Reply

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Geotis appears to take a rather flippant attitude toward the "organized updrafts" and "weak-echo regions" of thunderstorms. That is certainly his prerogative. We would remind him that a few hailstorms have organized updrafts but no discernible downdrafts, and if we are ever to modify hail we must modify the immediate vicinity of the weak-echo region, i.e., the source regions of hail.

His comments concerning the apparent inconsistencies in the paper do deserve an explanation. There are three situations in which hail is encountered in the vicinity of the updrafts at cloud base. The first and most common situation occurs while flying near the echo wall (strong horizontal reflectivity gradient). Cases b, c and d in Fig. 1 of Auer and Marwitz (1972) are examples of this type. We included a column describing the "circumstances" for each encounter in Table 1 of our paper. It may be seen that most of the encounters were at the edge of the updrafts and in the near vicinity of the radar echo wall. Although it was not specifically pointed out in the article, the position-keeping for the radar echo and aircraft was by means of two independent and absolute systems, both of which have errors (see Marwitz, 1972). We are guilty of presenting the data without modification, and not as we are sure it must have been. We certainly realize that the hail sizes and concentrations in this region were such as to produce radar echoes. In fact, suggested relationships between radar reflectivity factors and the presence of the observed hail spectra at cloud base have been pointed out by Auer (1972). Perhaps we

should have "adjusted" the flight paths so that the encounters appeared more reasonable, i.e., in the edge of the radar echo.

The second situation in which hail is encountered is from "precipitation streamers" (Browning and Donaldson, 1963). In this case a small ensemble of hailstones descends from the echo overhang through the updrafts of the weak echo region. We believe this was the case for Fig. 1a, in which a "momentary spurt" (Table 1) of hail was encountered well away from the main echo.

The third situation for hail encounters is as a precursor to updraft dissipation. In this case hail is encountered in the updrafts, but on the next pass rain and hail without updrafts will be encountered because the precipitation particles in the overhang descend into the area where previously there were organized updrafts.

Although Geotis chose to attribute the apparent inconsistencies in the article as due to "bad measurementship," we rather believe the above comments indicate we are only guilty of being too honest and, perhaps, not explicit enough.

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