# Fraser King

PhD(c) Student · Remote Sensing, Snowfall & Machine Learning

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## Education

**University of Waterloo** *Waterloo, Ontario, Canada*

PhD, Geography *2019 - present*

- Advisor: Dr. Christopher Fletcher
- Thesis focus on Machine Learning applications and Remote Sensing of precipitation

**University of Waterloo** *Waterloo, Ontario, Canada*

Master of Science *2017 - 2019*

- Advisor: Dr. Christopher Fletcher
- Thesis focus on Remote Sensing of snow using CloudSat-CPR retrievals

**University of Waterloo** *Waterloo, Ontario, Canada*

Bachelor of Computer Science (Honours) *2012 - 2017*

- Graduated with Distinction on the Dean's Honour List
- Participated in the Honours Co-op program with Outstanding performance reviews

## Professional Experience

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| 2022 | **Land Surface Modelling Intern**, Aquanty Inc. |
| 2019 | **Machine Learning Research Intern**, Aquanty Inc. |
| 2018 | **Graduate Research Assistant**, University of Waterloo |
| 2017 | **Graduate Teaching Assistant**, University of Waterloo |
| 2016-2017 | **Senior Developer**, TD Bank |
| 2015-2016 | **Mobile Engineer**, Intelligent Mechatronic Systems |

## Publications

**King, F.**, Kelly, R., & Fletcher, C. G. (2022). New opportunities for low-cost LiDAR-derived snow depth estimates from a consumer drone-mounted smartphone. *Cold Regions Science and Technology*, (in review).

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. *Atmospheric Measurement Techniques*, 15, 6035–6050. https://doi.org/10.5194/amt-15-6035-2022

**King, F.**, Duffy, G., & Fletcher, C. G. (2022). A Centimeter Wavelength Snowfall Retrieval Algorithm Using Machine Learning. *Journal of Applied Meteorology and Climatology*, https://doi.org/10.1175/JAMC-D-22-0036.1

**King, F.**, Kelly, R., & Fletcher, C. G. (2022). Evaluation of LiDAR-Derived Snow Depth Estimates From the iPhone 12 Pro. *IEEE Geoscience and Remote Sensing Letters*, https://doi.org/10.1029/2021MS002836

Fletcher, C. G., McNally, W., Virgin, G., & **King, F.** (2022). Toward efficient calibration of higher resolution Earth System Models. *Journal of Advances in Modeling Earth Systems*, 19, 1–5. https://doi.org/10.1109/LGRS.2022.3166665

**King, F.**, & Fletcher, C. G. (2021). Using CloudSat-derived snow accumulation estimates to constrain gridded snow water equivalent products. *Earth and Space Science*, e2021EA001835. https://doi.org/10.1029/2021EA001835

Duffy, G., **King, F.**, Bennartz, R., and Fletcher, C. G. (2021). Seasonal Estimates and Uncertainties of Snow Accumulation from CloudSat Precipitation Retrievals. *Atmosphere*, 12(3), 363. https://doi.org/10.3390/atmos12030363

**King, F.**, Erler, A. R., Frey, S. K., and Fletcher, C. G. (2020). Application of machine learning techniques for regional bias correction of snow water equivalent estimates in Ontario, Canada, *Hydrol. Earth Syst. Sci.*, 24, 4887–4902, https://doi.org/10.5194/hess-24-4887-2020

**King, F.**, & Fletcher, C. G. (2020). Using CloudSat-CPR Retrievals to Estimate Snow Accumulation in the Canadian Arctic. *Earth and Space Science*, 7(2), e2019EA000776. https://doi.org/10.1029/2019EA000776

## Awards, Fellowships, & Grants

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| 2022 | **Early Career Scientist Award (Runner-up for Outstanding Presentation)**, International Precipitation Working Group | *$ 50* |
| 2021 | **Campbell Scientific Canada Award**, Eastern Snow Conference | *$ 500* |
| 2020-2023 | **Doctoral Scholarship**, Natural Sciences and Engineering Research Council (NSERC) | *$ 63,000* |
| 2019 | **Exceptional Doctoral Student Scholarship**, University of Waterloo | *$ 10,000* |
| 2019 | **ESRI Canada GIS Centres of Excellence National Hackathon**, ESRI Canada | *$ 500* |
| 2019 | **Jack Rosen Memorial Award for Environmental Innovation**, University of Waterloo | *$ 2,000* |
| 2019 | **GRADflix Research Communication Video Winner - 1st Place**, University of Waterloo | *$ 1,000* |
| 2019 | **ESM-SnowMIP EGU Travel Grant**, Snow Models Intercomparison Project | *$ 1,000* |

## Presentations

### Invited Talks

Summer 2022. *DeepPrecip: A deep neural network for precipitation retrievals*. Invited Speaker, PMM Land Surface Working Group. Online.

Fall 2021. *Enhancing the Accuracy of Current Snow Water Equivalent Products through a Combination of Remote Sensing and Machine Learning Approaches*. Guest Lecture, Machine Learning Research Group, University of Guelph. Online.

