

Christopher Hopkinson

Dept. Geography, University of Lethbridge, Lethbridge, Alberta, Canada

Ph. +1 403 332 4586, Email: c.hopkinson@uleth.ca

Curriculum Vitae Summary

Education

- 2002 - 2004 Post-Doctoral Fellow, Dept. of Geography, Queen's University, Kingston ON
1997 - 2002 Ph.D. in Geography, Wilfrid Laurier University, Waterloo Ontario Canada
Thesis: *Investigating hydrological component spatiotemporal variability in the Canadian Rockies*
1995 - 2007 M.E.S. in Geography, Wilfrid Laurier University, Waterloo Ontario Canada
Thesis: *The impact of glacier recession upon the discharge of the Bow River above Banff, Alberta*
1992 - 1995 B.Sc. (Hons) in Geography, Manchester University, Manchester UK
Thesis: *Investigations into the summer melt water hydraulics of the Findelen Gletscher, Switzerland*
1991 - 1992 1st Yr Engineering, Manchester University, Manchester UK
1990 - 1991 Internship, Birmingham City Engineers, UK. Arranged by Royal Academy of Engineering

Research Interests

Remote sensing (LiDAR, thermal, photogrammetry); climate change; water resources; glaciology; forestry; ecosystem modeling & change; landscape disturbance; scaling; uncertainty; aerial survey logistics & monitoring.

Academic Posts

- 2013 - CAIP Research Chair & Associate Professor: ATIC & Dept. of Geography, University of Lethbridge
2012 - 2013 Visiting Scientist: Commonwealth Scientific & Industrial Research Organisation (CMAR), Australia
2007 - Adjunct Professor: Acadia University, Dalhousie University, Wilfrid Laurier University
2004 - 2011 Research Scientist & Lecturer: Applied Geomatics Research Group, Centre of Geographic Sciences
2001 - 2004 Lecturer (physical geography): Queen's University; McMaster University; Wilfrid Laurier University

Publications

Book chapters: **12**

Refereed Publications in International Journals: **44 (+9 submissions); 953 citations; h-index = 17; i10-index = 28**

Refereed Proceedings Papers: **31**

Non-Refereed Proceedings Papers and Conference presentations: **>100**

Funding

2002 - present Government and industry funding (as PI, CI, or funded collaborator) > \$8,000,000; >40 projects

Supervised Graduate Students

Ph.D. students: 2 (+ 1 committee member)

Master's students: 9

Community Service

Held Chair positions in 3 National/International societies; Member of 9 societies; Organized/supported 10 conferences; Lead > 50 workshops, guest seminars and public consultations; Supported 100s of researchers via academic LiDAR research lab.

Curriculum Vitae Appendices

Career

- 2013 Research Chair & Assoc. Professor, Dept. Geography, University of Lethbridge, Alberta
- 2012 - 2013 Visiting Research Scientist CSIRO, Canberra, Australia
Development of carbon biomass lidar monitoring strategy and climate model parameterization using lidar/hyperspectral remote sensing data.
- 2004 - 2011 Research Scientist, Lecturer Applied Geomatics Research Group, Nova Scotia Canada
Managed AGRG lidar research and applications lab. Coordinated international airborne remote sensing (lidar, thermal, spectral) research logistics, supported private sector and local economic development, taught courses in geomatics & remote sensing, directed graduate students/interns.
- 2004 Lecturer, Queen's University, Kingston, Ontario Canada
Lectured 4th year Earth System's Science
- 2002 - 2004 Post Doctoral Fellow, Queen's University, Kingston, Ontario Canada
Airborne and terrestrial remote sensing of forest ecosystems.
- 2002 Lecturer, McMaster University, Hamilton, Ontario Canada
Lectured 2nd year Hydrology
- 2001 Lecturer, Wilfrid Laurier University, Waterloo, Ontario Canada
Lectured 3rd year Meteorology
- 2001 Lecturer, Wilfrid Laurier University, Waterloo, Ontario Canada
Lectured 3rd year Drainage Basin Ecosystems
- 2001 - Present Business Partner, Otterburn Geographic
Hydrogeomatics consultancy specializing in remote sensing & in situ field design, RFP review.
- 1999 - 2001 Field Operations Manager, Optech Inc., Toronto, Ontario Canada (Laser mapping)
- 1997 - 1999 Assistant to Secretary General, Int'l. Assoc. Hydrological Sciences, Waterloo, Ontario Canada
- 1995 - 1999 Research Assistant, Wilfrid Laurier University, Waterloo, Ontario Canada
- 1990 - 1991 Survey Engineering Technician, Birmingham City Engineers, Birmingham, UK

Published Research Activities

Books (including contribution to 11 chapters):

Hopkinson, C., Pietroniro, A. and Pomeroy, J. (eds), 2008. *HYDROSCAN: Airborne laser mapping of hydrological features and resources*. Canadian Water Resources Association, Saskatoon. 376PP.

