them being in that of the Aar), two in the Po basin, one in the Rhone basin, and none at all in the Inn basin. It has been esti­mated that in the Rhine basin there are no fewer than nineteen large and thirty-seven small lakes. Of the smaller Swiss lakes we may mention the Dauben See, and the Oeschinen See, as well as the Märjelen See close to the Gross Aletsch glacier. There are of course an infinite number of Alpine tarns.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name of Lake. | River Basin. | Area in Square Miles. | Mean Height of Surface above Sea  Level in Feet. | Approximate Depth in Feet. |
| Geneva\* | Rhone. | 223 | 1230∙3 | 984∙3 |
| Constance\*.. | Rhine. | 208∙1 | 1305∙8 | 905∙5 |
| Neuchâtel ... | Aar, Rhine. | 92∙3 | 1427∙2 | 472∙4 |
| Maggiore\* ... | Ticino, Po. | 82∙7 | 646∙3 | 1230 ∙3 |
| Lucerne | Reuss, Aar, Rhine. | 43∙7 | 1433∙7 | ? 853 |
| Zurich | Limmat, Aar, Rhine. | 33∙8 | 1341∙9 | 469∙1 |
| Lugano\* | Po. | 19∙4 | 889∙1 | 902∙2 |
| Thun | Aar, Rhine. | 18∙5 | 1837∙3 | 711∙9 |
| Bienne | Aar, Rhine. | 16∙2 | 1423∙9 | 255∙9 |
| Zug | Reuss, Aar, Rhine. | 14∙8 | 1368∙1 | 1321∙4 |
| Brienz | Aar, Rhine. | 11∙5 | 1851 | 856∙4 |
| Morat | Aar, Rhine. | 10∙5 | 1427∙2 | 157∙4 |
| Wallenstadt. | Linth, Limmat, Aar, Rhine, | 8∙9 | 1394∙4 | c. 500 |
| Sempach | Aar, Rhine. | 5∙4 | 1663∙4 | ? |
| Hallwyl | Aar, Rhine. | 4 | 1483 | ? 1522∙8 |

The lakes marked \* are only partly in Swiss territory.

There are a great number of waterfalls in Switzerland, the loftiest being that of the Staubbach (1001 feet), in the valley of Lauter­brunnen, or “Clear Springs” (Bernese Oberland). In the Ober­land, too, we find the Handeck (200-220 feet), near the source of the Aar, while the Reichenbach descends in seven falls and the Giessbach in thirteen. The falls of the Rhine at Schaffhausen contain an enormous mass of water, though they are only 82 feet in height. In southern Switzerland the Pissevache fall (200 feet), in the Rhone valley, is the best known.

Dr A. Heim@@1 reckons up 471 glaciers in Switzerland and 462 in Austria, his figures for France and Italy being untrustworthy and incomplete; but Switzerland has 138 glaciers of the first rank *(i.e.,* over 43/4 miles long) as against 71 in Austria, though Austria has 391 of the second rank *(i.e.,* between 43/4 and 3 miles long) as against 333 in Switzerland. The distribution of the Swiss glaciers deserves notice, for in eleven cantons (that is, half of those in the Confederation) there are no glaciers at all, while in five others (Unterwalden, Vaud, St Gall, Schwyz, and Appenzell) they only cover about 13 square miles out of 709∙9 square miles of ice and snow in the Confederation, according to the official survey. Valais heads the list with 375∙1 square miles, then come the Grisons (138∙6), Bern (111∙3), Uri (44∙3), Glarus (13∙9), and Ticino (13∙1). The longest glacier in the Alps is the Gross Aletsch in the Bernese Oberland, 15 miles long; it has a basin of 49∙8 square miles and a maximum breadth of 1968 yards. In point of length the Unteraar glacier comes next (10∙4 miles), followed by the Gorner and Viescher glaciers (each 9∙4 miles). The lowest point to which a Swiss glacier is known to have descended is 3225 feet, attained by the Lower Grindelwald glacier in 1818. Dr Heim has ascertained that the maximum annual snowfall in the Alps takes place in the lower snow regions, a conclusion which the present writer can confirm from personal experience gained on the ascent of several of the highest Oberland peaks in January 1874 and 1879. Dr Heim states that in the central Alps of Switzerland the limit of perpetual snow varies from 9259 to 9023 feet. See Glacier.

In Switzerland, where the height above sea-level varies from 646 feet (Lago Maggiore) to 15,217 feet (Monte Rosa), we naturally find very many climates, from the regions of olives, vines, oaks and beeches, pines and firs, to those of high mountain pastures, rhododendrons, and of eternal snow (see Alps). As regards the duration of the seasons, there is a corresponding variety. It has been reckoned that, while in Italian Switzerland winter lasts only three months, at Glarus it lasts four, in the Engadine six, on the St Gotthard eight, on the Great St Bernard nine, and on the St Théodule always. A painstaking writer has calculated that, if Switzerland were flattened out into a plain, and reduced to the level of the sea, it would be comprised between the isotherms 51°∙8 and 55°∙4 F. As a matter of fact the mean temperature varies no less than 341/2°, for at Bellinzona it is 541/2° F., at Geneva 491/4°, at Basel 491/3°, at Chur 483/4°, at Interlaken 48°, while on the Great St Bernard it sinks to 30°, and on the St Théodule to 20°. The Alps form the boundary between the region where the rain­fall is greatest in summer and that where it is greatest in autumn, the winter and spring rainfall varying but slightly. These are the percentages of the annual rainfall in Switzerland at different seasons :—

*Rhine Basin;* winter, 18; spring, 25; summer, 33; autumn, 24.

