Course Description
This is an 8-week field course in Earth system science, with emphasis on field science, glaciology, and integrated Earth systems of the northern Coast Mountains in Alaska and Canada. Students will conduct original research and learn safe expeditionary practices while traversing the extreme environment of the Juneau Icefield. This course emphasizes field observations and research-based learning. Students will learn through relevant demonstrations, problem sets, pertinent lectures and discussions at camps, and through conducting research with a range of instrumentation across the Juneau Icefield. Academic topics include: glaciology, geophysics, geochemistry, alpine ecology, geomorphology, remote sensing, atmospheric science, hydrology, glacier travel, science communication, expedition planning, and leadership.

Instructor
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Prerequisites
Interest in Earth systems science

Course Details
Semester Offered: Summer 2019 and repeated each summer
Credits: 6 credits through the University of Maine or 6 credits through the University of Alaska, Southeast (UAS) for UAS degree enrolled students (8-week field camp).
Meeting time and place: Juneau, Alaska

Textbook
No textbooks are required for this course. We rely on peer-reviewed literature instead of textbooks. However, there are numerous books available for students in the field for review. Students interested in learning more about glaciology, glacial geology, or other topics within the academic curriculum on the Juneau Icefield are encouraged to consider the following textbooks after the summer:

Field Techniques in Glaciology and Glacial Geomorphology – by Bryn Hubbard & Neil Glasser
Glaciers & Glaciation, 2nd Edition – by Douglas Benn & David Evans
Dynamics of Ice Sheets and Glaciers – by Ralf Greve and Heinz Blatter
Fundamentals of Glacier Dynamics – by CJ Van Der Veen
**Class Communication**
I will primarily rely on email or video webinar prior to the summer program to communicate and share material with you, once you are enrolled in the course. Announcements will be made via email, so please check it frequently.

**Course Goals and Learning Outcomes**
The course ERS 499 Section 002: Juneau Icefield Research Program, will focus on answering four primary questions:

1) How do glaciers work?
2) How do glaciers relate to their surrounding environment?
3) How do we study glaciers and surrounding related environments?
4) What other skills are critical for Polar Earth systems science research?

More specifically, topics related to these questions that will be covered through lecture, lessons, workshops, and field research include the following:

**How do glaciers work?**
- Architecture of a Glaciers, Icefields, and Ice Sheets
- Glacier Energy and Mass Balance
- Glacier Dynamics
- Glacier Hydrology

**How do glaciers relate to their surrounding environment?**
- Juneau Icefield-specific glaciers
- Glacier Change
- Glacial Geology, Geomorphology, and Geology/Tectonics
- Climatology and Meteorology
- Hydrology
- Biosphere
  - Ecology
  - Biogeochemistry

**How do we study glaciers and the surrounding environments?**
- Geophysics
- Geochemistry
- Geomatics and Remote Sensing
- Numerical Modeling

**What other skills are critical for polar research?**
- Sciences Skills
  - Field Techniques
  - Quantitative Techniques
- Expeditionary Skills
  - Science Expedition Preparation and Planning
  - Field Safety
  - Glacier Mountaineering
- Communication Skills
  - Science Communication
  - Science Policy
**Course Schedule for Summer 2019**

Please note that the following calendar is tentative. Our beginning and ending dates are firm, but all other dates are subject to change due to weather and other logistical constraints. The purpose of this calendar is to provide an understanding of the general summer program as we cross the Juneau Icefield. Different portions of the summer are broken up into imprecise weeks or blocks. The main icefield program will depart Juneau via the Lemon Creek Trail to Camp 17, then to Camp 10, Camp 18, Camp 26, and down Llewellyn Glacier to its Terminus to Atlin Lake, where participants will be picked up by boat for transport to Atlin, British Columbia (Camp 30). Staff and students will travel as several self-sufficient trail parties, independently from camp to camp over a span of 1-3 days for each camp move.

Estimated programmatic dates are as follows:

**June 13 – June 20 (Juneau, Alaska):**
Students spend five or six days in Juneau doing orientation. The safety staff cover basic backcountry travel skills such as how to pack a backpack; how to layer in a rainy, temperate environment; hydration and nutrition; and blister care. Students do individual gear checks with staffers and start familiarizing themselves with how new equipment works. The whole group does some warm-up day hikes- one to a local peak and one onto the blue ice of the Mendenhall Glacier. Faculty deliver the first set of introductory academic lectures. Note that Juneau Week is geared primarily toward student orientation, but we welcome any faculty. Especially early-career faculty new to JIRP or faculty who may not have a strong backcountry background have appreciated attending these days of orientation. Additionally, if you’re traveling from far away, Juneau Week can be a good time to get over jetlag (Alaskan Standard Time is one hour further west than the Pacific Standard Time), organize research and personal equipment, and generally get your feet under you before heading up to the Icefield.

