



University of Manitoba
Faculty of Environment, Earth and Resources
Department of Environment and Geography

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COURSE DETAILS

Course Title & Number: GEOG 3310 Atmospheric Dynamics, Storms and Radar

Number of Credit Hours: 3

Class Times & Days of Week: T/Th 11:30 am - 12:45 pm

Location for Classes: 315 Wallace

Pre-Requisites: GEOG 2300

Note that GEOG 2300 requires the following: GEOG 1290 or GEOG 1291 (053.129) (C), or GEOG 1200 or GEOG 1201 (053.120) (C), and (MATH 1500 or MATH 1501 (136.150) (C), or MATH 1510 (136.151) (C), or MATH 1520 (136.152) (C), or MATH 1530 (136.153) (C)).

Instructor Contact Information

Instructor(s) Name:	Nicole Loeb (1st half) & Ronald Stewart (2nd half)
Office Location:	579 Wallace (Loeb) / 470 Wallace (Stewart)
Office Hours or Availability:	Make an appointment via email during regular daytime hours (8am – 4pm) to arrange a mutually convenient meeting time
Office Phone No.	Best way to communicate is email
Email:	loebn@umanitoba.ca ronald.stewart@umanitoba.ca All emails will be replied to within 48 hours

General Course Information & Goals

Critical dynamic processes are discussed that are associated with the Earth's atmosphere including the equations of motion (and their application), thermodynamic feedbacks, vorticity, jet streams, global circulations, and general synoptic scale disturbances. An introduction to mesoscale storms and weather radar will also be part of the course.

The science of meteorology is founded upon the observation, description, and explanation of the physical properties of the Earth's atmosphere. The goal of this science is to explain and predict the weather and various critical atmospheric elements (e.g temperature, precipitation, wind, humidity and clouds).

The purpose of the course is to provide students with an understanding of **dynamic** meteorological processes over synoptic (and some mesoscales) that contribute to general circulations, cyclonic systems, fronts and meso-scale convective storms. This will include Chapters 10-14 and 17 (from the required textbook), as well as powerpoint notes and handouts that will cover Topics 5 & 6 below in greater detail than the text. Reference to Canadian weather (atmosphere and surface) will be made throughout the course. Students should be prepared for mathematical/physical concepts to be treated in the course.

This course is required for careers in operational meteorology (weather forecasting), atmospheric and climate sciences. It can also serve as a solid foundation for basic atmospheric processes understanding for other physical sciences careers (e.g. environmental services/science).

Assignments are used to gauge student competency using quantitative assessments (calculations necessary) and short answer conceptual questions; students can submit assignments via UMLearn by scanning/photographing their completed hand-written work or using any word processor (as long as the word processor can handle equations/symbols). The mid-term and final tests are composed mainly of conceptual (short and long answer) questions, with limited quantitative questioning; these tests will have to be submitted by a specific time on the date of the test during class times (TBD), otherwise marks will be taken off. Your computer or device, and internet connection must meet the UM minimum requirements.

GEOG 3310 will be taught in person and lectures will NOT be recorded. All communication will be via U of M email/UM Learn and students are required to check this. In person or virtual meetings with the professor will be possible on an individual basis, at a mutually convenient date/time, made via email communication.

The assessments for this course are comprised of **2 assignments** (10% each) (strict due dates), **2 term projects** (20% each) a **mid-term test** (20%) (covering first half of course), and a **final test** (20%) (covering last half of course); no final exam.

Assignments are used to gauge student competency using quantitative assessments (calculations necessary) and short answer conceptual questions; students can submit assignments via UM Learn or email by scanning their completed hand-written work or using any word processor (as long as the word processor can handle equations/symbols). Your computer or device, and internet connection must meet the UM minimum requirements.

Using Copyrighted Material

Please respect copyright. We will use some copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made

available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Recording Class Lectures

The instructors and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission of the instructor. Course materials (both paper and digital) are for the participant's private study and research.

Textbook, Readings, Materials

Required textbook:

Stull, Roland B., Practical Meteorology: An Algebra-based Survey of Atmospheric Science , c2018.

(found here for free: https://www.eoas.ubc.ca/books/Practical_Meteorology/)

Supplementary Readings (not required) (can be found in UM library system or purchased online):

Holton, James R., An introduction to dynamic meteorology, 3rd edition, Academic Press, c1992.
Mid-latitude Synoptic Meteorology: Dynamics, Analysis & Forecasting (by Gary Lackmann)
Mesoscale Meteorology in Midlatitudes by P. Markowski and Y. Richardson (2010), Wiley Blackwell, 407 pp.

