

could learn from him, there seemed to be no reason for this supposition. He is long since perfectly recovered.

I am, Sir,

Your most obedient

Most humble servant,

Charlton Wollaston.

**XCVIII.** *Observations on the Tides in the Island of St. Helena: in a Letter from the Rev. Nevil Maskelyne, A. M. F. R. S. to Thomas Birch, D. D. Secretary to the Royal Society.*

Reverend Sir,

Read Nov. 18, 1762. **N**OT having met with any observations of the tides made in a place so near the line as this, or at an island situated in the middle of so large an ocean, I was desirous of making some experiments on this subject. For this purpose I had a post about 10 foot long erected in a convenient place in the harbour before James's fort, which was the properest situation that could be found, being to the leeward part of the island, where ships may ride at anchor safely all the year round.

One side of it was painted black, over which white strokes were painted at the distance of 3 inches, which

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which were marked with the figures 1, 2, 3, &c. according to the order of the strokes, reckoning upwards from the bottom. The water sunk down to about the figure 0 at the new and full moons; but as the water would often sink lower than this by the continual undulation, which it has even in the calmest times, and as it was by taking a medium between the greatest and least heights of the water by the side of the post in this undulation that I was to infer the true and proper height, I was therefore obliged to have the post lengthened by a piece at the bottom marked with strokes as the post it self, only with this difference, that the figures were set on from 0 downwards, as in the post they were set from 0 upwards. The observations where the water sunk below 0 were reckoned minus with respect to those where it rose above 0, which were reckoned plus: and a proper regard was had to this difference, in inferring the true height, in such circumstances, from a medium between several observations of the alternate rise and fall of the water.

But here you will perhaps think it incumbent upon me to clear my self from an objection, which at first sight may seem to render dubious the whole of my experiments. The alternate rise and fall of the water is generally so considerable that any one would be apt to conclude it impossible to find the true height of the water to a sufficient degree of exactness. In answer to this objection I can truly affirm, that I always found the mediums of each successive rise and fall to agree very nearly together, except in very great swells; from whence I was naturally led to conclude, that, by taking the medium of a great number of such observations

vations, I should obtain the true height of the water to a considerable degree of exactness. I therefore generally made 40 or 50 observations, and sometimes more than 100, if the rise and fall of the water seemed very irregular. And that such a method of procedure renders the observations very consistent with themselves appears from inspecting of them: for about the times of high and low tide, when the water is stationary for a long while together, different observations give the same altitude with a very little difference; and where the water is rising or falling at the fastest, the observations will shew a sensible rise or fall in the space of a very few minutes.

In order to find if a sensible difference could arise from any peculiar difference in different people's manner of judging of the altitude of the water, I desired Mr. Charles Mason, to whom we are indebted for a most excellent observation of the transit of Venus at the Cape of Good Hope, to observe the water at the same time I did, and in the result of trials made at different times we seldom differed more than  $\frac{1}{10}$  of one of the divisions of the post, and never  $\frac{2}{10}$ ths, that is never so much as half an inch. I cannot on this occasion omit doing Mr. Mason the justice to acknowledge the advantage I received from his frequent assistance in making of these observations, which it was in a manner impossible for one to have completed alone, on account of the almost constant attendance they required, and my living at some distance from the water side.

The following example of my method of making these observations may serve to give an idea of the whole. When the water sunk I took its altitude on the

the post at the lowest point, and immediately as it rose again I took it at the highest, and repeating the experiment in this manner, I at last took a mean of all the observations for the true height of the water. But the medium of the lowest and highest which immediately succeeded each other seldom differed much from the medium of them all. The numbers on the post by which the altitudes were taken, are at the distance of 3 inches from each other as I observed before. On November 16, 1761, 5<sup>h</sup> 16 P. M. I took the following observations of the altitude of the water by the side of the post 11, 12. 9 $\frac{1}{2}$ , 13 $\frac{1}{2}$ . 10, 12 $\frac{1}{2}$ . 9, 14 $\frac{1}{2}$ . 9, 12 $\frac{3}{4}$ . 9 $\frac{1}{2}$ , 13 $\frac{1}{2}$ . 10, 13. 9, 14. 9, 13. 9, 14.

