

Dr. David P. Keller

GEOMAR Helmholtz Centre for Ocean Research Kiel
Marine Biogeochemical Modeling Department
Düsternbrooker Weg 20
24105 Kiel – Germany

Email: dkeller@geomar.de

Phone: +49 (0)431 600 4290

ORCID: <https://orcid.org/0000-0002-7546-4614>

Research Interests

Earth system model-based assessments of carbon dioxide removal (negative emissions) approaches, especially ocean-based ones. Feedbacks between biogeochemical cycles and the climate. Marine ecosystems and biogeochemistry.

Education

2010 Ph.D. in Marine, Estuarine, and Environmental Science [specialization in biological oceanography] University of Maryland, College Park, MD

2001 B.Sc. with a double major in Marine Biology and Biological Oceanography
Millersville University, Millersville, PA

Professional Background

2015- GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
Senior scientist in the Marine Biogeochemical Modelling department (non-permanent staff; supported by external [grant] funding)

2010-2015 GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
Research Fellowship in the Marine Biogeochemical Modelling department

2004-2010 University of Maryland Center for Environmental Science, Horn Point Laboratory, Cambridge, MD
Graduate Research Assistant for Dr. Raleigh R. Hood

Teaching

Winter Semester 2012/13 2014/15 2016/17 2018/19 2020/21	<i>Instructor</i>	MNF-klim-302/ MNF-bioc-357 <i>How to make and keep a habitable planet - biogeochemistry-climate feedbacks and astrobiology</i> GEOMAR/Kiel University Climate Physics and Biological Oceanography M.Sc. Programs
Spring 2010	<i>Graduate Teaching Assistant</i>	MEES 661 <i>Physics of Estuarine and Marine Environments</i> University of Maryland, MEES Program
Fall 2009	<i>Graduate Teaching Assistant</i>	MEES 621 <i>Biological Oceanography</i> University of Maryland, MEES Program

Projects and Funding

Third-party Funding

2023 - 2027	Source: Windward Fund Type: Large consortium-based research project Role: Principal Investigator Title: <i>Aligning ocean alkalinity for sustainable, safe and verifiable long-term CO₂ removal (OCEAN ALK-ALIGN)</i> Total project amount: € 10,996,061
2022 - 2026	Source: European Union Horizon Europe Programme Type: Large consortium-based research project Role: Principal Investigator Title: <i>Response of the Earth System to overshoot, Climate neUtrality and negative Emissions (RESCUE)</i> Total project amount: € 7,999,426
2021 – 2024	Source: German Federal Ministry of Research and Education (BMBF) via the German Alliance for Marine Research (Deutsche Allianz Meeresforschung; DAM) Research Mission “Marine carbon sinks in decarbonization pathways” Type: Large consortium-based research project Role: Work Package 3.2 and 3.3 Leader Title: <i>CO₂ removal by alkalinity enhancement: potential, benefits and risks (RETAKE)</i> Total project amount: € 4,999,691
2021 – 2024	Source: German Federal Ministry of Research and Education (BMBF) via the German Alliance for Marine Research (Deutsche

- Allianz Meeresforschung; DAM) Research Mission “Marine carbon sinks in decarbonization pathways”
 Type: Large consortium-based research project
 Role: Work Package 6 Leader
 Title: *Searching for solutions for Carbon-sequestration in coastal ecosystems: sea4soCiety*
 Total project amount: € 5,313,000
- 2021 – 2024 Source: German Federal Ministry of Research and Education (BMBF) via the German Alliance for Marine Research (Deutsche Allianz Meeresforschung; DAM) Research Mission “Marine carbon sinks in decarbonization pathways”
 Type: Large consortium-based research project
 Role: Work Package 1.1, 2.1, and 2.2 Leader
 Title: *Unified ASsessment framework for proposed methods of MARine CDR and interim knowledge SYnthesiS (ASMASYS)*
 Total project amount: € 3,148,196
- 2020 - 2025 Source: European Union Horizon 2020 Programme
 Type: Large consortium-based research project
 Role: Coordinator / Leader
 Title: *Ocean-based Negative Emission Technologies - analyzing the feasibility, risks, and co- benefits of ocean-based negative emission technologies for stabilizing the climate (OceanNETs)*
 Total project amount: € 7,192,894
- 2019 - 2023 Source: European Union Horizon 2020 Programme
 Type: Large consortium-based research project
 Role: Work Package 5 leader
 Title: *Our common future ocean in the Earth system – quantifying coupled cycles of carbon, oxygen, and nutrients for determining and achieving safe operating spaces with respect to tipping points (COMFORT)*
 Total project amount: € 8,179,000
- 2018 - 2020 Source: NSF (National Science Foundation) via SESYNC
 Type: National socio-economic synthesis center (SESYNC) workshops
 Role: Participant
 Title: *New Scenarios and Models for Climate Engineering*
- 2016-2019 Source: DFG (German Research Foundation)
 Type: Research project
 PI: David Keller; Co-PI: Nico Bauer (Potsdam Institute for Climate Impact Research, PIK)
 Title: *Carbon Dioxide Removal Model Intercomparison Assessment (CDR-MIA)*

