Geography 200: Atmospheric Environments – An Introduction to Weather and Climate
Fall 2008

Instructor:
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Teaching Assistants:
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Course Web page:
http://www.geog.ubc.ca/courses/geog200/

Course Objectives:
To introduce the principle processes and concepts of meteorology and climatology at the synoptic and global scales: atmospheric energy, moisture, motion, weather systems and global climates.

Class locations and times:
The course consists of 3 one-hour lectures a week and a two-hour lab on most weeks.
Lecture: Rm 200, Monday, Wednesday & Friday 10:00-10:50
Labs: Section L1A: Rm 214, Tuesday 9:00-11:00
Section L1B: Rm 214, Tuesday 11:00-13:00
Section L1C: Rm 214, Thursday 9:00-11:00
Section L1D: Rm 214, Thursday 11:00-13:00

Course Evaluation:
There will be a mid-term test, two lab exams and a final course examination. Marks for the course will be allocated as follows:

Laboratory exams	**30%**
Mid-term test	**20%**
Final examination	**50%**

Important Dates:
These exams are scheduled tentatively. Please check with the instructor closer to the different exam dates.
Mid-term Exam Friday, Oct 10 10:00-10:50
Lab Exam #1 Oct 14 and 16 during regular lab hours
Lab Exam #2 Nov 25 and 27 during regular lab hours

Recommended Reading:
The primary text book for the course is:

Aguado, E. and E.J. Burt, 2004: *Understanding Weather and Climate*, 3rd Edition, Pearson – Prentice Hall, NJ.

The closest backup texts are:

Danielson, E.W, J. Levin and E. Abrams, 2003: *Meteorology*, 2nd Edition, McGraw-Hill, NY.

Ahrens, C.D., 1999: *Meteorology Today*, 6th Edition, West Publishing, MN.

The following book is recommended for students pursuing atmospheric science:

Stull, R.B., 1999: *Meteorology Today for Scientists and Engineers*, 2nd Edition, West Publishing, MN.

Please check the course web site for additional references and detailed reading suggestions.

Detailed Course Outline:

The following table provides a detailed course outline. A detailed and up-to-date lecture schedule is posted on the course web site.

Topic	Approx. Num. Lectures
1 Introduction	
Introduction to the course, atmospheric composition and vertical structure	**2**
2 Radiation Laws	
Energy, temperature, conservation and units of measurement. Radiation spectrum, surface radiative properties, radiation laws (Planck, Wien, Stefan-Boltzmann, Kirchhoff)	**2**
3 Solar Radiation	
Solar constant, cosine law of illumination. Earth-Sun controls on solar receipt (latitude, seasons, path length, time of day). Atmospheric controls on receipt (scattering, reflection, absorption, transmission), beam and diffuse solar input. Surface controls on receipt (sloping terrain, albedo). Net solar radiation.	**2**
4 Longwave Radiation and Net All-wave Radiation	
Longwave Radiation (IR) at the ground (emission, reflection, net absorbed). Atmospheric IR (selective absorption and emission by gases, effects of cloud, exchange in layers). "Greenhouse" (Atmosphere) effect. Net all-wave radiation budgets (terms, diurnal and annual budgets at all scales).	**2**
5 Heat Balance and Temperature	
Global annual heat balance and its latitudinal distribution. Diurnal heat balance at a site. Heat storage change and temperature. Surface distributions and vertical profiles of air temperature and its measurement.	**2**
6 Water Balance and Atmospheric Moisture	
Global hydrologic cycle, latitudinal variation of terms, water balance at a site. Humidity – Gas Law, measures, concept of saturation and partial saturation (Clausius-Clapeyron, Tetens, RH), dew-point, psychrometry, other measures of humidity. Evaporation, dew and frost. Fog and cloud types.	**4**

Mid-term Exam: Friday October 10 **1**

7 Atmospheric Thermodynamics
Gas Law, Hydrostatic Law. Buoyancy, equilibrium, lapse rates, dry adiabatic lapse rate, potential temperature (Poisson's equation). Tephigram construction and use. Normand's rule. Static stability applied to cloud development and air quality. **5**

8 Precipitation
Precipitation processes, types and measurement. **2**

9 Atmospheric Motion
Atmospheric pressure and its measurement and distribution, surface and upper-level charts. Forces of motion (gravity, pressure-gradient, Coriolis, friction, centripetal/centrifugal). **2**

10 Wind Systems
Large-scale flows. Geostrophic wind, Buy Ballot's law. Friction and Ekman spiral. Gradient wind, super- and sub-geostrophic flow, convergence and divergence. Cyclostrophic wind. Thermal advection and baroclinic instability. Thermal "wind" and jet streams. Divergence, vorticity and vertical motion. Shear and curvature. Vorticity theorem. Lee waves and Rossby waves. Continuity, divergence, vorticity and angular momentum. Surface effects of friction and turbulence. Local wind systems, thermal circulations on all scales. **5**

11 Air Masses, Fronts and Frontogenesis
Characteristics, classification and modification of air masses and fronts. Cyclogenesis and mid-latitude storms. Vorticity, divergence and storm development. Global wind systems and ocean currents. ENSO-type events. **3**

12 Global Climate and Climate Change
Climatic classification and global patterns of climate. Focus on climates of selected regions. Climate changes in the past, possible causes. Recent changes and the possible role of human activities. **3**

Lecture Notes

Lecture notes (PDF files of Powerpoint slides) will be posted in the resource section of the course web site either shortly before or right after each lecture.

Lab Schedule

The lab schedule as well as the necessary lab material is posted in the resource section of the course website.

To get the most benefit from the labs, you should look at the next exercise in the sequence before coming to the lab. The TA will outline the exercise and give appropriate hints to get you started or break through any sticking points. You will gain most from doing the laboratory in class and making use of the TA's expertise. At the end of the week the correct solution will be posted so you can learn from any mistakes. If you are still not feeling on top of the material consult your TA. You are free to work in groups as long as this does not become disruptive to the class.

Your work will not be handed in or graded. Grading will be limited to the 2 lab exams each of which will pose questions similar to, and based on the same topics, as those discussed in the preceding labs. The two lab exams will be held during the regular lab hours.

Even though attending the labs is not mandatory, it is strongly recommended that you attend the labs and make the best possible use of your teaching assistant. The material covered in the lab is a crucial component of the course and will be part of any course exam.