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THE SEVERE STORM OF 5TH AUGUST 1959 IN NORTHERN BASS STRAIT

by J.C. Langford

Divisional Office, Hobart

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Abstract: The formation of the severe storm of 5th August 1959 in northern Bass Strait is discussed briefly.

Although characteristically a secondary depression, it does not fit into an earlier classification. Correspondence between its appearance and the super-imposition of positive vorticity advection over a low level front is claimed.

While it is difficult to forecast the former, analysis of the westerlies from the oceanic data may resolve the whereabouts of a front. If one is predicted to be in a favourable position for further development, the first requirement - an alert - is satisfied.

1. INTRODUCTION

Attention to the necessary events foreshadowing the appearance of a secondary depression near coastal southeast Australia has been given by Maher (1955). The role of the well developed cold trough appearing to the northwest of a cyclone has been clearly shown to be most significant. From the conclusions it would appear that the formations discussed are those essentially occurring in a cold current, i.e. they pre-suppose that cold air has recently swept over the whole of southeast Australia from "an intense anticyclone in the Western Bight".

The severe storm[*] about coastal Victoria on the 5th August 1959, while it can be classified as a secondary depression, was not of the above category. There was no anticyclone south of the sub-tropics in the Australian region, there was no deep south to southwest current over southeast Australia, and cold air had only penetrated over Tasmania.

[*] See appendix.

In view of the departure of the formation of this storm from the ideal diagnostic situation there may be a tendency to accept it as an unforeseeable event in view of the absence of observations from the Southern Bight. Can it be classified as one of the unpredictable events that can breed in the strong westerlies and which dog Southern Australian forecasters?

The purpose of this article is to illustrate the inherent tidiness or organization behind its formation, to point to the resolution of its development to accepted ideas, and to confirm a basis of analysis which created a situation of an 'alert' for further development.

2. THEORETICAL BASIS

Petterssen (1955) has emphasized the relation between positive vorticity advection ahead of an advancing upper trough and sea level development. He has with others (1955) experimentally shown how this advection over a frontal zone appears as a strong criterion for surface development. To quote, "Investigation of a large number of cases of cyclogenesis has shown that the establishment of a region of appreciable low-level convergence results when and where an area of appreciable positive vorticity advection in the middle and upper troposphere becomes superimposed upon a low-level frontal system".

In Australia, Clarke (1956) has explored the first of the above generalizations for developments in the sub-tropics out of surface easterlies. He concluded that "Positive vorticity advection aloft, although apparently necessary, is definitely not a sufficient condition for cyclogenesis.

To verify the usefulness of the second hypothesis it was necessary to compute the vorticity advection at 300 mb between lat. 35° and 45°S on the 4th and 5th, and it was equally necessary to introduce a baroclinic zone beneath the area of maximum advection on the 5th.

3. SYNOPTIC SEQUENCE

(a) Vorticity Advection

The 300 mb charts for Australia and as far south as about lat. 45° are shown for 2300Z on 3rd and 4th August, 1959, in figures 1 and 2. Their construction over the ocean south of the Continent was assisted by estimation of lapse rates at selected points. The main feature is the contour height falls over the southeastern States as the trough deepened at about long. 140°E on the 4th.

