

Maike Sonnewald, Ph.D.

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Current position

7/2023–present	Assistant Professor: University of California Davis, CA
7/2023–present	Visiting Scholar: Princeton University, NJ
1/2022–present	Affiliate Assistant Professor: University of Washington, WA
2/2020–present	Affiliate Researcher: NOAA Geophysical Fluid Dynamics Laboratory (GFDL), NJ
8/2022–present	Associate Editor: <i>Journal of Artificial Intelligence for the Earth Systems</i> ¹

Education

2011-2016	University of Southampton, UK. Ph.D. Complex Systems Simulation through the National Oceanography Center Dissertation: Ocean model utility dependence on horizontal resolution Advisors: George Nurser, Joel J.-M. Hirschi, James Dyke
2006-2011	University of Southampton, UK. M. Sci. <i>magna cum laude</i> , complex systems simulation, 2011 M. Sci. <i>magna cum laude</i> , physical oceanography, 2010

Academic positions

11/2023	Visiting Professor: UC Lovaine, Bel.
2/2020–6/2023	Associate Research Scholar: Princeton University, NJ
2/2019–1/2022	Visiting Scientist: University of Washington
10/2015–2/2020	Postdoctoral Associate: Massachusetts Institute of Technology (MIT) . Advisor.: C. Wunsch, P. Heimbach & S. Dutkiewicz
2/2017–10/2019	Visiting Scientist: Harvard University
12/2018–1/2019	Visiting Scientist: Grenoble Les Alpes, Fr.
2016& 2017-2018	Visiting Scientist: University of Texas at Austin

Review articles (total: 3)

[1] Bronner, U., **Sonnewald, M.** and Wisbeck, M., *Marine modelling as the key to sustainable use and protection of the marine environment*. Invited, 2023, **The International Hydrographic Review**.

[2] **Sonnewald, M.**, Brajard, J., Duben, P., Lguensat, R. and Balaji, V., *Bridging theory, simulation, and observations of the global ocean using Machine Learning*, invited, 2021, **Environmental Research Letters**.

[2] Irrgang, C., Boers, N., **Sonnewald, M.**, Elizabeth A. Barnes, Christopher Kadow, Staneva, J., and Saynisch-Wagner, J. *Towards neural Earth system modelling by integrating artificial intelligence in Earth system science*, 2021, **Nature Machine Intelligence**. Featured on: [Carbonbrief](#), [Helmholtz Association of German Research Centers press release](#), [Physics.org](#), [eng-talks](#) and [Newsbreak](#).

Peer reviewed publications (total: 13)²

4 in review/revision, “*” indicates student advised and press coverage in [blue](#)

[4] **Sonnewald, M.**, Reeve, K., Lguensat, R. *A supergyre modulates the global overturning through upwelling in the Southern Ocean*. 2023, **Nature Commun. Earth Environ.**

²Manuscripts in preparation and in revision available at co-authors’ discretion.

