

CHAPTER 13 GEOPOTENTIAL

The recommended geopotential field is the GEM-T1 model given in the following table.

The GM_{\oplus} and a_{\oplus} values reported with GEM-T1 ($398600.436 \text{ km}^3/\text{s}^2$ and 6378137 m) should be used as scale parameters with the geopotential coefficients. The recommended $GM_{\oplus} = 398600.44$ should be used with the two-body term. Although the GEM-T1 is given with terms through degree and order 36, only terms through degree and order twenty are required for Lageos.

Values for the C_{21} and S_{21} coefficients are not included in the GEM-T1 model (they were constrained to be zero in the solution), and so they should be handled separately.

The C_{21} and S_{21} coefficients describe the position of the Earth's figure axis. When averaged over many years, the figure axis should closely coincide with the observed position of the rotation pole averaged over the same time period. Any differences between the mean figure and mean rotation pole averaged would be due to long-period fluid motions in the atmosphere, oceans, or Earth's fluid core (Wahr, 1987, 1990). At present, there is no independent evidence that such motions are important. So, it is recommended that the mean values used for C_{21} and S_{21} give a mean figure axis that corresponds to the mean pole position of the Chapter 3 Terrestrial Reference Frame.

The BIH Circular D pole positions from 1982 through 1988 are consistent with the IERS Reference Pole to within $\pm 0''005$ corresponding to an uncertainty of $\pm 0.01 \times 10^{-9}$ in C_{21} (IERS) and S_{21} (IERS).

This choice for C_{21} and S_{21} is realized as follows. First, to use the geopotential coefficients to solve for a satellite orbit, it is necessary to rotate from the Earth-fixed frame, where the coefficients are pertinent, to an inertial frame, where the satellite motion is computed. This transformation between frames should include polar motion. We assume the polar motion parameters used are relative to the IERS Reference Pole. Then, if $C_{21} = S_{21} = 0$ were used, the assumed mean figure axis would coincide with the IERS Reference Pole.

If \bar{x} and \bar{y} are the angular displacements of the Chapter 3 Terrestrial Reference Frame relative to the IERS Reference Pole then the values

$$C_{21} = \bar{x}C_{20},$$

$$S_{21} = -\bar{y}C_{20}$$

(Lambeck, 1970) should be added to the geopotential model, so that the mean figure axis coincides with the Chapter 3 pole. This gives normalized coefficients of

$$\bar{C}_{21}(\text{IERS}) = -0.17 \times 10^{-8},$$

$$\bar{S}_{21}(\text{IERS}) = 1.19 \times 10^{-9}.$$

For consistency with the desired Terrestrial Reference Frame, the $\bar{C}_{21}(\text{IERS})$ and $\bar{S}_{21}(\text{IERS})$ are recommended for use in place of $C_{21}(\text{GEM-T1})$ and $S_{21}(\text{GEM-T1})$.

REFERENCES

- Lambeck, K., 1971, "Determination of the Earth's Pole of Rotation from Laser Range Observations to Satellites," Bulletin Geodesique, 101, pp. 263-280.
- Marsh, J. G., Lerch, F. J., Putney, B. H., Christodoulidis, D. C., Smith, D. E., Felstentreger, T. L., Sanchez, B. V., Klosko, S. M., Pavlis, E. C., Martin, T. V., Robbins, J. W., Williamson, R. G., Colombo, O. L., Rowlands, D. D., Eddy, W. F., Chandler, N. L., Rachlin, K. E., Patel, G. B., Bhati, S., Chinn, D. S., 1988, "A New Gravitational Model for the Earth from Satellite Tracking Data: GEM-T1," J. Geophys. Res., 93, pp. 6169-6215.
- Wahr, J., 1987, "The Earth's C_{21} and S_{21} gravity coefficients and the rotation of the core," Geophys. J. R. Astr. Soc., 88, pp. 265-276. Corrections can be found in Geophys. J. Int., in press.
- Wahr, J., 1990, in press.

