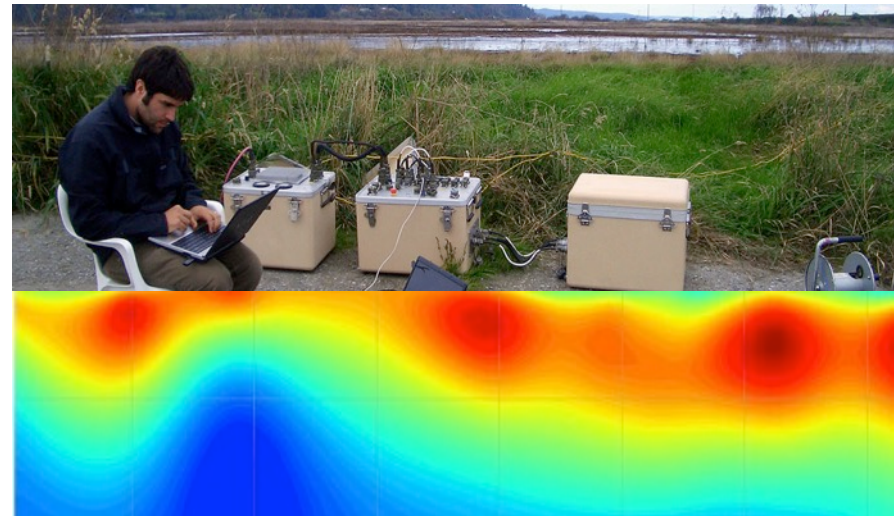




EOSC 350 : Environmental, Geotechnical and Exploration Geophysics I



September – December, 2017

Students

- Geologists?
- Geologic engineers?
- Other EOAS programs?
- P. Geo. or P. Eng.?
- Other?

Instructors

- Dikun Yang
 - Postdoctoral fellow
 - Applied geophysics (PhD, UBC, 2014)
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- Sarah Devriese
 - Postdoctoral fellow
 - Applied geophysics (PhD, UBC, 2016)
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- Devin Cowan
 - Research Scientist
 - Applied geophysics (MSc, UBC, 2016)
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Teaching assistants

- Michael Mitchell
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- Gabriela Racz
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- Vahid Dehghanniri
 - PhD student in volcanology
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Other contributors

- Doug Oldenburg (Director of Geophysical Inversion Facility)
- Thibaut Astic
- Dom Fournier
- Lindsey Heagy
- Seogi Kang
- GIF alumni...
- Community
 - GPG: Geophysics for Practicing Geoscientists
 - gpgLabs: A library of interactive apps for learning geophysics

First some problems of relevance

Finding Resources

Minerals

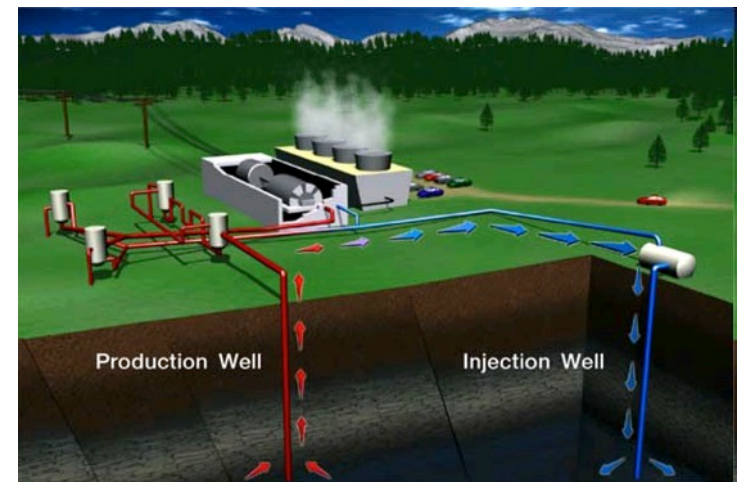
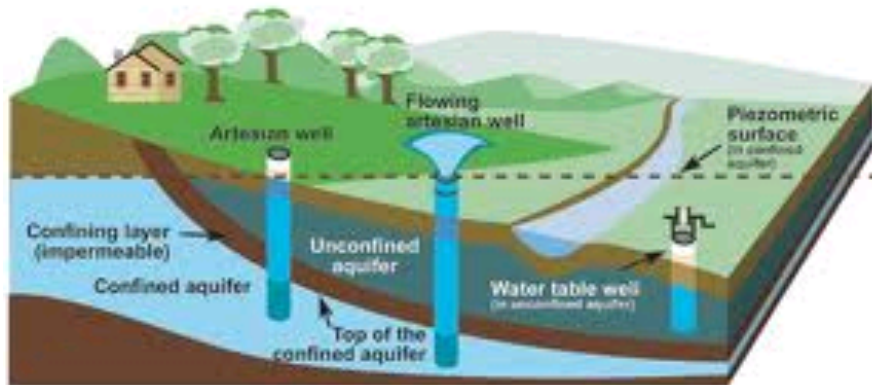


