

Received June 5, 1766.

XXVI. *A Letter to the President of the Royal Society, containing a new Manner of measuring the Velocity of Wind, and an Experiment to ascertain to what Quantity of Water a Fall of Snow is equal.*

Kirknewton, May 13, 1766.

My Lord,

Read June 19, 1766. **I** Should think myself most unworthy of the honour which your lordship and the Royal Society have done me, if the notice which you was pleased to take of my letter upon the late comet, did not make me more careful to observe whatever, I thought, might tend to improve the knowledge of nature, which is a capital part of the laudable design of the Society.

Your lordship knows, that my situation exposes me to every blast that blows, and affords a fair opportunity for measuring the velocity of the wind (the force of which I am, so often, obliged to feel). I have attempted to determine this by letting light downy feathers fly in the wind (the method, I understand, used by the ingenious Dr. Derham); but cannot say, in all the trials I have made (though I have let fifty of these feathers fly, one after the other, at a time), that I have ever seen above one, or two at most, upon which I could have founded a calculation. The velocity of the wind near the earth is very unequal, upon account of  
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the frequent interruptions it meets with from hills, trees, and houses; and even in open plains, the surface of the earth, though much smoother than it commonly is, must reflect, and interrupt such a fluid as the air, and occasion great irregularity in the velocity of its current: this is the reason, when a feather is let fly with the wind, why it seldom, if ever, describes a strait line, but moves sometimes in a kind of spiral, now high, and then low, sometimes to the right, and then again to the left; and why two feathers let fly at once, seldom, if ever, keep together, or describe similar lines.

But, at some considerable distance from the earth, the velocity of the wind seems to be regular and steady: nothing can be more uniform, than the velocity of a cloud in the sky appears to be, even in the greatest storm: it is like a ship carried away insensibly by a smooth and gentle current, passing over equal spaces in equal times. This suggested the thought, that the motion of a cloud, or its shadow, over the surface of the earth, would be a much more proper measure of the velocity of the wind.

In the end of March 1763, I had as favourable an opportunity of putting this method into practice, as I could have wished for; the storm was exceeding high, and moved with vast velocity; the sun was bright, the sky clear, except where it was spotted with light floating clouds; I took my station in the north window of my dining room, near the clock, from which I had a free prospect of the fields; the sun was in the meridian, the wind due west intersecting his rays at right angles; I waited until the fore-part of the shadow of a cloud, that was distinct, and well

defined, just touched a south and north line, which I had marked upon the ground; at that instant I began my reckoning, and followed the shadow with my eye in its progress, counting seconds all the while by the clock, until I had reckoned up 15 seconds; then I observed exactly where the foresaid edge of the shadow was. This experiment I repeated ten times in half an hour, and seldom found the difference of a second, in the time which different clouds took to move over the same space. On the 5th of May current, I repeated the trial four different times, the sun being also near the meridian, the wind in the west, with light clouds floating in a clear sky as formerly; and found that the shadows of different clouds took some of them 44, and others 45 seconds, to pass over the same space which they had moved over in 15 seconds, in the former trials.

	Feet.	
This space measures exactly	1384	= space passed over in 15 seconds,
which multiplied by	4	
	gives	5536 = space passed over in one minute,
which multiplied by	60	
	gives	332,160 = space passed over in one hour.

Which space is = 62.9 English miles per hour, the velocity of the wind in March 1763.

One third of this (or 21 miles nearly) shews the velocity of the wind on May the 6th, when it blew a fresh gale.

This day, May 12, there was a small westerly breeze, the velocity of which I measured upon the same line, the sun being 10 minutes past the meridian, and found that the shadow took 95 seconds to pass over the  
above

above space, which gives the velocity of the wind at the rate of 9.9 English miles per hour.

Thus, by having several lines in different directions of a known length marked upon the ground, one may easily (and with great accuracy, I imagine), measure the velocity of the wind. If a person was provided with an instrument for measuring the force of the wind, it would perhaps be worth while to observe, whether, when the velocities of different winds were the same, (or nearly so) the forces of these winds did not vary with the seasons of the year, the points of the compass from which the wind blows, and also with the different state of the barometer and thermometer, since the momentum of the wind depends not only upon its velocity, but also upon its density.

From the end of March 1765, to the end of March last, we, in this part of Scotland, had very little rain, and less snow in proportion; our rivers were as low, through the winter, as they use to be in the middle of summer; springs failed in most places, and brewers and maltsters were obliged, even in winter, to carry their water at a considerable distance; I was much afraid there would not be moisture enough in the earth for the purposes of vegetation, if this season should set in as dry as the former, before we got a new supply of rain. In the end of March last, we had a fall of snow; and, as I did not remember to have ever read an account of such an experiment, I wished to be able to determine, to what quantity of rain this fall of snow was equal.

The snow had been falling from five o'clock the former evening, till ten o'clock next day; about eleven o'clock I measured the depth of the snow, and found

it to be 6.2 inches ; then I took a stone jug, holding about three English pints, and turned the mouth of it downwards upon the snow measured, and where the ground below was smooth, and hard ; and by this means I took up all the snow from top to bottom in the jug ; this snow I melted by the side of a fire, and the 6.2 inches of snow yielded six tenths of an inch deep of water in the same jug. After emptying the jug, I dried, and weighed it in a balance, and took up the same quantity of snow in it as before, weighed it again, and found the weight of the snow taken up, and from this weight computed what quantity of water it should have produced, and found that it ought to have produced six tenths of an inch and  $\frac{1}{20}$  of an inch more : then I dissolved the snow, and found that it yielded a quantity of water in the bottom of the jug, six tenths of an inch deep as in the former experiment. The difference of  $\frac{1}{20}$  of an inch in the depth of the water, betwixt the weight and the melting of the snow, was probably owing to an exhalation from the jug, while the snow was melting by the fire, for I observed a steam sometimes rising from it. A greater or lesser degree of cold, or of wind, while the snow falls, and its lying a longer or shorter while upon the ground, will occasion a difference in the weight and in the quantity of water produced from a certain number of cubic feet, or inches, of snow ; but, if I may trust to the above trials, (which I endeavoured to perform with care) snow, newly fallen, with a moderate gale of wind, freezing cold, which was the case of the snow I made the trials upon, the 27th of March last, will produce a quantity of water equal to  $\frac{1}{20}$  part of its bulk ; or the earth, when covered with snow,

ten inches deep, will be moistned by it when melted; rivers, and springs recruited, as much as if a quantity of rain had fallen that covered the surface of the earth to the depth of one inch.

I am, my Lord,

with the greatest respect,

your Lordship's most obedient

and most devoted humble servant,

Alex. Brice.

Received June 5, 1766.

XXVII. *Some Observations on the Country and Mines of Spain and Germany, with an Account of the Formation of the Emery Stone; from William Rowles, Esq; Director General of the Mines of Spain; communicated by P. Collinson, F. R. S.*

Read June 19,  
1766.

**A**T the extremity of Old Castile, in Spain, is situated a territory called Montana, which is divided into two parts; the Low Montana is that chain of mountains, which bounds the