GEM-T1 NORMALIZED COEFFICIENTS

($\times 10^6$)

ZONALS

INDEX N M	VALUE	INDEX N M	VALUE	INDEX N M	VALUE	INDEX N M	VALUE	INDEX N M	VALUE
* 2 0	-484.1649906	3 0	0.9572357	4 0	0.5387322	5 0	0.0687802	6 0	-0.1481004
7 0	0.0905337	8 0	0.0459023	9 0	0.0283764	10 0	0.0572211	11 0	-0.0512619
12 0	0.0320806	13 0	0.0422319	14 0	-0.0197327	15 0	0.0018731	16 0	-0.0093772
17 0	0.0203968	18 0	0.0112912	19 0	-0.0046084	20 0	0.0153150	21 0	0.0097754
22 0	-0.0048440	23 0	-0.0241260	24 0	-0.0009556	25 0	0.0068867	26 0	0.0018391
27 0	0.0041234	28 0	-0.0058541	29 0	-0.0039091	30 0	-0.0002749	31 0	0.0051154
32 0	0.0000819	33 0	0.0022286	34 0	-0.0024803	35 0	0.0012731	36 0	0.0007396

SECTORIALS AND TESSERALS

INDEX N M	VALUE C	S	INDEX N M	VALUE C	S	INDEX N M	VALUE C	S
** 3 1	2.0297737	0.2495946	4 1	-0.5334272	-0.4751189	5 1	-0.0589503	-0.0955435
6 1	-0.0813751	0.0238900	7 1	0.2770971	0.0978177	8 1	0.0288561	0.0547223
9 1	0.1480477	0.0245251	10 1	0.0769655	-0.1381110	11 1	0.0095019	-0.0278111
12 1	-0.0492610	-0.0496520	13 1	-0.0540617	0.0434555	14 1	-0.0187462	0.0232244
15 1	0.0082868	0.0142124	16 1	0.0317099	0.0173493	17 1	-0.0309381	-0.0268459
18 1	-0.0002253	-0.0456055	19 1	-0.0115942	0.0053764	20 1	0.0145119	-0.0212711
21 1	-0.0153942	0.0417459	22 1	0.0083946	-0.0147250	23 1	0.0008657	0.0145970
24 1	0.0081178	-0.0291987	25 1	0.0037145	0.0043498	26 1	0.0049741	-0.0172518
27 1	0.0005230	0.0066113	28 1	0.0065294	-0.0100251	29 1	0.0034699	0.0024176
30 1	-0.0016171	-0.0090886	31 1	0.0051782	0.0023829	32 1	-0.0091529	-0.0092451
33 1	0.0012672	0.0021258	34 1	-0.0015608	-0.0091011	35 1	-0.0019069	0.0020110
36 1	0.0028774	-0.0058408	2 2	2.4389280	-1.3998397	3 2	0.9035491	-0.6204198
4 2	0.3470021	0.6640304	5 2	0.6557902	-0.3234056	6 2	0.0516096	-0.3749956
7 2	0.3177108	0.0916083	8 2	0.0703801	0.0684494	9 2	0.0311365	-0.0323882
10 2	-0.0805212	-0.0513356	11 2	0.0090541	-0.0992414	12 2	0.0076400	0.0349183
13 2	0.0534361	-0.0575844	14 2	-0.0348122	-0.0060681	15 2	-0.0216258	-0.0364425
16 2	-0.0156437	0.0245431	17 2	-0.0057800	0.0171247	18 2	0.0084083	0.0168428
19 2	0.0084369	-0.0104744	20 2	0.0198772	0.0032259	21 2	0.0009874	-0.0026067
22 2	-0.0142925	0.0020958	23 2	-0.0005313	-0.0017780	24 2	-0.0058515	0.0052022
25 2	0.0037220	0.0052068	26 2	-0.0052887	0.0002522	27 2	0.0102174	-0.0028223
28 2	-0.0084276	-0.0115524	29 2	0.0094632	-0.0043311	30 2	-0.0040515	-0.0053645
31 2	0.0066008	0.0008362	32 2	0.0018649	0.0043749	33 2	-0.0010231	0.0009548
34 2	0.0035817	0.0051783	35 2	-0.0025529	0.0010277	36 2	0.0001790	0.0012922
3 3	0.7209866	1.4131694	4 3	0.9909779	-0.2006215	5 3	-0.4482036	-0.2151363
6 3	0.0619709	0.0046430	7 3	0.2507429	-0.2091639	8 3	-0.0199664	-0.0869367
9 3	-0.1553742	-0.0840158	10 3	-0.0013119	-0.1614824	11 3	-0.0288895	-0.1324963
12 3	0.0324198	0.0179438	13 3	-0.0140259	0.0836615	14 3	0.0369311	0.0224222
15 3	0.0446271	0.0265447	16 3	-0.0320841	-0.0450272	17 3	0.0101214	0.0098939
18 3	-0.0010020	-0.0070483	19 3	0.0014391	0.0141955	20 3	0.0082691	0.0137151
21 3	0.0019941	0.0226923	22 3	0.0067253	-0.0080913	23 3	-0.0045642	-0.0119458

* \bar{C}_{20} does not include the zero frequency term; see Chapter 6 (Eq. 5) for the adjusted value.

