

Dr. Christopher Horvat

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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.

EMPLOYMENT HISTORY

Institute at Brown for Environment and Society, Brown University, Providence, RI
Voss Postdoctoral Fellow (2019-present)
NOAA Climate and Global Change Postdoctoral Fellow (2017-2019)

Harvard University and **National Institute of Water and Atmospheric Research**,
Wellington, NZ. *Frank Knox Memorial Fellow* (2017-2018)

Albedo (film). *Enduring Ice* (expeditions). Scientific lead, principal subject. [Link](#). (2016-present).

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)

PUBLICATIONS

20. **C. Horvat**, E Blanchard-Wrigglesworth, A. Petty. Observing Waves in Sea Ice with ICESAT-2. *Geophys Res. Lett.* 2020.

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.
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)

26. **C. Horvat**. Global Climate Models Divided by their Representation of the Marginal Ice Zone. *Subm. to Nat. Clim. Change*.
25. M. Ardyna [et al., incl **C. Horvat**]. Under-ice phytoplankton blooms: New phenological features in the Arctic Ocean?
24. M. Ardyna [et al., incl **C. Horvat**]. Wildfire aerosol deposition amplifies Arctic sea-ice loss and

phytoplankton production.

23. 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*. In review.

22. **C. Horvat**, B. Fox-Kemper, A lo Piccolo. Energetics of Brine Driven Eddies at Winter Sea Ice Leads. *J. Phys Oceanogr*. In review.

21. **C. Horvat**, C. Bitz, and C. Polashenski. Sea Ice Thinning and Surface Transformation Drive Solar Heating of the Arctic Ocean. *Nature Clim. Change*. In review.

MENTORING (publications in brackets)

Thesis Advising

Anna Lo Piccolo (University of Bologna, IT + Brown University). 2019-present. Masters Thesis. [21]

Jacinta Clay (Brown University, now Princeton University). 2018-2019. Senior Thesis. [21]

Yanan Wang (University of Huddersfield). External PhD Advisor.

Jarrett Valenti (Roger Williams University). Undergraduate Research.

Undergraduate Research Projects:

Radha Mastandrea (MIT, now Cambridge). 2016 [6]

Carlyn Chrabaszcz (Brown University). 2019.

RESEARCH SUPPORT

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 (\$2.1m to Brown). 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. 2019-2021. \$830,000 to Brown (\$40k to support C. Horvat work).

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

NASA Physical Oceanography. PI. **C. Horvat**, M. Stuecker, B. Fox-Kemper. Quantifying the Energetics of Eddy Mixing in the Arctic Ocean. \$500k (\$450k to Brown). 2021-2023.

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, Journal of Geophysical Research, Elementa, 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:

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.