

Jonathan C. Ryan

Postdoctoral Scholar

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Education

- Ph.D, Centre for Glaciology, Aberystwyth University** **2017**
Thesis title: Processes of Greenland Ice Sheet mass loss using unmanned aerial systems
Advisor: Prof. Alun Hubbard and Dr Neal Snooke
- MPhil, Scott Polar Research Institute, University of Cambridge** **2013**
Thesis title: Submarine geomorphology of the continental shelves of Southeast and Southwest Greenland from Olex data
Advisor: Prof. Julian Dowdeswell
- BSc. (Hons), first-class, School of Geography, University of Nottingham** **2012**
Thesis title: Dynamics of large woody debris in mountain streams, Rocky Mountain National Park, Colorado
Advisor: Prof. Colin Thorne
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Employment

- Postdoctoral Scholar, Department of Geography, UCLA** **2017-present**
Project: Mapping and dynamics and processes of meltwater formation and runoff on the surface of the Greenland Ice Sheet using a combination of aerial and satellite remote sensing.
Advisor: Prof. Laurence Smith
- Visiting Scholar, IBES, Brown University** **2017-present**
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Peer-reviewed publications

Journal articles:

- Ryan, J. C., Sessions, M., Wilson, R, Wünderlich, O., Hubbard A.,** In review
Recent rapid mass loss and surface lowering of Benito Glacier, Northern Patagonian Icefield, *Earth and Planetary Science Letters*.

- Ryan, J. C.**, Hubbard, A., Stibal, M., Irvine-Fynn, T. D., Cook, J., Box, J. E., Greenland's dark zone controlled by distributed, biologically-active, impurities. *Nature Communications*. In revision
- Jones, C., **Ryan, J. C.**, Holt, T., Hubbard, A., Structural Glaciology of Isunguata Sermia, West Greenland, *Journal of Maps*. In revision
- Todd, J., Christoffersen, P., Zwinger, T., Raback, P., Chauche, N., Hubbard, A., Benn, D., Luckman, A., Toberg, N., Slater, D., **Ryan, J. C.** A Full-Stokes 3D Calving Model applied to a large Greenland Glacier. *Journal of Geophysical Research Letters: Earth Surface*. In revision
- Cooper, M. G., Smith, L. C., Rennermalm, A. K., Miede, C., Pitcher, L. H., **Ryan, J. C.**, Yang, K., Cooley, S. W. Meltwater storage in low-density near-surface bare ice in the Greenland ice sheet ablation zone. *The Cryosphere Discuss.*, doi:10.5194/tc-2017-107. In revision
- Smith, L. C., Yang, K., Pitcher, L. H., Overstreet, B. T., Chu, V. W., Rennermalm, A. K., **Ryan, J. C.**, Cooper, M. G., Gleason, C. J., Tedesco, M., Jeyaratnam, J., van As, D., van den Broeke, M. R., van den Berg, W. J., Noel, B., Langen, P. L., Cullather, R. I., Zhao, B., Willis, M. J., Hubbard, A., Box, J. E., Jenner, B. A., Behar, A. E. Direct measurements of meltwater runoff on the Greenland Ice Sheet surface. *Proceedings of the National Academy of Sciences (PNAS) of the United States of America*, E10622–E10631, doi:10.1073/pnas.1707743114 2017
- Stibal, M., Box, J. E., Cameron, K. A., Mottram, R. H., Khan, A. L., Molotch, N. P., Christmas, N. A. M., Quaglia, F. C., Remias, D., Smeets, C. J. P., van den Broeke, M. R., **Ryan, J. C.**, Hubbard, A., Tranter, M., van As, D., Ahlstrom, A. P. Algae drive enhanced darkening of bare ice on the Greenland ice sheet, *Geophysical Research Letters*, 44, doi:10.1002/2017GL075958. 2017
- Ryan, J. C.**, Hubbard, A., Irvine-Fynn, T. D., Doyle, S. H., Cook, J. M., Stibal, M., and Box, J. E. How robust are in-situ observations for validating satellite-derived albedo over the dark zone of the Greenland Ice Sheet? *Geophysical Research Letters*, 44, doi: 10.1002/2017GL073661. 2017
- Ryan, J.C.**, Hubbard, A., Box, J.E., Brough, S., Cameron, K., Cook, J.M., Cooper, M., Doyle, S.H., Edwards, A., Holt, T., Irvine-Fynn, T., et al. Derivation of High Spatial Resolution Albedo from UAV Digital Imagery: Application over the Greenland Ice Sheet. *Frontiers in Earth Science*, 5, doi:10.3389/feart.2017.00040. 2017
- Ryan, J. C.**, Hubbard, A., Stibal, M., Box, J. E. Attribution of Greenland's ablating ice surfaces on ice sheet albedo using unmanned aerial systems, *The Cryosphere Discuss.*, doi:10.5194/tc-2016-204. 2017

Ryan, J. C., Hubbard, A. L., Box, J. E., Todd, J., Christoffersen, P., Carr, J. R., Holt, T. O., and Snooke, N. UAV photogrammetry and structure from motion to assess calving dynamics at Store Glacier, a large outlet draining the Greenland ice sheet, *The Cryosphere*, 9, 1-11, doi:10.5194/tc-9-1-2015. 2015

Book Chapters:

