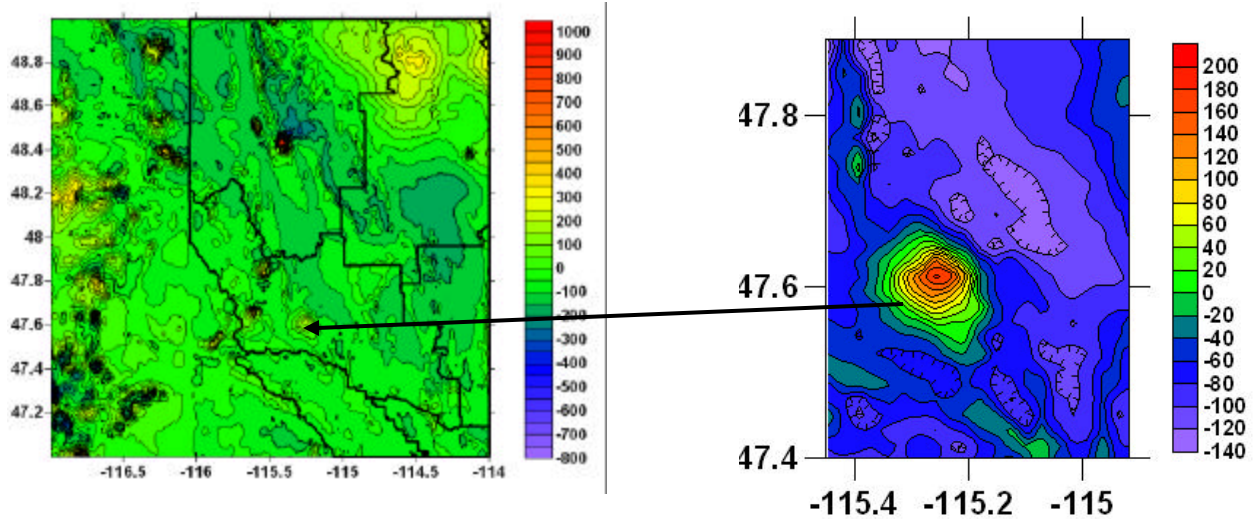


Here are the steps and results I had in mind for the Dipole.exe problem set:

Download data (NW_Montana_mag.dat)

Grid it {Long spacing (x) = $2/(\text{COS}(48)*111)$; Lat spacing = $2/111$ } at 2 km spacing yields: .0267, .0180

Map it



Now, pick a dipole anomaly. I drew a square around my chosen anomaly and then used Map/Digitize to grab the corners in long-lat coordinates:

Lower left: -115.448481224, 47.4022412302

Upper right: -114.923969161, 47.8946393637

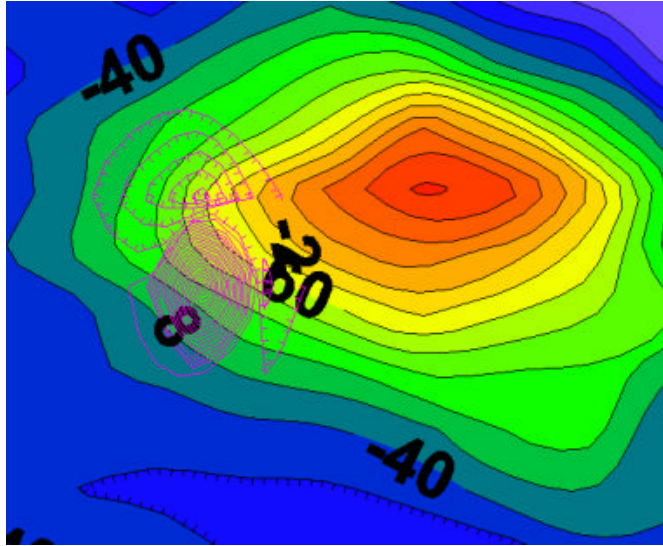
Then, Grid/Extract (rows: 23-51; cols: 59-79) to fit within those long-lat coordinates:

Now I have to play with Dipole.exe and choose appropriate parameters:

I have 29 rows and 21 columns (same as the extracted grid)
x0,dx,y0,dy = -115.45,.02678,47.396,.0180 from Surfer's Grid Info
dipole coordinates look to be ~ -115.27, 47.586, .009 (using digitize, and 1 km depth in degrees)
radius - try .0045 (0.5 km to start)
70,30
56000
.01
0
sds

Now, use PFDRIVER08 to change anomGS.grd to Surfer's format:

My initial guess is not so good, and I forgot to set the contour intervals equal!:



I need to make my sphere:

Deeper to get less gradient and more breadth; let's quadruple it to .038

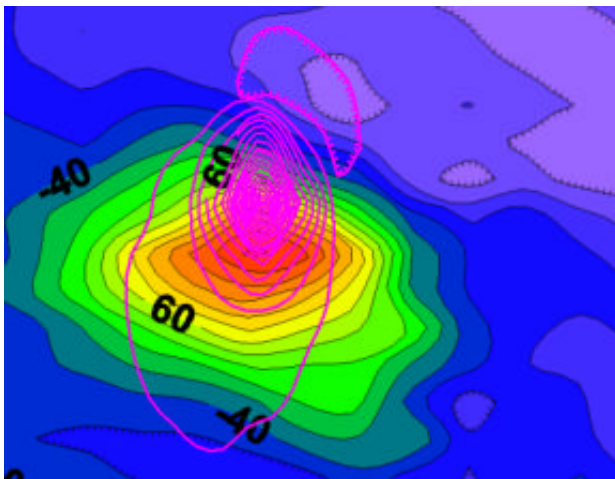
Bigger, I need more anomaly; let's triple that to .0135

Further east; go to -115.15 (recall Dipole.exe makes a mistake here and puts it too far west...)

Further north; go to 47.65

Add little susceptibility to .02

That's closer,



but the contours are still too tight, so

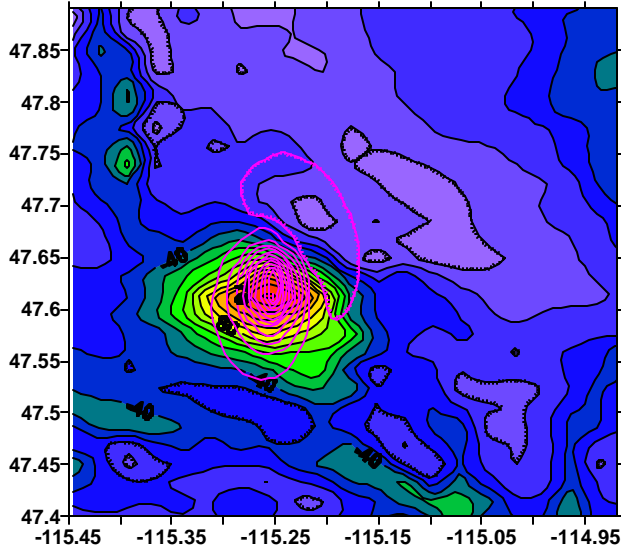
go deeper: .06 (6.65 km)

Radius = .02

add a little declination (40?)

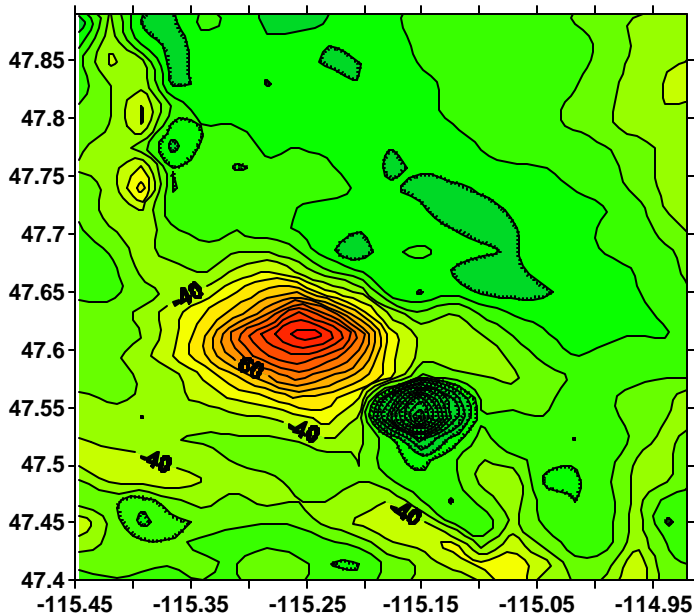
And come back south a bit (lat = 47.63)

