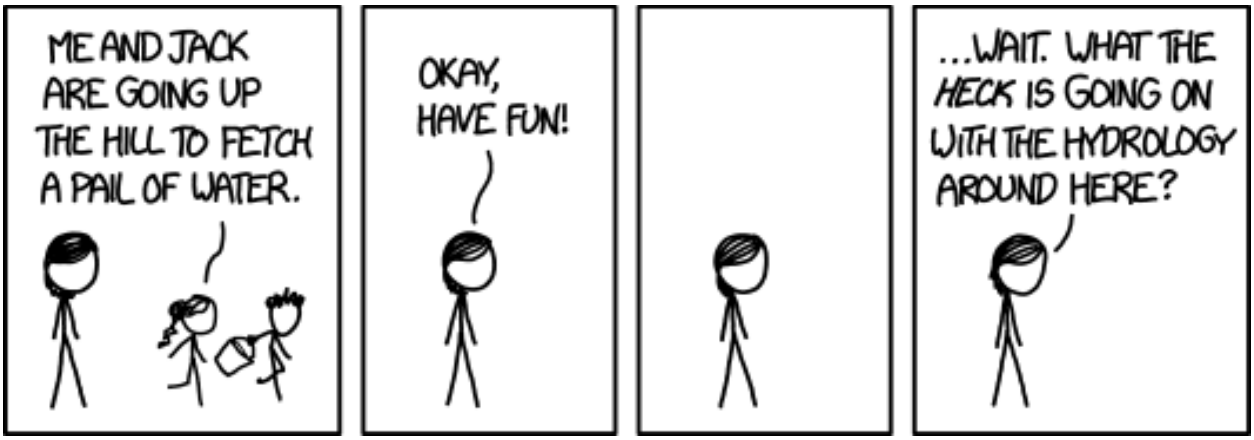

https://xkcd.com/1662/

ENR 4285: Watershed Hydrology
Spring Semester 2024
3 credit hours
Lecture: Monday/Wednesday 12:40 – 1:35 (Kottman 102)
Lab: Thursday 10am – 1pm or 2pm – 5pm (Heffner Building - ORW)

Instructor:
Dr. Rachel Gabor, gabor.40@osu.edu,
Office Hours**:** See Carmen

Teaching Assistant:
Scott Hickman, hickman.311@osu.edu
Office Hours**:** See Carmen

Course Description:

In this course we will study the movement of water and how water interacts with the landscape at the watershed/catchment scale. By the end of the semester students will be able to:

- Utilize basic scientific principles to describe controls of the hydrologic cycle on a watershed scale
- Understand the relationship between water and the landscape and how the landscape drives watershed hydrologic functioning
- Use multiple physical and chemical techniques to characterize the hydrology of a watershed
- Utilize the scientific method and conduct data analyses to investigate the hydrologic functioning of watersheds
- Describe some current areas of research in hydrologic sciences

Course Structure and Attendance Expectations

Class (Monday / Wednesday 12:40 – 1:35):

These sessions will happen in the classroom (Kottman 102). They will be a combination of lecture, activities, and discussion. Classes will be recorded using Zoom and posted to Carmen but will not be livestreamed on Zoom.

LECTURE ATTENDANCE EXPECTATIONS:. Attendance is not collected for points but it is in your best interest to attend class. **If you miss class you do not need to contact anyone**, please watch the recording, get notes from a classmate, and come to office hours with any questions.

Lab (Thursday 10-1 or 2-5)

Most weeks lab will meet either at the Heffner Building at the Olentangy River Wetlands or the computer lab at Kottman Hall. Labs will be a variety of computational data analyses, hands-on work in the classroom, and outdoor experiments. There may be a few weeks where labs are asynchronous assgnments to do on your own time.

Check the weekly modules and announcements on Carmen to be clear on what to expect each week. Note that due to weather sometimes plans for outdoor labs are subject to last minute changes and you may need to prepare to be outside in non-ideal weather.

