DEPARTMENT OF
Civil and
Environmental Engineering
UNIVERSITY OF WISCONSIN–MADISON

1. **COURSE NAME AND NUMBER**

   Civ Engr 515 Hydroclimatology for Water Resources Management

2. **CREDITS AND CONTACT HOURS**

   3 credits, 3 contact hours

3. **CANVAS COURSE URL**

   https://canvas.wisc.edu/courses/91823

4. **COURSE DESIGNATIONS AND ATTRIBUTES**

   This course carries the graduate course attribute.

5. **MEETING TIME AND LOCATION**

   Lecture: Tuesdays & Thursdays, 11:00am – 12:15pm, Room 1213 Engineering Hall

6. **INDICATE WHETHER THE COURSE IS REQUIRED, ELECTIVE, OR SELECTED ELECTIVE (IF YOU DO NOT KNOW, CHECK WITH YOUR ABET PROGRAM REPRESENTATIVE).**

   CEE515 is an elective course for the BSCE degree and MS/PhD degrees.

7. **INSTRUCTIONAL MODE**

   Face-to-face

8. **SPECIFY HOW CREDIT HOURS ARE MET BY THE COURSE**

   Traditional Carnegie Definition – One hour (i.e. 50 minutes) of classroom or direct faculty/instructor instruction and a minimum of two hours of out of class student work each week over approximately 15 weeks, or an equivalent amount of engagement over a different number of weeks.

9. **INSTRUCTORS AND TEACHING ASSISTANTS**

   a. **Instructor Title and Name**

      Paul Block, Assistant Professor

   b. **Instructor Availability**

      Available by appointment – please email me or see me after lecture to set a time.

Office hours or other depending on modality of instruction. Regular and substantive student-instructor interaction is always a requirement of UW-Madison for-credit learning activities.

   c. **Instructor Email/Preferred Contact**

      paul.block@wisc.edu

d. Teaching Assistant (if applicable)

Not applicable

e. TA Office Hours

Not applicable

f. TA Email/Preferred Contact

Not applicable

10. OFFICIAL COURSE DESCRIPTION

Students will be introduced to various strategies for integrating climate science into water resources, specifically addressing climatic influences on hydrologic variables, the prospects for prediction, and the implications on water management and development. Students will consider both space and time variability of hydrological processes in the context of sub-seasonal, seasonal, and climate change time-scales. The course format will include lectures, discussion, student presentations, and role- playing.

11. REQUISITES

Civ Engr 315 and Stat 224

12. LEARNING OUTCOMES

a. Course Learning Outcomes

By the conclusion of the course, all students should be able to:
a) understand local to global and present to future hydroclimatic challenges

b) perform diagnostics and attribution regarding the influence of climatic variables and phenomena on hydrologic variables

c) create and verify probabilistic statistical and dynamical hydroclimatic forecasts

d) explain the complexities of forecast communication

e) relate the state and complexities of climate change science and modeling as it relates to water management

Additionally, graduate students should also be able to:

f) proficiently write software codes to perform statistical analyses

g) determine multiple performance metrics and subsequently draw suitable conclusions

h) rigorously address and account for uncertainty and probabilistic outcomes

b. ABET Student Outcomes

In this course, students will attain:

(e) an ability to identify, formulate, and solve engineering problems

(g) an ability to communicate effectively

(j) a knowledge of contemporary issues

(n) an ability to understand common failure mechanisms of a component, process, or system and their causes and prevention

13. BRIEF LIST OF TOPICS TO BE COVERED

- Decision theory and analysis, risk and reliability, allocations
- The climate connection: scales, patterns and extremes
- Hydroclimatic forecasts: approaches, products, diagnostics, attribution, skill measures
- Statistical streamflow model forecasts: concepts, predictors, MLR, PCA
- Dynamical model forecasts: concepts, GCMs, downscaling, linking to a hydrology model
- Climate change: state of science, GCMs, time-scales, impacts on water resources
- Water and climate tools
- Special topics: resampling, insurance, option contracts, economics, water footprint

