Using GIS to Manage and Analyse Spatial and Temporal Data in the Study of Massive Landslide Behaviour

The Geo Engineering Centre

Queen's University

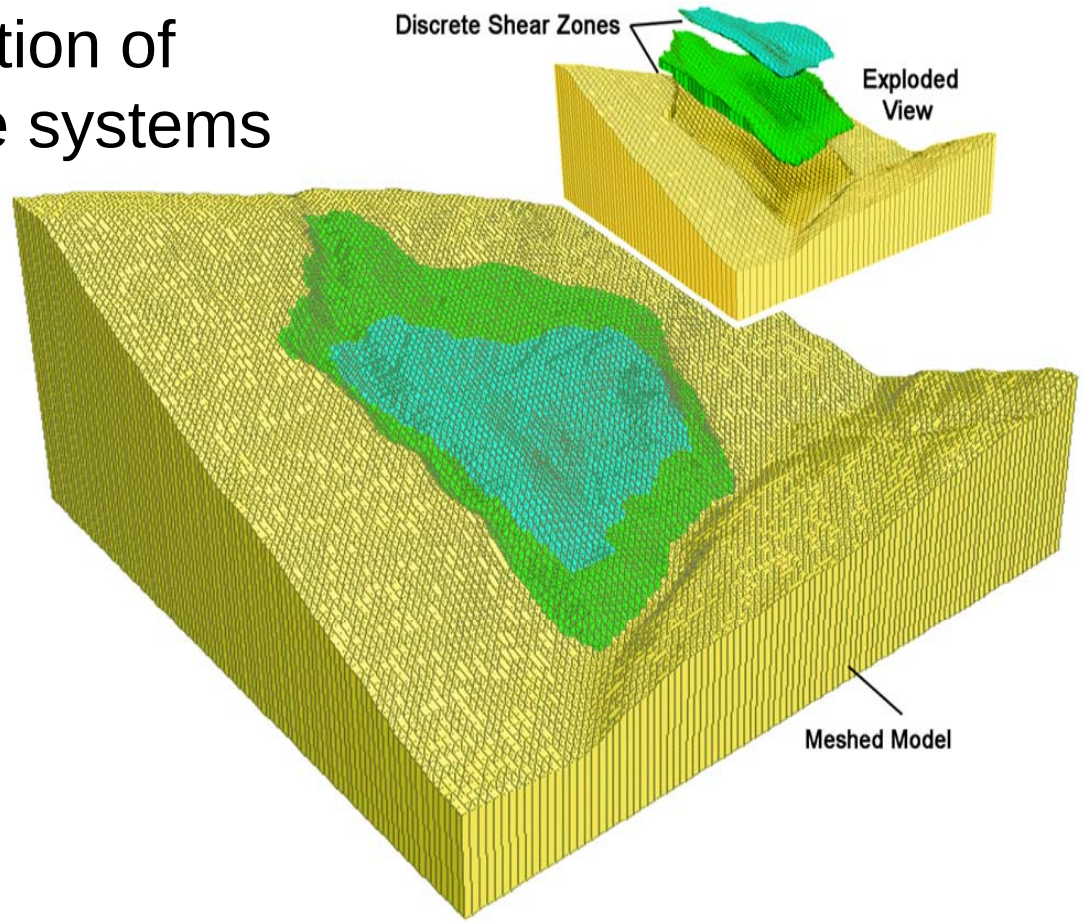
Katherine Kalenchuk

Jean Hutchinson

Mark Diederichs

Research Scope

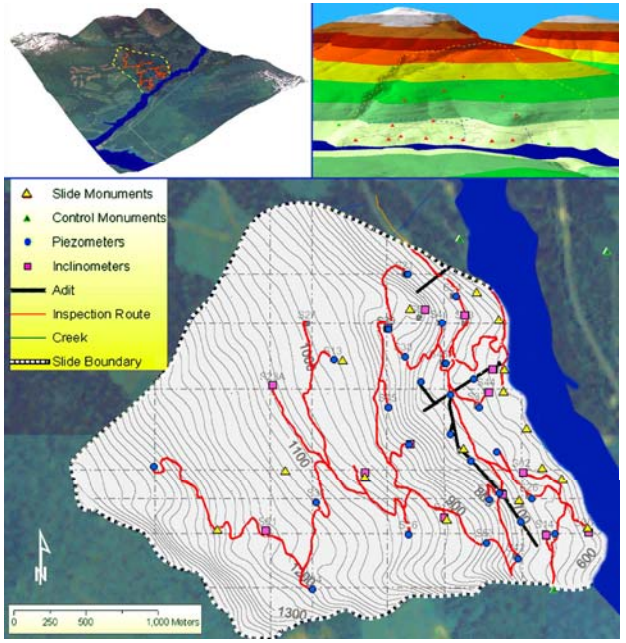
- Numerical simulation of massive landslide systems
  - Direction of Slope Deformations
  - Magnitude of Slope Deformations
  - Trained models can than be subject to trigger scenarios