** \bar{C}_{21} and \bar{S}_{21} should be the IERS values; see this chapter for recommended values.

INDEX		VALUE		INDEX		VALUE		INDEX		VALUE	
N	M	C	S	N	M	C	S	N	M	C	S
24	3	0.0069148	-0.0105925	25	3	-0.0032642	-0.0031087	26	3	-0.0002621	-0.0037215
27	3	-0.0051035	-0.0018585	28	3	-0.0002646	0.0011662	29	3	-0.0043864	-0.0017609
30	3	-0.0016075	0.0014770	31	3	-0.0018668	-0.0040769	32	3	-0.0006663	0.0029992
33	3	-0.0017072	-0.0028776	34	3	-0.0005145	0.0022065	35	3	0.0006733	0.0006861
36	3	-0.0008129	-0.0013852	4	4	-0.1900348	0.3084595	5	4	-0.2948236	0.0524087
6	4	-0.0927975	-0.4733069	7	4	-0.2737404	-0.1220207	8	4	-0.2460639	0.0677453
9	4	-0.0128303	0.0232637	10	4	-0.0973123	-0.0693825	11	4	-0.0332108	-0.0700036
12	4	-0.0653020	-0.0030125	13	4	-0.0088182	-0.0003732	14	4	-0.0088329	0.0018783
15	4	-0.0443760	0.0126416	16	4	0.0365123	0.0438559	17	4	0.0125878	0.0312242
18	4	0.0434167	0.0060924	19	4	0.0025699	0.0076747	20	4	-0.0017951	0.0008281
21	4	-0.0002550	0.0069894	22	4	-0.0094462	0.0167100	23	4	-0.0100336	-0.0016696
24	4	0.0060580	0.0181145	25	4	0.0063503	-0.0015335	26	4	0.0053222	0.0048968
27	4	0.0029164	-0.0006401	28	4	0.0028786	-0.0024855	29	4	-0.0063641	0.0007289
30	4	-0.0021102	-0.0039250	31	4	-0.0049509	-0.0016392	32	4	0.0020179	-0.0033825
33	4	-0.0002362	0.0003938	34	4	0.0028502	-0.0018773	35	4	0.0027442	0.0014864
36	4	0.0001181	-0.0058408	5	5	0.1777563	-0.6660281	6	5	-0.2657650	-0.5377472
7	5	0.0034750	0.0196519	8	5	-0.0249335	0.0853003	9	5	-0.0141122	-0.0600627
10	5	-0.0504401	-0.0438269	11	5	0.0459086	0.0552848	12	5	0.0306040	-0.0014745
13	5	0.0596176	0.0574460	14	5	0.0227952	-0.0116078	15	5	0.0160742	0.0108864
16	5	-0.0077242	-0.0016773	17	5	-0.0111472	-0.0056031	18	5	0.0017426	0.0211276
19	5	-0.0024457	0.0173789	20	5	-0.0104182	0.0003034	21	5	0.0177593	-0.0158911
22	5	-0.0046335	-0.0001257	23	5	0.0019941	-0.0079407	24	5	-0.0140838	-0.0079805
25	5	-0.0024585	-0.0023514	26	5	0.0043007	0.0106472	27	5	-0.0015884	0.0037103
28	5	0.0029222	-0.0002361	29	5	0.0034464	0.0035422	30	5	0.0033916	0.0006983
