GGS 656 - **The Hydrosphere;** Credits: 3
5:55 – 7:10 pm Tuesdays; Exploratory Hall 2310
Jan 20, 2026 - May 13, 2026

Syllabus

Overview: Components and transfer processes within the hydrosphere, which consists of aqueous envelope of Earth, including oceans, lakes, rivers, snow, ice, glaciers, soil moisture, groundwater, and atmospheric water vapor. Offers understanding of various components of the hydrosphere, spatial and temporal distributions, physics of transfer processes for redistribution, and appreciation of water's role in sustaining life and influencing global and regional energy and mass balance.

Prerequisites: Two semesters of calculus, preferably partial differential equations; or permission of instructor.

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Required text: Dingman, S. L., Physical Hydrology, 3rd Edition,Waveland Press, Inc.., 2015
Widely available as eText or hardcopy. 2nd edition is also OK.

Procedure: Material will be covered by lectures, not necessarily restricted to the text/supplemental and handouts. Students are expected to read the text and other assignments thoroughly prior to the lecture.

Performance: Material covered on the final exam will include handouts, lecture notes and outside readings.

Evaluation: All work must be your own. A grade of "0" will be assigned for any work which is clearly not your own or cheating of any type.

Homework	28 points (4 per assignment)
Paper Presentation	10 points
Final Exam	20 points
Pop Quizzes	12 (2 Points per quiz)
Project	30 points
TOTAL	100 points

Homework assignments: All assignments should be done neatly and professionally. All homework should be submitted on blackboard by the due date. The problem should be defined, diagrammed (if appropriate), and the solution should be developed in a step-by-step procedure. Spreadsheet answers can be included. The final solution should be reported to the appropriate significant figures and underlined. You are encouraged to work together in study groups; however, identical (copied) homework will be awarded a grade of zero (0). Incorrect homework may be neatly reworked and resubmitted for re-evaluation and partial credit.

Semester Project: The project will consist of a modeling or data analysis exercise to investigate a well-posed hydrological question. Models may be written by the student, or an existing model may be selected for the investigation. Project deliverables will consist of: 1. A brief project proposal presentation; 2. a 15-minute oral presentation. Here are a few ideas:

- The transmission of dam-induced stage changes in the Lower Colorado River: Data Interpretation: Stage data from different parts of LCR over tens to more than 100 km will be collected and analyzed to determine how a dam-induced flood travels through the LCR.
- The transmission of dam-induced stage changes in the Lower Colorado River: Modeling. Dam-induced stage variations will be modeled using kinematic wave or diffusive wave approximations. The model will be driven by upstream data.
- Measurement of discharge and stage changes in a local River. Students will deploy pressure transducers along different parts of the river to monitor dam-induced stage fluctuations.
- Measurement of moisture changes in the riparian zone of the Lower Colorado River due to dam-induced stage changes. This project will consist of a historical assessment of the LCR and how floods (natural and managed) have altered its course, if any.
- A 'backward' systems dynamics hydrologic model for a local creek/river.
- Discharge data from a local creek/river will be analyzed following Kirchner (Water Resources Research, 2009)
- A 'backward' systems dynamics hydrologic model for local springs/creek.
- Is Virginia getting warmer? Focus on extreme temperatures
- Students will collect ground and air temperature archives from weather stations across the state and delineate trends for number of days above 90 F or some other threshold, if any.
- Long-term (decadal) discharge variations in undammed Virginia rivers. Historical discharge data from undammed rivers or those little affected by dams will be analyzed.

Other project ideas:

http://www.ce.utexas.edu/prof/maidment/gradhydro99/termproj.html
http://www.ce.utexas.edu/prof/maidment/giswr2010/docs/termpaperlibrary.htm

Paper Presentation: Each student will be required to present a relevant research paper or topic at the start of one of the class sessions. The 15 minute presentation should be generally relevant (but not redundant) to the topic covered during that class session. Grading will be based on (1) relevancy and creativity of chosen paper/topic, (2) quality of presentation and visuals, (3) responses to questions and discussion. ***Any review materials should be sent out to the class by the Friday before the presentation. Please select a date for your paper presentation – preference will be given on a first come first served basis.***

Late Work: All work is expected to be completed on time.

Disabilities: Students with disabilities that require accommodation should contact the instructor so that the necessary arrangements can be made.

Course Outline

Date	Topic
Jan 20	Introduction: Course Requirements, Basic Hydrologic Concepts (Ch 1-2) Homework #1:
Jan 27	Precipitation (Dingman Ch 4) Homework #1
Feb 3	Snow and Snowmelt (Ch 5) – On-Line Video Lecture (no in-class meeting) Homework #2
Feb 10	Climate, soils and vegetation (Ch 3) Homework #3
Feb 17	Hydrometeorology Homework #4
Feb 24	Project Proposal Presentations
March 3	Water in Soils (Ch 6) Homework #5
March 17	Evapotranspiration (Ch 7)
March 23	Groundwater (Ch 8) Homework #6
March 31	Streamflow (Ch. 9) Homework #7
April 7	Water in Ice
April 14	Water in Oceans
April 21	Water Quality
April 28	Project Presentations & Review for Final
May 12:	**Final Exam (24-hour Take Home Exam)**

NOTE: This is a course outline and is subject to revision at the discretion of the instructor. You will be informed in class if changes are made.

WEB RESOURCES:

On-Line Precipitation Data:

http://www.eol.ucar.edu/projects/hydrometnet/virginia/
http://www.afws.net/search.htm
http://va.water.usgs.gov/
http://waterdata.usgs.gov/va/nwis/current/?type=precip&group_key=county_cd
http://afws.erh.noaa.gov/afws/county.php?type=precip&state=51
http://www.erh.noaa.gov/marfc/Archive/Precip/
http://www.cocorahs.org/ViewData/
http://climate.geog.udel.edu/~climate/html_pages/download.html
http://www.mlbs.virginia.edu/data.html

Hydrologic tools and data:

http://his.cuahsi.org/

Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability

Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit https://ds.gmu.edu/ for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, **all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct** (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal

Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: If you prefer to speak to someone ***confidentially***, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.

Use of AI (Artificial Intelligence) Tools Policy:

We expect your work in this course to be your original work, and not the product of AI (like chatbots or image- or video-generation tools. However, some drone-based image processing tools may have AI elements, and AI may be of use in the class project. In these cases, the use of AI should be acknowledged and/or cited in the homework or project. You may NOT use the text generated by AI in assignment answers or presentations. We need to your insights in your own words. You may NOT use AI during quizzes and exams.