Factors important for comparing arrays

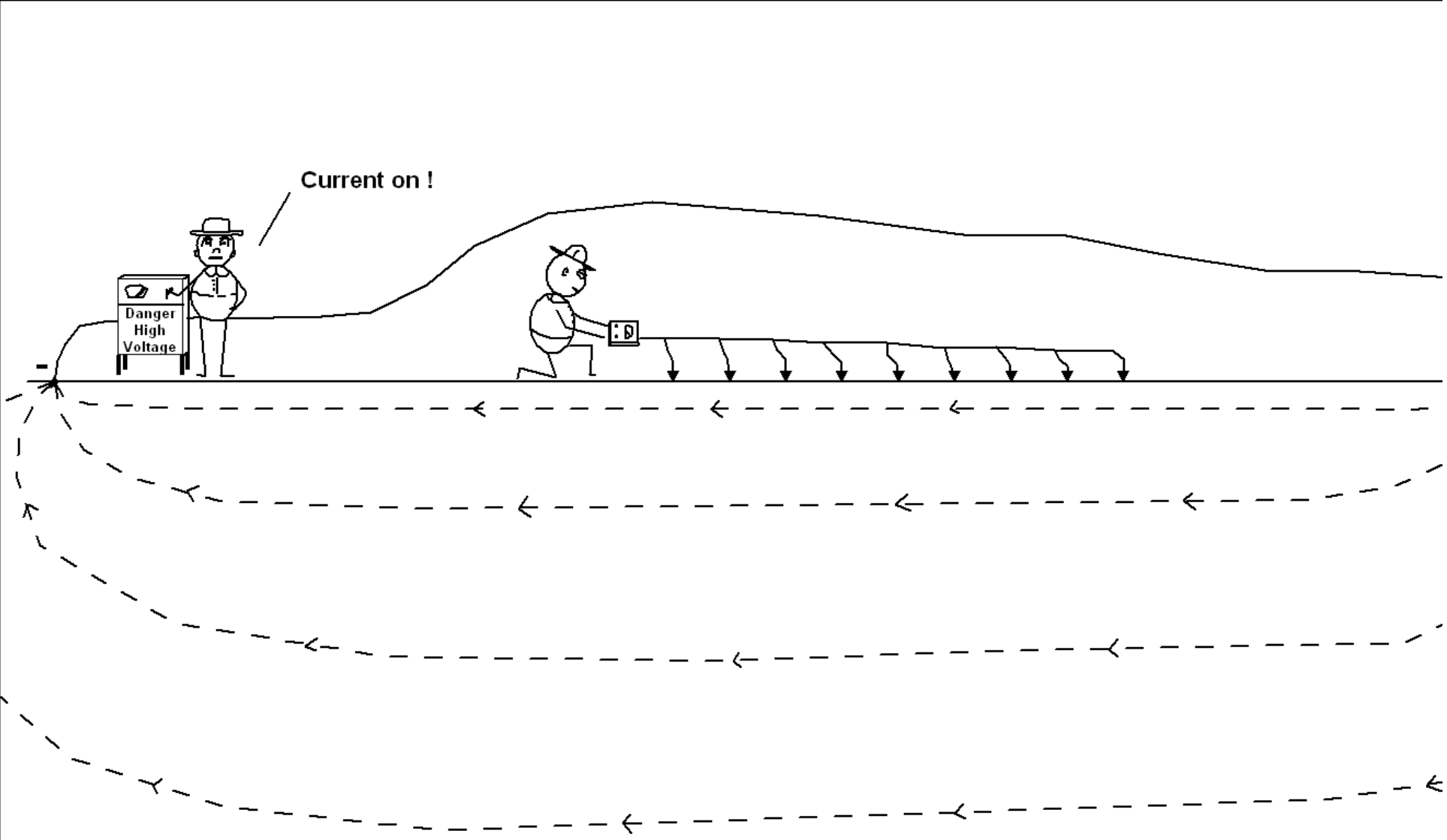
Current direction

Signal strength

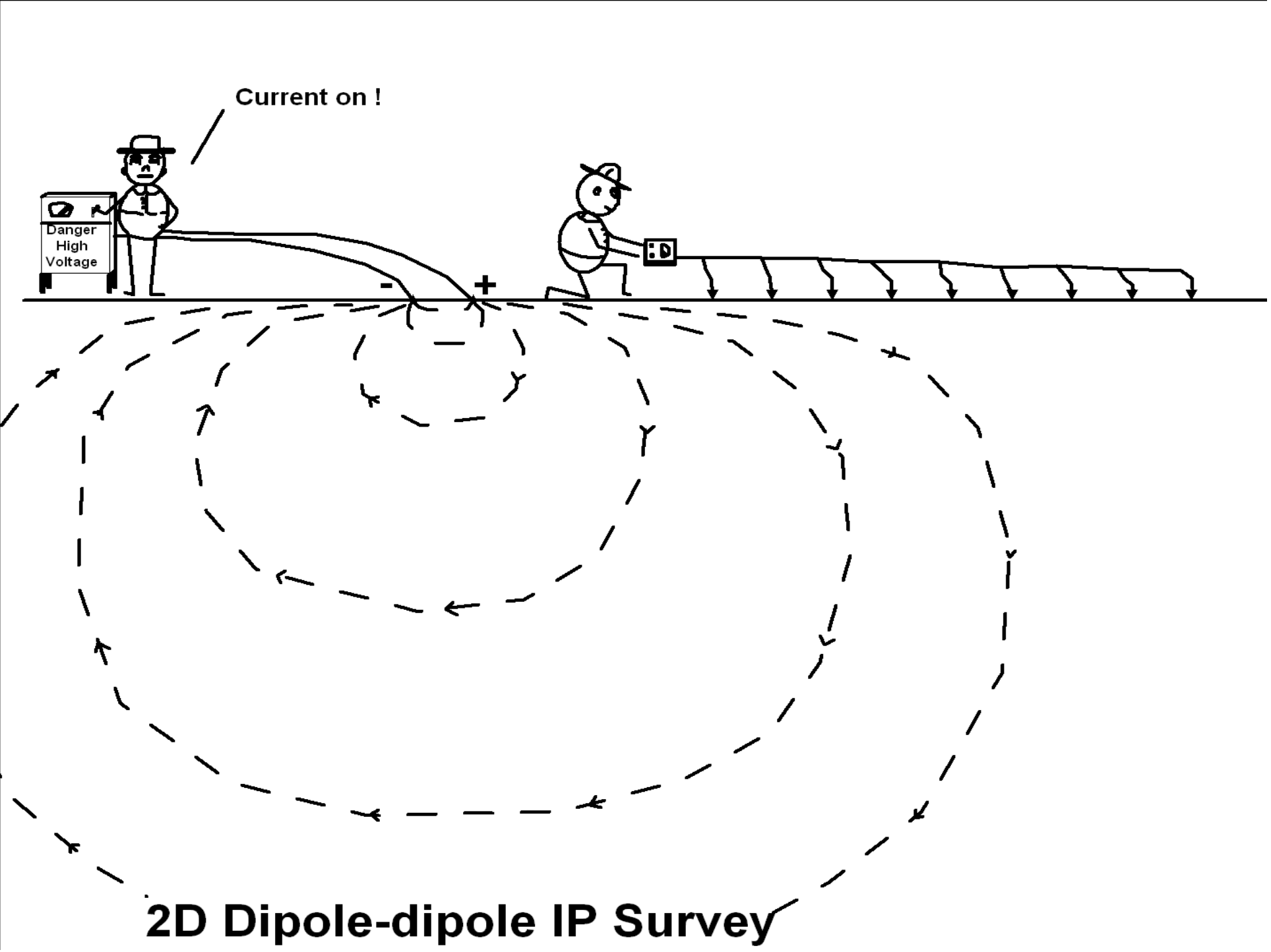
Electromagnetic coupling

Logistics and safety

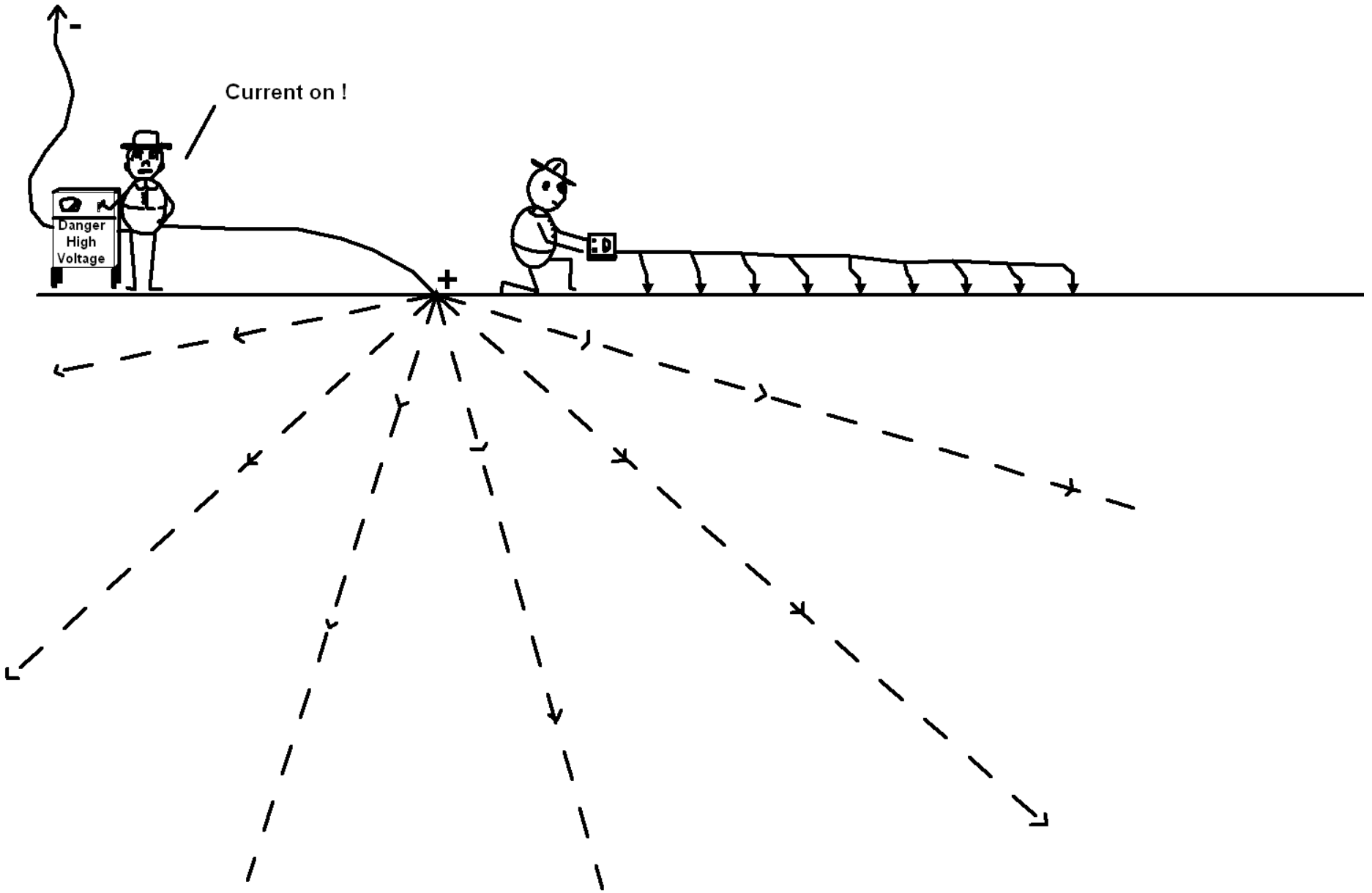
Efficiency of modeling



2D Gradient Array IP Survey



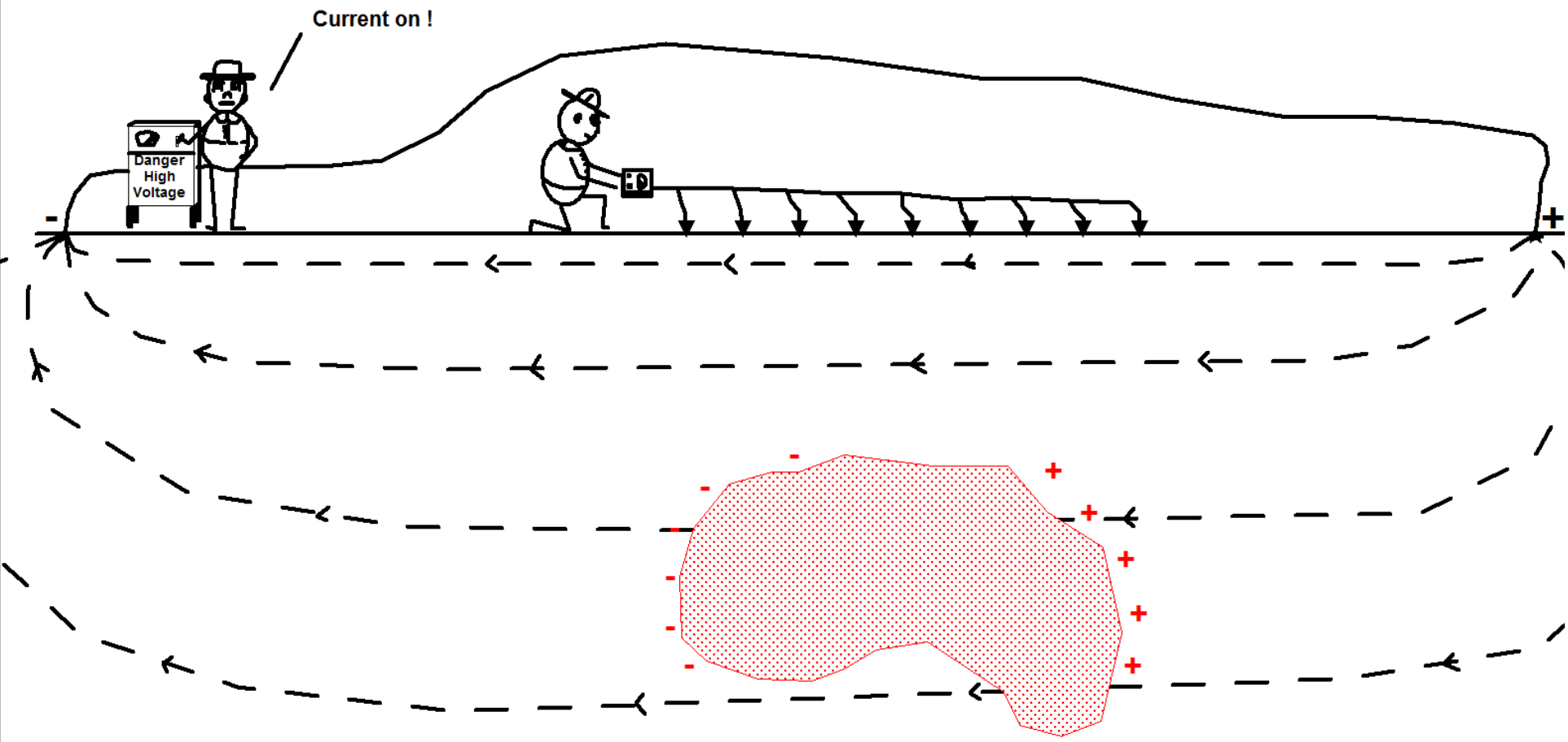
