An Assessment of the Gravity Data Collected at the Mohe Observation Center in China during the March 9, 1997 Total Solar Eclipse

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An assessment was done of the gravity data collected at the Mohe Observation Center in China during the March 9, 1997 total solar eclipse. After a search for the original tabulated measured data proved unsuccessful, the data was reconstituted by extracting values from a graph of the data found in a report. The reconstituted measured gravity values were processed by removing an approximation of what the gravity would have been had no eclipse occurred, leaving values of the gravity caused by the eclipse. These values were plotted and analyzed. The plot shows that, contrary to previous claims, there does not appear to be any anomalies in the data. The graph also suggests that the gravimeter collecting the data sensed the eclipse about eight minutes before it was visually noticeable. Based on the gravity profile of the eclipse, it appears to have behaved as expected.

1. Introduction

During a total solar eclipse that occurred the morning of March 9, 1997, the variations in gravity were measured at the Mohe Observation Center (MOC) in China using a high-precision LaCoste-Romberg D gravimeter. The data collected was analyzed and the results of that analysis were initially reported in reference 1. Due to the unexpected behavior of the data, subsequent reviews of the analysis raised questions of gravitational shielding by the Moon. Two large dips in the data that occur just before the start of the eclipse and just after the end fueled a plethora speculation about what may be happening to cause them, but no credible answers have been offered.

The following report discusses the techniques used to assess the Mohe gravity data and presents the findings of that assessment.

2. Obtaining the Measured Data

The eclipse began at 8:03:29 AM local time and concluded at 10:19:50 AM. According to reference 2, from 6:00 AM to 12:00 noon, a total of 1,760 data points were collected. However, after an exhaustive search through dozens of journals, and an unsuccessful attempt to access the World Data Center geophysical database [3], no tabular record of the data was found, nor was reference 1, which reference 2 seems to imply contained the data. The only available record of the measured data appears in two graphs, Fig. 1 and Fig. 4 in reference 2. The data used in this assessment was extracted from Fig. 4. That graph is shown here in Figure 1, below. There are three sets of information provided by the graph.

The solid curve labeled 1 is a calculated theoretical value of the gravity supposedly due to gravitational tides (GT) for that time. No discussion about the calculation or reference to any description of it is given. It is likely discussed in reference 1. The dots along the solid curve are the measured gravity (MG) values. Finally, the dotted curve labeled 2 is the difference between the MG values and the GT values in curve 1, or the delta gravity (DG) values. This is the change in gravity caused by the eclipse.

A reasonable representation of the data was obtained by extracting the values off of the graph. A grid was laid over the graph in a drawing program and the whole thing was magnified by a factor of six. Then the drawing window x-y coordinates of the various points were recorded and converted to their corresponding gravity values at particular times. Two sets of data were extracted: the GT values from curve 1 from 6:00 AM to 11:59 AM, and the DG values from curve 2 from 6:00 AM to 11:59 AM. One value of each was obtained for each minute. The values are listed in Table 1 of the Appendix. Once extracted, the raw values for the GT were fit to a third-order polynomial curve to smooth out the data. A plot of the data values and the fit are shown below in Figure 2. The R^2 of the fit is 0.9999, essentially perfect. The values for the data and the fit are given in Table 2 of the Appendix.

The extracted DG values (from Figure 1, curve 2) are shown in Figure 2, along with a blown up swatch of Figure 1 showing the original DG data with a grid laying over it. Side by side it is easy to see that the data extracted from Figure 1 (shown in the top graph in Figure 3) is essentially the same the data in curve 2 of Figure 1. The two curves in Figure 3 have the same profiles both in time and in gravity.

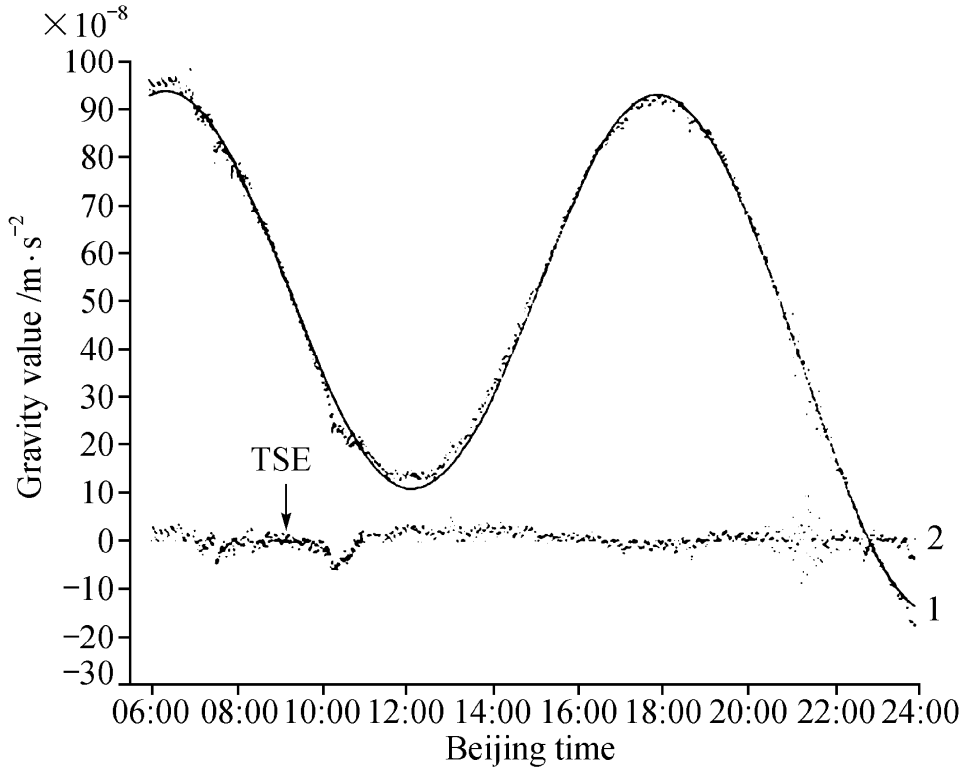

Figure 1: Measured gravity variations at MOC on March 9, 1997.

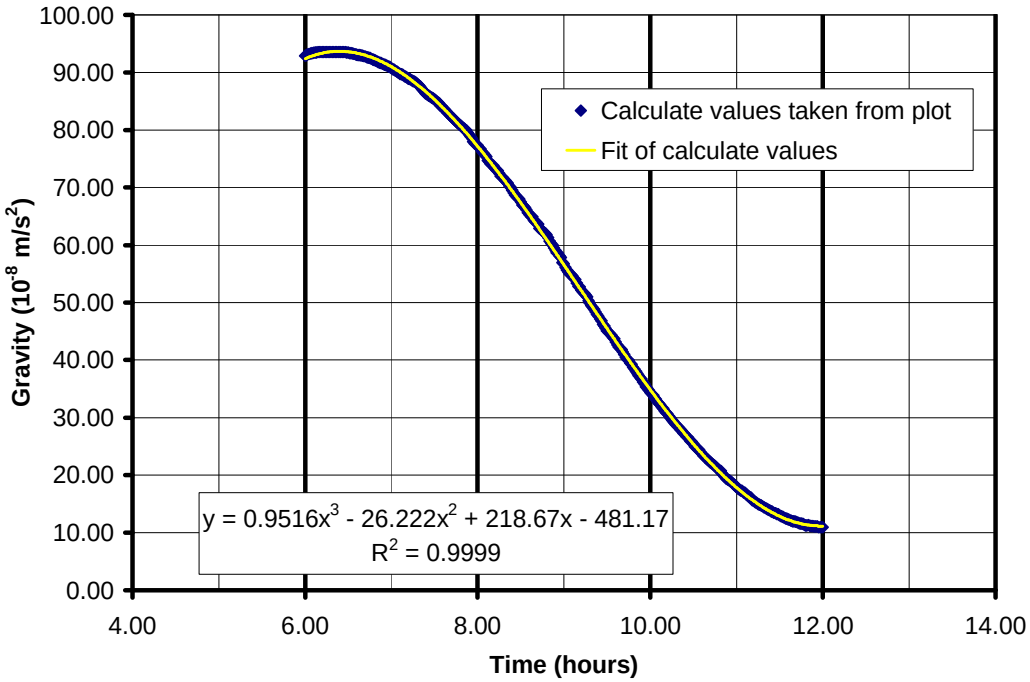

Figure 2: Plot of calculated theoretical gravity values taken from Reference 2, Fig. 4.

Using the GT data and the DG data, a set of extracted MG values for the eclipse can be formed. Adding the two together should give a set of points that is very similar to the measured points along the solid curve in Figure 1. As shown in Figure 4, the data points are distributed essentially the same in the reconstituted plot on the left as they are in the plot from Fig. 4 from reference 2. Table 3 in the Appendix has the measured values and the theoretical values used in the plot on the left in Figure 4.

