

## **Topics in Climate Dynamics**

**1-credit**

**Monday 3-4 pm**

**MPO conference room**

**Professor Amy Clement**

### **Course Description/Goal:**

The field of climate dynamics is rapidly evolving. There are a number of issues that are being hotly debated within the scientific community, as well as in public arenas, but which are not covered in textbooks or traditional climate dynamics courses. The goal of this 'Topics in Climate Dynamics' course is to expose students to emerging topics in the literature, and to have them critically evaluate journal articles to identify advances as well as the questions that remain open.

### **Course Design:**

Student participation will be central to this course. Each week, a student will present the topic of the week, which will be covered in 1-3 journal articles, and the student will be asked to respond to discussion questions that will be addressed in the readings (formulated by the professor). Each student is expected to present once during the semester. In addition, the student presenter will moderate the class blog (on blackboard) for that week, in which students will post comments and questions about the week's readings. All students are expected to read all papers covered in the course.

### **Grading:**

Presentations 80%

Blogs 20%

### **Topics:**

#### **Weeks**

Week 1: Course Introduction

Week 2-5: Pacific Climate Variability and Change

Week 6-11: Anthropogenic climate change

Week 12-13: Climate Policy

Week 14: Course wrap up

### **Presentation assignment:**

- WHY are we reading this paper? What is the issue that this is addressing? Additional background material
- Most important figure in the paper?
- 3 most important conclusions of the paper
- 3 biggest caveats/limitations of the paper

### **Blog assignment:**

- Develop discussion questions for class
- Manage weekly blog

| Date                                | Papers   | Presenter                     |
|-------------------------------------|--|-------------------------------|
| Jan 14                              | <b>Course intro</b>  | Amy                           |
| Jan 21-<br>MLK<br>day – no<br>class | xxxxxxxxxxxxxxxxxxxx   |                               |
| Jan 28                              | <p><b><u>Anthropogenic climate change in the Pacific: The basics</u></b></p> <p>Vecchi and Soden (2007)<br/> <a href="http://journals.ametsoc.org/doi/pdf/10.1175/jcli4258.1">http://journals.ametsoc.org/doi/pdf/10.1175/jcli4258.1</a></p> <p>Luo et al. (2012)<br/> <a href="http://www.pnas.org/content/early/2012/10/25/1210239109.full.pdf">http://www.pnas.org/content/early/2012/10/25/1210239109.full.pdf</a></p>                               | I-kuan                        |
| Feb 4                               | <p><b><u>Pacific Decadal Variability: Physical changes and ecosystem impacts</u></b></p> <p>DiLorenzo et al. (2008)<br/> <a href="http://imanu.org/papers/PDFs/DiLorenzo_GRL_2008.pdf">http://imanu.org/papers/PDFs/DiLorenzo_GRL_2008.pdf</a></p> <p>Deser et al. (2004)<br/> <a href="http://www.cgd.ucar.edu/cas/cdeser/Docs/deser.pacificdecclimvar.jclim04.pdf">http://www.cgd.ucar.edu/cas/cdeser/Docs/deser.pacificdecclimvar.jclim04.pdf</a></p> | Stacy                         |
| Feb 11                              | <p><b><u>Flavors of ENSO</u></b></p> <p>Takahasi et al. (2011)<br/> <a href="http://onlinelibrary.wiley.com/doi/10.1029/2011GL047364/abstract">http://onlinelibrary.wiley.com/doi/10.1029/2011GL047364/abstract</a></p> <p>Yeh et al. (2009)<br/> <a href="http://www.nature.com/nature/journal/v461/n7263/full/nature08316.html">http://www.nature.com/nature/journal/v461/n7263/full/nature08316.html</a></p> <p>Impacts of ENSO</p>                   | Johnnas (with Ben overseeing) |
| Feb 18                              | <p><b><u>Paleo-Pacific: Can we use the past to constrain models?</u></b></p> <p>Cobb et al. (2013)<br/> <a href="http://www.sciencemag.org/content/339/6115/67">http://www.sciencemag.org/content/339/6115/67</a></p> <p>DiNezio et al. (2011)<br/> <a href="http://www.aoml.noaa.gov/phod/people/dinezio/papers/DiNezio_et_al_LGM_Walker.pdf">http://www.aoml.noaa.gov/phod/people/dinezio/papers/DiNezio_et_al_LGM_Walker.pdf</a></p>                  | Kim                           |

