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act. Done once for all, it was done sufficiently. Repeated, indeed, it was, year by year; but that was to show, not that it was the single type of a continuous action, but that it was the continued type of a single action. Once for all, then, by the ruling of the type, must the Blood of Christ be offered in the true most Holy Place. The virtue of the offering lives on for ever, even as it reached back to "the foundation of the world,"<sup>1</sup> but the type forbids us to believe that the offering itself is continuous. There is, indeed, a continual dealing with that most precious Blood. But of that dealing, earth, not heaven, is the scene. There is a repeated sprinkling of it by Him, the true High Priest. But it is not before the Mercy-seat above, but on penitent and believing hearts here below, that He so sprinkles it.

The teaching, then, of the typical institution clearly is, that the action of the high-priest within the most Holy Place furnishes an accurate, if not a complete, representation of our Lord's action as High-Priest of His Church in heaven. And the analogy which it affords warrants the conclusion (with which we bring this part of our inquiry to a close), that not with altar, nor with sacrifice, but only with blood, and that as shed, and not continually, but once only, and once for all presented, does He minister there. By blood, once shed and once offered, the sins of the whole nation throughout the year were typically and ceremonially atoned for. By Blood, once shed and once offered, the sins of the whole world, throughout all the ages, were really and spiritually taken away.

T. T. PEROWNE.

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### ART. III.—WEATHER FORECASTS.

"**A**LMOST everyone," writes the Secretary to the Meteorological Office, in his admirable manual of "Elementary Meteorology,"<sup>2</sup> "imagines himself to be a born meteorologist." The remark is certainly so far justified, that upon questions connected with the science of meteorology people are in the habit of expressing themselves with a confidence which they would not venture to exhibit in reference to any other science with the principles of which they were not familiar. There are probably few persons who would attempt to predict a solar or lunar eclipse without having first mastered the elements of

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<sup>1</sup> Revelation xiii. 8.

<sup>2</sup> "Elementary Meteorology," by R. H. Scott.

astronomy ; but there are numbers who consider themselves quite competent to deal with the far more complicated problem involved in predicting the weather for months, or even years, beforehand, apparently without having thought it necessary to acquaint themselves with the first principles of the science of meteorology. And hence it comes to pass that when questions bearing upon weather predictions are under discussion, one frequently hears the wildest speculations advanced, and the crudest rules and maxims laid down, with a degree of confidence which, to those who have given some study to the subject, is simply amazing.

Strange as it may sound, it is probably to the exceedingly complicated nature of this science that this result is in the main due ; inasmuch as it is only quite recently that sufficient observations have been accumulated to lay the foundations of a science of weather prediction. And while scientific men have been waiting patiently for further light, and have forbore from laying down rules until they had obtained the data which would justify them in doing so, the less competent (as so often happens) "have rushed in" where the more competent "feared to tread."

Still, though meteorology is yet in its infancy, there are certain well-established laws which are now universally accepted by meteorologists ; and if the present state of the science does not warrant us in going very far in the way of weather prediction, it at any rate enables us to demonstrate the futility of a large proportion of the weather rules that have obtained general acceptance with the public.

It will be the aim of this article, after glancing at some of the principal of such attempts to forecast the weather, to point out where these fail, and to explain the principles upon which alone a sound system of weather prediction can be based.

I. In the first place, then, all predictions on the large scale, all attempts to foretell the weather of a year, or even of a season, must be pronounced utterly unreliable. They are at best mere guesses, if they are not, as in the case of some of the prophetic almanacs, attempts to trade upon the credulity of the uninformed. So far as such predictions have any scientific foundation at all, it is to be found in the assumption of the existence of what is called the cycle of the weather. That is to say, it is assumed that the changes in the weather follow a regular course, extending over a definite period of time, and that at the end of that period they begin anew, and are repeated again in the same order. For instance, it was at one time supposed that the Metonic cycle (discovered by Meton the Athenian, B.C. 443), a period of nineteen years, at the commencement of which the new and full moons begin to occur again on the same days of

the same month as they did nineteen years before, furnished such a cycle of the weather. But as this supposition seems now to have been generally abandoned, we need not waste time in showing that no such cycle exists. More recently the sun-spot cycle, a period of about eleven years, during which the spots on the sun go through a complete series of changes, passing from a maximum of frequency to a minimum, and back again to a maximum, has been brought into requisition. But though it has been shown, with a considerable degree of probability, that the changes in the number and frequency of the sun-spots are accompanied by some corresponding changes in the weather of the world as a whole, the relation between them is at present far too complicated, and too imperfectly understood, to admit of predictions being founded upon them for any particular locality.

