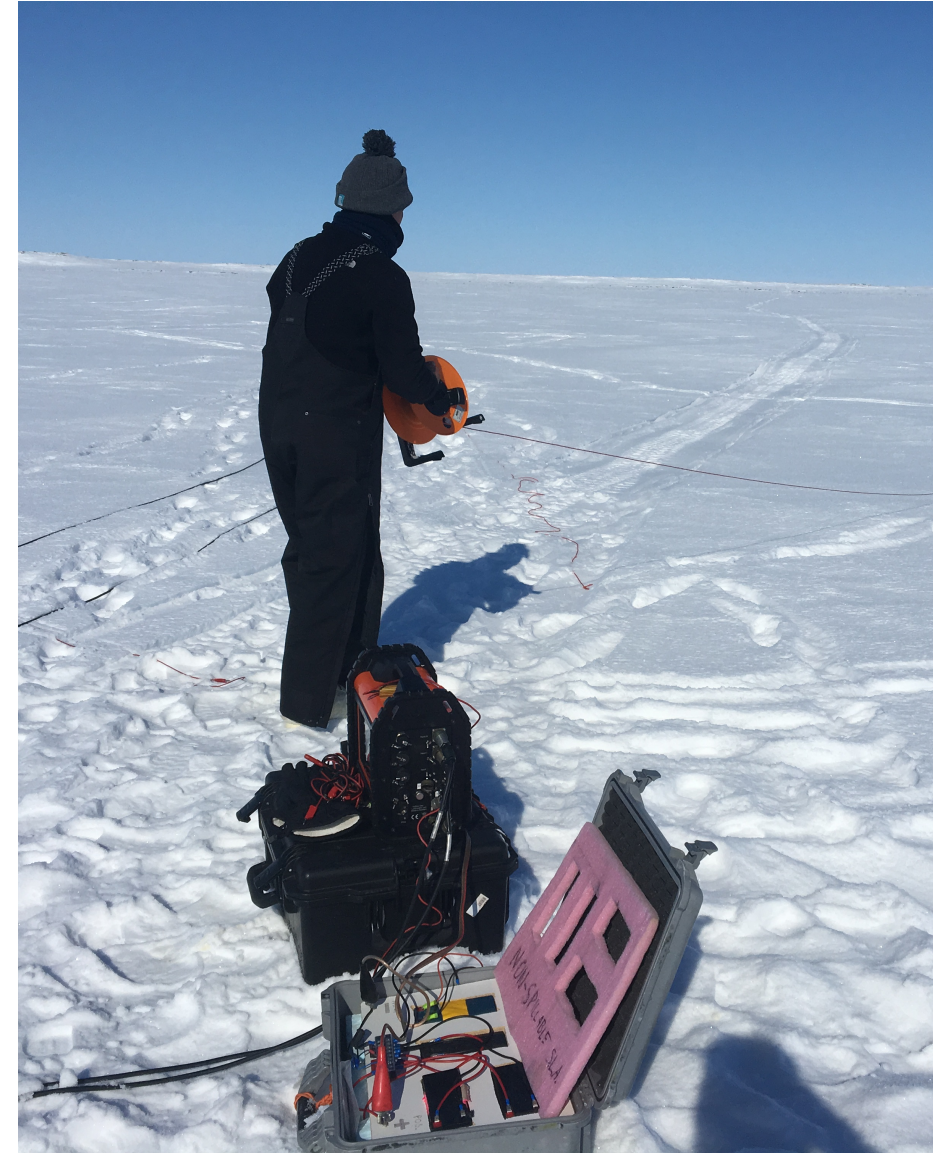


# What Urban and Environmental Geophysics means to me



# My current science focus? What methods and techniques do you use?

- Permafrost geophysics
  - How do Arctic lakes control permafrost thaw?
  - What is the role of Arctic lakes in C cycling?
  - How does annual thaw depth vary in space and time?
- Mountain hydrology
  - How does catchment setting control subsurface water movement?
  - How does snowmelt infiltration move to GW/SW and storage?
- Ground Penetrating Radar, Time-Lapse Resistivity, Nuclear Magnetic Resonance, Electromagnetics, Refraction





Laramie, WY



Philadelphia, PA

# What are the compelling and exciting research topics in U&E Geophysics?

- Climate change and population demands on resources drive the need to understand subsurface system functions.
  - How does water move through mountain catchments?
  - How and where does permafrost thaw and what are the climate implications?
- Geotechnical properties
- Environmental remediation
- Ecohydrogeophysics
- (Storm)water management
- Critical Zone



# What are the limitations of accomplishing that science?

- Insufficient data available over large, remote areas.
- Remote sensing is transforming understanding of surface processes, but still largely blind to subsurface
- Relatively small community capable of doing the subsurface part; limited instrument resources
- Difficult to attract students/postdocs with appropriate training who willing to work in field conditions



# How does U&E geophysics research influence related education opportunities & diversity?

- Hands-on work with instruments is engaging
- Opportunities to work in backcountry environments are fun!
- Direct experience at a study site provides context for data analysis
- Work can be local and involve socially relevant issues
- Exciting field work can help to recruit students