Rinehart, R., Radar for Meteorologists 3rd edition, Rinehart Publications, Columbia, MO, USA.
Battan, Louis J. Radar observation of the atmosphere. Rev. ed. Chicago: University of Chicago Press, 1973.

Doviak, R. J. Doppler radar and weather observations. Orlando, Fla.: Academic Press, c1984.
Weather and weather maps: a volume dedicated to the memory of Tor Bergeron (15.8.1891 13.6.1977), Basel; Boston: Birkhauser Verlag, 1981.

Bluestein, Howard B. Synoptic-dynamic meteorology in midlatitudes. Volume 1.
New York: Oxford University Press, 1992-1993.

Bluestein, Howard B. Synoptic-dynamic meteorology in midlatitudes. Volume 2. New York: Oxford University Press 1992.

Fundamentals of atmospheric physics by Murry L. Salby, Academic Press, 1996.
Fundamentals of atmospheric modeling by Mark Z. Jacobson, University Press, 1999.
Fabray, F. Radar Meteorology: Principles and Practice. Cambridge University Press, 2015

Tools:

All students should ensure they have non-programmable scientific calculators.

Course Lectures/Materials:

All lecture powerpoints and other digital content will be provided to students via UM Learn System. Be sure to familiarize yourself with the UM Learn System.

Course Technology

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by the instructor and/or the University of Manitoba Disability Services. Students should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline “gaming” during scheduled class time. If a student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (©[S Kondrashov](#). Used with permission)

Class Communication

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit:

http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy - 2014_06_05.pdf

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy

(http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

Expectations: Instructors Expect You To

We will treat you with respect and would appreciate the same courtesy in return. See [Respectful Work and Learning Environment Policy](#).

Academic Integrity:

Please see “Schedule A” at the back of this outline that outlines academic integrity policies and

student resources. Students should acquaint themselves with the University's policy on cheating and examination impersonation (see Section 7.0 of the University of Manitoba General Calendar). **Plagiarism and cheating in general, is a serious academic offence.**

All work/assignments submitted by each student is to be completed independently unless otherwise specified.

Students Accessibility Services

Student Accessibility Services

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services <http://umanitoba.ca/student/saa/accessibility/>

520 University Centre

204 474 7423

Student_accessibility@umanitoba.ca

Expectations: You Can Expect Instructors To

We value each student's viewpoint and input to each class. Therefore, we encourage students to interact with us in class by asking questions and answering questions posed by instructors and other students in the class. We expect students to respond the best they can, however, we do not expect perfection!

Class Schedule

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the – [ROASS Procedure](#)).

Date(s)	Class Content	Required Readings or Pre class Preparation
Approx. Jan 10-17 (3 lectures)	Forces that Control Wind, Wind Types, Conservation Principles, Intro to Local Winds, Thermal Wind, Jet Stream, Convergence/Divergence, Vorticity	Powerpoint/UM Learn/Course text
Approx. Jan 19-31 (4)	General Circulation, Rossby Waves, Barotropic & Baroclinic Instability, Large Scale Pressure Patterns	Powerpoint/UM Learn/Course text

Approx. Feb 2-14 (4)	Fronts, Frontogenesis, Cyclones & Cyclogenesis, Large-Scale Vertical Motions, Quasi-Geostrophic approximations	Powerpoint/UM Learn/Course text
Feb 20 - 24 break		

Approx. Feb 28 - Mar 7 (3)	Hodographs	Powerpoint/UM Learn/Course text
Approx. Mar 9-21 (4)	Thunderstorms & Severe Convective Storms	Powerpoint/UM Learn/Course text
Mar 23 – Apr 6 (5)	Weather (Doppler) Radar	Powerpoint/UM Learn/Course text

Course Evaluation Methods

We will be using a combination of assignments, term papers and tests for evaluation purposes. **No final exam is used.**

Refer to the Assignment Description on the following page of the syllabus for details of assignment answer formatting.

