Supplementary data for "The marsquake catalogue from InSight, sols 0–1011": Travel time table and reference Mars model

This supplement provides a look–up table for the major seismic bodywave arrivals shown in Fig. S1, and the reference model used in the main text for alignments.

The P-wave structure below ∼800km depth is not constrained by observations (Fig. S1b, shaded region). Therefore, the arrival times given in the travel time look-up table in Supp. Table S3 for P–waves beyond ∼100° are purely from model predictions. The reference model (solid black profiles in Fig. S1b) is constructed by combining mantle structure from one model of Stähler et al. (2021) and Khan et al. (2021), and crust from Knapmeyer-Endrun et al. (2021). Travel times are computed using the TauP toolkit (Crotwell et al., 1999).

The reference model is given in Section 2, in *named discontinuity (.nd)* format. The columns are depth (km), P– and S–wave speed (km/s), and density (g/cm^3). Note that the model includes a small inner core which does not reflect the truth according to our current knowledge about the martian interior. However, an inner core is needed otherwise the TauP toolkit (Crotwell et al., 1999) cannot compute travel times for core phases.

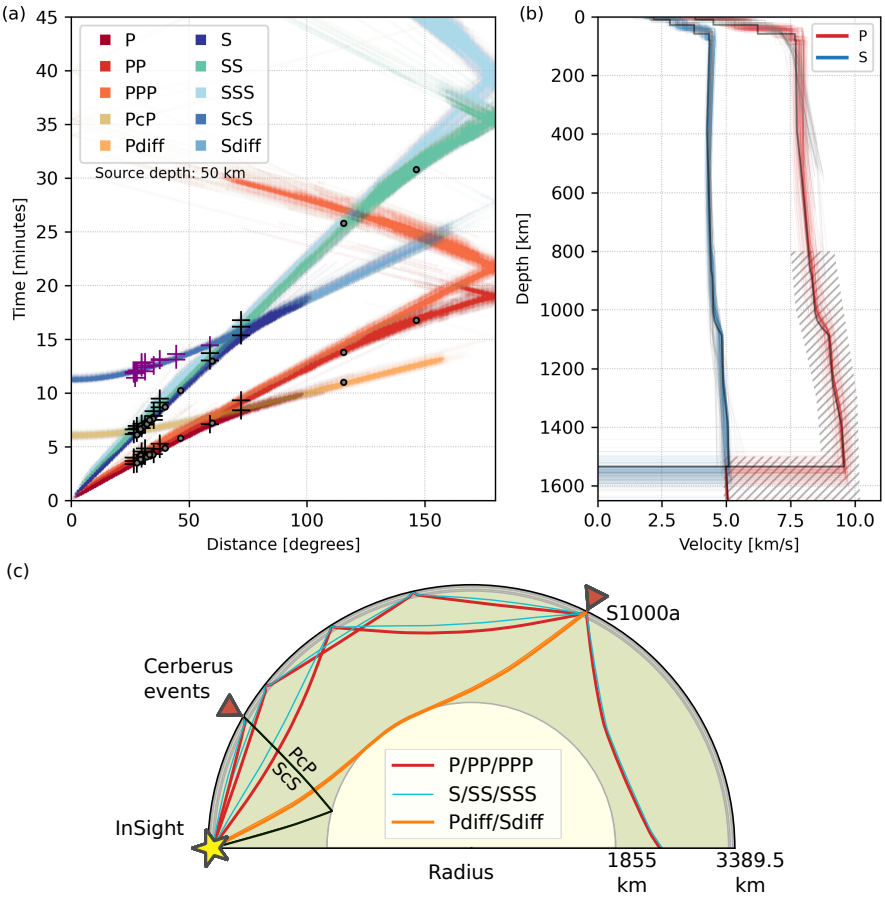

Fig. S1: Travel time curves and Mars models from the main text. The figure is the same as the main text and provided only for completeness.

1. Travel time look-up table

Supplementary Table S3: Travel time table for major seismic phases for a source depth is 50 km, as shown in the Fig. 1 of this supplement for distances 1–180° with 1-degree intervals. TauP predicts more than one arrival at discontinuities. In these cases, the first arrival of the phase is listed. The phase arrivals are in seconds relative to the origin time.