- [5] Jones, D., **Sonneewald, M.**, Rosso, I., Zhou, S., and Boehme, L., *Unsupervised classification identifies coherent thermaline structures in the Weddell Gyre*. 2023, **Ocean Science**.
- [6] Clare, M.*, **Sonneewald, M.**, Lguensat, R., Deshayes, J. and Balaji, V., *Explainable Artificial Intelligence for Bayesian Neural Networks: Towards trustworthy predictions of ocean dynamics*. 2022, **Journal of Advances in Modeling Earth Systems**.
- [7] Kaiser, B., Saenz, J.A., **Sonneewald, M.** and Livescu, D., *Automated identification of dominant physical processes*, 2022, **Engineering Applications of Artificial Intelligence**. Available: ArXiv
- [8] J. Krasting, M. De Palma, J. Dunne, J. John, and **Sonneewald, M.** *Regional Sensitivity Patterns of Arctic Ocean Acidification Revealed With Machine Learning*, 2022, **Nature Commun. Earth Environ.** <https://doi.org/10.1038/s43247-022-00419-4>.
- [9] **Sonneewald, M.**, and Lguensat, R. *Revealing the impact of global heating on North Atlantic circulation using transparent machine learning*, 2021, **Journal of Advances in Modeling Earth Systems**. Available: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021MS002496>. Featured on cover, and separately in the “Machine Learning Application to Earth System Modeling” edition.
- [10] **Sonneewald, M.**, and Lguensat, R. , Radhakrishnan, A., Sayibou, Z.*, Wittenberg, A.T. and Balaji, V. *Revealing the impact of global warming on climate modes using transparent machine learning and a suite of climate models*, 2021, **International Conference on Machine Learning: Spotlight paper at ClimateChangeAI Workshop**. Available: <https://www.climatechange.ai/papers/icml2021/13>
- [11] **Sonneewald, M.**, Dutkiewicz, S., Hill, C. and Forget, G. *Elucidating Ecological Complexity: Unsupervised Learning determines global marine eco-provinces*, 2020, **Science Advances**. DOI: 10.1126/sciadv.aay4740. Featured on: [EOS science news by AGU](#), [MIT News](#), [Hakai Magazine](#), [ECCO story map](#), [The Batch](#), [SciTechDaily](#), [Yahoo! Finance](#), [Dailyhunt](#), [Firstpost](#) and [Scienceblog](#).
- [12] Le Bras, I., **Sonneewald, M.**, and Toole, J.M. *A bulk Potential Vorticity budget for the western North Atlantic based on observations*, 2019, **Journal of Physical Oceanography**. DOI: 10.1175/JPO-D-19-0111.1.
- [13] **Sonneewald, M.**, Wunsch, C. and Heimbach, P. *Unsupervised Learning Reveals Geography of Global Ocean Dynamical Regions*, 2019, **Journal of Earth and Space Science** edition “Geoscience paper of the future”. 6. <https://doi.org/10.1029/2018EA000519>. Featured on: [MIT News](#), [Artificial Intelligence Research](#), [Physics.org](#) and [ECN magazine](#).
- [14] **Sonneewald, M.**, C. Wunsch, and P. Heimbach, *Linear Predictability: A Sea Surface Height Case Study*, 2018, **Journal of Climate**, 31, 2599–2611, DOI.org/10.1175/JCLI-D-17-0142.1
- [15] Bulczak, A.I., Bacon, S., Naveira Garabato, A.C., Ridout, A., **Sonneewald, M.**, and Laxon, S.W. *Seasonal Variability of Sea Surface Height in the Coastal Waters and Deep Basins of the Nordic Seas*, 2014, **Geophysical Research Letters**, 42, DOI:10.1002/2014GL061796.
- [16] **Sonneewald, M.**, Hirschi, J.J.-M., Marsh, R., McDonagh, E.L. and King, B.A. *Atlantic meridional ocean heat transport at 26N: impact on subtropical ocean heat content variability*, 2013, **Ocean Science**, 9, (6), 1057-1069. DOI:10.5194/os-9-1057-2013.
- [17] In review: **Sonneewald, M.**, *A hierarchical ensemble manifold methodology for new knowledge: An application to ocean physics*, in review, **JAMES**.
- [18] In review: Navarra, G.G*, **Sonneewald, M.**, Deng, Y., Liguori, G. and Di Lorenzo, E. *Using Deep Learning to forecast marine fishery indicators in the North Pacific*. In review **Nature Communications Biology**.
- [19] In review: Khatri. H., Griffies, S.M., Storer, B.A., Buzzicotti, M., Aluie, H., **Sonneewald, M.**, Dussin, R. and Shao, A., *A scale-dependent analysis of the barotropic vorticity1budget in a global ocean simulation*. **JAMES**.
- [20] In review: Kaiser, B. and **Sonneewald, M.** *Build AI with scientific definitions of interpretability and explainability*. In review. **Nature Machine Intelligence**.

Other publications (total: 3)

- [21] **The ECCO Consortium.** *A Twenty-Year Dynamical Oceanic Climatology: 1994-2013. Part 1: Active Scalar Fields*, 2017, **MIT DSpace**: <https://dspace.mit.edu/handle/1721.1/107613>.
- [22] **The ECCO Consortium.** *A Twenty-Year Dynamical Oceanic Climatology: 1994-2013. Part 2: Velocities and Property Transports*, 2017, **MIT DSpace**: <https://dspace.mit.edu/handle/1721.1/109847>.
- [23] Gille, S., Abernathey, A., Chereskin, T., Cornuelle, B., Heimbach, P., Mazloff, M., Menemenlis, D., Rocha, C., Soares, S., **Maike Sonnewald**, Villas Boas, B., and Wang, J. *Open Code Policy for NASA Space Science: A perspective from ocean modeling and ocean data analysis*, 2018, **NASA White Paper**, Available: <https://tinyurl.com/NASA-WhitePaper>

