

Georgy Manucharyan

University of Washington, School of Oceanography
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EDUCATION *Ph.D. with Distinction*, Atmosphere Oceans & Climate Dynamics, 2014
Department of Geology & Geophysics, Yale University, New Haven, CT, USA.

B.S. with Honors in Applied Physics and Mathematics, 2007
Department of Aerophysics and Space Research,
Moscow Institute of Physics and Technology, Dolgoprudny, Russia.

ACADEMIC POSITIONS • Assistant Professor, University of Washington, School of Oceanography 09/2019–present
Research directions: Mesoscale and Submesoscale Ocean Turbulence, Geophysical Fluid Dynamics, Deep Learning, Floe-Scale Sea Ice Dynamics, Ice-Ocean Interactions, Remote Sensing.

• Foster and Coco Stanback Postdoctoral Fellow, California Inst. of Technology, 2015–2019
Research topic: “*Meso- and Sub-Mesoscale Ocean Dynamics Under Sea Ice*”,
Mentor: Andrew Thompson (Caltech).

• Weston Howland Jr. Postdoctoral Scholar, Woods Hole Oceanographic Institution, 2014-2015
Research topic: “*Arctic Ocean Halocline*”,
Mentor: Michael Spall (WHOI).

• Graduate Research Fellow, Yale University, 2008–2014
PhD thesis: “*The Role of Upper-Ocean Mixing in Large-Scale Ocean and Climate Dynamics*”,
M. Phil thesis: “*Oceanic Response to Tropical Cyclones*”,
Advisor: Alexey Fedorov (Yale University).

• Geophysical Fluid Dynamics Summer School at WHOI – Fellow, 2010
Research topic: “*Dynamics of the Mixed Layers in Stratified Sheared Flows*”,
Mentor: Colm-cille Caulfield (University of Cambridge).

• Undergraduate Research Assistant, Shirshov Institute of Oceanology, Russia 2005–2007
Research topic: “*Ocean Data Assimilation Techniques*”,
Advisor: Mikhail Koshlyakov (Shirshov Institute of Oceanology).

PUBLICATIONS • **Manucharyan, G. E.** & Montemuro, B. P. (2022). SubZero: A Sea Ice Model with an Explicit Representation of the Floe Life Cycle. *Journal of Advances in Modeling Earth Systems (under review)*.

Google Scholar

• **Manucharyan, G. E.** & Stewart, A. L. (2022). Stirring of interior potential vorticity gradients as a formation mechanism for large subsurface-intensified eddies in the Beaufort Gyre. *Journal of Physical Oceanography*.

• **Manucharyan, G. E.**, Lopez-Acosta, R., & Wilhelmus, M. M. (2022). Spinning ice floes reveal intensification of mesoscale eddies in the western Arctic Ocean. *Scientific Reports*, 12(1), 1-13.

• **Manucharyan, G. E.**, & Thompson, A. F. (2022). Heavy footprints of upper-ocean eddies on weakened Arctic sea ice in marginal ice zones. *Nature Communications*, 13(1), 1-10.

• Chen, N., Fu, S., & **Manucharyan, G. E.** (2022). An efficient and statistically accurate Lagrangian data assimilation algorithm with applications to discrete element sea ice models. *Journal of Computational Physics*, 455, 111000.

