Dr. Jens Daniel Müller

In brief: I'm a biogeochemist studying the ocean carbon cycle through measurements of CO_2. Since 2020, I'm working as a PostDoc with Nicolas Gruber at ETH Zurich. We use global ship-based observations to document the accumulation of anthropogenic CO_2 and resulting acidification in the ocean interior. This work profits from my PhD experience, including the development of pH analytics, the interpretation of autonomous pCO_2 measurements from a voluntary observing ship and several months spent at sea. As a scientific coordinator of the project REgional Carbon Cycle Assessment and Processes (RECCAP2), I led an international team of 100 scientists in synthesizing the current knowledge on the ocean carbon sink through models and surface flux estimates.

Personal information

Birthday	February 5, 1986
Nationality	German
Family	Father of two
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Education

05/2018	PhD Tracegas Biogeochemistry Group (Prof. Gregor Rehder) Chemical Oceanography Department Leibniz Institute for Baltic Sea Research Warnemünde (IOW) Germany
08/2012	Master Benthic Ecology Group (Prof. Martin Wahl) Marine Ecology Research Division GEOMAR Helmholtz Centre for Ocean Research Kiel Germany

Current position

Since 07/2020	Postdoc Environmental Physics Group (Prof. Nicolas Gruber) Department of Environmental Systems Science (D-USYS) ETH Zurich Switzerland

Previous positions

06/2018 – 06/2020	Postdoc Tracegas Biogeochemistry Group (Prof. Gregor Rehder) Chemical Oceanography Department Leibniz Institute for Baltic Sea Research Warnemünde (IOW) Germany
10/2013 – 03/2014	Research associate Biological Oceanography Group (Prof. Ulf Riebesell) Marine Biogeochemistry Research Division GEOMAR Helmholtz Centre for Ocean Research Kiel Germany

Fellowships and awards

02/2019	Briese Award, Germany
06/2019	PhD award (German Water Chemical Society)
11/2019	PhD award (Baltic Sea Research Foundation)
06/2017	Best poster award (Baltic Sea Science Congress)
05/2005	Best Abitur Award (Bertha-von-Suttner Gymnasium)
07/2014 – 06/2018	PhD scholarship (ideational) German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes)
02/2007 – 06/2012	Full student scholarship German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes)

Supervision of bachelor/master students / Co-supervision of PhD students

07/2020 – present	2 master students, 2 interns, 2 term paper students Department of Environmental Systems Science (D-USYS) ETH Zurich Switzerland
06/2018 – 06/2020	Co-supervision of 2 PhD students Chemical Oceanography Department Leibniz Institute for Baltic Sea Research Warnemünde (IOW) Germany

Teaching activities

Since 04/2022	Lecturer Global Biogeochemical Cycles and Climate (with Nicolas Gruber) ETH Zurich
04/2019 – 09/2019	Lecturer Analytical and Environmental Chemistry I (with Gregor Rehder) University of Rostock
10/2018 – 03/2019	Lecturer Analytical Chemistry IV: Environmental Chemistry (with Gregor Rehder) University of Rostock

Organization of scientific meetings/ committees

Since 2020	Scientific coordinator of RECCAP2-ocean, a bottom-up initiative of ~100 international researchers to establish the scientific basis for the Global Carbon Budget
Since 2023	Co-PI of the SCOR working group 4D-BGC (Coordinating the Development of Gridded Four-Dimensional Data Products from Biogeochemical-Argo Observations)
Since 2022	Convener of four sessions on the ocean carbon sink at EGU and Ocean Sciences Meeting

Reviewing activities

Since 2022	Swiss Polar Institute (Exploratory Grants and Technogrants evaluation)
Since 2016	Reviewer for Biogeosciences, ESSD, Limnology and Oceanography Methods, Marine Chemistry, Nature Communications, Ocean Science
2023	Guest editor for a special issue in Oceanography

Major ongoing collaborations

Since 2023	Peter Brown Role of the Overturning Circulation in Carbon Accumulation (ROCCA) National Oceanography Centre, Southampton, United Kingdom

