Applied Surface Water Modeling

UT-Dallas GEOS-5313, Spring 2014

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Learn how to make detailed quantitative analysis and prediction of watershed response to precipitation, including surface water runoff, flood routing and storm hydrograph analysis/prediction, and stormwater quality modeling. This course is light on theory, and heavy on application of the most widely used surface water modeling programs (e.g. *HEC-HMS, TR-20, TR-55*). In general theoretical topics will be covered in the first meeting each week, followed by hands-on application of these concepts in the second meeting. McCuen (2004) will serve as the recommended text for theory, the Watershed Modeling System[1] interface (*WMS*, Fig. 1) will serve as the platform for practical applications. Students will recieve temporary copies of *WMS* for home use. GIS topics related to model parameterization will also be covered. A useful text on GIS and watershed modeling is Maidment (2002) and Arc Hydro.

This course is intended to provide the basic skills and experience needed to perform surface water modeling studies in hydrology. In this class, you will learn how to generate valid watershed delineations, and apply the most common streamflow (*HEC-1, and TR20 or TR55*) and water quality/transport models (*HSPF*) and to make meaningful analyses of the results. Laboratory exercises will provide hands-on experience using the *WMS* modeling software to explore is-

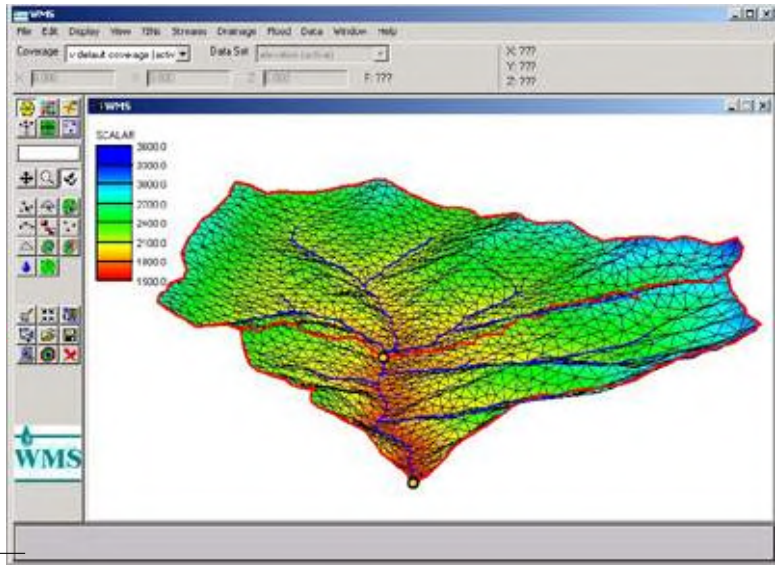

Figure 1: WMS model development and interpretation software interface.

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[1] http://www.aquaveo.com/software/wms-watershed-modeling-system-introduction

sues raised in the lectures. Temporary student copies of WMS will be available, so most modeling exercises can be completed off-campus.

Class meets 10am-12:45pm Thu. in ROC 2.701 beginning Jan. 16th.

Course Organization

Organizational Meeting

The first class meeting (Jan. 16th, ROC 2.701) will be dedicated to an organizational meeting, at which time a general outline of the class topics, and any desired changes in lab or lecture schedule will be discussed.

Grading/Syllabus

Course grades determined using the following weights: 60% homework, 20% midterm, 20% final. Major modeling homeworks will be due two weeks after assignment, smaller problem sets will be due one week after assignment.

Online Resources

WMS Software and Manuals

Windows self-installing executables are available from AquaVeo. Request a trial password according to the software instructions, we'll be issued teaching passwords some time in January.

Lecture Notes

PDF versions of the lecture notes are available online through the following links. For copyright reasons, these are generally accessible only from UTD IP addresses. For off-campus access use eLearning.

Table 1: Course Syllabus. "W" in Chapter column denotes WMS 8.1 Tutorial, "T" denotes textbook.

Week	Dates	Chapters	Lecture	Lab
1	Jan. 16		Organizational Meeting, Introduction to Surface Water Modeling	
2	Jan. 23		Watershed Characteristics	
3	Jan. 30	T3, W1.2	Watershed Definitions, Overview	Introduction to *WMS*
4	Feb. 6	T3, W1.4, W2.1	Calculating Watershed Parameters: Manning Eqn.	DEM Manipulation in *WMS*
5	Feb. 13	T3, W9	Calculating Watershed Parameters: Travel Time	Travel Time Calculation
6	Feb. 20	T4	Precipitation/Rainfall Characterization	Storm Event Specification
7	Feb. 27	T9, W8	Hydrographs	Runoff Calculation and Hydrographs, Rational Method
8	Mar. 6	T7, W11	Rational Method	Midterm Project
-	Mar. 13		Spring Break	
9	Mar. 20	T10-11, W5	Stream and Reservoir Routing	WMS Tutorial Chp. 5, Using TIN's, p. 51-68
10	Mar. 27	T9, W	TR-20 Modeling	WMS 6.1 Tutorial[2],chp. 19, pg. 213-223
11	Mar. 29, 31	W9	TR-55 Modeling	WMS Tutorial[3] p. 121-135
12	Apr. 3	W10	HEC-HMS Modeling	WMS Tutorial[4] p. 137-158
13	Apr. 10	W15	Floodplain Delineation, Dambreak	Floodplain delineation
14	Apr. 17		Finish HEC-HMS	
15	Apr. 23		Climate Change and Runoff Modeling	
-	May 30		Class final project presentations	

Week	Topic
1	Introduction to Surface Water Modeling
2	Watershed Dynamics
3	Estimating Surface Flow (Manning Roughness determination)
4	Estimating Travel Time (Time of Concentration)
5	Precipitation
6	Hydrographs
7	Rational Method (Peak Discharge Estimates)
8	Stream and Reservoir Routing
9	SCS TR-20 Watershed Model
10	SCS TR-55 Urban Watershed Model
11	USACE HEC-HMS Watershed Model
12	Distributed Modeling
13	Impact of Climate Change

Homework

PDF versions of the homework assignments are available online through the following links, or via eLearning:

Number	Topic
1	Surf Your Watershed
3	Automated Watershed Delineation
4	Manual Time of Concentration Calculation
5	Rainfall
	Midterm: UTD Runoff Changes
6	UTD TR-55 Hydrograph Models
-	Final project help: Online Data (Land Use)
7	Final Project

References

Maidment, D., 2002, Arc Hydro: GIS for Water Resources. ESRI Press, Redlands, CA, ISBN 978-1589480346.

McCuen, R. H., 2004, Hydrologic Analysis and Design. Prentice Hall, Upper Saddle River, New Jersey, 07458, third edn., ISBN 0-13-142424-6.