Xiaolong Wei

Department of Earth & Planetary Sciences, Stanford University
Room 315, Green Building, 367 Panama St, Stanford, California, 94305
Email: xwei2@stanford.edu | ORCID: 0000-0002-3160-6086
Website: https://profiles.stanford.edu/xiaolong-wei

Education

2018–2022 **Ph.D. in Geophysics**, University of Houston, Houston, USA

2015–2018 **M.S. in Geology**, Northwest University, Xi'an, China

2011–2015 **B.S. in Geophysics**, China University of Geosciences, Beijing, China

Professional Appointment

2023–present **Postdoctoral Research Fellow**, Stanford University, Stanford, USA

Research Interests

- **Detect, characterize, and monitor subsurface green energy resources**
  - Critical Earth and mineral resources, carbon capture and sequestration, hydrogen storage, and geothermal energy
  - Subsurface model reconstruction using multiple geoscientific observations (e.g., geophysics, geochemistry, geology, rock physics, etc)
- **Decision-driven geosciences**
  - Uncertainty quantification
  - Critical mineral drilling deployment, CO2 storage site selection, and ground water management strategy
- **Algorithms development**
  - Bayes' theorem, optimization, statistics, and deep learning
- **Drone geophysics**
  - Magnetic, electromagnetic, and LiDAR data acquisition
  - Applications of ground water, abandoned wells, and volcano

Publications

Peer-reviewed

10. **Wei, X.**, Sun, J. and Sen, M., 2023. 3D Monte Carlo geometry inversion using gravity data. *Geophysics*, (under review)

9. **Wei, X.**, Sun, J. and Sen, M., 2023. Reconstruction of multiple salt bodies using trans-dimensional Monte Carlo gravity inversion. *Geophysical Journal International*, (under revision)

8. Hu, Y., **Wei, X.**, Wu, X., Sun, J., Chen, J., Huang, Y. and Chen, J., 2023. 3D joint inversion of airborne magnetic and gravity gradient data using deep learning techniques. *Geophysics*, (accepted for publication)

7. Hu, Y., **Wei, X.**, Wu, X., Sun, J., Chen, J., Huang, Y. and Chen, J., 2023. A deep learning enhanced framework for multi-physics joint inversion. *Geophysics*, 88(1), pp.1-70. doi:10.1190/geo2021-0589.1

6. **Wei, X.**, Sun, J. and Sen, M., 2023. Quantifying uncertainty of salt body shapes recovered from gravity data using trans-dimensional Markov chain Monte Carlo sampling. *Geophysical Journal International*, 232(3), pp.1957-1978. doi:10.1093/gji/ggac430

5. **Wei, X.**, Li, K. and Sun, J., 2022. Mapping critical mineral resources using airborne geophysics, 3D joint inversion and geology differentiation: A case study of a buried niobium deposit in the Elk Creek carbonatite, Nebraska, USA. *Geophysical Prospecting*. doi:10.1111/1365-2478.13280

4. **Wei, X.** and Sun, J., 2022. 3D probabilistic geology differentiation based on airborne geophysics, mixed Lp norm joint inversion and petrophysical measurements. *Geophysics*, 87(4), pp.1-67. doi:10.1190/geo2021-0833.1. **Nominated by editors to be highlighted in Geophysics Bright Spots in The Leading Edge** (link).

3. **Wei, X.** and Sun, J., 2021. Uncertainty analysis of 3D potential-field deterministic inversion using mixed L p norms. *Geophysics*, 86(6), pp.G133-G158. doi:10.1190/geo2020-0672.1

2. Sun, J. and **Wei, X.**, 2020. Recovering sparse models in 3D potential-field inversion without bound dependence or staircasing problems using a mixed Lp-norm regularization. *Geophysical Prospecting*, 69(4), pp.901-910. doi:10.1111/1365-2478.13063.

1. Sun, J., Melo, A., Kim, J.D. and **Wei, X.**, 2020. Unveiling the 3D undercover structure of a Precambrian intrusive complex by integrating airborne magnetic and gravity gradient data into 3D quasi-geology model building. *Interpretation*, 8(4), pp.1-50. doi:10.1190/INT-2019-0273.1.

In preparation

2. **Wei, X.**, et al., Constructing priors for geophysical inversions constrained by surface and borehole geochemistry (in prep)

1. **Wei, X.**, et al., Prospectivity of copper-gold mineral resources using airborne geophysics and33D joint inversion in the QUEST area, British Columbia (in prep)

Conference proceedings

9. Hu, Y., **Wei, X.**, Wu, X., Sun, J., Huang, Y. and Chen, J., 2023, August. 3D Joint Inversion of Multi-physics Data Using Deep Learning Techniques. In *2023 XXXVth General Assembly and Scientific Symposium of the International Union of Radio Science* (URSI GASS) (pp. 1-4). IEEE. doi:10.23919/URSIGASS57860.2023.10265612.