Distance [°]	Pdiff [s]	P [s]	PP [s]	PPP [s]	PcP [s]	Sdiff [s]	S [s]	SS [s]	SSS [s]	ScS [s]
1	–	–	–	–	366.1	–	–	–	–	673.7
2	–	24.5	–	–	366.2	–	41.1	–	–	673.9
3	–	32.0	–	–	366.4	–	54.5	–	–	674.2
4	–	39.6	56.6	–	366.7	–	67.9	–	–	674.7
5	–	47.2	64.2	–	367.0	–	81.3	107.4	–	675.3
6	–	54.8	71.7	88.7	367.4	–	94.7	120.8	–	676.1
7	–	62.4	79.3	96.3	367.9	–	108.1	134.2	160.3	677.0
8	–	69.9	86.9	103.8	368.4	–	121.5	147.6	173.8	678.0
9	–	77.5	94.5	111.4	369.0	–	134.9	161.1	187.2	679.1
10	–	85.0	102.1	119.0	369.7	–	148.3	174.5	200.6	680.4
11	–	92.6	109.6	126.6	370.5	–	161.6	187.9	214.0	681.8
12	–	100.1	117.2	134.2	371.3	–	174.9	201.3	227.4	683.4
13	–	107.6	124.8	141.7	372.2	–	188.2	214.7	240.8	685.0
14	–	115.0	132.4	149.3	373.2	–	201.5	228.1	254.2	686.8
15	–	122.5	139.9	156.9	374.2	–	214.8	241.5	267.6	688.8
16	–	130.0	147.5	164.5	375.3	–	228.0	254.9	281.0	690.8
17	–	137.5	155.1	172.1	376.5	–	241.3	268.3	294.5	693.0
18	–	144.9	162.6	179.6	377.7	–	254.5	281.7	307.9	695.3
19	–	152.4	170.2	187.2	379.0	–	267.7	295.0	321.3	697.7
20	–	159.8	177.8	194.8	380.4	–	280.9	308.4	334.7	700.2
21	–	167.2	185.3	202.4	381.8	–	294.1	321.8	348.1	702.9
22	–	174.6	192.9	209.9	383.3	–	307.3	335.2	361.5	705.7
23	–	182.0	200.4	217.5	384.9	–	320.5	348.6	374.9	708.5
24	–	189.4	207.8	225.1	386.5	–	333.8	361.9	388.3	711.5
25	–	196.8	215.3	232.6	388.2	–	347.0	375.2	401.7	714.6
26	–	204.1	222.8	240.2	389.9	–	360.1	388.5	415.1	717.9
27	–	211.4	230.3	247.8	391.7	–	373.3	401.7	428.4	721.2
28	–	218.8	237.8	255.3	393.5	–	386.4	415.0	441.8	724.6
29	–	226.1	245.3	262.9	395.4	–	399.6	428.3	455.2	728.1
30	–	233.3	252.8	270.5	397.4	–	412.7	441.6	468.6	731.8
31	–	240.6	260.3	278.0	399.4	–	425.9	454.8	482.0	735.5
32	–	247.9	267.7	285.6	401.4	–	439.0	468.1	495.4	739.3
33	–	255.1	275.2	293.1	403.5	–	452.0	481.3	508.7	743.2
34	–	262.3	282.7	300.6	405.7	–	465.1	494.6	522.1	747.2
35	–	269.5	290.1	308.1	407.9	–	478.1	507.8	535.5	751.3
36	–	276.6	297.6	315.6	410.1	–	491.1	521.0	548.8	755.5
37	–	283.8	305.1	323.1	412.4	–	504.1	534.3	562.1	759.8
38	–	290.9	312.5	330.6	414.8	–	517.1	547.5	575.4	764.1
39	–	298.0	319.9	338.1	417.2	–	530.0	560.7	588.7	768.6
40	–	305.1	327.4	345.6	419.6	–	543.0	573.9	602.0	773.1
41	–	312.1	334.8	353.1	422.0	–	555.9	587.1	615.3	777.7
42	–	319.1	342.2	360.6	424.6	–	568.7	600.3	628.5	782.4
43	–	326.1	349.6	368.1	427.1	–	581.6	613.5	641.8	787.1
44	–	333.1	357.0	375.6	429.7	–	594.4	626.8	655.1	791.9