31	5	0.0009096	0.0014649	32	5	-0.0000480	-0.0027949	33	5	-0.0005132	0.0032353
34	5	-0.0012952	0.0000401	35	5	-0.0002351	-0.0007374	36	5	-0.0011798	0.0003403
6	6	0.0090593	-0.2363344	7	6	-0.3578527	0.1509175	8	6	-0.0664178	0.3128323
9	6	0.0705263	0.2166285	10	6	-0.0347366	-0.0777189	11	6	0.0084723	0.0242910
12	6	0.0013881	0.0458322	13	6	-0.0223869	-0.0118360	14	6	-0.0031868	0.0065119
15	6	0.0272318	-0.0517077	16	6	0.0179949	-0.0267835	17	6	0.0002920	-0.0204166
18	6	0.0311991	-0.0085569	19	6	-0.0062545	0.0039169	20	6	0.0127607	0.0009662
21	6	0.0042146	-0.0083501	22	6	0.0146261	0.0024348	23	6	0.0099988	0.0049568
24	6	-0.0003055	-0.0006641	25	6	0.0059358	-0.0067430	26	6	0.0085388	0.0031968
27	6	0.0017746	-0.0021342	28	6	-0.0083296	0.0020029	29	6	-0.0002960	-0.0024663
30	6	-0.0032177	0.0041679	31	6	-0.0005622	0.0007667	32	6	-0.0038310	0.0002190
33	6	0.0013824	-0.0012542	34	6	0.0005808	-0.0003220	35	6	0.0008304	-0.0014752
36	6	-0.0005757	-0.0008988	7	7	0.0015976	0.0220013	8	7	0.0704248	0.0748626
9	7	-0.1186233	-0.1005510	10	7	0.0097468	-0.0042901	11	7	0.0096093	-0.0918891
12	7	-0.0126975	0.0348291	13	7	0.0035736	-0.0066171	14	7	0.0374843	-0.0043588
15	7	0.0667130	0.0114545	16	7	0.0030511	-0.0090737	17	7	0.0229520	-0.0119809
18	7	-0.0007957	0.0067159	19	7	0.0051443	-0.0016620	20	7	-0.0077913	0.0048958
21	7	-0.0122279	-0.0014058	22	7	0.0127538	0.0013042	23	7	-0.0023282	0.0026452
24	7	-0.0025113	0.0050662	25	7	0.0002632	0.0034596	26	7	0.0054524	0.0025831
27	7	0.0069279	-0.0028217	28	7	-0.0046459	-0.0015444	29	7	0.0011830	-0.0072940
30	7	-0.0001720	-0.0001291	31	7	0.0014817	-0.0017479	32	7	-0.0030832	0.0018611
33	7	-0.0000405	0.0017756	34	7	0.0023148	0.0001028	35	7	0.0000748	0.0015282
36	7	-0.0001662	-0.0004199	8	8	-0.1188827	0.1223320	9	8	0.1844954	-0.0018494
10	8	0.0437468	-0.0924808	11	8	-0.0063530	0.0225827	12	8	-0.0212177	0.0169046
13	8	-0.0122964	-0.0110925	14	8	-0.0329416	-0.0131814	15	8	-0.0406660	0.0247325
16	8	-0.0134376	0.0022804	17	8	0.0311564	0.0087750	18	8	0.0457191	0.0004305