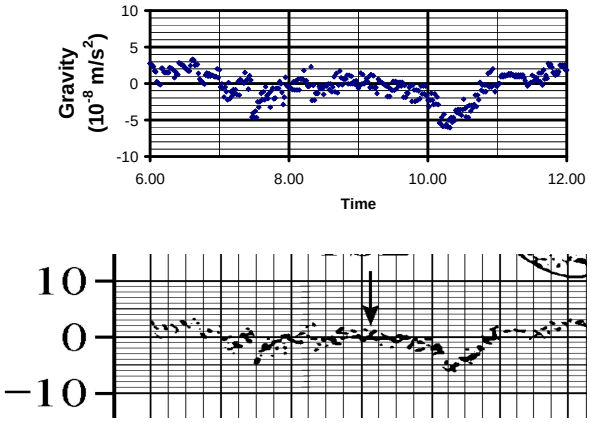

Figure 3: Extracted delta gravity data (top graph) compared to data from Ref. 2 (bottom graph).

Based on the comparisons above, it appears that reasonable representations of the MG and GT data collected at the MOC during the eclipse of March 9, 1997 have been extracted from the graphical record.

3. Processing the Data

As previously mentioned, an analysis of the measured data was done by subtracting the calculated theoretical gravity due to gravitational tides from the gravity values measured during the eclipse, attempting to isolate the effects of the eclipse. It appears the thinking was that the GT calculation does not model the effects of the eclipse, just what would normally factor into the tidal gravity when no eclipse is occurring. However, reviewing the graph of the measured and theoretical gravities, it appears that assumption was incorrect. The graph clearly shows that the gravitational tide model (GTM) was very successful at modeling the gravity caused by the eclipse. The calculation lies practically on top of the measured values during the eclipse. The only instances where the GTM appeared to have some difficulty were: transitioning from a no-eclipse configuration to an eclipse configuration; and from an eclipse mode back to a no-eclipse mode. In both cases it over predicted the strength of the gravity.

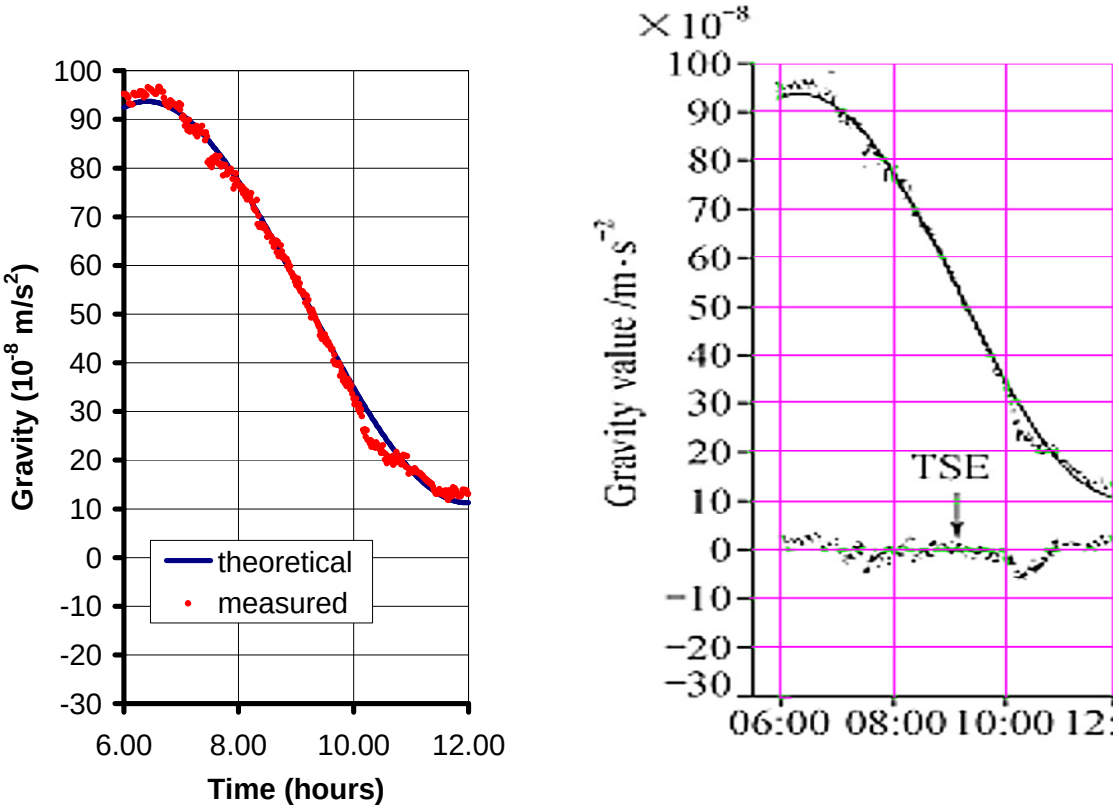

Figure 4: Comparison of extracted (left) and reported (right) measures gravity values.

One way to approximate what the gravity would be during the time the eclipse occurred if there was no eclipse; is to remove the gravity values during the eclipse from the measured data and do a polynomial fit of the data left. The gravity curve is well behaved over time, so the fit probably comes pretty close to what actually happens when there is no eclipse occurring. This was demonstrated by how well a polynomial fit tracked the GT gravity over time (Figure 2). To generate the new theoretical gravity (NGT) curve, the gravity values from 7:30 AM to 10:30 AM were removed from the measured data, and a fourth-order polynomial fit was done for the remaining points. Figure 5 shows the points that were used in the fit and the results of the fit. The fit does an excellent job of tracking the no-eclipse gravity data, producing an R^2 of 0.9992. The data points from the fit are listed in Table 4.

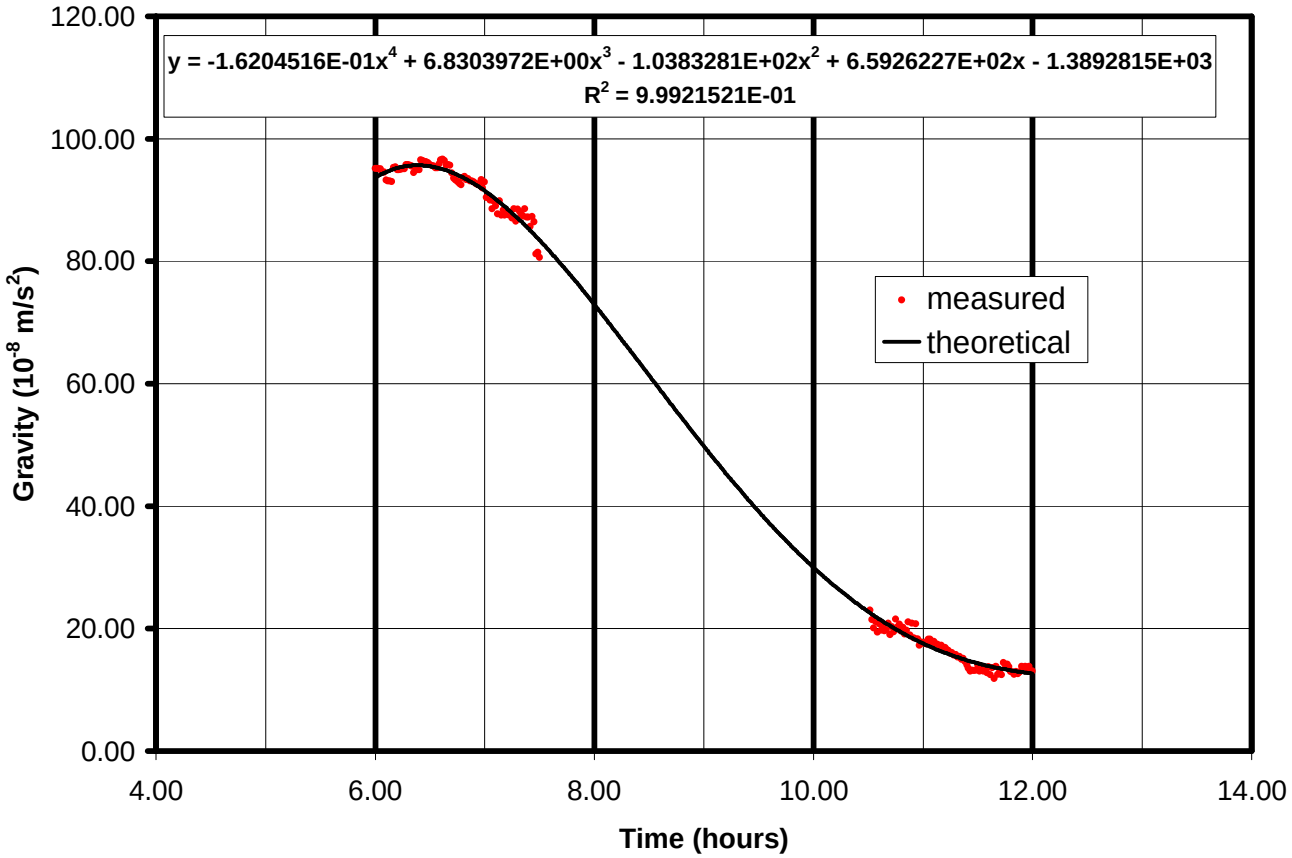

Figure 5: Non-eclipse measured gravity values and a fourth-order polynomial fit of those values.

Figure 6 shows that, if the eclipse data is placed back onto the graph with the NGT curve, there is now separation between the actual eclipse gravity values and the no-eclipse theoretical gravity curve. Now, when the theoretical gravity values are subtracted from the measured values, they produce the new delta gravity curve shown in Figure 7. These delta gravity values are listed in Table 5 of the Appendix along with the delta values using the original theoretical gravity data. The curve in Figure 7 is the one needed to adequately analyze the effects of the eclipse.