14. DISCUSSION SESSIONS

Not applicable

15. LABORATORY SESSIONS

Not applicable

16. REQUIRED TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS

None Required

Optional texts:

Statistical Methods in Water Resources, Helsel and Hirsch:
https://pubs.usgs.gov/twri/twri4a3/pdf/twri4a3-new.pdf

Water Resources Systems Planning and Management, Loucks:
http://unesdoc.unesco.org/images/0014/001434/143430e.pdf

Globalization of Water, Hoekstra and Chapagain:
http://onlinelibrary.wiley.com/book/10.1002/9780470696224

Statistical Methods in the Atmospheric Sciences, Wilks

Water Resources Sustainability, Mays

17. GRADING

Evaluation

Participation:	10%
Journal Review:	10%
Reflections (5):	5%
Homework (6):	50%
Final Project:	25%

Graduate students will be evaluated separately from undergraduate students on Homework and Final Projects, as detailed below.

Grades

A: 100-92 AB: 92-88 B: 88-82 BC: 82-78

C: 78-70 D: 69-60 F: 59-0

18. EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

There are no exams or quizzes for this course.

Participation:

Parts of the course will include group work, class discussion, and role-playing, thus participation will be critical to advance the learning objectives. All students are expected to regularly participate, in a reasonable manner, during each session. Clearly, attendance is required for full participation. To receive full credit, a student's contributions must reflect exceptional preparation, contain frequent major insights, and improve the quality of discussion. Student contributions reflecting thorough preparation, good insights, and improving the class discussion will receive 8%. Non-participants (saying nothing in class) will receive 5%. Unsatisfactory contributors reflecting inadequate preparation, few to no insights, and reducing the quality of class discussion will receive no more than 5%.

Journal Review Presentation:

Each student is required to summarize and critically review an article from the reading list and give a 15-minute power-point presentation. There will be a sign-up early in the course. Readings or links to readings will be posted on the course website. Further details will be given in class.

Reflections:

Students are expected to come to class have completed the assigned readings, ready for discussion. In addition to this, each student must complete reflections for five (5) readings from the assigned list, and submit a one-half to one page document reflecting and commenting on the reading. This should *not* be a summary of the reading but rather your impressions and conclusions. Reflections are due on the assigned day of the reading. Students are therefore encouraged not to wait until the end of the term to complete the reflections. Readings or links to readings will be posted on the course website.

Final Project:

Students will complete a final project in small groups, culminating in a presentation during finals week. Projects must encompass some aspects of the course materials presented. Topic ideas and project expectations will be posted on the course webpage early in the term. Other topics may be selected with the instructor's consent. Various deadlines (topic selection, update, etc.) will need to be met. More details will be given in class. *Graduate students will be required to complete Final Projects individually. They will also be required to add at least one additional component to the Final Project, as will be detailed in class, and perform in-depth development and analysis beyond that expected at the undergraduate level. This may include multiple forecast approaches, coupling forecasts and a decision-making model, unique tool development, or other features as approved by the instructor.*

19. HOMEWORK & OTHER ASSIGNMENTS

Homework:

Homework will be assigned throughout the course and typically due 2 weeks later in class. It will be posted on the course website, and will include creative problem solving, computer modeling, and critical thinking. *For each Homework assignment, graduate students will be required to complete an additional 1-3 problems of a critically challenging nature. Typically this will be an extension of the questions assigned to all students, requiring additional code writing and/or modeling, analyses, and interpretation*

20. OTHER COURSE INFORMATION

- Lecture power-points will be posted to the course website in advance of each session.
- You are expected to attend all lectures and lab sessions. In the event that you will be absent, please email me *in advance* as a courtesy. You will also be responsible for obtaining notes, etc. from a classmate.

21. RULES, RIGHTS & RESPONSIBILITIES

See the Guide's to Rules, Rights and Responsibilities

22. ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to https://conduct.students.wisc.edu/academic-integrity/.

23. ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA."

http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

24. DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/