Lindsey J. Heagy

Curriculum Vitae · December, 2017

PhD Candidate, University of British Columbia
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Education

2012 – present **PhD** in Geophysics, University of British Columbia
Supervisor: Dr. Douglas Oldenburg
Thesis: *Monitoring Hydraulic Fracturing with Electromagnetic Geophysics*

2008 – 2012 **BSc** with Honors in Geophysics, University of Alberta
First Class Honors
GPA: 4.0 / 4.0

Professional Experience

Apr. 2016 – Sept. 2017 **Aranz Geo Canada Limited** (Calgary, AB)
Computational Geophysics Consultant (part-time)

- Consulting on software architecture and user interface design for Steno3D, a technical communication and 3D visualization software product
- Technical writing and editing, including internal reports and abstracts for scientific conferences

Nov. 2015 – Apr. 2016 **3point Science Inc** (Calgary, AB)
Computational Geophysicist (part-time)

- Consulting on the development and design of interactive 3D visualization software for the geosciences

Jun. 2014 – Aug. 2014 **Schlumberger Doll Research** (Boston, MA)
Geophysics Intern

- Supervisor: Dr. Dzevat Omeragic
- Examined upscaling techniques and performed numerical simulations to investigate the feasibility of electromagnetic imaging of complex hydraulic fractures

Jun. 2013 – Aug. 2013 **Schlumberger Electromagnetic Imaging** (Richmond, CA)
Geophysics Intern

- Supervisor: Dr. Michael Wilt
- Developed a workflow for mapping hydraulic fractures using cross-well electromagnetic surveys
- Awarded the patent: "Determining proppant and fluid distribution" (US Patent App. 14/494,313) which was developed from this work

May 2012 – Aug. 2012 **ConocoPhillips Canada** (Calgary, AB)
Geophysics Summer Student

- Supervisor: Richard Forest
- Interpreted 3D seismic volumes covering 8 townships in Western Canada by tying synthetic seismograms, mapping seismic horizons, and examining seismic attributes.
- Worked with geologists and reservoir engineers to map a potential natural gas resource and propose a drilling location

May 2011 – Aug. 2011 **Alfred Wegener Institute of Polar and Marine Research** (Bremerhaven, Germany)
Geophysics Summer Student

- Conducted numerical simulations to generate velocity profiles and estimate transport of the Antarctic Circumpolar Current south of Africa
- This project was funded through the Research Internships in Science and Engineering (RISE) program of the German Academic Exchange Service (DAAD)

Teaching Assistantships

2013 – 2016 **EOSC 350: Environmental, Geotechnical, and Exploration Geophysics I**
University of British Columbia

- Instructor: Dr. Douglas Oldenburg
- Developed labs and assignments, including interactive numerical simulations for labs
- Coordinated content and website upgrades for the web-based resource "Geophysics for Practicing Geoscientists" (http://gpg.geosci.xyz)
- Worked with a Teaching Assistant Team of 5-6 members to instruct labs, mark assignments & exams for 50-60 geology and engineering students

2015 **Directed Studies: Inversion in Applied Geophysics**
University of British Columbia

- Instructor: Dr. Douglas Oldenburg
- Provided guidance for an undergraduate student in his independent study. He developed Jupyter Notebook Tutorials on the basics of geophysical inversions (https://github.com/jokulhaup/directed_studies)

2012 **EOSC 354: Analysis of Time Series and Inverse Theory for Earth Scientists**

University of British Columbia

- Instructor: Dr. Michael Bostock
- Instructed labs, marked labs and assignments for a class of 14 geophysics students

Service and Outreach

2017 **Journal of Open Source Software**
Editor: Geoscience, geophysics (http://joss.theoj.org/about)

2017 **Society of Exploration Geophysics Distinguished Instructor Short Course 2017**
Support Instructor for *Geophysical Electromagnetics: Fundamentals and Applications* by Dr. Douglas Oldenburg (http://disc2017.geosci.xyz)

