

# Brian J. Butterworth

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## EDUCATION

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

## PROFESSIONAL EXPERIENCE

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|---|----------------|
| <b>Postdoctoral Associate</b> – University of Calgary<br><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<br><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<br><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<br><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<br><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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Nomura, D., **B. Butterworth**, F. Deman, B. Delille, K. Campbell, E. Cimoli, M. Kiuchi, K. Suzuki, K. Yoshida, N. Kanna, Y. Kawaguchi, T. Hirawake, F. Fripiat, B. Else, J.-L. Tison, M. van Leeuwe, J. M. Rintala, L. A. Miller, K. Meiners, C. J. Mundy, H. Ikawa, and A. Ooki, 2018: Inter-calibration experiment for sea ice primary production in Saroma-ko Lagoon, Hokkaido, Japan, 1-9 March 2018. *Biogeochemical Exchange Processes at Sea Ice Interfaces (BEPSII) Meeting*, Davos, Switzerland.

Duke, P., B. Else, L.A. Miller, H. Thomas, K. Juniper, and **B. Butterworth**, 2018: Estimating pCO<sub>2</sub> in Cambridge Bay Nunavut Using an Autonomous Sensor Platform. *POLAR2018*. Davos, Switzerland.

**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.

Wohl, C., Else B. (Presenter), **B. Butterworth**, M. Ahmed, T. Papakyriakou, D. Capelle, J. Abbatt, D. Collins, A. Jones, W. Sturges, R. Beale, P. Nightingale, 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.

**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.

Else, B., **B. Butterworth**, 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.

**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.

Miller, S.D., 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.

**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.

**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.

**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.

**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.

## TEACHING EXPERIENCE

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### Metropolitan State University of Denver

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

### University of Colorado, Boulder

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| 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 Kuujuaupik, 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 |

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| 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 tether sonde.  | 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      |