# GeoComputation 2019

## Adventures in GeoComputation



## NEW ZEALAND
## GEOSPATIAL RESEARCH CONFERENCE 2019

18 September // Queenstown Memorial Hall // Queenstown, Otago
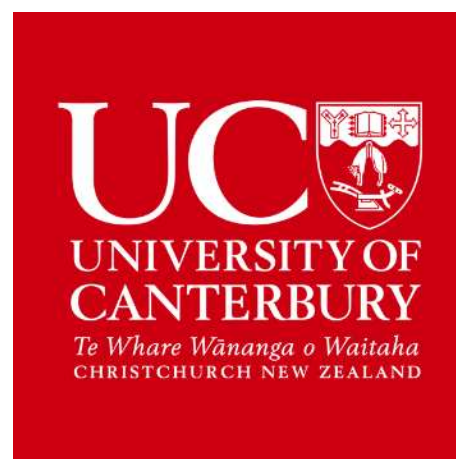
## Programme for figshare

# Contents

**https://auckland.figshare.com/GeoComputation2019**

**Welcome to the 15th International Conference on GeoComputation, GeoComputation 2019**, running from 18th to 21st September 2019 in Queenstown, NZ. This conference is grouped with the **New Zealand Geospatial Research Conference (NZGRC)** and the **Spatial Data Science with Python workshop**. It marks the return of the GeoComputation conference to New Zealand (after the 2nd conference in Dunedin, 1997) and of NZGRC to Otago (after Dunedin, 2013).

We have a broad and exciting programme for you, encompassing the following topic areas: a **themed session** on Novel spatiotemporal paradigms, and sessions on; Cyber GIS, Open Geospatial and VGI; Environmental modelling, Remote Sensing, Surfaces and Hydrology; Qualitative spatial reasoning and 'Geography in Text'; Applied (inc. urban and social) spatial analysis, Geosimulation and Agents; Geostatistics and Uncertainty; AI, Machine learning and Spatial data mining, and; Computational Movement Analysis.

The **proceedings** are online and available via the University of Auckland figshare site (permanent, with DOI): **https://auckland.figshare.com/GeoComputation2019**

You will find 23 papers and 41 extended abstracts there that have passed review by two members of our international Scientific Review Committee. In addition there are 4 keynote and 6 poster abstracts. The authors of submissions with the best reviews have been invited to extend their manuscripts so that they can be considered for a GeoComputation 2019 special issue of the **Journal of Spatial Information Science (JoSIS)**, to be published in 2020.

We would like to thank our excellent keynote speakers: Janet Franklin (University of California Riverside, US), Rachel Franklin (Newcastle University, UK), Shawn Laffan (University of New South Wales, Australia) and Mark Gahegan (University of Auckland). We are very grateful for the support from our

sponsors:

*Gold* - Koordinates (sponsoring Janet Franklin's keynote), University of Otago Sciences / Surveying (sponsoring Rachel Franklin's keynote);

*Silver* - Land Information New Zealand (LINZ);

*Bronze* - University of Auckland School of Environment, Geospatial Research Institute;

*NZGRC sponsor* - Spatial Industries Business Association (GRI and SIBA are jointly sponsoring the Icebreaker Reception),and;

*Other sponsor* - Locus.

We are also grateful to Serge Rey (University of California Riverside, US) for running his Spatial Data Science workshop here. Thanks to everyone supporting these events in various roles: the scientific reviewers, session chairs, conference helpers, our hosts, caterers and AV crew. Most of all thanks to you, the presenters and participants for making this event what it is.

Wishing you all a great conference and exciting adventures in GeoComputation.

And if you're on Twitter, remember to post your thoughts, photos etc. on the conference with the **#GeoComp2019** hashtag (we'll be posting from **@GeoCompNews**).

Cheers!

Tony Moore

(on behalf of the organising committee: Ben Adams, Mairead de Roiste, Mark Gahegan, Christina Hulbe, David O'Sullivan, Katarzyna Sila-Nowicka, Peter Whigham and Matthew Wilson (NZGRC chair))


https://www.otago.ac.nz/geocomputation/index.html

https://geospatial.ac.nz/nzgrc-2019/

# Figshare Collection Groupings

Keynotes and Front Matter:

- This document
- Geospatial data for forecasting global change impacts on ecosystems. *Janet Franklin*
- Our GIS is (still) too small. *Mark Gahegan*
- Inequality and the Smart City. *Rachel Franklin*
- An accessible GeoComputation. *Shawn Laffan*

Cyber GIS, Open Geospatial and VGI

- Space-Time is the Key: For Expressing Spatial-Temporal Computing. *Eric Shook*
- High Performance Geocomputation for Assessing Human Dynamics at Planet Scale. *Budhendra Bhaduri, Dalton Lunga, Hsiu-Han Lexie Yang, Jacob McKee, Melanie Laverdiere, Kuldeep Kurte and Jibonananda Sanyal*
- Geocomputational infrastructure for population-environment data. *Steven Manson, Tracy Kugler, David Van Riper, Jonathan Schroeder and Steven Ruggles*
- Longitudinal analysis of multilateral spatial interactions. *May Yuan and Wei Luo*
- Modeling Building Use and Population Distribution Opportunity Using Open Geosocial Data in Urban Areas. *Kevin Sparks, Kelly Sims, Gautam Thakur, Marie Urban and Robert Stewart*
- Streaming Geospatial Data into Virtual Reality. *Alexander Herzig*
- Reproducible Geocomputation: an open or shut case? *Mark Gahegan*

Environmental Modelling, Remote Sensing, Surfaces and Hydrology

- The Role of Theory and Geocomputation in Describing and Simulating Landscape Performance. *John Wilson*
- A Bivariate Thin-Plate Adaptive Smoothing Spline (BTPASS) to reduce noise in photogrammetric digital surface models. *Pascal Sirguey*
- Tracing and visualisation of contributing water sources in a model of flood inundation. *Matthew Wilson and Tom Coulthard*
- Evolution of micrometeorological observations: Instantaneous spatial and temporal surface wind velocity from thermal image processing.

