XXI. *On the Tides in the Port of London.* *By* J. W. Lubbock, *Esq., V.P. and Treas. R.S.*

Read June 16, 1831.

I HAVE the honour to present to the Society a discussion of observations of the tides made at the London Docks, in the form of various Tables, which show the time and height of high water, not only at different points of the moon's age, but also for the different months of the year, for every minute of the moon's parallax, and for every three degrees of her declination. This work has been accomplished by Mr. Dessiou of the Admiralty; but for the arrangement of the Tables, and the methods employed, I alone am responsible.

The tides take place in the river Thames with extreme regularity, and, as the rise is considerable*, the observations are made with facility. Those upon which the annexed Tables are founded are made at the entrance to the London Docks; the time of high water, or the time when the water has just made its mark, is there noted on a slate by the watchman on the pier-head, generally only to the nearest five minutes; this is afterwards copied in a book kept for the purpose by Mr. Peirse. I am enabled, through the kindness of Mr. Solly, the worthy Chairman of the London Dock Company, to present to the Society the books containing the observations which serve as the foundation of Mr. Dessiou's Tables. These observations are not made with sufficient care; but they are valuable from the extent of time during which they have been carried on, as they were instituted soon after the opening of the Docks in 1804, and have been continued without interruption to the present time. I am not aware of any series of observations of the tides so extensive, except that made at Brest by order of the French Government. Mr. Peirse informs me that the observations of the night are generally more correct than those of

* I believe about nineteen feet. I am not however able to speak with precision, not having yet been able to examine the observations of low water.

the day, (which I was not aware of until lately,) because the persons in attendance at night have nothing else to do than to look out for high water; but in the day, owing to the press of business at the top of the tide, the water has fallen an inch or two at times before it has been noticed. The water remains stationary for some little time at high water, and therefore it is difficult to fix the time of that phenomenon precisely, without the aid of some mechanical contrivance; this will however I hope soon be supplied both at the London and St. Katherine Docks.

I have also to present to the Society some observations of the tides made during one year at the East India Docks, under the superintendence of Captain Eastfield, and which were kindly undertaken at my suggestion: these observations were made with great care, and may, I believe, generally be depended upon to the minute.

When the variations in the time and height of high water due to changes in the parallax and declination of the luminaries are neglected, the theories of Bernoulli and of Laplace lead to the same results, and these results agree most remarkably with observation. The same agreement is manifested in the circumstance that the variations of the interval between the time of the moon's transit and the time of high water, and the variations of the height of high water from the mean height, are greatest at the equinoxes, and least at the solstices, or soon after; and also that the height of high water increases as the distance of the moon decreases, that is, as her parallax increases. The difference between the heights when her parallax is greatest and least may be considered nearly a foot at the London Docks.

The changes in the declinations of the sun and moon, and in the parallax of the moon, have a sensible effect both on the time and on the height of high water; the law however of these changes is so complicated, and the observations are so imperfect, that for the present I think it will be necessary to have recourse to empirical tables for their calculation. They are not in conformity with the theory of Bernoulli, which has, I believe, never before been compared with observation; nor can I reconcile them to the theory of Laplace. The constants which might be supposed the same for this port and for Brest, determined by means of these observations, do not agree with those determined by Laplace from the observations at Brest. The comparison would be ex-

tremely interesting, if the results of the observations at Brest were arranged in Tables similar to those which accompany this paper. In a classification of this kind it is necessary that the epoch of the phenomena should be defined by the minute of the moon's transit; the day of the moon's age is quite insufficient. A complete classification of this kind is desirable, because erroneous conclusions may be drawn from isolated portions of the curve; and it is necessary, in order to ascertain the agreement between theory and the fact, to compare them throughout the whole period or extent of the inequality whose effect is considered.

According to the theory of BERNOULLI, and the Tables founded upon it, which are given in various works on navigation *, the variation in the interval between the time of the moon's transit and the time of high water, due to changes in the moon's parallax, vanishes or is equal to zero when the moon passes the meridian at 2 o'clock or 8 o'clock (or when $\theta - \theta_1 - \lambda + \lambda_1 = 0$ or 180°). This is directly contrary to our observations, according to which the variation is the greatest at this age of the moon. See Table XV.

According to our observations, the time and the height of high water are the same, whether the moon's declination be north or south; if any difference obtain, it must be determined by more delicate means: nor is there any sensible difference whether the moon's transit be superior or inferior, as may be seen by Table XIII., where the observations for one month are separated, those corresponding to the superior and those corresponding to the inferior transits being kept distinct.

The Tables XV, XVI, XVII, XVIII, XIX and XX are intended to furnish the means of calculating empirically the time and height of high water, taking into account the changes in the different months of the year, and also those due to changes in the moon's parallax and declination. By means of these Tables, Mr. DESSIOU has calculated the times and heights of high water for the year 1826; and, having classed all the observations made at the London Docks in that year according to the different winds, has found for each a correction, which is given in Table XXI. The variation or correction due to the wind depends, of course, also on its rapidity or force; it appears however

* I have had occasion in the Preface to my "Account of the Traité sur le Flux et Réflux de la Mer," of DANIEL BERNOULLI, to point out an error which exists in several Tables of this kind, from the heading being reversed; but this error does not remedy the discrepancy in question.

generally to have but little effect on the tide. North-westerly gales raise the tide; south-westerly winds depress it.

Two maps are annexed to this paper, drawn by Mr. WALKER; the one showing the time of high water on the coast of Great Britain, the other throughout the world, or at least in as many places as it has been ascertained.

The following are the authorities from which these maps have been compiled.

The Chart of the British Isles is taken from the observations and surveys of Messrs. M'KENZIE, SPENCE and MURRAY on the South coast of England; from those of Captain HEWETT and Mr. THOMAS on the East coast; France and the North Sea have been copied from the Admiralty Charts; the coast of Scotland is from M'KENZIE, Captain HUDDART and the Admiralty Charts; and Ireland has been drawn from the surveys of Captain WHITE, Captain HUDDART, Mr. NIMMO, &c. &c.

In the Chart of the World, the Coast of France, Spain and Portugal is copied from the Admiralty Charts and the surveys of TOFINO; Africa from those of Captain OWEN; Newfoundland is from Captain BULLOCK; Nova Scotia and the coast of the United States are from the Admiralty Charts; South America and the west coast of North America have been copied from the Spanish Charts, and from the surveys of Captains KING, BEECHEY, VANCOUVER, &c. &c. The coasts of Persia, India and the Indian Seas have been taken chiefly from Captain HORSBURGH's Charts and Book of Directions; Australia is from the surveys of Captain FLINDERS, KING, &c. &c.

It will be seen that the continents alter the direction of the *cotidal* lines, (I mean the series of points at which it is high water at the same instant,) and that the progress of the tide is not always from east to west: in the Atlantic it is from south to north; so that it is high water at nearly the same time on the coast of Portugal and on the opposite coast of America. This remarkable circumstance is noticed by BACON*.

The map of the world is offered as a mere sketch, for our information on this subject is at present lamentably deficient. The map of Great Britain presents

* De Fluxu et Refluxu Maris. BACON's Works, vol. ii. p. 81. "Idque non fortuito notatum, sed de industria inquisitum atque repertum, aquas ad littora adversa Europæ et Floridæ iisdem horis ab utroque littore refluere, neque deserere littus Europæ cum advolvantur ad littora Floridæ, more aquæ (ut supra diximus) agitatæ in pelvi, sed plane simul ad utrumque littus attolli et demitti."

more details, and is, I trust, more accurate; the time of high water being generally well ascertained (as a first approximation) and easily observed on these coasts. Lines are drawn round the coast to mark the depth of the water: it is to be regretted that this method of indicating the soundings, which, according to Captain ALEXANDER *, is adopted by the Russians in their charts, is not more general. The tide which reaches the port of London is principally due to the tide which descends along the eastern coast of Scotland and England: this branch of the tide meets the tide which comes up the Channel off the sand called the Kentish Knock.

If when the tide is single, the height of the water is represented by a series of cosines, affected with constant coefficients; when the tide results from the union of two branches, each of this kind, the height of the water will still be represented by a series of cosines of angles, affected with other constant coefficients, the periods of the inequalities being the same as before, but the epochs, or the times when they arrive at their maxima and minima, different. This is shown by LAPLACE in the Méc. Cel. vol. ii. p. 225. FRESNEL has applied the same method (Mémoire sur la Diffraction de la Lumière, p. 279.) to finding the resultant of any number of luminous waves of the same length. This method rests upon the superposition or coexistence of small oscillations, which may not be rigorously true; but it may be stated generally, that when the tide results from the union of any number of partial tides, the resultant of the whole may be considered as one tide, affected with inequalities, of which the periods are the same as the periods of the inequalities of the partial tides of which it is composed, but of which the magnitudes and the epochs are different †. It is owing to this cause that the high water in some places takes place only once in twenty-four hours, which is a case of interference.

I shall now proceed to explain the manner in which the annexed Tables were formed.

Table I. was made by classifying all the transits of the moon which took place in the years 1808 to 1826 inclusive, and in each half hour; thus, all the transits were found from the Nautical Almanac which took place between twelve o'clock (A.M.) and half-past twelve (A.M.), the moon being above the

* See ALEXANDER's Travels to the Seat of War in the East, vol. ii. p. 101.

† If $A \cos(\theta - \lambda)$ represent any inequality, the constant A determines its magnitude, the variable θ its period, and the constant λ its epoch.

horizon; the inferior transits of the moon between the same limits were interpolated, and added to the rest. The mean of these transits for the month of January, with the equation of time, was found to be twenty-four minutes, and the mean corresponding time of high water $2^h\ 9^m$; the transits between half-past twelve and one, and in every succeeding half-hour, were treated in the same way. The columns underneath are given to explain more fully the method employed, which was the same for all the Tables.

All the details of these calculations are deposited in the library of the Society.

Table I.

	Time of Moon's Transit from Nautical Almanac.				Time of corresponding High Water from the Dock Books.			
	January. 0 to 30′.		January. 30′ to 1 hour.					
	January.	h. m.	January.	h. m.	January.	h. m.	January.	h. m.
1808	28	0 10 int^d.	28	0 33	28	2 15	28	2 40
——	....	.....	29	0 56 int^d.	....	....	29	2 45
1809	16	0 21	17	0 48 int^d.	16	2 0	17	2 30
1810	6	0 19 int^d.	6	0 49	6	2 0	6	2 30
1811	25	0 11 int^d.	25	0 41	25	2 0	25	2 30
1812	14	0 6	15	0 35 int^d.	14	2 0	15	2 35
1813	3	0 13 int^d.	3	0 39	3	2 30	3	2 25
1814	22	0 20 int^d.	22	0 44	22	2 30	22	2 45
1815	11	0 20 int^d.	11	0 44	11	2 15	11	2 40
1816	29	0 10	29	0 34 int^d.	29	2 35	29	2 45
——	....	.....	30	0 57	....	....	30	3 0
1817	17	0 2	....	.....	17	1 45	....	....
——	18	0 30 int^d.	18	0 56	18	2 15	18	2 25
1818	7	0 5 int^d.	7	0 37	7	1 45	7	2 15
1819	26	0 2 int^d.	26	0 33	26	1 45	26	2 0
1820	16	0 23 int^d.	16	0 55	16	2 15	16	2 30
1821	4	0 17	5	0 47 int^d.	4	2 10	5	2 20
1822	23	0 16	24	0 41 int^d.	23	2 20	24	2 35
1823	12	0 7	13	0 31 int^d.	12	2 15	13	2 30
——	....	.....	13	0 54	....	....	13	2 45
1824	1	0 8	2	0 32 int^d.	1	2 10	2	2 25
——	31	0 12	2	0 55	31	2 35	2	2 30
1825	19	0 14	20	0 36 int^d.	19	1 50	20	2 30
——	....	.....	20	0 58	....	....	20	3 0
1826	8	0 4	9	0 56	8	2 0	9	2 40
——	9	0 30 int^d.	....	.....	9	2 20	....	....
	22)	300	24)	1071	22)	47 30	24)	61 30
		$13\frac{3}{4}$		$44\frac{1}{2}$	Mean corresponding Time of High Water.	2 9	.....	2 34
Equation of Time*....		10	.....	10				
Mean time of transit...		24	.....	$54\frac{1}{2}$				

* The equation of time was generally taken for the 15th of the month.

Hence I infer that neglecting the influence of the moon's parallax and declination, when the moon passes the meridian at twenty-four minutes past twelve mean solar time in January, the time of high water at the London Docks is nine minutes past two.

The other Tables, which result immediately from the observations, were formed in the same manner, and are, I trust, sufficiently explained by the heading which accompanies each.

		In the notation of the Méc. Cel.
Let m be the mass	of the sun.	L
δ . . declination		v
θ . . hour angle		$nt + \varpi - \psi$
r . . distance from the centre of the earth		r
Π . . mean horizontal parallax		
l . . longitude		φ
n . . mean motion in its orbit		m
ω . . obliquity of the ecliptic		ε

The same letters accented at foot refer to the moon, $\omega_{,}$ being the inclination of her orbit to the equator; let also φ denote the geographical latitude of the port, in the notation of the Méc. Cel. $90° - \theta$.

Considering only the terms which are multiplied by the cube of the parallax, the forces which produce the phenomena of the tides are the partial differences of the function

$$\frac{3m}{2r^3}\left\{(\sin\varphi\sin\delta + \cos\varphi\cos\delta\cos\theta)^2 - \frac{1}{3}\right\}$$ See the Méc. Cel. vol. v. p. 168.

According to the theory of Laplace, this function being equal to $\Sigma A\cos(\theta - \lambda)$, θ being any variable angle depending on the time, and A and λ constants, the height of the water at any given time is equal to $\Sigma(A'\cos(\theta - \lambda')$, θ being the same angle as before, and A' and λ' other constants.

$$\left\{\sin\varphi\sin\delta + \cos\varphi\cos\delta\cos\theta\right\}^2 = \frac{\sin^2\varphi}{2} + \frac{\cos^2\varphi}{4} + \frac{\cos^2\varphi}{4}\cos 2\theta - \left\{\frac{\sin^2\varphi}{2} - \frac{\cos^2\varphi}{4}\right\}\cos 2\delta$$

$$+ \frac{\cos^2\varphi}{8}\left\{\cos(2\theta - 2\delta) + \cos(2\theta + 2\delta)\right\} + \frac{\sin 2\varphi}{2}\sin 2\delta\cos\theta.$$

If the longitude of the sun be introduced by putting for δ its value from the equation

$$\sin\delta = \sin\omega \sin l$$

l being reckoned from the first point of Aries,

$$\left\{\sin\varphi\sin\delta + \cos\varphi\cos\delta\cos\theta\right\}^2 = \frac{\cos^2\varphi}{2}\left(1 - \frac{\sin^2\omega}{2}\right) + \frac{\sin^2\varphi\sin^2\omega}{2}$$

$$+ \frac{\cos^2\varphi}{2}\left(1 - \frac{\sin^2\omega}{2}\right)\cos 2\theta$$

$$+ \frac{\cos^2\varphi\sin^2\omega}{8}\left\{\cos(2\theta - 2l) + \cos(2\theta + 2l)\right\}$$

$$+ \sin^2\omega\left\{\frac{\cos^2\varphi}{4} - \frac{\sin^2\varphi}{2}\right\}\cos 2l$$

$$+ \frac{\sin 2\varphi}{2}\sin 2\delta\cos\theta$$

Considering the results of many years so as to destroy the effects of changes in the moon's parallax and declination, and taking the mean of the times of high water when the moon passes the meridian at any given time, and twelve hours later, the tides, owing to the united action of the sun and moon, depend on the terms

$$\frac{3m\Pi^3\cos^2\varphi}{4}\left(1 - \frac{\sin^2\omega}{2}\right)\cos 2\theta$$

$$+ \frac{3m\Pi^3\cos^2\varphi\sin^2\omega}{16}\left\{\cos(2\theta - 2l) + \cos(2\theta + 2l)\right\}$$

$$+ \frac{3m\Pi^3\sin^2\omega}{2}\left\{\frac{\cos^2\varphi}{4} - \frac{\sin^2\varphi}{2}\right\}\cos 2l$$

$$+ \frac{3m_i\Pi_i^3\cos^2\varphi}{4}\left(1 - \frac{\sin^2\omega_i}{2}\right)\cos 2\theta_i$$

and the height of the water will be represented by

$$A\,m\,\Pi^3\left(1 - \frac{\sin^2\omega}{2}\right)\cos(2\theta - 2\lambda)$$

$$+ \frac{B\,m\,\Pi^3}{4}\sin^2\omega\left\{\cos(2\theta - 2l - 2\lambda) + \cos(2\theta + 2l - 2\lambda)\right.$$

$$+ C\,\Pi^3\sin^2\omega\cos 2l$$

$$+A_{,}m_{,}\Pi_{,}^{3}\left(1-\frac{\sin^{2}\omega_{,}}{2}\right)\cos\left(2\theta_{,}-2\lambda_{,}\right)$$

This expression coincides with that given by LAPLACE, (Méc. Cel. vol. v. p. 169, at foot,) when the terms multiplied by $\sin^{4}\frac{\omega}{2}$ are neglected, $nt+\varpi-mt$ (in the notation of the Méc. Cel.) being equal to the hour angle θ at the equinoxes and solstices, that is, when $l=0$, 90°, 180° or 270°; but LAPLACE neglects the term $\cos 2l$.

