

Course Syllabus



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About This Course

CLIM 614 Land-Climate Interactions – Spring 2025

TR 10:30-11:45am – Research Hall 281 “COLA Conference Room”

CRN **18030**

Instructor: Prof. Paul Dirmeyer pdirmeye@gmu.edu (<mailto:pdirmeye@gmu.edu>)

Office Hours: *By appointment*

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:

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

Course and Text:

The course will be conducted in class as regular bi-weekly meetings. Before each class, students should read the assigned material, return comments in markup form (on the PDFs using Adobe Acrobat or Reader) as uploaded files attached to weekly discussions, and come to class with questions and comments. The format of class is a “round table” discussion of the reading material, which are chapters and sections of a textbook in preparation by Prof. Dirmeyer and Dr. Eleanor Blyth called “The Land-Atmosphere System”. Here is an **outline of the book** (<https://canvas.gmu.edu/courses/33108/files/9386354?wrap=1>) ↓ (https://canvas.gmu.edu/courses/33108/files/9386354/download?download_frd=1) , and the **philosophy of the textbook** (<https://canvas.gmu.edu/courses/33108/files/9317725?wrap=1>) ↓ (https://canvas.gmu.edu/courses/33108/files/9317725/download?download_frd=1) - please read first!

Chapters will be posted here weekly (<https://canvas.gmu.edu/courses/33108/files/folder/Chapter%20PDFs>). There is also a **spreadsheet of useful information** (<https://1drv.ms/x/c/6ed93c8f6e971bda/ETiNVABqEBKkew8GGbf22QBnSug4yNcLs8CeNUcLhL9NQ?e=k11Cdo>) including a glossary, table of abbreviations, list of notation for variables, and a table of units that we will continue to update with your input.

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 reading and in-class discussion. The latter occurs 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 are also midterm and final exams, required as CLIM 614 is a core course in the Climate Dynamics graduate program – the final exam quantifies instructional rubrics for the curriculum.

Grading:

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|----------------------|------------------------------------|
| Homework: | 40% (8 assignments, 5% each) |
| Reading Feedback: | 15% |
| Mid-Term Exam: | 10% |
| Paper Presentations: | 20% (10% oral, 10% written report) |
| Final Exam: | 15% |

The **standard graduate grading scale** (<https://catalog.gmu.edu/policies/academic/grading/>) is used. Final grades may be uniformly “curved” for all students at the instructor’s discretion.

Weekly Calendar (subject to change)

| Date | Reading | Topic | Assignment | Due |
|-----------|--|---|--|--------|
| 21 Jan | <p><u>1.1-1.2</u> (https://canvas.gmu.edu/courses/33108/files/9294987?wrap=1) ↓ (https://canvas.gmu.edu/courses/33108/files/9294987/download?download_frd=1) , <u>8.1-8.3</u> (https://canvas.gmu.edu/courses/33108/files/9301352?wrap=1) ↓ (https://canvas.gmu.edu/courses/33108/files/9301352/download?download_frd=1)</p> | Introduction, Systems, L-A System Science | <p align="center"><u>Homework #0</u> (https://canvas.gmu.edu/courses/33108/assignments/1029795)</p> | 28 Jan |
| 23 Jan | <p align="center"><u>13.1-13.4</u> (https://canvas.gmu.edu/courses/33108/files/9439570?wrap=1) ↓ (https://canvas.gmu.edu/courses/33108/files/9439570/download?download_frd=1)</p> | Structural Concepts, Mathematical Concepts | | |
| 28 Jan | 2.1-2.4 | Land-Atmosphere Systems | Homework #1 | 7 Feb |
| 30 Jan | 9.1-9.4 | Climate Drivers | | |
| 4 Feb | 10.1, 14.1, 10.4 | Momentum, Water Balance at the Land Surface | | |
| 6 Feb | 14.3 | Water Balance (cont'd) | Homework #2 | 14 Feb |

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|-----------|-----------------|---|---------------|---------------|
| 11 Feb | 11.1-11.3, 14.4 | Carbon Balance at the Land Surface | | |
| 13 Feb | 10.3 | Energy Balance at the Land Surface | | |
| 18 Feb | 14.2 | Energy Balance (cont'd) | Homework #3 | 28 Feb |
| 20 Feb | 3, 4 | <i>Case Studies</i> | | |
| 25 Feb | 15.1 | Exchanges in the Atmosphere; Thermodynamics | | |
| 27 Feb | 15.2-15.3 | Boundary Layers and Turbulence | Homework #4 | 7 Mar |
| 4 Mar | | Journal Papers Assignment discussed | Papers Review | 22, 24 Apr |
| 6 Mar | | <u>Mid-Term</u> | | |
| | 10-16 Mar | Spring Break | | |
| 18 Mar | 10.2 | Radiative Transfer | | |



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|-----------|-----------|---|-------------|-----------|
| 20 Mar | 16.1-16.4 | Radiative Transfer and Vegetation | Homework #5 | 31 Mar |
| 25 Mar | 10.6 | Soil Physics | | |
| 27 Mar | 17.1-17.2 | Soil Physics | | |
| 1 Apr | | Soil Physics (cont'd) | Homework #6 | 14 Apr |
| 3 Apr | 12.1-12.2 | Land-Atmosphere Coupling Metrics | | |
| 8 Apr | 12.3-12.4 | Land-Atmosphere Coupling Metrics (cont'd) | | |
| 10 Apr | 12.5 | Land-Atmosphere Coupling Metrics (cont'd) | Homework #7 | 3 May |
| 15 Apr | 19.1 | Models of Land Systems | | |
| 17 Apr | 19.2 | Assembling an LSM | | |
| 22 Apr | | Paper Presentations I | | |

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|-----------|--------|--|--|----------------|
| 24 Apr | | Paper Presentations II | | |
| 29 Apr | 18 | <i>Ecohydrology and the Carbon Story</i> | | |
| 1 May | 7, 9.6 | Land Variability, Land Use Change | | |
| 13 May | | <u>Final Exam</u> | | 10:30- 1:10 |

Legend

with Dr. Blyth

Presentations in class

No class

Exam day

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.

Artificial Intelligence:

Mason guidelines for the use of AI (<https://infoguides.gmu.edu/Artificial-Intelligence/Plagiarism>) in courses should be understood and followed by all students. This course falls under the “unlimited use” policy – please be familiar with the parameters for this policy.

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/>) (<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** (<https://caps.gmu.edu/>) 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!