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|---------------------------|---|-------------|
| Feb 25                    | <p><b><u>Teleconnections: A classic</u></b></p> <p>Wallace and Gutzler (1981) Teleconnections in the Geopotential Height Field during Northern Hemisphere Winter</p> <p><a href="http://onlinelibrary.wiley.com/store/10.1002/qj.49710142802/asset/49710142802ftp.pdf;jsessionid=EAA20BC9632334EB6D663F2B4A69889D.d04t02?v=1&amp;t=hcjbsq6z&amp;s=7c9448fbbc b13eee34f5eccb77cb2e6f61925721">http://onlinelibrary.wiley.com/store/10.1002/qj.49710142802/asset/49710142802ftp.pdf;jsessionid=EAA20BC9632334EB6D663F2B4A69889D.d04t02?v=1&amp;t=hcjbsq6z&amp;s=7c9448fbbc b13eee34f5eccb77cb2e6f61925721</a></p> | Xue         |
| Mar 4                     | <p><b><u>Climate sensitivity: Unraveling the influences of aerosols and greenhouse gases and internal variability for the next few decades</u></b></p> <p>Booth et al. (2012)</p> <p><a href="http://www.nature.com/nature/journal/v484/n7393/full/nature10946.html">http://www.nature.com/nature/journal/v484/n7393/full/nature10946.html</a></p> <p>(this one is also interesting, but not required:<br/>Deser et al. (2012)</p> <p><a href="http://www.cgd.ucar.edu/cas/cdeser/Docs/deser.internal_variab.climdyn10.pdf">http://www.cgd.ucar.edu/cas/cdeser/Docs/deser.internal_variab.climdyn10.pdf</a></p> | Roque       |
| Mar 11<br>SPRING<br>BREAK | XXXXXXXXXXXXXXXXXXXX  |             |
| Mar 18                    | <p><b><u>Sea ice and climate change</u></b></p> <p>Bitz, C. M. and G. H. Roe, 2004: A Mechanism for the High Rate of Sea-Ice Thinning in the Arctic Ocean, J. Climate, 17, 3622–3</p> <p><a href="http://www.atmos.washington.edu/~bitz/Bitz_and_Roe_2004.pdf">http://www.atmos.washington.edu/~bitz/Bitz_and_Roe_2004.pdf</a></p>  | Amanda      |
| Mar 25                    | <p><b><u>Hanh Nguyen</u></b></p> <p>“Variability of the Hadley Circulation”<br/>(see Blackboard Course Documents)</p>   | Amy/Honghai |
| Apr 1                     | <p><b><u>Southern hemisphere trends: An important benchmark paper</u></b></p> <p>Thompson and Solomon (Science, 2002): Interpretation of Recent Southern Hemisphere Climate Change</p> <p><a href="https://www.sciencemag.org/content/296/5569/895.full">https://www.sciencemag.org/content/296/5569/895.full</a></p>   | Yu          |
| Apr 8                     | <p><b><u>Climate Policy</u></b></p> <p><a href="http://www.nationaljournal.com/member/magazine/the-scary-truth-about-how-much-climate-change-is-costing-">http://www.nationaljournal.com/member/magazine/the-scary-truth-about-how-much-climate-change-is-costing-</a></p>  | Angela      |

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|--------|--|-------|
|        | <a href="http://cognoscenti.wbur.org/2013/01/23/climate-politics-moomaw-hamel">you-20130207</a><br><a href="http://cognoscenti.wbur.org/2013/01/23/climate-politics-moomaw-hamel">http://cognoscenti.wbur.org/2013/01/23/climate-politics-moomaw-hamel</a>   |       |
| Apr 15 | <b>ENSO impacts/applications</b><br>Anyamba et al. (2009):<br><a href="http://www.pnas.org/content/106/3/955.long">http://www.pnas.org/content/106/3/955.long</a><br>Hsiang et al (2011):<br><a href="http://www.nature.com/nature/journal/v476/n7361/full/nature10311.html">http://www.nature.com/nature/journal/v476/n7361/full/nature10311.html</a> | Teddy |
| Apr 22 | <b>Course wrap up</b>  | Amy   |
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Charney (1975)

<http://onlinelibrary.wiley.com/store/10.1002/qj.49710142802/asset/49710142802ftp.pdf;jsessionid=EAA20BC9632334EB6D663F2B4A69889D.d04t02?v=1&t=hcjbsq6z&s=7c9448fbbcb13ee34f5eccb77cb2e6f61925721>

