Mingke Erin Li, Ph.D.

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Education

2023 Ph.D., Geomatics Engineering, University of Calgary, Canada

2019 M.Sc., Forestry, University of New Brunswick, Canada

2017 B.Sc., Geographic Information Science, Nanjing Forestry University, Nanjing, China

Research Interests

- Geographic Information Science; Spatial Data Infrastructure
- Discrete Global Grid Systems; Digital Earth
- Agent-based Artificial Intelligence for Geospatial Analysis
- GeoAI; Spatial Data Mining; Large-Scale Spatial Analytics
- Environmental and Climate Modeling

Peer-reviewed Publications

2026 **Li, M.E.**; Liang, S.H.L. DGGS-Q: a multi-agent framework for traceable natural language querying over DGGS-indexed geospatial data. *International Journal of Geographical Information Science.* Under review.

2026 **Li, M.E.**; Gao, M.; Liang, S.H.L. Harmonized Global to Regional Gridded Methane Inventories in A Discrete Global Grid Framework. *Scientific Data.* Under review

2026 Liao, C; **Li, M.**; Little B. uraster: Structured Raster to Unstructured Mesh. *The Journal of Open Source Software.* Under review.

2026 Gao, M; Ashena, Z; Liang, S.H.L.; **Li, M.E.**; Kiaei, S.; Saeedi, S. An Event-based Annualized Emission Estimation Toolkit for Upstream Oil and Gas Facilities. *Computers and Geosciences.* Under review.

2026 **Li, M.E.**; Liang, S.H.L. Natural Language to DGGS-Aware Methane Insights with a Multi-LLM-Agent Framework. *Proceedings in Spatial Knowledge and Information Canada 2026*.

2026 **Li, M.E.**; Liang, S.H.L. Enabling a Digital Earth for Methane Emissions Management with Equal-Area Discrete Global Grids. *International Journal of Digital Earth*. 19(1), 2607210.

2025 Liao, C.; Engwirda, D.; Cooper, M.; **Li, M.**; Fang, Y. Discrete Global Grid System-based Flow Routing Datasets in the Amazon and Yukon Basins. *Earth System Science Data*. 17(5), 2035–2062.

2024 **Li, M.**; Tousignant, C.; Chaudhuri, C.; Chabbouh, A. Utilizing Serverless Framework for Dynamic Visualization and Operations in Geospatial Applications. *International Journal of Digital Earth.*17(1), 2392835.

2024 Liu, J.; Li, J.; Qiao, L.; **Li, M.**; Stefanakis, E.; Zhao, X.; Huang, Q.; Wang, H.; Zhang, C. QuadGridSIM: A Quadrilateral Grid-based Method for High-performance and Robust Trajectory Similarity Analysis. *Transactions in GIS*. 28(1), 83-107.

2022 **Li, M.**; McGrath, H.; Stefanakis, E. Multi-scale Flood Mapping under Climate Change Scenarios in Hexagonal Discrete Global Grids. *ISPRS International Journal of Geo-Information.* 11(12), 627.

2022 **Li, M.**; McGrath, H.; Stefanakis, E. Multi-resolution Topographic Analysis in Hexagonal Discrete Global Grid Systems. *International Journal of Applied Earth Observation and Geoinformation*. 113, 102985.

2022 **Li, M.**; McGrath, H.; Stefanakis, E. Geovisualization of Hydrological Flow in Hexagonal Grid Systems. *Geographies*. 2(2), 227-244.

2021 **Li, M.**; McGrath, H.; Stefanakis, E. Integration of Heterogeneous Terrain Data into Discrete Global Grid Systems. *Cartography and Geographic Information Science*. 48(6), 546-564.

2020 **Li, M.**; Stefanakis, E. Geospatial Operations of Discrete Global Grid Systems – A Comparison with Traditional GIS. *Journal of Geovisualization and Spatial Analysis.* 4(2), 26.

2020 **Li, M.**; Stefanakis, E. Geo-feature Modeling Uncertainties in Discrete Global Grids: A Case Study of Downtown Calgary, Canada. *Geomatica.* 74, 175-195.

2020 **Li, M.**; Stefanakis, E.; McGrath, H. National Terrain Data Management on Discrete Global Grids in Canada. *AutoCarto2020.*

2020 **Li, M.**; MacLean, D.A.; Hennigar, C.R.; Ogilvie, J. Previous Year Outbreak Conditions and Spring Climate Predict Spruce Budworm Population Changes in the Following Year. *Forest Ecology and Management.* 458, 117737.