8. **Wei, X.**, Sun, J. and Sen, M., 2022. Trans-dimensional Bayesian gravity inversion and uncertainty analysis for salt reconstruction. In *IMAGE Technical Program Expanded Abstracts 2022*. doi:10.1190/image2022-3746659.1 .

7. **Wei, X.** and Sun, J., 2021. 3D probabilistic geology differentiation using mixed L p norm joint inversion constrained by petrophysical information. In *IMAGE Technical Program Expanded Abstracts 2021*. doi:10.1190/segam2021-3586619.1. **Best Student Paper in the Mining Sessions**.

6. **Wei, X.** and Sun, J., 2021. Uncertainty analysis of 3D geophysical inversion using airborne gravity gradient data conditioned on rock sample measurements. In *IMAGE Technical Program Expanded Abstracts 2021*. doi:10.1190/segam2021-3586552.1.

5. Hu, Y., **Wei, X.**, Wu, X., Sun, J., Chen, J., Chen, J., Huang, Y., 2021. Deep learning-enhanced multiphysics joint inversion. In *IMAGE Technical Program Expanded Abstracts 2021*. doi:10.1190/segam2021-3583667.1.

4. Li, K., **Wei, X.**, Sun, J., 2021. Geophysical characterization of a buried niobium and rare earth element deposit using 3D joint inversion and geology differentiation: A case study on the Elk Creek carbonatite2021. In *IMAGE Technical Program Expanded Abstracts 2021*. doi:10.1190/segam2021-3585069.1. **Best Paper in the Mining Sessions**.

3. **Wei, X.** and Sun, J., 2020. Uncertainty analysis of joint inversion using mixed Lp-norm regularization. In *SEG Technical Program Expanded Abstracts 2020* (pp. 925-929). Society of Exploration Geophysicists. doi:10.1190/segam2020-3428359.1.

2. **Wei, X.** and Sun, J., 2020. Quantifying uncertainties of deterministic geophysical inversions using mixed Lp norms. In *SEG Technical Program Expanded Abstracts 2020* (pp. 1404-1408). Society of Exploration Geophysicists. doi:10.1190/segam2020-3420227.1. **Best Poster in the Mining Sessions**.

1. Sun, J., Melo, A., Deok Kim, J. and **Wei, X.**, 2020. Characterizing a Precambrian intrusive complex by integrating potential field data into 3D quasi-geology model building. In *SEG Technical Program Expanded Abstracts 2020* (pp. 1374-1378). Society of Exploration Geophysicists. doi:10.1190/segam2020-3428385.1.

Conference abstracts

8. Sun, J., and **Wei, X.**, 2023, August. Mapping critical mineral resources using multiphysics inversion. In *IMAGE Technical Program Abstracts 2023*.

7. Hu, Y., **Wei, X.**, Wu, X., Sun, J., Chen, J., Chen, J., Huang, Y., 2023, August. Deep learning enhanced joint inversion for mineral exploration using airborne geophysics: Application in Decorah area. In *IMAGE Technical Program Abstracts 2023*.

6. **Wei, X.**, Sun, J. and Sen, M., 2023, August. 3D trans-dimensional Monte Carlo geometry inversion and uncertainty quantification using gravity data. In *IMAGE Technical Program Abstracts 2023*.

5. Sun, J., **Wei, X.** and Sen, M., 2023, August. Uncertainty quantification of anomalous body shapes using potential field data in a trans-dimensional Bayesian framework, *XXVIII General Assembly of the International Union of Geodesy and Geophysics* (IUGG) (Berlin 2023). doi:10.57757/IUGG23-4343.

4. **Wei, X.**, Sun, J. and Sen, M., 2022, December. A Bayesian framework for uncertainty analysis of anomalous body shapes using gravity data. In *AGU Fall Meeting Abstracts* (Vol. 2022, pp. NG35B-0469).

3. **Wei, X.** and Sun, J., 2021, December. Building 3D probabilistic geology differentiation models using mixed Lp norm joint inversion, airborne geophysics and petrophysical information. In *AGU Fall Meeting Abstracts* (Vol. 2021, pp. NG25A-0485).

2. **Wei, X.** and Sun, J., 2021, December. Analyzing uncertainty of 3D inversion using airborne geophysical data conditioned on petrophysical measurements. In *AGU Fall Meeting Abstracts* (Vol. 2021, pp. NS35C-0373).

1. Li, K., **Wei, X.**, Sun, J., 2021, December. Characterizing a buried niobium deposit using airborne geophysics, joint inversion, and geology differentiation. In *AGU Fall Meeting Abstracts* (Vol. 2021, pp. NS24A-05).

Open code and data

3. **Wei, X.** and Sun, J., 2021. Joint inversion of gravity gradient and magnetic data using mixed Lp norm regularization (1.0). *Zenodo*. doi:10.5281/zenodo.5774303.

2. **Wei, X.** and Sun, J., 2021. Interactive geology differentiation and 3D visualization of geological units (1.0). *Zenodo*. doi:10.5281/zenodo.5774309.