Peer Reviewed Journal Publications (45); 953 citations; h-index = 17; i10-index = 28:

- Goulden, T. **Hopkinson**, C., Jamieson, R. and Sterling, S. Sensitivity of watershed attributes to spatial resolution and interpolation method of LiDAR DEMs in three distinct landscapes. *Water Resources Research*. (Accepted)
- van Gorsel, E., A.J.A. Berni, P. Briggs, A. Cabello-Leblic, L. Chasmer, H.A. Cleugh, J. Hacker, S. Hantson, V. Haverd, D. Hughes, C. Hopkinson, H. Keith, N. Kljun, R. Leuning, M. Yebra, and S. Zegelin. 2013. Primary and secondary effects of climate variability on carbon and water exchange in an evergreen Eucalyptus forest. *Agriculture & Forest Meteorology* (In Press) doi.org/10.1016/j.agrformet.2013.04.027.

- Boyd, D. S., Hill, R. A., **Hopkinson**, C., and Baker, T. R. 2013. Landscape-scale forest disturbance regimes in southern Peruvian Amazonia. *Ecological Applications*. (In Press) doi.org/10.1890/12-0371.1
- Grünewald, Stötter, Pomeroy, Dacic, Moreno Baños, Marturià, Spross, **Hopkinson**, Burlando, and Lehning. 2013. Statistical modeling of the snow depth distribution in open alpine terrain. *Hydrol. Earth Syst. Sci.*, Vol. 17, 3005-3021. doi:10.5194/hess-17-3005-2013
- Hopkinson**, C., Lovell, J., Chasmer, L., Jupp, D., Kljun, N., van Gorsel, E. 2013. Integrating terrestrial and airborne lidar to calibrate a 3D canopy model of effective leaf area index. *Remote Sensing of Environment*. Vol 136: 301-314
- Goulden, T. **Hopkinson**, C., Demuth, M. N., 2013. Sensitivity of alpine glacial change detection and mass balance to sampling and datum inconsistencies. *The Cryosphere Discussions*. Vol 7, 55-101. doi:10.5194/tcd-7-55-2013
- Hopkinson**, C., Chasmer, L., Colville, Fournier, R., D., Hall, R., Luther, J., Milne, T., Petrone, R., St-Onge, B. 2013. Moving towards consistent ALS monitoring of forest attributes across Canada; the 'C-CLEAR' approach. *Photogrammetric Engineering and Remote Sensing*. Vol. 79, No. 2: 159-173.
- Wulder, M.A., J.C. White, C.W. Bater, N.C. Coops, C. **Hopkinson**, and G. Chen. 2012. Lidar plots-a new large-area data collection option: context, concepts, and case study. *Canadian Journal of Remote Sensing*. Vol. 38, No. 5: 600-618.
- Hopkinson**, C., Collins, T., Anderson, A., Spooner, I., Pomeroy, J. 2012. Spatial snow depth assessment using lidar transect samples and Public GIS data layers in the Elbow Creek Watershed, Alberta. *Canadian Water Resources Journal*. Vol 37(2): 69-87.
- Los, S.O., Rosette, J.A.B., Kljun, N., North, P.R.J., Suarez, J.C., **Hopkinson**, C., Hill, R.A., Chasmer, L., van Gorsel, E., Mahoney, C., Berni, J.A.J. 2012. Vegetation height products between 60° S and 60° N from ICESat and GLAS data. *Geoscientific Model Development*. Vol. 5: 413-432.
- Garroway, K., **Hopkinson**, C., Jamieson, R. 2011. Investigating the influence of surface moisture and vegetation cover on airborne lidar intensity data. *Canadian Journal of Remote Sensing*. Vol. 37(3): 275-284.
- Foy, N., Copland, L., Zdanowicz, Demuth, M.N., C., **Hopkinson**, C. 2011. Recent volume area changes of the Kuskawulsh Glacier, Yukon Territory, Canada. *Journal of Glaciology*. Vol. 57(203): 515-525.
- Hopkinson**, C., Crasto, N., Marsh, P., Forbes, D., Lesack, L. 2011. Investigating the spatial distribution of water levels in the Mackenzie Delta using airborne lidar. *Hydrological Processes*. Vol. 25(19): 2995-3011. DOI: 10.1002/hyp.8167.
- Chasmer, L., N. Kljun, C. **Hopkinson**, S. Brown, T. Milne, K. Giroux, A. Barr, K. Devito, I. Creed, and R. Petrone. 2011. Characterizing vegetation structural and topographic characteristics sampled by eddy covariance within two mature aspen stands using lidar and a flux footprint model: Scaling to MODIS, *Journal of Geophysical Research – Biogeosciences (special issue on flux scaling, invited)* Vol. 116, G02026, doi:10.1029/2010JG001567.
- Chasmer, L., W. Quinton, C. **Hopkinson**, R. Petrone, and P. Whittington, 2011. Vegetation canopy and radiation controls on permafrost plateau evolution within the discontinuous permafrost zone, Northwest Territories, Canada. *Permafrost and Periglacial Processes*. Vol. 22(3): 199-213. DOI: 10.1002/ppp.724.
- Hill, R., Boyd, D., **Hopkinson**, C. 2011. Relationship between canopy height and Landsat ETM+ response in lowland Amazonian rainforest. *Remote Sensing Letters*. Vol. 2 (3), 203-212.
- Hopkinson**, C., Barlow, J., Demuth, M., Pomeroy, J. 2010. Mapping changing temperature patterns over a glacial moraine using oblique thermal imagery and lidar. *Canadian Journal of Remote Sensing*. Vol. 36 (suppl. 2) pp. 257-265.

