

GEOG 3312b HUMAN IMPACTS ON WEATHER AND CLIMATE

Course Instructor

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Office hours: Wednesdays 1:30-3 pm or by appointment (made in advance via email)

Lectures: Mon 2:30 – 3:20 SSC 3018, Wed 3:30 – 5:20 SSC 3018

Tutorial: Tues 2:30 – 3:20 WL 257.

Objectives

This course examines intentionally and unintentionally modified weather and climates due to anthropogenic activities on scales ranging from local modification of microclimates in urban areas to global climate change due to changes in atmospheric composition. The processes underlying the changes are examined as well as the methods of detecting the changes. Surface modifications and alterations of the surface-atmosphere exchange processes will be discussed using the framework of surface radiation and energy balances. The course also explores how individuals, communities, businesses and governments may choose to respond to issues surrounding weather modification and climate change. The course is largely non-quantitative in its approach.

Course Prerequisites

One of Geography 2310A/B, 2320A/B or 2330A/B, or at least 3rd year standing in an Environmental Science or Earth Sciences program or Physics 2070A/B or permission of the instructor.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Format

There are three scheduled lecture hours and one tutorial hour per week. We will use the tutorial hours on an 'as needed' basis.

Evaluation

There will be four marked assignments and a final exam

Assignments	65%
Final Exam	30%
Participation	5%

Marks as posted by the course instructor are considered provisional until approved by the Department Chair. Final marks are received from the Registrar; errors may be corrected through use of a Marks Revision Form.

Penalties

Assignments handed in late without prior notification (1 week required) will have marks deducted, except for medical or other extraordinary circumstances, at the rate of 10% per day (including weekend days). For any marked component of 10% or less, contact the instructor for approval, otherwise official documentation is required. See the Policy on Accommodation for Medical Illness: <https://studentservices.uwo.ca/secure/index.cfm>.

Course Text

There is no required text. Students who have taken or expect to take Geog 3311 should have (or purchase) *Boundary Layer Climates*. Select texts are on reserve at Weldon Library and readings from these and materials supplied via OWL are an important component of the course. For a very short (and inexpensive) introduction to global scale climate change, students may wish to purchase:

Maslin, M. 2009. *Global Warming: A Very Short Introduction*. 2nd Edition. Oxford ; New York : Oxford University Press.

Note that everyone has access to the IPCC series of reports from

http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

Course Reserve Texts

The following texts are on reserve (one-day loan period) in the Weldon Library. Many other texts are available in the Library.

Bailey, W.G, T.R. Oke, and W.R. Rouse 1997. *The Surface Climates of Canada*. McGill-Queen's University Press, Montreal.

Brown, R.D. and Gillespie, T.J. 1995. *Microclimatic Landscape Design*. J. Wiley & Sons, New York .

Hewitt, C.N. and A.V. Jackson 2009. *Atmospheric Science for Environmental Scientists*. Wiley-Blackwell, Chichester, UK ; Hoboken, NJ.

Houghton, J.T. 2009. *Global Warming: The Complete Briefing*. Cambridge, New York, Cambridge University Press. (this text can also be accessed via the web using the library web site)

Oke, T.R. 1987. *Boundary Layer Climates*, Routledge, London.

Other Texts

There are MANY texts that cover global scale climate change and related aspects. Here I list a few that provide suitable introductory coverage and focus on the science (rather than policy or impact aspects).

Archer, D. 2012. *Global Warming: Understanding the Forecast*, 2nd Edition. John Wiley and Sons, Hoboken NJ.

Archer, D. & Rahmstorf, S. 2010. *The Climate Crisis: An Introductory Guide to Climate Change*. Cambridge University Press, Cambridge, UK ; New York .

Burroughs, W.J. 2007. *Climate Change: A Multidisciplinary Approach* 2nd ed. Cambridge University Press.

Dessler, A.E. 2012. *Introduction to Modern Climate Change*, Cambridge University Press, 2012.

O'Hare, G., J. Sweeney, R. Wilby 2005. *Weather, Climate and Climate Change: Human Perspectives*. Pearson Education Ltd, Essex.

