

SPACE 477: Space Weather Modeling Winter 2024

Course Syllabus

Course Objectives:

Students will develop a deep understanding of numerical modeling for space physics applications, learning the different mathematical and numerical approaches, the implicit and explicit assumptions, and the different types and purposes of models. The student will develop familiarity in building and running models including large-scale community models. The student will become familiar with the models available online, especially those at NASA's Community Coordinated Modeling Center (<http://ccmc.gsfc.nasa.gov/>). The opportunity to synthesize their understanding in written and oral reports and the ability to give and receive feedback will be part of the class.

Instructor:

Dr. Xianzhe Jia, Professor
Office: Rm 1433, Climate and Space Research Building
Email: xzjia@umich.edu

Grader:

Timothy Keebler, CLaSP Ph.D Student
Email: tkeebler@umich.edu

Lectures:

9:00 am to 10:30 am, Monday-Wednesday-Friday
2238 Climate and Space Research Building

Instructor Office Hours:

By appointment (set up after class or by email)

Reading Material:

Many journal articles: the class is mostly based on recent papers in peer-reviewed journals.

- "*An Introduction to Space Weather*", by Mark Moldwin
- "*Understanding Space Weather and the Physics Behind It*," by Delores J. Knipp
- "*Physics of the Space Environment*," by Tamas I. Gombosi

The first two are for undergraduates and the third is for graduate students.

Grading Apportionment:

Modeling Project #1	15%	(basic model usage)
Modeling Project #2	20%	(model analysis project)
Modeling Project #3	30%	(large-scale modeling project)
Paper Critique #1	15%	(brief reports)
In-class participation	10%	(group discussions)
Peer grading	10%	(grading of others)

Reports: Written and Oral

There will be 4 projects for this class. All will consist of an oral presentation (to the class) and a written report. All will be done individually, of varying length and content requirements and proportions toward your final grade.

- **One of them will be paper critique**, where I will assign each student a journal article to read and assess.
- **The remaining three reports are write-ups of your numerical modeling investigations**. We will use the Community Coordinated Modeling Center, CCMC, located at NASA Goddard Space Flight Center. The first of these will involve conducting a simple parameter study with an "Instant Run" code on CCMC. The second will be using existing runs and output from a "run-on-request" code. The final report will be based on submitting run-on-request jobs to conduct a numerical experiment and address a physics question. At any time in this class, you are free to use a different code of your own choosing. This is especially encouraged for those students engaged in numerical-oriented research projects; feel free to use your research code for the second and third projects in this class.

In-Class Participation: Discussions and Peer-grading

There are two ways that your in-class participation will be included in your final course grade. The first is to take part in the journal article critiques that we will conduct during class time. The second is to grade your peers on their oral reports, with points awarded for good explanations of the presenter's strengths and offering constructive suggestions for improvement.

SPACE 477: Space Weather Modeling Course Conduct Statement

Prof. Xianzhe Jia (xzjia@umich.edu)

The College of Engineering has an honor code. This is taken seriously.
See the website: <http://www.engin.umich.edu/students/honorcode/code/>

Policy on Collaboration

There are no homework sets or exams for this course; your grade is based on written and oral reports and in-class participation. You are allowed and encouraged to discuss together anything assigned in the class. However, all submitted work (content of all reports and presentation files) is to be generated by you alone.

You are not allowed to possess, look at, use, or in any way derive advantage from the existence of submissions prepared in prior years, whether these documents were former students' work product or copies of submissions/solutions that had been made available by others.

Unless arrangements are made with me beforehand, late submissions will be accepted but marked down 10%, until the time when the graded assignments are returned to the students (about a week). At this point, submissions for that assignment will no longer be accepted (again, unless arrangements were made prior to the original submission deadline).

Violations

Violation of this policy is grounds for the initiation of a report filed with the Dean's office and the case would come before the Honor Council of the College of Engineering. If you have any questions about this policy, please do not hesitate to contact me.