

# Sensing instrumentation for micro-environment data management

Keynote address by

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

This presentation describes an international research collaboration relating to micro-environment data monitoring and modelling for applications in agriculture. The particular area of agriculture in focus at this time is grape crop production. In viticulture, 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.

A fit-for-purpose wireless sensor network (WSN) terrestrial telemetry architecture is described 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 is 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.

## **Brief curriculum vitae - Philip J. Sallis PhD**

Philip 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.

Philip is a Fellow of the NZ Computer Society, Member of the Association For Computer Machinery, Lifetime Member of the International Association for Mathematical Geosciences, Member of the Royal Society of NZ, a Senior member of the IEEE, Hon Chair of the IEEE Instrumentation and Measurement Society (NZ Chapter) and Associate Editor for the International Journal of Sensing and Intelligent Systems.