Norman Julius Steinert

Senior Researcher

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Profile

I am a physical climate scientist, currently working at the CICERO Center for International Research in Oslo, Norway. My research investigates climate change mitigation scenarios and Earth system reversibility, and the role of tipping points in shaping long-term Earth system responses to climate change. This work focuses on self-amplifying climate feedbacks and their implications for climate mitigation scenarios. By combining Earth system models with reduced-complexity climate emulators, my research advances the understanding of climate feedbacks, their potential irreversibility under overshoot, and the risks they pose to achieving climate stabilization. Another major strand of my research focuses on the role of the land surface in the Earth system, with an emphasis on land-climate interactions, terrestrial carbon cycle dynamics, including permafrost-carbon release and high-latitude ecosystem stability under climate change.

Education

PhD in Physics, "Cum Laude", Complutense University of Madrid, *Madrid, Spain* — Oct 2017 – Dec 2021

Master of Science in Meteorology, Free University of Berlin, *Berlin, Germany* — Oct 2013 – Jul 2017

Bachelor of Science in Meteorology, Free University of Berlin, *Berlin, Germany* — Oct 2010 - Sept 2013

Career experience

Senior Researcher, CICERO – Center for International Climate Research, Oslo, Norway — Jan 2024 – present

Parental leave — June 2024 – Sept 2024

Postdoc, NORCE - Norwegian Research Centre, *Bergen, Norway* — Jan 2022 – Dec 2023

Research assistant, Global forecasters - CIEMAT, *Madrid, Spain* — Jun 2017 – Sept 2017

Intern, Reuniwatt, *Saint-Pierre, La Reunion, France* — Oct 2016 – Apr 2017

Student assistant, Max Planck Institute for Meteorology, *Hamburg, Germany* — Mar 2015 – Sept 2016

Intern, Alfred-Wegener-Institute, *Bremerhaven, Germany* — Feb 2014 – Apr 2014

Student assistant, FUB - Institute for Meteorology, *Berlin, Germany* — Nov 2013 – Jan 2015

Intern, ETH - Institute for Atmospheric and Climate Science, *Zurich, Switzerland* — Jul 2012 – Sept 2012

Student assistant, German Research Center for Geosciences, *Potsdam, Germany* — Jun 2012 – Nov 2013

Research mobility

Research stay, *3 months, 2023*, Potsdam Institute for Climate Impact Research, Potsdam, Germany

Research stay, *4 months, 2023*, UK Met Office and University of Exeter, Exeter, UK

Research stay, *1 months, 2021*, Utrecht University, *Utrecht, The Netherlands*

Research stay, *3 months, 2020-2021*, Max Planck Institute for Meteorology, *Hamburg, Germany*

Visiting Scientist positions

Jan 2025 – Dec 2025, Potsdam Institute for Climate Impact Research, Potsdam, Germany

Project funding

- NAVIGATE
  Navigating the uncharted territory of the Anthropocene climate
  WP co-lead, task lead (2.3/10 million NOK)
  Norwegian Research Council, Norway, 2025-2028
- Towards2020 Seed Funding Project
  GRAFITE (Global pRojections And Feedback Interactions in Tipping point Emulators)
  Project lead (0.5 million NOK)
  CICERO Center for Internation Climate Research, Oslo, Norway, 2024
- Fast Track Initiative Seed Funding Project
  LICORICE (Effects of climate-driven Land-surface Integrity Changes in permafrOst Regions on northward expanding agrICulturE)
  Project lead (0.5 million NOK)
  Bjerknes Centre for Climate Research, Bergen, Norway, 2023

Awards and Grants

- Best PYRN ECS Poster Presentation Award: Runner-up
  EUCOP6 European Conference on Permafrost, Puigcerdà, Spain, June 2023
- PhD Thesis Award, Spanish National Research Council - most relevant theses in 2021
  Spanish National Research Council (CSIC), Madrid, Spain, February 2023
- RCN Researcher Mobility Grant
  Research Council of Norway, NORCE Norwegian Research Centre, Bergen, Norway, December 2022
- Utrecht Network Young Researchers Grant
  Utrecht Network, April 2021

