

GIJS DE BOER

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Research Interests

My research revolves around understanding clouds, aerosols, precipitation and the surface energy budget, and the interactions between them, with a focus on high-latitude environments. This work involves analysis of long-term observations, data collection including use of unmanned aircraft, and modeling studies. Additionally, my research includes the development and deployment of innovative observing technologies for the atmosphere and ocean.

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

2011-present: *Research Scientist*, 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

Publications

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 (2019): Eye of the storm: Observing hurricanes with a small unmanned aircraft system, *Bull. Amer. Meteor. Soc.*, in review.

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. Kempainen, 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 (2019): Development of community, capabilities and understanding through unmanned aircraft-based atmospheric research: The LAPSE-RATE campaign, *Bull. Amer. Meteor. Soc.*, in review.

Hashino, T., G. de Boer, H. Okamoto and G.J. Tripoli (2019): Relationships between ice nucleation process and crystal habit for Arctic mixed-phase clouds -- a numerical study, *J. Atmos. Sci.*, in review.

de Boer, G., C.J. Cox and J.M. Creamean (2019): Accelerated springtime melt of northern Alaska river systems resulting from niveo-aeolian deposition events, *Arctic*, accepted for publication.

de Boer, G., Dexheimer, D., Mei, F., Hubbe, J., Longbottom, C., Carroll, P. J., Apple, M., Goldberger, L., Oaks, D., Lapierre, J., Crume, M., Bernard, N., Shupe, M. D., Solomon, A., Intrieri, J., Lawrence, D., Doddi, A., Holdridge, D. J., Hubbell, M., Ivey, M. D., and Schmid, B. (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>.

Matrosov, S.Y., M. Maahn, and **G. de Boer** (2019): Observational and Modeling Study of Ice Hydrometeor Radar Dual-Wavelength Ratios, *J. Appl. Meteor. Climatol.*, 58, 2005–2017, <https://doi.org/10.1175/JAMC-D-19-0018.1>

