

announce long beforehand the day on which such observations should be made; this is not required. Sufficient warning is given by the barometer, and if the instrument is found at any time to be falling rapidly, a series of hourly or two-hourly observations should be at once commenced in order to secure the gradual variations of the atmospheric pressure, together with the corresponding changes of the wind. Especially should the time and amount of the least pressure be secured. At the chief observatories in England, self-recording instruments are established. The principal instruments are the barograph and the anemometer; the former registers the gradual march of the atmospheric pressure, and the latter the direction and velocity of the wind. These records being continuous and unbroken, the slightest and briefest changes are traced with accuracy. It is much to be regretted that the expensive character of these instruments prevent their general adoption. I am happy to say that a self-recording anemometer was erected at the Sydney Observatory about twelve months ago, which I believe, gives entire satisfaction.

In concluding this paper, I think I may reasonably urge upon you the claims which Australian meteorology has upon you as a scientific Society. We are in a position to lend a helping hand to a science, the promotion of which is of the highest importance to the interests of the colonies. It is much to be regretted that some of our colonists who have plenty of leisure and means, do not come forward in the cause as earnestly as the many in the noble country from which we are sprung, but it must be remembered they have no encouragement. A noble example would be shown by our Philosophical Society, if we should only establish one meteorological station, and invite the co-operation of observers in the colonies. The Government have done all that can be expected of them, for, in addition to the Sydney Observatory, they support meteorological stations at Armidale, Newcastle, Bathurst, Goulburn, Deniliquin, Albury, and Cooma.

---



*Remarks on the preceding paper, made at the Meeting of 7th  
September, 1864, by*

THE REV. W. B. CLARKE, M.A., F.G.S. &c., V.P.

IN the paper just read there are 31 distinct propositions or statements, with an appeal to the public, and especially to this Society, to aid in researches such as those in which the author of that paper is so usefully engaged.

It may not be, perhaps, impertinent to mention this appeal before I proceed to notice the other very interesting subjects discussed by Mr. Tebbutt. There have been several writers in this colony already on the science of Meteorology or on some of its most important branches. Count Strzelecki, in his "*Physical Description of New South Wales and Van Diemen's Land*", published in 1845, entered on the Climatology of these colonies, and discussed the nature of the atmospheric currents from his own personal observations. He gives a table of monthly currents contrary in direction to surface winds; attributing some of the observed phenomena to increase or decrease of the Sun's declination, showing that a cold current moves frequently between two warmer currents entirely by virtue of its volume.

He further shows from his own observations, that at Port Phillip the rule adduced by Mr. Tebbutt for Adelaide obtains, viz.: polar winds prevail in summer; but he appears to oppose Mr. Tebbutt's solution of a *rise* of the equatorial current, stating that there is no proof of this from observation. Further, he shows that the rule stated for Port Phillip and now for Adelaide, is not maintained either in Tasmania, Port Jackson, or Port Macquarie, of which in the former the equatorial prevails both in summer and in winter, and in the latter two localities the winter is distinguished and not the summer by polar winds. He infers that such variations must depend on something more than a local cause, and probably belong to the influence of monsoons and winds existing within a certain dis-



tance of Terra Australis. He gives also skeleton charts of the prevailing winds in New South Wales and Tasmania, during the winters of 1840-1-2, and during the summer of 1840, by which we are to assume that, depending on the monsoons, the *winter* winds veer round and within Australia from *right* to *left*, and the *summer* from *left* to *right*.

Since the date of that work, the subject of *Cyclones* or Circular storms has been amply discussed, and among other writings a treatise on "*Australasian Cyclonology, or the law of storms in the South Pacific Ocean*," was put forth in 1853 by Mr. Dobson, of Hobart Town, in which he endeavours to show that the great storms of the Southern Pacific rotate from *left* to *right*, beginning near the Equator, progressing first westerly, then to S.W., and recurving towards S.E. He shows also, that the general storm track of the South Pacific Ocean appears to follow the curvature of the East Coast of Australia, as the storm track of the South Indian Ocean does that of the West Coast of Australia. He further points out that Bass's Strait is subject to two kinds of Cyclones, one changing from N.W. to S. and S.W., and the other from N.E. to E. and S.E. The work of Mr. Dobson is filled with examples from log-books and other data which, certainly, in many instances, justify his conclusions.

