

## REPORT ON THE SNOW SURVEY OF GREAT BRITAIN FOR THE SEASON 1948-49

By E. L. HAWKE and D. L. CHAMPION

THIS report is again primarily based on the data furnished by some 135 voluntary observers working on behalf of the Society. They contribute in each month from September to May daily statistics of snowfall and snow cover within visual range at well distributed sites representative of the principal climatic regimes in Great Britain. An important supplement to this material comes, through the courtesy of Sir Nelson K. Johnson, Director of the Meteorological Office, Air Ministry, from day-to-day observations of the state of the ground at about 110 of the official stations which supply regular returns to the department's serial publications—*The Daily Weather Report*, *The Weekly Weather Report* and *The Monthly Weather Report*.

Further sources of information are the diaries, notes and log-books of travellers and climbers, on whose co-operation the Survey chiefly depends for knowledge of the extent to which the higher mountains harbour snow during the summer months. Special reference must be made on this occasion to the work of the Durham University Exploration Society, whose members undertook the valuable study of snow conditions in the Cairngorms during July 1949 summarized on page 366. To all who have collaborated—the able corps of private observers, the Director of the Meteorological Office, his staff at Harrow and Edinburgh and the explorers both corporate and individual—the officers responsible for the conduct of the Society's Snow Survey express their most cordial thanks.

E. L. H.

### METRIC EQUIVALENTS OF INCHES AND FEET

1 in. = 0.025 m.	1 ft. = 0.305 m.
3 in. = 0.076 m.	2 ft. = 0.609 m.
6 in. = 0.152 m.	4 ft. = 1.219 m.
100 ft. = 30.5 m.	2500 ft. = 762.0 m.
500 ft. = 152.4 m.	3000 ft. = 914.4 m.
1000 ft. = 304.8 m.	3500 ft. = 1066.8 m.
1500 ft. = 457.2 m.	4000 ft. = 1219.2 m.
2000 ft. = 609.6 m.	

In general measurements of snow-depth cited in this Report refer to 0900 h. G.M.T., or thereabouts.

### SEPTEMBER 1948

The month was mild and abnormally wet, particularly in the western highlands of Scotland. Snowfall was confined to slight showers in the north of Scotland on the 20th and 21st. On the 22nd snow was reported lying down to 2000 ft. at Blairreich, Perthshire, and at 2500 ft. on the Cuillins, Isle of Skye.

### OCTOBER 1948

This month was mild until the 25th and very wet in the west of Scotland. Snow lay down to below 2500 ft. on the Fannich Hills, Sutherland on the 14th and 15th and at 2000 ft. on peaks in the Cairngorms on the 18th. During the early hours of the 25th a vigorous depression passed north-eastwards across the north of Scotland, and the cold air stream in its rear gave considerable local snowfalls in Scotland and lighter falls farther south. Snow lay down to sea level in the Shetland Islands from the 26th to 29th, at Fort William on the 26th, and to station level at Balmoral on the 29th. Snow cover was 3 in. deep at 490 ft. at Ardross, Ross-shire on the 26th and was reported at several stations below 500 ft. in Sutherland, the Orkney Islands and the Isle of Skye.

In England snow lay occasionally at several places in the north, but none appears to have lain south of the Pennines. On the 26th snow cover was reported down to below 1500 ft. from Eggleston,

Durham, and Chew Mount, Yorkshire, and an isolated snow shower occurred as far south as Princetown, Dartmoor (1359 ft.). On the 27th and 28th snow lay down to below 1000 ft. at High Close, Ambleside, Westmorland.

In Wales the snow cover was down to under 500 ft. on the Caernarvonshire mountains on the 26th, and to between 1500 ft. and 2000 ft. on the Brecon Beacons on the 28th.