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Distance	Pdiff	P	PP	PPP	PcP	Sdiff	S	SS	SSS	ScS
45	–	340.0	364.4	383.0	432.3	–	607.2	640.0	668.3	796.8
46	–	347.0	371.8	390.5	435.0	–	620.0	653.2	681.6	801.8
47	–	353.9	379.2	398.0	437.7	–	632.7	666.4	694.9	806.8
48	–	360.7	386.6	405.5	440.4	–	645.5	679.6	708.1	811.9
49	–	367.6	394.0	412.9	443.1	–	658.2	692.8	721.4	817.0
50	–	374.2	401.3	420.4	445.9	–	670.8	706.0	734.6	822.2
51	–	380.8	408.7	427.9	448.7	–	683.5	719.2	747.9	827.5
52	–	387.2	416.1	435.4	451.6	–	696.1	732.4	761.1	832.8
53	–	393.6	423.4	442.8	454.5	–	708.6	745.6	774.4	838.1
54	–	399.9	430.7	450.3	457.4	–	721.2	758.7	787.6	843.6
55	–	406.2	438.1	457.7	460.3	–	733.7	771.9	800.8	849.0
56	–	412.4	445.4	465.2	463.3	–	746.1	785.0	814.0	854.6
57	–	418.5	452.7	472.6	466.2	–	758.2	798.2	827.3	860.1
58	–	424.6	460.0	480.1	469.2	–	770.0	811.3	840.5	865.7
59	–	430.6	467.3	487.5	472.3	–	781.6	824.5	853.7	871.4
60	–	436.6	474.6	494.9	475.3	–	793.1	837.6	866.9	877.1
61	–	442.5	481.8	502.4	478.4	–	804.6	850.8	880.1	882.8
62	–	448.4	489.1	509.8	481.5	–	815.9	863.9	893.3	888.6
63	–	454.2	496.4	517.2	484.6	–	827.1	877.0	906.5	894.4
64	–	459.9	503.6	524.6	487.7	–	838.3	890.1	919.7	900.2
65	–	465.6	510.9	532.0	490.9	–	849.3	903.2	933.0	906.1
66	–	471.2	518.1	539.4	494.0	–	860.3	916.3	946.2	912.0
67	–	476.8	525.3	546.8	497.2	–	871.2	929.3	959.4	918.0
68	–	482.3	532.5	554.3	500.4	–	881.9	942.4	972.6	924.0
69	–	487.7	539.7	561.7	503.6	–	892.6	955.4	985.8	930.0
70	–	492.2	546.9	569.0	506.8	–	903.2	968.5	999.0	936.0
71	–	496.6	554.1	576.4	510.1	–	913.6	981.5	1012.2	942.0
72	–	501.0	561.3	583.8	513.3	–	922.4	994.5	1025.4	948.1
73	–	505.3	568.4	591.2	516.6	–	930.6	1007.5	1038.6	954.2
74	–	509.7	575.6	598.6	519.8	–	938.8	1020.5	1051.8	960.3
75	–	514.0	582.7	605.9	523.1	–	946.9	1033.5	1065.0	966.5
76	–	518.3	589.8	613.3	526.4	–	955.0	1046.5	1078.2	972.6
77	–	522.6	596.9	620.6	529.7	–	963.1	1059.4	1091.5	978.8
78	–	526.8	604.0	628.0	533.0	–	971.1	1072.4	1104.7	985.0
79	–	531.1	611.1	635.3	536.3	–	979.1	1085.3	1117.8	991.2
80	–	535.3	618.2	642.7	539.7	–	987.1	1098.3	1131.0	997.5
81	–	539.4	625.2	650.0	543.0	–	995.0	1111.2	1144.1	1003.7
82	–	543.4	632.3	657.4	546.3	–	1002.9	1124.1	1157.3	1010.0
83	–	547.1	639.3	664.7	549.7	–	1010.6	1137.0	1170.4	1016.2
84	–	550.8	646.4	672.0	553.0	–	1017.5	1149.8	1183.6	1022.5
85	–	554.4	653.4	679.3	556.4	–	1024.4	1162.7	1196.7	1028.8
86	–	558.1	660.4	686.6	559.7	–	1031.3	1175.6	1209.9	1035.1
87	–	561.8	667.3	693.9	563.1	–	1038.1	1188.4	1223.1	1041.4
88	–	565.4	674.3	701.2	566.5	–	1045.0	1201.3	1236.2	1047.7
89	–	569.0	681.3	708.5	569.8	–	1051.8	1214.1	1249.4	1054.0
90	–	572.6	688.2	715.8	573.2	–	1058.5	1226.9	1262.5	1060.4
91	–	576.1	695.2	723.1	576.6	–	1065.3	1239.7	1275.6	1066.7
92	–	579.7	702.1	730.4	580.0	–	1072.0	1252.5	1288.8	1073.0
93	–	583.2	709.0	737.6	583.3	–	1078.6	1265.2	1301.9	1079.4
94	–	586.6	715.9	744.9	586.7	–	1085.2	1278.0	1315.0	1085.7
95	–	590.1	722.8	752.1	590.1	–	1091.8	1290.7	1328.1	1092.1

