GEO-ELECTRICAL ELECTROMAGNETIC IDEAS

- Tailored to continuity of clay layer in sedimentary areas

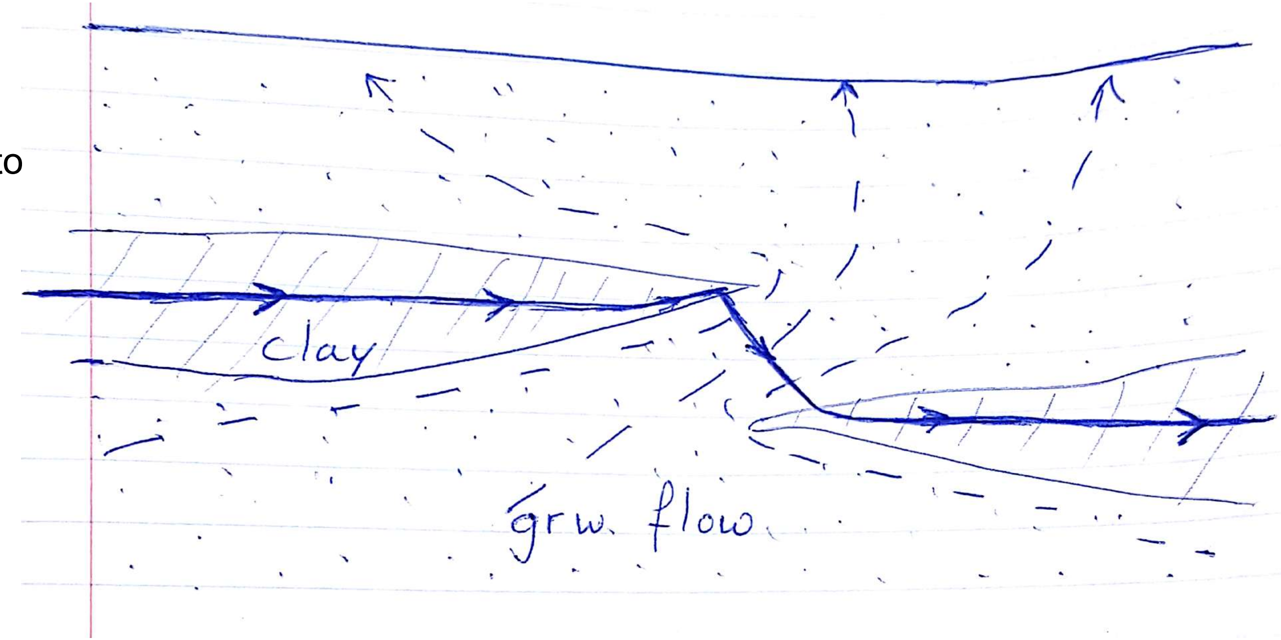
INNOVATIVE TAILORED METHODS

- Subsurface with non continuous clay layers
  - Look at the current distribution
  - Water flow pattern

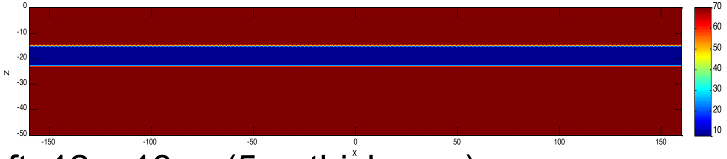
- Clay layers have high induced polarisation
- Hole in clay layer will give rise to vertical water flow: kwel or inzijging: Spontaneous Potential anomaly or sign change
- Electrical current has a relative important vertical component in an otherwise mainly horizontal current field: measuring the magnetic field caused by the current density pattern might reveal this vertical current
- The world is 3D: no 2D

SUBSURFACE SITUATION, HOLE IN CLAY LAYER

- Deep SP sign change
- Shallow no sign change
- Vertical electrical current: to be detected by: CurMag

