宋晓东教授简历

短简历

宋晓东 1986 年获得中国科技大学地球物理理学学士，1994 年获得美国加州理工学院地球物理学博士，之后在哥伦比亚大学做博士后、讲师和副研究员，1999 年起为美国伊利诺伊大学香槟分校助理教授、副教授、正教授，2010 起为南京大学、武汉大学、北京大学国家杰出访问教授，2020 全职回国任北京大学讲席教授、国家级专家。

宋晓东教授主要研从事地震学、地球深内部结构和动力学、东亚地区深部结构和区域构造、及地震灾害的研究。他与合作者的重要研究成果包括地球内核的旋转、分层结构、内内核赤道向各向异性的发现、中国岩石圈成像、及青藏高原南部印度板块岩石结构与地壳变形的联系。他与合作者 Paul Richards 教授 1996 年地球发现内核超速旋转，被美国 SCIENCE 杂志评为当年十大科学突破之一和被美国 DISCOVER 杂志评为二十世纪最重要的发现之一。已发表论文 110 多篇，包括第一作者或通讯作者 Nature/Science/PNAS 8 篇。

宋晓东曾获 1996 年美国 PopularScience 杂志的科技奖，1996 年国际地球物理和测地学联合会(IUGG)地球深部委员会(SEDI)青年科学家 Doornbos 奖，1997 年日本科技厅(STA) Fellow, 1998 年中国海外杰出青年基金(B 类)资助，2006-2007 伊利诺伊大学高等研究中心(CAS)研究员（Associate），2016 年 亚太地球物理学会(AOGS SE)杰出讲座。他是美国地球物理协会（AGU）会议多次专题的召集人和主持人，2008 年中美地震学合作研讨会组织成员和代表，2005-2010 美国国际地震研究协会(IRIS)全球地震台网(GSN)常委员会成员和主席，2015-2016 国际中国地球科学促进会(IPACES)副主席、主席。现任 Earthquake Science 主编，曾任 Earth and Planetary Physics 副主编、Geologica Sinica 副主编，及多个杂志编委。

现任中国地震学会地震学专业委员会主任，中国地震科学实验场人工智能首席科学家，中国地震局地球物理研究所科技委委员，自然资源部深地科学与探测技术实验室首届学术委员会委员，中国地质科学院深地国家重点实验室委员，中国地球物理学会智能地球物理专业委员会共同建议人（获批成立），中国地震学会地震人工智能专业委员会指导专家。江苏东海大陆深孔地壳活动国家野外科学观测研究站学术委员会委员，云南大理地球物理教育部野外科学观测研究站学术委员会委员，河北红山巨厚沉积与地震灾害国家野外科学观测研究站学术委员会委员。

教育经历

1986 年获得中国科学技术大学地球物理学士学位，
1986-1988 年在中国石油勘探开发研究院读研究生，
1991 年获得美国加州理工学院地球物理学硕士学位，
1994 年获得美国加州理工学院地球物理学博士学位（计算机副科）。

工作经历

1994-1999 美国哥伦比亚大学博士后 Lamont-Doherty Postdoctoral Fellow，

1996-1999 美国哥伦比亚大学副研究员和讲师 Storke-Doherty Lecturer，
1999-2003 美国伊利诺伊大学香槟分校助理教授，
2003-2008 美国伊利诺伊大学香槟分校终身副教授，
2008-2020 美国伊利诺伊大学香槟分校终身正教授，
2020-今 北京大学讲席教授、国家级专家。

2010-2015 南京大学国家杰出访问教授，
2015-2019 武汉大学国家杰出访问教授。
1998-2008、2016-今 中国地震局预测所、地球物理研究所兼职研究员，
2018-今 中国地震局兼职研究员。

科研项目

正在主持科技部国家重点研发计划项目、国家自然科学基金重点项目、自然资源部深地实验室开放课题。**主持过**中国国家自然科学基金海外杰出青年(B 类)、国家自然科学基金重点项目、国家自然科学基金面上项目、中国地震局行业专项；美国国家科学基金会（NSF）、美国联邦政府、哥伦比亚大学、伊利诺伊大学、William and Flora Hewlett 基金、伊利诺伊大学和法国联合基金。**并参加过**科技部 973 项目、中石油专项、中海油专项。

主要学术贡献

地球内核结构及其动力学

- ✧ 证实内核各向异性
- ✧ 发现内核上部分层结构
- ✧ 首次得到内核三维各向异性结构
- ✧ 发现内核沿赤道向各向异性的内内核与沿南北向各向异性的外内核
- ✧ 发现内核地震波时变并推测内核超速旋转
- ✧ 利用重复地震证实内核地震波时变
- ✧ 发现内核时变信号来源于内核内部（而非内核表面）
- ✧ 发现内核差速旋转发生变化，可能存在 60-70 周期摆动
- ✧ 发现中美洲下俯冲板片到达核幔边界形成的热化学结构的地震学证据

岩石圈结构及其动力学

- ✧ 首次得到我国全国 Pn 波速度和各向异性模型
- ✧ 首次应用噪声互相关方法得到我国 Rayleigh 面波频散图；首次应用噪声互相关方法提取面波衰减并应用于我国成像
- ✧ 利用噪声和地震数据得到我国与东亚地区岩石圈 S 波速度模型
- ✧ 发展了面波、接收函数、加 P 波约束的联合反演方法
- ✧ 发现青藏高原南部印度板块岩石圈撕裂可以提供地表地质、地震活动性和地壳变形的统一机制