A project within the 2nd phase of the German Research Foundation Priority Program 1689 (SPP 1689) - Climate engineering: risks, challenges, opportunities?
Amount: € 305,910

2015 Source: DFG (German Research Foundation)
Type: Workshop funding
Lead: David Keller
Title: *First Annual Carbon Dioxide Removal Model Intercomparison Project (CDRMIP) Workshop*
Amount: € 8,300

Projects without Funding

2015-present Title: *The Carbon Dioxide Removal Model Intercomparison Project (CDRMIP)*
PIs: David Keller, Andrew Lenton, Vivian Scott, and Naomi Vaughan
Website: https://www.kiel-earth-institute.de/CDR_Model_Intercomparison_Project.html

- A World Climate Research Program (WCRP) endorsed project contributing to the 6th Coupled Model Intercomparison Project (CMIP6)

Projects Participated in while on a Research Fellowship (2010-2015)

2013-2016 SPP 1689 - (1st phase) Climate engineering: risks, challenges, opportunities? [German Research Foundation Priority Program 1689] – *associated scientist in the ComparCE project*

2012-2015 SFB 754 - Climate-Biogeochemistry Interactions in the Tropical Ocean – *core support staff scientist for projects B1 and A7*

Supervisory Experience

Current Administrative Staff

Dr. Judith Meyer OceanNETs project manager (75% position)

Rita Erven OceanNETs graphic artist (25% position)

Current Postdocs / Scientists

Dr. Giang Tran RESCUE project, formerly also supervised in the COMFORT project

Dr. Volkmar Sauerland RESCUE project

Dr. Wanxuan Yao ASMASYS project

Neha Mehendale, M.Sc. RETAKE project

Dr. Margarita Liadova sea4soCiety project

Current Graduate Students

Jiajun Wu – Ph.D. candidate

Topic: *The carbon dioxide removal potential of macroalgae when combined with novel storage methods*

Miriam Tivig - Ph.D. candidate

Topic: *Improving the representation of biogeochemical cycling along the land-ocean continuum in Earth system models*

Chiara Ciscato – M.Sc. student

Topic: *Impacts of Ocean Alkalinity Enhancement on the Seasonal Cycle of Atmospheric CO₂ and Ocean pCO₂ in European Waters*

Past Graduate Students

2022 Estela de Almeida Monteiro– M.Sc. in Climate Physics (GEOMAR/ Kiel University)

Thesis: *Ocean oxygen in the CDRMIP CDR-reversibility experiment simulations*

2019 Makcim De Sisto – M.Sc. in Climate Physics (GEOMAR/ Kiel University)

Thesis: *Assessing the CO₂ mitigation potential of a combine Ocean Alkalinization and Direct Air Capture (DAC) treatment under low and high emission scenarios*

2018 Fabian Reith – Ph.D. awarded by the Faculty of Mathematics and Natural Sciences at the University of Kiel.

Thesis: *A novel view on ocean carbon sequestration by CO₂ direct injection*

2016 Nadine Mengis - Ph.D. awarded by the Faculty of Mathematics and Natural Sciences at Kiel University.

Thesis: *Towards a comprehensive, comparative assessment of Climate Engineering schemes -Metrics, Indicators and Uncertainties*