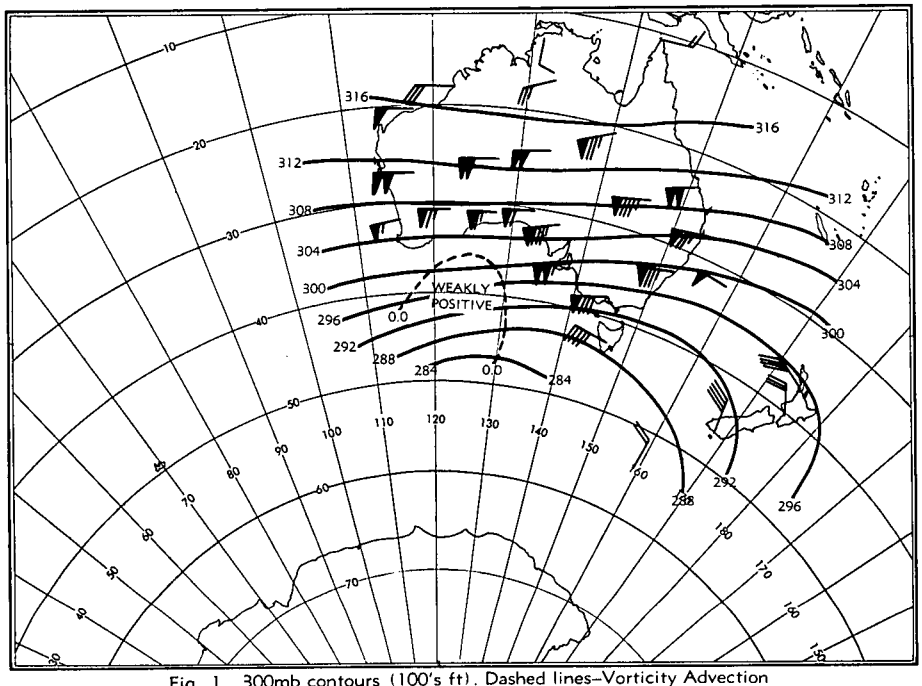

Fig. 1 300mb contours (100's ft). Dashed lines–Vorticity Advection at this level (10^{-8} sec^{-2}) 2300Z. 3rd August 1959

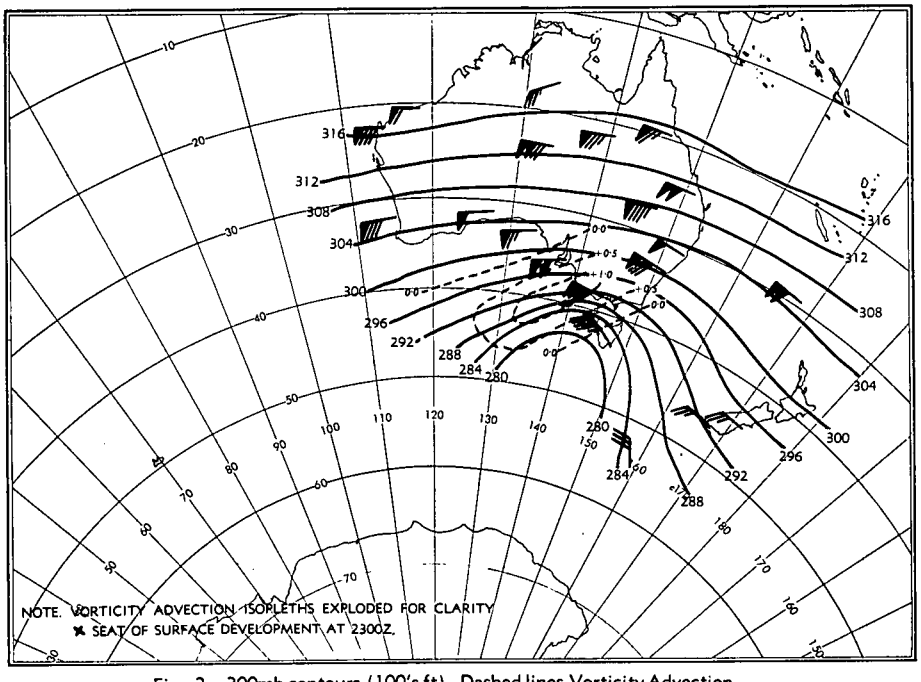

Fig. 2 300mb contours (100's ft). Dashed lines-Vorticity Advection at this level (10^{-8} sec^{-2}). 2300Z. 4th August 1959

Super-imposed on the figures are the isopleths of geostrophic vorticity advection from 35° to 45°S computed from the usual grid. A weak area of positive advection south of West Australia increased to a definite maximum in the 24 hours. Outside of these areas the vorticity advection was almost zero.

