The paper by Teske et al. (2015) allows us an opportunity to clarify many points about Schleier et al. (2012), Schleier and Peterson (2014), and our model, MULV-Disp 1.0, and it requires us to discuss numerous fundamental conceptual, statistical, mathematical, calculation, and other errors in Teske et al. (2015). These errors are so profound that they obviate the primary points of their paper. As we will show, many of the arguments Teske et al. (2015) use to claim that our model is flawed actually support our model.

The central arguments by Teske et al. (2015) are dependent on a fundamental misunderstanding and misuse of equations reported in Schleier et al. (2012) and Schleier and Peterson (2014) (discussed in more detail below).

Teske et al. (2015) incorrectly assumed the equations reported in our papers were our model, MULV-Disp. We presented the equations in Schleier et al. (2012) and Schleier and Peterson (2014) at the suggestion of reviewers and editors to emphasize the most significant factors influencing deposition. However, Teske et al. (2015) incorrectly used our equations in their paper because they treated the interaction parameters as single parameters, not as interaction terms. Because they treated each parameter as an independent variable that does not change other variables, ignoring the interaction terms, the sensitivity analysis that was performed by Teske et al. is flawed. It is apparent that they used an incorrect equation because they state, “If we vary each of the 9 parameters by 10% and compute the average deposition and divide by the average base deposition we arrive at the ratios shown in Table 3” (p. 265). There are 23 parameters in the model, excluding distance, but there are interaction terms that include distance. This misunderstanding is clearly demonstrated with the statement “S1 stated that smaller droplets travel farther from the spray source. Though correct, this statement does not reconcile with their previous statements that “deposition shows little dependence on distance” (p. 269).

Teske et al. (2015) also demonstrate a misunderstanding of statistical modeling with the following statement: “To determine how inconsistent the S1 model is, we computed the deposition in distance increments of 10 m, from 0 m to 180 m (the extent of the data reported in S1), finding an average base deposition of 0.00675 mg/cm², which can be inferred by inspection of Fig. 1. Assuming that they are using correct values, which we have already demonstrated isn’t the case, even this analysis is problematic. The values computed are median values at each corresponding distance; therefore, they are colinear because with a logarithmic change a one-unit increase represents a multiplicative change in the regression equation. More important, that means that there is a 50% probability that the real value is above or below that value. Teske et al. (2015) are taking the average of multiple medians on a logarithmic scale, which is incorrect because the percentage change of deposition at each distance is different. Therefore, it is incorrect for Teske et al. (2015) to change a single variable because there are 24 parameters, so this change not only would represent the multiplicative change in one variable, but multiplicative change in other parameters as well. Depending on the number of data points used and how they are stratified, the authors will get different answers (i.e., if they used distance increments of 5 m, from 0 m to 180 m). Consequentially, their analysis to demonstrate the “inconsistency” of the model is incorrect.

Another highly problematic statement in Teske et al. (2015) is “One of the best ways to interpret predictions from a regression model is to set a base case and vary each model parameter individually to confirm that the trends exhibited are physically meaningful. To this end, we use the default input parameters specified in S2, reproduced here as Table 2. These parameters result in the base case deposition shown in Fig. 1” (p. 264). Their analysis, only varying one parameter at a time when it changes others, is flawed. Their statement demonstrates a misunderstanding of k-fold cross-validation and statistical model validation. Schleier et al. (2012) contains two paragraphs describing appropriate model selection and validation. More important, k-fold is an unbiased quantitative measurement that directly addresses the issues we pointed out above with changing only one input when it in fact affects other inputs such as flow rate and droplet size. K-fold uses the corresponding flow rate and droplet size and incorporates the correct values for both into the interaction terms. The method that Teske et al. (2015) used to modify only one input at a time systematically biases the model because the correct input assumptions are not being used.

In addition to changing only one input parameter, the authors also ignored the following...