(With Nicky Best, Marta Blangiardo, Silvia Liverani – Imperial College London, Richard W. Atkinson – St. George's University of London, Gary W. Fuller – King's College London)

Airborne particles are a complex mix of organic and inorganic compounds, with a range of physical and chemical properties. Estimation of how simultaneous exposure to multiple air particles affects the risk of adverse health response represents a challenge for scientific research and air quality management. We present a Bayesian approach that can tackle this problem within the framework of time series analysis. We use Dirichlet process mixture models to cluster time points with similar particles and response profiles, while adjusting for aspects associated with time variation such as trend and seasonality through natural cubic splines. Inference is carried out via Markov Chain Monte Carlo methods. We illustrate our approach using daily data of a range of particle metrics and respiratory mortality for London (UK) 2002-2005. To better quantify the average health impact of these particles, we measure the same set of metrics in 2012, and we compute and compare the posterior predictive distributions of mortality under the exposure scenario in 2012 vs 2005. The model results in a partition of the days into three clusters. We find a relative risk of 1.02 (95% credible intervals (CI): 1.00, 1.04) for respiratory mortality associated with days characterised by high posterior estimates of nonprimary particles. A consistent reduction in the airborne particles in 2012 vs 2005 is also found and the analysis of the posterior predictive distributions of respiratory mortality suggests an average annual decrease of -3.5% (95% CI: -0.12%, -5.74%).

A multivariate circular-linear hidden Markov model for distributions-oriented wind forecast verification

Alessio Pollice – Universitá di Bari

(With Gianluca Mastrantonio – Politecnico di Torino, Alessio Pollice – Universitá degli Studi di Bari Aldo Moro, Francesca Fedele – ARPA Puglia)

Winds from the North-West quadrant and lack of precipitation are known to lead to an increase of PM10 concentrations in a residential neighborhood of the city of Taranto (Apulia, Italy). In 2012 the local government prescribed a reduction of industrial emissions by 10% every time such meteorological conditions are forecasted 72 hours in advance. Wind prediction is addressed using the Weather Research and Forecasting (WRF) atmospheric simulation system by the Regional Environmental Protection Agency (ARPA Puglia). In the framework of distributions-oriented forecast verification, we investigate the ability of the WRF system to properly predict the local wind speed and direction allowing different performances for unknown wind regimes. Ground-observed and WRF-predicted wind speed and direction at a relevant location are jointly modeled as a 4-dimensional time series with a finite number of states (wind regimes) characterized by homogeneous distributional behavior. Observed and simulated wind data are made of two circular (direction) and two linear (speed) variables, then the 4-dimensional time series is jointly modeled by a mixture of projected-skew normal distributions with time-independent states, where the temporal evolution of the state membership follows a first order Markov process. Parameter estimates are obtained by a Bayesian MCMC-based method and results provide useful insights on wind regimes corresponding to different performances of WRF predictions.

Designing a discrete choice experiment for peatland restoration

Jacqueline Potts – Biomathematics and Statistics Scotland (BioSS)

A discrete choice experiment has been designed to assess the public's willingness-to-pay for a programme of peatland restoration in Scotland. Each choice set includes a baseline option showing the expected percentage of peatlands in poor, intermediate, and good ecological condition if no restoration is undertaken, together with two options involving some degree of restoration at a specified cost. The inclusion of a "status quo" option in each choice set is generally recommended in the literature, but has implications for the efficiency of the experimental design. The choice of attribute levels is complicated by the constraint that the percentages in the three different conditions must sum to 100%, meaning that only two attributes can be fitted. The attributes chosen were the percentage restored from poor to good condition, and the percentage restored from intermediate to good condition. Additional attributes are used to allow respondents to express spatial preferences for restoration in either wilder or less remote areas, and in regions where peat is either more or less concentrated. The starting point for a pilot survey was an orthogonal design, but after modification it was no longer orthogonal, as choice sets involving an option with zero restoration had to be excluded since these correspond to the "status quo". In addition, the levels of the price attribute were swapped in cases where one option involved a greater degree of restoration at lower cost. Estimates obtained from the pilot