Winter 2019. *Bias Correction of Gridded SWE Using a Random Forest*. Invited Talk, Aquanty Inc., Waterloo, Ontario. In person.

### Contributed Presentations

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. Oral presentation: University of Waterloo Graduate Student Conference. In Person.

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. Oral presentation: AGU Collective Madison Meeting (SatMET). Online.

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. Oral presentation: AGU Frontiers in Hydrology Meeting. Online.

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. Oral presentation: International Precipitation Working Group. In person.

**King, F.**, Duffy, G., Milani, L., Fletcher, C. G., Pettersen, C., & Ebell, K. (2022). DeepPrecip: A deep neural network for precipitation retrievals. Oral presentation: Eastern Snow Conference. Online.

**King, F.**, Kelly, R., & Fletcher, C. G. (2022). What if you put a phone on a drone?. Oral presentation: Canadian Meteorological and Oceanographic Society. Online.

**King, F**, Duffy, G., Fletcher, C. G. 2021. A Centimeter Wavelength Snowfall Retrieval Algorithm Using Machine Learning. Poster: International Summer Snowfall Workshop. Online.

**King, F**, Fletcher, C. G. 2021. Using CloudSat-CPR derived snow accumulation estimates to constrain gridded snow water equivalent products. Oral presentation: Canadian Meteorological and Oceanographic Society. Online.

**King, F**, Kelly, R., Fletcher, C. G. 2021. Evaluation of LiDAR snow depth estimates from portable consumer devices and their application for citizen science. Oral presentation: Eastern Snow Conference. Online.

**King, F**, Fletcher, C. G. 2021. Using CloudSat-CPR derived snow accumulation estimates to constrain gridded snow water equivalent products. Oral presentation: IEEE Geoscience and Remote Sensing Society (IGARSS). Online.

**King, F**, Fletcher, C. G. 2020. Bias-correction of gridded SWE products using CloudSat-CPR snowfall estimates. Oral presentation: Canadian Meteorological and Oceanographic Society. Online.

**King, F**, Erler, A., Frey, S., Fletcher, C. G. 2020. Application of Machine Learning Techniques for Regional Bias Correction of SWE Estimates in Ontario, Canada. Oral presentation: Climate Informatics (CI). Online.

**King, F**, Fletcher, C. G. 2020. Evaluation of Gridded Snow Products Using CloudSat Snowfall Estimates. Poster: Canadian Space Agency (CSA) Workshop. CSA, Montreal, Canada.

**King, F**, Fletcher, C. G. 2019. Evaluation of Gridded Snow Products Using CloudSat Snowfall Estimates. Oral presentation: European Geosciences Union (EGU). Vienna, Austria.

**King, F**, Fletcher, C. G. 2019. Using CloudSat-CPR Retrievals to Estimate Snow Accumulation in the Canadian Arctic. Oral presentation: Canadian Meteorological and Oceanographic Society. Halifax, Nova Scotia.

## Research Projects

### Canadian Space Agency (CSA) Snowfall Project

As a highly qualified person (HQP) on the CSA-funded snowfall project, I was responsible for analysing the output from several spaceborne remote sensing instruments and presenting my results twice a year at bi-annual meetings. This project group consisted of members from various Universities and Government agencies, with a joint interest in improving next-generation space-based snowfall estimates. My participation resulted in various international conference presentations and several scientific publications related to the validation and application of CloudSat-CPR measurements.

## Teaching Experience

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| 2022 (March - June) | **Machine learning applications for land cover classification using Sentinel-2**, Course Lead | *Aggregate Intellect* |

## Mentoring

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| 2017-2019 | **Statistics Tutor**, Undergraduate Students in Math, Computer Science and Geography | *University of Waterloo* |

## Technical Skills

- **Programming Languages**: Python, C/C++, Objective-C, R, Rust, Go, Swift, Javascript, Bash
- **Technical Software**: scikit-learn, SciPy, Keras, PyTorch, Git, Numpy, Pandas, Tensorflow, SQL, HDF, netCDF

## Outreach & Professional Development

### Service and Outreach

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| 2021 | **Environment Building Mural Project (Canadian Map)**, Creator, Designer and Project Lead | *University of Waterloo* |
| 2021 | **Environment Graduate Student Recruitment**, PhD Student Panelist | *University of Waterloo* |
| 2018-2020 | **Canada Weather Network Data Contributor**, Network Member | *Ontario* |

### Development

**GraphCore AI Training:** Completed an online training course to use deep learning libraries like Tensorflow and Keras on the Graphcore Intelligent Processing Unit (IPU) pods.

**Compute Canada - High Performance Computing Course:** A two day in-person course provided in-depth detail into using the Niagara super-computing cluster (ie. submitting and parallelizing compute tasks).

**3 Minute Thesis Competition:** As a participant in this competition, I learned valuable techniques for communicating my research in a clear and concise manner to a wide audience.