Third party funding

04/2018 – 09/2018	BloomSail, National Geographic Society, 5k€, Germany

Selected expeditions and field campaigns

02/2019 – 03/2019	Baltic Sea, Gulf of Bothnia. RV Aranda, wintertime under-ice biogeochemistry.
05/2018 – 09/2018	Baltic Sea, Eastern Gotland Sea. SV Tina V, self-contained sailing expedition BloomSail with crew of 3, vertically resolved pCO_2 measurements to quantify net community production by cyanobacteria.
05/2015 – 06/2015	Baltic Sea. VOS Finnmaid, 8-week measurement campaign to study the progression of the springbloom after nitrate depletion.

Selected Science Communication and Outreach

09/2019	TV | arte Xenius | Die Ostsee: SOS für das europäische Meer | 27min episode about BloomSail expedition.
04/2019	Podcast | Segelradio - Hinnerk Weiler | 45min interview about the BloomSail expedition. Science from a sailors perspective.
04/2019	Online | International Ocean Systems | Article summarizing our ambitions to extend pH measurements from oceans to brackish waters.
12/2018	Print | National Geographic | EIN MEER VON BLAUALGEN | Report about NGS-funded BloomSail expedition.
10/2018	TV | Nordmagazin - Interview Thilo Tautz | 6min studio interview about BloomSail expedition.
08/2018	TV | BR Gut zu Wissen | Todeszonen in der Ostsee: Blaualgen
12/2017	Radio | NDR-Info Logo | 5min Interview together with Dr. Bernd Schneider on the publication of our textbook on Baltic Sea Biogeochemistry.
01/2017	Print | Zeit Studienführer | Mein Beruf: Ich bin Meeresforscher | Portrait of a young marine scientist.

Method and infrastructure developments

2014 – 2018	Co-development of an automated spectrophotometric pH measurement system that is commercially available and used in the Baltic Sea for operational monitoring activities on a voluntary observing ship

Publication list (*work published without PhD supervisor)

Under review

***Müller, J. D.**, Gruber, N., Schneuwly, A., Bakker, D., Gehlen, M., Gregor, L., Hauck, J., Landschützer, P., and McKinley, G.: Unexpected decline of the ocean carbon sink under record-high sea surface temperatures in 2023 [under review at Nature Climate Change], https://doi.org/10.21203/rs.3.rs-5198321/v1, 2024.

Ishii, M., Carter, B. R., Toyama, K., Rodgers, K. B., Feely, R. A., Chau, T.-T.-T., Chevallier, F., Desmet, F., Gregor, L., Iida, Y., Kitamura, Y., Müller, J.D., and Tsujino, H.: CO2 uptake in the Pacific from 1985 to 2018: a comparative assessment of observation-and model-based estimates, under review at Global Biogeochemical Cycles, https://doi.org/10.22541/essoar.173117017.78015455/v1, 2024.

In press

Olivarez, H.C., Lovenduski, N.S., Maroon, E., Müller, J.D., Fay, A.R., Krumhardt, K.M., Levy, M.N., Lindsay, K., McKinley, G.A., Rader, J.K., Internal climate variability modulates decadal changes in ocean anthropogenic carbon storage, accepted for publication at Environmental Research Letters.

2024

***Müller, J. D.** and Gruber, N.: Progression of ocean interior acidification over the industrial era, Science Advances, 10, eado3103, https://doi.org/10.1126/sciadv.ado3103, 2024.

*Doney, S. C., Mitchell, K. A., Henson, S. A., Cavan, E., DeVries, T., Gruber, N., Hauck, J., Mouw, C. B., **Müller, J. D.**, and Primeau, F. W.: Observational and Numerical Modeling Constraints on the Global Ocean Biological Carbon Pump, Global Biogeochemical Cycles, 38, e2024GB008156, https://doi.org/10.1029/2024GB008156, 2024.

