SUMA K4147: Water Resources and Climate
Summer 2019

COURSE SYLLABUS

Scheduled class times:

- Monday and Wednesday, 6:10-8:00 pm

Office hours:

- By appointment; place TBD

Instructors information:

- Dr. Laia Andreu-Hayles ¹ <lah@ldeo.columbia.edu>
- Dr. Indrani Pal ²,³ <ip2235@columbia.edu>

Affiliation/Office location:

1. Tree Ring Lab, Lamont Doherty Earth Observatory (LDEO), Eil, Columbia University
2. Columbia Water Center, Columbia University (Adjunct Scientist)

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

Course Overview:

The fragility of water resources under human development and a changing environment has received increasing awareness at every level of our society; driven by exciting developments in geoscience and bolstered by a surge in disastrous events across the world and public interest.

An important driver of water resource availability and quality is the interaction between the hydrologic cycle, the climate system, the land-surface, and society. With a world where 9 billion people or more lives in 2050, and a future when an increasingly variable and extreme climate system prevails according to a range of earth system models, the resulting impacts of the both on the water cycle are of key relevance to the sustainable management of water resources.

Relying purely on peer-reviewed facts, this course will cover the science needed to understand the main features of the global water/hydrologic cycle, the link between science of water and climate, how climate variability and change is affecting the water cycle, and by association between the natural and human systems. Using this knowledge, students will use case studies and review scientific literature in steps to critically evaluate real-world water security issues and propose possible 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 will be a valuable complement to other courses in the Sustainability Management Program.

Learning Objectives:
1. Understand the water/hydrological cycle and its connection to climate.
2. Understand how variability and changes in the climate affect/will affect water supply and availability on land.
3. Understand how water impacts ecosystems and society at large.
4. Learn how to critically evaluate a scientific article and write a review.
5. Diagnose a climate-related water resources problem and propose 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 peer-reviewed scientific reports and journal articles of high standards, and may be supplemented with ongoing news articles that are purely backed by peer-reviewed science or based on a renowned scientist’s views.

During the course, the students are expected to be critical about non-peer reviewed reports and articles. For example, information can be highly variable when articles are published by Wall Street Journal vs New York Times. Discussions of what can be considered “reliable sources” will be held during the course in order to help the students in the search of information for their final project. For instance, outlets such as “science daily” that are based on fact-based science mostly published based on peer-reviewed articles can be good sources of information that directs the student to the ‘real’ source of information. Likewise, “Live Science” or AGU-Eos can be a student’s source of scientific information too.

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 in class. The final grade will be calculated as follows:

- 5% - Attendance
- 35% - Written critiques
- 10% - Participation
- 20% - Exam
- 30% - Final Project (15% written paper + 15% presentation)
**Final grade letter equivalent**

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<thead>
<tr>
<th>Grade</th>
<th>Percentage Range</th>
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<tr>
<td>A+</td>
<td>&lt;100% to 98%</td>
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<tr>
<td>A</td>
<td>&lt;98% to 93%</td>
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<td>A-</td>
<td>&lt;93% to 90%</td>
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<td>B+</td>
<td>&lt;90% to 87%</td>
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<td>&lt;87% to 83%</td>
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<tr>
<td>B-</td>
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<td>C+</td>
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<td>C</td>
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<td>C-</td>
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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 held.

**Attendance** *(5% of final grade)*

Students are expected to attend class. The attendance grade will be proportional to the number of classes attended. Missing classes without justification may imply losing the complete attendance grade.

**Written critiques** *(35% of final grade)*

Written assignments will be requested for 7 scientific papers discussed in class. For all students, these written critiques are due via Courseworks/Canvas at 2PM on the day of class.

The grades of the 7 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). This shouldn’t just copy and paste the abstract.
- Two strengths and two weaknesses of the investigation/reading not based on personal thoughts. These should be based on scientific facts and evidence.
- One critical question that can be used as a part of the class discussion.

The critique should discuss, in author’s language, the readings in terms of the topics covered, the strengths and weaknesses of the articles, and critical aspects of the research presented. We have included the following list to act as a guideline for preparing your critique.

- Provide a general overview
- Explain the main ideas
- Explain important numbers/facts
- Incorporate original thought based on scientific evidence/methodologies.
- Tie the paper into the overarching theme of the course
Late Submission
Written critiques are due before **2PM on the day of class**. Please let us know of any extenuating circumstances that may prevent you from meeting this deadline as soon as possible. We considered that it is crucial that all the students have read and wrote a thoughtful review before the discussion in class. For this reason, critiques received after 3PM will be subject to deductions:

- 3:01 PM to 6:00 PM (day of class) – 5 point deduction
- 6:01 PM to Midnight on day of class – 10 point deduction
- Day after class – 15 point deduction
- Later than day after class– maximum grade possible will be **80**. Feedback from the instructor is not guaranteed.

**Participation** *(10% of final grade)*
Participation on the topics of discussion of the course will account for 7% of the final grade, while the 3% will be based on the student’s participation in the online discussions and forums in CANVAS. This grade will be an average from the individual evaluation of the instructors.

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. These recommendations apply for both class and forum discussions.

Particularly for the forum, a question in relation to the lectures will be posted weekly and the students are expected to comment with science-based arguments on both question and previous peer’s comments. The students can also post news or information of interest. Thoughtful thinking connecting the topics learned in class to real world problems are welcome.

