Bayesian Environmetrics
ISBA 2008 Satellite Workshop
Queensland University of Technology, Brisbane, Australia

Bayesian Analyses at NRW

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The main role of The Remote Sensing Centre is to measure and monitor landscape features using remotely sensed data. We have a particular interest in land use, land cover and vegetation structure, and we produce a number of statewide products describing these features. All of the products require the analysis, modelling and validation of data, and there are consequently many interesting statistical applications. This talk will describe some of the statistical modelling undertaken within the centre, with an emphasis on Bayesian approaches. The talk will concentrate on three applications. The first describes the analysis of validation data to determine the accuracy of thematic maps. One advantage of the Bayesian approach is the ability to include prior information on the accuracy parameters. We show how information from a similar area can be used in the analysis of map accuracy. We also illustrate how the fexibility of the posterior can be used to assist in the interpretation of map accuracy.

Our second application is also concerned with the quantification of uncertainty of spatial products. We describe how Bayesian Melding can be used to represent the uncertainty in deterministic models and we illustrate the method using the Revised Universal Soil Loss Equation (RUSLE). RUSLE measures soil loss into river systems, and spatial coverages of it are used in many water quality models, but the uncertainty of the coverage is poorly understood. Melding allows us to both quantify the uncertainty, and understand the main factors that contribute to the uncertainty.

The final application describes our current work with temporal remotely sensed imagery. There is a trend in the remote sensing field toward more data products collected more often, and the department has developed a considerable library of imagery over both time and space. The Moderate Imagine Spectroradiometer (MODIS) satellite, for example, provides daily measurements of the earth's surface. We use

one of the MODIS products (MOD13Q1), using 16 day averages to classify broadacre cropping patterns in Queensland, and we use annual Landsat imagery to monitor trends in vegetation clearing. The aim of the current research is to use multivariate time series models to help describe environmental patterns. We describe one model, an efficient Bayesian spatial dynamic factor model and show how it can be applied to remotely sensed imagery.