Hydrocarbons



Geothermal Energy

Ground Water



Natural Hazards

Volcanoes



Earthquakes

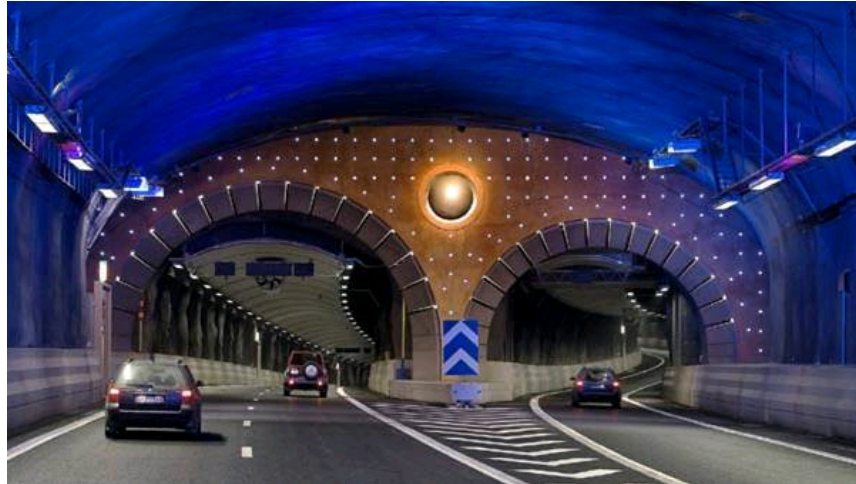


Tsunami



Geotechnical engineering

Tunnels



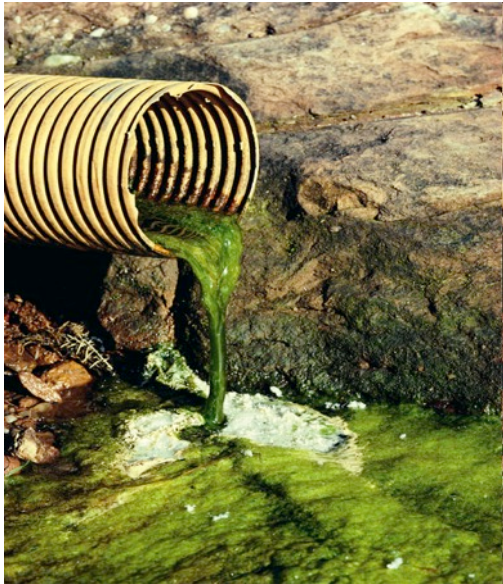
Slope stability



In-mine safety

Environmental

Water contamination



<http://www.centennialofflight.gov>

Salt water intrusion

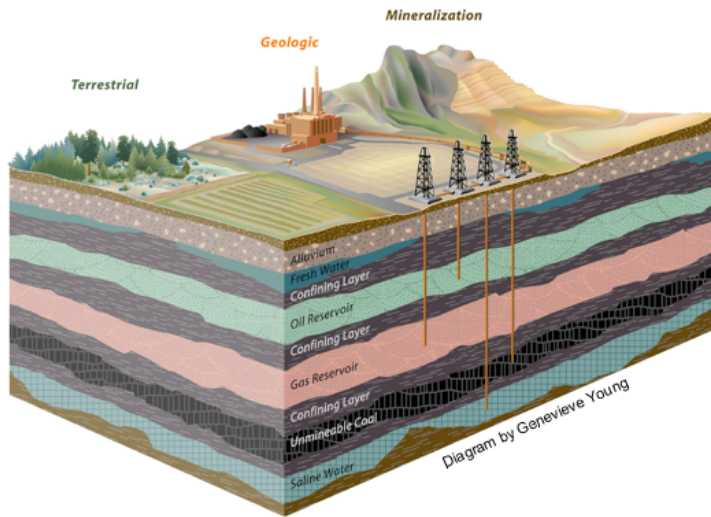


Unexploded Ordnance (UXO)

