and vertical diameter, 1851–83, and from the Neuchâtel observations, of horizontal diameter only, for 1862–83. The following table shows the discordances from the mean for each month of the year for the two series :—

| Month. | Greenwich. | Neuchâtel. |
|---|---|---|
| | ″ | ″ |
| January ... | −0·36 ... | +0·66 |
| February ... | −0·24 ... | +0·54 |
| March ... | −0·03 ... | +0·24 |
| April ... | +0·22 ... | −0·51 |
| May ... | +0·25 ... | −0·54 |
| June ... | +0·08 ... | −0·34 |
| July ... | +0·08 ... | −0·33 |
| August ... | +0·01 ... | −0·54 |
| September ... | −0·06 ... | −0·19 |
| October ... | −0·10 ... | +0·38 |
| November ... | −0·22 ... | +0·23 |
| December ... | −0·35 ... | +0·41 |

It appears obvious that these results must be attributed to other causes than physical changes in the sun s diameter.

## ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 JULY 17–23.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

*At Greenwich on July 17*

Sun rises, 4h. 4m. ; souths, 12h. 5m. 50·5s. ; sets, 20h. 7m. ; decl. on meridian, 21° 13′ N. : Sidereal Time at Sunset, 15h. 48m.

Moon (New on July 20) rises, 1h. 19m. ; souths, 9h. 0m. ; sets, 16h. 50m. ; decl. on meridian, 17° 15′ N.

| Planet. | Rises. h. m. | Souths. h. m. | Sets. h. m. | Decl. on meridian. ° ′ |
|---|---|---|---|---|
| Mercury ... | 5 59 | 13 14 | 20 29 | 13 45 N. |
| Venus ... ... | 8 23 | 15 6 | 21 49 | 7 53 N. |
| Mars ... ... | 2 14 | 10 35 | 18 56 | 24 1 N. |
| Jupiter... ... | 12 43 | 18 0 | 23 17 | 9 15 S. |
| Saturn... ... | 4 11 | 12 12 | 20 13 | 21 6 N. |

*Occultations of Stars by the Moon* (visible at Greenwich).

| July. | Star. | Mag. | Disap. h. m. | Reap. h. m. | Corresponding angles from vertex to right for inverted image. ° ° |
|---|---|---|---|---|---|
| 17 ... | 85 Tauri ... ... | 6 ... | 1 5 ... | 1 45 ... | 30 286 |
| 17 ... | Aldebaran ... | 1 ... | 3 16 ... | 3 33 ... | 139 172 |
| 18 ... | 115 Tauri... ... | 6 ... | 1 50 ... | 2 40 ... | 73 237 |

July. h.
19 ... 4 ... Saturn in conjunction with the Sun.
21 ... 17 ... Mercury in conjunction with and 3° 40′ south of the Moon.

*Variable Stars.*

| Star. | R.A. h. m. | Decl. ° ′ | | h. m. | |
|---|---|---|---|---|---|
| U Cephei ... ... | 0 52·3 | 81 16 N. | July 17, | 22 32 | *m* |
| | | | ,, 22, | 22 11 | *m* |
| R Corvi ... ... | 12 13·8 | 18 38 S. | ,, 20, | | *M* |
| δ Libræ ... ... | 14 54·9 | 8 4 S. | ,, 22, | 23 16 | *m* |
| U Coronæ ... ... | 15 13·6 | 32 4 N. | ,, 22, | 20 54 | *m* |
| U Ophiuchi... ... | 17 10·8 | 1 20 N. | ,, 21, | 2 31 | *m* |
| | | | | 22 38 | *m* |
| W Sagittarii ... | 17 [illegible]·8 | 29 35 S. | ,, 17, | 21 0 | *m* |
| | | | ,, 21, | 1 0 | *M* |
| U Sagittarii... ... | 18 25·2 | 19 12 S. | ,, 22, | 1 0 | *m* |
| R Scuti ... ... | 18 41·5 | 5 50 S. | ,, 23, | | *M* |
| S Sagittæ ... ... | 19 50·9 | 16 20 N. | ,, 20, | 2 0 | *m* |
| | | | ,, 23, | 2 0 | *M* |
| S Aquarii ... ... | 22 51·1 | 20 57 S. | ,, 18, | | *M* |
| S Pegasi ... ... | 23 14·8 | 8 18 N. | ,, 18, | | *M* |

*M* signifies maximum ; *m* minimum.