4. Data Analysis

With the non-eclipse contributions to the gravity removed, the curve in Figure 7 gives a vivid picture of the eclipse. Prior to the start of the eclipse, the figure shows the MG deviation from the NGT flickering between $\pm 3 \times 10^{-8}$ m/s^2, within the precision of the gravimeter. Once the eclipse starts at around 8:00 AM, the gravity gradually rises to a peak of about 8×10^{-8} m/s^2 around 9:00 AM, and then slowly declines until shortly after 10:00 AM, when it returns to its bouncing around between $\pm 3 \times 10^{-8}$ m/s^2. There does not appear to be any anomalies.

A more careful examination of the delta gravity curve does reveal two interesting observations. Figure 8 is the Figure 7 curve between 7:00 AM and 11:00 AM, blown up to provide some additional separation between the points on the curve. In Figure 8, four points have been labeled: the point corresponding to the first contact of the eclipse, the point corresponding to the fourth contact of the eclipse, a point labeled A, and one labeled B.

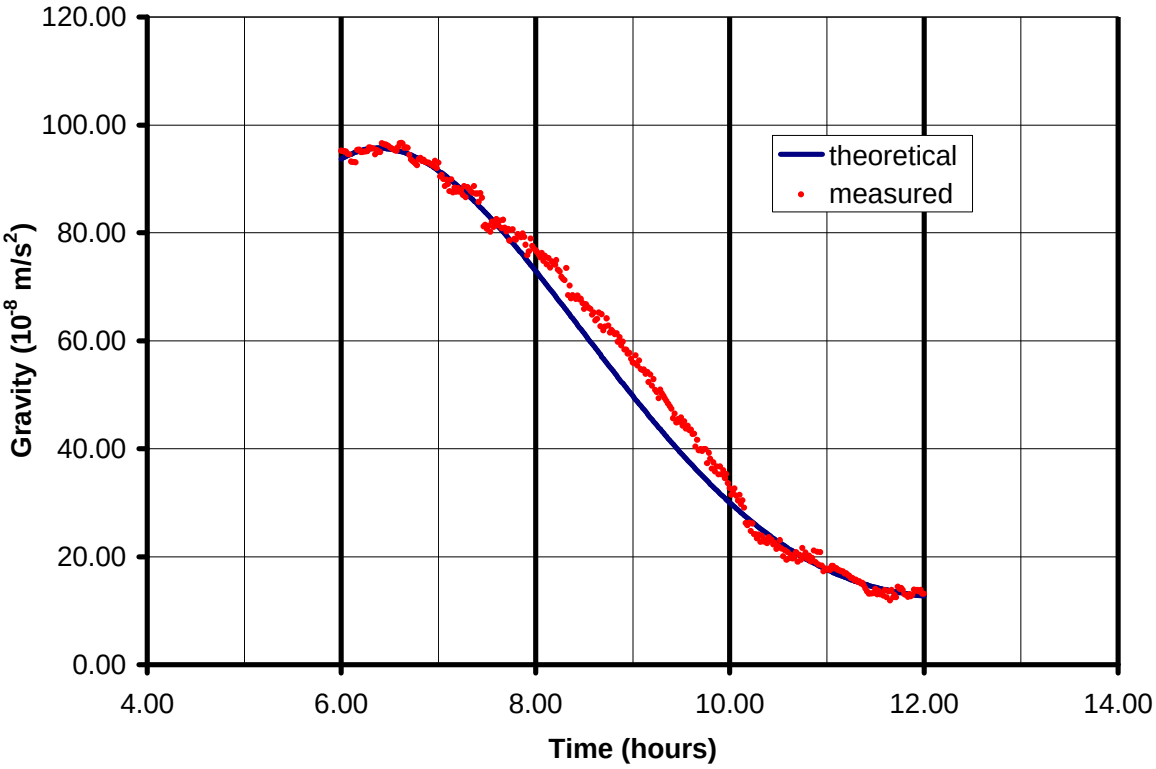

Figure 6: Measured gravity values plot with theoretical gravity curve without eclipse effects.

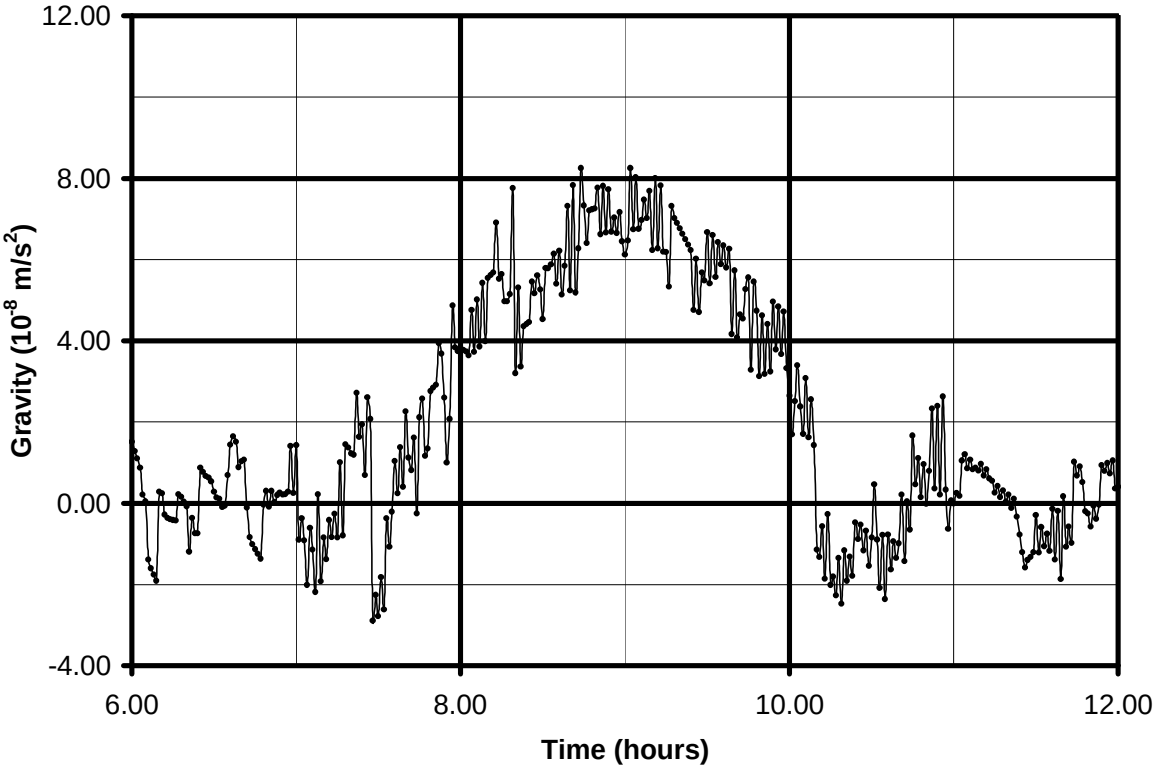

Figure 7: Delta gravity values using non-eclipse theoretical gravity values.

According to reference 2, the first contact, the time that the Sun begins to move behind the Moon, occurs at 8:03 AM. This is the time that the gravity measured by the gravimeter should begin to increase. However, the graph shows that at point A, the gravity started rising, and did not fall back into the noise range ($\pm 3 \times 10^{-8}$ m/s^2) until the eclipse was over. It appears that point A is actually when the eclipse began, at 7:55 AM, eight minutes before the eclipse visually appeared to begin.

Similarly, reference 2 indicates that the fourth contact of the eclipse, the time the Moon ceases to cover any of the Sun, was at 10:19 AM. At this point, the eclipse is over and the delta gravity readings should fall back to normal ($\pm 3 \times 10^{-8}$ m/s^2). However, a dramatic drop in the gravity reading occurred at point B, which signals the end of the eclipse. Point B is at 10:11 AM, once again, eight minutes before the visual end of the eclipse.

These two observations seem to indicate that the gravimeter senses the eclipse eight minutes before it is actually seen. Since it takes light a little over eight minutes to travel from the Sun to Earth, what the Sun appears to be doing now really happened eight minutes earlier. So, it looked like the first contact occurred at 8:03 AM, but it really happened at 7:55 AM, when the gravimeter detected it. It looked like the fourth contact was at 10:19 AM, but it actually occurred at 10:11AM, again, when the gravimeter sensed it. This all suggests that gravity happens instantly (or nearly instantly) and is not bound to the speed of light. If this finding stands, it is significant. There is a debate about the so-called "speed of gravity," with essentially two camps: the "speed of light" camp and the "instantly" camp. This data appears to support the camp claiming effects of gravity are felt instantly.

