<u>Directors Annual Program Summary – 2019</u>

As the longest operating Polar research and training program in North America, the **Foundation for Glacier & Environmental Research, Juneau Icefield Research Program (JIRP)** focuses on training and inspiring new generations of Earth and climate scientists, policy-makers, educators, and the broader community. JIRP is like no other polar research and education program on Earth. Our students spend eight weeks living on glaciers in Southeast Alaska and British Columbia, learning from a team of scientists and educators, conducting cutting-edge research, building collaborations, and experiencing the impacts of environmental change, firsthand. Students also learn communication skills on JIRP to help them engage in sustainable environmental solutions within their home communities.

JIRP brings together people from around the world who are interested in addressing environmental issues such as climate change, pollution, sea level rise, and developing sustainable solutions regarding the use of natural resources. Many JIRP alumni are now leading scientists, environmentalists, science policy advocates, energy experts, engineers, and educators. As a consortium representing dozens of academic institutions and several disciplines, JIRP provides tremendous opportunities for interdisciplinary collaboration and societal impact.

Our vision is to promote a collaborative, international, and inclusive Earth science community, one that can more effectively tackle the global environmental challenges we face. Developing effective environmental solutions requires communication and understanding between scientists, policy-makers, and the public. Solutions must span borders because environmental change and impacts are not confined by political boundaries. Solutions must also engage all communities because environmental challenges disproportionately impact low income and minority populations. Unfortunately, most Earth and Climate Science programs lack gender, ethnic, and economic diversity, and few science programs cross interdisciplinary and international boundaries while supporting all communities. **JIRP aims to fill these diversity gaps by becoming an international hub for collaborative Polar Earth systems science research, education, and environmental action.**

During FY2019 JIRP had over 90 qualified students apply, of which we accepted 32 to participate in the 2-month summer program. Students hailed from the United States, Europe, and South America. We had over 50 new professionals apply to participate in JIRP as Teaching or Research Faculty of which we were able to accept six new faculty along with our returning faculty. In total, we had 84 participants on the Juneau Icefield in 2019 between high school, undergraduate, graduate students, staff, teaching and research faculty. This includes supporting five graduate students completing part of their thesis and dissertation research. We also supported seven federally funded (NSF and NASA) or privately funded research teams from academic or research institutions to complete research on the Juneau Icefield. Research teams completed a range of glaciological, ecological, remote sensing, and field geophysical studies and they also incorporated our undergraduate and graduate students into their research. Participating Teaching Faculty and Research teams (*) hailed from the following institutions in 2019:

- NSF Ice Drilling Program*
- Montana State University*
- Columbia University*
- Colorado School of Mines*
- University of Maine*
- Wittenberg University
- U.S. Geological Survey
- The Ohio State University
- University of Alaska, Southeast
- GFZ, Potsdam (Germany)
- NASA Jet Propulsion Laboratory*
- Caltech*
- University of Washington*
- University of Buffalo*
- University of Oregon
- Northwest Community College, BC
- U.S. Fish and Wildlife
- University of Southern California
- National Snow and Ice Data Center
- University of Innsbruck (Austria)

Currently JIRP relies on over 40,000 hours of volunteer time from participating faculty and staff, annually. We have one full time program manager and a quarter time operations manager. We received 212 submitted interest forms to participate in JIRP2020. Due to increased student interest in JIRP and by funded research and educational institutions to develop new high school, undergraduate, or graduate programs, we are hiring two new part-time Associate Directors and will begin funding the Operations Manager half time instead of quarter time in FY2020. Further, our team submitted several scientific and research proposals in 2019. We funded scholarships to five under-represented, minority, or women participants on JIRP 2019 including providing full funding for two students. Lastly, and of significance, JIRP has officially published its long term meteorological station data, its long term geodetic elevation and glacier velocity data, and its long term (1946-current) mass balance dataset (https://juneauicefield.org/data and McNeil et al., Accepted). Note, the mass balance dataset, alone, represents the longest record in North America. The other two datasets provide a rare long-term (over 30 year record) and high spatial and temporal resolution time series of atmospheric and glacier dynamical processes over glaciated terrain, something that does not exist for any other glacier system in Alaska. JIRP mass balance and meteorological programs are now operated in collaboration with the U.S. Geological Survey Glacier monitoring program. This assures that JIRP standards are at a high level in terms of scientific scrutiny and quality assurance standards. JIRP is pursuing several new initiatives under the new director, Dr. Seth Campbell, which we believe will provide more opportunities for students, scientists, educators, and environmental leaders. These initiatives include the following:

1. ***Establishing stronger academic ties within the cryosphere and climate science community.*** JIRP has been inspiring students interested in Polar sciences since 1946. A recent collaboration between JIRP and the University of Maine provides new opportunities to increase JIRP resources and international visibility. The UMaine School of Earth and Climate Sciences and Climate Change Institute (CCI) bring significant academic, research, and infrastructure support to JIRP. UMaine has a strong international reputation in glaciology, climatology, and Earth systems science. CCI also represents one of the longest operating institutions in North America focused on climate change. Behind the scenes, UMaine administration is helping to build an endowment to support student scholarships, student stipends, and infrastructure improvements. We will continue to foster this relationship in the coming years.

2. ***Building new high school, undergraduate, graduate, and specialized programs within JIRP.*** Currently JIRP merges high school, undergraduate, and graduate students into one summer program. However, we receive a growing number of applications, more that we can curently accept. Although the technical skills acquired during JIRP engage all students, the high school

to graduate student range of experiences within one summer program challenges our ability to engage all students at the appropriate academic level. We also receive multiple requests per year from groups interested in conducting specialized field programs on the icefield. Most of our field stations are only used two weeks per year for the primary summer JIRP program so there is ample time available for other field camp use. We will continue to focus on undergraduate education. However, we hope to establish a fully-funded summer high-school program to engage more first-generation college students and underserved students. We also plan to develop a graduate field glaciology research and training progam and are considering other short-term field programs that the science community has approaches us about.

3. ***Establish new opportunities for first generation college students, minority, and native community students.*** We are working to leverage our multi-institutional and international collaborations to provide new opportunities for community members who are traditionally under-represented in the earth and climate sciences and who are most at risk to the many environmental challenges facing the planet. There are over 600 minority and native serving institutions in the United States, alone. Most have minimal resources or involvement in Earth, climate, or cryosphere research. This initiative has the potential to develop long-term engagement of the communities served by these institutions in cryosphere or related careers in polar research & development.

4. ***We are trying to establish a rotating postdoctoral position and funded graduate student positions within JIRP.*** JIRP provides a nearly unparalleled opportunity for early career scientists to gain experience in the logistics of operating field programs and establishing an international network of colleagues. JIRP also offers the opportunity to conduct research in a relatively accessible field site on multiple Earth systems science topics including glaciology, geomorphology, climatology, geology, ecology, biogeochemistry, and more. Our established field resources, field stations, and infrastructure provide a nearly 10:1 cost savings relative to conducting research in locations such as Antarctica or Greenland. There are numerous scientific studies which can be completed on the Juneau Icefield as an analog to less-accessible locations. We therefore plan to develop a rotating postdoctoral research program and graduate positions in conjunction with our academic partners over the coming years. As a start, in 2019 we submitted two international Postdoctoral proposals and supported five graduate students on the icefield to conduct their graduate research.

5. ***We are expanding our sustainability and science policy academic curriculum to help students and faculty pursue initiatives in their local and regional communities.*** Providing more opportunities for Earth systems science education is one important step needed to manage the many environmental challenges that society now faces. Earth sciences is one of the least taught subjects in high schools across the United States. However, developing sustainability initiatives and supporting science policies which help address our environmental challenges is perhaps more important. Students today are not just interested in obtaining an environmental degree, they are interested in pursuing solutions to the many environmental challenges we now face. Therefore, we are developing new academic curriculum focused on local and regional science policy, decision making processes, and on students and faculty developing sustainability initiatives in their local communities, post-JIRP. We expect this new concept to have an international reach due to our students originating from around the globe.

6. ***We are building national and international partnerships with other organizations that have similar goals.*** JIRP has established relationships with over two dozen leading academic institutions in cryosphere, Earth, and climate research around the United States and Europe. JIRP's unique non-profit structure allows for easy national and international collaboration on

research and education. These partnerships bring a range of resources, equipment, and opportunities to students, educators, and researchers who are willing to work together. We will continue to strengthen our established collaborations and develop new education and research partnerships both nationally and internationally to bolster international research, education, and communication.

