IESE
Institute of
Earth Science
and Engineering
Aotearoa

CITR, Department of Computer Science,
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Interactive Large-Data Modeling and Visualisation

Scientific Data Visualisation

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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*

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Interactive Graphics

- Cross-platform
- Scriptable, extendable
- High performance
- Selected open-source tools:
  - *Paraview*
  - *Voreen*
  - *Blender*
  - *Python*

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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.)

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Case study demonstration using Blender

- Digital elevation model with overlays
- Micro-earthquake hypocentres
- Computed velocity model

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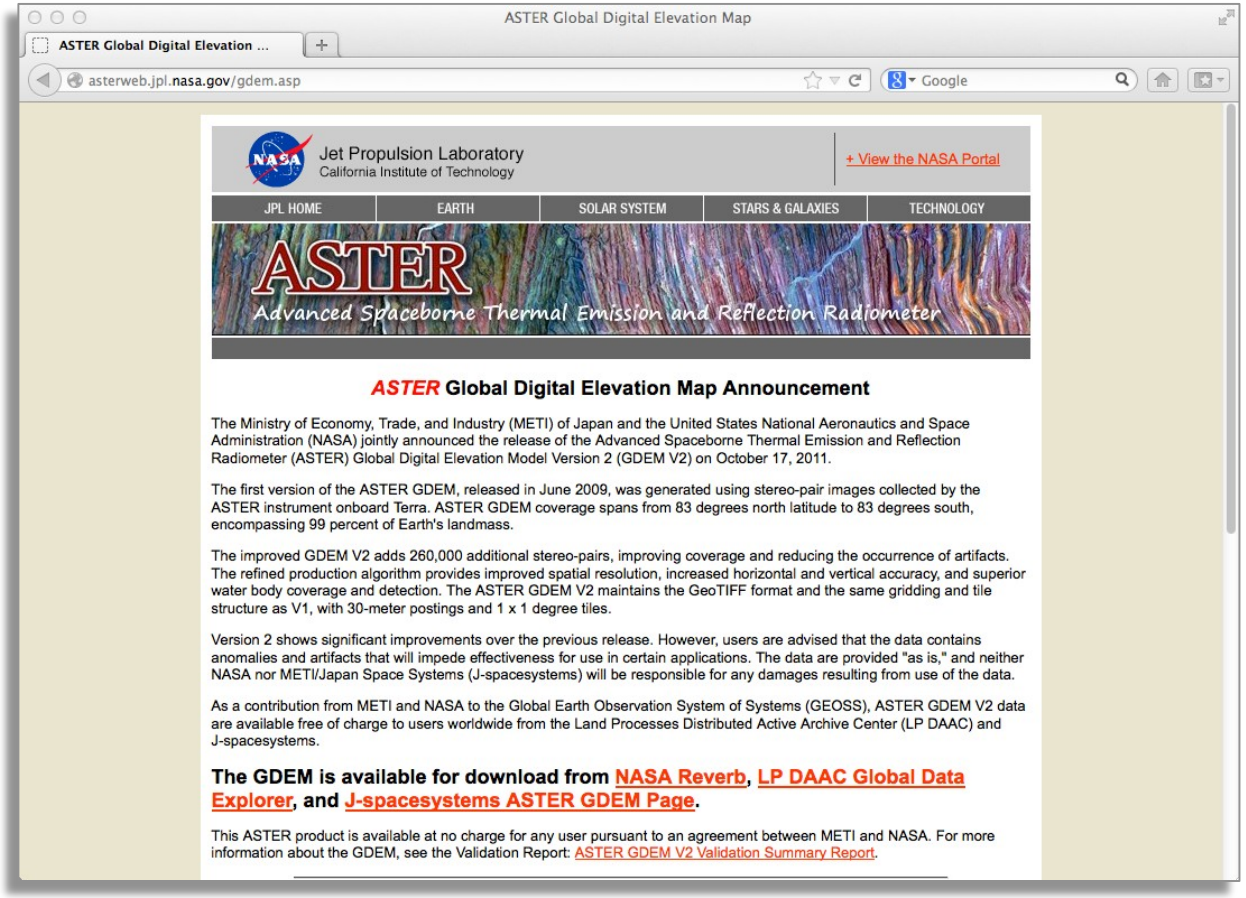
Digital elevation models: Geotiff files



