University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Global Climate Change

3 credits

MEES ***
Semester?

Course Objectives / Overview

Course Objectives: The specific objectives of the course are to provide the student with:

1. Basic understanding of the underlying physics behind global and regional climate.
2. Knowledge of proxy data approaches and resources that can be used for assessing past climates, with particular focus on climate variations.
3. Integrated and up to date knowledge of the scientific basis for understanding major drivers and components of the Earth's climate system.
4. Information on how natural events/phenomena and anthropogenic activities can influence regional and global climate.
5. A synthetic view of climate change predictions for the coming century with particular focus on the assumptions and uncertainties inherent in climate modeling and future emissions scenarios as developed by the Intergovernmental Panel on Climate Change (IPCC).

Expected Learning Outcomes

Learning Outcomes:

1. Students will be able to articulate examples of current and proxy climate data that can be used to differentiate between anthropogenic and natural climatic change.
2. Students will be able to describe principal threats and consequences of climate changes in different global ecosystems, including coral reefs, mangroves, and seagrasses; polar regions, desertification, intensification of fires and other ecosystem responses.
3. Students will be able to describe principal drivers of climate changes including the specifics of trace gas concentrations, changes over time, recent trends and potential mitigation pathways.
4. Students will be able to describe specific abrupt past changes in climate and their consequences (e.g. extinctions, ocean circulation changes).
5. Students will be able summarize the assumptions and performance of various climate modeling approaches.

INSTRUCTOR DETAILS:

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Hali Kilbourne
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CLASS MEETING DETAILS:

Dates: Tuesday/Thursday
Times: TBD
Originating Site:
IVN bridge number:
(*******)
Phone call in number:
(***)
Room phone number:
(*****)

CURRICULUM FULLFILMENT:

MEES *** fulfills a *** (PD, ISG, etc) MEES requirement. OR elective etc

Prerequisites
N/A

Teaching Assistant
TBD or N/A

Course Assessment / Grading

Course Grade: Participation in class discussions (and/or quizzes) (40%), Problem sets/assignments (30%), Course paper/project (30%).

Class discussions will be integral to the course. While there will be lecture materials, students are expected to interact with the instructor and each other in moderated discussion of each day's materials. Students will present papers to the class and are expected to contribute at least one question for class discussion each week.

Assignments, problem sets or quizzes will be given for the different sections of the course to verify understanding of important concepts and definitions. Since the course is designed to provide a synthetic understanding of the Earth's climate, it is critical that concepts of each section are understood.

Tentative Weekly Course Schedule

Course Grade: Participation in class discussions (and/or quizzes) (40%), Problem sets/assignments (30%), Course paper/project (30%).

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Assignments, problem sets or quizzes will be given for the different sections of the course to verify understanding of important concepts and definitions. Since the course is designed to provide a synthetic understanding of the Earth's climate, it is critical that concepts of each section are understood.

Course paper/project: The paper or project is a flexible assignment that must be approved by the instructors. The purpose is to provide the student with vehicle for applying the course materials to their own research or to a topic, ecosystem or region of interest. A literature review can be used for this but the student is expected to explore the concepts from the course and synthesize materials. The project may also be related to data analysis or similar work if pertinent to the course.

Lecture	Date	Lecture Topic	**Instructor**	**Required** Discussion Readings
1	1/28/20	Course Introduction/Energy Balance and the Greenhouse Effect	All/Cochrane	
2	1/30/20	A short history of global climate change	Cochrane	Arrhenius (1896) Sawyer (1972) Broecker (1975)
3	2/4/20	Radiation – principles, propagation, solar luminosity	Cochrane/ Kilbourne	Rind (2002) Zachos et al. (2001) Hansen et al. (2005) **ASSIGNMENT #1 DUE**
4	2/6/20	Radiation – solar cycles and Earth cycles	Cochrane/ Kilbourne	Hays et al. (1976) Hansen (2005)
5	2/11/20	Albedo – Land, Sea, Clouds and the Cryosphere	Cochrane/ Kilbourne	Hansen et al. (1992) *Kerr (2009) *Clement et al. (2009)
6	2/13/20	Atmospheric circulation	Cochrane	Seidel et al. (2008) Stephens (2011) Dessler (2010)
7	2/18/20	Ocean circulation	Grebmeier / Cooper	Toggweiler & Russell (2008) Trenberth & Fasullo (2013) Alley & Agustsdottit (2005)
8	2/20/20	Paleoclimates – Temperature/climate proxies	Kilbourne / Cooper	Jones et al. (2001) Huber (2008) *Noone (2009) *Sime et al. (2009)
9	2/25/20	Paleoclimates – Plate tectonics, volcanoes/ atmospheric changes	Kilbourne / Cochrane	Sagan & Mullen (1972) deMenocal (2001) Marcott et al. (2013)
10	2/27/20	Greenhouse gases (sources, sinks and effects)	Cochrane	Jackson et al. (2016) Le Quere et al. (2009) Murphy et al. (2009)
11	3/3/20	Sea level changes	Kilbourne	Kopp et al. (2009)