(b) Surface Analysis.

The second requirement of the hypothesis is the area of positive vorticity advection be super-imposed upon a low level frontal system on the 5th.

Figs. 3 - 6 are the 0600Z surface charts of the westerlies north of 55°S. On the 2nd and 3rd, complex but rather weakly developed disturbances were moving across the ocean just to the south of Australia. There is reason to believe that the disturbances were characteristically open wave structures to the north of the main cyclonic belt. They appeared to develop at about long. 110°E, and move east and later southeast to lose their identity south of the Tasman Sea - an example is the feature south of West Australia on the 2nd. The breadth of the strong westerly belt, i.e. its limitation south of 45° - 50°S, is clearly shown by this feature as it passes to the southeast of Tasmania on the 4th, Fig. 5, where the 984 mb isobar lies along lat. 45°S and the 976 mb isobar is near Macquarie Island, 54°S. The inference is that over this period there was a distinct belt of relatively weak westerlies south of lat. 45°S.

A marked frontal zone lay between Amsterdam Island (T T 52, T_dT_d 50) and Kerguelen Island (T T 29, T_dT_d 25) until late on the 3rd, when a wave passes between the two islands, Fig. 4. The eastern boundary of the front has been projected to the south of West Australia on the chart - sufficient speed being achieved by maintaining a low or constant pressure value at the same latitude, i.e. 50°, inferring new cyclogemesis in the cold front trough (Langford 1957).

On the 4th, see Fig. 5, mild westerlies continue to blow over Australia north of 40°S, with the cold air mass to the south. Early on the 5th this front had passed over Tasmania and entered southern Victoria and at the chart time of fig. 2 it was lying east-west beneath the area of vorticity advection.

Analysis of the Australian region at this time, i.e. late 4th and early 5th, was rendered difficult by the gale force westerlies in the southeast which made front detection uncertain. It is mainly the conception arising from the oceanic data that gives

