

Harsha Lokavarapu

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Education

University of California, Davis	MS	Computational Geodynamics (4.0 GPA) Thesis Adviser: Professor Louise H. Kellogg Secondary Adviser: Professor Eldridge G. Puckett (EGP)	2017–
University of California, Davis	BS	Computer Science	2015
	Minor	Applied Mathematics	2015

Appointments

2014-2017	Computational Infrastructure for Geodynamics (CIG)	Junior Assistant Programmer
2012	Certify Data Systems (Humana)	Internship as Code Developer

Programming Languages, Computing Skills, and Work Experience

Open Source Code Development

- Advanced Solver for Problems in Earth's ConvecTion ([ASPECT](#)) - A parallel, extensible finite element code to simulate convection in both 2D and 3D models written in C++.
- State-of-the-art model of the Earth's Geodynamo, [Calypso](#) - FORTRAN
- Generalized reservoir modeling library (MS Thesis Project: [Resecore](#)) - Python

Parallel Processing and High Performance Computing

Tools

- CMake, CTest - Build tool and Unit testing - (Git PR: [1](#), [2](#))
- CUDA - (Git: [PR](#))
- 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](#))
 - Re-factor existing benchmarks using C++ inheritance principles to reduce repetitive code. (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: [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	Deep Carbon Observatory
May 6-17, 2017	Participant	ASPECT Hackathon
2014-2016	Member	American Geophysical Union
June 14-September 20, 2016	Assistant Mentor	EGP’s Research Experience for Undergraduates Program
June 24-July 2, 2016	Participant	CIG - All Hands Meeting
2015	Participant	ASPECT Hackathon

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[†], J. M. Robey*, and H. Lokavarapu[@] (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[@] (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[@], Y. He[†], 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[@], 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[@], 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[@], H. Matsui, and E. M. Heien (2014) “Parallelization of the Legendre Transform for a Geodynamics Code”, *Annual Geophysical Union Fall Meeting 2014* [View Abstract](#)

[@]Undergraduate Student

^{*}Graduate Student

[†]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