The medium of all, which is 11  $\frac{4}{10}$  for the true altitude of the water. Mr. Mason at the same time by about as many observations found 11  $\frac{5}{10}$ .

Some times, when the rise and fall of the water was very quick, instead of taking the more regular rise and fall of the water, which succeed one another at longer intervals, I took notice of every the least rise and fall, in which case I had an assistant to write them down as fast as I told him. As an example of this, on December 2, 11<sup>h</sup> 15<sup>m</sup> A. M. by a mean of 69 observations taken in this manner, I found the altitude of the water to be 3  $\frac{4\frac{5}{10}}{10}$ ; and at 11<sup>h</sup> 21<sup>m</sup> A. M. by a mean of 52 observations taken at the more regular rising and fallings of the water, I found the altitude to be 3  $\frac{6\frac{8}{10}}{10}$ .

I always looked at my watch before I began to note the height of the water, and looked at it again when I had finished the experiment; the medium of the two times I set down as the true time of the observation.

observation. The times set down are exact to the minute.

What I endeavoured to attain by these experiments was the altitudes of high and low water, and the times of their happening. I generally began to observe the water some time before the expected time of high or low water, and continued the observations till the water either fell or rose. But it appears from the experiments that the water does not vary sensibly for 20 minutes or more from the times of high or low water. On this account it was impossible to find these times by direct observation, to any degree of accuracy; I therefore took equal altitudes of the water before and after, from whence these times may be inferred with some degree of exactness; you will perceive, by the times, that many of the observations were made in the night. In this case a person held a lanthorn to give light to the water, and the figures on the post, raising and sinking the lanthorn alternately, as the water rose or fell, while I observed the altitude of the water by the post.

I think that nothing remains further to be said, in explanation of the observations, but to take notice of the contents of each column in the table of observations. The first column contains the day of the month; the second shews the apparent time; the next column contains the altitude of the water according to the figures on the post, which are each 3 inches asunder, derived from a mean of several observations, the number of which is set down in the following column. The figures H. L. in this column signify that these are the altitudes at high and low water. The last column contains remarks on the state of the water,

water, chiefly shewing what might create any degree of uncertainty in the observations. Some of the altitudes are marked with 2 dots thus : and some with 4 thus :: . The first mark is to shew that the altitudes are to be esteemed doubtful on account of circumstances attending them: and the second mark is to shew that they are very doubtful.

I shall say nothing with respect to any conclusions that may be drawn from the above observations, except that the greatest rise and fall of the water, that I have observed, at the sygies of the Sun and Moon, is about 13 divisions of the post or 39 inches, and that the smallest rise and fall in the quadratures, is somewhat less than 7 divisions of the post, or about 20 inches; and that the mean time of high water happens 2<sup>h</sup> 15<sup>m</sup> after the Moon's passing the meridian, though in the course of every fortnight the said interval is very much varied by the different influence of the sun at different times, as the theory requires.

I am, Sir,

Your most obedient,

St. Helena, Jan.  
26, 1762.

Humble servant,

Nevil Maskelyne.

*Observations of the Tides made in the Harbour  
at James's Fort, St. Helena, by the Rev.  
Nevil Maskelyne, A. M. F. R. S.*

Read November 18, 1762.

1761.