- Included generating course material, leading tutorials on numerical simulations and inversions for electromagnetics, addressing questions from participants, documenting the events and participant presentations on a blog (https://medium.com/disc2017) and developing and maintaining the course website (https://disc2017.geosci.xyz)
- Locations for which I was a support instructor:
  - Denver, USA (January 30-31, 2017)
  - Perth, Australia (July 27-28, 2017)
  - Adelaide, Australia (August 2-3, 2017)
  - Brisbane, Austraila (August 7-8, 2017)
  - Delft, Netherlands (September 11-12, 2017)
  - Bonn, Germany (September 18-19, 2017)
  - Vienna, Austria (September 21-22, 2017)
  - Zurich, Switzerland (September 26-27, 2017)
  - Aarhus, Denmark (October 2-3, 2017)
  - Toronto, Canada (October 27, 2017)
  - Mexico City, Mexico (November 6-7, 2017)
  - Buenos Aires, Argentina (November 13-14, 2017)
  - Santiago, Chile (November 16-17, 2017)
  - Santa Cruz de la Sierra, Bolivia (November 22-23, 2017) - Cancelled
  - Rio de Janeiro, Brazil (November 28-29, 2017)
  - Calgary, Canada (December 5-6, 2017)
  - Vancouver, Canada (December 12-13, 2017)

2017 **JupyterCon**, August 22-25, New York, NY
Program Committee Member (https://conferences.oreilly.com/jupyter/jup-ny)

- This was the inaugural year for JupyterCon
- Committee responsibilities included: reviewing abstracts, outreach to potential speakers, event promotion

2016 **Banff International Research Station: Geophysical Simulation and Inversion Workshop**, August 19-21, Banff, AB
Supporting Organizer with Dr. Douglas Oldenburg, Dr. Adam Pidlisecky and Rowan Cockett (http://www.birs.ca/events/2016/2-day-workshops/16w2695)

2014 – present **GeoSci.xyz**
Core maintainer and contributor to online interactive textbooks for geophysics (http://geosci.xyz). Resources include:

- Geophysics for Practicing Geoscientists (http://gpg.geosci.xyz)
- Electromagnetic Geophysics (http://gpg.geosci.xyz)
- Computational Geophysics (http://computation.geosci.xyz)

2014 – present **SimPEG**
Core maintainer and contributor to the open source software (https://github.com/simpeg)
Community developer including leading weekly meetings and fielding user questions (google group: https://groups.google.com/forum/#!forum/simpeg, slack: http://slack.simpeg.xyz)

2014 – 2015 **Undergraduate Research Mentor**
Advised Mohamed Rassas on as a part of the Undergraduate Research Opportunities Research Experience Program at the University of British Columbia

- His work resulted in the presentation *A comparison of conventional and open channel hydraulic fracturing and the importance of imaging to optimize the fracturing process* at the Multidisciplinary Undergraduate Research Conference at the University of British Columbia

2005 – 2009 **Volunteer Instructor: Alberta Diploma Exam Reviews**
Developed and delivered review courses for Physics 30, Chemistry 30, Pure Math 30
Supervised by Mr. David Westra

Publications

Peer Reviewed Publications

1. **Heagy, L. J.**, R. Cockett, S. Kang, G. K. Rosenkjaer, and D. W. Oldenburg, 2017a, A framework for simulation and inversion in electromagnetics: Computers & Geosciences, **107**, 1 – 19
2. Caudillo-Mata, L. A., E. Haber, **L. J. Heagy**, and C. Schwarzbach, 2017, A framework for the upscaling of the electrical conductivity in the quasi-static maxwell's equations: Journal of Computational and Applied Mathematics, **317**, 388 – 402
3. Cockett, R., S. Kang, **L. J. Heagy**, A. Pidlisecky, and D. W. Oldenburg, 2015a, Simpeg: An open source framework for simulation and gradient based parameter estimation in geophysical applications: Computers & Geosciences, **85**, 142–154