大地震前地球介质时间变化与地震减灾

- ✧ 利用噪声互相关方法发现苏门答腊几个大地震引起周边介质的明显变化，首次表明大地震引起的变化超过断层面到周边较大范围的介质。

✧ 帮助描述和记录 1997 伽师强震序列的预报和前兆观测，从统计上说明此强震序列的预报是随机的，且概率很低。

学术荣誉

1989-1992 加州理工学院邵逸夫奖学金 Sir Run Run Shaw (of Hong Kong) Graduate Fellowship at Caltech

1994-1996 哥伦比亚大学Lamont-Doherty地球观测台博士后Postdoctoral Fellowship

1996-1999 哥伦比亚大学Lamont-Doherty地球观测台Storke-Doherty Lecturer

1996 内核超旋转的发现被美国SCIENCE评为当年十大科学突破之一。The work on the rotation of the Earth's inner core (Song and Richards, Nature, 1996) was named as a 1996 Break Through of the Year by SCIENCE magazine.

1996 美国Popular Science杂志科技奖。 It also won the 1996 Award for Science and Technology by PopularScience magazine.

1996国际地球物理和大地测量学联合会(IUGG)地球深部委员会(SEDI)青年科学家Doornbos奖。Doornbos Prize by the International Union of Geophysics and Geodesy committee on Studies of Earth Deep Interior (SEDI) for the work on inner core rotation.

1997 日本科技厅(STA) Fellow。 Science and Technology Agency (STA) Fellow, the Research Development Corporation of Japan

1998 中国国家自然科学基金会海外杰出青年基金(杰青B类)（首届）

2000 Work on inner core rotation was named as one of most important science discoveries in the 20th century by DISCOVER magazine.

2005内核超旋转的证实被美国DISCOVERY杂志评为当年最重要的100个科学发现之一。Science paper by Zhang et al. was selected as DISCOVER's 100 Top Science Stories of the year.

2006-2007入选美国伊利诺伊大学高等研究中心研究员。Associate, Center for Advanced Study, University of Illinois at Urbana-Champaign

2010-2020 国家级专家(短期)（南京大学、武汉大学、北京大学）

2016：地球内内核赤道各项异性工作被中国科学院中国发展报告选为“2015年中国科研代表性成果”；被大英百科全书(Encyclopedia Britannica)选为代表性工作“Year in Review 2015”。

2016亚洲大洋洲地球科学学会 (AOGS) 杰出讲座Asia Oceania Geosciences Society (AOGS) Distinguished Lecture

2020-今 北京大学讲席教授、国家级专家

学术服务

❖ 主编：**Earthquake Science (2021-)**

❖ **副主编：**Earth and Planetary Physics (2018-2022)，地球与行星论评(2020-)，地震译丛(2019-2020)，Geologica Sinica (2013-2018)

- **专刊主编：Tectonophysics (2010), Earthquake Science (2010),** TAO Terrestrial, Atmospheric, and Oceanic Sciences (2018)
- 编委：Earthquake Science (2008-2020), Progress in Natural Sciences (2000-2005), Journal of Earth Science (2006-)，Earth and Planetary Physics (2023-)，地震译丛(2021-)
- **美国国际地震研究协会(IRIS)全球地震台网(GSN)常务委员会**成员、**主席**
- 中国地球科学促进会（IPACES）创始会员、当选主席、主席
- 中美地震研究协调会代表和中美地震学合作研讨会组织成员
- **2006 年美国地球物理协会（AGU）西太平洋会议组织人**
- 多次美国地球物理协会（AGU）会议及其它国际会议专题召集人
- 长期论评中国 NSFC 及科技部项目，美国 NSF 及各部委项目，台湾科委项目。长期论评国内外期刊及专著稿件。

部分学术论文

+ 学生/博士后； ++访问学者；* 通讯作者；§ 邀请稿

地核和核地幔边界

Yang, Y.+, **Song, X.***(2023). Multidecadal variation of the Earth's inner-core rotation, Nature Geoscience, 16, 182-187. https://doi.org/10.1038/s41561-022-01112-z

Yang, Y.+ and **X.D. Song***, Origin of temporal changes of inner-core seismic waves, Earth Planet. Sci. Lett., 541 (1), 116267, doi: 10.1016/j.epsl.2020.116267, 2020.

Wang, T.+, **X.D. Song***, Xia H. Han, Equatorial anisotropy of Earth's inner inner core from autocorrelation of earthquake coda, Nature Geosci., 8 (3), 224-227, doi:10.1038/ngeo2354, 2015.

Sun, X.L.,+ **X.D. Song***, S.H. Zheng, and D.V. Helmberger, Evidence for a chemical-thermal structure at base of mantle from sharp lateral P-wave variations beneath Central America, Proc. Natl. Acad. Sci. USA, 104 (1), 26-30, doi:10.1073/pnas.0609143103, 2007.

Song, X.D.*, and D.V. Helmberger, Seismological evidence for an inner core transition zone, Science, 282, 924-927, 1998.

Song, X.D.*, and P.G. Richards Seismological evidence for differential rotation of the Earth's inner core, Nature, 382, 221-224, 1996.

东亚结构和地震研究

Li, J.T.+, **X.D. Song***, Tearing of Indian mantle lithosphere from high-resolution seismic images: Implications for lithosphere deformation in southern Tibet. Proc. Natl. Aca. Sci. USA, DOI: 10.1073/pnas.1717258115, 2018.