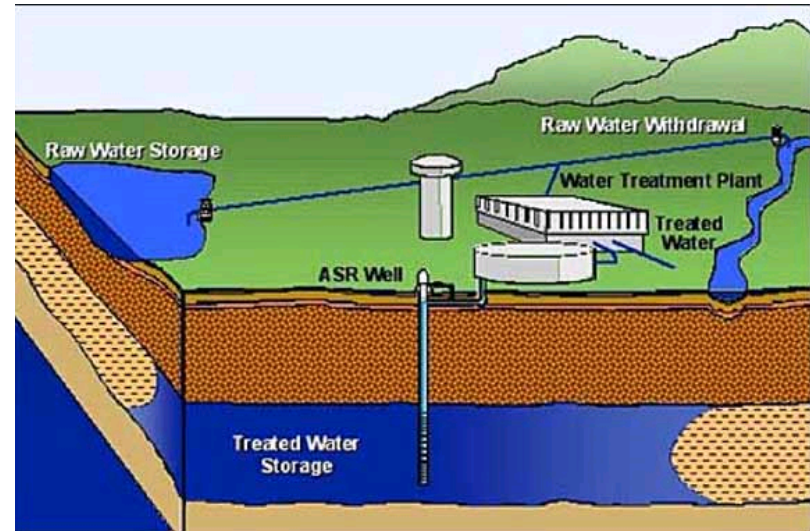


Surface or Underground Storage

CO2 sequestration



Aquifer Storage and Recover



Industrial Waste Disposal



Radioactive Waste

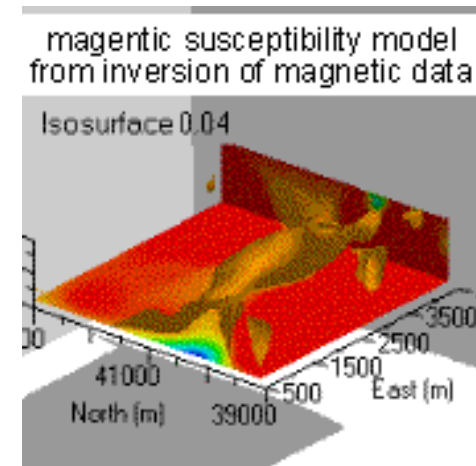
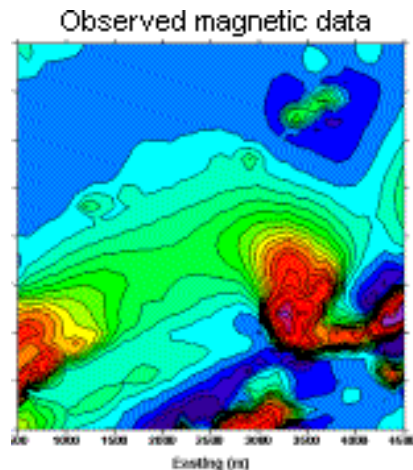


What do all these problems have in common?

- They all require ways to see into the earth without direct sampling.
- Geophysics is the only discipline that is devoted to this goal.

Broad overview

- Who uses geophysics?
- How does geophysics work?
- What can geophysics tell us?



Broad overview

- **What this course is:**

Introduction to applied geophysics, focus on what information geophysics can provide and how to approach solving problems with geophysics

- **What the course is not:**

A rigorous theoretical treatment of geophysical methods

- **Goal** is to help you understand how to use and apply geophysics in your professional careers, not turn you into a geophysicist!

Your expectations for this course?

1. New knowledge?

- ☐ “Geophysics 101”
- ☐ Some physics, a little math
- ☐ Application-oriented

2. New skills?

- ☐ Using geophysical information to make decisions

3. Attitudes?

- ☐ Geophysics is not intellectually scary
- ☐ It is fun!