7. ***We are building an Endowment to support a) student participant costs b) student stipends, and c) general operating and maintenance costs.*** College, let alone transformative field programs such as JIRP, is cost-prohibitive for most minority, under-represented, or rural students. Many students work during summer months to cover annual living expenses which means that most summer research or education programs are out of reach. JIRP is currently less expensive than all comparable international field education programs due to our reliance on volunteer efforts, donations, and grants. However, the cost is still prohibitive to the majority of students, worldwide. Our goal is to build our endowment to provide an annual return to cover all field fees and provide student stipends for participating students, as is standard on NSF Research Experience for Undergraduates programs. Secondly, the Juneau Icefield is a harsh environment on equpment and facilities resulting in significant annual maintenance costs. A larger endowment would provide funds for annual maintenance of the eleven field camps we use across the icefield and to replace aging field equipment on a rotating basis. The University of Maine has officially accepted involvement in this challenge and we are working with the UMaine Foundation to pursue this long-term effort.

8. ***We are updating facilities to include efficient renewable energy options (solar and wind) and waste management strategies.*** Like most international field programs, JIRP relies on fossil fuel for operations and logistics. JIRP works hard to reduce fuel use on the icefield by relying on human-powered transport when feasible and by pre-planning logistics which are beneficial for the entire program and multiple science teams, simultaneously. We also work to reduce waste on the icefield and recycle when possible. Although some reliance on fossil fuel will remain, renewable technologies exist which can help support day-to-day operations; we are pursuing partners interested in completing renewable energy R&D in austere or extreme environments. This includes the establishment of solar and wind energy systems which can be set up at the beginning of each season and stored inside buildings at the end of each summer when not in use. Prior energy analyses suggest that renewable energy systems could provide a significant component of our total power consumption at primary camps during summer operations. We have therefore initiated a full energy budget analysis to consider future renewable energy solutions across the icefield, where appropriate.

Through these initiatives, our goal is to make JIRP an international hub for collaborative Polar Earth systems science research, education, and environmental action. Support of JIRP will enable us to make a revolutionary leap that the Earth & climate science community needs.

Statistics at a Glance – 2019

- 32 Undergraduate students
- 45 Teaching Faculty and staff
- Faculty from 20 Institutions (U.S. and Europe)
- 7 Supported funded research programs
- 2 Associate Directors hired to develop new programs
- 5 Students completing graduate research
- >41,500 Volunteer hours
- Students from North America, South America, and Europe
- 11 AGU presentations accepted
- 3 Long-term datasets published in 2019
- 1 additional peer-reviewed manuscript accepted

Research Summary

In 2018, JIRP established a new initiative to support outside funded research which fits within the academic and research curriculum agreed upon by the Director of Academics & Research, Associate Directors, Program Manager, Operations and Safety Managers, Academic Council, and FGER Board of Directors. This initiative provides several benefits to FGER/JIRP, students, and participating science teams, and it has broader societal implications. These include the following:

1. Student gain valuable experience working on funded research.
2. Students develop broader collaborations, mentors, and opportunities from JIRP.
3. Participating research teams experience significant broader impacts from having dozens of students working on their research effort.
4. Participating research teams benefit from significant field support provided by JIRP faculty, staff, and students, thereby increasing overall field activities and likely deliverables.
5. Participating research teams enjoy a significant cost savings compared to conducting research in more challenging or costly environments such as Greenland or Antarctica.
6. Participating research teams can use established field camps across the icefield to support their research activities, thereby reducing significant logistical planning and burdens.
7. Participating research teams are provided opportunities to network with other teams prior to the summer, thereby gain opportunities to expand the scope of their research activity by sharing resources, experiences, and capabilities.
8. Participating research teams can test prototype scientific or Polar engineering studies at a minimal cost, thereby reducing overall costs and timelines for developing new research.
9. This model reduces the barrier to entry into Polar research by early career scientists, by providing low-cost opportunities with significant logistical, science, and field support available through JIRP.

These primary benefits have been realized by several science and engineering teams between 2018-2019 and we have new teams scheduled for 2020 with a request for proposals being advertised for research teams in 2020 through 2022. The following summaries have been provided by participating research teams from 2019 to provide examples of the research being completed on the icefield, and the potential for multi-disciplinary and complex research and development activities using the Juneau Icefield and JIRP facilities or resources.