Selected awards and honours

Honour	Elected a UC Davis Faculty Scholar of the Center for the Advancement of Multicultural Perspectives on Science (CAMPOS).
2023	Policy impact: World Climate Research Program by UNESCO and the International Science Council , invited panel speaker.
2023	Grant: Improving coastal sea level predictions with ocean process insight guided by machine learning. To NOAA Climate Program Office. PI. \$578,000
2023	Podcast feature: AGU “Third pod from the sun” and “Carry the two” collaboration.
2023	Grant: <i>Bridging theory to reality in projections of the Asian and West African monsoons (BRIDGE)</i> . National Environmental Research Council (UK). Co-I. £958,000 .
2022	Policy impact: World Climate Research Program by UNESCO and the International Science Council , invited panel speaker.
2021	Core member: University of California, Santa Barbara, Kavli Institute for Theoretical Physics (KITP) , “ML in the Physics of Climate”.
2021	Policy impact: Dept of Energy AI workshop ‘Ocean Grand Challenges’ keynote.
2021	Grant: French National Centre for Scientific Research (CNRS) laboratory collaboration, £2000.
2021	Policy impact: NOAA artificial intelligence strategy 2021-2025 . Agency wide recommendations.
2020-2021	Grant: Amazon Sustainability Data Initiative (ASDI), \$31,032.
2020	Grant: ASDI, \$48,595
2020	Policy impact: Work contributed to science basis for New Zealand’s Marine Protected Area legislation.
2017	Award: Kaufman Teaching Certificate Program (KTCP), MIT.
2016	Physical Oceanography Dissertation Symposium grant, University of Hawaii at Manoa, USA. \$1500.
2010	Graduate Scholarship: Engineering and Physical Sciences Research Council (ESPRC, UK).

Scientific cruises

2016	NORSEMAN II, Bering Strait mooring recovery and high resolution synoptic survey including Chukchi Sea.
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Invited conference panels

2021	Incorporating Data Science and Open Science in Aquatic Research Summit. 624 participants.
2020	AGU , <i>Challenges and opportunities of applying AI, ML and DL to problems in the environmental and geosciences.</i> ~1200+ participants.
2020	NOAA Workshop , <i>Leveraging AI in the Environmental Sciences.</i> 60+ participants.

Selected keynotes and invited talks (total: 63)

<u>2023</u>	total: 17
-	CLIVAR Predictability, Predictions, and Applications Interface Panel.
-	United Nations International Telecommunication Union.
-	University of Toronto Nobel Seminar Series.
<u>2022</u>	total: 14
-	CLIVAR Physical Oceanography review panel.
-	NOAA GFDL HQ site review.
Others	Climate Informatics , University of Liege , textbfSIAM, U. Cambridge , UC Davis , SIAM DS , U. Wisconsin-Madison , Max Planck Institute for Meteorology , UC Berkeley , MIT for EAPS and Mechanical Engineering , U. Rhode Island (Nov.) , IMSI , U. Chicago .
<u>2021</u>	<u>Talks total: 14</u>
-	AGU .
-	Dept of Energy AI workshop.
-	Climate Change AI .
-	NOAA , AI workshop.
Others	KITP , Scripps Institute of Oceanography , U. Washington , U. Chicago , International Conference on Machine Learning , Summit: Incorporating Data Science and Open Science in Aquatic Research , University Corporation for Atmospheric Research (UCAR) , U. California , Santa Cruz , GEOMAR Helmholtz Centre for Ocean Research , Technical U. Munich , Potsdam Institute for Climate Impact .
<u>2020</u>	<u>Talks total: 7</u>
-	NOAA Senior Management Meeting , Oceanic and Atmospheric Research .
Others	Los Alamos National Laboratory , U. Washington (engineering), U. Washington (phys. oceanography), U. British Columbia , NOAA , workshop, U. Washington (bio. oceanography).
<u>2019</u>	<u>Talks total: 7</u>
-	AGU .
-	Norway-US bilateral AI workshop . Two talks.
Others	Princeton University , WHOI , U. Tromsø , U. Bergen .
<u>2012-2018</u>	<u>Total talks: 17</u>
-	WHOI .
-	Columbia University , LDEO .
-	Yale University .
Others	MIT (2018 & 2015), Stony Brook University , U. Texas at Austin , U. Washington , Oregon State University , U. Oxford , MIT (Two invited student talks), U. Bristol , NOCS (2015, 2014 & 2013) and MONCACO meeting .

Mentoring and advising

2023-	Advising: Simon Draeger, UC Davis, Graduate.
2023-	Committee: Lin Yao, UC Davis, Graduate.
2023-	Advising: William Yik, Harvey-Mud, Holling Scholar (NOAA). Undergraduate.
2021-	Committee: Jacob Cohen, University of Washington. Ph.D. student.
2021-	Committee: Yvonne Jenniges, Alfred Wegener Institute (DE), Ph.D. student.
2021	Advising: Mariana Clare, Imperial College London, National Centre for Scientific Research (CNRS, Fr), Ph.D. student, now researcher at European Center for Medium Range Weather Forecasting.
2021-2022	Advising: Giangiacomo Navarra, Georgia Tech. Ph.D. student, now postdoc at Princeton.
2021	Advising: Zouberou Sayibou, Bronx Community College, undergraduate, now Junior at Stanford.
2019-	Mentoring: Catherine Wilka, now postdoc at Stanford.

Service

Review duties

Journals	Nature, JAMES, Geophysical Research Letters, Ocean Modelling, Journal of Geophysical Research, Journal of Physical Oceanography, Data Science and others.
Review Panel	NASA review panel 2017