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Distance	Pdiff	P	PP	PPP	PcP	Sdiff	S	SS	SSS	ScS
96	–	593.5	729.6	759.4	593.5	–	1098.3	1303.4	1341.2	1098.4
97	596.8	–	736.5	766.6	–	–	1104.7	1316.2	1354.3	1104.8
98	600.2	–	743.3	773.9	–	–	1111.1	1328.9	1367.4	1111.1
99	603.6	–	750.1	781.1	–	1117.5	–	1341.5	1380.5	–
100	607.0	–	756.9	788.3	–	1123.8	–	1354.2	1393.6	–
101	610.4	–	763.4	795.5	–	1130.2	–	1366.9	1406.6	–
102	613.7	–	769.9	802.8	–	1136.5	–	1379.5	1419.7	–
103	617.1	–	776.4	810.0	–	1142.9	–	1392.1	1432.7	–
104	620.5	–	782.9	817.2	–	1149.2	–	1404.7	1445.8	–
105	623.9	–	789.3	824.3	–	1155.6	–	1417.3	1458.8	–
106	627.3	–	795.7	831.5	–	1161.9	–	1429.9	1471.9	–
107	630.6	–	802.0	838.7	–	1168.3	–	1442.4	1484.9	–
108	634.0	–	808.4	845.9	–	1174.6	–	1455.0	1497.9	–
109	637.4	–	814.7	853.0	–	1181.0	–	1467.5	1510.9	–
110	640.8	–	820.9	860.2	–	1187.3	–	1480.0	1523.9	–
111	644.2	–	827.1	867.3	–	1193.7	–	1492.5	1536.9	–
112	647.5	–	833.3	874.5	–	1200.0	–	1505.0	1549.9	–
113	650.9	–	839.5	881.6	–	1206.4	–	1517.5	1562.9	–
114	654.3	–	845.7	888.7	–	1212.7	–	1529.6	1575.9	–
115	657.7	–	851.8	895.8	–	1219.1	–	1541.5	1588.8	–
116	661.0	–	857.9	902.9	–	1225.4	–	1553.2	1601.8	–
117	664.4	–	863.9	910.0	–	1231.8	–	1564.9	1614.7	–
118	667.8	–	870.0	917.1	–	1238.1	–	1576.6	1627.7	–
119	671.2	–	876.0	924.2	–	1244.5	–	1588.2	1640.6	–
120	674.6	–	881.9	931.3	–	1250.8	–	1599.7	1653.6	–
121	677.9	–	887.9	938.4	–	1257.2	–	1611.2	1666.5	–
122	681.3	–	893.8	945.4	–	1263.5	–	1622.6	1679.4	–
123	684.7	–	899.7	952.5	–	1269.9	–	1634.0	1692.3	–
124	688.1	–	905.5	959.5	–	1276.2	–	1645.4	1705.2	–
125	691.5	–	911.4	966.5	–	1282.6	–	1656.7	1718.1	–
126	694.8	–	917.2	973.6	–	1288.9	–	1667.9	1731.0	–
127	698.2	–	923.0	980.6	–	1295.3	–	1679.1	1743.8	–
128	701.6	–	928.7	987.6	–	1301.6	–	1690.3	1756.7	–
129	705.0	–	934.4	994.6	–	1308.0	–	1701.4	1769.6	–
130	708.4	–	940.1	1001.6	–	1314.3	–	1712.4	1782.4	–
131	711.7	–	945.8	1008.6	–	1320.7	–	1723.5	1795.3	–
132	715.1	–	951.4	1015.5	–	1327.0	–	1734.4	1808.1	–
133	718.5	–	957.0	1022.5	–	1333.4	–	1745.3	1820.9	–
134	721.9	–	962.5	1029.5	–	1339.7	–	1756.2	1833.7	–
135	725.3	–	968.1	1036.4	–	1346.1	–	1767.0	1846.6	–
136	728.6	–	973.6	1043.3	–	1352.4	–	1777.8	1859.4	–
137	732.0	–	979.1	1050.3	–	1358.8	–	1788.5	1872.1	–
138	735.4	–	984.4	1057.2	–	1365.1	–	1799.2	1884.9	–
139	738.8	–	989.4	1064.1	–	1371.5	–	1809.8	1897.7	–
140	742.1	–	993.8	1071.0	–	1377.8	–	1820.4	1910.5	–
141	745.5	–	998.2	1077.9	–	1384.2	–	1830.9	1923.2	–
142	748.9	–	1002.6	1084.8	–	1390.5	–	1841.4	1936.0	–
143	752.3	–	1007.0	1091.7	–	1396.9	–	1851.8	1948.7	–
144	755.7	–	1011.4	1098.5	–	1403.2	–	1860.0	1961.4	–
145	759.0	–	1015.7	1105.4	–	1409.6	–	1868.2	1974.1	–
146	762.4	–	1020.1	1112.2	–	1415.9	–	1876.4	1986.9	–