Non Peer Reviewed Publications

1. Kang, S., **L. J. Heagy**, R. Cockett, and D. W. Oldenburg, 2017, Exploring nonlinear inversions: A 1d magnetotelluric example: The Leading Edge, **36**, 696–699
2. Cockett, R., **L. J. Heagy**, and D. W. Oldenburg, 2016, Pixels and their neighbors: Finite volume: The Leading Edge, **35**, 703–706

Patents

1. Wilt, M., N. Cuevas, and **L. J. Heagy**, 2014a, Determining proppant and fluid distribution. (US Patent App. 14/494,313)

Conference Proceedings

(∗ : invited, † : award)

1. **Heagy, L. J.**, R. Cockett, and D. W. Oldenburg, 2017b, Modular electromagnetic simulations with applications to steel cased wells, *in* Proceedings of the 6th International Symposium on Three-Dimensional Electromagnetics: 125–129
2. ∗ Kang, S., R. Cockett, **L. J. Heagy**, and D. W. Oldenburg, 2016, Practices to enable the geophysical research spectrum: from fundamentals to applications: Presented at the 2016 AGU Fall Meeting
3. ∗ **Heagy, L. J.**, and D. W. Oldenburg, 2016b, Examining the impact of steel cased wells on electromagnetic signals: Presented at the 2016 AGU Fall Meeting
4. ∗ **Heagy, L. J.**, R. Cockett, and D. W. Oldenburg, 2016c, Geosci: Practices to collaboratively build online resources for geophysics education: Presented at the 2016 AGU Fall Meeting
5. Yang, D., D. W. Oldenburg, and **L. J. Heagy**, 2016, 3d dc resistivity modeling of steel casing for reservoir monitoring using equivalent resistor network, *in* SEG Technical Program Expanded Abstracts 2016: Society of Exploration Geophysicists, 932–936
6. **Heagy, L. J.**, R. Cockett, S. Kang, G. K. Rosenkjaer, and D. W. Oldenburg, 2015b, simpegem: An open-source resource for simulation and parameter estimation problems in electromagnetic geophysics: Presented at the 2015 AGU Fall Meeting
7. **Heagy, L. J.**, R. Cockett, S. Kang, and D. W. Oldenburg, 2015a, Real simulation tools in introductory courses: packaging and repurposing our research code.: Presented at the 2015 AGU Fall Meeting
8. Cockett, R., **L. J. Heagy**, S. Kang, and G. K. Rosenkjaer, 2015b, Development practices and lessons learned in developing simpeg: Presented at the 2015 AGU Fall Meeting
9. **Heagy, L. J.**, R. Cockett, D. W. Oldenburg, and M. Wilt, 2015c, Modelling electromagnetic problems in the presence of cased wells, *in* SEG Technical Program Expanded Abstracts 2015: 699–703
10. Kang, S., R. Cockett, **L. J. Heagy**, and D. W. Oldenburg, 2015, Moving between dimensions in electromagnetic inversions, *in* SEG Technical Program Expanded Abstracts 2015: 5000–5004
11. Cockett, R., S. Kang, and **L. J. Heagy**, 2014, Simpeg: An open-source framework for geophysical simulations and inverse problems: AGU Fall Meeting Abstracts, 07
12. **Heagy, L. J.**, A. R. Cockett, and D. W. Oldenburg, 2014a, Parametrized inversion framework for proppant volume in a hydraulically fractured reservoir, *in* SEG Technical Program Expanded Abstracts 2014: 865–869
13. Caudillo-Mata, L., E. Haber, **L. J. Heagy**, and D. W. Oldenburg, 2014, Numerical upscaling of electrical conductivity: A problem specific approach to generate coarse-scale models, *in* SEG Technical Program Expanded Abstracts 2014: 680–684
14. Fournier, D., **L. J. Heagy**, N. Corcoran, D. Cowan, S. G. R. Devriese, D. Bild-Enkin, K. Davis, S. Kang, D. Marchant, M. S. McMillan, M. Mitchell, G. K. Rosenkjar, D. Yang, and D. W. Oldenburg, 2014, Multi-em systems inversion - towards a common conductivity model for the tli kwi cho complex, *in* SEG Technical Program Expanded Abstracts 2014: 1795–1799