- K. Shrestha & **Manucharyan, G. E.** (2022). Parameterization of submesoscale mixed layer restratification under sea ice, *Journal of Physical Oceanography*, 52(3), 419-435.
- W. Moon, **Manucharyan, G. E.** & H. Dijkstra (2022) Baroclinic instability and large-scale wave propagation on planetary-scale atmosphere, *Quarterly Journal of the Royal Meteorological Society*.
- N. Chen, Fu, S. & **Manucharyan, G. E.** (2021). Lagrangian Data Assimilation and Parameter Estimation of a Simple Sea Ice Discrete Element Model, *Journal of Advances in Modeling Earth Systems*, 13(10).
- W. Moon, **Manucharyan, G. E.** & H. A. Dijkstra (2021). Eddy memory as an explanation of intraseasonal periodic behaviour in baroclinic eddies, *Quarterly Journal of the Royal Meteorological Society*, 147, 2395–2408.
- A. Kubryakov, Kozlov, I. & **Manucharyan, G. E.** (2021). Large mesoscale eddies in the Western Arctic Ocean from satellite altimetry measurements, *Journal of Geophysical Research: Oceans*, 126(5).
- George, T., **Manucharyan, G.E.**, & Thompson, A.F. (2021), Deep learning to infer eddy heat fluxes from sea surface height patterns of mesoscale turbulence, *Nature Communications*, 12, 800.
- Kenigson, J. S., Gelderloos, R., & **Manucharyan, G. E.** (2021). Vertical Structure of the Beaufort Gyre Halocline and the Crucial Role of the Depth-Dependent Eddy Diffusivity, *Journal of Physical Oceanography*, 51(3), 845-860.
- **Manucharyan, G.E.**, Siegelman, L., & Klein, P. (2021), A deep learning approach to spatiotemporal sea surface height interpolation and estimation of deep currents in geostrophic ocean turbulence. *Journal of Advances in Modeling Earth Systems*, 13, e2019MS001965.
- Kozlov, I. E., Plotnikov, E. V., & **Manucharyan, G. E.** (2020). Brief Communication: Mesoscale and submesoscale dynamics in the marginal ice zone from sequential synthetic aperture radar observations. *The Cryosphere*, 14(9), 2941-2947.
- Armitage, T.W.K., **Manucharyan, G.E.**, Petty A.A., et al. (2020), Enhanced eddy activity in the Beaufort Gyre in response to sea ice loss, *Nature Communications*, 11, 761.
- Nakayama, Y., **Manucharyan, G.E.**, et al. (2019), Pathways of ocean heat towards Pine Island and Thwaites grounding lines, *Scientific Reports*, Nov 22, 9(1):1-9.
- Proshutinsky, A., et al. including **Manucharyan, G.E.** (2019), Analysis of the Beaufort Gyre Freshwater Content in 2003–2018, *Journal of Geophysical Research: Oceans*, 124.
- Kozlov, I.E., Artamonova, A.V., **Manucharyan, G.E.** and Kubryakov, A.A. (2019), Eddies in the Western Arctic Ocean from spaceborne SAR observations over open ocean and marginal ice zones, *Journal of Geophysical Research: Oceans*, 124, 6601–6616.
- **Manucharyan, G.E.** and Isachsen P.E. (2019), Critical role of continental slopes in halocline and eddy dynamics of the Beaufort Gyre, *Journal of Geophysical Research: Oceans*, 124, no. 4.
- Zhao, M., Timmermans, M.-L., Krishfield, R., & **Manucharyan, G.E.** (2018), Partitioning of kinetic energy in the Arctic Ocean’s Beaufort Gyre. *Journal of Geophysical Research: Oceans*, 123, 4806–4819.
- Ardhuin, F. et al. including **Manucharyan, G.E.** (2018), Measuring currents, ice drift, and waves from space: the Sea surface Kinematics Multiscale monitoring (SKIM) concept, *Ocean Science*, 14.3, 337–354.
- **Manucharyan G.E.** & A.F. Thompson (2017), Submesoscale sea ice-ocean interactions in marginal ice zones, *Journal of Geophysical Research: Oceans*, 122, 9455–9475.
- Zhu P., **Manucharyan, G.E.** , Thompson, A.F., Goodman, J.C. & Vance, S.D. (2017), The influence of meridional ice transport on Europa’s ocean stratification and heat content, *Geophysical Research Letters*, 44, 5969–5977.