Bao, X.W.+, **X.D. Song***, J.T. Li, High-resolution lithospheric structure beneath Mainland China from ambient noise and earthquake surface-wave tomography, Earth Planet. Sci. Lett., 417, 132-141, DOI: 10.1016/j.epsl.2015.02.024, 2015.

Xu, Z.J.,+ and **X.D. Song*,** Temporal changes of surface wave velocity associated with major Sumatra earthquakes from ambient noise correlation, Proc. Natl. Aca. Sci. USA, 106, 14207-14212, 2009.

Zheng, S.H., X.L. Sun, **X.D. Song*,** Y.J. Yang, M.H. Ritzwoller, Surface wave tomography of China from ambient seismic noise correlation, Geochem. Geophys. Geosyst., 9, Q05020, doi:10.1029/2008GC001981, 2008.

Liang, C.T.+, **X.D. Song*,** and J.L. Huang, Tomographic inversion of Pn travel-times in China, J. Geophys. Res., 109, B11304, doi:10.1029/2003JB0027 89, 2004.

Zhang, G.M, L.R. Zhu, **X.D. Song*,** Z.X. Li, M.L. Yang, N.Q. Su, and X.Z. Chen, Predictions of the 1997 strong earthquakes in Jiashi, Xinjiang, China, Bull. Seism. Soc. Am., 89, 1171-1183, 1999

论评文章

宋晓东*, 地球内核内的核, 中国科学院2016科学发展报告(2015年中国科研代表性成果)

Song, X.D.* Differential Rotation of the Earth's Inner Core, Encyclopedia of Solid Earth Geophysics, H. Gupta (Ed.), 118-121, 2014.

Song, X.D.*, Inner core anisotropy, in Encyclopedia of Geomagnetism and Paleomagnetism (D. Gubbins and E. Herroro-Bervera, Eds.), 418-420, Springer, 2007.

Song, X.D.*, Three-dimensional structure and differential rotation of the inner core, in Earth Core: Dynamics, Structure, Rotation (V.M. Dehant, K.C. Creager, S. Zatman, S. Karato, Eds.), Geodynamics Series, Vol. 31, American Geophysical Union, 2003.

Song, X.D.*, The Earth's core, International Handbook of Earthquake and Engineering Seismology, (W. H. K. Lee, H. Kanamori, P. C. Jennings, and C. Kisslinger, Eds.), Volume 1, Chapter 56, Academic Press, San Diego, 2002.

Song, X.D.*, and X.X. Xu, The Earth's Core (in Chinese), New Frontiers of Sciences: Structure Evolution and Dynamics of the Earth (Eds: Y.X. Zhang, A. Yin), Higher Education Press, Beijing, China, 2002. 宋晓东和许晓霞，地核-20世纪的发现及展望，地球的结构、演化和动力学，主编：张有学和尹安，高等教育出版社，第四章，2002.

Song, X.D.*, Anisotropy of the Earth's inner core, Rev. of Geophysics, 35, 297-313, 1997.

Song, X.D., A review of Pn tomography of China, in Advances in Seismology and Physics of Earth's interior in China (Y.T. Chen and C.Y. Wang, Eds.), Seismology Press, Beijing, 321-345, 2004.

完整学术论文列表

+ 学生/博士后； ++访问学者；* 通讯作者；§ 邀请稿

1. Song, X.D.*, and D.V. Helmberger, Velocity structure near the inner core boundary from waveform modeling, J. Geophys. Res., 97, 6573-6586, 1992.
2. Song, X.D.*, and D.V. Helmberger, E_ect of velocity structure in D” on PKP phases, Geophys. Res. Lett., 20, 285-288, 1993.
3. Song, X.D.*, and D.V. Helmberger, Anisotropy of the Earth's inner core, Geophys. Res. Lett., 20, 2591-2594, 1993.
4. Song, X.D.*, and D.V. Helmberger, A P-wave velocity model of the Earth's core, J. Geophys. Res., 100, 9817-9830, 1995.
5. Song, X.D.*, and D.V. Helmberger, Depth-dependence of inner core anisotropy, J. Geophys. Res., 100, 9805-9816, 1995.
6. Song, X.D.*, Anisotropy in the central part of the inner core, J. Geophys. Res., 101, 16,689-16,097, 1996.
7. Song, X.D.*, and P.G. Richards Seismological evidence for differential rotation of the Earth's inner core, Nature, 382, 221-224, 1996.
8. Song, X.D.*, and D.V. Helmberger, PKP differential travel times: Implications for three-dimensional lower mantle structure, Geophys. Res. Lett., 24, 1863-1866, 1997.
§ 9. Song, X.D.*, Anisotropy of the Earth's inner core, Rev. of Geophysics, 35, 297-313, 1997.
10. Richards, P.G., X.D. Song, A.Y. Li, Detecting Possible Rotation of Earth's Inner Core, Science, 282, 1227a, 1998.
11. Zhou, Y.Q. and X.D. Song, A review of the mantle dynamic system and its evolution (in Chinese), Earth Sci. Frontiers, 5, Suppl., 11-39, 1998.
§ 12. Song, X.D.*, The Earth's inner core and the dynamics of the Earth's deep interior (in Chinese), Earth Sci. Frontiers, 5, Suppl., 1-10, 1998.
13. Song, X.D.*, and D.V. Helmberger, Seismological evidence for an inner core transition zone, Science, 282, 924-927, 1998.
14. Zhang, G.M, L.R. Zhu, X.D. Song*, Z.X. Li, M.L. Yang, N.Q. Su, and X.Z. Chen, Predictions of the 1997 strong earthquakes in Jiashi, Xinjiang, China, Bull. Seism. Soc. Am., 89, 1171-1183, 1999
15. Song, X.D.*, and A.Y. Li+, Support for differential inner core superrotation from earthquakes in Alaska recorded at South Pole station, J. Geophys. Res., 105, 623-630, 2000.
16. Song, X.D.*, Joint inversion for inner core rotation, inner core anisotropy, and mantle heterogeneity, J. Geophys. Res., 105, 7931-7943, 2000.
17. Song, X.D.*, Time dependence of PKP(BC)-PKP(DF) times: Could this be an artifact of systematic earthquake mislocations? Phys. Earth Planet. Inter., 122, 221-228, 2000.
18. Song, X.D.*, Comment on “The existence of an inner core super-rotation questioned by teleseismic doublets” by Georges Poupinet, Annie Souriau, and Olivier Coutant, Phys. Earth Planet. Inter., 124, 269-273, 2001.
§ 19. Song, X.D.*, The Earth's core, International Handbook of Earthquake and Engineering Seismology, (W. H. K. Lee, H. Kanamori, P. C. Jennings, and C.