2016 Jiajun Wu – M.Sc. in Biological Oceanography (GEOMAR/ Kiel University)

Thesis: *Photochemical degradation and the global cycling of marine biologically refractory dissolved organic matter evaluated with the University of Victoria Earth System Climate Model*

2015 Anja Sendelbeck - M.Sc. in Climate Physics (GEOMAR/ Kiel University)

Thesis: *Model-based assessment of impacts and side-effects of climate engineering by albedo enhancement*

2014 Tronje Kemena – M.Sc. in Climate Physics (GEOMAR/ Kiel University)
Thesis: *Impact of the carbon cycle on the development of a Snowball Earth*

2013 Annika Eisele – M.Sc. in biological oceanography (Lund University in cooperation with GEOMAR/ Kiel University)
Thesis: *Evaluation of modeling ecosystem seasonality in the University of Victoria Earth System Climate Model*

Professional Society Membership

Association for the Sciences of Limnology and Oceanography (ASLO)
American Geophysical Union (AGU)
European Geosciences Union (EGU)

Editor/Reviewer

Academic Editor

Frontiers in Climate - Negative Emission Technologies Editorial Board
Frontiers in Climate – Ocean-based Negative Emission Technologies Editorial Board
PLOS ONE (Channel – Responding to Climate Change) from 2018 to 2022

Grant and Funding Evaluation

USA National Science Foundation
The European Science Foundation - Research Foundation Flanders' (ESF-FWO)
European Union Horizon 2020 Program
UK Research and Innovation Program

Reviewer for International Journals and Books

Nature Climate Change
Geophysical Research Letters
Earth System Dynamics
Journal of Geophysical Research – Biogeosciences
Environment, Development, and Sustainability
Environmental Research Letters
Earth's Future
Journal of Marine Systems
Deep-Sea Research II

Journal of Plankton Research
Marine Ecology Progress Series
Geoscientific Model Development
SpringerNature (book reviews)
Frontiers in Climate

Other Recent Professional Activities

Lead presenter at the science-policy briefing: *Achieving Climate Neutrality and Paris Agreement Goals: Opportunities for Ocean-Based Methods of Carbon Dioxide Removal*. Oct. 2022 at the European Parliament in Brussels.

Co-convener of the session: Blue Scenarios: Ocean and Fisheries in Earth System Models. Scenarios Forum Workshop 2022, Vienna, Austria.

Contributor to the Aspen Institute report: Guidance for Ocean-Based Carbon Dioxide Removal Projects A Pathway to developing a code of conduct. December 2021.

Convener of the session: The Earth System and Carbon Dioxide Removal. Climate Engineering Conference 2017, Berlin, Germany.

Co-convener of the session: Negative Emissions: Staying Below 2°C. AGU 2016 Fall meeting. San Francisco, USA.

Conference organizer: 1st Carbon Dioxide Removal Model Intercomparison Workshop (CDR-MIP) Workshop. (2016) Institute for Advanced Sustainability Studies (IASS) Potsdam, Germany.

Co-convener of the session: Understanding Carbon-Cycle and Climate Feedbacks of Carbon Dioxide Removal Methods. Climate Engineering Conference 2014, Berlin, Germany.

Publications

Bauer, N., **Keller, D. P.**, Garbe, J., Karstens, K., Piontek, F., von Bloh, W., Thiery, W., Zeitz, M., Mengel, M., Strefler, J., Thonicke, K., and Winkelmann, R. (*submitted*) Exploring risks and benefits of overshooting a 1.5° carbon budget over space and time. *Environmental Research Letters*.

Wu, J., **Keller, D. P.**, and Oschlies, A. (2023) Carbon Dioxide Removal via Macroalgae Open-ocean Mariculture and Sinking: An Earth System Modeling Study. *Earth System Dynamics*. DOI 10.5194/esd-2021-104.

