# Ice model calibration using semicontinuous spatial data

Presenter: Won Chang

Department of Statistics, Seoul National University

Rapid changes in Earths cryosphere caused by human activity can lead to significant environmental impacts. Computer models provide a useful tool for understanding the behavior and projecting the future of Arctic and Antarctic ice sheets. However, these models are typically subject to large parametric uncertainties, due to poorly constrained model input parameters that govern the behavior of simulated ice sheets. Computer model calibration provides a formal statistical framework to infer parameters, using observational data, and to quantify the uncertainty in projections due to the uncertainty in these parameters. Calibration of ice sheet models is often challenging because the relevant model output and observational data take the form of semicontinuous spatial data with a point mass at zero and a right-skewed continuous distribution for positive values. Current calibration approaches cannot handle such data. Here, we introduce a hierarchical latent variable model that handles binary spatial patterns and positive continuous spatial patterns as separate components. To overcome challenges due to high dimensionality, we use likelihood-based generalized principal component analysis to impose low-dimensional structures on the latent variables for spatial dependence. We apply our methodology to calibrate a physical model for the Antarctic ice sheet and demonstrate that we can overcome the aforementioned modeling and computational challenges. As a result of our calibration, we obtain improved future ice-volume change projections.