

Maxime Tarka

Researcher · Deep learning for Earth observation, snow and water

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Available from February 2027, depending on location · open to relocation in Canada and Europe · French citizen (EU) · Canadian post-graduation work permit valid until 2029

Profile

Researcher in machine learning for Earth observation (M.Sc., ÉTS Montréal; thesis rated “Excellent”). Built a deep-learning pipeline that follows the snow cover of 22,155 glaciers every year from 1984 to 2025 (786,014 observations, five satellite sensors), with a split by glacier to avoid leakage, and released it with open code and data. Rebuilt a multi-site weather-station platform at Campus Sainte-Marthe, from the data loggers to the website, and adapted my open-source land-cover pipeline to a wildlife-habitat project at MacHydro. Seeking a PhD where data, deep learning and modelling meet environmental questions.

Research interests: playing with data, understanding it and showing it · technical problems and their root cause · what scales in space, in time and in data volume · the environment, for the science that surrounds us · systems that answer a need · simulation, experiments, analysis and processing · light and sound, data art, teaching

Education

M.Sc. in Construction Engineering (thesis) · École de technologie supérieure (ÉTS), Montréal 2024–2026

Supervised by Michel Baraër (ÉTS) and Caroline Aubry-Wake (University of Lethbridge). Article-based thesis defended 26 June 2026, rated “Excellent” and recommended by the jury for the Board of Directors Excellence Award.

Thesis title (in French): *Glacier decapitation and divergent behavioural trajectories: multi-sensor U-Net segmentation of 22,155 glaciers in western North America (1984–2025)*. espace.etsmtl.ca/id/eprint/4012

Engineering degree (Diplôme d'ingénieur, M.Eng. equivalent) · Arts et Métiers (ENSAM), France 2022–2026

Diploma expected early 2027. Generalist programme, dual degree with ÉTS: electrical engineering and automation, energy, mechanics and solid mechanics, fluid mechanics, materials and composites, system design, robotics, computer science, and manufacturing processes (casting, forging, woodworking).

Preparatory classes (CPGE) · Lycée Colbert, France 2020–2022

Publications and datasets

Under review

- **Tarka, M.**, Baraër, M., Aubry-Wake, C. *Divergent and asymmetrically reversible accumulation-zone failure across western North American glaciers*. Nature Climate Change, under review.

Preprint and dataset

- **Tarka, M.**, Baraër, M., Aubry-Wake, C. (2026). *Benchmarked and leakage-validated deep-learning glacier segmentation: a 42-year, five-sensor snow-fraction record for western North America*. SSRN preprint doi:10.2139/ssrn.7418104 · Submitted to ISPRS Journal of Photogrammetry and Remote Sensing · Code: github.com/Research-Tarka/glacier-fsnow-unet
- **Tarka, M.**, Baraër, M., Aubry-Wake, C. (2026). Dataset for the SSRN preprint above (v1.0). Zenodo. doi:10.5281/zenodo.22311126

In preparation

- **Tarka, M.** (first author), et al. Data article on the weather-station dataset of the Sainte-Marthe experimental catchment, Quebec, Canada (title not final).

Experience

Geospatial analyst intern · MacHydro (remote) · ENSAM final-year internship Sept – Nov 2026

- Developing a Python workflow that models wildlife habitat in British Columbia on a 10 m grid, from terrain, land-cover, forest, disturbance, snow and hydrology layers to annual habitat-area trends for each management unit (Theil-Sen, Mann-Kendall), with a viewer and GeoTIFF and CSV export. Confidential development for the company.

- Adapted my open-source land-cover pipeline, built in my own time and extended during the internship, to feed the workflow. Its U-Net uses FiLM conditioning on sensor and day of year (21 input channels, 10 m grid, Landsat 5/7/8/9 and Sentinel-2) and was trained on 705 hand-annotated scenes with splits by tile. Test mIoU 0.604 and kappa 0.749 on unseen tiles.
- Ran it over 42 years of imagery with CCDC-style break detection, which dates disturbances such as fires and cutblocks. [Weights on Hugging Face](#), MIT licence.

Developer · Campus Sainte-Marthe (ÉTS and City of Sainte-Marthe, Québec)

May – Aug 2026

- Rebuilt the BVECSM weather-station platform end to end, from the data loggers (Campbell Scientific, CRBasic, LoggerNet) to the website. Old and new data are merged into one history with versions, back to December 2015. Eight stations in a 9.75 km² catchment and about 7 million records, from 1-minute to daily series.
- Built the FastAPI website (about 60 pages) with dashboards, historical comparison, manual correction with an audit trail, downloads in CSV, Excel and Parquet, and model pages.
- Built a hydrological modelling pipeline with GR4J, GR4J-CemaNeige, MOHYSE, a differentiable GR4J in PyTorch, an LSTM and an EA-LSTM, run daily on two stream stations, next to 15 environmental models (snow, energy balance, evapotranspiration, groundwater, river temperature).
- Automated the system end to end, with logger files read every 30 seconds and syncs every 5 to 15 minutes. Researchers, ÉTS courses, the municipality and local farmers use it.

