3D Geological Modelling Conference

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)

Organising committee:

Laurent Ailleres, Lachlan Grose, Angela Rodrigues
Monash University

Carina Kemp
Amazon Web Services

James Taylor
BHP

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

Ruth Murdie
Geological Survey of Western Australia

Rabii Chaarani
Northern Territory Geological Survey & Monash University

Marie-Aude Bonnardot
Geoscience Australia

Helen McFarlane
CSIRO

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 (Office of Groundwater Impact Assessment, Qld)

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   **Ye** (**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