Mark R. Petersen

Education

- 2004 Ph.D., Applied Mathematics, University of Colorado, Boulder, 2004. Dissertation title: *A study of geophysical and astrophysical turbulence using reduced equations.*

- M.S., Atmospheric and Oceanic Science, University of Colorado, Boulder, 2002

- M.S., Mathematics and Statistics, University of Nebraska-Lincoln, 2000

- B.A., Environmental Engineering, University of Nebraska-Lincoln, 1995

Experience

- 2007-present: Research Scientist, Computational Physics and Methods (CCS-2) and the Climate, Ocean, and Sea Ice Model (COSIM) Team
Los Alamos National Laboratory

- 2005-2007: Postdoctoral Researcher, Computational Physics and Methods (CCS-2) and the Climate, Ocean, and Sea Ice Model (COSIM) Team
Los Alamos National Laboratory

- 1996–1998: Project Engineer, U.S. Filter, San Diego

Responsibilities

- MPAS-Ocean Developer, 2010–2016

- Lead MPAS-Ocean Developer, 2016–present

- PI for ASCR Leadership Computing Challenge (ALCC) award of 87 million CPU hours, 2017-2018, "Understanding the Role of Ice Shelf-Ocean Interactions in a Changing Global Climate", includes managing training and compute allocation amongst ten researchers.

- Represented LANL and MPAS-Ocean at NCAR 2016 CESM meeting, RFI for next-generation ocean model, and other CESM working group meetings since 2011.

- Mentor for post-doctoral researchers David Lee (LANL), Doo Young Lee (LANL), and Bill Arndt (NERSC)

- Mentor or co-mentor for LANL students Anne Behres (now staff member ORNL), Sean Williams (became CCS-3 staff), Divya Banesh, Nils Feige, Andreas Schmeisser

- Mentor for graduate students in the LANL Parallel Computing Summer Research Internship

- Keynote speaker at conferences, including the International workshop on Multi-scale (Un)-structured mesh numerical Modeling 2013 and 2015

- Hiring committee member for CCS-2 programmer and many CCS-2 and T-3 post-doctoral positions.

- Seminar speaker within LANL, including XCP Seminar March 2017, and yearly for LANL summer schools.

- Peer reviewer for Climatic Change, European J. of Physics, J. of Advances in Modeling Earth Systems, J Geophysical Res., J. Comp. Physics, J. Turbulence, Nature, Ocean Modelling, Oceanography Magazine, Physics of Fluids, Quarterly J Royal Met Soc, Remote Sensing of Environment, NSF research proposals

- Data visualization and scientific communication with public for LANL, e.g. http://www.lanl.gov/newsroom/picture-of-the-week/pic-week-9.php

Publications

- Petersen, M., Asay-Davis, X., Berres, A., Feige, N., Jacobsen, D., Jones, P., Maltrud, M., Ringler, T., Streletz, G., Turner, A., Van Roekel, L., Veneziani, M., Wolfe, J., Wolfram, P., Woodring, J., 2018. An evaluation of the ocean and sea ice climate of E3SM using MPAS and interannual CORE-II forcing. https://doi.org/10.5281/zenodo.1194911

- Larios, A., Petersen, M.R., Titi, E.S., Wingate, B., 2018. A computational investigation of the finite-time blow-up of the 3D incompressible Euler equations based on the Voigt regularization. Theor. Comput. Fluid Dyn. 32, 23–34. https://doi.org/10.1007/s00162-017-0434-0

- Berres, A.S., Turton, T.L., Petersen, M., Rogers, D.H., Ahrens, J.P., 2017. Video Compression for Ocean Simulation Image Databases. The Eurographics Association. https://doi.org/10.2312/envirvis.20171104

- Lee, D., Petersen, M., Lowrie, R., Ringler, T., 2017. Tracer Transport within an Unstructured Grid Ocean Model using Characteristic Discontinuous Galerkin Advection. arXiv:1711.04928.