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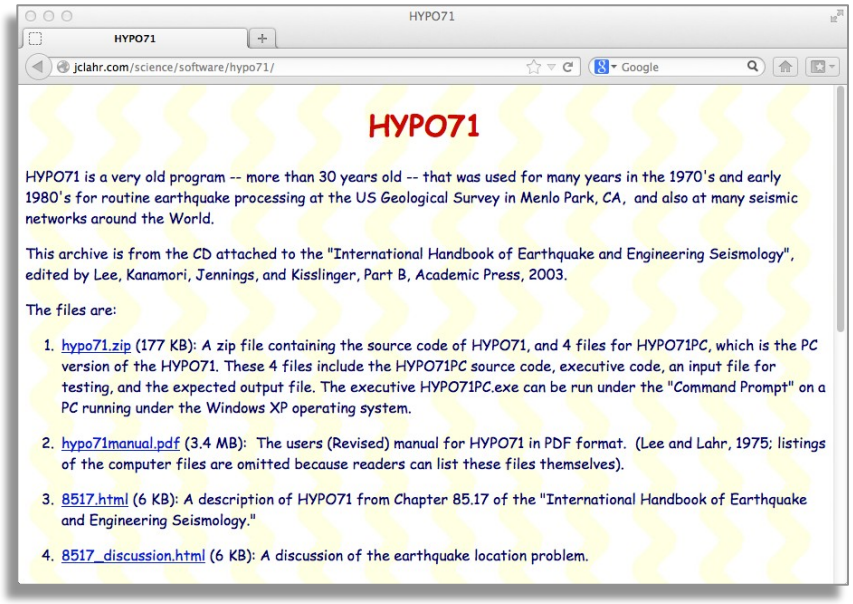
