

# Synoptic Dynamic Meteorology II (ATM 511)

## Spring Semester 2011 (3 credits)

Lecture: Tuesday & Thursday 8:45-10:05 in ES 232  
<http://www.atmos.albany.edu/deas/atmclasses/atm511>

### Instructor:

Professor Ryan Torn

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Office hours: Monday and Wednesday 12:30-1:30, or by appointment

### Course Objective:

This course will apply the governing equations of the atmosphere to understand the dynamics of synoptic to planetary-scale features ( $> 1000$  km), such as fronts, jet streaks, and cyclones.

### Prerequisites:

ATM 510 or consent of the instructor.

### Text:

*An Introduction to Dynamic Meteorology* by J. R. Holton

### Supplementary reading:

*Mid-Latitude Atmospheric Dynamics: A First Course*, by J. E. Martin

*Synoptic-Dynamic Meteorology in Midlatitudes*, by H. B. Bluestein

### Course Requirements:

4 Homework assignments 30%

2 Laboratory assignments 25%

Midterm exam (Tuesday March 15): 20%

Final exam (Friday May 6 3:30-5:30): 25%

Grading: A-E

### Course Outline:

1. Introduction
  - Overview of Balanced Weather Systems
  - Review of Governing Equations of Atmosphere (Holton Chapters 2 and 4, Martin Chapters 3 and 4)
2. Quasi-Geostrophic Dynamics and Potential Vorticity

- Derivation of Quasi-Geostrophic (QG) Equations (Holton 6.2, Martin 5.4)
- QG Vorticity, Thermodynamic, and Energy Equations (Holton 6.2, Martin 5.4)
- Potential Vorticity (Holton 6.3, Martin 9.1-9.2)
- PV Inversion and Applications (Holton 6.3, Martin 9.5, and class notes)

### 3. Vertical Motion

- Omega Equation: Vorticity and Thermal Advection Form (Holton 6.4.1, Martin 6.3)
- Q Vectors and Application to Vertical Motion (Holton 6.4.2, Martin 6.4)

### 4. Frontogenesis

- Kinematic and Dynamic Description of Frontogenesis (Holton 9.2, Martin 7.1)
- Vertical Motion at Fronts (Martin 7.2)
- Semi-geostrophic Equations (Holton 9.2.2, Martin 7.3)
- Upper-level Fronts (Martin 7.4, Class Notes)

### 5. Midlatitude Cyclogenesis

- QG Height Tendency Equation (Holton 6.3.1, Martin 8.3)
- Cyclogenesis from the QG Perspective (Martin 8.4, Class Notes)
- Cyclogenesis from the PV Perspective (Martin 9.3, Class Notes)

### 6. Atmospheric Waves and Instabilities

- Atmospheric Waves (Holton 7.2, 7.7)
- Baroclinic and Barotropic Instability (Holton 8.4.3, Class Notes)
- Downstream Development (Class Notes)
- Global Energy Cycle (Holton 8.4, Class Notes)