# Zhihao **LIU**

Research Assistant · Data Scientist · Geomatics Engineer

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## About Me

Passionate geodata professional with a strong focus on bringing values from sensors to decision-making via open-source solutions. Experienced in handling large, diverse datasets and proficient in scientific programming.

## Experience

### Data Scientist — Freelancing

Eurostar / IKOS — 2024.02 - 2024.03

- Offered consulting service for the development of a train tracking platform.
- Utilized the Unscented Kalman Filter (UKF) algorithm to estimate train state and fuse sensor data in real-time, detecting unplanned stops and delays in train service.
- Developed microservice by FastAPI, PostgreSQL.

### Teaching / Research Assistant — Part-time

University of Oslo — 2021.11 - 2023.11

- Served as a Teaching Assistant for GEO4300/9300 (Geophysical Data Science), Fall 2023, where I conducted a 35-hour Python lab and provided hands-on scientific programming training, and data analysis to students.
- How does climate change impact wind and solar production? This is a summer scholar project funded by UiO: Energy and Environmental. Focused on exploring machine learning algorithms for bias correction and spatial downscaling.
- Assisted in the IT department, providing technical support and troubleshooting.
- Research assistant in a research project, SNOWDEPTH, focused on estimating global snow depths using spaceborne data sources and machine learning for spatial-temporal modeling.

### Geomatics Professional — Permanent

BGP Offshore, China National Petroleum Corporation — 2014.07 - 2021.07

- Participated in over 12 offshore surveys globally in a world-class seismic team, BGP Prospector. The focus is to deliver high-quality geophysical datasets and de-risking offshore operations.
- Developed data processing pipeline and quality control software for geophysical surveys online/ offline.
- Took on technical responsibilities such as contract technical review, patents, and conference participation.
- Earned my license as a Registered Surveyor in 2018.
- Promoted to a senior position as Assistant Project Manager in January 2021.

## Education

### University of Oslo — Oslo, NO

M.Sc in Geoscience — 2021.08 - 2023.07

Focused on change detection related to cryospheric processes. I presented my thesis in IUGG 2023 Berlin with a traveling grant and sponsorship from the Industrial Liaison program. GPA 3.875/4.0:

- Geophysical Data Science (A)
- Advanced Remote Sensing and Topographic Analysis (A)
- Surveying, Photogrammetry and Spatial Analysis (A)
- Glacial and Periglacial Geomorphology (B)
- Remote Sensing (B)
- Floods, Avalanches and Landslides (B)
- IPCC AR6 Climate Seminar - Physical Science Basis (Pass)
- Thesis: Snow Depth Retrieval and Downscaling using Satellite Laser Altimetry, Machine Learning, and Climate Reanalysis (A)

### South West Petroleum University — Chengdu, PRC

B.Sc in Geodesy and Geomatics — 2010.09 - 2014.07

With a background in Engineering, GNSS, GIS and Programming language (C). Thesis: A WebGIS System for Urban Infrastructure Management (A)

## Projects

### Bias-correction and spatial downscaling of weather data for energy system modeling — ITS, UiO

Summer Researcher — 2023.05 - 2023.07

Understanding the resource availability and variability of solar and wind energy generation is essential to designing and planning optimal energy systems. This becomes more important when the climate system has changed the weather conditions of different regions of the world, increasing the intrinsic uncertainties associated with these types of renewable sources:

- A review of machine learning-based downscaling techniques for climate variables
- Capture historical patterns of weather anomalies by QDM (Quantile Delta Mapping). And use it for downscaling of CIMP6, to get debiased wind speed for energy system modeling.