- Chasmer, L., **Hopkinson**, C., Quinton, W. 2010. Quantifying errors in historical permafrost plateau change in the Canadian sub Arctic from aerial photography and airborne lidar from 1947 to 2008. *Canadian Journal of Remote Sensing*. Vol. 36 (suppl. 2) pp. 211-223.
- Goulden, T. and **Hopkinson**, C. 2010b. The effect of the deflection of the vertical on lidar observations. *Canadian Journal of Remote Sensing*. Vol. 36 (s2) pp. 365-375.
- Hilker, T., Hall, F.G., Coops, N.C., Lyapustin, A., Wang, Y., Grant, N, Nesic, Z., Black, T.A., Kljun, N., Chasmer, L., **Hopkinson**, C. 2010. Remote sensing of photosynthetic light use efficiency across two forested biomes: Spatial scaling. *Remote Sensing of Environment*, Vol. 114, 2863–2874
- Hopkinson**, C., Chasmer, L.E. Munro, D.S. Demuth, M.N. 2010. The influence of DEM resolution on simulated solar radiation-induced glacier melt. *Hydrological Processes*, Vol. 24: 775-788.
- Goulden, T. and Hopkinson. C., 2010a. The forward propagation of integrated system component errors within airborne lidar data. *Photogrammetric Engineering and Remote Sensing*. Vol. 76 (5): 598-601.
- Hopkinson**, C. and Chasmer, L.E., 2009. Testing lidar models of fractional cover across multiple forest ecozones. *Remote Sensing of Environment*. Vol. 113: 275-288.
- Chasmer, L., Barr A., **Hopkinson**, C., McCaughey, H., Treitz, P., Black, A., Shashkov, A. 2009. Scaling and assessment of GPP from MODIS using a combination of airborne lidar and eddy covariance measurements over jack pine forests. *Remote Sensing of Environment* Vol. 113: 82-93.
- Hopkinson**, C., Hayashi, M., Peddle, D. 2009. Comparing alpine watershed attributes from lidar, Photogrammetric, and Contour-based Digital Elevation Models. *Hydrological Processes*. Vol. 23: 451-463.
- Lipovsky, P.S. ,Evans, S.G., Clague J.J., **Hopkinson**, C., Couture, R., Bobrowsky, P., Ekström, G., Demuth, M.N., Delaney, K.B., Roberts, N.J., Clarke, G., Schaeffer. A. 2008. The July 2007 rock and ice avalanches at Mount Steele, St. Elias Mountains, Yukon, Canada. *Landslides*. Vol. 5: 445-455 (DOI 10.1007/s10346-008-0133-4).
- Lim, K., **Hopkinson**, C., Treitz, P. 2008. Examining the effects of sampling point densities on laser canopy height and density metrics at the forest plot level. *Forestry Chronicle*. Vol. 84, No. 6. pp.
- Chasmer, L., **Hopkinson**, C., Treitz, P., McCaughey, H., Barr, A., and Black, A. 2008. A lidar-based hierarchical approach for assessing MODIS fPAR. *Remote Sensing of Environment* Vol. 112, No. 12. pp. 4344-4357.
- Hopkinson**, C. Chasmer, L.E., Hall, R.J. 2008. The uncertainty in conifer plantation growth prediction from multitemporal lidar datasets. *Remote Sensing of Environment*. Vol. 112, No. 3. pp.
- Chasmer, L., Kljun, N., Barr, A., Black, A., **Hopkinson**, C., McCaughey, H., and Treitz, P. 2008. Influences of vegetation structure and elevation on CO₂ uptake in a mature jack pine forest in Saskatchewan, Canada. *Canadian Journal of Forest Research* Vol. 38: 2746-2761.
- Demuth, M.N., Pinard, V., Pietroniro, A., Luckman, B.H., **Hopkinson**, C., Dornes, P., Comeau, L. 2008. Recent and past-century variations in the glacier resources of the Canadian Rocky Mountains – Nelson River system. *Terra Glacialis* 11 (248): 27-52.
- Hopkinson**, C. and Chasmer, L.E. 2007. Using discrete laser pulse return intensity to model canopy transmittance. *Photogrammetric Journal of Finland*. Vol. 20, No. 2, pp. 16-26.
- Goodale, R., **Hopkinson**, C., Colville, D., Amirault, D. 2007. Mapping Piping Plover habitat in coastal areas using airborne lidar data. *Canadian Journal of Remote Sensing*. Vol. 33, No. 6, pp.519-533.
- Hopkinson**, C. 2007. The influence of flying altitude and beam divergence on canopy penetration and laser pulse return distribution characteristics. *Canadian Journal of Remote Sensing* Vol. 33, No. 4, pp. 312-324.

