

REPLY

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15 July 1983 and 6 September 1983

I welcome the comments by Orville (1984) who brings out some important aspects concerning my paper on cloud interaction and merging on Day 261 of GATE. Orville's criticism concerns 1) important details left out of the discussion, 2) restricting to three-dimensional results and 3) the little attention paid to what appears to happen in other natural cloud situations. In this reply, all of these points are briefly discussed.

1. Consideration left out

Orville notes that no mention was made of "image" clouds in the numerical results. However, the problem of "image" clouds created due to the periodic boundary conditions was studied carefully. It turned out that the minimum distance between the "image" impulses was 10 km, resulting in an echo separation of 7 km or more. Consequently the clouds could be considered isolated from their "image" clouds and the domain large enough so that no interaction would take place across the lateral boundaries. The lack of interactions through the lateral boundaries was also reflected in different fields (e.g., temperature, humidity, wind) which were undisturbed close to the boundaries during the whole simulation.

The correspondent found that the weakness of the GATE convection was not sufficiently emphasized in the paper. This study was, however, a sequel to the work reported by Turpeinen and Yau (1981) where a detailed description of the synoptic situation has already been presented.

The correspondent criticized the use of a time difference of 10 min or more between the two nonsimultaneous impulses. The choice, however, was not arbitrary but based on the radar observations. The edge-to-edge separation would have been different if the later impulse had been introduced less than 10 min after the first one. These experiments were not, however, carried out, since the simulations would have resembled more the ones with identical and simulta-

neous impulses. Echoes 5 min apart were considered simultaneous, since the sampling frequency was 5 min in the radar data available from Day 261 of GATE.

2. Issue of dimensions

Two-dimensional models are certainly useful in some atmospheric environments but with a complex wind profile (see Table 5 in Turpeinen, 1982) the use of three dimensions must be very essential. Furthermore, perturbation pressure forces, playing an important role in the merging processes, would be overestimated in the two-dimensional domain (Yau, 1979).

3. Neglect of other natural cloud situations

Orville criticized the paper by pointing out that too little attention was paid to what appears to happen in other natural cloud situations. The purpose of the study, however, was to explain the observed behavior of the cloud interactions and merging on Day 261 of GATE in a plausible way, rather than the presentation of general theory. I was encouraged to see that the results showed some similarities with those obtained by other researchers (Simpson *et al.*, 1980; Lopez, 1978) under different circumstances, suggesting that the major findings could be generalized.

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