308 - - - Q200601040002
Scientific Notebook No. 340: Magnetic Surveys in Fortymile Wash, Interpretation and data Analysis (05/25/1999 through 12/12/2005)

LABORATORY NOTEBOOK

CNWRA/SwRI

(D.A.F. 5/25/99)

MAGNETIC SURVEYS IN ~~GRA~~ FORTYMILE WASH ... INTERPRETATION AND DATA ANALYSIS

NOTEBOOK NO. 340
ISSUED TO DAVID FARRELL
ON 5/25 19 99
DEPARTMENT 20 USFIC KTI
RETURNED 19

Investigator : David A. Farrell (210) 522-5208
Bldg. 189 RM 212A.

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INITIAL ENTRIES

D.A.7.

Project No.

TITLE OBJECTIVES: Book No. May 25, 1999 1

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Determination of the tuff alluvial contact in ~~the~~ Fortymile Wash and the transition of the watertable from the tuff aquifers into the alluvial deposits is important for performance assessment. Depending on the location of the transition zone, radionuclide transport to receptor locations south of Yucca Mtn may be significantly reduced.

Within the Fortymile Wash region, wells ~~to~~ on the NTS indicate that the watertable is located within the tuff units. However, new Nye County well, in particular NC-EWDP-2D and Washburn 1x, indicate that the watertable is ~~t~~ located within the valley fill alluvial sediments. Note that NC-EWDP-2D and Washburn 1x are located south of the southern most boundary of the NTS ~~and lower part~~ D.A.7. 5/25/99. As a result, the location of the transition point can be constrained between wells JF-3 located on the NTS and the Nye County wells. It is also important to note

~~In an effort to better define the trans~~ 5/25/99 D.A.7.

that Nye County wells NC-EWDP-2D and Washburn 1x do not indicate the presence of significant tuff units. (Depth of NC-EWDP-2D ~~≈ 490~~ ≈ 493 m and Washburn 1x ≈ 200 m). This may suggest the termination of tuff units

D.A.7 5/25/99 ~~between JF-3 and we~~ south of JF-3 or increased depth of burial of the tuff units. ~~To~~. In an effort to address ~~the~~ D.A.7. 5/25/99 issues related to the continuity of the tuff units south of JF-3 and ~~to~~ ultimately issues related to the watertable transition point a magnetic survey was performed in Fortymile Wash during the period May 15 - 17, 1999. Field details related to the survey are contained in field note-book (P. Lafemina). The information contained in this notebook address post-field activities. These activities include data reduction, analysis and interpretation.

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D.A.F.
May 25, 1999

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SUMMARY OF FIELD ACTIVITIES:

Figure 1 shows the lines surveyed during the 3 day period. Line 1 was survey on May 15-16, 1999. Note that the northern portion of this lines (between J-13 and J-12) was surveyed using the bike method pioneered by CNWRA. The rest of the line was surveyed on foot. The Base stations for this survey line ~~were~~ was (D.A.F. 5/25/99) located between J-12 and J-13. Note that this line terminated at the 510 gate.

Line 2 was surveyed on May 17, 1999. The base station for this line was located adjacent (≈ 75 m) to the spill-way (discharge) pond for wells J-12 and JF-3.

Note that at the base station a magnetometer was installed. The purpose of this magnetometer was to drift correct the survey data.

Figure 2 shows the total magnetic ~~drift~~ field (D.A.F. 5/25/99) recorded at the base-station magnetometer during the ~~three~~ two (D.A.F. 8/24/2000) survey days (May 16-17, 1999) D.A.F. 8/24/2000. As shown in figure 2, base station magnetometer readings on days 1 and 2 (May 15 and 16) were noisy and erratic, (D.A.F. 5/25/99) ~~suggesting the impacts from loc~~ (May 25, 99 D.A.F.) and indicated impacts from local sources. The data from day 3 (May 17, 99) are much better and shows none of the erratic behaviors of the previous days. As a result, data from days 1 and 2 were not suitable for drift correcting the data for days 1 and 2.

May 26, 1999 D.A.F.

In an effort to examine the possible drift on days 1 and 2 data from two geomagnetic observatories were obtained ... Fresno, California and ~~Albuquerque~~ (D.A.F. 5/26/99) Tucson, Arizona. (D.A.F. May 26, 99) The ~~next~~ new (D.A.F. 5/26/99) ~~drift~~ geomagnetic data for these sites are given in Figure 3 for the days 1 and 2. The ~~data~~ geomagnetic field at these stations was sampled a 1 minute intervals. (D.A.F. 5/26/99)

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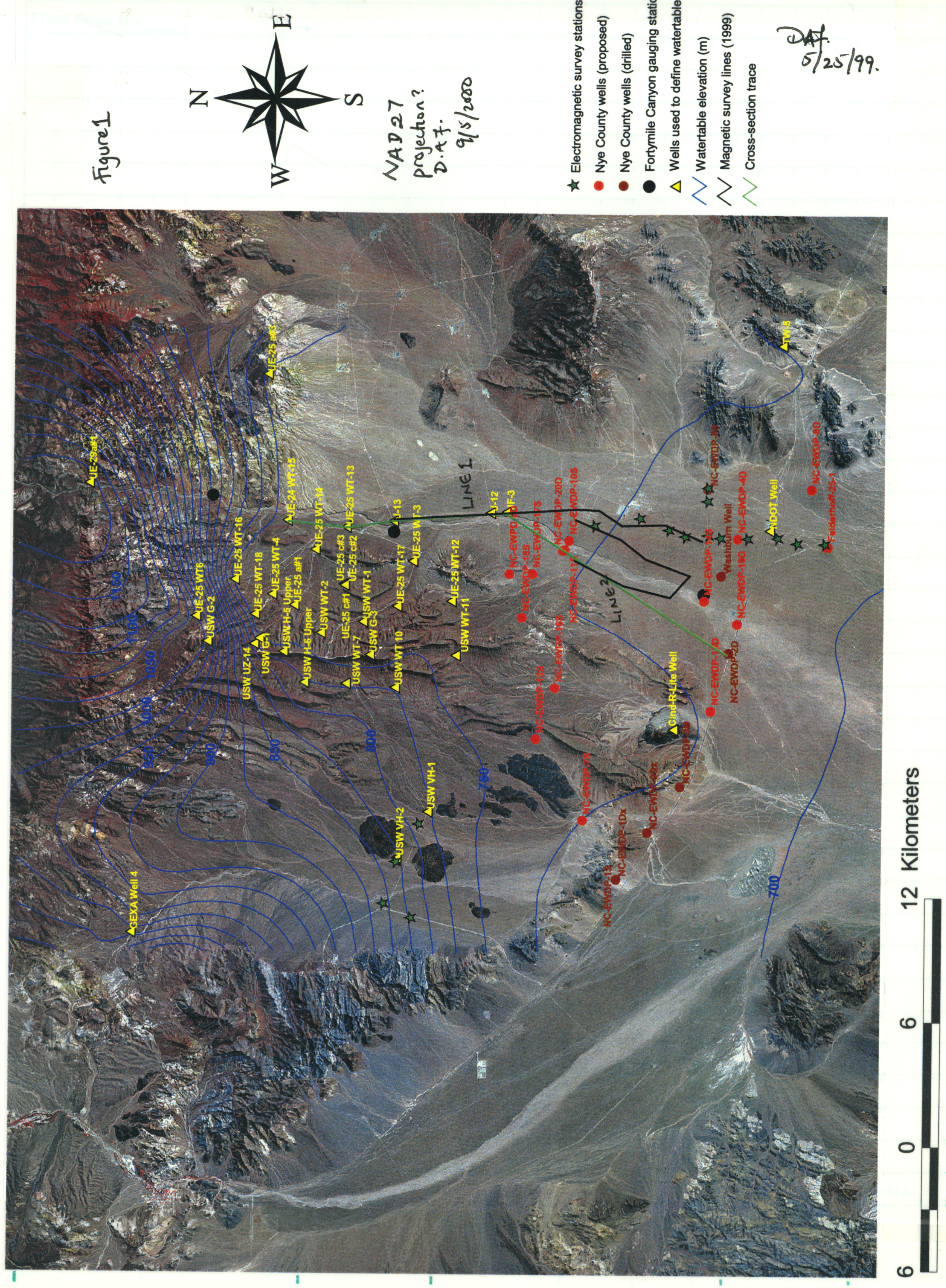
Figure1



NAD27 projection? D.A.F. 9/5/2000

D.A.F. 5/25/99.

D.A.J. 4 8/24/2000

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D.A.J. 8/24/2000 nothing removed from here

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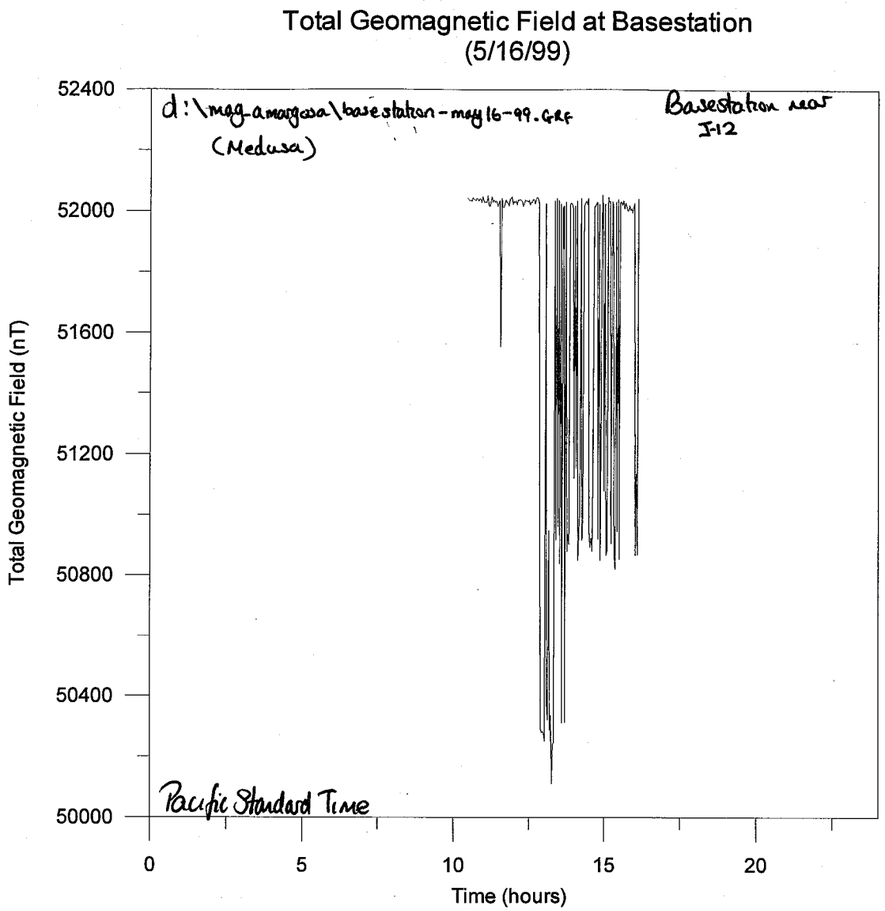

Figure 2a: Geomagnetic field at basestation (Total field)

Note: Data very noisy and (D.A.J. 8/24/2000) varies over approximately 2000 nT. This data is of very poor quality for generating a drift correction. Source of noise unknown but it may be due to a local phenomena such as a buried current source.

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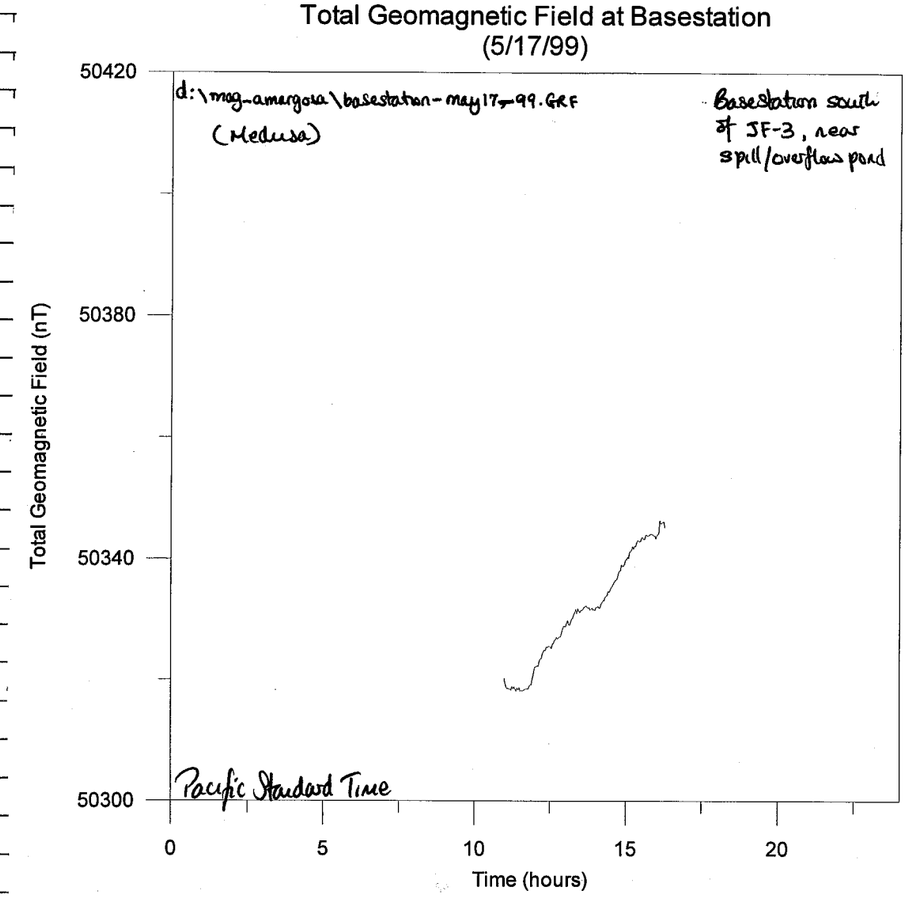

Figure 2b:
Geomagnetic field at base station (Total field)

Note: Much improved basestation data compared to 5/16/99. This data can be used for drift correcting rover data. In this case the base station was moved several kilometers south of its location on 5/16/2000. Range in drift during recording period is less than 70 nT.

