# Mostafa Kiani Shahvandi


| | |
|---|---|
| Address | Institute of Geodesy and Photogrammetry<br>ETH Zürich<br>HPV G51, Robert-Gnehm-Weg 15, 8093,<br>Zürich, Switzerland |
| Contact | mkiani@ethz.ch; ETH website, Personal website |


## Research interests

Earth system modelling and geophysical fluid dynamics

Solid Earth-ocean-climate dynamics and interactions

Earth rotation and effective angular momentum functions

Physics-informed neural networks

## Education

| | |
|---|---|
| 2024-2024 | ETH Zürich, Switzerland<br>Postdoc in Geodesy<br>Advisor: Prof. Benedikt Soja |
| 2020-2024 | ETH Zürich, Switzerland<br>Ph.D. in Geodesy<br>Thesis advisor: Prof. Benedikt Soja |
| 2024-2024 | University of Cambridge, United Kingdom<br>Visiting student, Department of Earth Sciences<br>Academic advisor: Prof. David Al-Attar |
| 2022-2022 | GFZ German Research Center for Geosciences<br>Visiting student, Section for Earth System Modelling<br>Academic advisor: Dr. Henryk Dobslaw, Dr. Robert Dill |
| 2017-2019 | University of Tehran, Iran<br>Master of Science in Geodesy (First Class Honors) |
| 2013-2017 | University of Tehran, Iran<br>Bachelor of Science in Geodesy (First Class Honors) |

## Awards

| | |
|---|---|
| 2020 | National best alumni award, across all Iranian universities |
| 2019 | 1st honorary M.Sc. student among all the Geodesy students |
| 2018 | Rank 1st (out of >2500) in national Geoscience Olympiad |
| 2017 | 1st honorary B.Sc. student among all the Geodesy students |
| 2017 | Rank 4th (out of >2500) in national Geoscience Olympiad |
| 2014-2018 | The best student award (FOE) for 8 consecutive semesters |
| 2017-2020 | Three times winner of the national elite's foundation award for exceptional achievements |

---

## Teaching

| | |
|---|---|
| 2017 | Geodetic Networks, TA, University of Tehran |
| 2022 | Gravity Field, TA, ETH Zürich |
| 2021-2024 | Space Geodesy, TA, ETH Zürich |

---

## Supervision of students

| | |
|---|---|
| 2022 | Christoph Baumann, ETH Zürich<br>**Bachelor thesis title**: Using machine learning to predict Earth deformation from InSAR time series, https://doi.org/10.3929/ethz-b-000551868 |
| 2022 | Christine Rösch, ETH Zürich<br>Junyang Gou, ETH Zürich<br>**Interdisciplinary project**: Machine learning for orbit determination, https://doi.org/10.3929/ethz-b-000617317 |
| 2021 | Michelle Halbheer, ETH Zürich<br>**Bachelor thesis title**: Prediction of atmospheric parameters from GNSS observations and weather models with machine learning, https://doi.org/10.3929/ethz-b-000573133 |

---

## Memberships

| | |
|---|---|
| 2021-present | American Geophysical Union associate |
| 2021-present | ETH AI Center associate |
| 2021-present | International Association of Geodesy |
| 2021-present | SIAM Data Science and Geosciences |
| 2020-present | IEEE Geoscience and Remote Sensing Society |
| 2023-present | GGOS Artificial Intelligence for Earth Orientation Parameter Prediction |
| 2024-present | IAG Joint Study Group on Machine Learning for Geodesy |

---

## Publications

For the full list of my publications please visit:

**Google scholar**: https://scholar.google.com/citations?hl=en&user=qCI0O08AAAAJ

**Researchgate**: https://www.researchgate.net/profile/Mostafa-Kiani-Shahvandi

**ORCID**: https://orcid.org/0000-0001-5705-7014

### Selected publications

[1] **M. Kiani Shahvandi**, S. Adhikari, M. Dumberry, S. Modiri, R. Heinkelmann, H. Schuh, S. Mishra, B. Soja "Contributions of core, mantle and climatological processes to Earth's polar motion", Nature Geoscience, 2024, https://doi.org/10.1038/s41561-024-01478-2

[2] **M. Kiani Shahvandi**, S. Adhikari, M. Dumberry, S. Mishra, B. Soja "The increasingly dominant role of climate change on length of day variations", Proceedings of the National Academy of Sciences, 2024, https://doi.org/10.1073/pnas.2406930121

[3] **M. Kiani Shahvandi**, S. Belda, M. Karbon, S. Mishra, B. Soja "Deep ensemble geophysics-informed neural networks for the prediction of celestial pole offsets", Geophysical Journal International, 2024, https://doi.org/10.1093/gji/ggad436