It may, however, be right to say, that a few scientists of acknowledged eminence have given the weight of their names to the theory of the sun-spot weather cycle. But when it is added that the most eminent among these, the distinguished mathematician and astronomer, Professor Piazzi Smyth, staked his reputation as a weather prophet on the prediction (avowedly based on the sun-spot cycle) that the year 1879 would be one of exceptional heat and drought, it will, we think, be admitted that any presumption in favour of the theory in question that might be derived from its advocacy by so high an authority, has been more than neutralized by so unlucky a prophecy. For it can hardly be necessary to remind our readers that the year in question proved to be one of the coldest and wettest that has been experienced in the present century.

A rule for predicting the prevailing character of the coming summer or winter, which appears to meet with considerable favour, is one founded on the direction of the wind at the time of the vernal or autumnal equinox. If the wind is from a northerly or easterly point at the time of the equinox—so it is that the rule is commonly stated—a dry and cold season may be expected to follow; if, on the other hand, the wind is from the south or west, the coming summer or winter, as the case may be, is likely to be warm and wet. Now, to say nothing of the extreme improbability of the character of a whole season being determined, or even indicated, by the direction of the wind on a single day some months beforehand, the inherent absurdity of the rule may be exposed by a glance at the weather charts issued daily by our Meteorological Office. Those who are in the habit of seeing these charts know that it is no uncommon thing, even over so small an area as that of the British Islands, for the wind to be blowing, in different localities, from every point of the compass on the same day and at the same

hour, so that, *e.g.*, it may be northerly over the west of England, westerly in the south, southerly in the east, and easterly in the north. This, indeed, would be the normal state of things, if a depression happened to be passing centrally over England—no uncommon occurrence at either equinox. And thus the rule, if it had anything in it, would indicate seasons of a different and even opposite character at places only a few miles apart.

A similar consideration at once disposes of nearly all the weather rules that have been framed on the assumption of a connection between the changes of the moon and changes in the weather.

The belief in some such connection is, indeed, so deeply rooted in the popular mind, that all argument on this subject seems in most cases thrown away. It is in vain to tell the confirmed believer in lunar weather rules that the so-called "changes of the moon" involve no real change in that luminary; but that when we speak of a change of the moon, we merely mean that the moon, as seen from the earth, occupies a certain position in regard to the sun, so as to present to the earth varying portions of its illuminated surface. It is in vain to tell him that there is no reason why the moon should, at these particular points, affect the weather on our earth, more than at other points in its course. Nor will it probably avail much if we add that nearly all the rules of this kind have been tested by careful and systematic comparison of the rule with the actual weather, and found wanting. But when it is shown that while the changes of the moon occur at the same time for the whole of our country, the most various kinds of weather may prevail in different parts of the country at the time of change, the most bigoted lunarian must admit that it is difficult to believe that the same influence can produce all these different and even opposite kinds of weather at one and the same time.

But it may, perhaps, be said, "Is it not an acknowledged fact that the moon exercises a powerful influence on the tides of the ocean? and may it not therefore exercise a similar influence on the great aërial ocean in which our globe is enveloped? And is it not reasonable to suppose that it may in this way affect the weather?" To this it may be replied that there is little doubt that the moon does affect our atmosphere in this way, but that the effect of such an influence, if it were perceptible, would not be to produce such changes in the weather as are popularly attributed to the moon, but to cause tides in the atmosphere corresponding to those of the ocean, and following the same course, so as to occur as much later every day as the moon is later in coming to the meridian. Now, if this were really the case, it would of course be shown by the barometer,

inasmuch as every increase or diminution in the height of the aerial ocean overhead, produces a corresponding rise or fall of the mercurial column, exactly proportioned to its amount; and as no such tidal variation of the barometer is observed, we must conclude either that the influence of the moon upon the atmosphere is too feeble to be appreciable by the most delicate instruments, or, as is more probable, that it is masked and overlaid by other and more powerful influences.

II. And now it is time to consider some of the less ambitious but more useful popular weather prognostics in which practical observers have embodied the results of their observations of the weather.

These are, for the most part, short rules or sayings founded on appearances in the sky, or clouds, or on the movements of animals, birds, plants, etc., indicating changes in the atmosphere already in progress, and such as are likely to lead to further changes either in the direction of rain or improving weather. The indications of this kind which portend the approach of rain have been so well summed up in the well-known lines of Dr. Jenner, that we can't do better than quote them, giving at the same time a rationale of the principal prognostics referred to by him, as read in the light of the most recent discoveries, bearing upon the connection of the weather with cyclonic or anti-cyclonic systems.

