

XIV.—*On the Formation of Clouds, as observed in the locality of Kirkby Lonsdale, Westmorland, in the month of October, 1847.* By WILLIAM STURGEON, Esq., in a letter to E. W. BINNEY, Esq.

(Read November 2nd, 1847.)

MY DEAR SIR,

HAVING had some experience as an observer of clouds, but having never witnessed such regular, and long continued transitions in the forms of aqueous vapour as those which have appeared, within the last fortnight, in this locality; nor being aware that any such have been recorded by Meteorologists, a description of them will be interesting to those philosophers whose studies are devoted to this class of natural phenomena.

The village in which I now reside, and where

these observations were made, is called Biggins, situated within a mile of Kirkby Lonsdale, and upon a mass of limestone rock, which rises steeply from the river Lune, which is about a mile distant from Biggins. Close to the river side the rock is covered with good soil, which grows excellent grass and corn ; but on the first steep rise of the acclivity, large blocks of limestone, in many places piled one above another, appear considerably higher than the soil, though a great portion of the space produces good pasturage, and is well stocked with fine trees, principally ash.

Opposite to Biggins, on the eastern side of the Lune, is Casterton Fell, which is one of a long chain of mountains that forms the eastern boundary of Lonsdale. The summit of Casterton Fell is about four miles from Biggins, with a well cultivated valley and the river Lune between them. The river and the chain of mountains are nearly parallel to each other, and to the meridian. The river runs southward to Lancaster, and empties itself into Morecambe Bay.

On the forenoon of Friday, the 1st instant, being in Kirkby Lonsdale, my attention was arrested by

a splendid bank of clouds rising from behind Casterton Fell, and extending both northwards and southwards, for several miles, along the eastern side of the mountain chain. The wind was easterly and pretty brisk, but still the clouds made no progress towards the place of observation. On looking about, I observed that the sky on the western side of Kirkby Lonsdale, and for a long track along the western side of the river, was completely covered with a dense rain-cloud ; but the space between this cloud and that bank of clouds which surmounted the fells, was perfectly clear : but the most curious part of the phenomena consisted in the stationary positions that both groups of cloud continued to appear in, when the wind was so high ; and not the trace of a cloud between them.

On my return to Biggins I had another *look out*, and still found the two groups of cloud nearly as before. I soon discovered the cause of their keeping their stationary positions in a high wind ; which was simply this.—The *western* border of the *eastern* clouds dissolved and disappeared as soon as it passed the summit of the mountains, whilst the *western* cloud, which hung over Biggins,

was recruited on its *eastern* edge, by a condensation of vapour from the clear part of the atmosphere. I watched this process for some hours, which was really beautiful. Nothing could be better calculated to give an idea of creation out of an apparent nonentity, than the continual formation of a dense cloud from the invisible vapour of a clear sky.

During the afternoon another phenomenon, of the same class, made its appearance. The *western* cloud, previously observed over this side of the river, had entirely disappeared; and one solitary insulated cloud hovered over head. The breeze still kept up, and this cloud kept its position. Its length might perhaps be a mile and a half, and its breadth three or four hundred yards. Having a pocket compass with me, I ascertained that its length was as nearly as possible in the magnetic meridian, almost at right angles to the direction of the wind. The phenomena displayed by this cloud were really interesting. It was dense in the middle, but ragged and thin at the edges. It was fed by the condensation of vapour on its *eastern* edge, and as continually wasted on its *western* edge by the re-dissolution or re-attenuation of that vapour. The axis of the cloud remained in nearly the same

position for more than three hours. It disappeared in the evening, by the whole heavens being overcast with dense cloud.

On the 14th October, I saw some fantastical transformations of clouds. They spring into existence in the clear air; float, in ever-changing shapes, for about a minute, then dissolve and disappear. They mostly commence as exceedingly thin filaments, which assemble in multitudes and form dense clouds. At this stage they often exhibit a whirling motion, spread out again into filamentaceous portions, and rapidly disappear.

As I have drawn no inference concerning the formation and annihilation of the clouds before described, I will take this opportunity of remarking that the phenomena would lead one to think that in the same horizontal stratum of air, the temperature is very different within a very short range of locality: and that there are vertical columns or strata, of different temperatures, arranged side by side alternately, over a small space of country.

On Casterton Fell, and over Biggins, &c. where the vapour formed cloud, the air must have been

colder than over the intervening valley, where no cloud was to be seen : and I cannot see any reason to think, that the vapour either ascended or descended during its transit over the valley. Descend it could not, because its specific gravity, whilst invisible, would not give it that tendency : and if it ascended it would reach a colder region of air, and still keep visible as cloud ; unless, indeed a column of warm air over the valley, reached from the ground to an altitude higher than the stratum of air in which cloud appeared. In that case there would not only be different degrees of temperature in the *same* stratum, but vertical columns of air of different temperatures also. Abiding by the facts only, it is obvious that the coolest air was over the highest land ; and consequently *nearer* to that land than to the valley below. But the general opinion amongst Meteorologists is, that the cold air found on mountains, is not due to the mountains themselves, but because their summits are situated in high strata of air, which would be cold whether the mountains were there or not. Perhaps it might be said that the superior radiation of heat from the valley, would warm the air to a higher altitude than that over the hills. Such an explanation would admit of a warm column between two cold ones ; but it would not explain the reason

of the *greatest portion* of the vacant space in which no cloud appeared, to be on the *east side* of the Lune, whilst a strong easterly breeze was blowing the *supposed* warm column of air, in the opposite direction. And in the case of the insulated cloud, which kept its stationary position for some hours, with a bright sky on every side, and the land westerly as high as at Biggins, the idea of radiation will not apply in any way.

If no satisfactory explanation has hitherto been given for phenomena of this class, the question will be an interesting one; and I should like to hear the opinions which such a problem might elicit from our Manchester Meteorologists.

I am, my dear Sir,

Yours very truly,

W. STURGEON.

E. W. BINNEY, Esq.



Sturgeon, William. 1848. "On the Formation of Clouds, as Observed in the Locality of Kirkby Lonsdale, Wetmoreland, in the Month of October, 1847." *Memoirs of the Literary and Philosophical Society of Manchester* 8, 390–396.

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