Ruddiman, W.F. 2008. *Earth's Climate Past and Future* 2nd Edition. W.H. Freeman and Co., New York.

Environment Canada 2008. Frequently asked questions about the science of climate change: 2008 Update. Authors: H. Hengeveld & E. Bush, with P. Edwards and J. Lacroix. Minister of Public Works and Government Services Canada Catalogue No. En56-219/2008E
<http://www.ec.gc.ca/scitech/default.asp?lang=En&n=2A953C90-1>

Hengeveld, H., Whitewood, B., Fergusson, A. 2005. An Introduction to Climate Change: A Canadian Perspective. Environment Canada.
<http://site.ebrary.com.proxy1.lib.uwo.ca:2048/lib/uwo/docDetail.action?docID=10111701>

Weekly Science Journals

The most recent developments in climate change are often announced in the journals *Nature*, and *Science*. These are available in the Taylor Library, and also via the Internet. Consult library staff for more information.

Nature, Macmillan Publishers. Q1.N2 Taylor Library. There are also related journals *Nature Geoscience* and *Nature Climate Change*

Science, The American Association for the Advancement of Science. Q1.S35 Taylor Library

Internet Resources

In addition to online journals, many scientific and other institutions maintain web sites with information of use to this course. ***Be aware of the non-peer reviewed content on these sites, and use with care. If you choose to use material obtained from the internet in assignments, they must be properly referenced, and should be used in addition to other published, peer-reviewed sources!***

Course Web Site

Web-based course materials are available from OWL (Sakai). Use <http://owl.uwo.ca> and then log in using your uwo username and password. The course site will contain the most recent versions of the course outline, assignments, select readings and other relevant course information.

Statement on Use of Electronic Devices

No calculators will be required or permitted in the exams. Students who require electronic assistance with language translation must obtain prior approval from the instructor.

Plagiarism

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Mental Health

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit the site below for more information on mental health resources:

<http://www.uwo.ca/uwo.com/mentalhealth/>.

Western's commitment to accessibility

The University of Western Ontario is committed to achieving barrier free accessibility for persons studying, visiting and working at Western.

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Support Services

Registrarial Services: <http://www3.registrar.uwo.ca/index.cfm>

Student Development Services: <http://www.sdc.uwo.ca/>

Details on the Assignments

1. Read and write a review of an article on urban-scale human impacts on weather and climate. (15%)
The article chosen must be confirmed with the instructor in advance. The intent of this exercise is to: a) gain experience in reading and analyzing scientific journal articles, and b) broaden your exposure to urban-scale impacts on weather and climate.
2. Urban Heat Island Traverse and Analysis (5%+25%)
Students will participate in groups to undertake an urban heat island traverse that measures air temperature along a transect in the City of London. The work will be done in two phases: data collection and basic analysis (5%), followed by a more detailed analysis using the full set of data collected by all groups (20%). In the first portion of the work, you will submit one set of data with your group. The second portion will involve individual analysis. More details will be provided in the tutorials.
3. Read and present to your peers a review of an article on an aspect of global climate change in one of the 3 following categories along with a short written synopsis (20%):
 - a. global climate change and cities
 - b. defining dangerous anthropogenic climate change
 - c. “geoengineering” of the climate system

This exercise will introduce you to scientific journal articles related to large scale climate change, provide some experience in short presentations in a conference-style format (i.e. a short set of visuals – powerpoint or pdf accompanied by your explanation), and the third is for the class as a group to gain exposure to a wider array of articles than we could all individually read.

Additional details on assignments will be provided during the course.

Course Schedule

How to read the table: Lecture topics are listed by date and should be considered approximate. In some weeks we may use the tutorial slot for a lecture to free up the 2 hour time period on Wednesdays. Associated readings that complement lectures are shown in the right-hand column. Readings from more than one source are shown. For text sources, the intent is to provide a range of possible texts that can provide support for the material, not all text readings are required (and keep in mind that many global climate texts are based off the IPCC reports).