2D Dipole-dipole IP Survey



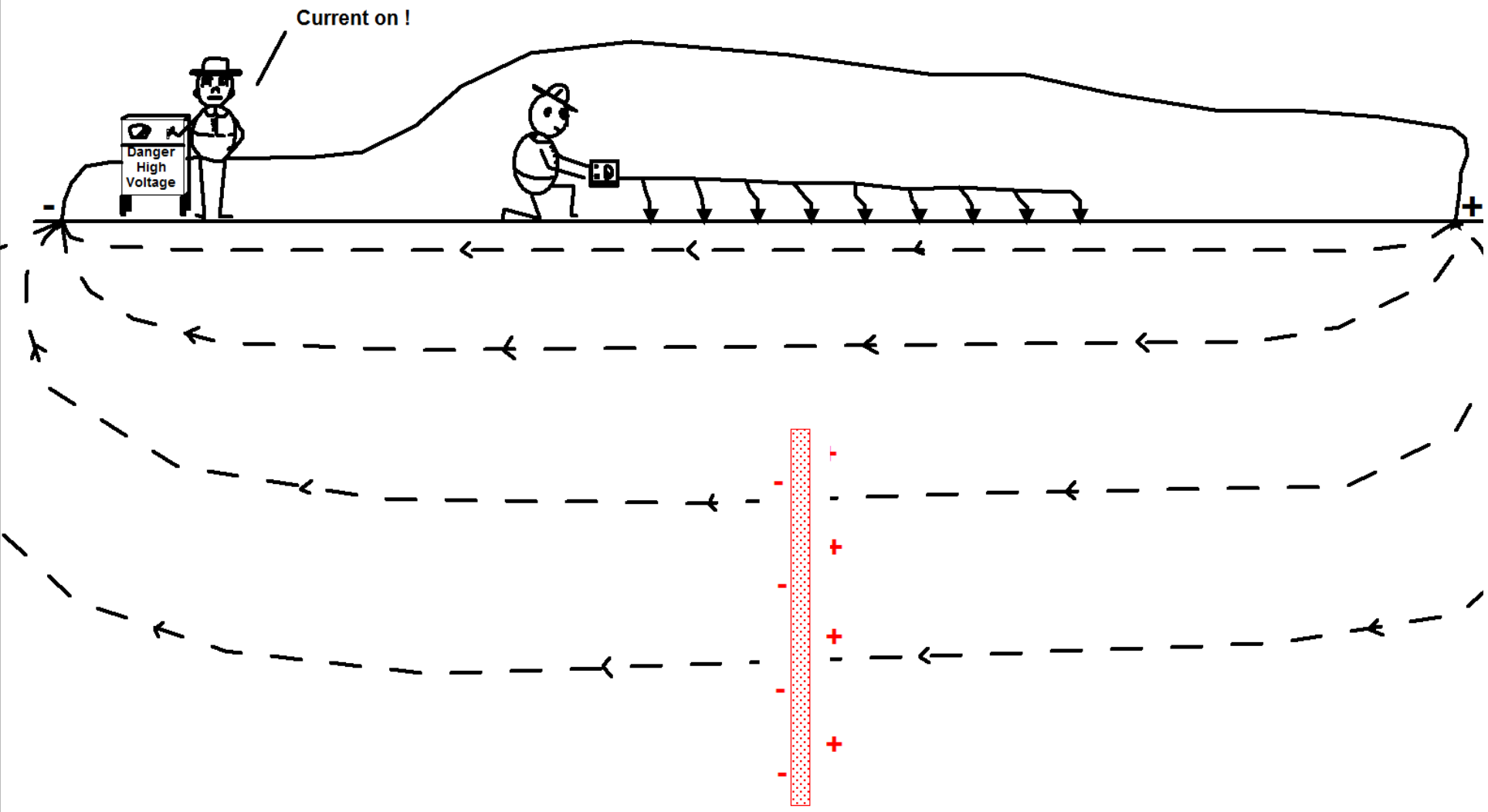
2D Pole-dipole IP Survey

Is this important?

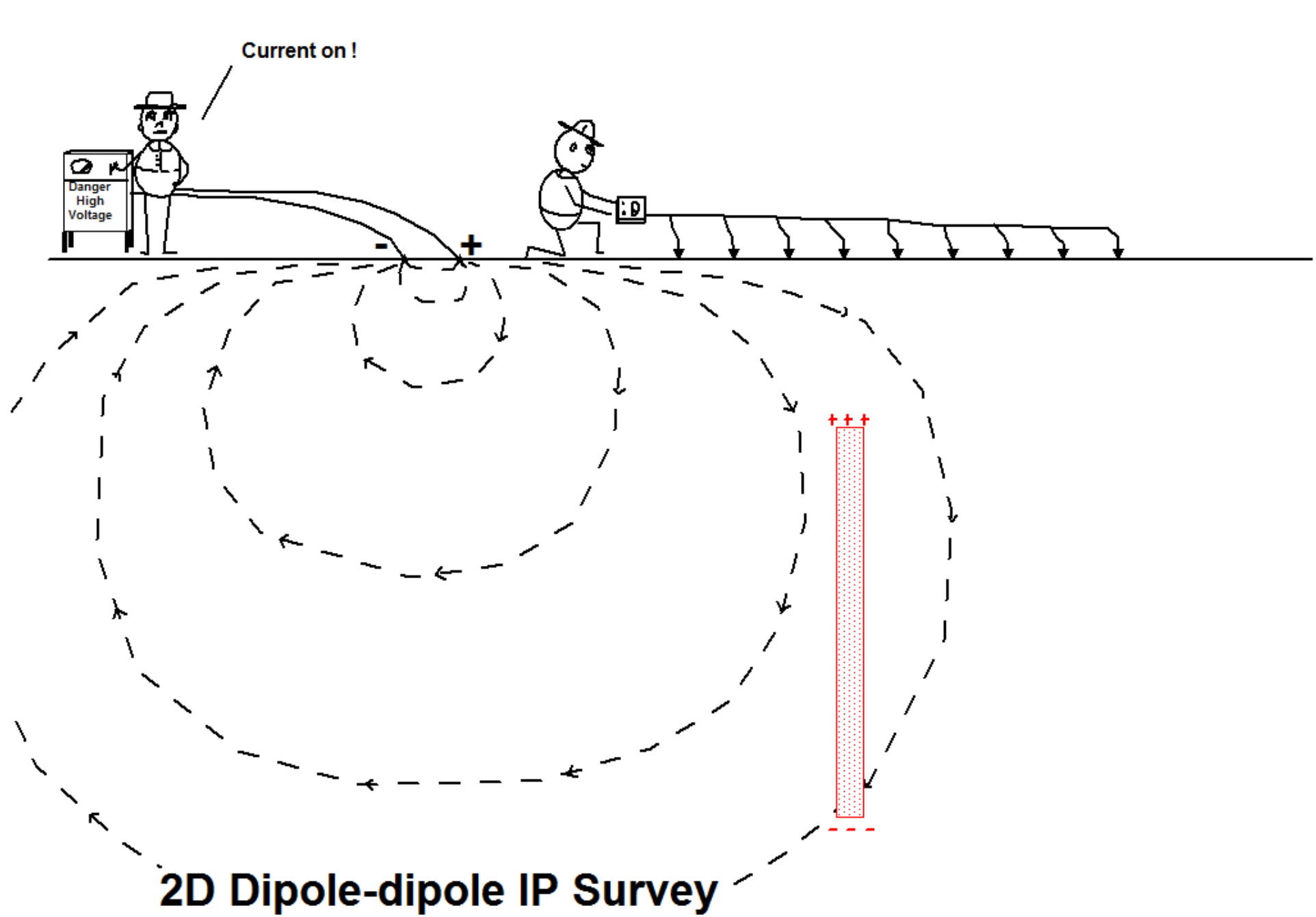
It depends on your target



2D Gradient Array IP Survey



2D Gradient Array IP Survey



2D Dipole-dipole IP Survey

Three dimensional
Or offset arrays

May also be better at resolving some three dimensional shapes

Factors important for comparing arrays

Current direction

Signal strength

Electromagnetic coupling

Logistics and safety

Efficiency of modeling

For deep penetration

The smallest distance between any receiver and transmitter electrode must be maximised

