
Comments on “In Defense of Observations and Measurements”

In a letter to the editor (Thomas, 1992), Thomas argued that scientists follow “fashion” rather than do what “really needs doing.” He further implied that modeling is generation of numbers, and stated that generating numbers is current scientific “fashion.” His sarcasm regarding the “environmental movement” is a self-caricature, and deserves no reply. The fact is that, unless they have independent wealth, scientists do what funding sources allow them to do. Otherwise, Thomas’s thrust is that what is really needed in our science is more field work.

His comment has the strong overtones of a field work vs. modeling antagonism. I hope that his letter does not stir up such a debate, which is artificial and counterproductive. I do not wish to join such a debate; I believe there will always be a need for both models and good field data collection, and it serves our science poorly to see these activities as anything but complementary in purpose. One must heartily agree with his statement that “advancement of science requires good data.”

It is unfortunate, however, that Thomas sees models as merely number generators (“based on hopes, dreams, and calculations...”). Models are, in fact, symbolic representations of our current understanding of a system. In that regard, it is interesting to look at his two examples, which I would argue have little to say in indictment of models or support of a preeminence of field work.

The first example is one of money spent unwisely by the U.S. Agency for International Development. This is surely not the first time this has occurred, and is regrettable, but makes a poor case for data collection vs. modeling. In fact, the principle problem cited was the folly in using untrained people to collect data, not in neglecting to consider field data. The example really does not indict the GIS (Geographical Information System) tool that was used, but merely shows how valuable tools can always be misused.

The second example of Thomas does no more to suggest that field data are more important than models. In this example, field observations have shown that atrazine may pass through subsoils to groundwater faster than a specific model predicted. This merely demonstrates the proper role of models, which must continually evolve along with our increasing knowledge of the processes involved. Data are needed, but models are necessary if the probe impedance is known. As Heimovaara (1992) has correctly pointed out, the procedure is not different from the Giese-Tiemann (T) equation as presented by Topp et al. (1988). Models are, in fact, symbolic representations of our current understanding of a system. In that regard, one wonders how valuable tools can always be misused.

The striking point here is that field observations have shown that atrazine may pass through subsoils to groundwater faster than a specific model predicted. This merely demonstrates the proper role of models, which must continually evolve along with our increasing knowledge of the processes involved.

Comments on “Time Domain Reflectometry: Measurements of Water Content and Electrical Conductivity of Layered Soil Columns”

In a recent manuscript, Nadler et al. (1992) compared the various existing methods for estimating electrical conductivity ($\sigma_e$) with time domain reflectometry (TDR). In the process, they presented a new method that is apparently simpler and more accurate than the existing approaches. As Heimovaara (1992) has correctly pointed out, the new procedure is not different from the Giese-Tiemann (T) equation as presented by Topp et al. (1988). Models are, in fact, symbolic representations of our current understanding of a system. In that regard, one wonders how valuable tools can always be misused.

Nadler et al. (1992) stated that dimensional analysis shows that the left side of the equation has the units of $m^{-1}$, and the right side has the units of $s^{-1}$. This statement is incorrect, a consequence of their mistake in equation substitution that produces terms on either side of the equation that indeed have the same dimensions ($m^{-1}$).

Nadler et al. (1992) also stated that their method would be different from G–T, because their calculation of electrical conductivities “deviated from the 1:1 correlation of values obtained by our approach and independent measurements.” However, that result was due to a substitution of the G–T method. They used the G–T equation for probe impedance that was recalculated in each field test using the current calculated permittivity and the reflection coefficient. In effect, they substitution for $Z_0$ (Eq. [2]) into the formulation of $K_e$ (Eq. [3]), yielding their $\sigma_e$ (Eq. [4]):

$$K_e = \frac{\varepsilon_0 c}{L} Z_0$$

$$Z = Z_0 \sqrt{1 + \rho} = Z_0 \sqrt{\frac{\varepsilon_0 c}{L}}$$

Received 19 Feb. 1993.

USDA-ARS
Water Management Research Unit
Fort Collins, CO 80523

References