INDEX		VALUE		INDEX		VALUE		INDEX		VALUE	
N	M	C	S	N	M	C	S	N	M	C	S
19	8	0.0148626	-0.0113273	20	8	-0.0020109	-0.0012912	21	8	-0.0181008	0.0025208
22	8	-0.0098173	-0.0068267	23	8	0.0042209	-0.0067954	24	8	-0.0024330	0.0075574
25	8	0.0014256	-0.0041241	26	8	0.0030889	-0.0021407	27	8	-0.0041794	-0.0044059
28	8	-0.0005655	-0.0031778	29	8	-0.0064245	0.0025406	30	8	0.0029536	0.0005720
31	8	0.0000872	-0.0011845	32	8	0.0008818	0.0033226	33	8	-0.0000823	0.0015750
34	8	0.0007083	-0.0007860	35	8	0.0002679	0.0001772	36	8	-0.0010487	-0.0005378
9	9	-0.0555457	0.0975889	10	9	0.1281797	-0.0481860	11	9	-0.0387774	0.0402849
12	9	0.0469380	0.0132223	13	9	0.0203827	0.0457820	14	9	0.0371609	0.0179332
15	9	0.0134441	0.0410187	16	9	-0.0165750	-0.0509825	17	9	-0.0032015	-0.0343246
18	9	-0.0135216	0.0192446	19	9	0.0017566	0.0086593	20	9	0.0228121	0.0072350
21	9	0.0173205	-0.0093913	22	9	0.0125106	-0.0094816	23	9	-0.0040274	-0.0103916
24	9	-0.0038940	-0.0014302	25	9	-0.0060297	0.0098442	26	9	0.0025191	-0.0006592
27	9	0.0003990	0.0021553	28	9	0.0029414	-0.0030550	29	9	-0.0016394	0.0024790
30	9	0.0001665	-0.0039351	31	9	-0.0038941	-0.0017016	32	9	0.0019461	0.0007681
33	9	-0.0002939	0.0018691	34	9	0.0012660	0.0015093	35	9	0.0010826	-0.0020731
36	9	-0.0003170	0.0005484	10	10	0.0945596	-0.0201041	11	10	-0.0520582	-0.0176126
12	10	-0.0091273	0.0316782	13	10	0.0433028	-0.0380383	14	10	0.0369953	-0.0027966
15	10	0.0095928	0.0160812	16	10	-0.0104171	0.0066056	17	10	0.0021050	0.0201193
18	10	0.0090063	-0.0108619	19	10	-0.0353538	-0.0026556	20	10	-0.0224201	-0.0080926
21	10	0.0036543	0.0018356	22	10	0.0050062	0.0203830	23	10	0.0199758	-0.0037585
24	10	0.0173535	0.0092954	25	10	0.0056907	-0.0044669	26	10	-0.0048370	0.0016645
27	10	-0.0083100	0.0060112	28	10	-0.0072826	0.0012046	29	10	0.0000602	0.0060144
30	10	0.0012265	-0.0010402	31	10	0.0025178	-0.0037447	32	10	0.0008308	-0.0019507
33	10	0.0002341	-0.0009449	34	10	-0.0014879	-0.0000093	35	10	-0.0014313	-0.0008354
36	10	-0.0003570	0.0004671	11	11	0.0543322	-0.0547288	12	11	0.0054143	-0.0095228
13	11	-0.0401906	0.0055015	14	11	0.0080835	-0.0413614	15	11	0.0017171	0.0289322
16	11	0.0140156	-0.0064368	17	11	-0.0171108	0.0175019	18	11	-0.0127989	-0.0005971
19	11	0.0164804	0.0134748	20	11	0.0113787	-0.0239305	21	11	0.0092806	-0.0367834
22	11	-0.0093740	-0.0183775	23	11	0.0038490	0.0136794	24	11	0.0127396	0.0121180
25	11	0.0055793	-0.0012766	26	11	0.0032045	0.0050467	27	11	-0.0011883	-0.0030951
28	11	-0.0006214	-0.0008290	29	11	-0.0093226	0.0004548	30	11	-0.0016207	0.0050752
31	11	-0.0016631	0.0058521	32	11	-0.0024010	-0.0006463	33	11	0.0055568	-0.0004803
34	11	0.0012406	-0.0038325	35	11	0.0006785	-0.0036583	36	11	0.0005880	-0.0007308
12	12	-0.0035280	-0.0117964	13	12	-0.0280059	0.0864102	14	12	0.0089681	-0.0320668
15	12	-0.0283317	0.0124872	16	12	0.0208803	0.0057370	17	12	0.0342734	0.0172570
18	12	-0.0261819	-0.0165262	19	12	0.0032037	0.0043292	20	12	-0.0040581	0.0172980
21	12	0.0028236	0.0127066	22	12	0.0074377	-0.0078426	23	12	0.0215777	-0.0166812
24	12	0.0123406	-0.0095152	25	12	-0.0055425	0.0110100	26	12	-0.0196457	0.0054338
27	12	-0.0004228	-0.0017182	28	12	0.0004024	0.0024269	29	12	-0.0008339	-0.0049254
30	12	0.0037915	-0.0034240	31	12	0.0001491	0.0046159	32	12	-0.0017118	0.0041940
33	12	0.0052208	0.0041268	34	12	0.0004550	0.0024876	35	23	0.0014841	-0.0020619
36	12	-0.0002182	-0.0016068	13	13	-0.0615483	0.0682661	14	13	0.0315333	0.0446234
15	13	-0.0281051	-0.0049829	16	13	0.0130754	0.0006134	17	13	0.0169075	0.0201122
18	13	-0.0065815	-0.0351551	19	13	-0.0060894	-0.0291709	20	13	0.0266491	0.0048913
21	13	-0.0181694	0.0115969	22	13	-0.0169455	0.0178453	23	13	-0.0104578	-0.0075112
24	13	-0.0036235	-0.0003824	25	13	0.0073795	-0.0151883	26	13	0.0027230	0.0014151
27	13	-0.0059813	-0.0041287	28	13	0.0000983	0.0035308	29	13	-0.0011458	-0.0019753
30	13	0.0146742	-0.0000192	31	13	0.0056871	0.0013250	32	13	0.0072556	0.0002229
33	13	0.0036684	0.0067767	34	13	-0.0080803	0.0012768	35	13	-0.0011849	0.0044812
36	13	0.0007685	0.0037948	14	14	-0.0505657	-0.0063741	15	14	0.0061707	-0.0256132