Day of observation.	Apparent time	The height in divisions and tenths	No. of observations.	N. B. The height is set down according to the divisions on the post, each of which is 3 inches.
Nov.	<sup>h</sup>			
24 12.	8 56 A. M.	1 $\frac{1}{2}$	L 17	
	9 32 A. M.	1, 8	34	
	9 52 A. M.	2 $\frac{1}{2}$	18	
	10 37 A. M.	4, 0	16	
	0 58 P. M.	11	16	
	2 27 P. M.	12, 4	H 55	
	3 29 P. M.	12	18	
	3 49 P. M.	11, 3	16	
	4 32 P. M.	9, 4	20	
	8 26 P. M.	1	L	
	9 54 P. M.	2 $\frac{1}{2}$		
2 13. High surf.	6 45 A. M.	4, 8	38	
	7 24 A. M.	3, 3	36	
	7 57 A. M.	2, 5	12	
	9 21 A. M.	1, 5	L 12	
	9 32 A. M.	2, 0	20	
	1 26 P. M.	10, 9	28	
	3 21 P. M.	13, 3	H 22	
	3 54 P. M.	12, 8	26	
	6 35 P. M.	6, 3	20	

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Day of observation.	Apparent time	The height.	
Nov. 14.	9 25 A. M.	2	8
	10 12 A. M.	1, 1	L 8
	10 53 A. M.	2, 0	14
	3 48 P. M.	12, 8	H 22
	4 24 P. M.	12, 6	22
	5 37 P. M.	10, 3	
	7 57 P. M.	4, 5	
15.	3 52 A. M.	12, 3	12
	4 49 A. M.	12, 3	H 14
	5 32 A. M.	11, 3	8
	6 8 A. M.	10 $\frac{1}{2}$	32
	7 46 A. M.	5, 3	18
	10 17 A. M.	0, 1	L 34
	11 22 A. M.	0, 4	
	11 37 A. M.	1, 5	
	0 21 P. M.	3, 5	18
	1 19 P. M.	5, 7	24
	1 53 P. M.	6, 97	18
	3 4 P. M.	10, 3	20
	3 17 P. M.	10, 5	20
	4 28 P. M.	12, 5	H 24
	5 2 P. M.	12, 0	24
	5 50 P. M.	11, 6	44
	6 37 P. M.	10, 3	16
	7 38 P. M.	8	10
	7 53 P. M.	7, 3	24
	8 4 P. M.	7	14
16.	5 47 A. M.	11, 6	H 22
	6 32 A. M.	11, 0	18
	8 0 A. M.	7	24
	8 50 A. M.	5, 6	16
	9 15 A. M.	4, 1	30
	10 5 A. M.	2, 44	18
	10 50 A. M.	1, 46	13
	11 25 A. M.	0, 8	L 24
	11 39 A. M.	1, 5	40
		4 G	2

16.



Day of observation.	Apparent time	The height.	
Nov.	h ' /		
♃ 16.	11 53 A. M.	1, 9	26
	0 40 P. M.	2, 41	24
	1 15 P. M.	4, 03	16
	1 21 P. M.	4, 0	17
	1 36 P. M.	4, 14	33
	1 54 P. M.	5, 1	24
	2 47 P. M.	7, 1	23
	4 17 P. M.	10, 55	20
	5 16 P. M.	11, 4	20
	5 39 P. M.	11, 8	H 29
	6 9 P. M.	11, 7	33
	6 44 P. M.	11, 3	19
	8 31 P. M.	7, 5	14
	8 45 P. M.	7, 06	17
	9 55 P. M.	5, 06	24
	10 53 P. M.	3, 42	32
	11 30 P. M.	2, 6	L 34
♃ 17.	0 34 A. M.	2, 86	35
	1 13 A. M.	3, 51	36
	6 59 A. M.	9, 9	26
	10 37 A. M.	3, 7	41
	0 22 P. M.	2, 3	21
	0 57 P. M.	1, 75	24
	1 20 P. M.	2, 7	26
	4 22 P. M.	8, 4	28
	6 54 P. M.	11, 0	H 22
	7 36 P. M.	10, 94	31
	9 20 P. M.	8, 56	26
	9 27 P. M.	8, 3	14
	9 46 P. M.	7, 84	22
♃ 18.	6 23 A. M.	9, 68	51
	7 4 A. M.	9, 9	28
	7 33 A. M.	9, 95	H 41
	8 0 A. M.	9, 52	56
	9 18 A. M.	7, 77	26
	9 59 A. M.	7, 1	21

