SUMA K4147: Water Resources and Climate
Summer 2016

Class Syllabus

Scheduled class times:
  Tuesday and Thursday, 6:10-8:00 pm
Office hours:
  By appointment; place TBD

Instructors information:
  Dr. Laia Andreu-Hayles ¹ <lah@ldeo.columbia.edu>
  Dr. Paula González ² <gonzalez@iri.columbia.edu>

Affiliation/Office location:
  ¹ Tree Ring Lab, Lamont Doherty Earth Observatory (LDEO), EI, Columbia University
  ² International Research Institute for Climate and Society (IRI), EI, Columbia University

Emails will be responded within 12 hours during the workweek. Emails sent on Saturday will not likely receive a response until Monday.

Course Overview:
The fragility of water resources under a changing climate has received increasing awareness amongst policy makers, planning and environmental agencies, stakeholders and beyond; driven by exciting developments in climate science and bolstered by a surge in media coverage.

An important driver of water resource availability is the interaction between the hydrologic cycle and the climate system. With climate models projecting a future of an increasingly variable and extreme climate system, the resulting impacts on the water cycle are of key relevance to the sustainable management of water resources.

This course will cover the science needed to understand the main features of the global hydrologic cycle, the link between hydrology and climate, and how climate change is affecting the water cycle, and by association the natural and human systems. Using this knowledge, students will use case studies and review scientific literature to critically evaluate real-world water security issues and develop sustainable solutions to address them.

The interaction between water and climate plays an integral role on the coupling between natural and human systems, and the experiences gained in this course are a valuable complement to other courses in the Sustainability Management Program.
Learning Objectives:
1. Understand the hydrologic cycle and its connection to climate.
2. Understand how changes in climate have affected/will affect how much water is available on land.
3. Understand how water impacts ecosystems.
4. Learn how to critically evaluate a scientific article.
5. Diagnose the cause of a climate-related water problem and develop solutions to address it.

-- This syllabus is a guide for our semester and is subject to further changes. --

Text/Readings:
There is no assigned textbook for this class. Readings will be taken from reports and scientific articles, and may be supplemented with news articles, depending on current events as the class progresses.

Resources and Communication Channels:
Courseworks/Canvas will be used to distribute reading materials, lecture slides, and to turn in assignments unless specified otherwise. Students are expected to check email on a daily basis during weekdays to stay current with course-related communications.

Course Requirements and Grading:
The course will consist of readings, homework assignments, one exam, and a final project, consisting of a paper and a presentation to the class. The final grade will be calculated as follows:

- 5% - Attendance
- 35% - Written critiques
- 10% - Participation
- 20% - Exam
- 30% - Final Project

Most classes will be divided in two sections. During the first part the instructor will deliver a theoretical basis, while on the second part a reading discussion will be hold.

Attendance (5% of final grade)
Students are expected to attend class. Missing three classes without justification (including the ‘shopping period’) will imply losing the complete attendance grade.

Written critiques (35% of final grade)
Written assignments will be requested for 6 of the 9 scientific papers discussed in class. For all students, these written critiques are due via Courseworks/Canvas at noon the day of class. The grades of the 6 written critiques will make up 35% of the student’s total grade.
Each critique must include:

- A short essay giving an overview of the reading (not less than 200 and no more than 300 words)
- Two strengths and two weaknesses of the investigation/reading
- Two critical questions that can be used as a part of the class discussion

**Participation** *(10% of final grade)*
Participation on the topics of discussion of the course will account for 10% of the final grade. This grade will be an average from the individual evaluation of the instructors and classmates.

This participation grading will be elaborated based on the participation of the students on the discussions of the readings during class, and on these and other topics proposed through Courseworks/Canvas. The students are expected to show critical thinking, respectful interactions with classmates and a positive attitude towards learning and freely discussing the topics proposed. Students are encouraged to share the critical questions from their assignments with their peers.

**Exam** *(20% of final grade)*
There will be one in-class two-hour written exam that will evaluate concepts, ideas, themes and issues that were covered in class until the evaluation date. It will be composed of short-answer essay questions.

**Final project** *(30% of final grade)*
The final project for this course will be a paper on an issue of the student’s choice related to water and climate. The total grade for the final project (30%) will be based 50% on the written paper and 50% on the presentation.

A mandatory **project proposal** will be due on July 25th for topic approval. The proposal will not be graded; it is meant to ensure an appropriate topic and it is a pre-requisite for the acceptance of the final project. Failing to turn the proposal on a timely manner will forfeit the student’s chance to earn the final project grade.

The student will be responsible for reading primary source material on the topic, evaluating the scientific certainty/uncertainty behind the issue, and recommending an adaptation strategy. The student will also be responsible for making the appropriate links and associations with the relevant theoretical material covered during the course.

The **written paper** will be due on August 10th. The written paper grades will be an average from the individual evaluation of the instructors.

The **presentation** will take place on August 11th. Presentation grades will be an average from the individual evaluations of the instructors and classmates.
**Policies and expectations:** Attendance, late papers, missed tests, class behavior and civility

Students are expected to arrive on time, attend all classes, and to stay until the end of class unless they have notified the instructor otherwise. Students are responsible for completing assigned readings and homework. Late assignments will be marked down unless an extension was granted. We ask that mobile devices be turned off during class.

