

## **EOS 322/722 Hydrologic Data Analysis Fall Semester 2019**

**Meeting times:** Wednesdays and Fridays 1:25-2:40

**Classroom:** Grainger Hall 1104

**Course resources:** sakai.duke.edu

**Professor:** Kateri Salk

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**Phone:** 919-684-1743

**Office:** 3115 Environment Hall

**Office hours:** TBD

**Teaching Assistant:** Cathy Chamberlin

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**Office:** 3120 Environment Hall

**Office hours:** TBD

### **Course Texts and Resources**

Required reading will consist primarily of scholarly articles, all of which will be provided on Sakai. Further resources will be accessed via online databases. Students will be expected to have installations of R, RStudio, and LaTeX installed on their computers (see Software Installation Guide).

### **Course Description**

Focus on development of quantitative approaches used to interpret observations on hydrological and environmental processes across space and time, with application to case studies in water science. In this course, we will (1) generate knowledge of fundamental processes in aquatic ecosystems as they relate to contemporary issues, (2) apply data science skills to datasets in the water resources field, and (3) quantitatively explore a topic in aquatic science through an in-depth course project. Prerequisites: prior experience with computational software (R preferred; Stata, MATLAB, and/or GIS acceptable). Instructor consent required. Instructor: Salk.

### **Course Objectives**

As part of their active participation and completion of the course, students will:

1. Synthesize information on fundamental and applied topics in water resources using quantitative analysis
2. Apply the appropriate steps of the data analytics pipeline to answer questions about aquatic systems
3. Develop oral, visual, and written skills for communicating findings and connecting topics to societal issues

### **Expectations**

My approach to teaching is to act as a facilitator in a learner-centered environment. While I have significant expertise in the topics presented in this course, my goal is to set up class sessions and assignments that push you to develop this expertise for yourselves. As a consequence, it is crucial for each of you to come to class each day ready to participate, take intellectual risks, and cooperate with each other. I will do my best to create a classroom environment in which you feel comfortable doing so.

## **Grading**

### *Assignments for guided sessions (60%)*

Each major unit of the course will be associated with an assignment that includes a discussion of a concept in aquatic science, analysis in R, and evaluation of findings from a real-world dataset.

Graduate students: an additional assignment will involve finding and reviewing an article pertaining to the use and application of big data in aquatic science. Each student will write a 400–600-word reflection on the article, which should include a summary of the article content and impressions on how big data influences scientific progress.

### *Course project (40%)*

Each student will choose a question pertaining to aquatic science or water resources and perform a quantitative analysis to answer this question. The project will be broken into several stages, including:

- Initial proposal and analysis plan (5%)
- Brainstorming sessions with classmates (5%)
- Report draft (5%)
- Final report (15%)
- Final presentation (10%)

## **The Duke Community Standard**

Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity.

To uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors;
- I will conduct myself responsibly in all my endeavors; and
- I will act if the Standard is compromised.

If a student engages in academic dishonesty (e.g., cheating, plagiarism), they will receive an automatic zero on that assignment. Additional incidences of academic dishonesty will result in automatic failure of the course. I will also report incidences of academic dishonesty to the Office of Student Conduct, who may choose to impose additional consequences.

## **Accommodations**

Students with disabilities seeking special accommodations must contact Emma H. Swain (eswain@duke.edu, 668-1267) at the Student Disability Access Office (SDAO) to obtain appropriate support. See also <http://www.access.duke.edu/>

There are several official channels on campus that allow accommodations for situations including disabilities, illness, and bereavement. However, I understand that many students cope with challenges throughout the semester that fall outside these official channels. If you are in a physical or emotional situation that prevents you from actively engaging in the course and completing coursework, please come to me and we can discuss alternate arrangements.

## Schedule

Date	Topic	Due (before class unless noted)
Wednesday 8/28 Friday 8/30	Introduction <ul style="list-style-type: none"> <li>• Big data in aquatic science</li> <li>• R boot camp</li> <li>• Fundamentals of visualization</li> </ul>	8/28: Complete software installation guide
Wednesday 9/4 Friday 9/6	Physical properties of lakes <ul style="list-style-type: none"> <li>• Stratification</li> <li>• Climate change</li> </ul>	9/4: Assignment 1
Wednesday 9/11 Friday 9/13	Physical properties of rivers <ul style="list-style-type: none"> <li>• Discharge</li> <li>• Channelization and dams</li> </ul>	9/11: Assignment 2
Wednesday 9/18 Friday 9/20	Water quality in lakes <ul style="list-style-type: none"> <li>• Water quality indicators</li> <li>• Trophic status, eutrophication</li> <li>• Spatial variability</li> </ul>	9/18: Assignment 3
Wednesday 9/25 Friday 9/27	Water quality in rivers <ul style="list-style-type: none"> <li>• Water quality indicators</li> <li>• Salinization</li> <li>• Spatial variability</li> </ul>	9/25: Assignment 4
Wednesday 10/2 Friday 10/4	Time series analysis <ul style="list-style-type: none"> <li>• Long-term datasets</li> <li>• Gaps and autocorrelation</li> <li>• Interpolation</li> </ul>	10/2: Assignment 5
Wednesday 10/9 Friday 10/11	High frequency data	10/9: Assignment 6
Wednesday 10/16 Friday 10/18	Mapping	10/16: Assignment 7
Wednesday 10/23 Friday 10/25	Project <ul style="list-style-type: none"> <li>• Generating questions and hypotheses</li> <li>• Choosing datasets</li> </ul>	10/23: Assignment 8 10/25: Initial proposal and analysis plan (end of class)
Wednesday 10/30 Friday 11/1	Project <ul style="list-style-type: none"> <li>• Work days</li> </ul>	
Wednesday 11/6 Friday 11/9	Project <ul style="list-style-type: none"> <li>• Brainstorming sessions</li> <li>• Work days</li> </ul>	
Wednesday 11/13	Project <ul style="list-style-type: none"> <li>• Report draft peer review</li> </ul>	11/13: Report draft
Friday 11/14 Wednesday 11/20	Project <ul style="list-style-type: none"> <li>• Work days</li> </ul>	11/20: Post-course reflection
Friday 11/22	Final presentations	11/22: Final presentation 11/22: Final report 11/25: Group project reflection

