

Clara Burgard

🏠 Grenoble, France

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🏠 Born 30.11.1991 in Strasbourg, France

I am a polar climate scientist particularly interested in the cryosphere. My research focusses on understanding better the interactions between the polar cryosphere and the climate system, especially ice-ocean interactions, with climate models.

EMPLOYMENT HISTORY

Postdoctoral researcher

Institut des Géosciences et de l'Environnement, Université Grenoble Alpes (UGA)

since 10.2022
Grenoble, France

- › Development of deep learning parameterisations to represent the melt at the base of Antarctic ice shelves as part of the IDEX DEEP-MELT project.

› MODELLING MACHINE LEARNING

Postdoctoral researcher

Institut des Géosciences et de l'Environnement, Centre National de la Recherche Scientifique (CNRS)

10.2020 – 09.2022
Grenoble, France

- › Evaluation, improvement and development of parameterisations to represent the melt at the base of Antarctic ice shelves as part of the H2020 PROTECT project

› MODELLING INTERNATIONAL COLLABORATION

Scientific coordinator for the Earth League

Department "Climate Service Center Germany (GERICS)", Helmholtz-Zentrum Geesthacht

01.2020 – 06.2020
Hamburg, Germany

- › Coordination of a voluntary alliance of prominent sustainability scholars (Earth League)
- › Tasks included the preparation and follow-up of virtual meetings, the coordination of collaborative publications, the support in the development of future projects of the alliance.

› PROJECT MANAGEMENT INTERNATIONAL COLLABORATION MICROSOFT OFFICE

Postdoctoral researcher

Working group "Sea Ice in the Earth System", Max Planck Institute for Meteorology

06.2019 – 12.2019
Hamburg, Germany

- › Development of a novel observation operator to translate the Arctic Ocean climate state as simulated by climate models (e.g. Max Planck Institute Earth System Model) into microwave brightness temperatures as could be observed by satellites from space.

› DATA ANALYSIS PROJECT MANAGEMENT CLIMATE MODELS 1D-MODELING
PASSIVE MICROWAVE REMOTE SENSING PYTHON BASH CLIMATE DATA OPERATORS GIT

Doctoral researcher

Working group "Sea Ice in the Earth System", Max Planck Institute for Meteorology

04.2016 – 06.2019
Hamburg, Germany

- › Analysis of the Arctic Ocean energy budget in simulations by a range of global climate models (CMIP5) to understand drivers of the ocean warming and sea-ice melting.
- › Development of a novel observation operator to translate the Arctic Ocean climate state as simulated by climate models (e.g. Max Planck Institute Earth System Model) into microwave brightness temperatures as could be observed by satellites from space.
- › This research was mainly funded by the ESA CCI Sea ice Phase 2.

› DATA ANALYSIS PROJECT MANAGEMENT CLIMATE MODELS 1D-MODELING
PASSIVE MICROWAVE REMOTE SENSING PYTHON BASH CLIMATE DATA OPERATORS GIT

Student assistant

Working group "Sea Ice in the Earth System", Max Planck Institute for Meteorology

01.2015 – 12.2015
Hamburg, Germany

- › Investigation of the Arctic Ocean energy budget in different reanalyses (ERA-Interim, NCEP, JR-25, C-GLORS).

› DATA ANALYSIS REANALYSES PYTHON BASH CLIMATE DATA OPERATORS

Student assistant

Working group "Sea ice remote sensing", Institute of Oceanography, University of Hamburg

04.2014 – 12.2014
Hamburg, Germany

- › Development of a program to compare satellite sea-ice observations from SMOS to in-situ observations conducted from a ship.

› DATA ANALYSIS PASSIVE MICROWAVE REMOTE SENSING SHIP OBSERVATIONS PYTHON

Student assistant

Working group "Integrated remote sensing", Institute of Geophysics and Meteorology,
University of Cologne

04.2013 – 07.2013

Cologne, Germany

- › Development of a program to format cloud and water vapor observations into a standard format for a project database.

