droplet evaporation rates are important factors in determining droplet size distribution and mineral deposition rates. To make these determinations, the meteorological observations (e.g., from the PG&E station, the tethered-balloon system and the 10-m meteorology tower) should be averaged, where practical, over intervals compatible with the actual sampling times.

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A LAGRANGIAN-SIMILARITY DIFFUSION-DEPOSITION MODEL

T. W. Horst

A Lagrangian-similarity diffusion model has been incorporated into the surface-depletion deposition model. This model predicts vertical concentration profiles far downwind of the source that agree with those of a one-dimensional gradient-transfer model.

The surface-depletion model of Horst (1977) is a method for correcting an atmospheric diffusion model for dry deposition. It requires only a deposition velocity v_d and an expression for $D(x,z,h)$, the crosswind-integrated airborne contamination at location (x,z) caused by a unit point source of nondepositing material at $(x = 0, z = h)$. Since the surface-depletion model uses a negative area source or sink of material at ground level to account for deposition, $D(x,z,0)$ is an essential element of the model.

The surface-depletion model has been improved by replacing the Pasquill-Gifford Gaussian plume formula for $D(x,z,0)$ with a Lagrangian similarity description. The latter theory predicts the vertical spread $\bar{z}$ of a contaminant in terms of the friction velocity u_* and the Obukhov length L,

$$d\bar{z}/dt = u_* k/\phi(\bar{z}/L) \qquad (1)$$

where ϕ is a function of atmospheric stability. $D(x,z,0)$ is assumed to be

$$D(x,z,0) = D(x,0,0) \exp\left[-(z/b\bar{z})^n\right] \qquad (2)$$

with $D(x,0,0)$ determined by the requirement of continuity. A gradient-transfer solution to the convective-diffusion equation predicts that $n = 2 - p$, if the eddy diffusivity is proportional to z^p ($p > 1$ for unstable conditions, $p = 1$ for neutral conditions, and $p < 1$ for stable conditions). Observations of atmospheric diffusion from a ground-level source, however, favor $n = 1.5$ for neutral conditions, $n < 1.5$ for unstable conditions, and $n > 1.5$ for stable conditions (Horst 1978a).

The new version of the surface depletion model has been tested with the vertical profiles of airborne contamination $C(z)$ predicted far downwind of the source. These profiles are independent of the source location (Horst 1978b) and are a function only of u_*, z/L, and the deposition $v_d C(z_d)$. One-dimensional gradient-transfer theory predicts that

$$C(z) - C(z_d) = \frac{v_d C(z_d)}{u_* k} \int_{z_d}^{z} \frac{\phi(z'/L)\, dz'}{z'} \qquad (3)$$

The best agreement between the surface depletion model and equation (3) is found with a value of $n = 1$ in neutral conditions, $n < 1$ in unstable conditions, and $n > 1$ in stable conditions. As might be expected, this agrees with the gradient-transfer solution to the convective-diffusion equation rather than with the observational data on vertical diffusion.