Kisslinger, Eds.), Volume 1, Chapter 56, Academic Press, San Diego, 2002.
20. Song, X.D.*, and X.X. Xu, Inner core transition zone and anomalous PKP(DF) waveforms from polar paths, Geophys. Res. Lett., 29(4), 10.1029/2001GL013822, 2002.
§ 21. Song, X.D.*, and X.X. Xu, The Earth's Core (in Chinese), New Frontiers of Sciences: Structure Evolution and Dynamics of the Earth (Eds: Y.X. Zhang, A. Yin), Higher Education Press, Beijing, China, 2002. 宋晓东和许晓霞，地核-20世纪的发现及展望，地球的结构、演化和动力学，主编：张有学和尹安，高等教育出版社，第四章，2002.
22. Sun, X.L.+, and X.D. Song, PKP travel times at near antipodal distances: Implications for inner core anisotropy and lowermost mantle structure, Earth Plant. Sci. Lett., 199, 429-445, 2002.
§ 23. Song, X.D.*, Three-dimensional structure and differential rotation of the inner core, in Earth Core: Dynamics, Structure, Rotation (V.M. Dehant, K.C. Creager, S. Zatman, S. Karato, Eds.), Geodynamics Series, Vol. 31, American Geophysical Union, 2003.
24. Xu, X.X.+, and X.D. Song, Evidence for inner core super-rotation from time-dependent differential PKP travel times observed at Beijing Seismic Network, Geophys. J. Int., 152, 509-514, 2003.
25. Huang, J.L., X.D. Song, S.Y. Wang, Fine structure of Pn velocity beneath Sichuan-Yunnan region, Sci. China, Ser. D., 46 Suppl., 201-209, 2003.
26. Liang, C.T.+, X.D. Song, and J.L. Huang, Tomographic inversion of Pn travel-times in China, J. Geophys. Res., 109, B11304, doi:10.1029/2003JB0027 89, 2004.
27. Song, X.D.*, S.T. Li, Y.C. Li, S.H. Zheng, and X.N. Xie, Structure of lithospheric mantle and its implications for major basins in China (in Chinese), Earth Sci.-J. China Univ. Geosci., 29(5), 531-5 38, 2004.
28. Song, X.D., A review of Pn tomography of China, in Advances in Seismology and Physics of Earth's interior in China (Y.T. Chen and C.Y. Wang, Eds.), Seismology Press, Beijing, 321-345, 2004.
29. Zhang, J.(^), X.D. Song (^*), Y.C. Li, P.G. Richards, X.L. Sun, F. Waldhauser, Inner core differential motion confirmed by earthquake doublet waveform doublets, Science, 309, 1357-1360, doi:10.1126/science.1113193, 2005. (^ equal contribution)
30. Sun, X.L.+, G. Poupinet (^), and X.D. Song (^), Examination of systematic mislocation of South Sandwich Islands Earthquakes using station pairs: Implications for inner core rotation, J. Geophys. Res., 111, B11305, doi:10.1029/2005JB004175, 2006. (^ alphabetic order)
31. Liang, C.T.+, and X.D. Song, A low velocity belt beneath northern and eastern Tibetan Plateau from Pn tomography, Geophys. Res. Lett., 33, L22306, doi:10.1029/2006GL027926, 2006.
§ 32. Song, X.D.*, Inner core anisotropy, in Encyclopedia of Geomagnetism and Paleomagnetism (D. Gubbins and E. Herroro-Bervera, Eds.), 418-420, Springer, 2007.
33. Zheng, S.H., X.L. Sun, and X.D. Song, Fine structure in lowermost mantle beneath