› DATA ANALYSIS OBSERVATIONS FORTRAN

EDUCATION



Ph.D. in Geosciences

International Max Planck Research School for Earth System Modelling,
Max-Planck-Institute for Meteorology and University of Hamburg

04.2016 – 06.2019

Hamburg, Germany

- › THESIS TOPIC: Rethinking the relationship between the observed, simulated and real Arctic sea-ice evolution
- › ADVISORS: Dirk Notz, Lars Kaleschke

M.Sc. Integrated Climate System Sciences

University of Hamburg

10.2013 – 11.2015

Hamburg, Germany

- › THESIS TOPIC: Drivers of past and future Arctic sea-ice evolution in CMIP5 models
- › ADVISORS: Dirk Notz, Lars Kaleschke

B.Sc. Geophysics and Meteorology

University of Cologne

10.2010 – 07.2013

Cologne, Germany

- › THESIS TOPIC: Schneebeobachtungen mittels Mikro-Regen-Radar in Polargebieten (Snow observations with a Micro Rain Radar in polar regions)
- › ADVISORS: Maximilian Maahn, Susanne Crewell, Nicole van Lipzig

Abibac, German-French Secondary School leaving examination

Lycée International des Pontonniers

09.2002 – 07.2009

Strasbourg, France

- › Graduated with high honours

INTERNATIONAL EXPERIENCE



Visiting scientist

Working group "Paleo and Polar Climate" of Marika Holland, National Center of
Atmospheric Research

03.2018 – 04.2018

Boulder, CO, USA

- › Investigation of the use of the 1D sea-ice model ICEPACK developed by the CICE Consortium (incl. Los Alamos National Laboratory and NCAR) for the simulation of microwave brightness temperatures.

› 1D-MODELING PYTHON FORTRAN

Visiting scientist

Working group of Alexandra Jahn at the Institute for Arctic and Alpine Research &
Department for Atmospheric and Oceanic Sciences, University of Colorado

01.2018 – 04.2018

Boulder, CO, USA

- › Exchange and collaboration on the development of the Arctic Ocean Observation Operator.

› DATA ANALYSIS 1D-MODELING PYTHON

6-weeks Master's course

University Centre in Svalbard

02.2015 – 03.2015

Longyearbyen, Norway

- › Course about the remote sensing of the cryosphere (glaciers, ice sheets, sea ice, snow).

› REMOTE SENSING FIELDWORK

Internship

Department for Observation Systems, Météo France

02.2013 – 03.2013

Toulouse, France

- › Experimental testing of an in-situ measurement system for snow height.

› OBSERVATIONS PRACTICAL EXPERIMENTS

ERASMUS semester

University Centre in Svalbard

08.2012 – 12.2012

Longyearbyen, Norway

- › Course on Polar Meteorology, including one-week measurement campaign on land.
- › Course on Polar Oceanography, including one-week measurement cruise.

› DATA ANALYSIS OBSERVATIONS FIELDWORK MATLAB

PEER-REVIEWED PUBLICATIONS



Jourdain, N.C., P. Mathiot, **C. Burgard**, J. Caillet and C. Kittel (2022): [Ice shelf basal melt rates in the Amundsen Sea at the end of the 21st century](#), *Geophysical Research Letters*, doi: 10.1029/2022GL100629.

We build an ensemble of three ocean–sea–ice–ice–shelf simulations for both the recent decades and the late 21st century. Our simulations suggest that high-end melt projections previously used to constrain recent sea level projections may have been significantly overestimated.

Burgard, C., N. C. Jourdain, R. Reese, A. Jenkins and P. Mathiot (in review): ["An assessment of basal melt parameterisations for Antarctic ice shelves"](#), *The Cryosphere Discussions*, doi: 10.5194/tc-2022-32.

The ocean-induced melt at the base the floating ice tongues (ice shelves) around Antarctica is the highest uncertainty factor in the Antarctic contribution to future sea level. We re-tune, assess and compare the performance of several existing parameterisations to simulate basal melt rates on a circum-Antarctic scale, using an ocean simulation resolving the sub-shelf cavities as our reference. We find that simple quadratic slope-independent and plume parameterisations yield the best compromise.

Smith, A., A. Jahn, **C. Burgard**, D. Notz (2022): ["Improving model-satellite comparisons of sea ice melt onset with a satellite simulator"](#), *The Cryosphere*, 16, 3235–3248, doi: 10.5194/tc-16-3235-2022.

The timing of Arctic sea ice melt each year is an important metric for assessing how sea ice in climate models compares to satellite observations. Here, we utilize a new tool for creating more direct comparisons between climate models projections and satellite observations of Arctic sea ice, such that the melt onset dates are defined the same way. This tool allows us to identify climate model biases more clearly and gain more information about what the satellites are observing.

