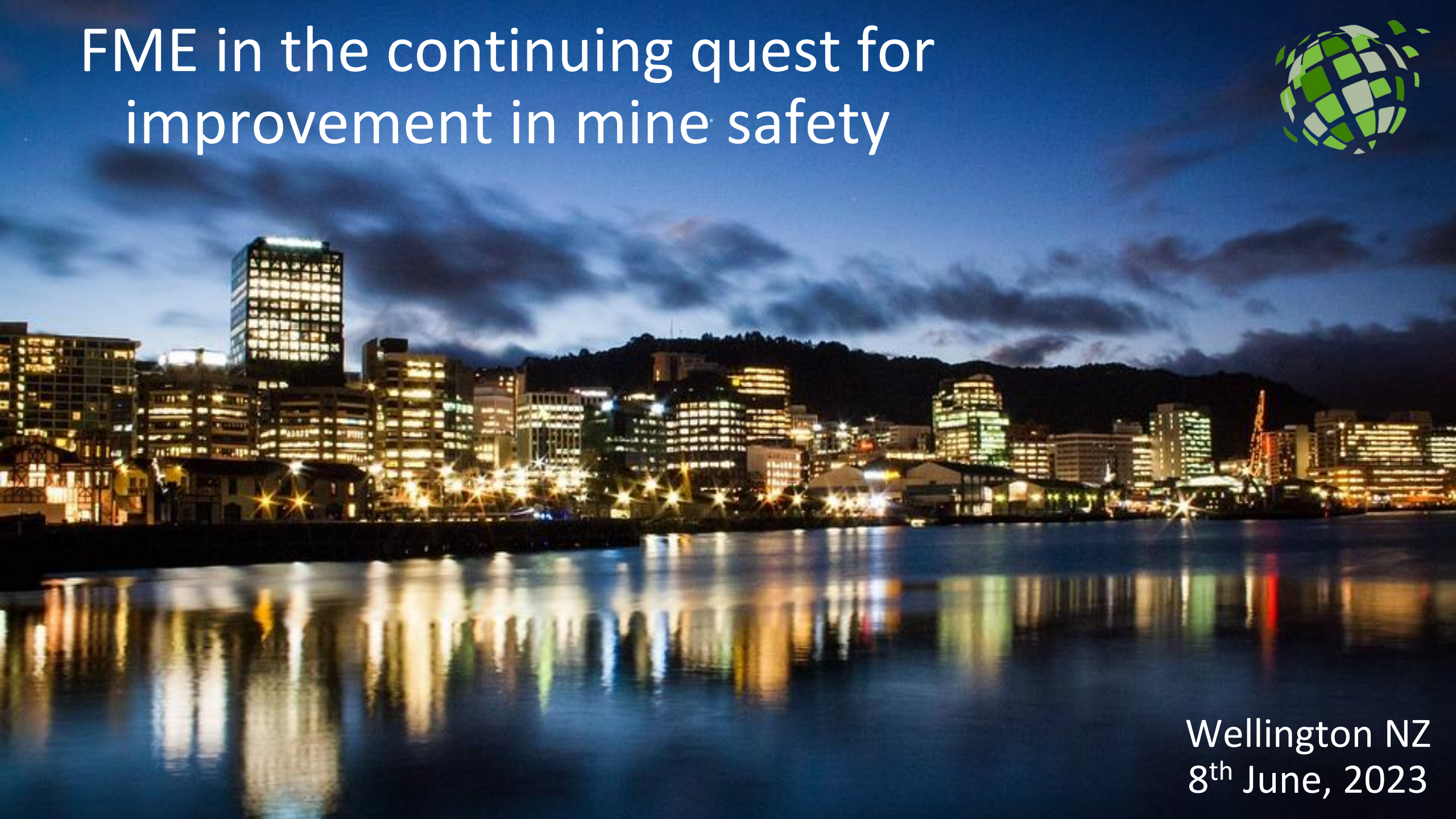
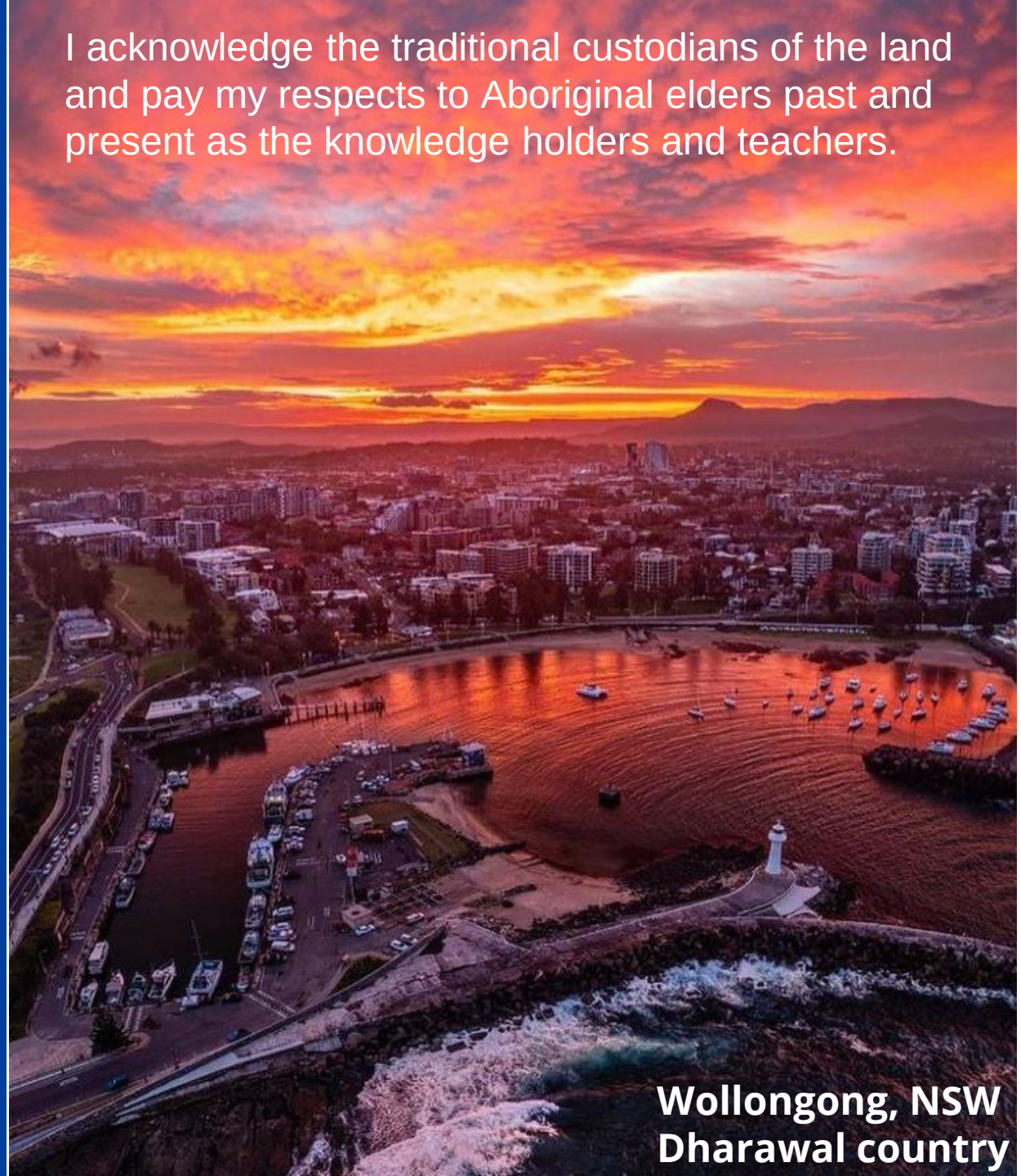
FME in the continuing quest for improvement in mine safety