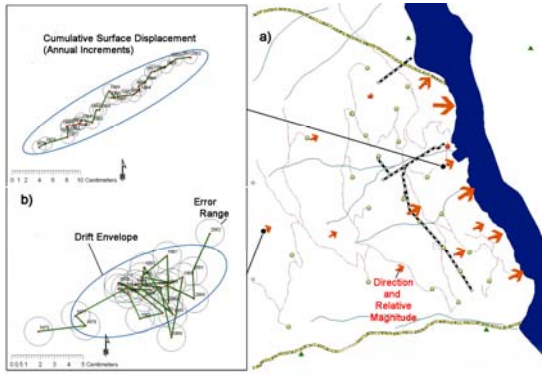


Hutchinson et al, 2006

Geodatabase Development

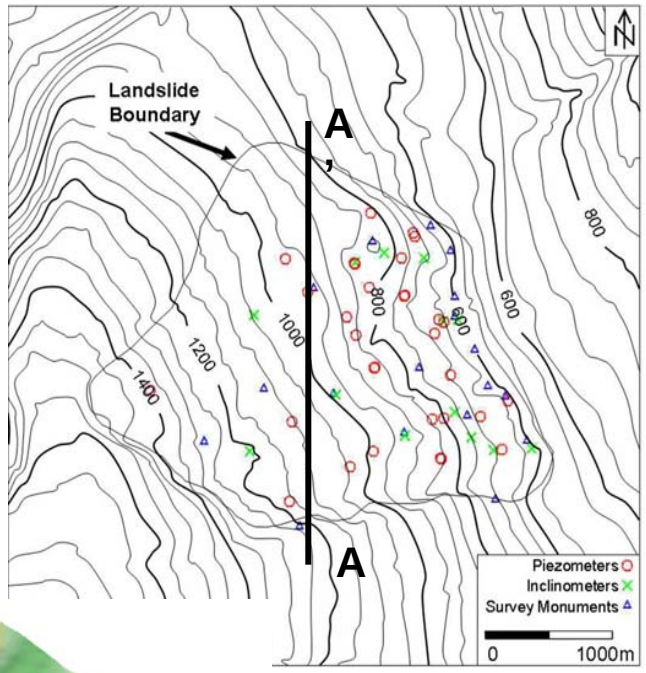
- Collected Field Data
  - Slide conditions
  - Slide behavior
- Derived Field Data
  - Geostatistical interpolation to develop continuous fields
- Model Data
  - Simulated Slide Behavior

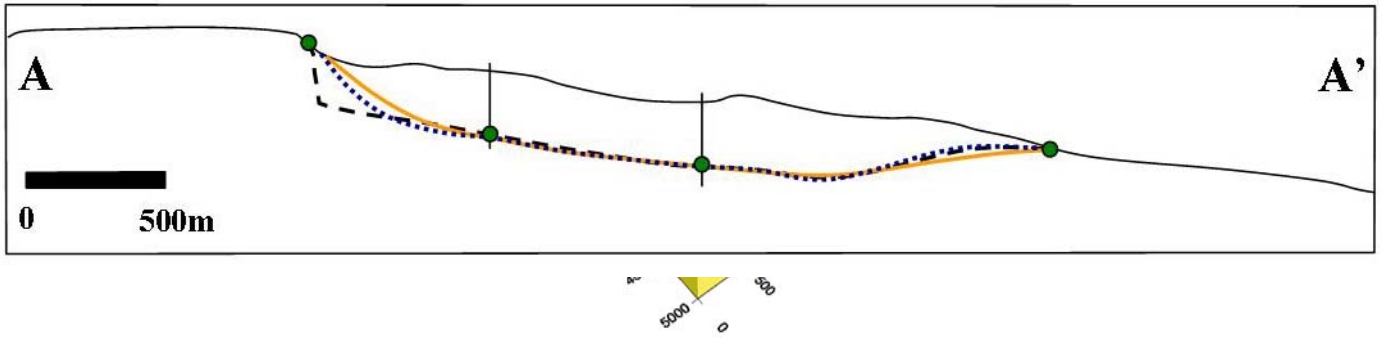




Geodatabase Development

- **Collected Field Data**
  - Bore hole intercepts and Aerial Photographs, DEM
  - Inclinometers, Survey Monuments
- **Derived Field Data**
  - Shear Surface Geometry
- **Model Data**
  - Slide Behavior

