# Dr. Karin Kvale

Principal Scientist, Aotearoa Blue Ocean Research
325A Muritai Road, Eastbourne, Lower Hutt 5013, New Zealand
Phone: +64 22 503 3236
aotearoablueocean@gmail.com
https://karinkvale.github.io/
https://www.researchgate.net/profile/Karin-Kvale
https://scholar.google.de/citations?user=7_ZzZC0AAAAJ&hl=en&oi=ao

## Education

PhD Climate Science (December 2014)
University of New South Wales, Australia

MSc Atmospheric Science (2009)
University of Victoria, British Columbia, Canada

BSc Environmental Science (2005)
Indiana University, U.S.A., with minors in Geology, Mathematics and Geography

## Nationalities

United States of America, birthright citizen

Commonwealth of Australia, naturalized citizen

## Employment

Principal Scientist (10/2024 – present)
Aotearoa Blue Ocean Research, Lower Hutt, New Zealand (self-employed consultancy)

Senior Scientist (05/2021- 10/2024)
GNS Science, Environmental Processes and Modelling Division, Lower Hutt, New Zealand

Scientist (06/2018-05/2021)
GEOMAR Helmholtz-Centre for Ocean Research, Biogeochemical Modelling Division, Kiel, Germany

Scientific Programmer (09/2014-06/2018)
GEOMAR Helmholtz-Centre for Ocean Research, Biogeochemical Modelling Division, Kiel, Germany

## Affiliations

Affiliate Member of the Faculty of Graduate Studies (04/2023 - present)
University of Victoria Faculty of Graduate Studies, School of Earth and Ocean Sciences
Victoria, BC, Canada

Associated Scientist (05/2021 – present)
GEOMAR Helmholtz Center for Ocean Research, Kiel, Germany

Adjunct Senior Research Fellow (10/2022- 10/2024)
Victoria University Wellington Antarctic Research Centre, Wellington, New Zealand

## Extended Absences from Work *adjusts to 8-10 years post-PhD (depending on criteria)*

Full-time maternity leave (07/2012-03/2013)

Part-time (50%) maternity leave (03/2013-08/2014)

Full-time maternity leave (07/2015-03/2016)

Part-time (50%) maternity leave (03/2016-11/2016)

Corona child care leave (03/2020-06/2020)

Part time (75%) work due to child care (09/2024 – present)

## Publications To Be Submitted (next ~4 weeks)

**Kvale K**, Somes C, Oschlies A, Landolfi A. Reawakening the bipolar seesaw. TBS to *Nature (invited to Nature Geosci. but we will try Nature first)*.

**Kvale K**, Frenger I, Getzlaff J, Koeve K, Kriest I, Landolfi A, Oschlies A. The open uncertainty window in ocean biogeochemical responses to fossil carbon emissions. TBS to *Biogeosciences Discussions*.

## Publications in Peer Review

Zhang Z, Wu P, Wang X, Pang Q, Wang Y, Zhang X, **Kvale K**, Zeng EY, Lei L, Zhang Y. Toward a united ecological risk assessment of marine plastics pollution. In revision with *Nature Sustainability*.

Fillman N, Schmittner A, **Kvale K**. Variable stoichiometry effects on Glacial/Interglacial Ocean Model Biogeochemical Cycles and Carbon Storage. In review *with Paleoceanography and Paleoclimatology*. 10.22541/essoar.169049091.16856096/v1.

## Refereed Publications

Egger M, Booth A, Bosker T, Everaert G, Garrard S, Havas V, **Kvale K**, Mitrano D, Niemann H, Pang Q, Proietti M, Puskic P, Richon C, Royer S-J, Savoca M, van Vulpen M, Lebreton L, Zhang Y, Zhang Z. Evaluating the net environmental impact of removing plastic pollution from the North Pacific Garbage Patch. In press with *Scientific Reports,* Will be published 27.05.2025.

Zhao S, **Kvale K**, Zhu L, Zettler ER, Egger M, Bos RP, Mincer T, Amaral-Zettler LA, Nakajima R, Galgani L, Richon C, Lebreton L, Niemann H, Law KL, van Sebille E, Chiba S, Stubbins A, Thiel M. (2025) The distribution of subsurface microplastics in the ocean. *Nature*. **641**, 51–61. https://doi.org/10.1038/s41586-025-08818-1.

**Kvale K**, Azimrayat Andrews Z, Egger M. (2024) Mind the fragmentation gap. Peer-reviewed Comment in *Nature Communications*. 10.1038/s41467-024-53962-3.

Martin AP, Bahamondes Dominguez A, Baker CA, Baumas CMJ, Bisson KM, Cavan E, Freilich M, Galí M, Henson S, **Kvale KF**, Lemmen C, Luo JY, McMonagle H, de Melo Virissimo F, Ove

Möller K, Richon C, Suresh I, Wilson JD, Woodstock MS. (2024) When to add a new process to a model – and when not: a marine biogeochemical perspective. *Ecological Modelling*. **498**:110870. 10.1016/j.ecolmodel.2024.110870.