### Course Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>LECTURE/EVENTS</th>
<th>ASSIGNMENTS</th>
<th>ADDITIONAL MATERIAL</th>
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<tbody>
<tr>
<td>Jul 5</td>
<td><strong>CLASS 1</strong></td>
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<td>Physical Hydrology</td>
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<td></td>
<td>Introduction to the hydrologic cycle</td>
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<td>(Dingman) Chapter 2, 8, Appendix B</td>
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<td>Jul 7</td>
<td><strong>CLASS 2</strong></td>
<td>- Reading discussion</td>
<td>Climate Change and Water (IPCC), Chapter 1</td>
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<td>Introduction to climate and water</td>
<td>Oki and Kanae, 2006, <em>Science</em></td>
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<td>Jul 12</td>
<td><strong>CLASS 3</strong></td>
<td>- Written critique 1 due</td>
<td>Held &amp; Soden, 2006, <em>J Climate Climate and Water</em>, Chapters 2 &amp; 3</td>
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<td></td>
<td>The impact of climate change on the hydrologic cycle</td>
<td>Trenberth, 2011 <em>Clim Res</em></td>
<td>Hegerl et al., 2015, <em>BAMS</em></td>
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<td>Jul 14</td>
<td><strong>CLASS 4</strong></td>
<td>- Written critique 2 due</td>
<td>Seager et al., 2015, <em>J. of Clim.</em></td>
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<td>Climate variability and change</td>
<td>Williams et al., 2015, <em>GRL</em></td>
<td>Greene et al., 2011, <em>EOS</em></td>
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<td>Jul 19</td>
<td><strong>CLASS 5</strong></td>
<td>- Written critique 3 due</td>
<td>Williams, 2012, <em>PNAS</em></td>
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<td>The role of ecosystems to changes in the hydrologic cycle</td>
<td>Allen et al., 1998, <em>PNAS</em></td>
<td>Bonan, 2008, <em>Science</em></td>
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<td>Paleo-perspectives on hydroclimate variability</td>
<td>Cook et al., 2010, <em>J Quaternary Sci</em></td>
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<td>Jul 25</td>
<td><strong>FINAL PROJECT PROPOSAL DUE</strong></td>
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<td>Jul 26</td>
<td><strong>CLASS 7</strong></td>
<td>- Written critique 5 due</td>
<td>Pederson, 2014, <em>PNAS</em></td>
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<td>The coupling of past hydroclimate variability with human systems</td>
<td>Buckley et al., 2010, <em>PNAS</em></td>
<td>DeMenocal, 2011, <em>Science</em></td>
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<td>Jul 28</td>
<td><strong>CLASS 8</strong></td>
<td>- Written critique 6 due</td>
<td>Taylor et al., <em>BAMS, 2012</em></td>
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<td>Climate change projections</td>
<td>Sedlaceck &amp; Knutti, 2014, <em>EnvResLett</em></td>
<td><em>Book: Climate &amp; Water</em>, Chapter 4 &amp; 5</td>
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<td>Date</td>
<td>Lecture/Events</td>
<td>Assignments</td>
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<td>Aug 2</td>
<td><strong>CLASS 10</strong>&lt;br&gt;Regional climate projections and their applications</td>
<td>- Reading discussion&lt;br&gt;Winkler et al., 2011b, Geography Compass&lt;br&gt;Giorgi, 2008, WMO&lt;br&gt;Greene et al., 2012, Water Resour Res</td>
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<td>Aug 4</td>
<td><strong>CLASS 11</strong>&lt;br&gt;EXAM</td>
<td>STUDY!</td>
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<td>Aug 10</td>
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<td>FINAL PROJECT DUE</td>
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<td>Aug 11</td>
<td><strong>CLASS 13</strong>&lt;br&gt;FINAL PROJECT PRESENTATIONS</td>
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APPENDIX A

Student Information Page

Please complete this information page and post to the Courseworks site before the first class meeting. We will use this information to plan the semester, to get to know you, and to contact you by email or phone if the need arises. We will not share this information with anyone without your consent.

Name_______________________________ Student ID# ____________________

Preferred contact phone: ______________________

My UNI email address: _________________________________

Identify the degree program or certificate program you are in:

Explain why you are taking this course and how it fits into your degree or certificate program.

What are your expectations for the course?

Briefly describe related experiences or courses that are relevant to this course:

If you require special accommodations, please indicate that below and be sure to discuss them with me soon.
Appendix B

Policies and Expectations:

Academic Integrity

The School of Continuing Education does not tolerate cheating and/or plagiarism in any form. Those students who violate the Code of Academic and Professional Conduct will be subject to the Dean’s Disciplinary Procedures. The Code of Academic and Professional Conduct can be viewed online:
http://ce.columbia.edu/node/217

Please familiarize yourself with the proper methods of citation and attribution. The School provides some useful resources online; we strongly encourage you to familiarize yourself with these various styles before conducting your research:
http://library.columbia.edu/help/howto/endnote.html

Violations of the Code of Academic and Professional Conduct will be reported to the Associate Dean for Student Affairs.

Accessibility Statement

Columbia is committed to providing equal access to qualified students with documented disabilities. A student’s disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University’s Health Services website:
http://health.columbia.edu/services/ods/support