This course is designed as a graduate level class in a seminar format to provide an opportunity for students to develop a deeper understanding of hydroclimate variability across a range of time scales. Topics include theoretical and model-based understanding of the processes governing hydroclimate variability in space and time, hydroclimate variability over the Common Era, recent and current trends in precipitation, drought, soil moisture, and riverflow, and projections of future hydroclimate change. Readings are from classic, foundational, and recent papers, and topics will include: hydroclimate reconstructions of the Common Era (particularly from tree rings, but also other proxies), expectations from models and theory about the sign and range of forced and unforced variability in global and regional hydroclimate systems, inferences about large-scale controls on hydroclimate variability across a range of time scales and climate states, uncertainties in observations and reconstructions of the hydroclimate system, statistical challenges in interpreting and reconstructing hydroclimate variability, and projections of future hydroclimate changes.

This syllabus and course schedule are subject to change. Please check regularly for updated information on D2L.

Locations and Times
Monday, 3:30pm to 6PM
Bannister Tree-Ring Laboratory Building, Room 424 (Large Conference Room)
Course materials online via D2L (http://d2l.arizona.edu)

Instructor Information
Kevin Anchukaitis
Associate Professor, School of Geography and Development
Laboratory of Tree Ring Research
Room S514, Environment and Natural Resources Building 2 (ENR2)
Room 419, Bannister Tree Ring Lab Building
Office Phone: (520) 626-8054
Email: kanchukaitis@email.arizona.edu

Office Hours
Office Hours in Autumn 2017 are by appointment

Course Information

Credits
Students may register for 2 (presentation and discussion) or 3 credits (final synthesis assignment).

Prerequisites
Continuing graduate student status or permission from instructor. Prior statistical, atmospheric science, and climate science courses are encouraged.

Course Objectives and Expected Learning Outcomes
This course has the following expected learning outcomes:

• Factual: You will acquire fundamental knowledge of the state, variability, and trends in large-scale features of global and regional hydroclimate. You will become familiar with methods for observing and modeling hydroclimate variability in the past, present, and future. You will become familiar with the terminology used to describe hydroclimate variability. You will also be able to locate and acquire...
appropriate data and access up-to-date peer reviewed literature on hydroclimate in the past, present, and future.

- Conceptual: You will cultivate a first-order understanding of the process and physical laws governing variability in the hydroclimate system and be able to apply this understanding to generate hypotheses about the outcomes of changes in radiative forcing and the role of natural and internal variability. You will be able to identify and where appropriate qualify and quantify sources of uncertainty in theory, models, data, and projections.

- Procedural: You will gain experience and practice in gathering, summarizing, and synthesizing theory, conceptual and physical simulations, data, and inferences about hydroclimate variability from a variety of sources, including both those assigned as part of the class and other supporting articles from the literature.

- Metacognitive: You will recognize the potential and limitation of both theory and observations in predicting and understanding hydroclimate variability. You will be able to identify reasonable (and unreasonable) inferences or conclusions from your analyses. You will develop an enhanced recognition of how potential biases – including both methodological as well as cognitive – enter into analyses of hydroclimate systems. You will practice deploying both quantitative analyses and qualitative reasoning to assess likelihood and bias in published papers and how these effect the strength and utility of the inferences that can be made.

**Required Texts or Readings**

There is no required textbook for this course. Required readings will be posted on D2L.

**Assignments and Methods of Assessment**

Paper Presentations: [50%] Students will all lead at least 1, and likely 2, presentation on readings for the class. These presentation will include an introduction to the broader topic, the position of the paper under discussion within that topic, the importance and relevance of the paper, methods, results, and analyses. In most cases, the presenter will need to draw on other related literature, make connections to earlier papers, and review or introduce theoretical, observational, or methodological concepts. The presentation should be an expansive synthesis of the paper, related work, and its larger context, include discussions of uncertainty and precedent, and be critical in a scholarly way without invective. The presentation should be no more than 30 minutes long and should draw on figures and graphics from the assigned paper(s) as well as any other resources that presenter finds useful for conveying important concepts. The quality of the presentation will be assessed and quantified by the instructor, based on a rubric available on D2L.

Paper Discussant and Class Participation: [50%] Students will elect to serve as the discussant for at least one paper presentation. The discussant will be in charge of starting and guiding the discussion following the paper presentation itself. The discussant should have an in-depth familiarity with the paper(s) under discussion, associated literature, terms and physical process discussed in the primary papers(s), and should prepare a series of motivating questions in order to stimulate discussion. All students are also expected to participate actively in all paper discussions, read all assigned papers, and familiarize themselves with the material prior to class. The quality of the discussant’s role and the overall participation in the class will be assessed and quantified by the instructor, based on a rubric available on D2L.

