Supplementary Material for "Azimuthal Anisotropy From Multimode Waveform Modeling Reveals Layering Within the Antarctica Craton"

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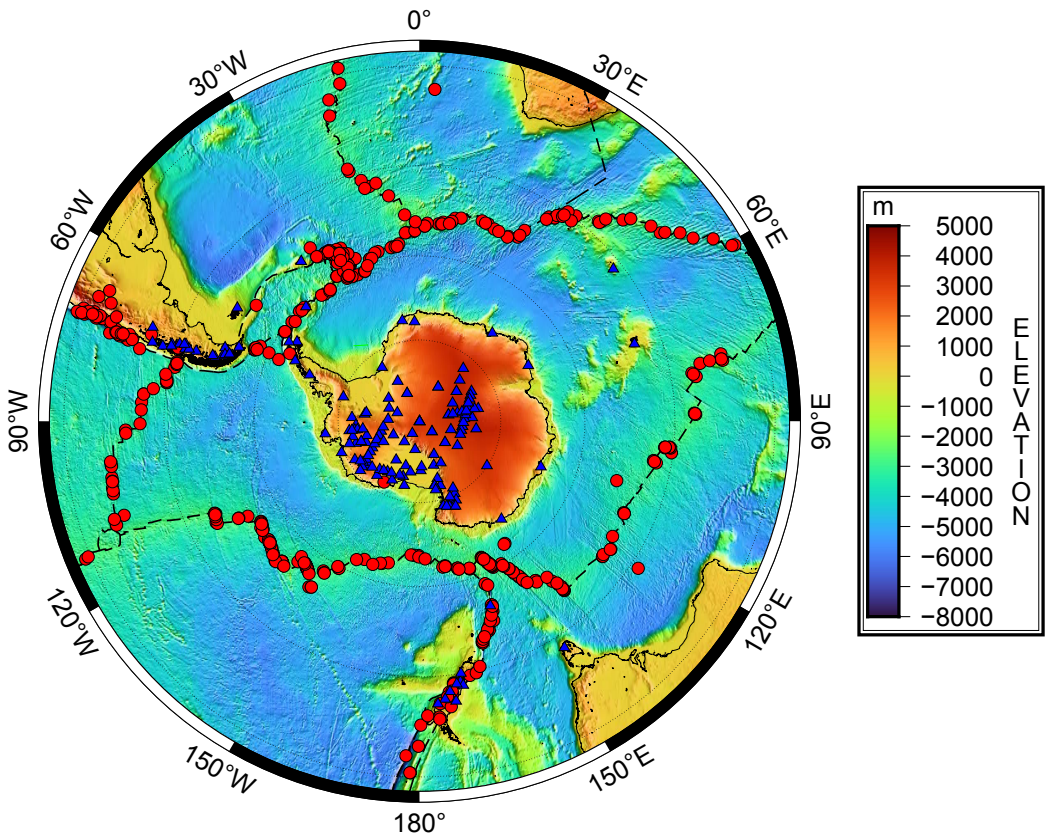

Figure S1: Maps of the selected event location (red circles) and stations (blue triangles) superimposed on bathymetry and topography Tozer et al. (2019). Ocean ridges are shown by the dashed black lines.

Reference:

Tozer, B. and Sandwell, D.T. and Smith, Walter H.F. and Olson, C. and Beale, J.R. and Wessel, P., (2019) "Global bathymetry and topography at 15 arc sec: SRTM15+", *Earth Space Sci.*, 6(10), 1847–1864,
doi: 10.1029/2019EA000658