Wood RA, Baker JA, Beaugrand G, Boutin J, Conversi A, Donner RV, Frenger I, Goberville E, Hayashida H, Koeve W, **Kvale K**, Landolfi A, Maslowski W, Oschlies A, Romanou A, Somes CJ, Stocker TF, Swingedouw D. (2024) Opportunities for Earth Observation to inform risk management of ocean tipping points. *Surveys in Geophysics*. https://doi.org/10.1007/s10712-024-09859-3

Azimrayat Andrews Z, **Kvale K**, Hunt C. (2024) Slow biological microplastics removal under ocean pollution phase-out trajectories. *Environmental Research Letters.* **19**:064029. 10.1088/1748-9326/ad472c.

Saini H, Meissner KJ, Menviel L, **Kvale K**. (2024) Transient response of Southern Ocean ecosystems during Heinrich stadials. *Paleoceanography and Paleoclimatology*. https://doi.org/10.1029/2023PA004754.

Frenger I, Landolfi A, **Kvale K**, Somes C, Oschlies A, Yao W, Koeve W. (2024) Misconceptions of the marine biological carbon pump in a changing climate: Thinking outside the "export" box. *Global Change Biology*. 30, e17124. https://doi.org/10.1111/gcb.17124.

Richon C, **Kvale K**, Lebreton L, Egger M. (2023) Legacy oceanic plastic pollution must be addressed to mitigate possible long-term ecological impacts. *Microplastics and Nanoplastics.* **3**:25. https://doi.org/10.1186/s43591-023-00074-2.

Gurgacz N, **Kvale K**, Eby M, Weaver A. (2023) Impact of plastic pollution on atmospheric carbon dioxide. *FACETS*. **8**: 1-7. https://doi.org/10.1139/facets-2023-0061.

Saini H, Meissner KJ, Menviel L, **Kvale K**. (2023) Impact of iron fertilisation on atmospheric $CO_2$ during the last glaciation. *Climates of the Past*. https://doi.org/10.5194/cp-19-1559-2023.

**Kvale K**, Hunt C, James A, Koeve K. (2023) Regionally disparate ecological responses to microplastic slowing of faecal pellets yields coherent carbon cycle response. *Frontiers in Marine Science: Marine Pollution*. 10.3389/fmars.2023.1111838.

**Kvale K** and Oschlies A. (2023) Recovery from microplastic-induced marine deoxygenation may take centuries. *Nature Geoscience*. 10.1038/s41561-022-01096-w.

**Kvale K**. (2022) Implications of plastic pollution on global marine carbon cycling and climate. Invited review at *Emerging Topics in Life Sciences*: Impact of Plastic Pollution on Organisms and the Environment, Portland Press. https://doi.org/10.1042/ETLS20220013.

Taucher J, Bach L, Prowe AEF, Boxhammer T, **Kvale K**, Riebesell U. (2022) Global decline of diatoms through ocean acidification. *Nature*. https://doi.org/10.1038/s41586-022-04687-0.

Yao W, **Kvale K**, Koeve W, Landolfi L, Achterberg E, Bertrand E, Oschlies A. (2022) Simulated future trends in marine nitrogen fixation are sensitive to model iron implementation. *Global Biogeochemical Cycles*. https://doi.org/10.1029/2020GB006851.

**Kvale K**, Keller DP, Koeve W, Meissner KJ, Somes C, Yao W, Oschlies A. (2021) Explicit silicate cycling in the Kiel Marine Biogeochemistry Model version 3 (KMBM3) embedded in the University of Victoria Earth System Climate Model version 2.9. *Geosci. Model Devel*. https://doi.org/10.5194/gmd-14-7255-2021.

Saini H, **Kvale K**, Chase Z, Kohfield K, Meissner KJ, Menviel L. (2021) Simulated response of marine ecosystems to Last Glacial Maximum boundary conditions. *Paleoceanography and Paleoclimatology* 36, e2020PA004075.

**Kvale K**, Prowe AEF, Chien C-T, Landolfi A, Oschlies A. (2021) Zooplankton grazing of microplastic can accelerate global loss of ocean oxygen. *Nature Communications* 12, 2358. https://doi.org/10.1038/s41467-021-22554-w.

**Kvale K**, Koeve W, Mengis N. (2021) Calcifying phytoplankton demonstrate an enhanced role in greenhouse atmospheric $CO_2$ regulation. *Front. in Marine Science: Marine Biogeochemistry* 7. https://doi.org/10.3389/fmars.2020.583989.