- Top 3 presentations at PhDay Physics Complutense 2019
  Complutense University Madrid, Spain, November 2019
- Ernst-Reuter-Gesellschaft Travel Grant
  Free University of Berlin, Germany, August 2016

Media and outreach

- NRK “The Daily News”, 13 Oct 2025, NRK1 TV Norway.
- CICERO News article, 13 Oct 2025, “New report confirms world reaches first climate tipping point”, CICERO.
- Jesse Steinmetz, 29 May 2025**,** “2 billion people could face chaotic and 'irreversible' shift in rainfall patterns if warming continues”, *Live Science*.
- Daniel Bardsley, 12 February 2025, “Climate change impact will continue beyond 2100 even if targets are met, study says”, *The National*.
- CICERODagen 2024, 25 April 2024, “En samtale om vippepunkter”, CICERO.
- Volker Mrasek, 20 June 2023, “Forscher modellieren zu erwartende Treibhausgasemissionen”, *Deutschlandfunk*.

Leadership and professional activities

- Member of advisory board for the Carbon Dioxide Removal Model Intercomparison Project Phase 2 (CDRMIP2), *2025-present*
- Member of the coordinating team for Reduced Complexity Model Intercomparison Project Phase 3 (RCMIP3), *2025-present*
- TCRE assessment (Jones et al., in prep.) co-lead Land contribution Group*, 2025-present*
- Domain co-lead TIPMIP permafrost domain*, 2024-present*
- Section co lead in Global Tipping Points Reports 2023 & 2025, *2023 & 2025*
- Student Mentorship, *Freie Universität Berlin, 2011-2013*

Code and software development

Experienced in code development using collaborative software best practices, releasing version-controlled open-source software. Experienced user of python, R, FORTRAN, bash, HTML, Git, HPC, LaTeX and Unix systems. Experience in handling and processing large climate and observational datasets (netcdf4, hdf5). Code and software developments include:

- PerCX Simple permafrost carbon response model: primary development. (*Steinert et al., 2025, ESD*); https://github.com/normansteinert/PerCX.git
- METEOR multi-timescale regional climate emulator: co-development. (*Sandstad et al., 2025, GMD*); https://github.com/benmsanderson/METEOR.git
- PRIME spatially resolving pattern-scaling emulator: co-development. (*Mathison et al., 2025, GMD*)

Supervision

Ulrike Mühlhaus, Masters's thesis, 2025, PIK, Potsdam, Germany

Callum Christie, Master's project, 2023, University of Exeter, Exeter, UK

Nagore Meabe Yanguas, Master's thesis, *2023*, Complutense University of Madrid, Spain

Alejandro Campos Saz, Master's thesis, *2022*, Complutense University of Madrid, Spain

Francisco Javier Pérez Pérez, Master's thesis, *2021*, Complutense University of Madrid, Spain

Mentoring-program, *2011-2014*, Free University of Berlin, Germany

Organization of Meetings

EGU General Assembly 2026, Session co-convener: Advances in climate change emulation for impact projections, *2026, Vienna, Austria*

EGU General Assembly 2026, Session co-convener: Towards net zero and beyond: remaining carbon budgets, negative emissions, mitigation pathways, overshoot and implications for policy, *2026, Vienna, Austria*

EGU General Assembly 2026, Session co-convener: Permafrost-climate-feedbacks: past, present and future, *2026, Vienna, Austria*

EGU General Assembly 2025, Session co-convener: Towards net zero and beyond: remaining carbon budgets, negative emissions, mitigation pathways and implications for policy, *2025, Vienna, Austria*

EGU General Assembly 2025, Session co-convener: Statistical and physical emulator for climate impacts, *2025, Vienna, Austria*

EGU General Assembly 2024, Session co-convener: Towards a net-zero world and beyond: remaining carbon budgets, ambitious mitigation pathways with or without temperature overshoot, and implications for policy, *2024, Vienna, Austria*

EUCOP6 - 6th European Conference on Permafrost, Session convener: "Modeling of permafrost-climate feedbacks in future scenarios"*, 2023*, Puigcerdà, Spain.