- **Manucharyan G.E.**, A.F. Thompson, & M.A. Spall, (2017), Eddy-Memory mode of multi-decadal variability in residual-mean ocean circulations with an application to the Beaufort Gyre, *Journal of Physical Oceanography*, 47, 855–866.
- **Manucharyan G.E.**, M.A. Spall, & A.F. Thompson (2016), A theory of the wind-driven Beaufort Gyre variability, *Journal of Physical Oceanography*, 46, 3263–3278.
- **Manucharyan G.E.** & M.A. Spall (2016), Wind-driven freshwater buildup and release in the Beaufort Gyre constrained by mesoscale eddies, *Geophysical Research Letters*, 43(1), pp 273–282.
- **Manucharyan G.E.** & C.P. Caulfield (2015), Entrainment and mixed-layer dynamics of a surface-stress-driven stratified fluid, *Journal of Fluid Mechanics*, 765, pp 653–667.
- **Manucharyan G.E.** & A.V. Fedorov (2014), Robust ENSO across a wide range of climates, *Journal of Climate*, 27, 5836–5850.
- **Manucharyan G.E.**, W. Moon, F. Sévellec, A.J. Wells, J.-Q. Zhong, & J.S. Wettlaufer (2014), Steady turbulent density currents on a slope in a rotating fluid, *Journal of Fluid Mechanics*, 746, pp 405–436.
- **Manucharyan G.E.** & M.-L. Timmermans (2013), Generation and separation of mesoscale eddies from surface ocean fronts, *Journal of Physical Oceanography*, 43, 2545–2562.
- **Manucharyan G.E.**, C.M. Brierley, & A.V. Fedorov (2011), Climate impacts of intermittent upper ocean mixing induced by tropical cyclones, *Journal of Geophysical Research*, 116, C11038.
- **Manucharyan G.E.** (2010), Dynamics of the Mixed Layers in Stratified Shear Flows, WHOI GFD Summer School, Ann. Proc. Vol. 2010, pp 240–259 [NOT peer-reviewed].

FUNDING

- UW**, Computing for the Environment, “*Deep Learning for Massive Compression of Climate Model Simulations and Data*”, PI: G.E. Manucharyan, Co-I: S. Wang (UW), \$55K 2022
- NASA, OSTST**, “*Exploring the plausibility and limitations of SSH interpolation with deep learning*” PI: G.E. Manucharyan, \$653K 2021–2025
- NASA, FINESST**, “*Inferring ocean energy transfers in submesoscale currents using high-resolution satellite sea ice observations*” FI: Kitty Wang, PI: G.E. Manucharyan, \$135K 2020–2023
- ONR MURI**, “*Mathematics and Data Science for Improved Physical Modeling and Prediction of Arctic Sea Ice*”, PI: D. Giannakis (Dartmouth), \$7.5M, of which \$1M to UW 2019–2023
- NSF, OCE** “*Submesoscale Sea Ice-Ocean Interactions in Marginal Ice Zones*”, PIs: A.F. Thompson (Caltech) and G.E. Manucharyan, \$540K, of which \$480K to UW 2018–2020
- NSF, XSEDE**, computing grant, “*The role of the continental slope in the wind-driven eddy dynamics of the Beaufort Gyre*”, \$26.5K 2016

FELLOWSHIPS & AWARDS

- Foster and Coco Stanback Postdoctoral Fellowship, California Institute of Technology. 2014
- Weston Howland Jr. Postdoctoral Scholarship, Woods Hole Oceanographic Institution. 2014
- Philip M. Orville Prize “*For recognition of outstanding research and scholarship in the Earth Sciences*”, Yale University. 2014
- Elias Loomis Prize for “*Excellence in Studies of Physics of the Earth*”, Yale University. 2011
- Charlton Dows Cooksey Jr. Memorial Fellowship, Yale University. 2010–2012
- Geophysical Fluid Dynamics Fellowship, Woods Hole Oceanographic Institution. 2010
- Bateman Fellowship, Yale University. 2008