In 1859, Mr. W. S. Jevons, then a member of this Society, published in *Waugh's Almanac* an elaborate collection of data concerning the climate of Australia and New Zealand. These were collected from contributions to newspapers and other sources and from his own recorded observations. So far as they bear on the question immediately before us, he adopts the conclusion, that his "facts fall into beautiful harmony on the single supposition of two antagonistic winds."

He speaks, firstly, "*of the Great westerly wind of the Southern Hemisphere*," secondly, of the "*monsoon-like summer wind on the S.E. Coast*." I quote one passage from this essay, because it fitly introduces what I have to say respecting my own opinions. Speaking of the ultimate causes of the changes of weather, he says:—

"The rain-bearing winds of New South Wales may be connected with the S.E. trades, which, according to common rule,



commence a little north of Moreton Bay, but move up and down with the sun. Now, if these winds at any time extended themselves unusually far south, a wet season might be produced along the S.E. coast. This theory finds support, I believe, from the Rev. W. B. Clarke, who has watched and investigated the climate many years.

“Just the same effect would be produced, if any cause acted from the centre of Australia to hinder the advent of sea winds, and project the fiery breath of the sun-heated plains upon the unexpecting coast lands, or during hot winds.” And then he adds, with needful caution, “these are mere speculations; to *reason* accurately upon such wide-acting causes, will not be within any person’s power till meteorology is quite another thing. Australia is more sea-surrounded than any other large surface of land, and, as it is only over the wide ocean that the winds perform their normal course, meteorology is, perhaps, a simpler problem in this land than anywhere else.”

There is a fact also mentioned by Mr. Jevons, which must be borne in mind, that in Australia similar phenomena are apt to prevail almost synchronously over very wide areas. On one occasion, at least, a severe hot wind was felt from Moreton Bay to Port Phillip, a distance of at least 800 miles; rains are equally general at times, and what I have already pointed out in comparing the weather near Sydney with that in Mr. Kennedy’s experience in the interior, and what the late Admiral King found in comparing Paramatta with Sir T. L. Mitchell’s experience in Tropical Australia, the laws affecting the barometer are nearly constant.

In any discussion on storms in Australia these facts should be borne in mind.

I must now apologise for referring to my own individual efforts in this region of science. Probably, from their distant date and the manner in which they were published, my earlier attempts to interest the Australian community in the laws of storms may have passed somewhat out of view. And it is probable, that at that time Mr. Tebbutt may have been too young to notice such a subject in the columns of a public journal. But, twenty-two years ago, in the month of January, 1842, I published the particulars of a great storm that had just traversed the whole



of the eastern portion of New South Wales ; and I think it was the first attempt of the kind bearing on the wide area often visited by such atmospherical derangements. As this account attracted some notice, I commenced a series of papers on all the general topics of Meteorology, which were published in the *Sydney Herald* in that year, 1842, in which, among other things, I proposed to show that our Eastern Australian storms revolve from *left to right*, and that the conflict of opposing winds is the principal agency employed. I will quote a few remarks to show how far Mr. Jevons's notion of monsoon-like winds and the easterly set of the atmosphere alluded to by Mr. Tebbutt, were anticipated by me 22 years ago, in connection with the South and East Coasts of what was then altogether New South Wales.

“ In Bass's Strait a sort of monsoon prevails at certain periods of the year, the wind blowing from the east for a time, though generally from the westward at the other season ; and so powerful is the westerly wind that the trees upon Kent's Group point to the east.

“ Beyond this, the great westerly circuit winds which travel round the earth have their full influence, affected only by the great southerly currents of air which sometimes—as well as the northern ones—produce derangements in the ordinary phenomena of the winds.

“ It may be assumed, therefore, that as easterly and southerly winds are the most prevalent on the east side of the dividing mountains ; so on the south-west side of these ranges the prevalent winds inland ought to be from westerly points. Such is the case, for there is direct evidence to show that the south-westerly winds blow over the land from about the Gulf of Alexandria to the Blue Mountains ; and north and north-westerly from the N. W. interior to the Blue Mountains,—the least violent of them becoming *west winds* when they reach the mountains, and descending into the seaward country to the east as west winds, yet slightly deflected according to the passes through which they descend.