Outline of topics

1. Foundations:

- ❑ Physical properties - Dikun
- ❑ A 7-step framework for applying geophysics - Dikun

2. Geophysical surveys (modules):

- ❑ Magnetic (magnetic susceptibility) - Dikun
- ❑ Seismic (density, elastic parameters) - Sarah
- ❑ Ground penetrating radar (electrical permittivity) - Devin
- ❑ DC resistivity (electrical conductivity/resistivity) - Devin
- ❑ Electromagnetic (electrical conductivity/resistivity) - Dikun

3. Emphasis throughout:

- ❑ Understand the basics of the surveys.
- ❑ Have reasonable expectations for when and a survey should be used and information provided.

Teaching and learning activities

- **Lecture:**

- Presentations by the instructors

- Demos/hands-on practice using interactive apps

- **Team-based learning (TBL) case history:**

- A publication on the use of a geophysical method to solve a practical problem

- Read the paper and answer individual TBL questions as homework; submit your answers online before the team discussion

- Answer team TBL questions as a team and submit worksheets in class

Teaching and learning activities

■ Quiz:

Ten multiple choice questions at the end of each topic are answered individually.

Same questions are discussed as part of TBL and submitted as a team

■ Lab:

Mostly computer-based exercises using interactive apps

Use the department's computers (get user account from the main office) or your own devices

Instructed by TA's

Turn in worksheets before deadlines (assignment)

Contribution to final grade

- Final 40%
- Midterm 10%
- Labs 20%
- Individual quizzes ...10%
- Individual TBL 10%
- Team quizzes* 5%
- Team TBL* 5%

* Zero grade for missed team activities

Marking

- Individual TBL: multiple choice questions; online form submission
- Individual quiz: multiple choice questions; paper-based bubble sheet
- Team TBL and labs: short-answer questions; paper-based worksheet; word-grade evaluation; no specific comment will be made on papers; answers will be available after the worksheets have been evaluated
 - **AWE-INSPIRING** = 95% (you did all the work very well and very clearly understand the material)
 - **BRILLIANT** = 80% (you did the work and understand all of the concepts)
 - **COMPETENT** = 65% (you did the work and understand most of the concepts)
 - **DECENT** = 50% (you did the work but don't quite understand all the concepts)
 - **FALL-SHORT** = 0% (you didn't do the work, or only some of it)

Important web links

- Course website

- <http://eosc350.geosci.xyz/en/latest/index.html>

- “Textbook”

- GPG: Geophysics for Practicing Geoscientists
 - <http://gpg.geosci.xyz/>

- Interactive apps

- GPG labs
 - <https://github.com/geoscixyz/gpgLabs>
 - Follow online instructions or ask TA’s to setup

Rules

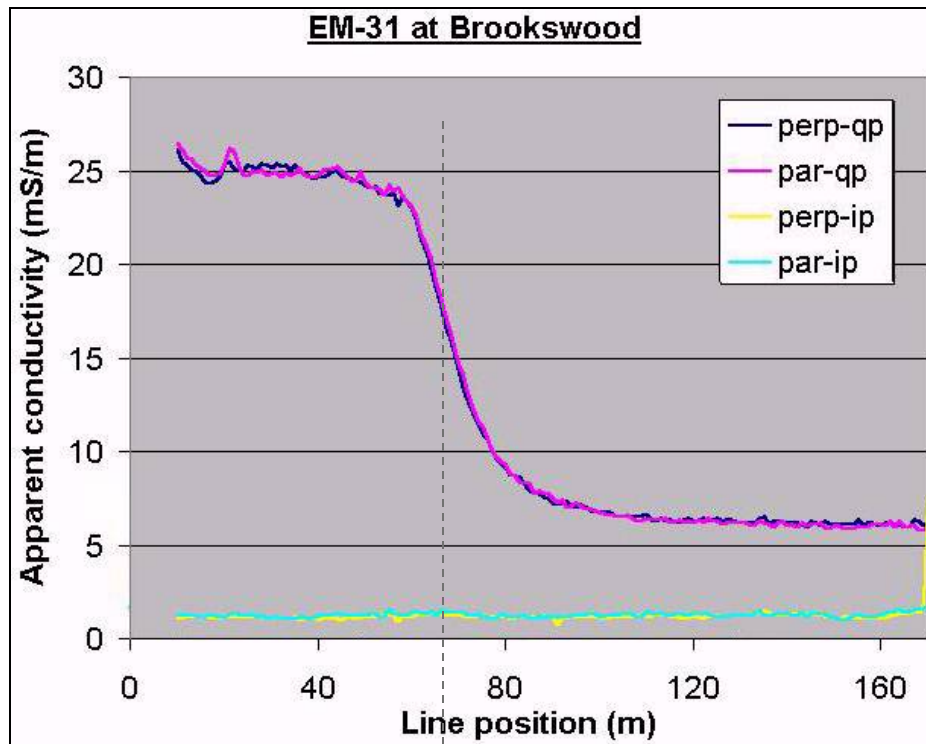
- Electronic devices are used only for course-related teaching and learning purposes.
- If you feel it is absolutely necessary, please get out of the classroom to use them for other purposes.
- Quizzes, midterm and final exams can be rescheduled individually for medical or emergency reasons.
- Flexibility in attending one of the three lab sessions – contact the TA

