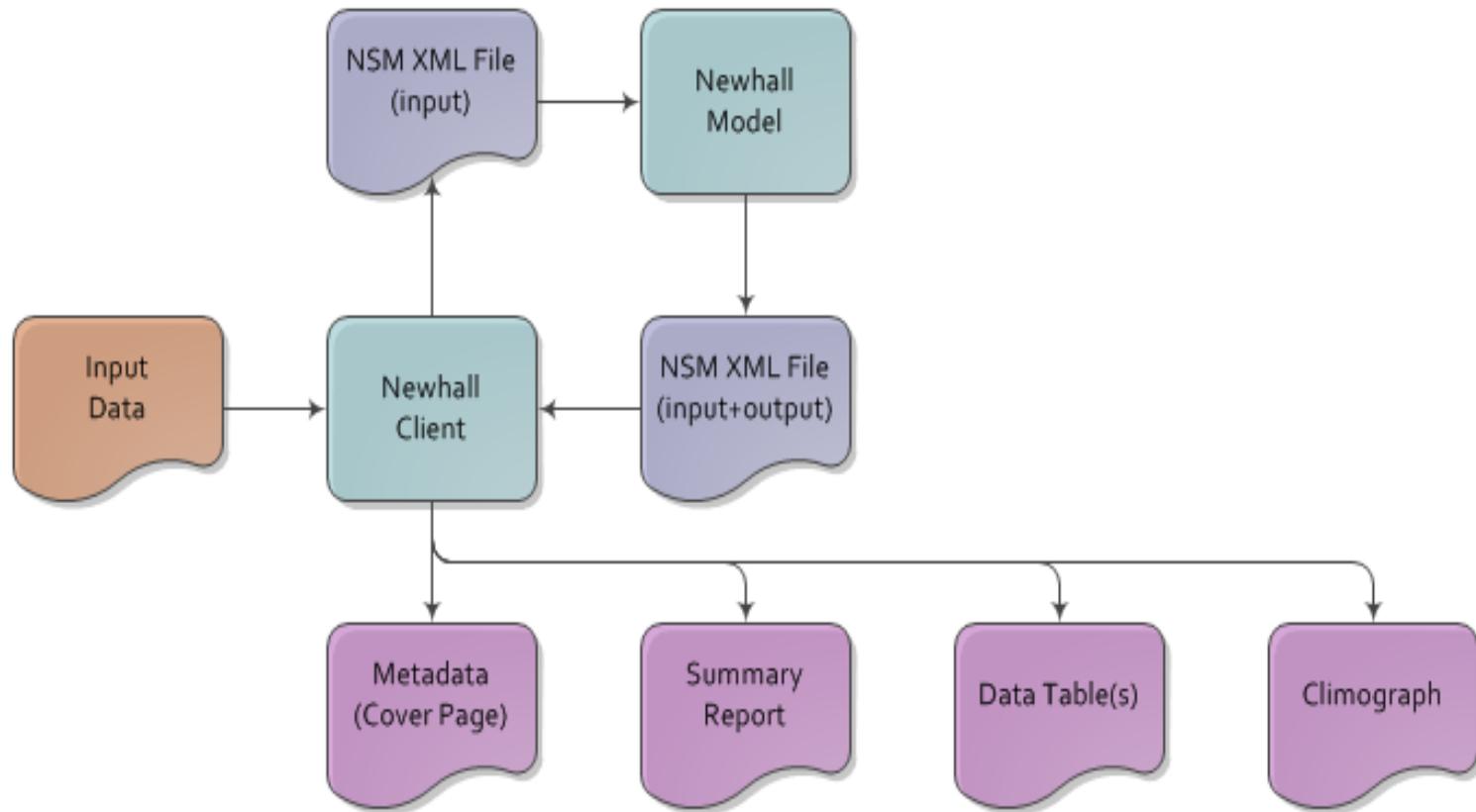
Soil Moisture Calendar

	Dry in SMCS	Moist/Dry	Moist
JAN	█	█	█
FEB	█	█	█
MAR	█	█	█
APR	█	█	█
MAY	█	█	█
JUN	█	█	█
JUL	█	█	█
AUG	█	█	█
SEP	█	█	█
OCT	█	█	█
NOV	█	█	█
DEC	█	█	█