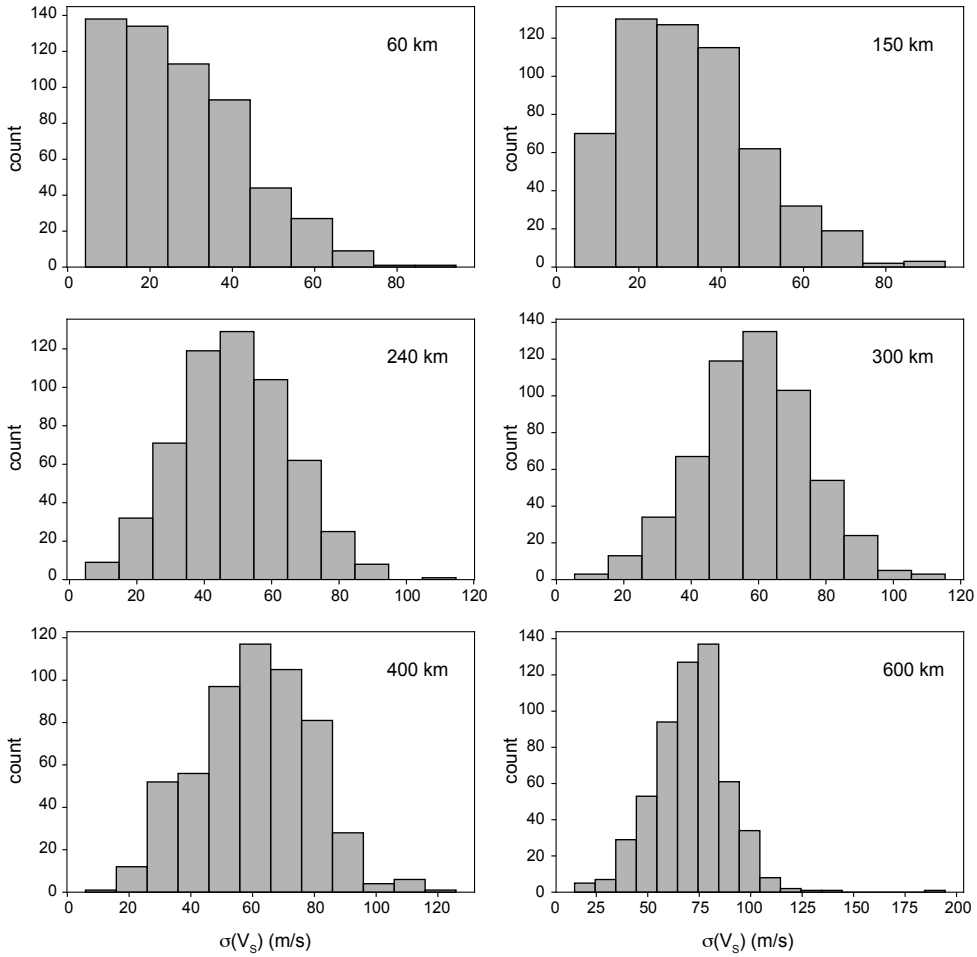

Figure S2: Distribution of path-averaged velocity $V_{SV}(z)$ standard deviations at different depths. All paths shown in Fig. 2 of the main text were included, and the standard deviation for each path is calculated from the ensemble of models obtained by our MCMC algorithm.

