

### Reply

By PAULINE M. AUSTIN and ALAN C. BEMIS

*Dept. of Meteorology, Massachusetts Institute of Technology,  
Cambridge 39, Mass.*

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The suggestion of a "virtual layer," caused by the attenuation of radar power by heavy rain, is interesting. However, we believe that there is very little danger of confusing such a virtual layer with a layer-type echo caused by actual stratification in the atmosphere. The theoretical case, as shown in fig. 1, does not resemble a layer, but shows only a slight indentation in the precipitation echo just above the bright band, where the echo, being on the borderline of detection, must be weak. Moreover, this theoretical case is probably more extreme than any which would be observed experimentally, since heavy rain ( $14 \text{ mm hr}^{-1}$ ) was assumed to extend over a fairly wide area. Rain of this intensity is seldom observed under a bright band, and then only in localized showers.

It is apparent that these calculations were based, in part, upon the values of relative radar-reflectivity indicated in our fig. 3.<sup>1</sup> It should be emphasized that fig. 3 shows only *relative* values of reflectivity for particles of one particular size or mass. The size chosen (1-mm radius when melted to a raindrop) was not a "median size." No assumptions were made concerning absolute values of the reflectivity, drop-size distribution, or rainfall rate.

The layer-type echo in our fig. 2 is obviously not a "virtual layer" of the type described by Atlas and Banks, since the indentation below the layer is far too deep. Moreover, the rainfall rates recorded during the storm varied from a trace to only 1 mm hr<sup>-1</sup>, much too light for noticeable distortion due to attenuation. It is important to keep in mind that attenuation is always present, but we believe it would be difficult to actually observe this virtual-layer effect amidst the usual complex weather picture with its continually changing shower structure, slanting precipitation columns, and often pronounced stratification.

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<sup>1</sup> P. M. Austin and A. C. Bemis, "A quantitative study of the 'bright band' in radar precipitation echoes," *J. Meteor.*, **7**, 145-151, 1950.