LAPLACE supposes that

$$A=(1+nx)\,B \qquad A_{,}=(1+n_{,}x)\,B$$

n being the mean motion of the luminary in its orbit, and x an indeterminate quantity, to be determined by the observations. Making these substitutions, differentiating the expression for the height to find the time of high water, and supposing $\mathrm{d}\theta=\mathrm{d}\theta_{,}$ and $\omega=\omega_{,}$,

$$\tan\left(2\theta_{,}-2\lambda_{,}\right)=\frac{\dfrac{m\Pi^{3}}{m_{,}\Pi_{,}^{3}}\dfrac{(1+nx)}{(1+n_{,}x)}\sin\left(2\theta_{,}-2\theta-2\lambda_{,}+2\lambda\right)+\dfrac{m\Pi_{3}}{2m_{,}\Pi_{,}^{3}}\dfrac{\sin^{2}\omega\cos 2l}{(1+n_{,}x)\left(1-\frac{\sin^{2}\omega)}{2}\right.}\sin\left(2\theta_{,}-2\theta-2\lambda_{,}+2\lambda\right)+C'\sin\left(2\theta_{,}-2\lambda_{,}-2l\right)}{1+\dfrac{m\Pi^{3}}{m_{,}\Pi_{,}^{3}}\dfrac{(1+nx)}{(1+n_{,}x)}\cos\left(2\theta_{,}-2\theta-2\lambda_{,}+2\lambda\right)+\dfrac{m\Pi^{3}}{2m_{,}\Pi_{,}^{3}}\dfrac{\sin^{2}\omega\cos 2l}{(1+n_{,}x)\left(1-\frac{\sin^{2}\omega)}{2}\right.}\cos\left(2\theta_{,}-2\theta-2\lambda_{,}+2l\right)+C'\cos\left(2\theta_{,}-2\lambda_{,}-2l\right)}$$

C' being a constant different from C, θ and $\theta_{,}$ being the values of those variables at the instant of high water.

If we consider the mean of all the months of the year, column A, Table III.

$$\tan\left(2\theta_{,}-2\lambda_{,}\right)=\frac{\dfrac{m\Pi^{3}}{m_{,}\Pi_{,}^{3}}\dfrac{(1+nx)}{(1+n_{,}x)}\sin\left(2\theta_{,}-2\theta-2\lambda_{,}+2\lambda\right)}{1+\dfrac{m\Pi^{3}}{m_{,}\Pi_{,}^{3}}\dfrac{(1+nx)}{(1+n_{,}x)}\cos\left(2\theta_{,}-2\theta-2\lambda_{,}+2\lambda\right)}$$

The constants which enter into this expression may be determined by means of column A. The mean of this column is $1^{\mathrm{h}}\ 25^{\mathrm{m}}$; I therefore take

$$\lambda_{,}=1^{\mathrm{h}}\ 25^{\mathrm{m}}, \qquad \lambda-\lambda_{,}=2^{\mathrm{h}}, \qquad \lambda=3^{\mathrm{h}}\ 25^{\mathrm{m}}$$

$\dfrac{m\Pi^{3}(1+nx)}{m_{,}\Pi_{,}^{3}(1+n_{,}x)}$ = tangent of twice the difference of the interval when the moon passes the meridian at 2^{h} and at 5^{h}. I take

$$\log.\frac{m\Pi^{3}(1+nx)}{m_{,}\Pi_{,}^{3}(1+n_{,}x)}=9{\cdot}5784858$$

When the moon passes the meridian at three o'clock, $\theta - \theta_1 - \lambda + \lambda_1 = 15°$.

log. sin 30° =	9.6989700	log. cos 30° =	9.9375806
	9.5784858		9.5784858
	9.2774558		9.5160164 = log. ·3281
log. 1.3281 =	.1232308		
	9.1542250 = log. tan 8° 7′ or 32′ 38″ in time		

$2\theta_1 - 2\lambda_1 = -32'\ 38''$, $\theta_1 - \lambda_1 = 16\frac{1}{4}'$, $\theta_1 = 1^h\ 25^m - 16^m = 1^h\ 9^m$

In this way the following Table was calculated.

Time of Moon's Transit.	Interval between the Moon's Transit and the Time of High Water.		Error of Calculation.
	Observed.	Calculated.	
h	h. m.	h. m.	m.
0	1 57	1 56	— 1
1	1 42	1 41	— 1
2	1 26	1 25	— 1
3	1 11	1 9	— 2
4	56	54	— 2
5	45	44.1	— 0.9
6	42	41	— 0
7	52	53.7	+ 1.7
8	1 23	1 25	+ 2
9	1 56	1 56.3	+ 0.3
10	2 10	2 9	— 1
11	2 8	2 6.5	1·5

According to Table III. the establishment * of the London Docks is $1^h\ 57^m$. Adding ten minutes, the establishment of London Bridge is $2^h\ 7^m$. The establishment of the London Docks according to Mr. Bulpit, who has calculated the times and heights of high water in the river for many years, is 2^h. Mr. Bulpit's calculations are founded on tables constructed by the late Captain Huddart, which have not been published.

In the Philosophical Transactions, vol. xiii. p. 10, Flamsteed gives "A correct Tide-table, showing the true times of the high waters at London Bridge to every day in the year 1683." It appears from his remarks that the earliest Tide-tables which were calculated for the Port of London were made on the supposition that the tide always followed three hours after the moon's transit.

* By the establishment of any port is meant the time of high water at new and full moon.

The Annuaire du Bureau des Longitudes and various works on navigation give $2^h\ 45^m$ for the establishment of the Port of London; it seems therefore probable that the high water takes place now much earlier than it did formerly. It is generally admitted that the constant $\lambda - \lambda_1$ is the same at different ports; this, however, requires to be confirmed by accurate determinations, and is one of the most interesting questions in the theory of the tides. BERNOULLI makes this constant 20° or $1^h\ 20^m$ only in time; LAPLACE adopts the same value, though not expressly. BERNOULLI's Table for finding the time of high water, which is given in the Annuaire du Bureau des Longitudes, and in works on navigation, is quite inapplicable to the Port of London on this account, even in the mean distances of the moon, as the following comparison will show:

Time of Moon's Transit.	Interval between the Moon's Transit and the Time of High Water.		Error of Calculation.
	Observed.	Calculated.	
h	h m	h m	m
0	1 57	1 57	0
2	1 26	1 23½	− 2½
4	56	55	− 1
6	42	54½	+ 12½
8	1 23	2 0	+ 37
10	2 10	2 20	+ 10

The Table in the Annuaire for the year 1829 was made use of; the Table in that for 1831 differs from that only in form.

If $\lambda = \lambda_1$ the greatest tide takes place at new and full moon.

The quantity λ is called by LAPLACE the fundamental hour of the port.—Exposition du Système du Monde, p. 289.

I shall now compare the heights of high water, calculated by means of the same constants with those given by observation column B, Table V.

According to the preceding theory, the height of high water

$$= D + E\{\cos 2(\theta_1 - \lambda_1) + .3788 \cos 2(\theta - \lambda)\}$$

D and E being constants to be determined by observation.

When the moon passes the meridian at two o'clock, $2\theta_1 - 2\lambda_1 = 0$, $2\theta - 2\lambda = 0$

——————————— eight o'clock, $2\theta_1 - 2\lambda_1 = 0$, $2\theta - 2\lambda = 180°$

Hence by column B. Table V.

$$22.80 = D + 1.3788\,E$$
$$19.43 = D + .6212\,E$$

Whence $D = 16.68$ and log. $E = .64819$, $E = 4{\cdot}448$

When the moon passes the meridian at

h.	h.			
2		the height of high water	$= 16.68 + 4{\cdot}448\{1 + .3788\} = 22.80$	
3 or	1	do.	do.	$= 16.68 + 4.448\{\cos 8°\ 7' + .3788 \cos 22°\} = 22.64$
4 or	0	do.	do.	$= 16.68 + 4.448\{\cos 15°\ 25' + .3788 \cos 44°\ 30'\} = 22.17$
5 or	11	do.	do.	$= 16.68 + 4.448\{\cos 20°\ 45' + .3788 \cos 69°\ 30'\} = 21.42$
6 or	10	do.	do.	$= 16.68 + 4.448\{\cos 22°\ 2' - .3788 \sin 8°\} = 20.56$
7 or	9	do.	do.	$= 16.68 + 4.448\{\cos 15°\ 45' - .3788 \sin 44°\} = 19.79$
8		do.	do.	$= 16.68 + 4.448\{1 - .3788\} = 19.43$

The following Table gives a comparison between theory and observation.

Time of Moon's Transit.	Height of High Water.		Error of Calculation.
	Observed.	Calculated.	
h.	Ft.	Ft.	Ft.
0	22.46	22.17	− .29
1	22.72	22.64	− .08
2	22.80	22.80	0
3	22.59	22.64	+ .05
4	22.10	22.17	+ .07
5	21.28	21.42	+ .14
6	20.37	20.56	+ .19
7	19.56	19.79	+ .23
8	19.43	19.43	0
9	20.10	19.79	− .31
10	20.92	20.56	− .36
11	21.85	21.42	− .43

I shall now endeavour to show that the expression for $\tan(2\theta_1 - 2\lambda_1)$, p. 387, line 13, does not satisfy the observations.

When the moon passes the meridian at 2 o'clock $\theta - \theta_1 - \lambda + \lambda_1 = 0$.

$$\tan(2\theta - 2\lambda_1) = \frac{-C' \sin 2l}{1 + C' \cos 2l} \text{ nearly.}$$

When the moon passes the meridian at 8 o'clock, $\theta - \theta_1 - \lambda + \lambda_1 = 90°$

$$\tan(2\theta_1 - 2\lambda_1) = \frac{-C' \sin 2l}{1 - \frac{m\,\Pi^3}{m_1 \Pi_1^3} + C' \cos 2l} \text{ nearly.}$$

At the end of May $l = 45°$ nearly, and then according to Table III. when the moon passes the meridian at 2, the interval between her transit and H. W. is $1^h\ 16^m$ nearly; when the moon passes the meridian at 8, the interval between her transit and H. W. is $1^h\ 38^m$ nearly. The variation or difference being in the one case -5^m, ($1^h\ 20^m - 1^h\ 25^m = -5^m$), and in the other $+13^m$, ($1^h\ 38^m - 1^h\ 25^m = +13^m$).

The formula gives in the one case

$$\tan(2\theta_1 - 2l_1) = -C'$$

and in the other

$$\tan(2\theta_1 - 2l_1) = \frac{-C'}{1 - \frac{m\Pi^3}{m_1\Pi_1^3}}$$

according to which the variation or difference should be in both cases of the same sign: hence the variations or differences -5^m and $+13^m$ are not owing to this inequality.

It is possible that this discrepancy may be owing to the terms which have r_1^4 in the denominator; but the observations are made so carelessly that I shall not attempt to take these terms into consideration.

The discrepancy which I have pointed out is sufficient to show that Table III. cannot be represented by the expression of p. 387, line 13, whatever value be given to the constants employed: this discrepancy is not confined to the epoch I have noticed, but extends throughout the year.

Neglecting this discrepancy which not only prevents the expression above from representing the observations, but must also I think vitiate any conclusions to be drawn respecting the mass of the moon; in April when $l = 0$, and

when the moon passes the meridian at 5^h, the interval is $0^h\ 34^m$

. . . . . 11 . . . . . 2 14

$$2^h\ 14^m - 34^m = 1^h\ 40^m$$

I may suppose

$$\tan 1^h\ 40^m = \tan 25° = \frac{m\Pi^3(1 + nx)}{m_1\Pi_1^3(1 + n_1x)} + \frac{2m_1\Pi_1^3}{m\Pi^3}\,\frac{\sin^2\omega}{(1 + n_1x)\left(1 - \frac{\sin^2\omega}{2}\right)}$$

$$\cdot 4663 = \cdot 3788 + \frac{m\Pi^3}{2m_1\Pi_1^3}\,\frac{\sin^2\omega}{(1 + n_1x)\left(1 - \frac{\sin^2\omega}{2}\right)}$$

from which equation combined with the equation

$$\frac{m\,\Pi^3}{m_{,}\Pi_{,}^3}\frac{(1+n\,x)}{(1+n_{,}x)}=.3788$$

$1+n\,x$ may be determined.

The theory of LAPLACE differs essentially from that of BERNOULLI, in supposing the constants to be modified by local circumstances, which consideration introduces the factor $\frac{1+n\,x}{1+n_{,}x}$.

According to the observations at Brest, $1+n\,x=1.01891, 1+n_{,}x=1.25291$

$$\log.\frac{m\,\Pi^3}{m_{,}\Pi_{,}^3}\frac{(1+n\,x)}{(1+n_{,}x)}=9.5385031\,?\qquad \frac{m\,\Pi^3}{m_{,}\Pi_{,}^3}\frac{(1+n\,x)}{(1+n_{,}x)}=.3455.$$

Whence

$$\log.\frac{m\,\Pi^3}{m_{,}\Pi_{,}^3}=9.6283227$$

which gives the mass of the moon equal to that of the earth divided by 74.946.

If $m_{,,}$ be the mass of the earth, by an extension of the third law of KEPLER, $\frac{(m+m_{,,})\,\Pi^3}{(m_{,}+m_{,,})\,\Pi_{,}^3}$ is nearly equal to the ratio of the squares of the periodic times of the moon about the earth, and of the earth about the sun, or of their mean motions. This ratio is known very accurately to be .0748013. Hence neglecting $m_{,,}$ with regard to m, we have

$$\frac{m\,\Pi^3}{(m_{,}+m_{,,})\,\Pi_{,}^3}=(.0748013)^2.$$

If we neglect the factor $\frac{1+n\,x}{1+n_{,}x}$ which is nearly unity;

$$\log.\frac{m\,\Pi^3}{m_{,}\,\Pi_{,}^3}=9.57846$$

$$\log.\frac{m\,\Pi^3}{(m_{,}+m_{,,})\,\Pi_{,}^3}=7.74782\qquad \log.\frac{m_{,}+m_{,,}}{m_{,}}=1.83064$$

$$\frac{m_{,}}{m_{,}+m_{,,}}=\frac{1}{67.7},$$

which gives the mass of the moon equal to that of the earth, divided by 66.7.

Astronomers will, no doubt, concur in following the opinion of LAPLACE. "En considérant la pétitesse des quantités qui m'ont servi à déterminer l'ac-

croissement de l'action lunaire et en réflechissant que ces quantités sont du même ordre que les pétites erreurs dont l'application du principe de la coéxistence des ondulations très pétites aux phénomènes des marées est susceptible ; je n'ose garantir l'exactitude de cette valeur de la masse lunaire, et j'incline à penser que les phénomènes astronomiques sont plus propres à le fixer."

A very slight change in the interval employed produces a considerable alteration in the mass of the moon.

After differentiation $\mathrm{d}\theta$ was supposed $= \mathrm{d}\theta_l$, but since the time of the moon's synodic revolution is 29.530 days, and that in this time the hour angle of the moon is less by one circumference than that of the sun,

$$\mathrm{d}\theta = \frac{29.530}{28.530}\,\mathrm{d}\theta_l$$

The observations of the times and height of high water in different months of the year may be nearly represented by neglecting in the expression for the height, the term of which the argument is $2\theta + 2l - 2\lambda$, but it is not easy to see why the coefficient of this inequality differs so much from that of the inequality of which the argument is $2\theta - 2l - 2\lambda$, the cause of this difference must be clearly established before the theory can be considered complete.

