NOTES AND CORRESPONDENCE

1. Introduction

I read with interest the paper “Anomalous Gradient Winds: Existence and Implications” (Mogil and Holle, 1972), and, in particular, the descriptions of the analysis techniques the authors used to arrive at their conclusion that anomalous gradient winds existed in the two cases they discuss, since the existence of negative absolute vorticity is interesting in itself, as well as if connected with the occurrence of clear-air turbulence. The authors’ methods of analysis appear to heavily bias their data towards their conclusion, and the analyses themselves seem suspect.

2. Discussion of Case 1

The analysis of Case 1 in the original paper, with high winds in the vicinity of Midland, Texas, raises two main questions.

1) The height analysis for 200 mb in Fig. 4 of the paper minimizes the height gradient in the vicinity of Midland. For example, the height of 12,020 m lies halfway between the 12,000-m contour and the 12,030-m contour, instead of being somewhat closer to the 12,030-m contour. The height 12,003 m at El Paso suggests that the 12,000-m contour should be displaced southward, requiring a northward displacement of the 12,030-m contour if the local contour is to parallel the observed wind. The combination of these changes in the synoptic analysis would considerably increase the height gradient, and hence the geostrophic wind. In the vicinity of Midland the geostrophic wind should be increased by a factor of about 1.5, and near El Paso rather more. The ratios in Fig. 5A of the actual wind to the geostrophic wind (original paper) should be decreased proportionately. This results in a maximum $V_{ax}/V_{e}$ of about 2.0, which, according to the caption for that figure, is insufficient for anomalous flow.

2) The authors of the original paper assume that the mesoscale feature of the wind field is unaccompanied by a compensating mesoscale perturbation in the height field. This assumption is crucial, because they utilize a grid distance of 111 km in their vorticity calculations. Data points are on the order of 3 grid distances apart, suggesting that the interpolation scheme strongly influences the results of the vorticity computations. Their Fig. 5 shows this to be so. In Fig. 5A, only Midland lies inside the isopleth 3.0 for the ratio $V_{ax}/V_{e}$, and that on the edge. In Fig. 5B, no data points lie within the maximum contour of absolute vorticity.

In contrast, I constructed an alternative vorticity analysis of the area, shown as relative vorticity in Fig. 1, using grid points 276.5 km apart. This distance is more typical of the distance between data points, and the grid points can be seen to be generally close to the original stations. Separate analyses of the $u$ and $v$ components of the wind and a finite difference calculation were used to obtain the field of relative vorticity. Only one grid point had a negative relative vorticity, and it has a positive absolute vorticity, in contrast to the claim of Mogil and Holle.  

3. Discussion of Case 2

Case 2 in the original paper, that of anticyclonic flow with somewhat lighter winds than Case 1, also raises questions.

1) The height analysis for the 200-mb level shown in Fig. 7 of the original paper is clearly not an analysis of...
the analysis in Fig. 2 of the original data from Mogil and Holle's Fig. 7 fits the observed winds rather well. However, the most curious feature of Mogil and Holle's analysis of Case 2 appears in their Fig. 8A, wherein we find contours of ratio of actual to geostrophic winds of 3.0 and 3.5, despite the fact that no observed winds occur inside the area surrounded by the 3.0 line.

4. Conclusions

I conclude that the cases analyzed by Mogil and Holle provide no evidence for anomalous winds nor negative absolute vorticity. Working with the data has also led me to conclude that the synoptic network is inadequate for detailed analysis of mesoscale features of the wind field.

Acknowledgment. I thank Frederick Sanders and Rory Thompson for inspiring interest, disagreeing about the existence of negative absolute vorticity, and being interested.

REFERENCE