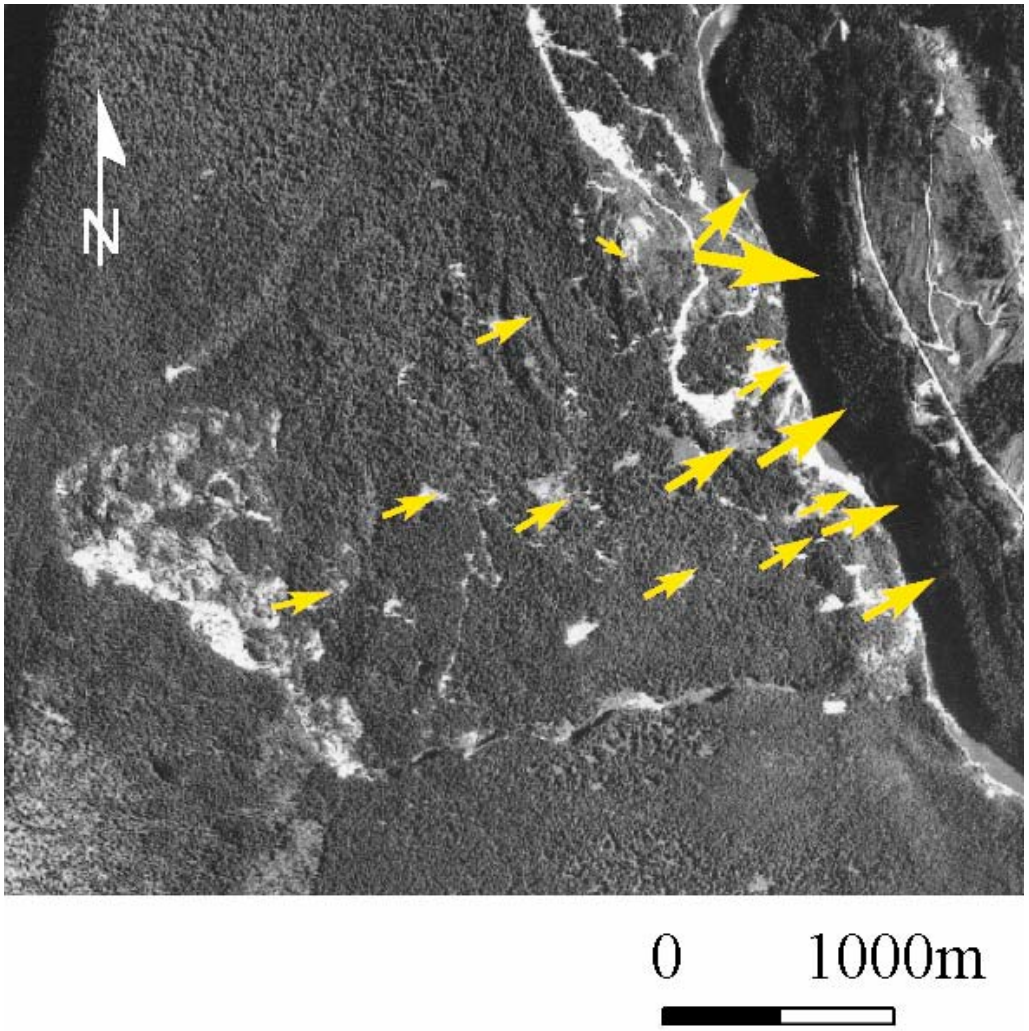




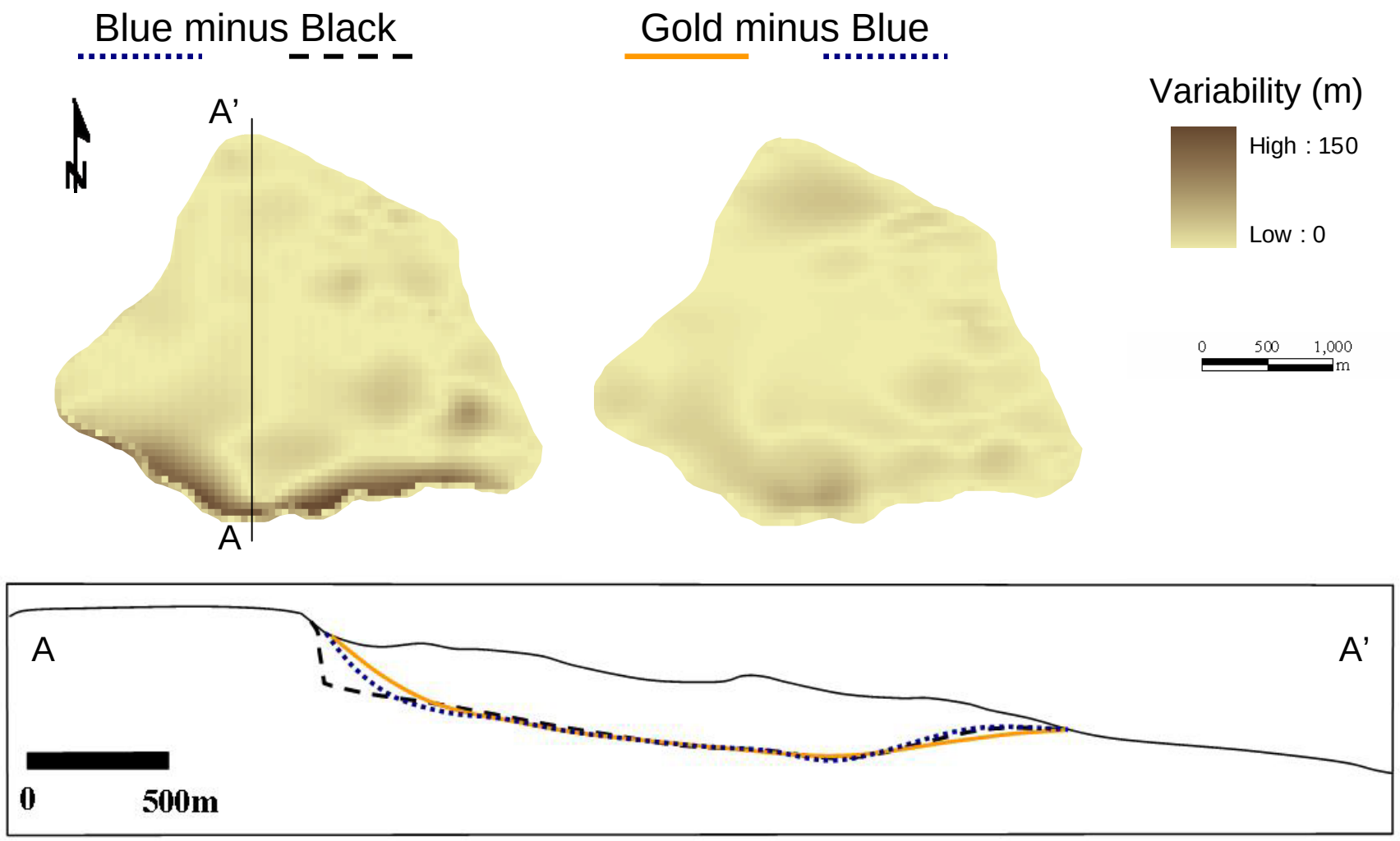
Research Phase 1

Hypothesis:

Direction of deformation is primarily controlled by the 3-dimensional geometry of shear surfaces.

