Testing spatio-temporal models for epidemics using latent residuals in the Bayesian framework

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This talk describes joint work with Max Lau and George Streftaris (HWU) and Glenn Marion (BioSS) on the use of latent residuals in the Bayesian framework to test and compare spatio-temporal models for epidemics. A key issue in modelling epidemics in space and time is to be able to distinguish the spatial transmission kernel, which characterises the spatial nature of the dispersal of the pathogen from infective to susceptible individuals. Knowledge of the spatial transmission kernel is important when selecting potential control strategies, for example based on eradication of susceptibles within a radius of a newly discovered infection. It is challenging to compare the fit of models that employ different spatial transmission kernels and techniques such as Bayesian model choice can be complicated to implement. In this talk we present an approach that extends the concept of model testing using posterior predictive model checks. Specifically we show how it is possible, using non-centred parameterisations, to define latent processes to which classical tests can be applied in order to assess the validity of the selected model. We show that the process can be defined so that the resulting tests are sensitive to misspecification of the spatial kernel. Moreover we show how the imputed process can be used to provide diagnostics of the nature of the mismatch between model and data. The methods are illustrated using simulated data sets and using a data set on the spatio-temporal dynamics of an invasive plant species in the UK.