Babiker, M., Berndes, G., Blok, K., Cohen, B., Cowie, A., Geden, O., Ginzburg, V., Leip, A., Smith, P., Sugiyama, M., Yamba, F., Al Khourdajie, A., Arneth, A.,

Lima de Azevedo, I. M., Bataille, C., Beerling, D., Bezner Kerr, R., Bradley, J., Buck, H. J., Cabeza, L. F., Calvin, K., Campbell, D., Cols, J. C., Daioglou, V., Harmsen, M., Höglund-Isaksson, L., House, J. I., **Keller, D. P.**, Kleijne, K. d., Kugelberg, S., Makarov, I., Meza, F., Minx, J. C., Morecroft, M., Nabuurs, G. J., Neufeldt, H., Novikova, A., Nugroho, S. B., Oschlies, A., Parmesan, C., Peters, G. P., Poore, J., Portugal-Pereira, J., Postigo, J. C., Pradhan, P., Renforth, P., Rivera-Ferre, M. G., Roe, S., Singh, P. K., Slade, R., Smith, S. M., Tirado von der Pahlen, M. C. and Toribio Ramirez, D. (2022) Cross-sectoral Perspectives. In: *IPCC, 2022: Climate Change 2022: Mitigation of Climate Change*. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change., ed. by Shukla, P. R., Skea, J., Slade, R., Al Khourdajie, A., van Diemen, R., McCollum, D., Pathak, M., Some, S., Vyas, P., Fradera, R., Belkacemi, M., Hasija, A., Lisboa, G., Luz, S. and Malley, J.. Cambridge University Press, Cambridge, UK, pp. 1245-1354. DOI 10.1017/9781009157926.005.

Keller, D. P., Ketelhake, S., Meyer, J., Neumann, B., Oschlies, A., Proelß, A. and Rickels, W. (2022) Achieving Climate Neutrality and Paris Agreement Goals: Opportunities for Ocean-Based Methods of Carbon Dioxide Removal, *Science Policy Brief*. CDRmare, Kiel, Germany, 8 pp. DOI 10.3289/cdrmare.oceannets_1.

Chien, C. T., Durgadoo, J. V., Ehlert, D., Frenger, I., **Keller, D. P.**, Koeve, W., Kriest, I., Landolfi, A., Patara, L., Wahl, S. and Oschlies, A. (2022) FOCI-MOPS v1 – Integration of Marine Biogeochemistry within the Flexible Ocean and Climate Infrastructure version 1 (FOCI 1) Earth system model. *Geoscientific Model Development*, 15 . pp. 5987-6024. DOI 10.5194/gmd-15-5987-2022

Lee, J. Y., Marotzke, J., Bala, G., Cao, L., Corti, S., Dunne, J. P., Engelbrecht, F., Fischer, E., Fyfe, J. C., Jones, C., Maycock, A., Mutemi, J., Ndiaye, O., Panickal, S., Zhou, T., Milinski, S., Yun, K. S., Armour, K., Bellouin, N., Bethke, I., Byrne, M. P., Cassou, C., Chen, D., Cherchi, A., Christensen, H. M., Connors, S. L., Di Luca, A., Drijfhout, S. S., Fletcher, C. G., Forster, P., Garcia-Serrano, J., Gillett, N. P., Kaufmann, D. S., **Keller, D. P.**, Kravitz, B., Li, H., Liang, Y., MacDougall, A. H., Malinina, E., Menary, M., Merryfield, W. J., Min, S. K., Nicholls, Z. R. J., Notz, D., Pearson, B., Priestley, M. D. K., Quaas, J., Ribes, A., Ruane, A. C., Sallee, J. B., Sanchez-Gomez, E., Seneviratne, S. I., Slangen, A. B. A., Smith, C., Stuecker, M. F., Swaminathan, R., Thorne, P. W., Tokarska, K. B., Toohey, M., Turner, A., Volpi, D., Xiao, C. and Zappa, G. (2021) Future global climate: scenario-based projections and near-term information. In: *IPCC Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth: Assessment Report of the Intergovernmental Panel on Climate Change: Chapter 4.*, ed. by Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Pean, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M. I., Huang, M., Leitzell, K., Lonnoy, E., Matthews, J. B. R., Maycock, T. K., Waterfield, T., Yelekçi, O., Yu, R. and Zhou, B.. IPCC, Genf, Switzerland, pp. 1-195.

