



Fig. 3. Comparison of predicted and measured concentration using all data except for 194.10 minutes (35 points).

adjustments, the average difference in the calculated velocity is less than 2% and the difference in dispersion coefficient is less than 2.5%.

The regression method presented is simpler to apply than either the graphical method presented by the author or that by Wang et al. and yields essentially the same results for the example. The spreadsheet implementation allows easy testing of various assumptions regarding the data set.

With the LR method the transverse dispersion coefficient can also be estimated if the aquifer thickness, mass loading, and porosity are known (or can be estimated) from other sources. The estimated values of the velocity and dispersion coefficient are strongly dependent on the early and late parts of the time-concentration curve. For example, disregarding the first five or just the last value which appears to be in error, significantly changes the calculated velocity and dispersion coefficient. Therefore, the early and late portions of the time-concentration curves should be measured more frequently.

Visual smoothing of the input data can help to adjust for "noise" and improve the accuracy of the calculated results. This is very easy to do in the spreadsheet environment.

Acknowledgments

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References

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REPLY TO the preceding Discussion by William E. Kelly, Oldrich Mazac, and Stanislav Mares of "Data-Analyses Methods for Determining Two-Dimensional Dispersive Parameters"

by Jiu J. Jiao

The author would like to thank Kelly, Mazac, and Mares for their careful reading and discussion of his paper in which the DPA and LG method were introduced.

The DPA method demonstrates that dispersivities may be estimated by checking the shape and area of a contaminant plume which could be delineated by surface geophysical

methods. Therefore, the author suggests that this method could be especially useful if the data are obtained by surface resistivity measurements.

The author quite agrees with Kelly, Mazac, and Mares about the difficulties in accurately estimating concentration values of an aquifer using geophysical methods. When these methods are used in estimating aquifer transport properties, the most challenging work is how to substitute the resistivity values into the concentration data, not how to estimate dispersivities after the concentration data are obtained.

The author feels, however, that their statement that "substitution of point values of the concentration by resistivity values determined by the surface measurements appears only to be possible if the transport process can be represented by a one-dimensional model" seems somewhat pessimistic. This implies that surface measurements are, in practice, not applicable because no transport process in a real aquifer is one-dimensional.

Many researchers have delineated contaminant plumes by interpreting geophysical data, such as the geophysical surveys in the Borden aquifer (MacFarlane et al., 1983; Greenhouse and Harris, 1983). It is difficult to obtain point values of concentration, but the DPA method does not require necessarily concentration values and can use the conductivity or resistivity directly if they are approximately proportional to concentration values. The dispersivities estimated from the general pattern of the plume by the DPA method may not be very accurate, but they may be instructive for organizing further contamination surveys or may be adequate to use as initial guesses in a numerical model.

The method developed in the original paper was for two-dimensional dispersion caused by instant injection in a one-dimensional flow system. The method has been tentatively extended to the continuous injection situation (Jiao and Rushton, 1992), which is the usual case for most contaminant problems caused by landfills or mine water. There is also no technical difficulty in extending this method for a three-dimensional plume. The author believes that the basic idea of using the plume to estimate dispersivities, not the particular method, may be extended to more complex situations, such as two-dimensional flow. For these situations, instead of the simple DPA method, more complicated methods or even numerical methods may be required.

The LG method transforms the concentration-time curve into a straight line and then estimates the dispersivities based on the slope of the line. Kelly, Mazac, and Mares suggest a simpler alternative: the linear regression (LR) method. The author believes that the LR method is valuable, because the linear regression is well-known and can be easily practiced. It is general and may be used for estimating parameters from other equations.

However, the author wishes to say that it is still useful to develop some methods based on the particular transport equations to estimate dispersivity parameters because these methods may have some physical implications relating to the equations. For example, the two straight lines in Figure 4 (see the original paper) should coincide if the assumptions of the basic equation (1) are valid. The deviation of the two lines can be an indication of the degree of the real aquifer differing from the theoretical assumptions.

The author agrees that the data for the early and late parts of the concentration-time curve are erroneous. This is because the values of concentration in these parts are very small and are very sensitive to local heterogeneities (this is true even for a tracer test in homogeneous laboratory media). When the LG method is used, the straight lines are drawn based on the data points near to the origin in Figure 4. This means only the data on central portions of the concentration-time curve (Figure 3)

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are mainly used. The author is mystified by the statement that "the estimated values of the velocity and dispersion coefficient are strongly dependent on the early and late parts of the time-concentration curve." The data on those parts may have little effect on the general dispersivity features of the aquifer.

Finally, the author wishes to correct an error. In equations (14) and (15), the figures should be exchanged. These two equations should read: $D_1 D_t = 0.000147$ and $D_1 / D_t = 3.102530$. After the solution of the two equations, D_t should be $0.02138 \text{ m}^2/\text{d}$, instead of $0.2138 \text{ m}^2/\text{d}$.

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CORRECTION

The Reply to the Discussion by Amir Gamliel of "In Situ Soil Remediation Using Vapor Extraction Wells, Development and Testing of a Three-Dimensional Finite-Difference Model" in the November-December 1993 issue, v. 31, no. 6, on page 1034 was authored by both Mansour Sepehr and Zohrab A. Samani.



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