LAB ATTENDANCE EXPECTATIONS: Attendance is expected for labs and you may not be able to make up a missed lab. **If you must miss lab please contact Dr. Gabor as soon as you can, ideally before lab.**

WHAT IF I'M SICK?:

Please do not come to class while sick. Please mask in class if you think you are exposed to COVID/flu/RSV/etc or possibly contagious. Your number one priority when ill is to rest as much as possible and get better. Please communicate with Dr. Gabor and your TA as much as possible about your situation so we can work with you.

Nothing we do in class is more important than the health and well-being of you, your classmates, and your instructors. Please respect that by taking care of yourself and doing all you can to avoid exposing those around you.

What Book Do I Need?

Main Text:

- Hendriks, Martin. 2010. *Introduction to Physical Hydrology*, Oxford University Press

This text is required. A physical copy is available on reserve at the CFAES library. Unfortunately there is no online edition. There is also a physical copy in Dr. Gabor's office and with the TA which you can borrow but cannot leave Kottman with.

Supplemental Texts (for reference):

- Brooks, Kenneth, Peter F Ffolliott, Joseph A Magner. 2012. *Hydrology and the Management of Watersheds.* 4th edition. Wiley-Blackwell. (eBook available online through OSU library)

- Hornberger, George M., Patricia Wiberg, Jeffrey P. Raffensberger, Paolo D'Odorico. *Elements of Physical Hydrology*. Johns Hopkins University Press.

- Occasional supplementary reading will be posted on Carmen.

How to use the text: I will post readings associated with the lecture. You are expected to refer to the text as a supplement to lecture, to reinforce main points and enrich your understanding

How Will Course Communication take Place?

Course Announcements will be made using the "Announcement" page on Carmen. We recommend you adjust your individual Carmen settings so that course announcements are sent to your email.

Email to your instructor/TA can be done through Carmen or directly to our osu emails. Please include "ENR4285" in the subject line to help draw our attention to your email. We will endeavor to reply to email within 24 hours of receipt within standard working hours (Mon-Fri, 9-5).

Office Hours are posted to Carmen. These will be in person at Kottman but we can meet on Zoom if necessary and requested. These are times for you to ask questions about the course or other questions about water science at SENR. If you need to meet and cannot make the scheduled office hours please email to arrange another time to meet.

Carmen There will be a module on Carmen for each week of class with details of what material is covered that week and what work you need to do.

What Assignments Will There Be?

ASSIGNMENT CATEGORY	PERCENT OF GRADE
Homework (~12 - 15 total)	50%
Lab Reports (~12 - 15 total)	50%
Total	**100%**

Can I Get More Detail About These Assignments?

Homework Assignments:

Weekly homework assignments will be submitted on paper. Homework assignments will be challenging so please start them early so you have time to ask for help. Each assignment will have two submissions.

Your first submission will be due **in class on Wednesday** and will be graded out of a total of 3 points. To get full credit all problems must be substantially attempted. Each assignment will be returned on Thursday with either a 100% or a "redo", indicating you have one chance to fix your mistakes.

Your second (redo) submission will be due **in class on Monday** and will be graded for correctness based on points listed on the assignment. You can turn this in even if you did not submit a first submission.

Your second submission must be done on a new piece of paper but only needs to include the questions which need corrections. You MUST staple your original submission to your redo OR turn your original submission back in if you choose not to do a redo, to get a full grade on the assignment.

Grades will be assessed on both the write-up and the final answer. You must clearly show your work so someone else can easily follow it. Units must be written next to every number in every step of your analysis, unless it is a unit-less number. **Please refer to the Carmen page about homework expectations for more detail.**

Academic integrity and collaboration: You are encouraged to work with other classmates on assignments. However you should do the write-ups entirely on your own, in your own words, to ensure you fully understand the solution. Nothing on your assignment should be copied from an internet source.

Lab Assignments:

Lab assignments will vary throughout the semester. Some weeks you can earn full points for participating during the lab period, but most weeks there will be a short lab report due. Some weeks lab reports will be submitted in teams of 2 - 4 students. Lab Reports will be due the Thursday after the lab is assigned if not finished in lab.