Ryan, J.C., Dowdeswell, J. A., and Hogan, K. A.: Three cross-shelf troughs on the continental shelf of Southwest Greenland from Olex data, *Atlas of Submarine Glacial Landforms: Modern, Quaternary and Ancient*, Geological Society of London. 2016

Scholarships and funding

Aberystwyth University Doctoral Career Development Scholarship (£91,089) 2013-2017

Aberystwyth University Research Fund (£4,500) 2015

Fieldwork experience

Unmanned aerial vehicle surveying, Kangerlussuaq, Greenland	July 2017
Unmanned aerial vehicle surveying, Northern Patagonian Icefield, Chile	April 2017
Unmanned aerial vehicle surveying, Kangerlussuaq, Greenland	July 2016
GPS surveying and automatic weather station installation, Kangerlussuaq, Greenland	August 2015
Unmanned aerial vehicle surveying, Kangerlussuaq, Greenland	June-August 2015
Unmanned aerial vehicle surveying, Kangerlussuaq, Greenland	August 2014
GPS surveying, Store Glacier, Greenland	July 2014
Unmanned aerial vehicle surveying, Store Glacier, Greenland	May-July 2014
Unmanned aerial vehicle surveying, Store Glacier, Greenland	August 2013
Oceanographic data collection, West Greenland	June-July 2013
Water sampling and stream gauging, Rocky Mountain National Park, Colorado	June-July 2012

Fieldwork competencies

- Safe and effective management, logistics and leadership of teams in remote polar environments
- Construction and maintenance of electric and petrol-powered unmanned aerial vehicles (UAVs)
- Development of UAV telemetric and sensor packages including multi-spectral camera, broadband radiometers and kinematic GPS
- Operation of unmanned aerial vehicles including over 200 fixed-wing UAV surveys in Greenland
- Installation and management of remote networks of geodetic

- GPS and automatic weather stations
- Trained in powerboat handling, firearms and bear-awareness, VHF radio and Iridium communications

Conference talks and presentations (selected)

*Invited

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| * Ryan, J. C. Store Glacier calving rates and velocity patterns from repeat UAV surveys, <i>Weekly Glaciology Seminar</i> , ETH Zurich, Switzerland. | 23 October 2017 |
| Ryan, J. C. Investigating the dynamics of Store Glacier, West Greenland using UAVs, IASC Workshop and Network on Arctic Glaciology annual meeting, Obergurgl, Austria. | 22 March 2015 |
| Ryan, J. C. UAVs to investigate a tidewater glacier in Greenland, International Glaciological Society (IGS) Nordic Branch meeting, Hotel Dyrholaey, Iceland. | 30 October 2014 |

Supervision

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| Edward Roberts, third-year undergraduate, Aberystwyth University
<i>Thesis title: Spatial patterns of melt on Fornogletscher, European Alps from unmanned aerial vehicles.</i> | 2016-present |
| Christine Jones, second-year PhD student, Aberystwyth University (co-supervision).
<i>Thesis title: Investigating the structural glaciology of Isunguata Sermia, West Greenland using unmanned aerial vehicles.</i> | 2016-present |
| Daniel Vegh, Masters student, Aberystwyth University
<i>Thesis title: Mapping surface hydrology of K-Sector of West Greenland using unmanned aerial vehicles.</i> | 2015-2016 |
| Leo Nathan, Masters student, Aberystwyth University
<i>Thesis title: Flow dynamics and crevasse patterns of Isunguata Sermia, West Greenland using unmanned aerial vehicles.</i> | 2015-2016 |

Outreach (selected)

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| New York Times , "As Greenland melts, where is the water going?" | December 5 2017 |
| Eos , "Thirteen Innovative Ways Humans Use Drones" | October 11, 2017 |
| Eos , "On-the-Ground Measurements Overestimate Earth's Albedo" | August 18, 2017 |

Earth Magazine , "Observers at the edge of the ice: Smaller, cheaper machines can safely go where humans can't"	August 28, 2016
New York Times , "Greenland is melting away"	October 28, 2015
Discover Magazine , "Getting Droned on Greenland's Ice Sheet."	August 30, 2015
Motherboard , "Arctic Drone Footage of a Melting, Human-Stained Greenland"	October 31, 2014
Daily Mail , "The incredible images of 'dark snow' in Greenland."	September 11, 2014
NSIDC , "Greenland's summer: pressure is on, and off."	August 20, 2014

Research skills

I work predominantly with open-source software and undertake data processing, analysis and presentation using Python in a Linux (Ubuntu) environment. My research has taught me to automate the download, extraction and storage of large datasets including tens of thousands of aerial images, the MODIS, Landsat and Sentinel-2 archives, and weather station time-series data. I have experience of working with a broad range of datatypes (e.g. time series, spatial and numerical) stored in a variety of formats. My approach to data analysis involves the compiling of comprehensive datasets and extraction of patterns using statistics and machine learning. To do this I exploit the computer vision, geospatial, machine learning, data manipulation libraries in Python. These include OpenCV and scikit-image for image processing, scikit-learn for classification, regression and clustering, GDAL and OGR for raster and vector data manipulation and analysis. I use QGIS to visualise the results of data analysis and Inkscape for map and figure production. Finally, I communicate the research in a concise and intelligible manner with Latex.

References

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Prof Poul Christoffersen • pc350@cam.ac.uk
Dr Tristram Irvine-Fynn • tdi@aber.ac.uk