15. Devriese, S. G. R., N. Corcoran, D. Cowan, K. Davis, D. Bild-Enkin, D. Fournier, **L. J. Heagy**, S. Kang, D. Marchant, M. S. McMillan, M. Mitchell, G. K. Rosenkjar, D. Yang, and D. W. Oldenburg, 2014, Magnetic inversion of three airborne data sets over the tli kwi cho kimberlite complex, *in* SEG Technical Program Expanded Abstracts 2014: 1790–1794
16. Wilt, M., **L. J. Heagy**, and J. Chen, 2014b, Hydrofracture mapping and monitoring with borehole electromagnetic (em) methods: Presented at the 76th EAGE Conference and Exhibition 2014
17. † **Heagy, L. J.**, D. W. Oldenburg, and J. Chen, 2014b, Where does the proppant go? examining the application of electromagnetic methods for hydraulic fracture characterization: Presented at the GeoConvention 2014, CSEG
    † Student Honourable Mention Integrated Poster
18. † **Heagy, L. J.**, and D. W. Oldenburg, 2013, Investigating the potential of using conductive or permeable proppant particles for hydraulic fracture characterization, *in* SEG Technical Program Expanded Abstracts 2013: 576–580
    † Award of Merit (Best Student Paper, Annual Meeting)

Other Conference Presentations

1. **Heagy, L. J.**, and R. Cockett, 2017, Deploying a reproducible course: Presented at the JupyterCon, https://youtu.be/XY3Tq9Wd1_A
2. **Heagy, L. J.**, D. Fournier, S. Kang, and C. Miller, 2017c, Simulation and parameter estimation in geophysics: Presented at the British Columbia Geophysical Society Meeting
3. **Heagy, L. J.**, 2016, Using open source tools to refactor geoscience education: Presented at the SciPy 2016, Austin, TX, https://youtu.be/lW2LDsevvDk
4. **Heagy, L. J.**, 2015, Using python to span the gap between education, research, and industry applications in geophysics: Presented at the SciPy 2015 Conference in Austin, TX, https://youtu.be/4msHJMBvzaI
5. Rosenkjaer, G. K., **L. J. Heagy**, R. Cockett, S. Kang, and D. W. Oldenburg, 2015, Practical integration of processing, inversion and visualization of magnetotelluric geophysical data: Presented at the SciPy 2015 Conference in Austin, TX
6. ∗ **Heagy, L. J.**, D. W. Oldenburg, M. Wilt, and J. Chen, 2014c, Using electromagnetics to delineate proppant distribution in a hydraulically fractured reservoir: Presented at the SEG Development and Production Forum, Santa Rosa CA
    ∗ Invited to “Best of the Development and Production Forum” at the SEG 2014 Annual Meeting

Software Contributions

2014 – present **SimPEG**
Software for numerical simulations and inversions in geophysics
https://github.com/simpeg/simpeg

2014 – present **discretize**
Discretization tools for finite volume and inverse problems
https://github.com/simpeg/discretize

2016 – present **geoana**
Analytic solutions in geophysics
https://github.com/simpeg/geoana

Awards and Scholarships

2016 **UBC Library: Innovative Dissemination of Research Award**
Awarded for the SimPEG framework and community development ($\$1,000$). With Rowan Cockett and Seogi Kang.

