STANFORD UNIVERSITY

DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Friday, October 18, 2002
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)

Sandra McBride
Duke University

Hierarchical Bayesian calibration: An application to airborne particulate matter monitoring data

In studies of the relationship betweeen airborne fine particulate matter (PM2.5) and health, researchers frequently use monitoring data with the most extensive temporal coverage, even if such data may come from a monitor that has not met U.S. Environmental Protection Agency (USEPA) reference monitor standards. For the Phoenix area, measurements from a "gold standard" reference monitor are available less frequently and have levels of accuracy and bias that differ from a co-located non-reference monitor. Using the soil constituent of PM2.5 as an illustration, we describe a Bayesian hierarchical model that combines information from reference and non-reference monitors to produce a temporally resolved estimate of the reference concentration time series as well as the unknown mean concentration time series. Mean concentrations are modeled using a regression structure that reflects the influence of meteorology. To account for bias in monitors relative to each other, a multiplicative bias parameter in the mean for the non-reference monitor is used. Estimation of the bias parameter involves inference about the ratio of normal means as in the well-known Fieller-Creasy problem. We develop a reference prior for the hierarchical model that permits simultaneous inference about the underlying mean concentrations and the bias parameter. For this case study, we describe the implications of using non-reference monitoring data in models relating PM2.5 and health. This work is joint with Merlise Clyde, Associate Professor in ISDS, and Allan Marcus, USEPA.