Central Pacific from PKP waves recorded at China Sesmic Network, Chinese J. Geophys., 50(1), 183-191, 2007.
34. Sun, X.L.,+ X.D. Song, S.H. Zheng, and D.V. Helmberger, Evidence for a chemical-thermal structure at base of mantle from sharp lateral P-wave variations beneath Central America, Proc. Natl. Acad. Sci. USA, 104 (1), 26-30, doi:10.1073/pnas.0609143103, 2007.
35. Sun, D.Y., D.V. Helmberger, X.D. Song, S.P. Grand, Predicting a global perovskite and postperovskite phase boundary, in Post-Perovskite: The Last Mantle Phase Transition (K. Hirose, J. Brodholt, T. Lay, D. Yuen, Eds.), Geophys. Monogr. Ser., Vol. 174, American Geophysical Union, 2007.
36. Song, X.D.*, G. Poupinet, Inner core rotation from event-pair analysis, Earth Planet. Sci. Lett., doi:10.1016/j.epsl.2007.06.034, 2007.
37. Sun, X.L.,+ and X.D. Song, Tomographic inversion for three-dimensional anisotropy of Earth's inner core, Phys. Earth. Planet. Inter., 167, 53-70, doi:10.1016/j.pepi.2008.02.011, 2008.
38. Sun, X.L.+, and X.D. Song, The inner inner core of the Earth: Texturing of iron crystals from three-dimensional seismic anisotropy, Earth Planet. Sci. Lett., 56-65, doi:10.1016/j.epsl.2008.01.049, 2008.
39. Dai, W.,+ and X.D. Song*, Detection of motion and heterogeneity in Earth's liquid outer core, Geophys. Res. Lett., 35, L16311, doi:10.1029/2008GL034895, 2008.
40. Song, X.D.*, and W. Dai, Topography of Earth's inner core boundary from high-quality waveform doublets, Geophys. J. Int., 175, 386-399, doi: 10.1111/j.1365-246X.2008.03909.x, 2008.
41. Zheng, S.H., X.L. Sun, X.D. Song*, Y.J. Yang, M.H. Ritzwoller, Surface wave tomography of China from ambient seismic noise correlation, Geochem. Geophys. Geosyst., 9, Q05020, doi:10.1029/2008GC001981, 2008.
42. Xu, Z.J.,+ and X.D. Song, Temporal changes of surface wave velocity associated with major Sumatra earthquakes from ambient noise correlation, Proc. Natl. Aca. Sci. USA, 106, 14207-14212, 2009.
43. Xu, Z.J.+, and X.D. Song, Joint inversion for crustal and Pn velocities and Moho depth for eastern margin of Tibetan Plateau, Tectonophysics, 491, 185-193, 2010.
44. Lindner, D.+, X.D. Song*, and P. Ma, New insights into the inner-core rotation and its variability, J. Geophys. Res., 115, doi:10.1029/2009JB006294, 2010.
45. Sun, X.L.+, X.D. Song*, S.H. Zheng, Y.J. Yang, and M.H. Ritzwoller, Three dimensional shear wave velocity structure of the crust and upper mantle beneath China from ambient noise surface wave tomography, Earthq. Sci., 23, 449-463, **Doi**: 10.1007/s11589-010-0744-4, 2010.
46. Song, X.D.*, Preface to the special issue on ambient noise seismology, Earthq. Sci., 23, 395-396, **Doi**: 10.1007/s11589-010-0744-4, 2010.
47. Li, H.Y., S.T. Li, X.D. Song, M. Gong, X. Li, J. Jia, Crustal and uppermost mantle velocity structure beneath northwestern China from seismic ambient noise tomography, Geophys. J. Int. 188, 131-143 DOI: 10.1111/j.1365-246X.2011.05205.x, 2012.

48. Bao, X.W.+, **X.D. Song***, M.J. Xu, et al., Crust and upper mantle structure of the North China Craton and the NE Tibetan Plateau and its tectonic implications, Earth Planet. Sci. Lett., 369-370, 129-137, 2013.
49. Xu, Z.J.+, **X.D. Song*,** L.P. Zhu, Joint inversion of receiver function and surface wave dispersion using Neighborhood Algorithm: An application to Hi-Climb linear array in Tibetan Plateau, Tectonophys., 584, 209-220, 2013.
50. Huang, H.H.+, Z.J. Xu, Y.M. Wu, **X.D. Song***, B.S. Huang, N.L. Minh, First Local Seismic Tomography for Red River Shear Zone, Northern Vietnam: Stepwise Inversion Employing Crustal P and P_n Waves, Tectonophys, 584, 230-239, 2013.
51. Xu, Z.J.+, **X.D. Song***, S.H. Zheng, Shear velocity structure of crust and upper mantle in China from surface wave tomography using ambient noise and earthquake data, Earthq. Sci., 26(5):267-281, doi:10.1007/s11589-013-0010-7, 2013.
52. Wang, T.,+ J. Revenaugh, and **X.D. Song*,** Two-dimensional/three-dimensial waveform modeling of subdcuting slab and transition zone beneath Northeast Asia, J. Geophys., Res., Solid Earth, 119, 4766–4786, doi:10.1002/2014JB011058, 2014.
53. Sun, X.+, X. Bao, M. Xu,D.W. Eaton, **X.D. Song**, L. Wang, Z. Ding, N. Mi, D. Yu, and H. Li (2014), Crustal structure beneath SE Tibet from joint analysis of receiver functions and Rayleigh wave dispersion, Geophys. Res. Lett., 41, 1479–1484, doi:10.1002/2014GL059269, 2014.
54. A Perttu, D Christensen, G Abers, X Song, Insights into mantle structure and flow beneath Alaska based on a decade of observations of shear wave splitting, J. Geophys. Res., 119 (11), 8366-8377, 2014.

§ 55. Song, X.D.* Differential Rotation of the Earth's Inner Core, Encyclopedia of Solid Earth Geophysics, H. Gupta (Ed.), 118-121, 2014.