- Lee, D., Lowrie, R., Petersen, M., Ringler, T., Hecht, M., 2016. A high order characteristic discontinuous Galerkin scheme for advection on unstructured meshes. Journal of Computational Physics 324, 289–302. https://doi.org/10.1016/j.jcp.2016.08.010

- Samsel, F., Klaassen, S., Petersen, M., Turton, T.L., Abram, G., Rogers, D.H., Ahrens, J., 2016a. Interactive Colormapping: Enabling Multiple Data Ranges, Detailed Views of Ocean Salinity 10.

- Samsel, F., Petersen, M., Abram, G., Turton, T.L., Rogers, D., Ahrens, J., 2016b. Visualization of Ocean Currents and Eddies in a High-Resolution Global Ocean-Climate Model 4. Supercomputing Conference Proceedings 2015

- Ware, C., Rogers, D., Petersen, M., Ahrens, J., Aygar, E., 2016. Optimizing for Visual Cognition in High Performance Scientific Computing. Electronic Imaging 2016, 1–9. https://doi.org/10.2352/ISSN.2470-1173.2016.16.HVEI-130

- Woodring, J., Petersen, M., Schmeisser, A., Patchett, J., Ahrens, J., Hagen, H., 2016. In Situ Eddy Analysis in a High-Resolution Ocean Climate Model. IEEE Transactions on Visualization and Computer Graphics 22, 857–866. https://doi.org/10.1109/TVCG.2015.2467411

- Wolfram, P.J., Ringler, T.D., Maltrud, M.E., Jacobsen, D.W., Petersen, M.R., 2015. Diagnosing Isopycnal Diffusivity in an Eddying, Idealized Midlatitude Ocean Basin via Lagrangian, in Situ, Global, High-Performance Particle Tracking (LIGHT). J. Phys. Oceanogr. 45, 2114–2133. https://doi.org/10.1175/JPO-D-14-0260.1

- Petersen, M.R., Jacobsen, D.W., Ringler, T.D., Hecht, M.W., Maltrud, M.E., 2015. Evaluation of the arbitrary Lagrangian–Eulerian vertical coordinate method in the MPAS-Ocean model. Ocean Modelling 86, 93–113. https://doi.org/10.1016/j.ocemod.2014.12.004

- Reckinger, S.M., Petersen, M.R., Reckinger, S.J., 2015. A study of overflow simulations using MPAS-Ocean: Vertical grids, resolution, and viscosity. Ocean Modelling 96, 291–313. https://doi.org/10.1016/j.ocemod.2015.09.006

- Samsel, F., Petersen, M., Geld, T., Abram, G., Wendelberger, J., Ahrens, J., 2015. Colormaps That Improve Perception of High-Resolution Ocean Data, in: Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems, CHI EA '15. ACM, New York, NY, USA, pp. 703–710. https://doi.org/10.1145/2702613.2702975

- Ahrens, J., Jourdain, S., OLeary, P., Patchett, J., Rogers, D.H., Petersen, M., 2014. An Image-Based Approach to Extreme Scale in Situ Visualization and Analysis, in: SC14: International Conference for High Performance Computing, Networking, Storage and Analysis. Presented at the SC14: International Conference for High Performance Computing, Networking, Storage and Analysis, pp. 424–434. https://doi.org/10.1109/SC.2014.40

- Petersen, M.R., Williams, S.J., Maltrud, M.E., Hecht, M.W., Hamann, B., 2013. A three-dimensional eddy census of a high-resolution global ocean simulation. J. Geophys. Res. Oceans 118, 1759–1774. https://doi.org/10.1002/jgrc.20155

- Ringler, T., Petersen, M., Higdon, R.L., Jacobsen, D., Jones, P.W., Maltrud, M., 2013. A multi-resolution approach to global ocean modeling. Ocean Modelling 69, 211–232. https://doi.org/10.1016/j.ocemod.2013.04.010

- Williams, S., Petersen, M., Hecht, M., Maltrud, M., Patchett, J., Ahrens, J., Hamann, B., 2012. Interface Exchange as an Indicator for Eddy Heat Transport. Computer Graphics Forum 31, 1125–1134. https://doi.org/10.1111/j.1467-8659.2012.03105.x