“ The course of both N.W. and S.W winds seems to be defined pretty accurately in the above statements as *circuit winds* meeting somewhere about  $147^{\circ}$  and  $150^{\circ}$  E., and about that point



turning seawards as west winds, the curves, as it were, touching at the point where a common tangent would stretch away towards the West Coast, and where, according to observation, the trees lean from the west."

One of the points which I proposed to elucidate, was that "some of the southerly gales off the East Coast of Australia come from the north (as they should do), if there be any truth in the laws affirmed for the southern hemisphere."

In allusion to the prevalence of winds on the south coast, I have cited several instances in which, what is general for *South Australia*, the winds veered from *left to right*.

In subsequent papers during several years I published observations on the storms along the east coast, and especially on thunder-storms; and of these I had logged down carefully with barometers, thermometers, and time-keeper close at hand, every few minutes or seconds, every change that occurred. Many of these I now produce. Much, however, of the matter I had prepared I sent, at the request of Admiral Erskine and by his hands, to the late Colonel Reid.

My object in alluding to these descriptions is to show that during the time when meteorological observations had not been commenced here as a public duty and the facilities were far less than they are at present, private observers were at work and recorded their discoveries, just as Mr. Tebbutt is now doing with such praise-worthy industry. The appeal to private observers, at the close of his paper, has therefore already had encouragement beforehand.

Another object in referring to my own pursuits, in connection with the study of storms, is to justify the observations which I wish to offer on Mr. Tebbutt's paper,—as proving that I enter upon its discussion with some claim to offer an opinion, inasmuch as I speak as much from observation as from theoretical views. And I may say that I have recorded far more observations on this subject than I have ever had leisure to put in print. What I have been enabled to do in the latter way has, I am happy to know, met the approval of others; and not only has Dr. Leichhardt, but Mr. Piddington of Calcutta has also mentioned my old labours with approval.—(*Sailor's Horn Book*, 2nd Ed., p. 631.)



Mr. Tebbutt commences his paper with a remark relating to what is called Saxby's system. I agree with him in thinking, that whatever merit there may be in proving that derangements of the atmosphere are often coincident with certain epochs of the moon, there is nothing yet sufficiently known to authorise any dicta on the subject and to justify predictions of weather in Australia as deduced from it. Nay, many allotted days have indicated nothing of fulfilment.

Two suggestions occur to me—that if there be any truth in the idea that the passage of the moon over the equator is the sole cause of storms and changes of weather, it must have also been so from the beginning of creation, and no such thing as irregular variations could ever have occurred in the state of season; and that if the moon's influence affect any portions of the earth beneath her attraction, all ought to be equally affected in the same way in succession.

Now, facts certainly not fully coinciding with the theory, we need not look about for arguments to justify it. Noah Webster has a far greater belief in the lunar influence than Mr. Saxby;—but it may be safe to reject it as the main agent with Sir J. Herschel and M. Arago, who both deny it on convictions derived from a consideration of all the phenomena presented to their enquiry. Nevertheless, I would speak with the highest respect of Mr. Saxby who is not, as some imagine, a mere pretender, but a man of science and well versed in all appliances to illustrate his subject: but he appears to me to have ridden his hobby a little too hard, as at present there is not evidence enough to sanction his conclusions.

Admiral Fitz Roy who, Mr. Tebbutt thinks, has established a system which we should also initiate in New South Wales appears to me to have deserved the great credit which is assigned to him as a most diligent and indefatigable observer, and a very practical and useful guide in directing others to observe and utilise their observations. But, it is not yet acknowledged that his system is perfect, or altogether to be depended on. I might quote on this head evidence that cannot be refuted. But I would guard these remarks on the conscientious labours of such men as Fitzroy and Saxby, by saying that I have read very carefully



and with much advantage the extensive lessons of the former, and that I name the latter author only in connection with what has been observed in Australasia; and that it is not in a spirit of presumption that I venture to make the following remarks.