- Costa, M. H., Cotrim da Cunha, L., Cox, P. M., Eliseev, A. V., Hensen, S., Ishii, M., Jaccard, S., Koven, C., Lohila, A., Patra, P. K., Piao, S., Rogelj, J., Syampungani, S., Zaehle, S., Zickfeld, K., Alexandrov, G., Bala, G., Bopp, L., Boysen, L., Cao, L., Chandra, N., Ciais, P., Denisov, S. N., Dentener, F. J., Douville, H., Fay, A., Forster, P., Fox-Kemper, B., Friedlingstein, P., Fu, W., Fuss, S., Garcon, V., Gier, B., Gillett, N. P., Gregor, L., Haustein, K., Haverd, V., He, J., Hewitt, H. T., Hoffman, F. M., Ilyina, T., Jackson, R., Jones, C., **Keller, D. P.**, Kwiatkowski, L., Lamboll, R. D., Lan, X., Laufkötter, C., Le Quere, C., Lenton, A., Lewis, J., Liddicoat, S., Lorenzoni, L., Lovenduski, N., MacDougall, A. H., Mathesius, S., Matthews, D. H., Meinshausen, M., Mokhov, I. I., Naik, V., Nicholls, Z. R. J., Nurhati, I. S., O'Sullivan, M., Peters, G., Pongratz, J., Poulter, B., Sallee, J. B., Saunio, M., Schuur, E. A. G., Seneviratne, S. I., Stavert, A., Suntharalingam, P., Tachiiri, K., Terhaar, J., Thompson, R., Tian, H., Turnbull, J., Vicente-Serrano, S. M., Wang, X., Wanninkhof, R. and Williamson, P. (2021) Global Carbon and other Biogeochemical Cycles and Feedbacks. In: *IPCC Climate Change 2021: The Physical Science Basis: Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change : Chapter 5.*, ed. by Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Pean, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M. I., Huang, M., Leitzell, K., Lonnoy, E., Matthews, J. B. R., Maycock, T. K., Waterfield, T., Yelekci, O., Yu, R. and Zhou, B.. IPCC, Genf, Switzerland, pp. 1-221.
- Kvale, K. F., **Keller, D. P.**, Koeve, W., Meissner, K. J., Somes, C. J., Yao, W. and Oschlies, A. (2021) Explicit silicate cycling in the Kiel Marine Biogeochemistry Model version 3 (KMBM3) embedded in the UVic ESCM version 2.9. *Geoscientific Model Development*, 14 (12). pp. 7255-7285. DOI 10.5194/gmd-14-7255-2021
- Tivig, M., **Keller, D. P.** and Oschlies, A. (2021) Riverine nitrogen supply to the global ocean and its limited impact on global marine primary production: a feedback study using an Earth System Model. *Biogeosciences*, 18 . pp. 5327-5350. DOI 10.5194/bg-18-5327-2021.
- Keller, D. P.**, Brent, K., Bach, L. T. and Rickels, W. (2021) Editorial: The Role of Ocean-Based Negative Emission Technologies for Climate Mitigation. *Frontiers in Climate*, 3. Art.Nr. 743816. DOI 10.3389/fclim.2021.743816
- Jebari, J., Táíwò, O. O., Andrews, T. M., Aquila, V., Beckage, B., Belaia, M., Clifford, M., Fuhrman, J., **Keller, D. P.**, Mach, K. J., Morrow, D. R., Raimi, K. T., Visioni, D., Nicholson, S. and Trisos, C. H. (2021) From moral hazard to risk-response feedback. *Climate Risk Management*, 33 . Art.Nr. 100324. DOI 10.1016/j.crm.2021.100324.
- Pereira, L. M., Morrow, D. R., Aquila, V., Beckage, B., Beckbesinger, S., Beukes, L., Buck, H. J., Carlson, C. J., Geden, O., Jones, A. P., **Keller, D. P.**, Mach, K. J., Mashigo, M., Moreno-Cruz, J. B., Visioni, D., Nicholson, S. and Trisos, C. H. (2021) From fAIRplay to climate wars: making climate change scenarios

more dynamic, creative, and integrative. *Ecology and Society*, 26 (4).
Art.Nr. 30. DOI 10.5751/ES-12856-260430.