BLC = Boundary Layer Climates, SCC = Surface Climates of Canada.

Week	Date	Lecture Topics	Readings
1	Jan. 7	Introduction. Intentionally and unintentionally modified climates.	
	Jan. 9	Surface Microclimates I: Introduction to surface microclimates. The surface radiation budget.	BLC Chp 1 SCC Chp 2
2	Jan. 14	Surface Microclimates I: Introduction to surface microclimates. The surface energy balance.	BLC Chp 1, 2 and 7 SCC Chp 2
	Jan. 15	Assignment 1 Introduction	
	Jan. 16	Surface Microclimates II: Manipulation of surface radiation balance to effect change in surface climates	
3	Jan. 21	Surface Microclimates II: continued.	
	Jan. 22	UHI Traverse Introduction	
	Jan. 23	Surface Microclimates III: Surface and subsurface modifications for crops. Mulching. Frost protection. Wind breaks.	BLC Chp 7 SCC Chp 13 Brown and Gillespie (1995).
4	Jan. 28	Urban Climates: Concepts and Methods	Lowry (1977), Oke et al. (2011), Stewart & Oke (2012)
	Jan. 30	Urban Climates: The Radiation Budget	SCC Chp 13, Oke (1988), Arnfield (2003)
5	Feb. 4	Urban Climates: Energy Balance Terms	SCC Chp 13, Oke et al. (2011)
	Feb. 6	Urban Climates: Anthropogenic Heat	Sailor (2011)
6	Feb. 11	Urban Climates: Winds	SCC Chp 13
	Feb. 13	Urban Climates: The Urban Heat Island Part I	Oke et al. (2011), Runnalls and Oke (2000).
7	Feb. 18-22	Reading Week	

8	Feb. 25	Urban Climates: The Urban Heat Island Part II	Arnfield (2003) Yow (2007)
	Feb. 26	Traverse Data Due	
	Feb. 27	Urban Effects on Precipitation Urban article review (written portion) due	Shepherd et al. (2010), Lowry (1998).
9	Mar. 4	Global Climate Change I: The Climate System and GHG	IPCC* 1 Houghton Chps 1-3, Maslin Chps 1-2, Ruddiman Part I Dessler, Chp 1, 5;
	Mar. 5		
	Mar. 6	Global Climate Change: Carbon Cycle Global Climate Change: Radiative Forcing	Houghton Chp 2, IPCC 2, Dessler Chp 6 Archer Part I
10	Mar. 11	Global Climate Change: Observations	Houghton Chp 4, Maslin Chp 4 Ruddiman Chp 18, IPCC 3-5, IPCC 9,
	Mar. 13	Global Climate Change: Observations	Dessler Chp 7, Archer Chp 11
11	Mar. 18	Global Climate Change: Modelling Global Climates	Houghton Chp 5, Maslin Chp 5, Ruddiman Chp 19, IPCC 8
	Mar. 20	Global Climate Change: Emissions Scenarios	Dessler Chp 8
12	Mar. 25	Climate Change Projections & Impacts: Global	Houghton Chps 6-7, Maslin Chp 6-7, IPCC 10, Dessler Chp 9, Archer Chp 12
	Mar. 26	Climate Change Projections & Impacts: North America	IPCC 11
	Mar. 27	Presentations: Global Climate Change	
13	Apr. 1	Responding to Global Climate Change on Various Scales: Special Guest Lecture Prof. G. McBean Geography/PoliSci	Houghton Chps 9-10; Maslin Chps 3, 8-10; Climate Change 2007: Synthesis Report
	Apr. 2	Responding to Global Climate Change on Various Scales	
	Apr. 3	Presentations: Global Climate Change	
14	Apr. 8	What is the relationship between urban climates and global climates?	Oke (1997) McCarthy et al. (2010) Rosenfeld et al. (1995), EPA (2009)
	Apr. 9	Heat Island Traverse Analysis Due	
	Apr. 10	Review	

* IPCC here is taken to mean the Fourth Assessment Report (AR4 or FAR) of Working Group I (The Physical Science Basis).