RESEARCH EXPERIENCE

GNS Science Wellington, NZ
Senior Scientist, Computational Geoscientist 2014 – present
Characterize, predict, and quantify uncertainty in environmental and earth processes and responses across spatiotemporal scales using traditional and alternative data fusion and discovery paradigms (see Research Achievements for details), for example:

- Alternate data-fusion paradigms in hydrogeology
- Completion and clustering of sparse hydrochemical data
- Effect of climate-change impacts on coastal environments
- Estimation and scaling of hydrostratigraphic units with hydrogeophysical data
- Evaluating role of large earthquakes on aquifer dynamics
- Hydrogeophysical modeling of geothermal systems
- Hybrid numerical inverse solver combining evolutionary and gradient algorithms
- Joint-inverse numerical solver combining genetic and artificial neural network algorithms
- Modeling conditional uncertainty in rainfall-recharge estimates
- Predicting aquatic species and metrics under natural and anthropogenic stresses
- Predicting groundwater recharge as function of stream flow and oxygen isotopes
- Real-time mapping of surficial aquifers using hydrogeophysical data
- Real-time classifying of landscape components using hyperspectral data
- Reduced order analysis of multi-scale geosystems
- Spatiotemporal downscaling of virtual climate station network
- Unconventional oil-gas prospecting with gravity, magnetics, radiometric
- Unconventional shale-gas prospecting with local/global geochemistry/mineralogy
- International collaboration (active): Australia (Geoscience Australia), Brazil (University of Campinas; University of Brasilia, Federal University of Natal; Empresa Brasileira de Pesquisa Agropecuária), China (Chinese Academy of Sciences; Sun Yat-sen University), Georgia (Tblisi State University), Italy (Semeion Institute; University of Florence), New Zealand (Regional councils, Ministry of Business, Innovation and Employment), Spain (Institute of Environmental Assessment and Water Research), USA (United States Geological Survey-Denver, University of Colorado-Denver).

Victoria University Wellington, NZ
School of Geography, Environment, and Earth Sciences 2015-present
Associate Professor – Honorary Research Associate

University of Colorado Denver, CO
Department of Mathematical & Statistical Sciences 2014-present
Associate Professor - Adjoint

Department of Mathematical & Statistical Sciences 2010-present
Center for Computational and Mathematical Biology
Associate Professor - Advisory board member

- Adaptive artificial adaptive mathematical models in environment and medicine
- Ecosystem network modeling (supervised/unsupervised machine-learning

Department of Geography and Environmental Science 2004-2010
Lecturer – Adjunct

- Modeling unsaturated zone flow and transport

University of Campinas Campinas, Brazil
Geosciences Institute 2013

Visiting professor

- Uncertainty analysis in self-organizing map estimates of gold mineralization

University of Brasilia Brasilia, Brazil
Geosciences Institute 2013
Visiting professor

- Joint geophysical imaging of phosphate deposits
- Joint inversion of receiver function and surface wave dispersion

University of Campinas Campinas, Brazil
Center for Meteorological and Climate Research Applied to Agriculture 2012
Visiting professor

- Soft computing and hybrid modeling of climate-change and sugar cane

Empresa Brasileira de Pesquisa Agropecuária Campinas, Brazil
Satellite Monitoring 2012
Visiting scientist

- Classifying soil and crop types from satellite hyperion data
- Mapping of agricultural targets using MODIS data and artificial neural networks
- Multi-scale remote mapping of ecosystem changes using machine-learning algorithms
- Harvest forecasting with multi-sensor data and agroclimatic database
- Landscape discrimination in Brazil using hyperspectral data and self-organizing map

Geological Survey of Brazil Fortaleza, BR
Visiting scientist 2008

- Groundwater exploration in fractured crystalline terrain

University of Brasilia Brasilia, BR
Geosciences Institute 2008
Visiting professor

- Joint hydrogeologic-geophysical imaging of salt water intrusion

U.S. Geological Survey Denver, CO
Research Geophysicist 2005 – 2014
Inverse, computational-intelligent, and hybrid modeling solutions
(see Research Achievements for details) for:

- Aquatic-mining ecosystem connectivity and response
- Data fusion of disparate, sparse, coupled, nonlinear, and noisy data
- Climate-change effects and socio-economics of United States
- Climate-change effects on groundwater recharge
- Climate and hydrology in formation of acid-rock drainage
- Connectivity mapping among groundwater system variables
- Coupled watershed processes under climate change
- Detection and discrimination of unexploded ordnance
- Differentiating background and mine-related acidity and metals
- Downscaling and spatiotemporal modeling of climate data
- Dual permeability and reactive transport model development
- Economic feasibility of mining undiscovered mineral deposits
- Efficacy of reactive barriers to mitigate mine-waste problems
- Hydrogeologic properties from magnetic resonance data
- Estimating properties from spatially-limited sampling and different scales
- Flood-warning tool for Haitian government
- Forecast change in ecological integrity for Chicago area