*Meteor-Showers.*

| | R.A. | Decl. | |
|---|---|---|---|
| | ° | ° | |
| Near *o* Cassiopeiæ ... | 11 .. | +48 ... | Very swift. Streaks. |
| ,, 63 Cygni... ... | 315 ... | 47 ... | Swift. Short. |
| From Cassiopeia ... | 350 ... | 52 ... | Very swift. |

## GEOGRAPHICAL NOTES.

THE July number of the Proceedings of the Royal Geographical Society contains a detailed report of the paper read by Dr. Junker on his explorations in Central Africa. Mr. Delmar Morgan contributes, from Russian sources, a long account of Russian geographical work in 1886, which contains much that is interesting. One of the most important Expeditions was that under J. V. Ignatieff, to explore the magnificent Khan Tengri group of mountains in the Thian Shan, whose summits soar to a height of 22,000 to 24,000 feet. The botanist of the Expedition, A. N. Krasnof, made some extremely important investigations, with especial reference to the flora of the high snow and ice regions of the Thian Shan, as compared with that of the Polar regions recently worked up by Wittrock. M. Krasnof is of opinion that the valley of the Ili once had an entirely different vegetation to that possessed by it now, and that this early plant-life has completely perished owing to the desiccation of Central Asia and the consequent change in its climate. Formerly, M. Krasnof says, the whole flora of the Ili valley was similar to that still preserved at the foot of the snowy mountains, resembling that of Central Russia. At present all the lower chains are deprived of the moisture they derived from melting ice-fields, and have changed their flora in the most radical way, having now only Central Asian forms. M. Krasnof's general conclusions are that formerly the Thian Shan flora was intermediate between the Altai and the Alpine, and resembled more closely that of the Central and Northern Caucasus. The process of desiccation began in the south, and showed itself by the formation of detritus, retreat of the glaciers, and disappearance of lakes. It caused the formation of loess deposits, sand, and pebble-strewn plains, while it diminished the areas of marshes and black-earth deposits. All plants common to Polar and Alpine regions disappeared from the southern slopes and syrts, while coniferous and deciduous arborescent vegetation also vanished from all waterless slopes. Wherever the snow has ceased to lie, the ancient flora has also perished, only a few species having adapted themselves to a continental climate and assumed an Asiatic character.

THE current number of *Petermann's Mitteilungen* contains several papers of special scientific interest. M. Yokoyama contributes an account of a paper by J. Tanaka, on the vegetation zones of Japan, while Herr Ernst Hartert describes the botanical results of his journey along with Herr Standinger in the Western Soudan. Dr. Supan's paper on the climate of Europe, as regards the duration of a certain mean temperature in different areas, will be found of great value in working out the physical geography of Europe. Dr. Supan's object is to show the length of time (the number of months) a mean temperature—low, temperate, or high—prevails in a European area, and to mark off on maps the areas in which the temperature endures, the number of months being expressed by colours. Many geographical and biological considerations depend on such general facts of climate as Dr. Supan is endeavouring to work out. He divides temperature into three classes : (1) 0° Cent. and under, which he calls the "Frost Period" ; (2) 10° to 20° C., the "Warm Period" ; (3) 20° C. and over, or the "Hot Period." The duration of these temperatures he has noted at 471 different stations in Europe and the countries round the Mediterranean. The results, which he has represented cartographically by areas of colour, may be briefly summarized thus :—The lines of equal duration of the "Frost Period" run similarly to the winter isothermal lines, changing from a southerly direction in the West of Europe to a south-easterly and then east-south-easterly in the East of Europe. As regards the "Warm Period," it is only on the Atlantic side of Europe that the lines of equal duration run distinctly south-east, elsewhere on the Continent they approximate very nearly to the parallels of latitude ; while for the "Hot Period" they show a north-easterly direction. Thus in all three maps the contrast between the oceanic west and the continental east comes out very sharply. A glance at Maps 1 and 2 explains why the Norwegian highland was in the Glacial epoch the birth-place of North European land-ice ; the reason is not to be found in the extraordinarily low temperatures, but in the duration of the cold and warm periods. In all districts where a coast range of mountains interposes between the interior and the sea, or where the hills rise abruptly from the sea, the lines of equal duration press closely together, notably in Norway and the Alps. Dr. Supan emphasizes the importance, in considering the climate of Europe