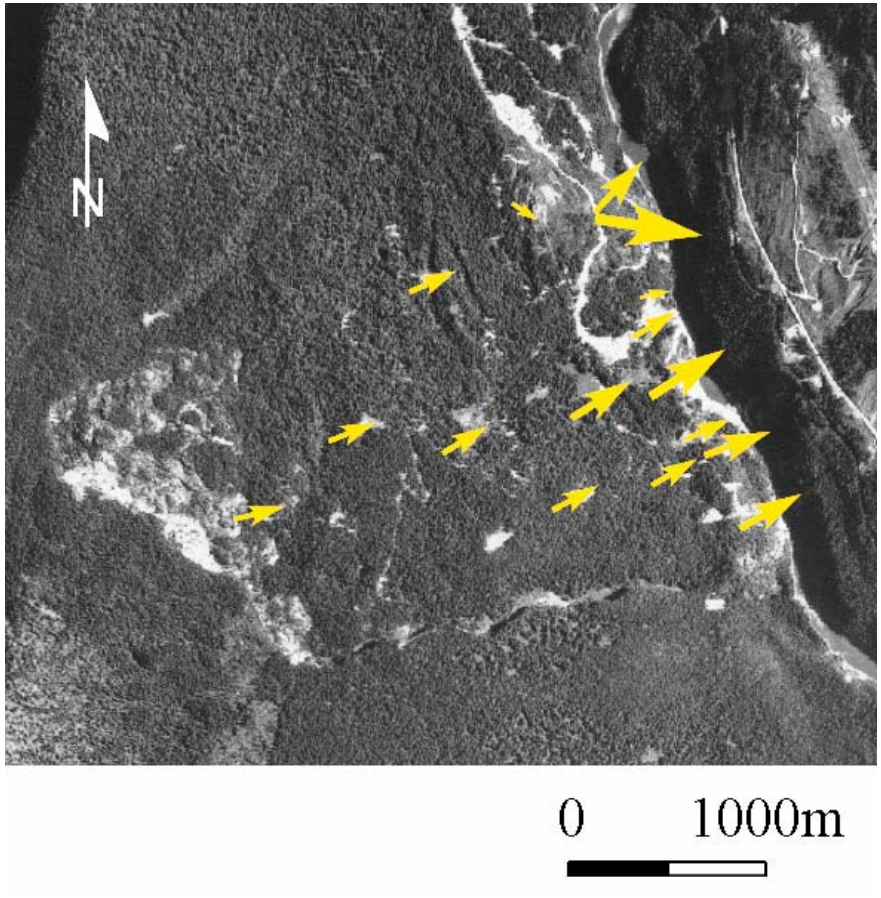


Manipulation, Analysis and Visualization

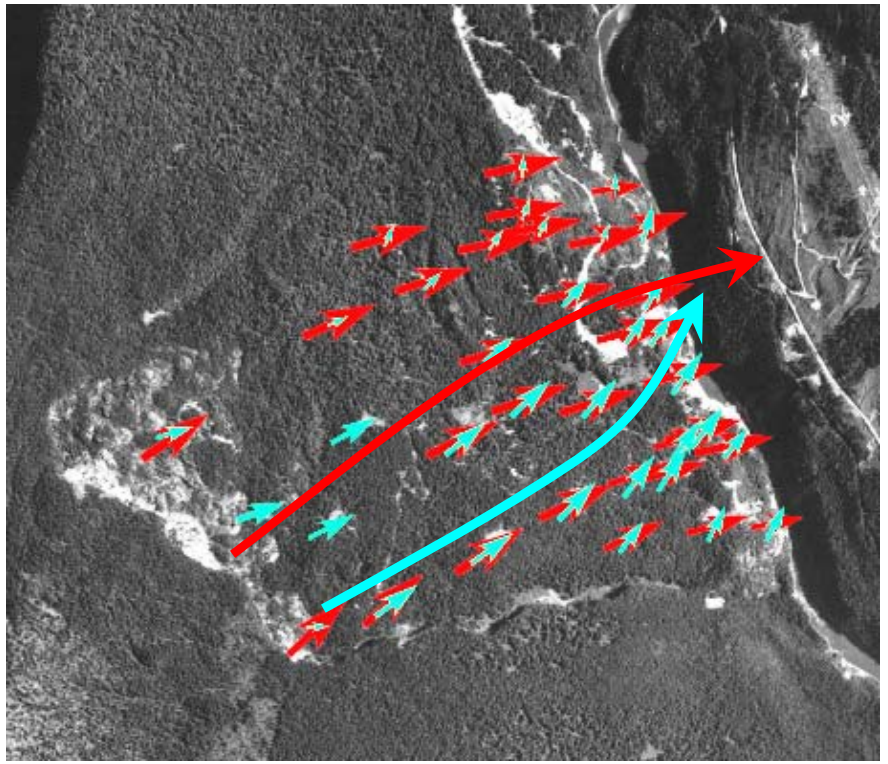


Manipulation, Analysis and Visualization

Field Data

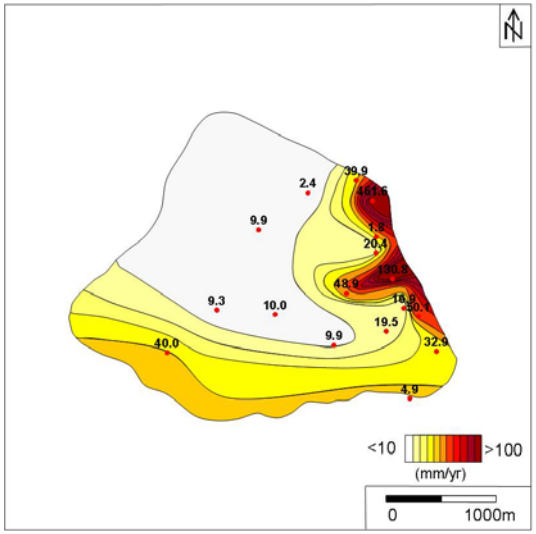


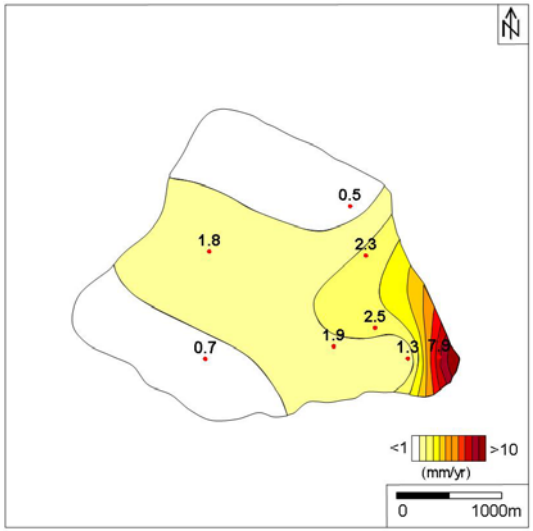
Model Data



Research Phase 2

