

GIJS DE BOER

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Summary of Work to Date

I have undertaken work to improve understanding of the Earth system, specifically including key processes related to the Earth's atmosphere and surface, the interactions between them, and the impact of such interactions on planetary weather and climate. This has included deployment of various observing systems in connection with field campaigns spanning the globe, from the tropics to the Arctic Ocean. These campaigns have included land-, ship-, and airborne deployment of remote- and in-situ sensors and have been sponsored by various agencies, including NSF, NOAA, DOE, ONR, and NASA. It also includes supporting the development and management of a robust program to deploy uncrewed aircraft systems for Earth System research at the University of Colorado. These efforts have resulted in a significant number of publications in peer-reviewed journals, including numerous data papers that describe datasets collected, and the publication of numerous community data sets. In addition, I have served in a variety of leadership roles supporting the broader scientific community to enhance collaborative research outcomes. Finally, I have taken on administrative roles supporting the University of Colorado, helping develop strategic partnerships, advance principles of diversity, equity, and inclusion, and implement strategic visions.

Education and Training

2009-2011 Postdoctoral Fellow, Lawrence Berkeley National Laboratory
2004-2009 PhD, The University of Wisconsin – Madison (Atmospheric and Oceanic Sciences)
2002-2004 M.S., The University of Wisconsin – Madison (Atmospheric and Oceanic Sciences)
1998-2002 B.S., Cornell University (Earth and Atmospheric Sciences)

Professional Experience

2022-present: *Senior Research Scientist*, The Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado Boulder
2022-present: *Director of National Laboratory Partnerships*, Research and Innovation Office (RIO) at the University of Colorado Boulder
2021-present: *Associate Director for Science, Chief Scientist*, Integrated Remote and In Situ Sensing (IRISS) at the University of Colorado Boulder
2020-present: *Founder*, Boreas Consulting
2011-2022: *Research Scientist I-III*, The Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado Boulder
2011-2012: *Project Scientist*, Lawrence Berkeley National Laboratory
2009-2011: *Postdoctoral Researcher*, Lawrence Berkeley National Laboratory
2009: *Postdoctoral Scholar*, The University of Wisconsin – Madison
2002-2009: *Research Assistant*, The University of Wisconsin – Madison
2001-2002: *Research Assistant*, Northeast Regional Climate Center at Cornell University
2001: *Teaching Assistant*, Cornell University: Dept. of Earth and Atmospheric Science

Selected Peer-Reviewed Products

[79 peer-reviewed publications, 22 published data sets since 2008, h-index: 29]. A full list is available at https://psl.noaa.gov/people/gijs.deboer/Research_Website/Gijs_de_Boer_Publications.html

