

LETTERS TO THE EDITORS

[Correspondents are requested to observe the following rules when submitting letters for publication: the material should be clearly written (if not typed) on one side of the paper only; it should carry ample margins at top and bottom as well as at each side of the text; typed matter should be double line-spaced.]

Blue Sun and Moon

[The Editors much regret the late publication of correspondence concerning this subject. The reason for this delay was the hope that some authoritative explanation of this optical phenomenon would be forthcoming. It is apparent, however, that the optics involved are complex in the extreme.]

There is no shadow of doubt that the scattering of the light of the sun and moon by smoke from the Alberta forest fires (*Weather*, January 1951, p. 22) was responsible for the phenomenon. The pilot of a 'Meteor' from the R.A.F. Station, Leuchars, Fife, reported a very dense 'haze layer', thousands of feet thick, situated at the top of the troposphere. As he ascended through this layer, the sun became progressively less blue and appeared quite normal when observed from the 'haze'. It is quite remarkable that the prevailing circulation and conditions should have been such as to permit the smoke to hold together over such a vast distance. The press reported a blue sun or moon successively from Denmark, Switzerland, Italy, Malta and Gibraltar during the two days after it was seen in Britain so this aerial river of smoke crossed half the globe, remaining apparently within the troposphere, yet it escaped dispersal by storms or capture and precipitation by cloud and rain.

Our normal experience is that a sun seen through haze is red—not blue, for the blue suffers greater scattering than the red, according to Rayleigh's λ^{-4} scattering law. But Rayleigh's law applies only when the scattering particles are small compared with the wavelength of the light. A general formula for the scattering of light by spherical particles has been given by Mie (*Ann. Phys.*, Vol. 25, 1908, p. 377), but except in cases where the particle size is very small (when it reduces to Rayleigh's Law) or very large compared with the wavelength, its application is extremely complicated and the necessary computation is a formidable task.

But it appears that, when the particles are approximately uniform in size, with diameters of the order of a few microns, the colour of transmitted sunlight will range from green through light blue to azure blue, depending on the size distribution of the particles. Some observers in Scotland reported the initial colour of the sun to be green, changing slowly to deep blue. Approximate uniformity of particle size would be achieved by the steady precipitation of the larger particles during the long passage from the source.

An interesting experimental illustration of the phenomenon is described by B. A. Keen (*Q.J. Roy. Met. S.*, Vol. 63, 1937, p. 338)—Editors.]

Will you permit me a little space to put on record the curious colours observed on the luminary in the Wrexham district on 26 September? The night had been overcast, obscuring entirely the total eclipse of the moon; rain ceased at 0830 hrs and a strong, cool northerly wind blew. The visibility during the day was much below what one expects with maritime polar air, only reaching 6 miles. There was plenty of low cloud, and when this broke I noticed what seemed like ordinary structureless cirrostratus, but throughout the day it failed to produce any halo phenomena.

At 1600 hrs the low cloud broke again, revealing the sun, which assumed a silvery blue appearance, sufficiently marked to attract the attention of ordinary passers-by. The evening was mainly overcast, but at times, particularly at 2000 hrs, the moon was visible, a bright green, which attracted the attention of even more people. I found out later that the observer at Bwlchgurn, on the mountains to the NW, saw the sun at sunrise, and reported its colour as blue. Thus the responsible agency was operative for at least 14 hours. The presence of a layer of smoke at high altitude has been postulated as the cause, although, at that time, I had no definite evidence as to where it came from. It was observed from aircraft, and it was probably responsible for my observing what I thought to be cirrostratus.

The last occurrence locally of a similar phenomenon was a blue moon on 24 December 1947. After a warm sunny day, the evening was mainly cloudy and the moon showed through the cloud at times. There was occasional drizzle, and I think the cloud was stratus or altostratus. The fair had come to Wrexham and was in the Beast Market, and the phenomenon was seen by people, all of whom were either in the Beast Market, or not far off, and I feel fairly certain that the proximity of the fair lights had something to do with it, but it may not have been the entire cause. I cannot remember now exactly how much coloured light was used in the fair, but I do not think there was very much. The phenomenon was sufficient to attract the attention of people not at all observant, or connected with meteorology.