56. HH Huang+, YM Wu, X Song, CH Chang, SJ Lee, TM Chang, HH Hsieh, Joint Vp and Vs tomography of Taiwan: Implications for subduction-collision orogeny, Earth and Planet. Sci. Lett. 392, 177-191, 2014.
57. HH Huang+, YM Wu, X Song, CH Chang, H Kuo-Chen, SJ Lee, Investigating the lithospheric velocity structures beneath the Taiwan region by nonlinear joint inversion of local and teleseismic P wave data: Slab continuity and deflection, Geophys. Res. Lett. 41 (18), 6350-6357, 2014.
58. **宋晓东***， 李江涛， 鲍学伟， 李思田， 王良书， 任建业， 中国西部大型盆地的深部结构及对盆地形成和演化的意义，地学前缘， 22（1），127-137 2015. **Song, X.,** Li, J., Bao, X., Li, S.c Wang, L., Ren, J. Deep structure of major basins in Western China and implications for basin formation and evolution (in Chinese). *Earth Science Frontiers* 22 (1), 127-137, 2015.
59. Wang, T.+, **X.D. Song***, Xia H. Han, Equatorial anisotropy of Earth's inner inner core from autocorrelation of earthquake coda, Nature Geosci., 8 (3), 224-227, doi:10.1038/ngeo2354, 2015.

60. Bao, X,W.+ X Sun, M Xu, DW Eaton, **X Song**, L Wang, Z Ding, N Mi, H Li, D Yu, Z Huang, P Wang. Two crustal low-velocity channels beneath SE Tibet revealed by joint inversion of Rayleigh wave dispersion and receiver functions, Earth Planet. Sci. Lett. 415, 16-24, 2015.
61. Bao, X.W.+, **X.D. Song***, J.T. Li, High-resolution lithospheric structure beneath Mainland China from ambient noise and earthquake surface-wave tomography, Earth Planet. Sci. Lett., 417, 132-141, DOI: 10.1016/j.epsl.2015.02.024, 2015.
62. Xin, D., **Song, X.*,** Wang, T. Localized temporal variation of Earth's inner-core boundary from high-quality waveform doublets. *Earthquake Science* 28 (3), 175-185, 2015.
63. Du, X., **Song, X.,** Zhang, M., Lu, Y., Chen, P., Liu, Z., Yang, S. Shale gas potential of the Lower Permian Gufeng Formation in the western area of the Lower Yangtze Platform, China. *Marine and Petroleum Geology* 67, 526-543, 2015.
64. 王涛、**宋晓东***、夏晗，地球"内内核"的近赤道面各向异性，世界地震译丛，2015年第5-6期doi:10.16738/j.cnki.issn.1003-3238.2015Z1002, 2015.
65. Xia, H.H., X.D. Song*, and T. Wang, Extraction of triplicated PKP phases from noise correlations, Geophys. J. Int. 205, 499–508 doi: 10.1093/gji/ggw015, 2016.
66. **宋晓东***，地球内核内的核，中国科学院2016科学发展报告(2015年中国科研代表性成果)
67. Li, X.+, **X. Song***, and J. Li (2017), Pn tomography of South China Sea, Taiwan Island, Philippine archipelago, and adjacent regions, J. Geophys. Res. Solid Earth, 122, doi:10.1002/2016JB013787, 2017.
68. Wang, T.*, **X. Song*** Support for equatorial anisotropy of Earth's inner-inner core from seismic interferometry at low latitudes. Phys. Earth Planet. In. (2017), http://dx.doi.org/10.1016/j.pepi.2017.03.004
69. Ye, Z.++, Li, J.T.+, Gao, R.++, **Song, X.D.,** Li, Q., Li, Y., … Li, W. (2017). Crustal and uppermost mantle structure across the Tibet-Qinling transition zone in NE Tibet: Implications for material extrusion beneath the Tibetan Plateau. Geophysical Research Letters, 44, 10,316–10,323. https://doi.org/10.1002/2017GL075141.
70. Wang Q.+, **X.D. Song***, J. Y. Ren (2017), Ambient noise surface wave tomography of marginal seas in east Asia, Earth Planet. Phys., 1, 13-25, doi: 10.26464/epp2017003.
71. Li, J.T.+, **Song, X.D.*,** Zhu, L., & Deng, Y. (2017). Joint Inversion of Surface Wave Dispersions and Receiver Functions with P Velocity Constraints: Application to Southeastern Tibet. Journal of Geophysical Research: Solid Earth, 122(9), 7291-7310.
72. Deng, Y.F.++*, Li, J.T.*, **Song, X.D.***, Zhu, L.P. Joint inversion for lithospheric structures: Implications for the growth and deformation in Northeastern Tibetan Plateau. Geophys. Res. Lett., https://doi.org/10.1029/2018GL077486, 2018.
73. Li, H.++, **Song, X.D**., Lü, Q., Yang, X., Deng, Y., Ouyang, L., et al. (2018). Seismic imaging of lithosphere structure and upper mantle deformation beneath