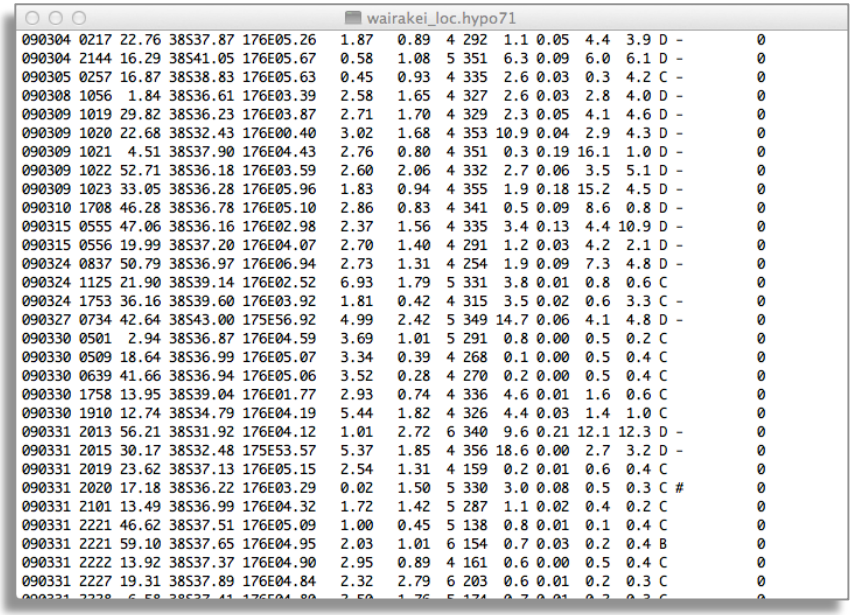