If the transmitter to receiver distance is large

The signal at the receiver

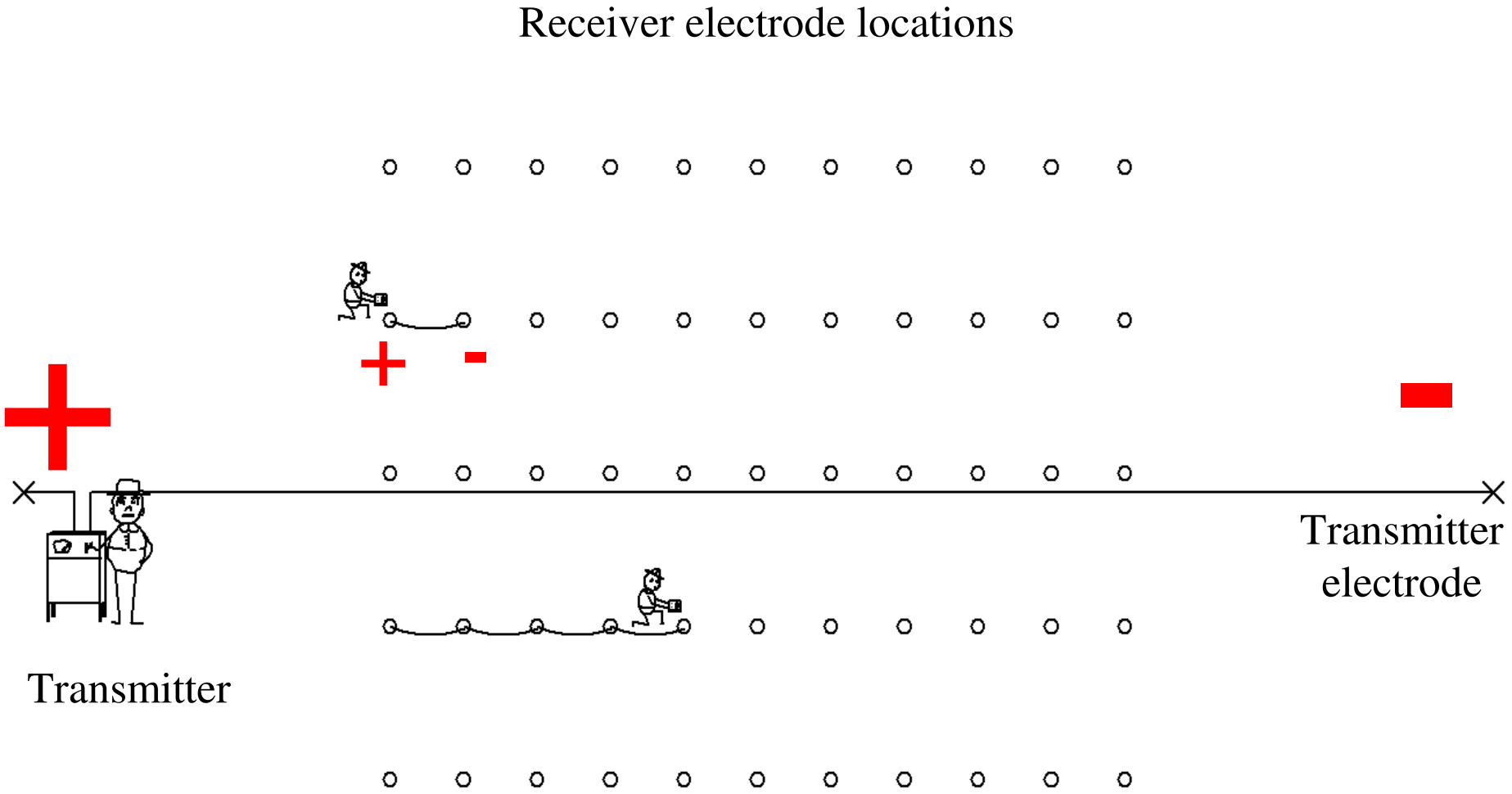
Is likely to be small

To detect a reasonable IP signal, 10uV of secondary signal is needed

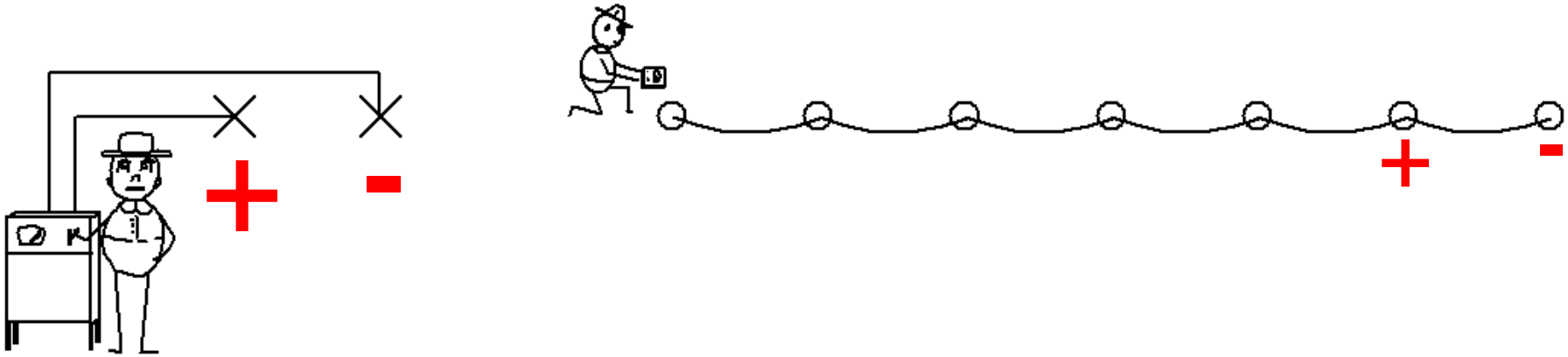
Therefore, at least **3mV** of primary signal is required

