Seismic Tomography: What Comes Next?

Seismological Society of America
28–30 October | Toronto, Ontario

Technical Program

Friday, 28 October 2022

- Registration Open, 4–5 PM
- Opening Reception, 5–6 PM
- Opening Keynote, 6–7 PM

Saturday, 29 October and Sunday, 30 October 2022

- Posters & Breakfast, 7:30–9 AM
- Morning Plenary and Oral Session, 9–10:10 AM
- Oral Session, 10:45–11:45 AM
- Lunch, Noon–1 PM
- Afternoon Plenary and Oral Session, 1–2:30 PM
- Poster Session, 2:45–3:45 PM
- Panel Discussion, 3:45–4:45 PM
- Evening Plenary, 5–6 PM
- Reception, 6–7 PM

Keynote Speakers

- Sergei Lebedev, University of Cambridge and Dublin Institute for Advanced Studies: *"Increasing the Resolution of Global and Regional Tomography: Progress and Challenges"*
- Nicholas Rawlinson, University of Cambridge: *"From Traveltime to Adjoint Waveform Tomography in SE Asia"*
- Jeroen Ritsema, University of Michigan: *"Morning Keynote: Invited: Large Low-velocity Provinces (LLVPs) in the Lowermost Mantle"*
- Barbara Romanowicz, University of California, Berkeley and College de France: *"Forty Years of Global Mantle Tomography: Achievements and Challenges Ahead"*
- Carl Tape, University of Alaska Fairbanks: *"Seismic Imaging of Sedimentary Basins with Complex Seismic Wave Propagation"*
- Jeroen Tromp, Princeton University: *"Source Encoding and Uncertainty Quantification for Global Waveform Inversion"*

Co-Chairs: Andreas Fichtner of ETH Zürich and Clifford Thurber of the University of Wisconsin-Madison

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Friday, 28 October 2022

4–5 PM	Registration Open
5–6 PM	Reception
6–7 PM	Opening Keynote: Forty Years of Global Mantle Tomography: Achievements and Challenges Ahead. **Romanowicz, B.**

Saturday, 29 October 2022

7:30–9 AM	Posters & Breakfast
Morning Plenary and Oral Session	
9–9:30 AM	Morning Plenary: Large Low-velocity Provinces (LLVPs) in the Lowermost Mantle. **Ritsema, J.**
9:30–9:50 AM	Whole Earth Oscillations: The Key to Imaging Earth's Deep Interior. **Deuss, A.**, Jagt, L., van Tent, R., Talavera-Soza, S.
9:50–10:10 AM	Fast and Automated Global-scale Waveform Inversion. **Thrastarson, S.**, van Herwaarden, D., Fichtner, A.
Oral Session	
10:45–11:05 AM	Upper Mantle Anisotropy and Attenuation From Global Adjoint Tomography. **Bozdag, E.**, Orsvuran, R., Espindola, A., Peter, D.
11:05–11:25 AM	Radial Anisotropic Structure of the Upper Mantle. **Priestley, K.**, Ho, T., Debayle, E.
11:25–11:45 AM	Implications of General Viscoelastic Ray Theory for Anelastic Seismic Tomography. **Borcherdt, R. D.**
Noon–1 PM	Lunch
Afternoon Plenary and Oral Session	
1–1:30 PM	Afternoon Plenary: Increasing the Resolution of Global and Regional Tomography: Progress and Challenges. **Lebedev, S.**, Bonadio, R., Xu, Y., Fullea, J.
1:30–1:50 PM	Full-3D Inversion of Slowness Vectors Measured Across Seismic Arrays. **Vazquez, L.**, Jordan, T. H.
1:50–2:10 PM	Ambient Noise Tomography Across Dense Nodal Arrays. **Lin, F.**, Wu, S., Rabade, S., Liu, C., Farrell, J., *et al.*
2:10–2:30 PM	Complex Seismic Anisotropy Beneath the Central Appalachian Mountains from SKS-splitting Intensity Tomography. **Link, F.**, Long, M. D., Mondal, P.
2:45–3:45 PM	Poster Session
3:45–4:45 PM	Panel Discussion. Sergei Lebedev, Jeroen Ritsema, Jeroen Tromp
5–6 PM	Evening Plenary: Source Encoding and Uncertainty Quantification for Global Waveform Inversion. **Tromp, J.**
6–7 PM	Reception