Day of observation.	Apparent time	The height.	
Nov. 18.	11 21 A. M.	5, 03	38
	0 59 P. M.	3, 14	44
	1 24 P. M.	3, 13	26
	1 42 P. M.	3, 14	L 24
	2 16 P. M.	3, 73	22
	3 48 P. M.	5, 13	23
	5 4 P. M.	6, 92	27
	5 15 P. M.	7, 1	10
	7 26 P. M.	10, 36	H 56
	7 49 P. M.	10, 2	41
8 23 P. M.	10, 1	20	
24 19.	5 47 A. M.	6, 72	30
	6 1 A. M.	7, 3	40
	6 24 A. M.	7, 93	35
	7 37 A. M.	9, 2	18
	7 59 A. M.	9, 52	22
	8 15 A. M.	9, 75	H 36
	8 38 A. M.	9, 52	29
	9 7 A. M.	8, 92	31
	10 28 A. M.	7, 16	25
	10 49 A. M.	7, 12	25
	2 25 P. M.	2, 67	L 27
	2 48 P. M.	3	26
	3 17 P. M.	2, 83	36
	6 4 P. M.	6, 8	18
	6 19 P. M.	7, 1	34
8 22 P. M.	9, 9	36	
8 53 P. M.	10, 5	H 29	
9 23 P. M.	10, 2	27	
11 14 P. M.	8, 87	15	
18 20.	0 10 A. M.	7, 64	39
	6 13 A. M.	5, 55	20
	7 22 A. M.	7, 07	27
	9 22 A. M.	9, 2	42
	9 41 A. M.	10, 3	19
	9 56 A. M.	9, 6	H 36

Surf high, and rise and fall of water very irregular, there seems to be a great swell at sea.

Day of observation.	Apparent time	The height.	
Nov. ♀ 20.	h ' A. M.		
	10 14 A. M.	9, 5	22
	10 54 A. M.	9, 0	33
	0 28 P. M.	6, 7	48
	1 21 P. M.	6, 1	30
	1 37 P. M.	5, 4	32
	2 52 P. M.	3, 8	31
	3 28 P. M.	3, 5	24
	3 57 P. M.	2, 8	L 32
	4 33 P. M.	3, 2	21
	6 43 P. M.	6, 4	38
	7 2 P. M.	7, 0	21
9 55 P. M.	11, 9	H 32	
10 40 P. M.	11, 5	30	
10 55 P. M.	11, 5	38	
A great swell this day.			
♂ 21.	7 32 A. M.	6	18
	8 9 A. M.	7, 1	36
	10 57 A. M.	10, 2	H 44
	11 43 A. M.	10, 0::	26
	11 46 A. M.	9, 4	13
	1 14 P. M.	7, 3	121
	2 47 P. M.	4, 8	38
	3 39 P. M.	3, 5	30
	4 32 P. M.	2, 9	L 18
	7 30 P. M.	6, 1	36
8 23 P. M.	7, 5	32	
High swell. Sea a little calmer.			
O 22.	8 55 A. M.	7, 3	33
	11 9 A. M.	11, 5	34
	11 42 A. M.	11, 5	H 27
	2 32 P. M.	7, 2	108
	3 46 P. M.	5, 4	70
	5 24 P. M.	3	34
	6 0 P. M.	2, 7	L 36
6 30 P. M.	2, 7	46	
Swell still great, but the rise and fall more regular than of late.			
♂ 23.	9 33 A. M.	7, 1	54
The swell a good deal abated and rise and fall pretty regular.			