Wrexham

S. E. ASHMORE

At 2300 BST on 26 September, from a point half a mile south of Selly Oak (Birmingham) railway station, I noticed and remarked on the fact that the moon appeared distinctly blue in colour. This was all the more remarkable in view of the fact that the wind was in the north, bringing over industrial smoke and haze from the Black Country north of us. Under such conditions the moon almost always appears reddish in colour.

St. John's College, Cambridge

GRAEME C. JACKSON

During the afternoon of Tuesday 26 September 1950, a sheet of what appeared to be thin altostratus (C_M) spread above scattered cumulus, and at evening the latter dispersed. The moon, only a few hours past full, rose pale and wan, being observed to be blue from 2120 to 2310 BST, giving only enough light to cast a barely perceptible shadow.

Weather was calm and dry after a day of rising pressure and NNE. wind, force 4.

Exeter, Devon

W. N. LAVIS

On the night of 26 September at about 2300 BST I went out and noticed that the moon was a most peculiar colour, something between a sea-green and a turquoise-blue. There were no stars visible, but visibility was quite good. I saw the moon rising and it was then a normal orange-yellow. The night was still, and I could see no cloud crossing the face of the moon. The wind had been NNE. and backed to west by the morning.

Is there any connection between this phenomenon and the expression 'Once in a blue moon'?

Phenological Report Station,
nr. Crewkerne, Somerset

W. F. S. CASSON
(Colonel)

Leiden Invitation to Readers of *Weather*

Any reader of *Weather*, visiting Holland this summer, who would like to meet Dutch 'weather-friends' will receive a warm welcome at Leiden with members of the Meteorological and Astronomical Group of the Physical Society of Students. As we also take our holidays during the summer, potential visitors are kindly requested to call as early as possible and to write to Mr. J. Koolhoven, Zijdweg 1, Wassenaar, Holland, in order to enable us to make arrangements. If we are 'at home' we will gladly offer hospitality.

Meteorological and Astronomical Group,
Physical Society of Students, Leiden, Holland

P. J. FETERIS

[Readers of *Weather* would also welcome our Dutch 'weather-friends', and they understand that a number of us will have the pleasure of meeting some of them, including Mr. Feteris himself, at Malham Tarn Field Centre in September.—Eds.]

January Weather Freaks in Canada

For the third consecutive month a new monthly mean temperature record was set up in January in Halifax, N. S. In view of the length of the record, over a period of 82 years, this is a noteworthy fact. In a decided reversal of form, the month's last day brought the lowest temperature in the past 26 years, as the mercury skidded to 13.1°F below zero.

At noon on 31 January a remarkable halo complex became visible as cirrostratus clouds veiled the sky. 22° and 46° haloes were seen, with any colour present being generally quite faint. Parhelia on the 22° halo were conspicuous as was the colourless parhelic circle. The very rare coloured arc of lower contact was visible on the upper limb of the 22° halo. Two equally rare brilliantly coloured contact arcs splayed upwards from the points where the 46° halo touched the horizon. The display was visible, at least in part, over a period of about one hour.

Dominion Public Weather Office,
Halifax, Canada

R. A. HORNSTEIN

Will-o'-the-Wisp

Mr. I. C. Roberts asks if will-o'-the-wisp can emit enough heat to cause combustion. According to Dr. M. Minnaert (*Light and Colour in the Open Air*, London, 1940, p. 352) this is so.

It has occurred to me that there may be more than one cause for the phenomenon. Could it not happen that animals or birds might get luminous matter caught in their fur or feathers? This would account for some of the movements, as is stated to happen with owls in West Africa.