Other logistics

- Your 350 ID number
 - ❑ First four digits of your student ID/username
 - ❑ ID for online submission/announcement
- Team
 - ❑ 7 people per team
 - ❑ Checkout the 350 website for teams
- Advanced learning opportunities
 - ❑ Prep for honors/grad school
 - ❑ Want to be a geophysicist
 - ❑ Have specific geoscientific problems

A few more examples

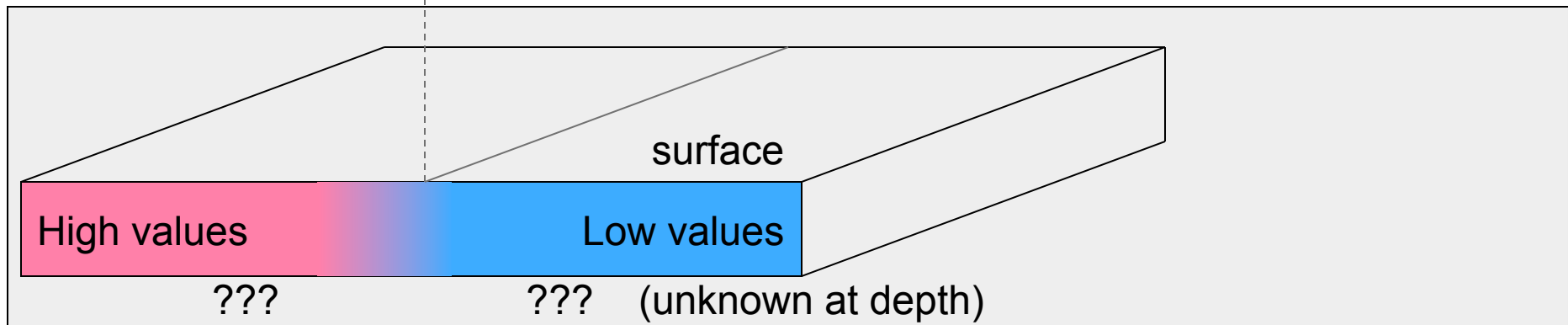
Examples



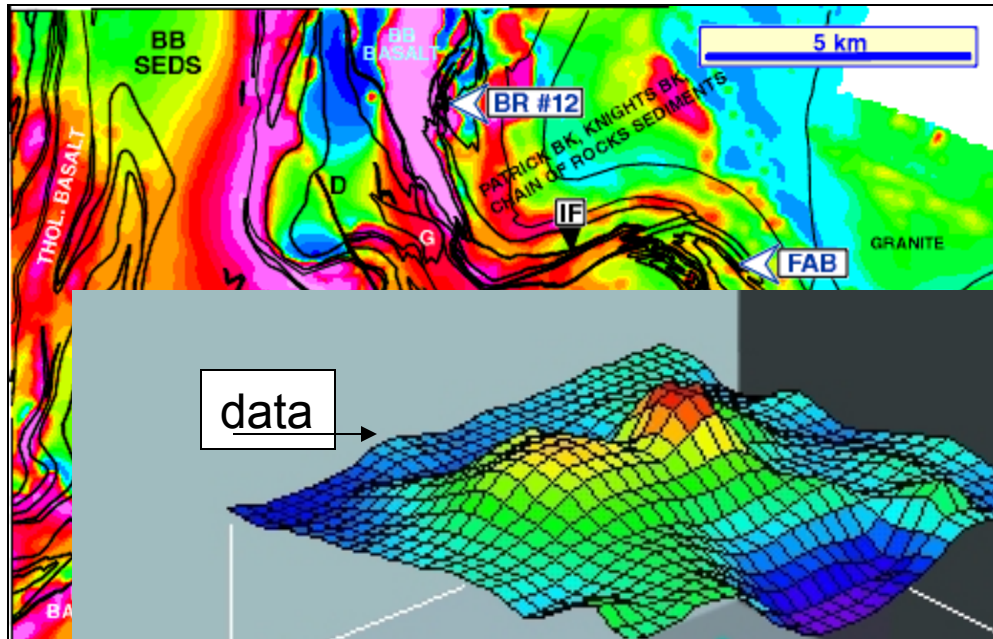
Profile of measured electrical conductivity over an aquifer



