

# Brian J. Butterworth

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## EDUCATION

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<b>Postdoctoral Associate, Geography</b> University of Calgary	2016 – present
<b>Ph.D., Atmospheric Science</b> University at Albany, State University of New York	2016
<b>M.A., Geography</b> University of Colorado, Boulder	2011
<b>B.S., Environmental Science</b> University of Delaware	2007

## PROFESSIONAL EXPERIENCE

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<b>Postdoctoral Associate</b> – University of Calgary <i>Studies: Ship and tower-based eddy covariance measurements of carbon dioxide flux over sea ice in the Canadian Arctic</i>	2016 – present
<b>Graduate Researcher</b> – Atmospheric Sciences Research Center <i>Dissertation: Air-Sea Carbon Dioxide Exchange in the Southern Ocean and Antarctic Sea Ice Zone</i>	2012 – 2016
<b>Affiliate Faculty</b> – Metropolitan State University of Denver	2011 – 2012
<b>Geocoding Analyst</b> – University of Wisconsin <i>Study: Drinking Water Systems, Hydrology, and Childhood Gastrointestinal Illness in Central and Northern Wisconsin</i>	2011 – 2012
<b>Graduate Researcher</b> – University of Colorado, Boulder <i>Thesis: A Climatological Study of the Relationship between Alpine Treeline and Thermally-Driven Upslope Winds on Niwot Ridge, Colorado</i>	2008 – 2011
<b>Undergraduate Researcher</b> – University of Delaware <i>Study: Impact of the biological control agent <i>Rhinoncomimus latipes</i> on mile-a-minute weed, <i>Persicaria perfoliata</i>, in field cages</i>	2006

## PEER-REVIEWED PUBLICATIONS

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**Butterworth, B. J.**, and B. G. T. Else, 2018: Dried, closed-path eddy covariance method for measuring carbon dioxide flux over sea ice. *Atmospheric Measurement Techniques Discussion*, in review, <https://doi.org/10.5194/amt-2018-159>

**Butterworth, B. J.**, and S. D. Miller, 2016: Air-sea exchange of carbon dioxide in the Southern Ocean and Antarctic marginal ice zone. *Geophysical Research Letters*, **43**, 7223–7230, <https://doi.org/10.1002/2016GL069581>

**Butterworth, B. J.** and S. D. Miller, 2016: Automated Underway Eddy Covariance System for Air–Sea Momentum, Heat, and CO<sub>2</sub> Fluxes in the Southern Ocean. *Journal of Atmospheric and Oceanic Technology*, **33**, 635–652, <https://doi.org/10.1175/JTECH-D-15-0156.1>

Hough-Goldstein, J., M. Schiff, E. Lake and **B. Butterworth**, 2008: Impact of the biological control agent *Rhinoncomimus latipes* (Coleoptera : Curculionidae) on mile-a-minute weed, *Persicaria perfoliata*, in field cages. *Biological Control*, **46**, 417–423, <https://doi.org/10.1016/j.biocontrol.2008.04.001>

## PUBLISHED DATASETS

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Miller, S. and **B. Butterworth**, (2016). Eddy covariance air-sea momentum, heat, and carbon dioxide fluxes in the Southern Ocean from the Nathaniel B. Palmer (cruise NBP1210). Integrated Earth Data Applications (IEDA). doi: <http://dx.doi.org/10.1594/IEDA/323564>.

Miller, S. and **B. Butterworth**, (2016). Eddy covariance air-sea momentum, heat, and carbon dioxide fluxes in the Southern Ocean from the Nathaniel B. Palmer (cruise NBP1402). Integrated Earth Data Applications (IEDA). doi: <http://dx.doi.org/10.1594/IEDA/323565>.

## CONFERENCE PRESENTATIONS

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**Butterworth, B.**, and B. Else (Presenter), 2017: Eddy Covariance Measurements of Greenhouse Gas Exchange in an Arctic Marine Environment. *ArcticNet 2017 Annual Scientific Meeting*, Winnipeg, Manitoba. [Poster Presentation]

Wohl, C., Else B. (Presenter), **Butterworth B.**, Ahmed M., Papakyriakou T., Capelle D., Abbatt J., Collins D., Jones A., Sturges W., Beale R., Nightingale P., and M. Yang, 2017: Continuous Observations of a Suite of Volatile Organic Compounds in the Surface Ocean and Lower Atmosphere of the Canadian Arctic. *ArcticNet 2017 Annual Scientific Meeting*, Winnipeg, Manitoba. [Oral Presentation]

**Butterworth, B.**, and S.D. Miller, 2016: Air-Sea Exchange of Carbon Dioxide in the Antarctic Marginal Ice Zone. *ArcticNet 2016 Annual Scientific Meeting*, Winnipeg, Manitoba. [Oral Presentation]

Else, B., **Butterworth, B.**, and S. Rysgaard, 2016: Oxygen, Salt, and Heat Exchange Measured at the Ice-Ocean Interface During the Ice Algae Bloom Period. *ArcticNet 2016 Annual Scientific Meeting*, Winnipeg, Manitoba. [Poster Presentation]

**Butterworth, B.**, and S.D. Miller, 2016: Air-Sea Exchange of Carbon Dioxide in the Southern Ocean and Antarctic Marginal Ice Zone. *Air-sea Gas Flux; Progress and Future Prospects Science Workshop*, IFREMER, Brest, France. [Oral Presentation]

Miller, S., and **B. Butterworth**, 2015: Automated underway eddy covariance system for air-sea momentum, heat and CO<sub>2</sub> fluxes in the Southern Ocean. *SOOS-WCRP-ESA Workshop on Southern Ocean Surface Fluxes*, Frascati, Italy. [Oral Presentation]