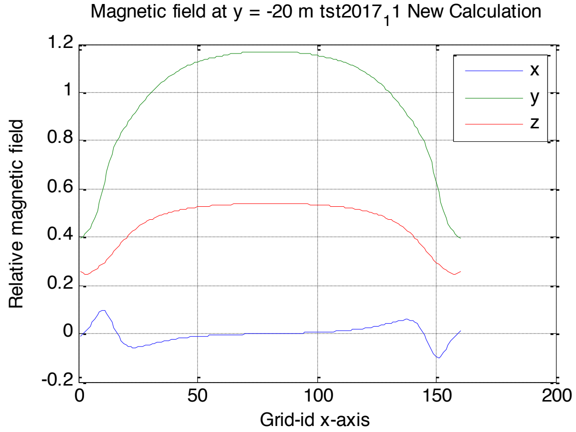


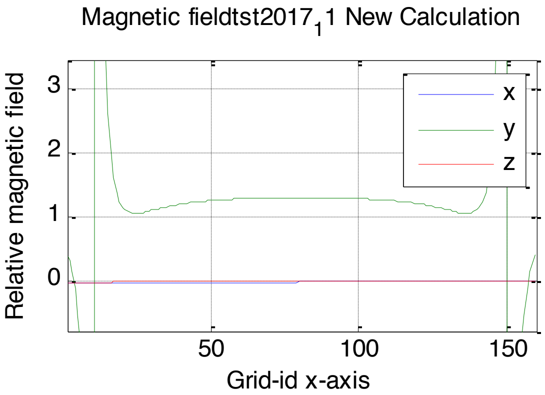
ONE CLAY LAYER (11, 10 AND 8)

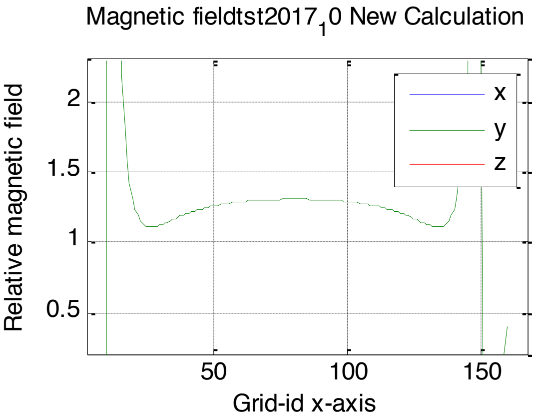


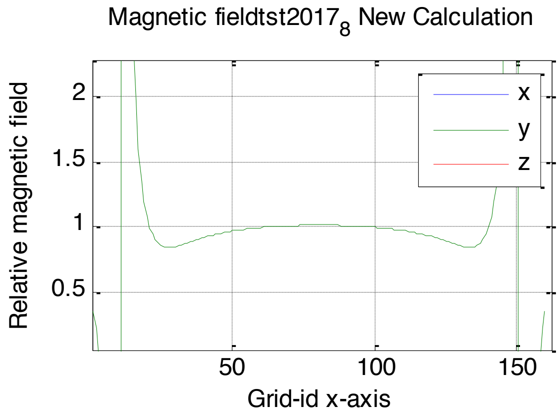
- Left: 12 – 18 m (5 m thickness)
- Middle:16 – 20 m (5 m thickness)
- Right: 16 – 23 m (8 m thickness)

- Conclusion:



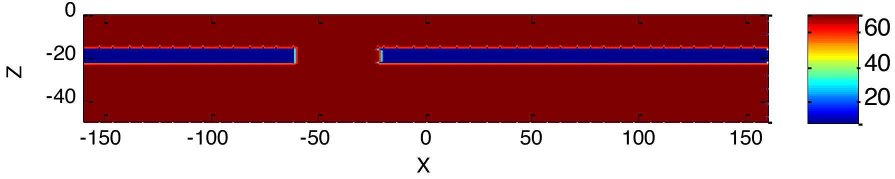


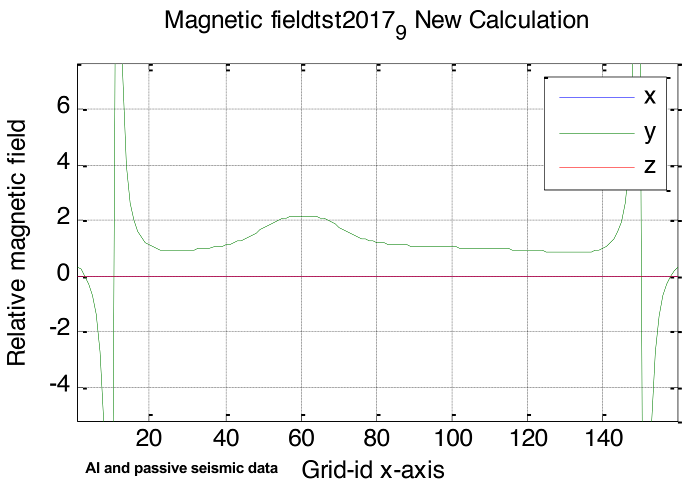


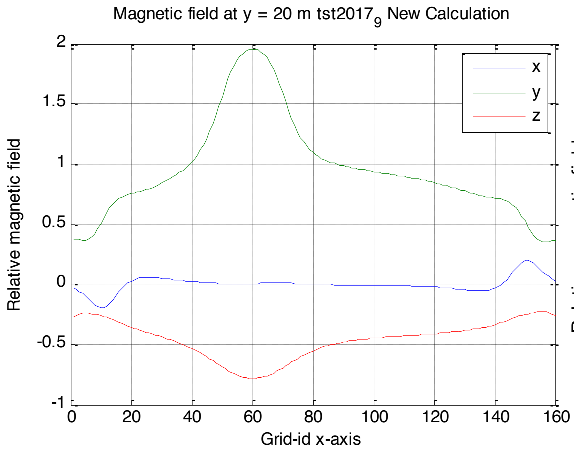


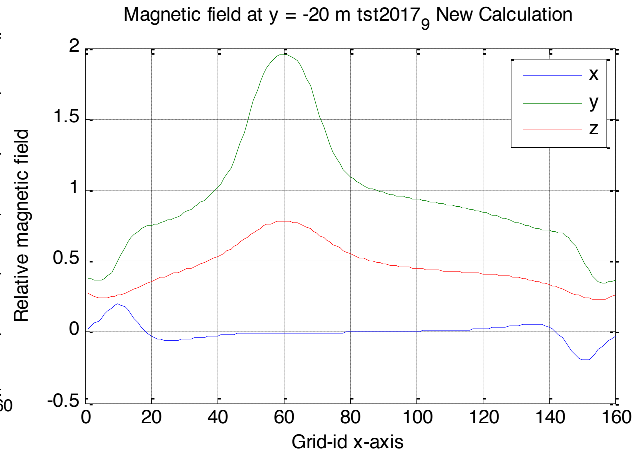
CLAY LAYER WITH HOLE

- _9:

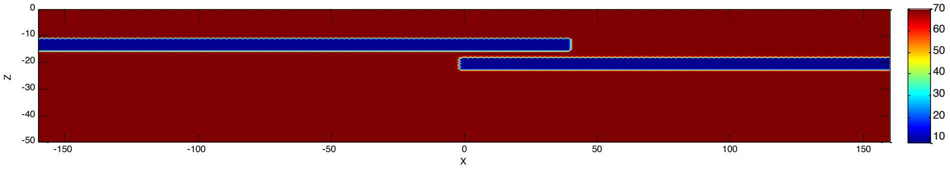


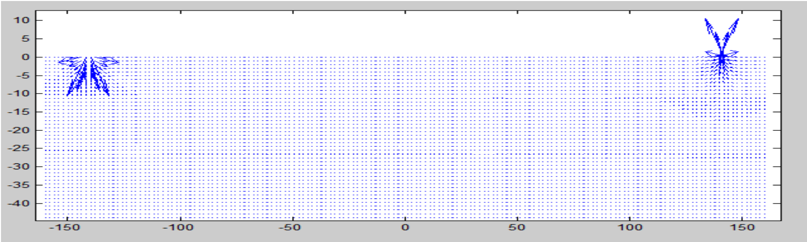


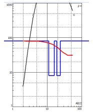


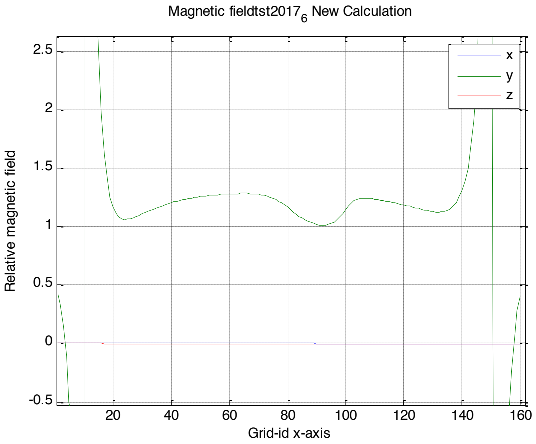


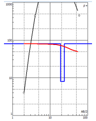
MODEL_6: TWO CLAY LAYERS

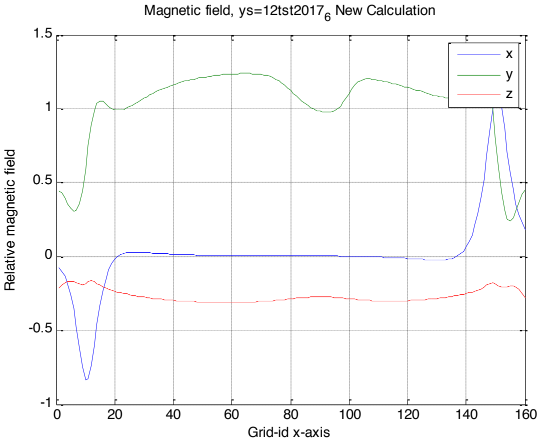






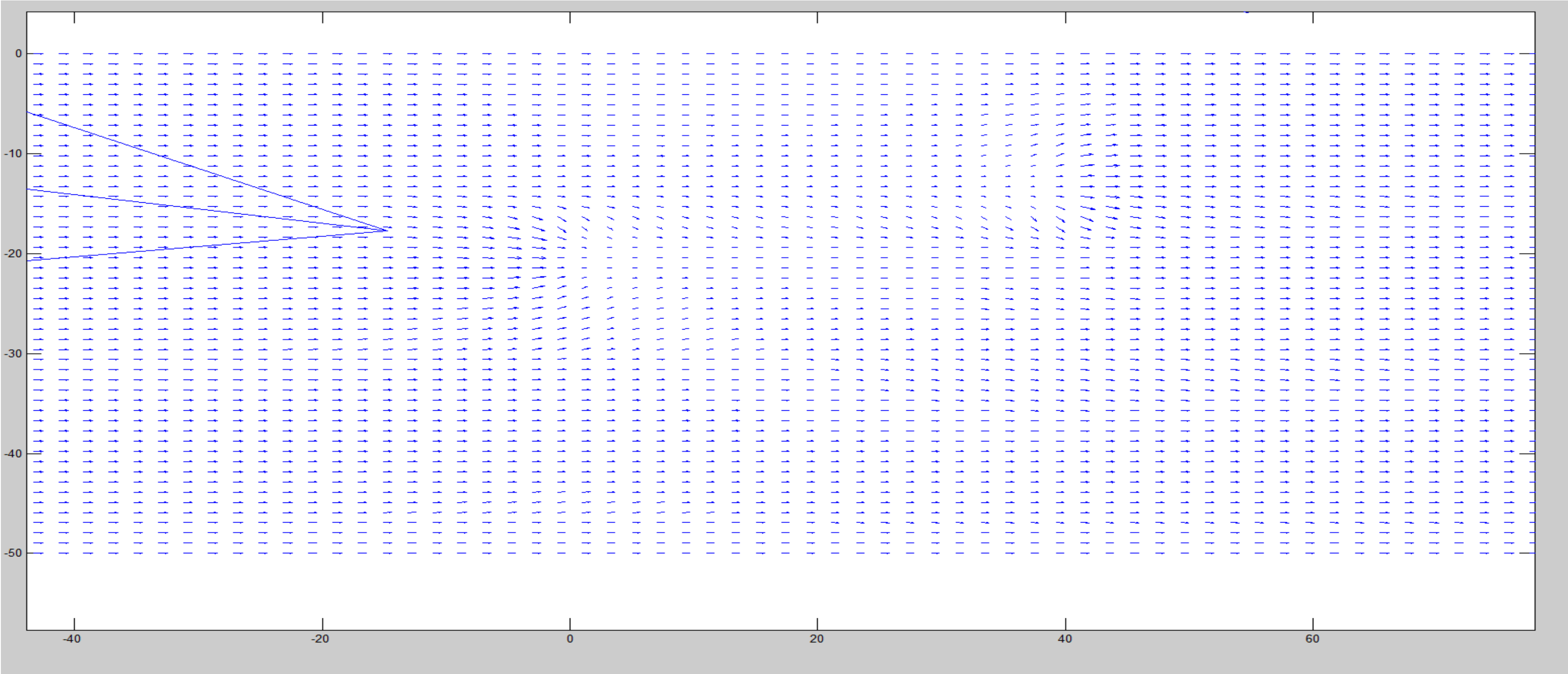




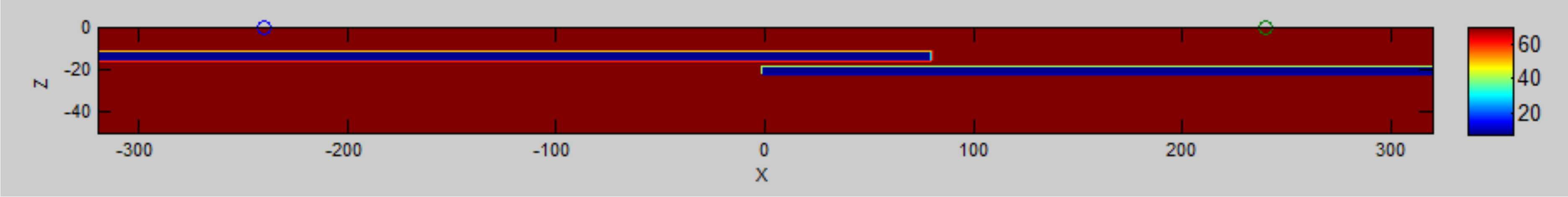


AI and passive seismic data

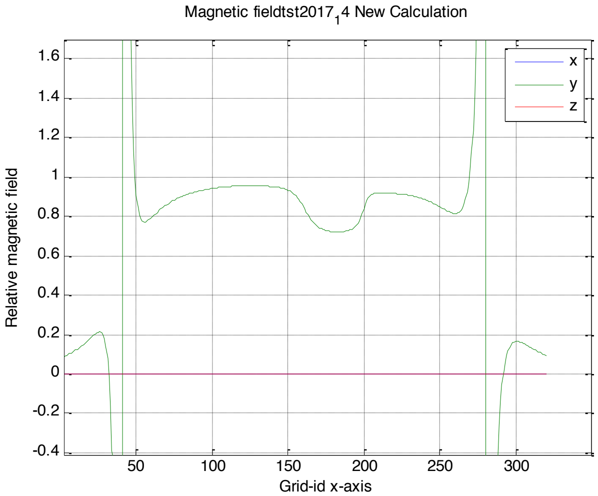
CURRENT FLOW PATTERN

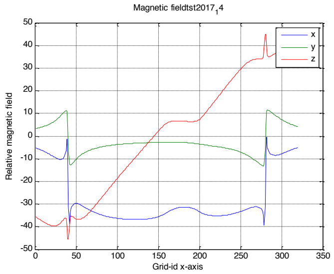


MODEL TST2017_14



- To compare with _6
- Electrodes at -240 and 240





QUESTIONS ON CURMAG

- Is the idea of interest?
- Does the magnetic field add to the information by all electrode combinations (at the surface)
- Can the cables be shielded enough?
- Higher frequencies → depth discrimination?

DEVELOPMENT NEEDED FOR CURMAG

- Develop instrument that can measure the magnetic field of a AC of e.g. 20, 40, 60, 80, 180, 280 Hz: higher frequencies gives a better instrument response, but cause more IP-like effects

- Instrument consists of:
  - 3 Coils for 3 components; ca. 70 cm diameter, 1000 windings
  - Recorder: some high quality (= 24 bit) audio recorder: 100 – 300 Euro
  - High quality (audio) pre-amplifier
  - AC geo-electrical equipment:: (TU-Delft has Sting)

- Data consists of time series, per station. For each station FFT, amplitude of power spectrum is plotted along the x-axis for the three components