Saturday Posters

1. New Imaging Strategies for Constraining Arbitrarily Oriented Upper Mantle Anisotropic Fabrics With Teleseismic P- and S-wave Delay Times. **VanderBeek, B. P.**, Faccenda, M.
3. Anisotropic Seismic Tomography with the Reversible Jump Markov Chain Monte Carlo. **Del Piccolo, G.**, VanderBeek, B. P.
5. Implementation of "Spherical Earth" for Box-tomography in Regional Scale. **Karakostas, F. G.**, Morelli, A., Molinari, I., VanderBeek, B. P., Faccenda, M.
7. 3D Anisotropic Transdimensional Seismic Tomography of the Inner Core Using Normal Mode and Body Wave Data. **Brett, H.**, Hawkins, R., Waszek, L., Lythgoe, K., Deuss, A.
9. Seismic Wave Modeling in Anisotropic Media With Fracture Sets Using the Finite-difference Rotated Staggered Grid. **Zhang, O.**, Schmitt, D. R.
11. Understanding Parameter Trade-offs in Anisotropic Inversion of Surface Wave Measurements. **Boyce, A.**, Bodin, T., Durand, S., Soergel, D.
13. Model Parameterization and Sensitivity Kernels in 3D Anisotropic Media. **Gupta, A.**, Chow, B., Tape, C., Modrak, R., Abers, G.
15. Global 3D Model of Mantle Attenuation Using Seismic Normal Modes. **Talavera-Soza, S.**, Jagt, L., Cobden, L., Faul, U. H., Dalton, C. A., *et al.*
17. Double-difference Seismic Attenuation Tomography. Guo, H., **Thurber, C. H.**
19. Resolution and Trade-offs in Anelastic Full-waveform Inversion for Global-scale Models. **Espindola, A.**, Peter, D., Orsvuran, R., Bozdag, E., Magnoni, F., *et al.*
21. Seismic Evidence of Slab Segmentation and Melt Focusing Atop the 410-Km Discontinuity in NE Asia. **Song, J.**, Rhie, J., Kim, S.
23. Bayesian Imaging of the Hawaiian ULVZ From Sdiff Postcursors. **Martin, C.**, Cottaar, S., Bodin, T.
25. New Global Models of 3D Mantle Density From Recent Normal Mode Measurements. **van Tent, R.**, Cobden, L., Deschamps, F., Fichtner, A., Gebraad, L., *et al.*
27. Normal Mode Constraints on Vs, Vp and Their Ratio in the Earth's Mantle. **Jagt, L.**, Koelemeijer, P., Cobden, L., Cottaar, S., Deuss, A.