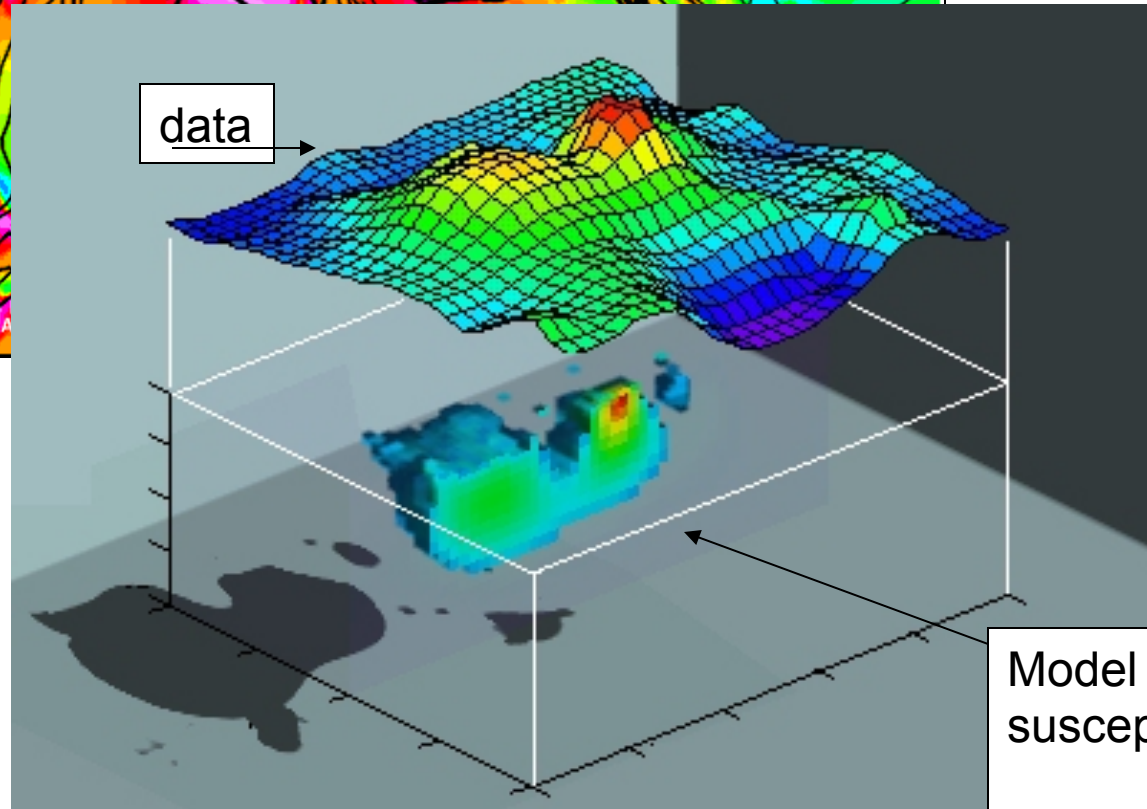
Outcome:
physical property values.



