Land-Climate Interactions
CLIM 614
Spring 2023 Syllabus

Instructor: Paul Dirmeyer pdirmeye@gmu.edu

Course Description: This is an interdisciplinary course providing detailed description of surface energy and water balance over land and radiative and turbulent transfer. Introduces numerical techniques for modeling land surface and applications in weather, climate, and hydrologic forecasting and simulation. Includes hands-on experience with computational land surface modeling, including sensitivity experiments to reinforce theoretical concepts. Exposure to contemporary research through reading and reviewing seminal journal papers. May not be repeated for credit.

Learning Objectives:

- Understanding of surface water and energy balances between land and atmosphere.
- Understanding of the hydrologic, thermal, radiative and dynamical interactions between land and atmosphere.
- Ability to perform rigorous calculations and analysis of data.
- Developing intuition and empirical understanding along with technical expertise.
- Familiarity with the evolution of the field of research and its current state of the art.

Course Delivery: The course will be conducted in class as regular bi-weekly lectures. Students are expected to view the lecture materials in advance of class (they will be posted online as a PDF file at least a day before each lecture) and be prepared to discuss the material during the lecture period.

Textbook: There is no required textbook. The instructor is currently writing a textbook on the subject, and draft material will be given as reading assignments for enrolled students. These supplemental textbooks may be useful:

- Climate Change and Terrestrial Ecosystem Modeling by Gordon Bonan
- Terrestrial Hydrometeorology by Jim Shuttleworth
- Ecological Climatology by Gordon Bonan

Office Hours: There are no fixed office hours – extra meetings can be requested by contacting the instructor.

Assignments: As a graduate course in a research-oriented science, the course is geared toward providing informational instruction as well as scientific research experience. The former is accomplished via in-class discussion. The latter is accomplished through associated computational homework assignments, which are exploratory in nature, and two journal paper presentations. In one presentation, the student takes the role of co-author of a published paper, presenting the work as if at a scientific conference. In the second presentation, the student is in the role of providing a critical peer-review of the scientific paper. There is also a final exam, required because CLIM 614 is a core course in the Climate Dynamics graduate program – the final exam quantifies instructional rubrics for the curriculum.

CLIM 614-002 CRN 20187	**Land/Climate Interactions**	Tue/Thu 10:30PM - 11:45PM Innovation Hall 139

All lecture notes will be available prior to class via Blackboard

Date	Reading	Topic	Assignment	Due
24 Jan	Stephens et al. 2023	Introduction	Homework #0	31 Jan
26 Jan	A1-A2, I1-I2	Scientific Process, Systems as a Concept		
31 Jan	1.2-1.4 1.1.2	Structural Concepts: Models, Scales; Mathematical Concepts: Budgets	Homework #1	7 Feb
2 Feb	1.1.3-1.1.5 2.1	Mathematical Concepts: Conduction, Extinction, Feedback, Sensitivity, Correlation		
7 Feb	D.4, 2.3	Water Balance at the Land Surface		
9 Feb		Water Balance (cont'd)	Homework #2	16 Feb
14 Feb	D.1	Momentum		
16 Feb	II, III, IV, V, VI	Land-Atmosphere Systems		
21 Feb	D.3, 2.2	Energy Balance at the Land Surface	Homework #3	28 Feb
23 Feb		Energy Balance (cont'd);		
28 Feb	E.1-E.3	Carbon Balances		
2 Mar	3.1-3.2	Atmospheric Thermodynamics	Homework #4	12 Mar
7 Mar		Atmospheric Thermodynamics (cont'd)		
9 Mar		Journal Paper Assignments	Paper Review	18-20 Apr
13-19 Mar		Spring Break	Spring Break	
21 Mar	D.2	Radiative Transfer		
23 Mar	4	Radiative Transfer and Vegetation	Homework #5	30 Mar
28 Mar	D.6, 5.1-5.2	Soil Physics		
30 Mar		Soil Physics		
4 Apr		Soil Physics (cont'd)	Homework #6	13 Apr
6 Apr	C.1-C.2	Land-Atmosphere Coupling Metrics		
11 Apr	C.3-C.4	Land-Atmosphere Coupling Metrics (cont'd)	Homework #7	27 Apr
13 Apr	II, III, IV, V, VI	Ecohydrology and the Carbon Story		
18 Apr		Paper Results Presentations I		
20 Apr		Paper Results Presentations II		
25 Apr	C.5	Land-Atmosphere Coupling Metrics (cont'd)		
27 Apr	7.1-7.2	Models of Land Systems		
2 May	VII	Land Variability, Land Use Change		
4 May		Review		
16 May		Final Exam		10:30-1:10

Grading:		
	Homework	40% (8 assignments, 5% each)
	Reading Feedback	20%
	Paper Presentations	20% (10% talk, 10% review)
	Final Exam	20%

with Dr. Blyth
Student presentations in class
No class
Exam day

Grading: The standard graduate grading scale is used. Final grades may be uniformly "curved" for all students at the instructor's discretion.

Students with Disabilities: *If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474, http://ods.gmu.edu. All academic accommodations must be arranged through the ODS.*

GMU Email: All George Mason students are issued an e-mail account. *Students must use their university-provided email account to receive important University information, including messages related to this class.*

Honor Code: *Mason is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process.* The Biology Department strongly enforces the GMU Honor Code. Students are expected to read and adhere to the George Mason University Honor Code. **Ignorance of the Honor Code is no excuse for infractions thereof.** *The principle of academic integrity is taken very seriously, and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification.*

Online Behavior: Circumstances currently dictate that much instruction at GMU is being conducted online. Please familiarize yourself with the core rules of "Netiquette"; students must carefully craft their communication in the online classroom to avoid misinterpretation.

Mason Diversity Statement: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual, group and organizational level. The implementation of this commitment to diversity and inclusion is found in all settings, including individual work units and groups, student organizations and groups, and classroom settings; it is also found with the delivery of services and activities, including, but not limited to, curriculum, teaching, events, advising, research, service, and community outreach.

Acknowledging that the attainment of diversity and inclusion are dynamic and continuous processes, and that the larger societal setting has an evolving socio-cultural understanding of diversity and inclusion, Mason seeks to continuously improve its environment. To this end, the University promotes continuous monitoring and self-assessment regarding diversity. The aim is to incorporate diversity and inclusion within the philosophies and actions of the individual, group and organization, and to make improvements as needed.

Student privacy: Student privacy and rights are described under the Family Educational Rights and Privacy Act (FERPA; see: https://registrar.gmu.edu/ferpa/).

Where to Get Help: If you encounter any difficulties in this course, first contact your research advisor **immediately!** Do not wait until the end of the semester to ask for help in understanding the material in order to improve your grade - by then, it may be too late. Do not be afraid to ask for help - that is your professor's job!

The Counseling Center is committed to improving academic and personal skills and offers many workshops and counseling groups throughout the semester.

Make use of the many rich academic and personal opportunities available at Mason!