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~~Figure 4 shows a comparison of the field basestation data and the geomagnetic field data obtained from the geomagnetic observatories in Fresno and Tucson.~~ Compares (D.A.F. 8/24/2000) (D.A.F. 8/24/2000)

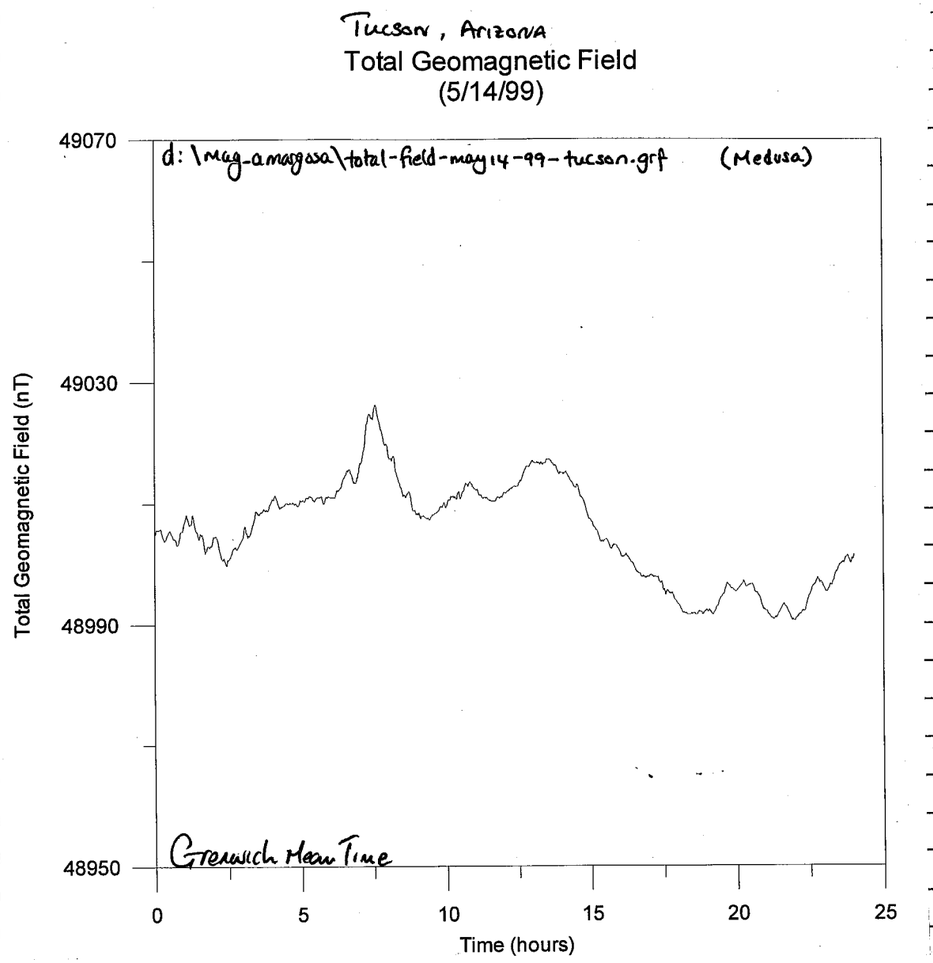

Figure 3a (i): Geomagnetic field (total) for Tucson, AZ (5/14/99)

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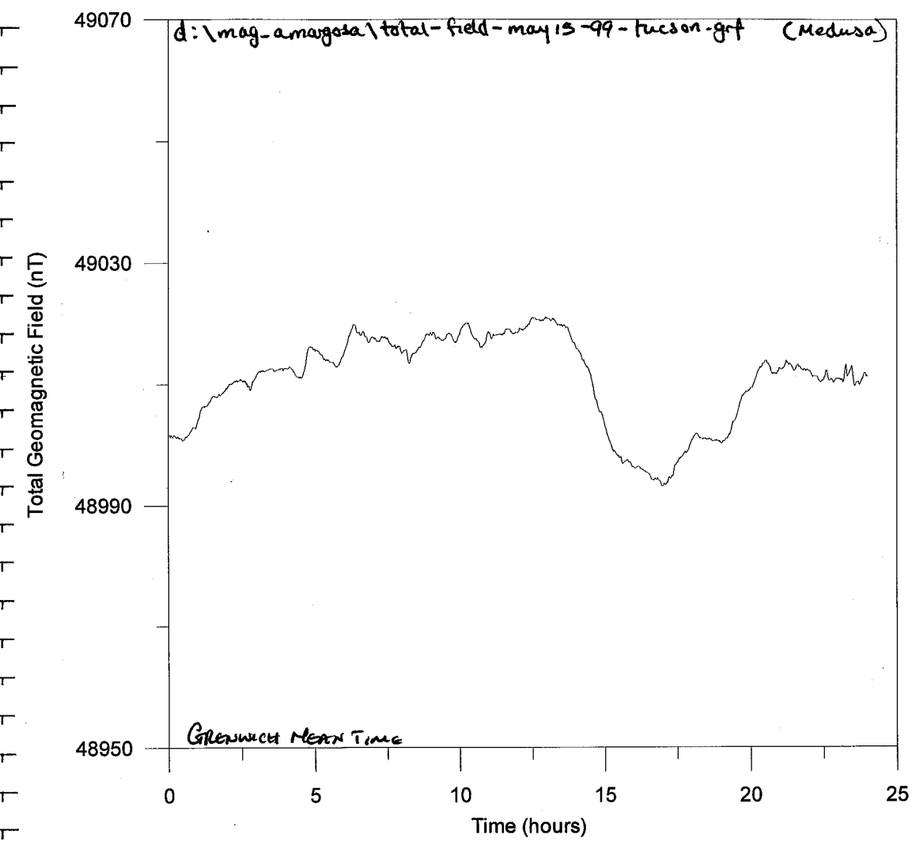

Figure 3a(ii): Geomagnetic field (total) for Tucson, AZ (5/15/99)

D.A.F.
8/24/00

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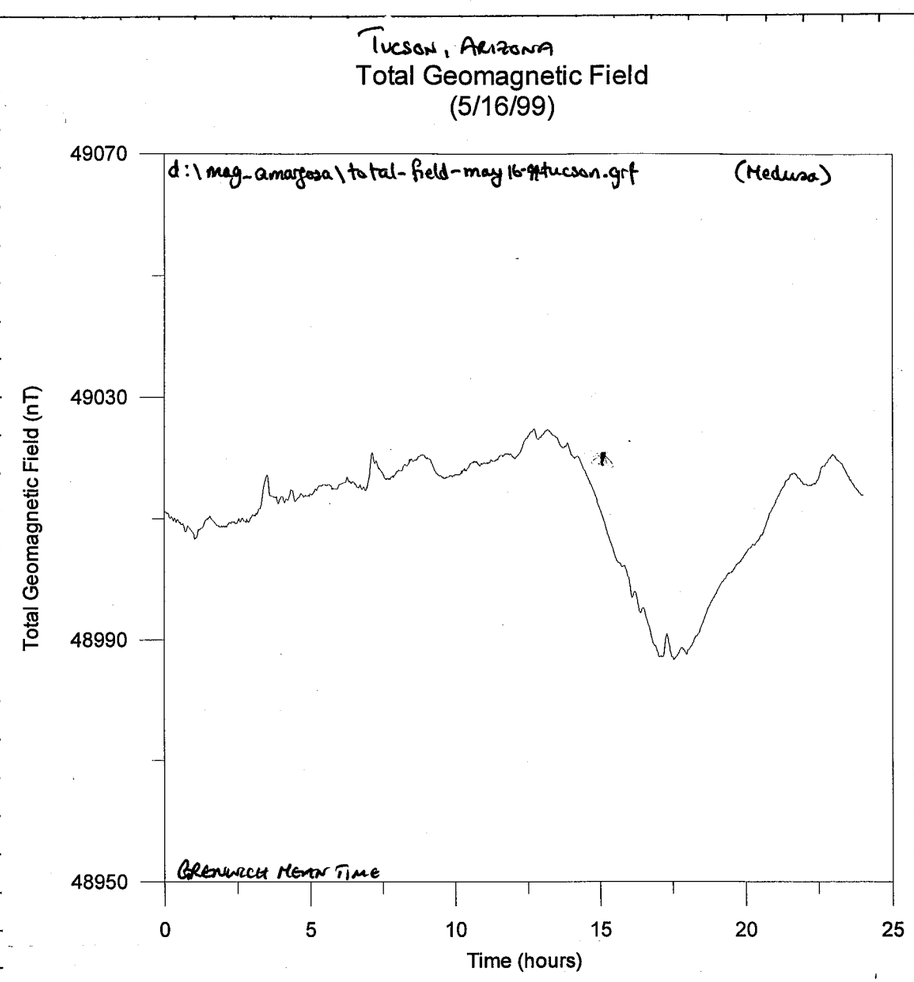

Figure 3(a) (iii) Geomagnetic field (total) for Tucson, AZ (5/16/99)

D.A.T.
8/24/00

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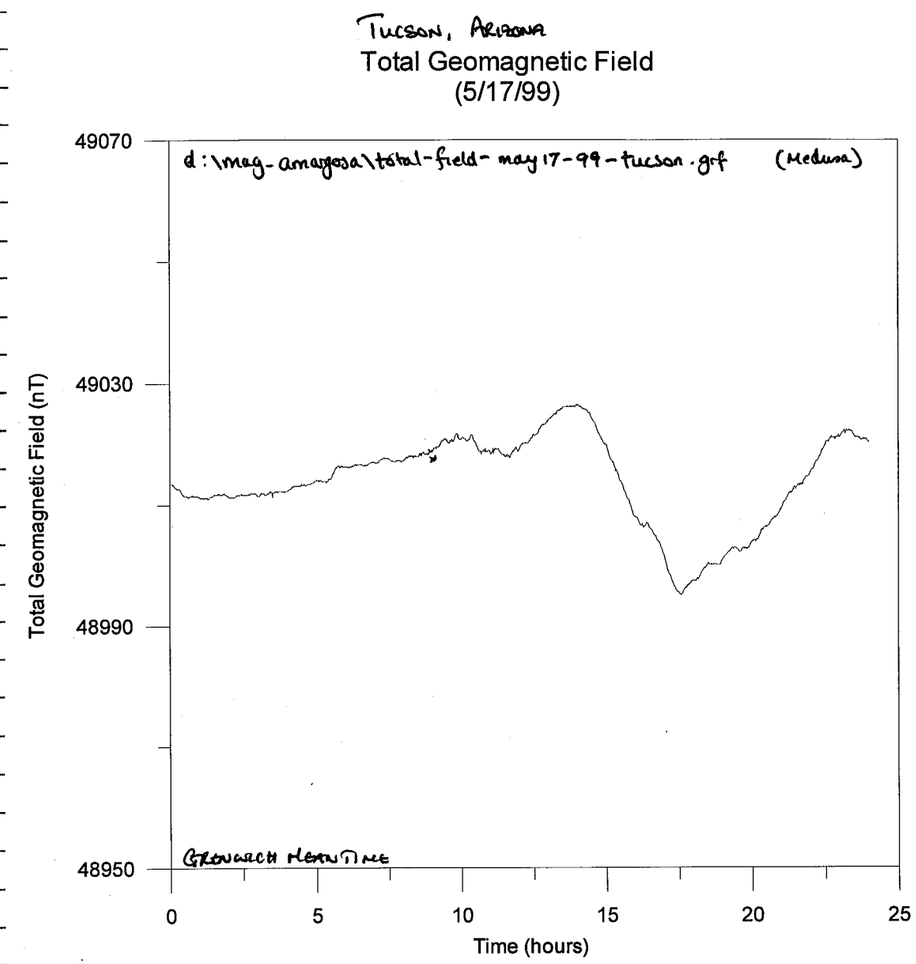

Figure 3a(iv): Geomagnetic field (total) for Tucson, AZ (5/17/99)
(D.A.T. 8/25/2000)

D.A.T.
8/25/00

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D.A.J.
5/25/00

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FRESNO, CALIFORNIA
Total Geomagnetic Field
(5/14/99)

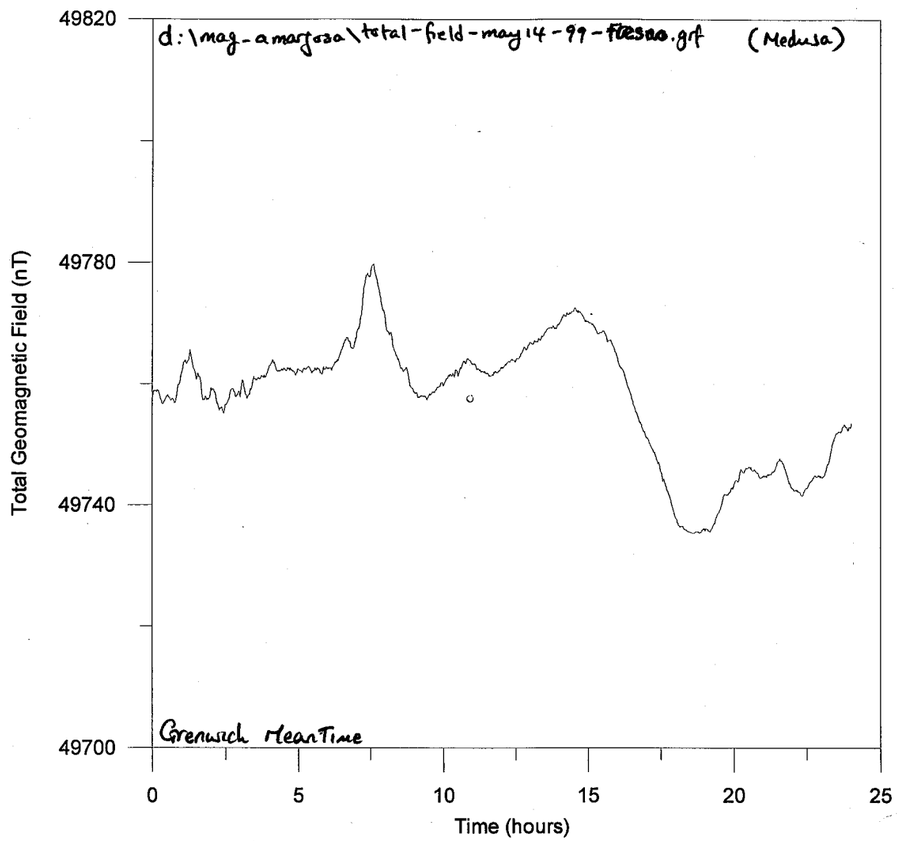

Figure 3b (i): Geomagnetic field (Total) for Fresno, Ca (5/14/99)

