The five successful SECURE Feasibility projects from the May 2015 Call.

Title: Statistical software to identify spatiotemporal patterns and coherence over river networks

Lead applicant: Dr Claire Miller, School of Mathematics and Statistics, University of Glasgow.

Environment agencies invest a wealth of resource in monitoring river nutrient levels in order to protect water quality and for compliance reporting to Europe. Advanced statistical models incorporating the river structure can aid in the identification of common spatiotemporal nutrient patterns and potentially provide efficiency savings in the monitoring budget. In this project, statisticians and environmental scientists from The University of Glasgow, the Scottish Environment Protection Agency and the Environment Agency will collaborate to develop and implement novel statistical software tools, for use within the environmental science community, to identify spatiotemporal and coherent river water quality patterns.

Title: **Feasibility testing of low-cost sensors to represent spatio-temporal variability of ambient ground-level NO2 and O3 concentrations**

Lead applicant: Stefan Reis, (NERC Centre for Ecology & Hydrology, CEH).

Ambient air pollution and urban air quality in particular present an ongoing challenge for citizens, local authorities and researchers. We will build on recent developments in electrochemical sensors to develop a coherent approach to quantify the accuracy and uncertainty of air quality measurements and identify covariate factors affecting low-cost sensors, using the measurement of ground-level nitrogen dioxide (NO_2) and ozone (O_3) as an example. Applying laboratory and field-based evaluation and validation methods, we will develop robust approaches to advise and guide crowd-sourcing efforts for air pollution data to test novel statistical modelling approaches for fusing low-cost sensor data with reference monitoring data to best estimate the spatiotemporal patterns in pollution fields.

Title: **STAGE: STAtistical modelling of Groundwater Extremes**

Lead Applicant: Ben Marchant, BGS

Extreme earth system events such as landslides, earthquakes, groundwater droughts and floods and sink holes have catastrophic consequences for local population and infrastructure. We will conduct workshops and a pilot-study to bring together earth scientists and extreme value statisticians with the goals of (i) better understanding the processes that drive these events (ii) predicting their frequency and intensity and (iii) quantifying the uncertainty of the predictions. The pilot-study will focus on groundwater droughts and floods. We will use existing data to build statistical models that link the occurrence of these events to climatic variables which allow us to predict their occurrence under future climate scenarios and inform policy makers where mitigation efforts are required.

Title: Getting the right spatial & social mix: improved methods for planning community Renewable Energy facilities

Lead Applicant: Prof Alexis Comber, CDRC (Consumer Data Research Centre), Leeds Institute for Data Analytics, University of Leeds

There are many different types and sizes of biomass Renewable Energy (RE) solutions available. However, the inputs associated with **feedstock transport** need to be minimised for maximal net energy gains. In addition, supportive local communities are required for wider RE uptake. Current research and practice related to RE facilities planning has **2 critical gaps**: A lack **of robust spatial statistical methods** to optimally locate **multiple** RE facilities; failure to consider **community receptiveness and participation** in RE planning. This project will identify **key environmental factors** (e.g. agri. land use, resource availability) related to ***supply*** and model **key social factors** (e.g. receptive communities, land owners) related to ***demand.***

Title: Detection of abrupt changes in land and ocean ecosystems

Lead applicant: Dr Claudie Beaulieu

The Earth's climate system and ecosystems often exhibit abrupt changes, which due to the limited time to adapt can have severe socio-economic impacts. Limitations of statistical techniques for the detection of abrupt changes in the environment pose restrictions on the analyses of existing data. By providing flexible statistical tools especially tailored to analyse abrupt changes in the climate and ecosystems, this project is going to improve robustness and reliability of abrupt changes detection leading to better evidence and understanding of their underlying mechanisms.