The hollow winds begin to blow,  
 The clouds look black, the glass is low,  
 The soot falls down, the spaniels sleep,  
 And spiders from their cobweb creep.  
 Last night the sun went pale to bed,  
 The moon in halos hid her head.  
 The boding shepherd heaves a sigh,  
 For see ! a rainbow spans the sky.  
 The walls are damp, the ditches smell,  
 Closed is the pink-eyed pimpernel.  
 Hark ! how the chairs and tables crack !  
 Old Betty's joints are on the rack,  
 Her corns with shooting pains torment her,  
 And to her bed untimely sent her.  
 Loud quack the ducks, the peacocks cry,  
 The distant hills are looking nigh.  
 How restless are the snorting swine !  
 The busy flies disturb the kine.  
 Low o'er the grass the swallow wings,  
 The cricket too, how sharp he sings !  
 Puss on the hearth, with velvet paws  
 Sits wiping o'er her whiskered jaws.  
 Through the clear stream the fishes rise,  
 And nimhly catch the incautious flies.  
 The glow-worms, numerous and bright,  
 Illumed the dewy dell last night.  
 At dusk the squalid toad was seen  
 Hopping and crawling o'er the green.

The whirling dust the wind obeys,  
 And in the rapid eddy plays.  
 The frog has changed his yellow vest,  
 And in a russet coat is dressed.  
 Though June, the air is cold and still,  
 The mellow blackbird's voice is shrill.  
 My dog, so altered is his taste,  
 Quits mutton bones on grass to feast.  
 And see yon rooks, how odd their flight !  
 They imitate the gliding kite,  
 And seem precipitate to fall,  
 As if they felt the piercing ball—  
 'Twill surely rain—I see with sorrow  
 Our jaunt must be put off to-morrow.

Here then, in the first place, the rising of the wind, accompanied by a falling barometer and threatening sky ("The hollow winds begin to blow, the clouds look black, the glass is low") indicates the approach of a cyclonic depression, which, as it passes over, almost always brings with it more or less rain. The halo round the sun or moon is another indication of the same thing, inasmuch as halos are formed in the high, thin cirro-stratus cloud which usually precedes the denser masses of vapour which accumulate round the centre of the depression. The pale appearance of the sun or moon later on, shows that the cirro-stratus is thickening, and therefore that the depression is still advancing. The falling of soot in chimneys, the dampness of walls, the offensive smells proceeding from ditches, etc., are the result of the damp, close condition of the air in front of an advancing depression. And to the same cause may be attributed the rheumatic pains in the joints, the shooting of corns, etc., experienced by many persons upon the approach of rain, as well as the low flight of insects, and of birds in search of them, the creaking of the wood-work of furniture, and the restlessness of many animals, as shown by their cries or movements ; while on the other hand, the appearance of toads and glow-worms in unusual numbers, and the singing of blackbirds, are indications furnished by animals to which damp weather is welcome. The unseasonable chilliness of the air in summer ("Though June, the air is cold and still") is also, in many cases, one of the first indications of the approach of the great mass of cloud and vapour which accompanies a depression. And to the same cause is to be ascribed the closing of the pimpernel and other flowers specially sensitive to cold or damp. And lastly, an unusual transparency of the air, technically known as "visibility" ("The distant hills are looking nigh") is one of the most generally accepted signs of rain, though meteorologists are not agreed as to the explanation of it. The

following local proverbs may be quoted as showing how generally this has been observed :

"When the Isle of Wight is seen from Brighton or Worthing, rain may be expected."

"When to the people about Arbroath the Bell Rock light is particularly brilliant, rain is expected."

"About Cape Wrath, and along that part of the coast, when the Orkney Islands are distinctly seen, a storm, or a continuation of bad weather, is prognosticated."

"When from Ardersier and the adjoining parish on the south-east side of the Moray Firth the distant Ross-shire hills are distinctly seen in the morning, rain is expected that day."

"To the people in Eaglesham, in Renfrewshire, when the Kilpatrick hills appear near, a change to wet is looked for; but when they appear remote, dry weather will continue."

It may be added that "audibility"—that is, a state of the air in which sounds are more easily heard, or at greater distances than usual—is also regarded as an indication of rain, though in this case also the reason is uncertain.

We have only space to mention two or three of the principal signs of fine weather. When the wind, after blowing for some time from the S.E. or S. with rain, veers to W. or N.W., an improvement in the weather may shortly be expected; the reason of this being that the shift of wind shows that the depression which had caused the disturbed weather has passed over, and is moving away. The improvement may, however, in this case be only temporary, as at certain seasons the depressions follow one another rapidly, and the approach of the next will bring about a renewal of the unsettled weather.