*Lauvset, S. K., Lange, N., Tanhua, T., Bittig, H. C., Olsen, A., Kozyr, A., Álvarez, M., Azetsu-Scott, K., Brown, P. J., Carter, B. R., Cotrim da Cunha, L., Hoppema, M., Humphreys, M. P., Ishii, M., Jeansson, E., Murata, A., **Müller, J. D.**, Pérez, F. F., Schirnick, C., Steinfeldt, R., Suzuki, T., Ulfsbo, A., Velo, A., Woosley, R. J., and Key, R. M.: The annual update GLODAPv2.2023: the global interior ocean biogeochemical data product, Earth System Science Data, 16, 2047–2072, https://doi.org/10.5194/essd-16-2047-2024, 2024.

*Pérez, F. F., Becker, M., Goris, N., Gehlen, M., López-Mozos, M., Tjiputra, J., Olsen, A., **Müller, J. D.**, Huertas, I. E., Chau, T. T. T., Cainzos, V., Velo, A., Benard, G., Hauck, J., Gruber, N., and Wanninkhof, R.: An Assessment of CO2 Storage and Sea-Air Fluxes for the Atlantic Ocean and Mediterranean Sea Between 1985 and 2018, Global Biogeochemical Cycles, 38, e2023GB007862, https://doi.org/10.1029/2023GB007862, 2024.

*Resplandy, L., Hogikyan, A., **Müller, J. D.**, Najjar, R. G., et al.: A Synthesis of Global Coastal Ocean Greenhouse Gas Fluxes, Global Biogeochemical Cycles, 38, e2023GB007803, https://doi.org/10.1029/2023GB007803, 2024.

*Terhaar, J., Goris, N., **Müller, J. D.**, DeVries, T., Gruber, N., Hauck, J., Perez, F. F., and Séférian, R.: Assessment of Global Ocean Biogeochemistry Models for Ocean Carbon Sink Estimates in RECCAP2 and Recommendations for Future Studies, Journal of Advances in Modeling Earth Systems, 16, e2023MS003840, https://doi.org/10.1029/2023MS003840, 2024.

2023

***Müller, J. D.**, Gruber, N., Carter, B., Feely, R., Ishii, M., Lange, N., Lauvset, S. K., Murata, A., Olsen, A., Pérez, F. F., Sabine, C., Tanhua, T., Wanninkhof, R., and Zhu, D.: Decadal Trends in the Oceanic Storage of Anthropogenic Carbon From 1994 to 2014, AGU Advances, 4, e2023AV000875, https://doi.org/10.1029/2023AV000875, 2023.

*DeVries, T., Yamamoto, K., Wanninkhof, R., Gruber, N., Hauck, J., **Müller, J. D.**, et al.: Magnitude, Trends, and Variability of the Global Ocean Carbon Sink From 1985 to 2018, Global Biogeochemical Cycles, 37, e2023GB007780, https://doi.org/10.1029/2023GB007780, 2023.

*Gruber, N., Bakker, D. C. E., DeVries, T., Gregor, L., Hauck, J., Landschützer, P., McKinley, G. A., and **Müller, J. D.**: Trends and variability in the ocean carbon sink, Nat Rev Earth Environ, 1–16, https://doi.org/10.1038/s43017-022-00381-x, 2023.

*Yasunaka, S., Manizza, M., Terhaar, J., Olsen, A., Yamaguchi, R., Landschützer, P., Watanabe, E., Carroll, D., Adiwira, H., **Müller, J. D.**, and Hauck, J.: An Assessment of CO2 Uptake in the Arctic Ocean From 1985 to 2018, Global Biogeochemical Cycles, 37, e2023GB007806, https://doi.org/10.1029/2023GB007806, 2023.