**Kvale K**, Prowe AEF, Chien C-T, Landolfi A, Oschlies A. (2020) The global biological microplastic particle sink. *Scientific Reports* 10, 16670. https://doi.org/10.1038/s41598-020-72898-4.

Kriest I, Kähler P, Koeve W, **Kvale K**, Sauerland V, Oschlies A. (2020) One size fits all? – Calibrating an ocean biogeochemistry model for different circulations. *Biogeosciences* 17. https://doi.org/10.5194/bg-17-3057-2020.

**Kvale KF**, Prowe AEF, Oschlies A. (2020) A critical examination of the role of marine snow and zooplankton fecal pellets in removing ocean surface microplastic. *Frontiers in Marine Science: Marine Pollution* 6. https://doi.org/10.3389/fmars.2019.00808.

Yao W, **Kvale KF**, Achterberg E, Koeve W, Oschlies A. (2019) Hierarchy of calibrated global models reveals improved distributions and fluxes of biogeochemical tracers in models with explicit representation of iron. *Environmental Research Letters* 14(11). DOI 10.1088/1748-9326/ab4c52.

**Kvale KF**, Turner KE, Landolfi A, Meissner KJ. (2019) Phytoplankton calcifiers control nitrate cycling and the pace of transition in warming icehouse and cooling greenhouse climates. *Biogeosciences* 16. https://doi.org/10.5194/bg-16-1019-2019.

**Kvale KF**, Turner K, Keller DP, Meissner KJ. (2018) Asymmetric dynamical ocean responses in warming icehouse and cooling greenhouse climates, *Environmental Research Letters* 13(12). DOI 10.1088/1748-9326/aaedc3.

**Kvale KF** and Meissner KJ. (2017) Primary production sensitivity to phytoplankton light attenuation parameter increases with transient forcing, *Biogeosciences* 14. https://doi.org/10.5194/bg-14-4767-2017.

**Kvale KF**, Khatiwala S, Dietze H, Kriest I, Oschlies A. (2017) Evaluation of the Transport Matrix Method for simulation of ocean biogeochemical tracers. *Geosci. Model Devel*. 10(6). https://doi.org/10.5194/gmd-10-2425-2017.

**Kvale KF**, Meissner KJ, Keller DP. (2015) Potential increasing dominance of heterotrophy in the global ocean. *Environmental Research Letters* 10(7). DOI 10.1088/1748-9326/10/7/074009.

**Kvale KF**, Meissner KJ, Keller DP, Eby M, Schmittner A. (2015) Explicit planktic calcifiers in the University of Victoria Earth System Climate Model version 2.9. *Atmosphere-Ocean* 53(3). https://doi.org/10.1080/07055900.2015.1049112.

**Kvale KF**, Zickfeld K, Meissner KJ, Tanaka K, Bruckner T, Weaver A. (2012) Carbon dioxide emission pathways avoiding dangerous ocean impacts. *Weather, Climate and Society* 4(3). https://doi.org/10.1175/WCAS-D-11-00030.1.

**Kvale KF** and Pryor SC. (2006) Precipitation composition in the Ohio River Valley: Spatial variability and temporal trends. *Water, Air and Soil Pollution* 170. https://doi.org/10.1007/s11270-006-2861-1.

Renshaw CE, Johnson GD, **Kvale KF**. (2000) A laboratory exercise to determine dinosaur speeds using dimensional analysis. *Journal of Geoscience Education* 48. https://doi.org/10.5408/1089-9995-48.3.342.

## Other Publications

Baztan J, Jorgensen B, Carney Almroth B, Bergmann M, Farrelly T, Muncke J, Syberg K, Thompson R, Boucher J, Olsen T, Alava J-J, Assefa-Aragaw T, Bailly D, Bartolotta J, Collins T, Cordier M, De-Falco F, Deeney M, Fernandez M, Gall S, Gammage T, Ghiglione J-F, Gündogdu S, Jansen T, Issifu I, Knoblauch D, Wang M, **Kvale K**, Monsaingeon B, Moon S, Morales-Caselles C, Reynaud S, Rodriguez-Seijo A, Stoett P, Varea R, Velis C, Villarrubia-Gomez P, Wagner M (2024) Primary Plastic Polymers: urgently needed upstream reduction. Editorial in *Cambridge Prisms: Plastics*: 1-3. doi:10.1017/plc.2024.8.

**Kvale K**, Gurgacz N, Eby M, Weaver A (2023) Carbon leaching from plastic pollution is negligible - the larger threat to the climate is the production of plastics. *The Conversation*.

Karali, N, Palm E, Baztan J, Gomes P V, Khanna N, **Kvale K**, Lacerda A L, Jorgenson, B (2023) Policy Brief: Climate change impacts of plastics (1.0). *Scientists' Coalition for an Effective Plastics Treaty,* https://doi.org/10.5281/zenodo.7972056

**Kvale K.** (2022) What are small size microplastics distributions telling us? Invited commentary, *Global Change Biology*, doi:10.1111/gcb.16129.