of such regions of depression as the valleys of the Rhone and Rhine, the low-lying region of Hungary, and the plain of Poland.

NEWS of the African traveller, Herr Gottlob Ad. Krause, has been received at Berlin through the missionary Steiner from Christiansborg on the Gold Coast. On April 16, Herr Krause arrived at Salaga, north of the Appanti kingdom; proceeding in a northerly direction he succeeded in reaching the vicinity of Timbuctoo. At present, most likely, he has arrived at the Togo coast.

## THE PROGRESS OF GEOGRAPHY.

AT the anniversary meeting of the Royal Geographical Society, held on May 23, 1887, General R. Strachey, the Vice-President, delivered an address, from which we take the following extracts:—

The attention of geographers during the year, as far as regards Africa, has been chiefly directed to the basin of the Congo, where many explorers, of various nationalities, have been employed in exploring and surveying the numerous streams which combine to make the Congo one of the greatest fluvial systems of the world. Other explorers have been engaged in the same region in examining into its economical and prospective commercial resources, but at present without definite results. An excellent summary of the geographical work done in the Congo region up to the middle of last year was given to the Society in this hall, in June last, by Sir Francis de Winton, who had then recently returned from his two years' administration of the country. The most important of the new explorations he described was that of Lieut. Wissmann and his party, who had embarked on the upper waters of the Kassai River, near the part made known to us by Livingstone and Cameron, and navigated it to its junction with the Congo. Since then Dr. Wolff, one of Wissmann's companions, has explored the Sankuru, a large northern tributary of the Kassai, and found it navigable for a long distance. One result of this latter exploration is to show that another navigable river of the far interior, the Lomami, enters the Sankuru from the north-east, and that it is a distinct river from the Lomami of Cameron, recently ascended by Grenfell, which enters the Congo near Stanley Falls.

The direction which the Kassai takes—in a long curve, from south-east to west-north-west—causes it to be the recipient of nearly all the drainage of the southern half of the Congo basin, and near its junction with the main stream it adds to its volume the waters of another great tributary, the Quango, besides the Mfini from a chain of great lakes further north. The united waters are poured into the Congo through the Kwa, which, according to Mr. Grenfell's measurement, is contracted in its passage through a range of low hills, and at its mouth is only 700 yards wide (a little higher up only 450 yards); the depth of the swiftly flowing stream Mr. Grenfell was unable to ascertain, as no bottom was touched with a line 120 feet long.

The prospective value to the Congo State of the Kassai, with its immense mileage of navigable waters flowing through fertile plains, is acknowledged on all hands. Already stations have been founded on its banks, and Portuguese traders are choosing the newly-discovered river route in preference to their old inland road into the interior from Loanda. It has been during the past few months repeatedly reascended by river steamers, once by Sir Francis de Winton himself.

Equal in importance and extent have been the explorations and surveys along the main river and many of its tributaries carried out by Mr. Grenfell. The chief of these explorations were noticed by the Marquis of Lorne in the Address of last year; and a brief general account of his surveys was given, together with a reduction of his admirable series of river charts, in the October number of our Proceedings. Since then Mr. Grenfell has added to his achievements the ascent of the unknown portion of the Quango between its junction with the Kassai (or Kwa) and the Falls of Kikunji, which latter was the farthest point, coming down river, reached by a former traveller, Von Mechow.