D.A.J.
8/25/00

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5/25/00

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FRESNO, CALIFORNIA
Total Geomagnetic Field
(5/15/99)

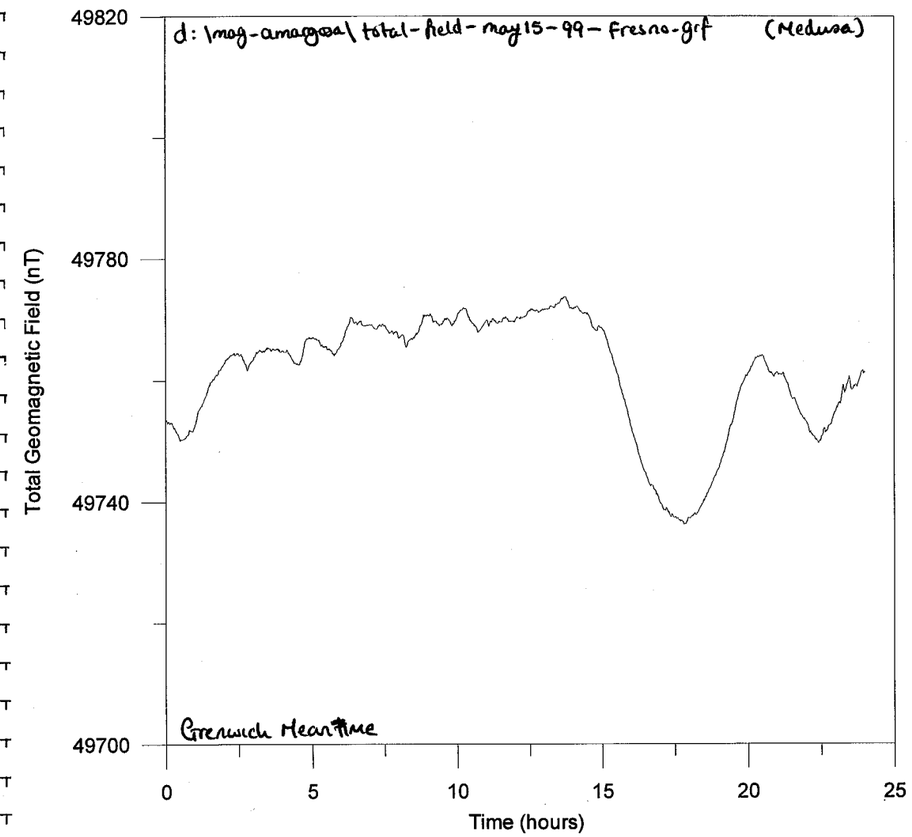

Figure 3b (ii): Geomagnetic field (Total) for Fresno, Ca (5/15/99)

D.A.J.
8/25/00

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D.AJ 8/25/00

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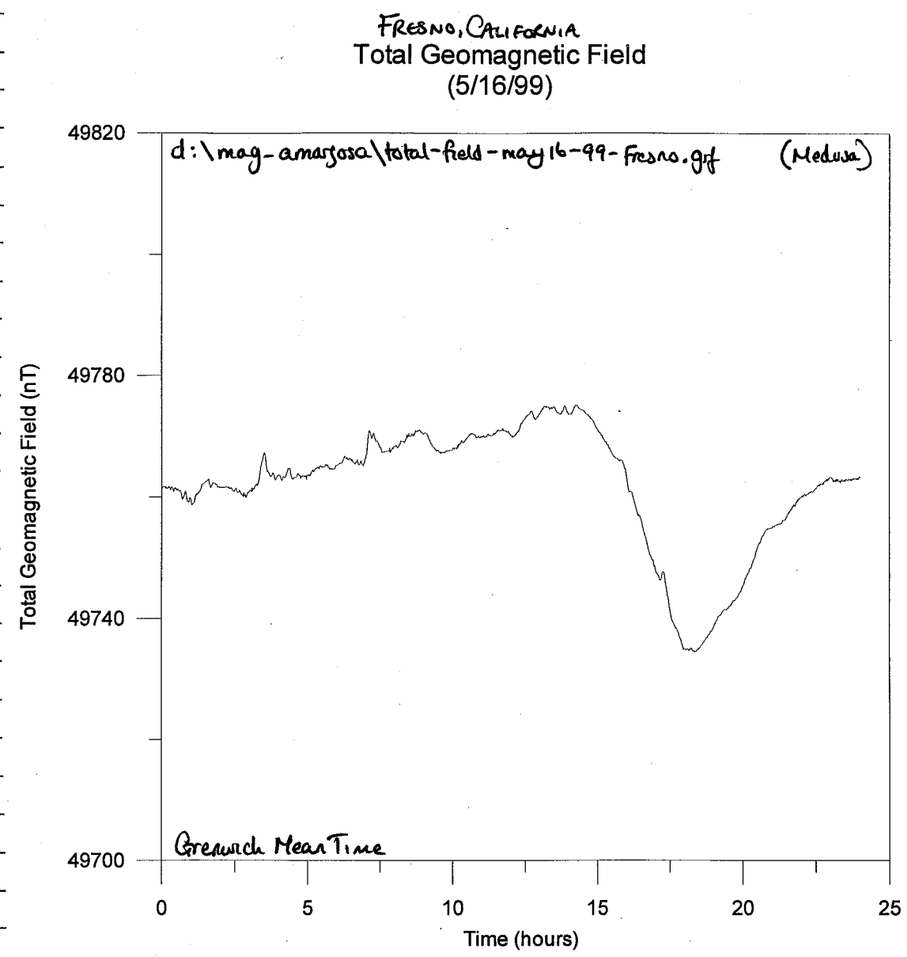

Figure 3b (iii): Geomagnetic field (total) for Fresno, Ca (5/16/99)

D.AJ. 8/25/00

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D.AJ. 8/25/00

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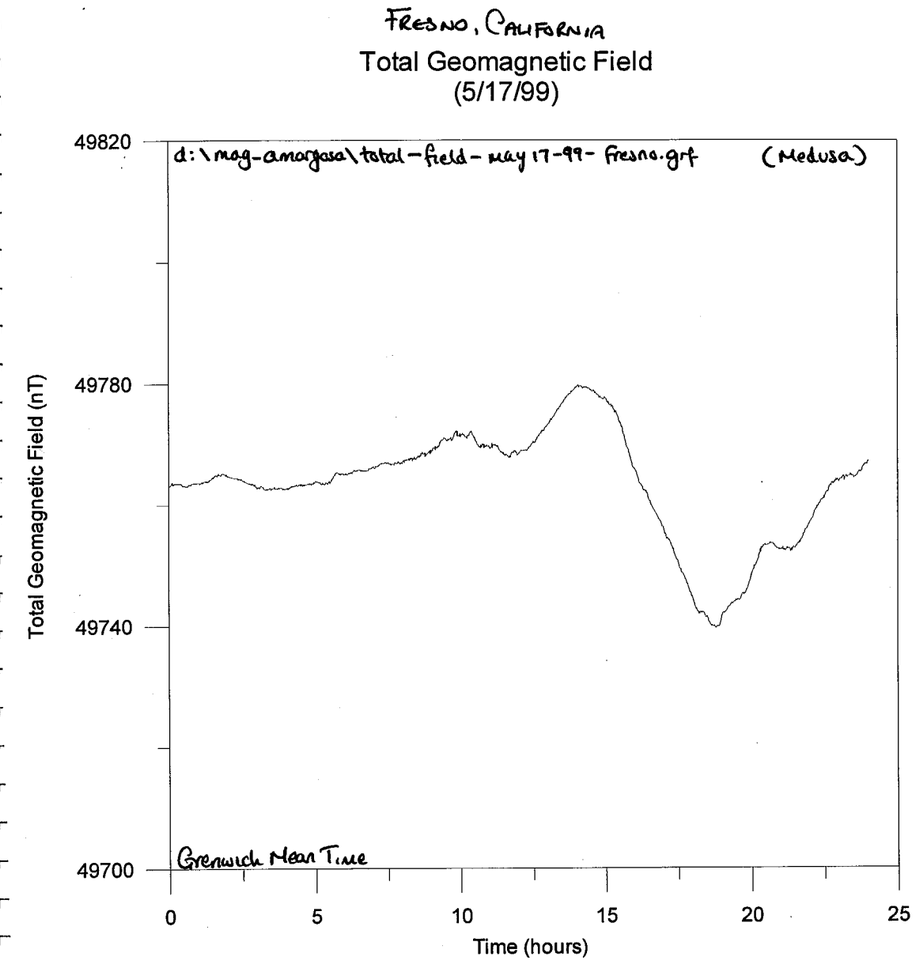

Figure 3b (iv): Geomagnetic field (total) for Fresno, Ca (5/17/99)

D.AJ 8/25/00

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D.A.7. 8/25/00

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To determine which of the two geomagnetic observatories may be used to drift correct YM geomagnetic data, data from YM for date 5/17/99 was compared to data from the geomagnetic observatories. Figure 4 shows this comparison. It is evident that the basic trends in the YM data are present in the Fresno data. Because the slopes of the data curves are quite similar Fresno may be used to drift correct YM data. Recall that the drift correction simply corrects the data relative to some starting point so there is no need to worry about the obvious shift between the magnitudes of the data for YM and Fresno. Note that 7 hours were added to the YM times to convert to Greenwich Mean Time.

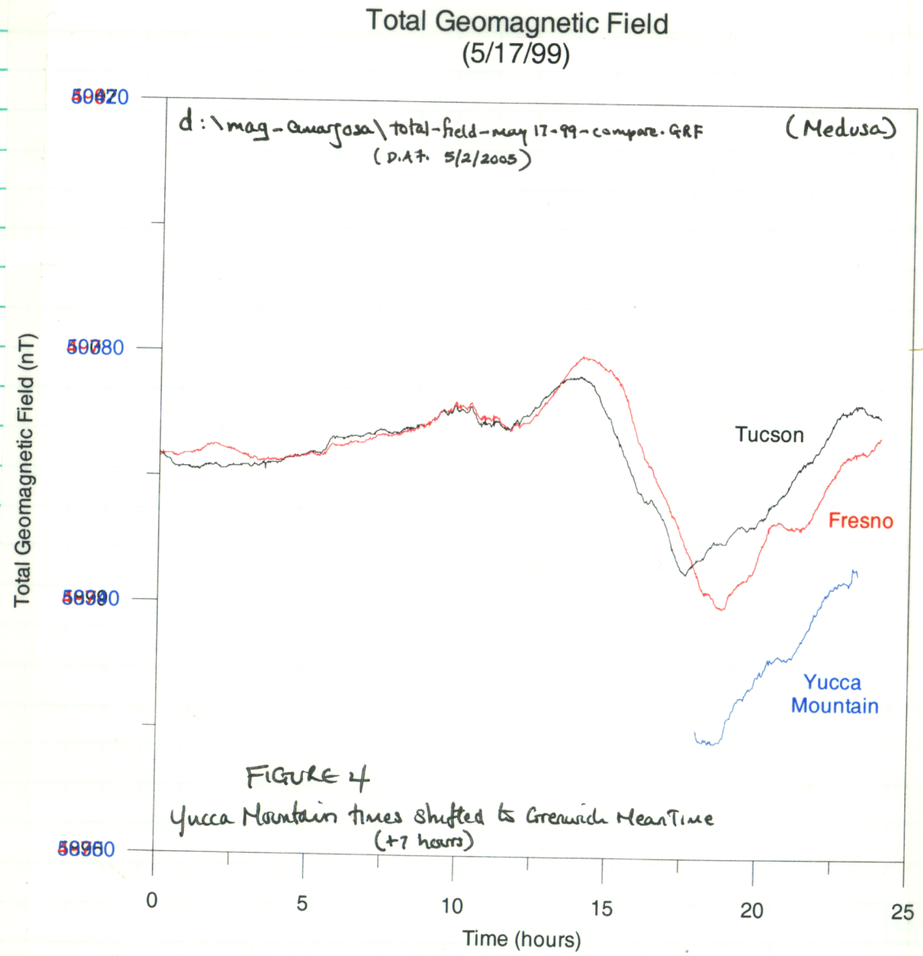

FIGURE 4
Yucca Mountain times shifted to Greenwich Mean Time (+7 hours)

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D.A.7
8/25/00

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Figure 4: Comparison of total geomagnetic field at YM (5/17/99) with the total geomagnetic fields at Fresno, Ca and Tucson, Az. (Note the range in the vertical axis for all data sets is 120 nT.

D.A.7.
9/4/00

At the time the data were reduced by C. Connor, software that would allow geomagnetic data collected at geomagnetic observatories to be used for drift corrections (D.A.7. 9/4/00) was not available at CNWRA (note that C. Connor reduced the data during May, 99). As a result, no drift corrections were performed on the data for the days which had poor basestation recordings. The following summarized the corrections performed by C. Connor:

Date: 5/18/99
Sender: Charles Connor
To: David Farrell, Peter LaFemina
Priority: Normal
Subject: 5/16/99 data

1) I looked over the dirft file collected for 5/16/99. This file has problems and will not be useful for making the drift correction.

