correction ; and therefore the practical accuracy of the tables would be very little improved by introducing into them the parallax correction. But Mr Whewell has shown that the general law and the approximate amount of the parallax correction may be traced in the observations of a single year ; and that thus the tables are rendered practically as well as theoretically better by such a correction being employed. The same is true, though less conspicuously, of the correction for lunar declination.

Although the establishment and mean range of tide were known or given for every several port, yet no general tables have yet been framed, which, even with the help of those data, would equally apply to the computation of the several times and heights of their tides. So extremely im­perfect is the present state of the general theory, that each place still requires to have its own particular tables for this purpose. Mr Lubbock has constructed auxiliary tables from which both the times and heights may be computed for Ply­mouth, Portsmouth, Sheerness, London, Pembroke, Bristol, Liverpool, and Leith, and the times for Brest and Howth. The hydrographer royal, Captain Beaufort, has actually com­puted and published the tide-tables to that extent for all those places, with the addition of the time for Ramsgate. Mr Lubbock’s tables are also used for computing the tide-tables of the British and the Nautical Almanacs. With re­gard to the accuracy of the tide predictions so computed, Mr Lubbock says they will sometimes, though rarely, deviate an hour from the observed time of high water, owing to ac­cidental causes. Generally, however, they may be depend­ed on to within ten minutes ; and it should be recollected that it is difficult to ascertain within five minutes the instant of high water, the fluctuations of height being then so very minute that the water is said to hang. The predicted amount of the height is liable to still greater uncertainties; which is the more to be regretted, because disastrous effects often arise from unexpected and unusually high tides, which are occasioned by storms and reduced atmospheric pressure.

Tolerably accurate tide-tables have long been published annually for London, and still better for Liverpool. But it has been the practice in this country to form tide-tables for other places, merely by taking the time which is stated in the London or Liverpool tables, and, if necessary, to add or subtract some constant quantity, according to the place. Even without this alteration the Liverpool tables have been generally used for the whole of the west coast of England. But tables are published, professing to give the hours at most of the principal ports of England in parallel columns, the times for different pinces having constant dif­ferences. Thus the hour of high water at Plymouth is stated as always 1h. 55m. later than the hour in the same half day at London, although they belong to different tran­sits. The like may be said of the American Almanac, which in a similar manner professes to predict the tides for a great many places. Nor does the British Almanac or Edinburgh Almanac follow a more correct course. Indeed the tides in the latter have as yet been computed from the obsolete rules of Laplace. The assumption of a constant difference in the tide-hours at different places is by no means correct, as we might expect it to be from consider­ing how the tide is transmitted from place to place, and as it appears to be from observation.

According to Mr Lubbock, the great obstacle to perfec­tion in calculations or predictions of the tides, consists in the fluctuations of the establishments. Suppose the esta­blishment to change a minute per annum, and that, having determined it from all the observations of twenty-one years, we employ it in calculations of the time of high water for the eleventh year, and compare the calculated times with the observed, they will not be affected with any constant error; but if we calculate for the twenty-first year, the calculated times will have a constant error of ten minutes. Similar remarks apply to the height. If the channel be­come deeper, the title-wave travels with greater velocity, and the high water happens sooner. From a very ancient tide-table discovered by Mr Yates, and copied by Mr Lub­bock into the Phil. Trans. for 1837, p. 103, it would ap­pear that the tide at London had formerly been fully an hour later than at present. The argument or entry of the table is the day of the moon’s age, which runs up to thirty days. The tide-hour on the first day is 8h∙ 48m∙ ; and with a daily increase of forty-eight minutes, it occurs just at 3h∙ on the thirtieth day.@@1 But Mr Lubbock finds that the esta­blishment of the port of London has been subject to changes even within the present century ; and he notices the diffi­culty of predicting the time of high water with certainty, unless these changes can be accounted for. The high wa­ter appears now to be nearly as late as in 1804; in 1821 it was fully ten minutes earlier. The removal of the Old London Bridge appears to have affected neither the time nor the height of high water ; but it has made the low wa­ter sink about eighteen inches more than formerly. The following table shows the establishment of the port of London, and mean height of tide when the moon’s transit occurs at 0h. ; in other words, the mean time and height of tide at new and full moon from 1802 to 1835; supposing the moon’s horizontal parallax 57', and declination 15°.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Year.** | **Establishment** | | **Height.** | **Year.** | **Establishment.** | | **Height.** |
| **1802** | **h.**  **2** | **xn.**  **5·9** | **Feet.**  **21·90** | **1819** | **h.**  **1** | **m.**  **57·1** | **Feet.**  **22·20** |
| **1803** | **2** | **6·1** | **22·14** | **1820** | **1** | **56·7** | **22·38** |
| **1804** | **2** | **7·4** | **22·42** | **1821** | **1** | **56·5** | **22·51** |
| **1805** | **2** | **4·5** | **22·17** | **1822** | **1** | **57·8** | **22·35** |
| **1806** | **o** | **6·3** | **22·11** | **1823** | **2** | **1·1** | **22·48** |
| **1807** | **2** | **0·9** | **22·15** | **1824** | **1** | **57·9** | **22·51** |
| **1808** | **2** | **4·7** | **22·07** | **1825** | **2** | **1·0** | **22·43** |
| **1809** | **2** | **4·4** | **22·39** | **1826** | **2** | **2·9** | **22·40** |
| **1810** | **2** | **4∙2** | **22·21** | **1827** | **1** | **59·9** | **22·38** |
| **1811** | **2** | **0·8** | **22·43** | **1828** | **1** | **69·9** | **22·86** |
| **1812** | **2** | **0·0** | **22·48** | **1829** | **1** | **59·9** | **22·60** |
| **1813** | **1** | **58·7** | **22·30** | **1830** | **1** | **66·7** | **22·56** |
| **1814** | **1** | **59·8** | **22·33** | **1831** | **1** | **59·6** | **22·53** |
| **1815** | **1** | **59·8** | **22·19** | **1832** | **2** | **2·5** | **21·95** |
| **1816** | **1** | **58·5** | **22·34** | **1833** | **2** | **5∙3** | **22·26** |
| **1817** | **1** | **57·2** | **22·31** | **1834** | **2** | **4·2** | **22·28** |
| **1818** | **1** | **57·0** | **22·40** | **1835** | **2** | **4∙4** | **22·29** |

In 1832 none of the lower portions of the Old London Bridge, which obstructed the natural flow of the tidal w aters, was removed excepting two piers ; and in the following year almost the whole of that structure was cleared away as regarded the masonry and starlings, although the course of the river was far from being completely cleared, many portions still remaining a foot or two above low-water mark, and which were finally removed in 1834.

Hitherto no care has been taken to specify to which tran­sit of the moon the tide at any place is referred, and various mistakes have originated in this want of precision. It seems desirable that some conventional agreement were adopted upon this point. Mr Lubbock has employed the transit which precedes a given high water at London by about two days three hours, and which, according to the notation al­ready described, he terms transit B. If transit A, which occurs about twelve hours and twenty-five minutes sooner,

@@@1 On this however we have to remark, that since the mean lunation consists of little more than twenty-nine days and a half, almost half the number of new ninons would occur on the thirtieth day ; so that, although the table had been in every other respect correct, it would not make the mean time of “ find at london brigge” on the day of new moon to have exceeded 3h∙ 26m.. Flamsteed, in 1683, made it just 3h∙. Ilia tables were the first which gave the time of the tide for the moon’s lower transit, or twice a day.