*Rodgers, K. B., Schwinger, J., Fassbender, A. J., Landschützer, P., Yamaguchi, R., Frenzel, H., Stein, K., **Müller, J. D.**, Goris, N., Sharma, S., Bushinsky, S., Chau, T.-T.-T., Gehlen, M., Gallego, M. A., Gloege, L., Gregor, L., Gruber, N., Hauck, J., Iida, Y., Ishii, M., Keppler, L., Kim, J.-E., Schlunegger, S., Tjiputra, J., Toyama, K., Vaittinada Ayar, P., and Velo, A.: Seasonal Variability of the Surface Ocean Carbon Cycle: A Synthesis, Global Biogeochemical Cycles, 37, e2023GB007798, https://doi.org/10.1029/2023GB007798, 2023.

*Kappel, E., Costello, M., Galgani, L., Gordó-Vilaseca, C., Govindarajan, A., Kouhi, S., Lavin, C., McCartin, L., **Müller, J. D.**, Pirenne, B., Tanhua, T., Zhao, Q., and Zhao, S.: Introduction to Frontiers in Ocean Observing, Oceanog, https://doi.org/10.5670/oceanog.2023.s1.1, 2023.

***Müller, J. D.**: RECCAP2-ocean data collection, [Dataset], https://doi.org/10.5281/zenodo.7990823, 2023.

2022

*Dai, M., Su, J., Zhao, Y., Hofmann, E. E., Cao, Z., Cai, W.-J., Gan, J., Lacroix, F., Laruelle, G. G., Meng, F., **Müller, J. D.**, Regnier, P. A. G., Wang, G., and Wang, Z.: Carbon Fluxes in the Coastal Ocean: Synthesis, Boundary Processes, and Future Trends, Annual Review of Earth and Planetary Sciences, 50, 593–626, https://doi.org/10.1146/annurev-earth-032320-090746, 2022.

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2021

Müller, J. D., Schneider, B., Gräwe, U., Fietzek, P., Wallin, M. B., Rutgersson, A., Wasmund, N., Krüger, S., and Rehder, G.: Cyanobacteria net community production in the Baltic Sea as inferred from profiling pCO2 measurements, Biogeosciences, 18, 4889–4917, https://doi.org/10.5194/bg-18-4889-2021, 2021.

Honkanen, M., **Müller, J. D.**, Seppälä, J., Rehder, G., Kielosto, S., Ylöstalo, P., Mäkelä, T., Hatakka, J., and Laakso, L.: The diurnal cycle of pCO2 in the coastal region of the Baltic Sea, Ocean Science, 17, 1657–1675, https://doi.org/10.5194/os-17-1657-2021, 2021.

Jacobs, E., Bittig, H. C., Gräwe, U., Graves, C. A., Glockzin, M., **Müller, J. D.**, Schneider, B., and Rehder, G.: Upwelling-induced trace gas dynamics in the Baltic Sea inferred from 8 years of autonomous measurements on a ship of opportunity, Biogeosciences, 18, 2679–2709, https://doi.org/10.5194/bg-18-2679-2021, 2021.

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2019

Wanninkhof, R., Pickers, P. A., Omar, A. M., Sutton, A., Murata, A., Olsen, A., Stephens, B. B., Tilbrook, B., Munro, D., Pierrot, D., Rehder, G., Santana-Casiano, J. M., **Müller, J. D.**, Trinanes, J., Tedesco, K., O'Brien, K., Currie, K., Barbero, L., Telszewski, M., Hoppema, M., Ishii, M., González-Dávila, M., Bates, N. R., Metzl, N., Suntharalingam, P., Feely, R. A., Nakaoka, S., Lauvset, S. K., Takahashi, T., Steinhoff, T., and Schuster, U.: A Surface Ocean CO2 Reference Network, SOCONET and Associated Marine Boundary Layer CO2 Measurements, Frontiers in Marine Science, 6, https://doi.org/10.3389/fmars.2019.00400, 2019.

2018

Müller, J. D. and Rehder, G.: Metrology of pH Measurements in Brackish Waters—Part 2: Experimental Characterization of Purified meta-Cresol Purple for Spectrophotometric pHT Measurements, Front. Mar. Sci., 5, 177, https://doi.org/10.3389/fmars.2018.00177, 2018.