INDEX		VALUE		INDEX		VALUE		INDEX		VALUE	
N	M	C	S	N	M	C	S	N	M	C	S
16	14	-0.0191226	-0.0382895	17	14	-0.0133370	0.0117613	18	14	-0.0092828	-0.0109400
19	14	-0.0051227	-0.0126448	20	14	0.0103228	-0.0117620	21	14	0.0187760	0.0086994
22	14	0.0087280	0.0102407	23	14	0.0046108	-0.0032737	24	14	-0.0186436	0.0014570
25	14	-0.0219418	0.0132058	26	14	0.0039290	0.0056350	27	14	0.0119702	0.0066379
28	14	-0.0021064	-0.0065025	29	14	-0.0051525	0.0019409	30	14	-0.0000327	-0.0025522
31	14	-0.0072828	0.0012481	32	14	0.0046569	0.0069216	33	14	0.0092319	0.0025099
34	14	-0.0010431	-0.0002878	35	14	-0.0004836	-0.0001238	36	14	-0.0048384	-0.0040665
15	15	-0.0180948	-0.0080854	16	15	-0.0125321	-0.0322958	17	15	0.0049435	0.0057493
18	15	-0.0377619	-0.0198247	19	15	-0.0183164	-0.0127675	20	15	-0.0227306	-0.0004135
21	15	0.0166205	0.0149837	22	15	0.0279373	0.0031033	23	15	0.0177318	-0.0022813
24	15	0.0098097	-0.0135286	25	15	-0.0019899	-0.0022710	26	15	-0.0113797	0.0047010
27	15	-0.0043373	0.0001002	28	15	-0.0082106	0.0053751	29	15	-0.0012718	-0.0024918
30	15	0.0028146	-0.0092780	31	15	0.0004541	-0.0043732	32	15	0.0039107	-0.0049375
33	15	-0.0030055	0.0021726	34	15	0.0007643	0.0030005	35	15	0.0002609	0.0028304
36	15	-0.0018223	0.0018634	16	16	-0.0324114	-0.0043686	17	16	-0.0290683	0.0018848
18	16	0.0097880	0.0050024	19	16	-0.0199047	-0.0119326	20	16	-0.0106685	0.0016919
21	16	0.0087331	-0.0051553	22	16	0.0000892	-0.0049265	23	16	0.0049029	0.0117671
24	16	-0.0004908	0.0062766	25	16	0.0030419	-0.0127972	26	16	0.0058241	-0.0041510
27	16	0.0065849	-0.0041072	28	16	-0.0083073	-0.0076860	29	16	-0.0021980	-0.0055327
30	16	0.0006189	0.0056597	31	16	-0.0045141	0.0048013	32	16	0.0029187	0.0041010
33	16	-0.0003879	0.0019724	34	16	0.0011337	-0.0026578	35	16	0.0001314	-0.0013369
36	16	0.0013405	-0.0020055	17	17	-0.0383106	-0.0206234	18	17	0.0061142	0.0087663
19	17	0.0279459	-0.0108837	20	17	0.0042934	-0.0089776	21	17	-0.0067459	0.0008396
22	17	0.0138079	-0.0111258	23	17	-0.0072125	-0.0066031	24	17	-0.0084625	0.0018817
25	17	-0.0083083	0.0005500	26	17	-0.0048890	0.0082820	27	17	0.0055505	0.0015914