#### NOVEMBER 1948

The weather of this month was abnormally dry and mild, consequently the snowfall was for the most part slight and confined to the higher ground in the north. In Scotland snow lay below 1000 ft. in the Shetland Islands on the 5th and 6th, below 1500 ft. in the Orkney Islands and in the Sutherland and Ross-shire Hills from the 4th to 8th, and below 2500 ft. in the Cairngorms. On the 6th the cover lay below 1500 ft. in the Braes of Glen Livet, Banffshire, and on the Cuillins.

In England snow lay down to between 2500 and 3000 ft. on the Furness Fells on the 6th, and in Wales a light cover down to 3000 ft. was reported on Snowdon on the 8th.

#### DECEMBER 1948

The month was generally mild and stormy, and apart from scattered showers, heavy locally in Scotland, little snow fell until the end of the month. On the 27th a cold front, associated with an intense depression moving north-eastwards over Iceland, crossed the British Isles and the Arctic air in its rear gave considerable snowfalls in the north and west.

On the 27th to 31st the snow line was down to 840 ft. at Whitchester, Berwickshire, and on the 30th and 31st was below 500 ft. in parts of Ross-shire, Nairnshire and at Mauchline, Ayrshire; in Glen Lyon, Perthshire, the snow lay 3 in. deep at 760 ft. on the 31st. In Glenshiel, Ross-shire, the cover was 8 in. deep at 500 ft. on the 31st. On the other hand, no snow was observed in the Orkney or Shetland Islands, and only slight showers were reported in North Uist, Outer Hebrides. It is of interest to note that the first snow cover of the season at Dalwhinnie, Inverness-shire (1176 ft.) did not occur until the 30th.

In England, the Pennines generally were snow covered down to the 1000-ft. level from the 28th onwards, and the snow-line fell to below 500 ft. in the Lake District and Furness Fells on the 28th. On the 30th snow lay 12 in. deep at Wirksworth, Derbyshire, 8 in. deep at Mansfield, Nottinghamshire, and 6 in. deep as far south as Shawbury, Shropshire. On this day the snow cover was 6.5 in. deep on level ground and 18 in. deep in drifts at Chew Mount (1500 ft.). Slight snow showers were reported on the 29th and 31st at Ulverscroft, Leicestershire, and on the latter date "snow lying" was reported at 1359 ft. at Princetown, Dartmoor. East Anglia and the southern counties generally were snow-free throughout the month.

In Wales the snow-line was down to 500 ft. or lower on most of the mountains in the northern and central counties on the 30th and 31st, there being a depth of 3 in. with drifts up to 2 ft. 6 in. deep at Bwlch Tunnel, Denbighshire. The snow cover was down to below 1000 ft. on the Brecon Beacons, but at Crickhowell, in this area, no snow was reported.

D. L. C.

#### JANUARY 1949

The first month of 1949 was predominantly mild. Except at a few stations in the far north of Scotland and in the Hebrides mean temperature was everywhere above normal, the general excess over the average amounting to 2.1° F. (1.2° C.) in England and Wales and 1.4° F. (0.8° C.) in Scotland. Large areas of England and South Wales and various lowland districts of eastern Scotland were wholly free from snow or sleet, and away from the mountains snow cover lasting continuously for a week or more was rare. The chief spell of wintry weather occurred early in the month. On the 1st an exceptionally deep depression travelled eastward across Ireland and thence to a position off the west coast of Norway by the morning of the 3rd. On the 4th another disturbance of less

intensity passed from north-west Ireland to East Anglia. Behind both these systems air of Arctic origin engulfed most of Britain and widespread snowfalls resulted, the heaviest of them at low and moderate levels coming to western Scotland. At Glenshiel (500 ft.) snow lay to a depth of 12 in. on the 2nd and 4th and 13 in. on the 3rd. Residual drifts persisted there for the rest of the month. Similar depths were reported from a few upland stations in northern England—e.g. at 1000 ft. near Bacup, Lancashire, on the 4th, where drifting to 4 ft. was produced by high winds. Elsewhere, at levels of 200 ft. and above, depths of 3 in. to 8 in. were common about this time. As far south as Dartmoor (Princetown, 1359 ft., and Tavistock, 457 ft.) the ground was covered 6 in. deep on the morning of the 3rd, but most of the accumulation disappeared within 24 hours. On the 6th all the islands of the Inner Hebrides were reported to be under snow: at Colonsay, Inner Hebrides, a layer 5 in. to 6 in. thick remained on the ground for four or five days. South-east of a line from the Wash to the Severn estuary the snowfalls were localized and appreciable depths were uncommon, even on the hills; 2 in. at Downe (560 ft.), Kent, on the 2nd was outstanding.