(a) all of the readings indicate high magnetic gradients - perhaps caused by a magnetically noisy environment.

(b) prior to 12:49, drift was very erratic - on the order of 20 - 40 nT variation between readings

(c) after 12:49, there is up to 2000 nT variation

conclusion: these data are not useful for drift corrections

2) I did the following corrections to the 5/16/99 data

a) collated the data streams
b) filtered the data to exclude values greater than 60,000 nt and less than 30,000 nT
c) did the igrf correction
d) converted lat/lon to UTM NAD 83

Note: the stn file indicates that these data were NOT collected in differential GPS mode (code 1 in GPGAA string instead of code 2)

-Chuck

51699nsFl.ulm 51699.dnl

Witne

Recorded by

D.A.J. 9/5/2000

From Page No.____

Date: 5/18/99
Sender: Charles Connor
To: David Farrell, Peter LaFemina
Priority: Normal
Subject: 40 series and busted

Like the 5/16 drift file, the 5/14 drift file is cooked.

So I have processed the following without the drift corrections

what has been done for each data set

a) collated the data streams
b) filtered the data to exclude values greater than 60,000 nt and less than 30,000 nT
c) did the igrf correction
d) converted lat/lon to UTM NAD 83

NOTE: a heading correction was not done to the bike data

(heading correction data not available)

4051499bFI.utm 40ws5149FI.utm bustedFI.utm

D.A.J.
9/5/2000

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D.A.J. 9/5/2000

From Page No.____

Date: 5/18/99
Sender: Charles Connor
To: David Farrell, Peter LaFemina
Priority: Normal
Subject: processed data

David,

The data you collected on May 17 is processed and attached in the following file called 51799dfi.utm

I did the following to the file

1) I converted the stn files to x,y,z files by collating the data streams.

2) drift corrected the data using the magnetometer base station data you provided in file 517799.dnl

To make the drift corrections, I assumed that the times between the base station magnetometer and the field magnetometer were synchronized

I deleted one unusual (high magnetic gradient) reading from the base station file before performing the drift correction

If you plot the drift file (51799.dnl [remember that the data given in this file are in 1/10 nT units]), you will see that there was approximately 30 nT drift during the data collection period - or about 10 percent of the total magnitude of anomalies you observed. The drift was very linear and consistent throughout the day - there is no question that it is successfully removed by data processing in this case.

3) I filtered the data sets - removed all values greater than 60,000.0 nT and removed all values less than 30,000 nT - a total of 2 data points were removed

4) I performed an International Geomagnetic Reference Field correction

5) I converted the lat / long coordinates to a NAD83 UTM projection.

I did not perform a heading correction. The data show an excellent long wavelength anomaly but also have considerable short wavelength noise in the 10-30 nT range. You might consider filtering the data using an FFT.

If you have any questions - call (ext. 6649)

Chuck

51799DFI.utm

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D.A.J. 9/5/2000

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~~Plots of the UTM files~~ (D.A.J. (9/5/2000)

The files
- ~~51699nsf.utm~~ D.A.J. 1/29/02
- ~~4051499bfl.utm~~
- ~~40WS5149fl.utm~~
- ~~bustedfl.utm~~
- ~~51799DFL.utm~~

are contained on the ~~media~~ (D.A.J. 9/5/2000) computer storage media attached to this note book.

→
- 51699nsf.utm
- 4051499bfi.utm
- 40WS5149fi.utm
- bustedfi.utm
- 51799Dfi.utm

D.A.J. 1/29/02

Field Survey Lines Used for Current Analysis

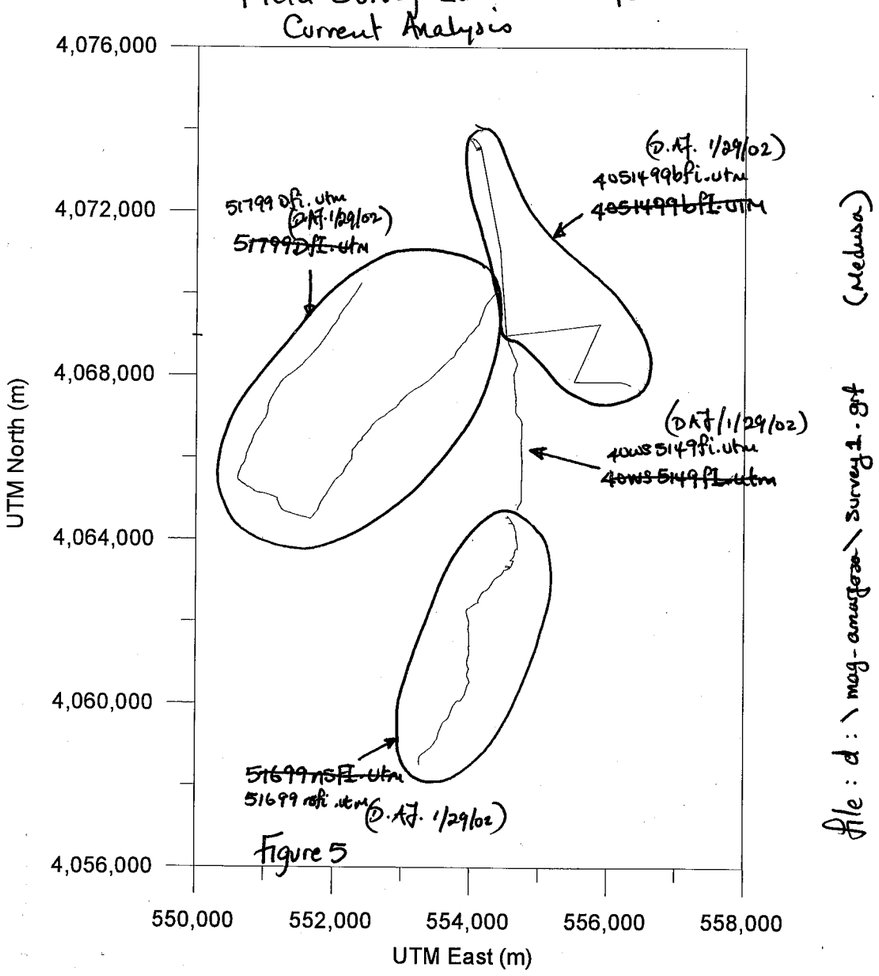

Figure 5

file: d:\mag-amargosa\survey1.grf (Medusa)

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D.A.J. 9/5/2000

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Note: ~~Bustedfl.utm~~ Bustedfi.utm (D.A.J. 1/29/02) is not included in this plot and is not considered in this analysis.

Note: line ~~51799DFL.utm~~ 51799dfi.utm (D.A.J. 1/29/02) is plotted incorrectly. In fact the line is plotted ~~approximately~~ (D.A.J. 9/5/02) too far north. The approximation translation of the line is (166.97m – 5479.5m) where (east, north). The reason for the translation is due to the fact that ~~the~~ (D.A.J. 11/15/01) incorrect ~~basestation~~ (D.A.F. 9/5/02) coordinates were used for the GPS base station. The new location of the line is shown in Figure 6. This new line is based on data files: ~~51799DFL-east.utm~~ 51799Dfi-east.utm (D.A.J. 1/29/02), ~~51799DFL-south.utm~~ 51799Dfi-south.utm (D.A.F. 1/29/02), ~~51799DFL-west.utm~~ 51799Dfi-west.utm (D.A.J. 1/29/02)

Modified Survey Line Locations Used for Current Analysis

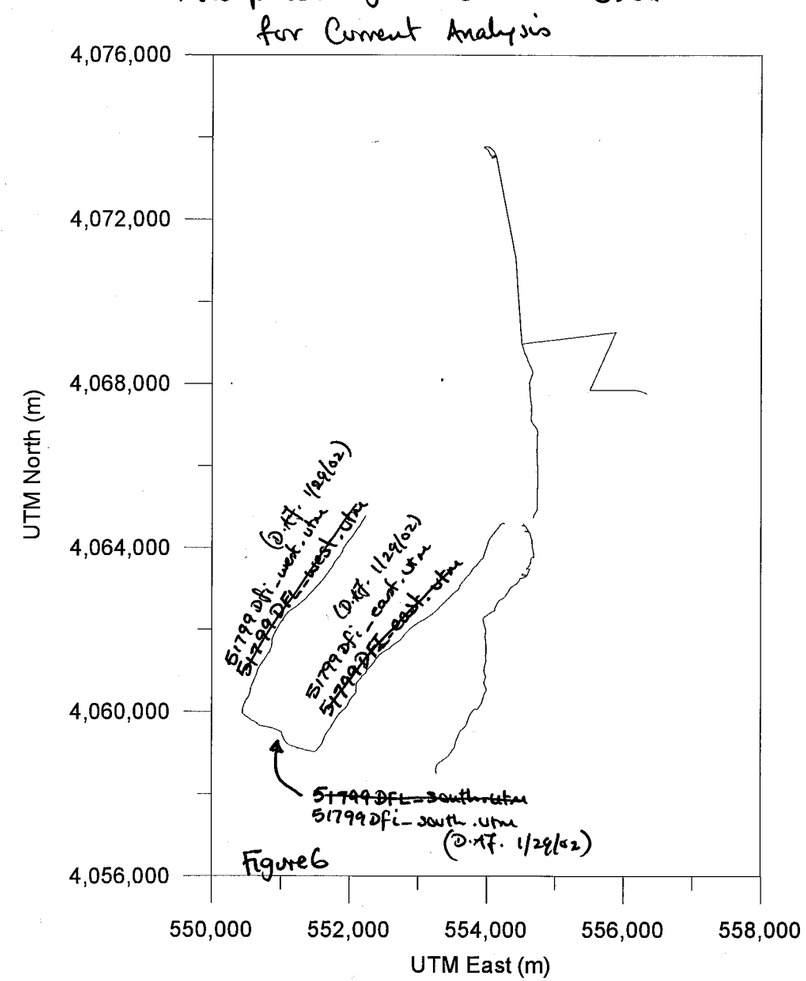

Figure 6

file: d:\mag-amargosa\survey2.grf (Medusa)

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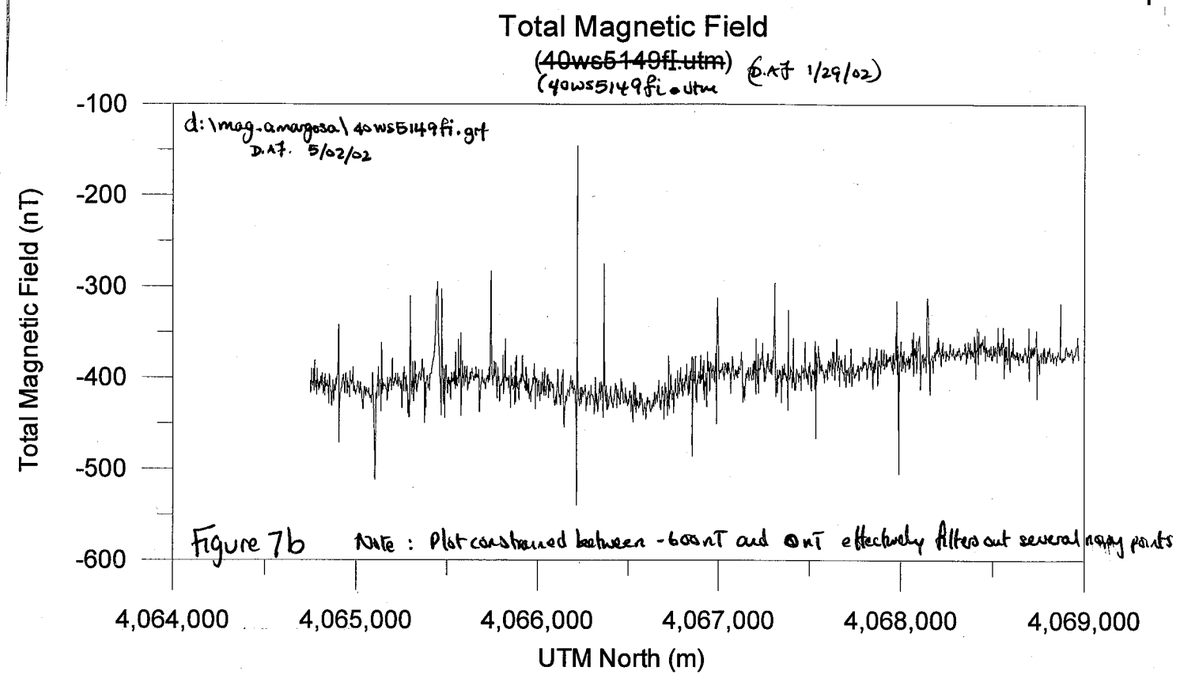
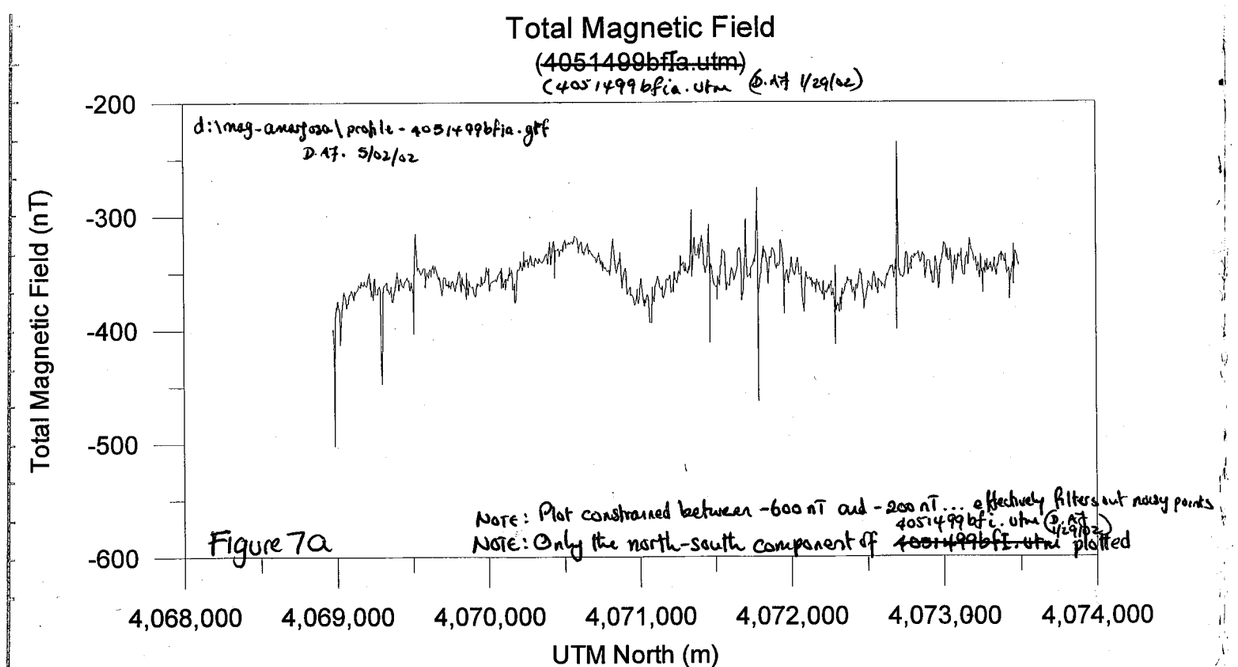
The following figures show plots of the magnetic anomalies based on C. Connor's corrections.





