

# Cold Regions Hydrology Modeling Design Workshop

With

The Watershed Modeling System (WMS)

and

The Gridded Surface Subsurface Hydrologic Analysis (GSSHA) Model

Start	Finish	Duration	Activity	Topic
13:00	13:15	15	Greeting	Introduction / GSSHA Resources
13:15	13:30	15	Lecture	WMS Basics / Overview
13:30	13:45	15	Lecture	GSSHA Basics / Overview
13:45	14:15	30	Lecture	Effects of Temperature on Hydrology
14:15	14:45	30	Lecture	Snow Lecture
14:45	15:20	35	Tutorial	Snow Demo & Tutorial
15:20	15:30	10		<i>Break</i>
15:30	16:00	30	Lecture	Permafrost Lecture
16:00	17:00	60	Tutorial	Hydro-thermodynamics Demo & Tutorial
17:00	17:10	10	Closing	Wrap up




## GSSHA


- 7.15 – Updates for snow, frozen ground
- 8.0 – Updates for permafrost

## WMS

- 11.2 – Current release version, available for USACE via software request portal
  - Set up most GSSHA features
- 11.3 – Beta release version, only available on the Aquaveo website
  - Updated permafrost, frozen ground options



 [Software](#) [Services](#) [Support](#) [Downloads](#) [About](#)

 [Watershed Modeling System](#)

[Introduction](#) [Watershed Tools](#) [Supported Models](#) [Learning](#) [Free Trial](#) [What's New](#) [Pricing](#)

<https://www.aquaveo.com/downloads-wms>

## USACE / DoD

- Email Cassandra Ross and request a license  
(cassandra.g.ross@usace.army.mil)

## Non-DoD

- Reach out to Aquaveo for more information





Watershed Modeling System

[Introduction](#)

[Watershed  
Tools](#)

[Supported  
Models](#)

[Learning](#)

[Free  
Trial](#)

[What's  
New](#)

[Pricing](#)

## WMS 11.2 Tutorials

<https://www.aquaveo.com/software/wms-learning-tutorials>

WMS General

WMS Hydrology

WMS Distributed Hydrology

WMS Additional

### GSSHA Modeling

GSSHA - Initial Overland Flow Model Setup



GSSHA - Corrected Overland Flow



GSSHA - Infiltration



GSSHA - Roughness



GSSHA - Stream Flow



Post-Processing and Visualization of GSSHA Model Results



GSSHA Groups



### Applications

Precipitation Methods in GSSHA



GSSHA Land Use Change – Industrial



GSSHA Land Use Change – Residential



GSSHA Land Use Change – Residential Location



GSSHA Land Use Change – Buffer Strips



GSSHA Land Use Change – Detention Basins



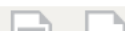
GSSHA Land Use Change – Infiltration Basins



GSSHA Land Use Change – Wetlands



Long Term Simulations



### Calibration

Manual Calibration of GSSHA Models



Stochastic Simulations of GSSHA Models



Automated Calibration of GSSHA Models



### Groundwater Modeling

Groundwater Modeling in GSSHA



Advanced Groundwater Modeling in GSSHA



Subsurface Storm Drains



Subsurface Tile Drains



- Permafrost updates part of GSSHA 8.0
- Included with WMS 11.3
- Available on the GSSHA Wiki, [https://gsshawiki.com/GSSHA\\_Download](https://gsshawiki.com/GSSHA_Download)

## GSSHA™ Executable Installation Downloads [\[edit\]](#)

GSSHA is released periodically as the model is updated with new features. Only the latest official release version is maintained along with Beta versions released on this site. While earlier release versions remain available on the site they are not supported and may not be compatible with the current version of WMS. The most current versions of the model are located at the top of the page, with older versions below. Beta versions typically appear at the very bottom of page. We strongly suggest that users start using the current release version 7.15a.