2014 – 2017 **NSERC Vanier Scholarship**
Vanier Scholars demonstrate leadership skills and a high standard of scholarly achievement in graduate studies in the social sciences and/or humanities, natural sciences and/or engineering and health. The Vanier Scholarship is the top graduate scholarship in Canada. ($\$50,000 \times 3$)

2014 – 2017 **Alexander Graham Bell Canada Graduate Scholarship**
Awarded to high caliber scholars who are engaged in a doctoral program in the natural sciences or engineering (Declined) ($\$35,000 \times 3$)

2014 – 2018 **Four Year Fellowship (FYF) for PhD Students**
Selection based on academic excellence, upon the recommendation of the graduate program at UBC ($\$18,000 \times 4$, declined 3/4)

2013 **Special UBC Graduate Scholarship - W.H. Mathews Scholarship**
Awarded for academic achievement in Earth, Ocean and Atmospheric Sciences at UBC ($\$5,000$)

2012 **Governor General's Silver Medal**
Awarded annually to the three undergraduate students (institution-wide) who achieve the highest academic standing overall upon graduation from his/her Bachelor degree program (University of Alberta)

2012 **Lieutenant-Governor's Gold Medal**
Awarded to the convocating student from an Honours program in the Faculty of Science who has shown the highest distinction in scholarship (University of Alberta)

2012 **APEGGA Past Presidents' Medal in Geophysics**
Awarded to the convocating student who is a Canadian Citizen or Permanent Resident with the highest academic standing in a specialization or honours program in Geophysics on the basis of the final year

2011 **The APEGGA Scholarship in Geophysics**
Awarded on the basis of superior academic achievement in Honors Geophysics or Specialization in Geophysics ($\$3,000 \times 2$)

2010 – 2012 **The David K Robertson Award in Geophysics and Geology**
Awarded to a student entering the third year of a BSc Specializing in Geology or Geophysics on the basis of passion and talent in their field of study, demonstrated leadership, participation in extracurricular activities, and academic standing. ($\$5,000 \times 2$)

2010 – 2012 **The Encana Geology and Geophysics Scholarship**
Awarded to student(s) with superior academic achievement entering the third or fourth year of study for a Bachelor of Science with a major in Geology or Geophysical Sciences. ($\$3,500 \times 2$)

2009 – 2011 **Louise McKinney Post Secondary Scholarship, Government of Alberta**

Recognizes students for their academic achievements at a provincial level and encourages them to continue in their undergraduate program of study ($\$2,500 \times 3$)

2009 **Pearl Cuthbertson Memorial Award**
Awarded to a student entering the second year of study for a Bachelor of Science degree who has completed Science 100. Selection based on academic standing and demonstrated determination, curiosity and enthusiasm for science. ($\$2,000 \times 2$)

2009 **Pearson Book Prize**
Awarded for academic achievement in Writing Studies in Science 100

2008 – 2012 **Dean's Honor Roll, University of Alberta**
Awarded for academic achievement ($\times 4$)

Grants

2014 **Science Center for Learning and Teaching - Development Grant**
Development of online interactive resources for undergraduate geophysics at UBC ($\$2,500$)

Principal Investigator: Dr. Douglas Oldenburg

Media

Apr. 24, 2017 Guest on Episode 41, *Undersampled Radio* by Graham Ganssle and Matt Hall (https://undersampledrad.io)

Jan. 24, 2017 Guest on Episode 11, *Seismic Soundoff* by the Society of Exploration Geophysicists (http://seg.org/podcast)

Jun. 7, 2012 Article: *Science 100 pioneer grounded in geophysics - University of Alberta Spring Convocation 2012: Celebrating Talented People* (https://www.ualberta.ca/news-and-events/newsarticles)

Professional Development

Conferences Attended

2017 EM-6: The 6th International Symposium in Three-Dimensional Electromagnetics

2016 FORCE11: The Future of Research Communications and e-Scholarship Meeting

2015 – 2016 (2) SciPy Conference

2014 – 2015 (2) British Columbia Geophysical Society EM Workshop

2014 SEG Development and Production Forum

2014	GeoConvention
2014 – 2016	(3) AGU Annual General Meeting
2011 – 2016	(6) Society of Exploration Geophysics Annual Meeting

Courses Attended

2015	*Presenting Data and Information* by Edward Tufte
2014	SEG Distinguished Instructor Short Course: *Microseismic Imaging of Hydraulic Fracturing: Improved Engineering of Unconventional Shale Reservoirs* by Shawn Maxwell