Mark R. Petersen

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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)
  Climate, Ocean, and Sea Ice Model Team (COSIM)
  Los Alamos National Laboratory
- 2005-2007: Postdoctoral Researcher, Computational Physics and Methods (CCS-2)
  Climate, Ocean, and Sea Ice Model Team (COSIM)
  Los Alamos National Laboratory
- 1996–1998: Project Engineer, U.S. Filter, San Diego

Responsibilities

- Ocean model developer for the Model for Prediction Across Scales-Ocean (MPAS-Ocean), 2010–2016
- Lead MPAS-Ocean Developer, 2016–present. Responsible for algorithms, code repository, verification and validation, and training new researchers.
- Leadership team, DOE Energy, Exascale, Earth System Model (E3SM), Co-lead of Cryosphere simulation campaign, 2018–present
- PI for ASCR Leadership Computing Challenge (ALCC) award of 87 million CPU hours, 2017-2019, "Understanding the Role of Ice Shelf-Ocean Interactions in a Changing Global Climate".
- Mentor or co-mentor for 10 post-doctoral researchers (three currently)
- Mentor or co-mentor for 15 LANL students (three currently)
- Mentor and instructor in the LANL Parallel Computing Summer Research Institute
- Regular speaker and recruiter at university mathematics and engineering departments, about careers in computational fluid dynamics at DOE. Recently includes Stanford, UC-Berkeley, CU-Boulder, Montana State, and LANL summer internship programs.

- Peer reviewer for Nature, Nature Communications, J. Comp. Physics, Physics of Fluids, Quarterly J Royal Met Soc, Ocean Modelling, J. Phys. Oceanography, Climatic Change, European J. of Physics, J. of Advances in Modeling Earth Systems, J. Geophysical Res., J. Marine Sciences, J. Turbulence, Oceanography Magazine, Remote Sensing of the 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` and 2016 National Lab Science Day on the Capitol Hill, Washington D.C.

Community Service

- Mentor students yearly in science fair and computer programming projects, ranging from grades 5 to 12. Several students progress to state and international levels.
- Science fair judge at county, regional, state, and international levels, and for New Mexico Supercomputing Challenge. Four-time judge at Intel International Science and Engineering Fair.
- Speaker for youth groups on science, computing, and climate modeling, including fifth grade to high school classrooms, New Mexico Supercomputing Challenge, and high school students and teachers at Intel International Science and Engineering Fair.
- Children's choir director, 2005–2018
- Foster parent, adoptive parent of three children from New Mexico Social Services

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.

Publications

- Hoch, K. E., Petersen, M. R., Brus, S. R., Engwirda, D., Roberts, A. F., Rosa, K. L., Wolfram, P. J., 2020. MPAS-Ocean simulation quality for variable-resolution North American coastal meshes. Journal of Advances in Modeling Earth Systems, 12, e2019MS001848. `https://doi.org/10.1029/2019MS001848`

- Lee, D.Y., Lin, W., Petersen, M.R., 2020. Wintertime Arctic Oscillation and North Atlantic Oscillation and their impacts on the Northern Hemisphere climate in E3SM. Clim Dyn, https://doi.org/10.1007/s00382-020-05316-0

- Jeong, H., and Coauthors, 2020. Impacts of Ice-Shelf Melting on Water-Mass Transformation in the Southern Ocean from E3SM Simulations. J. Climate, 33, 5787–5807, https://doi.org/10.1175/JCLI-D-19-0683.1

- Lee, D. Y., Petersen, M. R., Lin, W., 2019. The Southern Annular Mode and Southern Ocean surface westerly winds in E3SM. Earth and Space Science, 6, 2624– 2643. https://doi.org/10.1029/2019EA000663

- Banesh, D., Petersen, M., Wendelberger, J. et al, 2019. Comparison of piecewise linear change point detection with traditional analytical methods for ocean and climate data. Environ Earth Sci. 78: 623. https://doi.org/10.1007/s12665-019-8636-y

- 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., 2019. An evaluation of the ocean and sea ice climate of E3SM using MPAS and interannual CORE-II forcing. Journal of Advances in Modeling Earth Systems, 11, 1438– 1458. https://doi.org/10.1029/2018MS001373

- Golaz, J.-C., Caldwell, P. M., Van Roekel, L. P., Petersen, M. R. et al. 2019. The DOE E3SM coupled model version 1: Overview and evaluation at standard resolution. Journal of Advances in Modeling Earth Systems, 11, 2089-2129. https://doi.org/10.1029/2018MS001603

- Lee, D, M. Petersen, R. Lowrie, T. Ringler. 2018. Tracer Transport within an Unstructured Grid Ocean Model using Characteristic Disco ntinuous Galerkin Advection. Computers & Mathematics with Applications. 0898-1221. https://doi.org/10.1016/j.camwa.2018.09.024

- 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., 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

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