- Maahn, M., F. Hoffmann, M.D. Shupe, G. de Boer, S.Y. Matrosov, and E.P. Luke (2019): Can liquid cloud microphysical processes be used for vertically-pointing cloud radar calibration?, *Atmos. Chem. Phys.*, 12, 3151–3171, <https://doi.org/10.5194/amt-12-3151-2019>.
- Barbieri, L.K., S.T. Kral, S.C.C. Bailey, A.E. Frazier, J.D. Jacob, D. Brus, P.B. Chilson, C. Crick, J. Elston, H. Foroutan, J. González-Rocha, B.R. Greene, M.I. Guzman, A.L. Houston, A. Islam, O. Kempainen, E.A. Pillar-Little, J. Reuder, S.D. Ross, M. Sama, D.G. Schmale III, T.J. Schuyler, S. Smith, S. Waugh, A. Doddi, D. Lawrence, C. Dixon, S. Borenstein, and **G. de Boer** (2019): Intercomparison of small unmanned aircraft system (sUAS) measurements for atmospheric science during the LAPSE-RATE campaign, *Sensors*, 19, 2179, doi:10.3390/s19092179.
- Creamean, J.M., R.M. Kirpes, K.A. Pratt, N.J. Spada, M. Maahn, **G. de Boer**, R.C. Schnell and S. China (2018): Marine and terrestrial influences on ice nucleating particles during continuous springtime measurements in an Arctic oilfield location, *Atmos. Chem. Phys.*, 18, 18023-18042, <https://doi.org/10.5194/acp-18-18023-2018>.
- 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.*, 0, <https://doi.org/10.1175/BAMS-D-18-0254.1>.
- Solomon, A., **G. de Boer**, J.M. Creamean, A. McComiskey, M.D. Shupe, M. Maahn and C. Cox (2018): The relative impact of cloud condensation nuclei and ice nucleating particle concentrations on phase-partitioning in Arctic mixed-phase stratocumulus clouds, *Atmos. Chem. Phys.*, 18, 17047-17059, <https://doi.org/10.5194/acp-18-17047-2018>.
- Nolan, P., J. Pinto, J. Gonzalez-Rocha, A. Jensen, C.N. Vezzi, S.C.C. Bailey, **G. de Boer**, C. Diehl, R. Laurence III, C.W. Powers, H. Foroutan, S.D. Ross and D.G. Schmale III (2018): Coordinated unmanned aircraft system (UAS) and ground-based weather measurements to predict lagrangian coherent structures (LCSs), *Sensors*, 18, 4448, doi:10.3390/s18124448.
- Williams, C.R., M. Maahn, J.C. Hardin, **G. de Boer** (2018): Clutter Mitigation, Multiple Peaks, and High-Order Spectral Moments in 35-GHz Vertically Pointing Radar Velocity Spectra, *Atmos. Meas. Tech.*, 11, 4963-4980, <https://doi.org/10.5194/amt-11-4963-2018>, 2018.
- Norgren, M., **G. de Boer** and M.D. Shupe (2018): Observed aerosol suppression of cloud ice in low-level Arctic mixed-phase clouds, *Atmos. Chem. Phys.*, 18, 13345-13361, <https://doi.org/10.5194/acp-18-13345-2018>.
- Miller, N.B., M.D. Shupe, J.T.M. Lenaerts, J.E. Kay, **G. de Boer** and R. Bennartz (2018): Process-based evaluation of ERA-Interim, Climate Forecast System version 2, and Community Earth System Model 2 in central Greenland, *J. Geophys. Res.*, 123, doi: <https://doi.org/10.1029/2017JD027377>
- 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>.
- Creamean, J.M., M. Maahn, **G. de Boer**, A. McComiskey, A.J. Sedlacek, Y. Feng (2018): The influence of local oil exploration and regional wildfires on summer 2015 aerosol over the North Slope of Alaska, *Atmos. Chem. Phys.*, 18, 555-570, doi:10.5194/acp-18-555-2018.
- Maahn, M., **G. de Boer**, J.M. Creamean, G. Feingold, G. McFarquhar, W. Wu and F. Mei (2017): The observed influence of local anthropogenic pollution on northern Alaskan cloud properties, *Atmos. Chem. Phys.*, 17, 14709-14726, doi: 10.5194/acp-17-14709-2017.
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- D.E. Wolfe, R. Zamora (2017): Advancing Science and Services during the 2015-16 El Niño: The NOAA El Niño Rapid Response Field Campaign, *Bull. Amer. Meteor. Soc.*, early online release, doi: 10.1175/BAMS-D-16-0219.1.
- Matrosov, S., C.G. Schmitt, M. Maahn and **G. de Boer** (2017): Atmospheric ice particle shape estimates from polarimetric radar measurements and in situ observations, *J. Atmos. Ocean. Tech.*, 34, 2569-2587, doi:10.1175/JTECH-D-17-0111.1.
- Kalesse, H., **G. de Boer**, A. Solomon, M. Oue, M. Ahlgrimm, D. Zhang, M.D. Shupe, E. Luke and A. Protat (2016): Understanding rapid changes in phase partitioning between cloud liquid and ice in stratiform mixed-phase clouds: An Arctic case study, *Mon. Wea. Rev.*, 144, 4805-4826.
- de Boer, G.**, S. Palo, B. Argrow, G. LoDolce, J. Mack, R.-S. Gao, H. Telg, C. Trussel, J. Fromm, C.N. Long, G. Bland, J. Maslanik, B. Schmid, and T. Hock (2016): The Pilatus Unmanned Aircraft System for Lower Atmospheric Research, *Atmos. Meas. Tech.*, 9, 1845-1857, doi:10.5194/amt-9-1845-2016.
- de Boer, G.**, M.D. Ivey, B. Schmid, S. McFarlane, and R. Petty (2016): Oliktok Point: Providing Access to Arctic Skies for Unmanned Aircraft and Tethered Balloons, *EOS*, 97, doi:10.1029/2016EO046441.
- 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. Burkhart, T. Haiden, B. Goodison, M. Maturilli, M. Shupe, **G. de Boer** and co-authors: International Arctic Systems for Observing the Atmosphere (IASOA) (2016): An International Polar Year Legacy Consortium, *Bull. Amer. Meteorol. Soc.*, 97, 1033-1056.
- Intrieri, J.M., **G. de Boer**, M.D. Shupe, J.R. Spackman, J. Wang, P.J. Neiman, G.A. Wick, T. Hock and R.E. Hood (2014): Global Hawk dropsonde observations of the Arctic atmosphere during the Winter Storms and Pacific Atmospheric Rivers (WISPAR) campaign, *Atmos. Meas. Tech. Discuss.*, 7, 4067-4092.
- de Boer, G.**, M.D. Shupe, P.M. Caldwell, S.E. Bauer, P.O.G. Persson, J.S. Boyle, M. Kelly, S.A. Klein and M. Tjernström (2014): Near-Surface Meteorology During the Arctic Cloud Ocean Study (ASCOS): Evaluation of Reanalyses and Global Climate Models, *Atmos. Chem. Phys.*, 14, 427-445.
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- Solomon, A., M.D. Shupe, P.O.G. Persson, H. Morrison, T. Yamaguchi, G. Feingold, P.M. Caldwell and **G. de Boer** (2014): The sensitivity of springtime Arctic mixed-phase stratocumulus clouds to surface layer and cloud-top inversion layer moisture sources, *J. Atmos. Sci.*, 71, 574-595.
- de Boer, G.**, S. Menon, S.E. Bauer, T. Toto and A. Vogelmann (2013): Evaluation of aerosol-cloud interactions in the GISS ModelE using ASR observations, *J. Geophys. Res.*, 118, 6383-6395, doi: 10.1002/jgrd.50460.
- de Boer, G.**, T. Hashino, G.J. Tripoli and E.W. Eloranta (2013): A Numerical Study of Aerosol Influence on Mixed-Phase Stratiform Clouds through Modulation of the Liquid Phase, *Atmos. Chem. Phys.*, 13, 1733-1749.
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- de Boer, G.**, W.D. Collins, S. Menon, C.N. Long (2011): Using Surface Remote Sensors to Derive Radiative Characteristics of Mixed-Phase Clouds: An Example from M-PACE, *Atmos. Chem. Phys.*, 11, 11937-11949.
- Morrison, H., P. Zuidema, A. Ackerman, A. Avramov, **G. de Boer**, J. Fan, A. Fridlind, T. Hashino, J.