After the close of the first week there was no recurrence of widely distributed snow, though from the 8th to 12th and again around the 20th short-lived incursions of Arctic air brought sporadic falls, particularly in the north and west of Scotland. Glen Livet (1050 ft.) had 2 in. lying on the 12th and 2.5 in. on the 21st; Auchintoul (420 ft.), Sutherland, 4 in. on the 11th and 1.5 in. on the 19th; Aviemore (1050 ft.), Inverness-shire, 4 in. on the 20th and 21st, with drifts to 4 ft. at 1500 ft.; Glenshiel (500 ft.), 4 in. on the 12th. In Wales, Bwlch Tunnel (900 ft.), Denbighshire, reported 2 in. on the 11th. Among the few English stations to experience a cover after the 7th were Barnt Green (640 ft.), Worcestershire, with 0.5 in. on the 12th, and West Bromwich (543 ft.), Staffordshire, with 0.7 in. also on the 12th. On the same morning there were light coatings farther south—at Whipsnade (720 ft.), Bedfordshire, and Downe (560 ft.).

In the Scottish Highlands, the Fannich Hills had a snow cover to below 2500 ft. and Ben Wyvis to below 3000 ft. throughout the month. The Cuillins were covered to below 3000 ft. until the 22nd.

The number of days giving snow or sleet at low or moderate levels (less than 1000 ft.) exceeded 10 only in central and northern Scotland, where it reached 19 at Strathy (120 ft.), Sutherland, 15 at Baltasound (31 ft.), Shetland Islands, 13 at Hatston (35 ft.), Orkney Islands, and 12 at Wick (119 ft.), Caithness. The maximum frequencies of snow cover at stations below 1500 ft. were 15 days at Braemar (1111 ft.), Aberdeenshire, and 11 days at Balmoral (927 ft.), Aberdeenshire, and Dalwhinnie (1176 ft.), Inverness-shire.

#### FEBRUARY 1949

This was another mild month. For Britain as a whole the mean temperature exceeded the average by about 2.5° F. (1.4° C.). Over the southern half of England and in South Wales snow was limited to occasional scattered showers, chiefly on the 8th, 9th, 12th and 27th, and no cover was reported, even at stations above the 700 ft. level. In northern England and North Wales the falls, though more widely distributed than in the south, were infrequent and mostly light, deposits of as much as 3 in. being rare below 1500 ft. Higher up, a depth of 6 in. with 18-in. drifts in sheltered hollows, occurred at 2800 to 3000 ft. on Helvellyn and Fairfield Tops on the 12th. In Scotland several observers commented on the scarcity of snow. While many of the mountains had their usual February coating all through the month, the snow-line was often abnormally high; on Ben Nevis it was above 3000 ft. from the 15th to 19th. In the Isle of Skye, the Cuillins at 3000 ft. appear to have been without a 50 per cent cover until the 7th and from the 16th to 21st.

