DEPARTMENT OF
Civil and
Environmental Engineering
UNIVERSITY OF WISCONSIN–MADISON

COURSE NAME AND NUMBER

Civ Engr 515 Hydroclimatology for Water Resources Management

CREDITS AND CONTACT HOURS

3 credits, 3 contact hours

CANVAS COURSE URL

https://canvas.wisc.edu/courses/375524

COURSE DESIGNATIONS AND ATTRIBUTES

This course carries the graduate course attribute.

MEETING TIME AND LOCATION

Lecture: Tuesdays & Thursdays, 9:30am – 10:45am, Room ME 1152

THE COURSE IS

CEE 515 is an elective course for the BSCE degree and MS/PhD degrees.

INSTRUCTIONAL MODE

In person

SPECIFY HOW CREDIT HOURS ARE MET BY THE COURSE

This class meets for two 75-minute lecture periods each week over the semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 3 hours/week out of the classroom. This course meets the requirement for regular and substantive student-instructor interaction through twice weekly lectures, office hours, periodic homework assignments, presentations, and graded projects.

INSTRUCTORS AND TEACHING ASSISTANTS

Instructor Title and Name

Paul Block, Associate Professor

Instructor Availability

Office hours (1269 Engineering Hall) Mondays 4:00-5:00 pm and by appointment

Instructor Email/Preferred Contact

paul.block@wisc.edu

Teaching Assistant (if applicable)

Not applicable

TA Office Hours

Not applicable

TA Email/Preferred Contact

Not applicable

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.

REQUISITES

Civ Engr 415 and Stat 224

LEARNING OUTCOMES

Course Learning Outcomes

By the conclusion of the course, all students will be able to:

- identify local to global and present to future hydroclimatic challenges
- perform diagnostics and attribution regarding the influence of climatic variables and phenomena on hydrologic variables
- design and verify probabilistic statistical and dynamical hydroclimatic forecasts
- explain the complexities of forecast communication
- explain the state and complexities of climate change science and modeling as it relates to water management

Additionally, graduate students will be able to:

- write software codes to perform statistical analyses
- use multiple performance metrics and subsequently draw suitable conclusions

ABET Student Outcomes

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

3.an ability to communicate effectively with a range of audiences

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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

DISCUSSION SESSIONS

Not applicable

LABORATORY SESSIONS

Not applicable

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

GRADING

<u>Assessment Criteria</u>

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.

<u>Expected Grade Breaks</u>

A:	100-92
AB:	92-88
B:	88-82
BC:	82-78
C:	78-70
D:	69-60
F:	59-0

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 review an article from the reading list and give a 10-minute power-point presentation. The presentation should include questions for class discussion. There will be a sign-up early in the course. Readings will be posted on the course website. Further details will be given in class.

Reflections:
Students are expected to come to class having 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.*

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 select Homework assignments, 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

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. If you will be absent, please email me *in advance*. You will also be responsible for obtaining notes, etc. from a classmate.

The following is the expected week by week schedule:

Week	**Topic**	**Assignment (due)**
Week 1	Introduction to predictions; World water resources	HW 1 (Sep 26)
Week 2-3	Decision theory and analysis Risk and reliability Allocations	HW 2 (Oct 10)
Week 4-5	The climate connection: scales, patterns and extremes	HW 3 (Oct 31)
Week 6	Hydroclimatic forecasts: approaches, products, diagnostics, verification	
Week 7-8	Statistical streamflow model forecasts: concepts, predictors, MLR, PCA	Project Idea (Oct 24) HW 4 (Nov 14)
Week 9	Dynamical model forecasts: concepts, GCMs, downscaling, linking to a hydrology model	Project Prospectus (Nov 9) HW 5 (Nov 28)
Week 10	Climate change: state of science, GCMs, time-scales, impacts on water resources	
Week 11	Time-series sampling and disaggregation, resampling	HW 6 (Dec 12)
Week 12	Economics, insurance, forecast-based financing; Irrigation and crop modeling; water and climate tools	
Week 13	Applications of forecasts	
Week 14	Final Project presentations	Final presentations

ACADEMIC POLICIES AND STATEMENTS

This course follows the academic policies and statements that are reviewed and updated annually, as needed. These currently include:

- Teaching and Learning Data Transparency Statement
- Privacy of Student Records and the Use of Audio Recorded Lectures Statement
- Campus Resources for Academic Success
- Course Evaluations and Digital Course Evaluations
- Students' Rules, Rights and Responsibilities
- Diversity and Inclusion Statement
- Academic Integrity Statement
- Accommodations for Students with Disabilities
- Academic Calendar and Religious Observances

The instructor reserves the right to modify this syllabus as circumstances warrant.