**Kvale K** (2022) Microplastics. Invited contribution to *The Climate Book*, Thunberg, G. (ed) Penguin Press, London, UK.

**Kvale KF**. (2014) Representations of biological calcification in two climate models, PhD Dissertation, University of New South Wales, Sydney, Australia.

**Kvale KF**, Meissner KJ, d'Orgeville M, Matear R, McNeil B, England MH. (2011) The combined impact of CO2-dependent parameterizations of Redfield and rain ratios on ocean carbonate saturation. *Biogeosciences Discussions*.

**Kvale KF**. (2008) Carbon Dioxide Emission Pathways Avoiding Dangerous Ocean Impacts. Masters Dissertation, University of Victoria.

## Seminars

Surfactants' global regulation of $CO_2$ fluxes across the air-sea interface

Seminar, GEOMAR Helmholtz Centre for Ocean Research Kiel (15/05/2025)

Plastics' climate threat

Invited talk, Univ. of Shandong (17/06/2024)

Plastics' climate threat

Invited talk, Univ. of Amsterdam (27/03/2024)

Plastics' climate threat

Seminar, Climate Change Research Centre, Univ. of New South Wales (22/03/2024)

The global biological microplastic particle sink

Invited talk, Univ. of Southampton (27/07/2022)

The global biological microplastic particle sink

Invited talk, British Antarctic Survey (07/07/2022)

The global biological microplastic particle sink

Invited talk, Cambridge Univ. Dept. of Earth Sciences (06/07/2022)

The global biological microplastic particle sink

Invited talk, Univ. of New South Wales Centre for Marine Science and Innovation (11/05/2022)

The biological microplastic particle sink

Invited talk, UVic developer's webinar series, international audience (27/05/2021)

The biological microplastic particle sink

Invited talk, JETZON webinar series, international audience (26/05/2021)

The biological microplastic particle sink

Invited talk, Ocean Plastic Webinars, international audience (06/04/2021)

Diatoms in the UVic ESCM- model assessment and future directions

GEOMAR Helmholtz Centre for Ocean Research, Kiel (15/09/2020)

The biological microplastic particle sink

GEOMAR Helmholtz Centre for Ocean Research, Kiel (19/05/2020)

Marine transitions in warming icehouse and cooling greenhouse climates

Climate Change Research Centre, UNSW, Sydney, AU (13/02/2019)

## Significant Interviews, etc.

Interview with Nature journalist for upcoming special issue on the Plastics Carbon Cycle (19/05/2025)

BBC special mention (02/12/2024) https://www.bbc.co.uk/newsround/articles/czr3gkdryg7o

Plastics unchecked: The ocean-climate disruption and legal state obligations (26/11/2024)

Presentation development for Gallifrey Foundation side event at UN Global Plastics Treaty INC5, Busan Korea

Microplastics pose risk to ocean plankton, climate, other key Earth systems

Claire Asher, Mongabay (09/10/2023)

https://news.mongabay.com/2023/10/microplastics-pose-risk-to-ocean-plankton-climate-other-key-earth-systems/

Douglas Hamilton, The Weather Network (05/05/2023)

How plastic is fuelling a hidden climate crisis in Southeast Asia

Lou Del Bello, China Dialogue (19/05/2022)

https://chinadialogueocean.net/en/pollution/how-plastic-is-fuelling-a-hidden-climate-crisis-in-southeast-asia/

In the ocean, its snowing microplastics

Sabrina Imbler, New York Times, (03/04/2022)

https://www.nytimes.com/2022/04/03/science/ocean-plastic-animals.html

## Research Visits

GEOMAR Helmholtz Centre for Ocean Research Kiel (03-23/05/2025)

University of Oxford Geoscience Department, UK (22/10-28/11/2019)

Climate Change Research Centre, UNSW, Sydney, AU (03-16/02/2019)

University of Oxford Geoscience Department, UK (29/10-04/11/2017)

University of Oxford Geoscience Department, UK (08/05-13/05/2017)

## Conference Presentations

**Kvale K** (2025) A global estimate of microplastics' impact on surfactant generation in the sea surface microlayer. Surface Plastic Remote Sensing (SPARSE) workshop, Siena Italy.

**Kvale K** (2025) Surfactants' global regulation of $CO_2$ fluxes across the air-sea interface. EGU General Assembly, Vienna, Austria.

**Kvale K**, Stirling C, Druce M (2025) Impact of Fe-Zn-Cd co-limitation on biological carbon pump efficiency in a simulated Holocene Southern Ocean. Antarctic Science Platform Hui, Wellington NZ.

**Kvale K**, Azimrayat Andrews Z (2024) Food web retention of microplastics may sustain future surface concentrations. SOLAS Science and Society workshop. Goa India.