*Soil climate terms include Subgroup criteria as defined in Soil Taxonomy (1999) and keys to Soil Taxonomy (2010) and those proposed in Newhall source code (VanWambeke et al, 1992)

print PDF

jNSM System Components



Newhall Model Run Inputs

- **Metadata** (user information, climate network, start/end years, date of model run, source units – English/Metric, etc.)
 - **12 monthly precipitation values***
 - **12 monthly air temperature values***
 - **Elevation**
 - **Latitude/Longitude**
 - **Configurable parameters**
 - MAAT-MAST relationship
 - Water holding capacity
- * Requires Serially Complete Input Data Records**

3 Types of jNSM Jobs

- Single station- single run ← Interactive
- Multiple stations – single run ← Batch via file
- Single station - multiple run ← row = 1 model run

A

	A	B	C	D	E	F	G
1	stationName	netType	latDD	lonDD	elev	tJan	tFeb
2	ALLENTOWN LEHIGH VLY AP	HCN	40.65	-75.45	119	-2.72	-1.17
3	ALTOONA BLAIR CO AP	HCN	40.30	-78.32	450	-2.56	-1.17
4	ALTOONA 3 W	HCN	40.50	-78.47	402	-3.06	-1.61
5	BAKERSTOWN 3 WNW	HCN	40.65	-79.98	375	-3.00	-1.33
6	BELTZVILLE DAM	HCN	40.77				
7	BIGLERVILLE	HCN	39.93				
8	BLOSERVILLE 1 N	HCN	40.27				
9	BLUE MARSH LAKE	HCN	40.38				
10	BRADFORD RGNL AP	HCN	41.80				
11	BRADFORD 4 SW RES 5	HCN	41.90				

AD	AE	AF	AG	AH
pdType	pdStartYr	pdEndYr	awc	maatmast
Normal	1971	2000	200	1.2
Normal	1971	2000	200	1.2
Normal	1971	2000	200	1.2

B

	A	B	C	D	E	F	G
1	stationName	netType	latDD	lonDD	elev	tJan	tFeb
2	WILLIAMSPORT	HCN	41.24	-76.92	520	22.4	23.6
3	WILLIAMSPORT	HCN	41.24	-76.92	520	27.7	28.1
4	WILLIAMSPORT	HCN	41.24	-76.92	520	25.4	30.6
5	WILLIAMSPORT	HCN	41.24	-76.92	520	31.3	28.9
6	WILLIAMSPORT	HCN	41.24	-76.92	520	26.5	23.6
7	WILLIAMSPORT	HCN	41.24	-76.92	520	29.2	27.1
8	WILLIAMSPORT	HCN	41.24	-76.92	520	29.4	21.9
9	WILLIAMSPORT	HCN	41.24	-76.92	520	24.6	23.3
10	WILLIAMSPORT	HCN	41.24	-76.92	520	26.9	32.1
11	WILLIAMSPORT	HCN	41.24	-76.92	520	19.4	21.9

AD	AE	AF	AG	AH
pdType	pdStartYr	pdEndYr	awc	maatmast
annual	1895	1895	7.874	2.16
annual	1895	1896	7.874	2.16
annual	1897	1897	7.874	2.16
annual	1898	1898	7.874	2.16
annual	1899	1899	7.874	2.16
annual	1900	1900	7.874	2.16
annual	1901	1901	7.874	2.16
annual	1902	1902	7.874	2.16
annual	1903	1903	7.874	2.16
annual	1904	1904	7.874	2.16