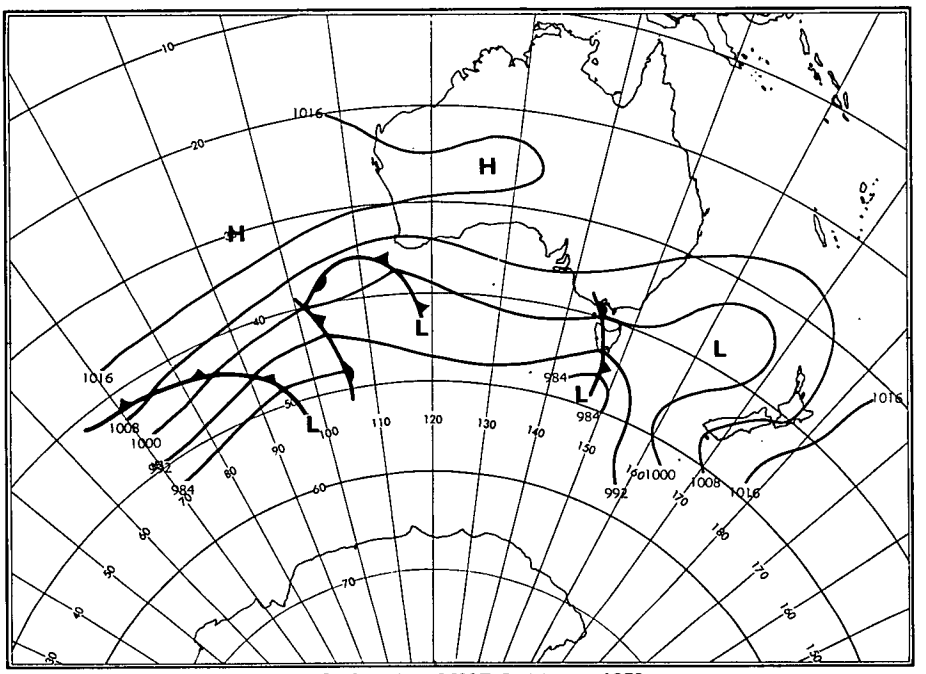

Fig. 3 Surface chart 0600Z. 2nd August 1959

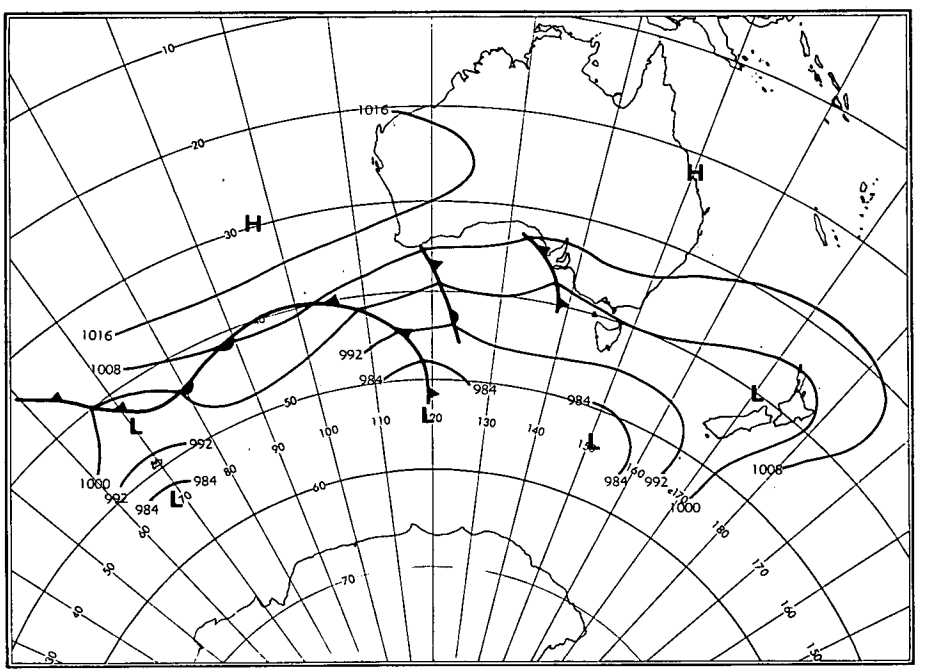

Fig. 4 Surface chart 0600Z. 3rd August 1959

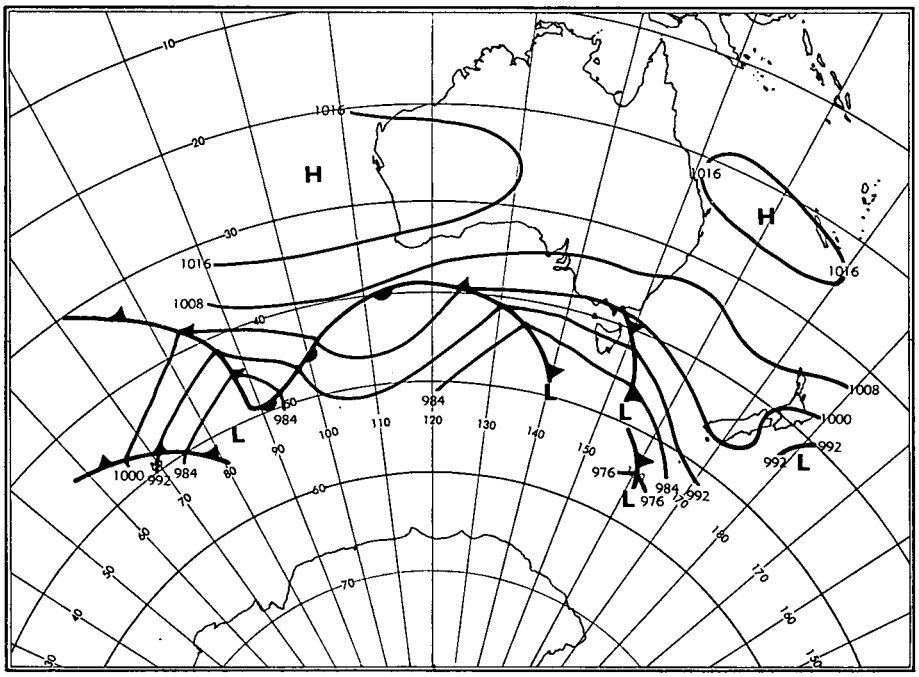

Fig. 5 Surface chart 0600Z. 4th August 1959

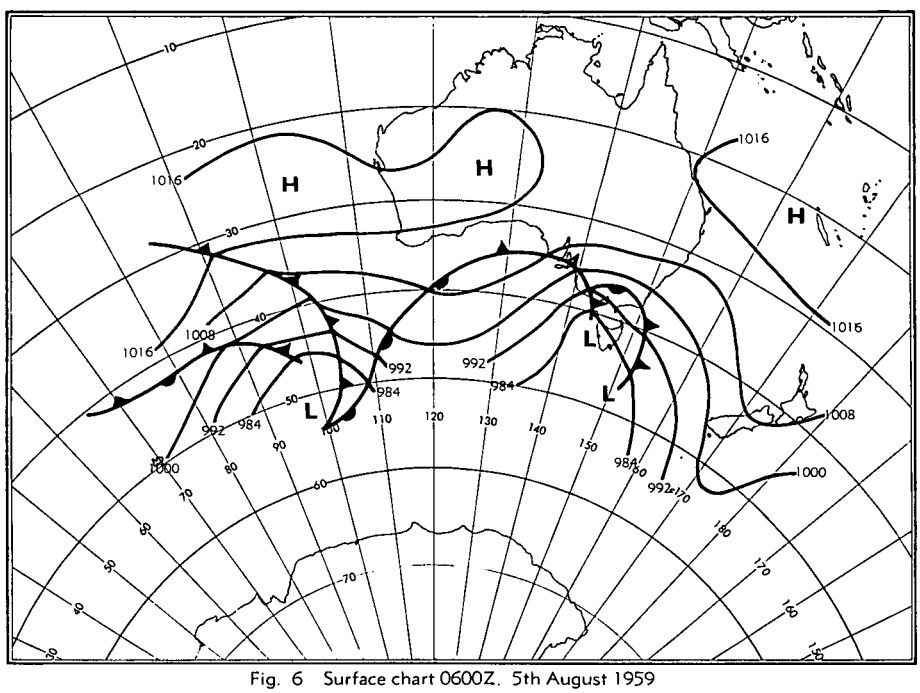

Fig. 6 Surface chart 0600Z. 5th August 1959

an indication of possible frontal position and alignment. Without it, and more so since no front had entered West Australia, the imminence of cold weather in southeast Australia possibly could not be forecast.

It is not claimed that the frontal configuration over southeast Australia is correct in detail, see Fig. 6. Whether the warm front spur has any significance or not is unknown.

However, it has been shown that there was a correspondence between the vorticity advection aloft, its super-position on a low level frontal system and sea-level development which in this case was a severe storm of relatively brief duration.

4. CONCLUSION

It is a triumph for the analysis of the westerlies from the oceanic data, or at least a confirmation of its fruitfulness, to predict the advent of the cold front and air mass close to Southern Australia. However, use of the hypothesis depends also on the prediction of the vorticity advection, to which also Clarke (1956) has referred. Successful estimation and prediction of this quantity just to the south of Australia must be at least based on confident analysis to 50 - 55°S.

APPENDIX

(Extract from "Weather Review Victoria - August 1959" pages 7d and 7e).

"A violent storm swept over Victoria on the 5th and caused widespread damage over the State.

Telegraphic and telephonic services in many parts of the State and also to Tasmania were severed..... The Postmaster General's Department regarded it as the worst storm since 1880.

Shipping in the Melbourne port was battered, some vessels being blown from their moorings, small craft wrecked and piers badly damaged. Severe erosion was reported along the eastern side of the Bay".

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