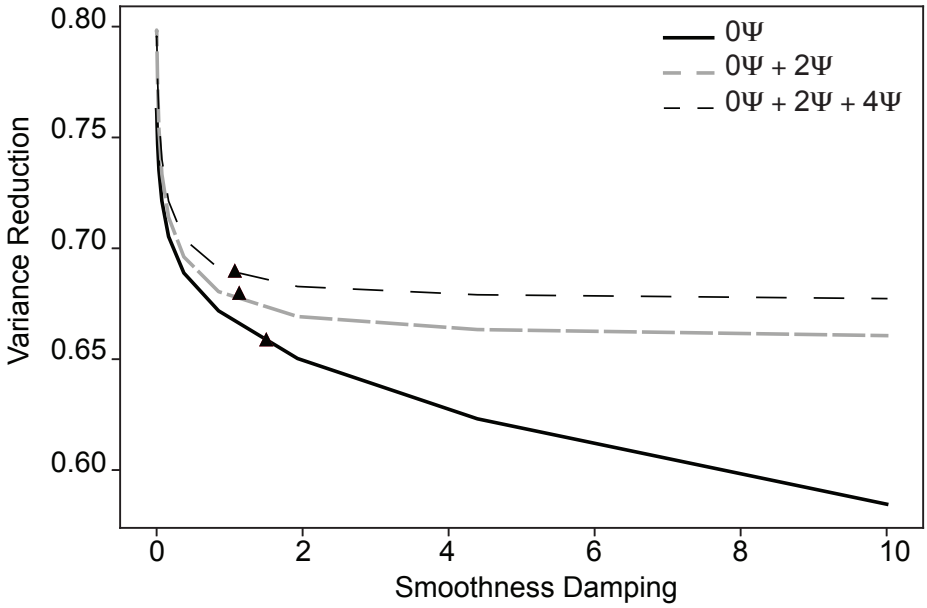

Figure S3: Example of damping parameter selection based on the L-curve method. The optimal damping parameters are selected at the elbow of the curves and are denoted by triangles. We first searched for the damping parameters for the 0Ψ-term. The $0\Psi + 2\Psi$ curve was obtained by fixing the selected isotropic damping parameter and changing the 2Ψ-term damping. The $0\Psi + 2\Psi + 4\Psi$ curve resulted from varying the 4Ψ damping parameter while fixing the isotropic and 2Ψ-term damping parameters.

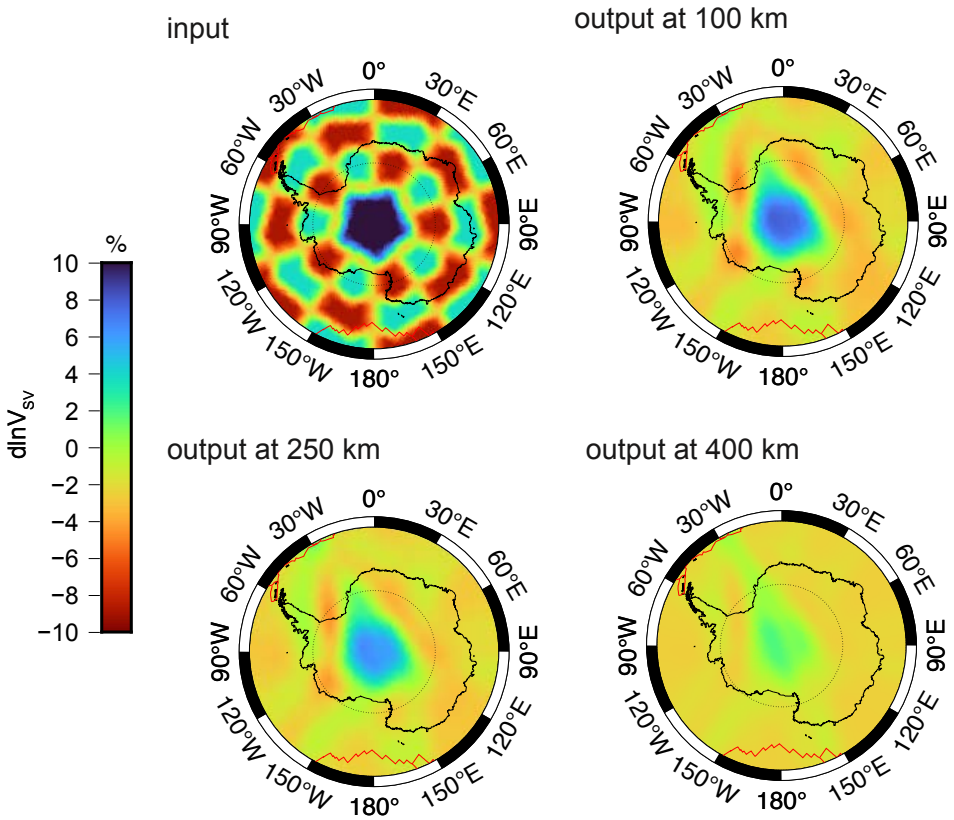

Figure S4: Synthetic tests with isotropic checkerboard input model and the corresponding isotropic output models at 100 km, 250 km depth, and 400 km. The input cells span 30 degrees in longitude and 8 degrees in latitude. The anomaly at the pole has a radius of 8 degree.