				DeConto and Polard (2016)
12	3/5/20	Ice ages, glaciers, cryosphere; sea ice and ice sheet balance	Cooper	Rignot et al. (2014) Khan et al. (2014)
13	3/10/20	Life, Ecosystems and Climate	Cochrane	Davis & Shaw (2001) Peterson (2003)
14	3/12/20	Ocean Acidification: The other CO_2 problem	Cooper	Hall-Spencer et al. (2008) Six et al. (2013) Khatiwala et al. (2009) **ASSIGNMENT #2 DUE**
*****	**3/17/20**	***Spring Break***	**********	**********
*****	**3/19/20**	***Spring Break***	**********	**********
15	3/24/20	Methods - Measuring Climate 1	Cochrane/ Kilbourne	Stott et al. (2004) Huber (2009)
16	3/26/20	Methods - Measuring Climate 2	Cochrane	Kaufman et al. (2009) Zachos et al. (2008)
17	3/31/20	Climate Modeling 1	Cochrane/ Kilbourne	Crowley (2000) Cox et al. (2000)
18	4/2/20	Climate Modeling 2	Cochrane/ Kilbourne	Sokolov et al. (2009) Cochrane and Barber (2009) Cox et al. (2013)
19	4/7/20	Climate variability and thresholds (Climate dynamics?)	Kilbourne / Cochrane	*Salinger (2005a) *Salinger (2005b) Lenton et al. (2008) **ASSIGNMENT #3 DUE**
20	4/9/20	Future Climates – Probabilities of change, Novel/disappearing climates	Cochrane	Mora et al. (2013) Walker (2007) Alley et al. (2003)
21	4/14/20	Future climates- global, regional and local changes	Cochrane	Dai (2013) Cook et al. (2009) Diffenbaugh et al. (2013)
22	4/16/20	Consequences – Biological impacts of climate change – Lower trophics/high latitudes	Grebmeier	TBA
23	4/21/20	Consequences – Biological impacts of climate change – Upper trophics/high latitudes	Grebmeier	TBA
24	4/23/20	Consequences of climate change – Hydrology and Hurricanes	Cochrane	Emanuel (2005) Barnett et al. (2008) Williams et al. (2015) **ASSIGNMENT #4 DUE**
25	4/28/20	Consequences – Coral, seagrasses, mangroves and other tropical marine ecosystems	Kilbourne	TBA

26	4/30/20	Consequences – Agriculture and Society	TBA	Sterman & Sweeney (2007) Zhang et al. (2011) Motha & Baier (2005) Pacala and Socolow (2004)
27	5/5/20	Consequences – Climate change and global wildfire	Cochrane	
28	5/7/20	Geoengineering	Cochrane	Ruddiman (2003) Reichstein et al. (2013) Hansen et al. (2012)
29	5/12/20	Current Events/Course Wrap Up	All	Thomas et al. (2004) Cullingham et al. (2011) Jolly et al. (2015) **COURSE PAPER/PROJECT DUE**

***** indicates related readings

Required textbooks, reading and/or software or computer needs

No Text Book is required. Readings will be provided.

Optional Texts: (a) **Climate Change 2013: The Physical Science Basis** by IPCC. 2013. Cambridge University Press. *This is the source for the latest synthesis on climate change and it is currently driving global policy. Note, you can access this for free in pdf form at http://climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf*
(d) **The Rough Guide to Climate Change** by Robert Henson. 2011. Rough Guides Ltd. *This is a breezier overview but gives broad coverage of climate change issues.*
(e) **What We Know About Climate Change** by Kerry Emanuel. 2007. MIT Press. *This is the shortest book of any worth you are likely to find on climate change! It's not comprehensive but it still manages to be useful, informative and readable.*
(f) **The Discovery of Global Warming** by Spencer R. Weart. 2008. Harvard University Press. *If you want to know the history of the whole climate change debate then this is the book you want. It is relatively light on the science but it does give you a good idea of who did what, when and why. The book is supplemented with material at the author's website https://history.aip.org/climate/index.htm*

Course Communication

Students should contact Instructors by email. Course announcements will be made via MOODLE and/or email. Discussion papers and other course materials will be available via Google Drive.

Resources

[Course website: www.moodle.com/xxxxx]

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved of various academic and research-related policies by which all students and faculty must abide.

Please visit http://www.umces.edu/consolidated-usm-and-umces-policies-and-procedures for a full list of campus-wide academic policies.

Course-Specific Policies and Expectations

Class discussions will be integral to the course. While there will be lecture materials, students are expected to interact with the instructor and each other in moderated discussion of each day's materials. Students will present papers to the class and are expected to contribute at least one question for class discussion each week.

Late work may be accepted for extenuating circumstances at the discretion of the instructors.