*Benjamin Schumacher, Marwan Katurji, Ivana Stiperski, Christina Dunker and Jiawei Zhang*

- Joint use of space-borne SAR, optical imagery and air-borne LiDAR for improved mapping of forest structural types in New Zealand. *Jan Zörner, John R. Dymond, James D. Shepherd, Susan K. Wiser, David Pairman and Marmar Sabetizade*
- Calculating the surface melt rate of Antarctic glaciers using satellite derived temperatures. *Lars Brabyn and Glen Stichbury*
- Automated glacier terminus detection in time series of satellite imagery using the 2D Wavelet Transform Modulus Maxima (WTMM) segmentation method. *Julia Liu, Ellyn Enderlin and Andre Khalil*
- Coupling an XFEM code for linear elastic fracture propagation to a viscous flow model. *Martin Forbes and Christina Hulbe*

Qualitative Spatial Reasoning and Geography in the Text

- He Tatai Whenua: Automated Extraction of Landscape Terms and their Meanings in New Zealand Maori. *Kristin Stock, Hone W. Morris, Margaret Forster, Rex Paraku and Ekaterina Egorova*
- A New Data Model for Depicting Traditional Ecological Knowledge in GIS via Motifs, Folk Thesauri and Narratives. *Kierin Mackenzie, Dylan Kirk, Christophe Claramunt and Femke Reitsma*
- Mapping Languages and Demographics with Georeferenced Corpora. *Jonathan Dunn and Benjamin Adams*
- Mining the Semantic Similarity of Spatial Relations from Text. *Niloofar Aflaki, Christopher B. Jones and Kristin Stock*
- A modification of RCC*-9. *Azadeh Izadi, Torsten Hahmann, Hans W. Guesgen and Kristin Stock*
- Extracting Geometric Representations Of Trajectories Using Topological Data Analysis. *Thomas Edwards, Christopher Jones and Padraig Corcoran*

Applied spatial (urban and social) analysis, Geosimulation and Agents

- Geosimulating hazard warning triggers: geometry, dynamics, and timing. *Thomas Cova*
- Application of Vector Agents to Weed detection from UAV imagery. *Kambiz Borna, Tony Moore, Barbara Bollard and Akbar Ghobakhlou*
- Detecting, Modeling and Predicting Vertical Urban Growth: A Systematic Review. *Yuanyuan Huang, Yan Liu and Scott Lieske*

- A spatial simulation model to explore the potential impact of gene drives as a control on invasive wasps. *David O'Sullivan, George Perry and Phil Lester*
- Social Spatial: A Qualitative GIS for Social Big Data Investigations. *Michael Martin*
- Is Servicing Commuters the Goal of the Public Transport System? *Itzhak Benenson, Maria Marinov and Eran Ben Elia*
- Learnings from developing and implementing geospatial urban planning decision-support tools in Aotearoa New Zealand. *Mirjam Schindler, Rita Dionisio, Ines Falcao and Simon Kingham*
- Geocomputation and Spatial Analytics. *Alan Murray*
- Areal interpolation of population in the USA using a combination of national parcel data and a national building outline layer. *Eric Weber, Jessica Moehl and Amy Rose*
- The importance of managing co-variate and distance biases in point-pattern clustering. *Peter Whigham, Brandon de Graaf, Rashi Srivastava and Paul Glue*

Geostatistics and Uncertainty

- Using local maps of spatial accuracy for benthic habitat models. *Jennifer Miller, Marji Puotinen and Ben Radford*
- Computing Uncertainty of Natural Neighbour Interpolation. *Thomas Etherington*
- Quality of Geo Web Services – Elements, Measures, Procedures. *Wolfgang Reinhardt*
- Scalable geographically weighted regression for big data. *Daisuke Murakami, Narumasa Tsutsumida, Takahiro Yoshida, Tomoki Nakaya and Binbin Lu*
- Geographically Weighted Non-negative Principal Component Analysis for Exploring Spatial Variation in Multidimensional Composite Index. *Narumasa Tsutsumida, Daisuke Murakami, Takahiro Yoshida, Tomoki Nakaya, Binbin Lu and Paul Harris*
- Kernel Density Analysis of Active Transport to School Patterns in Dunedin Adolescents. *Long Chen, Antoni Moore and Sandra Mandic*
- Integration of precision farming data and spatial statistical modelling to interpret field-scale maize grain yield variability in New Zealand. *Guopeng Jiang, Miles Grafton, Diane Pearson, Mike Bretherton and Allister Holmes*

Novel Spatio-Temporal Paradigms

- Teaching Agent-Based Modelling and Machine Learning in an integrated way. *Ellen-Wien Augustijn-Beckers, Rania Kounadi, Tatjana Kuznecova and Raul Zurita-Milla*
- Scientific workflows for discovering appropriate parameter settings in environmental modelling. *Nenad Radosevic, Matt Duckham and Gang-Jun Liu*
- Spatially detail urban carbon mapping: Integration of top-down and bottom-up approaches.*Takahiro Yoshida, Yoshiki Yamagata and Daisuke Murakami*
- Enabling spaces by GeoComputation. *Luke Bergmann and David O'Sullivan*
- Combining longitudinal data analysis with networks to examine spatio-temporal variation. *Sarah Gadd, Peter Tennant, Mark S Gilthorpe and Alison Heppenstall*
- Our GIS is a Game Engine: Bringing Unity to Spatial Simulation of Rockfalls. *Rob Harrap, Jean Hutchinson, Zac Sala and Matt Ondercin*
- The integration of vector-based cellular automata and partitioned rules for simulation of land use change. *Yi Lu and Shawn Laffan*
- Coupling Machine Learning and Cellular Automata-Markov Chain to Model Urban Expansion in a Fast Developing Area: A Case Study of Liangjiang New District of Chongqing, China. *Tingting Xu, Jay Gao and Giovanni Coco*