Newhall Model Run Outputs

- Soil moisture regime classification
- Soil subgroup modifier
- Soil temperature regime classification
- Annual water balance
- Summer water balance
- Estimated potential evapotranspiration
- Soil moisture and temperature calendars
- Soil Moisture Control Section 'state' summaries (cumulative & consecutive days)

Station: WILLIAMSPORT
 Period of Record: 1930 - 1930
 Period Type: normal
 Mean Annual Precipitation: 703 mm
 Soil Temperature Regime: Mesic

Latitude: 41.24°
 Longitude: -76.52°
 Elevation: 158 m
 Waterholding Capacity: 200 mm
 Soil Moisture Regime: Ustic
 Subgroup Modifier*: Wet Tempustic

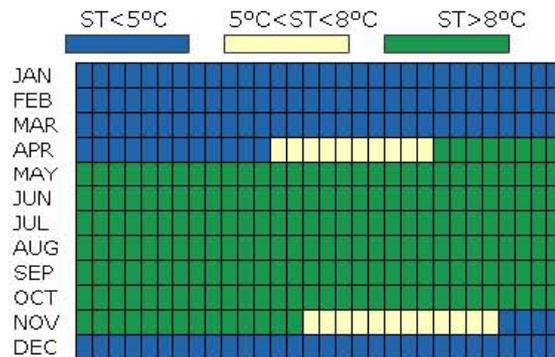
Calendar Report

Soil Climate Regime--Newhall Simulation Model

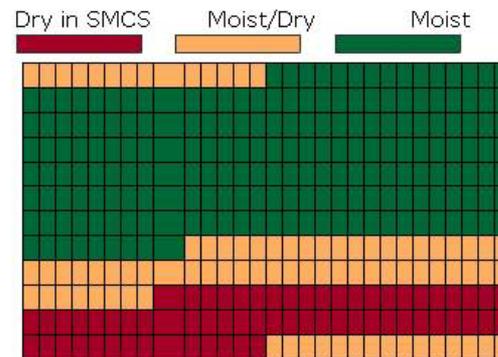
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Soil Temperature Calendar