- de Boer, G., et al., 2023: **Supporting Advancement in Weather and Water Prediction in the Upper Colorado River Basin: The SPLASH Campaign**, *Bull. Amer. Meteor. Soc.*, accepted, <https://doi.org/10.1175/BAMS-D-22-0147.1>.
- Feldman, et al., including G. de Boer: **The Surface Atmosphere Integrated Field Laboratory (SAIL) Campaign**, *Bull. Amer. Meteor. Soc.*, accepted, <https://doi.org/10.1175/BAMS-D-22-0049.1>.
- Oehri, J., et al., including G. de Boer: **Vegetation Type is an Important Predictor of the Arctic Summer Land Surface Energy Budget**, *Nature Comm.*, 13, 6379, <https://doi.org/10.1038/s41467-022-34049-3>.
- de Boer, G., R. Calmer, G. Jozef, J. Cassano, J. Hamilton, D. Lawrence, S. Borenstein, A. Doddi, C. Cox, J. Schmale, A. Preußner, and B. Argrow: **Observing the Central Arctic Atmosphere and Surface with University of Colorado Uncrewed Aircraft Systems**, *Nature Sci. Data.*, 9, 439, <https://doi.org/10.1038/s41597-022-01526-9>.
- Dada, L., H. Angot, I. Beck, A. Baccarini, L.L.J. Quéléver, M. Boyer, T. Laurila, Z. Brasseur, G. Jozef, G. de Boer, S. Henning, S. Bucci, M. Dütsch, A. Stohl, T. Petäjä, K.R. Daellenbach, T. Jokinen, and J. Schmale: **A Central Arctic Extreme Aerosol Event Triggered by a Warm Air-Mass Intrusion**, *Nature Commun.*, 13, 5290, <https://doi.org/10.1038/s41467-022-32872-2>.
- Stevens, B., et al., including G. de Boer (2021): **EUREC4A**, *Earth Sys. Sci. Data*, 13, 4067–4119, <https://doi.org/10.5194/essd-13-4067-2021>.
- Shupe, M.D. et al., including G. de Boer (2022): **Overview of the MOSAiC Expedition-Atmosphere**, *Elementa: Sci. of Anthropocene*, 10(1), <https://doi.org/10.1525/elementa.2021.00060>.
- Nicolaus, M., et al., including G. de Boer et al. (2021): **Overview of the MOSAiC Expedition – Snow and Sea Ice**, *Elementa: Sci. of Anthropocene*, 9, <https://doi.org/10.1525/elementa.2021.000046>.
- de Boer, G., et al. (2020): **Development of community, capabilities and understanding through unmanned aircraft-based atmospheric research: The LAPSE-RATE campaign**, *Bull. Amer. Meteor. Soc.*, 101, E684-E699, <https://doi.org/10.1175/BAMS-D-19-0050.1>
- de Boer, G., et al. (2019): **Atmospheric observations made at Oliktok Point, Alaska, as part of the Profiling at Oliktok Point to Enhance YOPP Experiments (POPEYE) campaign**, *Earth Syst. Sci. Data*, 11, 1349–1362, <https://doi.org/10.5194/essd-11-1349-2019>
- de Boer, G., et al. (2018): **A Bird’s Eye View: Development of an Operational ARM Unmanned Aerial Systems Capability for Atmospheric Research in Arctic Alaska**, *Bull. Amer. Meteor. Soc.*, 99, 1197–1212, <https://doi.org/10.1175/BAMS-D-17-0156.1>
- de Boer, G., B. Argrow, J. Cassano, J. Cione, E. Frew, D. Lawrence, G. Wick and C. Wolff (2018): **Advancing unmanned aerial capabilities for atmospheric research**, *Bull. Amer. Meteor. Soc.*, 100, ES105-ES108, <https://doi.org/10.1175/BAMS-D-18-0254.1>
- Dole, R.M., et al., including G. de Boer (2017): **Advancing Science and Services during the 2015-16 El Niño: The NOAA El Niño Rapid Response Field Campaign**, *Bull. Amer. Meteor. Soc.*, 99, 975-1001, <https://doi.org/10.1175/BAMS-D-16-0219.1>
- Uttal, T., S. Starkweather, J. Drummond, T. Vihma, C.J. Cox, E. Dlugokencky, J. Ogren, B. McArthur, L. Schmeisser, V. Walden, T. Laurila, L. Darby, A.P. Makshtas, J. Intrieri, J.F. Burkhardt, T. Haiden, B. Goodison, M. Maturilli, M. Shupe, G. de Boer et al. (2015): **International Arctic Systems for Observing the Atmosphere (IASOA): An International Polar Year Legacy Consortium**, *Bull. Amer. Meteorol. Soc.*, 97, 1033-1056, <https://doi.org/10.1175/BAMS-D-14-00145.1>
- de Boer, G., M.D. Ivey, B. Schmid, S. McFarlane, and R. Petty (2016): **Unmanned platforms monitor the Arctic atmosphere**, *EOS*, 97, <https://doi.org/10.1029/2016EO046441>
- Morrison, H., G. de Boer, G. Feingold, J.Y. Harrington, M.D. Shupe and K. Sulia (2012): **Resilience of Persistent Arctic Mixed-Phase Clouds**, *Nature Geosci.*, 5, 11-17, <https://doi.org/10.1038/NCEO1332>

Public Presentations

Over 200 first-author presentations, with over 30 invited presentations since 2017, including:

Gijs de Boer Curriculum Vitae

- de Boer, G.: Recent work in high latitude observing with remotely-piloted aircraft, *National Academies of Science, Engineering and Medicine Workshop on Technology Developments to Advance Antarctic Research*, 3 May 2022, Virtual.
- de Boer, G.: The Study of Precipitation, the Lower Atmosphere and Surface for Hydrometeorology (SPLASH), *DOE Understanding and Predictability of Integrated Mountainous Hydroclimate Workshop*, 19 January 2022, Virtual.
- de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *Univ. of Kentucky Mechanical Engineering Seminar*, 3 December 2021, Lexington, KY.
- de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *NCAR EOL and RAL Seminar Series*, 16 November 2021, Virtual.
- de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *Univ. of Wisconsin Atmospheric and Oceanic Sciences Colloquium*, 8 November 2021, Madison, WI.
- de Boer, G.: Enhanced Observing of the Ocean-Air Interface with Emerging Technologies, *Panel at the Tropical Pacific Observing Needs to Advance Process Understanding and Representation in Models Workshop*, 26 May 2021, Virtual.
- de Boer, G. et al.: The Study of Precipitation, the Lower-Atmosphere and Surface for Hydrometeorology (SPLASH), *NOAA OAR Senior Management Meeting*, 30 November 2020, Virtual.
- de Boer, G., et al., From the Tropics to the Poles: Field Deployment of Small Unmanned Aircraft Systems for NOAA Research, *NOAA OAR Portfolio Seminar Series*, 24 July 2020, Virtual.
- de Boer, G., Unmanned Observers: How drones contribute to your local weather forecast, *AIAA SciTech Forum 360 Panel "Aerospace Innovation Enables Resilient Communities"*, 6 January 2020, Orlando, FL.
- de Boer, G., UAS Weather and Climate Research in Polar Regions (and beyond), *National Academy of Sciences Committee on Earth Science and Applications from Space Fall Meeting*, 17 December 2019, Washington, DC.
- de Boer, G.: Atmospheric Observing with Small Unmanned Aircraft Systems (sUAS): Recent Results and Upcoming Adventures, *CIMMS Workshop on Current and Future Uses of Unmanned Aircraft Systems (sUAS)*, 29 October 2019, Norman, OK.
- de Boer, G., et al.: A Quest for New Perspectives: Challenges and Opportunities in the Development of Engineering Solutions to Support Arctic Science, *NOAA OAR Forums on the Arctic and Engineering*, 9-10 October 2019, Seattle, WA.
- de Boer, G.: Atmospheric Observing with small unmanned aircraft systems (sUAS): Recent results and upcoming adventures, *NOAA Global Monitoring Division seminar series*, 28 August 2019, Boulder, CO.
- de Boer, G., et al.: Profiling at Oliktok Point to Enhance YOPP Experiments (POPEYE), *Interagency Arctic Research Policy Committee (IARPC) Atmosphere Collaboration Team Meeting*, 30 October 2018, virtual.
- de Boer, G.: ISARRA 2018: An Overview of ISARRA 2018 and LAPSE-RATE, *US Global Change Research Program Interagency Working Group on Observations*, 14 August 2018, Washington, DC.
- de Boer, G.: Use of unmanned aircraft and tethered balloons to advance understanding of Arctic boundary layers: Examples from the field, *National Academy of Sciences Workshop on the Future of Boundary Layer Observing*, 24-26 October, 2017, Warrenton, VA.
- de Boer, G.: Recent Observational Efforts to Understand Clouds and Aerosols in Arctic Alaska, *Kyushu University Seminar*, 8 September, 2017, Fukuoka, Japan.
- de Boer, G.: Drivers of Spatial Variability in Arctic Surface Energy Budgets: An Observational Perspective, *Gordon Research Conference on Radiation and Climate*, 17-21 July, 2017, Lewiston, ME.
- de Boer, G., The Oliktok Point Observational Facility, *US CLIVAR Workshop on Translating Process Understanding to Improve Climate Models*, 16 October, 2015, Princeton, NJ.
- de Boer, G., et al., Observational Efforts to Understand Aerosol-Cloud Interactions at High Latitudes, *NCAR CGD seminar*, 17 February, 2015, Boulder, CO.

Field Campaign Leadership/Participation

- Coordinated Observations of the Arctic Lower Atmosphere (COALA, 2014)*: PI and field participant.
Coordinated a two-week field effort to deploy unmanned aerial activities in the Arctic environment.