AI, Machine Learning and Spatial Data Mining

- A Computational Framework for Monitoring Black-Odorous Water from Remote Sensed Data and Data Mining Techniques. *Yichun Xie, Ji Yang, Alicia Zhou, Chenghu Zhou and Yong Li*
- Network-constrained Bivariate Clustering Method for Detecting Urban Black Holes and Volcanoes. *Zhihui Wu and Qiliang Liu*
- How does socio-economic and demographic dissimilarity determine physical and virtual segregation? *Michael Dorman, Tal Svoray and Itai Kloog*
- Using Machine Learning Methods to Identify and Classify the Regions and Projections of Online Maps. *Jialin Li and Ningchuan Xiao*

- Using mixed-effect random forest models to capture spatial patterns: a case study on urban crime. *Raul Zurita-Milla, Afnindar Fakhrurrozi and Ourania Kounadi*
- Experiential modelling of urban street: a combining approach with neural image assessment and street experiment. *Yoshiki Yamagata, Takahiro Yoshida, Haruna Matsui, Perry Yang and Chen Helen*
- Learning Digital Geographies through a Graph-Based Semi-supervised Approach. *Pengyuan Liu and Stefano De Sabbata*
- The Effectiveness of Sentiment Analysis for Detecting Fine-grained Service Quality. *Mohammad Masoud Rahimi, Elham Naghizade, Stephan Winter and Mark Stevenson*

Computational Movement Analysis

- Using movement parameters to infer dynamic interactions between moving object pairs. *Jennifer Miller*
- Activity Change Index (ACI) – new aspects of indoor mobility identified from GPS and lifelogging data. *Katarzyna Sila-Nowicka and Piyushimita Thakuriah*
- Understanding population fluctuations through volunteered geographic information and novel indicators: The experience of Rakiura, Stewart Island, New Zealand. *Mathew Darling, Benjamin Adams, Caroline Orchiston, Thomas Wilson and Brendon Bradley*
- Visualising Data From Dolphin Observations Through Adaptively Ordered Space-time Matrices. *Judy Rodda and Antoni Moore*
- Using crowdsourced data to map bicycling behaviour. *Vanessa Brum-Bastos, Colin Ferster and Trisalyn Nelson*
- From generalisation to segmentation: Douglas-Peucker-Ramer and movement data. *Aubrey Miller, Antoni Moore and Greg Leonard*
- Comparing the costs of pedestrian wayfinding heuristics across different urban network morphologies. *Debjit Bhowmick, Stephan Winter and Mark Stevenson*
- Analysis of an Ad-hoc Platoon Formation and Dissolution Strategy on a Multi-lane Highway. *Santa Maiti, Stephan Winter, Lars Kulik and Sudeshna Sarkar*
- Towards Intervention and Counterfactual modelling in spatial agents: A simulation of constrained movement at the Observational level. *Saeed Rahimi, Antoni B. Moore and Peter A. Whigham*
- Ant Colony Optimization-based Spatial Scan Statistic for Detecting Statistically Significant Spatial Communities in Vehicle Movements. *Sancheng Zhu, Qiliang Liu and Zhihui Wu*

Posters

- Extracting Area and Period of Influence of New Rail Service on Real Estate Market Using Fused-MCP. *Koichiro Den and Ryo Inoue*
- Short-term Traffic Volume Prediction at a Signalised Intersection Using LSTM. *Ryo Masuda and Ryo Inoue*
- Accuracy of Pléiades Photogrammetric Products Under Direct and Controlled Georeferencing. *Clare Lewis, Pascal Sirguey and Simon Cox*
- Modelling ice shelf flow over isolated bathymetric rises on the seafloor. *Holly Still and Christina Hulbe*
- Exploring the Influence of Source and Scale of Phenological Model Inputs at Continental Scale. *Hamed Mehdi Poor, Raul Zurita-Milla, Emma Izquierdo-Verdiguier and Julio L. Betancourt*
- Automated large scale hazard indication mapping for snow avalanches. *Yves Buehler, Daniel von Rickenbach, Marc Christen, Stefan Margreth, Andreas Stoffel, Lukas Stoffel and Roderick Kühne*

# General Programme

| | |
|---|---|
| **Weds. 18th Sept.** | **NZGRC 2019 / *Spatial Data Science Workshop*** (Queenstown Memorial Centre, Main Hall Tiered, Stage Area, Supper Room) |
| 0900 – 1040 | Keynote and Plenaries (T) / *Session 1 (St)* |
| 1040 – 1115 | Morning Break (Su) |
| 1115 – 1300 | Regular Talks (T) / *Session 2 (St)* |
| 1300 – 1400 | Lunch and Posters (Su) |
| 1400 – 1545 | Regular Talks (T) / *Session 3 (St)* |
| 1545 – 1615 | Afternoon Break (Su) |
| 1615 – 1730 | Lightning Talks & Plenary (T) / *Session 4 (St)* |
| 1800 – 2000 | GeoComputation Icebreaker Reception (Su) |
| **Thurs. 19th Sept.** | **GeoComputation 2019** (Rydges Lakeland Hotel, Queenstown, Clancy's, Wakatipu Rooms, Common Area) |
| 0915 – 1030 | Welcome and Keynote 1 (Q) |
| 1030 – 1100 | Morning Break (Co) |
| 1100 – 1200 | Parallel Session 1 (Q, Cl, W) |
| 1200 – 1230 | Posters (Co) |
| 1230 – 1400 | Lunch (Co) |
| 1400 – 1520 | Parallel Session 2 (Q, Cl) |
| 1520 – 1600 | Afternoon Break (Co) |
| 1600 – 1700 | Parallel Session 3 (Q, Cl) |
| **Fri. 20th Sept.** | **GeoComputation 2019** (Rydges Lakeland Hotel) |
| 0920 – 1030 | Keynote 2 (Q) |
| 1030 – 1110 | Morning Break (Co) |
| 1110 – 1230 | Parallel Session 4 (Q, Cl, W) |
| 1230 – 1400 | Lunch (Co) |
| 1400 – 1520 | Parallel Session 5 (Q, Cl) |
| 1520 – 1600 | Afternoon Break (Co) |
| 1600 – 1700 | Keynote 3 (Q) |
| 1900 – onwards | Conference Dinner (Prime Restaurant) |
| **Sat. 21st Sept.** | **GeoComputation 2019** (Rydges Lakeland Hotel) |
| 0920 – 1030 | Keynote 4 (Q) |
| 1030 – 1110 | Morning Break (Co) |
| 1110 – 1230 | Parallel Session 6 (Q, Cl, W) |
| 1230 – 1400 | Lunch (Co) |
| 1400 – 1500 | Parallel Session 7 (Q, Cl) |
| 1500 – 1530 | Afternoon Break (Co) |
| 1530 – 1630 | Parallel Session 8 (Q, Cl) |
| 1630 – 1640 | Conference Close |

