3D Geological Modelling meeting

Current 3D geological modelling practices and R&D in the mining/exploration industries, government organisations and academia

2nd circular, program and registration

Date: April 8-9, 2025 with workshop on Apr 7 and Apr 10

Venue: Tradewinds Hotel, Fremantle, Western Australia

Conference theme: Discuss the current practices in 3D geological modelling in the mining/exploration industries, government organisations and academia at all scales: applications, current state of the art, challenges, latest and future advances. The conference is organised by the Loop3D foundation and we encourage attendance and presentations from everyone.

Registration: the conference is limited to 120 participants and registration is now open at: https://loop3d.org/3Dconference2025.html

Program: (details in the following pages)

Monday 7 April, 2025	workshop: how to use Loop; hands on map2loop and LoopStructural libraries
Monday 7 April, 2025	ice breaker in the evening
Tuesday 8 April, 2025	technical presentations, poster presentations and discussion
Wednesday 9 April, 2025	technical presentations, poster presentations and discussion
Thursday 10 April, 2025	machine learning and 3D modelling; integrated geophysics and geological modelling

Organising committee:

Laurent Ailleres, Lachlan Grose, Angela Rodrigues
Monash University

Mark Jessell, Corinne Debat, Guillaume Pirot
University of Western Australia

Marie-Aude Bonnardot
Geoscience Australia

Carina Kemp
Amazon Web Services

Ruth Murdie
Geological Survey of Western Australia

Helen McFarlane
CSIRO

James Taylor
BHP

Rabii Chaarani
Northern Territory Geological Survey & Monash University

Loop3D Conference Workshop 1
Practical 3D Geological Modelling Using Loop

7th April 2025

Presenters: Lachlan Grose [LG], Laurent Ailleres [LA], Rabii Chaarani [RC], Noelle Cheng [NC], Michel Nzikou [MN], Ayla Edwards [AE], Axel Mengelle-Nicole [AM]

08:00-08:30 *Registration & Welcome*

08:30-09:00 Introduction TALK [LA]
Overview of the Loop project.

09:00-09:30 Introduction to 3D geological modelling using LoopStructural [LG]
Introduction to implicit modelling, open source software and the Loop ecosystem.

09:30-10:00 Interactive 3D Modelling using Loop in QGIS HANDS ON [LG]
Including the public release of the LoopStructural QGIS plugin allowing for modelling directly from a QGIS environment.

10:00-10:30 *morning tea*

10:30-11:00 Loop web application and usability updates TALK [LA/NC]
Overview of the Loop web applications and the future vision for building accessible and usable applications.

11:00-11:45 Preparing a Loop ready dataset TALK [RC]
An overview of the processes required to make a public geological survey dataset model ready.

11:45-12:00 Automatic map deconstruction using QGIS TALK [MN]
Overview of the map2loop QGIS plugin and an overview of using this for building 3D models.

12:00-13:00 *lunch*

13:00-15:00 Map2loop qgis + web applications HANDS ON [LA/NC/LG/NC]
Field application of null space navigation to investigate several geological scenarios.

15:00-15:30 *afternoon tea*

15:30-16:30 Resource modelling and advanced Loop use using Loop TALK [LG]
Introduction of the LoopResources framework and advanced use cases of Loop using Python. If time permits some examples

16:30-17:00 Wrap up discussion [ALL]

17:00-17:30 *Wrap up discussion*

3D Geological Modelling Conference
Technical Sessions

8th April 2025

08:20-08:50 Registration & Welcome

Chair: Mark Jessell

08:50-09:30 **Keynote** - **Marie-Aude Bonnardot**: An integrated fair modelling approach to map Australia's subsurface (Geoscience Australia)

09:30-10:00 **Giovanni Spampinato**: Improving the understanding of the geology, ore genesis and structural control of the Nifty copper deposit: the Nifty 3D model (CSIRO)

10:00-10:30 **Andrew Calvert**: 3D seismic reflector orientations from 2D seismic profiles across the Kalgoorlie greenstone belt (Simon Fraser University, Canada)

10:30-11:00 Morning tea

Chair: Marie-Aude Bonnardot

11:00-11:30 **Michael Hillier:** AI-Driven Approaches to Scalable 3D Geological Modelling: Methods, Applications, and Challenges (Geological Survey of Canada)

11:30-12:00 **Laure Capar:** Next level for QGIS: 3D representation and modelling (BRGM, France)

12:00-12:30 **Nicolas Clausolles:** An open-source toolbox for 3D geological modelling in QGIS (BRGM)

12:30-13:30 Lunch

Chair: Guillaume Pirot

13:30-14:00 **Kerry Bardot:** Incorporating structure into groundwater models (University of Western Australia)

14:00-14:30 **Anne Bui:** Workflow and challenges of regional geological models built from large multi-disciplinary datasets that underpin groundwater conceptualisation and modelling (Geological Survey of Queensland)

14:30-15:00 Afternoon tea

Chair: Helen McFarlane

15:00-15:30 **Ben Jupp:** Regional prospectivity analysis applying fuzzy logic and machine learning - extending into 3D (SRK consulting)

15:30-16:00 **Lance Karlson:** The challenges of geological modelling with blast hole measure while drill data (University of Western Australia and BHP)

16:00-18:00 **Poster Session:**

P1 - Vinicius Antunes: Preliminary mangetic and gravity inversions for the Yaoure greenstone belt, Ivory Coast, West Africa.