- Hopkinson, C., Popescu, S., Flood, M., Maher, R.** 2007. A survey on the need for lidar training, *Photogrammetric Engineering and Remote Sensing*, 73 (5). PP 537 – 546.
- Chasmer, L.E., **Hopkinson, C., Smith, B., Treitz, P.** 2006. Examining the influence of changing laser pulse repetition frequencies on conifer forest canopy returns. *Photogrammetric Engineering and Remote Sensing*. 72 (12) pp. 1359-1367.
- Chasmer, L.E., **Hopkinson, C., Treitz, P.** 2006. Investigating laser pulse penetration through a conifer canopy by integrating airborne and terrestrial lidar. *Canadian Journal of Remote Sensing*, 32 (2) pp. 116-125.
- Hopkinson, C., Demuth, M.N.** 2006. Using airborne lidar to assess the influence of glacier downwasting to water resources in the Canadian Rocky Mountains, *Canadian Journal of Remote Sensing*, 32 (2) pp. 212-222.
- Hopkinson, C., Chasmer, L., Lim, K. Treitz, P., Creed, I.** 2006. Towards a universal lidar canopy height indicator, *Canadian Journal of Remote Sensing*, 32 (2) pp. 139-153.
- Hopkinson, C., Chasmer, L.E., Zsigovics, G., Creed, I., Sitar, M., Kalbfleisch, W., Treitz, P.** 2005. Vegetation class dependent errors in lidar ground elevation and canopy height estimates in a Boreal wetland environment *Canadian Journal of Remote Sensing*, 31 (2) pp. 191–206.
- Hopkinson, C., Chasmer, L.E., Young-Pow, C., Treitz, P.** 2004. Assessing plot-level forest metrics with a ground-based scanning lidar. *Canadian Journal of Forest Research*, 34 pp. 573-583.
- Hopkinson, C., Sitar, M., Chasmer, L.E., Treitz, P.** 2004. Mapping snowpack depth beneath forest canopies using airborne lidar. *Photogrammetric Engineering and Remote Sensing*, 70 (3) pp. 323-330.
- Töyrä, J., Pietroniro, A., Hopkinson, C., Kalbfleisch, W., 2003. Assessment of airborne scanning laser altimetry (lidar) in a deltaic wetland environment. *Canadian Journal of Remote Sensing*, 29 (6): pp718-729.
- Hopkinson, C. and Young, G.J.** 1998. The effect of glacier wastage on the flow of the bow river. *Hydrological Processes*, 12, (10-11), pp1745-1763.
- Hopkinson, C. and 11 others,** 1997, An integrated approach to the planning and management of an urban wetland. *Canadian Water Resources Journal*. 22 (1) pp45-56.

Peer Reviewed Proceedings Publications (31):

- Hopkinson, C., Chasmer, L., Kljun, N., van Gorsel, E., McCaughey, H., Barr, A., Black, A.** 2012. ALS monitoring of changes in forest biomass carbon storage. *Proceedings of the SilviLaser meeting in Vancouver, Canada, 16-19 September 2012*.
- Chasmer, L., Petrone, R., Brown, S., **Hopkinson, C., Mendoza, C., Diiwu, J., Quinton, W., Devito, K.** 2012. Sensitivity of modelled actual evapotranspiration to canopy characteristics within the Western Boreal Plain, Alberta. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).
- Crasto, N., **Hopkinson, C., Marsh, P., Forbes, D., Spooner, I.** 2012. Delineation of lakes and channels in the Mackenzie Delta, NWT using airborne lidar. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).
- Fox, A., Hopkinson, C., Chasmer, L. 2012. Simulating canopy transmittance at variable zenith and azimuth angles using lidar echo classification, vertical intensity and spatial point density distributions. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).....(publication lost during Redbook preparation after being submitted, reviewed and edited)

