Borisov Dmitry, Ph.D.

Geophysicist

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Research Interests

- Numerical modeling of wave propagation: finite difference, finite element methods
- Seismic imaging: full-waveform inversion, migration, tomography
- Surface waves and near-surface characterization
- Machine learning

Education

2010 – 2014	**Ph.D.** (With Honors) in Geophysics, Institut Physique du Globe de Paris, France. Thesis title: *3D elastic FWI of time-lapse seismic data using injection method.*
2007 – 2010	**M.Sc.** in Reservoir Engineering, Ecole Nationale Superieure de Geologie (**ENSG**), Nancy, France. Thesis title: *Pre-stack inversion of time-lapse seismic data.*
2003 – 2007	**B.Sc.** in Geophysics, Lomonosov Moscow State University (**MSU**), Russia. Thesis title: *Processing of VSP dataset from Western Siberia.*

Employment History

2019 – ····	Assistant Research Professor, Exploration Services, **Kansas Geological Survey**.
2015 – 2018	Postdoctoral research associate, Theoretical & Computational Seismology, Department of Geosciences, **Princeton University**.
2013	4-month internship, **SHELL Global Solutions International**, Advanced Imaging Team, R&D, Rijswijk, Netherlands. Improved seismic imaging using multi-parameter acoustic full-waveform inversion.
2010	6-month internship, **TOTAL**, Seismic R&D Department, Pau, France. Workflow definition for pre-stack inversion of time-lapse seismic data.
	2-month internship, **GPC IP**, Paris, France. Reservoir fluid flow simulation and heat transfer in porous media.
2007	6-month part-time job, **GEOVERS**, Moscow, Russia. Seismic processing & interpretation of surface and VSP data.

Research Publications

Journal Articles

1. Aktharuzzaman, M., Anwar, S., **Borisov, D.** & He, J. (2024). Experimental full waveform inversion for elastic material characterization with accurate transducer modeling. *Mechanical Systems and Signal Processing*, *213*, 111320.
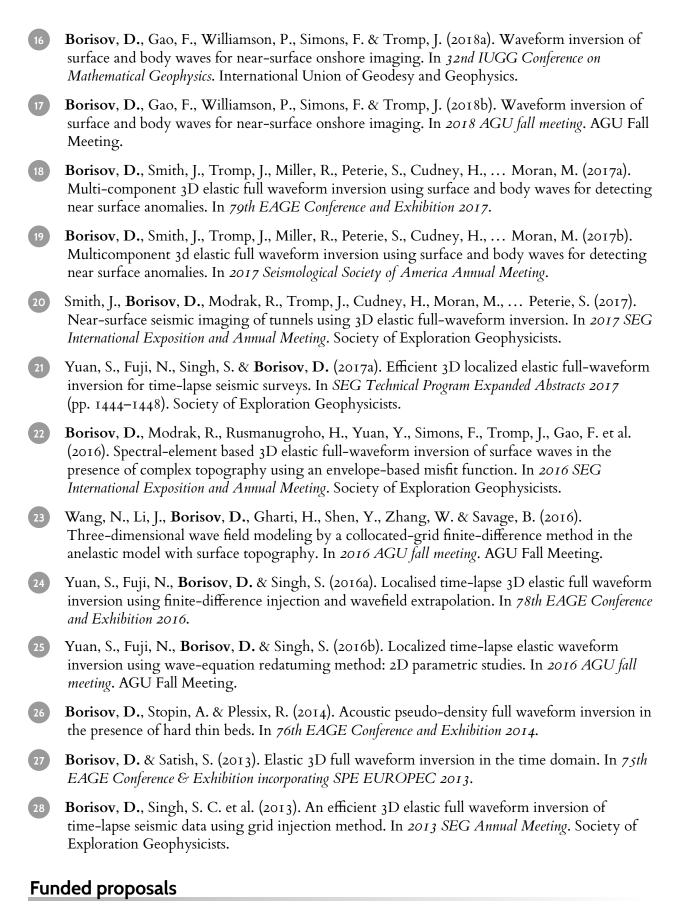
[2] **Borisov, D.**, Miller, R. D. & Sloan, S. D. (2023). Waveform inversion of shallow seismic data with randomly selected sources. *Journal of Environmental and Engineering Geophysics*. doi:10.32389/JEEG22-038

[3] He, J., **Borisov, D.**, Fleming, J. D. & Kasemer, M. (2022). Subsurface polycrystalline reconstruction based on full waveform inversion-A 2D numerical study. *Materialia*, *24*, 101482.