🗎 Publications

Peer-reviewed journal articles (by date)

Accepted/In review

- Ritchie, P., N. J. Steinert, ..., N. Wunderling: *The implications of overshooting 1.5°C on Earth system tipping elements - a review*
  In review [preprint]
- Steinert, N. J., J. Schwinger, E. Burke, B. Zhu, T. Gasser, G. Munday, C. Mathison, S.-W. Park, H. Lee: *AMOC tipping slows permafrost carbon release during overshoot.*
  In review [preprint]
- Kug, J.-S., Y. Shin, J.-H. Oh, C. Liu, S.-W. Yeh, J. Schwinger, K. Zickfeld, S.-I. An, S.-W. Son, S.-K. Min, H. Lee, N. Steinert: *Climate Change Hysteresis and Irreversibility*.
  In review
- Winkelmann, R., ..., N. J. Steinert, ..., et al.: *The Tipping Points Modelling Intercomparison Project (TIPMIP): Assessing tipping point risks in the Earth system*.
  In review [preprint]
- García-Pereira, F., J. F. González-Rouco, N. Meabe-Yanguas, P. de Vrese, N. J. Steinert, J. Jungclaus, S. Lorenz: *Permafrost sensitivity to soil hydro-thermodynamics in historical and scenario simulations with the MPI-ESM*.
  Accepted [preprint]; The Cryosphere
- Sandstad, M., N. J. Steinert, S. Baur, B. M. Sanderson: *METEORv1.0.1: A novel framework for emulating multi-timescale regional climate responses*.
  Accepted [preprint]; Geoscientific Model Development

2025

- Steinert, N. J., and B. M. Sanderson: *Normalizing the permafrost carbon feedback contribution to the Transient Climate Response to cumulative Emissions and the Zero Emissions Commitment*, 16, 1711–1721, (2025).
  Earth System Dynamics
- Sanderson, B., ... N. J. Steinert, ..., et al.: *flat10MIP: An emissions-driven experiment to diagnose the climate response to positive, zero, and negative CO2 emissions*, 18, 5699–5724, (2025).
  Geoscientific Model Development
- Steinert, N. J., J. Schwinger, R. Chadwick, J.-S. Kug, H. Lee: *Irreversible land water availability changes from a potential ITCZ shift during temperature overshoot*, 13 (5), e2024EF005787, (2025).
  Earth's Future
- Munday, G., C. D. Jones, N. J. Steinert, C. Mathison, E. Burke, C. Smith, C. Huntingford, R. Varney: *Risks of unavoidable impacts on forests at 1.5°C with and without overshoot*, 15, 650–655, (2025).
  Nature Climate Change
- Samantaray, A., K., & Steinert, N. J., P. Mooney: *Plant and soil characteristics as key predictors for future agricultural drought*, 20, 054059, (2025).
  Environmental Research Letters

- Mathison, C. T., E. Burke, E. Kovacs, G. Munday, C. Jones, C. Smith, C. Huntingford, A. Wiltshire, N. J. Steinert, L. Gohar, R. Varney: *A rapid application emissions-to-impacts tool for scenario assessment: Probabilistic Regional Impacts from Model patterns and Emissions (PRIME)*, 18, 1785-1808, (2025).
  Geoscientific Model Development
- Park, S-W., J.-S. Kug, H. Lee, N. J. Steinert, S.-I. An, S. Jongsoo: *Potential intensification of permafrost carbon feedback under net-zero and negative emissions*. 11, eadn8819, (2025).
  Science Advances