Wellington NZ
8th June, 2023

I acknowledge the traditional custodians of the land and pay my respects to Aboriginal elders past and present as the knowledge holders and teachers.



Wollongong, NSW
Dharawal country

Presenter

Patrick Booth

Research Fellow, UOW
Principal, MeCee Solns

UNIVERSITY OF WOLLONGONG AUSTRALIA

meCee PTY LTD SOLUTIONS

750 lives were lost in underground coal mines around the world in the past decade as a result of methane gas explosions and gas outbursts.

The Research Problem

Current gas emission prediction tools have limited application due to reduced spatial and time base resolution.

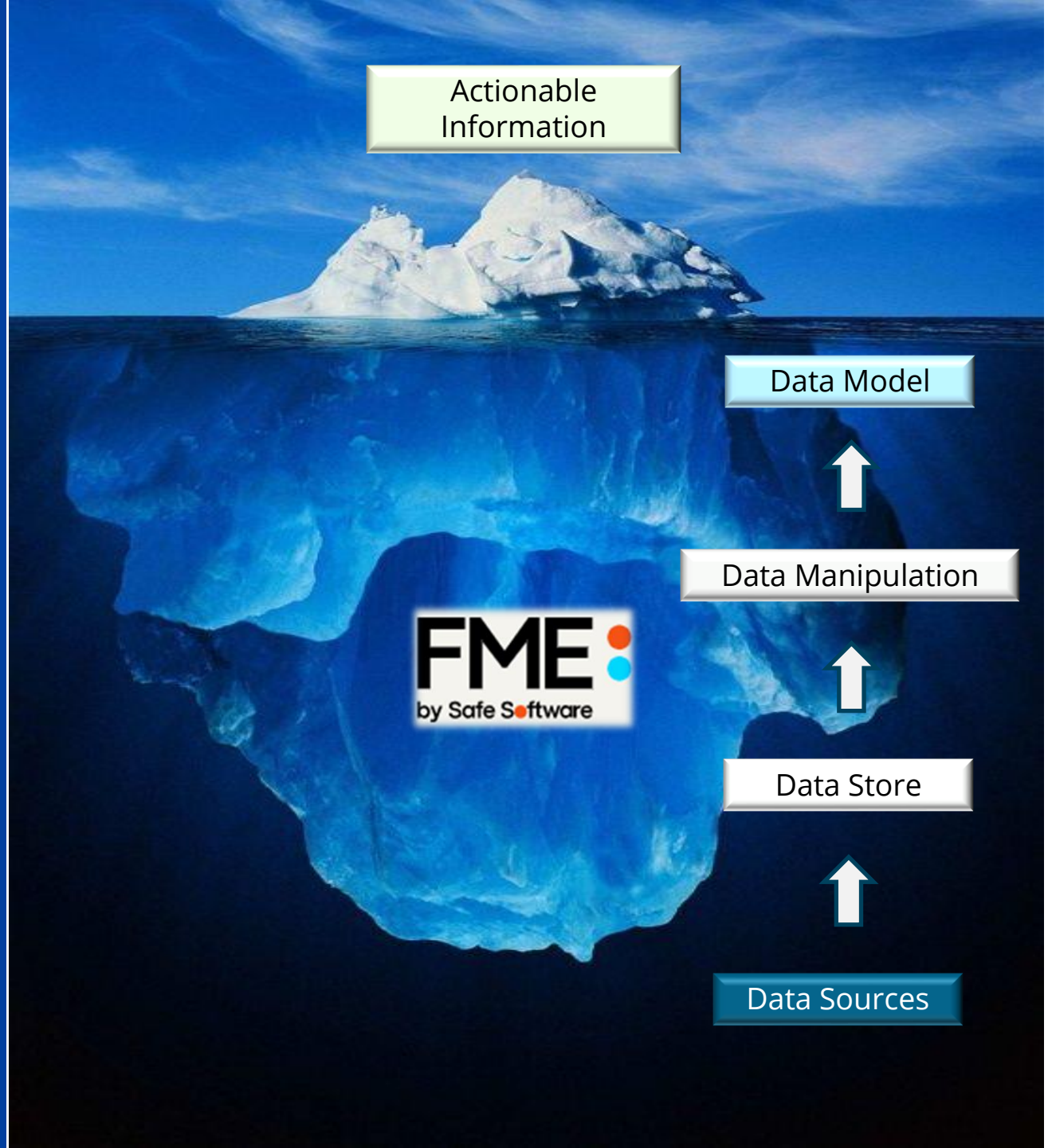
The Objective

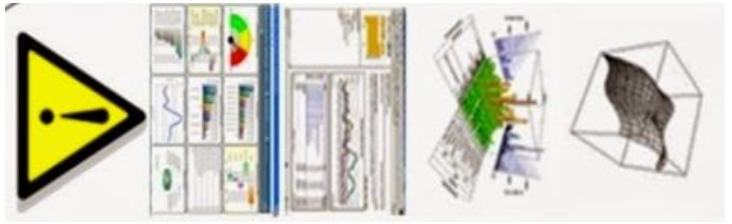
To develop a high resolution dynamic model for transient gas emission prediction from underground coal mines based on specific site conditions.

Today's agenda

What did we learn over our journey?