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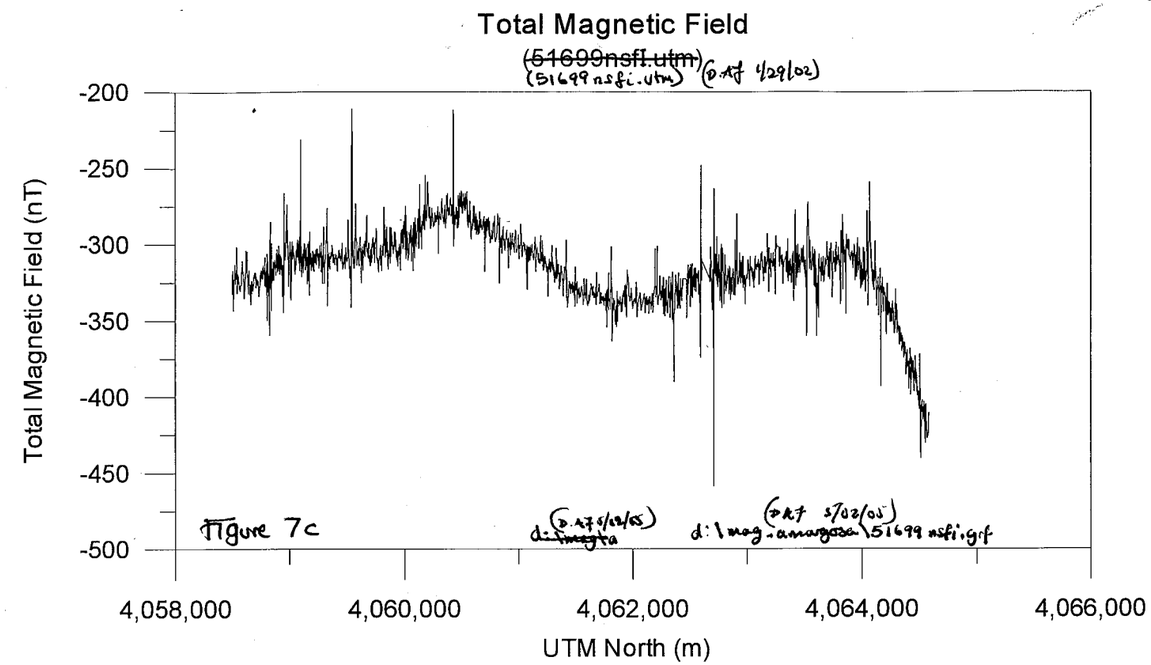
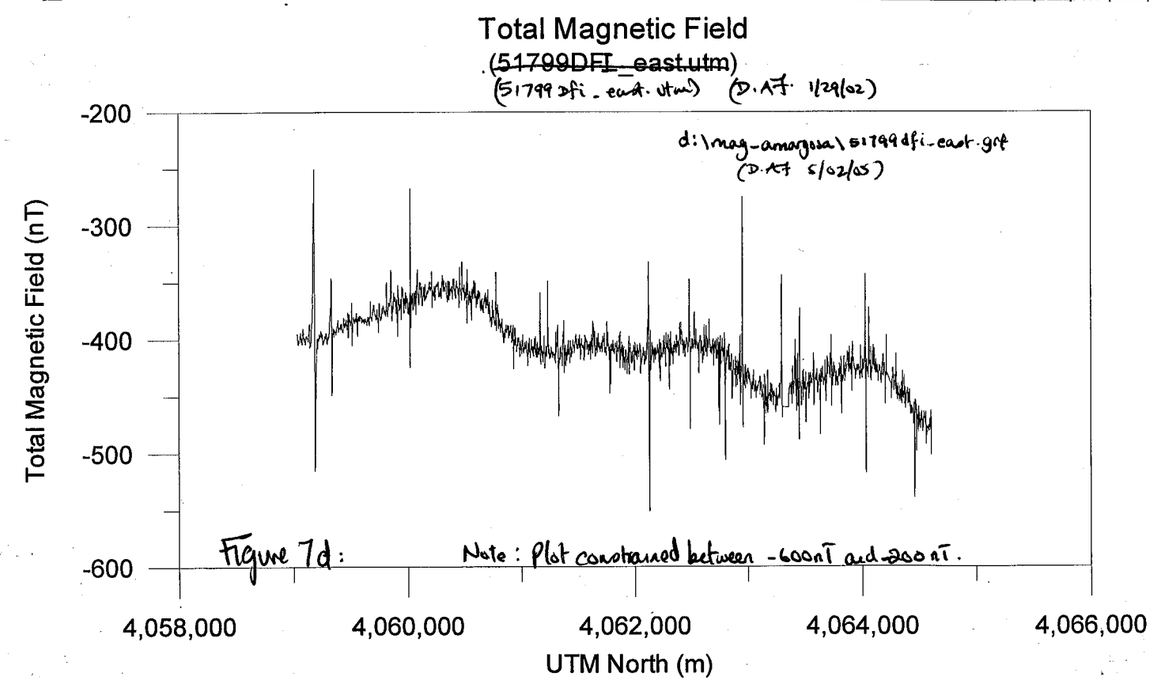


Note: Plot constrained between -600nT and -200nT. This effectively filters out two noisy data points.



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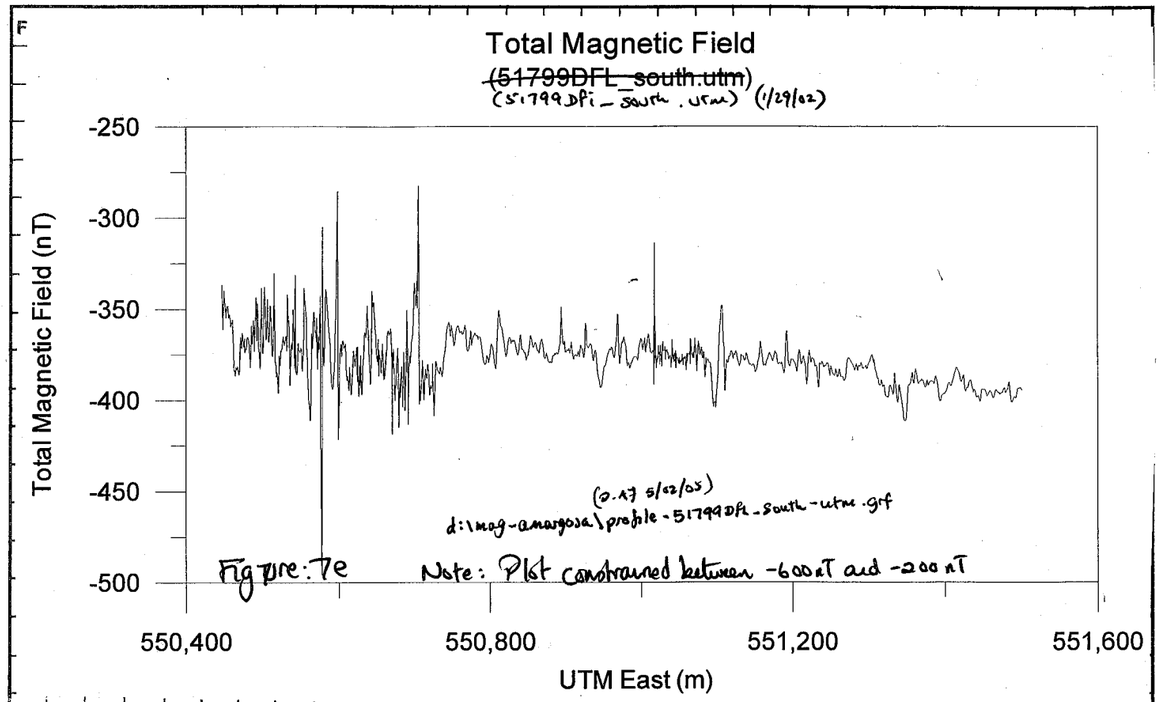

Figure: 7e Note: Plot constrained between -600nT and -200nT

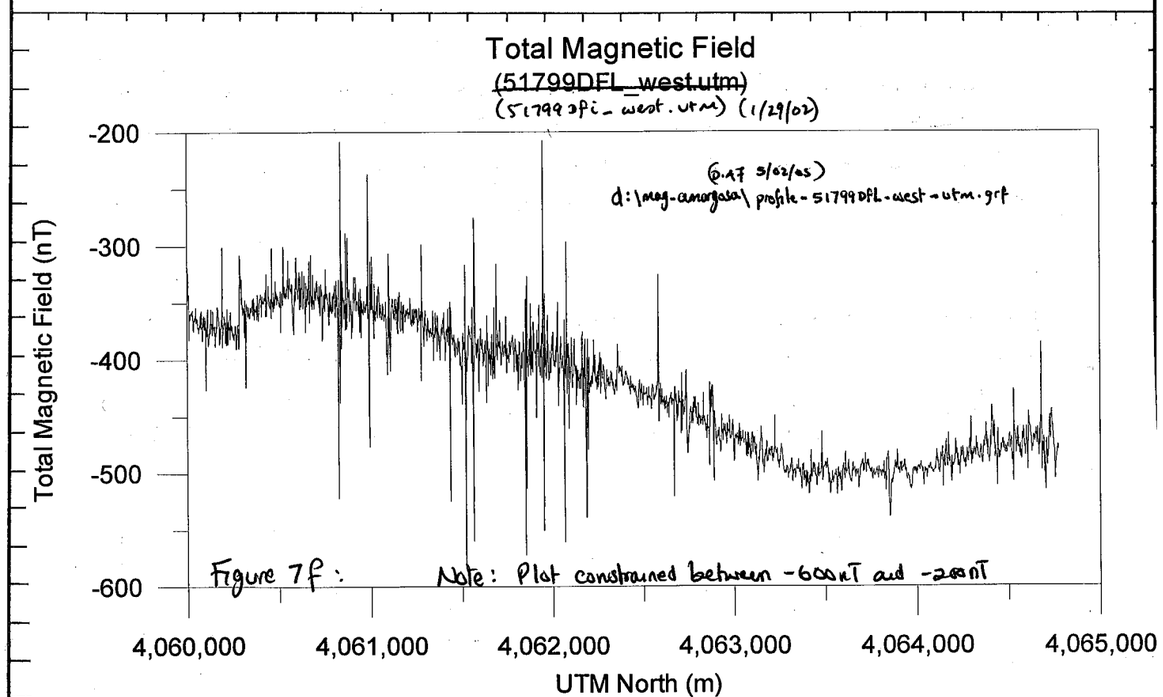

Figure 7f: Note: Plot constrained between -600nT and -200nT

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D.Af. 11/15/01

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BUILDING A NORTH-SOUTH MAGNETIC PROFILE

To build a north-south magnetic profile the following magnetic lines were combined (refer to Figure 5 on page 18):

- line ~~40514996fl.utm~~ 40514996fi.utm (D.Af 1/29/02)
- line ~~40WS5149fl.utm~~ 40WS5149fi.utm (D.Af. 1/29/02)
- line ~~51699NSFl.utm~~ 51699NSfi.utm (D.Af 1/29/02)

Note that the ~~40514996fl.utm~~ 40514996fi.utm (D.Af 1/29/02) is broken at approximately north 4069000 to remove the east-west component of the line. The north-south component of the line is that shown in Figure 7a, page 20.

Note also that there is a gap between the end of line ~~40WS5149fl.utm~~ 40WS5149fi.utm (D.Af 11/29/02) and the start of line ~~51699NSfl.utm~~ 51699NSfi.utm (1/29/02 D.Af) (see Figure 5, p. 18). This small data gap is filled by assuming a linear behavior between the two end points of these lines. Because the data gap is small relative to the long-wave length trends in the data this assumption should have minimal impact on the processing of the data and any future results.

It is also important to note that line ~~51699NSfl.utm~~ 51699NSfi.utm (D.Af 1/29/02) runs in a south-south-east direction and is therefore ~~not~~ (D.Af. 11/15/01) truely north-south. For the purposes of this initial processing this fact is ignored. This assumption may impact the final results and needs to be re-assessed at some later time.

Figure 8 shows the north-south line produced by combining the three lines. The profile shows a gradually decreasing magnetic field from north to south. This trend transforms to a relatively flat basin structure with a relatively small perturbation. The southern part of the line shows an initial rapid increase in the magnetic field with the rest of the line maintaining a relatively flat trend but with considerable perturbation. These various components of the line are illustrated in figure 8.