[4] Liu, Q., Waheed, U. b., **Borisov, D.**, Simons, F. J., Gao, F. & Williamson, P. (2022). Full-waveform centroid moment tensor inversion of passive seismic data acquired at the reservoir scale. *Geophysical Journal International*, *230*(3), 1725–1750.

[5] **Borisov, D.**, Gao, F., Williamson, P. & Tromp, J. (2020). Application of 2D full-waveform inversion on exploration land data. *Geophysics*, *85*(2), R75–R86.

[6] Smith, J., **Borisov, D.**, Modrak, R., Cudney, H., Moran, M., Sloan, S., … Wang, Y. (2019). Tunnel detection at Yuma proving ground, Arizona, USA. part 2: 3D Full-Waveform Inversion experiments. *Geophysics*, *84*(1), 1–98.

[7] Modrak, R. T., **Borisov, D.**, Lefebvre, M. & Tromp, J. (2018). Seisflows—flexible waveform inversion software. *Computers & Geosciences*, *115*, 88–95.

[8] Wang, N., Li, J., **Borisov, D.**, Gharti, H., Shen, Y., Zhang, W. & Savage, B. (2018). Modeling three-dimensional wave propagation in anelastic models with surface topography by a collocated-grid finite-difference method. *Journal of Geophysical Research*.

[9] Wang, Y., Miller, R., Peterie, S., Cudney, H., ..., **Borisov, D.**, … Tromp, J. (2018). Tunnel detection at Yuma proving ground, Arizona, USA. part 1: 2D Full-Waveform Inversion experiments. *Geophysics*, *84*(1), 1–44.

[10] **Borisov, D.**, Modrak, R., Gao, F. & Tromp, J. (2017). 3D elastic full-waveform inversion of surface waves in the presence of irregular topography using an envelope-based misfit function. *Geophysics*, *83*(1), 1–45.

[11] Yuan, S., Fuji, N., Singh, S. & **Borisov, D.** (2017b). Localized time-lapse elastic waveform inversion using wavefield injection and extrapolation: 2-D parametric studies. *Geophysical Journal International*, *209*(3), 1699–1717.

[12] **Borisov, D.** & Singh, S. C. (2015). Three-dimensional elastic full waveform inversion in a marine environment using multicomponent ocean-bottom cables: A synthetic study. *Geophysical Journal International*, *201*(3), 1215–1234.

[13] **Borisov, D.**, Singh, S. C. & Fuji, N. (2015). An efficient method of 3-D elastic full waveform inversion using a finite-difference injection method for time-lapse imaging. *Geophysical Journal International*, *202*(3), 1908–1922.

Conference Proceedings

[1] **Borisov, D.**, Zhang, Y., Ivanov, J., Miller, R. D. & Sloan, S. D. (2024). Building an initial model for near-surface surface waves based full-waveform inversion with deep learning. In *Seventh International Conference on Engineering Geophysics, Al Ain, UAE, 16–19 October 2023* (pp. 24–29). Society of Exploration Geophysicists.

[2] Ivanov, J., Peterie, S., Miller, R. D., **Borisov, D.** & Sloan, S. (2024). Enhanced converted-surface-wave imaging (cswi) method for the detection of an elongated empty space using challenging seismic data collected at a desert site. In *Seventh International Conference on Engineering Geophysics, Al Ain, UAE, 16–19 October 2023* (pp. 282–286). Society of Exploration Geophysicists.

3. Miller, R. D., Peterie, S. L., **Borisov, D.** & Klock, J. (2024). Direct detection of 135 m deep void using high resolution seismic reflection. In *Seventh International Conference on Engineering Geophysics, Al Ain, UAE, 16–19 October 2023* (pp. 133–136). Society of Exploration Geophysicists.

