Workshop on Watershed Modeling with *GSSHA*

June 19-20, 2018

National Water Center, Tuscaloosa, Alabama

You will learn the basics of:

- *Gridded Surface Subsurface Hydrologic Analysis* (*GSSHA*) model, developed at the U.S. Army Corps of Engineers, Engineering Research and Development Center and the University of Wyoming
- *Dept. of Defense Watershed Modeling System* (*WMS*), developed by Aquaveo LLC
- Spatial data needed to estimate distributed *GSSHA* model parameters, including data requirements, basics of *GSSHA/WMS* and how to find and use spatial geographic data to develop GSSHA models using the *WMS Hydrologic Model Wizard*.

The *GSSHA* model with *WMS* support constitutes a complete watershed analysis system that can be used for a variety of hydrologic science and engineering computation and design evaluation, such as flood simulation, hydrologic impacts of land use change, best management practice design, and testing of flood mitigation measures.

Course Layout:

Through a combination of lectures and experiential applications, the course features the spatially distributed modeling components of this system. The course begins with an overview of the capabilities of the *WMS* to ensure maximum benefit from the hands-on portions of the class. Attendees will learn to use *WMS* to set up *GSSHA* models that include overland flow, infiltration, distributed rainfall, hydraulic structures, continuous simulations, flood inundation mapping, and groundwater/surface water interaction.

Outcome:

Having completed this course, attendees will gain a working knowledge of the U.S. Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC) *GSSHA* model that is supported by the Watershed Modeling System (*WMS*) graphical user interface software. Attendees will also understand how, when, and why to apply the tools to specific studies as well as understand input data requirements. This class provides users with sufficient background to easily deploy a sophisticated hydrological model.

Who Should Attend?

The course is intended for anyone interested in watershed hydrology, including flooding, the effects of land use or landscape changes on hydrology, and/or analyzing best management practices and flood control measures, as well as sediment transport. Best management practices or flood control measures simulated in GSSHA can include lakes, dams, detention basins, and wetlands. Experience with hydrologic modeling and numerical methods are a plus, but not required. Some college-level background in hydrologic science and/or engineering is required.

Instructors: This short course will be taught by the lead *GSSHA* developer Dr. Charles W. Downer USACE-ERDC, *GSSHA* application expert Stephen J. Turnbull USACE-ERDC. Instructors for sediment transport are Nawa Raj Pradhan USACE-ERDC and Gary Brown USACE-ERDC. Guest appearances by Dr. Fred L. Ogden NWC, as he sees fit.

Utility: Once *GSSHA* models are developed, they can be archived and run in the LINUX supercomputer environment. The *GSSHA* code is parallelized using OpenMP for execution on

multi-core CPUs and is being parallelized by USACE-ERDC for execution in a distributed memory environment.

Requirements: Attendees will provide their own computer. Licenses for Watershed Modeling System (*WMS*) 10.1 software will be provided. This software can be downloaded from http://www.aquaveo.com/downloads.

You will be provided with information to license *WMS* at the start of the course.

You can download most of the tutorials here: http://www.aquaveo.com/software/wms-learning-tutorials and PDFs of the presentations can be downloaded from the main page of GSSHA wiki http://gsshawiki.com/Gridded_Surface_Subsurface_Hydrologic_Analysis. These materials will also be available at the course.

Fees, access, other: The course is offered free of charge by dedicated civil servants, just trying to make it great. The course will be taught at the National Water Center, 205 Hackberry Lane Tuscaloosa, AL 35401 http://water.noaa.gov/. PDHs are awarded based on contact hours. There are 16 possible contact hours. Participants from the NOAA Summer Innovators Program will have the opportunity to incorporate *GSSHA* into project work, and get to know the *GSSHA* developers.

Information: For information about the course contact Charles W. Downer charles.w.downer@usace.army.mil. For local Tuscaloosa information, including the National Water Center, contact Dr. Fred L. Ogden Fred.Ogden@noaa.gov.

Location: The course will be taught in the National Water Center, 205 Hackberry Lane Tuscaloosa, AL 35401. More information on the location can be found here: http://water.noaa.gov/about/nwc

Schedule: The basic course is two days.

Day 1 – Introduction to *GSSHA* and Building a Basic *GSSHA* Model with the Hydrologic Wizard
Day 2 - *GSSHA* Model Applications

A detailed itinerary follows.

DETAILED SCHEDULE

Day 1 Tuesday, June 19, 2018. Introduction to GSSHA and Building a Basic GSSHA Model with the Hydrologic Wizard

Start	Finish	Duration	Activity	Topic
08:30	08:45	15	Greeting	Introduction of Instructors/Attendees
08:45	09:30	45	Lecture	Introduction to Hydrologic Modeling – Presentation 1
09:30	10:15	45	Lecture	Introduction to *GSSHA* – Presentation 2
10:15	10:30	15	Break	
10:30	10:45	15	Lecture	*WMS* overview using digital spatial data Presentation 4
10:45	11:00	15	Lecture	Images and projections – Pres 5
11:00	11:25	25	Workshop	*WMS* basics and images – Tutorial 40 through 7
11:25	12:00	30	Demo	Using the *WMS Hydrologic Model Wizard*
12:00	13:00	60	Lunch	
13:00	13:20	20	Lecture	Watershed delineation using DEMs – Presentation 7
13:20	13:40	20	Lecture	Overland flow modeling in *GSSHA* – Presentation 8
13:40	13:50	10	Lecture	Basic model setup in *WMS* – Pres 9
13:50	14:10	20	Workshop	Basic model setup with *WMS* with the *Hydrologic Wizard* - Tutorial 47 sec. 8
14:10	14:40	30	Lecture	Stream routing – Presentation 12A
15:40	14:55	15	Lecture	Assigning channel properties with *WMS* – Presentation 12B
14:55	15:10	15	Break	
15:10	15:30	20	Workshop	Adding streams to your model with the *Hydrologic Wizard* – Tutorial 47 Sec. 9
15:30	15:45	15	Lecture	Developing index maps with spatial data - Presentation 10
15:45	16:15	30	Lecture	Modeling infiltration – Pres 11A
16:15	16:25	10	Lecture	Using *WMS* to develop infiltration inputs – Presentation 11B
16:25	16:45	20	Workshop	Adding overland processes to your model using the *Hydrologic Modeling Wizard* – Tutorial 47 Section 10-16
16:45	17:00	15	Recap of 1st day	

Day 2, Wednesday, June 20, 2018 GSSHA Model Applications

Start	Finish	Duration	Activity	Topic
08:30	09:00	30	Lecture	Hydraulic structures and embankments – Presentation 15
09:00	09:15	15	Lecture	Using *WMS* to develop land-use change scenarios – Pres 17
09:15	10:45	90	Workshop	Land use change – Tutorial 50 & 51
10:45	11:30	30	Lecture	Flood inundation modeling – Pres 20&21
11:30	12:30	60	Lunch	
12:35	13:30	60	Workshop	Flood inundation modeling – Tut 55
13:30	14:00	30	Lecture	Sediment Transport – Pres 21
14:00	14:15	15	Lecture	Sediment Transport Interface – Pres 21A
14:15	15:00	45	Workshop	Sediment Transport – Tutorial 53
15:00	15:15	15	Break	
15:15	15:45	30	Lecture	In-stream sediment transport
15:45	16:30	45	Workshop	In-stream sediment transport
16:30	16:40	15	Lecture	Additional resources – Presentation 23
16:45	17:00	15	Course wrap up	