# Detailed GeoComputation Programme
## https://auckland.figshare.com/GeoComputation2019

| Wednesday 18th September | Venue: Queenstown Memorial Centre (see map) | |
|---|---|---|
| 0900 - 1700 | *New Zealand Geospatial Research Conference* | *Spatial Data Science Workshop with PySal (Serge Rey)* |
| 1800 - | *GeoComputation **Icebreaker Reception** (sponsored by **Geospatial Research Institute (GRI)** and **Spatial Industries Business Association (SIBA)**)* | |

| Thursday 19th September | Venue: Rydges Lakeland Hotel (see map) | | |
|---|---|---|---|
| 0915 - 0930 | *Welcome to the Conference and Housekeeping (Queenstown Room)* | | |
| 0930 - 1030 | *Keynote 1: **Janet Franklin** (**Geospatial data for forecasting global change impacts on ecosystems**) (sponsored by **Koordinates**) (Queenstown Room, Chair: Ben Adams)* | | |
| 1030 - 1100 | Morning break | | |
| 1100 - 1200 | *Parallel Session 1 Stream 1:* **Cyber GIS** *(Queenstown Room, Chair: Janet Franklin)* | *Parallel Session 1 Stream 2:* **Surfaces and Hydrology** *(Clancy's Room, Chair: Yichun Xie)* | *Parallel Session 1 Stream 3:* **Geography in the Text** *(Wakatipu Room, Chair: Rachel Franklin)* |
| 1100-1120 | **Space-Time is the Key: For Expressing Spatial-Temporal Computing.** *Eric Shook* | **The Role of Theory and Geocomputation in Describing and Simulating Landscape Performance.** *John Wilson* | **He Tatai Whenua: Automated Extraction of Landscape Terms and their Meanings in New Zealand Maori.** *Kristin Stock, Hone W. Morris, Margaret Forster, Rex Paraku and Ekaterina Egorova* |
| 1120-1140 | **High Performance Geocomputation for Assessing Human Dynamics at Planet Scale.** *Budhendra Bhaduri, Dalton Lunga, Hsiu-Han Lexie Yang, Jacob McKee, Melanie Laverdiere, Kuldeep Kurte and Jibonananda Sanyal* | **A Bivariate Thin-Plate Adaptive Smoothing Spline (BTPASS) to reduce noise in photogrammetric digital surface models.** *Pascal Sirguey* | **A New Data Model for Depicting Traditional Ecological Knowledge in GIS via Motifs, Folk Thesauri and Narratives.** *Kierin Mackenzie, Dylan Kirk, Christophe Claramunt and Femke Reitsma* |
| 1140-1200 | **Geocomputational infrastructure for population-environment data.** *Steven Manson, Tracy Kugler, David Van Riper, Jonathan Schroeder and Steven Ruggles* | **Tracing and visualisation of contributing water sources in a model of flood inundation.** *Matthew Wilson and Tom Coulthard* | **Mapping Languages and Demographics with Georeferenced Corpora.** *Jonathan Dunn and Benjamin Adams* |

| Thursday 19th September | Venue: Rydges Lakeland Hotel (see map) | |
|---|---|---|
| 1200 - 1230 | *Poster* Session (Common Area, Chair: Lars Brabyn) | |
| | **Extracting Area and Period of Influence of New Rail Service on Real Estate Market Using Fused-MCP.** *Koichiro Den and Ryo Inoue* | |
| | **Short-term Traffic Volume Prediction at a Signalised Intersection Using LSTM.** *Ryo Masuda and Ryo Inoue* | |
| | **Accuracy of Pléiades Photogrammetric Products Under Direct and Controlled Georeferencing.** *Clare Lewis, Pascal Sirguey and Simon Cox* | |
| | **Modelling ice shelf flow over isolated bathymetric rises on the seafloor.** *Holly Still and Christina Hulbe* | |
| | **Exploring the Influence of Source and Scale of Phenological Model Inputs at Continental Scale.** *Hamed Mehdi Poor, Raul Zurita-Milla, Emma Izquierdo-Verdiguier and Julio L. Betancourt* | |
| | **Automated large scale hazard indication mapping for snow avalanches.** *Yves Buehler, Daniel von Rickenbach, Marc Christen, Stefan Margreth, Andreas Stoffel, Lukas Stoffel and Roderick Kühne* | |
| 1230 - 1400 | Lunch | |
| 1400 - 1520 | *Parallel Session 2 Stream 1:* <br> ***Open Geospatial and VGI*** <br> *(Queenstown Room, Chair: David Medyckyj-Scott)* | *Parallel Session 2 Stream 2:* <br> ***Geosimulation and Agents*** <br> *(Clancy's Room, Chair: Shawn Laffan)* |
| 1400-1420 | **Longitudinal analysis of multilateral spatial interactions.** <br> *May Yuan and Wei Luo* | **Geosimulating hazard warning triggers: geometry, dynamics, and timing.** <br> *Thomas Cova* |
| 1420-1440 | **Modeling Building Use and Population Distribution Opportunity Using Open Geosocial Data in Urban Areas.** <br> *Kevin Sparks, Kelly Sims, Gautam Thakur, Marie Urban and Robert Stewart* | **Application of Vector Agents to Weed detection from UAV imagery.** <br> *Kambiz Borna, Tony Moore, Barbara Bollard and Akbar Ghobakhlou* |
| 1440-1500 | **Streaming Geospatial Data into Virtual Reality.** <br> *Alexander Herzig* | **Detecting, Modeling and Predicting Vertical Urban Growth: A Systematic Review.** <br> *Yuanyuan Huang, Yan Liu and Scott Lieske* |
| 1500-1520 | **Reproducible Geocomputation: an open or shut case?** <br> *Mark Gahegan* | **A spatial simulation model to explore the potential impact of gene drives as a control on invasive wasps.** <br> *David O'Sullivan, George Perry and Phil Lester* |