Evaluation of Routine Atmospheric Sounding Measurements using Unmanned Systems (ERASMUS, 2015-2016): PI and field participant. Coordinated three separate two-week field deployments to Arctic Alaska to collect atmospheric measurements using unmanned aircraft.

ARM Airborne Carbon Measurements (ACME-V, 2015): Co-investigator for airborne mission using the DOE G-1 aircraft in northern Alaska.

El Nino Rapid Response (2016): Field and lab participant. Assisted with campaign forecasting and spent time in the field with the NASA Global Hawk, helping to plan flights with this unmanned aircraft.

Inaugural Campaigns for ARM Research using Unmanned Systems (ICARUS, 2016-2017): PI and field participant. Planned and coordinated unmanned aircraft and tethered balloons in Arctic Alaska.

Profiling at Oliktok Point to Enhance YOPP Experiments (POPEYE, 2018): PI and field participant. Planned and coordinated three months of targeted observing using unmanned aircraft, tethered balloon systems and unmanned aircraft in northern Alaska to support Year of Polar Prediction studies.

Aerosol Vertical Profiling at Oliktok Point (AVPOP, 2018): co-PI. Helped to plan and coordinate tethered balloon profiling of the lower Arctic atmosphere during spring 2018.

Lower Atmospheric Profiling Studies at Elevation – a Remotely-piloted Aircraft Team Experiment (LAPSE-RATE, 2018): PI and field participant. Coordinated activities by 17 UAS flight teams and surface observing capabilities across the San Luis Valley of Colorado for intensive observing over a one-week campaign.

Arctic Heat (2019): Participant and instrument PI. Supplied the miniFlux instrument for Arctic flights from a NOAA Twin Otter aircraft during summer 2019.

Multidisciplinary drifting Observatory for the Study of Arctic Climate (2019-2020): Platform PI, Project co-PI, co-organizer and field participant. Deployment of unmanned aircraft over the central Arctic Ocean for a 6-month time window, including 2.5 months spent in the field. Co-PI for DOE ARM proposal to deploy the ARM mobile facility as part of MOSAiC. Lead for MOSAiC UAS activities and involved with organization of MOSAiC since 2011.

Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC, 2020): Co-PI and instrument PI. Involved in planning for the ATOMIC campaign and PI for deployment of the miniFlux instrument suite on shipborne UAS systems for the campaign.

Wisconsin's Dynamic Influence of Shoreline Circulations on Ozone Wisco-DISCO21 (2021): Platform PI and field participant. Involved in planning for the deployment of uncrewed aircraft platforms, coordination with local authorities for site access permissions, and post-campaign data processing and preparation.

Tracking Aerosol Convection interactions Experiment (TRACER, 2021-2022): TRACER-UAS PI and field participant for DOE-supported field deployment. Conducted platform development and deployment planning efforts for extended deployment of uncrewed aircraft systems to the greater Houston area during TRACER. Additional work to conduct data quality evaluation and data processing.

Study of Precipitation, the Lower Atmosphere, and Surface for Hydrometeorology (SPLASH, 2021-2023): SPLASH PI and field participant for NOAA-supported field deployment. Conducted platform deployment for flux systems, radars, uncrewed aircraft and crewed research aircraft in the East River Watershed of Colorado. Additional work includes data quality evaluation, dataset preparation, and data processing.

External Research Funding

Lead Investigator for research funding totaling over \$9.0M, from a distribution of federal agencies (including NSF, NOAA, DOE) and co-PI for proposals totaling more than an additional \$2.1M.

Interdisciplinary Activities, Outreach and Awards

- *Presidential Early Career Award for Science and Engineering (PECASE) (2013 award, given in 2016)*
- *CIRES/NOAA Bronze Medal Award (2023)*: For scientific achievement in the design and implementation of the complex Atlantic Tradewind Ocean-atmosphere Mesoscale Interaction Campaign
- *CIRES/NOAA Bronze Medal Award (2023)*: For extraordinary contributions to the year-long Multidisciplinary Drifting Observatory for the Study of Arctic Climate (MOSAiC) polar expedition
- *CIRES/NOAA Bronze Medal Award (2022)*: For work development of a fully coupled, ocean-ice-atmosphere model that delivers daily, 0-10 day, sea ice forecast guidance to the NWS Alaska Region
- *Arctic Circle Prize (2022)*: Awarded to the MOSAiC Expedition