FIELD EXPERIENCE	<ul style="list-style-type: none"> • CLIVAR Carbon and Hydrographic Oceanography Cruise, R/V Melville (PO2, leg 2), Chief Scientist: Sabine Mecking (University of Washington). 2013
TEACHING EXPERIENCE	<ul style="list-style-type: none"> • University of Washington, Seattle, WA [Course Instructor] <ul style="list-style-type: none"> Introduction To Field Oceanography, OCEAN 220 2022 Introduction To Fluid Dynamics, OCEAN 511 A, Joint with ATM S 505 A 2021 Geophysical Fluid Dynamics II, OCEAN 513 2021 Topics In Physical Oceanography, OCEAN 569 2021 Special Topics In Oceanography, OCEAN 240 2020 Introduction To Field Oceanography, OCEAN 220 2020 Physics Across Oceanography: Fluid Mechanics And Waves, OCEAN 285 2020 Integrative Oceans, OCEAN 210 2020 • Yale University, New Haven, CT [Graduate TA and/or Guest Lecturer] <ul style="list-style-type: none"> Physical Oceanography 2010,11,13,14 Introduction to Concepts in Geology & Geophysics 2013 Asymptotic Methods 2012 Physics of Weather and Climate 2012 Atmosphere, Ocean, and Environmental Change 2009 • Physics & Technology Evening High School (ЗФТШ), Dolgoprudny, Russia <ul style="list-style-type: none"> Advanced Mathematics – Lecturer 2007–2008 Physics, Mathematics – Correspondence School Grader 2004–2005
MENTORING	<ul style="list-style-type: none"> • PhD Students at UW <ul style="list-style-type: none"> Scott Martin, Deep Learning SSH and eddy analysis 2021– Yang (Kitty) Wang, Energy fluxes in mesoscale/submesoscale ocean turbulence 2019– • Postdoctoral Scientists at UW <ul style="list-style-type: none"> Channing Prend, Submesoscale dynamics in Southern Ocean marginal ice zones 2022– Brandon Montemuro, Development of a floe-resolving sea ice model, SubZero 2019– Kalyan Shrestha, Parameterization of submesoscale restratification under sea ice 2019–22 • Graduate Student Committee at UW <ul style="list-style-type: none"> Cassia Cai, Physical Oceanography 2021– Georges Kanaan, Biological Oceanography 2021– Ryan Eastmann, Atmospheric Science 2020-21 Maleen Kidiwela, Marine Geology and Geophysics 2019– Ethan Campbell, Physical Oceanography 2019– Samuel Brenner, Physical Oceanography 2019–22 • Undergraduate Students at UW <ul style="list-style-type: none"> Robin Chartrand, Satellite image analysis of sea ice and ocean filaments 2022 Yuna Liu, Discrete element sea ice modeling 2022 Yaoning Yu, Reconstruction of under-ice ocean currents using ML 2022 Murray Kang, Reconstruction of under-ice ocean currents using ML 2022 Camille Viviani, Floe size distribution in Nares Strait 2022 James Kunetz, Science communication and writing 2021 Snehal Shokeen, GFD lab experiments using “optical altimetry” 2020 • UW Robinson Center Transition School <ul style="list-style-type: none"> Bohan Yao, Evolution of shapes of interacting clusters of ideal vortices 2022 • Graduate and Undergraduate Summer School Students

Tom George, Caltech SURF, Estimation of eddy heat fluxes with Deep Learning 2018
Jessica Kenigson, GFD Summer School at WHOI, Beaufort Gyre halocline 2017
Robert Fajber, GFD Summer School at WHOI, Seing the ocean through sea ice 2017
Peiyun Zhu, Caltech SURF, Salinity-driven meridional circulation in Europa’s ocean 2016

• **Students Mentored Remotely**

Shivam Jha, B.S., Indian Inst. of Tech., Dhanbad, Ocean dynamics in sea ice leads 2022
Shuai Meng, M.S., U. Penn., ML reconstruction of the Southern Ocean overturning 2021
Rosalinda Lopez-Acosta, Ph.D., UC Riverside, Ocean dynamics and sea ice floes 2019-21

