

Lindsey J. Heagy

Curriculum Vitae · March, 2018

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: *Electromagnetic methods for imaging subsurface injections*
intended submission: June 1, 2018
- 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 – present **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, Australia (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 **American Geophysical Union (AGU) Annual Meeting Session Organizer: Open Source Software in the Geosciences**
Member of the organizing committee along with Anna Kelbert, Luz Andelica Caudillo Mata, Jared Peacock, Suzan van der Lee, Juan Lorenzo, and Louise Pellerin

- Selected invited panelists for panel discussion (recording available at: <https://youtu.be/0GO4ZZ5Ry6M>)
- Drafted discussion questions for the panel and reviewed abstract submissions
- Follow up includes discussion within the AGU to elevate the visibility and support for open source software within the AGU

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>)

- Awarded a 2 day workshop at the Banff International Research Station
- Invited 25 researchers and graduate students from 5 universities across Canada and the United States to discuss strategies for integration and cross-disciplinary communication between each of the sub-disciplines of geophysics.
- Much of the discussion focussed on using the open-source software framework SimPEG as a tangible means of building a community of researchers across the various disciplines of geophysics

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>)

2014 – present

SimPEG

Core maintainer and community developer (<https://github.com/simpeg>)

- Contribute code, review pull requests, and provide input on development plans
- Organize weekly meetings (all are recorded: https://www.youtube.com/playlist?list=PLh1r7wwe-P8_C31v)
- Support users by answering questions on the google group (<https://groups.google.com/forum/#!forum/simpeg>) and slack channel (<http://slack.simpeg.xyz>)
- Maintain the SimPEG blog (<https://medium.com/simpeg>)

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 in the Alberta high school curriculum
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

Peer Reviewed Publications (submitted or in review)

1. Cockett, R., **Heagy, L. J.**, and E. Haber, 2018, Efficient 3d inversion for the richards equation (in review): *Computers & Geosciences*

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/IW2LDsewDk>
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/4msHJMBvzal>
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

I contribute to a number of open-source software projects, all of which are accessible through my GitHub profile <https://github.com/lheagy>. The major projects I contribute to are:

- 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 × 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 × 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 × 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 × 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 × 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 × 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 × 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 × 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 (×4)

Grants

- 2014 **Science Center for Learning and Teaching - Development Grant**
For development of online interactive resources for undergraduate geophysics at the University of British Columbia (\$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 Exploration '17
- 2017 JupyterCon
- 2017 EM-6: The 6th International Symposium in Three-Dimensional Electromagnetics
- 2016 FORCE11: The Future of Research Communications and e-Scholarship Meeting
- 2015 – 2017 (3) 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