Tunbridge Wells

CICELY M. BOTLEY

Although I have not myself seen the phenomenon, it may help towards settling the discussion to point out a statement in a recently published book on Devonshire (County Series). According to this, in the marshy tracts of the county the will-o'-the-wisp (*ignis fatuus*) is rarely seen by the country people, by whom it is regarded with superstitious awe, except shepherds, trappers and night-poachers who tread secluded ways. In other words, unless you are a habitual night-farer there is small chance of observing it.

Hampstead

L. C. W. BONACINA

Weather Forecasts in the B.B.C. Home-Service Programme

I find it most irritating to arrive home in the evenings in time to hear the announcer say, "The news will follow in three-quarters of a minute". The great majority of the readers of *Weather* must be hard-working folk who cannot reach their wireless sets in the evening even in time to hear the 6 o'clock 'pips'. Could not the evening forecasts be broadcast at 6.55 p.m., or immediately before the 9 o'clock news? Many more would be able to listen, and it would be greatly appreciated.

St. John's Wood, London

C. D. OVEY

Gravity Waves

In your issue of July 1950 I pointed out that a pressure jump travelling across a weather chart is not a phenomenon analogous to a shock wave or hydraulic jump. In a letter in December 1950 issue [unfortunately given over the name of Mr. Culnan] Mr. Tepper complains that my argument is not valid because it is based on the properties of the linearized equations of motion, while the analogy is only obtained with the full equations. The analogy is extremely restricted, however, because it is only obtained if the atmosphere consists of two layers, both moving with the same velocity and both having an adiabatic lapse-rate. This oversimplified model omits two very important properties of the real atmosphere (apart from having the temperature at the absolute zero at about 29 km. and empty space above) namely the variation of wind speed with height and the internal static stability. It is not true that the latter can be replaced by having all the stability concentrated at a single inversion of temperature. For these reasons I do not regard Freeman's paper (*J. Meteorol.*, Aug. 1948, p. 138) as practical meteorology.

What of the perturbation theory? It omits no important property of the atmosphere in setting up the equations, but in solving them it assumes the motion to be only a small disturbance of some basic horizontal motion. One may argue indefinitely about the validity of that, but the fact remains that the theory does give remarkably good results. The velocity of the Krakatoa air-wave was correctly calculated by Taylor (*Proc. Roy. Soc.*, A 156, p. 318) and that wave produced pressure jumps just as big as those reported by Tepper (*J. Meteorol.*, Feb. 1950, p. 21) for which he claims that the theory is inadequate. The velocity and even the form of the air-wave due to the Great Siberian Meteorite was correctly calculated (*Proc. Roy. Soc.*, A 201, p. 137); and the meteorite was no chicken, being much more powerful than one thousand atomic bombs. Finally, the properties of waves in the lee of mountains have been very fairly described (e.g. see this issue, p. 99).

Mr. Tepper claims that the pressure jumps cannot be caused by falling rain because falling rain does not always produce a pressure jump in thunderstorms. Actually the observations excellently reported by Tepper are just what one would expect. Rain falling from the freezing level to 1,000 mb at 10 m. sec.⁻¹, would, according to Tepper's Fig. 11, be retarded by the lesser winds near the ground, a distance of about 1.6 mi compared with the point of release. The winds aloft would cover this distance in about 2.1 min if they were at right angles to the squall line, and so the rain would arrive 2.1 min late. In fact the pressure began to rise 4.5 min before the rain gush at the ground, while the pressure rise ended approximately at the rain gush. There is surely no difficulty here.

Many thunderstorms do produce rapid pressure-rises in falling rain, but it is quite easy for them not to—if they are slow moving, for instance. However, the rain weight must first abolish the upward momentum of the air, and until this is done a surplus of pressure will not appear at the ground, even in heavy rain. The rain-producing air of the squall line is advancing over air with almost no vertical velocity and so the pressure rise quickly appears at the ground.