**LEADERSHIP
& SERVICE**

- Creator and organizer of the **Data Science in Oceanography** undergraduate summer program at the University of Washington. 2022
- DEI Committee, UW School of Oceanography 2022
- Faculty Search Committee, UW School of Oceanography 2021-22
- Creator and organizer of the **Modeling the Granular Nature of Sea Ice** workshop 2021
- Organizer and chair of sessions at Ocean Sciences Meetings 2018,20,22
- Peer reviewed proposals for NASA, NSF, and publications for Journal of Geophysical Research: Oceans, Geophysical Research Letters, Journal of Fluid Mechanics, Journal of Physical Oceanography, Ocean Science, Nature Communications, Journal of Advances in Modeling Earth Systems, Journal of Climate, and many more... 2011-present
- Selected participant in the “*New Generation of Polar Scientists Leadership Symposium*”, Catalina Island, CA and the “*Marine Geoscience Leadership Consortium, Consortium for Ocean Leadership*”, Washington D.C. 2015
- Colloquium Committee, Department of Geology & Geophysics, Yale University. 2012-14
- Co-creator of the Geophysical Fluid Dynamics Independent Research Group – a volunteer collaboration of students and postdocs at Yale University conducting novel theoretical and experimental research in geophysical fluid dynamics 2010–2013

**CONFERENCES
& WORKSHOPS**

- Ocean Sciences Meeting, not in Hawaii (online) 2022
 Title: “*Spinning ice floes reveal intensification of mesoscale eddies in the western Arctic Ocean*”
 Session Chair: “*Floe-scale sea ice processes: constraints from observations and models*”
- Workshop on “Modeling the Granular Nature of Sea Ice” 2021
 Title: “*SubZero: a Sea Ice Model with an Explicit Representation of a Floe Lifecycle*”
- Ocean Sciences Meeting, San Diego, CA 2020
 Title: “*Mesoscale and Submesoscale Sea Ice-Ocean Interactions in the Arctic Ocean*”
 Session Chair: “*Sea Ice Dynamics and Predictability*”
- Arctic Dynamics Workshop, Massachusetts Institute of Technology, Cambridge, MA 2019
 Title: “*Eddies in the Beaufort Gyre: Big or Small?*”
- Frontiers in Oceanic, Atmospheric, and Cryospheric Boundary Layers 2018
 Kavli Institute for Theoretical Physics, UC Santa Barbara
 Title: “*Submesoscale sea ice-ocean interactions in marginal ice zones*”
- Ocean Sciences Meeting, Portland, OR 2018
 Titles: “*Knocking on the doors of non-equilibrium mesoscale turbulence*” and
 “*Heavy footprints of mesoscale and submesoscale ocean turbulence on weakened*”

sea ice in the Arctic and Southern Oceans” (Invited);
 Session Chair: *“Role of Small-Scale Processes in the Dynamics of the Changing Arctic Ocean”*

Geophysical Fluid Dynamics Summer School (staff member), WHOI, Woods Hole, MA. 2017

AGU Fall Meeting, San Francisco, CA 2016
 Title: *“Eddy-Memory mode of decadal ocean variability”*

Forum for Arctic Modeling & Observational Synthesis, WHOI, MA 2016
 Title: *“The role of mesoscale eddies in the wind-driven Beaufort Gyre variability”*
 Panelist for the discussion topic: *“Role of small-scale processes”*

Ocean Sciences Meeting, New Orleans, LA 2016
 Title: *“Transient halocline and freshwater dynamics of the Arctic’s Beaufort Gyre”*

American Geophysical Union, Fall Meeting, San Francisco, CA 2015
 Title: *“Wind-Driven Freshwater Buildup in the Beaufort Gyre is Inevitably Constrained by Mesoscale Eddies”*

Conference on Atmospheric and Oceanic Fluid Dynamics, Minneapolis, MN 2015
 Title: *“Arctic Halocline Response to Changing Surface Stress Forcing”*

Geophysical Fluid Dynamics Summer School, WHOI, Woods Hole, MA 2009–12,14

Conference on Atmospheric and Oceanic Fluid Dynamics, Newport, RI 2013
 Title: *“Generation and Separation of Mesoscale Eddies from Surface Ocean Fronts”*

65th annual meeting of APS, Division of Fluid Dynamics, San Diego, CA 2012
 Titles: *“Entrainment and Mixing Dynamics of Surface-Stress-Driven Linearly Stratified Flow in a Cylinder”*; *“Steady Rotating Density Currents on a Slope”*