Tran, G. T., Oschlies, A. and **Keller, D. P.** (2020) Comparative Assessment of Climate Engineering Scenarios in the Presence of Parametric Uncertainty. *Journal of Advances in Modeling Earth Systems*, 12 (4). Art.Nr. e2019MS001787. DOI 10.1029/2019MS001787.

Mengis, N., **Keller, D. P.**, MacDougall, A., Eby, M., Wright, N., Meissner, K. J., Oschlies, A., Schmittner, A., Matthews, H. D., and Zickfeld, K. (2020) Evaluation of the University of Victoria Earth System Climate Model version 2.10 (UVic ESCM 2.10), *Geosci. Model Dev.*, <https://doi.org/10.5194/gmd-2019-373>

Franke, A., Blenckner, T., Duarte, C. M., Ott, K., Fleming, L. E., Antia, A., Reusch, T. B. H., Bertram, C., Hein, J., Kronfeld-Goharani, U., Dierking, J., Kuhn, A., Sato, C., van Doorn, E., Wall, M., Schartau, M., Karez, R., Crowder, L., **Keller, D. P.**, Engel, A., Hentschel, U. and Prigge, E. (2020) Operationalizing Ocean Health: Toward Integrated Research on Ocean Health and Recovery to Achieve Ocean Sustainability. *One Earth*. DOI: 10.1016/j.oneear.2020.05.013

Kreuter, J., Matzner, N., Baatz, C., **Keller, D. P.**, Markus, T., Wittstock, F., Bernitt, U. and Mengis, N. (2020) Unveiling assumptions through interdisciplinary scrutiny: Observations from the German Priority Program on Climate Engineering (SPP 1689), *Climatic Change*, 162, pp. 57-66. DOI: 10.1007/s10584-020-02777-4.

Reith, F., W. Koeve, **D. P. Keller**, J. Getzlaff, and A. Oschlies (2019) Meeting climate targets by direct CO₂ injections: What price would the ocean have to pay? *Earth System Dynamic.*, 10, pp. 711-727. DOI: 10.5194/esd-10-711-2019.

Mengis, N., **D. P. Keller**, W. Rickels, M. Quaas, and A. Oschlies (2019), Climate Engineering-induced changes in correlations between Earth system variables - Implications for appropriate indicator selection. *Climatic Change*. doi: 10.1007/s10584-019-02389-7

Kvale, K. F., K. Turner, **D. P. Keller**, and K. Meissner (2018), Asymmetric dynamical ocean responses in warming icehouse and cooling greenhouse climates. *Environmental Research Letters*, 13 (12). Art.Nr. 125011. doi: 10.1088/1748-9326/aaedc3

Keller, D. P. (2018), Marine Climate Engineering. In: *Handbook on Marine Environment Protection: Science, Impacts and Sustainable Management.*, ed. by Salomon, M. and Markus, T.. Springer International Publishing, Berlin, Germany, pp. 261-276. ISBN 978-3-319-60154-0, doi: 10.1007/978-3-319-60156-4

