University of Victoria

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

COURSE OUTLINE
Atmospheric Physics
Lecture Tuesday, Wednesday, Friday 12:30-1:30 (HSD A240, in person)
Tutorial Tuesday 8:30-10:30 (BWC B119/121, in person)

PREREQUISITES: PHYS 102A/102B, or PHYS 110/111, or PHYS 120/130
COREQUISITES: One of EOS 225, 325, MATH 204; One of CHEM 245, PHYS 317

CONTACT INFO:

Instructor(s):	Adam Monahan
Email:	monahana@uvic.ca
Office:	BWC A311
Office Hours:	Monday and Friday 10:00-11:00

Teaching Assistant:	Robert Payne	gpayne1654@uvic.ca

COURSE DESCRIPTION

An introduction to the study of the atmosphere as a physical system. Equations of motion; force balances; thermodynamics; phase changes of water; radiative transfer; waves and instabilities; predictability.

LEARNING OUTCOMES

By the end of this course, you will be able to:

1. Use fundamental dynamical and thermodynamic principles to quantify relationships between atmospheric fields and relate these to weather and climate processes.
2. Identify space and time scales of different atmospheric processes and relate these to their associated physical mechanisms.
3. Apply concepts of predictability in the context of weather forecasts and climate change projections.
4. Use mathematical and computational tools to analyze and interpret atmospheric data and present your results in writing.
5. Produce and interpret graphical representations of atmospheric data.

COURSE MATERIALS

EOS/PHYS 340 lecture notes are available on the Brightspace site. Lectures will be recorded and posted to Brightspace.

BRIGHTSPACE

https://bright.uvic.ca/d2l/home/396182

EVALUATION

Tutorial Exercises		15% (best 7 of 8)
Assignments		15% (best 3 of 4)
Midterm exam	(75 minutes)	30%
Final exam	(180 minutes)	40%

Essential Course Requirements: Students must complete both the midterm exam and the final exam to pass the course. Students who do not complete at least these requirements will be assigned an N in the course and a maximum grade of 49%. No supplemental examinations or additional work for extra marks are offered in this course.

Exams: There will be one 75-minute midterm exam, held during the tutorial session on Tuesday, February 25, and a 180-minute final exam which will be scheduled centrally. All examinations are completely open book. You may bring in any printed or handwritten material. During the examination you may use a calculator so long as it does not communicate with other devices.

Tutorial Exercises: During the tutorials, you will work on computer-based exercises in which you will analyze and plot simulated data for an exoplanet atmosphere. There will be 8 tutorial exercises, all based on the same dataset. In general, later exercises will rely on results from earlier exercises. Although only the best 7 of 8 exercises will count toward your final grade, it is important that all exercises be completed. Either the Instructor or a Teaching Assistant will be present during the tutorials to assist you with the exercises. **Tutorial exercises will be made available in advance of the Tuesday morning tutorial sessions, and the exercise will be due by 4:00 pm on the following Thursday**. Tutorial exercises will be submitted through Brightspace. You will not be asked to provide your code in the tutorial exercises, although several exercises will require you to provide sample calculations showing how a plot was produced or a quantity computed. The sample calculation should include the equation(s) to be used, as well as an example of the use of the equation(s) in the calculation.

You may use any computing language to carry out the tutorial exercises (e.g. Python, Matlab, Excel). There will be no tutorial in the first week of class. In order to use the time of the first tutorial well, I strongly encourage you to *learn how to import the dataset into the computing language you will use for its analysis before the first tutorial session.*

Participation in the tutorial sessions is not mandatory. You are free to work on the tutorial exercises on your own or with others outside of the tutorial, or to only attend part of the tutorial. While I recognize that for many students the tutorials partially conflict with other courses, I do recommend attending as much of the tutorial sessions as you can to obtain help and feedback with your data analysis.

It is expected that you have access to a computer for use in the tutorial exercises. Please let the Instructor know if you do not have access to a computer.