Due Date:	Assessment Tool	Value of Final Grade
Approx. Jan 24 (submit at the start of the class)	Assignment #1 (expect marks back in <1 week)	10%
Approx. Feb 7 (submit at the start of the class)	Term Paper & Presentation #1 (expect marks back in <1 week)	20%
Feb 16 (conducted during class)	mid-term test (expect marks back prior to VW date)	20%
Approx. Mar 14 (submit at the start of the class)	Assignment #2 (expect marks back in <1 week)	10%

Approx. Mar 31 or April 4 (submit at the start of the class)	Term Paper & Presentation #2	20%
Apr 11	Final test	20%

Term Paper Details – worth 40% of final grade

Schedule:

Term paper 1:

Jan 26 – One-quarter to half-page project proposal due

Feb 7 - Term Paper 1 due

Term paper 2:

March 21 - One-quarter to one-half project proposal due

March 31 or April 4 - Term Paper 2 due

Guidelines:

In this term project, you will read research papers and reports (e.g., journal articles) on a subject below selected by yourself, and write a review on the subject. Guidelines below:

- The report should be 5-7 doubled-spaced pages long and based on 3 or, at most, 4 articles
- Figures (and their captions) can appear embedded within the text or at the end of the paper, sequentially.
- You are encouraged to include your own critical views of the subject in your review. • Original research and topics different from those below are encouraged, however, you must discuss your topic idea with me first.
- The paper should include an introduction (why the topic is important scientifically and to society in general) followed by the main body of the paper (the main body should be well organized and include sub-sections where appropriate).
- Figures/tables should be numbered in order of appearance (e.g. Figure 1, Figure 2, etc.) and should be ***explicitly referred to in your discussion!*** That is, don't show a figure and not talk about it.
- All references should be at the end of the paper in alphabetical order according to the lead author name.
- You should use RECENT publications for your project! 1 older reference (prior to 2005) is fine for the introduction/background, but make sure you use the most up-to date research articles possible for the bulk of the work. Failure to do so will impact your mark.

The review should demonstrate a good understanding on your part of the chosen subject.

The paper will be graded on overall organization, clarity, understanding of the

subject,grammar, completeness, neatness and using up-to-date more recent references.

The following aspects should be considered when writing your paper (I encourage you to have others proofread your report):

- Is the material well organized and is the flow logical?
- Does the introduction clearly state the purpose and/or motivation of the review?
- Is the paper and presentation clear and easily understandable?
- Write it in such a way that other students can learn from your review.
- Are figures appropriate and effective in supporting the text in the paper?
- Do the figures have adequate captions and are they clearly discussed and referred to in your paper?
- DO NOT plagiarize! Strict penalties will ensue.

You will also give a short 5-6 minute presentation to the class based on this paper. **The presentation will be graded on organization, clarity and understanding of the subject, grammar and spelling, as well as timing.** The following aspects should be considered when preparing/delivering your presentation:

- The talk should not be longer than 5-6 minutes. Be sure to practise it beforehand!
- You will probably not be able to cover all the material in the written paper.
- First slide should be the title.
- One or 2 slides should be used for an Introduction to your topic including why the topic is important to society and some relevant background to the topic.
- The introduction should also clearly state the objective for your talk. Given the short presentation, its objective might be a subset of the overall report's presentation.
- Organize your talk so the flow is logical which normally just follows that of the paper.
- Discuss the topic in such a way so that other students can learn from your presentation
- Decide on figures that are appropriate and effective in supporting your discussion
- Figures should have citations - which source was used.
- Speak clearly and loud enough when delivering your talk.
- Be sure to have a Conclusions slide that 'answers' your objective.
- Last slide should include all references.

Example Topics:**Part 1 (first report):**

- Low-level jets
- Downslope windstorms and/or terrain-induced rotors
- Land or sea breezes
- Polar Lows and Arctic Extreme Weather
- Valley flows
- Orographic precipitation M
- Mountain waves
- Gravity waves
- Density Currents

Fog

Extratropical cyclones

Part 2 (second report):

Micro or macrobursts

Drylines

Weather radar and its application / polarization techniques

Boundary layer rolls

Wind shear and aviation

Tornadogenesis

Mesoscale convective system/complex

Land/vegetation influence on cloud/storm initiation

Rainbands

Non-mesocyclone tornadoes (NMT's)

Convection Initiation processes

Some common journals in the library system (online) include:

American Meteorological Society (many journals)

Atmosphere-Ocean (Canadian Meteorological and Oceanographic Society)

Electronic Journal of Severe Storms Meteorology (EJSSM)

Atmospheric Research

Quarterly Journal of the Royal Meteorological Society (QJRMS)

Tellus

Journal of Geophysical Research - atmospheres

Earth Interactions

Boundary Layer Meteorology

Agricultural and Forest Meteorology

Arctic

Grading

It will be important to attend the lectures and interact with the instructors and other students. Students will not be permitted to write make-up tests or hand in late assignments except for documented medical or compassionate reasons. A grade of zero will be recorded for missed assignments, tests and quizzes. Late assignments will be penalized 10% per day (including weekends and holidays). Students may have access to their marks prior to the voluntary withdrawal date and are encouraged to talk with instructors before a decision to withdraw is made.