Caltech (Authors: PhD student, Celeste Labedz and M.S. student, Ellen Robo)

The Caltech-JPL team is testing the potential uses of a new seismic technology, Distributed Acoustic Sensing (DAS) in the cryosphere. DAS uses a fiber optic cable connected to a laser to measure instantaneous strain along the cable, providing data similar to a high spatial density of seismometers. With the help of JIRP staff and students, the Caltech-JPL team deployed 3.2 km of cable in North Basin next to Camp 10 that collected continuous strain measurements for 4.5 days. A 40-shot active seismic survey provided a controlled source of seismic waves to compare DAS to traditional seismometers in the cryosphere. Multiple seismic wave phases are detectable from the active source survey, including surface waves whose frequency dispersion is consistent with glaciers' increasing density with depth. Visual inspection of five hours of passive data collection has already shown over 100 icequakes, which are discrete sources of seismic waves due to natural motions of the ice such as basal sliding, crevasses opening, and faulting within the ice. The timing of seismic wave arrivals at different portions of the DAS cable reveals the location of the icequakes, and some areas demonstrate repeating similar icequakes that can be stacked for a better signal-to-noise ratio than individual events. Only the surface of the DAS data has been scratched, so the Caltech-JPL team is developing algorithms to efficiently process this large data set to examine icequakes, glacial structure, subglacial hydrology, and more. The JIRP staff, students, and facilities were instrumental in conducting this research, and the Caltech-JPL team is hopeful that JIRP can continue facilitating seismic field work as the relatively young field of cryo-seismology develops.

Montana State University (Author: Dr. Christine Foreman)

The Foreman Research Group at Montana State University (www.foremanresearch.com) studies life in icy environments. Our field work at JIRP this past season integrated well with the students' "Living Systems of the Ice and Snow- Ecology and Glacier Melt" project. We collected snow and ice samples from the Llewellyn Glacier to field test two new microbial activity measurements using Raman micro-spectroscopy. Enrichment cultures were setup to isolate algae, bacteria, and cyanobacteria. Shallow ice cores were hand-drilled from the blue ice area of the Llewelyn Glacier, and we obtained two 1m sections (226m and 294m) of the IDDO thermally drilled ice core at the Matthes-Lllewellyn ice divide. In partnership with the Joint Genome Institute the microbial metagenome of these samples is being sequenced to reveal the diversity and dynamics of the microbial ice core communities. The logistics and opportunity to engage with JIRP students and faculty made this a highly successful field campaign. I have remained in contact with one of the students and recently wrote several letters of recommendation to graduate schools on her behalf. The supportive environment of JIRP helps promote diversity in many fields of cryosphere research, with hands-on training that encourages students to go beyond their perceived boundaries. JIRP is an exemplar for training the next generation of scientists and engineers.

Ice Drilling Program (Author: Grant Boeckmann)

In late July to early August 2019, a team of three from IDP-WI traveled to Juneau, AK for a beneficial testing opportunity with the Juneau Icefield Research Program (JIRP). The team consisted of IDP Mechanical Engineer Grant Boeckmann, IDP Field Support Manager Anna de Vitry, and IDP contractor and Warehouse Manager Jim Koehler. Utilizing the well-established logistics of the JIRP program, the IDP team was able to test new Thermal Drill modifications including a new 300 m drill cable, a prototype ethanol delivery mechanism and new heat rings. The team successfully reached 294 m and was able to refine operating procedures for the equipment. I would also like to add that the testing was hugely beneficial in characterizing the performance of the drill for future projects. Also, training and field experience is extremely valuable, especially in remote sites such as the JIRP Divide Camp. We are very thankful for the opportunity and would like to thank JIRP for all their support. I had an amazing time at JIRP this year, seriously the most memorable field expedition I've had. The staff were amazing. The faculty were fascinating. And the students were great, so positive all the time! I would love to come back in the future. You have a great program and should be proud.

