

# Jonathan C. Ryan

## Postdoctoral Scholar

Institute for Environment and Society at Brown (IBES)  
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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

- Visiting Scholar, IBES, Brown University** **2018-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
- Postdoctoral Scholar, Department of Geography, UCLA** **2017-2018**  
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
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## **Peer-reviewed publications (6 lead author; 11 total)**

### *Journal articles:*

- Jones, C., **Ryan, J. C.**, Holt, T., Hubbard, A., Structural Glaciology of Isunguata Sermia, West Greenland, *Journal of Maps*, 14(2), doi:10.1080/17445647.2018.1507952. 2018
- Ryan, J. C.**, Sessions, M., Wilson, R., Wünderlich, O., Hubbard A., Rapid surface lowering of Benito Glacier, Northern Patagonian Icefield, *Frontiers in Earth Science*, 6(47), doi:10.3389/feart.2018.00047. 2018
- Todd, J., Christoffersen, P., Zwinger, T., Raback, P., Chauche, N., Benn, D., Luckman, A., **Ryan, J. C.**, et al., A Full-Stokes 3D Calving Model applied to a large Greenland Glacier. *Journal of Geophysical Research Letters: Earth Surface*. doi:10.1002/2017JF004349. 2018
- 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*, 12, 955-970, <https://doi.org/10.5194/tc-12-955-2018>. 2018
- Ryan, J. C.**, Hubbard, A., Stibal, M., Irvine-Fynn, T. D., Cook, J., Smith, L. C., Cameron, K., Box, J. E., Dark zone of the Greenland Ice Sheet controlled by distributed biologically-active impurities, *Nature Communications*, 9(1), doi:10.1038/s41467-018-03353-2. 2018
- Smith, L. C., Yang, K., Pitcher, L. H., Overstreet, B. T., Chu, V. W., Rennermalm, A. K., **Ryan, J. C.**, et al., 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.**, et al. 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., 2017

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.

**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

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**Scholarships and funding**

NSF #1836473: Navigating the New Arctic (NNA): Co-production of shorefast ice knowledge in Uummannaq Bay, Greenland (\$441,962) 2018-2021

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

Aberystwyth University Research Fund (£4,500) 2015

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**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

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## **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
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## **Conference talks and presentations (selected)**

\*Invited

- \***Ryan, J. C.** Store Glacier calving rates and velocity patterns from repeat UAV surveys, *Weekly Glaciology Seminar*, 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
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## **Supervision**

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

West Greenland using unmanned aerial vehicles.

Leo Nathan, Masters student, Aberystwyth University  
Thesis title: Flow dynamics and crevasse patterns  
of Isunguata Sermia, West Greenland using unmanned  
aerial vehicles.

2015-2016

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### **Outreach (selected)**

<b>New York Times</b> , “As Greenland melts, where is the water going?”	December 5 2017
<b>Eos</b> , “Thirteen Innovative Ways Humans Use Drones”	October 11, 2017
<b>Eos</b> , “On-the-Ground Measurements Overestimate Earth’s Albedo”	August 18, 2017
<b>Earth Magazine</b> , “Observers at the edge of the ice: Smaller, cheaper machines can safely go where humans can't”	August 28, 2016
<b>New York Times</b> , “Greenland is melting away”	October 28, 2015
<b>Discover Magazine</b> , “Getting Droned on Greenland’s Ice Sheet.”	August 30, 2015
<b>Motherboard</b> , “Arctic Drone Footage of a Melting, Human-Stained Greenland”	October 31, 2014
<b>Daily Mail</b> , “The incredible images of ‘dark snow’ in Greenland.”	September 11, 2014
<b>NSIDC</b> , “Greenland’s summer: pressure is on, and off.”	August 20, 2014

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### **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.

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### **References**

**Prof. Laurence Smith** • lsmith@geog.ucla.edu  
**Prof. Alun Hubbard** • abh@aber.ac.uk  
**Prof. Poul Christoffersen** • pc350@cam.ac.uk  
**Dr. Tristram Irvine-Fynn** • tdi@aber.ac.uk

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