

# UKSim2011

## Keynote Speaker-1

### Food for the World – GeoComputation meeting the challenge

Keynote address by

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*Sensors; monitoring telemetry; modelling; agronomy; meteorology*

Meeting the challenge of providing sufficient and high quality food for the World is a hunger reducing necessity, which is an imperative for global sustainability and economic prosperity. Much of the popular emphasis for the scientific contribution to help meet this challenge is focussed on climate change and global warming. At a specific level of contextual detail, studies continue with climate variation and environment factor influences on agronomy, giving rise to an emerging domain of multi-disciplinary research activity known as *agrometeorology*.

Agronomy can be considered as combining agriculture, viticulture and horticulture. For each of these crop production contexts, timely and accurate environment impact information is critical for decision-making precision. Climate in particular, plays a significant role in determining crop yield and quality. The term *agrometeorology* has emerged to represent the area of research specifically related to climate studies in the agronomic domain.

This presentation will describe how work in the area of *agrometeorology* relates to *geocomputation*, which is another so-called 'new' multi-disciplinary (some use the term trans-disciplinary) field that combines mathematics, computer science, information systems, electrical engineering, geodetic science, geography, econometrics and various associated disciplines such as plant biology and physiology, soil science and a range of environmental sciences.

In this presentation, as an example of *agrometeorology*, an international collaborative research project will be described with particular reference to vineyard management. A wireless sensor network (WS) terrestrial telemetry architecture is outlined together with a description of its implementation from concept, through design and development, to deployment in the field. Details of the sensors, their calibration and testing will also be provided. The sensor arrays are housed in a framework with their own (solar) power supplies, GPS, Wi-Fi transmitter and micro-computer for *in situ* signal processing and data communications protocol processing. Data is passed from individual sensor arrays at parameterised intervals through a coordinating node (a gateway) to an Internet enabled upload process to a central server. This server acquires data from all the international locations. Monitoring software on

the server provides immediate real-time reporting to each location while also populating a 'public' website, which illustrates analysed data in terms of actual and trend information. This information system and its use will be outlined.

Processing the monitored data for a variety of purposes requires geostatistical analyses and mathematical modelling. Some data is interpolated (using inverse distance weighting, kriging, etc) for use with GIS applications (some examples will be given) and in the case of estimation or prediction of single data values or events, models with more sophistication such as the ensemble Kalman filter (EnKF) are used.

The real-time monitoring system and web-based information system are designed for use by decision-makers. Some examples of this information being used by crop managers will be described, as will some research projects underway by members of the international scientific team.

## Authors Biography



Dr Philip J. Sallis completed a PhD in the area of meta- information process modelling at City University London in 1979. Since then he has held academic position in England, Australia and New Zealand, with past and current research professorships in the USA, Hong Kong and Chile. He was appointed to the Foundation Chair in Information Science at The University of Otago, New Zealand in 1987, a position he held for 13 years. In 1999 he became Deputy Vice Chancellor at the Auckland University of Technology (AUT) where he led the academic, research innovation and enterprise activities of the university. Choosing to leave that role after a decade, he returned to full-time research and is now Director of the Geoinformatics Research Centre at AUT, while also retaining the position of Pro Vice Chancellor, assisting the Vice Chancellor with a range of strategic planning and ambassadorial tasks.

Philip's return to full-time research was for the most part because he wanted to pursue some ideas he had for environment monitoring and modelling related to agronomy. His keynote lecture describes how this idea took hold and how it has provided him with an opportunity for leadership of an innovative international collaboration of academics, scientists and practitioners, especially in the wine industry. He will outline the overall concept for the research programme, the wireless sensor Network (WSN) he and his colleagues have designed, built and deployed across eight countries together with the real-time environment monitoring software and web-base information system designed for use by managers and decision-makers in the field. He will also describe the data modelling approaches being used for estimation/prediction of event information and the range of projects being worked on by members of his international research group.

Since completing his doctoral studies Philip has been at the forefront of tertiary computing education for 35 years and held senior academic and research development positions. He has been a regular conference speaker, publisher of journal articles and books, designer of curriculum and member of numerous review committees including ACM, IEEE, SEARCC, the BCS and other international computing groups. He was for 3 years President of the NZCS during which time he was a chair of three NZ government commissions relating to

computing in schools, science curriculum and information technology with industry. His awards include an IBM doctoral research scholarship, a Davidson Trust Research Fellowship, a United States Library of Congress (National Digital Mapping Archive) research award, two Australian and two New Zealand research awards, two professional fellowships and several research funding grants in the UK, USA, Australia, New Zealand and Chile.

With his wife Dr Kathy Garden, he spends several months each year in Chile where from his position as Adjunct Research Professor at the Catholic University in Maule (Geospatial information Processing Laboratory) he coordinates the work of the GRC throughout South America. He also works closely with the Environmental Research Laboratory at Ritsumeiken Asia-Pacific University to which he makes frequent visits.

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