If l_l be the longitude of the moon reckoned from her perigee, and increased by a constant, considering the terms depending on the changes of the moon's parallax, the height of the water may be represented by

$$m\,\Pi^3 \cos\,(2\theta - 2\lambda)$$
$$+ m_l \Pi_l^3 \left\{ \cos\,(2\theta_l - 2\lambda_l) + C\left(\cos\,(2\theta_l - 2\lambda_l - l_l) + \cos\,(2\theta_l - 2\lambda_l + l_l)\right)\right\}$$

or

$$m\,\Pi^3 \cos(2\theta - 2\lambda) + m_l\,\Pi_l^3 \{1 + C\cos l_l\} \cos\,(2\theta_l - 2\lambda_l)$$

$$\tan\,(2\theta_l - 2\lambda_l) = \frac{\dfrac{m\,\Pi^3}{m_l\Pi_l^3}\,\dfrac{\sin\,(2\theta_l - 2\theta - 2\lambda_l + 2\lambda)}{(1 + C\cos l_l)}}{1 - \dfrac{m\,\Pi^3}{m_l\Pi_l^3}\,\dfrac{\cos\,(2\theta_l - 2\theta - 2\lambda_l + 2\lambda)}{(1 + C\cos l_l)}}$$

According to this formula, the variation in the interval which elapses between the time of the moon's transit, and the term of high water, is equal to zero when the moon passes the meridian at 2 o'clock or 8 o'clock; and this is the case whatever value be given to the constant C, or the constant which I have sup-

posed to be included in the angle l_1: this result is directly contrary to observation, as may be seen by Table VIII. This difficulty may be got over by supposing the coefficients (C) of the angles $2\theta_1 - 2\lambda_1 - l_1$ and $2\theta_1 - 2\lambda_1 + l_1$ to be different; it remains however to assign the cause of this difference.

Not having been able to satisfy myself with respect to this and other discrepancies, I shall not attempt to form any Tables from theory for the purpose of calculating the effects due to changes in the declination of the luminaries, and in the parallax of the moon; but I hope that no great length of time will elapse before the results contained in M. Dessiou's Tables will be confirmed by more accurate observations here and elsewhere, and that the problem of the tides will meet with the attention it deserves, no less practically than in connection with Physical Astronomy, and particularly with the determination, even if imperfectly, of the mass of the moon. "Les marées ne sont pas moins interessantes à connoître, que les inégalités des mouvemens célestes. On a négligé pendant long-temps de les suivre avec une éxactitude convenable, à cause des irrégularités qu'elles présentent; mais ces irrégularités disparaissent en multipliant les observations."—Exp. Syst. du Monde, p. 289.

The Tables XV. XVI. &c. present irregularities, owing to the comparative paucity and the imperfection of the observations. M. Dessiou has therefore formed Tables from these, in which these irregularities are arbitrarily removed: these Tables are published in the Companion to the British Almanac for 1832, and no doubt represent the phenomena rather better than the former. As, however, these alterations are arbitrary, I have preferred giving here the results of the observations without any change. The observations employed were taken in all cases indiscriminately from the Dock books.

I have now only to express my acknowledgements to the Committee of the Society for the Diffusion of Useful Knowledge, and to Mr. Pond the late superintendent of the Nautical Almanac, who have given me M. Dessiou's assistance in forming the annexed Tables.

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XXI. Showing the influence of the direction of the Wind on the time and height of High Water.

Table I.

Showing the time of High Water at the London Docks corresponding to the mean time
vations made between the 1st of January

January.			February.			March.			April.			May.			June.		
Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.
h m	h m		h m	h m		h m	h m		h m	h m		h m	h m		h m	h m	
0 24	2 9	22	0 26	2 17.8	19	0 23.5	2 25.8	26	0 17.5	2 17.8	23	0 12	2 5.5	23	0 15.8	2 3	19
0 54.5	2 34	24	0 58	2 45	25	0 53.2	2 48	26	0 47	2 38.2	20	0 43.5	2 26.5	21	0 44.2	2 25	20
1 24	3 1	20	1 27	3 7.5	25	1 23.5	3 5	22	1 15	2 57.2	23	1 12.5	2 46.8	21	1 14.2	2 46.5	21
1 55	3 20	24	1 59	3 31.5	21	1 53.5	3 32	28	1 46	3 21	23	1 42.2	3 11.5	22	1 46	3 10.5	23
2 24	3 47	27	2 28.5	3 51.5	25	2 24.2	3 52.5	23	2 16.5	3 42	22	2 11.2	3 29.5	22	2 16	3 32.2	20
2 55	4 8	22	3 0	4 18.2	25	2 55	4 14.2	25	2 46.8	4 4.5	20	2 42.2	3 51.5	21	2 45	3 54.5	22
3 24	4 33	27	3 30	4 43	24	3 25	4 32.5	24	3 14	4 23	19	3 10.5	4 9.5	20	3 14	4 18.2	22
3 54	4 59	27	3 59	5 7.2	20	3 55.5	4 54	22	3 43.2	4 39	19	3 42	4 35.8	26	3 45	4 42	24
4 26	5 26	24	4 27.8	5 26.5	23	4 26.2	5 19	24	4 13	5 3	23	4 11	4 56	22	4 15	5 8	23
4 55	5 50	25	5 3.2	5 54.2	25	4 53.8	5 37.2	20	4 43	5 20.2	19	4 42	5 23	21	4 46	5 37.2	26
5 25	6 25	26	5 31.5	6 18.5	22	5 23.8	6 0.8	20	5 11.5	5 45.2	21	5 11	5 44.8	25	5 17	6 8	24
5 56	6 54	28	6 0.2	6 39.8	19	5 56	6 23.2	24	5 43.8	6 11	22	5 43	6 19.5	24	5 46	6 39	23
6 26	7 19	23	6 29	7 15	21	6 24	6 50.8	21	6 15.8	6 43	25	6 9.8	6 45.5	20	6 16	7 14	25
6 55	7 57	24	7 0.5	7 44.2	19	6 55	7 24.3	23	6 47	7 17.8	20	6 39	7 22.5	26	6 46	7 52	25
7 24	8 30	24	7 29	8 22	19	7 25.5	7 55.2	21	7 16.5	8 4.5	24	7 11	8 16	28	7 15	8 34	22
7 56	9 13	25	7 58	8 57	18	7 55	8 48.2	23	7 49	9 2.2	23	7 41.5	9 8.8	24	7 46	9 19	27
8 26	10 1	21	8 28.2	9 44.5	22	8 24.5	9 42	23	8 15.5	9 49.8	21	8 12.5	9 54	26	8 17	9 58.5	23
8 56	10 41	23	8 58	10 34.5	16	8 55.2	10 37.8	22	8 41.5	10 34.2	23	8 43.8	10 48.5	27	8 46	10 42	23
9 27	11 22	20	9 28.5	11 20.2	23	9 24.2	11 21.5	22	9 14.8	11 27	26	9 12.5	11 22.5	21	9 16	11 17.5	23
9 54	11 56	23	9 59.5	12 4.5	18	9 54	12 3.5	25	9 45.2	12 1.5	24	9 40.5	11 56.5	24	9 46	11 51	19
10 25	12 29	18	10 29.2	12 34.8	21	10 24.2	12 38.5	22	10 15.8	12 32	24	10 10.8	12 24.5	25	10 15	12 21	23
10 53	12 56	21	11 0.5	13 11	22	10 53.8	13 4.5	25	10 45	13 0	25	10 40.5	12 50.5	22	10 45	12 48	20
11 24	13 23	24	11 30	13 36.5	18	11 25.2	13 31.2	27	11 15.5	13 23.5	22	11 11	13 18.2	25	11 14	13 12	19
11 56	13 48	21	11 59	14 0	21	11 54.2	13 54	21	11 45.8	13 53	26	11 41.2	13 42.5	21	11 45	13 39	22
12 26	14 13	23	12 28.2	14 20	21	12 24	14 21	28	12 16.5	14 12.2	22	12 10	14 1.5	21	12 15	14 0.5	20
12 56	14 35	21	12 58.8	14 42.8	23	12 54.2	14 38.2	22	12 46.5	14 34.2	22	12 40.2	14 26.8	23	12 45	14 22	20
13 26	14 58	22	13 28.5	15 6.2	23	13 24	15 6	25	13 14.8	14 56	22	13 11.2	14 46.5	22	13 14	14 45	20
13 54	15 19	21	13 59	15 26.5	22	13 55	15 29.5	27	13 44.5	15 14.5	21	13 41.5	15 9	20	13 45.5	15 9	23
14 26	15 47	28	14 29.5	15 52.2	27	14 25	15 50.5	20	14 14.5	15 37	21	14 10	15 25	21	14 17	15 32	22
14 57	16 11	23	15 0.2	16 16.5	20	14 54	16 10.5	25	14 44.5	15 59	22	14 41	15 46.2	23	14 47	15 55	20
15 26	16 33	23	15 29.5	16 39	24	15 23	16 32	22	15 16.5	16 19	21	15 10.5	16 10	20	15 15	16 17	22
15 54	17 3	25	16 1	17 1.2	25	15 52	16 52	21	15 47	16 38	21	15 38.2	16 30.2	20	15 46	16 41	25
16 26	17 31	27	16 31.5	17 27.8	20	16 23	17 16	26	16 15.5	17 2.2	19	16 9.2	16 54.8	25	16 16	17 10	22
16 55	17 57	24	16 59	17 45	20	16 55.5	17 38.5	22	16 45	17 22	22	16 44	17 23	26	16 45	17 36	24
17 26	18 25	27	17 32	18 12	23	17 24	17 57.2	20	17 16.2	17 45	22	17 12.2	17 50	22	17 15.5	18 6	26
17 56	18 55	25	17 59	18 39.2	19	17 50.5	18 23.8	20	17 46	18 13.5	20	17 40.5	18 16.8	23	17 46	18 41	25
18 24	19 21	24	18 26.5	18 58	18	18 23	18 53.8	24	18 13.2	18 41	19	18 10.5	18 50.5	24	18 15	19 13	22
18 56	20 2	24	18 58.8	19 36.8	25	18 54	19 22.5	20	18 44	19 16	25	18 40	19 34	26	18 45	19 50	30
19 27	20 40	23	19 29.5	20 8.5	17	19 23	20 1.5	23	19 15.5	20 5	24	19 10.5	20 15.5	24	19 17.5	20 38	24
19 56	21 22	23	19 59	20 50.8	20	19 53.5	20 46	22	19 45	20 54.5	21	19 40	21 5	26	19 46	21 26	21
20 26	21 57	22	20 28	21 39.2	19	20 23.3	21 44	23	20 14.5	21 39	24	20 11.5	21 58.5	27	20 14	21 57	24
20 55	22 44	20	20 59.2	22 29.2	20	20 54	22 40.5	25	20 45.5	22 37.2	26	20 41.8	22 46	24	20 45	22 42	25
21 24	23 23	22	21 33	23 14.2	19	21 24.3	23 24.8	22	21 16	23 22.2	23	21 11.2	23 23	26	21 17	23 23.5	24
21 54	23 56	21	21 57.5	23 56.2	19	21 53	24 4.5	23	21 45.2	24 3.5	25	21 42.5	24 0	25	21 46	23 55.5	20
22 26	24 29	23	22 28.8	24 29.5	21	22 23.5	24 43	26	22 13.8	24 29	22	22 11.2	24 30	24	22 15	24 23.5	22
22 57	25 0	21	23 0	25 4	23	22 55.5	25 7.2	27	22 45.8	25 4	30	22 40.2	24 58	21	22 47	24 51	22
23 26	25 26	21	23 31	25 31.8	20	23 26	25 35.5	23	23 17	25 31.2	20	23 8	25 23.5	26	23 17	25 17	21
23 55	25 49	20	24 0	25 57	21	23 54	25 57.6	22	23 45.8	25 55	22	23 41.2	25 44	22	23 46	25 40	20

Table I.

(reckoned from noon) of the Moon's Transit in each month of the year; from 13,073 obser-
1808 and the 31st of December 1826.

July.			August.			September.			October.			November.			December.		
Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.	Moon's Transit. P.M.	Corresponding H. W.	No. of Obs.
h m	h m		h m	h m		h m	h m		h m	h m		h m	h m		h m	h m	
0 21	2 11	19	0 19	2 17	22	0 9	2 14	26	0 0	2 6	24	23 59	1 51	22	0 13.2	1 58	22
0 49	2 32	22	0 51.5	2 45	25	0 40	2 36	25	0 30	2 26	23	0 29	2 9	20	0 42	2 21.2	19
1 20	2 57	23	1 19	3 3	20	1 10.5	2 59	24	1 1	2 48	25	0 59	2 33	22	1 9.2	2 38.5	20
1 50	3 18	23	1 48	3 27	26	1 41	3 24	24	1 41	3 7	23	1 31	2 55	21	1 40.2	3 6	22
2 20	3 41	25	2 19	3 49	25	2 10	3 43	20	2 2	3 30	21	2 1	3 16	20	2 11	3 23	23
2 51	4 5	25	2 48	4 14	27	2 39.5	4 3	27	2 32	3 50	25	2 31	3 38	22	2 41	3 46	22
3 21	4 33	24	3 20.5	4 35	24	3 10	4 26.5	20	3 3	4 8	20	3 1	4 0	20	3 11	4 11	23
3 51	4 57	27	3 49.5	5 0	23	3 39	4 44	22	3 31	4 28	20	3 31	4 20	22	3 41	4 34	24
4 21	5 23	23	4 19	5 25	25	4 9	5 3	21	4 0	4 46	21	4 3	4 44	23	4 11.5	5 0	26
4 50	5 50	26	4 50	5 47	25	4 40	5 26	25	4 29	5 8	22	4 33	5 12	21	4 42	5 24	25
5 21	6 19	28	5 20.5	6 14	22	5 12.5	5 56	21	5 1	5 33	24	5 0	5 35.5	20	5 11.5	5 57	24
5 52	6 51	25	5 49	6 36	22	5 41.5	6 17	19	5 31	5 57.5	20	5 29	6 4.5	23	5 41	6 31	28
6 21	7 24	22	6 18	7 6	22	6 10.5	6 40	21	6 1	6 23	20	5 59	6 35	23	6 12	7 13	26
6 50	7 50	27	6 49	7 33	24	6 41	7 10	22	6 32	7 1	25	6 31	7 13	26	6 42	7 46	24
7 21	8 36	25	7 19	8 12	21	7 11.5	7 45	21	7 4	7 42	23	7 1	8 3	24	7 11	8 23	27
7 53	9 17	24	7 48	8 51.5	22	7 42	8 34	22	7 31.5	8 39	21	7 29	8 51	23	7 41	9 15	23
8 23	9 58	21	8 19	9 39	24	8 13	9 27	21	7 59.5	9 25	22	8 1	9 44	26	8 10	9 54	25
8 51	10 33	20	8 50	10 29	23	8 41	10 22	22	8 29.3	10 13	25	8 31	10 29	24	8 43	10 35	26
9 23	11 14.5	23	9 20.5	11 12	22	9 11.5	11 14	23	8 59.5	11 4	27	9 0	11 13	25	9 11	11 16	22
9 53	11 49	21	9 50	11 55.5	21	9 42	11 48	23	9 31	11 52	24	9 30	11 50	25	9 41	11 51	23
10 23	12 23	22	10 18	12 23.5	20	10 12	12 30	23	10 0	12 21	26	10 0	12 14	23	10 12	12 19	23
10 53	12 55	19	10 48	12 55.5	22	10 41.5	12 59	23	10 30	12 49	26	10 31	12 47	25	10 41.5	12 55	20
11 23	13 19	23	11 18	13 22	23	11 9	13 19	21	11 1	13 15	25	11 1	13 12	22	11 10	13 17	21
11 53	13 47.5	21	11 48.5	13 47.5	23	11 40	13 49	27	11 31	13 43	25	11 30	13 33	21	11 39	13 34	20
12 23	14 6.5	21	12 20	14 18	26	12 10	14 14	23	12 1	14 3	23	12 0	13 56	22	12 9	13 58	23
12 53	14 35	22	12 51	14 41	24	12 39	14 34	23	12 29.5	14 25	25	12 29	14 18	20	12 40	14 22	22
13 20	14 58	23	13 18.5	15 4	21	13 10	14 56	27	13 0	14 44	22	12 58	14 32	21	13 11	14 45	21
13 51	15 16	21	13 48	15 27.5	26	13 41	15 18.5	25	13 30	15 8.5	24	13 30	14 57	23	13 41.5	15 10	25
14 20	15 41.5	25	14 19	15 50	26	14 12	15 40.5	23	14 0	15 28	22	14 1	15 17	21	14 14	15 31	21
14 51	16 6.5	25	14 50	16 12	23	14 41	16 3	22	14 29	15 45	23	14 30	15 38	20	14 43	15 52	21
15 21	16 31.5	25	15 19	16 35	22	15 10	16 22	23	15 0	16 8	22	15 0	15 59.5	21	15 11	16 12	23
15 52	16 56.5	25	15 50	17 0	27	15 39.5	16 43	21	15 30	16 23	22	15 30	16 20	22	15 42	16 40	25
16 21	17 26	27	16 22	17 23	22	16 9	17 5	23	16 1	16 48.5	23	15 59	16 40	20	16 12	17 5	23
16 52	17 55	26	16 51.5	17 47.5	23	16 40	17 30	22	16 31	17 11	20	16 30	17 12	24	16 40.5	17 32	24
17 22	18 21.5	23	17 19	18 11.5	23	17 11	17 48	23	17 0.5	17 30	23	17 1	17 34	24	17 11	18 2	29
17 50	18 51	26	17 48	18 35.5	22	17 41	18 15	19	17 31	17 56	23	17 30	18 4	20	17 42	18 33	25
18 22	19 21	28	18 19.5	19 2	25	18 10.5	18 40	20	18 2	18 29	21	18 0	18 39	26	18 12	19 6	26
18 51	19 54	24	18 50	19 36	22	18 41	19 11	19	18 30.5	19 1	24	18 31.5	19 13	25	18 41	19 44	24
19 20	20 33	23	19 20	20 10	23	19 10.5	19 44	21	19 0	19 39	20	19 2	20 1.5	23	19 9.5	20 33	24
19 49	21 15	22	19 50	20 58	21	19 41.5	20 38	21	19 39.5	20 34	26	19 30	20 52	23	19 40	21 3	28
20 20	21 54	24	20 19.5	21 43	24	20 11	21 37	22	20 1	21 35	25	19 59.5	21 41	26	20 12	21 52	25
20 50	22 39	22	20 49	22 32	21	20 41	22 27	20	20 31	22 20	28	20 29	22 22	23	20 40	22 40	23
21 21	23 16.5	22	21 19	23 9	23	21 10	23 9	22	21 1	23 15	25	21 0.5	23 9	26	21 13.5	23 18.5	25
21 51	23 53	21	21 51	23 53.5	23	21 40	23 53	25	21 30	23 50	23	21 31	23 47	24	21 42.5	23 45	19
22 20	24 22	20	22 21	24 27	21	22 10	24 26	23	22 0.5	24 28	29	22 1.5	24 17	23	22 11	24 14	22
22 50	24 51.5	21	22 51.5	24 55	22	22 40	24 58	21	22 32	24 53	25	22 31	24 43	22	22 41.5	24 45	22
23 20	25 22	22	23 19	25 23	21	23 9.5	25 24	26	23 2	25 20	24	22 59	25 10	19	23 10.5	25 10	20
23 51	25 46	24	23 49	25 44	22	23 39	25 50	22	23 31	25 40	22	23 28	25 30	23	23 41	25 34	21