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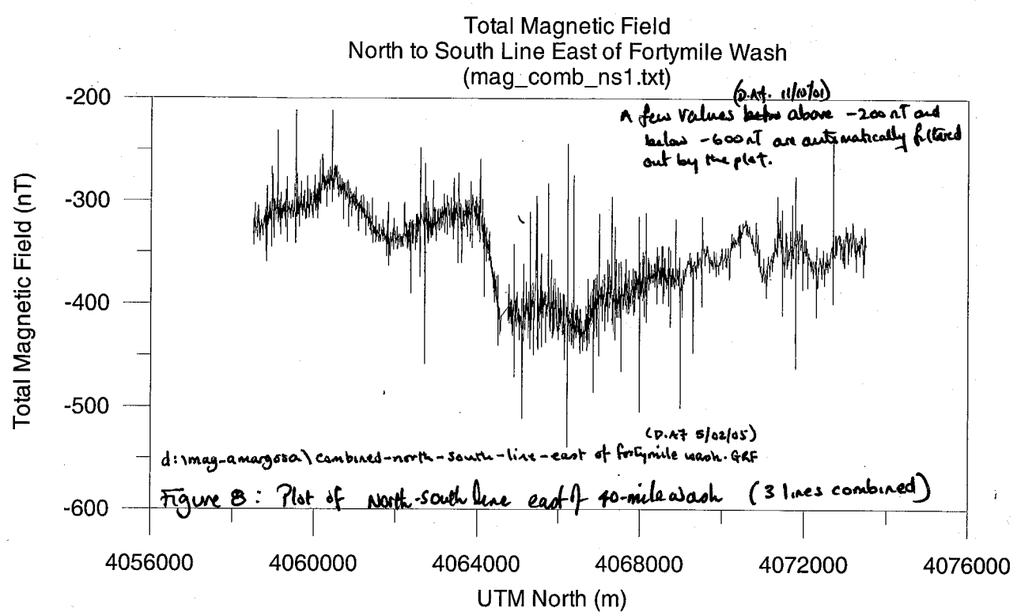

Figure 8: Plot of North-South line east of 40-mile wash (3 lines combined)

The data in Figure 8 are quite noisy and do not p.readily display the various trends described. Digital filtering provides one approach to remove or ~~sup~~ (D.A.J. 11/15/01) reduce the effect of the noise on the data and therefore reveal the true trends in the data. To remove the high frequency/short-wavelength features observed in the data a low pass-Butterworth filter may be employed.

This is accomplished by first transforming the data into the spectral wavenumber (or frequency domain) using a Fast Fourier transformation (FFT) and then low-pass filtering the data using a low-pass Butterworth filter. However, before the data can be transformed into the wavenumber data it has to be interpolated onto a regular ~~mesh~~ (D.A.J 11/15/01) interval.

The interpolation, Fourier transformation, and low-pass filtering were all performed using the computer code FOURIER-FILTER-1D developed at CNWRA.

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The + line data shown in Figure 8 were interpolated onto a regular spaced 1-D mesh. The mesh spacing is approximately 1.8m. The interpolated data are shown in Figure 9. Comparison of Figures 8 & 9 show that all of the major features of the data are preserved in the interpolated data.

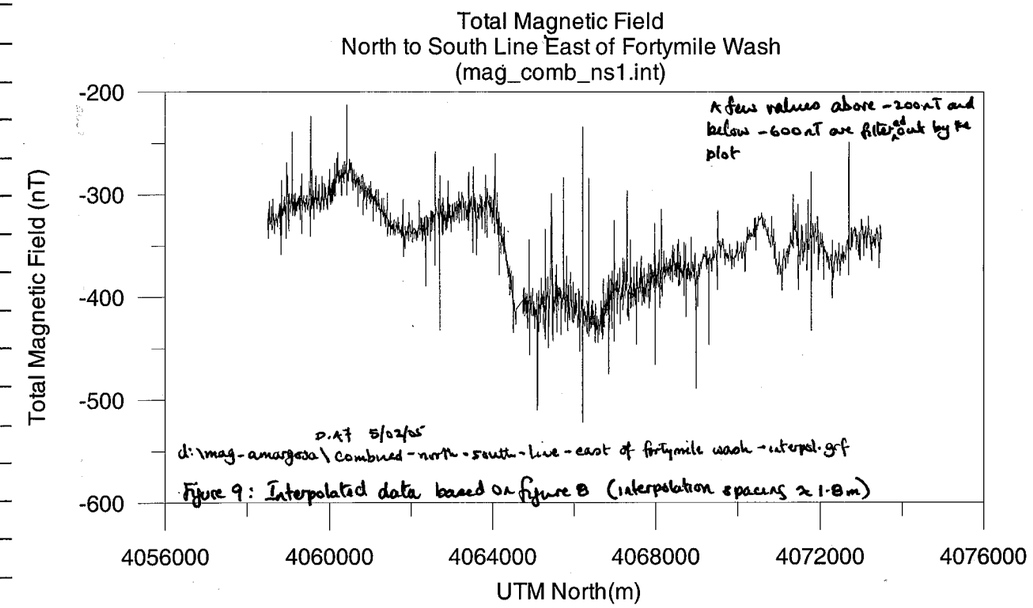

Figure 9: Interpolated data based on figure 8 (interpolation spacing ≈ 1.8m)

The new interpolated dataset is composed of 8192 data points or 2^{13} data points. The 2^{n} data points is necessary requirement for implementing the fast Fourier transform.

Because the data set is noisy it is necessary to filter the data. Here a low pass filter is applied. However, the frequency spectrum (or the wavenumber spectrum) of the data must be determined first to identify the cut-off frequency for the low-pass filter.

Figure 10 shows the computed frequency spectrum of the data computed using FOURIER-filter_1D. Note that the box-cart ~~filt~~ window function is used .... this is equivalent to having no window

Input parameters to: dt = 1.8 ; sign = -1 ; nlog = 14

high pass filter → reject

low pass filter → reject

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- average value removed from data (this option allows for better resolution of the amplitudes at the spectral frequencies) ~~this option~~ (D.A.J. 11/15/01)

setting nlog = 14 essentially doubles the data length and results a smaller Δf in the frequency domain. This ~~option~~ (D.A.J. 11/15/01) essentially pads the ~~time~~ (DAJ 11/15/01) data with zeros and therefore does not alter the spectral characteristics of the signal.

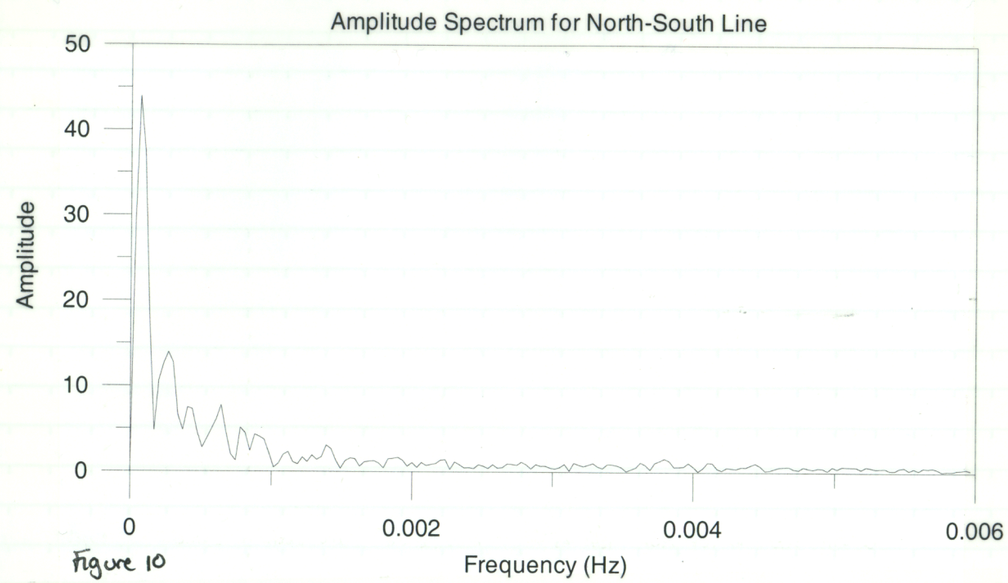

Figure 10

data: d:\mag-amargosa\fil-unfiltered-north-south.dat

Based on figure 10, a cut-off frequency of approximately (D.A.J. 11/15/01) greater than 0.001 Hz ~~0.001 – 0.002 (Hz)~~ can be used to low pass filter the data. We select a low pass filter frequency of 0.002 Hz which corresponds to a wavelength of 500 m. This provides a resolution of approximately ~~150~~ (D.A.J 11/15/01) 125 m, thus ensuring that small scale features are ignored and the larger geologic units are taken into account. Figure 11 shows the filtered time series (d:\mag-amargosa\filtered-north-south.data). Note that some caution should be used when interpreting the end-data of the filtered data set because of potential aliasing.

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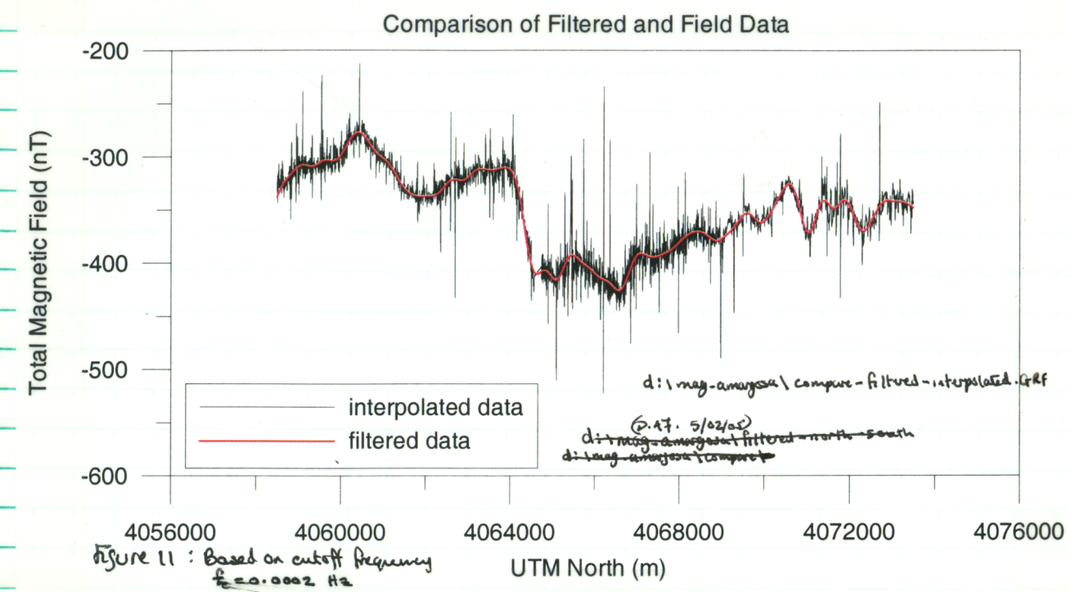

d:\mag-amargosa\compare-filtered-interpolated.GRF

(D.A.J. 5/02/02) ~~d:\mag-amargosa\filtered-north-south~~ ~~d:\mag-amargosa\compare~~

Figure 11: Based on cutoff frequency $f_c = 0.0002$ Hz

The filtered data more clearly displays the long-wavelength trends in the data. This data set can be modeled. In this work a structural model is used to interpret/model the data. Several hard constraints ~~base de~~ (D.A.J 11/15/01) based on well data are used to constrain the model. These data are based on wells WT #15, WT#13, J-13, J-12, ~~and~~ (D.A.J. 11/15/01) JF-3, and NC-EWDP-2D. These wells are all located along the general trend of the survey line. Figure 12 provides a cross-sectional geologic model for the site based on geologic data for these wells.

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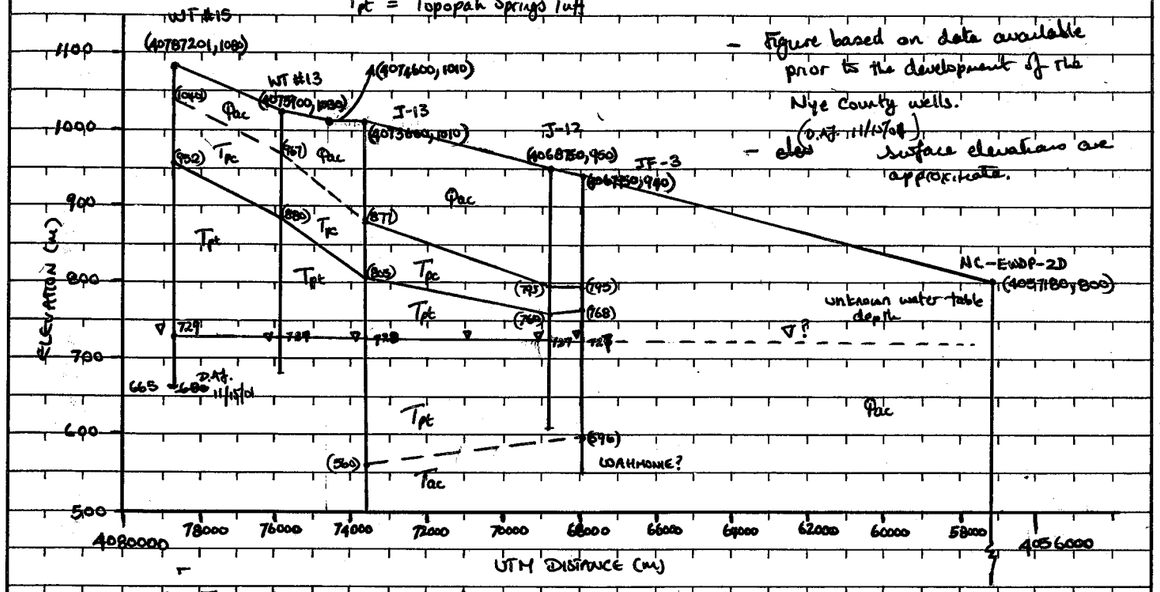
T_{ac} ≡ Calico Hills Tuff
Q_{ac} ≡ alluvium
T_{pc} ≡ Tiva Canyon Tuff
T_{pt} ≡ Topopah Springs Tuff



- Figure based on data available prior to the development of the Nye County wells. (D.A.J. 11/15/01)
- ~~elev~~ surface elevations are approximate.

