

Polar Systems Science - SIOC 209- 4 Credits

Fall Quarter 2018: Tu, Th 11:00-12:20 pm

Location Eckart 236

Instructors: Jeff Severinghaus and Fiamma Straneo

The polar regions are intrinsically complex, under-observed systems where the ocean, the atmosphere, the cryosphere and the biosphere are strongly interconnected. Rapid ongoing changes, in both hemispheres, have raised scientific and societal interest in these regions with the goal of understanding the mechanisms behind the observed changes as well as their global impacts (e.g. sea level rise due to melting ice sheets). These changes often exceed model predictions, reflecting in many cases our limited understanding of feedbacks across multiple system components. These components often lie in different academic disciplines, hampering their study by traditional modes of scholarship. As a result, there is a growing demand for scientific understanding that can stretch across disciplines and for scientists equipped with the tools and knowledge to address the societally-relevant, urgent and complex questions that relate to the polar regions.

This interdisciplinary course aims to expose students to the concept of System Science and provide them with the tools needed to address a problem from multidisciplinary perspectives. It will introduce the basic components of the polar systems – sea-ice, glaciers and ice sheets, polar ocean and atmosphere – but also, highlight feedbacks amongst components. Students will be introduced to examples of questions where progress requires a ‘system understanding’ – e.g. impact of icebergs on ecosystems and sea-ice and the large scale ocean circulation; katabatic winds from ice sheets and their potential feedbacks on sea-ice and dense water formation; impact of algae and black carbon on the albedo and hence melting of glacial ice; differences in sea-ice variability in the Arctic and Antarctic. Through much of the course students will choose a topic related to a polar system and carry out a project that will be presented to the class at the end.

Requirements

While there are no required courses to participate in this class, some introduction to the physical climate system and the ocean, as well as introductory calculus will be helpful. This course is mainly aimed at post-departmental exam students from different disciplines.

Credit & Homework

Grades will be based on in-class participation and presentations and a final project.

Some Reference Text and Websites:

- The Arctic Climate System: M. Serreze and R. G. Barry, Cambridge University Press, p. 365, 2005.
- Arctic Monitoring and Assessment Program: www.amap.no
- Scientific Committee on Antarctic Science www.scar.org

Syllabus

September

27th Thursday - Introduction to course and polar systems – Jeff S. and Fiamma S.

October

2nd Tuesday - Ian Eisenman - Sea Ice

4th Thursday – *Current topics – Sea-ice*

9th Tuesday - Fiamma Straneo - Polar Oceans

11th Thursday - *Current topics – Polar Oceans*

16th Tuesday - Dan Lubin - Polar Atmosphere

18th Thursday - *Current topics Polar Atmosphere*

23rd Tuesday - Jeff Severinghaus Paleo Polar

25th Thursday - *Current topics Paleo Polar*

30th Tuesday - Helen Fricker - Glaciology of Polar Regions

November

1st Thursday - *Current topics Paleo Polar Ice Sheets*

6th Tuesday - Jeff Bowman - Polar Marine Ecosystems

8th Thursday - *Current topics Polar Marine Ecosystems*

13th Tuesday – Examples of Polar Systems

15th Thursday - Examples of Polar Systems

20th Tuesday - Examples of Polar Systems

22nd - THANKSGIVING

27th Tuesday - Examples of Polar Systems

29th Thursday - Student Project Presentations

December

4th Tuesday - Student Project Presentations

6th Thursday - Student Project Presentations