Müller, J. D., Bastkowski, F., Sander, B., Seitz, S., Turner, D. R., Dickson, A. G., and Rehder, G.: Metrology for pH Measurements in Brackish Waters—Part 1: Extending Electrochemical pHT Measurements of TRIS Buffers to Salinities 5–20, Front. Mar. Sci., 5, 176, https://doi.org/10.3389/fmars.2018.00176, 2018.

Müller, J. D., Schneider, B., Aßmann, S., and Rehder, G.: Spectrophotometric pH measurements in the presence of dissolved organic matter and hydrogen sulfide: Perturbations of spec pH measurements, Limnol. Oceanogr. Methods, 16, 68–82, https://doi.org/10.1002/lom3.10227, 2018.

*Schneider, B. and **Müller, J. D.**: Biogeochemical Transformations in the Baltic Sea, Springer International Publishing, [Textbook], https://doi.org/10.1007/978-3-319-61699-5, 2018.

Müller, J. D.: Ocean acidification in the Baltic Sea : involved processes, metrology of pH in brackish waters, and calcification under fluctuating conditions, [Dissertation], Universität Rostock, https://doi.org/10.18453/rosdok_id00002303, 2018.

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*Wahl, M., Schneider Covachã, S., Saderne, V., Hiebenthal, C., **Müller, J. D.**, Pansch, C., and Sawall, Y.: Macroalgae may mitigate ocean acidification effects on mussel calcification by increasing pH and its fluctuations: Biogenic fluctuations mitigate OA effects, Limnol. Oceanogr., 63, 3–21, https://doi.org/10.1002/lno.10608, 2018.

2017

*Fritzsche, E., Gruber, P., Schutting, S., P., Fischer, J., Strobl, M., D., **Müller, J. D**, Borisov, S. M., and Klimant, I.: Highly sensitive poisoning-resistant optical carbon dioxide sensors for environmental monitoring, Analytical Methods, 9, 55–65, https://doi.org/10.1039/C6AY02949C, 2017.

*Saderne, V., Fietzek, P., **Müller, J. D.**, Körtzinger, A., and Hiebenthal, C.: Intense pCO2 and [O2] Oscillations in a Mussel-Seagrass Habitat: Implications for Calcification., Biogeosciences Discuss., [Preprint], 1–33, https://doi.org/10.5194/bg-2017-351, 2017.

2016

Müller, J. D., Schneider, B., and Rehder, G.: Long-term alkalinity trends in the Baltic Sea and their implications for CO2-induced acidification, Limnol. Oceanogr., 61, 1984–2002, https://doi.org/10.1002/lno.10349, 2016.

2015

*Schulz, J., Möller, K. O., Bracher, A., Hieronymi, M., Cisewski, B., Zielinski, O., Voss, D., Gutzeit, E., Dolereit, T., Niedzwiedz, G., Kohlberg, G., Schories, D., Kiko, R., Körtzinger, A., Falldorf, C., Fischer, P., Nowald, N., Beisiegel, K., Martinez-Arbizu, pedro, Rüssmeier, N., Röttgers, R., Büdenbender, J., Jordt-Sedlazeck, A., Koch, R., Riebesell, U., Iversen, M., Köser, K., Kwasnitschka, T., Wellhausen, J., Thoma, C., Barz, K., Rhode, S., Nattkemper, T. W., Schoening, T., Peeters, F., Hofmann, H., Busch, J., Hirche, H.-J., Niehoff, B., Hildebrandt, N., Stohr, E., Winter, C., Herbst, G., Konrad, C., Schmidt, M., Linke, P., Brey, T., Bange, H. W., Nolle, L., Krägefsky, S., Gröger, J., Sauter, E., Schulz, M., **Müller, J. D.**, Rehder, G., Stepputtis, D., Beszteri, B., Kloster, M., Kauer, G., Göritz, A., Gege, P., Freiherr von Lukas, U., and Bathmann, U. V.: Aquatische Optische Technologien in Deutschland, Marine Science Reports - Meereswissenschaftliche Berichte, 97, 1–83, https://doi.org/10.12754/msr-2015-97, 2015.

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