1. A data-driven culture is key
2. Automate the heavy lifting while being platform agnostic
3. Some examples
   a) 3D visuals & DEMs
   b) Lab & CAD data cleaning
4. Democratise the data to drive decisions and maintain operational flexibility





Data reporting and presentation layer relies on robust and repeatable data systems & processes

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Real time Data

- Production
- Gas / Ventilation
- Machinery
- Personnel

Non spatial Data

- Laboratory Results
- Planning files
- Other flat files
- Tool specific data/code

Spatial Data

- Survey drawings
- Downhole logs
- Seismic survey
- Other tracking

A data-driven culture is the key
FME can help with that !

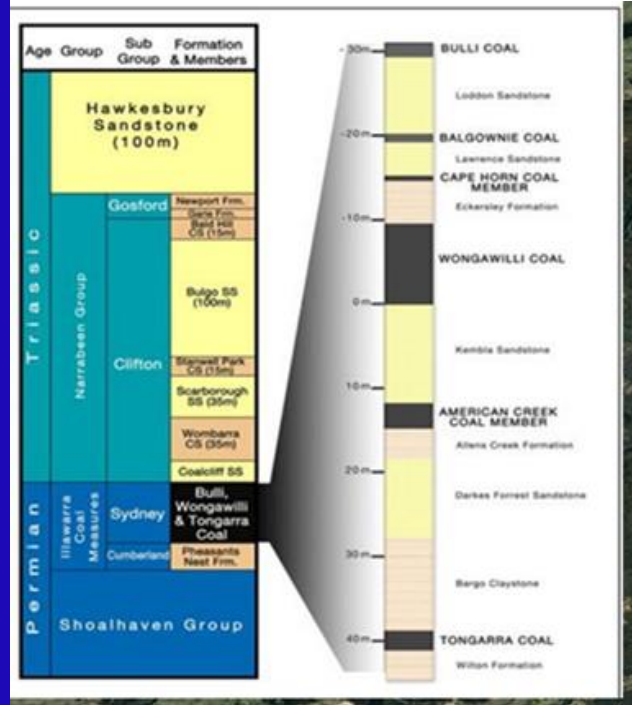
Decisions made based on fundamentals, facts and data without placing an additional burden on operational staff.

Technology and data source agnostic.

Automated and systematic data processing
with improved resolution in space & time.

Reporting and presentation layer agnostic.

Regional scale



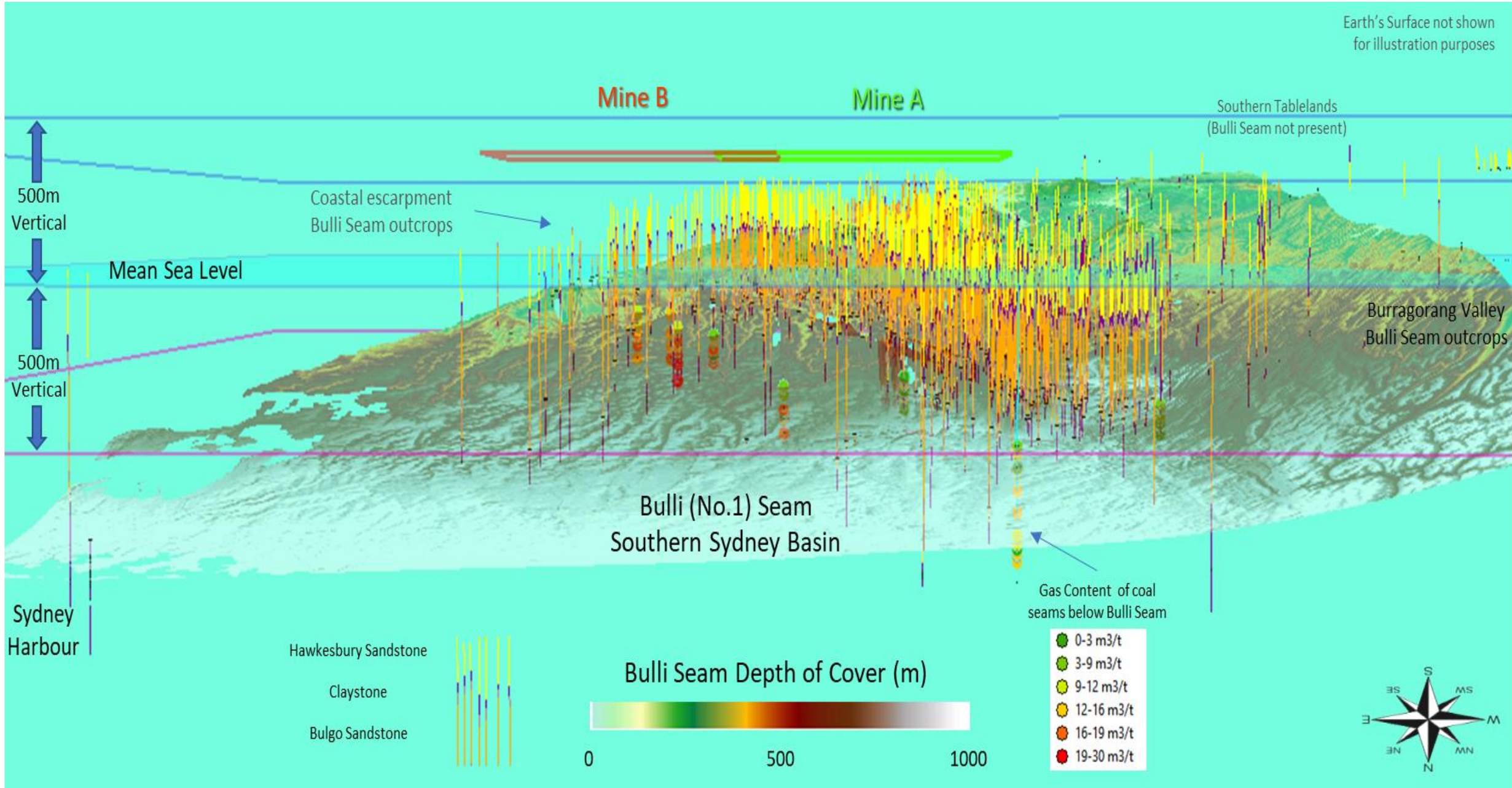
Sydney Basin in NSW, Australia

Home to 6 Million people and typically produces +10Mt of premium quality coking coal per annum from the deeper southern area.