At large spacings and low earth resistivity, this may be difficult to achieve

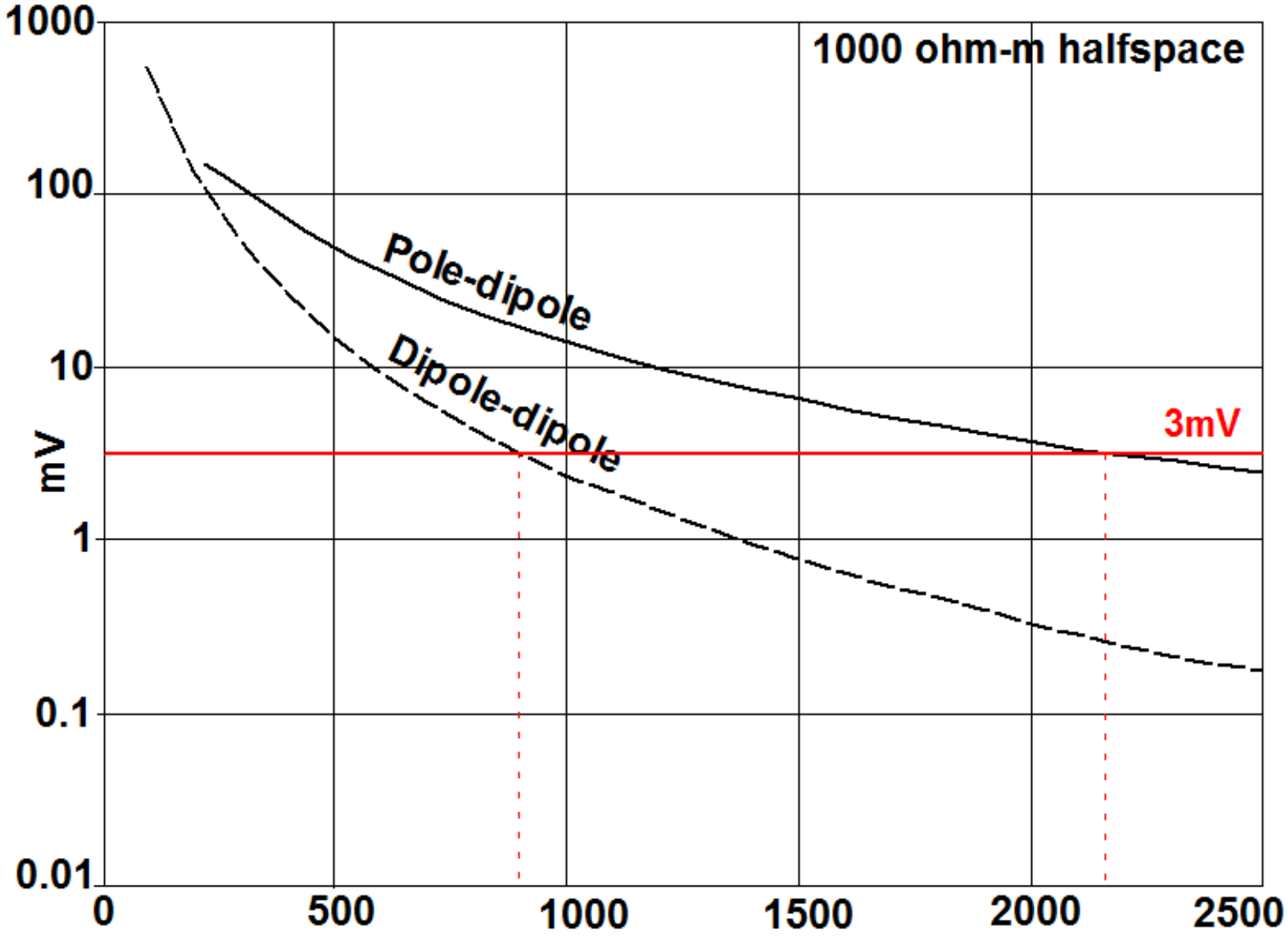
Survey geometry can help



Gradient array transmitter electrodes add together



Dipole-dipole transmitter electrodes partially cancel


1000 ohm-m halfspace
Pole-dipole
Dipole-dipole
3mV
mV
1000
100
10
1
0.1
0.01
0
500
1000
1500
2000
2500
Receiver to transmitter distance

Signal strength for large spacings

Gradient array highest

Pole-dipole intermediate

Dipole-dipole relatively poor

Factors important for comparing arrays

Current direction

Signal strength

Electromagnetic coupling

Logistics and safety

Efficiency of modeling

If the earth resistivity is low then the electromagnetically coupled signal between the transmitter and the receiver may be similar to the observed secondary IP signal.

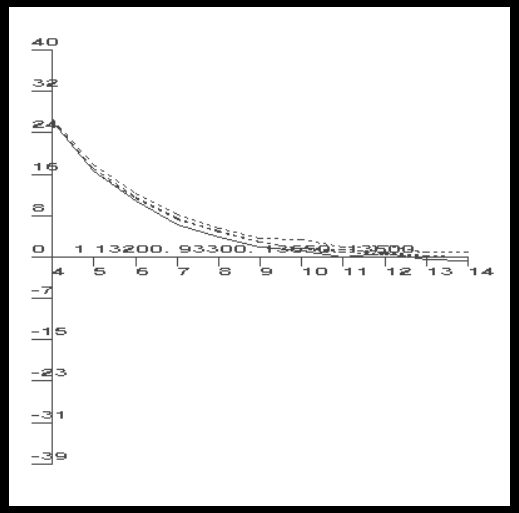
This is much worse if the transmitter wires are long.

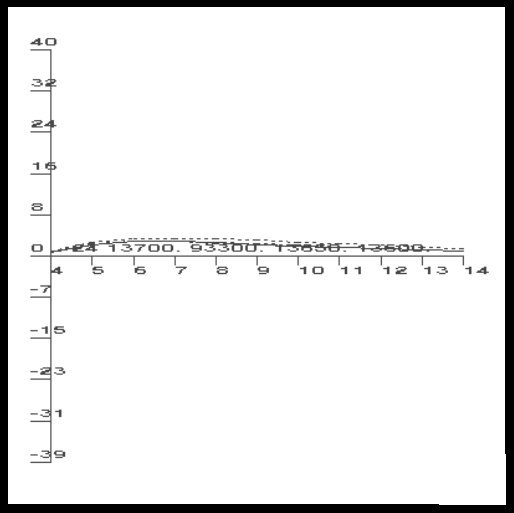
The apparent electromagnetic coupling can be positive or negative relative to the IP signal

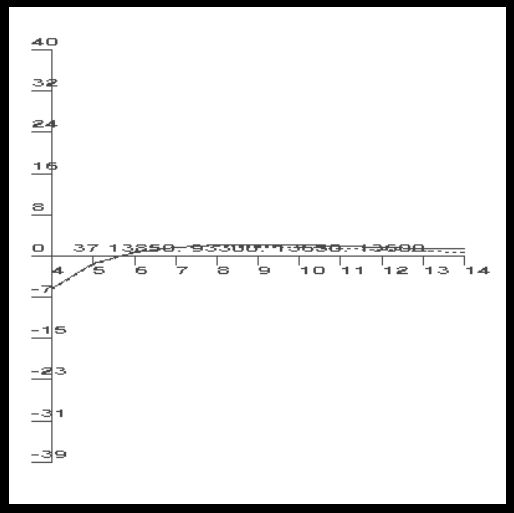
If the transmitter wire passes the receiver dipole (gradient array), the coupling will be negative. If the receiver is outside the transmitter (dipole-dipole) the coupling is positive

For gradient array surveys coupling may be high but is recognisable as a negative apparent IP signal

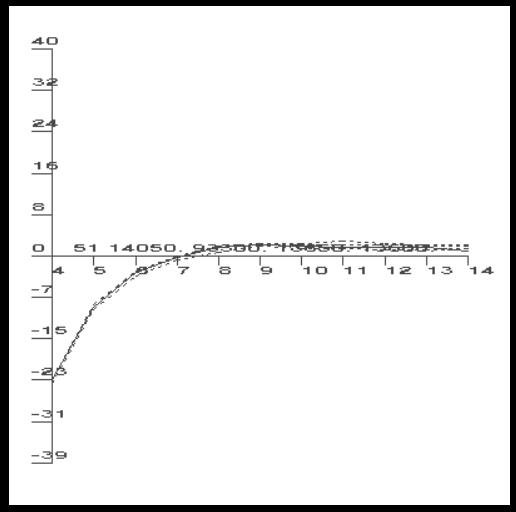
For dipole-dipole surveys the coupling may be lower but it is indistinguishable from a normal IP signal.

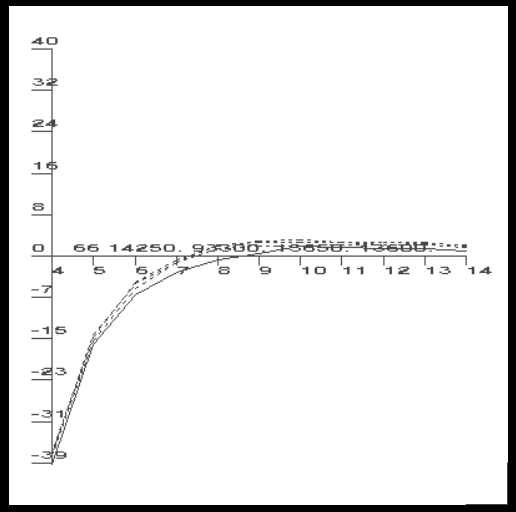


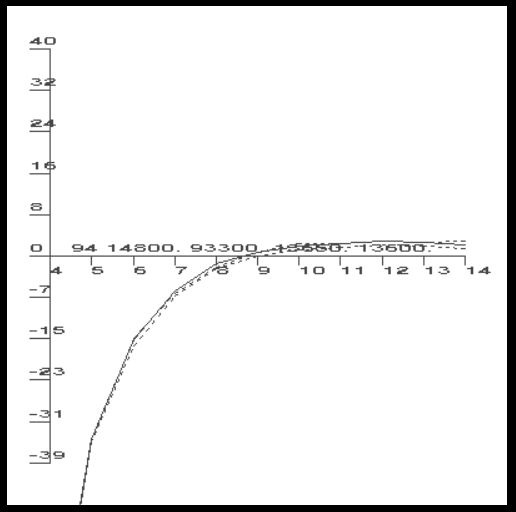




Effect of EM coupling as Tx moves past Rx







In general, if electromagnetic coupling problems are expected it is best to avoid gradient array