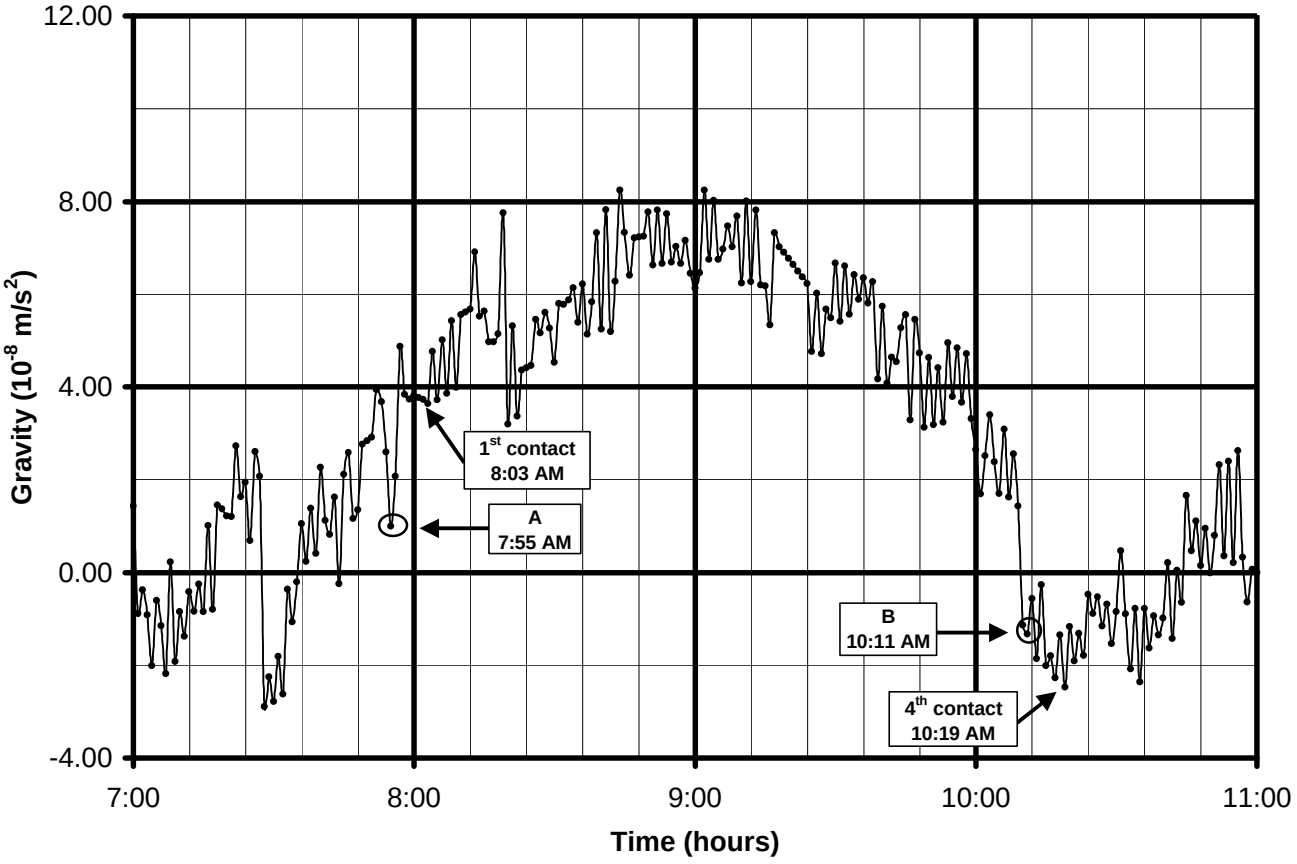

Figure 8: Graph showing difference between visual contact points and gravimeter contact points.

5. Findings

There were five findings identified as a result of this assessment:

1. The actual measured gravity values are not easily accessible.

2. The model used to produce the gravitational tide gravity values in the original analysis apparently also models the eclipse.

3. When the data is properly processed, there does not appear to be any anomalies in it.

4. The gravimeter registers the effects of the eclipse about eight minutes before they become visually apparent.

5. The data appears to show that the effects of gravity are felt instantly regardless of distance.

6. Conclusion

The gravity data collected at the Mohe Observation Center during the March 9, 1997 eclipse appears to behave as expected.

References

[1] Wu Chuanzhen, et al., The high-precision measurements of gravity fields during the March 9, 1997 Mohe total solar eclipse, Solar Eclipse and Nearground Environment (in Chinese), Beijing: Science Press, 1999, 213-218.

[2] Wang, Q., et al., *Gravity anomaly during the Mohe total solar eclipse.* Chinese Science Bulletin., 1999. **46:21:** p. 1833.

[3] Peng, F., et al., *The Internet Databases of the World Data Center for Geophysics, Beijing*. Data Science Journal, 2007, **6.**

Appendix

Table 1: Theoretical gravity values and delta gravity values taken from plots of data from the Mohe Observation Center (China) during the March 9, 1997 eclipse.

Table 2: Theoretical gravity values calculated for the Mohe Observation Center (China) during the March 9, 1997 eclipse and their fit values.

Table 3: Measured gravity values and calculated theoretical gravity values from the Mohe Observation Center (China) during the March 9, 1997 eclipse.

Table 4: Measured gravity values and calculated theoretical gravity values without eclipse from the Mohe Observation Center (China) during the March 9, 1997 eclipse.

Table 5: Delta measured gravity values from theoretical gravity values calculated with and without eclipse data for the Mohe Observation Center (China) during the March 9, 1997 eclipse.

Minute of Hour	Table 1: Theoretical gravity values and delta gravity values taken from plots of data from the Mohe Observation Center (China) during the March 9, 1997 eclipse (10^{-8} m/s^2)											
	6:00 AM		7:00 AM		8:00 AM		9:00 AM		10:00 AM		11:00 AM	
	theo	delta	theo	delta	theo	delta	theo	delta	theo	delta	theo	delta
0:00	92.91	2.78	90.79	1.89	77.34	-0.44	56.75	-0.67	34.38	-2.28	17.86	-0.33
0:01	93.08	2.61	90.63	-0.50	76.95	-0.56	56.14	-0.33	34.10	-3.17	17.63	0.00
0:02	93.19	2.50	90.46	-0.06	76.67	-0.67	55.64	1.44	33.82	-2.28	17.52	0.00
0:03	93.25	2.33	90.29	-0.67	76.28	-0.83	55.30	-0.06	33.43	-1.33	17.30	0.94
0:04	93.30	1.72	90.12	-1.83	76.00	0.22	54.97	1.22	33.20	-2.28	17.24	1.17
0:05	93.36	1.61	89.96	-0.50	75.67	-0.89	54.80	-0.06	32.76	-2.89	17.02	0.89
0:06	93.42	0.22	89.79	-1.11	75.33	0.33	54.63	0.17	32.48	-1.44	16.91	1.17
0:07	93.47	0.06	89.68	-2.22	74.72	-0.89	54.24	0.67	32.25	-2.83	16.63	1.00
0:08	93.53	-0.06	89.56	0.11	74.44	0.61	54.02	0.22	31.81	-1.83	16.35	1.11
0:09	93.58	-0.17	89.40	-2.11	74.11	-0.89	53.40	0.89	31.58	-2.89	16.24	1.11
0:10	93.58	2.06	89.23	-1.11	73.94	0.61	52.85	-0.56	31.14	-5.39	16.07	1.33
0:11	93.58	2.06	89.12	-1.72	73.83	0.61	52.68	1.22	30.92	-5.50	15.63	1.11
0:12	93.58	1.56	88.95	-0.83	73.38	0.61	52.18	-0.50	30.64	-4.67	15.51	1.33
0:13	93.58	1.50	88.84	-1.33	73.05	1.78	51.84	1.06	30.25	-5.89	15.35	1.17
0:14	93.58	1.50	88.67	-0.83	72.88	0.33	51.62	-0.56	29.91	-4.22	15.18	1.17
0:15	93.58	1.50	88.56	-1.50	72.43	0.39	51.34	-0.56	29.63	-5.89	15.01	0.94
0:16	93.58	1.50	88.39	0.28	71.99	-0.33	51.00	-1.39	29.35	-5.61	14.84	1.17
0:17	93.58	2.17	88.28	-1.61	71.82	-0.39	50.33	0.61	29.02	-6.00	14.73	0.94
0:18	93.58	2.11	88.06	0.56	71.54	-0.28	49.94	0.33	28.79	-5.00	14.62	1.17
0:19	93.58	2.00	87.78	0.39	71.21	2.28	49.50	0.22	28.46	-6.06	14.40	0.94
0:20	93.58	1.89	87.56	0.17	71.04	-2.33	49.16	0.11	28.24	-4.67	14.29	1.17
0:21	93.58	0.78	87.22	0.06	70.76	-0.28	48.83	0.00	27.96	-5.33	14.17	0.89
0:22	93.58	1.61	86.94	1.50	70.31	-2.28	48.38	-0.11	27.68	-4.67	13.95	1.17
0:23	93.58	1.22	86.66	0.33	70.03	-1.33	47.94	-0.22	27.29	-5.06	13.90	0.78
0:24	93.58	1.22	86.38	0.56	69.53	-1.33	47.60	-0.33	27.06	-3.67	13.73	0.39
0:25	93.58	2.83	86.16	-0.78	69.14	-1.33	47.15	-1.78	26.79	-4.00	13.62	0.00
0:26	93.58	2.72	85.99	1.06	68.75	-0.39	46.82	-0.50	26.56	-3.56	13.45	-0.33
0:27	93.58	2.61	85.83	0.44	68.42	-0.72	46.21	-1.78	26.28	-4.11	13.39	-0.11
0:28	93.58	2.56	85.66	-4.61	68.19	-0.33	45.93	-0.78	25.95	-3.56	13.28	0.00
0:29	93.53	2.44	85.49	-4.06	67.97	-0.72	45.54	-0.94	25.78	-4.33	13.17	0.17
0:30	93.47	2.17	85.32	-4.67	67.52	-1.50	45.09	0.28	25.50	-3.56	13.00	1.11
0:31	93.36	2.00	85.10	-3.78	67.02	-0.28	44.87	-0.94	24.94	-2.17	12.89	0.22
0:32	93.36	1.94	84.88	-4.67	66.80	-0.33	44.59	0.28	24.78	-3.44	12.72	0.89
0:33	93.30	1.72	84.65	-2.50	66.52	-0.28	44.31	-0.72	24.50	-4.56	12.61	0.44
0:34	93.25	1.72	84.32	-3.28	66.13	-0.06	43.97	0.17	24.39	-3.17	12.50	0.78
0:35	93.19	2.44	84.15	-2.50	65.63	-0.83	43.69	-0.33	23.94	-4.67	12.39	0.39
0:36	93.14	3.17	83.87	-1.33	65.29	-0.06	43.19	0.17	23.66	-3.00	12.28	1.44
0:37	93.08	3.33	83.59	-2.22	65.01	-1.17	42.63	-0.33	23.38	-3.78	12.22	0.22
0:38	93.02	3.17	83.31	-1.17	64.90	-0.50	42.30	0.17	23.10	-3.00	12.11	1.44
0:39	92.97	2.50	83.04	-2.22	64.29	0.94	42.02	-1.89	22.88	-3.33	12.00	-0.22
0:40	92.91	2.61	82.76	-0.44	64.06	-1.17	41.80	-0.28	22.71	-2.89	11.94	1.83
0:41	92.86	2.61	82.48	-1.67	63.90	1.39	41.46	-1.89	22.43	-1.61	11.89	0.61
0:42	92.80	1.39	82.25	-2.06	63.67	-1.28	40.96	-1.28	22.15	-3.17	11.83	1.11
0:43	92.69	0.61	81.98	-1.33	62.95	-0.22	40.46	-1.33	21.99	-1.61	11.72	0.72
0:44	92.58	0.39	81.70	-3.28	62.78	1.72	40.18	-0.56	21.76	-2.22	11.61	2.72
0:45	92.52	0.22	81.53	-1.00	62.50	0.78	39.96	-0.22	21.65	0.17	11.55	2.39
0:46	92.41	0.06	81.25	-0.61	62.22	-0.17	39.51	-2.44	21.32	-0.94	11.50	2.61
0:47	92.30	-0.11	81.03	-2.11	62.05	0.61	39.23	-0.22	21.04	-0.22	11.38	2.22
0:48	92.19	1.17	80.86	-2.00	61.77	0.61	38.73	-0.89	20.81	-1.11	11.27	1.50
0:49	92.08	1.44	80.58	-0.67	61.33	0.61	38.39	-2.44	20.70	-0.22	11.27	1.44
0:50	91.96	1.00	80.36	-0.67	60.71	1.11	38.06	-0.89	20.26	-1.11	11.33	1.11
0:51	91.85	1.33	80.19	-0.67	60.32	-0.06	37.67	-2.28	20.03	-0.22	11.22	1.61
0:52	91.69	1.00	79.97	0.28	60.04	1.11	37.33	-1.00	19.70	1.39	11.10	1.28
0:53	91.63	1.11	79.52	-0.06	59.54	-0.06	37.00	-2.11	19.36	-0.50	11.10	1.61
0:54	91.52	1.11	79.19	-1.22	59.10	1.00	36.66	-0.33	19.20	1.61	11.05	2.56
0:55	91.41	1.00	78.91	-2.89	58.71	-0.06	36.22	-1.44	19.08	-0.50	11.05	2.39
0:56	91.29	0.94	78.57	-1.89	58.54	0.28	35.83	-0.33	18.86	2.00	11.05	2.56
0:57	91.18	0.94	78.01	0.83	58.09	-0.11	35.38	-1.44	18.64	-0.22	10.94	2.28
0:58	91.07	2.00	77.68	-0.28	57.87	0.39	35.04	-0.33	18.42	-1.11	10.94	2.56
0:59	90.96	0.78	77.46	-0.44	56.98	-0.33	34.77	-1.67	18.19	-0.33	10.94	1.83