Other papers

- Zhang et al. (2013) <http://journals.ametsoc.org/doi/abs/10.1175/JAS-D-12-0331.1>
- Hwang et al (2013) [http://www.atmos.washington.edu/~dargan/papers/hfk\\_submitted.pdf](http://www.atmos.washington.edu/~dargan/papers/hfk_submitted.pdf)
- Wang et al. (2013) <http://www.pnas.org/content/early/2013/03/15/1219405110.full.pdf>
- Grise et al. (2013) [http://www.atmos.washington.edu/~mzelinka/Grise\\_et\\_al\\_subm.pdf](http://www.atmos.washington.edu/~mzelinka/Grise_et_al_subm.pdf)
- Bollasina et al. (2011) <http://www.sciencemag.org/content/334/6055/502>
- L'Huereux et al. (2013)  
<http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1840.html>
- DiNezio et al. (2013)
- Fasullo and Trenberth (2012): A less cloudy future.... Science.
- Science of Science Communication: <http://www.nasonline.org/programs/sackler-colloquia/upcoming-colloquia/agenda-science-communication.html>
- <http://iprc.soest.hawaii.edu/users/xie/tokenaga-jc12.pdf>
- From katinka:
- (1) Demoto et al. 2013: Mechanism of tropical low--cloud response to surface warming using weather and climate simulations (GRL) (2) Soden et al. 2008: Quantifying Climate Feedbacks Using Radiative Kernels (J. Climate) (3) Stephens et al. 2005: Cloud Feedbacks in the Climate System: A Critical Review (J. Climate) (4) Bony et al. 2006: How Well Do We Understand and Evaluate Climate Change Feedback Processes? (J. Climate) (5) Clement et al. 2011 (6) Yeh and Kirtman 2006 (7) Ogata et al. 2013: Interdecadal Amplitude Modulation of El Nino/Southern Oscillation and its Impacts on Tropical Pacific

Decadal Variability (J. Climate) (8) Alexander 2010: Extratropical Air-Sea Interaction, Sea Surface Temperature Variability, and the Pacific Decadal Oscillation

- Clark et al. (2012), Global climate evolution during the last deglaciation, Proceedings of the National Academy of Sciences of the United States of America, 109(19), E1134-E1142.
- [http://www.atmos.washington.edu/~kelly/pubs/McCusker\\_etal\\_JClim\\_2012.pdf](http://www.atmos.washington.edu/~kelly/pubs/McCusker_etal_JClim_2012.pdf)
- <http://www.metoffice.gov.uk/research/news/recent-pause-in-warming>
- Kang et al. 2013
- Zhang et al. 2013- aerosols and warming
- Evan et al. 2013
- <http://www.nature.com/ngeo/journal/v6/n7/full/ngeo1854.html>

"One of the barriers students face in writing critically is their misunderstanding of exactly what this process entails. For example, if a student thinks a critical analysis of a major theorist in the field, a canonical text, or a widely accepted theorem involves showing how the theorist, author, or proof is wrong, this is an incredibly intimidating prospect. It would take an extremely confident, or extremely foolish, student to produce a demolition of a piece of work that was widely referenced, published in several languages, and generally regarded as authoritative. So one of the first things teachers have to do is wrestle learners away from the mistaken notion that criticism is inherently negative.... For many of us the word critical carries negative connotations. Being critical is equated with cynical pessimism, with taking great pleasure in knocking down what other people have created; in short, with attacking and destroying what we portray as the naive and shortsighted efforts of others. It is important to say from the outset, then, that critical reading is a process of appraisal, involving the recognition of positive as well as negative elements. "

"Critical reading, like critical thinking, is often thought of as a purely intellectual process in which rationality is valued above all else. ... However, critical reading as it is outlined here recognizes that thought and reasoning is infused with emotional currents and responses. Indeed, the feeling of connectedness to an idea, theory, or area of study that is so necessary to intellectual work is itself emotional."

"So in critical reading we pay attention to our emotions, as well as our intellect. In particular, we investigate our emotional responses to the material we encounter. We can try to understand why it is that we become enthused or appalled, perplexed or engaged, by a <paper>. As we read work that challenges some of our most deeply held assumptions, we are likely to experience strong feelings of anger and resentment against the writer or her ideas, feelings that are grounded in the sense of threat that this work holds for us. It is important that we know this in advance of our reading and try to understand that our emotional reactions are the inevitable accompaniment of undertaking any kind of intellectual inquiry that is really challenging."

"Critical reading can increase our sense of connectedness to a text by increasing our ability to give an informed rationale as to why we hold the convictions and beliefs we do. When we give a piece of literature a careful critical appraisal we have a sense of its strengths and weaknesses. The intellectual convictions we derive from this appraisal are informed by this same even-handed sense of what is strongest and weakest about our convictions and about why, on balance, we hold these even as we recognize their shortcomings. The point at which the best critical readers operate is the point of informed commitment, ...which means being able to give a rationale and to cite evidence for our ideas while always being open to reexamining and rethinking these in the light of further experience."

From Teaching for Critical Thinking: Tools and Techniques to Help Students Question Their Assumptions, by Stephen D. Brookfield