Glaciology Lab 3: Theory workshop

Background information

As we have discussed in class, glaciology is a relatively young science, and we have very little observational data compared with the number of glaciers worldwide. Theoretical work therefore has an important role in advancing the field. Theory papers may seem intimidating at first, but we are building the tools to tackle them together.

This lab will apply a version of the CREATE method to help you analyze a published work of (mostly) theoretical glaciology. The goals are to (1) practice recognizing and following along with the mathematical concepts we have been reviewing; (2) engage more deeply with the primary literature of our discipline; and (3) communicate science with each other.

Materials

- Lab notebook
- Laptop computer (optional)
- Selected glaciological article

Procedure and questions

The procedure includes several parts. For parts 1 and 2, there should be 3 groups of 4 students each, and **each group should divide the parts so that each person does one of 1A-1D.** For Part 3, we will reorganize into four groups of 3 students each. Everyone will then have the chance to learn from every other group's analysis.

Part 1A: Consider the concepts *(one team member)*

1. Read through the introduction of your paper.
2. Highlight key concepts in the introduction. On the paper or in your lab notebook, define any unfamiliar terms (you can use your computer or phone for this, or ask me).
3. Write a quick summary in your own words of the introduction. What do the authors say about work that had already been done when this paper was published? What do they highlight as key questions or problems that need to be addressed?
4. Draft a concept map of the introduction, noting key concepts and including arrows with linking words to describe their relationship.
5. Revise the concept map: look for concepts and relationships that could be reorganized for more clarity. Are there relationships between concepts that could run in another direction?
6. Draw the concept map your group designs in the blank space provided on the next page.

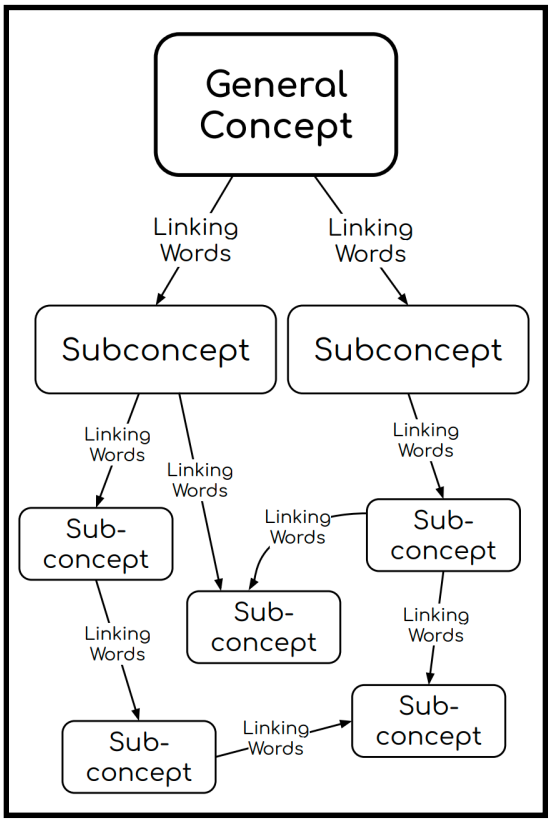

Figure 1. An example concept map.

Concept map

Part 1B: Read the methods & results *(one team member)*

1. Skim through the methods and results sections. (If your paper has descriptive headings instead of “Methods” and “Results”, choose the sections that describe how the work was done and report what was found.)
2. Draw a diagram or cartoon in the space provided below to illustrate how the study was done.
   A. Identify one or more key equations and draw a picture of a glacier to indicate what the equation(s) refer to.
   B. If your paper includes experimental data, draw how the data was collected and processed.

Part 1C: Identify the research question(s) *(one team member)*

1. With your group, write down the research question(s) the paper proposes to answer. You can usually figure this out from the introduction (what do they claim is important?) and the focus of the results. Note these below. There may be only one, or you may identify more.
   -
   -
   -
2. Check in with your group member analyzing figures (Part 4, below) to see which figures they have identifies as most important to the analysis. Review each of those figures and make note of what specific question, or component of the overall research question, is addressed in it. Fill out the first column of Table 1, next page.

Part 1D: Analyze the figures *(one team member)*

1. For each figure or table presented in the results, annotate on the paper or on your diagram how the authors produced it from the methods. If you have more than 4 figures, choose the ones that seem most important to the results. Confirm with your group member identifying research questions (Part 3, above) which figures should be analyzed.
2. For each of the important figures you identified, write a short description and identify the key takeaway. Fill out the remaining columns in **Table 1, next page.**

Part 2: Evaluate the conclusions

Come back together with your group to do this step.

3. Let each person take a turn to present their part of the analysis. Take notes on the sections other group members completed. You can fill in the spaces allocated to the relevant sections during this time.
4. Together, read the Discussion and Conclusions sections of the paper.
5. Decide together: Do the methods applied do a good job of answering the research question? Why or why not? Summarize your thoughts below.

6. Based on this paper, its strengths/weaknesses, and any assumptions the authors make, what are some research questions that could be addressed in a future study?

Figure	Research question addressed	Brief description	Key takeaways
1			
2			
3			
4			

Part 3: Share your expertise

For this step we will split into new groups. Each new group should have someone who read each of the three assigned articles.

1. Allocate about 10 minutes to go through each paper together. The person who read each paper should give a summary of the research questions, methods, and key conclusions identified in their group's analysis; those who did not read the paper should ask questions to be sure they understand.

2. After reviewing the papers together, discuss and record:
   - What are some commonalities among the papers you shared?

   - What concepts from class did you recognize in the papers?

Lab closing reflection

You can complete this reflection in a conversation with your group, or you can reflect individually and write a short summary to turn in to me. Please choose what best suits your reflective mode, and be sure to respect your group members' preferences.

✦ What concepts or methods from these papers might be useful to keep in mind as you continue to approach new problems in glaciology?