Durand, G., M. van den Broeke, G. Le Cozannet, T.L. Edwards, P.R. Holland, N.C. Jourdain, B. Marzeion, R. Mottram, R.J. Nicholls, F. Pattyn, F. Paul, A.B. Slangen, R. Winkelmann, **C. Burgard**, C.J. van Calcar, J.B. Barré, A. Bataille, and A. Chapuis (2022): ["Sea-Level Rise: From Global Perspectives to Local Services"](#), *Frontiers in Marine Sciences*, doi: 10.3389/fmars.2021.709595.

Overview paper of the motivation and working plan of the H2020 PROTECT project. We advocate that addressing the problem of future sea-level rise and its impacts requires (i) bringing together a transdisciplinary scientific community, from climate and cryospheric scientists to coastal impact specialists, and (ii) interacting closely and iteratively with users and local stakeholders to co-design and co-build coastal climate services, including addressing the high-end risks.

Burgard, C., D. Notz, L.T. Pedersen and R.T. Tonboe (2020): ["The Arctic Ocean Observation Operator for 6.9 GHz \(ARC30\) – Part 2: Development and evaluation"](#), *The Cryosphere*, 14, 2387-2407, doi: 10.5194/tc-14-2387-2020.

Presentation of the workflow of the Arctic Ocean Observation Operator (ARC30) that we developed, including a comparison of the microwave brightness temperatures simulated with ARC30 from climate model output with brightness temperatures observed by satellites. We find that the two sets of brightness temperatures compare well in cold conditions and that differences in warm conditions are driven by uncertainty in the simulated sea-ice concentration and melt-pond fraction.

Burgard, C., D. Notz, L.T. Pedersen and R.T. Tonboe (2020): ["The Arctic Ocean Observation Operator for 6.9 GHz \(ARC30\) – Part 1: How to obtain sea-ice brightness temperatures at 6.9 GHz from climate model output"](#), *The Cryosphere*, 14, 2369-2386, doi: 10.5194/tc-14-2369-2020.

Investigation of the feasibility of an observation operator producing passive microwave brightness temperatures for sea ice at a frequency of 6.9 GHz. Experiments conducted in a 1D setup, using a complex 1D thermodynamic sea-ice model and a 1D microwave emission model. We find that realistic brightness temperatures can be simulated in winter from a simplified linear temperature profile and a self-similar salinity profile in the ice.

Burgard, C. and D. Notz (2017): ["Drivers of Arctic Ocean warming in CMIP5 models"](#). *Geophysical Research Letters*, 44, 4263-4271, doi: 10.1002/2016GL072342.

Investigation of changes in the Arctic Ocean energy budget simulated by 26 general circulation models from the CMIP5 framework to understand whether the Arctic Ocean warming between 1961 and 2099 is primarily driven by changes in the net atmospheric surface flux or by changes in the meridional oceanic heat flux. We find that the models strongly disagree, due to different changes in the meridional oceanic heat flux.

Maahn, M., **C. Burgard**, S. Crewell, I.V. Gorodetskaya, S. Kneifel, S. Lhermitte, K. Van Tricht and N.P. van Lipzig (2014): ["How does the spaceborne radar blind zone affect derived surface snowfall statistics in polar regions?"](#). *Journal of Geophysical Research: Atmospheres*, 119(24), 13-604, doi : 10.1002/2014JD022079.

Investigation of the effect of the blind zone of the CloudSat satellite near the surface on snowfall estimates by comparing snowfall estimates based on CloudSat measurements with snowfall estimates based on a ground-based Micro-Rain-Radar (MRR). Two blind zone heights were investigated. We find that the resulting snowfall statistics from CloudSat are biased compared to the MRR, for both blind zone heights.

OTHER PUBLICATIONS



Bouissou, B., **C. Burgard** and N.C. Jourdain (submitted). [Parameterising ocean-induced melt of an idealised Antarctic ice shelf using deep learning](#), *Proceedings of the ECCOMAS Congress 2022*.

Short conference paper summarising the results of B. Bouissou's master internship. We find that ocean-induced sub-shelf melt can be parameterised using a neural network in an idealised geometry and taking a few limitations into account.

Regoto, P., **Burgard, C.** and Jones, C. (2022). What Do We Mean By "Climate" And "Climate Change"?, *Frontiers for Young Minds*, doi: 10.3389/frym.2022.671886.