P2 – Elizabeth Bruce: Investigating the effects of wavelet compression on gravity inversion with examples from the Eastern Yilgarn Craton, Western Australia

P3 – **Nyeonkeon Kang**: 3D basin scale geological modelling for evaluating petroleum potential in the Jeju basin, Korea

P4 – **Guillaume Pirot:** Stochastic modelling of the lower Burdekin delta aquifer

P5 - **Ernest Swierczek**: Geotechnical structural modelling – explicit way to control geotechnical risk

3D Geological Modelling Conference
Technical Sessions

9th April 2025

08:20-08:50 Registration & Welcome

Chair: Kerry Bardot

08:50-09:30 **Keynote** – **Helen McFarlane**: Interrogating Archean domes: insights from barcoded magmatic stratigraphy and 3D modelling (CSIRO)

09:30-10:00 **Gabriel Berni**: Fault slip tendency, numerical and 3D modelling applied to target ranking at North Stawell (CSIRO)

10:00-10:30 **Kieran Thompson:** Geochemical mapping of dolerite dykes: challenges and solutions in automated block modelling (Alcoa)

10:30-11:00 Morning tea

Chair: Lachlan Grose

11:00-11:30 **Imadeddine Laouici**: A knowledge-driven modeling formalism for automatic structural interpretation (BRGM, France)

11:30-12:00 **Davis Huang:** Geological ontologies for the mineral exploration domain – a review (University of Western Australia and CSIRO)

12:00-12:30 **Amandine Fratani:** Fault data association with graph in mining context (RING, Universite de Lorraine, France)

12:30-13:30 Lunch

Chair: Sasha Banaszczyk

13:30-14:00 **Thomas Poulet:** Capturing permeability anisotropy in complex geological settings: implications for mineral exploration (CSIRO)

14:00-14:30 **Peter Schaubs:** 3D geological models and process understanding for mineral exploration (CSIRO)

14:30-15:00 Afternoon tea

Chair: Laurent Ailleres

15:00-15:30 **David Nathan:** 3D Modelling and Surface Curvature Analysis of the Osterhorngruppe Nappe: Insights into Detachment Kinematics and Salt Tectonics in the Northern Calcareous Alps (RWTH Aachen University, Germany)

15:30-16:00 **Mark Lindsay:** Spatial error constraints reduce overfitting for potential field geophysical inversion (CSIRO)

16:00-16:30 **Tasman Gillfeather-Clark**: Discovering Open File 3D Geoscience Models: A Survey of the WAMEX Database (GSWA)

16:30-17:30 **Laurent Ailleres**: An overview of Loop and the Loop Vision followed by a panel discussion on the future of 3D modelling in geology
Panel members: Helen McFarlane, Marie Aude Bonnardot, Klaus Gessner, Ben Jupp
Moderator: Laurent

Loop3D Conference Workshop 2
Recent Geophysical Developments: Inversion and Analysis

10th April 2025

Presenters: Jeremie Giraud [JG], Vitaliy Ogarko [VO], Mark Jessell [MJ], Michel Nzikou [MN], Guillaume Pirot [GP]

08:00-08:30 *Registration*

08:30-08:45 Introduction TALK [JG]
Overview of current state of inversion research globally and specifics of what will be covered.

08:45-09:15 Introduction to unconstrained inversion and ADMM using Tomofast-x TALK [VO]
General presentation of the Tomofast-x open-source potential fields inversion code, and introduction to the ADMM petrophysical bound constraints with field application.

09:15-10:00 Tomofast-x unconstrained inversion & ADMM HANDS ON [VO & JG]
Interactive examples using synthetic and field data.

10:00-10:30 *morning tea*

10:30-11:00 QGIS plugins DEMO [MJ & MN]
An overview of in-house QGIS Plugins recently developed to assist in geophysical analysis and inversion, together with geological forward modelling.

11:00-11:45 Introduction to level set inversions TALK [JG]
Introduction to geometrical inversion using level-sets, presentation of a field example.

11:45-12:00 Machine Learning and Inversion TALK [VO]
This talk highlights the promise of machine learning methods in geophysical inversion and their ability to complement and improve upon classical approaches through the integration of geological knowledge.

12:00-13:00 *lunch*

13:00-13:30 Introduction to null space analysis, the example of gravity and magnetics TALK [JG]
Exploring the concept of “null space”, how to perturb a model without changing (too much) its misfit and generate new solutions quickly.

13:30-14:00 Case studies Pyrenees gravity analysis of slab subduction TALK [JG]
Field application of null space navigation to investigate several geological scenarios.

14:00-15:00 Null space navigation HANDS ON [JG & VO]
Examples with Python: synthetic models using gravity and magnetic data, and field example using gravity data from the Pyrenees.

15:00-15:30 *afternoon tea*

15:30-16:00 presentation trans-D TALK [JG]
Introduction of the concept of trans-D inversion in 3D with field application example.

16:00-17:00 LAB trans-D DEMO + t-SNE HANDS ON [JG, GP, MJ & VO]
Analysis of results from 3D trans-D gravity inversion of synthetic and field data, visualisation using dimensionality reduction techniques.

17:00-17:30 *Wrap up discussion*