*Details of this syllabus, including but not limited to grading and schedule, are subject to change at the instructor's discretion. Students will be notified of any changes in advance and in writing.*

## **Campus Resources for Students**

Your mental and physical wellbeing is integral to your ability to be academically successful. Below, I have compiled a list of resources around campus that are available to support you. In addition, please feel free to come by my office anytime if you need to talk to someone or would like help finding support resources on campus.

### **Academic Resource Center**

<http://arc.duke.edu/>

At the Academic Resource Center, we work with you to create a comprehensive approach to your learning, so you can reach your highest academic potential. Some of the services we offer include:

- [Peer Tutoring](#): One-on-one meetings and walk-in tutoring for select courses
- [Study Groups](#): Facilitated group learning opportunities for specific math and science courses.
- [Learning Consultations](#): Any Duke undergraduate student can meet with an ARC learning consultant to enhance your academic skills and learn strategies tailored to how you learn and the courses you are taking. This includes strategies for time management, how to balance study, work and extra-curricular activities, how to take effective notes, and more
- [ADHD/LD Support](#): Students with a diagnosed learning difference, including ADHD, can receive individualized academic support including academic and ADHD coaching, time management support, tutoring, and compensatory learning strategies

### **Graduate Career Services**

[Duke Career Center](#)

### **Mental Health Resources**

[Counseling and Psychological Services](#): CAPS helps Duke Students enhance strengths and develop abilities to successfully live, grow and learn in their personal and academic lives. We offer many services to Duke undergraduate, graduate, and professional students, including brief individual and group counseling, couples counseling and more. CAPS staff also provide outreach to student groups, particularly programs supportive of at-risk populations, on a wide range of issues impacting them in various aspects of campus life.

[Duke Reach](#): DukeReach directs students, faculty, staff, parents, and others to the resources available to help a student in need. DukeReach is located in the Dean of Students Office and works with departments and groups across campus and in the community, including Housing, CAPS, Student Health, community health providers, the Academic Resource Center, and more.

[DuWell](#): DuWell helps students focus on their individual wellness by looking at the integration of many areas of their life through areas of wellness promotion and risk mitigation. We engage students through a variety of wellness experiences across campus in an effort to reduce stress and anxiety while emphasizing self-care.

## **Sexual Assault Resources**

If you have experienced sexual assault, sexual harassment, gender violence, relationship violence, or stalking, please reach out for help. There are several resources around campus to support you:

[The Women's Center](#): 919-684-3897. Services are available to all genders, not just women.

[Office of Student Conduct](#): 919-684-6938

[Duke Police](#): 919-684-2444

My door is always open if a student needs someone to listen or to connect them with resources. As an employee of Duke, I am a mandatory reporter, meaning that if I receive a report of sexual assault, I am required to confidentially report this to the Office of Student Conduct (OSC). The OSC will follow up with the student to provide further information, but the student is not required to respond and the conversation will not be shared beyond myself and the OSC. The following resources around campus are not mandatory reporters: The Women's Center, medical providers, campus clergy, and CAPS counselors.

## **Recreation and Exercise Opportunities**

[Duke Recreation Website](#): Information about exercise facilities, intramural sports, and fitness services

[Al Buehler Trail](#): A hiking and running trail south of Duke's west campus, free for use. The main trail is 3 miles long with beautiful scenery, and a separate 0.58 mile "fitness loop" includes bodyweight training stop points for a guided workout. Emergency phones are placed at 7 locations along the trail.

[Duke Gardens](#): Free admission and inexpensive parking. Located on the east side of Duke's west campus.

## **Food Insecurity**

As part of our community care, we have a food exchange available for students, faculty and staff who find themselves on campus without the means to eat. The Nicholas School understands there may be times when financial situations may make it difficult to provide a meal for yourself and we want to make sure we can help minimize these situations. As such, the first floor kitchen in Grainger Hall and the second floor kitchen in LSRC have been stocked with non-perishable single-serve food items that you are invited to take if you need it.