Nogherotto, R., **Burgard, C.** and Jones, C. (2022). What is causing our climate to change so quickly now?, *Frontiers for Young Minds*, doi: 10.3389/frym.2022.668763.

Contributions to special issue "Climate Change" of the *Frontiers for Young Minds* journal, which is aimed at a young audience. The manuscripts are reviewed by children.

Burgard, C. (2019). "Rethinking the relationship between the observed, simulated and real Arctic sea-ice evolution". *PhD Thesis*, Universität Hamburg, Hamburg. doi:10.17617/2.3165898.

10 single-author and 4 co-author blog posts for the *EGU Cryosphere Blog* between 2016 and 2021, e.g.

Burgard, C. (2016). Image of the Week – The Journey of a Snowflake, *EGU Cryosphere Blog*, awarded best EGU Blog Post 2016.

Blog posts about diverse cryospheric topics.

Bell H., **C. Burgard**, A. Winkler, M. Yasir (2015): Common Impacts of Mining, Natural Gas Extraction and Shipping Activities in the Arctic. *ACCESS newsletter 11*.

Synthesis of student summer school projects investigating the impacts of different activities in the Arctic on the environment, economy and population.

CONFERENCES & WORKSHOPS AND TRAINING SCHOOLS

PRESENTATIONS

Forum for Research into Ice Shelf Processes 2022	<i>Northumbria, UK, 09.2022</i>
Machine Learning for Polar Regions Workshop	<i>online, 06.2022</i>
8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS) 2022	<i>Oslo, Norway, 06.2022</i>
EGU General Assembly 2022	<i>Vienna, Austria, 05.2022</i>
Ocean Sciences Meeting 2022 - virtual presentation	<i>online, 02.2022</i>
vEGU 2021 - vPICO presentation	<i>online, 04.2021</i>
shareEGU 2020 - Pico Presentation (Highlight)	<i>online, 05.2020</i>
IGS Symposium "Sea Ice at the Interface"	<i>Winnipeg, MB, Canada, 08.2019</i>
European Security Seminar - North, George C. Marshall Center - Invited	<i>Garmisch-Partenkirchen, Germany, 02.2019</i>
3 Cluster Conference - Invited	<i>Berlin, Germany, 09.2018</i>
POLAR2018	<i>Davos, Switzerland, 06.2018</i>
Cryospheric and Polar Processes Seminar, National Snow and Ice Data Center	<i>Boulder, CO, USA, 02.2018</i>
Workshop on improved satellite retrievals of sea-ice concentration and sea-ice thickness for climate applications - Invited	<i>Hamburg, Germany, 10.2017</i>
Joint Seminar at the Max Planck Institute for Meteorology	<i>Hamburg, Germany, 08.2017</i>
Polar Prediction Workshop & 2nd Sea Ice MIP Meeting	<i>Bremerhaven, Germany, 03.2017</i>

POSTERS

Arctic System Change Workshop, National Center for Atmospheric Research	<i>Boulder, CO, USA, 04.2018</i>
Workshop on Multi-scale modelling of ice characteristics and behavior	<i>Cambridge, UK, 09.2017</i>
EGU General Assembly 2017	<i>Vienna, Austria, 04.2017</i>
EGU General Assembly 2016	<i>Vienna, Austria, 04.2016</i>

TRAINING SCHOOLS

GeoScience Communication School	Trieste, Italy, 09.2019
Snow Winter School	Hailuoto, Finland, 02.2019
Polar Prediction School	Abisko, Sweden, 04.2018
Summer School on Earth System Modelling	Hamburg, Germany, 09.2017
NERC Advanced Training Course - Earth Observations for Weather and Climate Studies	Reading, UK, 09.2016
Arctic Climate Change, Economy and Society and Arctic Resilience Report Summer School	Stockholm, Sweden, 09.2014