Final Project: For those students registered for 3 credits for the course, a final culminating and synthetic project is required. This assignment can be an original manuscript, literature review or annotated bibliography, an original analysis of hydroclimate data, or another written or analytical project approved by the instructor. The assignment is due on D2L no later than Thursday, December 7th, 2017, at 5:00pm Arizona time.
Grade polices and Letter Grade Distribution:
University policies regarding grades and grading systems are available at:
http://catalog.arizona.edu/2015-16/policies/grade.htm

Grade distribution for this course:
A: 90% and above
B: 80% to 89%
C: 70% to 79%
D: 65% to 69%
E: below 65%

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively. Please be aware of deadlines for requesting these grades. Any requests for reconsideration of a grades must be made to the instructor no later Monday, December 11th at 5pm.

There is no final exam for this course.

Late work
Assignments that are not completed or handed in on time, without prior arrangement with the instructor, will receive no credit. Presenters and discussants are expected to fulfill these roles on the days they select at the start of the semester.

University Policies

Course Communications
All communications concerning class are via official UA email addresses. It is the student’s responsibility to regularly check for email communications concerning class information and policies, and to contact the instructor from the student’s official UA email address.

Course materials
Course materials will be available online via D2L (http://d2l.arizona.edu)

Absence and Class Participation Policy
The UAs policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy Absences pre-approved by the UA Dean of Students (or deans designee) will be honored. See http://uhap.web.arizona.edu/policy/appointed-personnel/7.04.02

Active participation in the course is vital to the learning process. As such, attendance is strongly encouraged at all meetings of the class.

Because the course is for graduate students, who often may have to travel for fieldwork or professional conferences, please make arrangements with the instructor before you anticipate being absent for one of these reasons. Seminar classes depend on the active participation of the students, and attendance may be reflected in the final course grade.

Assignment and Grading Policy for Students Who Register Late
Students who register late for the course will be required to take on the same number of presentation and discussant roles as other student.
Classroom Behavior Policy
To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. Students engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See [http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students](http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students).

Accessibility and Accommodations
Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit [http://drc.arizona.edu](http://drc.arizona.edu). If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See [http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity](http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity).

For written exercises, the University Libraries have some excellent tips for avoiding plagiarism, available at: [http://www.library.arizona.edu/help/tutorials/plagiarism/index.html](http://www.library.arizona.edu/help/tutorials/plagiarism/index.html).

UA Nondiscrimination and Anti-harassment Policy
The University is committed to creating and maintaining an environment free of discrimination; see [http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy](http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy). Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students
UA Academic policies and procedures are available at: [http://catalog.arizona.edu/policies](http://catalog.arizona.edu/policies).

Student Assistance and Advocacy information is available at: [http://deanofstudents.arizona.edu/student-assistance/students/student-assistance](http://deanofstudents.arizona.edu/student-assistance/students/student-assistance).

Confidentiality of Student Records
Please see the University’s policy on the confidentiality of student records here: [http://www.registrar.arizona.edu/ferpa/default.htm](http://www.registrar.arizona.edu/ferpa/default.htm).

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.
## Course Schedule

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<th>Reading and Discussion Topic</th>
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<td>Course introduction and overview</td>
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<td>Session 2 — August 28</td>
<td>Global Theory and Hydroclimate Fundamentals</td>
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<td>Session 3 — September 11</td>
<td>Global Theory and Hydroclimate Fundamentals</td>
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<td>Session 4 — September 18</td>
<td>Intertropical Convergence Zone and Storm Tracks</td>
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<td>Session 5 — October 2</td>
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<td>Session 6 — October 9</td>
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<td>Session 13 — November 27</td>
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<td>Session 14 — December 4</td>
<td>Future Projections and Summary</td>
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</tbody>
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Session 2:  *Global Theory and Hydroclimate Fundamentals I* — August 28


Session 3:  *Global Theory and Hydroclimate Fundamentals II* — September 11


Session 4:  *Intertropical Convergence Zone and Storm Tracks* — September 18


Session 5:  *Internal Variability* — October 2


Session 6: 20th Century Observations — October 9


Session 7: Streamflow I — October 16


Session 8: Streamflow II — October 23


Session 9: Snow and Streamflow — October 30


**Session 10: Common Era Paleoclimate I — November 6**


**Session 11: Common Era Paleoclimate II — November 13**


**Session 12: Future Projections I — November 20**


Session 13: Future Projections II — November 27


Session 14: North American Monsoon — December 4
