

Dr. Christopher Horvat

Assistant Professor (Research)
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group website: www.brownpog.com

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EMPLOYMENT

Brown University, Providence, RI, USA.

Assistant Professor (Research) of Environment and Society (2020-present).

Voss Postdoctoral Fellow (2019-2020)

NOAA Climate and Global Change Postdoctoral Fellow (2017-2019)

Harvard University and **NIWA**, Wellington, NZ. *Frank Knox Memorial Fellow* (2017-2018)

Under The Polar Sky (film). Scientific lead, principal subject. [Link](#). (2016-present)

EDUCATION

Ph.D in Applied Mathematics, **Harvard University**, 2017.

S.M. in Applied Mathematics, **Harvard University**, 2013.

B.S. in Mathematics, B.S. in Physics, **University of Pittsburgh**, 2011.

TEACHING EXPERIENCE

As a Teaching Fellow:

AM 201 (Harvard University): Applied Mathematical Modelling (fall 2012, fall 2016)

EPS 134 (Harvard University): Intro to Physical Oceanography (spring 2014, spring 2016)

EPS 231 (Harvard University): Climate Dynamics (spring 2015).

AWARDS + HONORS

At Brown University

NOAA Climate and Global Change Postdoctoral Fellowship, (2017-2019).

Voss Postdoctoral Fellowship, (2019-2021).

Royal Canadian Geographic Society Expedition of the Year, (2017).

At Harvard University:

Knox Memorial Fellowship, (2017-2018)

COMNAP/SCAR Antarctic Research Fellowship (2017)

Graduate Climate Conference SCRIM Fellowship, (2016)

Butler Conservation Fund Frenchboro Residency, (2016)

National Defense Science and Engineering Graduate (NDSEG) Fellowship, (2013-2016)

HUCE Graduate Consortium Fellowship (2014-2016)

Smith Fellowship in Applied Mathematics (2011-2013)

At University of Pittsburgh:

Culver Prize in Mathematics (2010)

Blumberg Award in Mathematics (2010)

RESEARCH SUPPORT (Amounts in \$USD)

Active Awarded Grants + Support

Schmidt Futures Foundation. PI. A. Alberello, V. Dansereau, **C. Horvat**, E. Olason, P. Rampal. The Scale Aware Sea Ice Project. \$10.4m (\$3.1m to CH Group). 2020-2026.

NASA Proposals with ICESat-2. PI. **C. Horvat** and E. Blanchard-Wrigglesworth. Waves in sea-ice: detection, attenuation and floe size impacts with ICESat-2. \$355k (\$175k to Brown). 2020-2022.

NSF Navigating the New Arctic. Collaborator. J. Ryan, A. Lynch, L. Smith, B. Dale. Co-production of shorefast ice knowledge in Uummannaq Bay, Greenland. \$830,000 to Brown. 2019-2021.

MOSAiC International Arctic Drift Experiment. Project Partner. **C. Horvat** with Hwang and Ren, Floe-scale observation and quantification of Arctic sea ice breakup and floe size during the autumn-to-summer transition (MOSAiCFSD). \$0 to Brown.

Pending Competitive Grants

NSF Navigating the New Arctic. co-I. R. Duddu, C. Horvat. DIM-SIM: a Data-Informed Mechanics-based Ship-Ice Mechanics framework for Operation and Navigation in the Arctic. 2021-2024. \$440,000 to Brown.

NSF Arctic Program. co-I. B. Pearson, C. Horvat. Surface Wave-energized Mixing, Sea Ice and the Arctic Ocean. 2022-2024. \$175,000 to Brown.

SUPERVISION (publications in brackets)

Current

Anna Lo Piccolo (Brown University). 2019-present. Masters Thesis + PhD. [26]
Yanan Wang (University of Huddersfield, UK). 2019-present. External PhD Advisor.
Momme Hell (Brown University) 2021-present. Postdoctoral Research Associate.
Ding Ding Wei (Brown University) 2021-present. Undergraduate Research.
Lucas Washburn (Brown University) 2020-present. Undergraduate Research.

Previous:

Jacinta Clay (Brown University, now Princeton University). 2018-2019. Senior Thesis.
Jarrett Valenti (Roger Williams University, now Ford). Undergraduate Research. 2019.
Radha Mastandrea (MIT, now Cambridge). Undergraduate Research. 2016 [6]
Carlyn Chrabaszcz (Brown University). Undergraduate Research. 2019.