I can, of course, have no objection to the establishment here of Observatories or Meteorological stations to test any of these views. Therefore, my remarks must not be interpreted into a denial of the value of such stations, could we only discover where they could be placed. Together with the late Admiral King, I waited on a late Governor, Sir Charles Fitz Roy, to urge the establishment of an Astronomical Observatory near Sydney, and if our recommendation, backed as it was by Capt. Owen Stanley, R.N., had been attended to, the present Astronomer would have been saved much inconvenience, and the Observatory would have been placed where it ought to have been, on the Silica Range, on the North Shore.

I do not, therefore, object to fresh stations, but, with my views relating to storms, I do not yet see where we could place these stations, so as to become fore-casters of change. And the adoption of these is the main object, as I take it, of Mr. Tebbutt's paper.

In order to show this, I have entered into so much preliminary matter, before I examine the grounds of his argument.

The first point noticed is the easterly tendency of the atmosphere in this hemisphere as well as in the northern, the latter of which is dwelt on by Admiral Fitz Roy, though it must be added that his synchronous curves are very irregular in this respect. .

That the atmosphere partakes of the earth's motion there can be little doubt: I have shown this in my *Herald* essays. The upper wind in all known temperate latitudes is generally from the west, and of examples of this I would mention the dust (with American infusoria) so constantly falling over the Cape de Verd Islands, of which I have been eye witness; and the volcanic ashes from South American eruptions which, falling upon the trade wind, were carried by it to the westward back again towards Jamaica.

Mr. Tebbutt shows in his diagrams that there is, apparently,



an easterly set in this way between the S.W. and N.E. points of a line joining Adelaide and Brisbane. But, whether this is due to the general atmospheric translation from west to east, or to the influence of a compound motion or resolution of forces of a southerly wind and a westerly wind during gales, does not appear.

That gales which come in at Adelaide from the S.W. and blow towards the N.E. in a right line, must by necessity have a seeming tendency to the east, is clear ; but, it may be open to conjecture whether gales which blow fiercely from the south would progress to the eastward, unless the general westerly current could overpower them.

All this is on the supposition that such gales are *right-lined*. It is doubtful, however, whether they are not actually circular. and if it be so (and there can be no comparison as to the changes of wind following the same order at Sydney as well as at Adelaide and Brisbane, unless they are) the easterly progression must be due to some other cause.

I will state what I believe the cause to be.

In dealing with storms in Australia we must well weigh all the local conditions. Surrounded by wide oceans its coasts are exposed to the prevailing ocean winds. Along the east coast, at a moderate distance from it, runs a barrier of high land from 3,000 to 7,200 feet in elevation, separating the eastern coast from the low interior, the southern part of which is exposed to the S.W.,—say about Adelaide.

The tendency of the drainage of the northern part of the mountain barrier is (as shown by the Darling) in the same N.E. and S.W. line of which, in reversed direction, storms are assumed to travel from Adelaide to Brisbane.

Now, it is reasonable to assume, that unless a storm has a vertical thickness greater than the height of the Cordillera it cannot cross it ; and, therefore, only such storms as are more than from 3,000 to 7,200 feet thick can cross the mountains, even if their area be wide enough : and thus many storms bringing heavy rains from S.W. never cross to the eastward at all, but travel along the western slopes of the Cordillera, leaving all the eastward dry and only slightly affected by other atmospherical



conditions consequent on the passage of the eastward edge of the gale.

Similarly, if gales come in from the N.E., unless they are vertically thick enough, they also travel southwardly along the eastern slopes of the Cordillera, and never water the western interior.

I have collected examples of numerous gales which, although violent along the coast and up to the slope of the mountains, deluging the sea board with rain, have only been recognised at Bathurst or Wellington by a slight shower or Scotch mist, or a gently disturbed atmosphere. Such was the case during some of our late tempestuous weather ; for, whilst the Coast was under floods, patches of the western country were suffering from drought, being cut off by the high lands from access of the easterly winds.

Mr. Tebbutt's mention of *scud* at Windsor when there is a storm at Sydney, and of only rare westerly gales at the former place, is thus to be explained. The *scud* being probably only evaporated moisture is borne on the very top of a thin gale ; and he, no doubt, rightly admits such local influences from the coasts and mountains.

Mr. Tebbutt quotes the case of the storm of 25th and 26th October, 1863, showing that the same changes of wind and barometrical oscillations occurred between Adelaide and Windsor at an interval of 26 hours, and about a day later at Brisbane.

