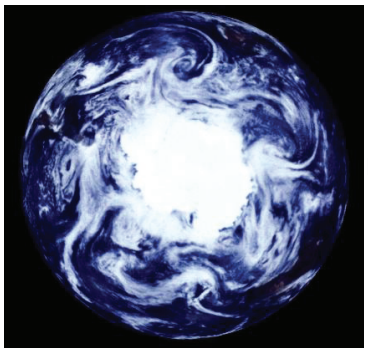
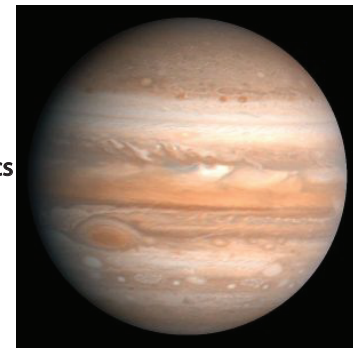


CLIM 411
Introduction to Atmospheric Dynamics



Credits: 3

Prerequisites: CLIM 111 and MATH 213 (Analytic Geometry & Calculus III), or permission of instructor.

Time: 9-10:15am
Venue: Exploratory Hall L505

Instructor: Natalie Burls
Assistant Professor
Dept. of Atmospheric, Oceanic, & Earth Sciences
https://cos.gmu.edu/aoes/profile-natalie-burls/
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Course Objectives: Students will become familiar with the basic concepts of dynamic meteorology, develop an appreciation of meteorological phenomena across multiple spatio-temporal scales, and be able to apply these concepts to understanding weather and climate phenomena. The course will focus on the following topics:

- Important dynamical balances within atmospheric motion (e.g. geostrophic, hydrostatic, and thermal wind)
- Conservation laws such as energy, mass, momentum, vorticity, and entropy
- Approximations enabling solutions describing the behavior of specific atmospheric phenomenon e.g. the quasigeostrophic equations
- Key structure and development of the mid-latitude weather systems and the related dynamical interpretation.

Catalog Description: Observational bases and fundamentals of fluid dynamic principle for understanding atmospheric motions across multiple spatial and temporal scales; covers basic conservation laws of mass, momentum, and energy; concepts of circulation and vorticity; balanced atmospheric flows, e.g.

geostrophic wind and shear, thermal wind; quasi-geostrophic and isentropic potential vorticity analysis for mid-latitude cyclones and fronts.

Duration: Jan 22, 2019 - May 11, 2019
Last day to drop with no tuition penalty – Feb 5th
Last day to drop with a tuition penalty – Feb 11th

Grading: Homework 30%, Mid-term 30%, Final 40%
Homework: There are six homework problem sets. Each set carries 5% of the total grade. Homework problem sets are due the week after they are assigned. You will also be assigned an in-class rotating tank demonstration (see applicable blackboard assignment for grading rubric) which will form part of your homework grade.

Grade Disputes
Any dispute regarding a grade on any assignment must be made in writing via email within 1-week of receipt of the grade on that assignment.

Required Textbook: Martin, Jonathan E., Mid-Latitude Atmospheric Dynamics, John Wiley and Sons, 324pp.

Syllabus and Schedule

Lecture	Topic	Textbook Chapter	Homework Assignments	Rotating Tank Demos
Wed 22nd Jan	Nature of fluids and useful mathematical tools	1.1-1.5		Dye Stirring
Mon 27th Jan	Nature of fluids and useful mathematical tools	1.1-1.5	HW#1	
Wed 29th Jan	Nature of fluids and useful mathematical tools	1.1-1.5		
Mon 3rd Feb	Nature of fluids and useful mathematical tools	1.1-1.5		
Wed 5th Feb	Fundamental forces and apparent forces	2.1-2.2		
Mon 10th Feb	Fundamental forces and apparent forces	2.1-2.2	HW#2	Density Current
Wed 12th Feb	Fundamental forces and apparent forces	2.1-2.2		Rossby Waves
Mon 17th Feb	Fundamental forces and apparent forces	2.1-2.2		Solid Body Rotation
Wed 19th Feb	Fundamental forces and apparent forces	2.1-2.2		Ekman Layers
Mon 24th Feb	Conservation of momentum, mass and energy	3.1-3.3	HW#3	
Wed 26th Feb	Conservation of momentum, mass and energy	3.1-3.3		
Mon 2nd Mar	Conservation of momentum, mass and energy	3.1-3.3		
Wed 4th Mar	Midterm			
Mon 9th Mar	Spring Break			

Wed 11th Mar	Spring Break			
Mon 16th Mar	Conservation of momentum, mass and energy	3.1-3.3		
Wed 18th Mar	Conservation of momentum, mass and energy	3.1-3.3		
Mon 23th Mar	Conservation of momentum, mass and energy	3.1-3.3	HW#4	
Wed 25th Mar	Equations of motion and applications	4.1-4.5	Student lecturers	
Mon 30th Mar	Equations of motion and applications	4.1-4.5	Student lecturers	
Wed 1st Apr	Equations of motion and applications	4.1-4.5		Hadley Circulation & Thermal Wind Balance I
Mon 6th Apr	Equations of motion and applications	4.1-4.5	HW#5	Hadley Circulation & Thermal Wind Balance II
Wed 8th Apr	Equations of motion and applications	4.1-4.5		
Mon 13th Apr	Equations of motion and applications	4.1-4.5		Balanced Vortex
Wed 15th Apr	Equations of motion and applications	4.1-4.5		
Mon 20th Apr	Circulation; Vorticity; Potential Vorticity	5.1-5.3	HW#6	
Wed 22nd Apr	Circulation; Vorticity; Potential Vorticity	5.1-5.3		
Mon 27th Apr	Circulation; Vorticity; Potential Vorticity	5.1-5.3		Flow over a Barrier on a Beta Plane
Wed 29th May	Circulation; Vorticity; Potential Vorticity	5.1-5.3		
Mon 4th May	Quasi-Geostrophic System	5.4		
Mon 11th May	Final Exam	7:30 am – 10:15 am		