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Distance	Pdiff	P	PP	PPP	PcP	Sdiff	S	SS	SSS	ScS
147	765.8	–	1024.5	1119.1	–	1422.3	–	1884.6	1999.6	–
148	769.2	–	1028.8	1125.9	–	1428.6	–	1892.8	2012.2	–
149	772.6	–	1033.1	1132.7	–	1435.0	–	1900.9	2024.9	–
150	775.9	–	1037.5	1139.5	–	1441.3	–	1909.0	2037.6	–
151	779.3	–	1041.8	1146.1	–	1447.7	–	1917.2	2050.2	–
152	782.7	–	1046.1	1152.6	–	1454.0	–	1925.3	2062.9	–
153	786.1	–	1050.4	1159.1	–	1460.4	–	1933.4	2075.5	–
154	789.5	–	1054.6	1165.6	–	1466.7	–	1941.4	2088.2	–
155	792.8	–	1058.9	1172.1	–	1473.1	–	1949.5	2100.8	–
156	796.2	–	1063.1	1178.5	–	1479.4	–	1957.5	2113.4	–
157	–	–	1067.4	1185.0	–	1485.8	–	1965.6	2126.0	–
158	–	–	1071.6	1191.4	–	1492.1	–	1973.6	2138.6	–
159	–	–	1075.8	1197.8	–	–	–	1981.5	2151.2	–
160	–	–	1080.0	1204.1	–	–	–	1989.5	2163.7	–
161	–	–	1084.2	1210.5	–	–	–	1997.4	2176.3	–
162	–	–	1088.3	1216.8	–	–	–	2005.3	2188.8	–
163	–	–	1092.5	1223.1	–	–	–	2013.2	2201.4	–
164	–	–	1096.3	1229.4	–	–	–	2021.1	2213.9	–
165	–	–	1100.1	1235.7	–	–	–	2028.9	2226.4	–
166	–	–	1103.8	1241.9	–	–	–	2036.8	2238.9	–
167	–	–	1107.5	1248.1	–	–	–	2043.8	2251.4	–
168	–	–	1111.2	1254.3	–	–	–	2050.7	2263.9	–
169	–	–	1114.9	1260.5	–	–	–	2057.6	2276.4	–
170	–	–	1118.5	1266.7	–	–	–	2064.5	2288.8	–
171	–	–	1122.2	1272.8	–	–	–	2071.4	2301.0	–
172	–	–	1125.9	1278.9	–	–	–	2078.3	2312.9	–
173	–	–	1129.5	1285.0	–	–	–	2085.2	2324.7	–
174	–	–	1133.2	1291.1	–	–	–	2092.0	2336.5	–
175	–	–	1136.8	1297.2	–	–	–	2098.9	2348.2	–
176	–	–	1140.4	1303.3	–	–	–	2105.7	2359.9	–
177	–	–	1144.0	1309.3	–	–	–	2112.5	2371.5	–
178	–	–	1147.6	1315.3	–	–	–	2119.3	2383.2	–
179	–	–	1151.2	1321.3	–	–	–	2126.1	2394.7	–
180	–	–	1154.8	1327.3	–	–	–	2132.8	2406.3	–