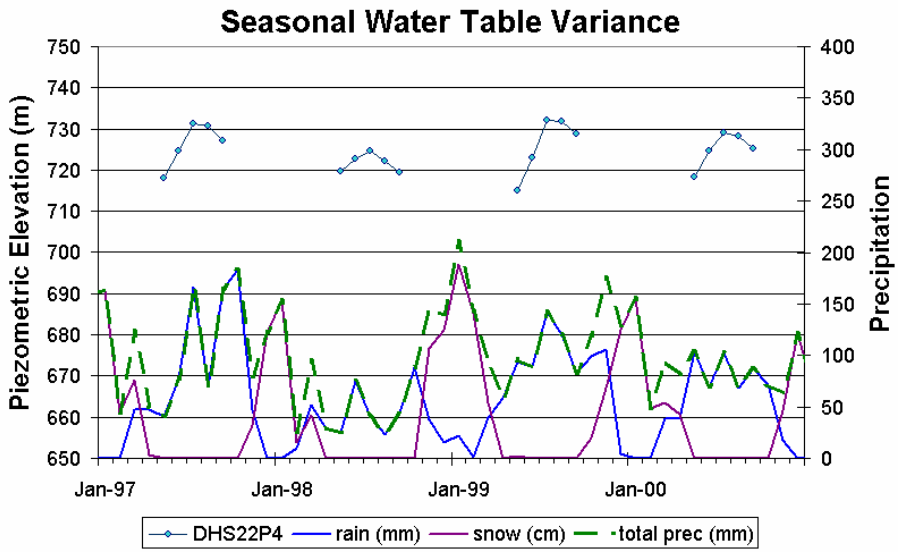
- Deformation Rates may be controlled by the distribution of mechanical strength parameters
- Challenges
  - Little or no available data
  - Interpolation of displacement rates and handling the zero isopach
  - Localized independent behavior