- Goulden, T., **Hopkinson**, C., Jamieson, R. 2012. Sensitivity of modeled watershed attributes to DEM spatial resolution. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).
- Hopkinson**, C., Demuth, M.N., Sitar, M. 2012. Hydrological implications of periglacial expansion in the Peyto Glacier catchment, Canadian Rockies. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).
- Hopkinson**, C., Pomeroy, J., DeBeer, C., Ellis, C. Anderson, A. 2012. Relationships between snowpack depth and primary lidar point cloud derivatives in a mountainous environment. *Remote Sensing and Hydrology 2010 Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010* (IAHS Publ. 352). pp 352-354
- Huh, K., Mark, B., **Hopkinson**, C. 2012. Changes of topographic context of the Yanamarey glacier in the Tropical Peruvian Andes. *Remote Sensing and Hydrology 2010* (Proceedings of a symposium held at Jackson Hole, Wyoming, USA, September 2010) (IAHS Publ. 352).
- Bater, C. Wulder, M.A., Coops, N.C., **Hopkinson**, C., Coggins, S.B., Arsenault, E., Beaudoin, A., Guindon, L., Hall, R.J., Villemaire, P., Woods, M. 2011. Model development for the estimation of aboveground biomass using a lidar-based sample of Canada's boreal forest. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Boyd, D.S., Hill, R.A., Baker, T.R., **Hopkinson**, C. 2011. Gap Size Frequency Distributions for Peruvian Amazonian Rainforests Determined by Airborne Laser Scanning: Implications for Biodiversity and Carbon Accounting. *Remote Sensing Photogrammetry Society mtg*, Bournemouth, UK. September, 2011.
- Chasmer, L., **Hopkinson**, C. Petrone, R. Quinton, W. 2011. Fusion of airborne lidar and WorldView-2 MS data for classification of depth to permafrost within Canada's sub-Arctic. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Fox, A., **Hopkinson**, C. Chasmer, L. Wile, A. 2011. Stability of lidar-derived raster canopy attributes with changing pulse repetition frequency. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Hopkinson**, C., Colville, D., Bourdeau, D., Monette, S., Maher, R. 2011. Scaling plot to stand-level lidar to public GIS data in a hierarchical approach to map the biomass of Nova Scotia. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Hopkinson**, C., Wulder, M.A., Coops, N.C., Milne, T., Fox, A., Bater, C.B. 2011. Airborne lidar sampling of the Canadian boreal forest: Planning, execution & initial processing. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Lovell, J.L., D.L.B. Jupp, E. van Gorsel, J. Jimenez-Berni, C. **Hopkinson**, and L. Chasmer, 2011. Foliage profiles from ground based waveform and discrete point lidar. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Morrison, H., **Hopkinson**, C., Chasmer, L., Kljun, N. 2011. Using a GIS approach to optimize effective leaf area index by Canadian boreal forest species using airborne lidar. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Morrison, H., **Hopkinson**, C., Wulder, M.A. 2011. Optimal lidar gridding parameterization for effective leaf area estimation in the boreal forest Yukon Territory, Canada. *Proceedings of the SilviLaser 2011 Conference*, Oct. 16-20, Hobart, Tasmania.
- Berni, A.J., N. Kljun, E. Van Gorsel, V. Haverd, R. Leuning, A. Cabello-Leblic, A. Held, C. **Hopkinson**, L. Chasmer, 2011. 3D spatial distribution of biophysical parameters derived from hyperspectral and lidar remote sensing. Improving the constraints in land surface modelling. *34th International Symposium on Remote Sensing of Environment*. Sydney Australia. April 10-15.

- Van Gorsel, E., N. Kljun, R. Leuning, A.J. Berni, A. Cabello-Leblic, A. Held, V. Haverd, C. **Hopkinson**, L. Chasmer, and K Youngentob, 2011. Use of high resolution lidar and hyperspectral data to evaluate the sensitivity of net ecosystem exchange to stand structural and plant chemical properties. *34th International Symposium on Remote Sensing of Environment*. Sydney Australia. April 10-15.
- Hill, R., Boyd, D., **Hopkinson**, C. 2010. Integrating airborne lidar and Landsat ETM+ data for large area assessment of forest canopy height in Amazonia. *ISPRS Silvilaser proceedings*. Freiburg, Germany.
- Hopkinson**, C. and Chasmer, L.E. 2007. Modeling canopy gap fraction from lidar intensity. *ISPRS Silvilaser workshop proceedings in ESPOO, Finland*.
- Chasmer, L., Barr, A., Black, A., **Hopkinson**, C., Kljun, N., McCaughey, H., and Treitz, P. 2007. Using airborne lidar for the assessment of canopy structure influences on CO² fluxes. *ISPRS Silvilaser workshop proceedings in ESPOO, Finland*.
- Hopkinson**, C., K. Lim, L. E. Chasmer, P. Treitz, I. F. Creed, C. Gynan. 2004, Wetland grass to plantation forest - estimating vegetation height from the standard deviation of lidar frequency distributions. *Proceedings of the ISPRS working group VIII/2, 'Laser-Scanners for Forest and Landscape Assessment* Freiburg, Germany 03-06 October 2004 ISPRS 36, 8/W2.
- Hopkinson**, C., L. E. Chasmer, Gabor Zsigovics, I. F. Creed, Michael Sitar, P. Treitz and Robert, V. Maher. 2004, Errors in LiDAR ground elevation and wetland vegetation height estimates. *Proceedings of the ISPRS working group VIII/2, 'Laser-Scanners for Forest and Landscape Assessment* Freiburg, Germany 03-06 October 2004 ISPRS 36, PART 8/W2.
- Chasmer, L.E., **Hopkinson**, C., Treitz, P., 2004. Assessing the 3D-frequency distribution of airborne and ground-based lidar data for red pine and mixed deciduous forest plots. *Proceedings of the ISPRS working group VIII/2, 'Laser-Scanners for Forest and Landscape Assessment* Freiburg, Germany 03-06 October 2004 ISPRS 36, PART 8/W2.
- Hopkinson**, C. and English, M.C. 2001. Spatio-temporal Variations of $\delta^{18}\text{O}$ Isotope Signatures of Hydrological Components within a Glacierised Mountainous Basin. *Proceedings of the 58th Eastern Snow Conference*. Ottawa, Ontario, Canada. May 14 - 18, 2001.
- Hopkinson**, C., Lowe, A., Zawadzki, A., English, M., 2001. Using Oxygen Isotope Tracers to Evaluate and Optimize Flow Components Generated by the UBC Watershed Model in a Mountainous Basin. *Proceedings of the 58th Eastern Snow Conference*. Ottawa, Ontario, Canada. May 14 - 18, 2001.
- Hopkinson**, C., and 10 others. 2001. Mapping the spatial distribution of snowpack depth beneath a variable forest canopy using airborne laser altimetry. *Proceedings of the Eastern Snow Conference*, Ottawa, May 14-18.
- Chasmer, L. and **Hopkinson**, C. 2001. Using airborne laser altimetry and GIS to assess scale induced radiation loading errors in a glacierised basin. *Proceedings of the 58th Eastern Snow Conference*.
- Hopkinson**, C. 1997, The net volumetric loss of glacier cover within the Bow Valley above Banff, Alberta, 1951 - 1993 *Joint ESC/WSC proceedings of the Banff meeting*, May 1997.
- Hopkinson**, C. and Young, G.J. 1997. The impact of glacier recession to the Bow River above Banff, Alberta, 1951 - 1993 *Joint ESC/WSC proceedings of the Banff meeting*, May 1997.