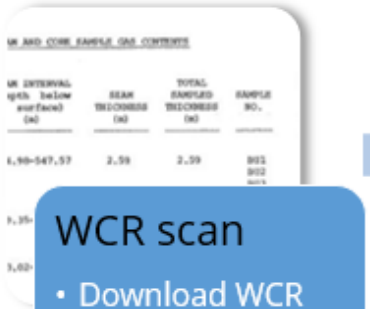
Warragamba Dam
(Main Sydney Water Supply)

Katoomba
St Marys
Wetherill Park
Macquarie Park
Frenchs
Camden
Campbelltown
Bankstown
Sydney
Hurstville
Sutherland
Maroubra
Kurnell
Woronora Dam
Cataract Dam
Bowral
Moss Vale
Avon Dam
Cordeaux Dam
Robertson
Dapto
Wollongong

Regional scale

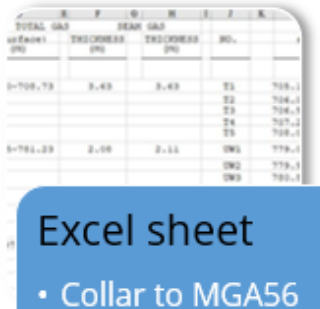


3D Exploration boreholes



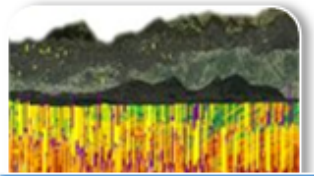
WCR scan

- Download WCR
- Clean image
- OCR conversion



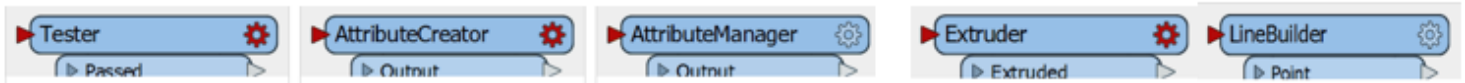
Excel sheet

- Collar to MGA56
- Feet to (m)
- Depth to RL
- Validate strata

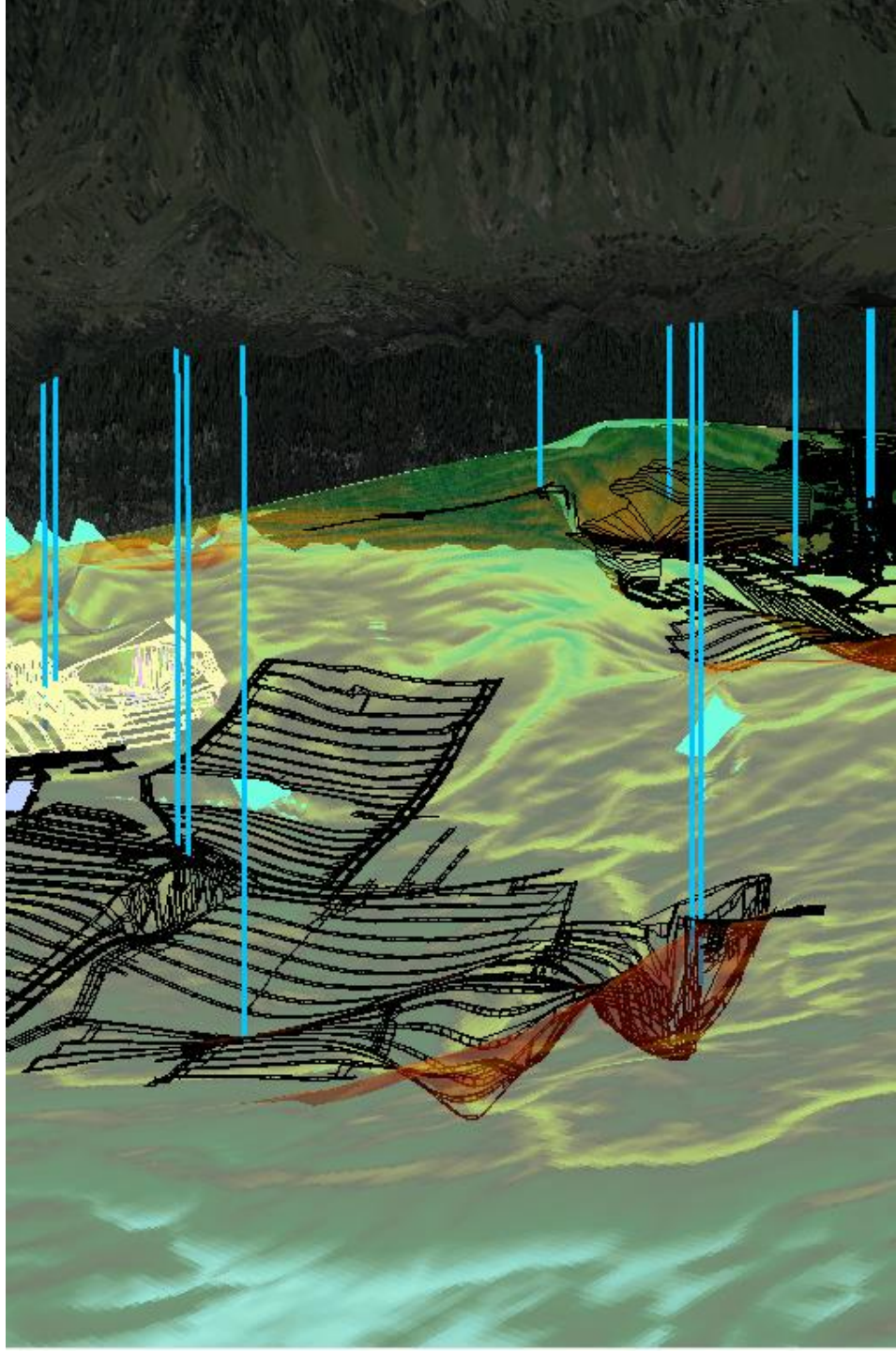


Produce 3D lines

- Create 3D point
- Add strata geology or remarks as attribute(s)
- Join 3D points to create 3D polylines



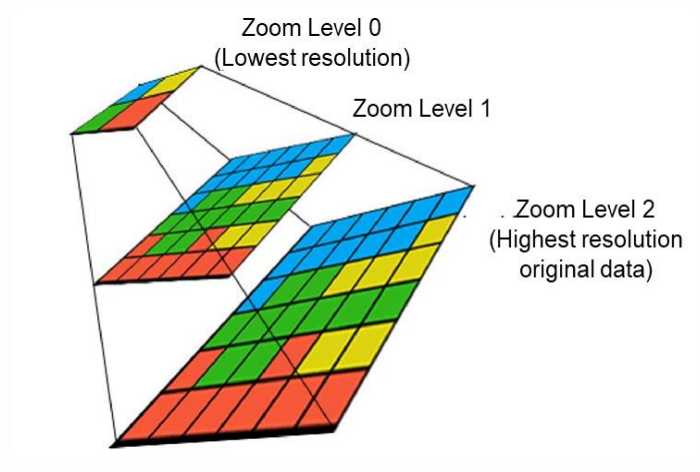
Some of the key transformers



DEMs and raster calculations

Best available Z Data

- Ideally 3D points and lines
- Contours
- Exploration data
- Seismic data with structures
- Survey data
- DGS data