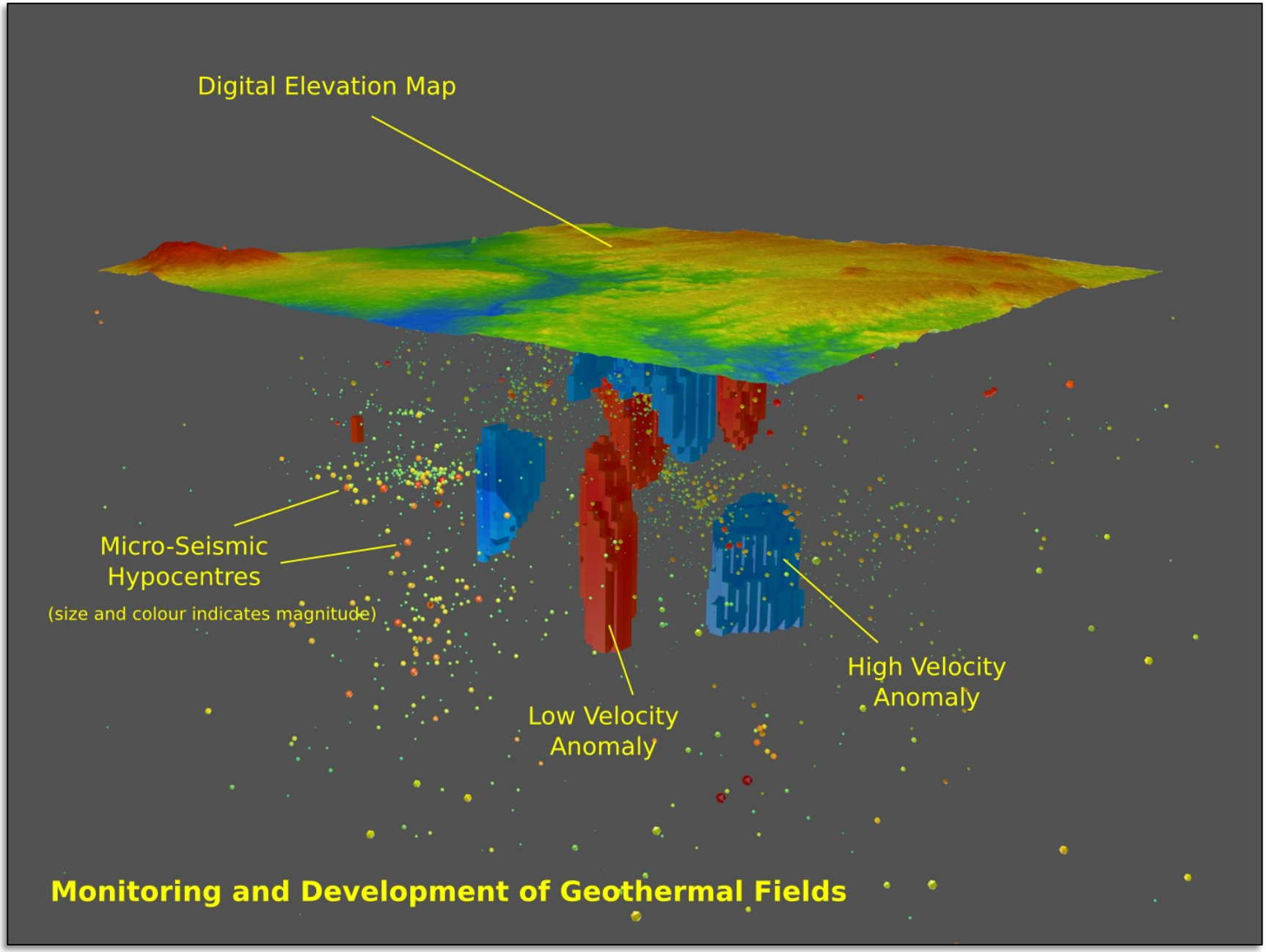
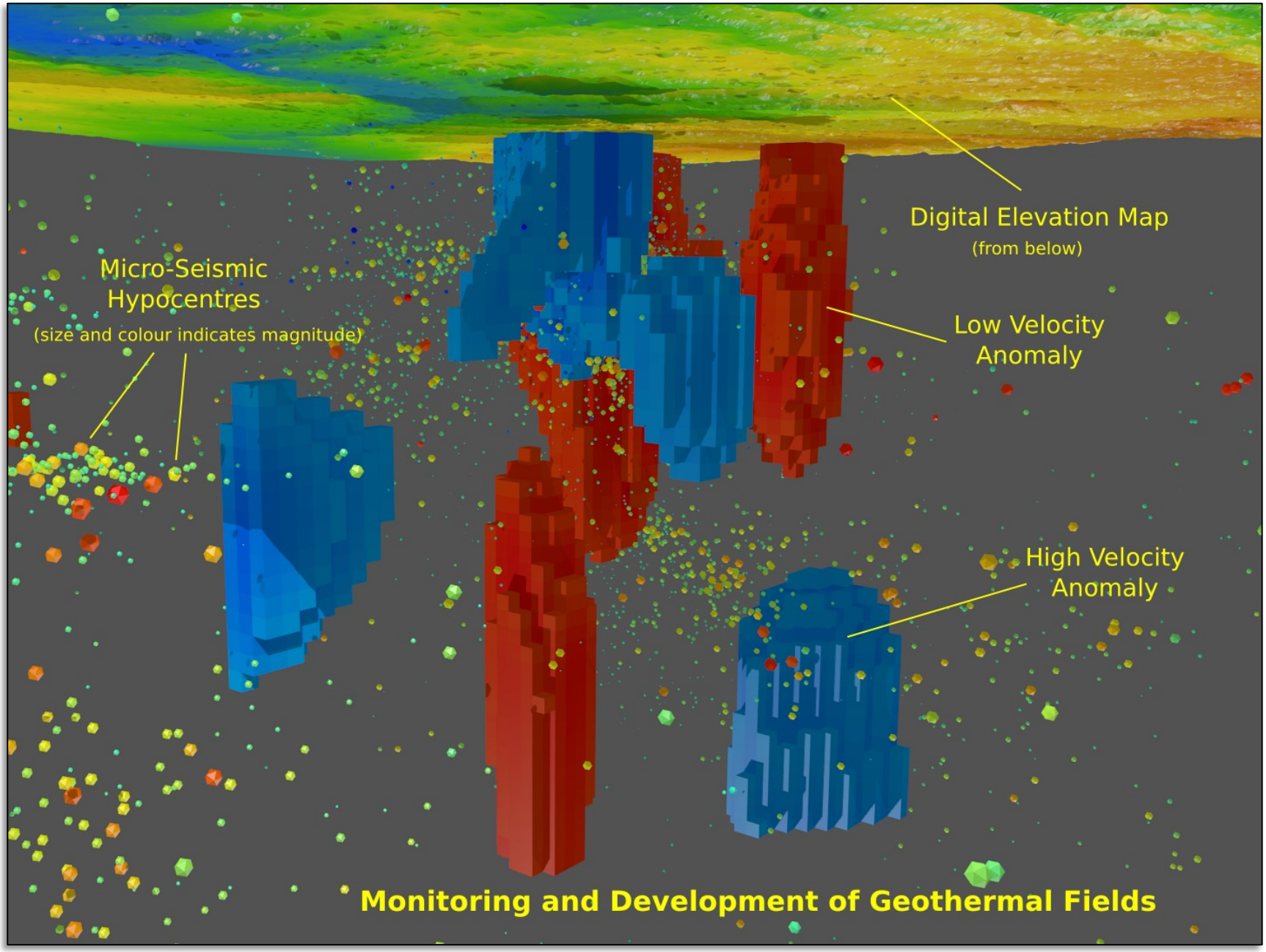