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	90-100	4.25-4.5	4.5
A	80-89	3.75-4.24	4.0
B+	75-79	3.25-3.74	3.5
B	70-74	2.75-3.24	3.0
C+	65-69	2.25-2.74	2.5
C	60-64	2.0-2.24	2.0
D	50-59	Less than 2.0	1.0
F	Less than 50		0

Assignment Grading Times

See the Class Schedule Tables.

Assignment Extension and Late Submission Policy

Students will not be permitted to write make-up tests or hand in late assignments except for documented medical or compassionate reasons. A grade of zero will be recorded for missed assignments, tests and quizzes. Late assignments will be penalized, either: (a) 10% per day (including weekends and holidays) or (b) a specified number of marks, at the discretion of the instructor, if late (by minutes or hours) on the actual due date. Students may have access to their marks prior to the voluntary withdrawal date and are encouraged to talk with instructors before a decision to withdraw is made.

Students who are unable to meet a course requirement due to medical circumstances are currently not required to submit medical notes. However, students are required to contact their instructor or academic advisor by email to inform them of the missed work and to make arrangements for extensions, deferrals, or make-up assignments.

Please follow these guidelines if you are unable to meet an academic requirement for your courses.

- Contact your instructor for term work such as a midterm/test, assignment.
- Inform your instructor/advisor as soon as possible, do not delay.
- Email your instructor/advisor from a U of M email address, and include your full name, student number, course number, and academic work that was missed.

Schedule “A”

Section (a): A list of academic supports available to Students, such as the Academic Learning Centre, Libraries, and other supports as may be appropriate:

Writing and Learning Support

The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor's feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at:

<http://umanitoba.ca/student/academiclearning/>

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 201 Tier Building.

University of Manitoba Libraries (UML)

As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources,

and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by subject: <http://bit.ly/WcEbA1> or name: <http://bit.ly/1tJ0bB4>. In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. For a listing of all libraries, please consult the following: <http://bit.ly/1sXe6RA>. When working remotely, students can also receive help online, via the Ask-a Librarian chat found on the Libraries' homepage: www.umanitoba.ca/libraries.

Section (b): A statement regarding mental health that includes referral information:

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. *Student Counselling Centre*:

<http://umanitoba.ca/student/counselling/index.html>

474 University Centre or S207 Medical Services

(204) 474-8592

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

Student Support Intake Assistant http://umanitoba.ca/student/case_manager/index.html

520 University Centre

(204) 474-7423

University Health Service

Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

University Health Service <http://umanitoba.ca/student/health/>

104 University Centre, Fort Garry Campus

(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness

Contact our Health and Wellness Educator if you are interested in information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

Health and Wellness Educator <http://umanitoba.ca/student/health/>

[wellness/welcome.html](http://umanitoba.ca/student/health/wellness/welcome.html)

Katie.Kutryk@umanitoba.ca

469 University Centre

(204) 295-9032

Live Well @ UofM

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

<http://umanitoba.ca/student/livewell/index.html>

Section (c): A notice with respect to copyright:

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community.

Visit <http://umanitoba.ca/copyright> for more information.

Section (d): A statement directing the student to University and Unit policies, procedures, and supplemental information available on-line:

Your rights and responsibilities

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The [Academic Calendar](#)

<http://umanitoba.ca/student/records/academiccalendar.html> is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form <http://umanitoba.ca/registrar/>
- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support <http://umanitoba.ca/academicintegrity/> View the **Student Academic Misconduct** procedure for more information.
- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

Respectful Work and Learning Environment

http://umanitoba.ca/admin/governance/governing_documents/community/230.html

Student Discipline

http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

Violent or Threatening Behaviour

http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at: http://umanitoba.ca/admin/governance/governing_documents/community/230.html More information and resources can be found by reviewing the Sexual Assault site <http://umanitoba.ca/student/sexual-assault/>

- For information about rights and responsibilities regarding **Intellectual Property** view the policy http://umanitoba.ca/admin/governance/media/Intellectual_Property_Policy-2013_10_01.pdf

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site <http://umanitoba.ca/faculties/>

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations http://umanitoba.ca/academic_advisors/

Student Advocacy

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>

520 University Centre

204 474 7423

student_advocacy@umanitoba.ca