When calculating your grade we will drop your lowest lab score. This could include a "0" for a missed lab, since it will often not be possible to make a lab up if missed.

Academic integrity and collaboration: You are encouraged to work with other classmates on assignments. However you should do the write-ups entirely on your own, in your own words, to ensure you fully understand the solution. Nothing on your assignment should be copied from an internet source.

A sample week of assignments (first weeks of semester):

Monday	Wednesday	Thursday
Jan 15	Jan 17 Turn in HMWK 2	Jan 18 • HMWK 2 returned in lab • Work on lab 2 (write-up due next week)
Jan 22 Turn in redo of HMWK 2	Jan 24 Turn in HMWK 3	Jan 25 • HMWK 3 returned in lab • Turn in lab 2 report • Work on lab 3 (write-up due next week)

Can I Turn In Work Late?

Because of the constant rotation of new and redo assignments, students are encouraged to do everything possible to stay on top of assignment deadlines. This will help us get prompt feedback to you and help you stay on top of work.

If you must miss a lab please contact Dr. Gabor as soon as possible, ideally before the lab. It will not always be possible to make up a missed lab

If you need to prioritize work, your first priority should be the 1st submission of your homework assignments. Your second priority should be your redos. Your third priority should be lab reports. We are unlikely to grant extensions for 1st homework submissions due to the quick grading turn around. Extensions on lab reports are usually possible if requested before the deadline.

Please contact Dr. Gabor for requests related to lab and the TA (Scott Hickman) for any homework-related needs (including if you need to submit outside of class).

Other Course Policies

1) There will likely be times you find an aspect of this course particularly challenging. I invite you to come to office hours for help. The sooner you bring forth your concerns, the sooner I can help – there is very little that can be done at the end of the semester.

2) Sometimes mistakes happen during grading. If you feel that your grade on an assignment is incorrect, please submit in writing an explanation of why you wish to appeal your grade within one week of the assignment being returned. Final course grades are non-negotiable outside of clerical error.

3) You are encouraged to work with other classmates on assignments. However you should do the write-ups entirely on your own, in your own words, to ensure you fully understand the solution.

4) If something is happening in your life that will impact your full participation in the course, please utilize campus resources and give me a heads up so we can best help you succeed.

5) Classes are recorded on Zoom for the benefit of students who may need to miss class and so you can refer back to them. These links should not be shared outside the class.

Course Calendar

Below is a DRAFT calendar of topics and assignments. This is subject to change. A current calendar will be constantly updated on Carmen throughout the semester and should be referred to regularly.

The units (different colors on calendar) are:
-Water Cycle and Water Balances
-Atmospheric Water
-Groundwater
-Surface Water

Week	Monday (class)	Wednesday (class)	Thursday (lab)
1	**Jan 8 & Jan 10** – Asynchronous and Online Course introduction, Water Cycle, Mass/Energy Balance HMWK 1: (due by 5pm Wed, no redo)		**Jan 11** (ORW) Lab 1: Math for Hydrology (due in class)
2	**Jan 15** MLK Jr Day (No Class)	**Jan 17** Catchment Water Balance HMWK 2 due	**Jan 18** (Computer lab) Lab 2: Calculating Catchment Water Balances
3	**Jan 22** Residence time Runoff Ratio HMWK 2 redo due	**Jan 24** Intro to Atmospheric Water (energy & physical properties) HMWK 3 due	**Jan 25** (ORW) Lab 3: Measuring and mapping Precipitation across a watershed
4	**Jan 29** Thermodynamics of water HMWK 3 redo due	**Jan 31** Water in the Atmosphere HMWK 4 due	**Feb 1** (ORW) Lab 4: Snow Survey
5	**Feb 5** Adiabatic Uplift and Lifting Mechanisms HMWK 4 redo due	**Feb 7** Intro to Evapotranspiration HMWK 5 due	**Feb 8** (computer lab) Lab 5: Orographic analysis of Precipitation
6	**Feb 12** Controls on ET/PET, energy flux, vapor gradients HMWK 5 redo due	**Feb 14** Calculating PET HMWK 6 due	**Feb 15** (computer lab) Lab 6: Climate Change and Snow in the West

