NSF·Duke·NCSU·UNC

Joint MUMS Program Transition - SPUQ Workshop
May 14-17, 2019
SPEAKER/ABSTRACT

Mengyang Gu, Johns Hopkins University
"A review of model calibration methods with an application by fusing multiple sources of data from the eruption of the Kilauea Volcano in 2018"

Abstract:
Model calibration or data inversion involves using experimental or field data to estimate the unknown parameters in a mathematical model. In the first part of the talk, I will present a review of a few approaches for model calibration or data inversion with the focus on model discrepancy and measurement bias. A few state-of-art methods, such as modeling the discrepancy by the Gaussian stochastic process (GaSP) or scaled Gaussian stochastic processes (S-GaSP), L2 calibration, Least squares (LS) calibration and orthogonal Gaussian process calibration, will be introduced. The connection and difference between these methods will be discussed. In the second part of talk, I will discuss our ongoing works on calibrating a geophysical model by integrating the different types of the field data, such as the interferometric synthetic aperture radar satellite (InSAR) interferograms, GPS data, velocities of tilt and lava lake from the Kilauea Volcano during the eruption in 2018. This task is complicated by the discrepancy between the model and reality different sample sizes and possible bias in field data. We introduce the scaled Gaussian stochastic process (S-GaSP), a new stochastic process to model the discrepancy function in calibration for the identifiability issue between the calibrated mathematical model and the discrepancy function. We also compare a few approaches to model the measurement bias in the data. A feasible way to fuse the field data from multiple sources will then be discussed. The calibration models are implemented in the "RobustCalibration" R Package on CRAN. The scientific goal of this work is to use data in May 2018 during the earthquake and the eruption of the Kilauea Volcano to resolve the location, volume, and pressure change in the Halema'uma'u Reservoir, as well as relating the results to the inferences from the past caldera collapses.