28	17	0.0045201	-0.0042606	29	17	0.0045708	-0.0027849	30	17	0.0010057	-0.0015438
31	17	-0.0059335	0.0025686	32	17	-0.0036602	0.0018909	33	17	-0.0021426	0.0030432
34	17	0.0003626	0.0025764	35	17	0.0033863	-0.0024391	36	17	0.0021679	-0.0008490
18	18	-0.0044492	-0.0050647	19	18	0.0216467	-0.0031131	20	18	0.0105771	0.0013024
21	18	0.0168304	-0.0065691	22	18	0.0070311	-0.0102955	23	18	-0.0019056	-0.0063023
24	18	0.0043072	-0.0050725	25	18	-0.0013004	-0.0106697	26	18	-0.0090148	0.0075516
27	18	-0.0051898	0.0059394	28	18	0.0003645	-0.0008295	29	18	-0.0020095	-0.0001378
30	18	0.0003035	0.0008530	31	18	0.0025645	0.0008491	32	18	0.0022105	-0.0014795
33	18	0.0008702	-0.0012393	34	18	-0.0027232	-0.0000869	35	18	0.0015003	-0.0005937
36	18	0.0000693	0.0005306	19	19	0.0064638	0.0104244	20	19	-0.0070980	0.0084586
21	19	-0.0209515	0.0158790	22	19	0.0066210	-0.0046952	23	19	-0.0086827	0.0074916
24	19	0.0005274	-0.0150179	25	19	0.0091802	0.0021317	26	19	0.0016260	0.0007199
27	19	0.0009254	-0.0062305	28	19	0.0044182	0.0138003	29	19	-0.0021920	0.0015059
30	19	-0.0056266	-0.0026384	31	19	0.0020172	0.0028162	32	19	0.0030881	-0.0015146
33	19	0.0016796	0.0002369	34	19	0.0005953	-0.0010032	35	19	-0.0029031	0.0005932
36	19	-0.0002562	-0.0000695	20	20	0.0017085	-0.0135051	21	20	-0.0190411	0.0185361
22	20	-0.0133152	0.0147789	23	20	0.0172248	-0.0090475	24	20	-0.0060619	-0.0003298
25	20	-0.0037315	-0.0066217	26	20	0.0094830	-0.0109488	27	20	0.0029525	0.0030106
28	20	-0.0009805	0.0011271	29	20	-0.0047996	0.0031625	30	20	-0.0000276	0.0035666
31	20	0.0018947	0.0005595	32	20	-0.0015881	0.0014199	33	20	0.0020822	-0.0007525
34	20	0.0008917	-0.0003975	35	20	-0.0007745	-0.0008763	36	20	-0.0009128	-0.0008661
21	21	0.0024775	-0.0068510	22	21	-0.0132244	0.0075983	23	21	0.0108195	0.0076428
24	21	0.0105744	0.0011197	25	21	0.0053968	0.0031404	26	21	-0.0003907	-0.0024147
27	21	0.0020712	-0.0045432	28	21	0.0024900	0.0002697	29	21	-0.0093986	-0.0059494
30	21	-0.0074518	-0.0030982	31	21	0.0023358	0.0035767	32	21	0.0011690	0.0058848