29. Influence of Shear-wave Velocity Heterogeneity on SH Wave Reverberation Imaging of the Mantle Transition Zone. **Liu, M.**, Ritsema, J., Chaves, C.
31. Tomography for Plate Tectonics and Geodynamics: Advances, Open Questions, Future Opportunities. **Wu, J.**, Colli, L.
33. New Global and Tectonic-type 1D Models of the Upper Mantle. **Civiero, C.**, Lebedev, S., Xu, Y., Bonadio, R.
35. What Is "High Resolution" When It Comes to Continental Lithospheric Structure? **Bezada, M. J.**, Zhu, Z., Lee, H., Ford, H., Long, M.
37. Comparing Lithospheric Thickness From Sp Receiver Functions and Tomography in the Southwestern US. **Shallon, B.**, Ford, H. A.
39. Lithospheric Control on the Paleogene Uplift and Volcanism in Ireland and Britain: Insights From Optimal Resolution Tomography. **Bonadio, R.**, Lebedev, S., Chew, D.
41. Investigation of Lithospheric Structure in NE India Based on Love Wave Data. **Chanu, N.**, Kumar, N., Mukhopadhyay, S.
43. WINTERC-G in Eastern North America: Local Control for a Global Multiparameter Model of the Mantle. **Levin, V.**, Lebedev, S., Fullea, J., Li, Y., Chen, X.
45. Off-great-circle Propagation of Earthquake Surface Waves in the NW Himalaya and Adjacent Areas. **Mir, R. R.**, Parvez, I. A.
47. Seismic Structure Beneath Mexico City: Linking the Spatial Correlation and Seismic-imaging Methods. **Aguilar-Velázquez, M.**, Pérez-Campos, X., Pita-Sllim, O., Gil-Vargas, N., Baena-Rivera, M., *et al.*
49. Fusion of Seismic Tomography Maps Using a Probability Graphical Model. **Gerstoft, P.**, Zhou, Z., Olsen, K. B.
51. Finite-frequency Kernels for Pg/Lg Phases. **Nelson, P.**, Modrak, R., Begnaud, M., Phillips, S.
53. SALSA3D: Updated Tomographic Velocity Models for Improved Travel-time Prediction and Uncertainty. **Conley, A. C.**, Porritt, R. W., Davenport, K., Begnaud, M., Rowe, C., *et al.*
55. Symplectic Geometry and Hamiltonian Monte Carlo Method. **Öztürk, F.**, Diner, Ç.
57. Earthquake Tomography Integrated With Gravity Data: An Application From NE-Italy. **Zampa, L. S.**, Magrin, A., Rossi, G., Bohm, G., Tondi, R., *et al.*
59. Seismotectonic Characteristics of the Taltal Segment in Northern Chile, Inferred Using Local Earthquake Tomography. **Leon-Rios, S.**, Calle-Gardella, D., Reyes-Wagner, V., Comte, D., Roecker, S.
61. Using a Consistent Travel-time Framework to Compare Three-dimensional Seismic Velocity Models for Location Accuracy. **Begnaud, M.**, Conley, A. C., Davenport, K., Porritt, R., Ballard, S., *et al.*
63. A Neural Network Travel Time Function for Direct Travel Time Tomography. **Taufik, M.**, Alkhalifah, T.
65. Local Earthquake Tomography at the North-central Chilean Margin: A Tool to Decipher the Chilean-type Subduction Zone. **Navarro-Aránguiz, A. P.**, Comte, D., Farías, M., Leon-Rios, S., Calle-Gardella, D., *et al.*
67. Finite-frequency Tomography in the Chile Triple Junction Region. **Kondo, Y.**, Obayashi, M., Sugioka, H., Ito, A., Shiobara, H., *et al.*
69. AI-enhanced Seismic Tomography for the Oklahoma Region. **Chai, C.**, Maceira, M.
71. Identification of the Meso-Kaynoy Complexes of the Earth's Crust of Azerbaijan by Seismic Tomography. Guliyev, I. G. I., **Yetirmishli, G. Y. G.**, Kazimova, S. S. K.
73. The Spiral Global Travel-time-based Model to Serve as a Starting Model for Global Adjoint Tomography. **Simmons, N. A.**, Morency, C., Chiang, A., Myers, S. C.
75. Seismic Velocity Structure at the Ionian Thrust Belt. **Karastathis, V.**, Drakatos, G., Vavassis, Y., Mouzakiotis, E., Sboras, S., *et al.*
77. 3D Seismic Structure and Crustal Evolution of the South of Portugal Mainland (Preliminary Results). **Cavacundo, O. B. M.**, Dias, N. C. A., Matias, L. H. M., Rio, I.

