GIJS DE BOER
Senior Research Scientist, Cooperative Institute for Research in the Environmental Sciences
University of Colorado Boulder and NOAA Physical Sciences Laboratory
R/PSD 3, 325 Broadway, Boulder, CO 80305
(303) 497-6648; gijs.deboer@colorado.edu; http://www.esrl.noaa.gov/psd/people/gijs.deboer/

Summary of Work to Date

Work conducted in the roles outlined below has been directed at the development and deployment of innovative strategies for expanding our collective understanding of weather and climate. This has involved conducting and directing research in lower atmospheric physics, managing engineering work to advance observational capabilities, and leading diverse teams to foster enhanced knowledge of the Earth System. This has additionally included work with a variety of US and international partners and funding bodies to support the presentation, publication and solicitation of financial support for innovative research directions. Finally, this has involved serving US and international organizations in the coordination and development of international research initiatives.

Education and Training

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
2021-present:	*Associate Director for Science, Chief Scientist*, Integrated Remote and In Situ Sensing at the University of Colorado Boulder
2020-present:	*Founder,* Boreas Consulting
2018-2022:	*Research Scientist III*, The Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado Boulder
2014-2018:	*Research Scientist II*, The Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado Boulder
2011-2014:	*Research Scientist I*, 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

[69 publications, 15 data sets since 2008, h-index: 26]. A full list is available at https://psl.noaa.gov/people/gijs.deboer/Research_Website/Gijs_de_Boer_Publications.html

de Boer, G., R. Calmer, G. Jozef, J. Cassano, J. Hamilton, D. Lawrence, S. Borenstein, A. Doddi, C. Cox, J. Schmale, A. Preußer, 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.

de Boer, G., S. Borenstein, R. Calmer, C. Cox, M. Rhodes, C. Choate, J. Hamilton, J. Osborn, D. Lawrence, B. Argrow and J. Intrieri (2022): **Measurements from the University of Colorado RAAVEN Uncrewed Aircraft System during ATOMIC**, *Earth Sys. Sci. Data*, 14, 19–31, https://doi.org/10.5194/essd-14-19-2022.

Cione, J.J., G. Bryan, R. Dobosy, J. Zhang, G. de Boer, A. Aksoy, J. Wadler, E. Kalina, B. Dahl, K. Ryan, J. Neuhaus, E. Dumas, F. Marks, A. Farber, T. Hock and X. Chen (2020): **Eye of the storm: Observing**

hurricanes with a small unmanned aircraft system, *Bull. Amer. Meteor. Soc.*, 101, E186-E205, https://doi.org/10.1175/BAMS-D-19-0169.1

de Boer, G., C. Diehl, J. Jacob, A. Houston, S.W. Smith, P. Chilson, D.G. Schmale III, J. Intrieri, J. Pinto, J. Elston, D. Brus, O. Kemppinen, A. Clark, D. Lawrence, S.C.C. Bailey, M.P. Sama, A. Frazier, C. Crick, V. Natalie, E. Pillar-Little, P. Klein, S. Waugh, J.K. Lundquist, L. Barbieri, S.T. Kral, A.A. Jensen, C. Dixon, S. Borenstein, D. Hesselius, K. Human, P. Hall, B. Argrow, T. Thornberry, R. Wright and J.T. Kelly (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., 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

de Boer, G., M.D. Ivey, B. Schmid, D. Lawrence, D. Dexheimer, F. Mei, J. Hubbe, J.O.E. Hardesty, A. Bendure, M.D. Shupe, A. McComiskey, H. Telg, C. Schmitt, S. Matrosov, I. Brooks, J.M. Creamean, A. Solomon, D.D. Turner, C. Williams, M. Maahn, B. Argrow, S. Palo, C.N. Long, R.-S. Gao and J. Mather (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

Morrison, H., G. de Boer, G. Feingold, J.Y. Harrington, M.D. Shupe and K. Sulia (2012): **Resillience of Persistent Arctic Mixed-Phase Clouds**, *Nature Geosci.*, 5, 11-17, https://doi.org/10.1038/NGEO1332

