Dr. Arne Spang

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Professional appointments

10/2025 - 10/2025	3-week stay as guest researcher at ETH Zürich, Switzerland
10/2022 - present	Postdoctoral Researcher at University of Bayreuth, Germany Numerical model development and execution
08/2022 - 09/2022	Postdoctoral Researcher at University of Mainz, Germany Numerical model execution
04/2018 – 09/2018	Research Assistant at University of Mainz, Germany Numerical model execution

Education

10/2018 - 07/2022	Doctoral Candidate in Computational Geodynamics at University of Mainz, Germany Final grade: magna cum laude (very good) Thesis: Thermomechanical modeling of magmatic systems
10/2015 - 04/2018	Master of Science in Geoscience at University of Mainz Final grade: 1.2 (very good) Thesis: Pressure dependence of vapor/melt partition coefficients of boron in silicate melts, 1.0 (very good)
10/2012 - 03/2016	Bachelor of Science in Geoscience at University of Mainz Final grade: 1.4 (very good) Thesis: A quantitative analysis of bubble coalescence in basaltic magmas, 1.0 (very good)

Funding acquisition

10/2025	Co-PI of “Data2Model: Building the knowledge to convert observations to models”. Proposal for a PhD student as part of the DFG SPP DEFORM. Fully funded (261 000 €).
01/2026	WiN-UBT Research Stay Grant 2026. Mobility grant for early career researchers (2 000 €).

Teaching

12/2023 - 04/2024	Seminar leader for “Introduction to Thermomechanical Modelling”
10/2020 - 03/2021	Teaching assistance for “Geophysical Modelling”
04/2019 - 09/2020	Planning and execution of practical seminars on “The Dynamics of the Lithosphere”
04/2018 - 09/2018	Student assistance in “Hydrogeology” (Preparation of practice and exam tasks)
04/2017 - 09/2018	Student assistance in “Applied Geophysics” (Preparation and automation of practice tasks)

Supervision

04/2024 - 10/2024	Muhammad Ilham Hamadi, Master thesis, “Postseismic relaxation due to thermally activated ductile deformation” (main supervisor)
12/2023 -	Tatjana Weiler, PhD thesis, “Modelling of deep earthquake generation in the Hindu Kush” (co-supervisor)
12/2023 -	Danielle Silva Souza, PhD thesis, “Experimental investigation of Antigorite dehydration reactions under deformation” (mentor)
10/2023 -	Hao Liu, PhD thesis, “Geodynamic modelling of the Changbai magmatic system” (external advisor)
06/2022 - 05/2023	Zornitsa Kunchova, Master thesis, “Modelling of magmatic systems underneath the Klyuchevskoy group of volcanoes, Kamchatka” (co-supervisor)
10/2021 - 02/2022	Elisabeth Walter, Bachelor thesis, “Geophysical Modelling of Magma Induced Uplift at Campi Flegrei, Italy” (co-supervisor)

Skills

Languages	English (very good, written and spoken) German (native speaker)
Programming	Matlab (daily for 4 years) Julia (daily for 3.5 years) Python (weekly for 4 years) C/C++ and Bash (occasionally for 7 years)
Development	DEDLoc, https://github.com/ArneSpang/DEDLoc LaMEM, https://github.com/UniMainzGeo/LaMEM geomIO, https://bitbucket.org/geomio/geomio GeophysicalModelGenerator, https://github.com/JuliaGeodynamics/GeophysicalModelGenerator.jl
Other Software	Geodynamic modeling on HPC clusters, Visual Studio Code, Git, Paraview, GMT, Inkscape, Windows, Ubuntu OS

Monographies

1. **Spang, A.** (2022). Thermomechanical Modeling of Magmatic Systems (Doctoral dissertation, Johannes Gutenberg-Universität Mainz). http://doi.org/10.25358/openscience-7509