Table S1: Stations Used

Network	Station Code
ZM	P124
IU	QSPA
YT	ST13
YT	MA04
ZJ	SPLN
YT	ST03
YT	ALYS
YT	P061
GE	SNAA
ZM	N124
AI	ORCD
YT	BEAR
YT	GM05
IU	CASY
YT	ST02
IU	PMSA
GT	VNDA
YT	STEW
ZM	ALYS
ZM	N156
YT	MA08
YT	KOLR
XD	PMC02
XD	PSP02
G	DRV
XH	RS17
YT	WAWA
YT	DNTW
XH	RS12

YT	LONW
ZM	N198
ZM	N140
YT	ST04
YT	UNGL
YT	FISH
YT	MILR
YT	SIPL
YT	WILS
YT	MA09
YT	WHIT
YT	AGO3
YT	ST09
YT	ST10
YT	SURP
YT	N140
YT	SWEI
YT	BENN
XH	RS09
AI	SMAI
ZJ	KNYN
YT	ST14
XH	RS14
ZJ	MICH
YT	MA07
YT	MA01
ZM	GM03
YT	HOWE
YT	ST12
YT	DUFK
ZJ	FOOT
YT	ST06

ZM	P061
XH	RS08
ZJ	RKST
IU	SBA
YT	DEVL
YT	MA06
ZM	GM01
YT	THUR
ZM	N132
AI	JUBA
ZM	AGO1
YT	FALL
ZM	N206
XH	RS13
ZJ	GRAW
ZM	N190
YT	ST01
ZM	N100
YT	ST08
ZM	P071
PS	SYO
AI	ESPZ
ZJ	SAMH
ZM	GM02
YT	PECA
YT	ST07
II	TAU
G	PAF
XD	PMC01
YE	WERK
YT	CLRK
ZM	SWEI

YE	OBHI
ZM	N173
AI	BELA
YT	MECK
ZM	AGO3
YT	UPTW
YT	SILY
ZM	N215
ZM	P116
YE	SPOLE
YT	MA03
ZM	N148
YT	AGO1
ZM	N182
YT	MA10
ZM	P080
YT	MPAT
YT	BYRD
YT	HOWD
ZJ	DUBY
ZM	GM05
YT	WAIS
ZM	N165
XD	PSP03
G	CCD
YT	RMBO
ZM	GM07
ZM	P090

Table S2: Events list

event_id	datetime	latitude	longitude	depth
C200501031759A	2005-01-03 17:59:34	-50.69	161.51	12
C200501290637A	2005-01-29 06:37:50	-57.06	-140.86	12
C200504161218A	2005-04-16 12:18:37	-54.41	-132.31	12
C200505121115A	2005-05-12 11:15:40	-57.57	-138.91	12
C200505180910A	2005-05-18 09:10:58	-56.43	-26.5	107.4
C200506120227A	2005-06-12 02:27:53	-55.74	-124.24	20.1
C200506121926A	2005-06-12 19:26:29	-56.4	-26.7	97.8
C200507151758A	2005-07-15 17:58:39	-57.63	-147.9	12.6
C200507251945A	2005-07-25 19:45:19	-56.23	-27.48	86.3
C200508070217A	2005-08-07 02:17:52	-46.8	33.62	16
C200509050737A	2005-09-05 07:37:35	-56.59	-142.54	12
C200510290405A	2005-10-29 04:06:01	-45.24	97.12	12
C200512221220A	2005-12-22 12:20:11	-54.57	-135.91	15
C200601240427A	2006-01-24 04:27:15	-54.57	-135.8	19.1
C200602080504A	2006-02-08 05:04:56	-54.6	143.95	12
C200602230404A	2006-02-23 04:04:11	-54.64	1.95	12
C200603090959A	2006-03-09 09:59:59	-59.7	-29.7	15
C200603101012A	2006-03-10 10:12:22	-60.67	-46.62	16
C200603231357A	2006-03-23 13:57:46	-62.4	165.38	18.7
C200605291410A	2006-05-29 14:10:53	-41.81	88.42	12
C200607131913A	2006-07-13 19:13:45	-61.2	-36.65	18.1
C200608140403A	2006-08-14 04:04:01	-55.76	-124.36	23.3
C200608161653A	2006-08-16 16:53:56	-58.77	148.73	13.5
C200608200341A	2006-08-20 03:41:56	-61.27	-34.52	17.2
C200609061142A	2006-09-06 11:42:45	-61.09	-34.09	13.2
C200610060508A	2006-10-06 05:08:57	-41.22	80.7	12
C200610061625A	2006-10-06 16:25:34	-49.99	-114.6	12.1
C200610091819A	2006-10-09 18:19:36	-51.09	28.85	12
C200610100802A	2006-10-10 08:02:57	-56.18	-122.41	12