Minute of Hour	Table 2: Theoretical gravity values calculated for the Mohe Observation Center (China) during the March 9, 1997 eclipse and their fit values (10^{-8} m/s^2)											
	6:00 AM		7:00 AM		8:00 AM		9:00 AM		10:00 AM		11:00 AM	
	data	fit	data	fit	data	fit	data	fit	data	fit	data	fit
0:00	92.91	92.40	90.79	91.04	77.34	77.20	56.75	56.59	34.38	34.93	17.86	17.92
0:01	93.08	92.51	90.63	90.90	76.95	76.90	56.14	56.23	34.10	34.59	17.63	17.71
0:02	93.19	92.62	90.46	90.75	76.67	76.59	55.64	55.86	33.82	34.26	17.52	17.50
0:03	93.25	92.72	90.29	90.60	76.28	76.28	55.30	55.49	33.43	33.92	17.30	17.29
0:04	93.30	92.82	90.12	90.44	76.00	75.97	54.97	55.12	33.20	33.59	17.24	17.09
0:05	93.36	92.91	89.96	90.29	75.67	75.66	54.80	54.75	32.76	33.26	17.02	16.89
0:06	93.42	92.99	89.79	90.12	75.33	75.35	54.63	54.38	32.48	32.93	16.91	16.69
0:07	93.47	93.07	89.68	89.96	74.72	75.04	54.24	54.01	32.25	32.60	16.63	16.50
0:08	93.53	93.15	89.56	89.79	74.44	74.72	54.02	53.64	31.81	32.27	16.35	16.31
0:09	93.58	93.22	89.40	89.62	74.11	74.40	53.40	53.27	31.58	31.94	16.24	16.12
0:10	93.58	93.29	89.23	89.45	73.94	74.08	52.85	52.90	31.14	31.62	16.07	15.94
0:11	93.58	93.35	89.12	89.27	73.83	73.76	52.68	52.53	30.92	31.29	15.63	15.75
0:12	93.58	93.40	88.95	89.09	73.38	73.44	52.18	52.16	30.64	30.97	15.51	15.58
0:13	93.58	93.46	88.84	88.90	73.05	73.11	51.84	51.79	30.25	30.65	15.35	15.40
0:14	93.58	93.50	88.67	88.72	72.88	72.79	51.62	51.42	29.91	30.33	15.18	15.23
0:15	93.58	93.54	88.56	88.53	72.43	72.46	51.34	51.05	29.63	30.02	15.01	15.06
0:16	93.58	93.58	88.39	88.33	71.99	72.13	51.00	50.68	29.35	29.70	14.84	14.90
0:17	93.58	93.62	88.28	88.14	71.82	71.80	50.33	50.32	29.02	29.39	14.73	14.73
0:18	93.58	93.64	88.06	87.94	71.54	71.47	49.94	49.95	28.79	29.08	14.62	14.57
0:19	93.58	93.67	87.78	87.74	71.21	71.14	49.50	49.58	28.46	28.77	14.40	14.42
0:20	93.58	93.69	87.56	87.53	71.04	70.80	49.16	49.21	28.24	28.46	14.29	14.27
0:21	93.58	93.70	87.22	87.32	70.76	70.47	48.83	48.84	27.96	28.15	14.17	14.12
0:22	93.58	93.71	86.94	87.11	70.31	70.13	48.38	48.47	27.68	27.85	13.95	13.97
0:23	93.58	93.72	86.66	86.90	70.03	69.79	47.94	48.10	27.29	27.55	13.90	13.83
0:24	93.58	93.72	86.38	86.68	69.53	69.45	47.60	47.74	27.06	27.25	13.73	13.69
0:25	93.58	93.72	86.16	86.46	69.14	69.11	47.15	47.37	26.79	26.95	13.62	13.56
0:26	93.58	93.71	85.99	86.24	68.75	68.77	46.82	47.00	26.56	26.65	13.45	13.43
0:27	93.58	93.70	85.83	86.02	68.42	68.42	46.21	46.63	26.28	26.36	13.39	13.30
0:28	93.58	93.68	85.66	85.79	68.19	68.08	45.93	46.27	25.95	26.06	13.28	13.18
0:29	93.53	93.66	85.49	85.56	67.97	67.73	45.54	45.90	25.78	25.77	13.17	13.06
0:30	93.47	93.64	85.32	85.32	67.52	67.39	45.09	45.54	25.50	25.49	13.00	12.94
0:31	93.36	93.61	85.10	85.09	67.02	67.04	44.87	45.17	24.94	25.20	12.89	12.83
0:32	93.36	93.58	84.88	84.85	66.80	66.69	44.59	44.81	24.78	24.91	12.72	12.72
0:33	93.30	93.54	84.65	84.61	66.52	66.34	44.31	44.44	24.50	24.63	12.61	12.61
0:34	93.25	93.50	84.32	84.36	66.13	65.99	43.97	44.08	24.39	24.35	12.50	12.51
0:35	93.19	93.45	84.15	84.12	65.63	65.64	43.69	43.72	23.94	24.07	12.39	12.41
0:36	93.14	93.40	83.87	83.87	65.29	65.28	43.19	43.36	23.66	23.80	12.28	12.32
0:37	93.08	93.35	83.59	83.62	65.01	64.93	42.63	43.00	23.38	23.53	12.22	12.23
0:38	93.02	93.29	83.31	83.36	64.90	64.58	42.30	42.64	23.10	23.25	12.11	12.14
0:39	92.97	93.23	83.04	83.11	64.29	64.22	42.02	42.28	22.88	22.99	12.00	12.06
0:40	92.91	93.16	82.76	82.85	64.06	63.86	41.80	41.92	22.71	22.72	11.94	11.98
0:41	92.86	93.09	82.48	82.59	63.90	63.51	41.46	41.56	22.43	22.45	11.89	11.91
0:42	92.80	93.02	82.25	82.32	63.67	63.15	40.96	41.20	22.15	22.19	11.83	11.83
0:43	92.69	92.94	81.98	82.06	62.95	62.79	40.46	40.84	21.99	21.93	11.72	11.77
0:44	92.58	92.86	81.70	81.79	62.78	62.43	40.18	40.49	21.76	21.68	11.61	11.70
0:45	92.52	92.77	81.53	81.52	62.50	62.07	39.96	40.13	21.65	21.42	11.55	11.65
0:46	92.41	92.68	81.25	81.25	62.22	61.71	39.51	39.78	21.32	21.17	11.50	11.59
0:47	92.30	92.59	81.03	80.97	62.05	61.35	39.23	39.43	21.04	20.92	11.38	11.54
0:48	92.19	92.49	80.86	80.69	61.77	60.98	38.73	39.07	20.81	20.67	11.27	11.49
0:49	92.08	92.39	80.58	80.41	61.33	60.62	38.39	38.72	20.70	20.43	11.27	11.45
0:50	91.96	92.29	80.36	80.13	60.71	60.26	38.06	38.37	20.26	20.19	11.33	11.41
0:51	91.85	92.18	80.19	79.85	60.32	59.89	37.67	38.02	20.03	19.95	11.22	11.38
0:52	91.69	92.07	79.97	79.56	60.04	59.53	37.33	37.67	19.70	19.71	11.10	11.35
0:53	91.63	91.95	79.52	79.27	59.54	59.16	37.00	37.33	19.36	19.48	11.10	11.32
0:54	91.52	91.83	79.19	78.98	59.10	58.80	36.66	36.98	19.20	19.25	11.05	11.30
0:55	91.41	91.71	78.91	78.69	58.71	58.43	36.22	36.64	19.08	19.02	11.05	11.29
0:56	91.29	91.58	78.57	78.40	58.54	58.06	35.83	36.29	18.86	18.79	11.05	11.27
0:57	91.18	91.45	78.01	78.10	58.09	57.70	35.38	35.95	18.64	18.57	10.94	11.27
0:58	91.07	91.32	77.68	77.80	57.87	57.33	35.04	35.61	18.42	18.35	10.94	11.26
0:59	90.96	91.18	77.46	77.50	56.98	56.96	34.77	35.27	18.19	18.13	10.94	11.26