Assignments: Four assignments will be given throughout the term. These assignments provide you with the opportunity to further apply concepts discussed in class and the tutorial exercises to the analysis of physical processes in the atmosphere. In addition to providing you with experience in applying course concepts, the assignments are intended as exercises in scientific communication. Please ensure that your answers are clear and concise. Use text to explain your calculations as appropriate. Of the 4 assignments, only the best 3 will count toward the final grade. As the midterm and final exams will include analyses similar to those on the assignments, it is to your advantage to make sure that you complete all assignments. In the assignments, you must show your work as well as the final answer.

COURSE POLICIES

If you need an academic accommodation to address barriers to your education, please register with the Centre for Accessible Learning (CAL) as soon as possible, if you have not done so already. We work with the CAL to create a learning environment that is equitable and inclusive for all.

POLICY: CLASS CONDUCT

The student code of conduct for the Tri-Faculties of Humanities, Science, and Social Sciences describes the rights and responsibilities of students in the Tri-Faculties.

POLICY: LATE/MISSED ASSIGNMENTS OR EXAMINATIONS

Of the 4 assignments, only the best 3 will count toward the final grade. Of the 8 tutorial exercises, only the best 7 will count toward the final grade.   As such, you can choose not to submit up to one assignment and one tutorial exercise due to illness or affliction without penalty.

Assignments are due at 4:00 pm on the afternoon of the date indicated in the weekly calendar below. Assignments may be submitted to me in class or in the drop box beside the SEOS main office on the 4th floor of the A wing of the Bob Wright Centre. **Do not slide assignments under my office door**. Late assignments will be accepted with a grade penalty of 20% per day.

Tutorial exercises are due at 4:00 pm on the afternoon of the Thursday in the same week as the tutorial session. Tutorial exercises are to be submitted via Brightspace. Late tutorial exercises will be accepted with a grade penalty of 20% per day.

If you are unable to write the midterm exam at the time scheduled, a make-up exam will be scheduled for the following week.

POLICY: ATTENDANCE

Attendance in class is expected but not required. Attendance in tutorials is encouraged but not required. Classes will be recorded, with recordings posted on Brightspace, but the tutorials will not.

POLICY: ACADEMIC INTEGRITY

It is every student's responsibility to be aware of the university's policies on academic integrity, including policies on **cheating, plagiarism**, **unauthorized use of an editor**, **multiple submission**, and **aiding others to cheat**.

Policy on Academic Integrity: web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html

If you have any questions or doubts, talk to me, your course instructor. For more information, see uvic.ca/learningandteaching/cac.

You are encouraged to discuss tutorial exercises and assignment questions with other students but submitted material must be your own work.

POLICY: USE OF AI

You may use generative AI in this course (eg. ChatGPT) to help with your assignments. Generative AI tools can be effective tools to assist writing computer code. Note that you will still need to understand the code to modify/debug it and ensure that it is in fact carrying out the desired computations.

COURSE FEEDBACK

I value your feedback on this course. Towards the end of term, as in all other courses at UVic, you will have the opportunity to complete an anonymous survey regarding your learning experience (CES). **The survey is vital for providing feedback** to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. The survey is accessed online and can be done on your laptop, tablet, or mobile device. I will remind you and provide you with more detailed information nearer the time but please be thinking about this important activity during the course.

COURSE WEEKLY CALENDAR

Last day to add courses: January 22nd
Last day to drop a course without penalty of failure: February 28th

