Add also the equation for 6° difference of tem­perature of the standard brass scale and the glass rods, between 62° and 68°, the tem­perature at which the glass rods were laid off, 11∙8368 in = 0∙9864

Length of the base, in temperature 62°, re­

duced to the level of the lower extremity.... 27,404∙0843 Reduction from the height of the lower end of

the base above the mean level of the sea, supposed to be 54 feet = 0∙0706

True length of the base, reduced to the mean

level of the sea 27,404∙0137

In making the reduction to the level of the sea, the mean semidiameter of the earth is assumed to be 3,492,915 fa­thoms.

With respect to this measurement, General Roy remarks that “ infinite pains were taken, both in the field and otherwise, throughout the whole operation, to obtain a just conclusion and as the means employed appear to be fully adequate to the attainment of the object in view, there seems to be no good reason to doubt that the accuracy of the result corresponded to the skill and attention with which the operation was conducted.

The measurement of the base having been effected, the next object was to proceed with the triangulation ; but a delay of three years intervened before the operations were resumed. In the summer of 1787, the instrument intended for the measurement of the angles (a large theodolite, having its horizontal circle of three feet in diameter) was completed by Ramsden, and carried to the station at the south end of the base on the 3lst of July. Sir Joseph Banks, as presi­dent of the Royal Society, had in the mean time put himself in communication with Μ. Cassini, whom the Academy of Sciences had appointed to co-operate in the junction of the French and English triangles ; but as the season was now too far advanced to admit of the operation being completed before the winter set in, it was resolved, after a few angles had been observed, to proceed to Dover and Calais to exe­cute the coast triangles, leaving the inland part of the series to be executed afterwards. In this operation General Roy was accompanied by Dr Blagden, and assisted by Mr Isaac Dalby (afterwards professor of mathematics in the Military College), whose ingenuity and scientific knowledge render­ed most essential service. At Dover the party was met by Cassini, Mechain, and Legendre, distinguished members of the Academy of Sciences, who had crossed the channel for the purpose of concerting the measures necessary for mak­ing reciprocal observations on both coasts. For the dis­tant signals a great number of white lights had been pre­pared, and also several reverberatory lamps; and the French academicians having been furnished with a sufficient num­ber of the lights for the observations on their side of the channel, returned to Calais on the 25th of September, when the observations were begun. The weather proved extreme­ly unfavourable, but, fortunately, on the particular nights on which the most important observations on the English side were to be made, namely, those at Dover and Fairlight Down, the atmosphere was clear, and the observers were enabled to intersect with great accuracy the French stations of Blancnez in the neighbourhood of Calais, and Montlambert (or Boulemberg), near Boulogne, and thus esta­blish the triangular connexion between the two countries.

After this operation was concluded, the instrument was carried to a few more of the stations ; but two still remained unobserved, when, in the beginning of November, the bad­ness of the weather obliged the party to desist until the fol­lowing summer. The observations at the two remaining stations were made in the ensuing August.

In order that no precaution should be omitted to insure the accuracy of the operation, it was resolved to measure a base of verification towards the termination of the triangles. The ground selected for this purpose was Romney Marsh, a tract which, on account of its levelness, was exceedingly well suited to the purpose. The marsh had been previously covered by the sea, and a considerable part of it, particularly towards the bottom of the range of hills that separate it from the Wealds of Kent, is still lower than the sea at high water. A preliminary survey of the marsh having been made, a line was selected running from High Nook on the spire of Ruckinge church, and of nearly six miles in length. The terminal points were marked by sinking two wooden pipes into the ground. This base was not measured with the glass rods, but with a steel chain of 100 feet in length, made by Ramsden, and of which the accuracy had been tested by measuring with it a portion of the Hounslow Heath base simultaneously with the glass rods. The mea­surement was executed by Lieutenant Fiddes of the royal engineers. The apparent length of the base, or that given directly by the measurement, was 28,536 feet 8∙835 inches ; and after the proper reductions were made, the correct ho­rizontal distance between the pipes, in feet of the standard brass scale, at temperature 62°, and at the level of the sea, was found to be 28,535 feet 8∙128 inches.

On connecting the base with the series of triangles ex­tending from Hounslow Heath, its length, as deduced from the former base, was computed to be 28,533∙3 feet ; so that the computed length fell short of the measured length about twenty-eight inches. This agreement is probably as near as was to be expected, and may be taken as conclusive proof of the general accuracy of the whole of the operations ; nevertheless, as there were reasons for supposing that the accuracy attained in the base of verification was not equal to that of the original base, the whole of the triangles were computed from the latter. The measurement on Romney Marsh does not enter as a datum into any of the results of the survey.

By reason of the superior magnitude and excellence of the instrument employed, the measurement of the angles was performed with a degree of accuracy which had pro­bably never been equalled in any former survey. Although the reduction to the centre of the station requires a very simple calculation, it was thought desirable to avoid, as much as possible, reductions of every kind, and accordingly the centre of the great theodolite was adjusted by means of a plummet over the precise points marking the stations. The whole number of stations at which it was placed was twenty-three. In nine cases the instrument was elevated to the top of a tower, church steeple, or other building ; and in the fourteen other cases, the station was marked by sink­ing a pipe into the ground, to indicate the precise spot over which the instrument had been placed, in order that the ob­servations might be repeated, or the stations connected with others in any future operation. The sides of the triangles were computed by plane trigonometry ; that is to say, the portion of the earth’s surface over which the triangulation extended was regarded as a plane, and the measured bases as straight lines on that plane. This supposition, though in the small portion of surface in question it did not lead to errors of great magnitude, is inadmissible in an extensive survey. The spherical excess was indeed roughly computed for each triangle, but merely for the purpose of showing the amount of the errors of observation ; and the observed angles of each triangle were adjusted so that the sum should equal 180°, by applying to each an arbitrary correction.

The calculation of the triangles, and the determination of the relative positions of the Paris and Greenwich Obser­vatories, with the lengths of the degree of meridian and perpendicular, are given in detail in the Phil. Trans. for 1790 ; but the results are not now of much importance, inas-