Minute of Hour	Table 3: Measured gravity values and calculated theoretical gravity values from the Mohe Observation Center (China) during the March 9, 1997 eclipse (10^{-8} m/s^2)											
	6:00 AM		7:00 AM		8:00 AM		9:00 AM		10:00 AM		11:00 AM	
	meas	calc	meas	calc	meas	calc	meas	calc	meas	calc	meas	calc
0:00	95.18	92.40	92.93	91.04	76.76	77.20	55.93	56.59	32.65	34.93	17.58	17.92
0:01	95.13	92.51	90.40	90.90	76.34	76.90	55.89	56.23	31.43	34.59	17.71	17.71
0:02	95.12	92.62	90.69	90.75	75.92	76.59	57.30	55.86	31.98	34.26	17.50	17.50
0:03	95.05	92.72	89.93	90.60	75.45	76.28	55.43	55.49	32.59	33.92	18.24	17.29
0:04	94.54	92.82	88.61	90.44	76.20	75.97	56.34	55.12	31.31	33.59	18.26	17.09
0:05	94.52	92.91	89.79	90.29	74.77	75.66	54.70	54.75	30.37	33.26	17.78	16.89
0:06	93.21	92.99	89.01	90.12	75.68	75.35	54.55	54.38	31.48	32.93	17.86	16.69
0:07	93.13	93.07	87.74	89.96	74.15	75.04	54.68	54.01	29.76	32.60	17.50	16.50
0:08	93.09	93.15	89.90	89.79	75.33	74.72	53.86	53.64	30.43	32.27	17.42	16.31
0:09	93.05	93.22	87.51	89.62	73.51	74.40	54.16	53.27	29.05	31.94	17.23	16.12
0:10	95.34	93.29	88.34	89.45	74.69	74.08	52.35	52.90	26.23	31.62	17.27	15.94
0:11	95.40	93.35	87.55	89.27	74.37	73.76	53.76	52.53	25.79	31.29	16.87	15.75
0:12	94.96	93.40	88.25	89.09	74.05	73.44	51.66	52.16	26.31	30.97	16.91	15.58
0:13	94.96	93.46	87.57	88.90	74.89	73.11	52.85	51.79	24.76	30.65	16.57	15.40
0:14	95.00	93.50	87.88	88.72	73.12	72.79	50.87	51.42	26.11	30.33	16.40	15.23
0:15	95.04	93.54	87.03	88.53	72.85	72.46	50.50	51.05	24.13	30.02	16.00	15.06
0:16	95.08	93.58	88.61	88.33	71.80	72.13	49.30	50.68	24.09	29.70	16.06	14.90
0:17	95.78	93.62	86.53	88.14	71.41	71.80	50.93	50.32	23.39	29.39	15.68	14.73
0:18	95.76	93.64	88.49	87.94	71.19	71.47	50.28	49.95	24.08	29.08	15.74	14.57
0:19	95.67	93.67	88.13	87.74	73.41	71.14	49.80	49.58	22.71	28.77	15.36	14.42
0:20	95.58	93.69	87.70	87.53	68.47	70.80	49.32	49.21	23.79	28.46	15.43	14.27
0:21	94.48	93.70	87.38	87.32	70.19	70.47	48.84	48.84	22.82	28.15	15.01	14.12
0:22	95.32	93.71	88.61	87.11	67.85	70.13	48.36	48.47	23.18	27.85	15.14	13.97
0:23	94.94	93.72	87.23	86.90	68.46	69.79	47.88	48.10	22.49	27.55	14.61	13.83
0:24	94.94	93.72	87.24	86.68	68.12	69.45	47.40	47.74	23.58	27.25	14.08	13.69
0:25	96.55	93.72	85.69	86.46	67.78	69.11	45.59	47.37	22.95	26.95	13.56	13.56
0:26	96.43	93.71	87.30	86.24	68.38	68.77	46.50	47.00	23.10	26.65	13.10	13.43
0:27	96.31	93.70	86.46	86.02	67.70	68.42	44.86	46.63	22.25	26.36	13.19	13.30
0:28	96.24	93.68	81.18	85.79	67.75	68.08	45.49	46.27	22.51	26.06	13.18	13.18
0:29	96.11	93.66	81.50	85.56	67.01	67.73	44.96	45.90	21.44	25.77	13.22	13.06
0:30	95.81	93.64	80.66	85.32	65.89	67.39	45.82	45.54	21.93	25.49	14.05	12.94
0:31	95.61	93.61	81.31	85.09	66.76	67.04	44.23	45.17	23.03	25.20	13.05	12.83
0:32	95.52	93.58	80.18	84.85	66.36	66.69	45.09	44.81	21.47	24.91	13.61	12.72
0:33	95.26	93.54	82.11	84.61	66.06	66.34	43.72	44.44	20.08	24.63	13.06	12.61
0:34	95.22	93.50	81.09	84.36	65.93	65.99	44.25	44.08	21.19	24.35	13.29	12.51
0:35	95.90	93.45	81.62	84.12	64.80	65.64	43.39	43.72	19.41	24.07	12.80	12.41
0:36	96.57	93.40	82.54	83.87	65.23	65.28	43.52	43.36	20.80	23.80	13.76	12.32
0:37	96.68	93.35	81.40	83.62	63.76	64.93	42.66	43.00	19.75	23.53	12.45	12.23
0:38	96.46	93.29	82.20	83.36	64.08	64.58	42.80	42.64	20.25	23.25	13.59	12.14
0:39	95.73	93.23	80.88	83.11	65.16	64.22	40.39	42.28	19.65	22.99	11.84	12.06
0:40	95.77	93.16	82.40	82.85	62.70	63.86	41.64	41.92	19.83	22.72	13.81	11.98
0:41	95.70	93.09	80.92	82.59	64.89	63.51	39.67	41.56	20.84	22.45	12.52	11.91
0:42	94.41	93.02	80.27	82.32	61.87	63.15	39.92	41.20	19.03	22.19	12.95	11.83
0:43	93.55	92.94	80.72	82.06	62.57	62.79	39.51	40.84	20.32	21.93	12.49	11.77
0:44	93.25	92.86	78.51	81.79	64.15	62.43	39.93	40.49	19.45	21.68	14.43	11.70
0:45	93.00	92.77	80.52	81.52	62.85	62.07	39.91	40.13	21.59	21.42	14.03	11.65
0:46	92.74	92.68	80.63	81.25	61.54	61.71	37.33	39.78	20.23	21.17	14.20	11.59
0:47	92.48	92.59	78.86	80.97	61.96	61.35	39.20	39.43	20.70	20.92	13.76	11.54
0:48	93.66	92.49	78.69	80.69	61.59	60.98	38.18	39.07	19.56	20.67	12.99	11.49
0:49	93.84	92.39	79.75	80.41	61.23	60.62	36.28	38.72	20.21	20.43	12.90	11.45
0:50	93.29	92.29	79.47	80.13	61.37	60.26	37.48	38.37	19.08	20.19	12.52	11.41
0:51	93.51	92.18	79.18	79.85	59.84	59.89	35.74	38.02	19.73	19.95	12.99	11.38
0:52	93.07	92.07	79.84	79.56	60.64	59.53	36.67	37.67	21.10	19.71	12.63	11.35
0:53	93.06	91.95	79.22	79.27	59.11	59.16	35.22	37.33	18.98	19.48	12.94	11.32
0:54	92.94	91.83	77.76	78.98	59.80	58.80	36.65	36.98	20.86	19.25	13.86	11.30
0:55	92.71	91.71	75.80	78.69	58.38	58.43	35.19	36.64	18.52	19.02	13.67	11.29
0:56	92.53	91.58	76.51	78.40	58.34	58.06	35.96	36.29	20.79	18.79	13.83	11.27
0:57	92.40	91.45	78.93	78.10	57.59	57.70	34.51	35.95	18.35	18.57	13.54	11.27
0:58	93.32	91.32	77.53	77.80	57.72	57.33	35.28	35.61	17.24	18.35	13.82	11.26
0:59	91.96	91.18	77.06	77.50	56.63	56.96	33.60	35.27	17.80	18.13	13.10	11.26