TABLE II. (Interpolated from Table I.)

Showing the Interval between the Moon's Transit and the time of High Water at the London Docks for every month in the year.

Moon's Transit. Mean Solar Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.
P.M.													
h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
0 0	1 53	1 57	2 3	2 5	1 57	1 51	1 54	1 56	2 7	2 6	1 52	1 50	1 57
0 30	1 44	1 51	2 1	1 56	1 48	1 44	1 48	1 57	1 59	1 56	1 40	1 43	1 50
1 0	1 39	1 47	1 52	1 47	1 39	1 36	1 41	1 51	1 52	1 47	1 34	1 33	1 43
1 30	1 35	1 39	1 41	1 39	1 31	1 28	1 34	1 42	1 45	1 36	1 24	1 27	1 35
2 0	1 25	1 32	1 37	1 30	1 22	1 21	1 26	1 36	1 37	1 28	1 15	1 16	1 26
2 30	1 21	1 26	1 26	1 22	1 12	1 13	1 19	1 29	1 27	1 19	1 7	1 8	1 19
3 0	1 12	1 18	1 17	1 14	1 2	1 7	1 13	1 22	1 19	1 6	0 59	1 3	1 11
3 30	1 8	1 13	1 6	1 1	0 56	1 0	1 10	1 14	1 9	0 57	0 49	0 55	1 3
4 0	1 4	1 7	0 57	0 53	0 48	0 55	1 6	1 9	1 2	0 46	0 42	0 50	0 57
4 30	0 59	0 58	0 52	0 43	0 43	0 52	1 1	1 3	0 50	0 39	0 39	0 46	0 50
5 0	0 56	0 52	0 42	0 35	0 36	0 51	1 0	0 55	0 45	0 32	0 36	0 44	0 45
5 30	1 0	0 47	0 35	0 30	0 35	0 52	0 58	0 50	0 39	0 26	0 36	0 49	0 43
6 0	0 57	0 39	0 27	0 27	0 36	0 55	1 0	0 47	0 32	0 22	0 36	0 57	0 41
6 30	0 54	0 46	0 27	0 29	0 41	1 2	1 3	0 46	0 29	0 29	0 42	1 3	0 44
7 0	1 3	0 44	0 29	0 39	0 58	1 12	1 5	0 47	0 32	0 37	1 1	1 9	0 51
7 30	1 8	0 53	0 34	0 58	1 19	1 26	1 18	0 57	0 46	1 6	1 23	1 24	1 6
8 0	1 19	1 0	0 57	1 21	1 36	1 37	1 27	1 10	1 5	1 25	1 42	1 41	1 22
8 30	1 36	1 17	1 23	1 45	1 55	1 48	1 36	1 26	1 30	1 43	1 58	1 49	1 39
9 0	1 46	1 37	1 45	2 3	2 8	1 58	1 45	1 44	1 55	2 4	2 13	2 0	1 55
9 30	1 56	1 53	2 0	2 14	2 15	2 3	1 53	1 57	2 5	2 20	2 20	2 8	2 5
10 0	2 3	2 5	2 10	2 16	2 15	2 5	1 57	2 6	2 13	2 21	2 14	2 8	2 9
10 30	2 4	2 5	2 13	2 16	2 11	2 5	2 1	2 7	2 18	2 19	2 16	2 11	2 10
11 0	2 2	2 11	2 9	2 12	2 8	2 0	2 0	2 7	2 13	2 14	2 11	2 9	2 8
11 30	1 56	2 6	2 5	2 8	2 3	1 56	1 55	2 2	2 9	2 12	2 3	1 59	2 3
A.M.													
0 0	1 51	2 1	1 59	2 2	1 54	1 49	1 52	1 59	2 6	2 2	1 56	1 51	1 57
0 30	1 46	1 51	1 54	1 52	1 48	1 41	1 43	1 55	1 58	1 55	1 49	1 44	1 50
1 0	1 38	1 44	1 44	1 45	1 39	1 34	1 41	1 49	1 49	1 44	1 34	1 37	1 41
1 30	1 31	1 38	1 40	1 36	1 31	1 28	1 34	1 44	1 41	1 38	1 27	1 31	1 35
2 0	1 24	1 27	1 32	1 27	1 19	1 20	1 24	1 37	1 32	1 28	1 16	1 22	1 27
2 30	1 20	1 23	1 24	1 19	1 9	1 12	1 20	1 28	1 24	1 16	1 8	1 10	1 18
3 0	1 13	1 16	1 15	1 9	1 2	1 5	1 14	1 20	1 17	1 8	1 0	1 3	1 10
3 30	1 8	1 9	1 7	0 57	0 54	0 59	1 9	1 14	1 7	0 53	0 50	0 59	1 2
4 0	1 8	1 0	0 58	0 47	0 47	0 55	1 5	1 7	0 58	0 47	0 41	0 55	0 56
4 30	1 5	0 56	0 51	0 42	0 42	0 53	1 4	1 0	0 52	0 40	0 42	0 52	0 52
5 0	1 1	0 46	0 41	0 33	0 38	0 51	1 2	0 55	0 42	0 29	0 33	0 51	0 45
5 30	0 58	0 40	0 33	0 28	0 37	0 53	1 0	0 51	0 35	0 25	0 34	0 51	.0 42
6 0	0 59	0 40	0 32	0 28	0 39	0 56	1 0	0 46	0 31	0 27	0 39	0 53	0 43
6 30	0 58	0 33	0 30	0 30	0 49	1 1	1 1	0 44	0 30	0 30	0 42	1 0	0 44
7 0	1 8	0 38	0 30	0 40	1 1	1 13	1 6	0 47	0 33	0 39	0 59	1 6	0 52
7 30	1 14	0 39	0 40	0 59	1 12	1 31	1 17	0 56	0 49	1 4	1 22	1 18	1 5
8 0	1 27	0 52	0 57	1 17	1 39	1 40	1 29	1 13	1 15	1 34	1 41	1 34	1 23
8 30	1 33	1 12	1 27	1 37	1 57	1 50	1 39	1 31	1 39	1 49	1 53	1 53	1 40
9 0	1 51	1 30	1 50	1 59	2 9	2 1	1 51	1 45	1 55	2 14	2 9	2 4	1 57
9 30	2 0	1 40	2 0	2 12	2 16	2 8	1 58	1 54	2 8	2 20	2 16	2 4	2 5
10 0	2 2	1 59	2 13	2 16	2 19	2 8	2 2	2 4	2 15	2 27	2 16	2 4	2 10
10 30	2 3	2 1	2 18	2 16	2 18	2 6	2 2	2 5	2 17	2 21	2 12	2 3	2 10
11 0	2 2	2 4	2 12	2 16	2 16	2 2	2 2	2 4	2 16	2 18	2 11	2 1	2 9
11 30	1 59	2 1	2 9	2 11	2 8	1 57	2 0	2 1	2 12	2 9	2 2	1 55	2 4

Table III.

Formed from the preceding by taking the mean of the interval when the Moon passes the meridian at any given time, and twelve hours later.

Moon's Transit. Mean Solar Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	High Water.	A.
h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
0 0	1 52	1 59	2 1	2 4	1 55	1 50	1 53	1 57	2 6	2 4	1 54	1 50	1 57
0 30	1 45	1 51	1 57	1 54	1 48	1 43	1 45	1 56	1 58	1 55	1 44	1 44	1 50
1 0	1 39	1 45	1 48	1 46	1 39	1 35	1 41	1 50	1 50	1 45	1 34	1 35	1 42
1 30	1 33	1 38	1 40	1 38	1 31	1 28	1 34	1 43	1 43	1 37	1 26	1 29	1 35
2 0	1 25	1 29	1 34	1 29	1 20	1 20	1 25	1 37	1 34	1 28	1 16	1 19	1 26
2 30	1 20	1 24	1 25	1 20	1 10	1 12	1 19	1 29	1 25	1 18	1 8	1 9	1 18
3 0	1 13	1 17	1 16	1 12	1 2	1 6	1 13	1 21	1 18	1 7	1 0	1 3	1 11
3 30	1 8	1 11	1 7	0 59	0 55	1 0	1 9	1 14	1 8	0 56	0 50	0 57	1 3
4 0	1 6	1 3	0 58	0 50	0 48	0 55	1 6	1 8	1 0	0 47	0 42	0 53	0 56
4 30	1 2	0 57	0 52	0 43	0 42	0 53	1 3	1 1	0 51	0 40	0 40	0 49	0 51
5 0	0 59	0 49	0 42	0 34	0 37	0 51	1 1	0 55	0 43	0 31	0 35	0 47	0 45
5 30	0 59	0 43	0 34	0 29	0 36	0 53	0 59	0 51	0 37	0 26	0 35	0 50	0 43
6 0	0 58	0 40	0 30	0 28	0 38	0 56	1 0	0 47	0 32	0 24	0 38	0 55	0 42
6 30	0 56	0 40	0 29	0 30	0 45	1 2	1 2	0 45	0 30	0 29	0 42	1 2	0 44
7 0	1 5	0 41	0 30	0 40	0 59	1 13	1 6	0 47	0 33	0 38	1 0	1 8	0 52
7 30	1 11	0 46	0 37	0 58	1 16	1 28	1 18	0 56	0 47	1 5	1 22	1 21	1 5
8 0	1 23	0 56	0 57	1 19	1 37	1 38	1 28	1 12	1 10	1 29	1 41	1 37	1 23
8 30	1 35	1 14	1 25	1 41	1 56	1 49	1 38	1 29	1 34	1 46	1 55	1 51	1 39
9 0	1 49	1 33	1 47	2 1	2 9	1 59	1 48	1 45	1 55	2 9	2 11	2 2	1 56
9 30	1 58	1 46	2 1	2 13	2 16	2 5	1 55	1 56	2 6	2 20	2 18	2 6	2 5
10 0	2 2	2 2	2 12	2 16	2 17	2 7	1 59	2 5	2 14	2 24	2 15	2 6	2 10
10 30	2 3	2 3	2 15	2 16	2 14	2 6	2 2	2 6	2 17	2 20	2 14	2 7	2 10
11 0	2 2	2 7	2 11	2 14	2 12	2 1	2 1	2 6	2 15	2 16	2 11	2 5	2 8
11 30	1 57	2 3	2 7	2 10	2 5	1 57	1 58	2 2	2 10	2 10	2 3	1 57	2 3

Table IV.

Showing the Height of High Water at the London Docks corresponding to the mean time of the Moon's Transit in each month of the year; from 6638 observations made between the 1st of January 1808 and the 31st of December 1826.

January.			February.			March.			April.			May.			June.		
Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.
h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.	
0 24	22	22	0 26	22.73	19	0 23.5	22.87	26	0 17.5	22.8	23	0 12	22.75	23	0 16	22.47	19
0 54.5	22.33	24	0 58	22.69	25	0 53	22.8	26	0 47	23.03	20	0 43.5	22.76	21	0 44	22.4	20
1 24	22.42	20	1 27	22.75	25	1 23.5	23	22	1 15	22.97	23	1 12.5	22.95	21	1 14	22.64	21
1 55	22.79	24	1 59	22.7	21	1 53.5	22.77	28	1 46	22.85	23	1 42	22.89	22	1 46	22.5	23
2 24	22.6	27	2 28.5	22.98	25	2 24	22.79	23	2 16.5	23	22	2 11	22.98	22	2 16	22.58	20
2 55	22.71	22	3 0	22.72	25	2 55	22.42	25	2 47	22.83	20	2 42	22.52	21	2 45	22.5	22
3 24	22.46	27	3 30	22.39	24	3 25	22.5	24	3 14	22.42	19	3 10.5	22.45	20	3 14	22.18	22
3 54	22.19	27	3 59	22.23	20	3 55.5	22.4	22	3 43	22.17	19	3 42	22.09	26	3 45	22.1	24
4 26	21.92	24	4 28	21.81	23	4 26	21.83	24	4 13	21.83	23	4 11	21.78	22	4 15	22	23
4 55	21.7	25	5 3	21.3	25	4 56	21.44	20	4 43	21.5	19	4 42	21.33	21	4 46	21.36	26
5 25	21.06	26	5 31.5	21.17	22	5 24	21.17	20	5 11.5	21.02	21	5 11	20.7	25	5 17	21.02	24
5 56	21	28	6 0	20.46	19	5 26	20.56	24	5 44	20.28	22	5 43	20.13	24	5 46	20.68	23
6 26	20.15	23	6 29	19.6	21	6 24	19.92	21	6 16	19.88	25	6 10	19.98	20	6 16	20.47	25
6 55	19.85	24	7 0.5	19.37	19	6 55	19.3	23	6 47	19.08	20	6 39	19.83	26	6 46	20.2	25
7 24	19.73	24	7 29	18.5	19	7 25.5	19.3	21	7 16.5	18.92	24	7 11	19.74	28	7 15	19.73	22
7 56	19.25	25	7 58	19.1	18	7 55	18.81	23	7 49	18.94	23	7 41.5	19.74	14	7 46	19.86	27
8 26	19.85	21	8 28	18.94	22	8 24.5	19.25	23	8 15.5	19.25	21	8 12.5	20.15	26	8 17	20.06	23
8 56	19.89	23	8 58	19.3	16	8 55	19.3	22	8 41.5	19.48	23	8 44	20.28	27	8 46	20.56	23
9 27	20.23	20	9 28.5	19.85	23	9 24	20.06	22	9 15	20.4	26	9 12.5	20.99	21	9 16	20.7	23
9 54	20.37	23	9 59.5	20.2	18	9 54	20.46	25	9 45	21	24	9 40.5	21.19	24	9 46	21.08	19
10 25	21.08	18	10 29	20.97	21	10 24	21.04	22	10 16	21.51	24	10 11	21.72	25	10 15	21.28	23
10 53	21.44	21	11 0.5	21.45	22	10 54	21.52	25	10 45	22	25	10 40.5	22.28	22	10 45	21.75	20
11 24	21.5	24	11 30	21.21	18	11 25	22.12	27	11 15.5	22.69	22	11 11	22.39	25	11 14	22.12	19
11 56	22.35	21	11 59	22.22	21	11 54.5	22.34	21	11 46	22.56	26	11 41	22.75	11	11 45	22.14	22

