SHAW History

Check this page for information on updates, new releases, and corrections to the SHAW model.

The following gives a brief history of the various versions of the SHAW model. Check on the version of the model you have been using.

SHAW 3.0 (Released 5/2017; last updated 11/2024)

Modifications:
- Provisions for output of direct comparison of simulated and measured values and goodness-of-fit statistics to facilitate coupling with optimization schemes, such as PEST
- Option for Kosugi soil moisture release curve included (version 3.0.3)
- Provisions for sub-surface lateral flow exiting profile under saturated conditions (version 3.0.3)
- Number of snow nodes expanded to 200 (version 3.0.3)
- Provisions allowed for ice being present at saturation (version 3.0.3)
- Minor change to improve convergence when ice content changes rapidly (version 3.0.3)
- Number of soil nodes expanded to 99 nodes (version 3.0.2)
- Modified transfer within plant canopy to use Lagrangian far-field turbulent transfer
- Options for controlling stomatal closure
- Choice of units for weather file
- Increased flexibility for output options
- Corrected error in computing thermal conductivity of very dry soils

Known bugs:
- Water balance errors encountered for timesteps when snow fell on warm soil and completely melted and when entire surface snow layer was lost to sublimation (Fixed with version 3.0.3)
- Transpiration for remainder of timestep after exhausting evaporation of water on leaves was not considered. (Fixed with version 3.0.3)
- Latent heat parameters LS, LV, and LF were not set as real numbers in subroutines where they were not used, which caused problems for some compilers. (Fixed with version 3.0.3)
- Some compilers encounter errors when taking arcsin of term too close to -1.0 or 1.0. (Provisions incorporated in version 3.0.3)
- Potential divide by zero if daily solar radiation is zero. (Fixed with version 3.0.3)
- User interface (ShawGUI) incorrectly repeated directory path to soil temperature and moisture files for the SHAW input files when running SHAW. (Fixed 5/2019 version 3.0.2a)
- User interface (ShawGUI) incorrectly assigns soil horizon properties to soil nodes by entry order and disregards depths. (Fixed 3/2019 version 3.0.2)
- Model incorrectly assigned precipitation as snow when using daily time steps. (Fixed 3/2019, version 3.0.2)
- Some local variables were not included in SAVE statements which could result in erroneous output when the model is compiled with some Fortran compilers.   Potential problem variables were daily output of snowmelt in water balance file and daily output in the total soil water content and solute concentration files. (Fixed 3/2019, version 3.0.2)
- Problems opening and writing to the side-by-side profile comparison file (profile.out). (Fixed 7/2017, version 3.0.1.)

SHAW 2.7b and 2.7b-SI (Released 7/2012)

Modifications:
- Improved routines for turbulent transfer within plant canopy

Known bugs:
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.6b-SI (Released 3/2012)

Modifications:
- Included provisions for stratified atmospheric stability within the plant canopy, i.e. cold snow beneath a warm vegetation canopy
- Included provisions for clumping of vegetation on radiation transfer

Known bugs:
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.5b and 2.5b-SI (Released 8/2009)

Modifications:
- Modified check for matrix singularity of soil water balance solution to account for a dry soil layer overlying saturated layer (Released 1/20/2011)
- Improved routines for incoming long-wave radiation and radiation transfer within plant canopy

Known bugs:
- Direction of heat flow by liquid convection was incorrect (fixed 2/15/2011)
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.4b (Released 3/2002)

Modifications:
- Modified check for matrix singularity of soil water balance solution to account for a dry soil layer overlying saturated layer (Released 1/20/2011)
- Limited water potential in plants to avoid positive pressure within plants (Released 10/10/2006)
- Provisions of saturated conditions with positive pore pressures (Released 3/12/2002)

Known bugs:
- Direction of heat flow by liquid convection was incorrect (fixed 2/15/2011)
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.3 (Released 2/1997)