Research Funding

Year	Source & Purpose	Investigator Status	Amount
2014-2016	Alberta Innovates - Technology Futures PDF funding to support lidar sensor integration & data centre research	PI	\$140,000
2013	Govt. Alberta & Airborne Imaging Funding to support lidar stakeholder workshop and discussion forum	PI	\$7,500

2013+	<u>CAIP & University of Lethbridge</u> Terrestrial ecosystem remote sensing chair startup funding	PI	\$400,000
2013+	<u>NASA</u> Surface Water & Ocean Topography mission; Canadian research team.	CI (PI = Dr. A. Pietroniro)	TBD
2012- 2015	<u>Canadian Space Agency</u> Cluster for Subarctic Ecosystems in Transition, C-SET	CI (PI = Dr. W. Quinton)	\$450,000
2012	<u>Govt Alberta</u> Issues surrounding the development of lidar standards	PI	\$4,000
2012	<u>Nova Scotia Govt.</u> Provincial lidar specification / review	Sub contract	\$3,000
2011- 2012	<u>NRCan</u> (Canadian Forest Service) Boreal forest canopy & LAI modeling	PI (2 projects)	\$26,000
2011-2012	<u>HRM</u> Automated GIS watershed modeling of the Halifax Harbour drainage basin	Principle applicant	\$20,000
2011-2014	<u>FORNT</u> Towards landscape management of boreal ecosystems	Collaborator (PI = Dr. J-C. Ruel)	\$215,000
2011-2012	<u>NSERC</u> Spatio-temporal modeling of landscape energetics & environment change	CI (Thermal lead) (PI = Dr. R. Maher)	\$150,000
2011-2012	<u>HRM</u> Automated 3D CAD / GIS modeling buildings in downtown Halifax	PI	\$18,000
2011	<u>NRCan</u> Glacial / periglacial changes and datum-related errors in the Canadian Rockies	PI	\$10,000
2010-2011	<u>NRCan</u> Sampling the Canadian boreal ecozone with airborne lidar to scale from field plot to satellite data products	CI (PI = Dr. M. Wulder)	\$58,000
2010-2013	<u>NSERC SG</u> Understanding and prediction of permafrost thaw on northern water resources	Collaborator (PI = Dr. W. Quinton)	\$24,000
2010-2012	<u>NRCan</u> Mapping & automating forest canopy attribute extraction in Newfoundland	CI (PI = Dr. J. Luther)	\$151,600
2010-2011	<u>NERC</u> Improving forest carbon uptake estimates using high res remote sensing data across European Fluxnet sites	CI (PI = Dr. N. Kljun)	\$394,000
2009-2010	<u>NRCan</u> Surface property and in situ scaling considerations in support of land ice altimetry	PI	\$5,000
2009-2010	<u>NS Power Inc.</u> Modeling sustainable biomass fuel resources using lidar & GIS	RS lead (PI = Dr. R. Maher)	\$180,000
2009-2010	<u>Nova Scotia Environment</u> Lidar data to support coastal watershed & community risk mitigation	Co-PI	\$70,000
2009- 2010	<u>NERC (UK)</u> Using lidar to improve quantification of changes in terrestrial carbon sinks at the Tumberumba fluxnet site, Australia	CI (PI = Dr. N. Kljun)	\$50,400
2009	<u>HRM</u> GIS modeling flood water levels and potential trail system in Cole Harbour	PI	\$7,000
2009	<u>Env Can / CWS</u> Lidar watershed mapping in Kejimikujik National Park, Nova Scotia	PI	\$20,000
2008 - 2011	<u>NRCan / Env Can</u> Mackenzie Delta lidar hydrological mapping & GIS modeling	PI (3 combined projects)	\$55,000
2008 -2009	<u>HRM</u> Halifax Harbour GIS flood impact delineation from lidar DEM	PI	\$14,000
2008-2009	<u>NERC (UK)</u> Determining on site variability of CO2 and H2O fluxes using footprint and lidar data in the Canadian boreal forest	Collaborator (PI = Dr. N. Kljun)	\$105,800
2008-2009	<u>City of Calgary</u> Mapping snowpack water resources in the Elbow watershed	PI	\$20,000