FIGURE 12: Cross-schematic of geologic units along the survey line ... prior to the development of the Nye County wells (obtained from Nell Coleman).

Table 1 provides estimated magnetic parameters for these various geologic units. ~~Data taken from~~ (D.A.J. 11/15/01)

GEOLOGIC UNIT	M (A/m)	MI (degrees)	MD (degrees)
Q_{ac}	0.0	0	0
T_{pc}	1.0	-45	170
T_{pt}	1.3	55	355
T_{ac}	0.1	56	6
WAHMONIE	0.11	56	6
PROW PASS TUFF	0.26	-4	50
BULLFROG TUFF	1.70	41	12

M ≡ magnetic intensity MI ≡ magnetic inclination MD ≡ magnetic declination

Data in Table 1 were taken from the following sources:

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- Schlinger, C.M., D.R. Veblen, and J.G. Rosenbaum, 1991. Magnetism and magnetic mineralogy of ash flow tuffs from Yucca Mountain, Nevada. Journal of Geophysical Research, 96(B4), p. 6035-6052.

- Hudson, M.R., D.A. Sawyer, and G. Warren, 1994. Paleomagnetic and rotation constraints for the Middle Miocene southern Nevada volcanic field. Tectonics, 13(2), p. 258-277.

The data listed in Table 1, and the geologic contacts displayed in Figure 12, were used to construct a geologic cross-section for the survey line. The geologic contacts ~~shown in Figure 11~~ (D.A.J. 11/15/01) ~~were used~~ at boreholes were used as hard constraints in the model. The geologic model was constructed by Peter La Femina during the summer and fall of 1999. The model was constructed using the magnetic and gravity modeling software GM-SYS. GM-SYS is a program for calculating the gravity and magnetic responses from a geologic model. Models may be two-dimensional 2D or 2 3/4-D. It is important to note that GM-SYS is a forward modeling software package. The software is not capable of performing inverse modeling. As a result, models fitted to the data are not based on objective or statistical criteria. Therefore, models produced by GM-SYS represent one of many models that are capable of fitting the data.

As pointed out, Figure 12 forms the basis for the initial starting model in GM-SYS. The filter field observed magnetic field data shown in Figure 11 are used to constrain the model, that is, model responses computed by GM-SYS using the magnetic parameters shown in Table 1, are compared to this data to guide model development. Through ~~this~~ a (D.A.J. 11/15/01) hand calibration procedure a model was developed that honored the geologic contacts observed in the well bores and matched the observed magnetic field (Figure 11). This magnetic model is shown in Figure 13. It is important to note that the model is based on an assumed horizontal earth surface. This is a somewhat reasonable assumption given that the slope of surface over the extent of the model is less than 1° (degree). This assumption can be validated if required by subsequent modeling ~~which includes the upper~~ (11/15/01 D.A.J.) topography that accounts for topography.

As stated earlier the model accounts for all of the geologies observed at the various wells. The lowest layer of the model is unknown as indicated by the question mark. Whether this contact represents bedrock is currently not known. In addition the basement geometry of the model is not know and as a result the model may not accurately represent this surface. Recall that there is some non-uniqueness present in models of this nature.

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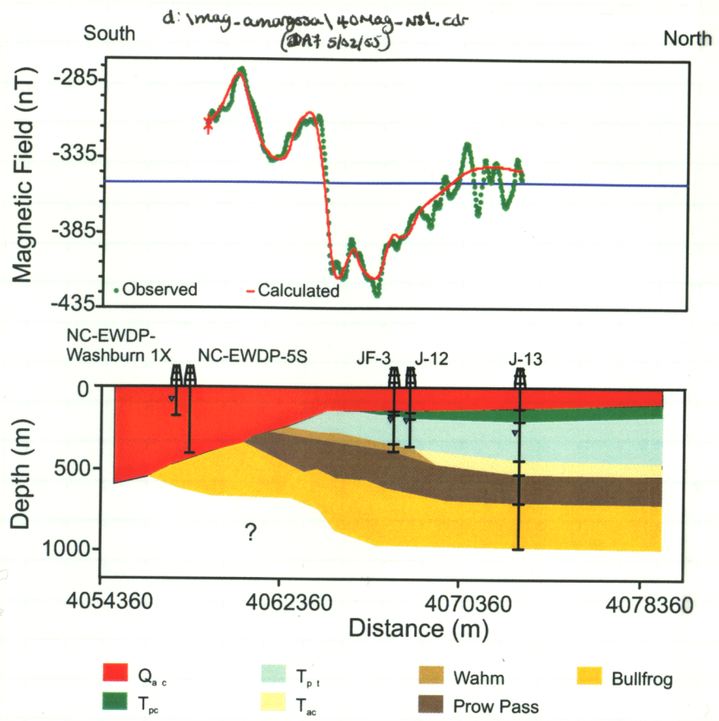

Figure 13: Computed geologic cross-section based on magnetic model. Upper figure shows the general agreement between the observed data and calculated field.

However, the model does appear to provide a good fit to the observed data. An interesting feature of the model increasing alluvial thickness to the south. This increasing thickness is supported by boreholes NC-EWDP-Washburn 1X and NCEWDP-5S which, although not along the survey line, are in the general region. Alluvial thicknesses in these wells help to constrain the depth of the tertiary volcanic rocks. Because the model does not extend as far south as NC-EWDP-2D ~~this~~ (D.A.F. 11/15/01) this well is not used to constrain the depth to the tertiary volcanics.

In the model we use an unconformable surface to represent the contact between the alluvial sediments. While this model provides a good fit to the data, there is currently no data available that supports it.

The increasing thickness of the alluvial deposit shown in the model is supported by other models and data. These include apparent alluvial thicknesses determined from vertical electrical resistivity soundings (see US. Geological Survey - Open-file Report 89-234, Figure 14), and the Bouguer gravity map of Healey et al. 1980 (Healey, D.L., Wahl, R.R., and Oliver, H.W., 1980. Death Valley Sheet. In: The Collection Complete Bouguer gravity map of Nevada. University of Nevada, Reno, Nevada Bureau of Mines and Geology, map 69, scale 1:250,000, 1 Sheet), and Bouguer gravity data present in Snyder and Carr (1982: USGS Open-file Report 82-701).

Figure 14 is essentially a replot of Figure 13 (lower portion). On Figure 14 we connect the points that define the watertable measured at various boreholes (see USGS Open-file Report 95-159, Table 1,

TABLE 2: Watertable Elevation at Selected Wells

WELL ID	MEASURED WATERLEVEL (m)	
J-13	728.47	Based on USGS Openfile Report 95-159
J-12	~~728.43~~ (D.A.F. 11/15/01) 727.97	
JF-3	727.8	Based on OCRWM (Analysis report MDL-NBS-HS-000011)
NC-EWDP-1X WASHBURN 1X	715.6	⇒ Based on Nye County Early Warning Drilling Program - Phase 1 - 1999 Report.

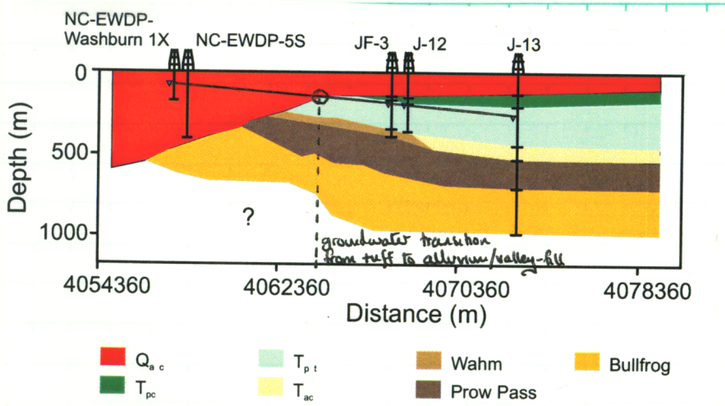

Figure 14: Superposition of depth of watertable on geologic cross-section model (assumes a linear watertable trend between monitoring wells.

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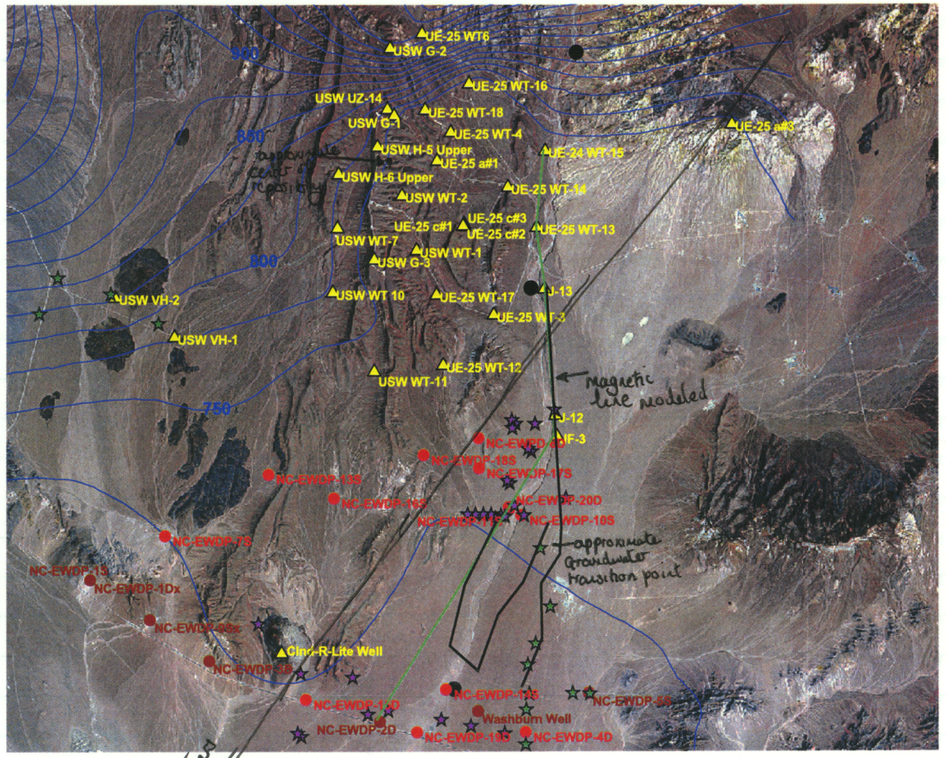
Based on figure 14, the estimated tuff-alluvium contact is at UTM-north 4064015 m.



D.A.F. 1/18/02 In correct scale in miles and not kilometers

- Electromagnetic survey stations (1998)
- Electromagnetic survey stations (1999)
- Nye County wells (proposed)
- Nye County wells (drilled)
- Fortymile Canyon gauging stations
- Wells used to define watertable
- Watertable (m)

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Figure 15: Site scale map showing the approximate location of the groundwater transition from tuff to alluvium (valley-fill).

distance from repository center (D.A.F. 11/15/01) to transition point ≈ 15.5 km.

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PROCESSING THE LINE 51799DFI-EAST.UTM (see Figure 6)

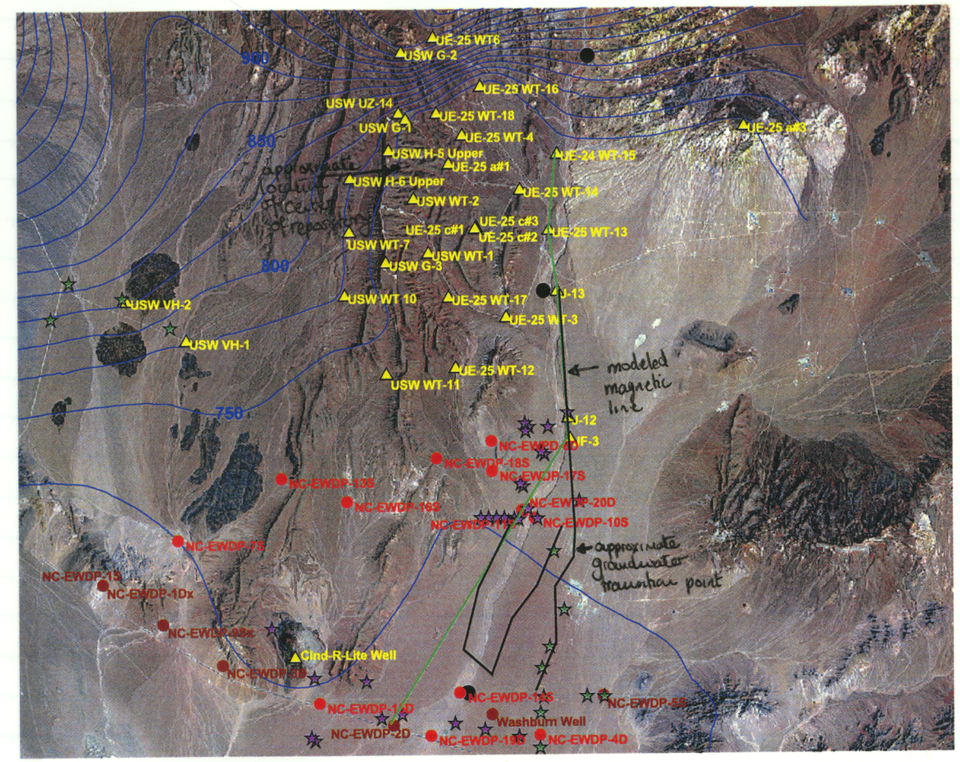

Figure 15: Site-scale map showing the approximate location of the groundwater transition from tuff to alluvium (valley-fill)

- Electromagnetic survey stations (1998)
- Electromagnetic survey stations (1999)
- Nye County wells (proposed)
- Nye County wells (drilled)
- Fortymile Canyon gauging stations
- Wells used to define watertable
- Watertable (m)

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The magnetic line 51799DFi-east.utm is shown in figure 6. This line was processed using a procedure similar to that described previously. Magnetic profiles along the line are shown in figures 16 and 17.

