# ATOC-540
# Synoptic Meteorology I
# Fall 2020

**Time:** Monday/Wednesday – 08:35 AM – 09:55 AM
**Location:** Virtual classroom; all lectures will be presented in real-time and will be recorded for later access

**Instructor:** Professor John R. Gyakum
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Office hours : Remote meetings may be held immediately after class or scheduled by appointment
**Teaching Assistant:** To be announced

## Grading

| | |
|---|---|
| Quiz 1 (Take-home, due Wednesday, October 7) | 20% |
| Quiz 2 (Take-home, due Wednesday, November 18) | 20% |
| Assignments (3) | 30% |
| Final Exam (to be scheduled by the University during Dec. 8-22) | 30% |
| | 100% |

Students with marks of D, F or J will not have the option of doing additional work to upgrade their mark.

There will be a supplemental examination, counting for 100% of the supplemental mark.

The University Student Assessment Policy exists to ensure fair and equitable academic assessment for all students and to protect students from excessive workloads. All students and instructors are encouraged to review this Policy, which addresses multiple aspects and methods of student assessment, e.g. the timing of evaluation due dates and weighting of final examinations.

**In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.**

## Textbook material

**Text (recommended):**
"Mid-Latitude Atmospheric Dynamics: A First Course" (2006) by Jonathan Martin

**Additional text books (supplemental):**
"Synoptic-dynamic meteorology in midlatitudes: Principles of kinematics and dynamics, Volume I" (1992) by Howard B. Bluestein

"Midlatitude Synoptic Meteorology: Dynamics, Analysis and Forecasting" (2011) by Gary Lackmann

## Course Objectives

Following this course, you should be able to…

• **Analyze and interpret** the basic features of weather maps (sea-level pressure, heights, etc.)
• **Apply** concepts of fluid dynamics to the real world atmosphere.
• **Explain** the key forces and balances governing large-scale weather systems, as well as the forces/terms we typically ignore and in what situations it is acceptable to omit them.

## McGill Policies

**Language of Submission:**

"In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives."

« Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue). »

**Academic Integrity:**

"McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures" (see McGill's guide to academic honesty for more information).

As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the Office for Students with Disabilities, 514-398-6009.

## Course Outline

| Class dates (all Monday or Wednesday, except the final class meeting is Thursday, December 3) | **Topics** | **Supplementary readings (Martin)** |
|---|---|---|
| Week 1 (September 2) | Introduction; Mathematical tools; units | Chapters 1.1-1.3 |
| Week 2 (September 9) | Scalar fields and their kinematics | |
| Week 3 (September 14, 16) | • Atmospheric pressure<br>• Hydrostatic balance | Chapters 2.1, 3.1 |
| Week 4 (September 21, 23) | • Coordinate systems<br>• Vector field kinematics | Chapter 1.4 |
| Week 5 (September 28, 30) | • Conservation of momentum<br>• Coriolis/ Centrifugal Forces | Chapters 2.2, 3.2 |
| Week 6 (October 5, 7) | • Mass continuity<br>• Geostrophic balance<br>• **Quiz 1 take-home due at 5:00 PM EDT, October 7** | Chapters 4.1, 4.4.1 |
| Week 7 (October 14) | • Geostrophic balance (continued)<br>• Thermal wind | Chapter 4.3 |
| Week 8 (October 19, 21) | • Temperature advection<br>• Thermal vorticity | |
| Week 9 (October 26, 28) | • Gradient/cyclostrophic balance<br>• Ageostrophic wind | Chapters 4.4.3-4.4.4 |
| Week 10 (November 2, 4) | • First Law of Thermodynamics<br>• Potential temperature | Chapter 3.3 |
| Week 11 (November 9, 11) | • Thermodynamic equation<br>• Static stability | |
| Week 12 (November 16, 18) | • Circulation<br>• Vorticity<br>• **Quiz 2 take-home due at 5:00 PM EDT, November 18** | Chapters 5.1-5.2 |
| Week 13 (November 23, 25) | • Vorticity advection<br>• Vorticity equation | Chapter 5.2 |
| Week 14 (November 30; December 2, 3) | •Introduction to quasi-geostrophic theory | Chapter 6.3 |
| December 8-22 (date to be announced by the university) | • **Final examination** | |