Interactive Large-Data Modeling and Visualisation

Scientific Data Visualisation

John Rugis
Outline

• IESE earth science context
• Geophysical data
• Tools for large-data modeling and visualisation
• Case study: demonstration
• Discussion and future direction
IESE: Data collection, analysis and interpretation

Borehole and Surface Seismic Networks

- *Earthquake locations*
- *Special data analysis and interpretation.*
- *Seismic velocity and velocity–ratio tomography*
- *Fracture density and orientation*
IESE: Data collection, analysis and interpretation

Magnetotelluric Surveys

- Resistivity and polarisation profiles
- Reservoir characterisation
- Geothermal site surveys
IESE: Geophysical Data

Typical model data:

• Digital elevation maps (surface)
• Micro-seismic events
• Computed velocity models
• Magnetotelluric results
• Structural features…

Overlapping underground data, a dense 3D volumetric space!
IESE: Data Modeling and Visualisation

Data management and work flow

• Interactive graphics for informed data exploration
• Deliverables:
  – Reports
  – Videos
  – Presentations
  – Live demonstrations
Interactive Graphics

• Cross-platform
• Scriptable, extendable
• High performance
• Selected open-source tools:
  – Paraview
  – Voreen
  – Blender
  – Python
Interactive Graphics

Data abstraction

• Data types:
  – *Points*
  – *Lines*
  – *Surfaces (open / closed meshes)*
  – *Volumes (voxels)*
  – *Each with associated scalar, vector, tensor attributes*
    
    *(size, shape, color, glyphs, etc.)*
Case study demonstration using Blender

- Digital elevation model with overlays
- Micro-earthquake hypocentres
- Computed velocity model
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Digital elevation models: Geotiff files
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Micro-earthquake hypocentres: Hypo71 files
Monitoring and Development of Geothermal Fields
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Low pressure-wave velocity

High pressure-wave velocity
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Future work

• Fully de-couple data from visualisation
• Common multi-user database
• Interactive stand-alone executable models
• …
Discussion & Questions?

(Blender demonstration)