east-central China and their tectonic implications. Journal of Geophysical Research: Solid Earth, 123. https://doi.org/10.1002/2017JB014992.
74. Li, J.T.+, **X.D. Song***, Tearing of Indian mantle lithosphere from high-resolution seismic images: Implications for lithosphere deformation in southern Tibet. Proc. Natl. Aca. Sci. USA, DOI: 10.1073/pnas.1717258115, 2018.
75. Li, M.+, **Song, X.,** Li, J. & Bao, X., 2018. Lithospheric structures of the Main Basins in Mainland China and its tectonic implications, Earth Science (in Chinese), 43, 10, p. 3362-3372, doi:10.3799/dqkx.2018.286.
76. Zheng, C.++, Ding, Z. **& Song, X.,** 2018. Joint inversion of surface wave dispersion and receiver functions for crustal and uppermost mantle structure beneath the north-south seismic zone, Chinese J. Geophys. (in Chinese), 61, 4, p.122-1224, doi:10.6038/cjg2018L0443.
77. C Hwang, WB Shen, CK Shum, **X Song**, Introduction to the special issue on Tibet: Contemporary geodetic geophysical observations and interpretations, TERRESTRIAL ATMOSPHERIC AND OCEANIC SCIENCES 30, 1-5, 2019.
78. Y Deng++, J Li+, **X Song**, H Li, T Xu, The lithosphericscale deformation in NE Tibet from joint inversion of receiver function and surface wave dispersion, Terrestrial, Atmospheric and Oceanic Sciences 30 (1), 127-137, 2019.
79. Li, J.+, **Song, X**.*, Wang, P., & Zhu, L. (2019). A generalized H-κ method with harmonic corrections on Ps and its crustal multiples in receiver functions. Journal of Geophysical Research: Solid Earth, 124. https://doi.org/10.1029/2018JB016356.
80. L Chen++, **X Song**, TV Gerya, T Xu, Y Chen, Crustal melting beneath orogenic plateaus: Insights from 3D Thermomechanical modeling, Tectonophysics 761, 1-15, 2019.
81. Y Deng++, J Li, T Peng, Q Ma, **X Song**, X Sun, Y Shen, W Fan, Lithospheric structure in the Cathaysia block (South China) and its implication for the Late Mesozoic magmatism, Physics of the Earth and Planetary Interiors 291, 24-34, 2019.
82. ZG Yang+, **XD Song***, Ambient noise Love wave tomography of China, Earth and Planetary Physics 3 (3), 218-231, 2019.
83. WS Wang+, **XD Song***, Analyses of anomalous amplitudes of antipodal PKIIKP waves, Earth and Planetary Physics 3 (3), 212-217, 2019.
84. Du X-B++, Chen P, Lu Y, **Song X.** Dual- system tract pattern: Significance for foreland basin reservoir prediction (Jurassic, Central Junggar Basin, West China). Geological Journal. 2019;1–13. https://doi.org/10.1002/gj.3557.
85. Du X-B++, Lu Y-C, Chen P, Li X-Q, **Song X-D**. The Lower Yangtze area: A next shale gas block for China? Preliminary potential assessment from some geology and organic geochemistry information. Geological Journal. 2019;1–22. https://doi.org/10.1002/gj.3585.

86. Zhang, G.+, X. Li, C. Zheng, **X.D. Song***, Crustal and uppermost mantle velocity structure beneath the central-eastern Tibetan Plateau from P-wave tomography（青藏高原中东部地壳和上地幔P波层析成像） *Acta Seismologica Sinica*, 2019，*41*(4), 411-424. https://doi.org/10.11939/jass.20190003.
87. 杨志高， 陈运泰， 张雪梅， 宋晓东，**青藏高原东缘及东北缘 S 波速度结构和径向各向异性**，地球物理学报，2019.
88. Li, J.+*, R.L. Weaver, J.Y. Yoritomo, **X.D. Song*** (2020), Application of temporal reweighting to ambient noise cross-correlation for improved seismic Green's function, Geophys. J. Int. 221, 265–272 doi: 10.1093/gji/ggaa001.
89. Zhou, L.Q.++, **X.D. Song***, R.L. Weaver, 2020. Retrieval of Amplitude and Attenuation from Ambient Seismic Noise: Synthetic Data and Practical Considerations, Geophys. J. Int., 222, 544–559. doi: 10.1093/gji/ggaa194.
90. Yang, Y.+ and **X.D. Song***, Yang, Y., & Song, X. (2020). Temporal changes of the inner core from globally distributed repeating earthquakes. Journal of Geophysical Research: Solid Earth, 125, e2019JB018652. https://doi.org/10.1029/2019JB018652.
91. Yang, Y.+ and **X.D. Song***, 2020. Origin of temporal changes of inner-core seismic waves, Earth Planet. Sci. Lett., 541, 116267 doi.org/10.1016/j.epsl.2020.116267.
92. Xia, H.H.+, **X.D. Song***, R.L. Weaver, J.T. Li, 2020. Amplitude and decay of long-period coda of great earthquakes, Phys. Earth. Planet. Inter., 306, 106538. https://doi.org/10.1016/j.pepi.2020.106538.
93. Jia, K., S. Zhou, J. Zhuang, C. Jiang, Y. Guo, Z. Gao, S. Gao, Y. Ogata, and X. Song (2020). Nonstationary Background Seismicity Rate and Evolution of Stress Changes in the Changning Salt Mining and Shale-Gas Hydraulic Fracturing Region, Sichuan Basin, China, Seismol. Res. Lett. XX, 1–12, doi: 10.1785/0220200092.
94. Bao, X., **Song, X**.*, Eaton, D. W., Xu, Y., & Chen, H. (2020). Episodic lithospheric deformation in eastern Tibet inferred from seismic anisotropy. Geophysical Research Letters, 47, e2019GL085721. https://doi.org/ 10.1029/2019GL085721.
95. Zhou, L., Song, X., Yang, X., & Zhao, C. (2020). Rayleigh wave attenuation tomography in the crust of the Chinese mainland. Geochemistry, Geophysics, Geosystems, 21, e2020GC008971. https://doi.org/10.1029/2020GC008971
96. Yang, Y.+, & Song, X.* (2020). Reply to Yao et al.'s comment on "Origin of temporal changes of inner-core seismic waves". Earth and Planetary Science Letters, 116639. https://doi.org/10.1016/j.epsl.2020.116639
97. Yang, Y., X. Song*, and A. T. Ringler (2021). An Evaluation of the Timing Accuracy of Global and Regional Seismic Stations and Networks, Seismol. Res. Lett. XX, 1–12, doi: 10.1785/0220210232.
98. Li, J., Song, X.*, Yang, Y., Li, M., Li, J., & Li, Y. (2021) Strong seasonal variations of seismic velocity in eastern margin of Tibetan Plateau and Sichuan Basin from ambient noise interferometry. Journal of Geophysical Research: Solid Earth, e2021JB022600. https://doi.org/10.1029/2021JB022600