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- Lenton, A., R. J. Matear, **D. P. Keller**, V. Scott, and N. E. Vaughan (2018), Assessing Carbon Dioxide Removal Through Global and Regional Ocean Alkalinization under High and Low Emission Pathways. *Earth System Dynamics*, 9 . pp. 339-357. doi: 10.5194/esd-9-339-2018
- Keller, D. P.** , A. Lenton, V. Scott, N. E. Vaughan, N. Bauer, D. Ji, C. D. Jones, B. Kravitz, H. Muri, and K. Zickfeld (2018), The Carbon Dioxide Removal Model Intercomparison Project (CDRMIP): rationale and experimental protocol for CMIP6. *Geoscientific Model Development*, 11 . pp. 1133-1160. doi: 10.5194/gmd-11-1133-2018
- Rickels, W., F. Reith, **D. P. Keller**, A. Oschlies, and M. Quaas (2018), Integrated Assessment of Carbon Dioxide Removal. *Earth's Future*, 6 (3). pp. 565-582. doi: 10.1002/2017EF000724
- Mengis, N., **D. P. Keller**, and A. Oschlies (2018), Systematic Correlation Matrix Evaluation (SCoMaE) – a bottom-up, science-led approach to identifying indicators. *Earth System Dynamics*, 9 (1). pp. 15-31. doi: 10.5194/esd-9-15-2018
- Feng, Y., W. Koeve, **D. P. Keller**, and A. Oschlies (2017), Model-based Assessment of the CO₂ Sequestration Potential of Coastal Ocean Alkalinization. *Earth's Future*, 5 (12). pp. 1252-1266. doi: 10.1002/2017EF000659
- Lenton, A., **D. P. Keller**, and P. Pfister (2017), How Will Earth Respond to Plans for Carbon Dioxide Removal? *Eos: Earth & Space Science News*, 98 . doi: 10.1029/2017E0068385
- Oschlies, A., H. Held, **D. P. Keller**, K. Keller, N. Mengis, M. Quaas, W. Rickels, and H. Schmidt (2017), Indicators and metrics for the assessment of climate engineering. *Earth's Future*, 5 (1). pp. 49-58. doi: 10.1002/2016EF000449.
- Reith, F., **D. P. Keller**, and A. Oschlies (2016), Revisiting ocean carbon sequestration by direct injection: A global carbon budget perspective. *Earth System Dynamics*, 7 . pp. 797-812. doi: 10.5194/esd-7-797-2016
- Partanen, A. I., **D. P. Keller**, H. Korhonen, and D. H. Matthews (2016), Impacts of sea spray geoengineering on ocean biogeochemistry. *Geophysical Research Letters*, 43 (14). pp. 7600-7608. doi: 10.1002/2016GL070111
- Feng, E. Y., **D. P. Keller**, W. Koeve, and A. Oschlies (2016), Could artificial ocean alkalinization protect tropical coral ecosystems from ocean acidification?

Environmental Research Letters, 11 (7). doi: 10.1088/1748-9326/11/7/074008

- Keller, D. P.**, I. Kriest, W. Koeve, and A. Oschlies (2016), Southern Ocean biological impacts on global ocean oxygen. *Geophysical Research Letters*, 43 (12). pp. 6469-6477. doi: 10.1002/2016GL069630.
- Mengis, N., T. Martin, **D. P. Keller**, and A. Oschlies (2016), Assessing climate impacts and risks of ocean albedo modification in the Arctic. *Journal of Geophysical Research - Oceans*, 121 (5). pp. 3044-3057. doi: 10.1002/2015JC011433.
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- Kvale, K. F., K. J. Meissner, **D. P. Keller**, M. Eby and A. Schmittner (2015), Explicit Planktic Calcifiers in the University of Victoria Earth System Climate Model, Version 2.9, *Atmosphere-Ocean*, doi: 10.1080/07055900.2015.1049112
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Technical Skills

Operating Systems:	Unix/Linux, Microsoft Windows, Apple Mac OS
Programming:	Fortran, Python
Models I run:	UVic Earth System Climate Model, Keller and Hood (2011) biogeochemical ecosystem model
Software:	Matlab, Ferret, Stella, Adobe Creative Suite, Microsoft Office, Subversion (Cornerstone), GIT, CMOR
Additional:	Experience working with NetCDF data, Some experience (6 mo.) working with the Regional Ocean Modeling System (ROMS)

Related Marine Science Experience

2002-2003 Marine Biologist/Manager
Reef Splendor, Hopewell Junction, NY
I was responsible for building and maintaining life support systems, maintaining water quality, propagating corals, and the care of livestock in a 5000 ft² saltwater fish and invertebrate wholesale/coral propagation facility. I also trained and supervised staff and sold equipment and provided support to customers concerning all aspects of aquarium keeping.

1998-2002 Team Leader
That Pet Place/That Fish Place, Lancaster, PA
I supervised and trained staff and assisted customers with sales and support of aquarium equipment. I maintained "display" reef aquariums at the store. I also set up and maintained aquariums and ponds at customers' homes.