Day of ob- servation.	Apparent time	The height.		
Nov. D 23.	h /			
	a 4 P. M.	10, 5	33	The rise and fall very regular.
	o 27 P. M.	11, 0	H 46	
	i 10 P. M.	11, 0	43	
	3 29 P. M.	6, 9	59	
	6 36 P. M.	2	37	Great swell, with a strong wind from the sea, renders the observation somewhat less certain.
	6 59 P. M.	1, 7	L 35	
	7 37 P. M.	1, 9	49	
	9 40 P. M.	6, 8	45	
J 24.	7 4 A. M.	2, 1	L 65	Sea very quiet and rise and fall very regular.
	7 59 A. M.	2, 6	56	
	10 2 A. M.	6, 4	48	
	10 24 A. M.	7, 2	44	
	o 47 P. M.	11, 1	43	
	i 11 P. M.	11, 1	H 57	
	i 30 P. M.	11, 0	53	
	2 52 P. M.	8, 9	31	
	3 45 P. M.	7, 6	47	
	4 18 P. M.	6, 4	71	
	6 56 P. M.	1, 9	54	
	7 28 P. M.	1, 6	L 50	
	8 7 P. M.	2, 0	52	
J 25.	7 52 A. M.	1, 7	L 54	
	8 21 A. M.	1, 7	47	
	11 4 A. M.	7, 3	56	
	o 55 P. M.	11, 0	34	
	i 58 P. M.	12, 0	H 35	
	2 17 P. M.	12, 0	34	
	2 46 P. M.	11, 0	30	
	4 50 P. M.	6, 7	31	
	7 53 P. M.	0, 7	L 48	
	8 42 P. M.	1, 3	41	
11 4 P. M.	6, 7	49		
24 26.	7 20 A. M.	1, 7	73	
	8 3 A. M.	1, 3	L 41	

Day of observation.	Apparent time	The height.		
Nov. 26.	h ' A. M.			
	8 11 A. M.	1, 5	36	
	9 1 A. M.	2, 3	42	
	11 23 A. M.	6, 4	36	A great swell.
	2 15 P. M.	11, 7	37	
	2 46 P. M.	11, 8	H 28	
	3 25 P. M.	10, 5	49	
5 25 P. M.	6, 7	41	A great swell.	
27.	7 42 A. M.	1, 5	36	{ A great swell and high surf but in the intervals very calm.
	9 2 A. M.	0, 9	L 55	{ Great swell and high surf.
	9 37 A. M.	1, 2	50	{ Great swell.
	8 6 A. M.	1, 6	47	{ Ditto.
	0 5 P. M.	6, 55	65	
	0 43 P. M.	7, 45	62	{ Swell so great, and rise and fall so irregular makes observing very uncertain.
	2 58 P. M.	11, 0	H 63	{ Swell abated, and rise and fall more regular.
	3 33 P. M.	11, 0	62	
4 20 P. M.	10, 4	86		
28.	7 40 A. M.	3, 0::	38	{ Swell great, but comes in slower, with longer intervals, surf inconsiderable, observing very uncertain.
	8 39 A. M.	1, 1	40	
	9 8 A. M.	0, 5	53	
	9 39 A. M.	0, 1	L 67	
	10 3 A. M.	0, 7	41	
	0 48 P. M.	6, 8	49	
	3 17 P. M.	10, 8	26	{ Sea calm, and rise and fall very regular.
	3 42 P. M.	11, 0	H 46	
	4 4 P. M.	11, 0	39	
	4 32 P. M.	10, 7	75	
6 20 P. M.	6, 8	38		
29.	7 58 A. M.	3, 6	60	
	10 6 A. M.	1, 0	L 45	
	10 31 A. M.	1, 0	51	
	0 21 P. M.	3, 6	40	
2 24 P. M.	8, 2	35		