| Thursday 19th September | Venue: Rydges Lakeland Hotel (see map) | |
|---|---|---|
| **1520 - 1600** | Afternoon break | |
| **1600 - 1700** | *Parallel Session 3 Stream 1:*<br>***Urban and Social Analysis***<br>*(Queenstown Room, Chair: Tom Cova)* | *Parallel Session 3 Stream 2:*<br>***Uncertainty***<br>*(Clancy's Room, Chair: Steven Manson)* |
| 1600-1620 | **Social Spatial: A Qualitative GIS for Social Big Data Investigations.**<br>*Michael Martin* | **Using local maps of spatial accuracy for benthic habitat models.**<br>*Jennifer Miller, Marji Puotinen and Ben Radford* |
| 1620-1640 | **Is Servicing Commuters the Goal of the Public Transport System?**<br>*Itzhak Benenson, Maria Marinov and Eran Ben Elia* | **Computing Uncertainty of Natural Neighbour Interpolation.**<br>*Thomas Etherington* |
| 1640-1700 | **Learnings from developing and implementing geospatial urban planning decision-support tools in Aotearoa New Zealand.**<br>*Mirjam Schindler, Rita Dionisio, Ines Falcao and Simon Kingham* | **Quality of Geo Web Services – Elements, Measures, Procedures.**<br>*Wolfgang Reinhardt* |
| **1700** | Close (free night to explore Queenstown) | |

| Friday 20th September | Venue: Rydges Lakeland Hotel | | |
|---|---|---|---|
| **0920 - 0930** | Housekeeping | | |
| **0930 - 1030** | *Keynote 2: **Mark Gahegan** (**Our GIS is (still) too small**)* <br> *(Queenstown Room, Chair: Tony Moore)* | | |
| **1030 - 1110** | Morning break | | |
| **1110 - 1230** | *Parallel (Themed) Session 4 Stream 1:* <br> ***Novel Spatiotemporal Paradigms 1*** <br> *(Queenstown Room, Chairs: Raul Zurita-Milla and Ellen-Wien Augustijn-Beckers)* | *Parallel Session 4 Stream 2:* <br> ***Geostatistics*** <br> *(Clancy's Room, Chair: Mark Gahegan)* | *Parallel Session 4 Stream 3:* <br> ***Spatial Data Mining*** <br> *(Wakatipu Room, Chair: Alan Murray)* |
| 1110-1130 | **Teaching Agent-Based Modelling and Machine Learning in an integrated way.** <br> *Ellen-Wien Augustijn-Beckers, Rania Kounadi, Tatjana Kuznecova and Raul Zurita-Milla* | **Scalable geographically weighted regression for big data.** <br> *Daisuke Murakami, Narumasa Tsutsumida, Takahiro Yoshida, Tomoki Nakaya and Binbin Lu* | **A Computational Framework for Monitoring Black-Odorous Water from Remote Sensed Data and Data Mining Techniques.** <br> *Yichun Xie, Ji Yang, Alicia Zhou, Chenghu Zhou and Yong Li* |
| 1130-1150 | **Scientific workflows for discovering appropriate parameter settings in environmental modelling.** <br> *Nenad Radosevic, Matt Duckham and Gang-Jun Liu* | **Geographically Weighted Non-negative Principal Component Analysis for Exploring Spatial Variation in Multidimensional Composite Index.** <br> *Narumasa Tsutsumida, Daisuke Murakami, Takahiro Yoshida, Tomoki Nakaya, Binbin Lu and Paul Harris* | **Network-constrained Bivariate Clustering Method for Detecting Urban Black Holes and Volcanoes.** <br> *Zhihui Wu and Qiliang Liu* |
| 1150-1210 | **Spatially detail urban carbon mapping: Integration of top-down and bottom-up approaches.** <br> *Takahiro Yoshida, Yoshiki Yamagata and Daisuke Murakami* | **Kernel Density Analysis of Active Transport to School Patterns in Dunedin Adolescents.** <br> *Long Chen, Antoni Moore and Sandra Mandic* | **How does socio-economic and demographic dissimilarity determine physical and virtual segregation?** <br> *Michael Dorman, Tal Svoray and Itai Kloog* |
| 1210-1230 | **Enabling spaces by GeoComputation.** <br> *Luke Bergmann and David O'Sullivan* | **Integration of precision farming data and spatial statistical modelling to interpret field-scale maize grain yield variability in New Zealand.** <br> *Guopeng Jiang, Miles Grafton, Diane Pearson, Mike Bretherton & Allister Holmes* | **Using Machine Learning Methods to Identify and Classify the Regions and Projections of Online Maps.** <br> *Jialin Li and Ningchuan Xiao* |

