ESS 203 Glaciers and Global Change

- 5 credits No pre-requisites
- NW Natural World
- I&S Individuals and Society
- W Optional W (Writing)
- http://courses.washington.edu/ess203/

Instructors:

Lectures leader:
Ed Waddington
Please call me "Ed"
edw at uw.edu

Lab leader:
Seth Williams
semw at uw.edu

Term-projects leader:
Jessica Badgeley
badgeley at uw.edu

Introductions

Who is Ed?

- He's a Professor in Earth and Space Sciences.
- Teaches graduate and undergraduate courses about glaciers, continuum mechanics, and computer modeling of ice and climate.
- Advises graduate students and some undergrads doing directed research projects.
- Carries out research on ice sheets in Greenland and Antarctica, to select ice-core drilling sites, to help ice-core geochemists to interpret paleoclimate records in the ice, and to figure out how big the ice sheets were in the past.

Introductions

It will be important to know your classmates for group discussions and Labs.

- We can start the process today

- We will use break-out rooms with 3 or 4 class-mates in each
- Take turns with each person in the room taking about 90 seconds to introduce yourself to your partners.
- Suggestion - your name and at least 2 other bits of information (for example, your reason for being here today; an interest of yours outside school; others …).
- Now that you know a bit about one another, each of you in turn can be interviewed for 2 or 3 minutes by the others in your group, so they can learn more about you.

UW is in Seattle

- Amazon's Spheres: Lush nature paradise adorns $4 billion urban campus

Beyond Amazon, what are The Spheres?

HINT:

- Although this an Earth Science department, they are ***not*** a **rock** group ☺

Let's take a few minutes with your group to identify some of Earth's "spheres".

The Spheres

They are not a rock group ***or*** Amazon's garden:
Can you name some Spheres?

- The ***atmosphere*** is the region of gases on planet Earth.
- The ***hydrosphere*** is the watery regions on planet Earth.
- The ***biosphere*** is the region hosting life on planet Earth.
- The ***lithosphere*** is the rocky tectonic plates (the uppermost 30 miles or so) on planet Earth.

What's the *Cryosphere*?

- The cryosphere is the ice on planet Earth. (*kryos*, Greek, icy, cold)

- Can you name some components of the Cryosphere?

Can you name some components of the Cryosphere?

Here's Ed's list

- Ice in clouds
- Seasonal snow
- Lake ice
- River ice
- Sea ice
- Glaciers
- Ice caps (e.g. in Patagonia, on Iceland, on some Canadian arctic islands)
- Greenland and Antarctic Ice Sheets
- Permafrost (ground ice).

ESS 203 Topics

- What is a glacier?
- How do glaciers respond to climate changes?
- Glaciers and sea level
- The climate record left in the landscape by glaciers.
- Climate records locked in glaciers (ice cores)
- Ice Ages and continental-scale glaciers (ice sheets)
- Glacier outburst floods
- Lakes under two miles of ice
- How do scientists formulate useful questions?
- How do scientists communicate their results?
- What is peer review, and how does it work?
- Why is there political controversy about ice?

ESS 203 web site

http://courses.washington.edu/ess203/

Canvas

- Writing assignments will be posted on Canvas (some postings will link to the class web site above).
- We will use the canvas GradeBook.
- Most documents will also be available on the class web site above as we transition the class to Canvas.

Syllabus

- We will go over general points now.
- For details, see class web site
  (linked from Canvas syllabus).

Syllabus – Executive Outline

- Course content and purpose
- Learning Objectives
- Tentative Timetable
- Reading materials
- Class structure, Lab structure
- Group research projects
- Tests
- Grading
- Disability-related needs, Safety, Religious accommodations, Academic integrity

- For details, see Canvas, which also links to class web site

Learning Objectives

You will understand:

- how and why the cryosphere is changing today.
- how glaciers alter landscape, climate, and sea level.
- how scientists can extract a wealth of information about past environments from ordinary materials such as ice, mud, stone, wood.
- How to read scientific papers, to get the unfiltered story from the original sources.
- How to find your ***own*** rough answers to key environmental questions.

Course Reading

Text:

Macdougall, *Frozen Earth: the once and future story of ice ages*. UC Press, 2013.