### GSSHA 8.0 Official Release Version [\[edit\]](#)

Version 8.0 of GSSHA features a major revision of the internal simulation components of GSSHA. The refactoring allows GSSHA to be modular in nature. The simulation components are now in a library. The aim of GSSHA 8.0 is to support programmatic integration of GSSHA with data, models, and modeling frameworks. GSSHA 8.0 has the simulation features refactored into a library that can be programmatically used. Further, GSSHA 8.0 supports the Basic Model Interface (BMI) and the extensions of BMI for the NextGen Modeling Framework. Check back frequently as this version will be updated regularly with new interface options for BMI access. Example projects using the GSSHA simulation library will be available soon.

On the physics side, GSSHA 8.0 has a significant update to the permafrost model. This will be featured in the upcoming training course.

More to come shortly!

Windows Version: GSSHA 8.0.016 with OpenMP, Windows x64. Date: September 17, 2024







## GSSHA Tutorials

@GSSHATutorials · 3 subscribers · 19 videos

GSSHA tutorial and training videos. ...more


[gsshawiki.com](http://gsshawiki.com)

 Subscribed 

<https://www.youtube.com/@GSSHATutorials>

Home Videos 

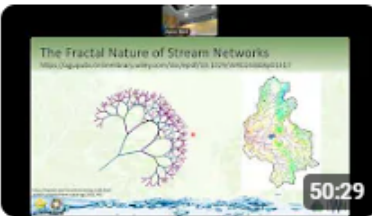
### Videos



Modeling Wetlands


- Large Scale Wetlands
  - Cover multiple grid cells
  - -> Model with the wetland physics
- Small Scale Wetlands
  - Smaller than a grid cell
  - -> Model as an increased retention depth, increased roughness

24:21



The Fractal Nature of Stream Networks


50:29



Scenarios

- The following scenarios will be simulated
- Base model (Park City Utah Watershed)

9:14



Overland Sediment Transport

- Approximation of sediment particles
  - Size
  - Specific gravity
- Sediment detachment
  - Sediment source
  - Overland flow limits
- Transport Capacity
  - Critical shear stress
  - Sediment transport
  - Multiple shear stress formulas
- Deposition

40:14

19 Recipes for using GSSHA and WMS as an EWN...

4 views · 4 weeks ago

18 Engineering with Nature Watershed Management...

27 views · 4 weeks ago

17 Simulating Land Use Change in GSSHA

7 views · 4 weeks ago

16 Sediment Transport Modeling in GSSHA

5 views · 4 weeks ago





## Utility Programs [\[edit\]](#)


- [CleanDam](#)
- [Format\\_Precip](#)
- [Format\\_HMET](#)

## Obtaining Data [\[edit\]](#)

This section gives sample values for many of the parameters used in GSSHA™.

## GSSHA™ Bibliography [\[edit\]](#)

Reports or papers where GSSHA™ was used.



[obtaining data](#)
[discussion](#)
[edit](#)
[history](#)
[delete](#)
[move](#)
[protect](#)
[watch](#)

## Obtaining Data:Sample Values

**Contents [\[hide\]](#)**

- 1 Overland Parameters
- 2 Stream Parameters
- 3 Culvert & Weir Parameters
- 4 Infiltration Process Parameters
- 5 Evapotranspiration Parameters
- 6 Soil and Groundwater Parameters
  - 6.1 Field Capacity
  - 6.2 Specific Gravity

### Overland Parameters [\[edit\]](#)

**TABLE 17.17 Adjustment for the Erodibility Factor (K)**

- For soils with high very fine sand content of greater than 15%
  - For soil textures coarser than loam (represented by the shaded area in the nomograph), subtract very fine sand and add the difference to the silt content. The 5% remaining very fine sand should
  - For soil textures finer than loam (represented by the area outside of the shaded area in the nomograph), add very fine sand and subtract the difference from the silt content. The 5% remaining very fine sand should

**information**

- [Overview](#)
- [Case Studies](#)

**tutorials**

- [All GSSHA Tutorials](#)

**utility programs**

- [CleanDam](#)
- [Format\\_Precip](#)
- [Format\\_HMET](#)

**primer**

- [Overview](#)
- [Pre-Processing](#)
- [Model Construction](#)
- [Capabilities](#)
- [Mapping](#)

## Obtaining Data:Obtaining Data

### Downloading Data from Public Sources [\[edit\]](#)

### Using the WMS Data Tool [\[edit\]](#)

### Sample Values [\[edit\]](#)