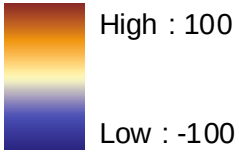


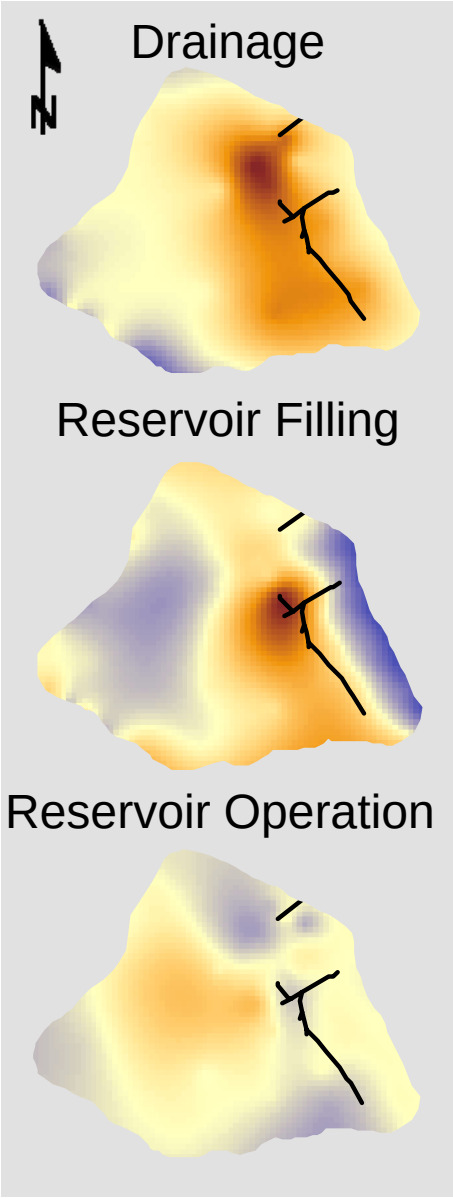


Research Phase 3

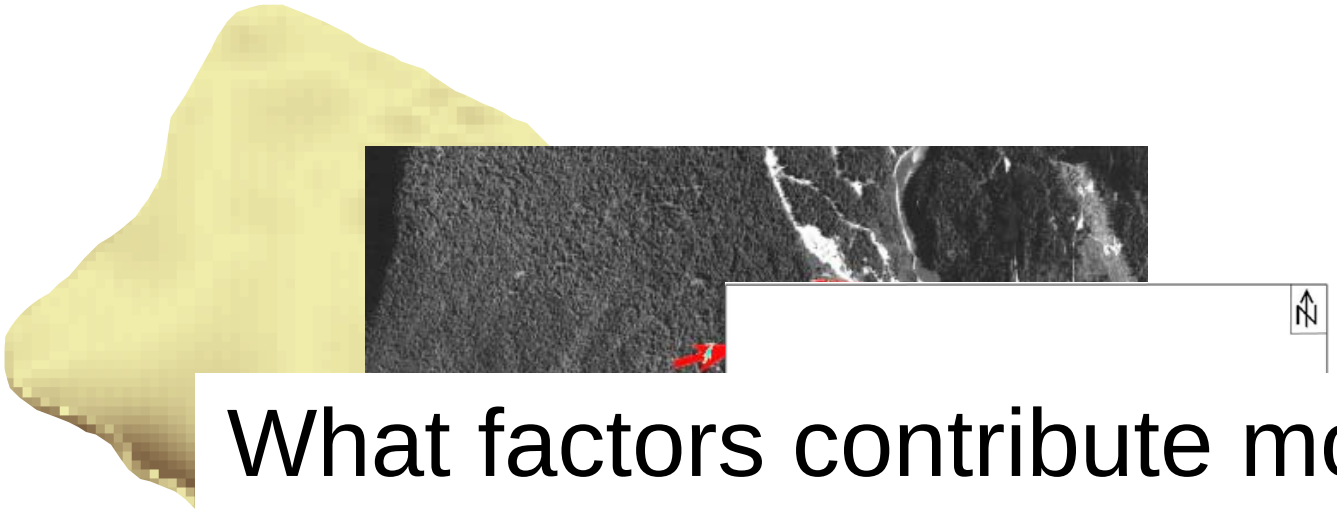
- Temporally variable slope behavior may be controlled by changing trigger conditions
- Challenges
  - Conditions defined in poorly sampled areas
  - Interpolation algorithms to avoid issues with poorly defined areas