Create DEM surfaces

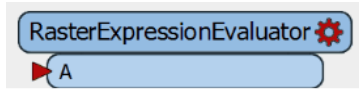
- Spline interpolation of Z
- Minimum curve approach
- Structures as barriers
- Measured values used
- Grid size / resolution 1 x 1m

Add spatial property

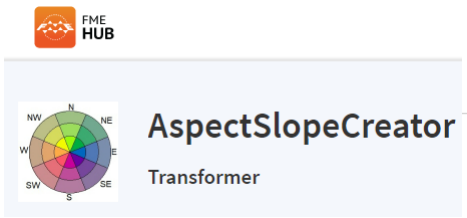
- Slope
- Aspect
- Curvature (plan & profile)
- Distance & vector to features
- Localised minima (sinks)
- Watershed / catchment

Raster Output

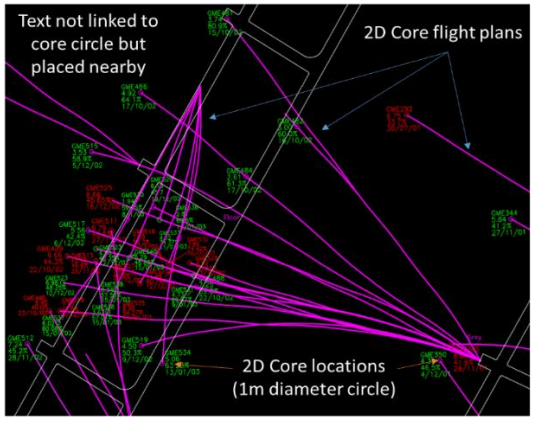
- AHD common Z reference
- Earth surface
- Each relevant strata or seam
- Fast depth of cover evaluation
- Single or multi-bands
- Appropriate resolution



Some of the key transformers used

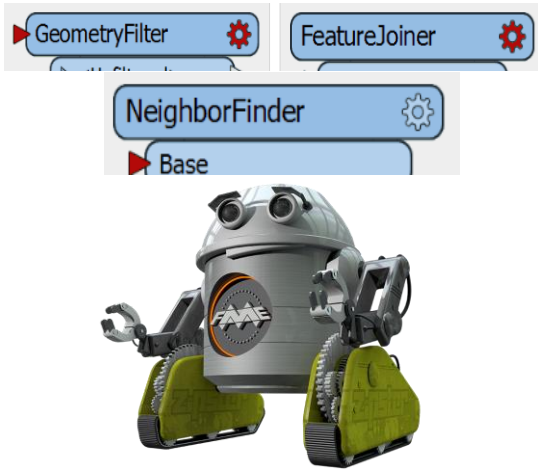


AutoCAD data cleaning and alignment

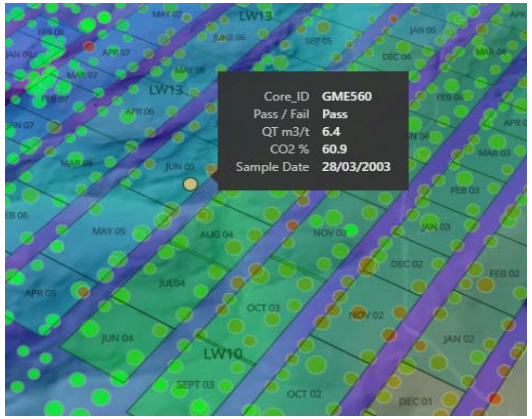


Pre 2010 core data
Text on plan only – difficult to reconcile if holes close together

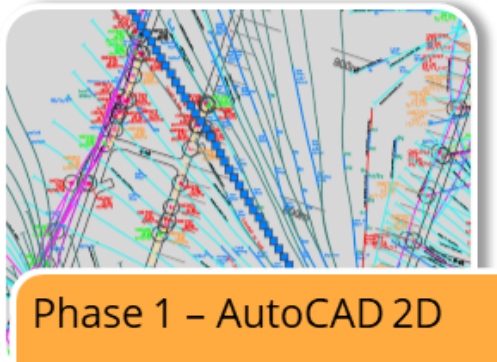
AutoCAD Map source
250+ drawing layers
Limited object data
Critical data as text only



Validation !
Manipulation of text
Creation of attributes
Attach attributes to geometry

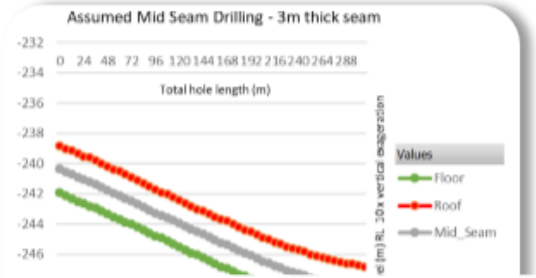


Attributed geometry
Common co-ordinate system
Well structured data !
Reduced errors downstream



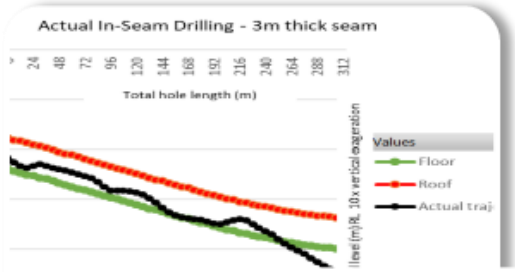
Phase 1 – AutoCAD 2D

- 2D only initially
- Extract start & end X,Y
- Apply Z from start & end
- Assume straight line in Z



Phase 2 – Floor/Roof 2.5D

- Produce floor & roof profile
- Extract Z each survey point
- Produce profile assume mid-seam
- Validate floor / roof touches