(It is available in digital form through the UW library
http://site.ebrary.com/lib/uwash/reader.action?docID=10654376

Selected articles from journals and peer-reviewed periodicals

- These articles will generally be posted on Canvas and/or the class web site.

http://courses.washington.edu/ess203/

Course Grading

25% - class tests (2)
40% - labs
10% - short writing assignments due at class
15% - group research project and report
10% - class participation

http://courses.washington.edu/ess203/

What will you do in this class?

Lectures, and group discussions in class.

- **Your attendance at classes is very important because of the discussions.**

My goal is to post lecture slides on the class web site and on Canvas under **Files** before each lecture (please check to see whether I succeed ☺).

- You can use them if you want to follow along.

http://courses.washington.edu/ess203/

What will you do in this class? (cont'd)

There will be frequent short writing Assignments (~1 page or less).

- CR/NC (no numerical grade) but completing them will contribute to your course grade.

There will be 2 Take-at-Home Mid-term Quizzes

- After 4 weeks and after 8 weeks.
- Study questions will be posted a week ahead.
- Each quiz will consist of some of those questions.
- I encourage you to work with classmates (Zoom or Slack) to figure out your best answers ahead.

There is no final exam.

What will you do in this class? (cont'd)

Each class, a previously identified volunteer

- recounts briefly (in less than 1 minute) 1 or 2 **highlights** from the previous class (**not** a summary of the entire class), and
- turns in a written report of ~100 words identifying those highlights.
- Volunteering to make these reports will enhance your class participation grade.

I am looking for a volunteer to report today's highlights (or lowlights) on Wednesday.

- Others please sign up for a future class in Canvas under the **Pages** tab.

What will you do in this class? (cont'd)

You will carry out a research project with a Group.

- Your group of 2 or 3 classmates will write a group paper and make a short oral presentation in Lab in Week 10.

What will you do in Labs?

Labs start this week.

Work in groups on exercises that supplement lectures.

- Your group will report your findings to the other groups.

Write 1-2 page assignment for each Lab.

- Your Lab leader (Seth) will assign grades to your Lab work. More details in Lab this week.

There will be 2 field trips to glacial features around Seattle.

- Under development
- Trips will be virtual or self guided

* Please access the posted Lab worksheets digitally each week before your Lab.

Lab This Week

James Balog – artist and scientist
Time-lapse photography of glaciers

http://extremeicesurvey.org/

Art meets Science

- We will watch an *Extreme Ice Survey* video

  https://www.youtube.com/watch?v=EjsyRHqzds4
- Your Lab groups will discuss the questions in the Lab 1 handout
- No formal writing assignment this week.

Action Items

1. **Assignment: HW 01 on Canvas** – due on Wednesday:

- Describe 2 things that you learned today about glaciers. (If you did *not* learn something new, you can find 2 things by looking up "glaciers" on the web or in an encyclopedia. Do not cut-and-paste!)
- What is 1 thing that you want to know about glaciers but don't (yet)? To keep it easy, please do not exceed 1 paragraph or 1/2 page. Thanks!

2. Reading assignment:

During the next week or so, we will be asking "*What is a Glacier?*"

- Please read the Wikipedia entry *Glacier* at
  http://en.wikipedia.org/wiki/Glacier
  in particular the sections *Types, Formation, Structure,* and *Motion.*

Action Items (cont'd)

3. Class Questionnaire:

We have posted a Day-1 Questionnaire so we can learn more about your backgrounds and interests

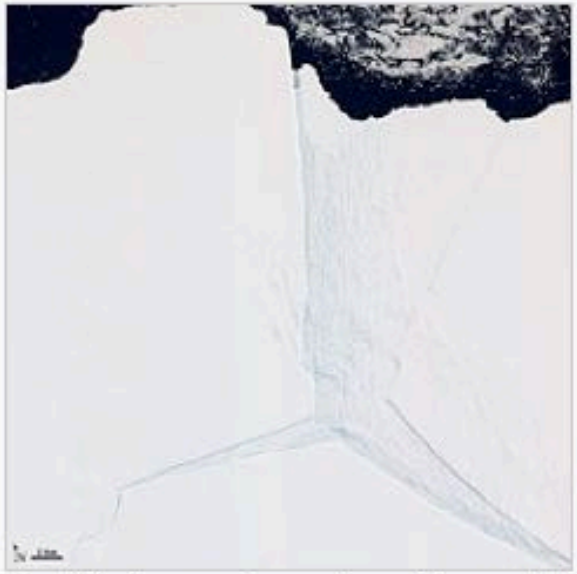
- you can fill it in on Canvas under **Quizzes**.
- Please return Questionnaires by Friday, or as soon as you can. Thanks.

