SUMA K4147: Water Resources and Climate
Summer 2021

COURSE SYLLABUS

Scheduled class times:

Tuesday & Thursdays, 6:10-8:00 pm

Office hours:

Tuesday & Thursdays, 5:30-6:10 pm on Zoom

Professors' contact information:

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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 the geosciences and bolstered by a surge in environmental disasters across the world.

Water resources availability and quality depend on the interaction among the hydrologic cycle, the climate system, the land-surface, and society. With a world where 9 billion or more people will live in 2050, and a future where an increasingly variable and extreme climate system prevails, an understanding of the linkages between climate and water is key for sustainable management of water resources

The distribution of global water resources are exacerbated by both climate change and socio-economic inequity issues. Some countries are and will be more affected than others unless appropriate strategy and technology resources aren't available to cope with newer scenarios. Our course will provide a fantastic context to think about how environmental changes connect

to both natural and anthropogenic factors including Diversity, Equity and Inclusion (DEI) both local and globally.

Relying on peer-reviewed evidence in the classroom and a hands-on-training workshop, this course covers: (1) the science needed to understand the interactions between water resources and climate systems; (2) analysis of water-climate data on online web tools to teach students making data-driven decisions; (3) how to read scientific papers and write critical reviews and opinions on state-of-the-art science (4) synergies with class peers and instructors through exciting discussions about ongoing societal issues around the world related to water. Finally, using such versatile knowledge and new skills acquired during the course, students will identify a real issue in relation to water and climate as a case study of their own choice and will propose solutions that she/he most cares about.

The interactions between water and climate plays an integral role on the coupling between natural and human systems, and thus the resourceful scientific and hands-on-training experience gained in this course will be a valuable asset to other courses and the Sustainability Management Program overall.

Specific Learning Objectives:

1. Understand science relevant to water resources and its connection to climate.
2. Understand how variability and changes in the climate affect/will affect water supply and availability on the land.
3. Understand how water impacts ecosystems and society at large.
4. Learn how to critically evaluate a scientific article and write a review / opinion.
5. Learn how to use online web tools to analyze water-climate data.
6. Diagnose a water resources problem, its connections to climate system 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 standard, and may be supplemented with on-going 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 the 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 publish news based on peer-reviewed articles, as such, can be a good source of information that directs students to the 'real' source of scientific information. Likewise, "Live Science" or AGU-Eos can be good sources of scientific information too. Search

for Information on DEI issues associated to water and climate topics will be encouraged and integrated in class discussions.

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 emails on daily basis during weekdays to stay up-to-date 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 the class. The final grade will be calculated as follows:

- 0% - Attendance
- 40% - Written critiques
- 10% - Participation
- 20% - Exam
- 30% - Final Project (15% written paper + 15% presentation)

Final grade letter equivalent

A+	**100% to 98%**	**C+**	**< 80% to 77%**
A	**< 98% to 93%**	**C**	**< 77% to 73%**
A-	**< 93% to 90%**	**C-**	**< 73% to 70%**
B+	**< 90% to 87%**	**D**	**< 70% to 60%**
B	**< 87% to 83%**	**F**	**< 60% to 0%**
B-	**< 83% to 80%**		

Most classes will be divided into 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 *(0% of final grade)*
Students are suggested to arrive on time, attend all classes, and to stay until the end of class unless they have notified the instructor otherwise. Attendance for in-class training sessions is the most effective way to take a full advantage of the learning/training in this course. Lectures are recorded but breakout sessions involving class discussions are impossible to record.

Written critiques *(40% 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 **3PM** on the day of class.

The grades of the 7 written critiques will make up 40% 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 be a copy and paste of 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 student's own 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 ***3PM 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 points deduction
- 6:01 PM to Midnight on day of class – 10 points deduction
- Day after class – 15 points 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 10% of the final grade, based on the student's in-class participation, online CANVAS weekly discussions (Discussion Forum), and engagement on the final presentation day with peers regarding the content presented and connections with previous course learnings. 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.

Discussion Forum

Throughout the semester, students are encouraged to post news or information of interest on the CANVAS discussion forum. Thoughtful thinking connecting to the topics learned in class to real world problems are very much welcome, as well as connection with DEI issues.

Exam *(20% of final grade)*

There will be one two-hour quiz 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 and multiple-choice 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 **Friday July 19th** 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 topic with societal good as focus.

The **written paper** will be due on **Wednesday August 4th.** 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 self-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 **Thursday August 5th**. 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. 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 responsible for completing assigned readings and homework. Late assignments will be marked down unless an extension was granted.

COURSE SCHEDULE

	LECTURE/EVENTS	MAIN READING	ADDITIONAL MATERIAL
June 29th	**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
July 1st	**CLASS 2** **Connections between climate and water**	***Reading :*** Oki & Kanae (2006) & Zhang & Wei (2021)	Bates et al. (2008)- Chapter 1 De Loë & Kreutzwiser (2000)
July 6th	**CLASS 3** **The impact of climate change on the water cycle**	***Written critique 1 due:*** Trenberth (2011) **Students get full grade in this first exercise, and instructor feedback for the preparing better following critiques*	Held and Soden (2006) Hegerl et al. (2015) Bates et al. (2008)- Chapter 2&3
July 8th	**CLASS 4** **Climate modes: variability and change**	***Written critique 2 due:*** Fyfe et al. (2016)	Trenberth (2015) Folland & Karl (2002)
July 13st	**CLASS 5** **The role of ecosystems to changes in the hydrological cycle**	***Written critique 3 due:*** Allen & Breshears (1998)	Williams et al. (2010) Aragão (2012) Bonan (2008)
July 15th	**CLASS 6** **Paleo-perspectives on hydroclimate variability**	***Written critique 4 due:*** Cook et al. (2010)	Cobb et al. (2003)
July 19th	**FINAL PROJECT PROPOSAL DUE**		

July 20th	**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 22th	**CLASS 8** **Climate Change Projections (Global Climate Models)**	**Written *critique 6 due:*** Sedlácek & Knutti (2014)	Bates et al. (2008)- Chapter 4&5 Hawkins (2011) Taylor et al. (2012) Cook et al. (2015)
July 27th	**CLASS 9** **Workshop** **Tools for Analyses** I. IRI Timescales decomposition tool II. Climate Explorer	***Reading for workshop*** Greene et al. (2011)	
Jul 29th	**Class 10** **EXAM**	**STUDY!**	
Aug 3th	**CLASS 11** **Water management approaches to climate variability and change**	**Written *critique 7 due:*** Dinku et al. (2014)	Goddard et al. (2014) Moss et al. (2017) Khoo (2009) Thomson et al. (2011) Sweeney et al. (2014) Schwarz et al. (2011)
Aug 4th		**FINAL PROJECT DUE**	
Aug 5th	**CLASS 12** **FINAL PROJECT PRESENTATIONS**		

READING MATERIAL REFERENCES

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Aragão, Luiz EOC. "Environmental science: The rainforest's water pump." *Nature* 489.7415 (2012): 217-218.

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Hegerl, Gabriele C., et al. "Challenges in quantifying changes in the global water cycle." *Bulletin of the American Meteorological Society* 96.7 (2015): 1097-1115.

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Moss, R. H., et al. Hell and High Water: Practice-Relevant Adaptation Science. Science 342 (6159), 696-698.(2017)

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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
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