**Kvale K**, Somes C, Landolfi A, Oschlies A (2024) Reawakening the thermal-bipolar seesaw. SOLAS Open Science Conference, Goa India.

**Kvale K**, Azimrayat Andrews Z (2024) Food web retention of microplastics may sustain future surface concentrations. Airborne microplastics- where are we now? workshop. Christchurch NZ.

McErlich C, Hardacre C, Goddard F, **Kvale K**, Revell L. (2024) Global climate model development to constrain the impact of airborne microplastics on climate change. New Zealand Meteorological Society Conference, Auckland NZ.

Egger M, Booth A, Bosker T, Everaert G, Garrard SL, Havas V, Huntley HS, **Kvale K**, Lebreton L, Niemann H, Qiaotong P, Proietti M, Puskic P, Richon C, Royer S-J, Savoca M, van Vulpen M, Zhang Y, Mitrano D. (2024) Evaluating the net environmental impact of removing plastic pollution from the North Pacific Garbage Patch. MICRO 2024, Lanzarote Spain.

Landolfi A, Frenger I, **Kvale K**, Somes C, Oschlies A, Yao W, Koeve W. (2024) Misconceptions of the marine biological carbon pump in a changing climate: Thinking outside the "export" box. EGU General Assembly, Vienna, Austria.

Saini H, Meissner KJ, Menviel L, **Kvale KF**. (2024) Impact of iron fertilisation on Southern Ocean ecosystems and global carbon cycle during the last glacial cycle. EGU General Assembly, Vienna, Austria.

**Kvale K** (2024) Representing zooplankton grazing of microplastics in models. 7th International Zooplankton Production Symposium, Hobart, Australia.

Azimrayat Andrews Z, **Kvale K** (2024) Marine microplastics: Modelling different phase-out scenarios and understanding their potential implications for marine contamination. AGU Ocean Sciences Meeting, New Orleans, USA.

Keller ED, **Kvale K**, et al. (2024) Southern Ocean biogeochemistry and marine primary production during the Last Interglacial. AGU Ocean Sciences Meeting, New Orleans, USA.

**Kvale K**, Somes C, Oschlies A (2024) Southern Ocean deep convection events reduce meridional temperature gradients in warm climates. AGU Ocean Sciences Meeting, New Orleans, USA.

**Kvale K**, Zhenna Azimrayat Andrews, Claire Hunt (2023). Aggressive reduction of marine microplastic pollution is required to reduce contamination. Aotearoa Plastic Pollution Alliance Hui. Raglan, NZ.

Stirling C, Druce M, Hennequin M, Bostock H, Swann G, **Kvale K.** (2023) Trace metal micronutrients: Regulating the Southern Ocean's carbon sink during the last glacial-interglacial cycle. Geoscience NZ annual meeting, Wellington, NZ.

**Kvale K** (2023) Current and future exposure of the mesopelagic to microplastics. Ocean Twilight Zone Symposium, Woods Hole Oceanographic Institute, MA, USA.

**Kvale K**, Frenger I, Getzlaff J, Koeve W, Kriest I, Landolfi A, Oschlies A (2023) The open uncertainty window in biological carbon pump responses to fossil carbon emissions. Ocean Twilight Zone Symposium, Woods Hole Oceanographic Institute, MA, USA.

Gurgacz-Safianowicz N, **Kvale K**, Eby M, Weaver A (2023) Relative climatic importance of production vs. pollution plastics carbon emissions. Canadian Metorological and Oceanographic Society Annual Meeting, St. Johns, Canada.

**Kvale K,** Oschlies A (2023) Recovery from microplastic-induced marine deoxygenation may take centuries. NZ Sea Ice Symposium, Christchurch NZ.

**Kvale K**, Hunt C, James A, Koeve W (2022) Microplastics slowing of faecal pellet sinking has a small total impact on global carbon cycle. New Zealand Aotearoa Plastic Pollution Alliance Hui, Auckland, NZ.

Saini H, **Kvale KF**, Meissner KJ, Menviel L. (2022) Impact of iron fertilisation on atmospheric $CO_2$ during the last glaciation. 14th International Conference on Paleoceanography, Bergen, Norway.

Saini H, **Kvale KF**, Meissner KJ, Menviel L. (2022) Simulated response of marine ecosystems to Last Glacial Maximum boundary conditions. PAGES OSM 2022, Agadir, Morocco.

Fillman N, Schmittner A, **Kvale K.** (2022) Variable stoichiometry effects on ocean model biogeochemical cycles. AGU/ASLO Ocean Sciences Meeting, Honolulu, USA.

Krapp M, **Kvale K**, Keller ED, Prebble J, Cortese P. (2022) Marine ecoregions and their sensitivity to past and future climate change. ICSHMO, Christchurch, NZ.