2019 **Li, M.**; MacLean, D.A.; Hennigar, C.R.; Ogilvie, J. Spatial-Temporal Patterns of Spruce Budworm Defoliation within Plots in Québec. *Forests.* 10, 232.

Conference Presentations

2026 **Li, M.E.**; Liang, S.H.L. Natural Language to DGGS-Aware Methane Insights with a Multi-LLM-Agent Framework. Oral presentation at the 9th Conference on Spatial Knowledge and Information (SKI) Canada, Feb. 2026, Banff, Alberta, Canada.

2025 **Li, M.E.**; Liang, S.H.L. Talking to the Planet: Natural Language x Digital Earth for Disasters. Oral presentation at the 133rd OGC Member Meeting - Innovation Summit, Oct. 2025, Boulder, U.S.

2025 **Li, M.E.**; Liang, S.H.L. Ask, Retrieve, Analyze: A Multi-Agent DGGS Framework for GenAI-Driven Methane Data. Oral presentation at the 133rd OGC Member Meeting - Discrete Global Grid Systems DWG, Oct. 2025, Boulder, U.S.

2025 **Li, M.E.**; Liang, S.H.L. Standardizing Spatial Intelligence for Gridded Methane Inventories: DGGS Meets EmissionML. Oral presentation at the 132nd OGC Member Meeting - EmissionML SWG, Jun. 2025, Online.

2025 **Li, M.E.**; Liang, S.H.L. Beyond the Graticule: Spatially Explicit Methane Inventories Using Discrete Global Grids. Oral presentation at the 132nd OGC Member Meeting - Discrete Global Grid Systems DWG, Jun. 2025, Online.

2025 **Li, M.E.**; Liang, S.H.L. Beyond the Graticule: Spatially Explicit Methane Inventories Using Discrete Global Grids. Oral and poster presentation at CanCH4 Symposium, May 2025, Ottawa, Canada.

2024 **Li, M.E.**; Liang, S.H.L. Mapping Methane: A Review of Bottom-up Gridded Inventories. Oral presentation at the 130th OGC Member Meeting - EmissionML ad-hoc, Nov. 2024, Online.

2023 **Li, M.**; McGrath, H.; Stefanakis, E. Flood susceptibility analysis on hexagonal grid meshes: a case study in southern New Brunswick, Canada. Poster presentation at GIS in Education and Research Conference, Mar. 2023, Toronto, Canada.

2022 **Li, M.**; McGrath, H.; Stefanakis, E. Analytical operations for terrain data modeled in Discrete Global Grid Systems. Oral presentation at Canadian Cartographic Association Annual Conference, May 2022, Online.

2021 **Li, M.**; McGrath, H.; Stefanakis, E. Integration of multi-source terrain data on Discrete Global Grids in Canada. Oral presentation at Canadian Cartographic Association Annual Conference, May 2021, Online.

2020 **Li, M.**; Stefanakis, E.; McGrath, H. National terrain data management on Discrete Global Grids in Canada. Oral presentation at AutoCarto 2020, Oct. 2020, Online.

2018 **Li, M.**; MacLean, D.A.; Hennigar, C.R.; Ogilvie, J. Spatial-temporal patterns of spruce budworm defoliation within measured plots in Québec. Oral presentation at the 9th Bi-Annual Eastern Canada - USA Forest Science Conference, Oct. 2018, Fredericton, Canada.

2018 **Li, M.**; MacLean, D.A. GIS analyses of factors influencing spruce budworm outbreak initiation in northern New Brunswick. Oral presentation at SERG International Workshop, Feb. 2018, Edmonton, Canada.

Other Invited Talks

2026 Introduction to Discrete Global Grid Systems (DGGS). Guest lecture at ENGO 551 Advanced Spatial Topics. University of Calgary. Jan 2026.

2025 Discrete Global Grid Systems (DGGS) and Their Role in Methane Emission Inventories. Presented at the Monthly Lunch and Learn at SensorUp Inc., May 2025.

2022 Flood Susceptibility Modeling in Discrete Global Grids under Climate Change Scenarios. Presented at the Canada Centre for Mapping and Earth Observation, Natural Resources Canada, Oct. 2022.

2022 Geospatial Data Analysis in Discrete Global Grid Systems - Progress and Perspectives. Presented at the China Agricultural University, May 2022.