4. Abbasi, S., Alfarraj, M., **Borisov, D.**, Jayaram, V., Alam, I. & Sarosh, B. (2023). A simultaneous denoising and event picking approach using supervised machine learning. In *Third International Meeting for Applied Geoscience & Energy* (pp. 1490–1494). Society of Exploration Geophysicists and American Association of Petroleum …

5. Aktharuzzaman, M., Anwar, S., **Borisov, D.**, Rao, J. & He, J. (2022). 2d numerical ultrasound computed tomography for elastic material properties in metals. In *Asme international mechanical engineering congress and exposition* (Vol. 86625, V001T01A012). American Society of Mechanical Engineers.

6. **Borisov, D.**, Miller, R. D., Peterie, S. L., Ivanov, J., Hoch, A. M. & Sloan, S. D. (2022). Graph-space optimal transport-based 3D elastic FWI for near-surface seismic applications. In *Second international meeting for applied geoscience & energy* (pp. 2153–2157). Society of Exploration Geophysicists and American Association of Petroleum …

7. **Borisov, D.**, Miller, R. D., Ivanov, J., Peterie, S. L. & Sloan, S. D. (2021a). Delineating mines using full-waveform inversion in Galena, Kansas. In *First international meeting for applied geoscience & energy* (pp. 1871–1875). Society of Exploration Geophysicists.

8. **Borisov, D.**, Miller, R. D., Ivanov, J., Peterie, S. L. & Sloan, S. D. (2021b). Waveform inversion of shallow seismic data with randomly selected sources. In *Sixth international conference on engineering geophysics, virtual, 25–28 october 2021* (pp. 190–194). Society of Exploration Geophysicists.

9. Ivanov, J., Peterie, S. L., Miller, R. D., **Borisov, D.**, D, S. S., Knippel, E. & Hoch, A. (2021). Detecting and delineating voids and mines using new surface-wave methods in Galena, Kansas. In *First international meeting for applied geoscience & energy* (pp. 1871–1875). Society of Exploration Geophysicists.

10. Miller, R. D., Ivanov, J., Peterie, S. L. & **Borisov, D.** (2021). Blurring the lines between near surface and conventional seismic imaging. In *Sixth international conference on engineering geophysics, virtual, 25–28 october 2021*. Society of Exploration Geophysicists.

11. Wu, F. V., **Borisov, D.**, Simons, F. J. & Williamson, P. (2021). Waveform inversion for shear velocity and attenuation via the spectral-element adjoint method. In *First international meeting for applied geoscience & energy* (pp. 697–701). Society of Exploration Geophysicists.

12. **Borisov, D.**, Ivanov, J., Peterie, S. L. & Miller, R. D. (2020). Full-waveform inversion with alternating source and model update for shallow seismic. In *2020 SEG International Exposition and Annual Meeting* (pp. 1860–1864). Society of Exploration Geophysicists.

13. Ivanov, J., Miller, R. D., Hoch, A. M., Peterie, S. L., Morton, S. & **Borisov, D.** (2020). A unique approach for estimating surface-wave instability and nonuniqueness. In *2020 SEG International Exposition and Annual Meeting* (pp. 1835–1839). Society of Exploration Geophysicists.

14. **Borisov, D.**, Gao, F., Williamson, P., Simons, F. & Tromp, J. (2019). Robust surface-wave full-waveform inversion. In *2019 SEG International Exposition and Annual Meeting*. Society of Exploration Geophysicists.

15. Wang, N., Martin, R., Chevrot, S. & **Borisov, D.** (2019). On the joint inversion of seismic waveforms and gravimetric anomalies – Application to the Pyrenees. In *2019 AGU fall meeting*. AGU Fall Meeting.

(16) **Borisov, D.**, Gao, F., Williamson, P., Simons, F. & Tromp, J. (2018a). Waveform inversion of surface and body waves for near-surface onshore imaging. In *32nd IUGG Conference on Mathematical Geophysics*. International Union of Geodesy and Geophysics.