2008-2009	<u>Govt. Alberta (SRD, AEP)</u> <i>Monitoring mountain snowpack resources using lidar</i>	PI	\$20,000 (+ in kind support)
2008 -2012	<u>ACOA AIF</u> <i>Geomatics technology integration for improved watershed management development (leading active hyperspectral research)</i>	CI (FLS lead) (PI = Dr. R. Maher)	\$2,820,000
2007 - 2008	<u>Université du Québec à Montréal</u> <i>Assessing lidar waveform data for canopy modeling</i>	Collaborator (PI = Dr. B. St-Onge)	\$14,000
2007 - 2008	<u>NRCan</u> <i>ICESat GLAS lidar comparison to airborne lidar for estimation of forest structure, volume & biomass</i>	Collaborator (PI = Dr. R. Hall)	\$15,000
2007 - 2008	<u>NB Emergency Measures Organization</u> <i>St John River floodplain mapping</i>	PI	\$55,000
2007 - 2008	<u>Institut Québécois d'Aménagement de la Forêt Feuillue</u> <i>Lidar forest plot characterization</i>	Collaborator (PI = Dr. F. Doyon)	\$15,000
2006 - 2008	<u>NRCan</u> <i>Terrain-based error propagation of glacial mass balance</i>	PI	\$25,000
2006 - 2011	<u>NASA (USA)</u> <i>Glacial volumes in the Cordillera Blanca, Peru using airborne lidar</i>	Collaborator (PI = Dr. B. Mark)	\$70,000
2006 - 2007	<u>Oxford Frozen Foods Inc.</u> <i>Town of Oxford flood risk assessment</i>	PI	\$25,000
2007	<u>GeoNet Inc.</u> <i>City of St John flood set back zone assessment</i>	PI	\$15,000
2006	<u>Nova Ski Ltd.</u> <i>Ski hill 3D animation and trail map development</i>	PI	\$10,000
2006	<u>NSCC</u> <i>Lidar curriculum research and development</i>	PI	\$25,000
2006	<u>CARIS Inc.</u> <i>Modeling lidar total propagated error</i>	PI	\$15,000
2005 - 2008	<u>NSERC</u> <i>Integrating environmental and geomatics technologies for landscape monitoring, assessment and restoration</i>	CI (PI = Dr. R. Maher)	\$1,500,000
2004 - 2008	<u>Canada Foundation for Innovation</u> <i>Enviro. Health Applications of Geomatics (lidar eqpt)</i>	CI (PI = Dr. R. Maher)	\$2,080,000
2003 - 2004	<u>CRYSYS, Climate Research Branch</u> <i>Influence of DEM scale on GIS glacier melt model</i>	PI	\$16,500
2002-2006	<u>Alberta Provincial Govt.</u> <i>Glacial water resource predictions in Alberta</i>	Applicant (CIs = Dr A. Pietroniro, M. Demuth)	\$230,000
2002 - 2005	<u>European Space Agency, CRYOSAT program</u> <i>CRYOSAT algorithm development for applications in the Canadian Rockies/Arctic</i>	CI (PI = M.N. Demuth)	Satellite failure! Project cancelled

Teaching

Training of Highly Qualified Personnel:

- Supervised graduate thesis students in integrated remote sensing and physical geography (flood plain hydrology, cryospheric processes, watershed assessment, canopy radiative transfer, glaciology, forest biomass).
- Supported >50 directed studies student projects and industry internships on remote sensing topics.
- Provided hundreds of university, government and graduate student researchers with access to airborne and terrestrial lidar data, training, and academic advice through C-CLEAR (Canadian Consortium for Lidar Environmental Applications Research). Lidar data acquisition and teaching ranged from Peruvian Andes to Canadian Arctic, and assisted researchers in Canada, USA, UK, South America, and Australia.
- Assisted federal, provincial, and municipal government staff with design and coordination of remote sensing data acquisition and analysis projects.
- Taught > 20 one to five day workshops on remote sensing at conferences, meetings, and in house.