- Global conditional climate-change trends
- Groundwater modeling of the Bishkek region, Kyrgyz republic
- Hillslope weathering and shallow ground-water quality
- Hydrogeologic map of Mauritania, Africa
- Imaging lithospheric boundaries and their uncertainty
- Infiltration and drainage in arid intermountain valleys
- Joint prediction of well yield in northeastern Brazil
- Joint inversion of seismic and magnetotelluric data for crustal imaging
- Joint estimation of extreme rainfall in ungauged basins
- Landscape discrimination using remote sensing data and artificial adaptive systems
- Metal mine waste speciation and toxicity effects on aquatic receptors
- Mineral-resource effects on aquatic ecosystems
- Modeling mineral-resource effects on the environment
- Modeling post-fire debris-flow volumes and their uncertainty
- Modeling hydrologic and geomorphic hazards across post-fire landscapes
- Near real-time airborne electromagnetic imaging of surficial aquifers
- Nonlinear uncertainty in joint seismic crustal imaging
- Optimization of stochastic reservoir operations
- Persistence of El Niño-Southern Oscillation phenomena over 2,000 years
- Predicting coastal hydro-meteorological hazards
- Predicting background and mine-related acidity and metals
- Probable undiscovered mineral endowments
- Post-fire debris and flood response
- Probable flooding in ungaged basins
- Quantifying streamflow uncertainty in ungaged basins
- Radar imaging of contaminant spill
- Reactive chemistry in Aries River basin tailings
- Reconstruction of global temperature change and solar activity
- Reconstructing conditional trends in climate and solar activity
- Remote location of improvised explosive devices
- Scaling of ground-water recharge measurements
- Sediment transport in mining-affected Aries River basin
- Spatial continuity from spatially-limited data for numerical inverse problems
- Statistical reliability of geophysical instruments to unexploded ordnance
- Stresses on water-quality in existing and proposed mining watersheds
- Stochastic assessment of undiscovered mineral resources
- Strong validation test for biodegradation model
- Tisa Basin tailings and waste dump inventory and risk prioritization
- Uncertainty in seismic joint inversion process
- Uncertainty in airborne estimates of gold mineralization
- Uncertainty in multi-component reactive groundwater systems
- Variably-saturated dual permeability flow and transport
- Vertical drainage and groundwater flow in arid intermountain valleys
- Water-quality response across hydrothermal alteration-mining gradient

U.S. Geological Survey Denver, CO
Research Hydrologist 2001-2004
Forward and inverse numerical modeling solutions for:

- Agricultural land-use study in South Platte River basin
- Calibration and predictive analysis of vadose zone models
- Enhanced remediation of toluene biodegradation in vadose zone

- Hydrologic risk assessment and flood protection for coastal basins
- Magnitude of mining stress based on seismic tomographic
- Post-wildfire assistance to US Federal Emergency Management Agency
- Post-wildfire flood potential in Willow and Mitchell Creek watersheds
- Preferential flow and transport in the High Plains aquifer
- Probable effects of proposed reservoir on river quantity and quality
- Satellite resolution and effects on wildfire-induced flood models
- Simulating water and solute transport in variably-saturated macroporous soil
- Stochastic optimization of reservoir operations for water-quality benefits

U.S. Geological Survey Urbana, IL
Supervisory Hydrologist 1997 – 2001

- National Water Quality Assessment of the Upper Illinois River Basin
- Urban land-use gradient study in the Upper Illinois River Basin
- Variably-saturated mass and energy transport in 2-dimensions
- Source-water risk assessment in the Upper Illinois River Basin

Consulting St. Paul, MN
Geophysicist and Hydrologist 1996

- Remediation of radioactive waste
- Unsaturated-zone leaching of agricultural chemicals
- Tomographic imaging of deep underground metal mines

U.S. Bureau of Mines Minneapolis, MN
Research Geophysicist and Hydrologist (field methods and modeling) 1986 – 1996

- Acid-mine drainage
- Cavity detection
- Characterization of porous/fractured, saturated/unsaturated environments
- Geomechanical/geophysical technology for fractured rock
- Hydromechanical flow and transport in fracture rock
- Hydrothermal flow and transport in porous and fracture rock
- In-situ leach mining of tailings and fractured rock
- Laboratory mechanical and acoustic testing of rocks
- Mine-structural integrity using geophysics (passive/active)
- Stochastic flow and transport in fractured rock
- Porous and fractured, saturated and unsaturated zone modeling

Consulting Milwaukee, WI
Geophysicist and Hydrologist (field methods and modeling) 1984-1986

- Mine waste impoundment siting
- Leachate plume characterization