Day of observation.	Apparent time	The height.	
Nov.	h /		
○ 29.	4 19 P. M.	11, 3	H 35
	4 45 P. M.	11, 1	41
	6 20 P. M.	8, 6	36
▷ 30.	4 23 A. M.	10, 7	H 55
	5 7 A. M.	10, 2	74
	6 13 A. M.	9, 0	43
	7 39 A. M.	6, 0	44
	7 58 A. M.	5, 0	68
	9 54 A. M.	1, 8	L
	10 26 A. M.	1, 9	53
	10 54 A. M.	2, 0	56
	11 27 A. M.	2, 3	75
	0 58 P. M.	4, 4	73
	1 13 P. M.	5, 1	54
	1 32 P. M.	5, 5	43
	3 22 P. M.	9, 3	40
	4 19 P. M.	10, 3	44
	4 51 P. M.	10, 7	H 42
	5 34 P. M.	10, 4	64
	6 23 P. M.	9, 6	57
	6 44 P. M.	9, 1	53
	8 18 P. M.	5, 5	45
Decem.			
♂ 1.	8 36 A. M.	5, 2	33
	9 45 A. M.	3, 5	56
	10 49 A. M.	2, 2	L 61
	11 23 A. M.	2, 3	75
	11 25 A. M.	2, 3	30
	0 22 P. M.	2, 7	49
	0 57 P. M.	3, 7	79
	2 13 P. M.	5, 4	48
	3 54 P. M.	8, 7	55
	5 40 P. M.	10, 4	H 42
	6 19 P. M.	10, 0	50
	7 13 P. M.	8, 5	57
	8 54 P. M.	6, 6	62

Day of observation.	Apparent time	The height.		
Dec.	h /			
2.	9 52 A. M.	4, 9	52	By a mean of 69 observations taken as fast as possible at every the least rise and fall. Taken from the greatest and more regular rises and falls by a mean of 52 observations.
	10 15 A. M.	4, 3	93	
	11 15 A. M.	3, 45		
	11 21 A. M.	3, 68		
	11 54 A. M.	3, 1	L115	
	0 33 P. M.	3, 3	74	
	1 34 P. M.	4, 1	87	
	3 51 P. M.	6, 2	95	
	4 12 P. M.	7, 1	127	
	5 57 P. M.	9, 4	94	
	6 21 P. M.	9, 9	H 73	
	6 49 P. M.	9, 7	91	A greater swell, observing somewhat uncertain all this day.
	7 55 P. M.	8, 8	43	
4 3.	7 47 A. M.	9, 3	54	A great swell; but very calm at times; observing upon the whole somewhat uncertain.
	8 20 A. M.	8, 5	55	

The violence of the swell has so loosened the nails and twisted the iron of the post, that it was necessary to take it off and repair it.

h 5. The post was fet up again as near the former height as could be judged.

	5 31 P. M.	5, 8	43
	6 49 P. M.	7, 7	40
o 6.	7 44 A. M.	8, 3	105
	9 2 A. M.	9, 2	47

Day of observation.	Apparent time	The height.	
Nov. 6.	10 14 A. M.	9, 5	H 50
	11 4 A. M.	9, 0	59
	11 49 A. M.	8, 1	61
	1 2 P. M.	7, 3	49
	3 29 P. M.	4, 0	42
	3 53 P. M.	3, 8	L 73
	4 25 P. M.	4, 0	61
	6 19 P. M.	5, 4	57
	6 31 P. M.	5, 1	59
	6 46 P. M.	6, 3	36
	7 5 P. M.	7, 1	75
} A great swell in these last observations, yet the rise and fall pretty regular at the smaller swells, and at times the sea pretty calm.			
D 7.	8 7 A. M.	7, 4	47
	8 24 A. M.	7, 8	62
	10 9 A. M.	9, 4	41
	10 39 A. M.	10, 0	H 69
	11 12 A. M.	9, 7	47
	1 5 P. M.	7, 8	69
	4 9 P. M.	3, 4	50
	4 46 P. M.	3, 2	L 57
	5 30 P. M.	3, 6	60
	8 27 P. M.	8, 0:	48
} A great swell in this observation, but all the others tolerably good.			
8 8.	9 32 A. M.	8, 5	50
	11 14 A. M.	10, 3	48
	11 42 A. M.	10, 5	H 49
	0 13 P. M.	10, 5	72
	2 0 P. M.	8, 5	54
	3 51 P. M.	5, 0	85
	5 26 P. M.	3, 0	46
	5 57 P. M.	2, 7	69
	6 30 P. M.	3, 0	49
8 9.	10 35 A. M.	9, 9	66
	0 19 P. M.	11, 7	71
	0 37 P. M.	11, 8	H 89
	1 0 P. M.	11, 8	72
	2 44 P. M.	9, 4	66