**Butterworth, B.**, and S.D. Miller, 2015: Air-Sea CO<sub>2</sub> Flux by Eddy Covariance in the Southern Ocean and Antarctic Sea Ice Zone. *7th International Symposium on Gas Transfer at Water Surfaces*, Seattle, WA. [Oral Presentation]

**Butterworth, B.**, and S.D. Miller, 2015: Unattended Measurements of High Latitude Air-sea CO<sub>2</sub> Exchange by Eddy Covariance, *19th Conference on Air-Sea Interaction*, Phoenix, AZ. [Oral Presentation]

**Butterworth, B.**, and S.D. Miller, 2014: Long-term Southern Ocean Air-sea CO<sub>2</sub> Flux by Eddy Covariance from an Ice Breaker. *Ocean Sciences Meeting*, Honolulu, HI. [Oral Presentation]

**Butterworth, B.**, and S.D. Miller, 2013: Air-sea Fluxes of CO<sub>2</sub> over the Southern Ocean. *6th International SOLAS Summer School*, Xiamen, China. [Oral and Poster Presentation]

## TEACHING EXPERIENCE

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### Metropolitan State University of Denver

Introduction to Physical Geography	2012 (2 classes)
Map Use	2012
Weather and Climate	2011

### University of Colorado, Boulder

Laboratory for Physical Geography I	2009 (3 classes), 2010 (2 classes), 2011 (3 classes)
Laboratory for Physical Geography II	2008 (3 classes), 2009 (3 classes), 2010 (3 classes)

## GRANTS

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Travel Grant – 2 <sup>nd</sup> International workshop of Air-Sea Gas Fluxes (France)	2016
Travel Grant – Surface Ocean Lower Atmosphere Study summer school (China)	2013
Travel Grant – University at Albany Graduate Student Association	2013
Adam Kolff Memorial Research Fellowship	2010

## HONORS & AWARDS

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Narayan R. Gokhale Distinguished Research Scholarship Award  
United States Antarctic Service Medal  
CU Boulder Geography Scholarship  
Outstanding Senior in Environmental Science Award – University of Delaware  
Member of Phi Beta Kappa – academic fraternity  
Member of Alpha Zeta – honors agricultural fraternity  
Honors Program at University of Delaware  
Tuition Scholarship – University of Delaware

## FIELD CAMPAIGNS

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Quebec City, QC (May 10 – 23): Installed eddy covariance system on board the CCGS Amundsen for the Summer 2018 Expedition. Sailed (May 17 – 21) as part of equipment testing cruise in the St. Lawrence Estuary.	2018
Hokkaido, Japan (Feb 27 – Mar 11): Deployed under-ice eddy covariance system for measuring O <sub>2</sub> fluxes in Saroma-ko Lagoon in Hokkaido, Japan as part of an international collaboration (SCOR Working Group 152 on Measuring Essential Climate Variables in Sea Ice) to compare methods for measuring biogeochemical properties of sea ice.	2018
Amundsen Leg 2a (Jul 5 – 14): Sailed aboard the research vessel CCGS Amundsen from Kuujjuarapik, Quebec to Iqaluit, Nunavut to take measurements of air-sea-ice gas exchange in Hudson Bay.	2017
Amundsen Leg 1 (May 22 – Jun 11): Sailed aboard the research vessel CCGS Amundsen as part of the BaySys project from Quebec City to St. Johns, Newfoundland. Installed eddy covariance system on the bow mast of the ship to collect measurements of air-sea-ice gas exchange of carbon dioxide and methane.	2017
Cambridge Bay, Nunavut (Apr. 21 – May 5): Traveled to Qikirtaajuk Island in Dease Strait to install an eddy covariance tower to collect long-term, continuous measurements of air-sea-ice carbon dioxide flux.	2017
Cranberry Lake, New York (Aug. 11 – 22): Lake-atmosphere gas exchange, collaboration between ASRC, SUNY ESF, Columbia University.	2014
Research Vessel Ice Breaker (RVIB) Nathaniel B. Palmer (June 22 – 29): Equipment repairs and 6-day cruise from Punta Arenas to Valparaiso, Chile	2013
RVIB Nathaniel B. Palmer (Nov. 19 – 26): Equipment repair, Punta Arenas, Chile	2013
RVIB Nathaniel B. Palmer (Dec. 20, 2012 – Feb. 12, 2013): Installed and maintained EC system aboard a 40-day cruise from Punta Arenas, Chile to McMurdo Station, Antarctica	2012

Niwot Ridge, Colorado (August): Collaboration with Daniel Wolfe (NOAA) investigating boundary-layer development on Niwot Ridge using tethersonde.	2010
National Center for Atmospheric Research (August): Bio-hydro-atmosphere interactions of Energy, Aerosols, Carbon, H <sub>2</sub> O, Organics & Nitrogen (BEACHON) study – Weather balloon releases to investigate troposphere over Hayman fire burn site.	2010
Niwot Ridge, Colorado (summer) – Installed EC equipment and an array (3km x 4km) of temperature probes on Niwot Ridge to investigate the interaction between the local meteorology and vegetation patterns.	2009
White Clay Creek State Park, Delaware (summer) – Tested the effectiveness of using host-specific weevil as a biological control agent for invasive mile-a-minute weed.	2006

## **JOURNAL REVIEWER**

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Atmospheric Measurement Techniques	2016, 2018
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## **ADVISORS**

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Postdoctoral	–	Dr. Brent G. T. Else,	University of Calgary, Geography
Ph.D.	–	Dr. Scott D. Miller,	University at Albany, SUNY, Atmospheric Science
Master's	–	Dr. Peter D. Blanken,	University of Colorado, Boulder, Geography