Other considerable additions have been made to our knowledge of the Congo region, by Lieuts. Kund and Tappenbeck, members of a scientific Expedition sent out in 1884 by the German African Association. These two courageous travellers, instead of following the courses of the rivers like others, and gleaning information only of the country and people along the banks, struck across the country, first from Stanley Pool to the south, and thence towards the east, crossing in succession all the southern tributaries, from the Quango inclusive to the Lukenye, beyond the Kassai; a toilsome and dangerous march of about 600 miles. Another member of the same Expedition. Dr. Büttner, made also a land journey, of less extent, but not less interest. Starting from San Salvador, the old capital of the Congo, he travelled eastward and crossed the Quango, reaching the capital of a Negro potentate named Kasongo, whence he struck northward to the main Congo above Stanley Pool. Much valuable information regarding the configuration of the country and the ethnology and products of the interior was obtained on these two journeys. We learn, for example, that the whole western section, to a distance some 400 miles inland, is a hilly country cut up by deep valleys, to which succeeds, further inland, a wide stretch of undulating plains, wooded only along the courses of streams, and that it is only when the eastern side of the Kassai is reached that continuous tropical forest is met with.

North of the Congo the French have been active both in completing the pioneer exploration of their new possessions and in laying down with scientific precision large tracts of country imperfectly known. The most important work of the latter kind is that of Capt. Rouvier, the representative of France on the joint Commission for laying down the boundary between the Congo State and the French possessions. This accomplished surveyor fixed numerous positions by a long series of observations both for longitude and latitude, and his Report, which will be accompanied by an atlas of thirty-eight maps on various scales, will form a solid contribution to our geographical knowledge of the region. An important pioneer exploration, about the same time, was made by M. Jacques de Brazza, brother of the eminent traveller, to the north and east of the French stations on the River Ogowé, undertaken soon after Mr. Grenfell's discovery of the magnitude of the Mobangi, and apparently with the object of ascertaining whether that great river flowed within the French boundary as fixed at the Berlin Conference. After a journey of a month's duration through dense forests, M. de Brazza emerged on an open plain, through which flowed, not the Mobangi, but the Sekoli, an independent tributary of the Congo lying far to the westward. After a fruitless attempt had been made to penetrate beyond this river, his party built canoes and descended the Sekoli to its mouth. It has been recently announced that by arbitration the French boundary has been extended a little farther to the east than fixed by the Berlin Conference, so as to include the right bank of the Mobangi. A complete and very useful *résumé* of all the geographical work accomplished by recent French explorers in the Ogowé-Congo region, by Major de Lannoy de Bissy, was contributed to our Proceedings for December last, illustrated by a map reduced from the French surveys.

Public interest has recently been directed towards the region north of the Congo, and the practicable routes it may offer to the Niam-Niam countries and the Egyptian Soudan, in consequence of the despatch of the Expedition under Mr. Stanley, for the relief and rescue of Emin Bey, which has adopted the Congo route to the Upper Nile in preference to the more direct and shorter route inland from Zanzibar. A paper giving a *résumé* of all published information regarding this region was recently read in this hall by our accomplished young colleague, Mr. J. T. Wills. Since then, you have had before you the greatest of all travellers in this little-known region, Dr. Junker, and heard his own account of his six years' explorations. The wide open plain country lying between the Congo and the Nile, which Dr. Junker described to us, is watered by numerous streams, the chief of which, the Welle-Makua, flows westerly in the direction of the Upper Mobangi, and, judging from Dr. Junker's maps, it is difficult to dispute his conclusion, in which Mr. Wills agrees, that the two rivers are the same. Other geographers believe that the Welle-Makua belongs to the Shari system and flows into Lake Chad. The alternative offers one of those problems in which speculative geographers seem to delight; but in this case it will not be long before a solution is arrived at in the only satisfactory way—namely, by actual exploration. Meantime we learn, by the latest news from the Congo, that Mr. Stanley has chosen to adopt a somewhat more direct route to Emin Pasha than that first proposed—namely, from the Congo near Stanley Falls by land to the shores of the Albert Nyanza.