PUBLICATIONS

25. **C. Horvat**. Marginal ice zone fraction benchmarks sea ice and climate model skill. *Nature Communications*. 2021. doi: 10.1038/s41467-021-22004-7
24. M. Meylan, **C. Horvat**, C. Bitz. A Floe Size Dependent Scattering Model in Two and Three dimensions for Wave Attenuation by Ice Floes. *Ocean Modeling*. 2021.
22. A. Petty [et al., incl **C. Horvat**]. Assessment of ICESat-2 sea ice surface classification with Sentinel-2 imagery: implications for freeboard and new estimates of lead and floe geometry. *Earth and Space Science*. 2021.
21. M. Ardyna [et al., incl **C. Horvat**]. Under-ice phytoplankton blooms: shedding light on the 'invisible' part of Arctic primary production. *Fron. Mar. Sci*. 2020.
20. **C. Horvat**, E Blanchard-Wrigglesworth, A. Petty. Observing Waves in Sea Ice with ICESAT-2. *Geophys Res. Lett*. 2020. doi: 0.1029/2020GL087629
19. K. Golden [et al., incl. **C. Horvat**]. Modeling Sea Ice. *Notices of the American Mathematical Society*. 2020.
18. E. Chassignet [et al., incl. **C. Horvat**]. Impact of horizontal resolution on global ocean-sea-ice model simulations based on the experimental protocols of the Ocean Model Intercomparison Project phase 2. *Geoscientific Model Development*. 2020. doi:10.5194/gmd-2019-374
17. S. Cooley, J. Ryan, L. Smith, **C. Horvat**, B. Pearson, et al., Coldest communities face greatest

reductions in Arctic shorefast ice. *Nature Clim. Change*. 2020.

16. **C. Horvat**, D. Flocco, D. Rees Jones, L. Roach, and K. Golden. The effect of melt pond geometry on the distribution of solar energy under first-year sea ice. *Geophys. Res. Lett.* 2020.

doi:10.1029/2019GL085956

15. **C. Horvat**, L. Roach, R. Tilling, B. Fox-Kemper, C. Bitz, K. Hill, C. Guider. Sea Ice Floe Size Reconstructed From Satellite Altimetry: Theory, Climatology, and Model Comparison. *The Cryosphere*. 2019. doi: 10.5194/tc-2019-134

14. L. Roach, C. Bitz, **C. Horvat**, S. Dean. Advances in modelling interactions between sea ice and ocean surface waves. *J. Adv. Mod. Earth Sys.* 2019.

13. E. Kyzivat, L. Smith, L. Pitcher, J. Fayne, S. Cooley, [et al., incl. **C. Horvat**]. A high-resolution airborne color-infrared camera water mask for the NASA ABoVE campaign. *Remote Sensing*. 2019. Doi: 10.3390/rs11182163

12. J-E. Lee, B. Fox-Kemper, **C. Horvat**, Y. Ming. The response of the East Asian monsoon to the precessional cycle: A new study using the Geophysical Fluid Dynamics Laboratory model. *Geophys. Res. Lett.* 2019. Doi: 10.1029/2019GL082661

11. A. Roberts, E. Hunke, S. Kamal, W. Lipscomb, **C. Horvat**, and W. Maslowski. A Variational Model for Sea Ice Ridging in Earth System Models, Part I: Theory. *J. Adv. Model Earth Sys.* 2019. Doi: 10.1029/2018MS001395

10. **C. Horvat** and E. Tziperman. Understanding melting due to ocean eddy heat fluxes at the edge of sea-ice floes. *Geophys. Res. Lett.* 2018. doi:10.1029/2018GL079363.

9. L. Roach, **C. Horvat**, S. Dean, and C. Bitz. An emergent sea ice floe size distribution in a global coupled ocean-sea ice model. *J. Geophys. Res. Oceans*. 2018. doi:10.1029/2017JC013692

8. C. Cuevas, N. Maffezzoli, J. Corella, A. Spolaro, P. Vallelonga, [et al., incl. **C. Horvat**]. Rapid increase in atmospheric iodine levels in the North Atlantic since the mid-20th century. *Nature Communications*, 2018. doi:10.1038/s41467-018-03756-1

7. **C. Horvat**, D. Rees Jones, S. Iams, D. Schroeder, D. Flocco, D. Feltham. Prediction and timing of sub-ice phytoplankton blooms in the Arctic Ocean. *Science Advances*, 2017. doi:10.1126/sciadv.1601191

6. **C. Horvat** and E. Tziperman. The evolution of scaling laws in the sea ice floe size and thickness distribution. *J. Geophys. Res. Oceans*. 2017, doi:10.1002/2016JC012573

5. B. Hwang, J. Wilkinson, E. Maksym, H.C. Graber, A. Schweiger, **C. Horvat**, et al.. Winter-to-summer transition of Arctic sea ice breakup and floe size distribution in the Beaufort Sea. *Elem Sci Anth*, 2017. doi:http://doi.org/10.1525/elementa.232

4. **C. Horvat**, E. Tziperman, and J.M. Campin. Effects of the floe size distribution on ocean eddies and sea ice melting. *Geophys. Res. Lett.* 2016, doi:10.1002/2016GL069742.

