Reply

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Troen *et al.* comment on some assumptions and conclusions made in formulation of the spectral turbulent diffusivity theory for plume dispersion (Prahm *et al.*, 1979). The main idea of the spectral turbulent diffusivity (STD) theory is to account for the scale dependence of the turbulent diffusion process by treating each Fourier mode of the concentration distribution by a separate diffusivity (Berkowicz and Prahm, 1979). Our aim was to develop a theory of turbulent diffusion which would reveal the essential features of this process, but would be easy to apply in numerical dispersion models. The physical basis of the STD theory is discussed in more detail in a forthcoming publication (Berkowicz and Prahm, 1980). Like any other theory dealing with turbulent phenomena, even the most sophisticated ones, the STD theory contains simplifying assumptions and suffers from certain limitations; however, it is the authors' opinion that the arguments put forward by Troen *et al.* do not contribute information which refutes the assumptions inherent in the STD theory for plume dispersion.

The assumption about a short time scale made in the spectral model for plume dispersion (Prahm *et al.*, 1979) does not refer to a single particle dispersion but to dispersion of a Fourier mode of the concentration distribution. Furthermore, we do not use the energy spectrum corresponding to time series of the turbulent fluctuations but the energy spectrum of the spatial fluctuations. The characteristic time scale is mainly determined by the characteristic time of the largest eddies. It is hard to accept the concept put forward by Troen *et al.* that the correlation time should be longer for a diffusion process where the short eddies are cut off than in the case of an unfiltered spectrum. It is more likely that the time scale is different for different Fourier modes of the concentration distribution.

The second argument of Troen *et al.* about inconsistency between the non-Gaussian concentration distribution of a plume prescribed by the STD theory and the assumptions of the theory must be based on a misunderstanding. We assume that the fluctuation of phases of each Fourier mode of the concentration distribution are governed by a specific diffusivity. Different Fourier modes are therefore characterized by different variances of the phase fluctuations. This results in a solely non-Gaussian distribution of the center of mass fluctuation of the instantaneous plume, and consequently in a non-Gaussian shape of the time-averaged plume.

We thank Troen *et al.* for their interest in our papers, but unfortunately their comments seem to be biased by misinterpretation of the discussed assumptions.

REFERENCE

Berkowicz, R., and L. P. Prahm, 1980: On the spectral turbulent diffusivity theory for homogeneous turbulence. *J. Fluid Mech.* (in press).

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