**Kvale K**, Kriest I, Frenger I, Oschlies A. (2022) Southern Ocean circulation metrics predict global biogeochemical change with warming. ICSHMO, Christchurch, NZ.

Fillman N, Schmittner A, **Kvale K**. (2021) Variable stoichiometry effects on ocean model biogeochemical cycles. American Geophysical Union Fall Meeting, New Orleans, USA.

**Kvale K** (2021) Millennial commitment to microplastics and their biogeochemical legacy. New Zealand Aotearoa Plastic Pollution Alliance Hui, Wellington, NZ.

Yao W, **Kvale KF**, Landolfi A, Koeve W, Achterberg E, Oschlies A. (2020) Future trends in oxygen minimum zone volume are sensitive to model representation of iron. European Geophysical Union Meeting, Vienna, Austria.

**Kvale KF**, Prowe AEF, Chien C-T, Landolfi A, Oschlies A. (2020) Modelling the global biological microplastic particle sink. European Geophysical Union Meeting, Vienna, Austria.

Saini H, **Kvale KF**, Meissner KJ, Menviel L, Missiaen L. (2020) Modelled response of marine ecosystems to Last Glacial Maximum forcing. European Geophysical Union Meeting, Vienna, Austria.

Kriest I, Kähler P, Khatiwala S, **Kvale K**, Sauerland V, Oschlies A. (2020) One size fits all? - Optimising ocean biogeochemistry for different circulations. AGU Ocean Sciences Conference, San Diego, USA.

Keller ED, Turnbull JC, Mikaloff-Fletcher S, **Kvale KF**, Moy C. (2019) Examining the Southern Ocean carbon sink in a warming world. AGU Chapman Conference: Understanding Carbon Climate Feedbacks, San Diego, USA.

Keller ED, Turnbull JC, Mikaloff-Fletcher S, **Kvale KF**, Moy C. (2019) Examining the Southern Ocean carbon sink in a warming world. 13th International Conference on Paleoceanography, Sydney, Australia.

**Kvale KF**. (2019) Future global ocean oxygen trends are potentially vulnerable to microplastic pollution. European Geophysical Union Meeting, Vienna, Austria.

Yao W, Achterberg E, Koeve W, **Kvale KF**, Oschlies A. (2019) Identifying benefits and remaining challenges of modelling the marine iron cycle by data-based calibration of a global ocean biogeochemical model. European Geophysical Union Meeting, Vienna, Austria.

**Kvale KF**, Turner KE. (2018) Biogeochemical controls of phytoplankton calcifiers in warming icehouse and cooling greenhouse climates. SFB 754 Ocean Deoxygenation Conference, Kiel, Germany.

**Kvale KF**, Turner KE, Keller D, Meissner KJ. (2018) Pushing versus popping the cork: ocean heat and carbon uptake and outgassing responses to symmetric increasing versus decreasing atmospheric CO2 concentrations. European Geophysical Union Meeting, Vienna, Austria.

**Kvale KF**, Kriest I. (2018) The impact of physical circulation state on marine biogeochemical parameter optimization in an ocean model. PALMOD Open Science Conference, Vienna, Austria.

Khatiwala S, Muglia J, Schmittner AS, **Kvale KF**. (2016) Exploring the controls on glacial-interglacial variations in atmospheric CO2 in an observationally-constrained ocean circulation-biogeochemical model. International Conference on Paleoceanography, Utrecht, Netherlands.

Khatiwala S, Muglia J, **Kvale KF**, Schmittner AS. (2016) Simulation of glacial ocean biogeochemical tracer and isotope distributions based on the PMIP3 suite of climate models, European Geophysical Union Meeting, Vienna, Austria.

**Kvale KF**, Meissner KJ, Keller DP. (2016) Potential increasing dominance of heterotrophy in the global ocean, American Geophysical Union Ocean Sciences Meeting, New Orleans, USA.

**Kvale KF**, Meissner KJ, Keller DP, Schmittner A. (2012) Explicit planktic calcifiers in the UVic ESCM, American Geophysical Union Ocean Sciences Meeting, Salt Lake City, USA.

**Kvale KF**, Meissner KJ, Matear R, McNeil B. (2011) The combined impact of CO2-dependent parameterizations of Redfield and rain ratios on ocean carbon chemistry, American Society of Limnology and Oceanography Aquatic Sciences Meeting, San Juan, Puerto Rico.

**Kvale KF**, Zickfeld K, Meissner, KJ, Weaver A, Tanaka K, Bruckner T. (2008) Balancing oceans and emissions: A cost-effective analysis, Canadian Meteorological and Oceanographic Society (CMOS) Annual Conference, Kelowna, BC, Canada.