**June 20-July 3 (Camp 17, Alaska):**
The first 10-14 days on the Icefield are dedicated to safety training for all students and any new faculty who elect to participate. The JIRP safety staff fill every day with a series of camp orientations (cook crew, work detail, bunkhouse etiquette, etc.), general Icefield protocols surrounding risk management and communication, and skiing and mountaineering skills. Skiing lessons are divided by levels, and students will change groups ever day depending on their progress. Safety staff teach the basics of glacier mountaineering in small groups so that everyone can comfortably cover harness use, rope skills, anchor building, crevasse rescue, and route finding. We spend as many hours as possible on the glacier every day so that everyone becomes accustomed to working in the sun, rain, wind, and fog, but we are almost always within a short, safe hike of camp. Using a combination of short lectures, group practice, and one-on-one mentorship, the staff work with participants to develop basic mastery of all necessary skills.

Towards the end of Block 1 some students will have learned safety skills to a satisfactory level ahead of the rest of the group. For a few days these students will assist with limited research needs on the Lemon Creek Glacier. Research faculty are welcome to work out of Camp 17 for this time, but teaching opportunities are limited. Students must apply their full energy into safety training. Consequently, there is very little time for academic lectures, and even fewer hours available for field trips. We encourage teaching faculty to join Block 1 to get the hang of JIRP and to learn the necessary glacier skills, but please be aware that academic teaching time is severely limited.

**July 3 – July 22 (Camp 10, Alaska):**
At Camp 10, the JIRP student program transitions from what we’ve traditionally called “the Institute” - training, training, training - to “the Expedition” - the bulk of the academics and science research. While safety staff still accompany all trail parties and continue to train students in glacier mountaineering, we begin to expect every student to take a more proactive role in making the Expedition happen. Because the
team is functioning at an efficient level, we can dedicate most of every work day to academics and student research projects. Camp 10 is our biggest camp (it sleeps over 60 people) and has the easiest access to a wide variety of glacial sub-environments. Taku Glacier, the deepest alpine glacier in the world at over 1500 m in the middle and fed by a series of large tributary glaciers, presents ideal field sites for mass balance pits, snowpack research, and strain analyses where the ice flow from different branches merge. A series of vegetated nunataks offer a variety of options for ecology research, and access to head of the deglaciated and forested Avalanche Canyon offers a standpoint for examining glacial geomorphology and more questions about ecology. Finally, two glacial lakes, one subglacial on the north side of camp and the other supraglacial on the south side of camp, present opportunities for a host of glacial hydrology inquiries. During this block the mass balance, isotope geochemistry, and geomatics teams often focus their data collection on covering the Taku Glacier system, the geophysics team chooses local sites of interest to work on, and the ecology team visits various nearby nunataks.

**July 22 – August 3 (Camp 18, Alaska):**
Camp 18 is, without compare, the most dramatic of the JIRP camps. Perched on the Cleaver, a bedrock promontory rising vertically 2000 ft./ 600 m from the Gilkey Trench, this camp offers unrivaled views of the ice dynamics of the Vaughan Lewis Icefall, the ogives of the Gilkey Trench, and the geomorphology of the walls of the trench as the surface of the Gilkey Glacier lowers. Additionally, a moderate ski out of camp leads trail parties to the upper reaches of the Matthes and Llewellyn Glaciers and the Divide between the two. Mountaineering training at Camp 18 focuses on nearby peak ascents, a culmination of all the technical and team management skills of the summer, and the ever-popular crevasse exploration. While everyone has a different summer on the Icefield, the safety staff do everything in their power to include every student who wants to rappel into and explore one of the large crevasses at the head of the Vaughan Lewis Icefall.

Research at Camp 18 is focused on the geomorphology of the Gilkey Trench, the deepest mass balance pits high in the accumulation zone, further exploration of nearby nunataks, and the ice flow dynamics of the Matthes-Llewellyn Divide. Informally known simply as “the Divide”, the remote field camp at the ice flow divide plays host to teams addressing a variety of research questions about ice strain and flow velocity. During this block the mass balance and geophysics teams focus their field inquires on field sites high in the accumulation zone, the isotope geochemistry team and the geomatics team often take the opportunity to explore the surrounding tributary glacier systems, and the ecology team works on the Cleaver.