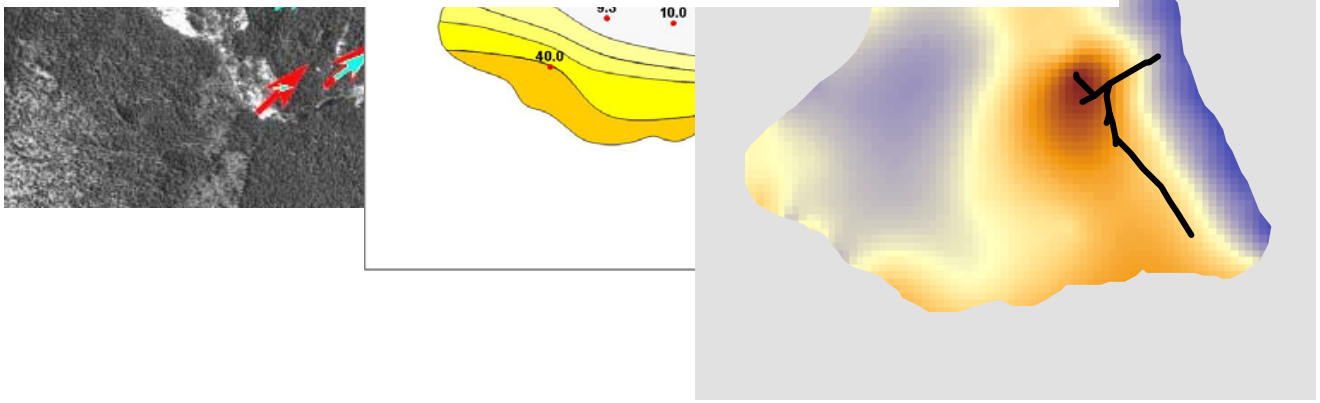




Looking Forward

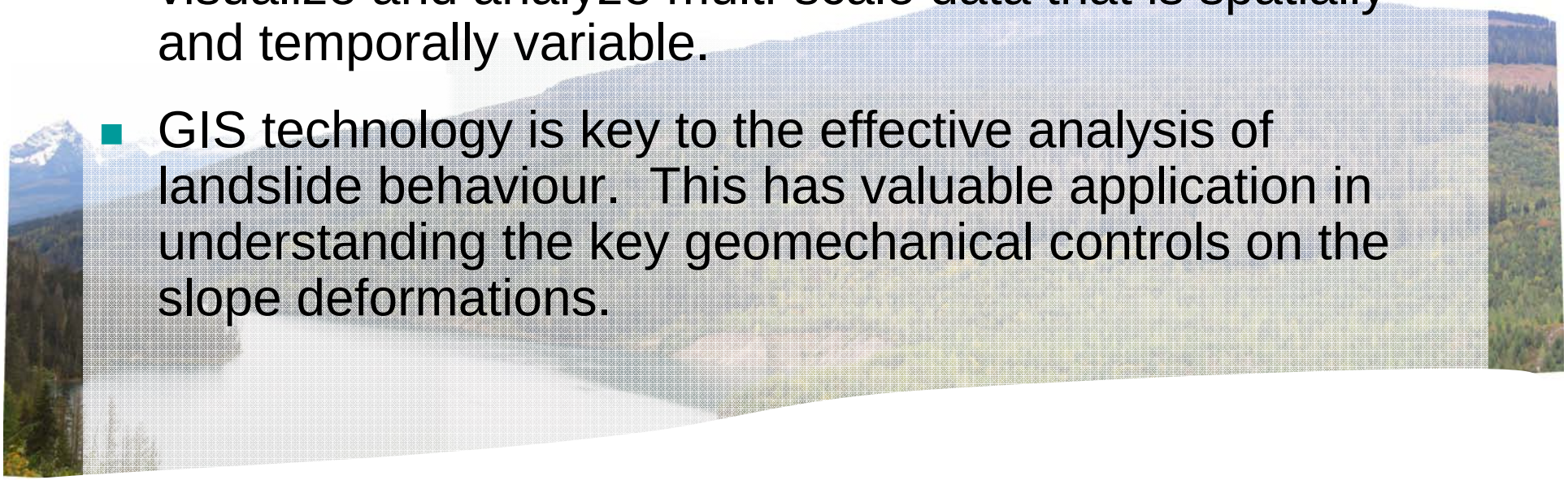


What factors contribute most to landslide behavior?



Conclusions

- A multi-faceted geodatabase amalgamates real, derived and simulated data.
- GIS tools are improving our ability to manipulate, visualize and analyze multi-scale data that is spatially and temporally variable.
- GIS technology is key to the effective analysis of landslide behaviour. This has valuable application in understanding the key geomechanical controls on the slope deformations.



Acknowledgements

NSERC CRSNG

BC hydro