WEEK	DATE	LECTURE	Tutorial	Assignment
1	January 7 January 8 January 10	Introduction Large-scale structure of Earth's atmosphere Residence times of atmospheric constituents	No tutorial **Homework**: Learn how to import tutorial dataset	
2	January 14 January 15 January 17	Ideal gas equation of state Saturation vapour pressure Measures of humidity	*Tutorial 1* Plotting profiles	
3	January 21 January 22 January 24	Condensation and cloud processes I Condensation and cloud processes II Pressure gradient force and hydrostatic equilibrium I	*Tutorial 2* Identifying constituents Finding missing temperatures	A1
4	January 28 January 29 January 31	Pressure gradient force and hydrostatic equilibrium II Internal energy and the first law of thermodynamics Specific heat capacities of ideal gases	*Tutorial 3* Calculating measures of vapour content	
5	February 4 February 5 February 7	Entropy and the Clausius-Clapeyron equation Blackbody radiation Radiative transfer I	*Tutorial 4* Calculating geopotential heights Calculating potential temperature	
6	February 11 February 12 February 14	Radiative transfer II Radiative transfer III Greenhouse effect & radiative energy budget I	*Tutorial 5* Calculating total column water Calculating optical depth profile	A2
7	February 18 February 19 February 21	READING BREAK		
8	February 25 February 26 February 28	Greenhouse effect & radiative energy budget II Adiabatic motion and dry static stability Moist static stability	Midterm examination	
9	March 4 March 5 March 7	Convection and convective available potential energy Centrifugal and Coriolis forces Equations of motion	Midterm exam discussion	
10	March 11 March 12 March 14	Balanced flow: geostrophic wind Balanced flow: gradient wind Drag and unbalanced flow	*Tutorial 6* Calculating LCL Adiabatic (T,p) profile	A3
11	March 18 March 19 March 21	Pressure as a vertical coordinate Thermal wind balance Vorticity and Rossby waves	*Tutorial 7* Calculating CAPE	
12	March 25 March 26 March 28	Synoptic-scale variability Planetary-scale circulation Predictability I	*Tutorial 8* Using thermal wind balance	
13	April 1 April 2 April 4	Predictability II Predictability III Review	No tutorial	A4

CHANGES DUE TO UNFORESEEN CIRCUMSTANCES

The above schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances. In the event of significant changes, a revised outline will be posted/circulated.

APPENDIX

SCHOOL OF EARTH AND OCEAN SCIENCES INFO

- SEOS Website: uvic.ca/seos
- SEOS Office: seos@uvic.ca
- SEOS Director: Dr. Jay Cullen, seosdirector@uvic.ca
- SEOS Mental Health & Wellness Contact: Dr. Andy Fraass, andyfraass@uvic.ca
- SEOS Undergraduate Advisor: Dr. Jon Husson, seosadvisor@uvic.ca
- SEOS Graduate Advisor: Dr. Roberta Hamme, seosgradadvisor@uvic.ca
- Ocean Science Mentor: Dr. Jody Klymak, seosoceansci@uvic.ca
- Climate Science Advisor: Dr. Colin Goldblatt, climateadvising@uvic.ca

UNIVERSITY STATEMENTS & POLICIES

- Academic Calendar: Information for All Students
- Creating a respectful, inclusive, and productive learning environment
- Accommodation of Religious Observance
- Accommodation and Access for Students with Disabilities
- Student Conduct
- Non-academic Student Misconduct
- Accessibility
- Diversity / EDI
- Equity statement
- Sexualized Violence Prevention and Response
- Discrimination and Harassment Policy

UVIC GRADING SYSTEM

As per the Academic Calendar:

Grade	Grade point value	Grade scale	Description
A+ A A-	9 8 7	90-100% 85-89% 80-84%	**Exceptional**, **outstanding** and **excellent** performance. Normally achieved by a minority of students. These grades indicate a student who is self-initiating, exceeds expectation and has an insightful grasp of the subject matter.
B+ B B-	6 5 4	77-79% 73-76% 70-72%	**Very good**, **good** and **solid** performance. Normally achieved by the largest number of students. These grades indicate a good grasp of the subject matter or excellent grasp in one area balanced with satisfactory grasp in the other area.
C+ C	3 2	65-69% 60-64%	**Satisfactory**, or **minimally satisfactory**. These grades indicate a satisfactory performance and knowledge of the subject matter.
D	1	50-59%	**Marginal** Performance. A student receiving this grade demonstrated a superficial grasp of the subject matter.
F	0	0-49%	**Unsatisfactory** performance. Wrote final examination and completed course requirements; no supplemental.
N	0	0-49%	Did not write examination or complete course requirements by the end of term or session; no supplemental.

STUDENT RESOURCES

POSITIVITY AND SAFETY

The University of Victoria is committed to promoting, providing, and protecting a positive and safe learning and working environment for all its members.