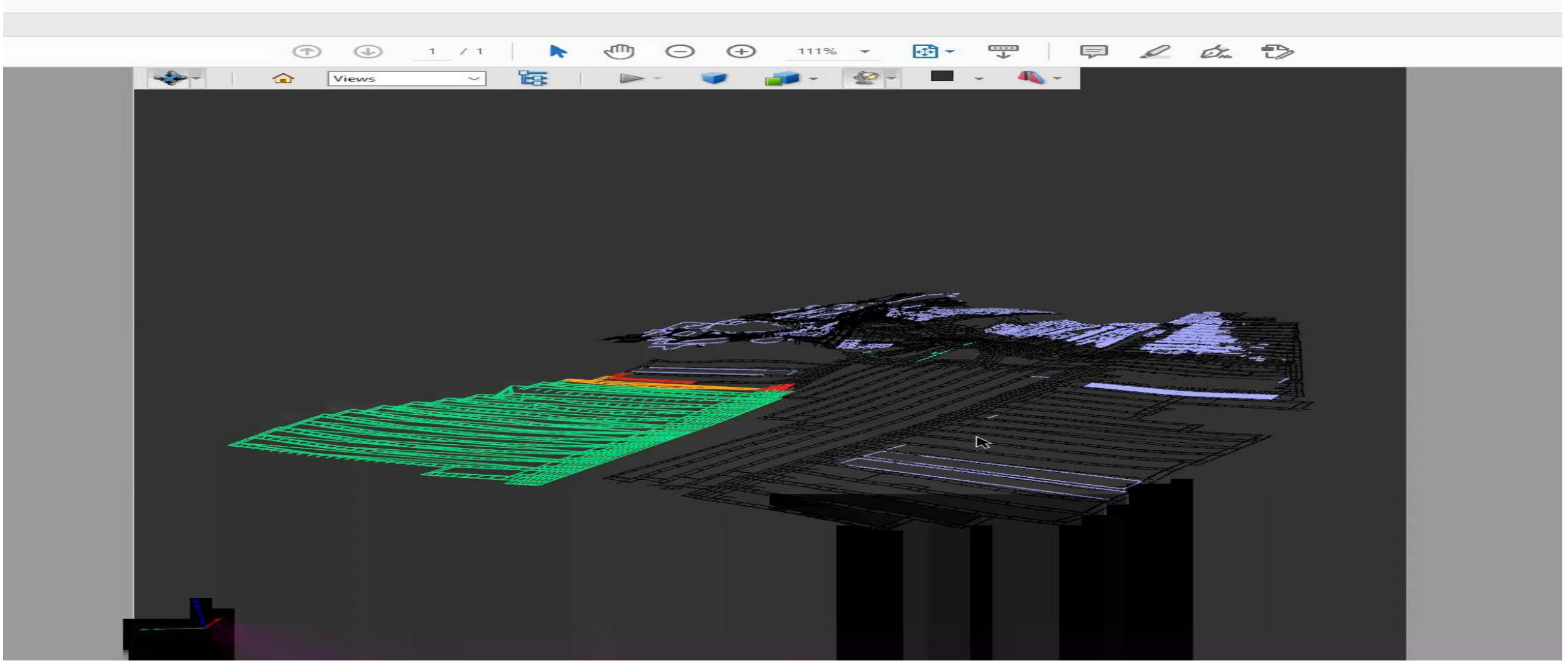


Phase 3 – True 3D Geometry

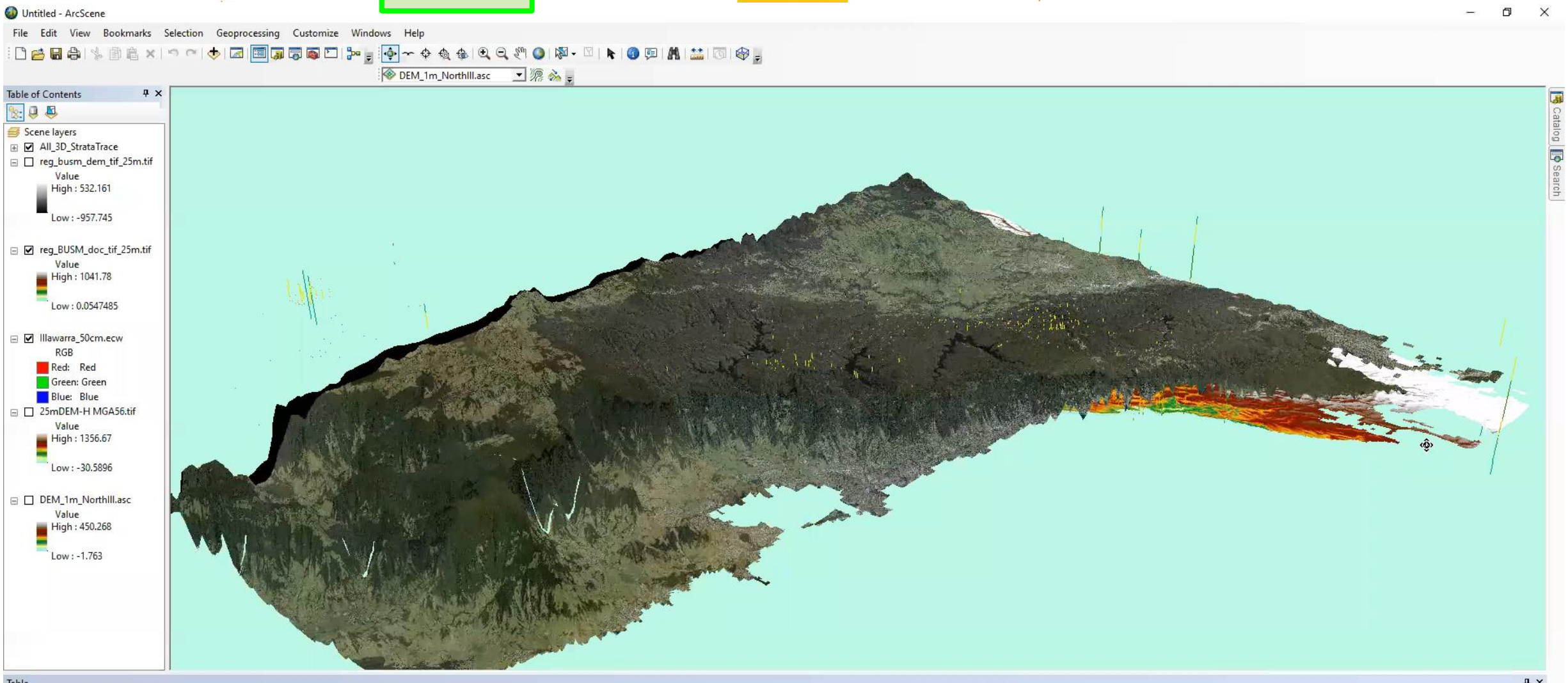
- Full azimuth, dip and length via DGS
- Convert all survey to 3D points
- Attach any commentary as attribute(s)
- Join 3D points to create 3D polyline

Why democratise the data ?