(17) **Borisov, D.**, Gao, F., Williamson, P., Simons, F. & Tromp, J. (2018b). Waveform inversion of surface and body waves for near-surface onshore imaging. In *2018 AGU fall meeting*. AGU Fall Meeting.

(18) **Borisov, D.**, Smith, J., Tromp, J., Miller, R., Peterie, S., Cudney, H., … Moran, M. (2017a). Multi-component 3D elastic full waveform inversion using surface and body waves for detecting near surface anomalies. In *79th EAGE Conference and Exhibition 2017*.

(19) **Borisov, D.**, Smith, J., Tromp, J., Miller, R., Peterie, S., Cudney, H., … Moran, M. (2017b). Multicomponent 3d elastic full waveform inversion using surface and body waves for detecting near surface anomalies. In *2017 Seismological Society of America Annual Meeting*.

(20) Smith, J., **Borisov, D.**, Modrak, R., Tromp, J., Cudney, H., Moran, M., … Peterie, S. (2017). Near-surface seismic imaging of tunnels using 3D elastic full-waveform inversion. In *2017 SEG International Exposition and Annual Meeting*. Society of Exploration Geophysicists.

(21) Yuan, S., Fuji, N., Singh, S. & **Borisov, D.** (2017a). Efficient 3D localized elastic full-waveform inversion for time-lapse seismic surveys. In *SEG Technical Program Expanded Abstracts 2017* (pp. 1444–1448). Society of Exploration Geophysicists.

(22) **Borisov, D.**, Modrak, R., Rusmanugroho, H., Yuan, Y., Simons, F., Tromp, J., Gao, F. et al. (2016). Spectral-element based 3D elastic full-waveform inversion of surface waves in the presence of complex topography using an envelope-based misfit function. In *2016 SEG International Exposition and Annual Meeting*. Society of Exploration Geophysicists.

(23) Wang, N., Li, J., **Borisov, D.**, Gharti, H., Shen, Y., Zhang, W. & Savage, B. (2016). Three-dimensional wave field modeling by a collocated-grid finite-difference method in the anelastic model with surface topography. In *2016 AGU fall meeting*. AGU Fall Meeting.

(24) Yuan, S., Fuji, N., **Borisov, D.** & Singh, S. (2016a). Localised time-lapse 3D elastic full waveform inversion using finite-difference injection and wavefield extrapolation. In *78th EAGE Conference and Exhibition 2016*.

(25) Yuan, S., Fuji, N., **Borisov, D.** & Singh, S. (2016b). Localized time-lapse elastic waveform inversion using wave-equation redatuming method: 2D parametric studies. In *2016 AGU fall meeting*. AGU Fall Meeting.

(26) **Borisov, D.**, Stopin, A. & Plessix, R. (2014). Acoustic pseudo-density full waveform inversion in the presence of hard thin beds. In *76th EAGE Conference and Exhibition 2014*.

(27) **Borisov, D.** & Satish, S. (2013). Elastic 3D full waveform inversion in the time domain. In *75th EAGE Conference & Exhibition incorporating SPE EUROPEC 2013*.

(28) **Borisov, D.**, Singh, S. C. et al. (2013). An efficient 3D elastic full waveform inversion of time-lapse seismic data using grid injection method. In *2013 SEG Annual Meeting*. Society of Exploration Geophysicists.

Funded proposals

Funded proposals (continued)

2019-2022   Miller, R.D., J. Ivanov, S.L. Peterie, and **D. Borisov**, Advancement in seismic imaging for tunnel detection: ASI to ASII–skinny, U.S. Army Corps of Engineers, Sponsor Award Number W909MY, KUCR Project Number 1001426, $499,999, (Co-PI)

2019   Miller, R.D., J. Ivanov, **D. Borisov**, S.L. Peterie, Acquisition Design and Data Conditioning in Advance of Implementation of K-Scope for Assessment of Groundbreaker Capabilities to Improve Subterranean Detection Capabilities, Fibertek, Inc. Department of Defense, Sponsor Award Number W909MY, KUCR Project Number: 1001118, $87,701, (Co-PI)