July.			August.			September.			October.			November.			December.		
Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	Height of Tide.	No. of Obs.
h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.		h m	Feet.	
0 21	22.3	19	0 19	22.28	22	0 9	22.67	26	0 0	22.97	24	23 59	22.67	22	0 13	22.75	22
0 49	22.43	22	0 51.5	22.5	25	0 40	22.77	25	0 30	23	23	0 29	23.08	20	0 42	22.11	19
1 20	22.57	23	1 19	22.73	20	1 10.5	22.92	24	1 1	23.12	25	0 59	23.04	22	1 9	22.26	20
1 50	22.72	23	1 48	22.57	26	1 41	22.83	24	1 31	23.11	23	1 31	23	21	1 40	22.46	22
2 20	22.69	25	2 19	22.78	25	2 10	23.13	20	2 2	22.97	21	2 1	22.92	20	2 11	22.86	23
2 51	22.6	25	2 48	22.75	27	2 39.5	22.91	27	2 32	22.58	25	2 31	22.53	22	2 41	22.46	22
3 21	22.5	24	3 20.5	22.59	24	3 10	22.82	20	3 3	22.58	20	3 1	22.8	20	3 11	22.29	23
3 51	22.44	27	3 49.5	22.57	23	3 39	22.69	22	3 31	22.62	20	3 31	22.35	22	3 41	22.01	24
4 21	22.22	23	4 19	21.6	25	4 9	22.13	21	4 0	21.94	21	4 3	21.9	23	4 11.5	21.95	26
4 50	21.75	26	4 50	21.76	25	4 40	21.7	25	4 29	21.61	22	4 33	21.52	21	4 42	21.43	25
5 21	21.4	28	5 20.5	21.29	22	5 12.5	21.08	21	5 1	20.84	24	5 0	20.9	20	5 11.5	21.23	24
5 52	21	25	5 49	20.99	22	5 41.5	20.7	19	5 31	20.64	22	5 29	20.6	23	5 41	20.78	28
6 21	20.67	22	6 18	20.28	22	6 10.5	20.08	21	6 1	19.69	20	5 59	19.9	23	6 12	20.28	26
6 50	20.29	27	6 49	19.92	24	6 41	19.62	22	6 32	19.85	25	6 31	19.52	26	6 42	20.04	24
7 21	19.97	25	7 19	19.66	21	7 11.5	18.94	21	7 4	19.22	23	7 1	19.17	24	7 11	19.68	26
7 53	20.04	24	7 48	19.39	22	7 42	19.23	22	7 31.5	19.04	21	7 29	19.57	23	7 41	19.54	23
8 23	20.02	21	8 19	19.31	24	8 13	18.84	21	7 59.5	19.14	22	8 1	19.63	26	8 10	19.74	25
8 51	20.23	20	8 50	19.63	23	8 41	19.58	22	8 29	19.82	25	8 31	19.65	24	8 43	20.5	26
9 23	20.28	23	9 20.5	19.89	22	9 11.5	19.94	23	8 59.5	20.18	27	9 0	20.65	25	9 11	20.79	22
9 53	20.6	21	9 50	20.55	21	9 42	20.42	23	9 31	21.19	24	9 30	20.73	25	9 41	21.3	23
10 23	20.9	21	10 18	20.73	20	10 12	21	23	10 0	21.38	26	10 0	21.17	23	10 12	21.28	23
10 53	21.28	20	10 48	21.14	22	10 41.5	21.64	23	10 30	22.08	26	10 31	21.83	25	10 41.5	21.62	20
11 23	21.67	23	11 18	21.73	23	11 9	22.08	21	11 1	22.19	25	11 1	22.47	22	11 10	21.77	21
11 53	21.84	21	11 48.5	22.03	23	11 40	22.31	17	11 31	22.48	25	11 30	22.58	21	11 39	22.06	20

TABLE V. (Interpolated from Table IV.)
Showing the Height of High Water at the London Docks.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Moon's Transit.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	Height of Tide.	B.
h m	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
0 0	22.30	22.23	22.44	22.67	22.75	22.30	21.95	22.13	22.56	22.97	22.68	22.49	22.46
0 30	22.07	22.73	22.85	22.90	22.75	22.43	22.34	22.35	22.74	23.00	23.08	22.37	22.63
1 0	22.36	22.70	22.85	23.00	22.87	22.53	22.48	22.56	22.87	23.12	23.04	22.21	22.72
1 30	22.47	22.75	22.95	22.91	22.91	22.57	22.62	22.67	22.86	23.11	23.00	22.39	22.76
2 0	22.76	22.71	22.78	22.92	22.95	22.54	22.71	22.65	23.03	22.98	22.92	22.72	22.80
2 30	22.62	22.97	22.72	22.93	22.70	22.54	22.66	22.77	22.96	22.60	22.54	22.61	22.72
3 0	22.67	22.72	22.43	22.63	22.47	22.34	22.57	22.69	22.85	22.58	22.79	22.35	22.59
3 30	22.41	22.39	22.48	22.28	22.23	22.14	22.48	22.49	22.73	22.62	22.36	22.11	22.39
4 0	22.14	22.22	22.29	21.98	21.89	22.05	22.37	22.08	22.30	21.94	21.94	21.97	22.10
4 30	21.89	21.79	21.78	21.64	21.49	21.69	22.07	21.66	21.84	21.61	21.56	21.64	21.72
5 0	21.59	21.34	21.40	21.22	20.94	21.21	21.63	21.60	21.32	20.86	20.90	21.31	21.28
5 30	21.05	21.18	21.11	20.59	20.37	20.86	21.28	21.19	20.85	20.65	20.58	20.95	20.88
6 0	20.89	20.46	20.46	20.08	20.03	20.58	20.91	20.72	20.30	19.72	19.89	20.47	20.37
6 30	20.11	19.59	19.80	19.52	19.87	20.34	20.55	20.14	19.79	19.84	19.53	20.14	19.93
7 0	19.83	19.37	19.30	19.01	19.79	19.98	20.19	19.82	19.20	19.30	19.18	19.82	19.56
7 30	19.64	18.68	19.23	18.93	19.74	19.79	19.99	19.56	19.11	19.05	19.57	19.59	19.40
8 0	19.33	19.09	18.88	19.07	19.98	19.95	20.03	19.36	19.00	19.15	19.63	19.67	19.43
8 30	19.86	18.96	19.26	19.38	20.22	20.28	20.07	19.42	19.29	19.83	19.65	20.20	19.70
9 0	19.93	19.32	19.43	19.98	20.68	20.62	20.24	19.72	19.80	20.20	20.65	20.68	20.10
9 30	20.24	19.86	20.14	20.70	21.12	20.88	20.35	20.04	20.23	21.16	20.73	21.11	20.54
10 0	20.51	20.20	20.58	21.25	21.53	21.18	20.67	20.48	20.81	21.38	21.17	21.29	20.92
10 30	21.14	20.98	21.14	21.75	22.08	21.51	20.99	20.89	21.39	22.08	21.81	21.49	21.43
11 0	21.45	21.45	21.64	22.34	22.35	21.94	21.37	21.37	21.94	22.19	22.45	21.72	21.85
11 30	21.66	21.21	22.16	22.63	22.63	22.11	21.71	21.85	22.24	22.47	22.58	21.97	22.10
	21.29	21.12	21.25	21.34	21.51	21.43	21.43	21.26	21.33	21.43	21.42	21.39	21.34

Table VI.

Showing the Time and the Height of High Water at the London Docks, corresponding to the mean time of the Moon's Transit for every minute of Horizontal Parallax, from 5414 observations made between the 1st of January 1808 and 31st of December 1826.

Hor. Par. 54′.				Hor. Par. 55′.				Hor. Par. 56′.				Hor. Par. 57′.			
Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.	
0 34	2 34.9	22 1	95	0 31.5	2 29.8	22 3.4	51	0 34	2 24.9	22 4.3	38	0 33.8	2 25.1	22 7.7	43
1 19.7	3 6.4	22 2.6	89	1 21.2	3 3.8	22 3.6	54	1 22.4	3 1.8	22 9.8	50	1 26	3 7	22 8.3	38
2 35.8	3 59.2	22 1.4	80	2 37.4	3 58.1	22 6.5	71	2 31.8	3 51	22 5.2	38	2 33.3	3 51.2	22 10	45
3 22.3	4 33.2	21 8.5	73	3 23.1	4 31.2	22 1.3	65	3 23	4 30	22 2.3	56	3 20.7	4 27	22 5.1	46
4 29.3	5 20.2	21 1	72	4 31.5	5 23.8	21 3.5	74	4 32.2	5 26.2	21 4.8	50	4 33	5 22.1	21 9.3	59
5 34.3	6 18	20 2.2	55	5 35.4	6 18	20 3	90	5 31.2	6 13.2	20 4	58	5 33.6	6 18	21 0.7	57
6 34.8	7 22	19 3.1	68	6 38	7 27.3	19 6.8	71	6 36.5	7 18.6	19 8.3	66	6 33.7	7 17.7	19 10.2	57
7 25.8	8 35	18 8.5	72	7 31.1	8 34.5	19 0.1	73	7 26.3	8 27.7	19 2.2	58	7 24.8	8 23.5	19 6	56
8 29.7	10 30	19 3.2	86	8 37.6	10 29	19 8	54	8 35	10 20	19 7.2	65	8 35.8	10 19.2	19 10.2	44
9 38.5	12 2.4	20 2.2	82	9 38.5	11 56.3	20 5.5	66	9 35.5	11 49.2	20 5.7	42	9 35.5	11 43	20 4.3	44
10 54.7	13 5	21 3	84	10 39.2	13 1.9	21 0.7	56	10 35.7	12 53.6	21 4	50	10 33.6	12 43	21 5	39
11 36.5	13 51.6	21 8	83	11 35.3	13 46.8	21 10.5	60	11 33	13 41.7	21 9.7	35	11 38	13 18.6	22 4.5	43

Hor. Par. 58′.				Hor. Par. 59′.				Hor. Par. 60′.				Hor. Par. 61′.			
Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit. P.M.	High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.	
0 36.2	2 21.8	22 9.3	42	0 37.6	2 20.9	23 0	33	0 31.8	2 12.5	22 11.1	52	0 32.2	2 10.4	23 1.5	92
1 27.3	3 2	23 0	37	1 28	3 1	23 0	42	1 30.8	2 56	23 2.1	66	1 28.2	2 53.2	23 6.5	78
2 32.6	3 51.8	22 9.7	50	2 30	3 46	23 0.9	48	2 34	3 45.4	23 5.2	72	2 28.3	3 39.3	23 6.3	43
3 24	4 30.8	22 5.2	46	3 24.6	4 26.3	22 10.4	73	3 28.1	4 26.4	23 3.4	90	3 29	4 32.5	21 2.5	2
4 32.3	5 22.3	22 2.6	55	4 32.3	5 20.6	22 3.7	114	4 33.7	5 8	22 5.4	27				
5 31.7	6 13	21 2.4	73	5 31.3	6 12.8	21 6.8	119								
6 30.4	7 11	20 3	57	6 34	7 15.6	20 5.2	121	6 33.2	7 22	20 3.2	8				
7 28.2	8 25.4	19 7.8	64	7 26.6	8 24	19 10.1	88	7 36	8 36.4	20 0.6	40				
8 31.2	10 4	19 7.2	49	8 32	10 6.7	20 2.8	56	8 34.8	10 4.2	20 3.5	99				
9 40	11 40	20 7.5	46	9 35.5	11 30	20 11	51	9 34.6	11 23.2	21 0.7	98	9 26.3	11 27	21 5	22
10 33.2	12 41	21 8.2	43	10 37.2	12 37	21 9	42	10 33.8	12 29.8	21 10.3	63	10 32.3	12 25.2	22 1.8	73
11 38.8	13 38	22 2.8	39	11 31.6	13 30	22 2.2	43	11 35.9	13 22	22 6.5	50	11 34.7	13 20.7	22 9	97

TABLE VII. (Interpolated from Table VI.)

Showing the Interval between the Moon's Transit and the Time of High Water at the London Docks, for every minute of her Horizontal Parallax.

Moon's Transit.	H. P. 54′.	H. P. 55′.	H. P. 56′.	H. P. 57′.	H. P. 58′.	H. P. 59′.	H. P. 60′.	H. P. 61′.
h m	h m	h m	h m	h m	h m	h m	h m	h m
0 0	2 9	2 5.8	2 1	1 56.6	1 53.9	1 53	1 43.5	1 42.6
0 30	2 1.9	1 58.8	1 51.6	1 52	1 47	1 44.9	1 41.1	1 38.6
1 0	1 52.6	1 49.7	1 45	1 46.8	1 40.8	1 38.6	1 33.4	1 31.5
1 30	1 43.4	1 39.7	1 37.6	1 40	1 34.1	1 32.5	1 25.4	1 24.4
2 0	1 34.2	1 31.8	1 28.6	1 29.6	1 27	1 25	1 18.6	1 17
2 30	1 25	1 23	1 19.7	1 19	1 19.8	1 16	1 12.4	1 10.7
3 0	1 16.9	1 14.8	1 12.3	1 10.5	1 12.6	1 8.3	1 5.2	
3 30	1 8.8	1 6.8	1 6	1 4	1 6.3	1 0.4	0 57.4	
4 0	0 59.8	0 59.2	0 58.6	0 55.6	0 58	0 54	0 50	
4 30	0 50.8	0 52.4	0 54.2	0 49.6	0 50.1	0 48.6	0 42.7	
5 0	0 46.3	0 46.6	0 47.6	0 46	0 45	0 44		
5 30	0 44	0 42.7	0 42	0 44.5	0 41.4	0 41.8		
6 0	0 43	0 43.4	0 39.5	0 43.4	0 39.8	0 40.4		
6 30	0 46.2	0 47.9	0 41	0 43.6	0 41	0 41.2		
7 0	0 56.2	0 53.7	0 49	0 49.6	0 47	0 47		
7 30	1 14.6	1 3.1	1 3.3	1 1.5	0 58	0 58.8	0 58.4	
8 0	1 38.2	1 22	1 22	1 18.8	1 14.8	1 16.6	1 11.6	
8 30	2 0.5	1 47	1 42.6	1 40.2	1 32	1 33.8	1 27.6	
9 0	2 14.6	2 4.8	2 0	1 56.6	1 46.4	1 45.2	1 39.2	
9 30	2 22.3	2 15.7	2 12.5	2 6.3	1 57.2	1 53.5	1 47.5	
10 0	2 26	2 21.5	2 17.6	2 10	2 4.8	1 58	1 53.2	
10 30	2 25.4	2 23.2	2 18.2	2 9.6	2 7.8	2 0	1 56	1 53.2
11 0	2 21.8	2 20	2 15.5	2 6.2	2 6	2 0.5	1 54.3	1 50
11 30	2 16.2	2 12.7	2 9.4	2 1.8	2 0.8	1 58.8	1 47	1 46.7

TABLE VIII. (Interpolated from Table VI.)

Showing the Height of High Water at the London Docks for every minute of the Moon's Horizontal Parallax.