Day of observation.	Apparent time	The height.	
Dec. 8 9.	3 26 P. M.	8, 2	54
	6 12 P. M.	2, 5	L 31
	6 38 P. M.	2, 6	57
Sea very smooth all this day.			
24 10.	7 32 A. M.	2, 6	L 48
	8 1 A. M.	2, 7	45
	11 27 A. M.	9, 9	39
	1 13 P. M.	12, 0	H 72
	1 33 P. M.	12, 0	81
	1 45 P. M.	12, 0	81
	3 1 P. M.	10, 0	46
	6 51 P. M.	2, 2	67
	6 59 P. M.	1, 9	47
	7 38 P. M.	1, 6	L 100
	8 5 P. M.	1, 8	119
8 11.	8 5 A. M.	1, 2	L 104
	8 9 A. M.	1, 1	44
	8 32 A. M.	1, 4	76
	11 51 A. M.	9, 4	40
	2 17 P. M.	12, 5	H 47
	2 35 P. M.	12, 5	47
	4 51 P. M.	8, 0	37
	5 23 P. M.	6, 7	31
	5 58 P. M.	4, 2	41
	8 19 P. M.	1, 0	L 81
	8 59 P. M.	1, 4	66
12 12.	7 46 A. M.	1, 7	101
	8 7 A. M.	1, 5	76
	8 37 A. M.	1, 26	134
	9 1 A. M.	1, 12	L 78
	9 26 A. M.	1, 3	69
	9 56 A. M.	1, 7	51
	10 16 A. M.	2, 5	59
	0 19 P. M.	8, 5	45
	2 32 P. M.	13, 1	54
	2 51 P. M.	12, 9	89

Day of observation.	Apparent time	The height.	
Dec. h 12.	3 7 P. M.	13, 0	H 46
	3 36 P. M.	12, 7	55
	4 27 P. M.	11, 0	39
	5 12 P. M.	9, 2	43
	5 29 P. M.	8, 5	54
o 13.	7 29 A. M.	3, 7	67
	9 13 A. M.	0, 9	46
	9 36 A. M.	0, 6	L 56
	9 57 A. M.	0, 9	46
	11 38 A. M.	3, 8	48
	0 12 P. M.	6, 0	50
	0 50 P. M.	7, 9	43
	3 46 P. M.	13, 5	H 53
	4 10 P. M.	13, 3	44
	6 15 P. M.	8, 7	43
6 37 P. M.	7, 95	62	
D 14.	7 42 A. M.	5, 0	88
	9 49 A. M.	0, 6	47
	10 12 A. M.	0, 3	L 52
	10 29 A. M.	0, 3	50
	11 15 A. M.	0, 8	45
	0 51 P. M.	5, 0	46
	3 55 P. M.	12, 0	43
	4 18 P. M.	12, 4	58
	4 45 P. M.	12, 4	H 50
	5 8 P. M.	12, 3	37
5 41 P. M.	11, 5	30	
f 15.	8 46 A. M.	4, 67	60
	9 7 A. M.	3, 57	40
	10 30 A. M.	1, 53	50
	10 59 A. M.	1, 26::	52
	11 23 A. M.	1, 15	L 78
	11 51 A. M.	1, 7	52
	0 50 P. M.	3, 24	54
1 4 P. M.	3, 7	54	

{ A great swell; observing very uncertain.

Observing better.