Now, these successive changes prove that that gale was a Cyclone,—having probably a diameter of about 250 miles, and a mean progress of about 24 miles per hour (which is in remarkable agreement with the rate of numerous great East Pacific storms and cyclones), the eastern edge of which grazed and came over the summit of the Cordillera where it was about 4000 feet above the sea ; the thickness of the storm being about 5000 feet, which is the height, as obtained by measurement by myself, of very many of the gales in this colony. Mr. Redfield and Mr. Piddington assume a thickness of a mile (280 feet more) for several known cyclones.

On the east coast the gales appear to me to be at certain seasons of an equally cyclonic character. And Mr. Tebbutt quite co-incides in opinion with me as to the nature of those gales, as resulting from the combined forces of polar aerial currents and



the set of the warm ocean current from the N.E., which has, I am persuaded, a great deal to do with the rains which have so often fallen upon our shores,—and especially during the late terrible season of floods.

I watched the state of the ocean during several of our late gales. It was everywhere, within reach of my sight, smoking with fog which, drifting in with the rain from the surface of the ocean current, caused that superabundant moisture which was twice observed on smooth walls and metallic surfaces that streamed with it, owing to the sudden condensation of the warm vapour. The high thermometer and the increase of Ozone which is characteristic of *sea* winds, both show how much those periods were affected by the influence of equatorial currents.

A storm of striking features, in February, 1863, was noticed by Mr. Tebbutt and registered in the *Empire*, which showed a progression to southwards.

Very little was wanting to the collected data, to give a complete history of that storm. Fortunately, I was at the time in a position to supplement Mr. Tebbutt's observations. I was then to the westward of the Bell River,—about 260 or 270 miles W. by N. of Windsor, and about 25 miles from the head of the Bogan. Having a barometer and thermometer with me, I was enabled to notice what took place; and one remarkable fact preceding the gale was, that we had the regular sea breeze on the evening before, which in all probability came in through a distance of 300 miles from the neighbourhood of Port Macquarie. I have frequently felt the sea breeze under the Liverpool Range. As there is no land much higher than 4000 feet between the two points, the sea breeze must at least have had about the same vertical thickness. In Maneero I have found it generally not more than that. As I was observing the western edge of the gale, the diameter of it must have been at least about 300 miles.

Another gale—that of April and May, 1864—is noticed by Mr. Tebbutt; and by the periods of minimum barometrical pressure and changes of wind, this was a gale from the northward.

Now, I would call attention to a fact I alluded to when I began, the wide area over which ordinarily the atmospherical phenomena are persistent.



When my late friend Mr. Kennedy was exploring the Barcoo and desert country about it and the Warrego, I carried on at St. Leonard's simultaneous observations, as I did when he was in York Peninsula. On the former occasion there was the most marked agreement with my own observations and those made by Mr. Kennedy. Eight hundred miles to the N.W.—especially on 28th–31st August, 1847—Kennedy had strong E. and N.E. winds on the desert of the Barcoo; whilst on the 26–27–28th, a heavy gale was blowing along the coast of Tasmania, and strong N.E. to N. winds blew at Sydney. The winds shifted from N.E. to S. in the latter part of September, 1847, both at Brisbane and on the Barcoo.

Again on 13th October, squalls and thunderstorms occurred simultaneously at Sydney and on the lower part of the Barcoo.

Such coincidences as these are, however, not always due to progressing gales. I suspect, from having made hundreds of similar observations, that separate storms often occur simultaneously, or nearly so, over wide regions, as if the moving causes were some kinds of electric shock propagated from a distance and successively charging (at minute intervals) areas of atmosphere in a similar condition. If Admiral Fitz Roy's dictum is true, that one storm cannot maintain itself for more than four days, it is impossible to account for the facts often observed of weeks of stormy weather without coming to some such conclusion as I long ago adopted, and which I am glad to see strengthened by Admiral Fitz Roy's opinion.

During thundery weather, I have frequently noticed the fact that thunderstorms are simultaneous, or nearly so, at Bathurst and Sydney; and if these storms be so propagated or connected, why not other kinds of storms, such as gales of wind and cyclones?

I will not now dwell further on this, but state distinctly that in my humble opinion Mr. Tebbutt rightly infers, not alone from the storms of 1861 cited by him, that such storms are occasioned by two currents.