3. **C. Horvat** and E. Tziperman. A prognostic model of the sea-ice floe size and thickness distribution, *The Cryosphere*. 2015, doi:10.5194/tc-9-2119-2015..

2. M. Tronzo, J. Barber, **C. Horvat**, et al. A three-dimensional mathematical and computational model of necrotizing enterocolitis. *J. of Theor. Biology*. 2013, doi:10.1016/j.jtbi.2012.11.018.

1. **C. Horvat** and M. Stoffregen. A solution to the lonely runner conjecture for almost all points. arXiv:1103.1662, 2011.

In review (please contact for manuscript)

32. P. Russell, **C. Horvat**. Extreme South Pacific Phytoplankton Blooms Induced by Tropical Cyclones. *In review*.

31. **C. Horvat**, L. Roach. WIFF1.0: A hybrid machine learning parameterization of Wave-Induced sea-ice Floe Fracture. *In prep for Geophysical Model Developments*.

30. **C. Horvat**, E. Buckley, S. Farrell, A. Petty. Laser Altimetry Reveals Biases in Passive Microwave Sea Ice Concentration Records. *In review*.

29. **C. Horvat**, A. Kohout, E. Blanchard-Wrigglesworth, R. Tilling, A. Petty. Defining the Marginal Ice Zone. *In review*.

28. **C. Horvat**, S. Seabrook, A. Cristi, L. Matthes, K. Bisson. The Case for Phytoplankton Blooms Under Antarctic Sea Ice. *In review*.

27. M. Ardyna [et al., incl **C. Horvat**]. Wildfire aerosol deposition amplifies Arctic sea-ice loss and phytoplankton production. *In review*.
26. A lo Piccolo, **C. Horvat**, B. Fox-Kemper. Energetics of Brine Driven Eddies at Winter Sea Ice Leads. *In prep for The Cryosphere*.

SELECTED REPORTING

About research:

Tracking Arctic Sea Ice in Nares Strait. [Canadian Geographic](#).

Solving the Mystery of the Arctic's Green Ice. [Phys.org](#).

Thinning Arctic Sea Ice lets in light, prompts algae-bloom study. [Reuters](#).

'Enduring Ice' Expedition Will Kayak Through the Harshes of Arctic Environments. [Seeker](#).

About the Westbrook ice disk collaboration: [Washington Post](#), [Gizmodo](#)

About science: [New York Times](#), [NPR](#)

PROFESSIONAL SERVICE

As a reviewer: (average ~10 papers, 2 proposals, 1 committee per year).

Journals: Cryosphere, Ann. Glaciology, Journal of Geophysical Research, Elementa, Frontiers, Ocean Modeling, Journal of Advances in Modeling Earth Systems, Journal of Physical Oceanography.

Proposals: National Science Foundation, NASA Cryosphere.

Committees: NASA ROSES.

As a committee member/team member:

NASA IceSat-2 science team (2020-present).

IARPC Sea Ice Collaboration Team (2019-present).

IARPC Physical Oceanography Self-Formed Team (2019-present).

NASA cryosphere Surface Deformation and Change working group (2020-pres).

Executive Committee, Arctic in Rapid Transition (2016-2018).

Council, Assoc. Of Polar Early Career Sciences (APECS) (2016-2017)

Council, APECS U.S. Branch (2016-2017)

Associate Editor, Contributor, EGU Cryosphere Blog (2016-2018)

Expert, Applied Math and Climate Change, Science in the News (2015-present)

SEMINARS/CONTRIBUTED TALKS/CONFERENCE PROCEEDINGS

- 2019 -

Seminars/contributed/community talks:

Machine Learning for Accelerating Wave-Ice Modeling. CRUNCH Seminar, Providence, RI.

Sea ice modeling from the floe scale up: coupling ocean surface waves and the floe size and thickness distribution. Norway Scotland Symposium on Waves and Marine Hydrodynamics, Edinburgh, Scotland.

