

## Harsha Lokavarapu

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### Education

University of California, Davis	MS	Computational Geodynamics (4.0 GPA) Thesis Adviser: <a href="#">Professor Louise H. Kellogg</a> Secondary Adviser: <a href="#">Professor Elbridge Gerry Puckett</a>	2017–
University of California, Davis	BS	Computer Science	2015
	Minor	Applied Mathematics	2015

### Appointments

2014-2017	<a href="#">Computational Infrastructure for Geodynamics</a> (CIG)	Junior Assistant Programmer
2012	<a href="#">Certify Data Systems</a> (Humana)	Internship as Code Developer

### Programming Languages, Computing Skills, and Work Experience

\* Note that all "Git" links are personal code samples

#### Open Source Code Development

- Advanced Solver for Problems in Earth's ConvecTion ([ASPECT](#)) written in C++. I am the 17/56 most active contributor.
- State of-the-art model of the Earth's Geodynamo, [Calypso](#) written in FORTRAN 90. I am the 3/4 most active contributor.
- Generalized reservoir modeling library (MS Thesis Project: [Resecore](#)) written in Python

#### Parallel Processing and High Performance Computing

##### Tools

- CMake, CTest - Build tool and Unit testing - (Git PR: [1](#), [2](#))
- CUDA - (Git: [PR](#))(SHT = Spherical Harmonic Transform)
- Distributed memory parallelism - MPI for C++ and FORTRAN
- Shared memory parallelism - openMP
- SLURM HPC scheduler
- Profilers: gdb and cuda-gdb

##### Machines

- National Science Foundation (NSF) Texas Advanced Computing Center
  - [Stampede](#) and [Stampede 2](#)
  - [Maverick](#)
- UCD Math and Physical Sciences (MPS) HPC Cluster
  - [Ymir](#) - 38 Dual socket, quad core (Intel E5620 2.4 GHz CPUs) with 24 GB RAM.
  - [Peloton](#) - 55 nodes with 64GB ram, 16 cores/32 threads (Intel Xeon E5-2630v3 Processors).

## Computations

- [ASPECT](#)
  - Design and implementation of parallel particle generation algorithms. (Git: [PR](#))
  - Design and implementation of parallel particle interpolation algorithms including harmonic averaging and bilinear least squares. (Git PR: [Harmonic Average](#), [Bilinear least squares](#))
  - Design 2-D analytical solution to Stokes equations in order to benchmark the accuracy of particle algorithms in ASPECT. (Git PR: [1](#), [2](#))
  - Refactor existing benchmarks using C++ inheritance principles to reduce repetitive code with the help of Harry R. Levinson and others who added some commits on Jan 3, 2017 (Harry Levinson was a sophomore summer student that I worked with) (Git PR: [SolCx](#), [SolKz](#), [Compositional Fields](#))
  - Implementation of Schmeling subducting slab benchmark from Schmeling et al., Physics of the Earth and Planetary Interiors 171 (2008) 198–223
  - Execute strong and weak scaling tests for original draft of publication [3] (see below), which was not included in the final publication
  - ASPECT contributions Git [timeline](#)
- [Calypso](#)
  - Optimization of Legendre Polynomial transform in a spherical geometry using CUDA for Nvidia GPUs
  - Design different implementations using CUDA Fast Fourier Transform (cuFFT) library, CUDA Basic Linear Algebra Subprograms (cuBLAS), and (CUB) library. (Git code: [PR](#), [Dev branch](#))
  - Profile and test optimizations using strong and weak scaling tests
  - Published results as poster [4], [6] (see below) at the 2014, 2015 Annual Fall AGU Meetings
  - Calypso contributions Git [timeline](#)

## Data Analysis and Visualization

- Bash scripting - running numerous jobs, job monitoring, and data collection (Git: [Code](#))
- Gnuplot - (Git: [Code](#))
- Paraview GUI and Scripting - (Git: [Code](#))
- Jupyter Notebooks and Python - (Git: [Deep Carbon](#), [Convergence Analysis](#), and [more](#))
- R - (Git: [Code](#))
- Visit

## Continuous Integration Tools

- Jenkins - Collaborate on continuous integration testing of all CIG based codes - [CIG Repository Status WebPage](#)
- Travis

## Outside Interests

- Virtual Reality - (Git: [VR-Experiments](#) using A-Frame library) - JavaScript
- 3-D Design/Printing - Tinkercad
- Machine Learning - (Keras Examples, Tensorflow Iris Classification Tutorial) - Python

### **Professional Affiliations and Activities**

2017–	Member	<a href="#">Deep Carbon Observatory</a>
May 6-17, 2017	Participant	<a href="#">ASPECT Hackathon</a>
June 14-September 20, 2017	Primary Mentor	Prof. Puckett’s Research Experience for Undergraduates (REU) Program
2014-2016	Member	<a href="#">American Geophysical Union</a>
June 14-September 20, 2016	Assistant Mentor	Prof. Puckett’s REU Program
June 24-July 2, 2016	Participant	CIG - <a href="#">All Hands Meeting</a>
2015	Participant	<a href="#">ASPECT Hackathon</a>