*Rhone Basin·. ,,* 21; ,, 26; ,, 26; ,, 27.

*Ticino Basin; ,,* 12; ,, 26; ,, 27; ,, 35.

It has been shown by careful observations that the rain (or snow) fall is greatest as we approach the Alps, whether from the north or south, the flanks of the great ranges and the valleys opening out towards the plains receiving much more rain than the high Alpine valleys enclosed on all sides by lofty ridges. Thus the annual rainfall is 35 inches at Basel but 641/2 at Beatenberg (above Inter­laken) and 69 at Schwyz, rising to 88 on the Grimsel and 102 on the St Bernardino, and falling again at Lugano to 63. Dr Heim calculates that the percentage of snow in the total annual rainfall in Switzerland varies from 63 on the Great St Bernard to 6 at Geneva, the mean fall of 34 being at Platta in the Grisons. Thunderstorms generally vary in frequency with the amount of rainfall, being most common near the great ranges, and often very local. The floods caused by excessive rainfall are sometimes very destructive, as in 1839, 1852, and 1868, while the same cause leads to landslips, of which the most remarkable have been those on the Rossberg above Goldau (1806), at Evionnaz (1835), and at Elm (1881).

As regards the larger cyclones or storms of Europe, a south wind in the Alps indicates that the barometrical minimum is in the English Channel, a west wind that it is in the North Sea, a north wind that it is in the Eastern Alps, and an east wind that the depression is in the Mediterranean, about Corsica. When the baro­metrical minimum shifts from the Atlantic over Scandinavia to Russia, a soutli-west wind in the Alps is followed by west and then north winds. The “ föhn ” is the most remarkable of the local winds in Switzerland,—a strong soutli-west or south wind, very hot and very dry. It was formerly supposed to come from the Sahara, but is now held to be a south-west or south wind which, saturated with moisture, crosses the Alps, precipitating a copious rainfall in its course ; commencing its descent in the northern valleys with a high temperature for these great heights, it neces­sarily increases in temperature and dryness as it passes into the high pressure of lower levels. Dr Hann concludes from observa­tion that, assuming the air to cool at the rate of 1° C. in every 100 metres of ascent, and the ridge crossed by the fohn to be 2000 metres in height, the heat lost on the ascent is only 0°·5 C., so that when the föhn reaches the north side it will have a heat, not of 10°, but of 20°. The fohn occurs most frequently in spring. Other local winds in the Alps are those which blow up a valley in the morning and down it in. the evening, due to the heating of the air in the valleys by the sun during the day and its cooling by terrestrial radiation at night. The cloud streamers from great Alpine peaks are due to the condensing of the moisture in a layer of air, and, as the moisture is carried away by the wind, so the streamer is dissolved.

For all these reasons Switzerland has many varieties of climate; and, while, owing to the distribution of the rainfall, the Ticino and Aar valleys are very fertile, the two great trenches between the main chain and its north outlier, though warm, are less pro­ductive, as the water comes from the rivers and not from the skies.

Asphalt is the only raw mineral product the export of which exceeds the import ; and it is obtained only in the canton of Neuchâtel, where the output of the Val de Travers deposit in 1883 reached 28,000 tons. Though iron ores are known (according to Weber and Brosi’s map) to exist in 13 localities, gold in 3, silver in 22, copper in 29, lead in 27, nickel and cobalt in 2, tin in 1, sulphur in 3, Switzerland is practically dependent for all its metals on foreign supply. While 35,161 tons of iron were obtained in 1870 (mostly from mines in the Jura), only 19,045 were obtained in 1881. True coal is wholly absent ; lignites, however, occur both in the Tertiary and the Quaternary formations, the most important workings being those of Käpfnach, Utznach, Mörschwyl, Dümten, Lutry, Conversion, and Oron. In 1870 the output was 33,364 tons, in 1881 only 6184. Anthracite occurs in Valais. Peat is common in many parts. Salt (42,000 tons) is procured from wells in Aargau, Basel, and Vaud. The first salt-deposit was discovered in 1836 at Rothenhaus (Basel canton), that of Rheinfelden in 1844, of Ryburg in 1845, and of Kaiseraugst in 1865. The wells at Bex have been worked since 1554.@@2

Game is not abundant in any part of Switzerland ; and rigorous game laws and other devices have been adopted in order to increase the number of wild animals. In 1875 a law was passed in accord­ance with which a commission marked out certain reservations or “districts francs pour la chasse au gibier de montagne”; and in 1881 their limits were revised for another term of five years, in­cluding an area of 5268 square kilometres in 1885. There were then within this area 8487 chamois and about 106 roebuck. The· chamois were most abundant in the Grisons, Bern, Glarus, and Freiburg. In the Alpine regions the marmot and Alpine hare are still common, and their numbers have increased under the pro­tective system. Grouse, partridge, wild duck, and snipe are the

@@@1 In his epoch-making work, *Handbuch der Gletscherkunde,* Stuttgart, 1855.

@@@2 See Stockalper, *Rapport sur le groupe 16 Produits Bruts Exp. Nat. S. à Zurich,.* 1883, and Hermann Streng, “ Rohprodukte u. deren Fundorte in der Schweiz,” ia *Zeitsch, f. Schweiz. Statistik,* 1884.