Peer-reviewed articles

9. **Spang, A.**, Thielmann, M., Pranger, C., de Montserrat, A., & Räss, L. (2026). Overcoming the numerical challenges owing to rapid ductile localization with DEDLoc (version 1.0.0), *Geoscientific Model Development*, 19, 369–388. https://doi.org/10.5194/gmd-19-369-2026
8. **Spang, A.**, Thielmann, M., de Montserrat, A., & Duretz, T. (2025). Transient propagation of ductile ruptures by thermal runaway. *Journal of Geophysical Research: Solid Earth*, *130*(6), e2025JB031240. https://doi.org/10.1029/2025JB031240
7. Paul, J., **Spang, A.**, & Piccolo, A. (2025). Hydration weakening and destruction of the North China Craton. *Tectonophysics*, 230756. https://doi.org/10.1016/j.tecto.2025.230756
6. Kaus, B.J.P., Thielmann, M., Aellig, P., de Montserrat, A., de Siena, L., Frasukiewicz, J., Fuchs, L., Piccolo, A., Ranocha, H., Riel, N., Schuler, C., **Spang, A.**, & Weiler, T., (2024). GeophysicalModelGenerator.jl: A Julia package to visualise geoscientific data and create numerical model setups. *Journal of Open Source Software*, 9(103), 6763. https://doi.org/10.21105/joss.06763
5. **Spang, A.**, Thielmann, M., & Kiss, D. (2024). Rapid ductile strain localization due to thermal runaway. *Journal of Geophysical Research: Solid Earth, 129(10)*, e2024JB028846. https://doi.org/10.1029/2024JB028846
4. Kiss, D., Moulas, E., Kaus, B. J., & **Spang, A.** (2023). Decompression and fracturing caused by magmatically induced thermal stresses. *Journal of Geophysical Research: Solid Earth, 128*(3), e2022JB025341. https://doi.org/10.1029/2022JB025341
3. **Spang, A.**, Baumann, T. S., & Kaus, B. J. (2022). Geodynamic modeling with uncertain initial geometries. Geochemistry, *Geophysics, Geosystems, 23*(6), e2021GC010265. https://doi.org/10.1029/2021GC010265
2. **Spang, A.**, Burton, M., Kaus, B. J., & Sigmundsson, F. (2022). Quantification of volcano deformation caused by volatile accumulation and release. *Geophysical Research Letters, 49*(10), e2021GL097502. https://doi.org/10.1029/2021GL097502
1. **Spang, A.**, Baumann, T. S., & Kaus, B. J. (2021). A multiphysics approach to constrain the dynamics of the Altiplano-Puna magmatic system*. Journal of Geophysical Research: Solid Earth, 126*(7), e2021JB021725. https://doi.org/10.1029/2021JB021725

Articles under review

2. Duretz, T., de Montserrat, A., Sevilla, R., Räss, L., Utkin, I., & **Spang, A.**. Automatic tuning of iterative pseudo-transient solvers for modelling the deformation of heterogeneous media. *Geoscientific Model Development.*
1. Piccolo, A., **Spang, A.**, Eskens, L., Andrić-Tomašević, N., Eizenhöfer, P., Le Breton, E. & Thielmann, M.. The dynamics and surface signal of slab break-off in continental settings:

Insights from 3D numerical modelling. *Journal of Geophysical Research: Solid Earth.* https://essopenarchive.org/users/929391/articles/1300702-the-dynamics-and-surface-signal-of-slab-break-off-in-continental-settings-insights-from-3d-numerical-modelling

Software

5. **Spang, A.** (2025). DEDLoc. https://github.com/ArneSpang/DEDLoc
4. **Spang, A.**, Thielmann, M., & de Montserrat, A. (2025). Numerical model used in "Transient propagation of ductile ruptures by thermal runaway". Zenodo. https://doi.org/10.5281/zenodo.14719483
3. **Spang, A.**, Thielmann, M., & Kiss, D. (2024). Numerical model used in "Rapid ductile strain localization due to thermal runaway". In Rapid Ductile Strain Localization due to Thermal Runaway. Zenodo. https://doi.org/10.5281/zenodo.12167393
2. Kaus, B., Popov, A., Ito, G., **Spang, A.**, Reuber, G., Ibragimov, I., Wang, X., Amorrow, T., Pusok, A., Schuler, C., Sanan, P., Brune, S., Yang, J., Bauville, A., & Piccolo, A. (2024). UniMainzGeo/LaMEM: v2.1.3 (2.1.3). Zenodo. https://doi.org/10.5281/zenodo.10563399
1. Kaus, B., **Spang, A.**, Thielmann, M., De Siena, L., Aellig, P., & Ranocha, H. (2023). JuliaGeodynamics/GeophysicalModelGenerator.jl: v0.5.5 (v0.5.5). Zenodo. https://doi.org/10.5281/zenodo.8329317

Invited presentations

03/2026	University of Leeds	Deep-focus earthquakes driven by thermal runaway
12/2025	University of Bonn	Understanding the physics of thermal runaway and ductile rupture propagation
10/2025	ETH Zürich	Ductile strain localization and transient rupture propagation by thermal runaway
09/2025	Geomod Lisbon	Transient propagation of ductile ruptures by thermal runaway
06/2025	TSK Webinar	Ductile strain localization and transient rupture propagation by thermal runaway
04/2024	EGU General Assembly	Thermal runaway and the challenges of rapid localization
03/2022	ETH Zürich	Thermomechanical modeling of magmatic systems
02/2022	University of Bayreuth	Geodynamic inversion with uncertain initial geometries
01/2022	University of Lausanne	Multidisciplinary approach to constrain the dynamics of the Altiplano-Puna magma system
08/2021	GEOMAR Kiel	3D geodynamic modeling of the dynamics of the Altiplano-Puna magma system

