

Reply

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Professor Lettau has made an interesting and welcome comparison of ϵ values derived from smoke puffs with those derived from wind-profile data. I must confess that it did not occur to me that the lower portion of my curve might be tested for a fit to his eq (2); otherwise, I would have considered using my neutral balloon data (Wilkins, 1958) as Lettau would have preferred. It is easily possible to fit the parabolic curve to the data and obtain a reasonable value for the surface roughness length.

We must wait for further data to resolve the question as to whether energy dissipation in the higher atmosphere cannot be fairly represented by a single curve. Only three of the 14 sets of data in Lettau's fig. 1 were taken above one kilometer, and two of these indicate a fairly small range of ϵ values. Certainly, we must regard as exceptional those conditions where ϵ associated with stratospheric turbulence approaches ϵ associated with surface turbulence. It may be that sizeable departures from the average are relatively infrequent at any given level in the stratosphere.

Of the several interesting features in Professor Lettau's illustration, one is that there appears to be, on the average, about an order of magnitude decrease in ϵ for each order of magnitude increase in elevation from one centimeter to well into the stratosphere. A relationship such as this may be found useful in dealing with a variety of problems involving atmospheric diffusion on a large scale.

REFERENCE

1. Wilkins, E. M., 1958: Observations on the separation of pairs of neutral balloons and applications to atmospheric diffusion theory. *J. Meteor.*, **15**, 324-327.