



---

**COURSE OUTLINE**  
**Dynamics of the Cryosphere**  
**Lecture: Human & Social Development A264 14:30-16:20 Tuesdays**

---

**Office Hours: Wednesdays 13:00-14:00 or by appointment**  
**Office Location: DTB B122**  
**Contact: randy@uvic.ca**

**COURSE DESCRIPTION**

Snow and ice dominate the Canadian landscape. There is virtually no area in Canada which escapes the influence of snow and ice. We skate on frozen ponds, ski down snow laden mountains, drive through snow blizzards and watch how ice jams in rivers cause rivers to swell and floods to occur. The duration and the thickness of snow and ice increase rapidly northwards, and glaciers are found in mountainous areas and in large parts of the Arctic region. Given that snow and ice impact heavily on the Canadian way of life, this course seeks to understand the dynamics of snow and ice in physical, climatological, and hydrological contexts. This course will examine snow properties, snow cover distribution, glacier hydrology, melt runoff, and ice in its many forms (lake ice, river ice, sea ice, and ground ice). The application of remote sensing and other remote observing systems to understanding the cryosphere will be examined. This course will also examine the implications of climate change on the cryosphere in Canada and beyond.

**CLASS MEETINGS**

Class meetings will typically comprise discussions around a topic as initiated by the instructor or used for term project work. Topics covered include:

- Components of the cryosphere
- State of the cryosphere and climate change
- Material properties of water, ice, and snow
- Energy exchanges
- Snow, freshwater ice, and water availability
- Glaciers and Ice Sheets
- Melt runoff and floods
- Sea ice
- Permafrost
- Climate interactions and climate change

## TAKE HOME EXERCISES

Two take home exercises will be given during the course. Further details, including evaluation criteria, will be provided in the class.

## TOPIC REVIEW PAPER

Each student is required to conduct a critical review of one peer-reviewed, published, journal article that addresses some aspect of the cryosphere (e.g. techniques or applications). The review will comprise a written component, assessing the article within the context of the literature. It will also comprise a presentation component, where the critical review is presented to the class and followed by a discussion led by the reviewer. You are encouraged to use Power Point or other preferred media to communicate your review and lead your discussion. Students should consider choosing a journal article and related references which align with their chosen (or anticipated) term project topics. Further details and evaluation criteria will be provided in class.

## TERM PROJECT

A group term project (3-4 people) will address an interesting aspect of the cryosphere. Groups are expected to develop a proposal in early January, and to design a scientific experiment which spans the length of the term. Students will have to consider logistical constraints, available data, software and manpower in the design of the project. Guidance and feedback will be provided by the course instructor.

The choice of your topic for your project is up to you and your group but a **one page proposal is due in class on October 5, 2021**. The final class meeting will be used for term project presentations, to be given in a conference style format. The final term project report is due on the last day of classes for the term.

Required format, evaluation criteria, and suggested topics will be provided in class.

Sample topics, from which focused projects may be derived.

Hydrologic cycle in the Arctic  
Environmental factors influencing glacier runoff  
Ice growth and decay  
Role of climate on the distribution of permafrost  
Role of permafrost in northern hydrology  
Northern snow redistribution and change  
Role of snow in the northern water budgets  
Role of snow in the terrestrial energy budget  
Role of lake ice in the climate system  
Role of sea ice in the climate system  
Snow metamorphosis  
Factors affecting the timing of snowmelt  
Cryosphere evidence for climate change in northern environments  
Factors driving the variability in sea ice extent  
The influence of ice sheets and glaciers on sea level change  
The relationship between sea ice and ocean current circulation  
Ocean-ice interactions  
The Freshwater budget of the Arctic

---



## GEOGRAPHY DEPARTMENT INFO

- Geography Department website: [uvic.ca/socialsciences/geography/](http://uvic.ca/socialsciences/geography/)
- Geography Department Chair: [geogchair@uvic.ca](mailto:geogchair@uvic.ca)
- Geography Undergraduate Advising: [geogadvising@uvic.ca](mailto:geogadvising@uvic.ca)

## BRIGHTSPACE

Lectures materials, assigned readings, and general course communications will be via Brightspace. You are required to come prepared for each lecture. This means you should have read and considered the recommended readings.

---

## POLICY ON LATE ASSIGNMENTS

Late lab assignments are subject to significant penalties: Late lab assignments are subject to significant penalties: 5% for each 12 hour period following the due date and time. Exceptions are not permitted except for circumstances involving medical or compassionate reasons. Written verification as proof may Td( )Tj0.036 T



**POSSIBLE FIELD TRIP**