University at Buffalo (Authors: Dr. Kristin Poinar & Dr. Erasmus Oware)

We brought two geophysical setups, ground-based transient electromagnetic (TEM) and seismo-electric (SE), to the Juneau Icefield. Our goals with these instruments were (1) to measure the thickness and water composition of subglacial sediments using TEM, and (2) to test whether SE can constrain the thickness and mineral composition of subglacial sediments by comparing it to TEM results. Our pilot research on the Juneau Icefield was supported by a University at Buffalo RENEW Institute SEED grant (details at: http://www.buffalo.edu/renew/research/seed-projects.host.html/content/shared/www/renew/seed-projects/6th-Round/probing-sub-ice-sediments.detail.html). We collected TEM data at two different field sites: 130 sites across a 0.2 km^2 area of a crevasse field above the Vaughan Lewis Icefall (Camp 18), and 46 sites across a smaller area in North Basin (Camp 10). A seismo-electric cable malfunction at Camp 18 meant that we were only able to collect SE data at the Camp 10 location, at six of our 46 TEM sites. Preliminary analysis of the TEM data suggest that >100 meters of wet sediments underlie the glacier in the Vaughan Lewis Basin above the icefall, and that the ice is ~400–500 meters thick here. This is modestly thicker than previous estimates, based on mass conservation, of ~300 meters

(Huss & Farinotti, 2012). No previous estimates of subglacial sediment thickness are available. The presence of crevasses in the Vaughan Lewis Basin study area adds an additional challenge to interpretation of our TEM data. We hypothesize that an unexpected sign switching in our data is due to water-filled crevasses. Water-filled crevasses would serve as confined vertical conductors that would channel currents toward the crevasses, disrupting the "layer cake" model traditionally used for geophysical interpretation. Similarly, air-filled crevasses would serve as confined vertical insulators that may also cause a sign switch. Active research is underway in our group to process our data in a way that successfully represents and retains the signals from water- or air-filled crevasses. To date, our project has resulted in two conference presentations (AGU Fall Meeting) and we are preparing 3 manuscripts for submission to peer-reviewed journals.

Columbia University (Authors: Dr. Jonny Kingslake and PhD Student, Elizabeth Case)

Glacial melt contributes more than half of modern sea-level rise. Constraining the rate and volume of this requires an understanding of liquid water, a key component of the energy and mass budgets of any glacial system. The temperate nature of the Juneau Icefield makes it an excellent field site for the study of near-surface and englacial water. In summer 2018, a near-surface snow aquifer was discovered at the icefield's divide during the drilling of shallow firn cores, and subsequently confirmed through further drilling and a shallow GPR survey. In 2019, we brought as suite of instruments to the icefield to better understand the transient nature of the aquifer. Wilson Clayton (Colorado School of Mines) measured surface energy balance, liquid water content and self-potential (developed by Clayton and deployed for the first time at the icefield) in the near surface (<3m) to quantify the melt introduced through ablation. Elizabeth Case (Columbia University) led a team of students to characterize the transient nature of the aquifer. They deployed two autonomous phase-sensitive radars along a flowline. Radar wave velocity is sensitive to meltwater content, so two-way travel time should change with meltwater content. Additionally, students were trained on shallow firn coring (4-9m), a HOBO Channel Data Logger to measure temperature and pressure in a borehole (collaboration with Dr. Kiya Riverman, University of Oregon), and shallow 400 MHz GPR (collaboration with Dr. Seth Campbell, University of Maine). The radar and cores show multiple layers of water present in both years, though the near-surface aquifer was less distinct and less widespread in 2019 than 2018. Nearby (~1 km away) drilling of a deep core (300m) in 2019 logged water flow into the borehole starting at near 20m below the surface, where we might expect a shallow aquifer to sit at the firn-ice transition. These indications from geophysics and drilling indicate a robust and consistent englacial water transport system.

Columbia University (Author: PhD Student, Allie Balter and Dr. Joerg Schaefer)

Temperature-sensitive glacier systems, such as the Juneau Icefield (JIF) in Alaska, are important natural laboratories for paleoclimate studies as their past variability provides insight into summer temperature changes. Because anthropogenic climate warming is amplified in the Arctic, understanding how this region has responded to climate changes in the past is essential for improving predictions of future changes. Owing to JIRP's presence on the icefield over the last 60 years, JIF is one of the longest studied ice masses in the world. Despite this, little is known about how JIF responded to past climate change, such as cold conditions during the Last Glacial Maximum or warming during deglaciation. How thick was JIF during the Last Glacial Maximum? At what time did JIF reach its thickest extent? How fast and how much did JIF retreat in response to warming during deglaciation and the early Holocene? To answer these questions, the 2019 Geomorphology Team collected ~20 bedrock samples from nunataks near Camp 18 and Divide Camp for cosmogenic exposure-age dating. Cosmic rays bombarding the Earth's surface induce nuclear reactions within minerals, creating rare isotopes not otherwise found on Earth, such as ^{10}Be. These isotopes are only produced when bedrock is exposed to the atmosphere (i.e., ice-free), and are produced at a known rate, so can be used as a clock for glacier retreat. Many of these exposure ages, both at different elevations and locations throughout the icefield, will allow us to determine the timing and magnitude of JIF response to past climate change. As an extension of JIRP, four students joined Allie Balter (project lead and PhD student at Columbia University) at the National Science Foundation funded University of Vermont Community Cosmogenic Facility to perform mineral separation on the bedrock samples collected during JIRP 2019. JIRP students therefore participated in both field sampling and laboratory work associated with this project. For project lead-Balter, the opportunity to lead field efforts, gain teaching experience, and become a part of the JIRP community has been invaluable at this early stage in her career.