Moon's Transit.	H. P. 54′.	H. P. 55′.	H. P. 56′.	H. P. 57′.	H. P. 58′.	H. P. 59′.	H. P. 60′.	H. P. 61′.
h m	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
0 0	21.85	22.04	22.07	22.47	22.43	22.60	22.70	22.90
0 30	22.06	22.28	22.36	22.64	22.73	22.97	22.92	23.09
1 0	22.16	22.30	22.65	22.67	22.90	22.98	23.05	23.35
1 30	22.22	22.31	22.80	22.70	23.00	23.00	23.18	23.54
2 0	22.24	22.29	22.66	22.76	22.93	23.05	23.31	23.56
2 30	22.19	22.28	22.45	22.83	22.81	23.07	23.42	23.52
3 0	21.87	22.18	22.30	22.61	22.60	22.97	23.38	
3 30	21.64	22.04	22.14	22.35	22.40	22.83	23.27	
4 0	21.37	21.66	21.82	22.08	22.14	22.60	22.92	
4 30	21.08	21.28	21.44	21.80	22.24	22.33	22.40	
5 0	20.70	20.80	20.90	21.45	21.73	22.00		
5 30	20.25	20.32	20.35	21.09	21.22	21.58		
6 0	19.78	19.95	20.04	20.50	20.73	21.00		
6 30	19.31	19.64	19.76	19.90	20.25	20.47	20.28	
7 0	18.95	19.30	19.48	19.64	19.90	20.13	20.12	
7 30	18.75	19.02	19.22	19.51	19.65	19.83	20.08	
8 0	18.90	19.28	19.33	19.63	19.60	19.50	20.12	
8 30	19.27	19.54	19.55	19.82	19.61	20.23	20.25	
9 0	19.90	19.93	19.95	20.05	19.93	19.40	20.55	
9 30	20.58	20.31	20.40	20.29	20.46	20.85	21.00	21.42
10 0	20.85	20.64	20.83	20.80	21.08	21.30	21.43	21.63
10 30	21.13	20.96	21.26	21.36	21.65	21.69	21.81	21.88
11 0	21.38	21.38	21.55	21.90	21.95	21.95	22.20	22.30
11 30	21.60	21.81	21.78	22.30	22.16	22.17	22.49	22.71

Table IX.

Showing the Time and Height of High Water at the London Docks corresponding to the mean time of the Moon's Transit for every three degrees of her declination north and south; from 5372 observations made between the 1st of January 1808 and the 31st of December 1826.

1° 30′ S. to 1° 30′ N. Decl.			
Moon's Transit.	High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.	
0 35	2 32.5	22 9.5	22
1 26	3 7	23 1	21
2 42	4 4	23 1	17
3 26	4 40.5	22 7.8	22
4 35	5 33	21 10	18
5 36	6 36.7	21 0	21
6 36.5	7 43.5	19 9	17
7 22	8 40.5	19 11	17
8 32	10 27	19 11	23
9 39	11 59	21 4	13
10 31	12 52	21 9	21
11 36	13 46	22 3	21

1° 30′ to 4° 30′ North Dec.				4° 30′ to 7° 30′ North Dec.				7° 30′ to 10° 30′ North Dec.			
Moon's Transit.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit.	High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.	
0 38	2 35	22 8.5	19	0 36	2 37.5	22 8	20	0 41	2 36	22 6	21
1 27	3 12	22 9	18	1 30	3 11	22 11	23	1 27	3 6	22 11	19
2 41	4 2	22 8	12	2 42	4 3	22 8	20	2 41	4 3	23 2	26
3 28	4 41	22 6	22	3 26	4 42	22 2	15	3 32	4 41	22 4.7	16
4 37	5 37	21 8.5	19	4 42	5 38	22	19	4 37	5 37	21 9.3	20
5 32	6 31	20 5	10	5 34	6 28	21 4.5	15	5 41	6 40	20 7.5	12
6 36.5	7 46	20 3.5	20	6 31	7 27.5	20 2	14	6 34.5	7 34.5	20	19
7 19	8 32.5	20 1	18	7 20.2	8 34	19 9	19	7 22.5	8 43	19 11.5	18
8 28	10 17	20 4	17	8 31	10 21	19 11	21	8 26	10 15	19 9	20
9 29	11 37	21 1	18	9 35	11 52	20 8	22	9 32	11 46	20 8	25
10 35	12 56	21 1	15	10 38	12 53	22	23	10 35	12 54	22	31
11 28	13 32	22 4	14	11 38	13 44	22 4	18	11 33	13 41	22 5	15
1° 30′ to 4° 30′ South Dec.				4° 30′ to 7° 30′ South Dec.				7° 30′ to 10° 30′ South Dec.			
0 36	2 29	22 7	18	0 34	2 28	22 9	17	0 33	2 28	22 8.5	21
1 28	3 10	22 6	18	1 30	3 13	22 11	20	1 30	3 6	22 9	23
2 39	4 4.7	22 3	25	2 39	4 0	22 11	16	2 36	4 0	22 10	17
3 30	4 46	22 6.5	16	3 21	4 32	22 8	15	3 20	4 33	22 4	23
4 35	5 33	21 5.5	18	4 39	5 39	21 8	15	4 34	5 31	21 9	14
5 29	6 22.7	21 1.7	15	5 40	6 36	21 4	15	5 32	6 24	21 0.3	20
6 37	7 35	20 2.5	18	6 40.5	7 40	20 2	17	6 36	7 34	20 4	19
7 18.5	8 43.5	19 6.5	17	7 19	8 42	19 7	17	7 20	8 38	20 2	20
8 24	10 21	20 5	13	8 37	10 39	20 5	24	8 36	10 31	20 1	19
9 37	11 53	21 2	18	9 30	11 45	20 10	14	9 36	11 47	21 1	24
10 45	12 59	22 1	17	10 31	12 42	21 10	20	10 35	12 49	21 10	18
11 39	13 46	22 7	20	11 31	13 39	22 5	26	11 42	13 45	22 5	19

TABLE IX. (Continued).

10° 30′ to 13° 30′ North Dec.				13° 30′ to 16° 30′ North Dec.				16° 30′ to 19° 30′ North Dec.			
Moon's Transit.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit.	High Water.	Height of Tide.	No. of Obs.	Moon's Transit.	High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.	
0 38	2 25	22 10	17	0 37	2 27	22 6.7	28	0 32	2 21	22 7.2	37
1 30	3 8	22 8	27	1 28	3 8	22 9	23	1 23	2 58	22 11	33
2 39	3 56	22 11	25	2 37	3 57	22 7	21	2 31	3 52	23 0	39
3 28	4 37	22 8	24	3 28	4 35	22 5.5	24	3 27	4 31	22 5.5	45
4 37	5 34	21 5.5	21	4 34	5 23	21 7.5	30	4 36	5 28	21 9.5	36
5 35.5	6 25	20 9	26	5 38	6 18	21 2	24	5 37.5	6 13.2	20 8.5	31
6 34.5	7 24	20 0.5	26	6 36.5	7 20.5	20 1	20	6 42	7 22.5	19 7.7	34
7 30	8 41	19 6.5	21	7 28	8 37	19 3.3	27	7 37	8 38	19 1.3	40
8 32	10 19	20 7	26	8 35	10 20	20 1	22	8 41	10 22	19 7	38
9 37	11 54	21 1	19	9 37	11 42	20 7	31	9 42	11 45	20 5	40
10 34	12 46	21 9	19	10 40	12 53.5	21 8	29	10 38	12 44	21 4	44
11 37	13 43	22 8	29	11 35	13 43	21 10	28	11 37	13 39	22 2	36
10° 30′ to 13° 30′ South Dec.				13° 30′ to 16° 30′ South Dec.				16° 30′ to 19° 30′ South Dec.			
0 40.6	2 26.4	22 8.7	25	0 32	2 20	23 0	25	0 30	2 17	22 7.5	39
1 21	3 2	22 9	20	1 23	3 2	22 11	26	1 20	2 52	22 10	38
2 32	3 53	23 0	24	2 26	3 45	22 10.5	28	2 29	3 42	22 11	34
3 20	4 28	22 6.8	20	3 25.5	4 27	22 7	29	3 21	4 22	22 9.3	35
4 31	5 31	21 8.2	22	4 27	5 17	21 11.2	28	4 25	5 15	21 11	39
5 39	6 26.5	20 11	21	5 24	6 9	20 9	28	5 28	6 10.5	21 0.5	39
6 38	7 35	20 2.3	23	6 32	7 19	19 10.3	26	6 28	7 5	20 0.2	38
7 20	8 35	19 7	22	7 23	8 30	19 3	26	7 24	8 19	19 6	42
8 32	10 22	20 4	24	8 36	10 18	20 1	25	8 32	10 12	19 9	36
9 33	11 43	20 10	29	9 35	11 38	20 9	22	9 36	11 35	20 8	45
10 35	12 50	21 8	18	10 34	12 41	21 4.5	25	10 36	12 38	21 5	39
11 34	13 40	22 10	14	11 38	13 38	22 4	25	11 32	13 30	22 2	36

19° 30′ to 22° 30′ North Dec.				22° 30′ to 25° 30′ North Dec.				Above 25° 30′ North Dec.			
h m	h m	ft. in.		h m	h m	ft. in.		h m	h m	ft. in.	
0 28.5	2 19	22 7	26	0 31	2 16	22 6.5	25	0 31	2 13	22 5.5	17
1 28	2 56	22 9	30	1 24	2 57	22 9	26	1 25	2 51	22 8	18
2 33	3 49	22 6	23	2 33	3 49	22 7	24	2 29	3 40	23 0	22
3 25	4 25	22 5.2	24	3 23	4 19	22 3	22	3 20	4 15	22 4.5	23
4 32	5 14	21 9.5	28	4 35	5 14	21 4.7	26	4 27	5 5	21 8.3	23
5 35	6 15	20 5	30	5 35	6 4.5	20 8.8	25	5 40.7	6 10.2	20 8	23
6 37	7 10	19 9	32	6 43.5	7 9.7	19 3	22	6 35	7 1	19 1	23
7 34.5	8 33.3	18 5	27	7 38	8 23	19 0.5	23	7 41	8 15	18 10	22
8 36	10 10	19 4	19	8 41	10 3	19 5	29	8 40	10 0	18 10	20
9 41	11 34	20 3	26	9 40	11 28.7	19 10	21	9 47	11 42	20 4	19
10 38	12 43	21 2	20	10 39	12 42	21 4	24	10 37	12 38	20 11	18
11 33	13 32	22 3	30	11 37	13 26	21 8	17	11 33	13 25	21 9	21
19° 30′ to 22° 30′ South Dec.				22° 30′ to 25° 30′ South Dec.				Above 25° 30′ South Dec.			
0 31	2 13	22 4.7	27	0 34	2 15	22 6.8	16	0 26	2 4	22 5	22
1 24	2 54	23 1	23	1 17	2 47	22 8	30	1 26	2 48	21 11	16
2 25	3 37	22 7	31	2 29	3 38	22 6	21	2 21	3 32	22 6	21
3 22	4 20.5	22 7.8	28	3 19	4 13.5	21 11.3	24	3 20	4 11	22 2	21
4 26	5 14	21 8.7	31	4 19	5 0	21 9.5	22	4 15	4 47	21 9.5	24
5 23.5	6 0.5	20 9.5	28	5 24.4	6 0.4	20 11.2	28	5 23.8	5 50.3	20 6.7	26
6 30.5	7 8	20 3	28	6 30	6 59	19 8	22	6 23	6 43	19 9	26
7 20	8 15	19 4.5	23	7 24	8 11	19 4.5	24	7 25	7 58	18 5.3	23
8 31	10 8	19 7	28	8 39	10 2	19 4	27	8 33	9 55	19 4	18
9 37	11 44	20 5	26	9 34	11 33	20 3	20	9 33	11 29	20 1	21
10 39	12 43	21 3.5	28	10 34	12 40	21 3.5	27	10 39	12 32	20 10.5	19
11 34.5	13 25	22 4	27	11 35	13 22	21 11	25	11 35	13 25	21 8	21

Table X. (Interpolated from Table IX.)

Showing the Interval between the Moon's Transit and the Time of High Water, and the Height of High Water at the London Docks for every three degrees of her Declination, North and South.

Time of Moon's Transit.	0° Dec.		3° Dec. N.		6° Dec. N.		9° Dec. N.		12° Dec. N.	
	Interval.	Height.	Interval.	Height.	Interval.	Height.	Interval.	Height.	Interval.	Height.
h m	h m	ft. in.	h m	ft. in.	h m	ft. in.	h m	ft. in.	h m	ft. in.
0 30	1 58.9	22 8.6	1 58.4	22 7.8	2 2.8	22 7.7	1 58	22 5.8	1 49	22 9.7
1 30	1 40	23 1.2	1 44	22 9	1 41	22 11	1 38.5	22 11.2	1 38	22 8
2 30	1 24.5	23 1.3	1 24	22 8	1 23.7	22 8.3	1 24.7	23 1.5	1 19.3	22 10.5
3 30	1 10.7	22 7.3	1 13	22 6	1 15.2	22 2.4	1 9.4	22 5	1 8.7	22 7.8
4 30	0 59	21 10.7	1 0	21 9.8	0 58	22 0.2	1 0.5	21 10.4	0 58	21 6.8
5 30	1 0.2	21 1.2	0 59	20 5.3	0 54	21 4.8	1 0	20 9.7	0 50	20 9.8
6 30	1 5.1	19 10.1	1 10.4	20 3.7	0 56.1	20 2	0 59.1	20 0.3	0 49	20 0.1
7 30	1 10.5	19 11	1 11.3	20 0.1	1 9.3	19 9	1 24	19 11.3	1 11	19 6.5
8 30	1 55	19 11	1 49	20 4	2 0.3	19 11	1 51	19 9.5	1 46	20 6.7
9 30	2 18.2	21 2.4	2 8	21 1	2 16	20 7	2 13	20 7.8	2 15.6	21 0.2
10 30	2 21	21 9	2 21.2	22 0.4	2 16	21 10.7	2 19	21 11	2 12.3	21 8.4
11 30	2 11	22 2.4	2 4.6	22 4	2 7	22 3.5	2 8	22 4.9	2 7.3	21 7.3
			3° Dec. S.		6° Dec. S.		9° Dec. S.		12° Dec. S.	
0 30			1 54.4	22 7	1 55	22 8.8	1 56	22 8.3	1 47.5	22 8.6
1 30			1 41.4	22 6	1 43	22 11	1 36	22 9	1 39.2	22 9.2
2 30			1 18	22 3.4	1 23.4	22 11	1 25.2	22 9.8	1 21.5	23 0
3 30			1 16	22 6.5	1 9.5	22 7	1 10.6	22 11.9	1 6.3	22 5.5
4 30			0 59	21 6.2	1 1	22 9	0 57.6	21 9.4	1 0	21 8.1
5 30			0 53.7	21 1.7	0 56	21 5	0 55	21 0.2	0 47.5	21 0.3
6 30			0 56	20 3.7	0 56.5	20 0.8	0 56.3	20 4.3	0 55	20 3.5
7 30			1 31·5	19 6.7	1 29	19 8.5	1 22.7	20 1.8	1 19.3	19 7
8 30			2 0.3	20 5.8	1 59.3	20 4.2	1 52	20 1.2	1 49	20 3.8
9 30			2 15	21 1	2 15	20 10	2 9	21 0	2 9.4	20 9.6
10 30			2 15	21 11	2 11	21 10	2 14	21 9.3	2 15	21 7
11 30			2 8.6	22 6.5	2 8	22 5	2 5	22 4	2 7	22 10

Time of Moon's Transit.	15° Dec. N.		18° Dec. N.		21° Dec. N.		24° Dec. N.		27° Dec. N.	
	Interval.	Height.	Interval.	Height.	Interval.	Height.	Interval.	Height.	Interval.	Height.
h m	h m	ft. in.	h m	ft. in.	h m	ft. in.	h m	ft. in.	h m	ft. in.
0 30	1 51.8	22 5.5	1 49.5	22 7	1 50	22 7	1 45	22 6.4	1 42	22 5.4
1 30	1 39.5	22 9	1 33.4	22 11	1 28	22 9	1 31.6	22 8.9	1 24.7	22 8.2
2 30	1 22	22 7.2	1 21	23 0	1 17	22 6	1 17	22 7.1	1 11	23 0
3 30	1 6.6	22 5.4	1 3.3	22 5.3	0 51.4	22 4.9	0 54	22 2.4	0 52.3	22 3.2
4 30	0 50	21 8	0 53.2	21 10.5	0 42	21 9.9	0 40	21 5.4	0 37.5	21 7.8
5 30	0 40	21 3.2	0 36.7	20 10	0 40.3	20 6	0 29.1	20 10	0 30.7	20 10.6
6 30	0 42.5	20 2.3	0 38.3	19 9.6	0 32	19 10.4	0 24.2	19 3.6	0 26	19 3
7 30	1 10	19 3.3	0 57.5	19 1.5	0 56.6	18 5.4	0 41	19 0.6	0 29	18 10.2
8 30	1 43	20 0.4	1 38.6	19 5.6	1 31.4	19 3	1 13	19 4	1 13.7	18 10.6
9 30	2 3.3	20 6	2 0.5	20 3	1 50.3	20 1	1 58.7	19 10	2 2.6	20 2.6
10 30	2 13.5	21 6.8	2 3.7	21 2.5	2 5	21 1.2	2 4.6	21 3.3	2 1	20 10
11 30	2 9	21 9.6	2 3	22 1	1 59.4	22 3	1 50	21 7.2	1 52.5	21 8.6
	15° Dec. S.		18° Dec. S.		21° Dec. S.		24° Dec. S.		27° Dec. S.	
0 30	1 48	23 0	1 48	22 7.5	1 42	22 4.7	1 42	22 6.4	1 37	22 4.8
1 30	1 37	22 10.9	1 29	22 10.3	1 28.4	23 0.3	1 26.6	22 7.9	1 21	21 11.4
2 30	1 17.8	22 10.4	1 13	22 11	1 10.6	22 7	1 9	22 6	1 8.6	22 5.6
3 30	1 2.6	22 6.4	0 59	22 8.4	0 56.9	22 6.6	0 51.7	21 10.8	0 47.7	22 1.2
4 30	0 49.5	21 10.7	0 49.2	21 10.2	0 47.3	21 8	0 40	21 8.4	0 28.3	21 7.4
5 30	0 45	20 7.8	0 42.3	21 0.1	0 35.5	20 8.5	0 43	20 9.2	0 26	20 5.5
6 30	0 47	19 10.6	0 37	20 0	0 38	20 3	0 29	19 8	0 20.5	19 7.5
7 30	1 10	19 3.1	0 58	19 6.3	1 1.7	19 5.1	0 49.5	19 4.3	0 33	18 6.4
8 30	1 40	20 0.2	1 39	19 8.8	1 37	19 7	1 17	19 4.1	1 22	19 3
9 30	2 2	20 8.4	1 58	20 7	2 5.6	20 4.6	1 57.7	20 1.7	1 44	20 0
10 30	2 7.6	21 3.9	2 2	21 4.1	2 5	21 1.9	2 6.4	21 2.5	1 53	20 9
11 30	2 1.3	22 2.7	1 58	22 1.8	1 51.4	22 3.6	1 48.5	21 10.4	1 51	21 7.2

TABLE XI. (Interpolated from Table IX.)