The new Arctic. NOAA Climate and Global Change Summer Institute, Steamboat Springs, CO, USA.

The disposition of solar radiation under ponded sea ice and consequences for under-ice ecology.

Gordon Research Conference on Polar Marine Science, Lucca, Italy.

Conference Proceedings:

C. Horvat, L. Roach, R. Tilling, C. Bitz, B Fox-Kemper. *The Sea Ice Floe Size Distribution Reconstructed From Satellite Altimetry: Theory, Climatology, and Model Comparison.* Poster. Gordon Research Seminar on Polar Marine Science, Lucca, Italy.

C. Horvat, L. Roach, R. Tilling, C. Bitz, B Fox-Kemper. *Remote sensing of the sea-ice floe size distribution using satellite altimetry.* IGS Sea Ice Symposium, Winnipeg, MT, Canada.

- 2018 -

Seminars/contributed/community talks:

Sea Ice Modelling and the Floe Size Distribution. The Future of Earth System Modeling: Polar Climate, Pasadena, CA, USA.

Sea ice from the floe scale up. University of Tasmania, Hobart, Australia.

The new Arctic: a Chris story. Brown University Lunch Bunch, Providence, RI.

Sea ice, floes, and the New Arctic from the floe scale up. Caltech Geoclub seminar, Pasadena, CA, USA.

Conference Proceedings:

C. Horvat, D. Flocco, D. Rees Jones. *The distribution of solar energy under ponded sea ice.* AGU Fall Meeting. Abstract no: C21D-0472

C. Horvat, E. Tziperman. SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA. *The Evolution of Scaling Laws in the Sea Ice Floe Size Distribution.*

L. Roach, C. Horvat, C. Bitz, S. Dean. *Improving the Representation of Coupled Wave-Ice-Ocean-Atmosphere Interactions via Simulation of the Floe Size Distribution.* AGU Fall Meeting. Abstract no: C34B-02

L. Roach, M. Smith, C. Horvat, S. Dean, C. Bitz. *Integrating In-Situ Observations with Process-Based Modelling of the Sea Ice Floe Size Distribution.* AGU Fall Meeting. Abstract no: C33F-1635

C. Bitz, L. Roach, A. Ordonez, C. Horvat, S. Dean, B. Fox-Kemper, M. Meylan. *Coupled Wave-Ice Interactions in the Marginal Ice Zone in Simulations with a Floe-Size Distribution.* AGU Fall Meeting. Abstract no: C33B-01.

- 2017 -

Seminars/contributed/community talks:

Floe size and thickness distributions. Isaac Newton Institute, Cambridge, UK.

The frequency and extent of sub-ice phytoplankton blooms in the Arctic Ocean. NOAA Climate Seminar.

Theory, modeling, and impact of the floe size distribution of sea ice. Australia National University, Canberra, AU.

Theory, modeling, and impact of the floe size distribution of sea ice. Otago University, Dunedin, NZ.

The Sea Ice Floe Size Distribution. National Institute of Water and Atmospheric Research, Wellington, NZ.

The Evolution of Scaling Laws in the Sea Ice Floe Size Distribution. University of Washington, Seattle, WA.

- 2016 -

Seminars/contributed/community talks:

The Sea Ice Floe Size Distribution. Oxford University, Oxford, UK.

Feedbacks of the floe size and thickness distribution. UK National Oceanography Centre, Southampton, UK.

Sub-ice phytoplankton blooms in the Arctic Ocean. Polar Prediction Workshop, Lamont-Doherty Earth Observatory.

Interaction of Sea Ice Floe Size, Ocean Eddies, and Ice Melting. Forum for Arctic Modeling and Synthesis, Woods Hole, USA;

Increase in the frequency and spread of sub-ice phytoplankton blooms in the Arctic Ocean. Graduate Climate Conference, Seattle, WA;

Conference Proceedings:

C. Horvat, *Effects of the sea ice floe size distribution on ocean eddies and sea ice melting.* EGU Spring Meeting, Abstract no: EPSC2016-630.

Evolution, response to forcing, and feedbacks of the floe size and thickness distribution.

C. Horvat, E. Tziperman. AGU Fall Meeting.

- 2015 -

Seminars/contributed/community talks:

Mathematics of Sea Ice Workshop, Vancouver, BC, Canada. *Thermodynamic and dynamic influence of the floe size distribution of sea ice*

Conference Proceedings:

C. Horvat, E. Tziperman. *Effects of the Sea Ice Floe Size Distribution on Polar Ocean Properties and Air-Sea Exchange*. AGU Fall Meeting.