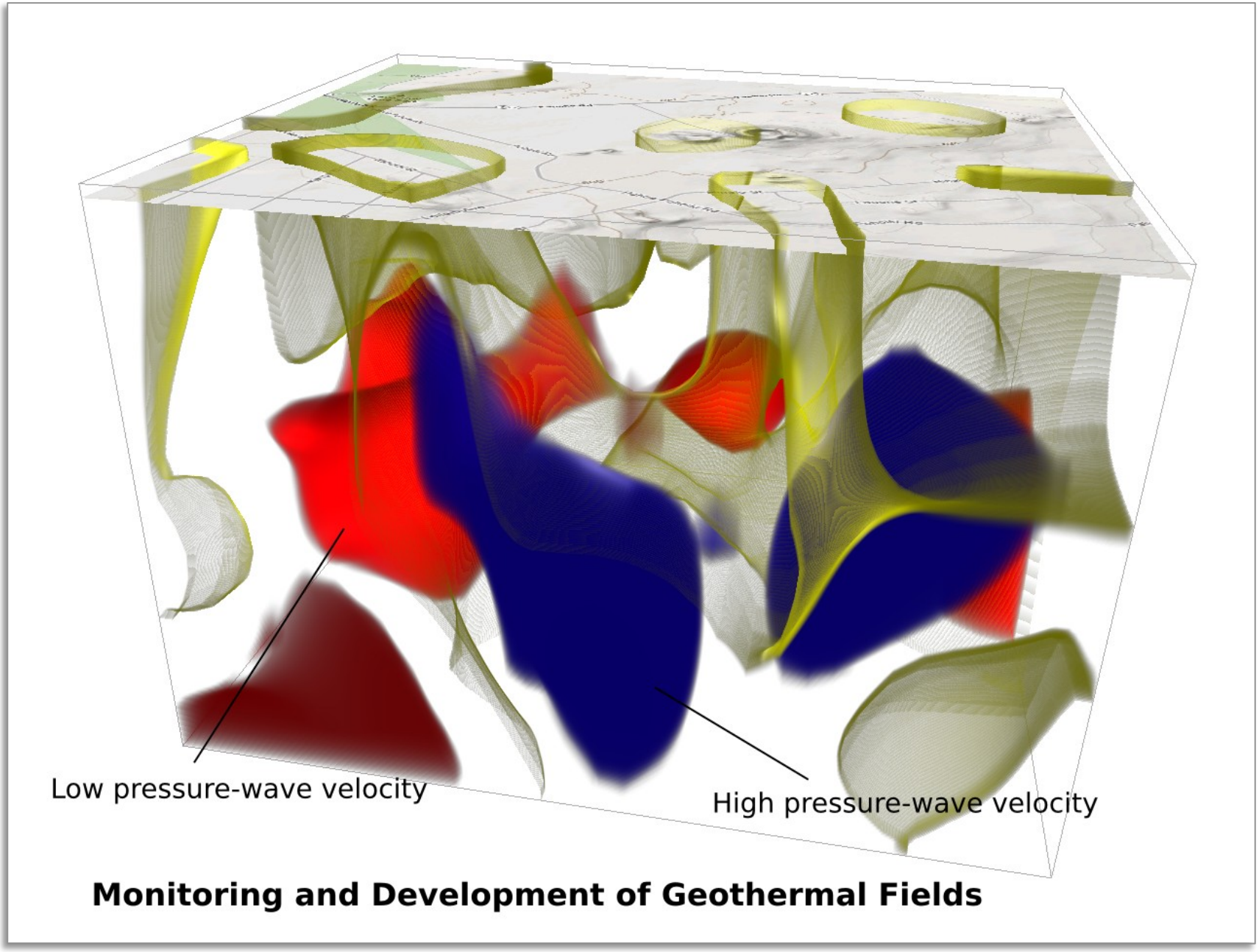
Micro-earthquake hypocentres: Hypo71 files