### **Publications**

#### **Refereed Journal Publications**

##### Submitted

- [1] L. H. Kellogg, D. L. Turcotte, M. Weisfeiler, H. Lokavarapu\*, S. Mukhopadhyay, (2018) “Implications of a Reservoir Model for the Evolution of Deep Carbon”, *Earth and Planetary Science Letters*, Ms. Ref. No.: EPSL-D-17-01055

##### Accepted

- [2] R. Gassmoeller, H. Lokavarapu\*, E. Heien, E. G. Puckett, and W. Bangerth, (2018) “Flexible and scalable particle-in-cell methods with adaptive mesh refinement for geodynamic computations”, *Geochemistry, Geophysics, Geosystems* manuscript 2018GC007508R [View Accepted Manuscript](#)

##### Appeared

- [3] E. G. Puckett, D. L. Turcotte, L. H. Kellogg, Y. He<sup>†</sup>, J. M. Robey\*, and H. Lokavarapu<sup>®</sup> (2018) “New numerical approaches for modeling thermochemical convection in a compositionally stratified fluid”, Special issue of . *Physics of the Earth and Planetary Interiors* associated with the 15th Studies of the Earth’s Deep Interior (SEDI) Symposium (*Phys. Earth. Planet. In.*) **276**:10–35, 10.1016/j.pepi.2017.10.004 [View Article](#)

#### **Poster Presentations**

- [1] L. H. Kellogg, H. Lokavarapu\*, D. L. Turcotte, and S. Mukhopadhyay (2017) “A reservoir model study of the flux of carbon from the atmosphere, to the continental crust, to the mantle”, *Annual Geophysical Union Fall Meeting 2017* [View Abstract](#)
- [2] J. Jiang, A. P. Kaloti, H. R. Levinson, N. Nguyen, E. G. Puckett, and H. Lokavarapu<sup>®</sup> (2016) “Benchmark Results Of Active Tracer Particles In The Open Souce Code ASPECT For Modelling Convection In The Earth’s Mantle”, *Annual Geophysical Union Fall Meeting 2016* [View Abstract](#)
- [3] E. G. Puckett, D. L. Turcotte, L. H. Kellogg, H. Lokavarapu<sup>®</sup>, Y. He<sup>†</sup>, and J. M. Robey\* (2016) “New Numerical Approaches To thermal Convection In A Compositionally Stratified Fluid”, *Annual Geophysical Union Fall Meeting 2016* [View Abstract](#)

- [4] H. Lokavarapu<sup>@</sup>, and H. Matsui (2015) “Optimization of Parallel Legendre Transform using Graphics Processing Unit (GPU) for a Geodynamo Code”, *Annual Geophysical Union Fall Meeting 2015* [View Abstract](#)
- [5] J. A. Russo, E. H. Studley, H. Lokavarapu<sup>@</sup>, I. Cherkashin, and E. G. Puckett (2014) “A New Monotonicity-Preserving Numerical Method for Approximating Solutions to the Rayleigh-Benard Equations”, *Annual Geophysical Union Fall Meeting 2014* [View Abstract](#)
- [6] H. Lokavarapu<sup>@</sup>, H. Matsui, and E. M. Heien (2014) “Parallelization of the Legendre Transform for a Geodynamics Code”, *Annual Geophysical Union Fall Meeting 2014* [View Abstract](#)

<sup>@</sup>Undergraduate Student

<sup>\*</sup>Graduate Student

<sup>†</sup>Postdoctoral Scholar

## CLASSES

### Computer Science Courses

- 10 - Concepts of Computing
- 20 - Discrete Mathematics for Computer Science
- 30 - Introduction to Programming and Problem Solving
- 40 - Software and Object-Oriented Programming
- 50 - Machine Dependent Programming
- 60 - Data Structures and Programming
- 120 - Theory of Computation
- 122A - Algorithm Design
- 140A - Programming Languages
- 150 - Operating Systems
- 152A - Computer Networks
- 153 - Computer Security
- 154A - Computer Architecture
- 158 - Parallel Architectures
- 170 - Artificial Intelligence
- 188 - Ethics in an Age of Technology

### Mathematics

- 21A - Differential Calculus
- 21B - Integral Calculus
- 21C - Expansions, Series, etc.
- 21D - Vector Analysis
- 22A - Linear Algebra
- 22B - Ordinary Differential Equations
- 118A - Partial Differential Equations (first quarter)
- 118B - Partial Differential Equations (second quarter)
- 125A - Real Analysis (Foundations of Calculus)
- 125B - Real Analysis (second quarter)
- 135A - Probability
- 150A - Modern Algebra (first quarter)
- 150B - Modern Algebra (second quarter)
- 167 - Advanced Linear Algebra: Machine Learning
- 228A - Computational methods for Partial Differential Equations