# How do I teach U&E Geophysics in the classroom?

- 3000 (jr level) Intro to Geophysics; focus on NS [**Flipped Classroom**]
- 5000 Engineering Geophysics
- Both:
  - Are team based learning
  - Involve hands-on measurement using field/lab instruments
  - Involve processing of their own data
  - Involve presentation/reading of current research
  - Utilize web teaching resources

# How do the research opportunities and education opportunities contrast?

- Fun for the students to experience field work on the quad, but missing on much of the real field experience
- Takes a lot of time to get up to speed on processing
- Would benefit from Inverse Theory before ALL coursework, but impractical
- When using instruments, difficult to engage many eyes around a small screen



# What are the benefits to students and society of U&E geophysics?

- Improved understanding of water resources quality and quantity
- Improved understanding of C cycling processes and geomorphological evolution
- Data to guide engineering, remediation, and oversight
  
- Develop quantitative abilities
- Develop technical skills (programming, software, data analysis, instrument operation)
- Develop non-technical 'soft science' skills (science questions, hypotheses, networking, project management, budgeting)

# Past and future of U&E geophysics?

- *in the past...*
- Mapping structures
- Mapping fractures
- Delineation of aquifers

- *present & future...*
- **Parameter estimates**
  - **Processes**
  - **Function**

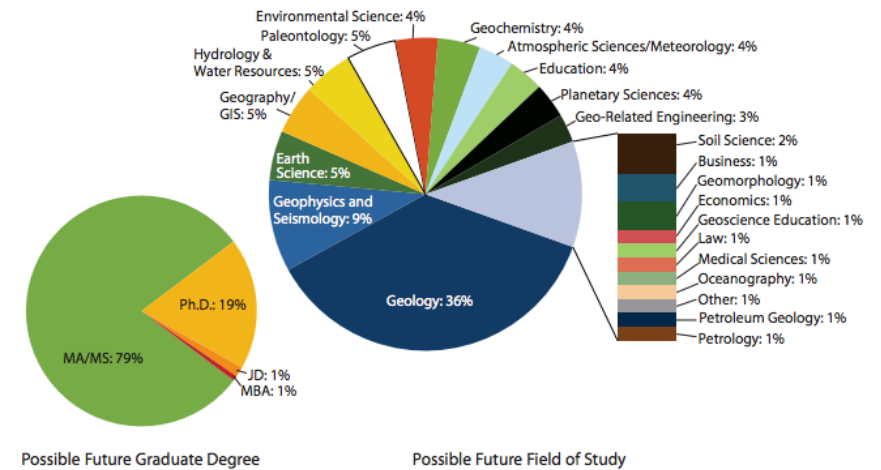
# Past and future of U&E geophysics?

- Future graduates may be trained in geophysics, employed in environmental field
- 10% graduate UG see geophysics as a possible future field, but this goes up to 20% for those with grad degrees.
  - Seems to indicate that something in grad experience makes geophysics more attractive.

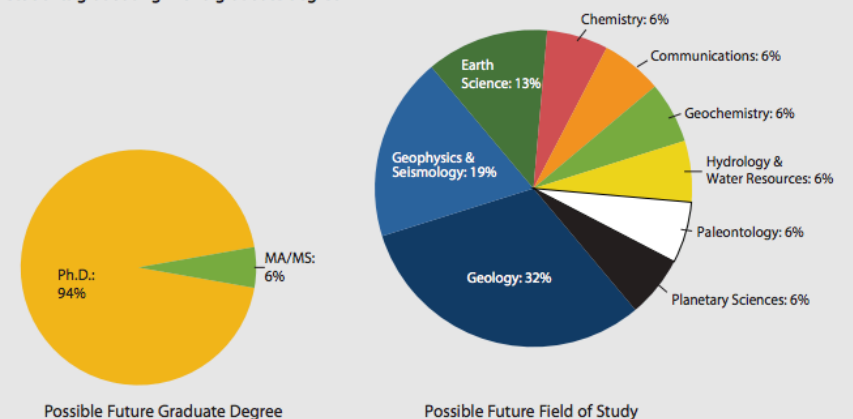
Future Plans: Working Toward a Graduate Degree

AGI 2017 Report

Students graduating with an undergraduate degree



Students graduating with a graduate degree



What have been your successes and failures (learning opportunities) from your research and teaching experiences?

- Broad success with student-lead field research projects
- Perceived success with flipped classroom, though some students disagree
- Perceived success with TBL, many students agree
- Perceived success with emphasizing science process through dedicated coursework and in geophysics classes
- Limited success with deep understanding of data processing/analysis even in upper level coursework
- Challenging to recruit women and domestic minorities
- Difficult to recruit UG lab assistants at fresh/soph levels

# How does my experience relate to the content that is important to increase diversity?

- GK12 Fellow 3yrs, teaching in urban middle school classrooms
- Diverse current research group of graduate & UGs: Native American, African American, Latina/o/x, first gen college students, first gen grad students, ~45% women (grad); ~50% (UG
- Mentor to Summer Research Apprentice pre-college students (first gen college students/minority/economically disadvantaged)