2024

- Schleussner, C.-F., ..., N. J. Steinert, ..., et al.: *Overconfidence in climate overshoot*, 634, 366-373 (2024).
  Nature
- Nitzbon, J., T. Schneider von Deimling, M. Aliyeva, S. E. Chadburn, G. Grossea, S. Laboor, H. Lee, G. Lohmann, N. J. Steinert, S. M. Stuenzi, M. Werner, S. Westermann, and M. Langer: *No respite from permafrost-thaw impacts in absence of a global tipping point*, 14, 573-585 (2024).
  Nature Climate Change
- Steinert, N. J., F. J. Cuesta-Valero, F. García-Pereira, P. de Vrese, C. Melo-Aguilar, E. García-Bustamante, J. H. Jungclaus, J. F. González-Rouco: *Underestimated land heat uptake alters the global energy distribution in CMIP6 climate models*, 51(10), e2023GL107613, (2024).
  Geophysical Research Letters
- García-Pereira, F., J. F. González-Rouco, C. Melo-Aguilar, N. J. Steinert, E. García-Bustamante, P. de Vrese, Johann Jungclaus, Stephan Lorenz, Stefan Hagemann, F. J. Cuesta-Valero, A. García-García and H. Beltrami: *First comprehensive assessment of industrial era land heat uptake from multiple sources*, 15, 547-564, (2024).
  Earth System Dynamics
- Bustamante, M., ..., N. J. Steinert, ..., et al.: *Ten New Insights in Climate Science 2023/2024*, 7, e19, 1-30, (2024).
  Global Sustainability
- Wunderling, N., … N. J. Steinert, …, et al.: *Climate tipping point interactions and cascades: A review*, 15(1), 41–74, (2024).
  Earth System Dynamics
- García-Pereira, F., J. F. González-Rouco, T. Schmid, C. Melo-Aguilar, C. Vegas-Cañas, N. J. Steinert, P. J. Roldán-Gómez, F. J. Cuesta-Valero, A. García-García, H. Beltrami, and P. de Vrese: *Thermodynamic and hydrological drivers of the subsurface thermal regime in Central Spain*, 10(1), 1–21, (2024).
  SOIL

2023

- Steinert, N. J., M. V. Debolskiy, E. J. Burke, F. García-Pereira, and H. Lee: *Evaluating permafrost definitions for global permafrost area estimates in CMIP6 climate models*, 19(1), 014033, (2023).
  Environmental Research Letters
- de Vrese, P., G. Georgievski, J. F. Gonzalez Rouco, D. Notz, T. Stacke, N. J. Steinert, S. Wilkenskjeld, and V. Brovkin: *Representation of soil hydrology in permafrost regions may explain large part of inter-model spread in simulated Arctic and subarctic climate*, 17(5), 2095–2118, (2023).
  The Cryosphere

2022

- Schwinger, J., A. Asaadi, N. J. Steinert, H. Lee: *Emit now, mitigate later? Earth system reversibility under overshoots of different magnitude and duration*, 13, 1641–1665, (2022).
  Earth System Dynamics
- Martin, M., … N. J. Steinert, …, et al.: *Ten new insights in climate science 2022*, 5, e20, 1–20, (2022).
  Global Sustainability.
- Melo-Aguilar, C. A., J. F., González-Rouco, N. J., Steinert, H., Beltrami, F., Cuesta-Valero, A., García-García, F., García-Pereira, E., García-Bustamante, P. Roldán-Gómez, T. Schmid and J. Navarro: *Near-surface soil thermal regime and land–air temperature coupling: a case study over Spain*., 2022.
  International Journal of Climatology

2021

- González-Rouco, J. F., Steinert, N. J., García-Bustamante, E., Hagemann, S., De-Vrese, P., Jungclaus, J. H., Lorenz, S. J, Melo-Aguilar, C., and: *Increasing the depth of a Land Surface Model: Part I: Impacts on the Subsurface Thermal Regime and Energy Storage*, 22(12), 3211-3230, (2021).
  Journal of Hydrometeorology
- Steinert, N. J., González-Rouco, J. F., De-Vrese, P., García-Bustamante, E., Hagemann, S., Melo-Aguilar, C., Jungclaus, J. H., and Lorenz, S. J.: *Increasing the depth of a Land Surface Model: Part II: Temperature Sensitivity to Improved Subsurface Thermodynamics and Associated Permafrost Response,* 22(12), 3231-3254, (2021).
  Journal of Hydrometeorology
- Steinert, N. J., González-Rouco, J. F., García-Bustamante, E., Melo-Aguilar, C., García-Pereira, F., and Alexeev, V.: *Agreement of Analytical and Simulation-Based Estimates of the Required Land Depth in Climate Models*, 48(20), e2021GRL094273, (2021).