INDEX		VALUE		INDEX		VALUE		INDEX		VALUE	
N	M	C	S	N	M	C	S	N	M	C	S
33	21	0.0007319	-0.0008394	34	21	0.0013743	-0.0006590	35	21	0.0013843	0.0027357
36	21	0.0007411	-0.0021175	22	22	-0.0014623	0.0047182	23	22	-0.0009034	-0.0021445
24	22	-0.0017322	-0.0013033	25	22	-0.0018741	-0.0017578	26	22	0.0109119	0.0091610
27	22	-0.0001430	0.0029341	28	22	-0.0048465	0.0005118	29	22	0.0096562	0.0044395
30	22	0.0032458	-0.0055410	31	22	-0.0062664	-0.0057325	32	22	-0.0046595	0.0007455
33	22	-0.0040992	-0.0010974	34	22	0.0008294	0.0004221	35	22	0.0000159	0.0033003
36	22	0.0005732	0.0006864	23	23	0.0008446	0.0002030	24	23	-0.0021435	-0.0090055
25	23	0.0045743	-0.0024633	26	23	0.0023537	0.0089516	27	23	-0.0053881	-0.0027372
28	23	-0.0026403	0.0063891	29	23	-0.0050118	-0.0000780	30	23	-0.0015833	-0.0053377
31	23	0.0095047	0.0056544	32	23	0.0038573	0.0004759	33	23	-0.0006277	-0.0043975
34	23	-0.0009300	-0.0021403	35	23	-0.0023783	-0.0015551	36	23	-0.0012168	-0.0005518
24	24	0.0023438	-0.0012129	25	24	0.0036065	-0.0038584	26	24	-0.0013736	0.0121837
27	24	-0.0019361	0.0026238	28	24	0.0068762	-0.0150841	29	24	-0.0025342	0.0037024
30	24	-0.0025120	-0.0000377	31	24	-0.0038298	-0.0019101	32	24	-0.0065905	0.0053251
33	24	0.0039903	-0.0004821	34	24	0.0067267	0.0008511	35	24	0.0025277	0.0021953
36	24	0.0006589	-0.0014201	25	25	0.0049455	0.0040141	26	25	-0.0039876	0.0082488
27	25	0.0118014	0.0031453	28	25	0.0011295	-0.0048096	29	25	0.0083057	0.0036286
30	25	0.0088475	-0.0056062	31	25	-0.0077449	-0.0002757	32	25	-0.0131730	0.0077043
33	25	-0.0012628	-0.0048224	34	25	0.0062516	-0.0082080	35	25	-0.0033892	0.0015231
36	25	0.0000270	0.0086477	26	26	0.0034281	-0.0042690	27	26	-0.0050080	0.0040035
28	26	0.0034421	0.0016811	29	26	0.0062584	-0.0036878	30	26	-0.0032087	0.0081399
31	26	-0.0046923	0.0003639	32	26	-0.0010511	-0.0015337	33	26	0.0081343	0.0055386
34	26	0.0010816	-0.0090061	35	26	-0.0143438	-0.0001412	36	26	0.0084469	0.0110849
27	27	0.0068945	0.0034538	28	27	-0.0099247	0.0013336	29	27	-0.0074725	-0.0021507
30	27	-0.0019206	0.0078152	31	27	0.0069960	0.0122525	32	27	-0.0030949	-0.0030221
33	27	-0.0103323	-0.0021297	34	27	0.0068974	-0.0005442	35	27	0.0027787	-0.0191290
36	27	-0.0101912	0.0042305	28	28	0.0067689	0.0019493	29	28	0.0103226	-0.0019625
30	28	-0.0089658	-0.0051589	31	28	0.0003428	0.0017261	32	28	0.0015717	0.0023530
33	28	-0.0108851	0.0018952	34	28	0.0045502	-0.0081979	35	28	-0.0108936	-0.0233542
36	28	0.0069480	0.0056619	29	29	0.0086336	0.0031601	30	29	0.0048227	0.0001240
31	29	-0.0054215	-0.0059502	32	29	-0.0033428	0.0025024	33	29	-0.0213209	0.0001932
34	29	-0.0038113	-0.0044842	35	29	-0.0039791	0.0005664	36	29	-0.0013415	-0.0024474
30	30	-0.0015075	-0.0004221	31	30	-0.0024527	0.0084230	32	30	0.0082893	0.0016713
33	30	0.0025217	-0.0134935	34	30	-0.0061161	0.0000268	35	30	0.0037128	-0.0028852
36	30	-0.0015551	-0.0020261	31	31	-0.0002319	-0.0000737	32	31	-0.0007616	-0.0027125
33	31	0.0001745	0.0011566	34	31	0.0023534	0.0022983	35	31	0.0013305	0.0010339
36	31	-0.0035516	0.0013604	32	32	0.0007277	0.0005068	33	32	0.0024100	-0.0000219
34	32	-0.0008166	-0.0011610	35	32	-0.0039791	0.0005664	36	32	-0.0008804	-0.0003000
33	33	-0.0002676	-0.0003603	34	33	0.0010234	0.0013813	35	33	-0.0002881	0.0016655
36	33	-0.0023972	-0.0026170	34	34	-0.0002093	-0.0006039	35	34	-0.0005168	0.0001237
36	34	0.0008324	0.0017560	35	35	0.0000938	-0.0001450	36	35	0.0002152	-0.0007347
36	36	0.0001484	0.0004197								