7	**Feb 19** Pan Evaporation and Penman-Monteith Equation HMWK 6 redo due	**Feb 21** Groundwater – Properties of the subsurface (hydraulic conductivity) HMWK 7 due	**Feb 22** (ORW) Lab 7: Groundwater Model
8	**Feb 26** Piezometers and Hydraulic Head HMWK 7 redo due	**Feb 28** Piezometers and Flow Gradients HMWK 8 due	**Feb 29**
9	**Mar 4** Infiltration and Hydraulic Gradients HMWK 8 redo due	**Mar 6** Intro to Darcy's Law HMWK 9 due (no redo)	**Mar 7** (Oval) Lab 8: Measuring groundwater at Mirror Lake
10	**Mar 11** Spring Break (No Class)	**Mar 13** Spring Break (No Class)	**Mar 14** Spring Break (No Class)
11	**Mar 18** Calculating Flow with Darcy's Law	**Mar 20** Intro to Streamflow HMWK 10 due	**Mar 21** Lab 9: Foldable Groundwater Models and Calculating Flow
12	**Mar 25** Measuring Discharge HMWK 10 redo due	**Mar 27** Hydrographs HMWK 11 due	**Mar 28** (ORW - RIVER) Lab 10: Measuring Discharge with Velocity-Area Method
13	**Apr 1** Interpreting Hydrographs HMWK 11 redo due	**Apr 3** Stream Gages and flow regime analysis HMWK 12 due	**Apr 4** (computer lab) Lab 11: Unit Hydrographs
14	**Apr 8** Tracers in Hydrology: Intro HMWK 12 redo due	**Apr 10** Tracers in Hydrology: Isotopes HMWK 13 due	**Apr 11** Lab 12: Tracer test / dilution gaging
15	**Apr 15** Tracers in Hydrology – advection, dispersion, reactions HMWK 13 redo due	**Apr 17** Urban stormwater control measures HMWK 14 due	**Apr 18** (ORW) Lab 13: Current Issues in Hydrology
16	**Apr 22** HMWK 14 redo due		

Required Course Technology

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Required equipment

- Desktop or Laptop: (Mac or PC) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at go.osu.edu/office365help. You will need to use Microsoft Excel in this class so be sure to have it downloaded by week 2.

What If I Need Help With Technology?

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

University Policies

Academic integrity policy

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so we recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, we am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.
Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- *Ten Suggestions for Preserving Academic Integrity (*go.osu.edu/ten-suggestions*)*
- *Eight Cardinal Rules of Academic Integrity* (go.osu.edu/cardinal-rules)

Safe and Healthy Buckeyes

Health and safety requirements: All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (https://safeandhealthy.osu.edu), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses.

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Counseling and Consultation Services/Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life Counseling and Consultation Services (CCS) by visiting ccs.osu.edu or calling (614) 292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org.

David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Accessibility accommodations for students with disabilities

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from

all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

This course adheres to The Principles of Community adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at https://go.osu.edu/principlesofcommunity. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (https://equityandinclusion.cfaes.ohio-state.edu/). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at https://studentlife.osu.edu/bias/report-a-bias-incident.aspx.

Student Resources

There are many resources on campus devoted to assisting students personally and academically. Please do not hesitate to utilize them if you find you need. Some include:

Counseling and Consultation Service: https://ccs.osu.edu/

Ohio State Writing Center: https://cstw.osu.edu/writing-center

Dennis Learning Center: http://dennislearningcenter.osu.edu/

Office of Diversity and Inclusion: https://odi.osu.edu/

OSU Libraries: https://library.osu.edu/

Buckeye Food Alliance: https://www.buckeyefoodalliance.org/

Mathematics and Statistics Learning Center: https://mslc.osu.edu/