Plagiarism

Hypothetical ESS 203 Assignment:
In a paragraph, outline the geography and human history of Amery Ice Shelf.

On Wikipedia, you find:

The **Amery Ice Shelf** (69°45′S 71°0′E) is a broad ice shelf in Antarctica at the head of Prydz Bay between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. He named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28). The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf.



Satellite image of a portion of the Amery Ice Shelf, where three giant rifts meet.

In 2001 two holes were drilled through the ice shelf by scientists from the Australian Antarctic Division and specially designed seabed sampling and photographic equipment was lowered to the underlying seabed. By studying the fossil composition of sediment samples recovered, scientists have inferred that a major retreat of the Amery Ice Shelf to at least 80 km landward of its present location may have occurred during the mid-Holocene climatic optimum (about 5,700 years ago).[1]

Wikipedia

The **Amery Ice Shelf** (69°45′S 71°0′E) is a broad ice shelf in Antarctica at the head of Prydz Bay between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. He named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28). The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf.

Student report

The Amery Ice Shelf (69°45′S 71°0′E) is a broad ice shelf in Antarctica at the head of Prydz Bay between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. He named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28). The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf.

Example 1: Is this plagiarism?

Wikipedia

The **Amery Ice Shelf** (69°45′S 71°0′E) is a broad ice shelf in Antarctica at the head of Prydz Bay between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. He named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28). The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf.

Student report

The Amery Ice Shelf (69°45′S 71°0′E) is a broad ice shelf at the head of Prydz Bay in Antarctica, between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf. Mawson named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28).

Example 2: Is this plagiarism?

Wikipedia

The **Amery Ice Shelf** (69°45′S 71°0′E) is a broad ice shelf in Antarctica at the head of Prydz Bay between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped on February 11, 1931 by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson. He named it for William Bankes Amery, a civil servant who represented the United Kingdom government in Australia (1925–28). The Advisory Committee on Antarctic Names interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf.

Student report

The broad Amery Ice Shelf is at the head of Prydz Bay in Antarctica, between the Lars Christensen Coast and Ingrid Christensen Coast. It is part of Mac. Robertson Land. The name "Cape Amery" was applied to a coastal angle mapped by the British Australian New Zealand Antarctic Research Expedition (BANZARE) under Douglas Mawson on February 11, 1931. ACAN (the Advisory Committee on Antarctic Names) interpreted this feature to be a portion of an ice shelf and, in 1947, applied the name Amery to the whole shelf. Mawson named it after William Bankes Amery, a civil servant from the United Kingdom government in Australia from 1925 to 1928.

Example 3: Is this plagiarism?

Avoiding plagiarism

Are you concerned about the quality of your written English?

- It won't ever improve if you copy other people's writing as your own to avoid embarrassment.
- Instructors in the class may annotate your grammar, spelling, sentence structures, and composition in your written work, but our goal is to help you write better in your next report.
- We do not deduct points mark for composition errors, if you are working to improve.

Are you trying to save time?

- Trying to tweak somebody else's text and to remove embedded links can take longer that writing in your own words. ☺

Don't try to cheat yourself out of value in your education!

Glaciers From Top to Bottom

Blue Glacier, Mt Olympus

- Lots of snow here.
- Note the ***bergschrund*** (that very(!) large crack).

Blue Glacier, Mt Olympus

- Note annual layering in the ice cliff.

High on Blue Glacier, Mt Olympus, in late June

- Note the ***crevasses***.
- Do you think this thing moves?
- Do you see any exposed ice?

Blue Glacier ***terminus***, Mt Olympus

In late June, from Panic Peak.