Among the greatest depths of snow reported from stations below 1000 ft. on the Scottish mainland were 4 in. at Glenshiel (500 ft.) on the 8th and at Fort William (34 ft.), Inverness-shire, on the 9th, 4.5 in. at Auchintoul (420 ft.) on the 27th, and 6 in. or more at Balmoral (927 ft.) also on the 27th. Above 1000 ft. the depth of the cover reached or exceeded 6 in. at Dalwhinnie (1176 ft.)

from the 22nd to 24th, as well as on the 27th and 28th; at Braemar (1111 ft.) on the 27th and 28th. Long stretches of the Perth-Inverness road lay under about 9 in. of snow at this time. Among the contributing stations Auchintoul (420 ft.) had the greatest number of days with observed snow or sleet—13; next came Elphin (700 ft.), Sutherland and Glen Livet (1050 ft.) with 12 each. For frequency of "snow lying" Dalwhinnie (1176 ft.) headed the list with 8 days.

#### MARCH 1949

Over the greater part of Britain this month proved to be a little colder than usual, and its first fortnight brought the principal snow spell of the 1948-49 season. Although the falls during that period affected at least three-quarters of the country's total area, and occurred frequently in many districts, nowhere were they anything out of the ordinary. The snow came chiefly with northerly winds, blowing at times with gale force, behind successive eastward-moving troughs of low pressure. Average depths of 6 in. or rather more were fairly common at intervals until the 9th at the 400 to 1000 ft. levels in Scotland and the northern half of England. They were also reported from Lerwick (259 ft.), Shetland Islands, on the 1st and 2nd. An outstanding measurement was one of 8 in. at High Close (553 ft.), Westmorland, at 1630 h. G.M.T. on the 5th.

In the southern half of England and over nearly the whole of Wales depths of as much as 4 in. do not appear to have accumulated below the 1000 ft. level, and even at that height were never at all general. There was, however, a good deal of drifting in exposed localities. On Broadway Hill (1048 ft.), Worcestershire, the road was blocked after a 4 in. fall on the 5th to 6th by long drifts about 3 ft. deep, some of which did not entirely melt away until the 23rd.

After the 14th snow was mainly confined to occasional showers in the northern uplands, though on the 18th and 19th these extended to the Chiltern Hills and some of the low hills in East Anglia and Kent.

In the Scottish Highlands, a snow cover persisted to below 3000 ft. throughout the month on Ben Wyvis and the Fannich Hills. On Ben Nevis, however, only patches of snow were observed to be lying below the 3000 ft. level after the 19th. Hoy Hills, in the Orkney Islands, were coated to below 1500 ft. on 16 of the first 20 days; the Brecon Beacons to below 2500 ft. from the 6th to 14th. On the 15th an ice-axe was needed for the ascent of some of the peaks near Ullswater and occasional cornices were found on Helvellyn. A striking insolation effect was reported from the Furness Fells on the 11th: southward-facing slopes at about 2500 ft. had less than 50 per cent snow cover, whereas hillsides at 500 to 1000 ft. facing north were completely white.

Among stations at low and moderate levels (less than 1000 ft.) the largest number of days with falls of snow or sleet was 17 at Lerwick; Auchintoul followed with 15 and Hatston with 13; the maximum frequencies for days with snow lying below the same limit were, in Scotland, 8 at Lerwick and Craibstone (300 ft.), Aberdeenshire; in England and Wales, 7 at Houghall (160 ft.), Co. Durham, and Belmont, Bolton (800 ft.), Lancashire. There was entire absence of snow or sleet in North Uist (Outer Hebrides), at Colonsay and at Mauchline as well as in the Isle of Man and many parts of southern Scotland and South Wales.

#### APRIL 1949

Notably genial weather marked this month over most of Britain. The mean temperature exceeded the average by 4.3° F. (2.4° C.) in England and Wales and by 3.2° F. (1.8° C.) in Scotland, where the extreme minimum, 26° F. (-3.3° C.), at Lerwick, Balmoral and Glen Livet on the 8th, had been under-passed in every previous April back to 1864. There were, however, brief cold spells between the 5th and 10th and from the 20th onwards: with these was associated occasional fairly widespread snow of the characteristic showery April type. In the Scottish Highlands substantial falls occurred at high levels on the 6th and 7th, a fresh deposit of 12 in. being reported from the area of the Cairngorms above 3000 ft. Ben Wyvis was coated to below 3000 ft. from the

5th to 11th and again from the 20th to 30th, and to below 1500 ft. on the 5th, 7th and 22nd. On the Fannich Hills a continuous cover was observed at below 3000 ft. from the 4th onwards; under the influence of mild Atlantic winds the snow-line in that district rose steadily from base level on the 8th to between 2500 and 3000 ft. on the 13th. In the Isle of Skye, the Cuillins were under snow to below 2500 ft. from the 7th to 10th, 20th to 24th, and on the 28th.