University of Washington (Author: Dr. Daniel Shapero)

Attending JIRP has been by far one of the high points of my professional career. I came into studying glaciology through applied mathematics; JIRP has given me the rare opportunity to become more involved in field work and to connect with both early career and senior researchers on the observational side of the discipline. Last year, I taught students at JIRP about glacier flow modeling using a software called *icepack* that I am developing through an NSF funded grant. The main goal of this project is to lower the barrier of entry to the subject for students and researchers at all levels of expertise. The students told me that using the model was a valuable learning experience and they provided great feedback on what I can do to improve icepack as an educational tool. I look forward to returning to JIRP this summer and in future field seasons, and I plan to incorporate data gathered through JIRP into my work on integrating models and observations.

American Geophysical Union JIRP Student Affiliated Presentations – 2019

1. Variations in Snow Albedo Due to Red Algae on the Juneau Icefield, (2019) **Lizzie Hebel, Emily Wilcox, Diana Castro, and Alexia Fabiani,** AGU, Tuesday, December 10, afternoon Poster B23J - 2543

2. Characterization of a Shallow Firn Aquifer at the Matthes-Llewellyn Glacier Divide, Juneau Icefield, Alaska (2019) **Hannah Verboncoeur, Jeremy Stock, Rebecca Mulheim, Eva Bingham, Winn Costantini, Ryan Armstrong, Julia Brazo, Mariama Dryak, and Seth Campbell,** AGU, Monday, December 9, afternoon, Poster C13C - 1307

3. 10Be Dating Constraints on the Deglaciation History of the Juneau Icefield, (2019) **Colby Rand, Keegan Bellamy, Yueyi Che, Josie Hoien, Natalie Johansen, and Jocelyn Reahl,** AGU, Wednesday, Dec 11, morning, Poster EP31D-2330

JIRP-Supported Research Presentations from JIRP - 2019

1. Supporting Diverse Student Participation in the Juneau Icefield Research Program, (2019) **Annie Boucher (1), Allen Pope (2), Seth Campbell (1),** Wednesday, December 11, 2:42 - 2:47 Moscone South - 303-304, L3 Panel talk U33B – 13 (1) University of Maine School of Earth and Climate Sciences, Orono, ME, (2) National Snow and Ice Data Center, Boulder, CO. AGU, Wednesday, Dec. 11, afternoon, U33B-13 ***(Invited Presentation)***

2. Taku Glacier, Alaska: On the verge of a calving retreat? (2019) **Chris McNeil (1), Jason M Amundson (2), Shad O'Neel (1), Martin Truffer (3), Louis Sass (1) and Roman J Motyka (4)** (1)USGS Alaska Science Center, Anchorage, AK, United States, (2)University of Alaska Southeast, Juneau, AK, United States, (3)University of Alaska Fairbanks, Geophysical Institute, Fairbanks, AK, United States, (4)Univ Alaska-Geophysical Inst, Juneau, AK, United States, AGU, Wednesday, Dec. 11, morning, C31B – 1496 ***(Invited Presentation)***

3. Subsurface profiles of crevasses in the temperate Vaughan Lewis Glacier, Juneau Icefield, Alaska inferred from transient electromagnetic (TEM) data, (2019) **Kristin Poinar (1), Beata M. Csatho (2), Kamelia Atefi Manfared (3), Erasmus Oware (1),** Monday, Dec. 9, 2:40 - 2:55 Moscone West - 2012, L2 Talk number: NS13A-05 (1) University at Buffalo, Buffalo, NY, United States, (2)University at Buffalo, Department of Geology, Buffalo, NY, United States, (3)University at Buffalo, Civil, Structural, and Environmental Engineering, Buffalo, NY, United States, AGU, Monday, Dec. 9, morning Poster NS11B – 0635. ***(Invited Presentation)***