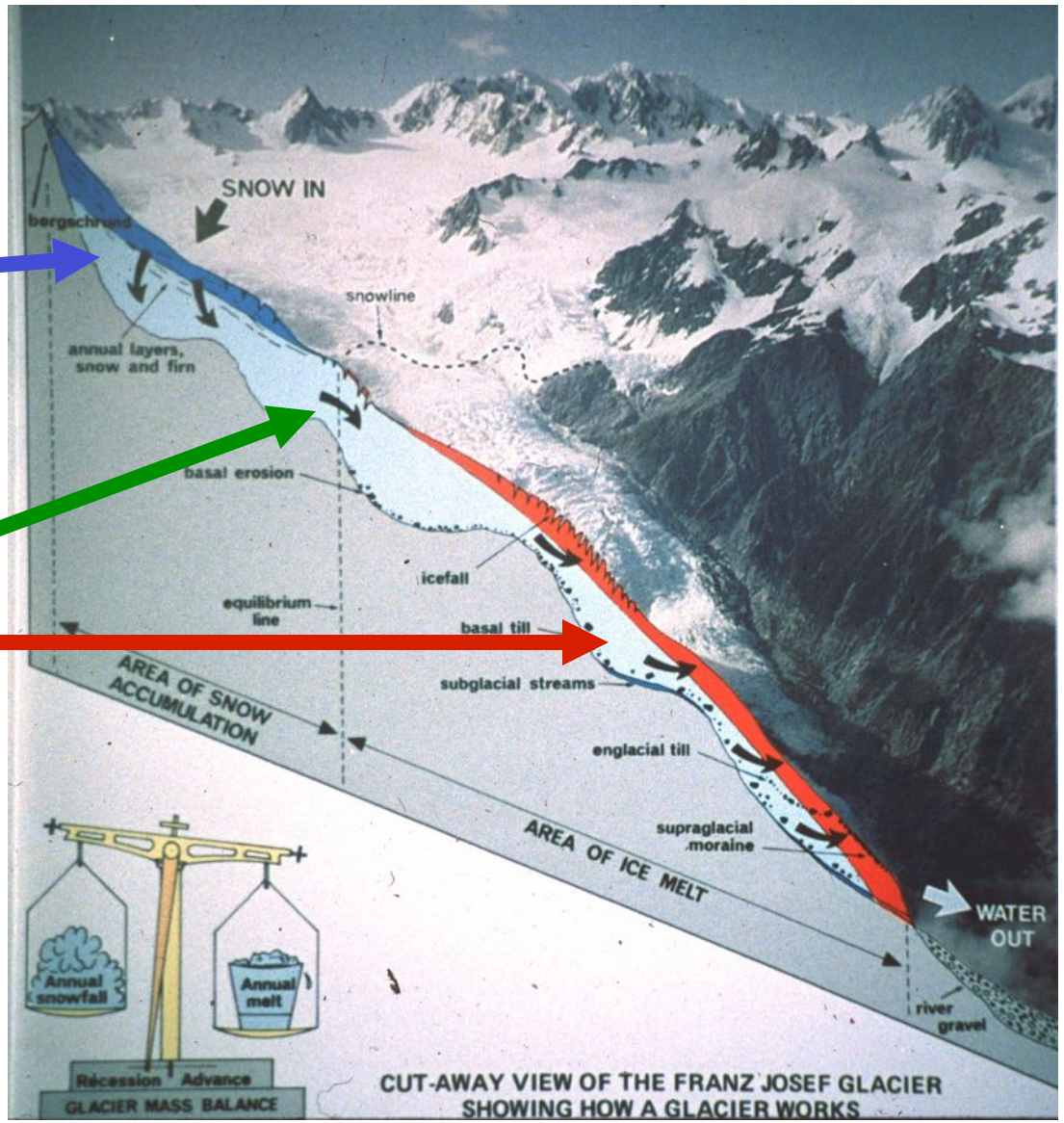
- Note the bare ice patches.
- Does this mean that the glacier is shrinking?

Wedgemount Glacier, Garibaldi Park, B.C.

- In ***ablation area*** near glacier terminus.
- Note the ***seracs*** (large ice blocks).
- Why is there no snow here?

Glacier Mass Budget

- Net accumulation of snow on upper glacier, where annual snowfall exceeds annual melting.
- Snowfall equals melting on "equilibrium line".
- Net melting ("ablation") on lower glacier.
- Ice flow continually carries excess ice and snow from ***accumulation area*** to ***ablation area*** to maintain a rough balance.



Nepal – Glaciers and people

Manang Glacier and Manang village, Annapurna Himal

- Note the lake dammed by a ***glacial moraine***.

