Reply

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I appreciate the comments by Dr. Briggs (1987) on my paper. I have learned over the past 20 years to listen carefully to him, since his conclusions are usually correct. I apologize for the typographical errors in section 3e.

The emphasis on the Bull Run data in the discussion of the enhancement of σ_y by buoyancy effects (Hanna, 1986) was a result of the sequence in which the original analysis was performed. No buoyancy enhancement correction was needed for the Kincaid data (my Fig. 10), which were analyzed before the Bull Run data, since the observed ratio $\sigma_y u/w_* x$ was constant (about 0.6) at small X^*. However, the observed $\sigma_y u/w_* x$ data showed a slight upturn at small X^* for Bull Run (my Fig. 11). The buoyancy enhancement formula allows this upturn to be simulated. Briggs is correct that, for consistency, the Kincaid analysis should have been redone using the buoyancy enhancement formula.

As he points out, enhancement of σ_y by buoyancy effects may be more evident at Bull Run because the wind speed is smaller and hence the dimensionless buoyancy flux F_* is more often greater than 0.06 at that site than at Kincaid.

The inconsistency mentioned by Briggs between the recommended Eq. (14), $\sigma_y/x = 0.6w_*/u$, and the σ_y/x ratios recommended for various stability classes is not evident in the data. These formulas are empirical fits to the observed data. His suggested formula, $\sigma_y/x = 0.6(w_*/u)[1 + (0.2u/w_*)^2]^{1/2}$, may, perhaps, provide a better fit to the data, but it is not known whether the scatter is less than for my Eq. (14). It would be interesting to plot the data in this way in a future research program. Incidentally, during the course of this project, it was discovered that the Weil and Brower (1984) relation between u/w_* and Pasquill stability classes may need to be corrected, since the Weil and Brower criteria hardly ever generate class D stability during the daytime, whereas the Pasquill scheme often generates class D stability.

This is an appropriate time to report recent findings in two separate tracer studies that it is difficult to reconcile σ_y values directly calculated from crosswind networks of monitors (Hanna, 1986) with σ_y values estimated from the Gaussian relation ($\sigma_y = C_y/\sqrt{2\pi}C_m$) between the observed maximum ground-level concentration, C_m, and the observed cross-wind integrated ground level concentration, C_y. The σ_y values typically differ by 20% to 40%, with the directly calculated value being larger. Since C_m, C_y and σ_y are all based on extensive tracer measurements, the discrepancy must be due to the non-Gaussian nature of the lateral concentration distribution. For instance, the observed C_m always will lie above a best-fit Gaussian curve for any observed lateral distribution. Thus, the σ_y formulas based on observed lateral concentration distributions produce estimates of C_m that are likely to be 20% to 40% low.

REFERENCES

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