Conference contributions

26. **Spang, A.**, Thielmann, M., de Montserrat, A., & Duretz, T., (2025) Transient propagation of ductile ruptures by thermal runaway. **Invited Oral** presentation at GeoMod, Lisbon.
25. **Spang, A.**, Thielmann, M., de Montserrat, A., & Duretz, T., (2025) 2D numerical models of ductile rupture propagation. Oral presentation at EGU General Assembly, Vienna
24. **Spang, A.**, Thielmann, M., Kiss, D., de Montserrat, A., & Räss, L. (2024) Thermal runaway as driving mechanism of deep earthquakes – Constraints from numerical modeling. Poster presentation at Ada Lovelace Workshop 2024, Sete.
23. **Spang, A.**, Thielmann, M., Kiss, D. and Pranger, C., (2024) Thermal runaway and the challenges of rapid localization. **Invited Oral** presentation at EGU General Assembly, Vienna. https://doi.org/10.5194/egusphere-egu24-18807
22. **Spang, A.**, Thielmann, M., and Kiss, D., (2024) Thermal runaway as driving mechanism of deep earthquakes – Constraints from numerical modeling. Oral presentation at EGU General Assembly, Vienna. https://doi.org/10.5194/egusphere-egu24-10403
21. **Spang, A.**, Thielmann, M., Kiss, D., (2023). 1D and 2D numerical models of rapid ductile strain localization due to thermal runaway. Poster presentation at GeoMod, Paris.
20. **Spang, A.**, Thielmann, M., Kiss, D., (2023). 1D and 2D numerical models of rapid ductile strain localization due to thermal runaway. Poster presentation at German-Swiss Geodynamics Workshop, Haltern am See.
19. **Spang, A.**, Thielmann, M., Kiss, D., (2023). GPU-based numerical models of rapid ductile strain localization due to thermal runaway. Poster presentation at EGU General Assembly, Vienna. https://doi.org/10.5194/egusphere-egu23-11594
18. **Spang, A.**, Piccolo, A., Kaus, B.J.P., (2022). 3D Thermomechanical modeling of magmatic intrusion, volcanic deformation and flank stability. Poster presentation at Ada Lovelace Workshop, Heviz.
17. **Spang, A.**, Burton, M. Kaus, B.J.P., Sigmundsson, F., (2022). Quantification of Volcano Deformation caused by Volatile Accumulation and Release. Oral presentation at EGU General Assembly, Vienna. https://doi.org/10.5194/egusphere-egu22-2639
16. **Spang, A.**, Burton, M. Kaus, B.J.P., Sigmundsson, F., (2022). Quantification of Volcano Deformation caused by Volatile Accumulation and Release. Virtual oral presentation at Physics of Volcanoes.
15. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2021). Geodynamic inversion with uncertain initial geometries. Oral presentation at German Swiss Geodynamics Workshop.
14. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2021). Geodynamic inversion with uncertain initial geometries. Virtual oral presentation at EG EGU General Assembly. https://doi.org/10.5194/egusphere-egu21-5680
13. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2021). Multidisciplinary approach to constrain the dynamics of the Altiplano-Puna magma system. Virtual oral presentation at Physics of Volcanoes.
12. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2021). Multidisciplinary approach to constrain the dynamics of the Altiplano-Puna magma system. Virtual oral presentation at DGG, Kiel.
11. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2021). Multidisciplinary approach to constrain the dynamics of the Altiplano-Puna magma system. Virtual oral presentation at VMSG Annual Meeting.

10. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2020). Geodynamic inversion with uncertain initial geometries. Virtual oral presentation at Geo Utrecht.

9. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2020). 3D Geodynamic Models of the Present-Day Altiplano-Puna Magmatic System. Virtual oral presentation at EGU General Assembly. https://doi.org/10.5194/egusphere-egu2020-5388

8. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2020). 3D Geodynamic Models of the Present-Day Altiplano-Puna Magmatic System. Oral presentation at Physics of Volcanoes, Hamburg.

7. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2019). 3D Geodynamic Models of the Present-Day Altiplano-Puna Magmatic System. Poster presentation at AGU Fall Meeting, San Francisco.

6. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2019). Towards 3D geodynamic modelling of the dynamics of the Altiplano-Puna Magma System. Poster presentation at Ada Lovelace Workshop, Siena.

5 **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2019). Towards 3D geodynamic modelling of the dynamics of the Altiplano-Puna Magma System. Oral presentation at Geo Münster, Münster.

4. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2019). Towards 3D geodynamic modelling of the dynamics of the Altiplano-Puna Magma System. Poster presentation at EGU General Assembly, Vienna.

3. **Spang, A.**, Baumann, T.S., Kaus, B.J.P., (2019). Towards 3D geodynamic modelling of the dynamics of the Altiplano-Puna Magma System. Poster presentation Physics of Volcanoes, Mendig.

2. **Spang, A.**, Helo, C., Mueller, S.P., Castro, J.M. (2018). Pressure and composition dependence of fluid/melt partition coefficients for boron in silicate melts. Oral presentation at Physics of Volcanoes, Kiel.

1. **Spang, A.**, Helo, C., Mueller, S.P., Castro, J.M. (2016). Bubble Coalescence in Basaltic Magmas. Poster presentation at Physics of Volcanoes, Mainz.