PhD Travel Support Report

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Project Title: Statistical Characterisation of Wind Fields over Complex Terrain for Bushfire Modelling Applications

Date of Travel: June/July 2016

In June/July 2016, Rachael Quill visited Europe to attend two conferences: the 3rd Conference of the International Society of Nonparametric Statistics (ISNPS) in Avignon, France, and the 26th Annual Conference of the International Environmetrics Society (TIES) in Edinburgh, Scotland. Despite their methodological focus, these conferences yielded some important ideas to further Rachael's PhD research as well as ideas that may be useful to other researchers within the BNHCRC.

ISNPS 2016, 11-16 June, Avignon, France

At ISNPS, Rachael attended numerous talks regarding methodologies used to better analyse data, particularly big data that can be diverse, complex and multi-dimensional. A particularly insightful plenary was given by Regina Lu from the Department of Statistics and Biostatistics at Rutgers University, USA, on Statistical Fusion Learning. The principles behind this work was to combine multiple sources of information to produce more powerful findings, and this may be of particular relevance in the areas of emerging probabilistic modelling within bushfire prediction.

There were also numerous sessions on statistical testing or goodness-of-fit tests, for which the theory can be used to determine significant differences between data samples or a data sample and a specified distribution. Advances in these areas, particularly in high-dimensional spaces, may prove useful in the future to evaluate fire modelling outputs.

TIES 2016, 18-22 July, Edinburgh, Scotland

At TIES, discussions were more applied and a number of talks included bushfire research as well as dealing with variables such as wind. Fire related topics included the detection of anthropogenic influences on weekly fire regimes presented by Kamil Feridun Turkmen from the University of Lisbon. Sylvia Esterby (University of British Colombia Okanagan) also presented some early work from a project on trends in seasonal extremes of the Canadian Fire Danger Index, and considered methods to cluster geographic areas based on similar observations. Robin Williams from the University of Exeter presented some new statistical methods for post-processing ensemble-based weather forecasts to avoid a bias towards under-dispersed ensemble results. Again, this work may be of particular relevance to

emerging ensemble-based fire prediction modelling research to avoid the under-dispersion problem.

A session on circular statistics was of particular relevance to Rachael's work in dealing with wind direction data. This session included a number of talks from researchers in Italy who deal with wind and wave direction data. Talks following this session will lead to further advancement of Rachael's work looking at comparing wind direction observations under different surface roughness conditions. Rosa Crujeras and colleagues from the University of Santiago de Compostela and the University of Lisbon also highlighted the use of circular statistics to identify human interference in global climatological fire regimes, with a case study in Northern Spain.

At TIES there was also a focus on the developing use of technology within statistical research. A number of talks highlighted the fact that we live in an ever more monitored world, and we need to develop better statistical approaches to dealing with such quantities and varieties of data. Agricultural technology talks highlighted how we can combine statistical analysis with remotely collected real-time data to improve agricultural systems on a relatively large-scale (*From the ground up: data science to agronomic* insight, David Clifford, The Climate Corporation). It might be interesting to consider how such methods could be incorporated into improved fire management both ahead of an event and in real-time.

The use of new technologies such as Virtual Reality (VR) and citizen science in opening up new sources of data was exhibited by Kerrie Mengerson and Erin Peterson (Queensland University of Technology). This team is using such technology in a range of projects such as mapping the health of the Great Barrier Reef and understanding Jaguar abundance in the Peruvian Amazon. The increasing availability of these kinds of technologies should be considered an opportunity in fire research where, for instance, a form of 'citizen science' is already considered important in reporting the behaviour of developing fire scenarios.

Report Prepared by Rachael Quill August 2016