99. Jiang, X., Song, X.*, Xia, H. H., & Weaver, R. L. (2021). On the generation and decay of the long-period coda energy of large earthquakes. Earthquake Science, 34(2), 103-113. doi: 10.29382/eqs-2021-0012
100. Li, J. T.*, & Song, X. D.* (2021). Crustal structure beneath the Hi-CLIMB seismic array in the central-western Tibetan Plateau from the improved H-κ-c method. Earthq Sci, 34(3), 199-210. doi: 10.29382/eqs-2021-0002
101. Yang Y, Song X*. (2021) Repeating earthquakes and temporal changes of the Earth's inner core. Reviews of Geophysics and Planetary Physics, 52(1):1-10. doi: 10.19975/j.dqyxx.2020-010
102. Song, X. (2021). Differential Rotation of the Earth's Inner Core. In: Gupta, H.K. (eds) Encyclopedia of Solid Earth Geophysics. Encyclopedia of Earth Sciences Series. Springer, Cham. https://doi.org/10.1007/978-3-030-58631-7_43
103. Jiang, X.+, Song X.* (2022) A Method to Determine Moment Magnitudes of Large Earthquakes Based on the Long‐Period Coda, Geophysical Research Letters 49 (12), e2022GL097801. https://doi.org/10.1029/2022GL097801
104. Yue, H., Shen, Z., Zhao, Z., Wang, T., Cao, B., Li, Z., Bao, X., Zhao, L., Song, X., et al. (2022) Rupture process of the 2021 M7. 4 Maduo earthquake and implication for deformation mode of the Songpan-Ganzi terrane in Tibetan Plateau, Proceedings of the National Academy of Sciences 119 (23), e2116445119. https://doi.org/10.1073/pnas.2116445119
105. Zhang, X.+, Song, X.*, Li, J. (2022). A comparative study of seismic tomography models of the Chinese continental lithosphere. Earthq Sci 35(3): 161–185, doi: 10.1016/j.eqs.2022.05.005
106. Wang, F.+, Song, X.*, Li, J. (2022) Deep Learning‐Based H‐κ Method (HkNet) for Estimating Crustal Thickness and Vp/Vs Ratio From Receiver Functions, Journal of Geophysical Research: Solid Earth 127 (6), e2022JB023944. https://doi.org/10.1029/2022JB023944
107. Li, M.+, Song, X.*, Li, J., Bao, X. (2022) Crust and upper mantle structure of East Asia from ambient noise and earthquake surface wave tomography, Earthq Sci, 35 (2), 71-92. https://doi.org/10.1016/j.eqs.2022.05.004
108. Cui, Q.++, Zhou, Y., Li, J., Song, X., Gao, Y., Cui, R. (2022) Crustal thickness (H) and Vp/Vs ratio (κ) images beneath the central Tien Shan revealed by the H-κ-c method. Tectonophysics, 822, 229157. https://doi.org/10.1016/j.tecto.2021.229157
109. Yang, Y., & Song, X.D.* (2022). Inner core rotation captured by earthquake doublets and twin stations. Geophysical Research Letters, 49, e2022GL098393. https://doi.org/10.1029/2022GL098393
110. Xiao, H.+, DeLucia, M., Song*, X., Li, J., & Marshak, S. (2022). Crustal thickness variations in the central midcontinent, USA, and their tectonic implications: New constraints obtained using the H-κ-c method. Geophysical Research Letters, 49, e2022GL099257. https://doi. org/10.1029/2022GL099257.
111. Yang, Y.+, Song, X.*(2023). Multidecadal variation of the Earth's inner-core rotation, Nature Geoscience, 16, 182-187. https://doi.org/10.1038/s41561-022-01112-z

112. Yang, Y. + and X.D. Song* (2023). Differential rotation of the Earth's inner core changes over decades and has come to near-halt, Nature Geosci, 16, 113-114. https://doi.org/10.1038/s41561-022-01113-y
113. Y Chen, S Ni, B Zhang, L Zhao, X Song, Y Wang (2023). Sensitivities of diffracted PKKPab waves to the velocity structures in the lowermost mantle Geophysical Journal International 233 (3), 1617-1631
114. Jiang XY+, Song XD*, Li T and Wu KX (2023). Moment magnitudes of two large Turkish earthquakes on February 6, 2023 from long-period coda. Earthq Sci 36, doi: 10.1016/j.eqs.2023.02.008