The greatest difficulty in the way of the theory of Freeman and Tepper is to find a mechanism which will produce a travelling pressure-jump. Tepper's suggestion that a cold front accelerates for a short time—as if the cold air were a solid wedge which receives a push from some supernatural being—cannot be taken seriously. For one thing, if a slow-speed pulse of the lee-wave type were set up it would travel backwards in the cold air and not forwards in the warm air. The only two recorded cases of travelling pressure-pulses (Krakatoa and Siberian Meteorite) were essentially extraordinary, but they tell us what would happen if one were produced—it would travel with about the speed of sound!

Wimbledon

R. S. SCORER

Low Minimum Temperatures

I wish to place on record the following temperature-minima :—

Night of 3 December 1950 Air 11.7°F Ground 2°F.

Night of 4 December 1950 Air 12.9°F Ground 3°F.

I usually agree fairly closely with the figures published in the *Daily Weather Report* for Manchester and Squires Gate, but as in this instance my readings are so much lower than those from the local official station, I am reporting them.

The air figures are taken in a Stevenson Screen with properly exposed NPL thermometers, but the ground minima were taken with a Six's max.-min. thermometer laid on the snow surface, the bulb projecting slightly above the surface of the metal scale. This thermometer agrees with the NPL thermometer to within $\frac{1}{2}$ °F when exposed under similar conditions.

As far as I am aware lower ground-minima have only been recorded in 1940, before I commenced observations at Broughton.

My previous lowest ground minimum was 6°F on 27 January 1945.

Broughton, Preston

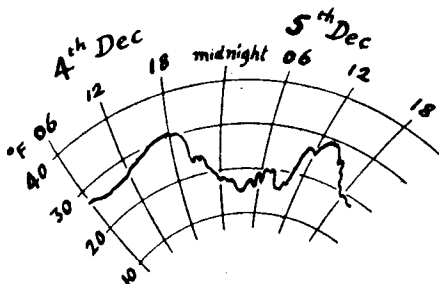
C. CUTHERT

Low Temperatures in Cheshire

I enclose the chart of my thermograph record including 4 and 5 December 1950. In addition to shewing the lowest screen-temperature I have ever recorded for the month of December, the trace for the night of 4 to 5 December is unusual in showing numerous fluctuations.

There was little wind during the night and, as far as I can ascertain, the sky was cloudless. The minimum on an exposed thermometer with bulb one inch above the snow surface was 4°F. Presumably the variations were caused by mixing of air currents and possibly our location on the slope of a hill might have an effect. Our elevation is 510 feet. The minimum on the chart, 15.2°F, was practically identical with that on the spirit thermometer in the screen and was in close agreement with that reported in the *D.W.R.* from Ringway Airport.

Romiley, near Stockport, Cheshire



Thermograph record for Romiley, Cheshire

F. EDWARDS

[Fluctuations in temperature of this kind may be observed on radiation nights when a light breeze brings from time to time pockets of warmer air. Such pockets of relatively warm air might occur among trees, where the ground cannot radiate so freely to the sky. Under such conditions a temperature change of 10°F in a space of two minutes has been observed.—Editors.]

Icicle Death in 1776 Commemorated

A tablet was placed yesterday at the parish church of St. Michael and All Angels, Bampton, Devon, to commemorate the death in 1776 of the son of the parish clerk, who was killed outside the church tower when struck in the eye by a falling piece of ice. His name is unknown, but his fate is recorded in the church records. The inscription on the tablet reads :

Bless my eyes,
Here he lies,
In a sad pickle,
Kill'd by an icicle.

The tablet, given to the church by a parishioner, has been placed in the tower above a stone originally laid to commemorate the tragedy. This stone contained the same verse but the words have become obliterated.

Quotation from THE TIMES, 10 January 1951

Variations in the Length of the day

In *Weather* of January 1951 a report was included on the Royal Astronomical Society meeting devoted to the fluctuations in the length of the sidereal day. With regard to the annual variation, Commander Lawford and I spoke on the effect of the seasonal changes

in the mean sea level. By assuming W. H. Munk's values for January–February in conjunction with our values for March–April, it appeared that there was more water between 45°N and 45°S in spring than in autumn. The effect of this, however, would be approximately three months out of phase with the observed changes in the length of the day and would therefore contribute very little.