In northern England, Kinder Scout was "thickly covered" between 1500 and 2000 ft. on the morning of the 8th. At levels below 1000 ft. in Scotland, Glenferness (700 ft.), Nairnshire, had 3 in. on the 7th, but with that exception no depth greater than 2 in. was reported. In Wales, the Caernarvonshire heights and Cader Idris were coated to under 2000 ft. on the 7th and 8th, and the Brecon Beacons at 2900 ft. from the 8th to 11th.

On the lower ground in the southern half of England and in South Wales there were only light scattered showers of sleet or snow during the short cold spells.

On the 22nd a small party making the ascent of Ben Nevis were swept down some 1500 ft. by an avalanche (probably the result of a loosened cornice) from near the top of the Gardy Loo gully and narrowly escaped with their lives.

#### MAY 1949

This was a month of approximately normal mean temperature over Britain as a whole. Except on the mountains in Scotland, northern England and North Wales there was very little snow. The Fannich Hills were covered to below 3000 ft. until the 19th and again on the 26th to 28th; from the 20th to 25th and 29th to 31st observations could not be made. On the Cuillins snow lay to below 2500 ft. from the 5th to 8th and to below 1000 ft. on the 6th. In Wales, Carnedd Llewelyn had a light coating above 2500 ft. on the 5th and 6th. About this time showers of sleet or snow were not uncommon at low levels in central, eastern and northern Scotland. They were reported also at stations above 700 ft. in the West Riding of Yorkshire, in Lancashire, and on the Cotswold Hills. Locally in Scotland there was a recurrence of slight snow showers from the 28th to 30th.

#### SUMMER, 1949

Through the courtesy of the Durham University Exploration Society we are able to present a summary of snow observations made during July in the upper Cairngorms by a party of its members who maintained a camp and a small meteorological station a few hundred feet below the summit of Ben Macdhui. In all, some 35 snow-patches were surveyed and measured for area within the region bounded by the River Dee to the south, Beinn A'Bhuird to the east and Loch Einich to the west. They consisted for the most part of wet snow which in many instances overlay masses of white or blue-white ice. Noteworthy in view of the warm spring and summer were the following: (a) a group of ten large patches at about the 3900 ft. level on the east-facing slope of Ben Macdhui; on July 11th these were of rapidly thawing snow with no discoverable ice beneath and embraced a total area of approximately 120,000 square yards (100,000 square meters); (b) two patches (slushy snow above white ice) occupying on July 11th 50,000 square yards (42,000 m.<sup>2</sup>) at an altitude of about 3750 ft. east of Cairn Lochan (Cairn Gorm district); aspect east-south-east; (c) two patches of similar constitution with a combined area of 100,000 square yards (84,000 m.<sup>2</sup>) on July 24th located on the slopes overlooking Garbh Uisge in the same district; aspect east, altitude about 3750 ft.; (d) five patches extending in all over 40,000 square yards (33,000 m.<sup>2</sup>) on July 29th on An Garbh Choire (Braeriach district), aspect east, altitude 3500 ft. to 3900 ft. All the patches examined, except those on Braeriach, were at a low angle of slope. No snow was observed in any of the north-facing corries along the northern margins of the Cairngorms. Few measurements of depth were made, but one Cairn Gorm patch occupying a steep-sided valley opening to the east appeared to be "very deep in the centre" on July 24th. In general, the accumulations of snow and ice were reported to be shallow and unlikely to survive the summer should ablation be maintained at the same rate as in July.