Gijs de Boer Curriculum Vitae

- *Member*: National Center for Atmospheric Research Observing Facilities Assessment Panel [2018-2023]
- *US Representative, Vice-Chair, and Chair*: International Arctic Science Committee (IASC) Atmosphere Working Group [2017-present]
- *Co-Lead*: Interagency Arctic Research Policy Committee (IARPC) Atmosphere Collaboration Community of Practice [2017-present]
- *Lead*: US Department of Energy Atmospheric System Research (ASR) Program High Latitude Processes Working Group and ASR focus group on cloud phase and mixed-phase cloud properties [2017-2023]
- *Site Scientist*: DOE ARM Northern Alaska facilities [2015-2023]
- *Conference Chair*: International Society for Atmospheric Research using Remotely piloted Aircraft (ISARRA) conference [2018]
- *Science Steering Committee*: ISARRA conferences [2015, 2016, 2023]
- *Conference Organization*: ISARRA conference [2018]; 1st and 2nd Workshops on Quantifying the Indirect Effect: from Sources to Climate Effects of Natural and Transported aerosol in the Arctic (QuIESCENT-Arctic) [2019, 2022]; NOAA OAR Forum on Engineering and Arctic Science [2019], International Radiation Symposium [2020]
- *Conference Session Convener*: Atmosphere-Through-Bedrock Observations, Modeling, and Science in the Upper Colorado River Basin (AGU, 2022-present); Use of Unmanned Aircraft in Atmospheric Science (AGU, 2016-present); Observing with autonomous vehicles in polar regions (2018 ASSW/Polar2018); Current and future observing strategies for understanding the evolving Arctic climate and ecological system (2015 Arctic Science Summit Week); Use of Unmanned Aircraft in Geoscience (2014 AGU); Observational Needs for Polar Climate Modeling (AGU 2012); Polar Observing Systems (2012 International Polar Year Conference)
- *Instructor*: International Arctic Research Center (IARC) Summer School on Modeling of the Arctic Climate System [2011 and 2016]; CU Pathways to Space (ASEN 1969) Guest lecturer [2018-present]
- *Member*: DOE ARM UAS advisory committee [2015-present]; AMS Committee on Laser Atmospheric Studies [CLAS, 2007-2011]
- *Meeting Presentation Awards and Honors*: Outstanding early career presentation, GEWEX Int'l. Science Conference [2014]; Outstanding Oral Presentation Award, Arctic Science Summit Week [2011]; Showcased Research Highlight, ASR Science Team Meeting [2011]; Chief Scientist Award: Poster Presentation, ARM Science Team Meeting [2008]

Mentorship, Education and Outreach

- Supported four outreach trips to Utqiagvik, Alaska for early career scientists to present research to the local community through public lectures, STEM camp activities, school visits, and radio interviews.
- Conducted school visits to give an overview of Arctic science and the MOSAiC expedition.
- Served as mentor for four Hollings scholars and will co-mentor two additional scholars in 2022.
- Coordinated outreach activities for the Lower Atmospheric Profiling Studies at Elevation – a Remotely-piloted Aircraft Team Experiment (LAPSE-RATE) campaign. Outreach activities included engagement with technical schools and holding a community open house in the Alamosa area.
- In partnership with the US Department of State and the Barbados Ministry of Education, coordinated an informational exchange session between UAS scientists and teachers and students at the Samuel Jackman Prescod Institute of Technology in Barbados.
- Coordinating outreach activities for the Study of Precipitation, the Lower Atmosphere and Surface for Hydrometeorology (SPLASH), including development of instrument superheroes and educational signage for the campaign, development of a teacher workshop, engaging with Gunnison area schools to offer access to SPLASH for summer students, mentoring of a RECCS scholar, public lectures, and more.
- Serving on the PhD committees for six students within the Atmospheric and Oceanic sciences and Aerospace Engineering departments at CU, and serving as supervisor or science advisor for three postdoctoral scholars.
- Mentoring several graduate and undergraduate students conducting research related to projects for which I was PI, including five current students.