Digital Elevation Map
Micro-Seismic Hypocentres
(size and colour indicates magnitude)
Low Velocity Anomaly
High Velocity Anomaly
Monitoring and Development of Geothermal Fields


Digital Elevation Map
(from below)
Micro-Seismic
Hypocentres
(size and colour indicates magnitude)
Low Velocity
Anomaly
High Velocity
Anomaly
Monitoring and Development of Geothermal Fields

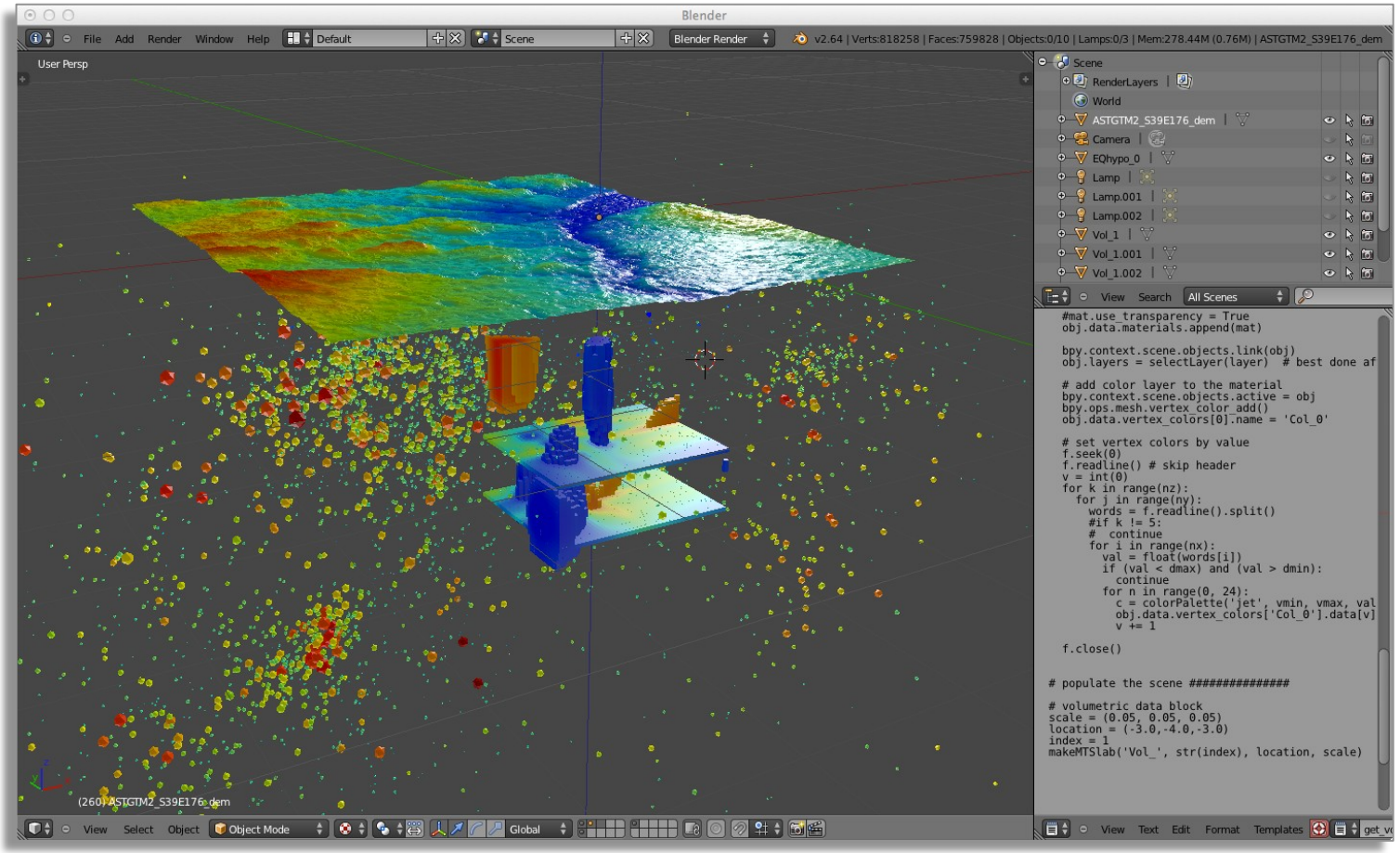


Monitoring and Development of Geothermal Fields

IESE: Data Modeling and Visualisation

Future work

- *Fully de-couple data from visualisation*
- *Common multi-user database*
- *Interactive stand-alone executable models*
- *…*

Discussion & Questions?

(Blender demonstration)