From July 10th to 28th the party carried out daily measurements of ablation in a snow-patch at about 3800 ft. near the camp beneath the summit of Ben Macdhui, a set of graduated poles hammered vertically into the snow being used for this purpose. Over the period of the observations ablation \* totalled 63.9 in. The average decrease in the depth of the snow was thus 3.55 in. per day, but there was a fairly wide range of variation. Below we give the two largest and the two smallest daily values, with readings of air temperature as recorded in a portable louvered thermometer screen set up at a height of 3 ft. above the ground close by the camp. Notes on weather, wind, relative humidity and rainfall are appended.

Dates 1949	Ablation	Temperature					
		Mean of readings at 9h., 15h. and 21h. on first date		Max. on first date		Min. on second date	
		° F.	° C.	° F.	° C.	° F.	° C.
July 22nd-23rd	6.7	54	12.2	65	18.3	50	10.0
July 10th-11th	6.4	60	15.6	74	23.3	53	11.7
July 19th-20th	1.0	42	5.6	—	—	38	3.3
July 16th-17th	1.2	37	2.8	42	5.6	34	1.1

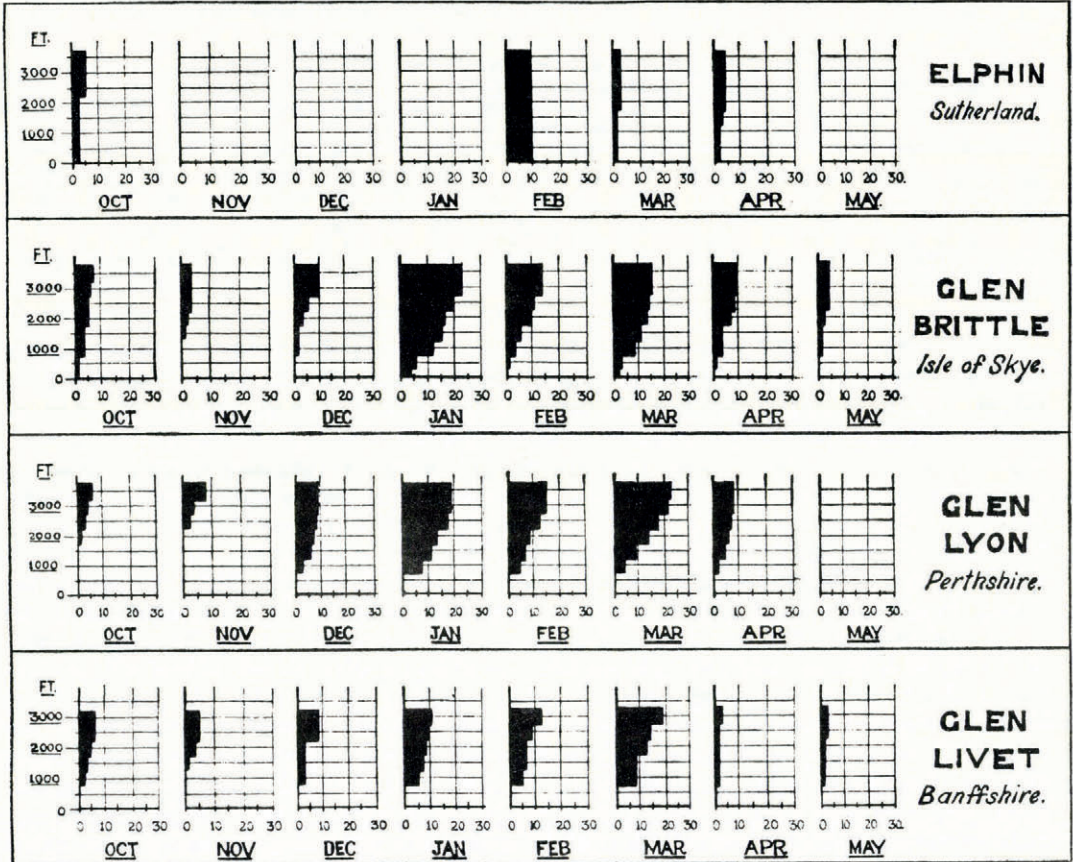
Notes.—July 22nd: hill fog morning and evening, occasional drizzle, sunny periods; light to moderate southerly or variable winds; relative humidity 100 per cent at 9h., 15h. and 21h.; rainfall 0.02 in. July 23rd: hill fog, thin drizzle and occasional light showers of rain morning, sunshine afternoon, hill fog evening; calm to light variable breezes; relative humidity 100 per cent at 9h. and 21h., 88 per cent at 15h.; rainfall trace. July 10th: fine throughout, patches of hill fog evening; wind moderate southerly, becoming light and variable, then moderate northerly; relative humidity 61 per cent at 9h., 54 per cent at 15h., 93 per cent at 21h.; rainfall trace; an abnormally warm day for the Highlands; air temperature reached 82° F. at Balmoral; the 74° F. registered near the summit of Ben Macdhui was probably exceptional at that altitude. July 11th: intermittent drizzle, bright periods, hill fog in evening; light west-north-west breeze; relative humidity 97 per cent at 9h., 93 per cent at 15h., 96 per cent at 21 h.; rainfall 0.02 in. July 19th: squally, rain at times, bright periods; strong to moderate northerly winds; relative humidity 85 per cent at 9h. and 15h., 92 per cent at 21h.; rainfall 0.07 in. July 20th: much hill fog, clear periods, heavy drizzle in evening; wind south to south-west, moderate to strong; relative humidity 100 per cent at 9h., 15h. and 21h.; rainfall 0.34 in. July 16th: hill fog throughout, drizzle at times, bright intervals in afternoon, wind north-north-east, moderate to fresh; relative humidity 100 per cent at 9h., 15h. and 21h.; rainfall 0.02 in. July 17th: much hill fog and drizzle, bright periods; light north-north-east wind; relative humidity 100 per cent at 9h., 15h. and 21h.; rainfall measurement not available.

