Mapping Groundwater in the Snowy Range

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Introduction

• Project goal: produce groundwater map in an alpine drainage

• Importance: monitoring, hydrologic studies

• Approach: airborne resistivity mapping and nuclear magnetic resonance (NMR) point soundings
Methods: Resistivity

- Around 12 square miles of resistivity data was collected through the Airborne Transient ElectroMagnetic (SkyTEM) survey.

- Advantage: it covers a large area.

- Disadvantage: it is not a direct measurement of water content.
Methods: Nuclear Magnetic Resonance

- Four point soundings were collected using nuclear magnetic resonance (NMR)

- Advantage: this is the only geophysics method that directly measures water content

- Disadvantage: each measurement applies to only one point.
Geologic Setting
TEM data overview
TEM data overview
Can we predict water from resistivity?

- Define “Conductive” points to be those with a standardized level less than 0, and “Resistive” points to be those with a standardized level greater than 0.
- Assume at 6 m depth, the presence of groundwater is controlled chiefly by nearby surface water.
- Choose a search distance of 100 m, the approximate radius of each TEM measurement.
- Check whether water shows up as an anomaly.
- Check whether anomalies tend to be water.
Sometimes, yes!
How wet is “wet”?

Groundwater – around 14% near surface.

Recall—peak of 7% at a depth of approximately 40 m.
Creating the groundwater map
Interpreting the groundwater map
And as imagination bodies forth
The forms of things unknown, the poet's pen
geophysicist
Turns them to shapes and gives to airy nothing
A local habitation and a name.

-A Midsummer Night’s Dream
Bedrock Resistivity

Bedrock Resistivities at 117 m (red) and 6 m (pink)
Sometimes, yes!

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<th># Points Within 100 m of Stream or Lake (WET)</th>
<th>Percent of ALL pts that are CONDUCTIVE</th>
<th>Percent of WET points that are CONDUCTIVE</th>
<th>Percent of CONDUCTIVE pts that are WET</th>
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<th>Percent of WET pts that are RESISTIVE</th>
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NMR data processing