| Friday 20th September | Venue: Rydges Lakeland Hotel | |
|---|---|---|
| **1230 - 1400** | Lunch | |
| **1400 - 1520** | *Parallel (Themed) Session 5 Stream 1:*<br>***Novel Spatiotemporal Paradigms 2***<br>*(Queenstown Room, Chairs: Ellen-Wien Augustijn-Beckers and Raul Zurita-Milla)* | *Parallel Session 5 Stream 2:*<br>***Applied Spatial Analysis***<br>*(Clancy's Room, Chair: May Yuan)* |
| 1400-1420 | **Combining longitudinal data analysis with networks to examine spatio-temporal variation.**<br>*Sarah Gadd, Peter Tennant, Mark S Gilthorpe and Alison Heppenstall* | **Geocomputation and Spatial Analytics.**<br>*Alan Murray* |
| 1420-1440 | **Our GIS is a Game Engine: Bringing Unity to Spatial Simulation of Rockfalls.**<br>*Rob Harrap, Jean Hutchinson, Zac Sala and Matt Ondercin* | **Areal interpolation of population in the USA using a combination of national parcel data and a national building outline layer.**<br>*Eric Weber, Jessica Moehl and Amy Rose* |
| 1440-1500 | **The integration of vector-based cellular automata and partitioned rules for simulation of land use change.**<br>*Yi Lu and Shawn Laffan* | **The importance of managing co-variate and distance biases in point-pattern clustering.**<br>*Peter Whigham, Brandon de Graaf, Rashi Srivastava and Paul Glue* |
| 1500-1520 | **Coupling Machine Learning and Cellular Automata-Markov Chain to Model Urban Expansion in a Fast Developing Area: A Case Study of Liangjiang New District of Chongqing, China.**<br>*Tingting Xu, Jay Gao and Giovanni Coco* | |
| **1520 - 1600** | Afternoon break | |
| **1600 - 1700** | *Keynote 3:* **Rachel Franklin** (**Inequality and the Smart City**) *(sponsored by* **University of Otago Division of Sciences / School of Surveying***)*<br>*(Queenstown Room, Chair: Matt Wilson)* | |
| **1700** | Close | |
| **1900 -** | ***Conference Dinner @ Prime Restaurant*** **(see map)** | |

| Saturday 21st September | Venue: Rydges Lakeland Hotel | | |
|---|---|---|---|
| **0920 - 0930** | Housekeeping | | |
| **0930 - 1030** | *Keynote 4: **Shawn Laffan** (**An accessible GeoComputation**)*<br>*(Queenstown Room, Chair: Peter Whigham)* | | |
| **1030 - 1110** | Morning break | | |
| **1110 - 1230** | *Parallel Session 6 Stream 1:*<br>***Computational Movement Analysis 1***<br>*(Queenstown Room, Chair: Eric Shook)* | *Parallel Session 6 Stream 2:*<br>***AI and machine learning***<br>*(Clancy's Room, Chair: Itzhak Benenson)* | *Parallel Session 6 Stream 3:*<br>***Qualitative Spatial Reasoning***<br>*(Wakatipu Room, Chair: Michael Martin)* |
| 1110-1130 | **Using movement parameters to infer dynamic interactions between moving object pairs.**<br>*Jennifer Miller* | **Using mixed-effect random forest models to capture spatial patterns: a case study on urban crime.**<br>*Raul Zurita-Milla, Afnindar Fakhrurrozi and Ourania Kounadi* | **Mining the Semantic Similarity of Spatial Relations from Text.**<br>*Niloofar Aflaki, Christopher B. Jones and Kristin Stock* |
| 1130-1150 | **Activity Change Index (ACI) – new aspects of indoor mobility identified from GPS and lifelogging data.**<br>*Katarzyna Sila-Nowicka and Piyushimita Thakuriah* | **Experiential modelling of urban street: a combining approach with neural image assessment and street experiment.**<br>*Yoshiki Yamagata, Takahiro Yoshida, Haruna Matsui, Perry Yang and Chen Helen* | **A modification of RCC\*-9.**<br>*Azadeh Izadi, Torsten Hahmann, Hans W. Guesgen and Kristin Stock* |
| 1150-1210 | **Understanding population movements through volunteered geographic information and novel indicators: The experience of Rakiura, Stewart Island, New Zealand.**<br>*Mathew Darling, Benjamin Adams, Caroline Orchiston, Thomas Wilson and Brendon Bradley* | **Learning Digital Geographies through a Graph-Based Semi-supervised Approach.**<br>*Pengyuan Liu and Stefano De Sabbata* | **Extracting Geometric Representations Of Trajectories Using Topological Data Analysis.**<br>*Thomas Edwards, Christopher Jones and Padraig Corcoran* |
| 1210-1230 | **Visualising Data From Dolphin Observations Through Adaptively Ordered Space-time Matrices.**<br>*Judy Rodda and Antoni Moore* | **The Effectiveness of Sentiment Analysis for Detecting Fine-grained Service Quality.**<br>*Mohammad Masoud Rahimi, Elham Naghizade, Stephan Winter and Mark Stevenson* | |

| Saturday 21st September | Venue: Rydges Lakeland Hotel | |
|---|---|---|
| **1230 - 1400** | Lunch | |
| **1400 - 1500** | *Parallel Session 7 Stream 1:* <br> ***Computational Movement Analysis 2*** <br> *(Queenstown Room, Chair: Katarzyna Sila-Nowicka)* | *Parallel Session 7 Stream 2:* <br> ***GeoComputation and Remote Sensing*** <br> *(Clancy's Room, Chair: Pascal Sirguey)* |
| 1400-1420 | **Using crowdsourced data to map bicycling behaviour.** <br> *Vanessa Brum-Bastos, Colin Ferster and Trisalyn Nelson* | **Evolution of micrometeorological observations: Instantaneous spatial and temporal surface wind velocity from thermal image processing.** <br> *Benjamin Schumacher, Marwan Katurji, Ivana Stiperski, Christina Dunker and Jiawei Zhang* |
| 1420-1440 | **From generalisation to segmentation: Douglas-Peucker-Ramer and movement data.** <br> *Aubrey Miller, Antoni Moore and Greg Leonard* | **Joint use of space-borne SAR, optical imagery and air-borne LiDAR for improved mapping of forest structural types in New Zealand.** <br> *Jan Zörner, John R. Dymond, James D. Shepherd, Susan K. Wiser, David Pairman and Marmar Sabetizade* |
| 1440-1500 | **Comparing the costs of pedestrian wayfinding heuristics across different urban network morphologies.** <br> *Debjit Bhowmick, Stephan Winter and Mark Stevenson* | **Calculating the surface melt rate of Antarctic glaciers using satellite derived temperatures.** <br> *Lars Brabyn and Glen Stichbury* |
| **1500 - 1530** | Afternoon break | |
| **1530 - 1630** | *Parallel Session 8 Stream 1:* <br> ***Computational Movement Analysis 3*** <br> *(Queenstown Room, Chair: Jennifer Miller)* | *Parallel Session 8 Stream 2:* <br> ***Environmental Modelling*** <br> *(Clancy's Room, Chair: Rob Harrap)* |
| 1530-1550 | **Analysis of an Ad-hoc Platoon Formation and Dissolution Strategy on a Multi-lane Highway.** <br> *Santa Maiti, Stephan Winter, Lars Kulik and Sudeshna Sarkar* | **Automated glacier terminus detection in time series of satellite imagery using the 2D Wavelet Transform Modulus Maxima (WTMM) segmentation method.** <br> *Julia Liu, Ellyn Enderlin and Andre Khalil* |
| 1550-1610 | **Towards Intervention and Counterfactual modelling in spatial agents: A simulation of constrained movement at the Observational level.** <br> *Saeed Rahimi, Antoni B. Moore and Peter A. Whigham* | **Coupling an XFEM code for linear elastic fracture propagation to a viscous flow model.** <br> *Martin Forbes and Christina Hulbe* |
| 1610-1630 | **Ant Colony Optimization-based Spatial Scan Statistic for Detecting Statistically Significant Spatial Communities in Vehicle Movements.** <br> *Sancheng Zhu, Qiliang Liu and Zhihui Wu* | |
| **1630 - 1640** | Conference close | |