The value used for January–February has therefore been discarded and a recomputation carried out on the same basis as for March–April. The new value gives an effect which has its maximum in February and August, and is precisely in phase with the total effect as determined by the performance of the best quartz-crystal clock. It moreover accounts for approximately 20 per cent of the observed effect, and is therefore comparable with the meteorological factors affecting the annual variation.

Hydrographic Department, Admiralty

V. F. C. VELEY

What occurred during the Transfiguration ?

I do not think Mr. Ashmore's modest suggestion (*Weather*, April 1949) that the Biblical account of the Transfiguration is based on the occurrence of a meteorological optical phenomenon can be dismissed on the ground of 'voices', as the Editorial note implies, or as of no interest as Dr. Sansom says. When I read the account of 'glories' in Pernter's *Optics* and the accounts of the Transfiguration in the three Gospels, I cannot honestly come to any other conclusion than that the optical part of the Transfiguration was a natural phenomenon of the 'glory' type. I have often said so to my clerical and other brethren long before Mr. Ashmore courageously said the same thing in print.

This conclusion is no reflection on the writers of the Gospels. Indeed, the fact that the accounts of the Transfiguration are consistent with meteorological optics increases, rather than diminishes, confidence that they are accounts of a historical event, and, as a corollary, confidence in the reality of other events related by the writers of the Gospels.

Similar reasoning applies to the relation between the 'standing still' of the sun in Joshua and Habakkuk, and the sun pillar or the rarer mock-suns at the points of contact of the haloes with the upper inverted tangent-arcs. Also to the burnt offering of Elijah on Mount Carmel and phenomena of atmospheric electricity.

In the state of knowledge of their time these writers regarded thunder, lightning and infrequent atmospheric optical phenomena as due to the direct intervention of God or of the spirits of departed prophets. It would be irreverent of us to ignore known facts and to attribute to such causes phenomena which can be explained by simple physics—God is responsible for simple physics and produces thereby many wonderful things, miraculous, in the old sense, to people who see them for the first time and have had no training in physics; miraculous also, in perhaps a deeper sense, to physicists whose faculty of wonder has become, not atrophied, but increased with increase of knowledge.

London, N.W.11

E. GOLD

Clear-air Turbulence

In the account of Dr. Hislop's paper on the subject clear-air turbulence published in *Weather* (February 1951, pp. 59–60) it appears that even after studies since 1948 the true nature of the bumpiness remains obscure. Does not the old sky-writing technique suggest itself as a method of study? Suitable smoke should remain visible for many minutes, and could be photographed from the air or from the ground at known intervals, and any vortex systems or wave systems would at once be apparent.

Oxford

G. C. VARLEY

Sunset Vapour-Trails

On 21 February at about 1725 GMT, *i.e.*, close to sunset, two jet aircraft were seen disporting themselves over West London in the general direction of WSW from St. John's Wood. My attention was first caught by the beauty of the vapour trails which they left behind them; these being illuminated in gold by the (invisible) setting sun. Later, one of the trails, viewed roughly at right angles to the direction of flight, developed clearly marked striations, like a succession of twenty or so golden pennies, but considerably thicker in proportion and with gaps between them. Finally, it occurred to me that, in such conditions, and particularly if prepared for them, there might be an unusually favourable opportunity for observing the detail of vapour trails; and that, possibly, where a meteorologist and jet aircraft are gathered together, the opportunity might be worth creating.

London, N.W.8

A. W. HASLETT

Corrigendum

The letter published on p. 62 of *Weather*, February 1951, and entitled 'Gravity Waves', which reached this office unsigned, was incorrectly ascribed to the sender Mr. Robert N. Culnan, whereas its author was Mr. MORRIS TEPPER. The editors are glad to correct this error, and regret any inconvenience caused to those concerned.