

Pavel Perezhogin

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Education and Employment

- Oct 2025 – Now █ **Research Scientist** in Mathematics Department. Courant Institute of Mathematical Sciences, New York University. **Lead Scientist** in M²LInES project.
- Dec 2021 – Oct 2025 █ **Postdoctoral Associate** in Mathematics Department. Courant Institute of Mathematical Sciences, New York University. Advisor: Dr. Laure Zanna
- 2017 – 2021 █ **PhD** in Mathematical Modeling, Numerical Methods and Software. Marchuk Institute of Numerical Mathematics of the Russian Academy of Sciences. Thesis Title: Stochastic and deterministic subgrid parameterizations for two-dimensional turbulence and their application in ocean circulation models (in Russian). Advisor: Dr. Andrey Glazunov
- 2011 – 2017 █ **BSc&MSc** in Applied Mathematics and Physics. Department of Control and Applied Mathematics. Moscow Institute of Physics and Technology (MIPT).

Awards

- 2019 █ **PhD Research Fellowship**, Russian Foundation for Basic Research, Grant No. 19-35-90023. Advisor: A. V. Glazunov.
- 2018 █ **Medal of the Russian Academy of Sciences** for students for the best scientific work in oceanology, atmospheric physics and geography.

Additional Experience

- Leadership █ Member of the **CESM-MLe Integration Team**, dedicated to incorporating Machine Learning-based parameterizations and techniques into the Community Earth System Model (CESM).
- Short-term visit █ Conducted a research project during the **Summer Program 2024** at the Center for Turbulence Research (CTR), Stanford University.
- Teaching █ **Invited** guest lectures "Machine Learning in Geophysics", Russia, Moscow, INM RAS (2023).
- Mentoring █ Grad. student Ivan Kobzar (co-advised with Andrey Glazunov, 2021) and Undergrad. Matias Ortiz (co-advised with Laure Zanna, 2023).
- Reviewing █ Journal of Advances in Modeling Earth Systems (JAMES) | Ocean Modeling | Geoscientific Model Development (GMD)

Selected Talks

- 2025 ━ American Geophysical Union (AGU) annual meeting, Climate Process Team (CPT) annual meeting, NCAR-DLR meeting (Boulder, Colorado), CESM Ocean Model Working Group
- 2024 ━ Ocean Sciences | CESM Ocean Model Working Group
- 2023 ━ Courant Atmosphere Ocean Science Colloquium (**invited**) | AGU Fall Meeting | APS Division of Fluid Dynamics | CESM Workshop | CPT Annual Meeting | NEMO Machine Learning WG (**invited**) | CESM Ocean Model WG meeting
- 2022 ━ AGU Fall Meeting | CPT Annual Meeting | NEMO Eddy Closure WG (**invited**)
- 2017-2021 ━ TRR 181 Seminar (**2021, invited**) | EGU General Assembly (**2020, 2021, online**) | AGU Fall Meeting (**2020, online**) | ECMWF Annual seminar (**2020, online**) | Winter School in Les Houches (**2019, poster**) | 32nd-IUGG (**2018**) | CITES-**2017**

Publications

Peer-reviewed Journal papers

- 1 Perezhigin, P., Adcroft, A., & Zanna, L. (2025). Generalizable neural-network parameterization of mesoscale eddies in idealized and global ocean models. *Geophysical Research Letters*, *52*(19), e2025GL117046.  doi:<https://doi.org/10.1029/2025GL117046>
- 2 Zhang, C., Perezhigin, P., Adcroft, A., & Zanna, L. (2025). Addressing out-of-sample issues in multi-layer convolutional neural-network parameterization of mesoscale eddies applied near coastlines. *Journal of Advances in Modeling Earth Systems (JAMES)*, *17*(5), e2024MS004819.  doi:<https://doi.org/10.1029/2024MS004819>
- 3 Falasca, F., Perezhigin, P., & Zanna, L. (2024). Data-driven dimensionality reduction and causal inference for spatiotemporal climate fields. *Phys. Rev. E*, *109*, 044202.  doi:<https://doi.org/10.1103/PhysRevE.109.044202>
- 4 Perezhigin, P., Zhang, C., Adcroft, A., Fernandez-Granda, C., & Zanna, L. (2024). A stable implementation of a data-driven scale-aware mesoscale parameterization. *JAMES*, *16*(10), e2023MS004104.  doi:<https://doi.org/10.1029/2023MS004104>
- 5 Perezhigin, P., & Glazunov, A. (2023). Subgrid Parameterizations of Ocean Mesoscale Eddies Based on Germano Decomposition. *JAMES*, *15*(10).  doi:<https://doi.org/10.1029/2023ms003771>
- 6 Perezhigin, P., Zanna, L., & Fernandez-Granda, C. (2023). Generative Data-Driven Approaches for Stochastic Subgrid Parameterizations in an Idealized Ocean Model. *JAMES*, *15*(10), e2023MS003681.  doi:<https://doi.org/10.1029/2023MS003681>
- 7 Ross, A., Li, Z., Perezhigin, P., Fernandez-Granda, C., & Zanna, L. (2023). Benchmarking of machine learning ocean subgrid parameterizations in an idealized model. *JAMES*, *15*(1), e2022MS003258.  doi:<https://doi.org/10.1029/2022MS003258>
- 8 Zasko, G. V., Glazunov, A. V., Mortikov, E. V., Nechepurenko, Y. M., & Perezhigin, P. (2023). Optimal energy growth in stably stratified turbulent Couette flow. *Boundary-Layer Meteorology*, *187*(1-2), 395–421.  doi:<https://doi.org/10.1007/s10546-022-00744-3>
- 9 Zhang, C., Perezhigin, P., Gultekin, C., Adcroft, A., Fernandez-Granda, C., & Zanna, L. (2023). Implementation and Evaluation of a Machine Learned Mesoscale Eddy Parameterization Into a