Graduate researcher, remote sensing and deep learning · ÉTS, Montréal

Sept 2024 – June 2026

- Developed a U-Net segmentation pipeline (snow, ice, cloud, other) for five sensors (Landsat 5/7/8/9, Sentinel-2), trained on a self-annotated corpus of 206 glaciers and 540 scenes. Test mIoU 0.705 with a split by glacier.
- Measured the leakage of a split by scene, where 35.9% of glaciers were on both sides of the split. In that run, scenes of glaciers seen in training score a per-scene mIoU of 0.696, against 0.575 for glaciers never seen.
- Reconstructed the end-of-summer snow fraction of 22,155 glaciers from 1984 to 2025, which gives 786,014 glacier-year observations.
- Used the record in a second manuscript, under review at Nature Climate Change, on how individual glaciers respond over four decades.
- Extended the pipeline to tributary glaciers (Kluane) and to water, vegetation, rock and debris classes (Peyto, Wapta). It now supports a doctoral colleague's thesis chapter and two supervisor-led projects.
- Field support for colleagues, with sampling for urban green-infrastructure studies and equipment installation at the Sainte-Marthe weather stations.

Conference contributions

- Canadian Geophysical Union Annual Meeting 2026, Halifax: *Glacier Decapitation: Three Regimes, One Climate, No Way Back?*
- Geotop Student Congress, 14 March 2026: *Satellite Evidence of Seasonal Glacier Truncation in Western Continental North America*.
- Co-authored, presented by B. Charonnat: Charonnat, B., Baraër, M., **Tarka, M.**, Bonnerot, T., Flumian, T., Valence, E., Masse-Dufresne, J., McKenzie, J. (2025). *Impacts of Glacial Retreat on Proglacial Hydro-Systems: Insights from Aufeis Formation Analysis*. IASC Network on Arctic Glaciology workshop, Niseko, Japan, January 2025.

Awards and funding

- Recommended for the ÉTS Board of Directors Excellence Award (reserved for theses rated “Excellent”), June 2026
- Excellence scholarship, Fondation Arts et Métiers, 2024
- ÉTS research scholarship throughout the M.Sc., 2024–2026

Open-source software

- landscape-change-detection-pipeline: configurable 14-stage pipeline that turns Landsat 5/7/8/9 and Sentinel-2 scenes into land-cover maps and dated change events. Earth Engine download on a common 10 m grid, U-Net with FiLM conditioning (CatBoost as second supported model), splits by tile, CCDC-style break detection that dates fires and cutblocks, snow, ice and water dynamics, vegetation trends and recovery, GeoTIFF/CSV export.
- glacier-fsnow-unet: the pipeline behind the SSRN preprint. 13 stages from DEM and scene download to per-glacier snow-fraction time series (1984–2025), with baselines (NDSI/NDVI threshold, random forest, DeepLabv3, SegFormer) and uncertainty analysis.

- Hugging Face: pre-trained U-Net checkpoint of the pipeline above (MIT licence, model card with per-class metrics and limitations).
- GlacierScope: standalone viewer for the 42-year glacier snow-fraction record. World map, per-glacier plots, centroid drift and area change, PNG/HTML/CSV export, offline use.
- Also: MaskForge (segmentation-mask annotation tool), Graphical Time-Series Corrector (sensor time-series cleaning), Multi-Format Converter (tabular, GIS, mesh and raster formats).

Technical skills

Machine learning: PyTorch (U-Net with attention and FiLM conditioning, LSTM, GPU training), SegFormer, DeepLabv3+, random forest, CatBoost, LightGBM, SHAP, Optuna, scikit-learn

Earth observation and geospatial: Landsat, Sentinel-2, Google Earth Engine, ArcGIS (including ArcGIS Hydro), QGIS, Zarr, rasterio, LiDAR and DEM processing

Data and statistics: Python (pandas, NumPy, numba, Parquet, DuckDB, Polars), Julia, MATLAB, JavaScript, SQL, survival analysis, Theil-Sen/Mann-Kendall trends, break detection (CCDC/COLD-style)

Hydrology: GR4J, MOHYSE, differentiable and LSTM-based rainfall-runoff models, HEC-HMS, MODFLOW (groundwater)

Software and tools: Git/GitHub, LaTeX, Hugging Face, VS Code, FastAPI, Streamlit, conda, SolidWorks, Abaqus, 3DEXPERIENCE, Microsoft Office, Canva

Engineering projects (ENSAM)

- **Formula Student Electric** (2023–24): led the propulsion energy-chain work package of the ENSAM electric race car.
- **Wire-arc additive manufacturing** (Feb–June 2024, team of two): first step toward a physical model giving the machine settings for a target part geometry. Bead height and width against substrate curvature and layer count: repeat beads varied by at most 1.2% in height and 2% in width; laser-arm scans fitted in Julia (mean error up to 0.1 mm); linear growth over five layers (R^2 0.98 width, 0.97 height).
- **Piezoelectric energy harvesting** (Feb–June 2023, team of two): identified a model of a bimorph harvester on a shaker bench (resonance 305.1 Hz, quality factor 101.7) and optimised its mean power in Python.
- **Photovoltaic grid connection** (Sept 2022–Jan 2023, team of two): Simulink model of a solar panel on the grid (DC/DC converter, MPPT, inverter) delivering its maximum power of about 400 W.

Outreach and memberships

- Water-cycle workshop (rain, runoff, infiltration) for Sainte-Marthe day camps, 2 July 2026.
- With a colleague, data, LiDAR scans and custom tools for an artist in residence at ÉTS who explores climate change through art, 2026.
- Member, Canadian Geophysical Union, 2026.

Languages

French (native) · English (daily professional use; TOEIC 845/990, 2023) · Driving licence: B (France)

Interests

Hiking and nature walks, swimming, cooperative board games. I am getting back into photography, and I make data art from my own scientific data.

References

Michel Baraër (ÉTS, M.Sc. supervisor) · Michel.Baraer@etsmtl.ca

Caroline Aubry-Wake (University of Lethbridge, M.Sc. co-supervisor) · caroline.aubrywake@uleth.ca