Sunday, 30 October 2022

7:30–9 AM	Posters & Breakfast
Morning Plenary and Oral Session	
9–9:30 AM	Morning Plenary: Seismic Imaging of Sedimentary Basins with Complex Seismic Wave Propagation. **Tape, C.**, Tian, Y., Chow, B., Smith, K.
9:30–9:50 AM	Towards the Geologic Parameterization of Seismic Tomography. **Tsai, V. C.**
9:50–10:10 AM	Lithospheric Thermochemical Heterogeneity in the Continental United States From Seismic Tomography. **Golos, E.**, Shinevar, W. J., Jagoutz, O., Behn, M., van der Hilst, R. D.
Oral Session	
10:45–11:05 AM	Improving Results and Interpretation in Time-dependent Tomography and Between Temporal Campaigns. **Hobé, A.**, Tryggvason, A.
11:05–11:25 AM	Time-dependent Passive Coda-wave Imaging for Monitoring Near-surface Systems. **Mao, S.**, Lecointre, A., Campillo, M., van der Hilst, R. D., Ellsworth, W. L., *et al.*
11:25–11:45 AM	Seismoelectric Effects for Subsurface Characterization. **Morency, C.**, Matzel, E.
Noon–1 PM	Lunch
Afternoon Plenary and Oral Session	
1–1:30 PM	Afternoon Plenary: From Traveltime to Adjoint Waveform Tomography in SE Asia. **Rawlinson, N.**, Wehner, D., Zenonos, A., Widiyantoro, S.
1:30–1:50 PM	Adjoint Waveform Tomography of the Western US for Improved Waveform Simulations and Source Characterization. **Rodgers, A. J.**, Krischer, L., Afanasiev, M., Boehm, C., Doody, C., *et al.*
1:50–2:10 PM	Structure and Evolution of the Australian Plate and Underlying Upper Mantle From Waveform Tomography With Massive Datasets. **de Laat, J. I.**, Lebedev, S., Celli, N., Chagas de Melo, B., Bonadio, R.
2:10–2:30 PM	Lithospheric Structures of Western Mid-continent Rift Revealed by Full-waveform Joint Inversion of Ambient-noise Data and Teleseismic P Waves. **Liu, Q.**, He, B., Liu, T., Lei, T., van der Lee, S.
2:45–3:45 PM	Poster Session
3:45–4:45 PM	Panel discussion. Nicholas Rawlinson, Barbara Romanowicz, Carl Tape.
5–6 PM	Closing Lecture: Cliff Thurber and Andreas Fichtner
6–7 PM	Closing Reception

Sunday Posters

2. Shear Velocity Structure of Northeastern India From Ambient Seismic Noise Tomography. **Singh, D. K.**
4. Crustal Structure of the East European Craton and Surrounding Orogens From Ambient Noise Tomography: Key Aspects of Craton Erosion and Mantle Plume Impact. **Petrescu, L.**, Borleanu, F., Placinta, A.
6. Imaging the Lithospheric Structure Beneath Portugal With Seismic Ambient Noise. **Silveira, G.**, Dias, N., Kiselev, S., Stutzmann, E., Custódio, S., *et al.*
8. Imaging the Crustal Velocity Structure Beneath Sikkim Himalaya Using Ambient Noise Tomography. **Uthaman, M.**, Singh, A., Singh, C., Kumar, G., Dubey, A. K.
10. High-resolution Imaging of the Shallow Subsurface and Relationship With Site Responses Using Joint Nodal and DAS Arrays Near Enid, Oklahoma. **Dangwal, D. S.**, Chen, X., Behm, M., Ng, R., Zhan, Z., *et al.*
12. Submarine Distributed Acoustic Sensing for Crustal Imaging in the Cascadia Forearc. **Fang, J.**, Yang, Y., Biondi, E., Williams, E. F., Zhan, Z.
14. Application of Ambient Noise Tomography Methods for IMS Seismic Arrays. Molero, A., **Starovoit, Y.**
16. Fiberoptic Versus Geophone / Accelerometer Data in Elastic Full Waveform Inversion of Borehole Seismic Data. Eaid, M. V., Keating, S. D., **Innanen, K. A.**, Macquet, M., Lawton, D. C.
18. Crustal Structure of Terceira Island (Azores): Sampling a Volcanic Island With a Dense Network. **Dias, N. A.**, Fontiela, J., Matias, L. M., Silveira, G., Veludo, I., *et al.*
20. Spectral-infinite-element Simulations of Seismic Wave Propagation in Self-gravitating 3D Earth Models. **Gharti, H.**, Eaton, W. P., Tromp, J.
22. Validating Tomographic Models of Alaska Using Seismic Wavefield Simulations. **McPherson, A.**, Chow, B., Tape, C.
24. Central Italy High-resolution Model for Accurate Ground Motion Simulation. **Stallone, A.**, Krischer, L., Magnoni, F., Casarotti, E., Fichtner, A.
26. Centroid-moment Tensor Inversions Using 3D Strain Green's Tensors for Earthquakes in the South Island Region, New Zealand. **Nguyen, T.**, Nguyen, N.
28. Modeling and Observation of Train Signals in the Urban Environment. **Lapietra Garcia, P.**, Gharti, H., Bucciarelli, D., Reed, M.
30. Understanding Subsurface Fracture Evolution Dynamics Using Time-lapse Full Waveform Inversion