Factors important for comparing arrays

Current direction

Signal strength

Electromagnetic coupling

Logistics and safety

Efficiency of modeling

Long transmitter wires cause problems

Long wires for pole-dipole

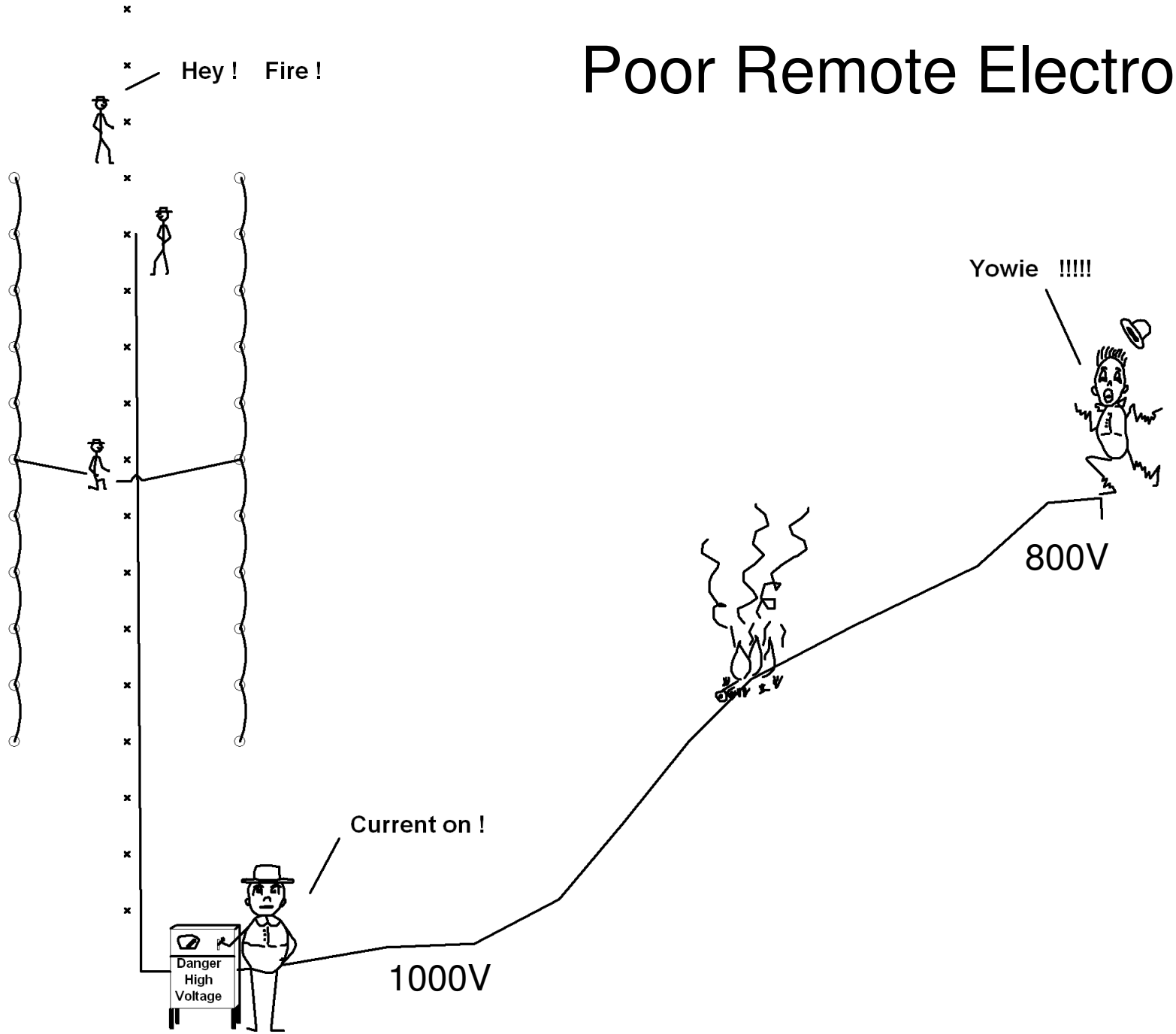
Or gradient array surveys

Are difficult to construct,

Are difficult to maintain

Represent a safety risk for fire or electrocution.