Showing the Interval between the Moon's Transit and the Time of High Water at the London Docks, for every three degrees of her Declination, North or South.

Moon's Transit.	0	3° Dec.	6° Dec.	9° Dec.	12° Dec.	15° Dec.	18° Dec.	21° Dec.	24° Dec.	27° Dec.	Mean.
h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
0 0	2 5	2 1.5	2 3.6	2 1.8	1 59	1 59	1 54.3	1 50.7	1 46.3	1 46.6	1 56.8
0 30	1 58.9	1 56.4	1 58.9	1 57	1 48.2	1 49.9	1 48.2	1 46	1 43.5	1 39.5	1 50.6
1 0	1 49.8	1 50.5	1 51.7	1 46.8	1 44	1 44.2	1 39.7	1 37.2	1 36.2	1 31	1 42.8
1 30	1 40	1 42.7	1 42	1 37.1	1 38.6	1 38.3	1 31.2	1 28.2	1 29	1 22.8	1 35
2 0	1 32	1 34	1 32.7	1 30.6	1 29.6	1 29.3	1 24	1 21.3	1 21.2	1 16.3	1 27.1
2 30	1 24.5	1 26	1 23.5	1 25	1 20.4	1 19.9	1 17	1 14.4	1 13	1 9.8	1 19.3
3 0	1 19.3	1 20	1 17	1 17.3	1 14.5	1 12.3	1 9	1 4.2	1 3.3	1 0	1 11.7
3 30	1 13.7	1 14	1 12.3	1 10	1 7.5	1 4.6	1 1.1	0 54.1	0 52.9	0 50	1 4
4 0	1 5.3	1 6.7	1 6	1 3.5	1 3	0 56.8	0 56.1	0 49.3	0 46	0 40.5	0 57.3
4 30	0 59	0 59.5	0 59.5	0 59	0 59	0 49.7	0 51.2	0 44.6	0 40	0 32.9	0 51.4
5 0	0 58	0 57.2	0 56.8	0 56.8	0 53.8	0 45	0 45.3	0 41.2	0 36	0 29.5	0 48
5 30	0 59.8	0 56.4	0 55	0 55.5	0 48.7	0 42.5	0 39.5	0 37.9	0 32.8	0 28.3	0 45.6
6 0	1 2	0 58.4	0 54.8	0 55.5	0 48	0 42.8	0 37	0 35.3	0 29.5	0 25.5	0 44.9
6 30	1 5.1	1 3.2	0 56.3	0 57.7	0 52	0 44.7	0 37.6	0 35	0 26.6	0 23.3	0 46.1
7 0	1 12.3	1 10.2	1 4	1 8.6	1 1.5	0 56	0 45.8	0 44	0 33	0 24.6	0 54
7 30	1 21.3	1 21.4	1 19.1	1 23.3	1 15.1	1 10	0 57.8	0 59.1	0 45.2	0 31	1 6.3
8 0	1 36	1 40	1 38	1 38	1 30	1 26.4	1 16	1 16	0 59	0 52	1 23.1
8 30	1 55	1 54.6	1 54.6	1 51.5	1 47.5	1 41.5	1 38.8	1 34.2	1 15	1 17.8	1 41
9 0	2 9	2 4.5	2 8	2 2.7	2 3	1 53.5	1 51	1 48	1 38	1 39	1 55.7
9 30	2 18.2	2 11.5	2 15.5	2 11	2 12.5	2 2.6	1 59.2	1 58	1 58.2	1 53.3	2 6
10 0	2 21.3	2 16	2 16	2 15.5	2 14.2	2 8	2 2.1	2 3.3	2 6.8	1 57	2 9.8
10 30	2 21	2 18.2	2 13.5	2 16.5	2 13.6	2 10.5	2 2.8	2 5	2 5.5	1 57	2 10.4
11 0	2 17.6	2 15	2 11	2 12.8	2 11.3	2 9.5	2 2.5	2 2.5	1 59.5	1 55	2 7.7
11 30	2 11	2 6.6	2 7.5	2 6.5	2 7.1	2 6.4	2 0.5	1 55.4	1 49.2	1 51.7	2 2.2

TABLE XII. (Interpolated from Table IX.)

Showing the Height of High Water at the London Docks for every three degrees of the Moon's Declination, North or South.

Moon's Transit.	0	3° Dec.	6° Dec.	9° Dec.	12° Dec.	15° Dec.	18° Dec.	21° Dec.	24° Dec.	27° Dec.	Mean.
h m	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
0 0	22.36	22.53	22.52	22.48	22.50	22.40	22.36	22.38	22.12	22.04	22.37
0 30	22.70	22.62	22.69	22.58	22.77	22.73	22.60	22.48	22.53	22.43	22.61
1 0	22.95	22.62	22.83	22.71	22.70	22.79	22.74	22.75	22.65	22.37	22.71
1 30	23.10	22.63	22.92	22.84	22.72	22.83	22.88	22.89	22.70	22.31	22.78
2 0	23.20	22.55	22.90	22.95	22.83	22.79	22.95	22.77	22.65	22.55	22.81
2 30	23.11	22.47	22.80	22.97	22.94	22.73	22.96	22.54	22.54	22.73	22.78
3 0	22.86	22.49	22.62	22.86	22.80	22.63	22.80	22.50	22.31	22.50	22.64
3 30	22.61	22.52	22.39	22.70	22.55	22.49	22.56	22.48	22.05	22.19	22.45
4 0	22.24	22.09	22.64	22.30	22.10	22.18	22.22	22.13	21.78	21.92	22.16
4 30	21.89	21.67	21.88	21.82	21.62	21.78	21.86	21.75	21.49	21.64	21.74
5 0	21.49	21.20	21.65	21.35	21.27	21.37	21.40	20.20	21.16	21.20	21.23
5 30	21.10	20.79	21.41	20.92	20.92	20.96	20.92	20.60	20.80	20.67	20.91
6 0	20.50	20.52	20.88	20.55	20.53	20.50	20.40	20.32	20.18	20.00	20.44
6 30	19.84	20.30	20.12	20.20	20.15	20.04	19.90	20.04	19.48	19.44	19.95
7 0	19.75	19.54	19.87	20.12	19.82	19.60	19.56	19.50	19.32	19.03	19.61
7 30	19.92	19.78	19.72	20.04	19.55	19.27	19.32	18.94	19.21	18.70	19.44
8 0	19.91	20.03	19.87	20.00	19.90	19.60	19.36	19.08	19.23	18.82	19.58
8 30	19.92	20.41	20.13	19.95	20.44	20.06	19.60	19.42	19.33	19.06	19.83
9 0	20.53	20.75	20.42	20.25	20.68	20.35	20.00	19.82	19.60	19.59	19.20
9 30	21.20	21.08	20.71	20.82	20.91	20.60	20.42	20.23	19.98	20.11	20.61
10 0	21.50	21.50	21.29	21.36	21.28	20.98	20.86	20.66	20.55	20.48	21.05
10 30	21.75	21.97	21.87	21.85	21.64	21.45	21.28	21.14	21.24	20.79	21.50
11 0	22.00	22.26	22.16	22.16	21.98	21.90	21.70	21.71	21.55	21.24	21.97
11 30	22.22	22.44	22.36	22.38	22.22	22.02	22.12	22.28	21.72	21.66	22.14

Table XIII.

Showing the Time of High Water at the London Docks corresponding to the Mean Time of the Moon's superior and inferior Transits, and also the Heights of High Water, in the Month of June, from 1090 Observations, made between the 1st of January 1808 and 31st of December 1826.

Superior.				Inferior.			
Moon's Transit.	Time of High Water.	Height of Tide.	No. of Obs.	Moon's Transit.	Time of High Water.	Height of Tide.	No. of Obs.
h m	h m	ft. in.		h m	h m	ft. in.	
0 16	2 3.2	22 5	20	0 15	2 0	22 3.4	19
0 44	2 22.5	22 5	20	0 45	2 24.2	22 5	20
1 11.8	2 45	22 8	22	1 14.9	2 44.5	22 7.2	19
1 41.9	3 10.2	22 7.8	23	1 45	3 9.8	22 6.5	23
2 15.2	3 30.5	22 6.5	20	2 17.7	3 33.6	22 7.6	22
2 46.8	3 55.6	22 7.2	26	2 44	3 53.1	22 6.4	16
3 17.2	4 22.6	22 6.4	17	3 13	4 14.3	22 4.8	27
3 44.9	4 40.3	22 3.6	29	3 46.7	4 43	21 10.1	28
4 16.9	5 11.3	21 10.9	19	4 12.7	5 7.1	21 11.1	26
4 44.6	5 35.9	21 4.8	29	4 46.2	5 37.4	21 4.4	21
5 17.6	6 10.2	21 3.3	23	5 14.4	6 5.2	21 1.7	27
5 44.5	6 37.7	20 7.8	26	5 47.4	6 42.7	20 8.1	22
6 15.7	7 16.6	20 2.7	25	6 15.4	7 10.2	20 5.6	22
6 45.5	7 51.5	20 0.8	26	6 45.3	7 50.7	20 2.2	29
7 16	8 35.2	19 8.7	24	7 16.5	8 37	19 9.8	22
7 45.3	9 16	19 9.2	25	7 46.5	9 21.5	19 11	23
8 15.6	9 58.5	20 1.9	24	8 15.3	9 57.2	19 10.4	23
8 45.4	10 44.3	20 2.6	23	8 45.3	10 39.6	20 7.4	25
9 16	11 21	20 9.2	25	9 17.4	11 19.5	20 8.3	22
9 46.1	11 56	21 1.1	20	9 45.5	11 50.8	20 11.9	19
10 16.2	12 21.7	21 4.3	23	10 14	12 22.7	21 2.4	22
10 43	12 52.7	21 8.1	20	10 48.9	12 46.8	21 7.5	22
11 16.1	13 11.1	22 1.4	22	11 15.5	13 18.3	21 9.6	18
11 45.6	13 40.7	22 0.5	20	11 45.3	13 38.2	22 2.6	22

TABLE XIV. (Interpolated from Table XIII.)

Showing the Interval between the Moon's Transit and the Times of High Water, and the Height of High Water in the month of June; the Interval and Heights corresponding to the Moon's superior and inferior Transits being distinguished.

	Superior.		Inferior.		Difference.	
Moon's Transit.	High Water.	Height.	High Water.	Height.		
h m	h m	Feet.	h m	Feet.	m	
0 0	1 52	22.21	1 49	22.25	+3	−.04
0 30	1 43.8	22.42	1 42.1	22.35	+1.7	+.07
1 0	1 35.5	22.56	1 34.4	22.51	+1.1	+.05
1 30	1 30.3	22.80	1 27.2	22.57	+3.1	+.23
2 0	1 21.3	22.59	1 20.9	22.58	+0.4	+.01
2 30	1 12.2	22.56	1 12.8	22.58	−0.6	+.02
3 0	1 7.4	22.56	1 4.6	22.46	+2.8	+.1
3 30	1 1.4	22.39	0 58.7	22.12	+2.7	+.27
4 0	0 55	22.11	0 55.3	21.90	−0.3	+.21
4 30	0 52.9	21.66	0 52.7	21.64	+0.2	+.02
5 0	0 51.9	21.34	0 51	21.26	+0.9	+.08
5 30	0 52.9	20.99	0 53	20.92	−0.1	+.07
6 0	0 56.9	20.45	0 55	20.58	+1.9	−.13
6 30	1 3.3	20.15	1 0.1	20.33	+3.2	−.18
7 0	1 15.5	19.90	1 12.2	20.01	+3.3	−.11
7 30	1 29.9	19.74	1 27.2	19.87	+2.7	−.13
8 0	1 36.8	19.96	1 38.5	19.89	−1.7	+.07
8 30	1 50.8	20.19	1 48.1	20.25	+2.7	−.06
9 0	2 2	20.47	1 57.9	20.64	+4.1	−.17
9 30	2 7.5	20.92	2 3.7	20.84	+3.8	+.08
10 0	2 7.8	21.22	2 7	21.10	+0.8	+.12
10 30	2 7.7	21.53	2 3.8	21.39	+3.9	+.14
11 0	2 2.3	21.91	2 0.1	21.70	+2.2	+.21
11 30	1 55	22.08	1 57.8	22.00	−2.8	+.08

Table XV.

Showing the Difference in the Interval between the Time of the Moon's Transit and the Time of High Water, and the Mean Interval (Column A. Table III.) in different Months of the Year.

Moon's Transit.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h m	m	m	m	m	m	m	m	m	m	m	m	m
0 0	− 5	+ 2	+ 4	+ 7	− 2	− 7	− 4	.....	+ 9	+ 7	− 3	− 7
0 30	− 5	+ 1	+ 7	+ 4	− 2	− 8	− 5	+ 6	+ 8	+ 5	− 6	− 6
1 0	− 3	+ 3	+ 6	+ 4	− 3	− 7	− 1	+ 8	+ 8	+ 3	− 8	− 7
1 30	− 2	+ 3	+ 5	+ 3	− 4	− 7	− 1	+ 8	+ 8	+ 2	− 9	− 6
2 0	− 1	+ 3	+ 8	+ 3	− 6	− 6	− 1	+11	+ 8	+ 2	−10	− 7
2 30	+ 2	+ 6	+ 7	+ 2	− 8	− 6	0	+11	+ 7	0	−10	− 9
3 0	+ 2	+ 6	+ 5	+ 1	− 9	− 5	+ 2	+10	+ 7	− 4	−11	− 8
3 30	+ 5	+ 8	+ 4	− 4	− 8	− 4	+ 6	+11	+ 5	− 7	−13	− 6
4 0	+10	+ 7	+ 2	− 6	− 8	− 1	+10	+12	+ 4	− 9	−14	− 3
4 30	+11	+ 6	+ 1	− 8	− 9	+ 2	+12	+10	0	−11	−11	− 2
5 0	+13	+ 3	− 4	−12	− 9	+ 5	+15	+ 9	− 3	−15	−11	+ 1
5 30	+16	.....	− 9	−14	− 7	+ 9	+16	+ 8	− 6	−17	− 8	+ 7
6 0	+16	− 2	−12	−14	− 4	+14	+18	+ 5	−10	−18	− 4	+13
6 30	+12	− 4	−15	−14	+ 1	+18	+18	+ 1	−14	−15	− 2	+18
7 0	+13	−11	−22	−12	+ 7	+21	+14	− 5	−19	−14	+ 8	+16
7 30	+ 5	−20	−29	− 8	+10	+22	+12	−10	−19	− 1	+16	+15
8 0	0	−27	−26	− 4	+14	+16	+ 5	−11	−13	+ 6	+18	+14
8 30	− 4	−25	−14	+ 2	+17	+10	− 1	−10	− 5	+ 7	+16	+12
9 0	− 7	−23	− 9	+ 5	+13	+ 3	− 8	−11	− 1	+13	+15	+ 6
9 30	− 7	−19	− 4	+ 8	+11	0	−10	− 9	+ 1	+15	+13	+ 1
10 0	− 8	− 8	+ 2	+ 6	+ 7	− 3	−11	− 5	+ 4	+14	+ 5	− 4
10 30	− 7	− 7	+ 5	+ 6	+ 4	− 4	− 8	− 4	+ 7	+10	+ 4	− 3
11 0	− 6	− 1	+ 3	+ 6	+ 4	− 7	− 7	− 2	+ 7	+ 8	+ 3	− 3
11 30	− 6	.....	+ 4	+ 7	+ 2	− 6	− 5	− 1	+ 7	+ 7	.....	− 3

Table XVI.

