CORS 221 Module 3: Physics of Planetary Climate – Fall 2010

1. PROFESSOR

Jason W. Barnes
Office: Engineering-Physics Building Room 331
Email: jwbarnes@uidaho.edu – Phone: (208) 885-7469
Office hours: Monday, Wednesday, Friday 12:20PM-1:20PM or by appointment

2. CLASS WEBSITE: http://barnesos.net/cors221/
3. COURSE SCHEDULE

Classroom: TLC 223
Tuesday, Thursday 9:30AM - 10:50AM
FINAL EXAM: 7:30AM-9:30AM Monday, December 13 (out of the way early!)

4. TEXTBOOKS

Taylor, Elementary Climate Physics – optional

5. CLASSWORK AND GRADING

Remember that your grade for this third of the course will be averaged with your grade from the thirds taught by Dr. Kline and Dr. Sammaruca. Grades for the course will be individually curved – *i.e.* curved separately for each assignment for the climate portion of the course. The curves will be set by those that turn in each assignment – hence not handing in work will not lower the curve, and will likely be quite detrimental to your final grade. Make sure to get your work done.

5.1. Homework (40%)

There will be 4 weekly class homeworks, due on Tuesdays in the lecture hall at the beginning of class. Homeworks will be accepted up to 1 week late for 50% credit. Homeworks turned in more than one week after the due date will receive only 10% total credit just to indicate that you tried. Homework 1 will be due on 2010 November 9. Homework 2 will be due on 2010 November 16. Homework 3 will be due on 2010 November 30. And Homework 4 will be due 2010 December 7.

5.2. Essay (20%)

A moderate 1.5-4 page (single-spaced) paper will be due at the start of the final exam at 7:30AM on 2010 December 13. The assignment is to read a popular article in a newspaper or magazine about the science of global warming. A movie or TV documentary would also be acceptible (i.e. *An Inconvenient Truth* or similar), *if it is about global warming.* You are to discuss three different points that you think the article that you read addressed well. Describe these points, and why you think that they accurately portray the science involved. Next find at least two different points that you think were either done incorrectly or could have been done better. Discuss why you thought they did not adequately portray the relevant science, and what might be able to be done to improve them. If you think that your article was perfect, with no flaws, or was perfectly bad, with no positive points, then choose another article!

5.3. Exam (40%)

This module of the class has one exam that will be 45 minutes to an hour long. The exam will have a mixture of multiple-choice questions, short answer questions, and one longer essay-type question. It will focus on concepts, though there will be at least one problem that you will need your calculator for. The

exam will be open-note; you are allowed to use any notes that you took over the course of the class, including old homeworks. No computers or cell phones can be used. Printed powerpoints are NOT acceptible – the notes must be in your own handwriting.

Since University regulations prevent me from giving you the exam in the last week of classes, the exam will be given during the usual final exam for the course – 2009 December 13 at 7:30AM. I don't like the early hour any more than you do, but unfortunately I don't have any say in the matter, either!

Note that according to the University of Idaho the following are valid reasons for missing an exam: Patricipating in an approved field trip or other offical UI activity, confined under doctors orders, called to active military duty, granted leave of absence by the academic dean, and if an exam falls on a day objectionable to a student because of religious beliefs.

6. ACADEMIC INTEGRITY

Students are encouraged to work together on homework. However, each student must write up their solutions independently. Copying from someone else's answers is not appropriate, even if you both talked about the answers together. Talk about the problems and their solutions, but be sure to do and submit your own work. Note that I can tell if you just copy down somebody else's sentences; write up your own answer that shows that you understand the problem.

Cheating and/or violations of the University's code for academic dishonesty (see `http://www.webs.uidaho.edu/fsh/2300.html`) will be referred to the appropriate administrative authorities for disciplinary action.

7. DETAILED SCHEDULE

	Physics of Planetary Climate		
introductory material	syllabus	1	syllabus and pictures
		1	scientific method & empiricism
		1	what is climate
light	nature of light	1	electromagnetic radiation
		1	wavelength / EM spectrum
	blackbody radiation	1	blackbody radiation
		1	Wien's law
		1	sigma*T^4
Teq	equilibrium temperature	2	radiative equilibrium
		2	Teq equation
		2	examples
	absorption lines	2	T+R+A=1
		2	absorptions in materials
	greenhouse	2	spectrum of atmosphere
		2	greenhouse effect
		2	leading greenhouse gases
seasons	temperature with latitude	3	poles are cold, equator is warm. why?
		3	warm your hands by the fire
		3	solar incidence angle
		3	calculate Teq as func of solar incidence
	seasons	3	solar incidence changes with season
		3	length of day changes with season
		3	show Teq for distance change
Long Climate history	past climate	4	geology: fossils and strata
		4	oxygen isotopes
		4	tree rings & historical records
	long-term climate	4	history of glacial events
		4	snowball earth
		4	heat transport & jungles at the poles
Medium-term Climate	ice age	5	Ice age for the last 2 Myr
		5	cycle of glacials and interglacials
		5	causes and nature of transitions
Milankovic cycles	orbital changes	5	eccentricity
		5	longitude of periapsis
		5	obliquity -- stabilized by Moon
Sun	faint young Sun paradox	6	fusion & hydrostatic equilibrium
		6	evolution of solar luminosity
	sunspots	6	what is a sunspot
		6	sunspot cycle
		6	sunspot effects on solar luminosity
	solar variability	6	historical
		6	millenia-long -- maunder minimum
Earth climate forcers	clouds' effect	7	cloud heating
		7	cloud cooling
	ocean circulation	7	gulf stream
		7	antarctic current
	continental drift	7	continental configuration effects
Short-term climate	global warming	8	temperature over last 13000 years
		8	temp over last 200 years
	Possible causes	8	Sun
		8	natural forces
		8	greenhouse
	investigation of causes	8	tracking down the logic tree
Consequences	temperatures	9	temperature projections
		9	warming mostly affects LOW temps
		9	warming mostly affects high latitudes
		9	consequences of warming for agriculture
	nonlinear effects	9	gulf stream shutoff?
		9	changing rainfall patterns
		9	paleotempestology (stronger hurricanes?)
	sea level rise	9	distribution of ice on Earth
		9	floating vs. grounded ice
		9	sea level history and future
mitigation	possible remediations	10	do nothing
		10	scale back emissions
		10	carbon sequestration
		10	geoengineering
	consequences of fixes	10	monetary costs
		10	human costs
		10	ecological costs

Fig. 1.—