### SNOWDEPTH - Global snow depths from spaceborne remote sensing for permafrost, high-elevation precipitation, and climate reanalysis — GEO, UiO

Research Assistant — 2021.12 - 2023.05

Seasonal snow depth is a key component of surface energy balance and the water cycle, which is related to scientific topics e.g. permafrost thawing, ice/snow albedo feedback, high-mountain precipitation, hydropower…Estimating snow depth by a 500 km away satellite is a challenging task, and requires delicated, careful signal processing:

- Contributed a reliable coregistration algorithm to xDEM.
- Developed a comprehensive workflow for retrieving snow depth from satellite laser altimetry, downscaling it by XGBoost, and interpreting snow dynamics by Shapley values.
- Demonstrated proficiency in handling and analyzing large and diverse geospatial datasets: ERA5, DTM1, FABDEM, ArcticDEM, GLO30.

## Creative Works

### Using 5.8 million to buy a unit in Oslo, which one is worth?

- The goal of this project was to determine which unit to buy in Oslo using multiple-criteria decision analysis (MCDA) if you have 5.8 million (the median price for a unit in the city). The project involved scraping property data from Finn, cleaning the data, and gathering spatial information from open-access databases, OpenStreetMap, and satellite images. An MCDA model was then created to make the final decision.

### What if the ice block expedition 1959 happens in 2021?

- In 1959, a three-ton block of ice from Mo i Rana by the Arctic Circle was trucked to Libreville by the Equator with an 11% mass loss. Is that true? What if we do it again in 2020 or 2021? I applied an energy balance model and coupled ERA 5 with such a historical event (the Ice Block Expedition of 1959). The results shows we should not blame to cliamte change.

### How to bury Longyearbyen by an avalanche?

- Avalanches are rapid snow mass movements over snow-covered slopes, which could be dangerous for people living in mountainous terrain due to long-time exposure. So, how to bury a town with a designed avalanche? I used Software RAMMS::Avalanche® to simulate slab avalanche movement by the Voellmy-fluid friction model. I found NVE's new report may overestimate the size of the avalanche in some scenarios.

### Agriculture change detection: the expansion of West Nile Delta

- Over the past three decades, Egypt has faced a significant challenge in ensuring food security due to its rapidly growing population. As a result, the Nile Delta region has become increasingly crowded. To tackle this issue, a study was conducted in the western Nile region using spectral analysis, NDVI, classification, and change detection techniques. The purpose of this study was to identify changes in agriculture practices and land use patterns over time.

### Field Trip to Ice Age Museum

- Noway has a fabulous landscape; what is the connection between the geomorphology process and nowadays's concerns? I wrote an introduction to the Quaternary geomorphology story of Norway, just like a museum brochure.

## Publications, Conferences and Patents

**Snow Distribution Patterns from Satellite Laser Altimetry** — Paper in submitting
Zhihao Liu, Désirée Treichler, Simon Filhol

**Snow Depth Retrieval and Downscaling Using Satellite Laser Altimetry, Machine Learning and Climate Reanalysis** — Oral Presentation
Zhihao Liu, Désirée Treichler, Marco Mazzolini · IUGG 2023, Berlin

**Unlocking the Secrets of Snow Depth - A Study of Satellite Altimetry and High-Precision Digital Elevation Models** — Oral Presentation
Sustainability Day 2023, UiO

**An identification system for underwater seismic devices** — Patent
PRC 201911154941X · Issued 2022 May 13

**Wide-towed sources in streamer seismic: a case study from Norway Q35** — Conference
Zhihao Liu, Bo Wen, Yuanjie Liu, Xuebin Qin, Qian Zhao · Society of Petroleum Geophysicists 2021, Chengdu

**Offshoreorinet v1.0 seismic QC software** — Software Copyright
2020SR0194691 · Issued 2020 Mar 2

## Skills

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| **Languages** | Chinese, English |
| **Tech Stacks** | Python, Matlab, QGIS, ArcGIS, Kriging, Kalman Filter, XGBoost, Shap, Gradient Descent, OpenStreetMap, Shapely, Geopandas, Xarray, Rasterio, Scikit-learn, SciPy, LaTex, Typst |
| **DevOps** | Git, GitHub, ETL, Docker, PostgreSQL, FastAPI, GCP |