Graduate Climate Conference, MIT, Woods Hole, MA 2011
 Title: *“Climate Impacts of Intermittent Mixing by Tropical Cyclones”*

American Geophysical Union Fall Meeting, San Francisco, CA 2011
 Title: *“Global Impacts of Intermittent Mixing Induced by Tropical Cyclones”*

Ocean Sciences Meeting, Portland, OR 2010

Fundamental Problems in Climate Dynamics, PCTS, Princeton, NJ 2009

**INVITED
 SEMINARS**

(**“Topics”
 Locations**)

- *“Spinning Ice Floes reveal intensification of mesoscale eddies in the western Arctic Ocean”*, Atmospheric and Oceanic Sciences, McGill University 2022
- *“Emerging Arctic Ocean turbulence revealed by rotating sea ice fragments”* 2021
 University of South Florida, College of Marine Science
- *“Eddy Memory in the Ocean”* 2021
 Leeds University, Department of Mathematics
- *“Ice-ocean interactions”* 2021
 US CLIVAR Phenomena, Observations, and Synthesis (POS) Panel
- *“Dynamical analysis of SSH observations via Deep Learning”* 05/2019
 NASA Jet Propulsion Laboratory, Pasadena, CA
- *“Spatiotemporal interpolation of SSH data using Machine Learning”* 06/2019
 SWOT Science Team Meeting, Bordeaux, France
- *“Heavy footprints of upper-ocean eddies on weakened Arctic sea ice”* 07/2019
 Laboratoire d’Océanographie et du Climat : Expérimentations et Approches

Numériques, Institut Pierre Simon Laplace, Paris, France.

- *“Deep Learning for disentangling information on subsurface flows and mesoscale eddy heat fluxes from SSH data”* 12/2019
Scripps Institution of Oceanography, UC San Diego, CA
- *“Turbulent dynamics of the Arctic Ocean and its interactions with the sea ice”*
UC Santa Barbara, Mechanical Engineering 02/2018
Florida State University, Earth Ocean and Atmospheric Science 03/2018
Woods Hole Oceanographic Institution, Physical Oceanography 04/2018
- *“Submesoscale sea ice-ocean interactions in marginal ice zones”*
UC Santa Barbara, Kavli Institute for Theoretical Physics. Frontiers in Oceanic, Atmospheric, and Cryospheric Boundary Layers 05/2018
- *Turbulent dynamics of the Arctic Ocean”*
UC Santa Cruz, Ocean Sciences 02/2017
- *“Ideas on mesoscale eddy parameterizations for transient flows”*
UC Los Angeles, Department of Atmospheric and Oceanic Sciences 03/2017
Caltech, Division of Geological and Planetary Science, Yuk Lunch Seminar 01/2016
- *“A hidden mode of decadal Arctic Ocean variability”*
Caltech, Environmental Science and Engineering 03/2016
Jet Propulsion Laboratory, NASA 06/2016
Woods Hole Oceanographic Institution, Department of Physical Oceanography 08/2016
- *“Wind-driven halocline dynamics of the Beaufort Gyre”*
Woods Hole Oceanographic Institution, Department of Physical Oceanography 07/2015
- *“Influence of tropical cyclones on large-scale ocean circulation”*
MIT-WHOI Joint Program Student Seminar 10/2014
Yale University, Department of Geology & Geophysics 10/2011
- *“Persistent ENSO across a wide range of climates”*
Caltech, Division of Geological and Planetary Sciences 05/2015
Columbia University, Lamont-Doherty Earth Observatory 01/2014
Princeton University, Program in Atmospheric and Oceanic Sciences 10/2013
- *“Mesoscale eddies and surface ocean fronts”*
Massachusetts Institute of Technology, EAPS, Sack Lunch Seminar 10/2014
University of Washington, Applied Physics Laboratory 03/2014
Woods Hole Oceanographic Institution, Department of Physical Oceanography 10/2013
Courant Institute for Mathematical Sciences, CAOS 09/2013
University of Miami, Rosenstiel School of Marine and Atmospheric Science 11/2012