Poor Remote Electrode



Factors important for comparing arrays

Current direction

Signal strength

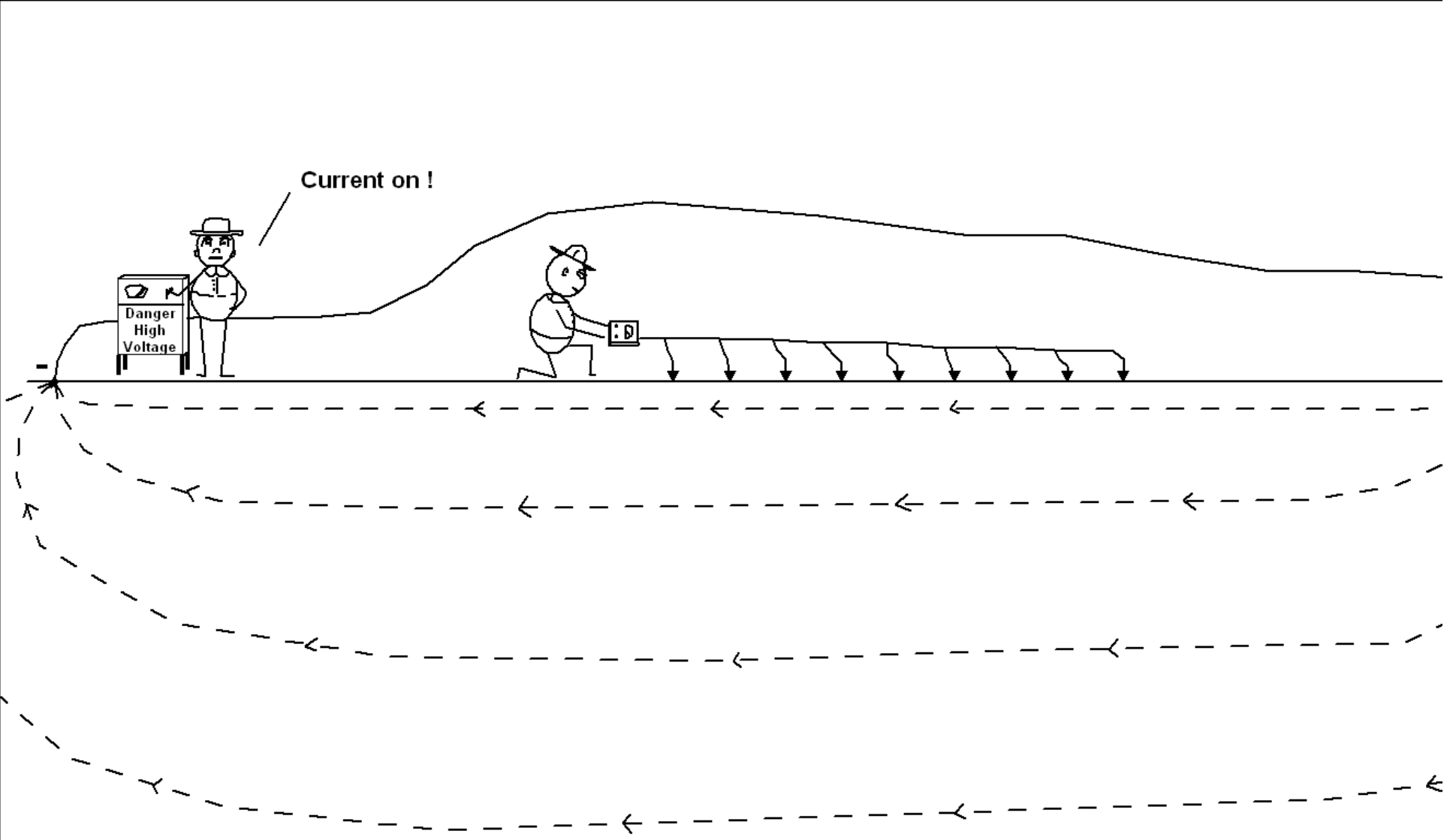
Electromagnetic coupling

Logistics and safety

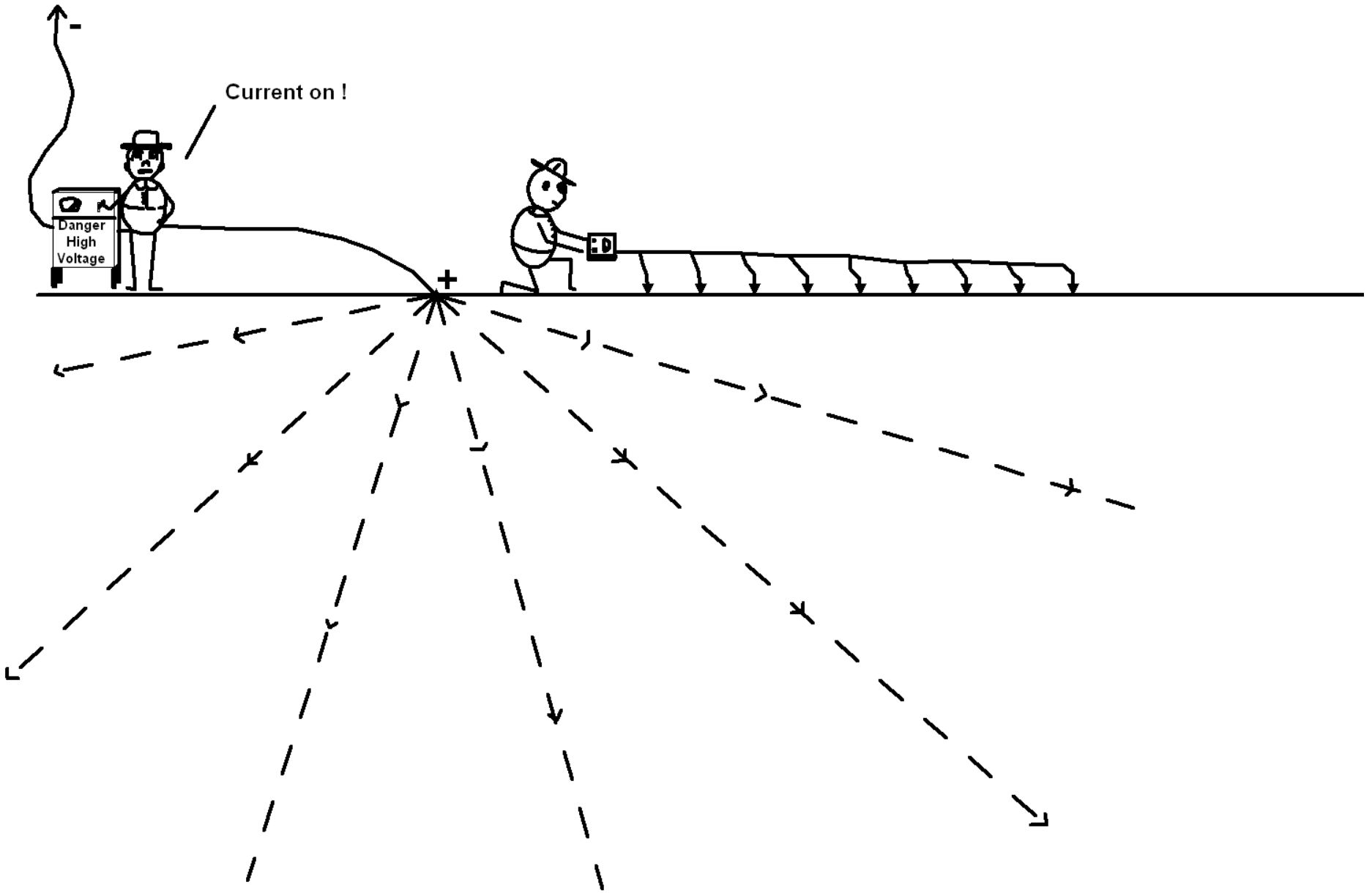
Efficiency of modeling

It is important to have as many independent data points as possible To use in inversion modelling (With some exceptions)

The more ways that the target is energised, the better will be the modeling process