Soil Moisture Calendar

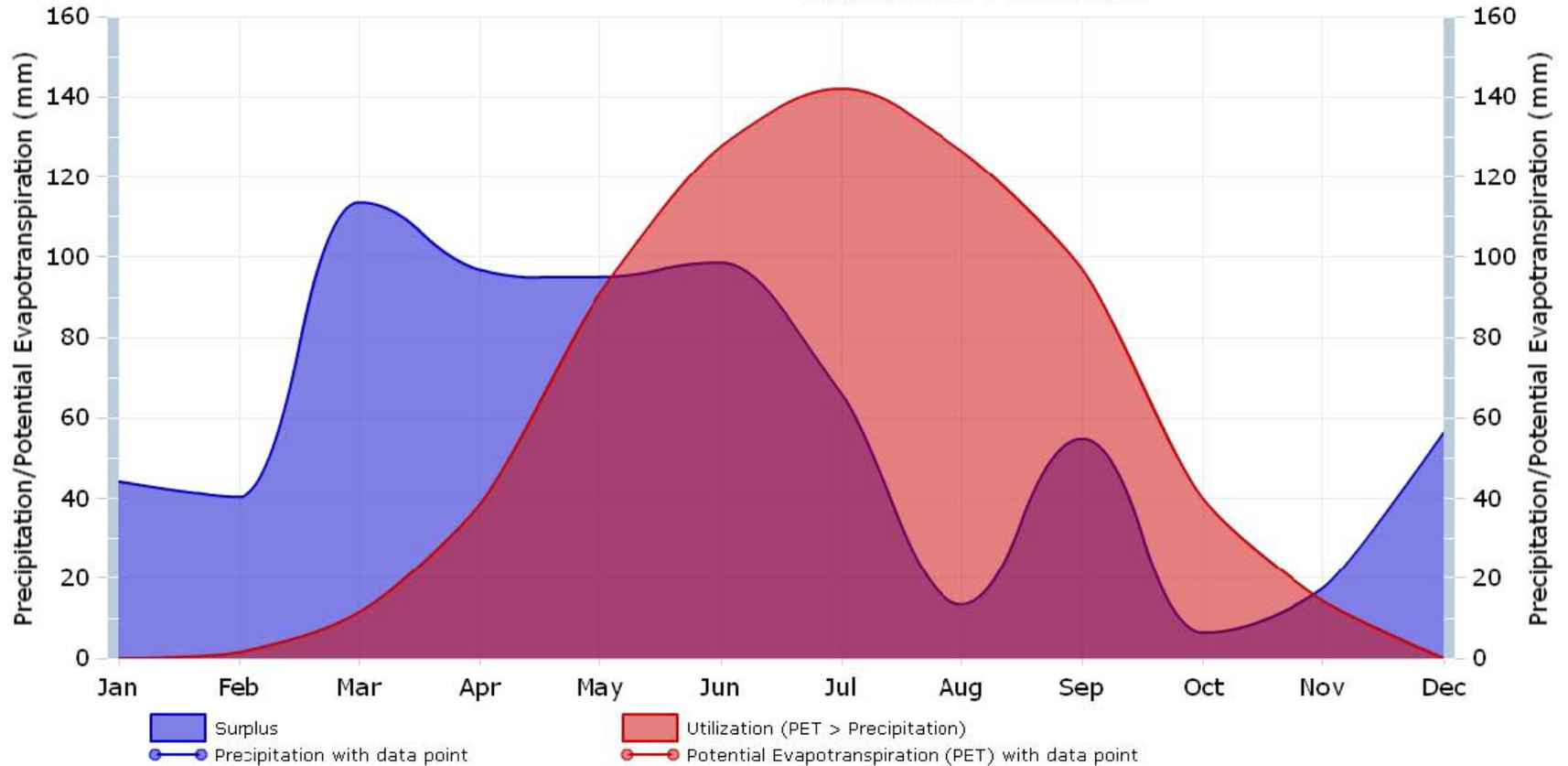


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 Waterholding Capacity: 200 mm
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Climograph



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MODEL RUN SUMMARY

jNSM version 1.4.5
nsm version 1.4.4
Model Run Date: 20110331

STATION

Name: WILLIAMSPORT
Network Type: HCN
Latitude: 41.24 Longitude: -76.92
Elevation: 158 ft
Country: US
State/Province: 42

CONTACT

Last Name: sloan
First Name: jim
Title:
Organization:
Address:
City:
State/Province:
Postal Code:
Country:
Email:
Phone:

Period of Record: 1930 - 1930
Period Type: normal

INPUTS in original source units (english):

Air-Soil Temperature Offset (°F): 2.2
Waterholding Capacity (in): 7.9
Mean Monthly Precipitation (in): 1.74,1.59,4.47,3.81,3.74,3.88,2.60,0.53,2.16,0.25,0.69,2.22
Mean Monthly Air Temperature (°F): 28.09,33.60,38.70,48.40,61.30,70.00,73.09,71.49,67.60,50.90,41.59,30.09

Summary

Model Run XML File

- Encapsulates all information in a model run
- Enables sharing and preserving runs
- Easily parsed with programming tools (data mining)

```
<?xml version="1.0"?>
- <model>
  - <metadata>
    - <stninfo>
      <nettype>HCN</nettype>
      <stnname>ALLENTOWN LEHIGH VLY AP</stnname>
      <stnid>0</stnid>
      <stnelev>119.0</stnelev>
      <stateprov>PA</stateprov>
      <country>US</country>
    </stninfo>
    + <mlra>
    + <cntinfo>
    + <notes>
      <rundate>20110505</rundate>
      <nsmver>1.4.4</nsmver>
      <srcunitsys>metric</srcunitsys>
    </metadata>
  - <input>
    - <location>
      <lat>40.65</lat>
      <lon>-75.45</lon>
      <usercoordfmt>DD</usercoordfmt>
    </location>
    - <recordpd>
      <pdtype>normal</pdtype>
      <pdbegin>1971</pdbegin>
      <pdend>2000</pdend>
    </recordpd>
    - <precips>
      <precip id="Jan">88.9</precip>
      <precip id="Feb">69.85</precip>
      <precip id="Mar">90.42</precip>
      <precip id="Apr">88.65</precip>
```

