

C.A.W.D.S. DISCUSSION GROUPS


For some time past, it has been customary to hold Friday afternoon discussion groups on meteorological subjects. Summaries of the more recent discussions are given below.

December 7th, 1951 - Frontal Analysis.

An article by Godson in the Q. J.R.M.S. of October 1951 was summarised by Mr. H.T. Ashton.

Temperature, wind and pressure distributions in the horizontal and vertical through a warm and a cold front were considered, and it was shown that the "frontal surfaces" were really zones, the thickness of which was often determinable and appreciable. Details can be obtained from Godson's article.

The situation of 26.11.51 was examined and it was demonstrated that frontal orientation was able to be obtained from suitable pibals on occasions. RAOBS, surface observations, and upper wind reports from Rathmines, Charleville, Townsville and other stations in the area were considered. "Extrapolation" of shears was shown to require caution where a pilot balloon may have been followed in one air mass only but would pass into another before reaching the C.P. surface being considered.

In the discussion which followed mention was made of the practice in analysis some years ago of showing many double fronts. Quite often the second front could have been the rear of the transition zone, which may be more clear cut than the leading edge. This can lead to inexperience resulting in placing the front at the rear instead of the leading edge of the transition zone, or a "discon" being sent for the rear edge only. On upper charts the drawing of a sharp  shaped trough was incorrect.

January 18th, 1952 - The Situation of the 3rd and 4th January, 1952.

Speaker : Mr. S. Karelsky

Mr. Karelsky described the situation by referring to the upper charts and 3 hourly surface charts for the period 2nd-4th Jan. He had tried to locate a surface warm front to account for the rain which developed over South Australia early on the 3rd and later extended to Victoria but it was difficult to justify a surface front in this region up to the 3rd from surface temperatures and winds. He then examined the possibility of an upper front using equivalent potential temperature diagrams, one set drawn so that each station

could be compared with any other station at the same time and another set drawn so that the change in E.P.T. structure with time could be seen for each station.

He thought increases in E.P.T. at Woomera, Parafield, Laverton, Rathmines from the 3rd to the 4th might indicate a possible upper warm front.

In the discussion various suggestions to explain the rain were advanced, but without being able to examine the charts closely it was difficult to reach a definite decision as to the cause of the rain.

From an examination of the charts and RAOB diagrams later, it is difficult to justify any type of upper front. The RAOB diagrams indicate that the increased E.P.T. from the 3rd to the 4th is due to increased moisture content, the rain apparently being due to the arrival of a moist tongue over the region together with convergence and associated up motion in the lower troposphere.

February 1st, 1952 - Frontal Passage at Melbourne on 16.1.52.

Speaker: Mr. J.N. McRae

On the 16th January, 1952, a sea breeze reached Laverton and Melbourne late in the morning and was followed by a cold front during the afternoon in which there was a marked drop in temperature, rise in humidity, increase in wind velocity but little change in wind direction except at Essendon where the sea breeze had not penetrated.

Autographic records from Laverton, Essendon and the Central Bureau were shown as well as synoptic charts and Laverton RAOB. From these records and reports of the frontal passage at Highett and Edithvale the orientation of the front through the Metropolitan area was sketched. From the speed of movement obtained from the frontal passages and the synoptic charts and the height of the cold air obtained from the Laverton RAOB the slope of the front and some approximate values of the vertical motion near the front were estimated.

February 8th, 1952. - The Diurnal Variation of Atmospheric Turbidity.

Speaker : Mr. R. Deland

Mr. Deland described Turbidity as a measure of the loss in intensity of the sun's direct radiation in traversing the atmosphere and the Turbidity Factor (T) as the ratio of the observed Extinction Coefficient to the theoretical Rayleigh Extinction Coefficient.

Using values of T calculated for Box Hill Melbourne from radiation figures Mr. Deland obtained curves for the diurnal variation of T which showed a maximum diurnal variation about 2 p.m. in summer and 1 p.m. in winter and having greater amplitude in summer than in winter.

In the discussion Mr. Deland mentioned several factors such as wind speed, direction that in looking for the cause of the extinction he had attempted to correlate with the turbidity factor. Mr. Clarke suggested that the effect of a diurnal variation in the ozone layer might be investigated.

Full details of Mr. Deland's work will probably be published elsewhere.

March 7th, 1952 - The General Circulation from North of Australia to S.E. Asia

On this date the discussion was continued of an article by B.W. Thompson, of Hong Kong, which appeared in the Q.J.R.M.S. of October, 1951. The discussion was notable for the differences of opinion held by those present from those expressed by the author.

The most contentious points appear to be:-

- (a) The position of the Intertropic Convergence Zone north of the equator in the Southern Hemisphere winter.
- (b) The existence of this Zone at all.

Considerable discussion ensued also on the methods and possibility of locating the Zone to the immediate north of, or over, Australia in the Southern summer.

Friday, 25th July, 1952.

Mr. F.A. Powell summarized an article entitled "A Model of Hurricane Formation", which was written for the "Journal of Applied Physics", April, 1950, by Herbert Riehl.

The article dealt with the thermal structure of an idealized storm centre, with the arguments presented based on diagrams and deductions which were founded on observations made in and around actual storms.

Mr. Powell reproduced some of Riehl's diagrams on Form F.160, which made the arguments clearer, and which showed, among other points,

(a) that the air within the tropical cyclone core must rise from the surface, and is not entrained at higher levels;

(b) that, within an incipient cyclone, the temperature changes in the rising air are frequently not adiabatic, but isothermal, with external heat supplied by the sea surface.

The importance of outflow aloft in maintaining the circulation was also shown. Several previously propounded theories, such as

Convictional instability,

Formation on wave on Intertropic "front",

Theory of dynamic instability, were examined in turn and each was found to be an insufficient explanation, in the light of Riehl's work. Riehl's proposed model of a hurricane was then examined, and it was seen that it was based, not on internal characteristics, but on external causes.

Among these were -

The disappearance of the trade winds aloft with resultant eddy flow. Association of westerly troughs and ridges in middle latitudes with tropical eddy flow, to produce an unbalanced state, and consequent cross-isobar flow (from high to low pressure) aloft, e.g. at the 200 mb. level.

Then when circulatory flow surface - aloft - surface begins, it will be maintained if -

(a) direction of cross-isobar flow is such that it can overcome the Coriolis force;

(b) the energy aspects are favourable - i.e. if the stability state of the air involved is suitable. This means that if drier air, e.g. "trade air", actually enters the centre of the system, the circulation will be destroyed. In general, saturated air is essential. Trade air, or other dry air, in the outskirts of the system, is, however, favourable.

The subject was then thrown open for discussion. The following points were made -

Mr. Maher and Woolcock queried the theory of formation of cyclones on the "Intertropic Front" entering into the question, since this is rarely a true front, but a convergence zone.

Mr. McRae pointed out that the theory of hurricane formation at a "triple point", or "three mass corner", had barely been covered in the article, but the argument appeared to discount this theory.

Clarke drew the attention of the meeting to the difference between Riehl's theory as expounded and the "classical" divergence theory.

Woolcock observed that the theory could be fitted in quite well with the fact that tropical cyclones in the Australian region frequently formed following a northward surge of colder air into tropical regions.

Mr. Morley commented that this was extremely interesting as the theory propounded by Sutcliffe which he had studied could also be applied to the situation. Mr. McRae then closed the discussion, thanking Mr. Powell for studying and making available an article from a publication which is normally available to the meteorological service.