Minute of Hour	Table 4: Measured gravity values and calculated theoretical gravity values without eclipse from the Mohe Observation Center (China) during the March 9, 1997 eclipse (10^{-8} m/s^2)											
	6:00 AM		7:00 AM		8:00 AM		9:00 AM		10:00 AM		11:00 AM	
	meas	calc	meas	calc	meas	calc	meas	calc	meas	calc	meas	calc
0:00	95.18	93.67	92.93	91.50	76.76	72.94	55.93	49.80	32.65	30.01	17.58	17.59
0:01	95.13	93.84	90.40	91.29	76.34	72.57	55.89	49.43	31.43	29.73	17.71	17.45
0:02	95.12	94.01	90.69	91.07	75.92	72.19	57.30	49.06	31.98	29.46	17.50	17.31
0:03	95.05	94.17	89.93	90.85	75.45	71.81	55.43	48.68	32.59	29.19	18.24	17.18
0:04	94.54	94.33	88.61	90.62	76.20	71.43	56.34	48.31	31.31	28.93	18.26	17.05
0:05	94.52	94.47	89.79	90.39	74.77	71.05	54.70	47.94	30.37	28.66	17.78	16.92
0:06	93.21	94.60	89.01	90.16	75.68	70.67	54.55	47.58	31.48	28.40	17.86	16.79
0:07	93.13	94.73	87.74	89.92	74.15	70.29	54.68	47.21	29.76	28.14	17.50	16.67
0:08	93.09	94.85	89.90	89.68	75.33	69.91	53.86	46.84	30.43	27.88	17.42	16.54
0:09	93.05	94.96	87.51	89.43	73.51	69.53	54.16	46.48	29.05	27.63	17.23	16.42
0:10	95.34	95.06	88.34	89.18	74.69	69.14	52.35	46.11	26.23	27.37	17.27	16.30
0:11	95.40	95.16	87.55	88.93	74.37	68.76	53.76	45.75	25.79	27.12	16.87	16.19
0:12	94.96	95.24	88.25	88.67	74.05	68.37	51.66	45.39	26.31	26.87	16.91	16.07
0:13	94.96	95.32	87.57	88.41	74.89	67.99	52.85	45.03	24.76	26.62	16.57	15.96
0:14	95.00	95.39	87.88	88.14	73.12	67.60	50.87	44.67	26.11	26.38	16.40	15.85
0:15	95.04	95.45	87.03	87.87	72.85	67.21	50.50	44.32	24.13	26.14	16.00	15.74
0:16	95.08	95.51	88.61	87.60	71.80	66.82	49.30	43.96	24.09	25.90	16.06	15.63
0:17	95.78	95.56	86.53	87.32	71.41	66.44	50.93	43.61	23.39	25.66	15.68	15.53
0:18	95.76	95.60	88.49	87.04	71.19	66.05	50.28	43.25	24.08	25.42	15.74	15.43
0:19	95.67	95.63	88.13	86.76	73.41	65.66	49.80	42.90	22.71	25.19	15.36	15.33
0:20	95.58	95.66	87.70	86.47	68.47	65.27	49.32	42.55	23.79	24.96	15.43	15.23
0:21	94.48	95.67	87.38	86.18	70.19	64.88	48.84	42.20	22.82	24.73	15.01	15.13
0:22	95.32	95.69	88.61	85.89	67.85	64.49	48.36	41.86	23.18	24.50	15.14	15.04
0:23	94.94	95.69	87.23	85.60	68.46	64.10	47.88	41.51	22.49	24.28	14.61	14.94
0:24	94.94	95.69	87.24	85.30	68.12	63.71	47.40	41.17	23.58	24.06	14.08	14.85
0:25	96.55	95.68	85.69	85.00	67.78	63.31	45.59	40.83	22.95	23.84	13.56	14.76
0:26	96.43	95.66	87.30	84.69	68.38	62.92	46.50	40.49	23.10	23.62	13.10	14.68
0:27	96.31	95.64	86.46	84.38	67.70	62.53	44.86	40.15	22.25	23.41	13.19	14.59
0:28	96.24	95.60	81.18	84.07	67.75	62.14	45.49	39.81	22.51	23.19	13.18	14.51
0:29	96.11	95.57	81.50	83.76	67.01	61.75	44.96	39.48	21.44	22.98	13.22	14.43
0:30	95.81	95.52	80.66	83.44	65.89	61.36	45.82	39.14	21.93	22.77	14.05	14.35
0:31	95.61	95.47	81.31	83.12	66.76	60.97	44.23	38.81	23.03	22.57	13.05	14.27
0:32	95.52	95.42	80.18	82.80	66.36	60.58	45.09	38.48	21.47	22.37	13.61	14.19
0:33	95.26	95.35	82.11	82.48	66.06	60.19	43.72	38.15	20.08	22.16	13.06	14.12
0:34	95.22	95.28	81.09	82.15	65.93	59.80	44.25	37.83	21.19	21.96	13.29	14.04
0:35	95.90	95.21	81.62	81.82	64.80	59.40	43.39	37.50	19.41	21.77	12.80	13.97
0:36	96.57	95.13	82.54	81.49	65.23	59.01	43.52	37.18	20.80	21.57	13.76	13.90
0:37	96.68	95.04	81.40	81.16	63.76	58.62	42.66	36.86	19.75	21.38	12.45	13.84
0:38	96.46	94.95	82.20	80.82	64.08	58.23	42.80	36.54	20.25	21.19	13.59	13.77
0:39	95.73	94.85	80.88	80.48	65.16	57.84	40.39	36.22	19.65	21.00	11.84	13.71
0:40	95.77	94.74	82.40	80.14	62.70	57.46	41.64	35.90	19.83	20.82	13.81	13.64
0:41	95.70	94.63	80.92	79.80	64.89	57.07	39.67	35.59	20.84	20.64	12.52	13.58
0:42	94.41	94.51	80.27	79.45	61.87	56.68	39.92	35.28	19.03	20.46	12.95	13.52
0:43	93.55	94.39	80.72	79.11	62.57	56.29	39.51	34.97	20.32	20.28	12.49	13.47
0:44	93.25	94.26	78.51	78.76	64.15	55.90	39.93	34.66	19.45	20.10	14.43	13.41
0:45	93.00	94.13	80.52	78.41	62.85	55.52	39.91	34.35	21.59	19.93	14.03	13.35
0:46	92.74	93.99	80.63	78.05	61.54	55.13	37.33	34.05	20.23	19.76	14.20	13.30
0:47	92.48	93.84	78.86	77.70	61.96	54.75	39.20	33.75	20.70	19.59	13.76	13.25
0:48	93.66	93.69	78.69	77.34	61.59	54.36	38.18	33.45	19.56	19.42	12.99	13.20
0:49	93.84	93.54	79.75	76.99	61.23	53.98	36.28	33.15	20.21	19.25	12.90	13.15
0:50	93.29	93.38	79.47	76.63	61.37	53.59	37.48	32.85	19.08	19.09	12.52	13.10
0:51	93.51	93.21	79.18	76.26	59.84	53.21	35.74	32.56	19.73	18.93	12.99	13.06
0:52	93.07	93.04	79.84	75.90	60.64	52.83	36.67	32.27	21.10	18.77	12.63	13.01
0:53	93.06	92.87	79.22	75.54	59.11	52.45	35.22	31.98	18.98	18.62	12.94	12.97
0:54	92.94	92.69	77.76	75.17	59.80	52.07	36.65	31.69	20.86	18.46	13.86	12.93
0:55	92.71	92.50	75.80	74.80	58.38	51.69	35.19	31.40	18.52	18.31	13.67	12.88
0:56	92.53	92.31	76.51	74.43	58.34	51.31	35.96	31.12	20.79	18.16	13.83	12.85
0:57	92.40	92.11	78.93	74.06	57.59	50.93	34.51	30.84	18.35	18.02	13.54	12.81
0:58	93.32	91.92	77.53	73.69	57.72	50.55	35.28	30.56	17.24	17.87	13.82	12.77
0:59	91.96	91.71	77.06	73.32	56.63	50.18	33.60	30.28	17.80	17.73	13.10	12.73