Lowell Glacier

Yukon Territory

- Note ***medial moraines.***

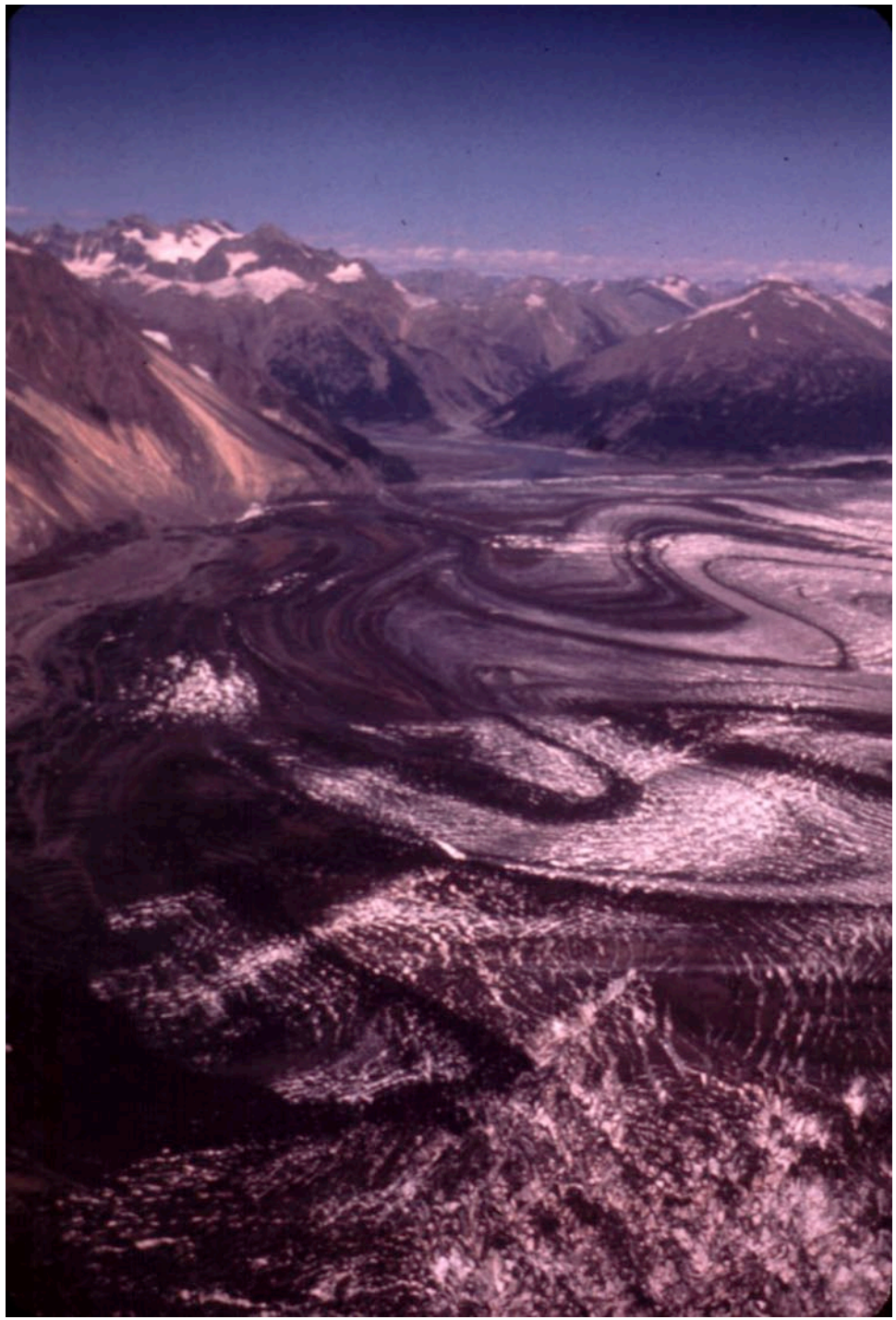
Whenever 2 tributary glaciers join, dirt and rock from their margins becomes part of the combined glacier downstream.

The glacier is ~2 miles across near its terminus in Lowell Lake.

Tweedsmuir Glacier

in northern British Columbia

- Note the looped medial moraines.
  This glacier ***"surges"*** every few decades.



Surging Glacier

Tweedsmuir Glacier surges into Alsek River.

- Note helicopter for scale.
- What might happen to the river when the glacier surges?

South Cascade Glacier, WA

1960-2006