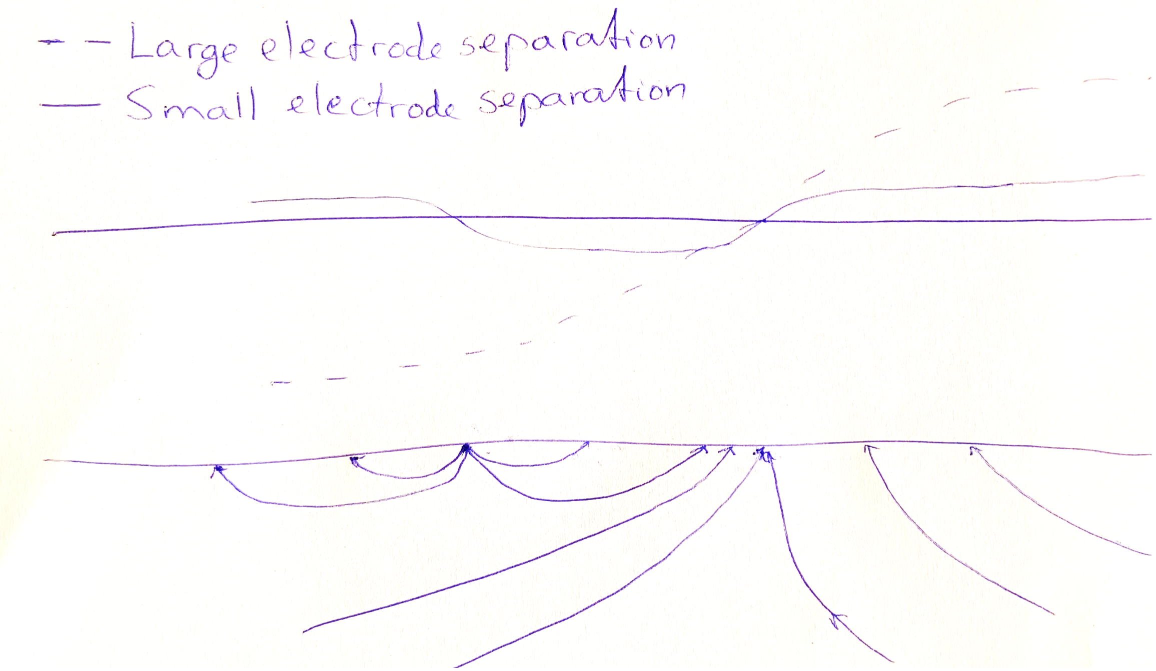
INNOVATIVE TAILORED MEASUREMENTS

- Plane current field induced by many electrodes, say 20 to 20 (Can the cables be shielded, f ranging from 1Hz to 50 kHz?)
- Focus on detecting lateral anomalies and not the total resistivity distribution
- Measuring magnetic field
  - Pro's:
    - More sensitive to changes in the field pattern at depth
    - Depth discrimination possible with frequency and with distance between electrodes
  - Con's:
    - Currents in a large area contribute to the field measured

- If it works: we make a major step:
  - For geohydrologists-clients
  - In science

SUBSURFACE SITUATION, BORDERS OF GRW SYSTEMS USING SP

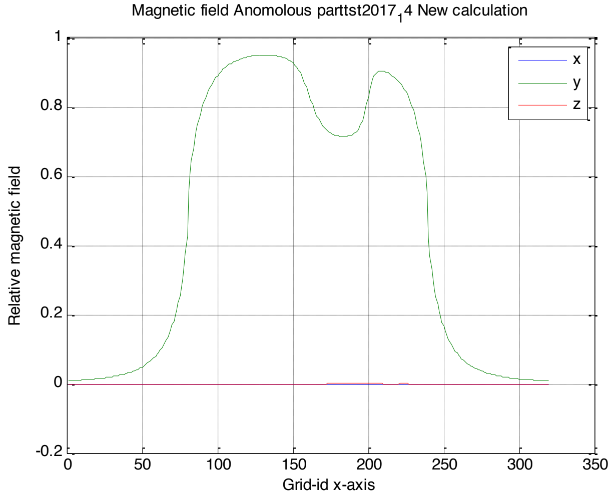
- SP sign change which is different for different depths (electrode separations)

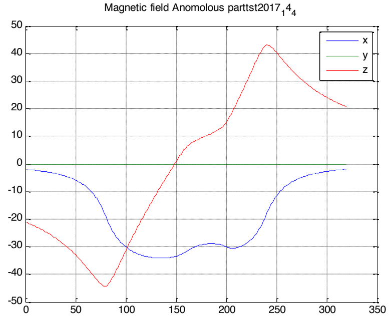


MODEL TST2017_14_4

u(:,:,:)=0;
v(1:80,:,:)=0;
v(240:320,:,:)=0;
w(:,:,:)=0;

- for ii=80:240





MODEL TST2017_14_2

```
u(:,:,:)=0;
v(:,:,:)=0;
w(1:80,:,:)=0;
w(240:320,:,:)=0;
```

- To compare with _6
- Electrodes at -240 and 240