C200610160035A	2006-10-16 00:35:40	-50.94	161.83	27.9
C200610220855A	2006-10-22 08:55:19	-45.63	95.89	12
C200611190155A	2006-11-19 01:55:09	-55.74	-24.47	14
C200611302120A	2006-11-30 21:20:17	-54.01	-133.95	12
C200701200621A	2007-01-20 06:21:10	-55.31	-29.33	12
C200702282313A	2007-02-28 23:13:22	-55.28	-29.18	14.5
C200703032052A	2007-03-03 20:52:13	-55.27	-129.31	19.9
C200703081114A	2007-03-08 11:14:37	-58.13	-7.93	13.9
C200703311249A	2007-03-31 12:49:09	-55.94	-123.61	12
C200704060554A	2007-04-06 05:54:25	-55.61	-123.85	12
C200704211753A	2007-04-21 17:53:48	-45.48	-72.95	12
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C200706051527A	2007-06-05 15:27:09	-60.7	-26.12	17
C200706240025A	2007-06-24 00:25:28	-55.78	-1.72	15
C200707131633A	2007-07-13 16:33:41	-55.34	-128.92	16.7
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C200707241833A	2007-07-24 18:33:08	-56.92	-141.62	24.6
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C200709070446A	2007-09-07 04:46:55	-55.92	-123.73	23.2
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C200711022231A	2007-11-02 22:31:46	-55.4	-128.8	13.6
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C200712080354A	2007-12-08 03:54:52	-60.68	-52	12
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C200806150837A	2008-06-15 08:37:23	-36.62	-107.67	22.4
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C201001070829A	2010-01-07 08:29:10	-53.55	158.84	18.9
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C201009031635A	2010-09-03 16:35:57	-43.56	172.12	12
C201010230309A	2010-10-23 03:09:21	-56.94	-141.67	22.3
C201010301518A	2010-10-30 15:18:41	-56.64	-142.63	19.9
C201011100405A	2010-11-10 04:05:30	-45.46	96.07	12
C201011210436A	2010-11-21 04:36:35	-54.7	-131.53	15
C201012070427A	2010-12-07 04:27:25	-58.1	-7.29	12
C201012070531A	2010-12-07 05:31:06	-58.1	-7.16	15
C201012080524A	2010-12-08 05:24:41	-56.49	-25.48	18.3
C201012240548A	2010-12-24 05:48:57	-63.59	-167.62	14.6
C201101031643A	2011-01-03 16:43:32	-59.6	149.85	15
C201101291158A	2011-01-29 11:58:21	-63.21	-164.59	12
C201102281104A	2011-02-28 11:04:21	-59.3	-17.16	15.7
C201103061432A	2011-03-06 14:32:42	-56.41	-26.68	101.2
C201105091854A	2011-05-09 18:54:46	-56.74	147.32	12
C201105130336A	2011-05-13 03:36:54	-59.64	-151.31	14.6
C201105210016A	2011-05-21 00:16:28	-56.04	-26.92	46.3
C201106051151A	2011-06-05 11:51:18	-56	146.91	12
C201107151326A	2011-07-15 13:26:07	-61.12	-22.85	12
C201107212301A	2011-07-21 23:01:47	-62.36	165.42	16.1
C201108211238A	2011-08-21 12:38:51	-56.58	-27.1	108.7
C201109030449A	2011-09-03 04:49:03	-56.57	-26.44	98.9
C201109091926A	2011-09-09 19:26:07	-49.93	163.2	18.7
C201111021459A	2011-11-02 14:59:32	-55.34	-129.08	15
C201111071651A	2011-11-07 16:51:28	-63.1	170.91	12
C201111111041A	2011-11-11 10:41:42	-55.72	-124.57	20.9
C201112110954A	2011-12-11 09:54:59	-55.97	-27.78	123.1
C201112161254A	2011-12-16 12:54:26	-46.01	-76.57	15.4
C201112230058A	2011-12-23 00:58:42	-43.67	172.56	12
C201112230218A	2011-12-23 02:18:06	-43.55	172.58	12
C201112231912A	2011-12-23 19:12:39	-52.19	28.35	23.6
C201112310019A	2011-12-31 00:19:20	-56.78	-142.35	20.6
C201201131602A	2012-01-13 16:02:28	-60.91	-26.81	12