# Keynotes

## Janet Franklin



Janet Franklin is a Distinguished Professor in the Department of Botany, University of California at Riverside since 2017.

She was previously a Regent's Professor Schools of Geographical Sciences and Urban Planning at Arizona State University where she was appointed in 2009. From 1988-2009 she was on the faculties of Geography and Biology at San Diego State University.

She received her Ph.D. in Geography from the University of California – Santa Barbara in 1988.

She specializes in Landscape Ecology, Biogeography, and Geographic Information Science. Franklin's research is focused on in the patterns and dynamics of terrestrial (land) plant communities at the landscape scale. Her work addresses the impacts of human-caused landscape change on the environment.

Human land use -- agriculture and urbanization -- and other large-scale human impacts such as climate change, and the introduction of exotic species, often interact with natural disturbance regimes such as fire, flooding and hurricanes, to shape plant community dynamics in forests, shrublands, and other ecosystems. How resilient are ecological communities to these impacts?

She is a Member of the National Academy of Sciences, USA, and a Fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and the Ecological Society of America.

## *Geospatial data for forecasting global change impacts on ecosystems*

Human activities have altered global patterns of biodiversity, and key processes of energy balance and biogeochemical cycling in the Earth system, especially over the last 500 years.

These changes have been so profound that they are detectable in the geological record and some have suggested that this is a new geological era, The Anthropocene. Owing to the anthropogenic global change agents -- land use change, climate change, nitrogen deposition,

altered disturbance regimes and transport of invasive species -- the planet may have already moved outside of a safe operating space for humanity in several dimensions.

I use geospatial data in my research for monitoring and forecasting the effects of land-use change (deforestation and urbanization leading to habitat loss and fragmentation), and climate change on biodiversity and ecosystem function. Processes leading to biodiversity loss are inherently spatial. Knowing where biodiversity is found is the basis for spatial conservation planning.

Knowing where on the landscape threats occur in relation to biodiversity is prerequisite to monitoring impacts. Forecasting where threats might occur in the future allows prediction of future impacts. The effects of climate change on species and ecosystems is already detectable globally, with earlier arrival of spring affecting plant and animal phenology, bird and other animal migrations, and so forth, and with species distributions shifting in directions consistent with observed climate changes.

I will show how static species distribution models, and dynamic population and community simulations, have been used to forecast the separate and combined impacts of climate and land use change on plant distributions. Geospatial data scientists play a critical role in these efforts.

## Rachel Franklin

Rachel Franklin recently joined Newcastle University as professor of geographical analysis in the Spatial Analytics and Modeling (SAM@NCL) Lab and the Centre for Urban and Regional Development Studies (CURDS). She is also a Fellow of the Alan Turing Institute and is the current editor of Geographical Analysis. Prior to Newcastle, she was the associate director of Brown University's initiative in spatial structures in the social sciences (S4), in the U.S. She is trained as a quantitative human geographer and her research focus is in spatial demography and the interplay between spatial analytics and demographic change, in particular quantifying patterns, sources and impacts of spatial inequality.

## Inequality and the Smart City

In this talk, I provide an overview of the promise and perils of the smart city, linking these to broader-scale technological changes occurring at global to local scales.

I then focus on the criticism that many elements of smart cities—for example, increased surveillance or algorithmic bias—may create or magnify societal and spatial inequalities.

The heart of the talk engages with one specific component of the smart city-inequality debate: how and for whom knowledge is produced within cities, with a focus on sensor placement, coverage gaps, and uncertainty variability.

A case study for Newcastle (UK) is presented to help illustrate the issues. In concluding, I highlight the importance of this aspect of smart city inequality, especially with regard to public health and policy efficacy.

## Shawn Laffan

Shawn Laffan's research interests are in geocomputation and geospatial data analysis, with application domains spanning biodiversity, terrain analysis, disease modelling and human distributions.

A key focus of this research is tool development, most of which is free and open source. He is the lead developer of the Biodiverse tool for the spatial analysis of diversity (http://purl.org/biodiverse).

He has a BSc(Hons) and PhD from the ANU. He has held academic positions at both ANU and UNSW, and is currently an Associate Professor at UNSW.

Since 2015 he has been a regional and associate editor of the International Journal of Geographical Information Science. He has also attended 60% of GeoComputation conferences including this one.

## An accessible GeoComputation

Researchers in GeoComputation typically have access to comparatively high powered computational systems, large amounts of data storage, ample knowledge for where and how such data can be found and,

perhaps most importantly, the ability to cobble it all together into a (semi-) coherent system of scripts and code libraries, possibly using a polyglot of languages and coding paradigms.