**August 3 – August 11 (Camp 26 Canada, Atlin, BC, and Juneau Alaska):**
Block 4 is different from Blocks 1-3 in that it’s mostly not on the Icefield. This block includes the four-day traverse from Camp 18 to Atlin, five days in Atlin itself, the bus and boat trip back to Juneau, and two days of program wrap-up in Juneau. The academics of Block 4 are focused on finishing the summer goals of student research groups and finalizing the student project presentations. Because of logistical constraints we usually limit faculty to a small group, and it’s critical for all Block 4 faculty to support all student research groups. Much of the academic time is spent on presentation skills and practice; consequently, all faculty members focus on more general science support and less on subject-specific expertise.

**August 11 – September 1 (Group Research Projects and Final Exam):**
Upon returning from JIRP, Groups complete their final projects in either short-format paper or poster form. This is done remotely, but accommodations can be made to complete all requirements before your departure from JIRP. Participants will also complete the written and open-book exam during this final week.

**Learning Assessment**

Students will complete multiple academic and research assignments as part of the academic curriculum. Each component counts as a percentage of the overall grade. Academic components include the following:
• **Safety Training:** Students will complete safety training for proper travel methods in glacier and mountain environments, through the entire program. Active participation is required and the development of skills to safely travel across the icefield is required as part of the program. (10%)

• **Science Communication Exercise:** Students will use the Instagram format to tell a short story through three-four captioned photos. (10%)

• **In Camp Exercises:** Students will complete a variety of short in-camp exercises to include workshops, group quantitative laboratories, and group discussions. (10%)

• **Research Team Mini-Expeditions:** Each of the six core research teams will be responsible for planning, organizing and leading a Mini-Research Expedition before the end of JIRP. These outings will take place during the final three weeks of JIRP and are meant to be a capstone experience that brings together student training in safety, logistics, group dynamics, and research. Each Mini-Expedition must include a focus that is relevant to a core research area and it will be overseen by an affiliated faculty and staff member. Your team will be responsible for completing a pre-expedition plan and post-expedition report to the entire group. (10%)

• **Earth Sciences Research:** Each JIRP participant will be a member of one of six core research groups. For 2019 these include 1) Glaciology, 2) Remote Sensing/Geomatics, 3) Geophysics, 4) Ecology, 5) Atmospheric Sciences, and 6) Geomorphology. While participants will be fully involved in one research area, every participant will have the opportunity to gain exposure to each. All research is conducted in groups and with the guidance of faculty and staff leaders. Participants will receive further information on these project areas upon arrival in Juneau or on the www.juneauicefield.org website. Primary deliverables for the research component of JIRP include the following:
  
  o **Research Project Abstract:** Each student will be required to write a personal abstract about their proposed group research. The abstract will be due within one week after the arrival at Camp 10 (5%)

  o **Research Project Proposal:** Each student will be required to participate in writing a group research project proposal based upon their proposed research activities. The proposal will be due upon arrival at Camp 18 (5%)

  o **Final Group Paper or Professional Poster:** Group projects will be synthesized into either a final, short-format paper or poster intended for an academic audience. The poster or paper will be due by August 30, 2019 (20%)

**NOTE:** In recent years, the majority of JIRP research groups have co-authored poster presentations at the Fall Meeting of the American Geophysical Union (AGU). Indeed, in 2015, 2016, 2017, and 2018, most JIRP participants were co-authors, and over half attended AGU. While not required as a JIRP “assignment”, attending and presenting at a conference is a fantastic learning opportunity and one we highly encourage. JIRP will have at least one representative at AGU to organize JIRP-specific gatherings and facilitate a quality experience for participants. Please know that your team’s work can still be presented at AGU or other conferences that might be more relevant or accessible, to include the Geological Society of America, Northwest Glaciologists Meeting, or International Glaciology Workshops, to list a few. The research leads of each Research project and JIRP’s Director of Academics & Research can help coordinate any presentation efforts by JIRP student participants. Please note, however, that you must be a member of
AGU if you intend to be listed as a co-author on an AGU abstract. Your student membership must be completed prior to your start with JIRP as the abstract submission deadline is while you will be on the Icefield. If you would like to attend AGU and/or be a co-author on an AGU abstract, please join as a student member prior to arriving in Juneau: https://membership.agu.org/students/.