Public Presentations

Over 200 first-author community presentations since 2004, including 31 invited presentations since January 2017. Some examples of recent invited presentations include:

de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *University of Kentucky Mechanical Engineering Seminar Series*, 3 December, Lexington, KY.

de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *NCAR Earth Observing Laboratory and Research Applications Laboratory Seminar Series*, 16 November, Virtual.

de Boer, G.: Robotic revolution: Recent work in Earth System observing with remotely-piloted aircraft, *University of Wisconsin Atmospheric and Oceanic Sciences Colloquium Series*, 8 November, Madison, WI.

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, 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, Washington, DC.

de Boer, G., M. Maahn, M. Norgren, J. Creamean, H. Telg, S. Matrosov, C. Williams, A. Solomon, T. Hashino, A. Jensen, D. Dexheimer, F. Mei and A. McComiskey: Observatory- and Model-based Efforts to Understand the Influence of Cloud-Nucleating Particles on Clouds in Arctic Alaska, *2019 American Geophysical Union Fall Meeting*, 13 December, San Francisco, CA.

de Boer, G., C. Cox, D. Lawrence, J. Osborn, J. Hamilton, J. Intrieri, M. Maahn, C. Cahill, G. Foscue, N. Hadland and J. Cassano: Observatory- and UAS-based Perspectives on the Surface Energy Budget of the Arctic, *2019 American Geophysical Union Fall Meeting*, 9 December, San Francisco, CA.

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, Norman, OK.

de Boer, G., J. Intrieri, J. Osborn, P. Johnston, D. Lawrence, C. Cox, S. Borenstein, S. Palo, A. Nuhaily, B. Argrow, C. Fairall, K. Wood, P. Hall, J. Leach and T. Ayers: 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, 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, Boulder, CO.

de Boer, G., M. Norgren, J. Creamean, A. Solomon, M. Maahn, H. Telg, D. Dexheimer, F. Mei, A. McComiskey and T. Hashino: Ice Nuclei and their Impact on Clouds in Alaska, *International Aerosol Conference*, 3-7 September, St. Louis, MO.

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, 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.

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 pm a NOAA Twin Otter aircraft during summer 2019.

Multidisciplinary drifting Observatory for the Study of Arctic Climate (2019-2020): PI, 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.

External Research Funding

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

Interdisciplinary Activities, Outreach and Awards

- *Presidential Early Career Award for Science and Engineering (PECASE)* (2013 award, given in 2016)
- *NOAA Bronze Medal Award:* 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.
- *US Representative*: International Arctic Science Committee (IASC) Atmosphere Working Group
- *Co-Lead:* Interagency Arctic Research Policy Committee (IARPC) Atmosphere Collaboration Team
- *Lead:* US Department of Energy Atmospheric System Research (ASR) Program High Latitude Processes Working Group and DOE ASR focus group on cloud phase and mixed-phase cloud properties
- *Site Scientist:* DOE ARM Northern Alaska facilities (2015-present)
- *Member*: National Center for Atmospheric Research Observing Facilities Assessment Panel (2018-present)
- *Conference Chair*: International Society for Atmospheric Research using Remotely piloted Aircraft (ISARRA) conference (2018)
- *Science Steering Committee:* International Society for Atmospheric Research using Remotely piloted Aircraft (ISARRA) conferences (2015 and 2016)
- *Conference Organization:* International Society for Atmospheric Research using Remotely piloted Aircraft (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:* 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 separate outreach trips to Utqiagvik, Alaska for early career scientists to present research to the local community, including through public lectures, STEM camp activities, school visits, and radio interviews.
- Conducted school visits to elementary schools in the greater Boulder area 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 current 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 five students within the Atmospheric and Oceanic sciences and Aerospace Engineering departments and served as supervisor or science advisor for three postdoctoral scholars.