Geophysical Research Letters

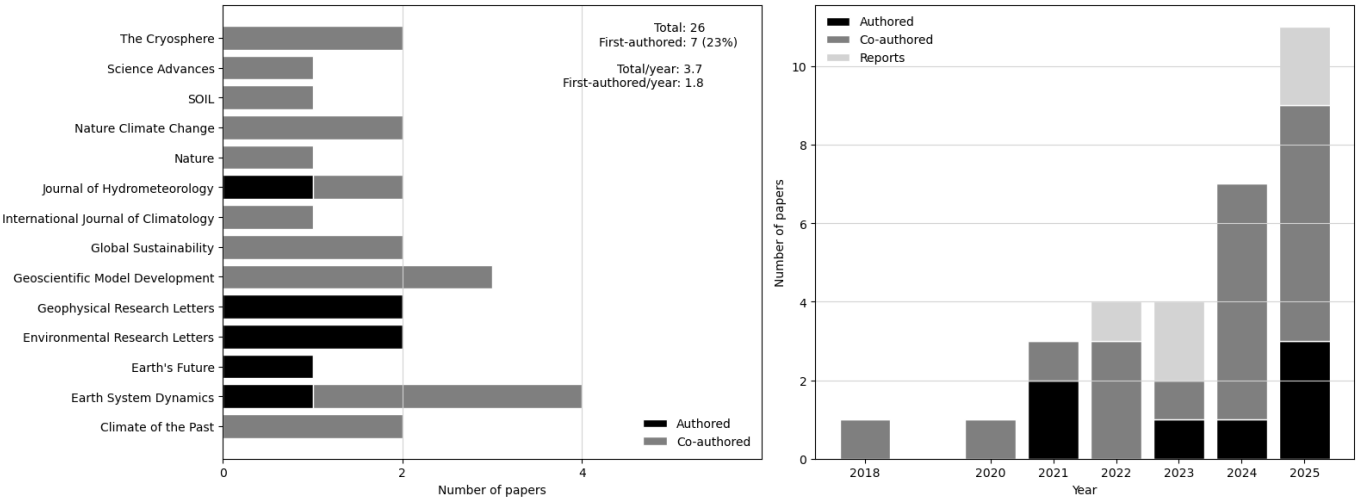
2018–2020

- Melo-Aguilar, C., González-Rouco, J. F., García-Bustamante, E., Steinert, N., Jungclaus, J. H., Navarro, J., and Roldán-Gómez, P. J.: *Methodological and physical biases in global to subcontinental borehole temperature reconstructions: an assessment from a pseudo-proxy perspective*, 16, 453–474, (2020)
  Climate of the Past
- Melo-Aguilar, C., González-Rouco, J. F., García-Bustamante, E., Navarro-Montesinos, J., and Steinert, N.: *Influence of radiative forcing factors on ground–air temperature coupling during the last millennium: implications for borehole climatology*, 14, 1583–1606, (2018).
  Climate of the Past

Reports

- Lenton, T. M., Milkoreit, M., Willcock, S., Abrams, J.F., Armstrong, McKay, D.I., Buxton, J.E., Donges, J.F., Loriani, S., Wunderling, N., Alkemade, F., Barrett, M., Constantino, S., Powell, T., Smith, S.R., Boulton, C. A., Pinho, P., Dijkstra, H.A. Pearce-Kelly, P., Roman-Cuesta, R.M., Dennis, D. (eds), (2025), ***Global Tipping Points Report 2025***. University of Exeter, Exeter, UK.
- Planetary Boundaries Science (2025). ***Planetary Health Check 2025***. Potsdam Institute for Climate Impact Research, Potsdam, Germany.
- T. M. Lenton, D.I. Armstrong McKay, S. Loriani, J.F. Abrams, S.J. Lade, J.F. Donges, M. Milkoreit, T. Powell, S.R. Smith, C. Zimm, J.E. Buxton, E. Bailey, L. Laybourn, A. Ghadiali, J.G. Dyke (eds) (2023), ***Global Tipping Points Report 2023***. University of Exeter, Exeter, UK.
- Future Earth, The Earth League, WCRP (2023), ***10 New Insights in Climate Science 2023/2024***. Stockholm
- Future Earth, The Earth League, WCRP (2022), ***10 New Insights in Climate Science 2022***. Stockholm

Statistics (Published/ in press, including scientific reports)



Publication statistics: First-authored (black), co-authored (gray) and scientific report (light gray) publications per scientific peer-reviewed journal (left) and per year (right). Per-year statistics are calculated from the year of first publication in the respective classification.

Languages

- German (Native)
- English (C2)
- Spanish (B1)
- Norwegian (A2)