However, many researchers outside GeoComputation and similar fields have no such access to systems and data, and are either intimidated by, or disinterested in, tool development, even in a single language environment. This issue is magnified for those outside of research environments who need and want access to model results to get their work done, but do not have access to researchers or analysts who can generate them.

Making analytical tools accessible beyond the academy is an ongoing concern across computational research domains. Cloud based systems are important for such processes, but are usually not free, and do not readily address the issues of data discovery and access. Biodiversity is a case in point. We are in the sixth mass extinction event in Earth's history, with ongoing threats due to processes such as climate changes and land use and land cover change. Understanding the spatial distribution of biodiversity in the past, present and future is essential for understanding how it all fits together and for the allocation of scarce conservation resources. It is unusual for conservation practitioners to have skills in modelling and access to computational resources.

The Biodiversity and Climate Change Virtual Laboratory (BCCVL) and EcoCloud projects have both been developed to enable such access. Both are major collaborative project between researchers across multiple universities, with primary funding from the Australian Research Data Commons (ARDC) and its antecedent organisations. They are open source projects that are freely accessible to anyone, and provide access to algorithms and data with a high performance computing back-end.

The BCCVL (https://bccvl.org.au) provides an easy to use interface for species distribution modelling applying up to 17 algorithms for multiple species simultaneously, with these results projected into the future under nine different potential emissions scenarios (Hallgren et al. 2015). Further analysis types support the identification of hotspots of endemic species, ensemble analyses to combine SDM results from different algorithms, as well as more specialised analyses such as for species traits and migratory species. All of this can be applied across terrestrial, marine and freshwater aquatic systems, with a range of visualisations and performance metrics being provided. Many essential data sets are provided, with support for users to upload their own.

The EcoCloud (https://ecocloud.org.au) is a broader project that provides access to virtual desktops (CoESRA) and interactive coding environments (RStudio and Jupyter) backed by high performance computing environments. Having such power available means that analytical workflows can be developed with realistically sized data sets, rather than scaled-down versions that can conceal crippling performance bottlenecks. Perhaps the part of EcoCloud with the broadest appeal is its Data Explorer. This provides a search interface across a wide range of environmental data for Australia (47,000 data sets at the time of writing), with code snippets making it a simple copy-and-paste exercise to load these data into a coding environment to integrate into analytical workflows.

Platforms like the BCCVL and EcoCloud remove some of the cognitive burden needed to implement and understand models and analytical tools, and obviate many of the computational limitations faced by researchers who will ultimately use the tools developed in GeoComputation and related fields.

Hallgren, W., Beaumont, L., Bowness, A., Chambers, L., Graham, E., Holewa, H., Laffan, S. et al (2016) The Biodiversity and Climate Change Virtual Laboratory: Where Ecology meets Big Data. Environmental Modelling and Software, 76, 182-186.

# Mark Gahegan

Mark Gahegan's research interests are broad, covering most aspects of GIS, visualization, philosophy of science, semantics and pragmatics, e-science, representation of scientific knowledge, geocomputation, digital remote sensing, artificial intelligence tools, spatial analysis, Voronoi diagrams, spatial databases and algorithms, and spatial reasoning. He has also dabbled in mineral potential mapping, epidemiology, habitat analysis, bio-informatics, e-learning and predicting land-cover change.



Mark is currently director of the Centre for eResearch at the University of Auckland, a group that aids researchers to tackle challenging computational research by providing scientific computing and software

engineering expertise, patternable services such as virtualised compute platforms, research data services, visualisation and analytics, and educational offerings to upskill the research community.

Mark came to Auckland from Penn State University, where he was involved in a number of funded research projects, from ontology capture to spatial epidemiology. He also directed a new Professional Masters degree program in GIS www.worldcampus.psu.edu/MasterinGIS_GIS.shtml, developed at the Dutton e-Education Institute www.e-education.psu.edu at Penn State, and delivered through World Campus www.worldcampus.psu.eduhttp://www.worldcampus.psu.edu.

## *Our GIS is (still) too small*

The Geographers who led the Quantitative Revolution did not have a GIS to help them. They learned the skills and built the tools they needed to address their problems of choice, and they did not expect anyone else to build the tools for them. In the meantime, GIS have been successfully applied over the last 30 years to many geographical problems. But technologies and associated theory can become limiting if they end up defining how we see the world and what we believe are worthy and tractable research problems. This talk explores some of the limitations currently impacting GISystems and GIScience from the perspective of technology and community, contrasting GIScience with other informatics communities and their practices. It explores several themes: (i) GIScience and the informatics revolution, (ii) the lack of a community-owned innovation platform for GIScience research, (iii) the computational limitations imposed by desktop computing and the inability to scale up analysis (iv) the continued failure to support the temporal dimension, and especially dynamic processes and models with feedbacks, (v) the challenge of embracing a wider and more heterogeneous view of geographical representation and analysis and (vi) the urgent need to foster an active software development community to redress some of these shortcomings. Geocomputation, too, suffers from the lack of a shared, community platform for software development, evaluation and use. How can we change this?

# Spatial Data Science with Python Workshop

The Spatial Data Science with Python (PySAL) workshop on 18th September will be led by Prof. Sergio Rey, University of California, Riverside. More detail and resources needed can be found at this github site: https://github.com/sjsrey/pysalworkshop

Schedule:

- 9:00-10:40
  - Overview of PySAL and workshop
  - Introductions
  - Setup
  - Jupyter notebooks
  - Python primer
- 10:40-11:15
  - Coffee Break
- 11:15-13:00
  - Spatial data processing
  - Choropleth mapping and geovisualization
- 13:00-14:00
  - Lunch
- 14:00-15:45
  - Spatial weights
  - Global spatial autocorrelation
  - Local spatial autocorrelation
- 15:45-16:15
  - Coffee Break
- 16:15-17:30
  - Spatial inequality dynamics
  - Regionalization and clustering

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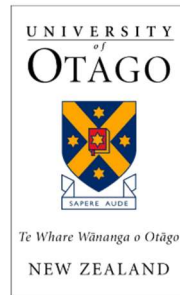


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