2022 Quantization, Analysis, and Application of Terrain Data Modeled in Discrete Global Grid Systems. Presented at the International Society for Photogrammetry and Remote Sensing Working Group IV/7 (Geo-Data Management) Webinar, Jan. 2022.

2021 Integration Platform for Canadian Terrain Data: A DGGS Perspective. Presented at the Canada Centre for Mapping and Earth Observation, Natural Resources Canada, Apr. 2021.

Work Experience

2024-present *Postdoctoral Associate, University of Calgary*

- Develop a scalable geospatial intelligence framework that integrates Discrete Global Grid Systems (DGGS) with an agentic multi-LLM architecture, enabling specialized AI agents to collaboratively plan, reason, and execute coordinated workflows for dynamic, location-aware querying and interpretation of environmental data.

- Develop a Digital Earth framework for methane emissions management using equal-area Discrete Global Grid Systems, enabling location-preserving allocation of facility-reported emissions and supporting hierarchical multi-scale spatial analysis and reporting.
- Contribute to the development of Emission Event Modeling Language (EmissionML), an emerging Open Geospatial Consortium standard designed to leverage geospatial sensing data for methane emissions detection, reporting, and mitigation.

2023-2024 *Geospatial Scientist, Geosapiens Inc.*

- Developed large-scale DTMs for Canada by applying XGBoost-based machine learning to remove vegetation and building artifacts from elevation data, enabling improved terrain representation for hydrological and environmental modeling.
- Designed cloud-native geospatial processing workflows using Discrete Global Grid Systems to support in-database spatial queries and enable on-the-fly geospatial operations and visualization for large-scale environmental datasets.
- Developed coastal flood models and calibrated fluvial flood models using the Height Above the Nearest Drainage framework to support large-area flood hazard assessment.
- Developed flood defence models through automated feature identification in 2D geospatial fields, supporting the evaluation of natural and engineered flood mitigation structures.

2020-2023 *Sessional Instructor, Department of Geomatics Engineering, University of Calgary*

- ENGO 351 Introduction to Geospatial Information Systems.
- ENGO 451 Design and Implementation of Geospatial Information Systems.

2022 *Research Internship, Canada Centre for Mapping and Earth Observation, Natural Resources Canada*

- Conducted flood susceptibility mapping under climate change as part of the National Flood Hazard Identification and Mapping Program, applying machine learning models including Random Forest, Artificial Neural Networks, Multilayer Perceptron, and Support Vector Machine to analyze geospatial predictors and generate national-scale flood susceptibility assessments.

2020-2022 *Research Assistant, Department of Geomatics Engineering, University of Calgary*

- Conducted large-scale network analysis to evaluate the impact of gasoline station infrastructure contraction on stranded assets, collaborating with researchers from the Department of Mathematics and Statistics at the University of Calgary.
- Developed machine learning-based flood susceptibility models within a hexagonal grid framework, employing Discrete Global Grid Systems as a scalable spatial data infrastructure for integrating multi-source geospatial data and projecting future flood risks under multiple climate change scenarios.
- Developed automated geospatial data extraction and integration pipelines using Natural Resources Canada web services, including a command-line interface tool to retrieve datasets from multiple NRCan sources and harmonize them to a common grid extent, spatial resolution, and coordinate system.

2017-2018 *Sessional Instructor, Faculty of Forestry and Environmental Management, University of New Brunswick*

- ENVS 6008 Management of Natural Systems.
- FOR 2281 Introduction to GIS with Applications in Environmental Management I.
- FOR 2282 Introduction to GIS with Applications in Environmental Management II.
- GIS Training for Natural Resource Professionals Workshop.

Awards & Honors

2022	Canadian Cartographic Association Best Presentation Award
2022	Esri Young Scholars Award – First Runner-up
2021-2023	CRSNG-CREATE DOTS Program Award
2021	Esri Canada Centre of Excellence App Challenge – First Runner-up
2020-2021	Geomatics Engineering Department FGS Award at the University of Calgary

Memberships

2025-present	OGC EmissionML DWG & SWG
2023-present	OGC Discrete Global Grid Systems DWG & SWG
2022-2023	Canadian Cartographic Association
2022-2023	Association of Canadian Map Librarians and Archivists
2021-2023	ISPRS WG IV/4 Data Management for Spatial Scenarios
2019-2023	Esri Canada Centre of Excellence