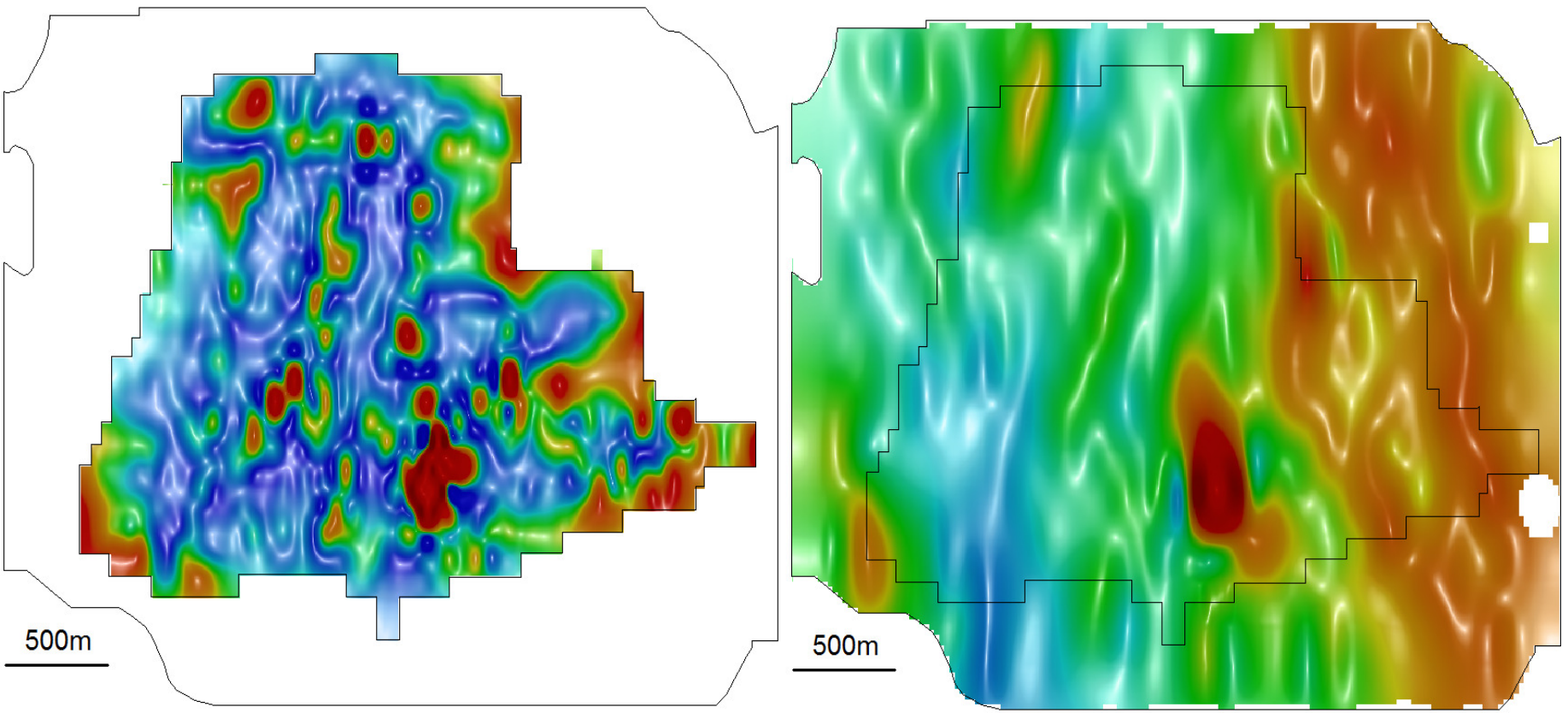
2D Gradient Array IP Survey



2D Pole-dipole IP Survey

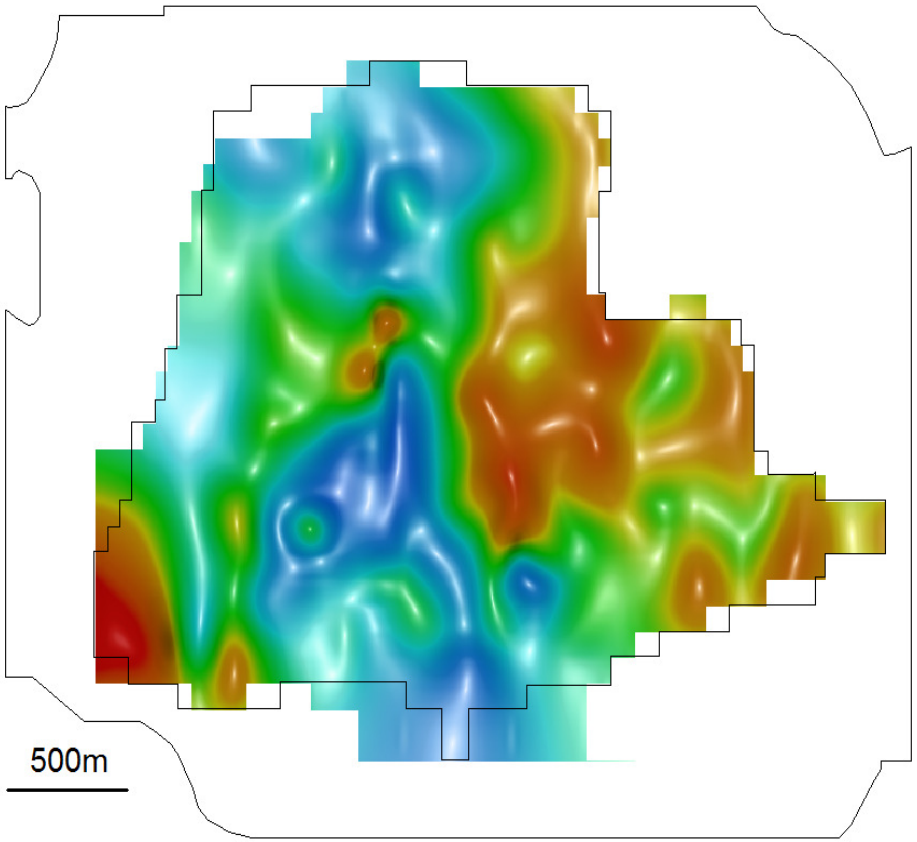
Offset pole-dipole

Gradient array

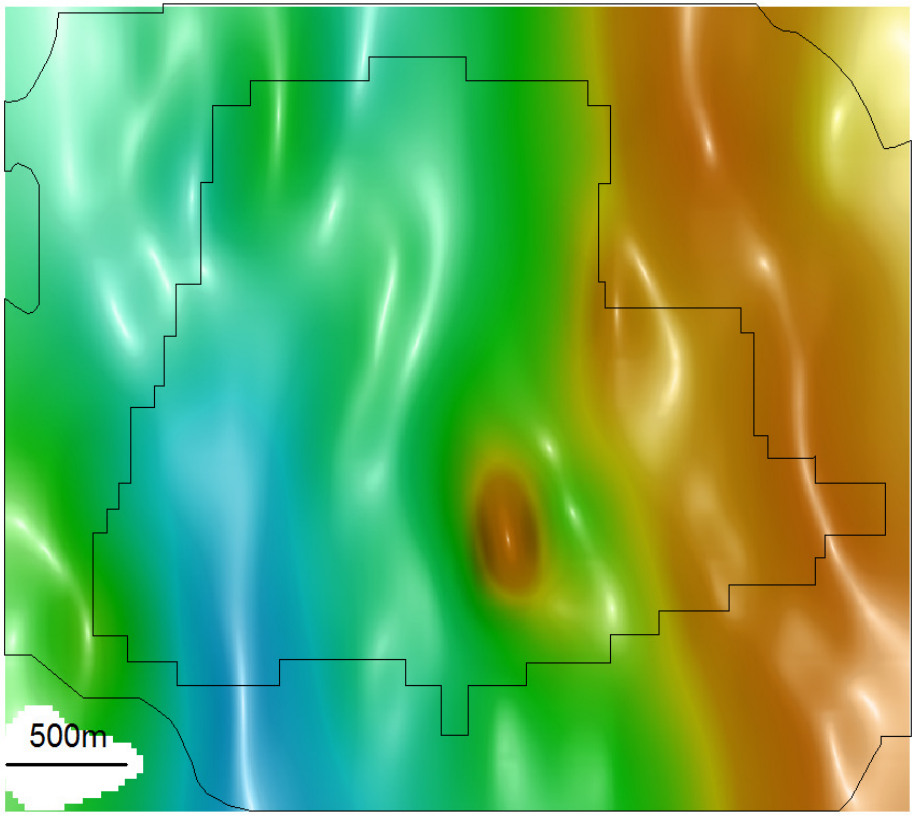


Compare Inversion Models at 50 metres below the surface

Offset pole-dipole

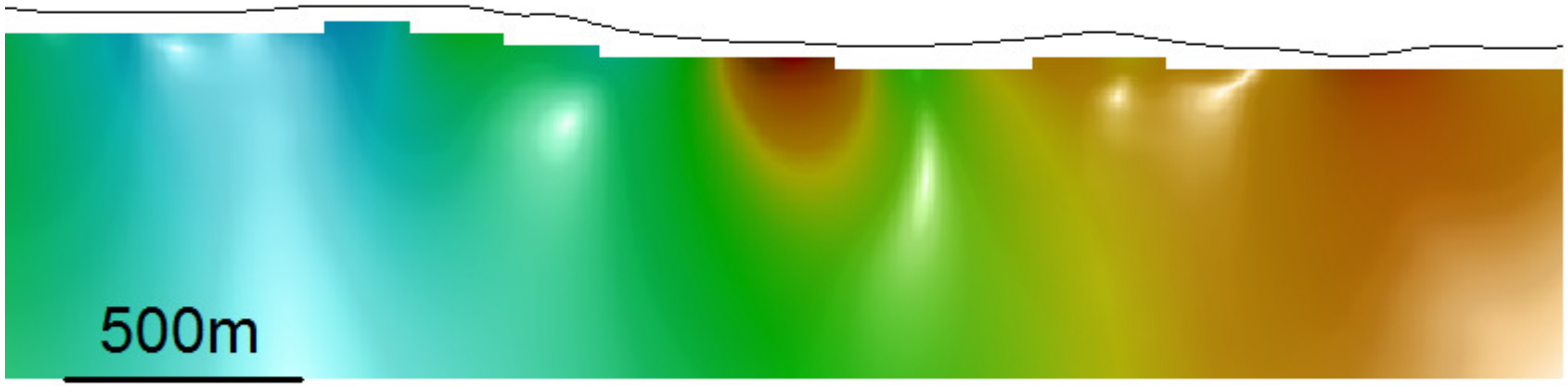


Gradient array

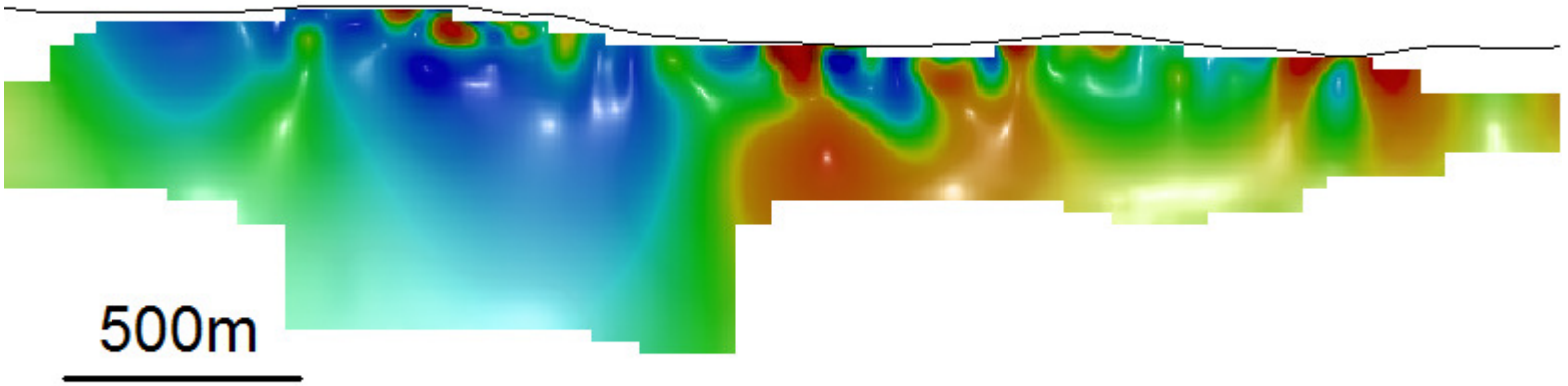


Compare Inversion Models at 250 metres below the surface

Gradient array



Offset pole-dipole



Compare inversion models on west to east cross section

THINK

Before you run an IP survey