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- Harrington, Y. Luo, M. Ovchinnikov, and B. Shipway (2011): Intercomparison of Cloud Model Simulations of Arctic Mixed-Phase Boundary Layer Clouds Observed During SHEBA, *J. Adv. Model. Earth Syst.*, 3, M06003.
- de Boer, G.**, H. Morrison, R. Hildner, and M.D. Shupe (2011): Evidence of Liquid-Dependent Ice Nucleation in High-Latitude Stratiform Clouds from Surface Remote Sensors, *Geophys. Res. Lett.*, 38, L01803.
- de Boer, G.**, T. Hashino, and G.J. Tripoli (2010): Ice Nucleation Through Immersion Freezing in Mixed-Phase Stratiform Clouds: Theory and Numerical Simulations, *Atmos. Res.*, 96, 315-324.
- de Boer, G.**, E.W. Eloranta, and M.D. Shupe (2009): Arctic Mixed-Phase Stratus Properties from Multiple Years of Surface-Based Measurements at Two High-Latitude Locations, *J. Atmos. Sci.*, 66, 2874-2887.
- Klein, S.A., R. McCoy, H. Morrison, A. Ackerman, A. Avramov, **G. de Boer**, and co-authors (2009): Intercomparison of model simulations of mixed-phase clouds observed during the ARM Mixed-Phase Arctic Cloud Experiment. Part I: Single layer cloud, *Q. J. Roy. Meteor. Soc.*, 135, 979-1002.
- de Boer, G.**, G.J. Tripoli, and E.W. Eloranta (2008): Preliminary Comparison of CloudSAT-Derived Microphysical Quantities with Ground-Based Measurements for Mixed-Phase Stratus Research, *J. Geophys. Res.*, 113, D00A06.
- Shupe, M.D., J.S. Daniel, **G. de Boer**, E.W. Eloranta, P. Kolias. C.N. Long, E.P. Luke, D.D. Turner and J. Verlinde (2008): A Focus on Mixed-Phase Clouds: The Status of Ground-Based Observational Methods, *Bull. Amer. Meteor. Soc.*, 89, 1549-1562.

Public Presentations

146 community presentations since 2004. A complete list of first author presentations can be found on my website.

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 flight activities by 17 unmanned flight teams and multiple 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.

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- *Multidisciplinary drifting Observatory for the Study of Arctic Climate (2019-2020)*: PI, co-PI, co-organizer and field participant. PI for effort to deploy 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.

External Research Funding

PI for research funding totaling \$7.1M, from a distribution of federal agencies (including NOAA, NSF, DOE) and co-PI for proposals totaling an additional \$2.5M.

Interdisciplinary Activities, Outreach and Awards

- *Presidential Early Career Award for Science and Engineering (PECASE)* (2013 award, given in 2016)
- *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 (OFAP) (2018-present)
- *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, conference chair); 1st Workshop on Quantifying the Indirect Effect: from Sources to Climate Effects of Natural and Transported aerosol in the Arctic (QuIESCENT-Arctic) (2019); NOAA OAR Forum on Engineering and Arctic Science (2019), International Radiation Symposium (2020)
- *Conference Session Convener*: Use of Unmanned Aircraft in Atmospheric Science (AGU, 2016-2019); 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)
- *Outreach*: Have participated in or funded six outreach trips for Arctic researchers (mainly early career) to Barrow, Alaska. These trips involve public lectures, STEM camp activities and classroom visits. Additional classroom visits in Boulder and surroundings.