- **Public Presentations in Atlin, British Columbia:** Each research team will be required to deliver a public presentation in Atlin, BC. These are short-format (~6-8 minutes), oral presentations completed as a team. (10%)

- **Public Presentations in Juneau, Alaska:** Upon return to Juneau at the end of the Program, each research team will organize a display for an informal, public event at the Mendenhall Glacier Visitor Center. (10%)

- **Final Exam:** A two hour final exam will be completed by each participant before departing JIRP (10%)

Through the academic curriculum above, students will be evaluated on criteria that measure academic and expeditionary participation and performance. Of significance are group collaboration, project design contributions, data collection and organization, analysis of data, and quality of presentations. Teamwork is fundamental to successful project completion. Participants typically must maintain contact and interaction throughout the field season to complete project reports, and presentations. The overall course rubric will be as follows:

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<th>Grading Rubric</th>
<th>1544 – 1600 points</th>
<th>97 – 100</th>
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<tbody>
<tr>
<td>A+</td>
<td>1496 – 1543 points</td>
<td>94 – 96</td>
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<tr>
<td>A</td>
<td>1432 – 1496 points</td>
<td>90 – 93</td>
</tr>
<tr>
<td>A-</td>
<td>1384 – 1431 points</td>
<td>87 – 89</td>
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<tr>
<td>B+</td>
<td>1336 – 1383 points</td>
<td>84 – 86</td>
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<tr>
<td>B</td>
<td>1272 – 1335 points</td>
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</tr>
<tr>
<td>B-</td>
<td>1224 – 1271 points</td>
<td>77 – 79</td>
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<tr>
<td>C+</td>
<td>1176 – 1223 points</td>
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<td>C</td>
<td>1112 – 1175 points</td>
<td>70 – 73</td>
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<tr>
<td>C-</td>
<td>1064 – 1111 points</td>
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<td>D+</td>
<td>1016 – 1063 points</td>
<td>64 – 66</td>
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<td>D</td>
<td>952 – 1015 points</td>
<td>60 – 63</td>
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<td>F</td>
<td>≤ 951 points</td>
<td>≤ 59</td>
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**Course Policy**
Attendance during the entire field program is traditionally required, however extenuating circumstances do occur. Students departing the program early may still receive full credit, however, this is at the discretion of the course instructor. Students are responsible for all material presented during the field program. By turning assignments in on time, you are eligible for full credit. Late assignments forfeit the right to any credit; any partial credit for late assignments will be up to the instructor’s discretion. Due to the nature of the field location, completion of field components of the program after the summer will not be possible.

**University of Maine Statements**
The University of Maine has statements on Academic Honesty, Student Accessibility Services, Course Scheduling, Observance of Religious Holidays, and Sexual Discrimination and Reporting. These
Academic Honesty Statement
Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

Students Accessibility Services
If you have a disability for which you may be requesting an accommodation, please contact Student Accessibility Services, 121 East Annex, 581-2319, as early as possible in the term. Students who have already been approved for accommodations by SAS and have a current accommodation letter should meet with me (Dr. Seth Campbell) privately as soon as possible.

Course Schedule Disclaimer (Disruption Clause)
In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Observance of Religious Holidays/Events
The University of Maine recognizes that when students are observing significant religious holidays, some may be unable to attend classes or labs, study, take tests, or work on other assignments. If they provide adequate notice (at least one week and longer if at all possible), these students are allowed to make up course requirements as long as this effort does not create an unreasonable burden upon the instructor, department or University. At the discretion of the instructor, such coursework could be due before or after the examination or assignment. No adverse or prejudicial effects shall result to a student’s grade for the examination, study, or course requirement on the day of religious observance. The student shall not be marked absent from the class due to observing a significant religious holiday. In the case of an internship or clinical, students should refer to the applicable policy in place by the employer or site.

Sexual Violence Policy

Sexual Discrimination Reporting
The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell any of your teachers about sexual discrimination involving members of the campus, your teacher is required to report this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity. Behaviors that can be “sexual discrimination” include sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct, and gender discrimination. Therefore, all of these behaviors must be reported.

Why do teachers have to report sexual discrimination?
The university can better support students in trouble if we know about what is happening. Reporting also helps us to identify patterns that might arise– for example, if more than one victim reports having been assaulted or harassed by the same individual.
What will happen to a student if a teacher reports?
An employee from the Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity will reach out to you and offer support, resources, and information. You will be invited to meet with the employee to discuss the situation and the various options available to you. If you have requested confidentiality, the University will weigh your request that no action be taken against the institution’s obligation to provide a safe, nondiscriminatory environment for all students. If the University determines that it can maintain confidentiality, you must understand that the institution’s ability to meaningfully investigate the incident and pursue disciplinary action, if warranted, may be limited. There are times when the University may not be able to honor a request for confidentiality because doing so would pose a risk to its ability to provide a safe, nondiscriminatory environment for everyone. If the University determines that it cannot maintain confidentiality, the University will advise you, prior to starting an investigation and, to the extent possible, will share information only with those responsible for handling the institution’s response.

The University is committed to the well-being of all students and will take steps to protect all involved from retaliation or harm.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services: 1-800-310-0000 or Partners for Peace: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:

For support services on campus: Office of Sexual Assault & Violence Prevention: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or see the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/