Minute of Hour	Table 5: Delta measured gravity values from theoretical gravity values calculated with and without eclipse data for the Mohe Observation Center (China) during the March 9, 1997 eclipse (10^{-8} m/s^2)											
	6:00 AM		7:00 AM		8:00 AM		9:00 AM		10:00 AM		11:00 AM	
	with	without	with	without	with	without	with	without	with	without	with	without
0:00	2.78	1.52	1.89	1.43	-0.44	3.81	-0.67	6.13	-2.28	2.65	-0.33	0.00
0:01	2.61	1.28	-0.50	-0.89	-0.56	3.77	-0.33	6.46	-3.17	1.69	0.00	0.26
0:02	2.50	1.11	-0.06	-0.38	-0.67	3.73	1.44	8.25	-2.28	2.52	0.00	0.18
0:03	2.33	0.88	-0.67	-0.92	-0.83	3.64	-0.06	6.75	-1.33	3.40	0.94	1.05
0:04	1.72	0.21	-1.83	-2.01	0.22	4.76	1.22	8.03	-2.28	2.38	1.17	1.21
0:05	1.61	0.05	-0.50	-0.61	-0.89	3.72	-0.06	6.75	-2.89	1.71	0.89	0.86
0:06	0.22	-1.39	-1.11	-1.15	0.33	5.01	0.17	6.97	-1.44	3.08	1.17	1.07
0:07	0.06	-1.60	-2.22	-2.18	-0.89	3.85	0.67	7.47	-2.83	1.62	1.00	0.83
0:08	-0.06	-1.76	0.11	0.23	0.61	5.42	0.22	7.02	-1.83	2.55	1.11	0.87
0:09	-0.17	-1.91	-2.11	-1.92	-0.89	3.99	0.89	7.68	-2.89	1.43	1.11	0.81
0:10	2.06	0.28	-1.11	-0.85	0.61	5.55	-0.56	6.23	-5.39	-1.14	1.33	0.96
0:11	2.06	0.25	-1.72	-1.38	0.61	5.61	1.22	8.00	-5.50	-1.33	1.11	0.68
0:12	1.56	-0.28	-0.83	-0.41	0.61	5.68	-0.50	6.27	-4.67	-0.57	1.33	0.84
0:13	1.50	-0.37	-1.33	-0.84	1.78	6.91	1.06	7.82	-5.89	-1.86	1.17	0.61
0:14	1.50	-0.39	-0.83	-0.26	0.33	5.52	-0.56	6.20	-4.22	-0.27	1.17	0.55
0:15	1.50	-0.41	-1.50	-0.84	0.39	5.64	-0.56	6.18	-5.89	-2.01	0.94	0.26
0:16	1.50	-0.43	0.28	1.01	-0.33	4.98	-1.39	5.34	-5.61	-1.81	1.17	0.43
0:17	2.17	0.22	-1.61	-0.80	-0.39	4.98	0.61	7.32	-6.00	-2.27	0.94	0.15
0:18	2.11	0.16	0.56	1.45	-0.28	5.15	0.33	7.03	-5.00	-1.35	1.17	0.31
0:19	2.00	0.04	0.39	1.37	2.28	7.76	0.22	6.90	-6.06	-2.48	0.94	0.04
0:20	1.89	-0.08	0.17	1.22	-2.33	3.20	0.11	6.77	-4.67	-1.17	1.17	0.21
0:21	0.78	-1.19	0.06	1.19	-0.28	5.31	0.00	6.64	-5.33	-1.91	0.89	-0.12
0:22	1.61	-0.36	1.50	2.72	-2.28	3.36	-0.11	6.50	-4.67	-1.32	1.17	0.10
0:23	1.22	-0.75	0.33	1.64	-1.33	4.36	-0.22	6.37	-5.06	-1.79	0.78	-0.33
0:24	1.22	-0.74	0.56	1.94	-1.33	4.41	-0.33	6.23	-3.67	-0.48	0.39	-0.77
0:25	2.83	0.88	-0.78	0.69	-1.33	4.46	-1.78	4.76	-4.00	-0.89	0.00	-1.20
0:26	2.72	0.77	1.06	2.61	-0.39	5.45	-0.50	6.01	-3.56	-0.52	-0.33	-1.58
0:27	2.61	0.68	0.44	2.08	-0.72	5.17	-1.78	4.71	-4.11	-1.16	-0.11	-1.40
0:28	2.56	0.63	-4.61	-2.90	-0.33	5.60	-0.78	5.68	-3.56	-0.68	0.00	-1.33
0:29	2.44	0.54	-4.06	-2.26	-0.72	5.26	-0.94	5.48	-4.33	-1.54	0.17	-1.20
0:30	2.17	0.28	-4.67	-2.79	-1.50	4.53	0.28	6.67	-3.56	-0.84	1.11	-0.29
0:31	2.00	0.14	-3.78	-1.81	-0.28	5.79	-0.94	5.42	-2.17	0.46	0.22	-1.22
0:32	1.94	0.10	-4.67	-2.62	-0.33	5.78	0.28	6.61	-3.44	-0.89	0.89	-0.58
0:33	1.72	-0.09	-2.50	-0.37	-0.28	5.88	-0.72	5.57	-4.56	-2.09	0.44	-1.06
0:34	1.72	-0.06	-3.28	-1.07	-0.06	6.14	0.17	6.42	-3.17	-0.78	0.78	-0.76
0:35	2.44	0.69	-2.50	-0.20	-0.83	5.40	-0.33	5.88	-4.67	-2.36	0.39	-1.17
0:36	3.17	1.44	-1.33	1.04	-0.06	6.21	0.17	6.35	-3.00	-0.77	1.44	-0.14
0:37	3.33	1.64	-2.22	0.24	-1.17	5.14	-0.33	5.81	-3.78	-1.63	0.22	-1.39
0:38	3.17	1.51	-1.17	1.38	-0.50	5.84	0.17	6.26	-3.00	-0.94	1.44	-0.18
0:39	2.50	0.88	-2.22	0.40	0.94	7.32	-1.89	4.17	-3.33	-1.35	-0.22	-1.87
0:40	2.61	1.03	-0.44	2.26	-1.17	5.24	-0.28	5.73	-2.89	-0.99	1.83	0.17
0:41	2.61	1.07	-1.67	1.12	1.39	7.83	-1.89	4.08	-1.61	0.21	0.61	-1.07
0:42	1.39	-0.10	-2.06	0.81	-1.28	5.19	-1.28	4.64	-3.17	-1.43	1.11	-0.58
0:43	0.61	-0.84	-1.33	1.62	-0.22	6.27	-1.33	4.54	-1.61	0.05	0.72	-0.98
0:44	0.39	-1.01	-3.28	-0.25	1.72	8.25	-0.56	5.27	-2.22	-0.65	2.72	1.02
0:45	0.22	-1.13	-1.00	2.11	0.78	7.33	-0.22	5.56	0.17	1.66	2.39	0.68
0:46	0.06	-1.25	-0.61	2.58	-0.17	6.41	-2.44	3.28	-0.94	0.47	2.61	0.90
0:47	-0.11	-1.36	-2.11	1.16	0.61	7.21	-0.22	5.46	-0.22	1.11	2.22	0.51
0:48	1.17	-0.03	-2.00	1.35	0.61	7.23	-0.89	4.74	-1.11	0.14	1.50	-0.20
0:49	1.44	0.30	-0.67	2.76	0.61	7.25	-2.44	3.13	-0.22	0.95	1.44	-0.25
0:50	1.00	-0.09	-0.67	2.84	1.11	7.77	-0.89	4.63	-1.11	-0.02	1.11	-0.58
0:51	1.33	0.30	-0.67	2.92	-0.06	6.63	-2.28	3.19	-0.22	0.79	1.61	-0.07
0:52	1.00	0.03	0.28	3.94	1.11	7.81	-1.00	4.41	1.39	2.33	1.28	-0.38
0:53	1.11	0.20	-0.06	3.68	-0.06	6.66	-2.11	3.24	-0.50	0.36	1.61	-0.03
0:54	1.11	0.26	-1.22	2.59	1.00	7.73	-0.33	4.96	1.61	2.39	2.56	0.93
0:55	1.00	0.21	-2.89	1.00	-0.06	6.69	-1.44	3.79	-0.50	0.21	2.39	0.79
0:56	0.94	0.22	-1.89	2.08	0.28	7.03	-0.33	4.84	2.00	2.63	2.56	0.98
0:57	0.94	0.28	0.83	4.87	-0.11	6.66	-1.44	3.67	-0.22	0.33	2.28	0.74
0:58	2.00	1.40	-0.28	3.83	0.39	7.17	-0.33	4.72	-1.11	-0.63	2.56	1.05
0:59	0.78	0.25	-0.44	3.74	-0.33	6.45	-1.67	3.32	-0.33	0.07	1.83	0.36