Environmetrics

Chair: Matías Salibián-Barrera (University of British Columbia)

DAVID J THOMSON, Queen's University
Experiments "Fixing" Ground-Level Ozone

A quality control study of Canadian ground-level ozone measurements shows that its autocovariances are time-dependent. The data are nongaussian, have both real and instrumental outliers, plus numerous missing values. In this situation, quality control tools need to be adapted because most assume approximate stationarity. Dividing the ozone series by the solar ultraviolet insolation largely removes the annual components but the ratio is still periodically correlated. The data are also coherent over large distances, e.g., between Kejimkujik, NS and the Experimental Lakes, ON. We show how both these features can be used to help restore missing sections.

HERBERT NKWIMI TCHAHOU, Statistique Canada
Indicators of Database Quality for Wetlands in Canada: Example of Analysis of Environmental Data

In order to monitor wetlands, Environment Canada (EC) has access to mega-databases that contain large quantities of information describing the Canadian territory in all its facets. To assess the quality of theses databases – that sometimes have attributes of Big Data, administritative data and survey data – we have taken advantage of finite population survey techniques and data analysis. We present a pilot project that was implemented: the employed methodology and an overview of the obtained results.

OFIR HARARI, Simon Fraser University
Design on Non-Convex Regions: Optimal Experiments for Spatial Process Prediction

Modeling a response over a non-convex design region is a common problem in diverse areas such as engineering and geophysics. The tools available to model and design for such responses are limited and have received little attention. We propose a new method for selecting design points over non-convex regions that is based on the application of multidimensional scaling to the geodesic distance. Optimal designs for prediction are described, with special emphasis on Gaussian process models, followed by a simulation study and an application in glaciology.

AUDREY-ANNE VALLÉE, Université de Neuchâtel
Incorporating Spatial and Operational Constraints in the Sampling Designs for Forest Inventories

In the province of Quebec, Canada, the forest is examined through regular inventories. Requirements for the spreading and the type of trees and for the cost are difficult to manage. We show that modern and advanced sampling techniques can be used to improve the planning of the forest inventories, even if there are many requirements. Our design includes balanced sampling, highly stratified balanced sampling and sample spreading through a two stage sample. The impact of these techniques on the satisfaction of the requirements and on the precision of survey estimates is investigated using field data from a Quebec inventory.

CAMILA CASQUILHO-RESENDE, University of British Columbia
Spatio-temporal Modelling of Temperature Fields in the Pacific Northwest

The modelling of temperature fields, which are crucial to understand a region's climate, can be challenging due to the topography of the study region. For instance, in the Pacific Northwest, extensive forests, mountains and proximity to the Pacific Ocean may create sudden changes in climate, contributing to the complexity of the modelling in the area. In this work,

we develop a hierarchical spatio-temporal model that handles nonstationarity for characterizing daily temperature fields in that region and describe a Bayesian method that can be used for spatial prediction.

PETER STARSZYK, University of Waterloo

Inferring Chemical Kinetics from Direct and Indirect Concentration Data

Many chemical compounds used in the agricultural industry bring large amounts of arsenic into the soil. As this poses serious environmental hazards, designing safe and effective arsenic decontaminating agents is an active research area. To do this, it is crucial to understand chemical kinetics between arsenic and various geochemicals at the molecular level. However, state-of-the-art direct measurement techniques aggregate concentration measures making it impossible to infer individual reaction rates. Here we include the modelling of mass spectrometry data which serve as indirect proxies to individual chemical concentrations. The study ultimately seeks identifiability of parameters through simulated and real spectral data.