of Continuous Active-source Seismic Monitoring Data. Liu, X., **Zhu, T.**

32. Time-dependent Passive Seismic Tomography in a Deep, Narrow-vein Mine. **Westman, E. C.**, Ghaychi-Afrouz, S.
34. Data Assimilated Full Waveform Inversion of Continuous Seismic Monitoring Data for Tracking the Evolution of CO2 Plumes. **Zhu, T.**, Huang, C.
36. CANVAS: An Adjoint Waveform Tomography Model of California and Nevada. **Doody, C.**, Rodgers, A. J., Chiang, A., Afanasiev, M., Boehm, C., *et al.*
38. Viscoacoustic Full-waveform Inversion: Theory and Application to Critical Zone. Zhu, T., **Xing, G.**
40. Adjoint Seismic Tomography of the Antarctic Continent Incorporating Both Earthquake Waveforms and Green's Functions From Ambient Noise Correlation. **Zhou, Z.**, Wiens, D. A., Lloyd, A. J.
42. Full-waveform Tomography of the African Continent. **van Herwaarden, D.**, Thrastarson, S., Afanasiev, M., Trampert, J., Fichtner, A.
44. Seismic Imaging Reveals a Melt-rich Storage Zone Below Yellowstone Caldera. **Maguire, R.**, Schmandt, B., Li, J., Jiang, C., Li, G., *et al.*
46. Source Encoding for Ultrasound Full Waveform Inversion. **Bachmann, E.**
48. Imaging the Alaskan Lithosphere Using Full-waveform Seismic Inversion. **Liu, T.**, Wang, K., Tape, C., He, B., Yang, Y., *et al.*
50. Pyatoa and SeisFlows: Automated Workflow Tools for Adjoint Tomography. **Chow, B.**, Modrak, R., Tape, C.
52. An Overview of Full-waveform Inversion Workflows to Image the Deep Earth. **Riaño, A. C.**, Orsvuran, R., Espindola, A., Huang, Q., Bozdag, E., *et al.*
54. Modernized Adjoint Tomography Workflow Applied to the South California Earthquake Center Community Velocity Models. **Thurin, J.**, Chow, B., Tape, C.
56. Lithospheric Imaging of the Cascadia Subduction Zone Based on Full-waveform Inversion. **Du, N.**, He, B., Lei, T., Liu, Q.
58. Optimal Transport for Elastic Source Full Waveform Inversion. **Masthay, T.**, Engquist, B.
60. On the Sensitivity of Local-scale Full-waveform Ambient Noise Inversion to Global Noise Sources. **Valero Cano, E.**, Peter, D.
62. Breaking Adria: Adjoint Tomography of a Disappearing Continental Microplate. **Casarotti, E.**, Magnoni, F., Stallone, A., Ciaccio, M., Di Stefano, R.
64. The Remnants of Continental Collision in Southern Appalachians: Constraints From Joint Full-waveform Inversion. **Lei, T.**, He, B., Wang, K., Du, N., Liu, Q.
66. Adjoint Tomography of the Middle East. **Orsvuran, R.**, Bozdag, E., Gok, R., Peter, D., Alotaibi, Z., *et al.*
68. Exploring the Outermost Outer Core With Full-waveform Modeling. **Vite Sanchez, R.**, Frost, D., Riaño, A., Creasy, N., Huang, Q., *et al.*
70. Adjoint Tomography of an Accretionary Wedge and Shallow Slow-slip Regions in the North Island of New Zealand. Adachi, S., Chow, B., **Kaneko, Y.**
72. Towards Box Tomography of the Root of the Iceland Plume at the Base of the Earth's Mantle. **Lyu, C.**, Su, H., Martin, C., Masson, Y., Romanowicz, B.
74. The Collaborative Seismic Earth Model: Generation 2. **Noe, S.**, van Herwaarden, D., Thrastarson, S., Gao, Y., Tilmann, F., *et al.*
76. Imaging of the Yellowstone Plume Using Box Tomography. **Kumar, U.**, Munch, F., Adourian, S., Lyu, C., Maurya, S., *et al.*
78. Hamiltonian Monte Carlo Sampling for Uncertainty Quantification in Real-world Tomography. **Gebraad, L.**, Zunino, A., Boehm, C., Fichtner, A.
79. Enhancing High Resolution Tomography Models of Subduction Zones Derived From Downward Continued Multichannel Seismic Data: Applications of Full Waveform Inversion and the Analysis of Coincident Electromagnetic Data. **Acquisto, T. M.**, Singh, S. C., Key, K., Naif, S., Bécel, A.