[4] **M. Kiani Shahvandi**, R. Dill, H. Dobslaw, A. Kehm, M. Bloßfeld, M. Schartner, S. Mishra, B. Soja "Geophysically-informed machine learning for improving rapid estimation and short-term prediction of Earth orientation parameters", Journal of Geophysical Research: Solid Earth, 2023, https://doi.org/10.1029/2023JB026720

[5] J. Gou, **M. Kiani Shahvandi**, R. Hohensinn, B. Soja "Ultra-short-term prediction of LOD using LSTM neural networks", Journal of Geodesy, 97, 2023, https://doi.org/10.1007/s00190-023-01745-x

[6] **M. Kiani Shahvandi**, M. Schartner, B. Soja "Neural ODE Differential Learning and its application in polar motion prediction", Journal of Geophysical Research: Solid Earth, 127(11), 2022, https://doi.org/10.1029/2022JB024775

[7] **M. Kiani Shahvandi**, B. Soja "Inclusion of data uncertainty in machine learning and its application in geodetic data science, with case studies for the prediction of Earth orientation parameters and GNSS station coordinate time series", Advances in Space Research, 70(3), pp. 563-575, 2022, https://doi.org/10.1016/j.asr.2022.05.042

[8] **M. Kiani Shahvandi**, M. Schartner, J. Gou, B. Soja "Data driven approaches for the prediction of Earth's effective angular momentum functions", IEEE Geoscience and Remote Sensing Symposium, 2022, https://doi.org/10.1109/IGARSS46834.2022.9883545

[9] **M. Kiani Shahvandi**, B. Soja "Small geodetic datasets and deep networks: attention-based residual LSTM autoencoder stacking for geodetic time series", Lecture Notes in Computer Science, vol 13163. Springer, Cham, 2022, https://doi.org/10.1007/978-3-030-95467-3_22

[10] **M. Kiani Shahvandi**, B. Soja "Modified deep transformers for GNSS time series prediction", IEEE Geoscience and Remote Sensing Symposium, 2021, https://doi.org/10.1109/igarss47720.2021.9554764

[11] **M. Kiani Shahvandi** "A new optimal image smoothing method based on generalized discrete iterated Laplacian minimization and its application in the analysis of earth's surface using satellite remote sensing imagery", Earth Science Informatics, 14, pp 81–97, 2021, https://doi.org/10.1007/s12145-020-00553-7

[12] **M. Kiani Shahvandi** "Applications of numerical integration in geodesy and geophysics", Acta Geophysica, 69, pp. 29-45, 2021, https://doi.org/10.1007/s11600-020-00525-x

[13] **M. Kiani Shahvandi** "Numerical solution of ordinary differential equations in geodetic science using adaptive Gauss numerical integration method", Acta Geodaetica et Geophysica, 55, pp. 277–300, 2020, https://doi.org/10.1007/s40328-020-00293-6

[14] **M. Kiani Shahvandi** "Simultaneous approximation of a function and its derivatives by Sobolev polynomials: Applications in satellite geodesy and precision orbit determination for LEO CubeSats", Geodesy and Geodynamics, 11(5), pp 376-390, 2020, https://doi.org/10.1016/j.geog.2020.06.002

[15] **M. Kiani Shahvandi** "Local geoid height approximation and interpolation using moving least squares approach", Geodesy and Geodynamics, 11(2), pp. 120-126, 2020, https://doi.org/10.1016/j.geog.2019.12.003

[16] **M. Kiani Shahvandi** "Template-based smoothing functions for data smoothing in geodesy", Geodesy and Geodynamics, 11(4), pp. 300-306, 2020, https://doi.org/10.1016/j.geog.2020.03.003

[17] **M. Kiani Shahvandi** "Spherical approximating and interpolating moving least squares in geodesy and geophysics: A case study for deriving gravity acceleration at sea surface in the Persian Gulf", Journal of geodetic science, 10, pp 124-135, 2020, https://doi.org/10.1515/jogs-2020-0112

[18] **M. Kiani Shahvandi**, N. Chegini, A. Safari, B. Nazari, "Producing gravity acceleration at sea surface in Persian Gulf using ellipsoidal splines", jgit, 8(1), pp 63-78, 2020, https://doi.org/10.29252/jgit.8.1.63

[19] **M. Kiani Shahvandi**, N. Chegini, A. Safari, B. Nazari "Spheroidal spline interpolation and its application in geodesy". Geodesy and Cartography, 46(3), pp 123-135, 2020, https://doi.org/10.3846/gac.2020.11316

[20] **M. Kiani Shahvandi**, N. Chegini, "Ellipsoidal spline functions for gravity data interpolation and smoothing", Earth Observation and Geomatics Engineering, 3(2), pp. 1-11, 2019, https://doi.org/10.22059/EOGE.2020.290542.1065