Joseph H. Kennedy

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Computational Scientist

Experienced with multi-institution open-source software development, high-performance computing, verification and validation of scientific models, and extensive experience with end-to-end data science projects encorporating machine learning and statistical analysis of Big Data using the scientific python ecosystem.

Technical Skills

Languages:	Python, R, C++, FORTRAN, SQL, Bash, LaTeX
Operating Systems:	Unix/Linux (desktop and HPCs), Windows, OSX
Math/Science Packages:	Anaconda, Scikit-learn, Pandas, Xarray, Numpy, Scipy, MATLAB
Climate/GIS Tools:	QGIS, NetCDF, NCO, NCL, PyNIO/PyNGL, CF-conventions
Web Development:	Javascript, HTML, CSS, PHP, Drupal, Jekyll
Data Science:	PCA, multivariate testing, regression analysis
Frameworks/Skills:	Agile software development, test-driven development, verification and validation, unit and integration testing, continuous integration, version control systems

Project Highlights

Developed LIVVkit, an ice-sheet model verification and validation toolkit, to provide a wide range of validation analysis covering atmosphere-ice and land-ice interactions as well as ice sheet dynamics. These analysis incorporate everything from point measurements (e.g., weather stations and ablation stakes) to airborne radar altimetry (e.g., NASA IceBridge) and satellite observations (e.g., RADARSAT, NASA GRACE). These analyses exercise the entire data science pipeline, from data wrangling and cleaning to reporting.

Developed EVV, a python package to evaluate the climate statistics of an Earth system model test ensemble against that of a baseline ensemble, by using several modern non-parametric (distribution-free) two-sample statistical tests (e.g., K-S test) for multivariate data to determine the equality of distributions. The critical value for rejecting the null hypothesis is determined by using bootstrap resampling.

Developed a statistical model of ice-crystalline fabric evolution and (two-way) coupled it to a ice sheet flow model by using a Principle Component Analysis (PCA) of the fabric distribution to determine an ice-flow enhancement factor in situ.

Professional Experience

Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA
Computational Scientist in Glaciology
Climate Change Science Institute **December 2016 – present**

Perform research tasks using DOE's Earth system model E3SM and ice sheet models (e.g., MPAS-LI, BISICLES, PISM, CISM); coordinate the verification and validation of E3SM, MPAS-LI, and BISICLES simulations; development of the Land Ice Verification and Validation toolkit (LIVVkit), a python-based toolkit for robust evaluation of ice-sheet models; and develop an extended V&V evaluation tool (EVE) for climate reproducibility testing of ESMs.

Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA
Postdoctoral Research Associate
Climate Change Science Institute **January 2015 – November 2016**

Perform research tasks using the Community Ice Sheet Model (CISM) and coordinate the development of the Land Ice Verification and Validation toolkit (LIVVkit) — a python-based toolkit for robust evaluation of ice-sheet models.
Advisor: Dr. Katherine J. Evans

Software

Technical and visionary lead of the Land Ice Verification and Validation toolkit (LIVVkit); a python-based, extensible verification and validation suite for land-ice models. Latest open-source release of LIVVkit, version 2.1.6, was on July 27, 2018. https://github.com/LIVVkit/LIVVkit

Creator of the ISMIP6 Atlas submission validation tool; an extension to LIVVkit which checks submissions to ISMIP6 experiments for correct file names, paths, metadata, etc. and produces a large variety of diagnostic plots. https://github.com/LIVVkit/Atlas

E3SM (Energy Exascale Earth System Model) core developer (infrastructure group) for phase 2; DOE's E3SM is a state-of-the-science Earth system model development and simulation project to investigate energy-relevant science using code optimized for DOE's advanced computers.

Developer on DOE's E3SM ecosystem projects

- MPAS-Analysis: Analysis for simulations produced with Model for Prediction Across Scales (MPAS) components and DOE's E3SM. https://github.com/MPAS-Dev/MPAS-Analysis
- A-Prime: Python based scripts to generate coupled priority metrics for DOE's E3SM. https://github.com/ACME-Climate/a-prime
- EVV: Extended verification and validation for Earth system models. https://github.com/LIVVkit/evv4esm

Contributor to open-source software projects

- Conda-forge recipe maintainer for JSON tricks
- PR19 and PR27 to sphinx-js leading to release of (bugfix) v2.0.1 and contributing to v2.2.

Publication Highlight

Kennedy, J.H., A.R. Bennett, Evans, K.J., S. Price, M. Hoffman, W.H. Lipscomb, J. Fyke, L. Vargo, A. Boghozian, M. Norman, P.H. Worley. (2017). LIVVkit: An extensible, python-based, land ice verification and validation toolkit for ice sheet models. Journal of Advances in Modeling Earth Systems, 9(2), 854–869.
doi:10.1002/2017MS000916

Education

University of Alaska Fairbanks, Department of Physics, Fairbanks, Alaska, USA
Ph.D., 2015, Physics. Advisor: Dr. Erin C. Pettit

Western Washington University, Department of Physics, Bellingham, Washington, USA
B.S., 2008, Physics. Minor: Astronomy

Awards

- 2016 ORNL CCSI Professional Development Award, $100,000
- 2013–2014 UAF Thesis Completion Fellowship, $15,000 + tuition
- 2011–2012 NSF CASE GK-12 Fellow, $45,000

Synergistic Activities

2016–present	Referee for the Australian Antarctic Division, the Geophysical Journal International, and the Journal of Mountain Science
2015–present	Participating in the Ice Sheet Model Intercomparison Project 6 (ISMIP6)
2015–present	Conducting multiple experiments for the Initialization of Models Intercomparison Project (initMIP)
2015–present	Presented 15 invited outreach talks, entitled ◇ The coolest science: Glaciers in the Earth system *(once)* ◇ Climate change today: An overview of the science, the observations, and a look toward the future *(twice)* ◇ Using computational science to understand Earth's climate *(12 times)*

Other Skills and Activities

- Wilderness experience including a continuous 700 mile, 33 day, canoe trip down the Yukon River
- Extensive boat experience: sailing, canoeing, power-boating, etc.
- Enjoy outdoor recreation: biking, hiking, backpacking, camping, etc.
- Trained in bear safety