ACADEMIC SERVICE

Member of the Organization team <i>for the weekly IGE seminars</i>	since 09.2021 Grenoble, France
Reviewer <i>for scientific publications such as The Cryosphere, Journal of Geophysical Research – Oceans, Science Advances, IPCC assessment reports, Journal of Climate</i>	since 12.2016
Convener <i>Mini-Symposium "Mathematics of Sea Ice, Ice Sheets and Ice Shelves" at ECCOMAS 2022</i>	06.2022 Oslo, Norway
Supervisor <i>Master internship of Benjamin Bouissou: "Parameterization of basal melting of an ice shelf with idealized geometry via a neural network"</i>	02.2022 - 06.2022 Université Grenoble Alpes
Early Career member <i>of the H2020 PROTECT Steering Committee</i>	10.2020 - 09.2021
Convener <i>Short course webinar "Science Blogging for Beginners" at shareEGU 2020</i>	05.2020 online
Convener <i>Short course "Polar Science Career Panel" at the EGU General Assembly 2018</i>	04.2018 Vienna, Austria
Convener <i>Short courses "Polar Science Career Panel" and "Successful strategies to design, develop and write a scientific paper" at the EGU General Assembly 2017</i>	04.2017 Vienna, Austria
Member of the Organization Committee <i>Max Planck Phdnet "Visions in Science" conference</i>	11.2016 - 10.2017 Berlin, Germany
PhD representative <i>International Max Planck Research School for Earth System Modelling</i>	10.2016 - 10.2017 Hamburg, Germany

OUTREACH & OTHER ACTIVITIES

Co-Developer <i>of the role play game "Cold Cooperation"</i>	since 06.2017
<ul style="list-style-type: none"> › A role game for older pupils, students, and adults about the trade-off between reducing CO2 emissions and sustaining a thriving economy, through the example of the sea-ice loss in the Arctic region. 	
Regular member of the EGU Cryosphere Division Blog Team <i>Author & Editor, Chief Editor (04.2017 - 05.2020), Outreach Officer (05.2020 to 05.2022)</i>	since 04.2016
<ul style="list-style-type: none"> › Writing and review of blog posts › Management of content and team, recruitment of authors and editors. 	
Co-Initiator and Member of the Editorial Team <i>of the Max Planck Institute for Meteorology Twitter account</i>	01.2018 – 12.2019
<ul style="list-style-type: none"> › Co-author on the proposal for the creation and management of the institutional @MPI_Meteo Twitter account › Communication with paper authors on the redaction of tweets and preparations of figures to be published through the Twitter account 	

Climate scientist providing input <i>at the I.C.E. Camp organized by the in.media.vitae Foundation and Arved Fuchs</i>	07.2018 & 07.2019
› Yearly recurring educative expedition in the Baltic Sea for a group of 16- to 18-year-olds, including lectures and practicals on climate change	
Initiator and organizer <i>of the internal Clim*art contest at the Max-Planck Institute for Meteorology</i>	11.2018 & 11.2019
› Internal institute contest that had the aim to consider more or less scientifically meaningful figures from an artistic perspective	
Initiator and coordinator <i>of the Climate Model Calendar 2019 and 2020</i>	2018 & 2019
› Early career researchers from Hamburg posed in a setting artistically representing their research topic related to climate modeling. The calendar was distributed within the Hamburg climate science community.	
Contributor <i>of the Nacht des Wissens Hamburg</i>	11.2017
› Quiz for the lay public about polar and ice facts	
Support for school workshops <i>at the Hamburger Pupil Congress (Schülerkongress) about climate change</i>	2016, 2017, 2019
› Debate about potential measures to slow down climate change	
› Playing our “Cold Cooperation” game	
› Discussion about mobility concepts for a climate-friendly future	

SCHOLARSHIPS & AWARDS

Recipient of Max Planck Institute Bonus <i>given for an exceptional contribution to the Max Plank Institute for Meteorology</i>	06.2019
› Development of a concept and editorial structure of an institutional Twitter account	
Recipient of a Travel Award <i>funded by the World Climate Research Programme (WCRP)’s Climate and Cryosphere (CliC) and APECS to attend the POLAR2018 conference in Davos, Switzerland.</i>	06.2018
› Award worth up to 890 CHF	
Author of the Best EGU Blog Post 2016 <i>for the blog post “The Journey of a Snowflake”</i>	01.2017
Scholarship <i>by the Heinrich Böll Stiftung</i>	04.2012 - 11.2015
› Support during the second half of my B.Sc. studies and full M.Sc. studies	
1st place <i>in the journalistic contest “Chassé-Croisé” organized by the French-German Youth Foundation</i>	06.2009

SKILLS

Programming	Expert: Python, CDO, UNIX Advanced: Bash, Matlab, LaTeX Beginner: Fortran 95, Git
Software	Expert: Microsoft PowerPoint Advanced: Microsoft Excel, Microsoft Word
Languages	Bilingual: German, French Fluent: English Good: Spanish Basic: Norwegian, Italian