On the other hand, the occurrence of unusually heavy dews at night is generally a sign of settled fine weather. This is explained by the fact that the calm still atmosphere and clear skies that accompany anti-cyclonic conditions are favourable to the rapid formation of dew. Under such circumstances an exceptionally thick mist in the early morning is often the precursor of a fine cloudless day. It should, however, be added that in winter the stillness of the air under an anti-cyclone often promotes the formation of dense local fogs, such as, to a great extent, neutralize the favourable effects of the prevailing high atmospheric pressure.

Again, when the wind, being light in force, tends to follow the course of the sun, or when, at the seaside, it is "in by day and out by night" (the equivalent in these latitudes of the tropical sea and land breeze), it may be taken as an indication of settled weather. The explanation of this is that these light breezes are ordinarily merged in the more powerful currents which prevail when depression systems are passing over our islands or their neighbourhood, and are only noticeable when an anti-cyclone has been formed over us—a state

of things which is, of course, favourable to the continuance of fine weather.

III. It will have been gathered from the foregoing remarks, that it is to a combination of local weather prognostics with the weather rules based on what, for brevity's sake, may be called the Cyclone theory, that we must look for a reliable system of forecasts. The information obtainable by a Central Weather Office (such as our own Meteorological Office) from a number of telegraphically-reporting stations, and embodied in synoptic weather charts, valuable as it is, especially in relation to the issue of Storm Warnings, is not sufficiently definite to enable the staff to frame daily forecasts that shall be of much practical use to any particular locality, except at times when some great disturbance, causing rains or strong winds over the whole country, is passing across our area.

On the other hand, the observer who has nothing but local indications to guide him will be at a great disadvantage as compared with one who, by the aid of the telegraph, is made acquainted with the state of the weather, and especially of the barometer, at a number of other stations at a considerable distance from him. But if some plan could be devised for combining these two sources of information, so as to embody the local knowledge available in each district in the daily forecast issued for that district, there can be no doubt that the forecasts would be attended by a much larger measure of success than they have hitherto attained.

It should, however, be added, in justice to the staff employed in our Meteorological Office, that they have some special drawbacks to contend with, such as make their task, in framing daily forecasts, a more than ordinarily difficult one.

While the United States Central Weather Bureau has an immense area from which it can draw its information, and most of the European observatories have the advantage of the reports telegraphed from this country, and thus receive from us from twenty-four to thirty-six hours' notice of the approach of any great storm coming from the westward (from which direction most of our disturbed weather reaches us) our own office has to the westward a great blank space of two or three thousand miles of ocean from which no information can be received. Something might perhaps be done, were the means forthcoming, by means of signal-ships moored out in the ocean, to remove or diminish this disadvantage. But it will probably be a long time before this is accomplished. And even with this additional help, the problem to be solved would still be a very complicated one. In the meantime it is well to realize the limitations imposed on us by the present imperfect state of Meteorological science, and to recognise the fact that the most

that is attainable, under existing circumstances, is to give a few hours' warning of the approach of any great storm, and to frame probable forecasts of the general character of the weather from day to day.

G. T. RYVES,  
(F. R. Met. Soc.).

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#### ART. IV.—INFALLIBILITY.

IT is a subject for deep thankfulness that the Protestant world is now bestirring itself, and is making an organized attempt to uphold the principles of the Reformation. Of course, such an effort is sure to call out a corresponding one on the part of the Romish Church, but believing (as we do) that the truth is on our side, we need not fear opposition so long as it is open and above-board. What gives peculiar life to the present movement is, that it circulates round a given individual, Martin Luther, the great Reformer; and as he is thus our centre-piece, it is well for our cause that his character and conduct can bear close inspection. When we say this, we do not mean to imply that Luther was free from marked and decided defects; but admitting these, we must also admit that his moral conduct was unimpeachable (whatever Rome may allege to the contrary), and that his sincerity is unquestionable. Indeed, so strongly is this latter quality exhibited in those severe mental struggles which he underwent before quitting the Church of Rome, that the study of his life ought to lead every candid mind to the conclusion, that if the peculiar doctrines of that Church were really of divine origin, Luther would have found rest, peace, and satisfaction there. For he certainly (if ever man did) gave them a fair trial. But being weighed in the balance, they were found wanting.

The tribute to this great man's memory on the four hundredth anniversary of his birth, and still more to the great revolution which was brought about through his instrumentality, is now being paid in various forms, by sermons, by speeches, and by publications, all bearing directly or indirectly on the great Romish controversy; and we would fain contribute our mite to this vast mass of thought and information, which we trust will prove effective in strengthening our Protestant brethren, checking the advances of the enemy, and perhaps winning over some stray sheep into the right paths. As our space is limited, we thought we could not do better than take the subject of infallibility, because this doctrine lies at the thres-