- Williams, S., Hecht, M., Petersen, M., Strelitz, R., Maltrud, M., Ahrens, J., Hlawitschka, M., Hamann, B., 2011a. Visualization and Analysis of Eddies in a Global Ocean Simulation. Computer Graphics Forum 30, 991–1000. https://doi.org/10.1111/j.1467-8659.2011.01948.x

- Williams, S., Petersen, M., Bremer, P.T., Hecht, M., Pascucci, V., Ahrens, J., Hlawitschka, M., Hamann, B., 2011b. Adaptive Extraction and Quantification of Geophysical Vortices. IEEE Transactions on Visualization and Computer Graphics 17, 2088–2095. https://doi.org/10.1109/TVCG.2011.162

- Petersen, M.R., Livescu, D., 2010. Forcing for statistically stationary compressible isotropic turbulence. Physics of Fluids 22, 116101. https://doi.org/10.1063/1.3488793

- Livescu, D., Ristorcelli, J.R., Petersen, M.R., Gore, R.A., 2010. New phenomena in variable-density Rayleigh–Taylor turbulence. Phys. Scr. 2010, 014015. https://doi.org/10.1088/0031-8949/2010/T142/014015

- Hecht, Matthew W., Holm, D.D., Petersen, M.R., Wingate, B.A., 2008. Implementation of the LANS-alpha turbulence model in a primitive equation ocean model. Journal of Computational Physics 227, 5691–5716. https://doi.org/10.1016/j.jcp.2008.02.018

- Hecht, M. W., Holm, D.D., Petersen, M.R., Wingate, B.A., 2008. The LANS-alpha and Leray turbulence parameterizations in primitive equation ocean modeling. J. Phys. A: Math. Theor. 41, 344009. https://doi.org/10.1088/1751-8113/41/34/344009

- Petersen, M.R., Hecht, M.W., Wingate, B.A., 2008. Efficient form of the LANS-alpha turbulence model in a primitive-equation ocean model. Journal of Computational Physics 227, 5717–5735. https://doi.org/10.1016/j.jcp.2008.02.017

- Petersen, M.R., Julien, K., Stewart, G.R., 2007a. Baroclinic Vorticity Production in Protoplanetary Disks. I. Vortex Formation. ApJ 658, 1236. https://doi.org/10.1086/511513

- Petersen, M.R., Stewart, G.R., Julien, K., 2007b. Baroclinic Vorticity Production in Protoplanetary Disks. II. Vortex Growth and Longevity. ApJ 658, 1252. https://doi.org/10.1086/511523

- Petersen, M.R., Julien, K., Weiss, J.B., 2006. Vortex cores, strain cells, and filaments in quasigeostrophic turbulence. Physics of Fluids 18, 026601. https://doi.org/10.1063/1.2166452

Awards

- Best Scientific Visualization & Data Analytics Showcase, Supercomputing Conference 2015, "Visualizing Ocean Currents and Eddies in a High-Resolution Global Ocean-Climate Model", Samsel, F., Petersen, M., Abram, G., Turton, T.L., Rogers, D., Ahrens, J. https://vimeo.com/145875477

- AAAS Science Data Stories Finalist, 2016, "Ocean Currents and Climate Change", Petersen, M. and Samsel, F. http://www.sciencemag.org/projects/data-stories/finalists/2016

- Finalist, Scientific Visualization & Data Analytics Showcase, Supercomputing Conference 2014, "In Situ MPAS-Ocean Image-Based Visualization", Ahrens, J., Jourdain, S., O'Leary, P., Patchett, J., Rogers, D., Fasel, P., Bauer, A, Petersen, M., Samsel, F., Boeckel, B.

Community Service

- Science Fair Judge for many years at county, regional, state, and international levels. Three-time judge at Intel International Science and Engineering Fair.

- Mentor in science and computer programming to numerous students, ranging from grades 5 to 12.

- Speaker for youth groups on science, computing, and climate modeling, ranging from fifth grade classrooms, New Mexico Supercomputing Challenge, to high school students at Intel International Science and Engineering Fair

- Children's choir director, 2005 to present

- Foster parent, adoptive parent of three children from New Mexico CYFD