Reply

R. CHEN, D. L. BOYER, AND L. TAO

Department of Mechanical and Aerospace Engineering, Arizona State University, Tempe, Arizona

23 June 1994

The authors certainly agree that all aspects of the cloud photographs in Fig. 17d of Chen et al. (1993) cannot be simulated by the drainage flow physical model considered. Inadvertently, the cloud photograph of Fig. 17d was rotated 180° relative to the experimental photographs and the interpretive sketch of Figs. 17a–c. The physical model experiments clearly show anticyclonic plume bands spiraling out from the Antarctic continent in a fashion similar to that of some of the cloud bands on the satellite photograph. For example, the band at "9 o'clock" on Fig. 17d (unrotated) appears to originate along the continental boundary and has its counterpart in Fig. 17c at "3 o'clock" (i.e., the same location as the cloud photograph when rotated 180°). Many of the other cloud streaks on Fig. 17d do not appear to have originated near the Antarctic continent and are most likely associated with midlatitude cyclones spiraling toward Antarctica as indicated by King and Turner (1994). Such phenomena were not simulated in the physical model because the average latitudinal temperature gradient was not considered.

The physical model experiments indicate that the cold air drainage flow can propagate well away from the Antarctic continent. Some theoretical arguments (Egger 1985; James 1989) indicate that the drainage flow will be choked in the vicinity of the continental margin. Some of the spiral bands in Fig. 17d also suggest that the drainage flow can advect some distance from the continent. There is insufficient evidence on this matter to come to a firm conclusion on the distance that the drainage flow can move away from Antarctica: this matter would seem an interesting topic for a future observational program.

The drainage flow in the physical model and the Antarctic atmosphere involves a balance between inertial terms, pressure gradient forces, gravity, Coriolis effects, and viscosity. One should thus not expect that the radius of curvature of the spiral bands would be that of the inertial radius. The authors appreciate the commentary by King and Turner (1995), clarifying aspects of our interpretation of the satellite photograph from Schwerdtfeger (1984).

Corresponding author address: Dr. D. L. Boyer, Dept. of Mechanical and Aerospace Engineering, Arizona State University, Tempe, AZ 85287-6106.

REFERENCES

Chen, R.-R., D. L. Boyer, and L. Tao, 1993: Laboratory simulation of atmospheric motions in the vicinity of Antarctica. *J. Atmos. Sci.*, **50**, 4058–4079.

Egger, J., 1985: Slope winds and the axisymmetric circulation over Antarctica. *J. Atmos. Sci.*, **42**, 1859–1867.

James, I. N., 1989: The Antarctic drainage flow: Implication for hemispheric flow on the Southern Hemisphere. *Antarct. Sci.*, **1**, 279–290.

King, J. C., and J. Turner, 1995: Comments on "Laboratory simulation of atmospheric motions in the vicinity of Antarctica." *J. Atmos. Sci.*, **52**, p. 1260.

Schwerdtfeger, W., 1984: *Weather and Climate Change of the Antarctic.* Elsevier Science, 261 pp.