Modifications:
- Corrections made to maintain solute balance when large infiltration events penetrate multiple soil layers. (Released 10/19/2004; program compiled to force model to pause at end of simulation before window is closed)
- Corrections made to prevent ice content from being set to zero when initial soil temperature profile has sub-freezing temperatures. (Released 3/9/2004)
- Modifications made to calculation of soil thermal conductivity to correct problems reported by Kennedy and Sharratt, Soil Science 163(8):636-645. (version 2.3.6, released 9/30/2003)
- Improper array dimension introduced by the modification of 5/25/2001 was corrected (Released 10/19/2001).
- Inaccuracies due to limitations of Green-Ampt infiltration equation when wetting front enters a layer of much higher conductivity were corrected (version 2.3.5, released 5/25/2001).
- Numerical problems asociated with very small root densities in an individual soil layer were corrected.
- Convergence of canopy layers was improved and interception of snow within the canopy was included (version 2.3.4, released 6/2000).
- Soil profile can have as many as 50 soil layers (version 2.3.3, released 5/1999).
- Executable created using newer compiler which allows faster runtimes (version 2.3.2, released 1/1999).
- Structure of model changed to facilitate coupling with other models.
- Residue layer can have a single residue node (rather than a minimum of two).
- Program was modified to be more transferrable to other Fortran compilers by incorporating SAVE statements in many of the subroutines (implemented 4/98, version 2.3.1).

Limitations:
- Water potential limited to air-entry potential

Known bugs:
- Model incorrectly calculated refreezing of snowmelt water precolating through snowpack (fixed 9/30/2003, version 2.3.6
- Numerical instabilities encountered with extremely tall (>20m) plant canopy (fixed 5/99, version 2.3.3).
- Errors in water balance with longer time steps under certain conditions of rapid snowmelt and disappearance of snowpack (fixed 2/99).
- Overestimation of water vapor transfer in soil layers with 0% clay content (fixed 1/99, version 2.3.2).
- Inaccurate water balance and transpiration if roots extend beyond half of the depth of the soil profile (fixed 3/97)
- Slight inconsistency in water balance experienced during freezing with high levels of solutes (fixed 4/97).
- Option for specifying NSP < 0 no longer works
- Program cannot be started on day 1, hour 0
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.2 (Released 6/1996)

Modifications:
- Corrections implemented to allow for complete sublimation of snow pack
- Corrections implemented for infiltration events which extend beyond soil profile

SHAW 2.1 (Released 11/1995)

Modifications:
- Warning issued when old output files are to be over-written

Limitations:
- Problems encountered if infiltration extends beyond soil profile
- Water potential limited to air-entry potential

Known bugs:
- Errors in solute leaching calculations when large infiltration events penetrated multiple soi layers created errors in solute balance (fixed 10/19/2004)
- Inaccurate water balance and transpiration if roots extend beyond half of the depth of the soil profile
- Run-time errors if sublimation is sufficient to consume all of snow pack within a time step (likely to occur only daily time steps)
- Inaccurate water balance and transpiration if roots extend beyond half of the depth of the soil profile
- Slight inconsistency in water balance experienced during freezing with high levels of solutes
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 2.0 (Released 6/1995)

Modifications:
- More control over output
- Input requirements changed (and hopefully simplified)
- More parameters hard-coded in the model
- Development of user interface
- Incorporation of plant canopy and transpiration, including provisions for changing plant canopy characteristics

Limitations:
- User not allowed to write over old output files
- Problems encountered if infiltration event extends beyond soil profile
- Water potential limited to air-entry potential

Known bugs:
- No adequate control of output for water flow between nodes (fixed 11/95)
- Run-time errors encountered when clay content equals zero (fixed 11/95)
- Inaccurate water balance and transpiration if roots extend beyond half of the depth of the soil profile

- Slight inconsistency in water balance experienced during freezing with high levels of solutes
- Small error in value of air porosity used in calculating soil thermal conductivity of very dry soils

SHAW 1.xx

Limitations:
- User interface not available
- Input simplified in later versions
- No daily weather input or daily time steps in early versions
- No plant canopy in early versions
- Problems encountered if infiltration event extends beyond soil profile

Known bugs:
- Incorrect value for heat capacity of soil hard-coded in model (fixed 9/90)
- Incorrect calculation of azimuth and solar angles for certain parts of the year (fixed 10/94)