

discover the antidote for snake-bites, you'll have a cure for yellow jack!"
ARTHUR STRADLING
29, Woodford Road, Watford, Herts

The Rainfall of the Globe

IN reference to a paragraph in an article on the rainfall of the globe in *NATURE*, vol. xxvi. p. 206, Prof. Loomis states that the heaviest rainfall is met with in the rain-belt, which surrounds nearly the whole globe lying between the north-east and south-east trade-winds.

Having been engaged in collecting records of rainfall at sea for some time back, I may take the opportunity of saying that I have received data enough to enable me to give an estimation of rates per annum for this rain-belt.

That for the Atlantic Ocean is calculated at 133.37 inches per annum, that for the Indian Ocean at 80.55 inches per annum, that for the Austro-Chinese Seas at 107.96 inches; but none has yet been made out for the Pacific Ocean, owing to absence of observation altogether from that quarter.

In physical atlases the rain-belt is continued across this ocean in the same latitudes as it is found to exist in the Atlantic and Indian Oceans, but as yet it is only conjectural, and it may probably be found to cross in other spaces by direct observations taken at sea. The observance of rainfall on islands in the open oceans would appear to afford but imperfect means of judging of the rainfall at sea surrounding them. It is frequently found that they differ very materially, as at St. Helena, the island may be covered with mists, invisible, while the ship outside is sailing under a clear sky and fresh breeze.

The ocean rainfall, therefore, can only be made out by observations on board ships, and these are not easy to get, and also take up a long time in effecting.

W. J. BLACK

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The Recent Unseasonable Weather

MR. ARCHIBALD'S letter on this subject displays great ability, and is deserving of much attention by meteorologists. Nothing can be, I think, more interesting and important than a proper interpretation of the meaning of the facts of the weather of the late extraordinary and contrasted seasons. Will you, therefore, allow me shortly to make a few remarks regarding the comparison pointed out by Mr. Archibald as existing between the weather of India and that of North Europe.

In the "Report on the Meteorology of India," 1877, the reporter, referring to the Himalayan regions, says: "There are two periods of cold, (1) when the snow is accumulating; and (2) when it is dissolving; and the first occurs in January and February, the latter in April and May." Again, he says: "The conclusion appears to be very strong that during the early months of the year, one very important factor in determining the peculiar features of the season is, the amount of snowfall and of snow accumulation in the Himalayan regions during the winter."

For six years past I have observed the same thing hold generally in the north of Europe, a cold winter being followed by a late spring and an ungenial summer, and *vice versa*. This I would therefore be inclined to regard as a general law. The weather of June, however, serves to indicate the difference between the meteorological conditions of India and North Europe. It has been ungenial, I think, solely, on account of the exceptional force and warmth of the winds of winter causing a vast detachment of the ice in the polar regions. This ice has floated into lower latitudes—has come much nearer to us—and has produced, in melting, icy winds. These commingling with the warmer tropical winds, have produced in their turn the recent changeable weather.

Our cold spring winds usually come from the east of north, but the prolongation of cold winds which we experienced in the middle of June, came from the west of north, indicating their origin to be in the masses of ice floating for the most part probably between Iceland and the American coast. Thus the movable ice has caused a high atmospheric pressure and a low temperature. The fixed ice, however, which forms by far the largest area within the Arctic Circle, has been during this winter relatively diminished, and from it, therefore, we should expect less incursion of cold winds; therefore a finer summer.

While, then, the chief influence of warm westerly winds in winter is, as I believe, to produce a fine summer, their minor influence must be, particularly when strongly developed, as they

have been during the past winter, by detaching an unusual quantity of Arctic ice, to produce unseasonable weather in early summer.

The same exception would take place in India, if we could suppose some part of the winter's accumulation on the Himalayas to be carried at the close of a severe winter down into the northern plains so as to distribute in melting, volumes of cold air throughout the otherwise warm atmosphere.

Dundee, July 3

DAVID CUNNINGHAM

Is the Axis of a Cyclone Vertical?

I AM not aware if it has ever been suggested, in explanation of the frequent (or rather, usual) incompleteness of cyclonic disturbances, that the axis of the cyclone may be inclined, and consequently only one side of the disturbance affect the earth's surface, the other half being at a greater or less elevation, according to the amount of the inclination, and thus (so far as wind currents are concerned at least) lost to us.

My own observations of storms in this country point to a southerly inclination of the cyclonic axis. I should be glad to know if observers in the southern hemisphere have traced any indications of a *northern* inclination in the cyclones there.

J. A. WESTWOOD OLIVER

Belle Vue, Springburn, Glasgow, June 25

THE idea propounded by Mr. Oliver, that the axes of cyclones are inclined, is no new one, nor is it the first time that a *southerly* inclination has been inferred to exist, to account for the preponderance of winds belonging to the southerly quadrants, and the comparative absence of those belonging to the northerly quadrants of cyclones in our latitudes.

The value of Mr. Oliver's opinion on this point must depend to a great extent on the nature of the observations on which he relies.

This supposed southerly inclination was formerly attributed by Andrau and other Dutch writers (according to Réclus), to the fact that a cyclone, starting from some point near the equator, must have its rotation-axis initially inclined to the terrestrial axis nearly at right angles, and that as it moves from thence polewards, the direction of its rotation-axis remaining fixed in space, it must *apparently* become gradually more and more inclined to the local horizon in a southerly direction. This explanation is ingenious, but there are many considerations, both theoretical and practical, which militate powerfully against it.

Another view—that of the Rev. W. Clement Ley, derived from observation (principally of the upper clouds)—makes the axis of a cyclone incline backwards as regards its direction of translation, and in favour of this notion, the retardation in the occurrence of the barometric maxima and minima on the summits of Mount Washington, Pike's Peak, and Mount Michell, noticed by Prof. Loomis, has been cited.

Ferrel, however, remarks that "a retardation of just about the same amount is observable in the occurrence of the times of maxima and minima in the diurnal changes of the barometric pressure at the summits of these same mountains, which cannot be explained by means of cyclones with reclining axes," so that in all probability the same cause acts in both cases, and is independent of any such special quality of cyclones as that inferred by Mr. Ley.

The hypothesis of Mr. Ley is, moreover, so much at variance with mechanical principles and with what we should naturally infer would take place, that, as Mr. Ferrel says, "we must hesitate to adopt it, without seeking further for some more plausible hypothesis to explain the observations."

The theory of cyclones, as developed by Ferrel and others, makes it far more probable that if there is any inclination at all, it will be *small*, and *forwards*, not backwards.

Ferrel thinks it possible that the elliptical form of the isobars and rain-areas is partly due to this forward inclination of the axis.

Moreover, the preponderance of southerly and westerly winds in our cyclones cannot correctly be adduced as an argument in favour of the southerly inclination of their axes, since it is mainly due to the fact that our cyclones are for the most part secondaries, moving within the periphery of a large, nearly permanent cyclone, whose centre generally lies not far from Iceland, and thus those winds and gradients predominate, which would tend to occur in that part of the large cyclone where we happen to be situated.

E. DOUGLAS ARCHIBALD