SUMMARY

At low and moderate levels throughout Great Britain the 1948-49 season is considered to have been snow-free to a notable if not exceptional degree. Records from the same ten selected representative stations at altitudes between 400 and 1200 ft., five of them in England, one in Wales and four in Scotland, give the following averages for the total number of days with "snow lying" from September to May since the post-war re-institution of the Survey: 1946-47, 66; 1947-48, 26; 1948-49, 13. Even around the 1000 ft. level in the Scottish Highlands the maximum reported frequencies of such days for those nine months of 1948-49 were only 39 at Braemar, and 35 at

\* The settling of the snow has been ignored in these figures.

Glen Livet. Over areas comprising some hundreds of square miles in the southern counties of England and in Wales the ground was never so much as half covered by snow at the hour of morning observation, while at numerous stations in the Devon-Cornwall peninsula and the southern half of Wales the entire season was reported to have passed without either snow or sleet. According to the data available, individual snowfalls below 1000 ft. were nowhere out of the ordinary, and none seems worthy of being singled out for special comment. The four-day cover at sea-level in the Shetland Islands from *October 26th-29th* should perhaps receive mention on account of its earliness; likewise the 3 in. coating at Ardross (490 ft.) on *October 26th*. E. L. H.



#### NOTE ON DURATION OF SNOW COVER ON BRITISH MOUNTAINS

In spite of the remarkably snow-free season, snow cover on our mountains was reported somewhere in every month from September to May, and in October the snow line was down to below 2000 ft. at each of the representative stations from Sutherland to South Wales, in marked contrast to the 1947-48 season when no mountain snow cover was observed in this month. The duration of snow cover in March 1949 considerably exceeded that of March 1948 at all mountain stations.