

Geology Uncertainty Automation using Google Protocol Buffers

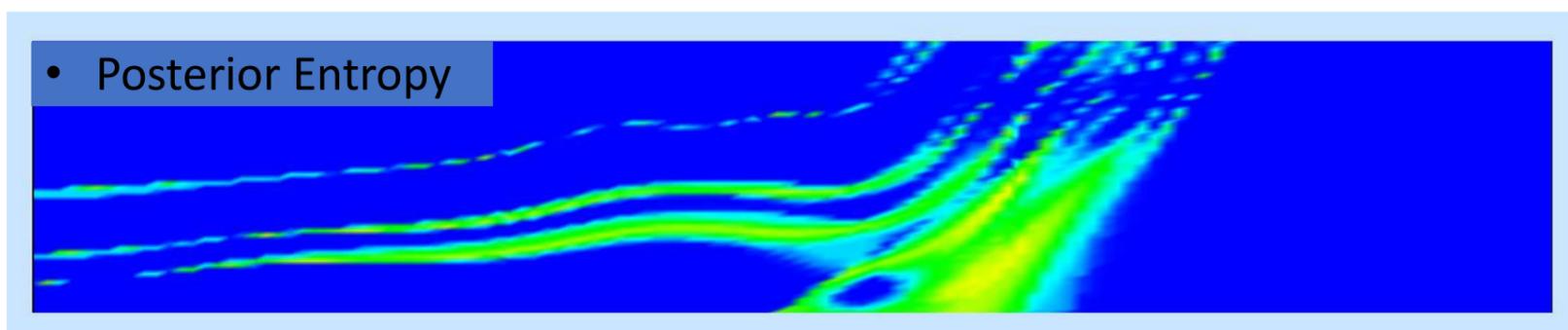
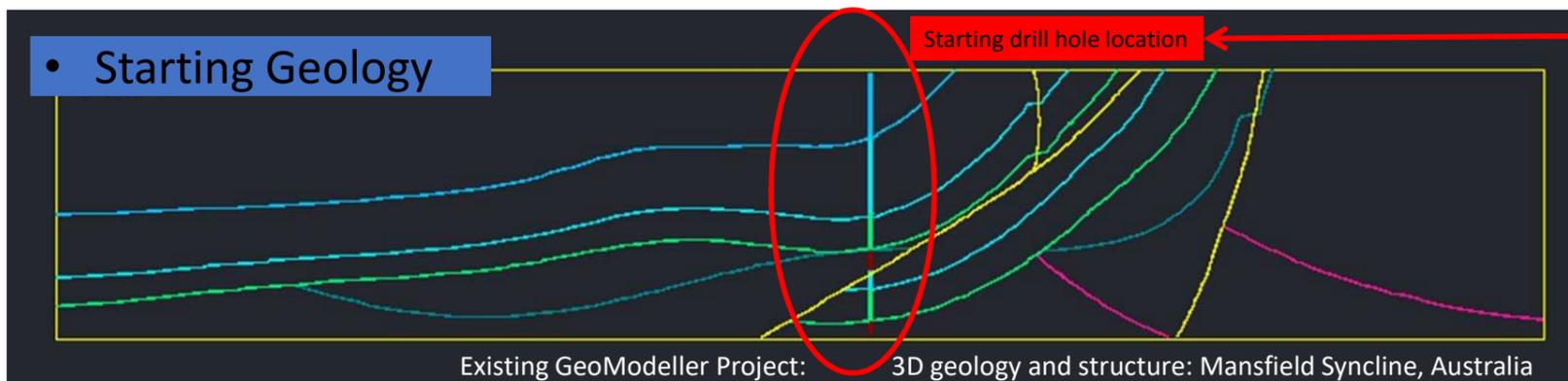
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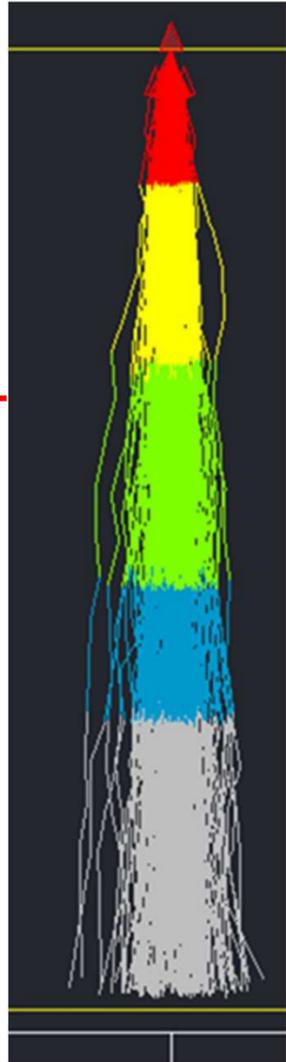
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- For a given 3D implicit structural geology model we can now characterise drill hole uncertainty with Markov Chain thinking
- Foliation orientations are perturbed using a Spherical Cap, von Mises-Fisher or Kent disturbance distribution
- Interface points and foliation locations are perturbed using either a Uniform, Normal or Laplace disturbance
- For any geo-series, the co-kriging compute parameters that encapsulate anisotropy, are available for stochastic explorations
- The zones of highest uncertainty are geology boundary locations (point, lines or surfaces)
 - In the GeoModeller v4 these are known as “Triple Lines” – which are now computed and hence facilitate this work

Business benefits: Optimize geological targeting using uncertainty analysis
 Maximize returns from your drilling budget
 Reduce risk for further exploration



2D section from the resulting 3D voxel - posterior outcome from stochastic inversion – A sensitivity analysis
 This shows the uncertainty of the geology formation boundaries (imaged in the Starting Geology cross-section above), as a consequence of a stochastic exploration of geology probability space, just perturbing the drill hole trace location uncertainty. Yellow (entropy) means highly variable predicted locations for formation boundaries, and Blue (entropy) means little variation.



200 variable locations of a single drill-hole trace (note geology key is different to 2D section, left)

You can do this too !

STEP 1 “Create” your own task

Use your own existing GeoModeller project to perform an uncertainty analysis

1. Launch GeoModeller v4
2. **Project>Save Batch Scripts ...** creates a batch script
3. Nominate a Task File Name (eg., MyMansfield.task)
4. Set your required output options press **> OK**

Your geology model is refactored to its original sparse observations, and its creation sequence for defining the formations, faults and geological pile.



STEP 2 “Run” your own task

1. Launch GeoModeller v4
2. Select from Main Menu (green button) **>Run GeoModeller Batch**

Alternately use Google Protocol Buffers

Template task files available at GitHub
<https://github.com/intrepid-geophysics>

GeoModeller API has:

- 76 Geology Operations
- And 42 Stochastic Inversion / Forward Operations

Refactoring a GeoModeller v4 project enables:

- Elimination of sections – make a pure 3D project
- Joining of projects
- Changing the project extents
- Plain text archiving of the project, independent of software code
- Most projects shrink below 1 Mbyte

Intrepid Geophysics’ HitHub Libraries