## Student Supervision[1]

Jungang Lu (2025-2026) PhD., State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai, China

Lu will spend 1 year of his PhD research time working with me to simulate chemical erosion of marine microplastics in an Earth System Model. Funding is applied for.

Zhenna Azimrayat Andrews (2023) MSc., Imperial College London, UK

Contamination implications of plastics phase-out. Co-supervised with the postgraduate research coordinator Ms. Claire Hunt (ICL). Finished with a Distinction, now enrolled in a PhD programme at Cambridge. Invited to present her research to the British House of Commons as a national finalist in STEM for Britain.

Natalia Gurgacz (2022-2023) MSc., University of Victoria, BC, Canada

Natalia quantified the impact of plastics carbon leachate on the global carbon cycle. Co-supervised with Michael Eby and Andrew Weaver (Univ. Victoria). Now a PhD candidate at Univ. Toronto.

Georgia Dennis (2021) Exploring the Breakdown of Microplastic in Marine Environments, BSc thesis, Univ. of Canterbury, New Zealand

[1] In my former roles at GNS and GEOMAR I could not take primary supervision responsibilities

Georgia developed a numerical representation of microplastic breakdown in an earth system model. Co-supervised with Laura Revell (Univ. Canterbury).

Nathaniel Fillman (2021-2023) MSc., Oregon State University, USA
Nathaniel used my diatom model to quantify the carbon storage effect of variable stoichiometry in a glacial ocean. Co-supervised with Andreas Schmittner (OSU). Now a PhD candidate at OSU.

Aidan James (2021) Assessing the effect of zooplankton faecal pellet slowing by microplastic contamination using a complex earth system model, MSc. Imperial College London, UK
Aidan is the first to quantify the impact of slowed faecal pellet sinking due to microplastic contamination on carbon cycling in an earth system model. Co-supervised with Claire Hunt (ICL).

Himadri Saini (2018-2022) PhD., Climate Change Research Centre, University of New South Wales, Sydney
Himadri used my diatom model to explore the role of diatom-coccolithophore competition in marine biogeochemistry over glacial cycles in the UVic ESCM. Co-supervised with Katrin Meissner and Laurie Menviel (UNSW). Now a postdoc in the same group.

Wanxuan Yao (2016-2021) Implications of Iron Model Complexity for the Projection of Global Biogeochemical Cycles: from the preindustrial era and into the future, PhD. Christian Albrects University, Kiel.
Wanxuan explored the impact of parameter optimisation on marine micro and macro nutrient cycling in the UVic ESCM. Co-supervised with Andreas Oschlies and Wolfgang Koeve (GEOMAR).

Jawwad Sarfraz (02/2020) HiWi[2] project at GEOMAR
Jawwad analysed a set of UVic ESCM model calibrations to quantify the sensitivity to small differences in ocean physics.

Hannah Geisinger (09/2017) HiWi project at GEOMAR
Hannah created hydrothermal forcing masks (e.g., iron, silica, alkalinity, DIC) for the UVic ESCM. These masks are published with the diatom model.

Katherine Turner (11/2015-06/2017) HiWi project at GEOMAR
Katherine set up and ran a series of ramping up and ramping down atmospheric $CO_2$ experiments using three configurations of the UVic ESCM. Her work resulted in 2 publications. Now a postdoc at Princeton.

## Teaching

Guest lecturer (VUW undergraduate and graduate level):
From 2022, lectures on environmental microplastics

Introduction to the Marine Environment (UNSW, ~200 students per session):
Course Coordinator (2009-2011)
Botany Bay Field Trip Leader/Lecturer (2010-2011)
Sydney Aquarium Field Trip Leader (2010-2011)

[2] HiWi is work-study undertaken outside of a regular thesis program

Coral Reefs: Ecology and Environment (UNSW, ~20 students):
Lady Eliott Island Field Trip Lecturer (02/2010)

Introduction to the Earth System (Univ. of Victoria, ~20 students):
Lab Teaching Assistant (09/2007-12/2007)

## Examination and Mentoring

Natalia Gurgacz-Safianowicz, MSc. (10.05/2023)
Committee examiner, Univ. of Victoria, BC Canada

Ellen Cliff, MSc. (6/01/2023) Mechanisms driving glacial deep ocean deoxygenation
External examiner, Oxford University Dept. of Earth Sciences

Mariana Hill-Cruz (from 2022)
GEOMAR postdoc researcher, I am acting officially as an external mentor advising on career progression

## Grants and Awards

Stirling C, Druce M, **Kvale K**, Bostock H, Swann G (pending) Southern Ocean blue-carbon resilience in a warming world: Legacies from past warm climates. Application in review with New Zealand Royal Society Marsden Fund.

Travel Bursary Award, Grantham Foundation (2023). 2350 USD in funding granted to travel to OTZ Symposium.