            Miller, R.D., J. Ivanov, **D. Borisov**, S.L. Peterie, Ground Truth Testing and Correlation of Seismic Interpretation and Borehole Sampling at Mosaic's Legacy Well Field in Hutchinson, Kansas, Burns & McDonnell Engineering, $77,92, (Co-PI)

2019-2024   Miller, R.D., S.L. Peterie, **D. Borisov**, and J. Ivanov, 2019, Time-Lapse, High-Resolution Imaging of a Void in the Hutchison Salt Beneath #1 Knackstedt Disposal Well, McPherson County, Kansas, Kansas Corporation Commission, KUCR Project Number 1001489, $14,803 per indicated years, (Co-PI)

2013 – 2014 700,000 CPU hours, "Elastic 3D Full Waveform Inversion of seismic data". TGCC, first French Petascale machine Curie (project #t2013047092)

Teaching

2018   Co-instructor, Computational Geophysics (GEO441), Princeton University
2016   Instructor, Computational Geophysics (GEO441), Princeton University

Invited teaching & Tutorials & Workshops

Oct 2023   Presenter at SEG Workshop, "A Decade of Advancement in FWI". Abu-Dhabi, UAE
Mar 2016   Computational Geosciences workshop on SPECFEM3D, Princeton University, USA
Jun 2016   Computational Infrastructure for Geodynamics workshop on SPECFEM3D, UC Davis, USA
Apr 2013   Presenter at SEG Workshop, "FWI: From Near Surface to Deep". Muscat, Oman

Invited Presentations

Mar 2024   Ohio University, Geological Sciences seminar
Oct 2023   Invited presentation for 7th International Conference on Engineering Geophysics
Jun 2021   Distinguished presentation for 6th International Conference on Engineering Geophysics
Jun 2017   IPGP, GPX-LITHOS meeting, Paris, France
May 2017   MIT, Earth Resources Laboratory, Friday Informal Seminar Hour
Feb 2016   Total, Upstream research, Houston, USA
Apr 2015   Chevron, Upstream research, Houston, USA
Mar 2015   Columbia University, Lamont-Doherty Earth Observatory

Invited Presentations (continued)

Feb 2015   Princeton University, Solid Earth Brown Bag Seminar, Department of Geosciences

Outreach and Service

2022   Guest associate editor for "Interpretation: Near-surface characterization special section, 2022."

2020   Session organizer and chair: "Near Surface (NS2)", 2020 SEG Annual Meeting.

2018   Session organizer: "Full-Waveform Inversion, modeling and imaging in Seismology and Near Surface Geophysics", 2018 AGU FALL Meeting.

2017   Session organizer: "Time-Lapse Monitoring of Earths Interior", 2017 AGU FALL Meeting.

Session organizer: "Advances in Full Waveform Modeling, Inversion, and Imaging", 2017 AGU FALL Meeting.

Session organizer: "Advances in Seismic Full Waveform Modeling, Inversion and Their Applications", SSA 2017 Annual Meeting.

2016   Leading board member in Python community "PrincetonPy", Princeton University

2015   Co-organizer, Princeton Geosciences, Solid Earth Brown Bag seminars

2014   Vice President, SEG Student Chapter at IPGP

2011   Co-organizer, IPGP, Earth sciences PhD Student Meeting

Peer Review

Reviewer for Geophysics

Reviewer for Geophysical Journal International

Reviewer for Journal of Applied Geophysics

Reviewer for IEEE Transactions on Geoscience and Remote Sensing

Reviewer for Scientific Reports

Reviewer for Earthquake Science

Reviewer for Near Surface Geophysics

Reviewer for The Leading Edge

Reviewer for Engineering

Reviewer for Journal Of Geophysical Research: Solid Earth

Reviewer for Engineering Geology

Skills

Languages   Russian – native language

English – full working proficiency

French – full working proficiency

Coding   Proficient: FORTRAN, C++, Python, MATLAB, Unix/Linux

HPC experienced: MPI, OpenMP

Misc.   LaTeX, Git, Seismic Unix, SPECFEM, Cubit, Paraview