



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: DC3921

Title: Analysis of Transformed Environmental Data with Detection Limits

Focus Categories: Water Quality, None

Keywords: Box-Cox Transformation; Mean Concentration; Detection Limits; E-M Algorithm; Bivariate Censored Observations

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Abstract

Human beings are concerned about the potential health and ecological effects of various environmental contaminants. Several government agencies are charged with setting and monitoring environmental standards of such contaminants. These agencies are required by law to establish a list of possible contaminants in air, water, food, and soil. For example, the Safe Drinking Water Act requires the Environmental Protection Agency to establish and update a list of water contaminants. This list is used to set drinking water regulation for acceptable concentration levels of toxicants in drinking water. Of particular concern is the occurrence and levels of microbial contamination (bacteria, viruses, and protozoa) and disinfection byproducts in drinking water. Such chemical contaminants and microbes co-exist with other chemical contaminants and microbes.

It is of interest to study the distribution of the mean concentration of such contaminants. For example, the most basic definition of risk defines it as the product of dose and the probability of (an adverse) effect per unit dose. Here, dose is the amount of toxicant or the number of microbes an individual consumes. The cancer potency factor is used to estimate the effect of an adverse effect in case of carcinogens. The mean concentration of the amount chemical or microbes in an environment (air, water, soil, etc) is often used as a direct measure of dose. Many times dose is a function of several variables and an estimate for the distribution of the joint mean concentration of chemical or occurrence of microbes may be required. USEPA (1991) defines dose as the product of many factors, including chemical concentration and intake rate, body weight, and exposure frequency, among others. For instance, one may require information on the joint density of the mean concentration and intake rate for fixed age groups and exposure duration.