Package Contents

- jNSM_installer.exe
- jNSM_UserGuide.pdf
- Template Batch Metric.xlsx
- All PA jNSM Example Batch Metric.xlsx/csv
- Williamsport PA jNSM Example Batch English.xlsx/csv
- WILLIAMSPORT_1930_1930.xml

- Currently collecting Peer Review comments
- Preparing submission for USDA CCE Certification

jNSM 1.4.5 - Java Newhall Simulation Model

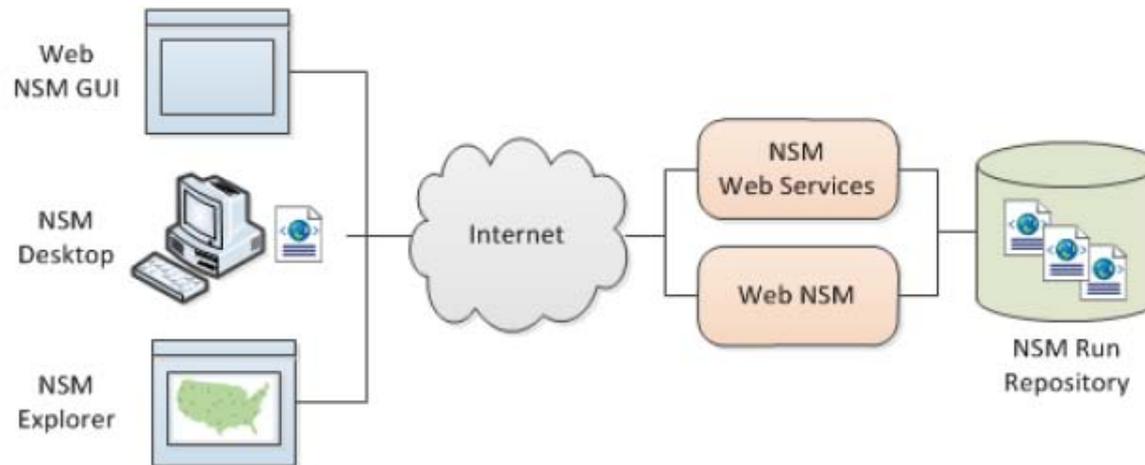
User Guide

May 5, 2011 **DRAFT**

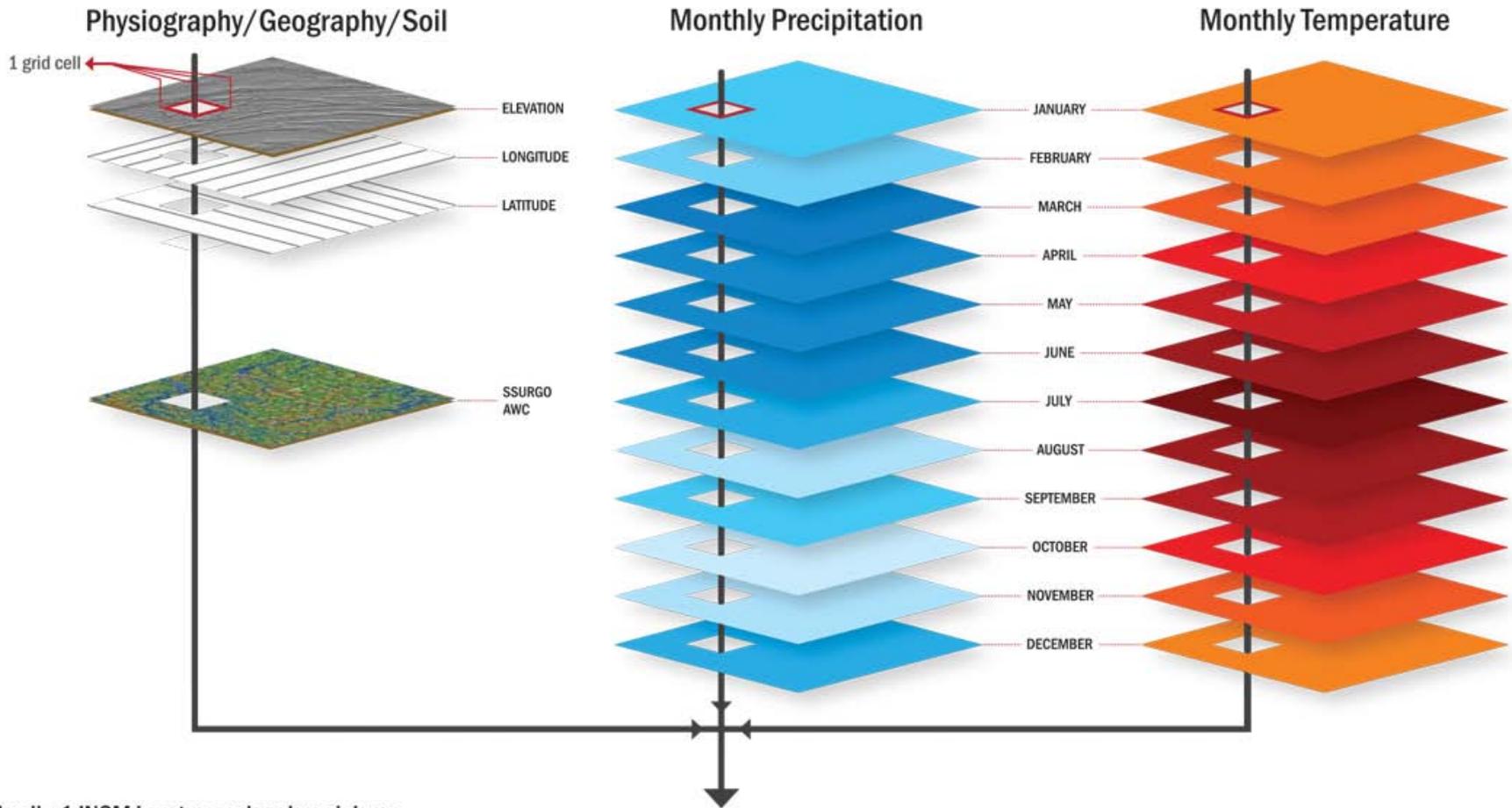
 **NRCS** Natural Resources
Conservation Service

Proposed Next Phase

- Web browser application
- Central model run repository
- Repository query and exploration tools; for example:
 - Find all Mesic, Typic Udic model runs
 - Find model runs within MLRA 147
 - Map model runs with soil climate regimes similar to Berks series
 - Map model runs where estimated PET > 640mm



jNSM inputs gathered through geospatial overlay of (28) map layers



1 grid cell= 1 jNSM input record and model run

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	
1	StationName	netType	LatDD	LonDD	elev	tJan	tFeb	tMar	tApr	tMay	tJun	tJul	tAug	tSep	tOct	tNov	tDec	pJan	pFeb	pMar	pApr	pMay	pJun	pJul	pAug	pSep	pOct	pNov	pDec	pdType	pdStartY	pdEndY	awc	maatmast	cntryCode	stp
2	CELL 10	PRISM CELL	-76.89	41.37	461	-5.26	-4.05	1.07	7.30	13.36	17.87	20.44	19.48	15.17	9.02	3.53	-2.35	72.44	63.84	82.35	88.52	98.08	117.26	102.18	87.12	103.98	83.06	89.79	73.92	Normal	1971	2000	200.00	1.20	USA	

END