Examples



Map: magnetic response, NB



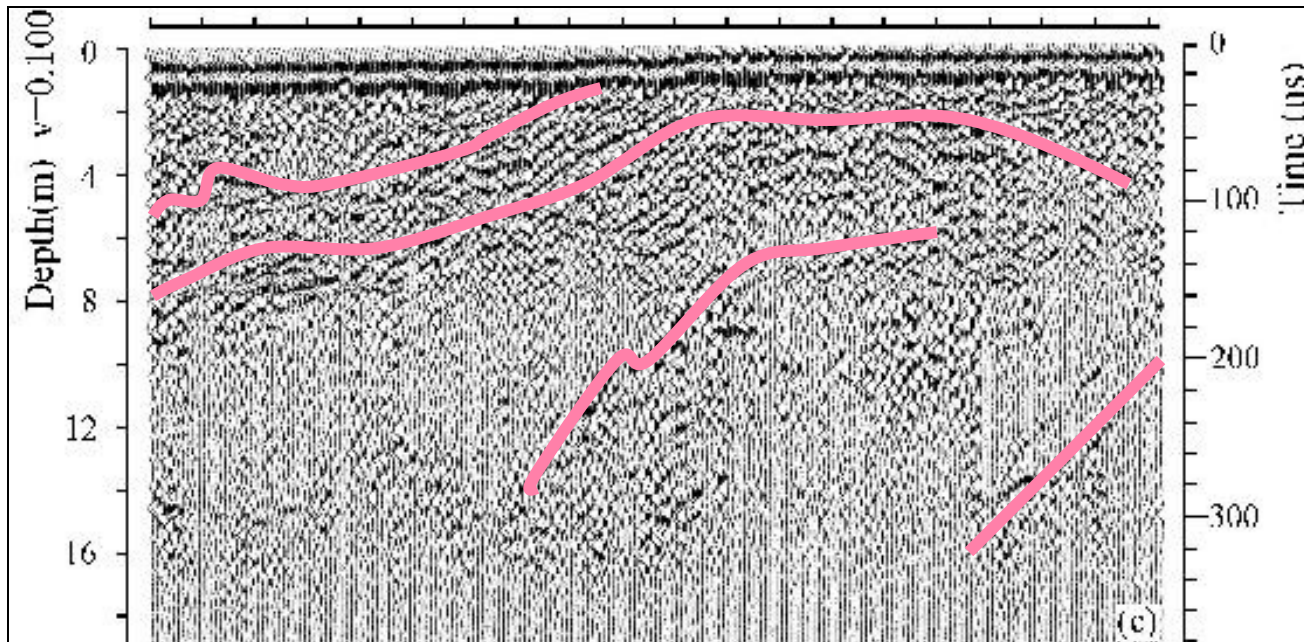
possible outcomes:

Structures on surface map.
Structures under surface.
Physical property distribution

Model of
susceptibility:

Red=high values

Examples

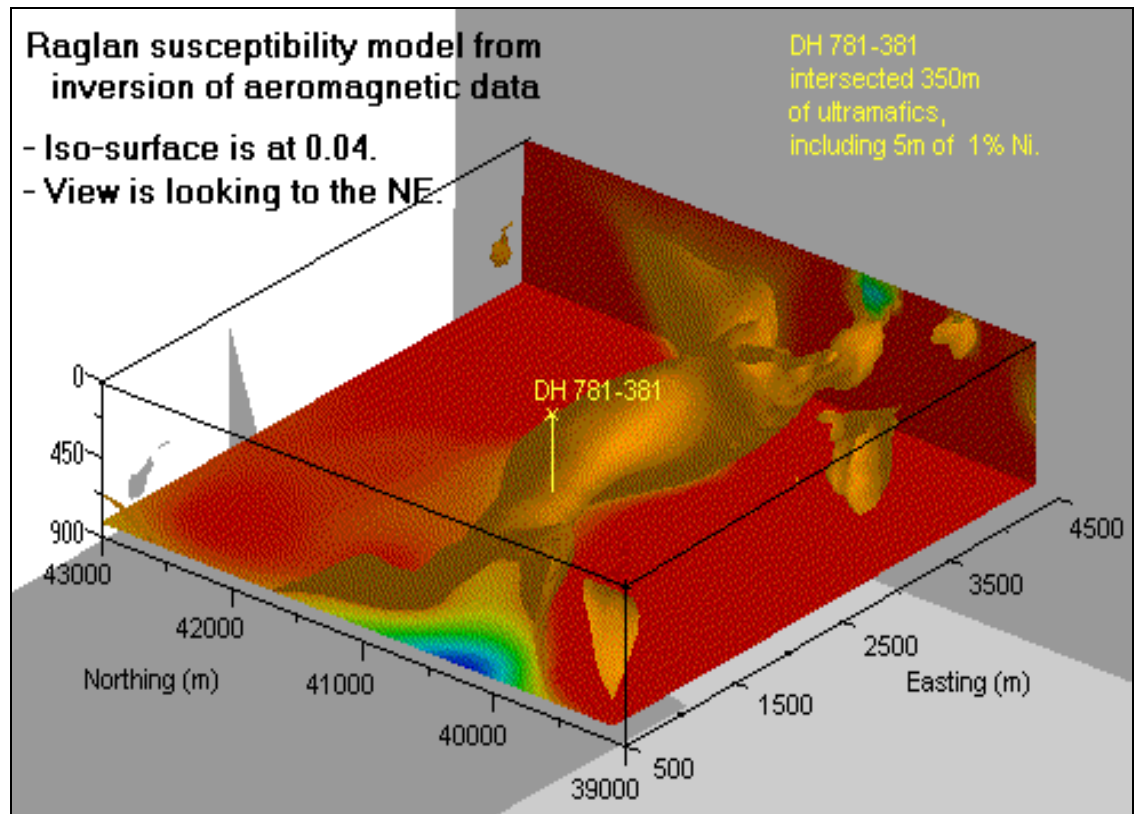
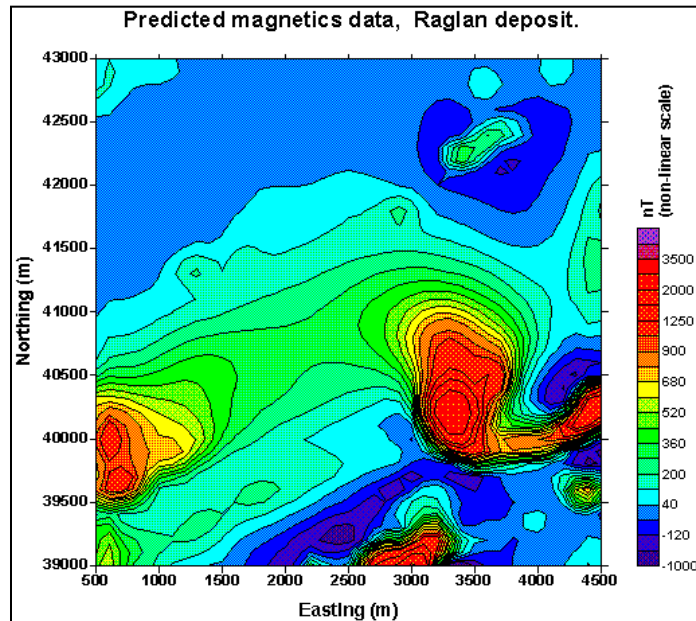
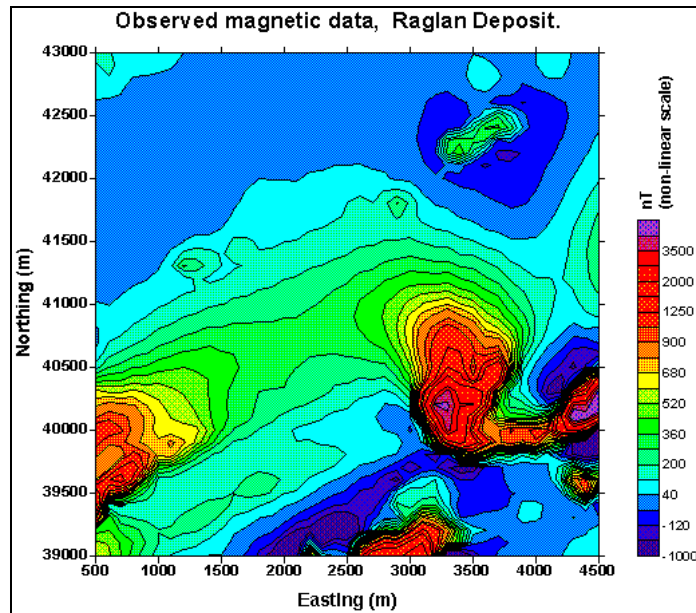


Seismic data:
Echoes of
sound energy

Model: locations of interfaces.

Exploration : Magnetics - Raglan deposit, Qué. (Flaconbridge)

Geological question:
Are outcrops connected at depth?



Upcoming activities

- Fri. Sept. 8
 - Lecture on physical properties
- Mon. Sept. 11
 - Lecture on the framework of applied geophysics
- Wed. Sept. 13
 - Quiz: foundations
 - TBL: “A geophysical journey around Ireland”
- Labs on Sept. 11, 12, 13
 - Physical properties of rocks
 - Not a computer lab