EEOS 383 – GIScience for Water Resources Research

Instructor: David E. Tenenbaum, Ph.D.
Assistant Professor
Environmental, Earth and Ocean Sciences - UMass Boston
Tel: 617-287-7396
Email: david.tenenbaum@umb.edu

Office hours:	Mondays	1:00 - 2:30 PM	S-1-060
	Wednesdays	1:00 - 2:30 PM	S-1-060
	(or email and make other arrangements)		

TA: Yun Yang
Email: yun.yang001@umb.edu

Office hours: TBA

Lectures: Tuesdays 5:30 to 8:00 PM McCormack M02-0415

Objectives: This course will provide students with an introduction to some key geographic information science approaches for investigating the movement of water through terrestrial landscapes. This includes two major themes, that each comprise about half of the course: The first focuses upon methods that have been developed to extract and represent the structure of watersheds from digital terrain data, and this will be followed by approaches that use passive remote sensing to describe landscape hydrologic conditions. We will work with a combination of digital terrain models and remotely sensed data. Students are expected to have a previous course in geographic information systems, along with background in environmental science / physical geography / hydrology.

Students will be expected to read reference materials and be prepared to discuss them each week. Class meetings will begin by focusing on the key concepts from the reference materials (both from the literature and from online materials such as slideshows and web pages). This will be followed by weekly lab exercises designed to explore the concepts introduced by the readings and to sequentially build capability and understanding in the application of GIScience techniques to water resources research. These exercises will use a combination of ArcGIS and Microsoft Excel to provide an opportunity for hands-on learning.

Course Web Page: http://www.faculty.umb.edu/david.tenenbaum/eeos383

Reference Material: Selected key papers and chapters from the literature, supplemented by slideshows and web pages, will provide the theoretical background (see following table or course web).

Course Evaluation:	Lab exercises	60%
	Mid-term exam	20%
	Final exam	20%

Students are reminded that they are required to adhere to the Code of Student Conduct, including its provisions related to Academic Honesty.

SYLLABUS

Date	Topic	Reading
DIGITAL TERRAIN ANALYSIS, FLOW PATHS, AND LANDSCAPE REPRESENTATION		
01/26/10	Course Intro.	N/A
02/02/10	Geographic Surfaces and their Properties	• Maxwell JC. 1870. On hills and dales. Philosophical Magazine, 40:421-427. • Mark DM. 1978. Topological properties of geographic surfaces: Applications in Computer Cartography. Harvard Papers on Geographic Information Systems, no. 5.
02/09/10	Gridded Digital Elevation Models	• Marks D, Dozier J, and J Frew. 1984. Automated basin delineation from digital elevation data. Geoprocessing, 2:299-311. • Jenson SK and JO Domingue. 1988. Extracting topographic structure from digital elevation data for geographic information systems analysis. Photogrammetric Engineering and Remote Sensing, 54(11):1593-1600.
02/16/10	Stream Networks and Drainage Basin Structure	• Tenenbaum DE. 1998. Watershed modeling. GEOG 202 Term Paper. • Topographic partition of watersheds with digital elevation models. Water Resources Research, 22(1):15-24.
02/23/10	Topographic Moisture Indices	• Beven KJ and MJ Kirkby. 1979. A physically based, variable contributed area model of basin hydrology. Hydrological Sciences Bulletin ,24:43-69. • Quinn PF, Beven KJ, and R Lamb. 1995. The ln(a/tanB) index: How to calculate it and how to use it within the TOPMODEL framework. Hydrological Processes, 9:161-182.
03/02/10	Representing Flow Divergence	• Dawes WR and D Short. 1994. The significance of topology for modeling the surface hydrology of fluvial landscapes. Water Resources Research, 30:1045-1056. • Tarboton DG. 1997. A new method for the determination of flow directions and upslope areas in grid digital elevation models. Hydrological Processes, 9:161-182.
03/09/10	Mid-term Review	N/A
03/16/10	Spring Vacation	N/A
03/23/10	Mid-term Exam	N/A
03/30/10	Landscape Representation for Modeling	• Band LE, Patterson P, Nemani R and SW Running. 1993. Forest ecosystem processes at the watershed scale: incorporating hillslope hydrology. Agricultural and Forest Meteorology, 63:93-126. • Band LE, Brun SE, Fernandes RA, Tague CL and DE Tenenbaum. 2000. Modelling watersheds as spatial object hierarchies: Structure and dynamics. Transactions in GIS, 4(3):181-196.
REMOTE SENSING OF SURFACE MOISTURE CONDITION		
04/06/10	Evapotranspiration and the Bowen Ratio	• Hornberger GM, Raffensperger JP, Wiberg PL, and KN Eshleman. 1998. Elements of Physical Hydrology. Johns Hopkins University Press, USA. Ch. 2: Catchment hydrology: Land-atmosphere interactions, 30-38. • Waring RH and SW Running. 1998. Forest Ecosystems, Analysis at Multiple Scales, 2nd ed. Academic Press, USA. Ch.2, Water cycle, 22-28.
04/13/10	Remote Sensing of LST and NDVI	• Price JC. 1984. Land surface temperature measurements from the split window channels of the NOAA 7 Advanced Very High Resolution Radiometer. Journal of Geophysical Research, 89(D5):7231-7237. • Goward SN. 1989. Satellite bioclimatology. Journal of Climate, 2:710-720.
04/20/10	Using LST and NDVI to Assess Surface Moisture	• Nemani RR and SW Running. 1989. Estimation of regional surface resistance to evapotranspiration from NDVI and thermal-IR AVHRR data. Journal of Applied Meteorology, 28(4):276-284. • Nemani RR, Pierce L, Running SW and S Goward. 1993. Developing satellite-derived estimates of surface moisture status. Journal of Applied Meteorology, 32:548-557.
04/27/10	Using LST and NDVI to Map Surface Moisture	• Sandholt I, Rasmussen K and J Andersen. 2002. A simple interpretation of the surface temperature/vegetation index space for assessment of surface moisture status. Remote Sensing of Environment, 79:213-224. • Andersen J, Sandholt I, Jensen KH, Refsgaard JC and H Gupta. 2002. Perspective in using a remotely sensed dryness index in distributed in hydrological modes at the river-basin scale. Hydrological Processes, 16:2973-2987.
05/04/10	The Relationship between TVDI & API	• Nelson BR, Kim D, Bates JJ and DJ Seo. 2006. Multi-sensor precipitation reanalysis. American Meteorological Society 2006 Annual Meeting, Atlanta, GA, Jan. 29 – Feb. 2, 2006. Paper #4.6. • Dunne T and LB Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Company, USA. Ch. 10, Calculation of flood hazard, 287-290, 366-367.
05/11/10	Final Review	N/A
TBA	Final Exam	N/A