Revell L, **Kvale K**, Evangeliou N (2023-2026) The longevity of airborne microplastic-climate forcing from legacy plastic pollution. 928,000 NZD, New Zealand Royal Society Marsden.

Stirling C, Druce M, Bostock H, Swann G, **Kvale K** (2023-2026) Metal micronutrients: Major players in the Southern Ocean's carbon sink. 929,000 NZD, New Zealand Royal Society Marsden.

[3]Oschlies A, **Kvale KF**. (2019) Ocean biogeochemical parameter optimisation in an offline earth system model. High performance computing allocation worth 10400€ from the North German Supercomputing Alliance (HLRN).

Oschlies A, **Kvale KF**. (2018) Ocean biogeochemical parameter optimisation in an offline earth system model. High performance computing allocation worth 52000€ from the North German Supercomputing Alliance (HLRN).

Oschlies A, **Kvale KF**, Kriest, I. (2017) Automated calibration of earth system model biogeochemistry. High performance computing allocation of about 3 million core hours worth 39520€ from the North German Supercomputing Alliance (HLRN).

[3] German regulations dictate my supervisor must be listed as primary investigator on all computing grants

Via:Mento mentee (2017-2018)

Awarded “Best Poster” at the SOLAS Summer School, Corsica, France (08/2011)
Awarded a University International Postgraduate Award, 2009 (UNSW Graduate School)
Awarded “Best Talk” at the UVic Graduate Student Workshop (2008)
Charles Deiss Scholarship, 2003 (IU Department of Geological Sciences)

## Service

### Scientific Memberships

Discover Oceans
*Springer Nature family journal started 2023, Editorial Advisory Board (2024-present)*

Global Change Biology
*Editorial Advisory Board (2023-present)*

Ocean-Land-Atmosphere Research (OLAR)
*Science AAAS family journal started 2021, Editor (2023-present)*
*Awarded Outstanding Editor, 2024*

Surface Ocean Lower Atmosphere Study (SOLAS)
*Scientific Steering Committee Member (2024-2026)*
*Early Career Scientist Scientific Steering Committee Member (2023-2024)*
*Theme 1 Greenhouse gases and the Oceans Working Group Leader (2024-present)*
*mCDR Oceania Working Group Leader (2024-present)*

Scientists’ Coalition for an Effective Plastics Treaty (SCEPT)
*Scientific engagement with and support for the UNEP plastics treaty negotiations (2022-present)*

Joint Exploration of the Twilight ZONe (JETZON)
*Started a working group on mesopelagic microplastics which I led (2022-2025), now a contributing member, and contributing to a working group on constraining the biological carbon pump (2022-present)*

### Referee for

Biogeosciences
Communications Earth & Environment
Coral Reefs
Earth System Dynamics
Ecological Modelling
Environmental Research Letters
Environmental Science and Technology
Frontiers in Marine Science
Geoscientific Model Development
Geophysical Research Letters
Global Biogeochemical Cycles
Global Change Biology

Journal of Advances in Modeling Earth Systems
Limnology & Oceanography
Marine Pollution Bulletin
Nature Communications
Nature Geoscience
PNAS Nexus
Philosophical Transactions of the Royal Society

National Science Center Poland (grant proposals)

### Conference session coordination

Science and Society, SOLAS Open Science Conference, Goa India (2024) **Kvale K**, Bach L, Bell T

Ecological and biogeochemical impacts of plastic pollution in the marine environment, AGU Ocean Sciences, New Orleans USA (2024) Richon C, **Kvale K**, Egger M, Laufkoetter C.

Global plastic contamination: a journey towards scientifically informed policies and solutions (ITS2.5), EGU General Assembly, virtual Vienna, Austria (2021) Aksenov Y, **Kvale K**, Peeken I, Rubio A, van Emmerik T, Waller B

### Workshop coordination

Benefits vs Risks of Ocean Plastic Pollution Cleanups – Community Meeting and Workshop (2024), side event at AGU Ocean Sciences, New Orleans, Co-coordinated with Matthias Egger, The Ocean Cleanup

GEOMAR RD2 and RD3 internal workshop held 30/10/2019

### UNSW Academic Board

Higher Degree Research Committee Student Member, UNSW Academic Board (2010-2011)
UNSW Academic Board Student Representative from Electorate B (2009-2010)
Research Committee Student Member, UNSW Academic Board (2009-2010)
Academic Services Committee Student Member, UNSW Academic Board (2009)

## Professional References

### Professor Andreas Oschlies (aoschlies@geomar.de)

Head of Research Unit Biogeochemical Modelling at GEOMAR, Germany
Andreas is my former postdoctoral supervisor and remains a frequent collaborator.

### Professor Katrin Meissner (k.meissner@unsw.edu.au)

Director, Climate Change Research Centre, University of New South Wales, Australia
Katrin was my PhD supervisor at UNSW and remains a frequent collaborator.