Graduate Courses Taught:

1. Airborne lidar remote sensing: theory, operations and applications *Centre of Geographic Sciences*, advanced

- diploma course.
2. Airborne thermal remote sensing: theory, technology and operations Centre of Geographic Sciences, advanced diploma course.
 3. Extraction of glacial geomorphic scale information from digital terrain data. Directed studies course, Saint Mary's University, Department of Geography.
 4. Terrestrial LiDAR Systems. Directed studies course, Acadia University, Department of Geology.
 5. Leaf Area Index; methods of observation and modeling. Directed studies course, Acadia University, Biology.
 6. GIS modeling of forest canopy and stand attributes. Directed studies course, Acadia University, Biology.
 7. The influence of geodetic datums on landscape change research. Directed studies course, Dalhousie University, Process Engineering.
 8. Several post-graduate GIS modeling independent studies courses on various hydrology, urban planning, geomatics and forestry topics. Centre of Geographic Sciences, advanced diploma course.

Undergraduate Courses Taught:

9. Principles of Hydrology (2nd yr). McMaster University, Department of Geography & Geology.
10. Drainage Basin Ecosystems (3rd yr). Wilfrid Laurier University, Department of Geography
11. Meteorology (3rd yr). Wilfrid Laurier University, Department of Geography
12. Earth Systems Science (4th yr). Queen's University, Department of Geography.

Graduate students supervised, co-advised, mentored:

Tristan Goulden, Ph.D. 2009 -2012. Biological Engineering, Dalhousie University (co-advisor with Rob Jamieson)
Thesis: *Uncertainty propagation of terrain-based watershed attributes to simulations of runoff and water quality*

Kyung In Huh, Ph.D. 2008 + Department of Geography, Ohio State University (field and lab-based mentoring)
Thesis: *Mapping glacier changes in the Peruvian Andes.*

Kayla Noble, M.Sc. 2012 +. Geography, Wilfrid Laurier University (co-advisor with Richard Petrone).
Thesis: *Investigating patterns of biomass loss due to fire in a boreal peatland landscape.*

Allyson Fox, MSc.AG. 2010 +. Biology, Acadia University.
Thesis: *Modeling the spatio-temporal distribution of solar radiation in a mixed wood environment.*

Heather Morrison, M.Sc.AG. 2010 +. Biology, Acadia University.
Thesis: *A lidar-based forest canopy GIS modeling and optimization tool kit*

Neville Crasto, M.Sc.AG. 2009-2011. Geology, Acadia University.
Thesis: *Geomorphometric applications of lidar to delineate deltaic channels & determine water levels in the Mackenzie Delta*

Tim Collins, MSc.AG. 2008-2009. Geology, Acadia University.
Thesis: *Mapping snowpack depth in a mountainous forested environment using GIS & airborne lidar*

Kevin Garroway. M.Eng. 2007-2010. Environmental Engineering, Dalhousie University.
Thesis: *Developing new techniques for mapping surface soil saturation in a heavily modified agricultural watershed*

Koreen Millard, M.Sc.AG, 2006-2008. Biology, Acadia University.
Thesis: *The development and application of geomatics techniques to assist in salt marsh restoration planning at Beausejour Marsh, New Brunswick*

Doug Stiff, M.Sc. 2006-2008. Geology, Acadia University.
Thesis: *Flood Risk in Oxford, Nova Scotia: Determining flood risk in an ungauged basin*

Tristan Goulden, M.Eng. 2006-2008. Geomatics Engineering, University of New Brunswick.
Thesis: *Modeling the system and terrain components of airborne lidar positional uncertainty.*

Service to the Community

Society executive duties

Canadian Remote Sensing Society

- Associate editor, Canadian Journal of Remote Sensing
- Chair: Atlantic Region Branch (2007-2012)

American Society of Photogrammetry & Remote Sensing

- Vice Chair: LiDAR committee (2006-2008)
- Chair: LiDAR committee (2008-2009)

Canadian water Resources Association

- National Director
- President: Nova Scotia branch (2007-2008)

Conference support

Canadian Symposium on Remote Sensing

- Organizing committee (2005)
- Technical committee (2005/2008/2009/2012)
- Workshop host (2009)

International Association of Hydrological Sciences

- Remote Sensing Symposium, 2010, Technical committee, session coordinator/ chair

Canadian Water Resources Association

- Workshop host (2009)
- Maritime Symposium Conference Chair (2008)

Silvilaser/Silviscan LiDAR conferences

- Expert panelist (2007)
- Technical committee (2008/2009/2010/2011/2012/2013)

Multitemp Conference

- Technical committee (2013)

CoastGIS Conference

- Invited workshop speaker (2013)