Showing the Difference in the Height of High Water and the Mean Height (Column B. Table V.) in different Months of the Year.

Moon's Transit.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h m	m	m	m	m	m	m	m	m	m	m	m	m
0 0	−.16	−.23	−.02	+.21	+.29	−.16	−.51	−.33	+.10	+.51	+.22	+.03
0 30	−.56	+.10	+.22	+.27	+.12	−.20	−.29	−.28	+.11	+.37	+.45	−.26
1 0	−.36	−.02	+.13	+.28	+.15	−.19	−.24	−.16	+.15	+.40	+.32	−.51
1 30	−.29	−.01	+.19	+.15	+.15	−.19	−.14	−.09	+.10	+.35	+.24	−.37
2 0	−.04	−.09	−.02	+.12	+.15	−.26	−.09	−.15	+.23	+.18	+.12	−.08
2 30	−.10	+.25	0	+.21	−.02	−.18	−.06	+.05	+.26	−.12	−.18	−.11
3 0	+.08	+.13	−.16	+.04	−.12	−.25	−.02	+.10	+.26	−.01	+.20	−.24
3 30	+.02	.....	+.09	−.11	−.16	−.25	+.09	+.10	+.34	+.23	−.03	−.28
4 0	+.04	+.12	+.19	−.12	−.21	−.05	+.27	−.02	+.20	−.16	−.16	−.13
4 30	+.17	+.07	+.06	−.08	−.23	−.03	+.35	−.06	+.12	−.11	−.16	−.08
5 0	+.31	+.06	+.12	−.06	−.34	−.07	+.35	+.32	+.04	−.42	−.38	+.03
5 30	+.17	+.30	+.23	−.29	−.51	−.02	+.40	+.31	−.03	−.23	−.30	+.07
6 0	+.52	+.09	+.09	−.29	−.34	+.21	+.54	+.35	−.07	−.65	−.48	+.10
6 30	+.18	−.34	+.07	−.41	−.06	+.41	+.62	+.21	−.14	−.09	−.40	+.21
7 0	+.27	−.19	−.26	−.55	+.23	+.42	+.63	+.26	−.36	−.26	−.38	+.26
7 30	+.24	−.72	−.17	−.47	+.34	+.39	+.59	+.16	−.29	−.35	+.17	+.19
8 0	−.10	−.34	−.55	−.36	+.55	+.52	+.60	−.07	−.43	−.28	+.20	+.24
8 30	−.16	−.74	−.44	−.32	+.52	+.58	+.37	−.28	−.41	+.13	−.05	+.50
9 0	−.17	−.78	−.67	−.12	+.58	+.52	+.14	−.38	−.30	+.10	+.55	+.58
9 30	−.30	−.68	−.40	+.16	+.58	+.34	−.19	−.50	−.31	+.62	+.19	+.57
10 0	−.41	−.72	−.34	+.33	+.61	+.26	−.25	−.44	−.11	+.46	+.25	+.37
10 30	−.29	−.45	−.29	+.32	+.65	+.08	−.44	−.54	−.04	+.65	+.38	+.06
11 0	−.40	−.40	−.21	+.49	+.50	+.09	−.48	−.48	+.09	+.34	+.60	−.13
11 30	−.44	−.89	+.06	+.53	+.53	+.01	−.39	−.25	+.14	+.37	+.48	−.13

Table XVII.

Showing the Difference in the Interval between the Time of the Moon's Transit and the Time of High Water, and the Mean Interval (Column A. Table III.) for every Minute of the Moon's Horizontal Parallax.

Moon's Transit.	H. P. 54′.	H. P. 55′.	H. P. 56′.	H. P. 57′.	H. P. 58′.	H. P. 59′.	H. P. 60′.	H. P. 61′.
h m	m	m	m	m	m	m	m	m
0 0	+12	+ 9	+ 4	.....	− 3	− 4	−13	−14
0 30	+12	+ 9	+ 2	+ 2	− 3	− 5	− 9	−11
1 0	+10	+ 8	+ 3	+ 5	− 1	− 4	− 9	−11
1 30	+ 8	+ 5	+ 3	+ 5	− 1	− 3	−10	−11
2 0	+ 8	+ 6	+ 2	+ 3	+ 1	− 1	− 8	− 9
2 30	+ 7	+ 5	+ 1	+ 1	+ 2	− 2	− 6	− 8
3 0	+ 6	+ 4	+ 2	.....	+ 2	− 2	− 6	
3 30	+ 6	+ 4	+ 3	+ 1	+ 3	− 2	− 5	
4 0	+ 4	+ 3	+ 2	− 1	+ 2	− 2	− 6	
4 30	.....	+ 1	+ 3	− 1	− 1	− 2	− 8	
5 0	+ 1	+ 1	+ 3	+ 1	0	− 1		
5 30	+ 1	0	− 1	+ 2	− 1	− 1		
6 0	+ 1	+ 1	− 3	+ 1	− 2	− 2		
6 30	+ 2	+ 4	− 3	− 1	− 3	− 3		
7 0	+ 4	+ 2	− 3	− 2	− 5	− 4		
7 30	+ 9	− 2	− 2	− 4	− 7	− 7	− 7	
8 0	+16	0	0	− 3	− 8	− 6	−11	
8 30	+21	+ 8	+ 3	+ 1	− 7	− 6	−12	
9 0	+19	+ 9	+ 4	+ 1	− 9	−10	−16	
9 30	+17	+11	+ 7	+ 1	− 8	−11	−18	
10 0	+16	+12	+ 8	0	− 5	−12	−17	
10 30	+15	+13	+ 8	− 1	− 2	−10	−14	−17
11 0	+13	+12	+ 7	− 2	− 2	− 8	−14	−18
11 30	+13	+10	+ 6	− 1	− 2	− 4	−16	−16

Table XVIII.

Showing the Difference in the Height of High Water, and the Mean Height (Column B. Table V.) for every Minute of the Moon's Horizontal Parallax.

Moon's Transit.	H. P. 54′.	H. P. 55′.	H. P. 56′.	H. P. 57′.	H. P. 58′.	H. P. 59′.	H. P. 60′.	H. P. 61′.
h m	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
0 0	−0.52	−.33	−.30	+.10	+.06	+.23	+ .33	+.53
0 30	− .50	−.28	−.20	+.08	+.17	+.41	+ .36	+.53
1 0	− .58	−.44	−.09	−.07	+.26	+.24	+ .31	+.61
1 30	− .55	−.46	+.03	−.07	+.23	+.23	+ .41	+.77
2 0	− .57	−.52	−.15	−.05	+.12	+.24	+ .50	+.75
2 30	− .54	−.45	−.28	+.10	+.08	+.34	+ .69	+.79
3 0	− .68	−.37	−.25	+.06	+.05	+.42	+ .83	
3 30	− .63	−.23	−.13	+.08	+.13	+.56	+1.00	
4 0	− .57	−.28	−.12	+.14	+.20	+.66	+ .98	
4 30	− .49	−.29	−.13	+.23	+.67	+.76	+ .83	
5 0	− .50	−.40	−.30	+.25	+.53	+.80		
5 30	− .47	−.40	−.37	+.37	+.50	+.86		
6 0	− .45	−.28	−.19	+.27	+.50	+.77		
6 30	− .54	−.21	−.09	+.05	+.40	+.62	+ .43	
7 0	− .64	−.29	−.11	+.05	+.31	+.54	+ .53	
7 30	− .75	−.48	−.28	+.01	+.15	+.33	+ .58	
8 0	− .68	−.30	−.25	+.05	+.02	−.08	+ .54	
8 30	− .54	−.27	−.26	+.01	−.20	+.42	+ .44	
9 0	− .26	−.23	−.21	−.11	−.23	−.76	+ .39	
9 30	+ .03	−.24	−.15	−.26	−.09	+.30	+ .45	+.87
10 0	− .09	−.30	−.11	−.14	+.14	+.36	+ .49	+.69
10 30	− .20	−.37	−.07	+.03	+.32	+.36	+ .48	+.55
11 0	− .31	−.31	−.14	+.21	+.26	+.26	+ .51	+.61
11 30	− .43	−.22	−.25	+.27	+.13	+.14	+ .46	+.68

Table XIX.

Showing the Difference in the Interval between the Time of the Moon's Transit and the Time of High Water, and the Mean Interval (Column A. Table III.) for every three degrees of the Moon's Declination.

Moon's Transit.	0	3° Dec.	6° Dec.	9° Dec.	12° Dec.	15° Dec.	18° Dec.	21° Dec.	24° Dec.	27° Dec.
h m	m	m	m	m	m	m	m	m	m	m
0 0	+ 8	+ 5	+ 7	+ 5	+ 2	+ 2	− 3	− 6	−11	−10
0 30	+ 9	+ 6	+ 9	+ 7	− 2	.....	− 2	− 4	− 7	−11
1 0	+ 8	+ 8	+10	+ 5	+ 2	+ 2	− 3	− 5	− 6	−11
1 30	+ 5	+ 8	+ 7	+ 2	+ 4	+ 3	− 4	− 7	− 6	−12
2 0	+ 6	+ 8	+ 6	+ 4	+ 3	+ 3	− 2	− 5	− 5	−10
2 30	+ 6	+ 8	+ 5	+ 7	+ 2	+ 2	− 1	− 4	− 5	− 9
3 0	+ 9	+ 9	+ 6	+ 7	+ 4	+ 2	− 2	− 7	− 7	−11
3 30	+11	+11	+ 9	+ 7	+ 5	+ 2	− 2	− 9	−10	−13
4 0	+ 9	+10	+10	+ 7	+ 7	+ 1	0	− 7	−10	−16
4 30	+ 8	+ 8	+ 8	+ 8	+ 8	− 1	0	− 6	−11	−18
5 0	+13	+12	+11	+12	+ 9	0	0	− 4	− 9	−16
5 30	+17	+14	+12	+13	+ 6	0	− 3	− 5	−10	−14
6 0	+20	+16	+13	+13	+ 6	+ 1	− 5	− 7	−13	−17
6 30	+21	+19	+12	+13	+ 8	.....	− 7	− 9	−18	−21
7 0	+21	+19	+12	+17	+10	+ 4	− 6	− 8	−19	−27
7 30	+16	+16	+14	+18	+10	+ 5	− 8	− 6	−20	−34
8 0	+14	+18	+16	+16	+ 8	+ 4	− 6	− 6	−23	−30
8 30	+16	+15	+15	+12	+ 8	+ 2	− 1	− 5	−24	−22
9 0	+13	+ 9	+12	+ 7	+ 7	− 2	− 5	− 8	−18	−17
9 30	+13	+ 7	+11	+ 6	+ 7	− 2	− 6	− 7	− 7	−12
10 0	+11	+ 6	+ 6	+ 6	+ 4	− 2	− 8	− 7	− 5	−13
10 30	+11	+ 8	+ 3	+ 6	+ 3	0	− 7	− 5	− 5	−13
11 0	+ 9	+ 7	+ 3	+ 4	+ 3	+ 1	− 6	− 6	− 9	−13
11 30	+ 8	+ 3	+ 4	+ 3	+ 4	+ 3	− 3	− 8	−14	−12

Table XX.

Showing the Difference in the Height of High Water, and the Mean Height (Column B. Table V.) for every three degrees of the Moon's Declination.

Moon's Transit.	0	3° Dec.	6° Dec.	9° Dec.	12° Dec.	15° Dec.	18° Dec.	21° Dec.	24° Dec.	27° Dec.
h m	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
0 0	−.10	+.07	+.06	+.02	+.04	−.06	−.10	−.08	−.34	−.42
0 30	+.09	−.01	+.06	−.05	+.14	+.10	−.03	−.15	−.10	−.20
1 0	+.23	−.10	+.11	−.01	−.02	+.07	+.02	+.03	−.07	−.35
1 30	+.34	−.13	+.16	+.08	−.04	+.07	+.12	+.13	−.06	−.45
2 0	+.40	−.25	+.10	+.15	+.03	−.01	+.15	−.03	−.15	−.25
2 30	+.39	−.25	+.08	+.25	+.22	+.01	+.24	−.18	−.18	+.01
3 0	+.27	−.10	+.03	+.27	+.21	+.04	+.21	−.09	−.28	−.09
3 30	+.22	+.13	.....	+.31	+.16	+.10	+.17	+.01	−.34	−.20
4 0	+.14	−.01	+.54	+.20	.....	+.08	+.12	+.03	−.32	−.18
4 30	+.17	−.05	+.16	+.10	−.10	+.06	+.14	−.08	−.13	−.08
5 0	+.21	−.08	+.37	+.07	−.01	+.09	+.12	−.28	−.12	−.08
5 30	+.22	−.09	+.53	+.04	+.04	+.08	+.04	−.05	−.08	−.21
6 0	+.13	+.15	+.51	+.18	+.16	+.13	+.03	+.11	−.19	−.37
6 30	−.09	+.37	+.19	+.27	+.22	+.11	−.03	−.06	−.45	−.49
7 0	+.19	−.02	+.31	+.56	+.26	+.04	0	−.46	−.24	−.53
7 30	+.52	+.38	+.32	+.64	+.15	−.13	−.08	−.35	−.19	−.70
8 0	+.48	+.60	+.44	+.57	+.47	+.17	−.07	−.28	−.20	−.61
8 30	+.22	+.71	+.43	+.25	+.74	+.36	−.10	−.28	−.37	−.64
9 0	+.43	+.65	+.32	+.15	+.58	+.25	−.10	−.28	−.50	−.41
9 30	+.66	+.54	+.17	+.28	+.37	+.06	−.12	−.31	−.56	−.43
10 0	+.58	+.58	+.37	+.44	+.36	+.06	−.06	−.26	−.37	−.44
10 30	+.32	+.54	+.44	+.42	+.21	+.02	−.15	−.29	−.19	−.64
11 0	+.15	+.41	+.31	+.31	+.13	+.05	−.15	−.14	−.30	−.61
11 30	+.12	+.34	+.26	+.28	+.12	−.08	+.02	+.18	−.38	−.44

Table XXI.

Showing the Influence of the Direction of the Wind on the Time and Height of High Water.

Direction of Wind.	Number of Tides observed.	Sum of Times of High Water.		Mean Error.	Sum of Heights of High Water.		Mean Error.
		Calculated.	Observed.		Calculated.	Observed.	
		h m	h m	m	ft. in.	ft. in.	inches.
N	38	202 43	201 43	−2	812 4	813 4	.....
NNE	53	271 20	272 45	+2	1150 2	1148 4	.....
NE	81	359 50	362 25	+2	1766 11	1772 9	+1
ENE	43	230 54	229 55	−1	938 3	951 4	+4
E	38	126 8	127 0	+1	829 7	834 9	+2
ESE	16	96 47	95 25	−5	348 5	344 5	−3
SE	23	125 0	125 5	.....	485 6	485 8	.....
SSE	18	117 34	117 55	+1	372 8	369 3	−2
S	29	148 58	149 30	+1	608 8	603 6	−2
SSW	36	262 25	264 40	+4	734 3	736 1	.....
SW	148	877 29	874 0	−1	3129 2	3123 2	.....
WSW	55	286 52	283 35	−4	1189 8	1179 8	−2
W	36	221 57	220 0	−3	771 9	771 1	.....
WNW	10	70 40	69 55	−4	210 7	209 10	.....
NW	37	189 51	188 35	−2	810 4	810 11	.....
NNW	36	197 41	197 10	−1	755 2	754 3	.....