LSQR and Bayesian frameworks. The Bayesian framework allows us to easily incorporate independent and complementary body-wave data into our joint inversion while quantifying the reduction in model uncertainties when doing so. We offer recommendations for the community to improve agreement between future constraints on Earth's upper mantle radial anisotropic structure.

Upper Mantle Anisotropy and Attenuation From Global Adjoint Tomography

Oral Presentation, Saturday, 29 October, 10:45 AM

BOZDAG, E., Colorado School of Mines, Colorado, USA, bozdag@mines.edu; ORSVURAN, R., Colorado School of Mines, Colorado, USA, rorsvuran@mines.edu; ESPINDOLA, A., King Abdullah University of Scinece and Technology, Thuwal, Saudi Arabia, armando.espindolacarmona@kaust.edu.sa; PETER, D., King Abdullah University of Scinece and Technology, Thuwal, Saudi Arabia, daniel.peter@kaust.edu.sa

The first-generation global adjoint models are isotropic or transversely isotropic constructed using traveltimes only to tackle the elastic structure perturbed around 1D Q models. While full 3D complexity of wave propagation is captured by numerical simulations we also need to address better physics in inversions through appropriate model parameterizations. In this study, we address the azimuthal anisotropy and anelasticity in global adjoint inversions.

Starting from GLAD-M25, we have so far performed 21 conjugate-gradient iterations to construct an azimuthally anisotropic upper-mantel model using minor and major-arc surface waves down to 40 s from a dataset of ~300 earthquakes. During the first 12 iterations, we used double-difference multitaper phase measurements. We continue our iterations with the exponentiated-phase misfit to better capture higher-mode surface waves and increase the resolution in the mantle transition zone. Our initial large-scale results are consistent with previous global azimuthally anisotropic models and plate motions. We also approach continental-scale resolution in densely covered regions in our global inversion.

Meanwhile, we explore the effect of anelastic structure on waveforms which is most pronounced on surface waves. Our ultimate goal is to construct an anelastic mantle model by simultaneously updating elastic and anelastic parameters by assimilating both the phase and amplitude information to perform exact FWI. We started global FWI from GLAD-M25 and its 1D Q model QL6. After combining multitaper phase and amplitude misfits during the first two iterations we continue with an envelope misfit. In a complementary study, we perform 3D global synthetic FWI with the same measurements used in FWI with real data to assess the trade-off between elastic and anelastic parameters. We perform our simulations on TACC's Frontera and PRACE's Marconi100. We will present our results with future directions in constraining the mantle structure.

3D Anisotropic Transdimensional Seismic Tomography of the Inner Core Using Normal Mode and Body Wave Data

Poster 7, presented Saturday, 29 October

BRETT, H., Utrecht University, Utrecht, Netherlands, h.brett@uu.nl; HAWKINS, R., Utrecht University, Utrecht, Netherlands, r.p.hawkins@uu.nl; WASZEK, L., James Cook University, Cairns, Australia, lauren.waszek@jcu.edu.au; LYTHGOE, K., Earth Observatory of Singapore, Singapore, Singapore, karen.lythgoe@ntu.edu.sg; DEUSS, A., Utrecht University, Utrecht, Netherlands, a.f.deuss@uu.nl

The Earth's inner core displays strong seismic heterogeneity, which is most likely formed as a result of growth processes and post solidification deformation. Accurately resolving seismic anomalies is therefore key to understanding the dynamic mechanisms of the inner core. However, being the deepest region of our planet, the inner core presents a unique challenge in seismic tomography, as the amount of good quality data is relatively low compared to the mantle/crust of the Earth.

To overcome this challenge, we have applied a transdimensional methodology to our body wave data producing a high resolution 3D model. In the transdimensional approach, the inversion itself determines the parameterization. We recover many well known features, such as the hemispherical difference between a slow and strongly anisotropic western region and a fast and only weakly anisotropic eastern hemisphere, without a priori imposing those in our parameterization. We have also identified new features using this methodology, such as a better resolved innermost inner core, which we find is in fact restricted to the eastern hemisphere. We also find an anisotropic western zone which is isolated to the northern hemisphere of the inner core. These features would have been more challenging to observe using a traditional tomographic method.