4. Ground-based transient electromagnetic characterization of the temperate Vaughan Lewis Glacier at the Juneau Icefield, Alaska, in the presence of crevasses, (2019) **Erasmus K. Oware (1), Kristin Poinar (1), Beata M Csatho (2), and Kamelia Atefi Monfared (3)** (1)University at Buffalo, Buffalo, NY, United States, (2)University at Buffalo, Department of Geology, Buffalo, NY, United States, (3)University at Buffalo, Civil, Structural, and Environmental Engineering, Buffalo, NY, United States, AGU, Monday, Dec. 9, morning Poster NS11B - 0635

5. DAS on Ice: Insights gained from deploying several kilometers of fiber optic cable on Taku Glacier, Alaska, (2019) **Ellen Trim Robo (1), Celeste Ritter Labedz (1), Ethan F Williams (1), Andrew Klesh (2), Mark P Panning (3,4), Alireza Marandi (5), and Zhongwen Zhan (1)** (1)California Institute of Technology, Pasadena, CA, United States, (2)NASA Jet Propulsion Laboratory, Pasadena, CA, United States, (3)Univ of FL-Geological Sciences, Gainesville, FL, United States, (4)Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, United States, (5)California Institute of Technology, Pasadena, United States, AGU, Tuesday, Dec. 10, afternoon, Poster S23D - 0665

6. Cross-correlation of ambient seismic signal during a glacial lake outburst flood at Lemon Creek Glacier, Alaska, (2019) **Celeste Ritter Labedz (1), Jason M Amundson (2), Florent Gimbert (3), Marianne S. Karplus (4), Stephen A Veitch (4) and Timothy C Bartholomaus (5)** (1)California Institute of Technology, Pasadena, CA, United States, (2)University of Alaska Southeast, Juneau, AK, United States, (3)ISTerre, Grenoble, France, (4)University of Texas at El Paso, Geological Sciences, El Paso, TX, United States, (5)University of Idaho, Moscow, ID, United States, AGU, Tuesday, Dec. 10, afternoon, Poster S23D - 0662

7. Spatial and temporal mapping of local subglacial hydrologic conditions during an outburst flood at Lemon Creek Glacier, Alaska, (2019) **Celeste Ritter Labedz (1), Jason M Amundson (2), Florent Gimbert (3), Marianne S. Karplus (4), Victor C Tsai (5,6), Stephen A Veitch (4), and Timothy C Bartholomaus (7)** (1) California Institute of Technology, Pasadena, CA, United States, (2)University of Alaska Southeast, Juneau, AK, United States, (3)ISTerre, Grenoble, France, (4)University of Texas at El Paso, Geological Sciences, El Paso, TX, United States, (5)California Institute of Technology, Seismological Laboratory, Pasadena, CA, United States, (6)Brown University, Department of Earth, Environmental and Planetary Sciences, Providence, RI, United States, (7)University of Idaho, Moscow, ID, United States, AGU, Tuesday, Dec. 10, Moscone South - eLightning Theater II, Talk C22D – 04

8. Active Seismic Studies in Lemon Creek Valley Glacier, Juneau, Alaska: Characterization of Subglacial Sediments to Understand Glacier Dynamics, (2019) **Lucia Gonzalez (1), Marianne S. Karplus (1), Stephen A Veitch (1), Julien Chaput (1), Adam D Booth (2), Galen Kaip (1), Jason M Amundson (3), Timothy C Bartholomaus (4),** AGU, Tuesday, December 10, afternoon, Poster S23D-0659 (1) University of Texas at El Paso, TX, (2) University of Leeds, (3) University of Alaska, Southeast, Juneau, AK, (4) University of Idaho, Boise, ID. Tuesday, Dec. 10, Moscone

JIRP 2020 Initial Planning at a Glance

- 34 Accepted Undergraduate Students from US, Europe, and Australia
  - 53% Cisgender Female
  - 38% Cisgender Male
  - 9% Transgender/nonconforming
  - 15% Minority
- 40 Waitlisted Undergraduate Students
- Faculty from 20 Institutions:
  - 47 Teaching Faculty & Staff

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