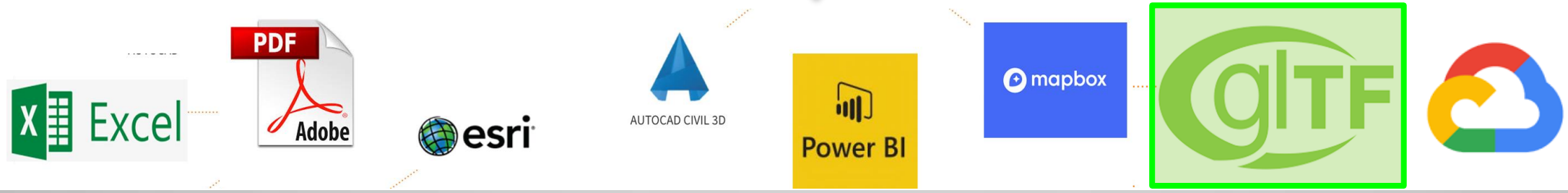
Democratise the data in multiple formats



Democratise the data in multiple formats



Democratise the data in multiple formats



Democratise the data in multiple formats

Excel

PDF Adobe

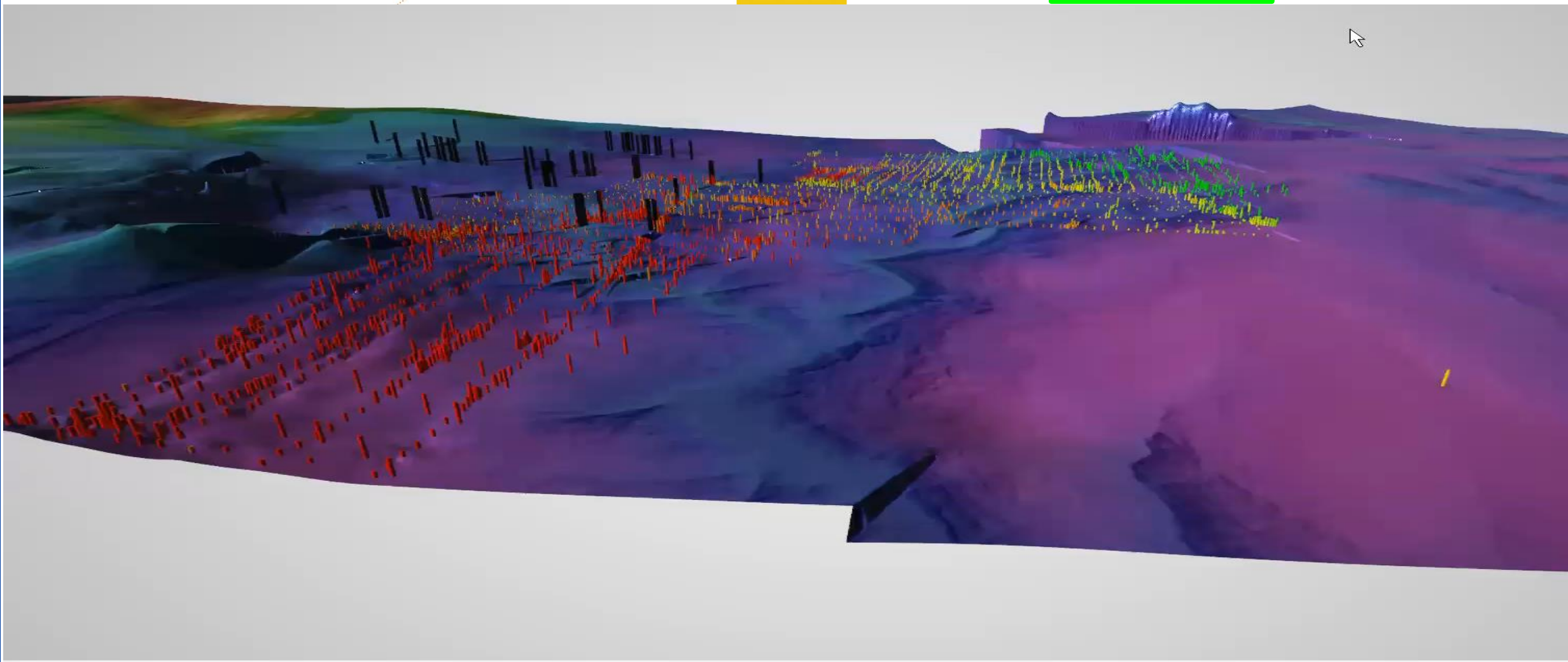
esri

AUTOCAD CIVIL 3D

Power BI

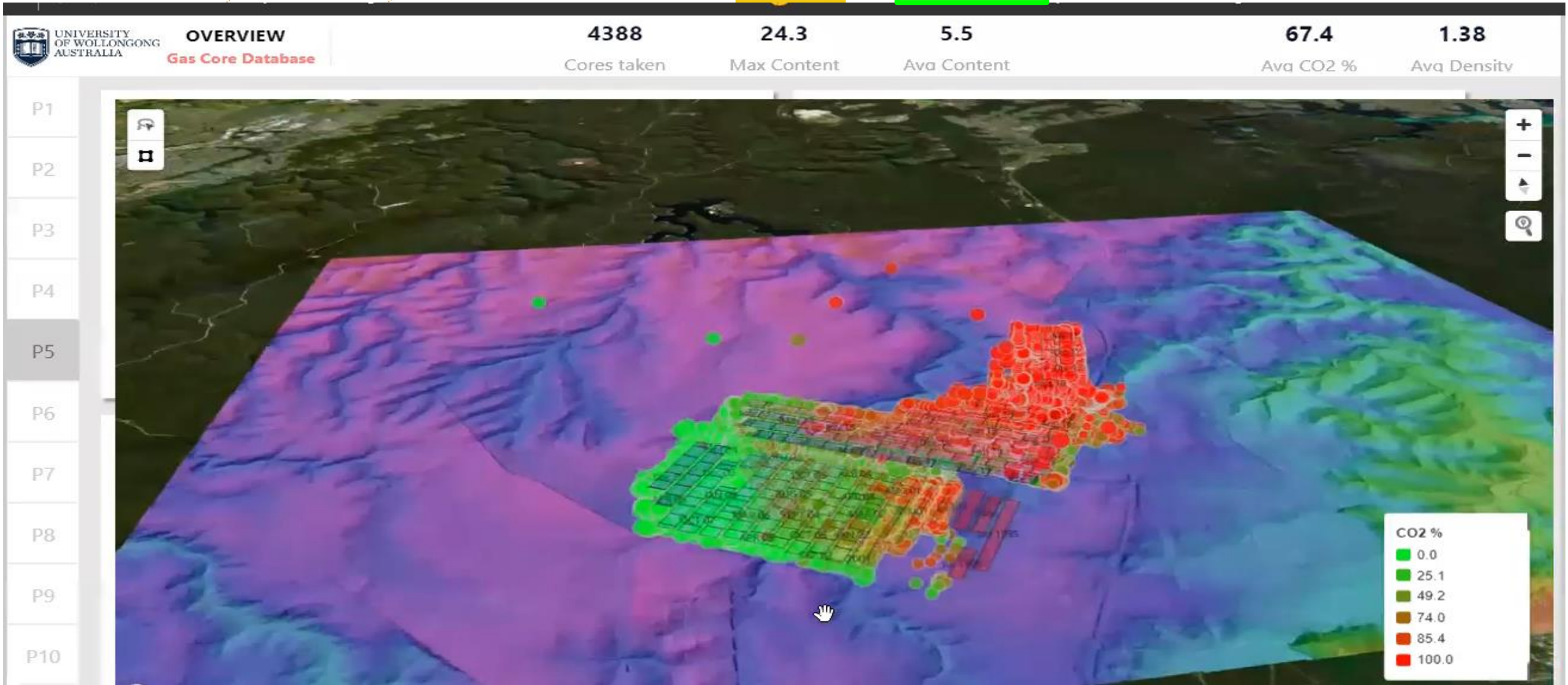
mapbox

glTF



Democratise the data in multiple formats

Excel · PDF · esri · AUTOCAD CIVIL 3D · Power BI · mapbox · glTF



Democratise the data in multiple formats

UNIVERSITY OF WOLLONGONG AUSTRALIA

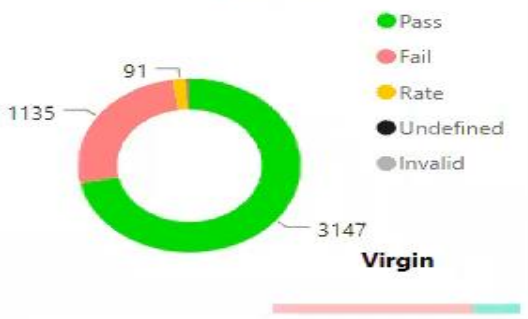
OVERVIEW

Gas Core Database

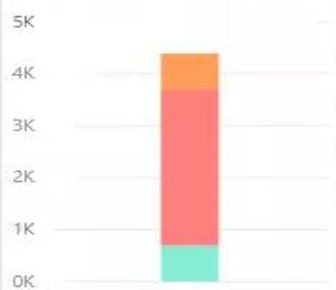
GME4063	4388	24.3	5.5	67.4	1.38
Last sample	Cores taken	Max Content	Avg Content	Avg CO2 %	Avg Density

Main P2 P3 P4 P5 P6 P7 P8 P9 P10

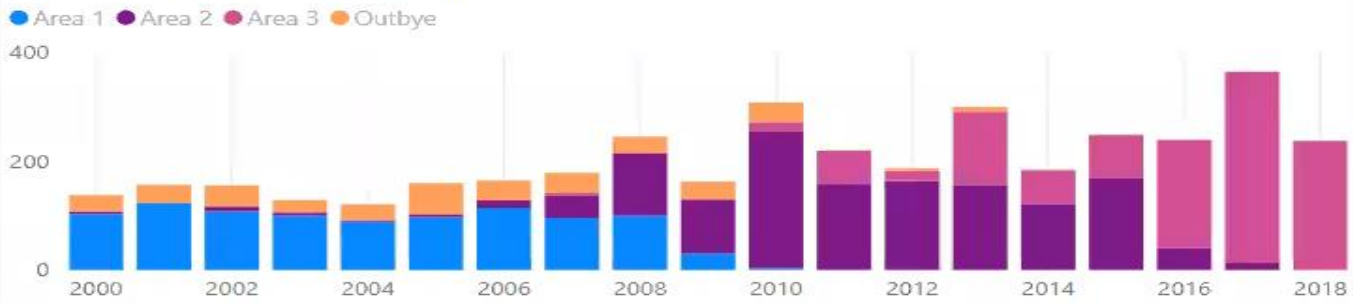
Core Results



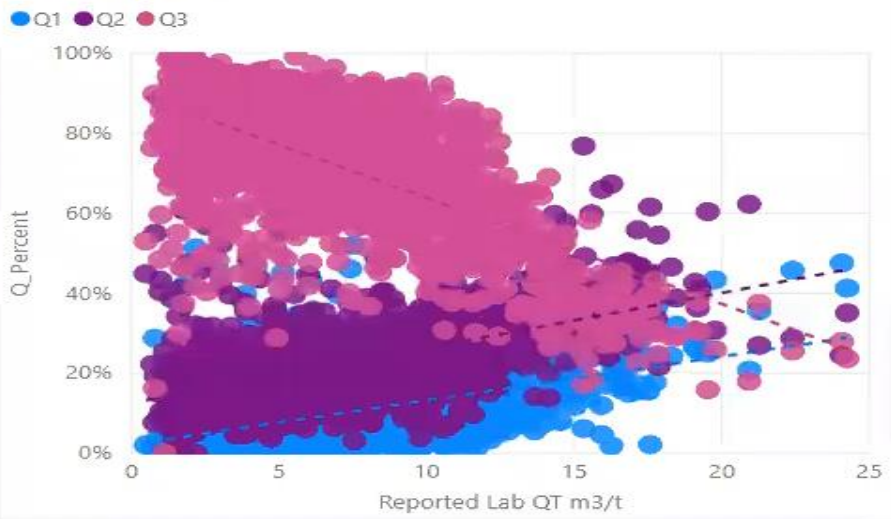
Gas Composition Range



Number of cores by Year and AreaName



Q1, Q2, Q3 vs QT



AreaName	Cores taken	Average Density m3/t	Average Gas Content Qt	Average Q3_Gas m3/t	IDR30Index	CO2 %
Area 1	1308	1.38	4.9	3.81	0.24	42.8
Area 2	1382	1.38	5.6	4.10	0.58	73.9
Area 3	1172	1.40	6.1	4.20	0.80	95.4
Outbye	517	1.37	4.6	3.55	0.27	49.2
West Area 3	9	1.41	11.4	4.03		1.1
Total	**4388**	**1.38**	**5.5**	**4.00**	**0.50**	**67.4**

Conclusion

Over the past 7 years of research, FME has been critical to the treatment of data from regional to microscopic scale.

Using structured data is fundamental to accurate gas emission modelling at high resolution in both space and time.

Maintaining vendor-agnostic workflows in FME avoids significant risk in production

Democratise and visualise the data to drive decision making in management.

Patrick@mecee.com.au

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See the solution

Thank you!