[Student Groups & Resources](#)

ACADEMIC RESOURCES

UVic Library - *UVic Library offers many services and resources for undergraduate and graduate students.*
[uvic.ca/students/academics/library-services](#)

Learning Resources - *UVic Learn Anywhere is the primary learning resource for students that offers many learning workshops and resources to help students with academics and learning strategies.*
[onlineacademiccommunity.uvic.ca/LearnAnywhere/learning-strategies](#)

Centre for Academic Communication - *Offers online and in-person one-on-one tutorials, workshops, and more.*
[uvic.ca/learningandteaching/cac](#)

Math & Stats Assistance Centre - *Offers drop-in, face-to-face tutoring and a friendly, collaborative study space for 100- and 200-level math and stats courses.*
[uvic.ca/science/math-statistics/current-students/undergraduate/msac](#)

MENTAL HEALTH & WELLNESS

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

SEOS Mental Health & Wellness Contact - *Dr. Fraass is a faculty member who can act as a sympathetic ear and (more importantly) provide guidance about: how to access the multitude of University support services, and which are useful in different circumstances. Andy can be found by dropping by his office or lab (Bob Wright A431, B409). He is also available via email for questions or to arrange a time to have a chat.* [andyfraass@uvic.ca](#)

Student Wellness Centre - *Our team of practitioners offers a variety of services to support students' mental, physical, and spiritual health.* [uvic.ca/student-wellness](#)

Counselling Services - *Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students.* [uvic.ca/services/counselling/](#)

Health Services - *University Health Services (UHS) provides a full-service primary health clinic for students and coordinates healthy student and campus initiatives.* [uvic.ca/services/health/](#)

ACCESSIBILITY

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a documented disability or health consideration that may require accommodations, please feel free to approach me and/or the Centre for Accessible Learning (CAL) as soon as possible.

Centre for Accessible Learning - *The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.* [uvic.ca/services/cal/](#)

ADVISING

For academic advising-related questions, students in the School of Earth and Ocean Sciences are also encouraged to meet with the SEOS Undergraduate Advisor (seosadvisor@uvic.ca) as well as an academic advisor in the Academic Advising Centre early in their studies to help map out a plan to declare a major and complete university program requirements.

Academic Advising Centre - *Academic advice and support is currently available by phone, email and virtual or in-person appointments.* uvic.ca/services/advising

Ombudsperson - *The ombuds office is an independent, impartial, and confidential resource for undergraduate and graduate students and other members of the University of Victoria community. The ombudsperson helps resolve student problems or disputes fairly.* uvicombudsperson.ca

ACADEMIC CONCESSION

You can request an academic concession if your course requirements are affected by unexpected and unavoidable circumstances, or conflicting responsibilities. Concession requests can be for an in-course extension, deferral, withdrawal under extenuating circumstances, or an aegrotat. Please speak to an advisor at the Academic Advising Centre if you have questions on how requesting a concession will affect your academic program.

Undergraduate Academic Concessions - uvic.ca/students/academics/academic-concessions-accommodations

EQUITY AND HUMAN RIGHTS AT UVIC

EQHR is a resource for students, staff, and faculty who have experienced sexualized violence, discrimination, and/or harassment and are looking for informal and/or formal resolution options as well as advice, coaching, and/or education. We are available for confidential consultations so that you can ask questions and learn your options.

EQHR – *By email at eqhr01@uvic.ca or in-person (Sedgewick C115).* uvic.ca/equity

Sexualized Violence Resource Office – *If you have been directly or indirectly impacted by sexualized violence, reach out to the SVRO for information, advice, resolution options (restorative and disciplinary) as well as support options and referrals. The SVRO is both survivor-centred and trauma-informed in their approach. You can reach us by phone at 250-721-8021 or by email at eqhr01@uvic.ca to book either an in-person (Sedgewick C119) or online appointment.* uvic.ca/svp

RESOURCES FOR INTERNATIONAL STUDENTS

International Centre for Students - *The primary office supporting international students on campus at the university-wide level.* uvic.ca/international-experiences

UVic Global Community Initiative - *Provides various supportive programming, including a Mentorship Program and Conversation Partner Program.* uvic.ca/international-experiences/get-involved/uvic-global-community

RESOURCES FOR INDIGENOUS STUDENTS

Indigenous Student Support - *UVic offers holistic services to Indigenous students throughout their academic journey.* uvic.ca/students/info-for/indigenous-students

Elders in Residence - *The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty, and administration in Indigenous ways of knowing and being.* uvic.ca/services/indigenous/students/programming/elders