**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. The specific point value of each question will be detailed at the time of the exam.

**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 the class theme “**water resources and climate**”. A real world problem in relation to water and climate should be presented. The total grade for the final project (30%) will be based on the written paper (15%) and the presentation (15%).
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. For the proposal we request the submission of a document of less than one page describing the project and how you plan to approach your paper. Failing to turn the proposal on a timely manner will forfeit the submission of the final project or points removal from the final written project.

The student will be responsible for reading primary source peer-reviewed material on the topic, evaluating the scientific uncertainty behind the issue, and recommending adaptation options, management approaches and/or strategies as appropriate depending on the topic discussed.

We reiterate – any issue proposed, studied or solutions discussed should be backed by scientific consensus, data, and/or facts, no personal thoughts or discovery is needed. The student will also be responsible for making the appropriate links and associations with the relevant theoretical material covered during the course. Students are expected to choose an interesting issue that solves a practical issue the world faces.

The written paper will be due on August 13th. This paper will be evaluated based on: 1) demonstrating a critical understanding of the peer-reviewed ONLY scientific literature and consensus knowledge that addresses the selected topic; and 2) proposing a creative, but feasible solution/management/adaptation strategy to the issue. The wide range of strategies can be proposed, but an approach demonstrated in the paper should have proven to be realistic or adapted elsewhere. The written paper grades will be an average from the individual evaluation of the instructors.

The presentations will take place on August 14th. The presentation will be evaluated by the ability to clearly present the problem and potential solutions to your peers, to address any questions and to defend the proposed adaptation strategy on a timely manner (TBD before the presentation).

Presentation grades will be an average from the individual evaluations of the instructors and classmates.

More complete final project guidelines will be circulated through Courseworks/Canvas in advance of the deadlines.

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 and stored properly during class.
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<thead>
<tr>
<th>Date</th>
<th>LECTURE/EVENTS</th>
<th>MAIN READING</th>
<th>ADDITIONAL MATERIAL</th>
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| Jul 8<sup>th</sup> | CLASS 1  
Water resources and climate: an overview |                                     | Milly et al. 2008  
Sivapalan et al. (2012)  
Gleick & Palaniappan (2010)  
Dingman (2015)  
Chapter 2, 8 & Appendix B |
| Jul 10<sup>th</sup> | CLASS 2  
Connections between climate and water | Reading Oki & Kanae (2006)  
*Guidance for written critique (in class)* | Bates et al. (2008)- Chapter 1  
Glick et al. (2000)  
De Loë & Kreutzwiser (2000) |
| Jul 15<sup>th</sup> | CLASS 3  
The impact of climate change on the water cycle | Written critique 1 due  
Hegerl et al. (2015)  
Bates et al. (2008)- Chapter 2&3 |
| Jul 17<sup>th</sup> | CLASS 4  
Climate variability and change | Written critique 2 due  
Folland & Karl (2002) |
| Jul 22<sup>th</sup> | CLASS 5  
The role of ecosystems to changes in the hydrological cycle | Written critique 3 due  
Aragão (2012)  
Bonan (2008) |
| Jul 24<sup>th</sup> | CLASS 6  
Paleo-perspectives on hydroclimate variability | Written critique 4 due  
| Jul 25<sup>rd</sup> |                                          | FINAL PROJECT PROPOSAL DUE |                                                                                                                                                      |
| Jul 29<sup>th</sup> | CLASS 7  
The coupling of hydroclimate variability with human systems | Written critique 5 due  
Buckley et al. (2010) | Pederson et al. (2014)  
deMenocal (2011)  
Cook et al. (2010)  
Gemenne et al. (2011) |
| Jul 31<sup>th</sup> | CLASS 8  
Global Climate Models | Written critique 6 due  
Sedláček & Knutti (2014) | Bates et al. (2008)- Chapter 4&5  
Hawkins (2011)  
Taylor et al. (2012)  
Cook et al. (2015) |
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<th>Date</th>
<th>LECTURE/EVENTS</th>
<th>ASSIGNMENTS</th>
<th>ADDITIONAL MATERIAL</th>
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<tr>
<td>Aug 5th</td>
<td><strong>CLASS 9</strong></td>
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<td><strong>WORKSHOP:</strong> Tools for Analyses</td>
<td>Greene et al. (2011)</td>
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<td></td>
<td>I. IRI Timescales decomposition tool</td>
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<td>II. Climate Explorer Good practices of scientific research and reporting</td>
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<td>Aug 7th</td>
<td><strong>CLASS 10</strong></td>
<td><strong>STUDY!</strong></td>
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<td>Aug 12th</td>
<td><strong>CLASS 11</strong></td>
<td><strong>Written critique 7 due</strong></td>
<td>Moss et al. (2017) Khoo (2009)</td>
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<td>Aug 13th</td>
<td><strong>FINAL PROJECT</strong></td>
<td><strong>DUE</strong></td>
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<td>Aug 14th</td>
<td><strong>CLASS 12</strong></td>
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<td></td>
<td><strong>FINAL PROJECT PRESENTATIONS</strong></td>
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Trenberth, Kevin E. "Has there been a hiatus?." *Science* 349.6249 (2015): 691-692.


APPENDIX A

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/locations/undergraduate/citationguide.html

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

You can find reference and citation management tools at:

http://library.columbia.edu/research/citation-management.html
http://www.chicagomanualofstyle.org/tools_citationguide.html

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