Numerical Ocean Circulation Model. *JAMES*, 15(10), e2023MS003697.

DOI: <https://doi.org/10.1029/2023MS003697>

- 10 Perezhigin, P., Chernov, I., & Iakovlev, N. (2021). Advanced parallel implementation of the coupled ocean–ice model FEMAO (version 2.0) with load balancing. *Geoscientific Model Development*, 14(2), 843–857. DOI: <https://doi.org/10.5194/gmd-14-843-2021>
- 11 Perezhigin, P. (2020a). 2D turbulence closures for the barotropic jet instability simulation. *Russian Journal of Numerical Analysis and Mathematical Modelling*, 35(1), 21–35. DOI: <https://doi.org/10.1515/rnam-2020-0003>
- 12 Perezhigin, P. (2020b). Testing of kinetic energy backscatter parameterizations in the NEMO ocean model. *Russian Journal of Numerical Analysis and Mathematical Modelling*, 35(2), 69–82. DOI: <https://doi.org/10.1515/rnam-2020-0006>
- 13 Perezhigin, P., Glazunov, A. V., & Gritsun, A. S. (2019). Stochastic and deterministic kinetic energy backscatter parameterizations for simulation of the two-dimensional turbulence. *Russian Journal of Numerical Analysis and Mathematical Modelling*, 34(4), 197–213. DOI: <https://doi.org/10.1515/rnam-2019-0017>
- 14 Dymnikov, V., & Perezhigin, P. (2018). Systems of hydrodynamic type that approximate two-dimensional ideal fluid equations. *Izvestiya, Atmospheric and Oceanic Physics*, 54, 232–241. DOI: <https://doi.org/10.1134/S0001433818030040>
- 15 Perezhigin, P., & Dymnikov, V. (2017). Modeling of quasi-equilibrium states of a two-dimensional ideal fluid. *Doklady Physics*, 62, 248–252. DOI: <https://doi.org/10.1134/S1028335817050032>
- 16 Perezhigin, P., Glazunov, A. V., Mortikov, E. V., & Dymnikov, V. P. (2017). Comparison of numerical advection schemes in two-dimensional turbulence simulation. *Russian Journal of Numerical Analysis and Mathematical Modelling*, 32(1), 47–60. DOI: <https://doi.org/10.1515/rnam-2017-0005>

Conference Proceedings

- 1 Perezhigin, P., Balakrishna, A., & Agrawal, R. (2024). Large eddy simulation of ocean mesoscale eddies. In *Center for Turbulence Research, Proceedings of the Summer Program*. Retrieved from https://web.stanford.edu/group/ctr/ctrsp24/vi07_PEREZHOGIN.pdf

Preprints

- 1 Zanna, L., Gregory, W., Perezhigin, P., Sane, A., Zhang, C., Adcroft, A. et al. (2025). *A Framework for Hybrid Physics-AI Coupled Ocean Models*. DOI: <https://doi.org/10.48550/arXiv.2510.22676>
- 2 Balwada, D., Perezhigin, P., Adcroft, A., & Zanna, L. (2025). *Design and implementation of a data-driven parameterization for mesoscale thickness fluxes*. DOI: <https://doi.org/10.22541/essoar.174835313.30541637/v1>
- 3 Wu, J., Perezhigin, P., Gagne, D. J., Reichl, B., Subramanian, A. C., Thompson, E., & Zanna, L. (2025). *Data-driven probabilistic air-sea flux parameterization*. DOI: <https://doi.org/10.48550/arXiv.2503.03990>

Note: Additional publications, including peer-reviewed in Russian journals (2), preprints (1), conference papers (3) and open source education/software (1) can be found at  pperezhigin.github.io/publications