And use susceptibility = .013 (just scale the amplitudes between the observation and calculation)

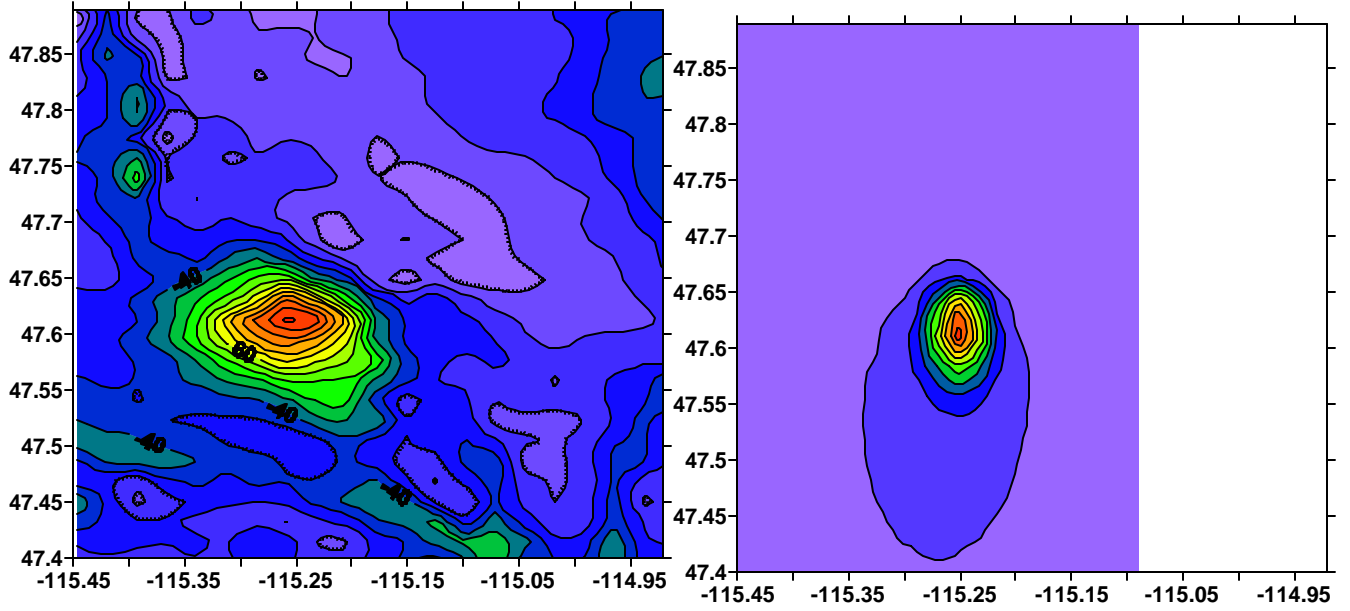


Close enough though it should be a little deeper to get less gradient but the pluton is not a sphere:

So, how different is the real anomaly from my spherical model? Surfer's Grid/Math will let us subtract the calculation from the observation and see the difference:

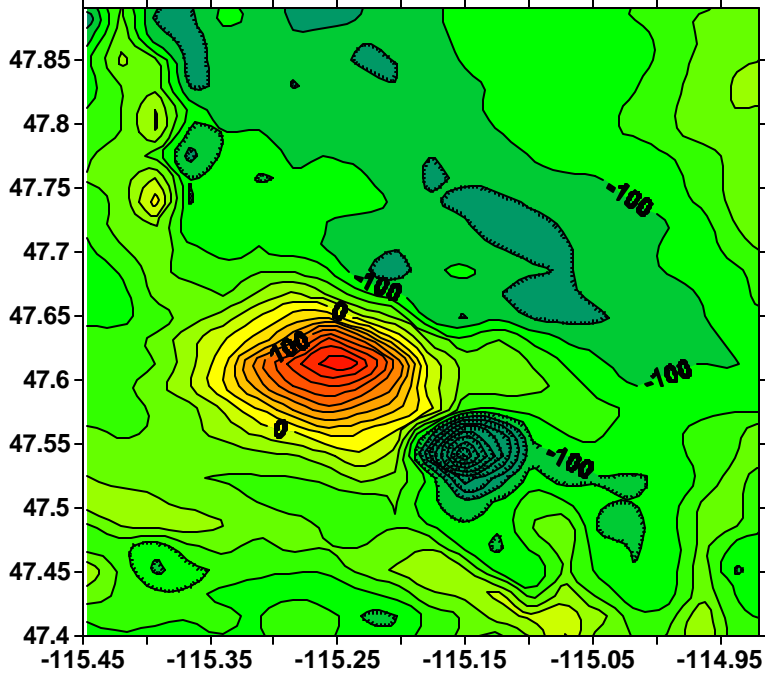


Looking at this figure, the difference makes me realize I've been forcing the declination around to 40°, when there might be a significant remanent component superposed on an induced moment. So, I am going to redo the calculation, using the present day field, then recalculate the difference and see what I get:

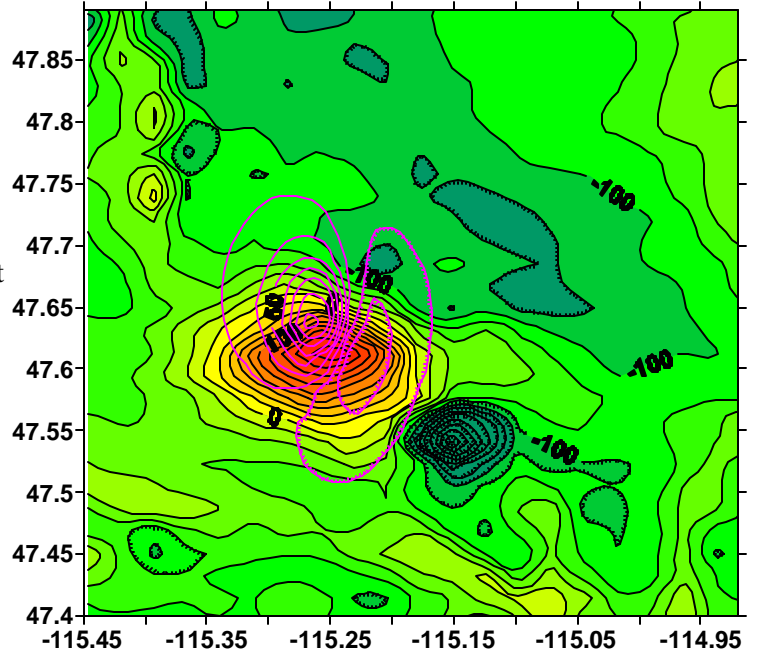


The figure on the left is the real anomaly, that on the right as above but $(D,I) = 14,70$; $z = 0.06$

The figure below is the difference (calculated using Surfer's Grid/math) which represents that part of the anomaly not accounted for by my buried sphere with induced magnetization in the present day field:



This figure to the right superposes the anomaly from a similar sphere to that above but with $D=120^\circ$, $I=50^\circ$. The low for this calculation is too close to the high in comparison to the anomaly I am trying to model. A little less inclination might help, but I think the dark blue low is probably from a different causative source as it is well-displaced, and has no flanking low to the northwest like it would if it was a low inclination magnetization. Thus, I should probably fiddle with the spherical model to account for a bit more of the observed anomaly.



The figure to the right shows magenta gravity contours superposed on the magnetic map of the anomaly in question. A gravity low overlies the magnetic dipole anomaly's high, but a gravity high overlies the magnetic low to the southeast – further evidence that there is a separate causative source.