C201201151340A	2012-01-15 13:40:26	-60.62	-56.47	13.6
C201201151421A	2012-01-15 14:21:37	-60.73	-56.22	17.7
C201201160359A	2012-01-16 03:59:50	-60.68	-56.27	12
C201201220553A	2012-01-22 05:53:49	-56.8	-24.52	12
C201202091852A	2012-02-09 18:52:52	-58.28	157.97	20.6
C201203242218A	2012-03-24 22:18:47	-54.65	-135.55	24
C201203250105A	2012-03-25 01:05:38	-54.66	-135.68	15
C201203280825A	2012-03-28 08:25:53	-57.15	-140.77	25.3
C201204141056A	2012-04-14 10:56:22	-57.59	-65.76	19.9
C201204171903A	2012-04-17 19:04:00	-59.26	-16.34	13.1
C201205180200A	2012-05-18 02:00:47	-44.9	-80.51	20.6
C201205232259A	2012-05-23 22:59:55	-50.48	139.42	12
C201205232319A	2012-05-23 23:19:22	-50.4	139.47	14.1
C201207031036A	2012-07-03 10:36:19	-40.05	173.63	230.4
C201207180425A	2012-07-18 04:25:30	-55.36	-128.96	20.3
C201208301218A	2012-08-30 12:18:46	-50.12	114.1	15.6
C201210091232A	2012-10-09 12:32:20	-60.65	153.39	20.7
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C201211160624A	2012-11-16 06:24:47	-53.95	-134.3	13.5
C201212030927A	2012-12-03 09:27:42	-54.5	-136.2	14.3
C201212071819A	2012-12-07 18:19:14	-38.31	176.08	165.1
C201301092146A	2013-01-09 21:46:02	-56.97	-141.78	26.4
C201301151609A	2013-01-15 16:09:43	-62.6	-161.94	12
C201302051909A	2013-02-05 19:09:39	-62.32	155.02	12.7
C201303190329A	2013-03-19 03:29:03	-59.1	-23.87	34.8
C201304021434A	2013-04-02 14:34:59	-40.19	45.32	12
C201304200511A	2013-04-20 05:12:04	-54.89	1.57	22.6
C201305200949A	2013-05-20 09:49:09	-44.95	-80.99	19.1
C201305271106A	2013-05-27 11:06:16	-54.67	-135.68	18.2
C201306160251A	2013-06-16 02:51:37	-56.38	-26.99	78.8
C201306161331A	2013-06-16 13:31:40	-58.33	158	12
C201307161941A	2013-07-16 19:41:59	-63.37	-62.41	12

C201307210509A	2013-07-21 05:09:39	-41.63	174.17	12
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