Given the limited resolution of body waves we have started including normal mode data into our transdimensional inversions. Normal modes are whole Earth oscillations which provide long wavelength information on seismic anisotropy in the inner core. We have measured inner core sensitive normal modes using the splitting function approximation in a way which explores the splitting function measurement model space. From this we quantify the uncertainty in individual splitting function coefficients for each mode. We have combined these new normal mode measurements with our body wave data in a transdimensional inversion for seismic structure in the inner core. This is the first time a transdimensional method has been used jointly with both normal mode and body wave data.

Breaking Adria: Adjoint Tomography of a Disappearing Continental Microplate

Poster 62, presented Sunday, 30 October

CASAROTTI, E., Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy, emanuele.casarotti@ingv.it; MAGNONI, F., Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy, federica.magnoni@ingv.it; STALLONE, A., Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy, angela.stallone@ingv.it; CIACCIO, M., Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy, mariagrazia.ciaccio@ingv.it; DI STEFANO, R., Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy, raffaele.distefano@ingv.it

The Adria plate plays a peculiar role in the geodynamics of the Central Mediterranean. It is the foreland of non-coeval mountain ranges and its margins are consumed in the process by subduction systems under the Alps to the north, the Apennines to the west and the Dinarides to the east.

The complex behavior of this system and the large heterogeneity in data availability lead to a fragmented understanding of the Adria plate. In particular, its lithospheric structure, in terms of Vp and Vs profiles, is poorly known due to a lack of seismic stations, poor earthquake location quality (large observational gaps) and the consequent lack of coverage by classical seismic tomography methods. The uncertainties increase the difficulty of correctly assessing the seismic hazard along the Adriatic coasts (including tsunami hazard).

Recently, we have proposed IMAGINE_IT, a reference 3D high-resolution seismic tomography of the Italian lithosphere. Enhanced accuracy is enabled by three-dimensional wavefield simulations based on SPECFEM3D in combination with an adjoint-state method. The Adria plate is located at the eastern border of the volume considered in the simulations, nevertheless, our tomography is able to image this plate with an unprecedented resolution and supports the idea that it is made of two distinct microplates having different fabric and behavior and separated by the Gargano deformation zone.

We have highlighted a northern portion with more complex wavespeed anomalies and a thinner crust, and a southern part with a more regularly layered wavespeed structure and a thicker crust. Here, we focus on additional details of those images, such as the mid-Adriatic ridge and a new set of iterations that exploit 7 years of additional data (IMAGINE_IT was limited to data until 2015) and the 2016-2019 AlpArray very dense regional arrays of broadband seismic stations which provide a new opportunity to improve our comprehension of the area.

3D Seismic Structure and Crustal Evolution of the South of Portugal Mainland (Preliminary Results)

Poster 77, presented Saturday, 29 October

CAVACUNDO, O. B. M., Instituto Dom Luiz, Universidade de Lisboa, Lisboa, Portugal, osoriodecavacundo@gmail.com; DIAS, N. C. A., Instituto Dom Luiz, Instituto Superior de Engenharia de Lisboa, Lisboa, Portugal, nmdias@fc.ul.pt; MATIAS, L. H. M., Instituto Dom Luz, Universidade de Lisboa, Lisboa, Portugal, lmmatias@fc.ul.pt; RIO, I., Instituto Dom Luiz, Universidade de Lisboa, Lisboa, Portugal, irio@fc.ul.pt

This work aims to derive an improved 3D tomographic crustal velocity model for Vp and Vs for southern Portugal, to better understand the inland seismicity distribution, especially around the Monchique igneous intrusion, elucidating the causes of seismic anisotropy reported by active seismic profiles of previous studies and to correlate the observed seismic heterogeneities with the tectonic evolution of the crust. We will present the preliminary results of the passive data modeling of P-wave and S-wave refracted phases, but P and S Moho reflections are to be included at a later stage.

We collected all data from previous passive and active seismic campaigns in the region; active data coming from 1970's and 1990's wide-angle refraction/reflection seismic profiles, whereas passive data provided by