End of table

2. Reference Mars model

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     0.000    3.8000    2.1841    2.3040
    10.000    3.8000    2.1841    2.3040
    10.000    4.5000    2.8102    2.5700
    28.000    4.5000    2.8102    2.5700
mantle
    28.000    6.2240    3.7530    2.8630
    58.816    6.2240    3.7530    2.8630
    58.816    7.6680    4.3340    3.4460
    80.000    7.6680    4.3340    3.4460
    80.000    7.7008    4.3460    3.4600
   100.000    7.7008    4.3460    3.4600
   110.000    7.7075    4.3371    3.4650
   120.000    7.7075    4.3371    3.4650
   130.000    7.7103    4.3303    3.4680
   140.000    7.7125    4.3273    3.4700
   150.000    7.7138    4.3240    3.4710
   160.000    7.7157    4.3209    3.4730
   170.000    7.7175    4.3178    3.4740
   180.000    7.7188    4.3145    3.4760
   190.000    7.7203    4.3113    3.4770
   200.000    7.7218    4.3081    3.4790
   210.000    7.7236    4.3054    3.4800
   220.000    7.7250    4.3020    3.4810
   230.000    7.7265    4.2987    3.4830
   240.000    7.7281    4.2956    3.4840
   250.000    7.7297    4.2925    3.4860
   260.000    7.7311    4.2894    3.4870
   270.000    7.7324    4.2861    3.4880
   280.000    7.7343    4.2832    3.4900
   290.000    7.7356    4.2800    3.4910
   300.000    7.7371    4.2769    3.4920
   310.000    7.7384    4.2739    3.4940
   320.000    7.7402    4.2708    3.4950
   330.000    7.7410    4.2675    3.4960
   340.000    7.7422    4.2643    3.4980
   364.907    7.7454    4.2564    3.5010
   390.263    7.7482    4.2482    3.5040
   415.126    7.7782    4.2574    3.5130
   439.992    7.8080    4.2666    3.5220
   464.859    7.8368    4.2755    3.5310
   489.725    7.8651    4.2843    3.5390
   514.592    7.8931    4.2930    3.5470
   539.458    7.9202    4.3013    3.5560
   564.325    7.9476    4.3099    3.5640
   589.192    7.9746    4.3185    3.5720
   614.058    8.0003    4.3262    3.5800
   638.925    8.0267    4.3344    3.5880
   663.791    8.0526    4.3425    3.5970
   688.658    8.0781    4.3505    3.6050
   713.524    8.1036    4.3585    3.6130
   738.391    8.1287    4.3663    3.6200
   763.257    8.1548    4.3749    3.6290
   788.124    8.1803    4.3832    3.6370
   812.991    8.2058    4.3914    3.6450
   837.857    8.2321    4.4003    3.6530
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   862.724    8.2586    4.4093    3.6620
   887.590    8.3281    4.4592    3.6740
   912.457    8.3531    4.4672    3.6830
   937.323    8.3795    4.4754    3.6920
   962.190    8.4047    4.4832    3.7010
   987.056    8.4314    4.4912    3.7110
  1011.923    8.4606    4.5001    3.7230
  1036.789    8.5413    4.5434    3.7480
  1061.656    8.7271    4.6570    3.8010
  1086.523    8.9972    4.8263    3.8730
  1111.389    9.0204    4.8331    3.8820
  1136.256    9.0425    4.8397    3.8900
  1161.122    9.0636    4.8462    3.8980
  1185.989    9.0843    4.8531    3.9050
  1210.855    9.1042    4.8599    3.9110
  1235.722    9.1255    4.8666    3.9190
  1260.588    9.1583    4.8810    3.9290
  1285.455    9.2171    4.9127    3.9430
  1310.321    9.2774    4.9458    3.9580
  1335.188    9.3391    4.9804    3.9740
  1360.055    9.4018    5.0163    3.9900
  1384.921    9.4654    5.0534    4.0070
  1409.788    9.4935    5.0666    4.0160
  1434.654    9.5118    5.0732    4.0230
  1459.521    9.5299    5.0797    4.0290
  1484.387    9.5477    5.0862    4.0350
  1509.254    9.5656    5.0928    4.0420
  1534.120    9.5830    5.0992    4.0480
outer-core
  1534.120    4.9911    0.0000    5.4790
  1666.648    5.0725    0.0000    5.5620
  1799.175    5.1469    0.0000    5.6390
  1931.702    5.2146    0.0000    5.7090
  2064.229    5.2757    0.0000    5.7720
  2196.756    5.3305    0.0000    5.8290
  2329.283    5.3792    0.0000    5.8790
  2461.810    5.4218    0.0000    5.9240
  2594.337    5.4585    0.0000    5.9620
  2726.864    5.4895    0.0000    5.9940
  2859.392    5.5147    0.0000    6.0210
  2991.919    5.5342    0.0000    6.0410
  3124.446    5.5481    0.0000    6.0560
  3256.973    5.5565    0.0000    6.0650
  3380.000    5.0000    0.0000    7.0000
inner-core
  3380.000    5.0000    3.0000    7.0000
  3389.500    5.5565    3.0000    6.0650
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