1. Sun, J., and **Wei, X.**, 2020. Solving the bound dependence and staircasing problems in 3D potential-field sparse inversions using a mixed Lp-norm regularization (1.0). *Zenodo*. doi:10.5281/zenodo.4057134.

Invited Talks

09/2023 **Wei, X.**, Yin, Z., Scheidt, C., Darnell, K., Wang, L. and Caers, J., Uncertainty quantification of the stratigraphic model conditioned on airborne geophysics, geochemistry, and drillholes. Post-Convention Workshop W7, *IMAGE*, Houston, USA.

07/2023 Sun, J., and **Wei, X.**, Building probabilistic quasi-geology models and mapping mineral resources using joint inversion and geology differentiation, *XXVIII General Assembly of the International Union of Geodesy and Geophysic* (IUGG) (Berlin 2023). doi:10.57757/IUGG23-4333.

09/2022 **Wei, X.**, Sun, J. and Sen, M., A Bayesian framework for uncertainty quantification of salt body shapes using gravity data. *Geophysical Society of Houston*, Houston, USA.

11/2021 **Wei, X.** and Sun, J., Build probabilistic quasi-geology models based on multiple airborne geophysical data and sparse joint inversions. *Geophysical Society of Houston*, online.

09/2021 **Wei, X.** and Sun, J., From deterministic to probabilistic geoscience modeling: analyzing uncertainties of geophysical inversions and constructing probabilistic subsurface models conditioned on petrophysical measurements. *SimPEG monthly seminar*, online.

Teaching Experience

2020 GEOL7330: Potential Field Methods of Geophysical Exploration (graduate core course), **guest lecturer**. *University of Houston.*

2019 GEOL4355: Geophysical Field Camp, **teaching assistant**. *University of Houston.*

Grants

2020–2021 $1,000; Proposal:"Uncertainty Analysis of Geophysical Inversions Conditioned on Spatial Distributions of Geologic Units"; Student Research Funding Program (independent of advisor) from EAS Department at University of Houston; PI: Xiaolong Wei

Awards & Honors

2022 Dan E. Wells Outstanding Dissertation Award, University of Houston

2022 The Innovation Prize in Frank Arnott - Next Generation Explorers Award ($3,000CAD)

2022 SEG Lucien LaCoste Scholarship ($5,305.12)

2022 Outstanding Graduate Work in Geophysics, University of Houston ($1,250)

2022 The Best Paper in the Mining Sessions at 2021 IMAGE Annual Meeting, Denver, USA (co-author)

2022 The Best Student Paper in the Mining Sessions at 2021 IMAGE Annual Meeting, Denver, USA

2021 Student Travel Award, University of Houston, Houston

2021 SEG Technical Program Registration Grant

2021 SEG John R. Butler Jr. Scholarship ($510.86)

2021 The Best Poster in the Mining Sessions at 2020 SEG Annual Meeting, Online

2020–2021 Outstanding Academic Achievement, University of Houston ($700×2)

2016–2018 The First Prize Scholarship, Northwest University, Xi'an, China (×3)

2015 The Best Bachelor Thesis, China University of Geosciences, Beijing, China

2013 The Second Prize Scholarship, China University of Geosciences, Beijing, China

Professional Service & Outreach

Peer-Reviewer

2023–present Geophysical Prospecting

2023–present Solid Earth

2022–present Geocarto International

2022 SEG Conference Proceeding

2021–present Geophysics

2021–present Geophysical Journal International

2021–present IEEE Transactions on Geoscience and Remote Sensing

2021–present Acta Geophysica

Conferences

2023 Session Co-convener: Advancing mineral exploration and responsible mining for energy transitions, AGU, San Franciscon, California, USA

2023 Session Chair for MME 1: Mineral Exploration: Geophysics 1 at IMAGE Annual Meeting, Houston, Texas, USA

2022 Session Chair for GM 1: Inversion Insights at IMAGE Annual Meeting, Houston, Texas, USA

2021 Session Chair for MG P1: New Methods and Case Histories 1 at IMAGE Annual Meeting (SEG and AAPG joint annual conference), Denver, Colorado, USA

Affiliations

2022–Present European Geosciences Union (EGU)

2021–Present Geophysical Society of Houston (GSH)

2020–Present American Geophysical Union (AGU), European Association of Geoscientists & Engineers (EAGE)

2018–Present Society of Exploration Geophysicists (SEG)

Others

2020–2021 Contributor of the joint inversion code to SimPEG (https://simpeg.xyz/)

Certifications

2022	Convolutional Neural Networks course given by Dr. Andrew Ng through Coursera, Inc.
2022	Remote pilot for the small unmanned aircraft system issued by Federal Aviation Administration
2021	FAA Part 107 Knowledge Test Prep for Drone Pilot on Udemy, Inc.
2021	ISInProG@Lario - 2021 International School on Inverse Problems in Geophysics on the shore of the Lario Lake
2021	Magnetotellurics (MT) short course given by Dr. Alan G. Jones
2018	Machine Learning course given by Dr. Andrew Ng through Coursera, Inc.