Day of observation.	Apparent time	The height.	
Dec. 8 15.	h /		
	1 21 P. M.	4, 1	51
	1 29 P. M.	4, 64	54
	4 27 P. M.	11, 56	52
	5 45 P. M.	12, 1	H 66
	6 9 P. M.	11, 9	54
	6 27 P. M.	11, 6	24
	6 31 P. M.	11, 46	12
	6 35 P. M.	11, 43	42
	6 39 P. M.	11, 47	36
6 43 P. M.	11, 0	32	
8 16.	9 24 A. M.	5, 3	56
	11 25 A. M.	1, 86	49
	11 45 A. M.	1, 6	61
	0 5 P. M.	1, 54	L 67
	0 27 P. M.	1, 75	43
	2 16 P. M.	4, 9	54
	2 40 P. M.	5, 5	52
	4 28 P. M.	10, 0	52
	4 54 P. M.	11, 1	46
	5 26 P. M.	11, 5	39
	5 53 P. M.	11, 7	56
	6 12 P. M.	12, 3	H 47
	6 33 P. M.	12, 04	46
24 17.	10 29 A. M.	5, 05	57
	0 25 P. M.	2, 1	61
	0 48 P. M.	2, 1	L 52
	1 3 P. M.	2, 3	62
	3 6 P. M.	4, 7	43
	3 22 P. M.	5, 1	60
	6 20 P. M.	10, 9	51
	6 37 P. M.	11, 26	44
	6 55 P. M.	11, 6	H 98
8 18.	6 46 A. M.	9, 84	56
	7 14 A. M.	9, 83	74
	7 41 A. M.	9, 84	H 72

Day of observation.	Apparent time	The height.	
Dec. 2 18.	8 1 A. M.	9, 84	68
	8 26 A. M.	9, 7	70
	8 55 A. M.	9, 17	78
	9 14 A. M.	8, 96	54
	11 26 A. M.	5, 3	61
	1 28 P. M.	3, 0	72
	1 43 P. M.	3, 0	81
	2 3 P. M.	2, 5	L 57
	2 28 P. M.	2, 6	56
	2 54 P. M.	2, 9	59
	4 8 P. M.	4, 6	64
	4 36 P. M.	5, 3	62
2 19.	6 56 A. M.	8, 2	54
	7 30 A. M.	9, 1	51
	7 54 A. M.	9, 1	58
	8 29 A. M.	9, 3	61
	8 46 A. M.	9, 65	H 62
	9 10 A. M.	9, 5	59
	10 15 A. M.	8, 5	53
	10 34 A. M.	8, 14	50
	11 49 A. M.	6, 5	57
	2 28 P. M.	2, 8	59
	2 57 P. M.	2, 6	59
	3 17 P. M.	2, 5	L 49
	3 37 P. M.	2, 8	55
	5 51 P. M.	5, 3	49
6 27 P. M.	6, 5	57	
20.	9 28 A. M.	10, 1	48
	9 57 A. M.	10, 3	H 55
	10 25 A. M.	10, 0	49
	0 55 P. M.	6, 2	75
	3 45 P. M.	3, 0::	32
	4 10 P. M.	2, 2	L 44
	4 31 P. M.	2, 6	53
4 37 P. M.	5, 3	46	

Very smooth all this day.

{ Swell fo quick nothing cer-  
tain can be done.

Swells very quick.  
Swells very quick.  
Swells very quick.

[ 606 ]

Day of observation,	Apparent time	The height.	
Dec.	h ' "		
21.	8 6 A. M.	6, 6	54
	10 25 A. M.	10, 1	52
	10 50 A. M.	10, 15	H 45
	11 16 A. M.	10, 1	51
	11 40 A. M.	9, 9	52
	1 56 P. M.	6, 7	42
	2 24 P. M.	6, 1	55
	4 38 P. M.	3, 1	63
	5 9 P. M.	2, 7	L 51
	5 41 P. M.	2, 9	57
22.	9 8 A. M.	6, 8	53
	11 42 A. M.	10, 1	42
	0 6 P. M.	10, 5	H 52
	0 26 P. M.	10, 3	51
	2 50 P. M.	6, 8	63
	3 10 P. M.	6, 2	67
	5 31 P. M.	3, 1	59
	5 52 P. M.	2, 7	53
	6 22 P. M.	2, 5	L 56
	6 39 P. M.	2, 8	60
	7 3 P. M.	3, 2	86