I state unreservedly, and I can show it by phenomena of storms noted down, as in the example I now produce, that there are always two winds at work in all great derangements of the atmosphere in Australia.



A heavy thunderstorm from S.W. is always preceded by a N.E. wind, and if such a wind in summer blows fresh after sundown, in 9 times out of 10 the next day will exhibit thunder.

So, preceding the gales of 6th and 9th August, 1861, I noticed the upper clouds progressing from the westward, and the surface wind from westward also,—when, quietly at first, a body of clouds which had formed in the east began to move westwardly, and the east wind wedged itself in between the two westerly strata, and after a struggle of about 3 hours obtained the mastery.

A similar phenomenon was observed by me before the cyclone of 11–12th June last, and that of June, 1857. So constant is the struggle between the polar and equatorial winds, that I have never missed it when I have looked for it, at the commencement and close of a hot wind. The hot wind frequently *commences at Sydney from seaward at N.E., and ends at S.W. or S.;* clouds, for hours preceding the change, gathering in S.W. by condensation of the vapour suspended by the N.W. wind through the contact with the S. wind. The N.E. wind *hot* is the hot N.W. current deflected by the N.E.

Furthermore, I have stood out in a furious hot wind for hours watching the wind vane, which is then oscillating between S.W. and N.W. ; and if any one will but place an aneroid on his table, under his eye, during one of our summer thunderstorms, he will observe the index oscillating to and fro, as the pressures occasioned by the two winds engaged in conflict alter according as they gain or lose strength by turns.

Taking then all these facts into consideration, I consider it demonstrated that there are always two winds engaged in all our storms.

Now, to utilise the observations we have by forecasting coming storms, seems to be the object of Mr. Tebbutt's paper. I agree with him, that to do this we must have more observers, and perhaps more correct ones than we have at present.

Many of the published notes in the daily papers are useless, from occasional typographical errors,—and errors of observation. I have been in the habit of checking the figures given by the observers, which, when the heights of the places of observation are known, is the easiest thing possible. If the readings are



correct, the difference calculated between any two places ought to agree within a few feet. I have occasionally found 50 and 60 feet of difference on different days, which shows that there must be errors in reading or recording the observations. But if we had fresh troops of observers, where shall we place them?

If our East coast storms come in from the N.E. or S.E., they must hit the coast at some point or other, and it does not at all follow that they must necessarily travel upwards or downwards. Sometimes they hit the coast after *recurving*, and get doubled up by recoil from the mountains, and then, after a short struggle, in which the wind backs (and of course blows) as it did in the heavy gale of the 1st July last, return after the fashion of circles made by a stone thrown into water, which circles run contrary when they impinge on an obstacle.

At other times, the whole coast, as during the late season, from Cape York to Cape Howe, is similarly affected in succession or contemporaneously, and in such a case, Coast stations might give warning. But, it is very doubtful whether S.W. gales running up the back of the Cordillera, could be so watched and turned to account.

Nevertheless, as information would be obtained, which, if to be relied on, is always valuable, the establishment of fresh stations for observation would be desirable.

But, I think a more desirable object would be the passing of a law by the legislature, rendering it imperative on masters of ships arriving from abroad, or belonging to our coasting marine, to place copies of their logs in the hands of the Astronomer. We often read of *hurricanes* off our coasts, such being the character assigned by masters of small craft to a blow of wind which a ship of 1000 tons would consider as nothing. On the other hand, we should obtain data in connection with N.E. gales, by vessels coming from the Islands, and with E. gales, by passages to and from New Zealand, which would be invaluable to persons engaged in deciphering the elements of Australasian storms, and in turning them to account.

---





Clarke, William Branwhite. 1864. "Remarks on the preceeding paper [On Australian Storms by John Tebbutt] made at the Meeting of 7th September, 1864." *Transactions of the Philosophical Society of New South Wales* 165–177.  
<https://doi.org/10.5962/p.345627>.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/73082>

**DOI:** <https://doi.org/10.5962/p.345627>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/345627>

**Holding Institution**

University of California Libraries

**Sponsored by**

MSN

**Copyright & Reuse**

Copyright Status: NOT\_IN\_COPYRIGHT

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.