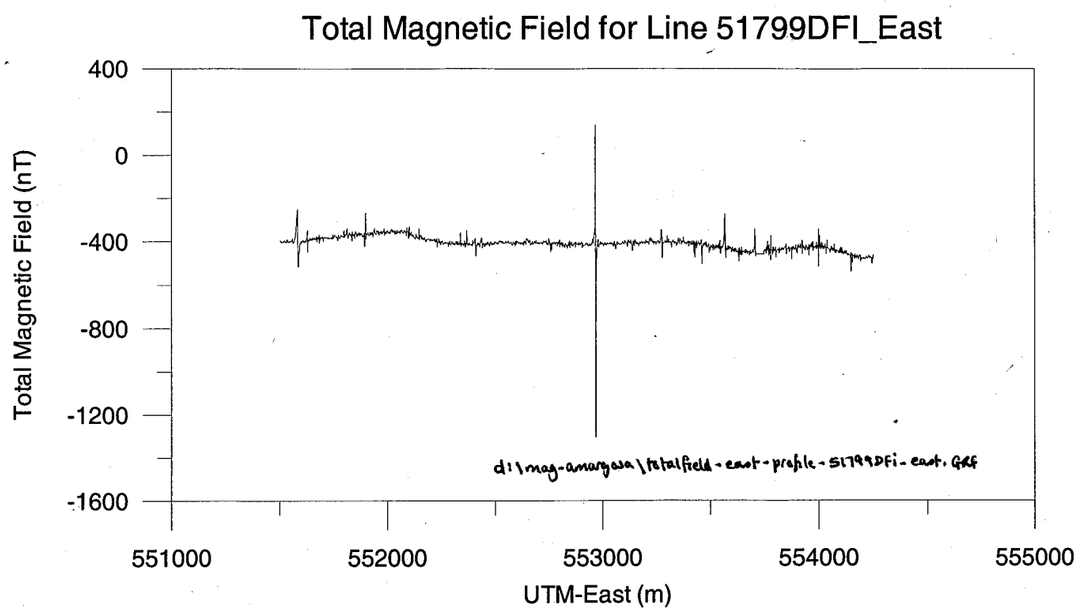

Figure 16a: East-west plot of total magnetic field along line 51799dfi-east.utm

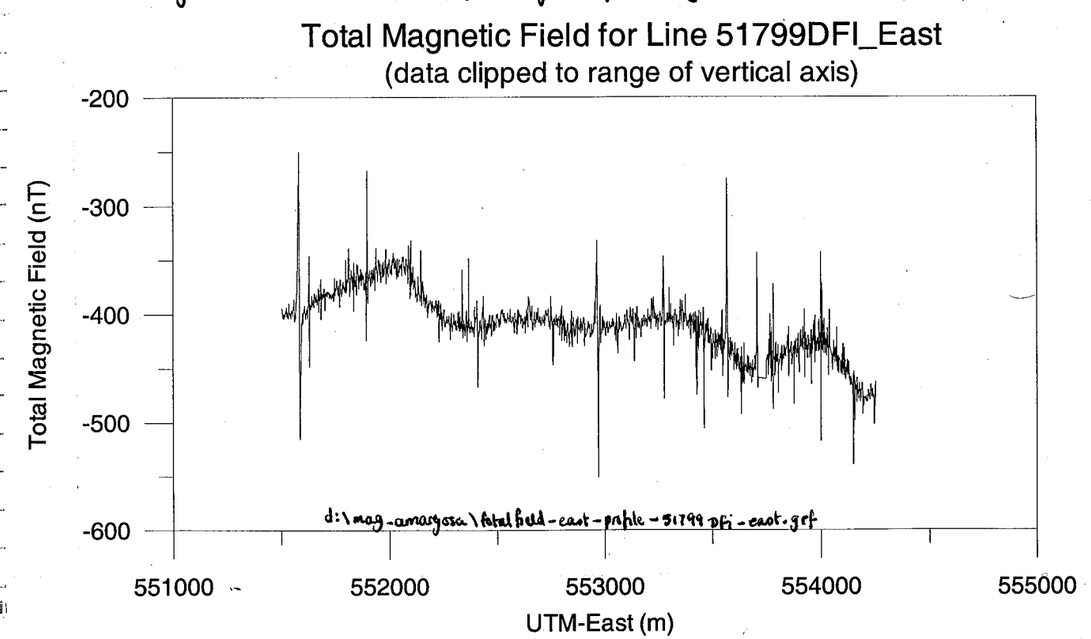

Figure 16b: East-west plot of total magnetic field along line 51799dfi-east.utm (data clipped to range of vertical axis)

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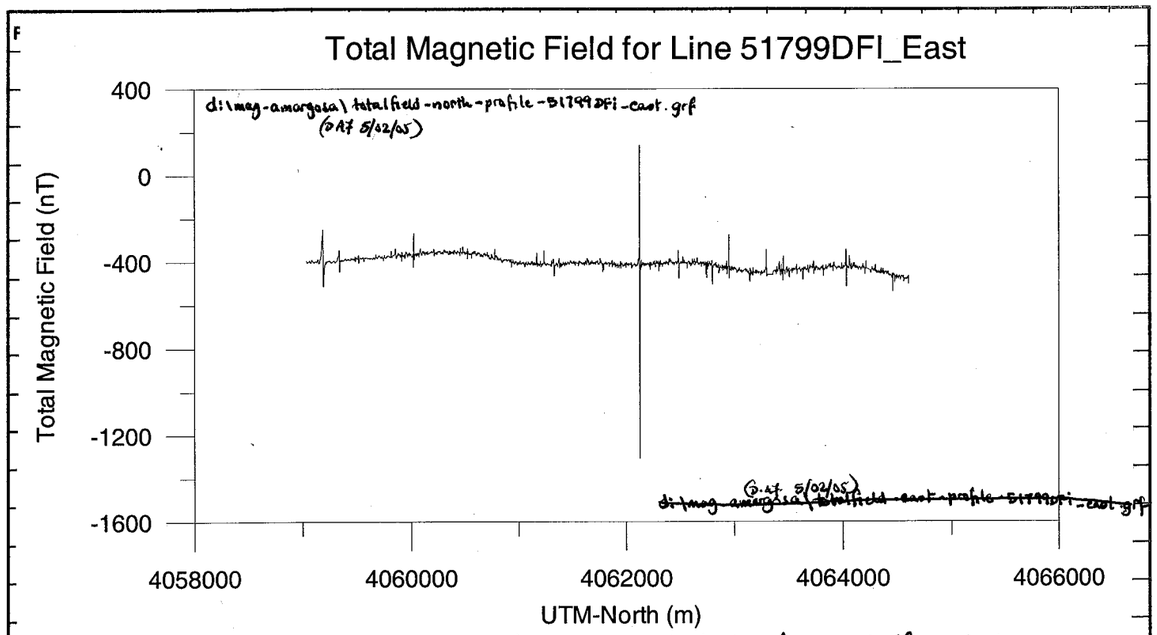

Figure 17a: North-south plot of total magnetic field along line 51799dfi-east.utm

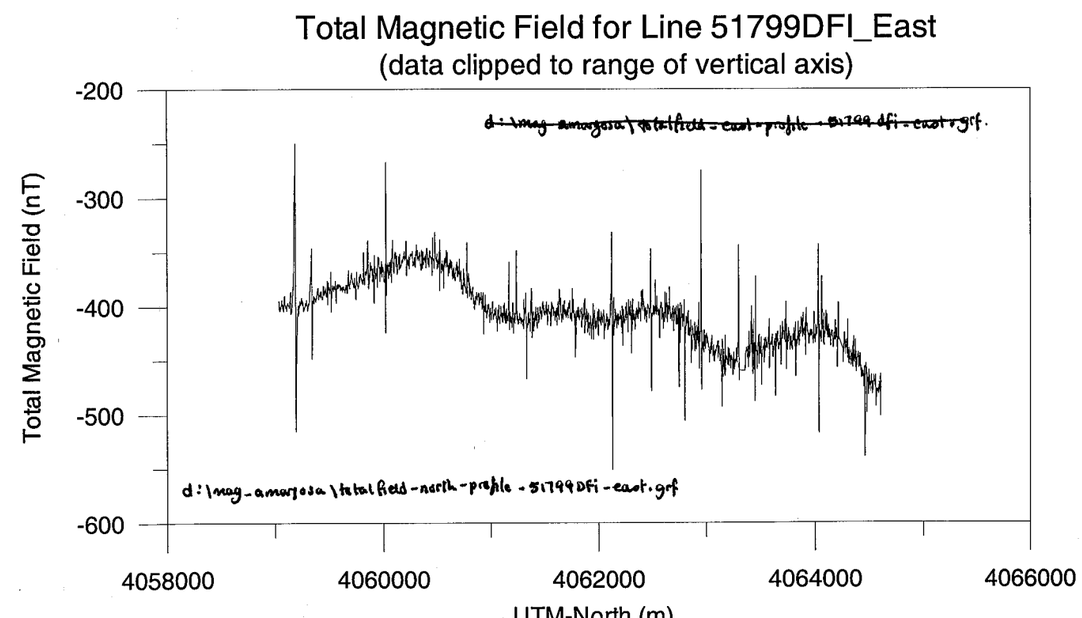

Figure 17b: North-south plot of total magnetic field along line 51799dfi-east.utm. (data clipped to range of vertical axis)

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~~Before the~~ (D.AF 1/29/02)

As shown in figures 16 and 17 the data are quite noisy. As a result the data must be filtered prior to modeling. Since we are interested in the longer wavelengths contained in the data, ~~a low p~~ (1/29/02 D.AF) low pass filtering the data is appropriate. We apply the low pass filter to the north-south data profile shown in figure 17. Similarly, low pass filtering could have been applied to east-west data profile. Filtering could also have been applied to a projection of the data onto a line that represents a least squares fit to x-y plot of the data. All approaches are expected to yield similar results

The data is filtered using the computer code FOURIER-FILTER-1D (see p.24). Because Fourier-filter-1D requires the data to be uniformly spaced before filtering, the data needs to be interpolated. The data is interpolated using the "INTERPOLATION" option present in FOURIER-FILTER-1D. A 4096 (ie 2^{12}) point interpolation is used. This yields a Δz spacing of approximately 1.36 m where z ranges between 4064602 m and 4059034 m (see plot figure 17). The amplitude spectrum of the interpolated data is shown in figure 18. [Note that because Fourier-filter-1D reads in only x-y data sets, it was necessary to ~~copy~~ (1/29/02 D.AF) extract the north and z data from 51799dfi-east.utm (D.AF 1/29/02) to a separate file 51799-y-projected.dat prior to running Fourier-filter-1D .... 51799-y-projected is the input to Fourier-filter-1D]. inputs to fourier-filter-1D : sign = -1 ; nlog = 14

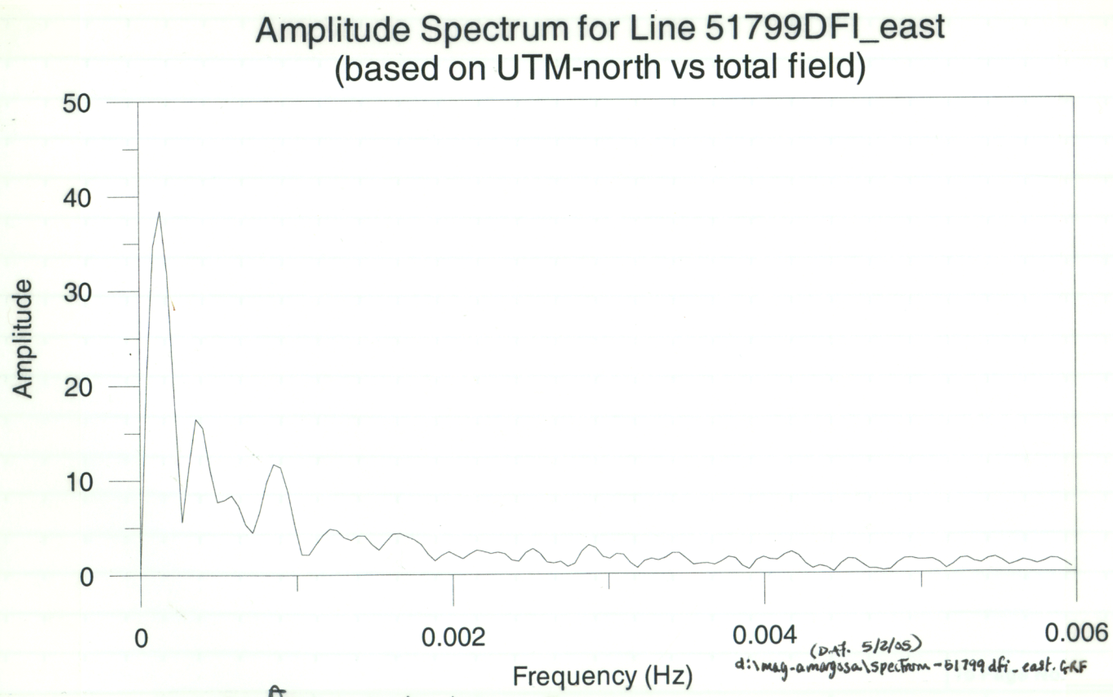

Figure 18: Frequency spectrum base on figure 17a.

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From Page No. Note that spectrum is based on mean removed data. (D.AF 1/29/02)

Note that a Rectangular window was used as the windowing function in Fourier-filter-1D. The ~~start time~~ or distance of the window was 4059034 and the window width was 5570 m. Mean must be added to filtered data.

Based on Figure 18 a low pass cutoff frequency of ~~0.0022~~ 0.002 Hz (D.AF 1/29/02) is appropriate. This is consistent with that used previously.

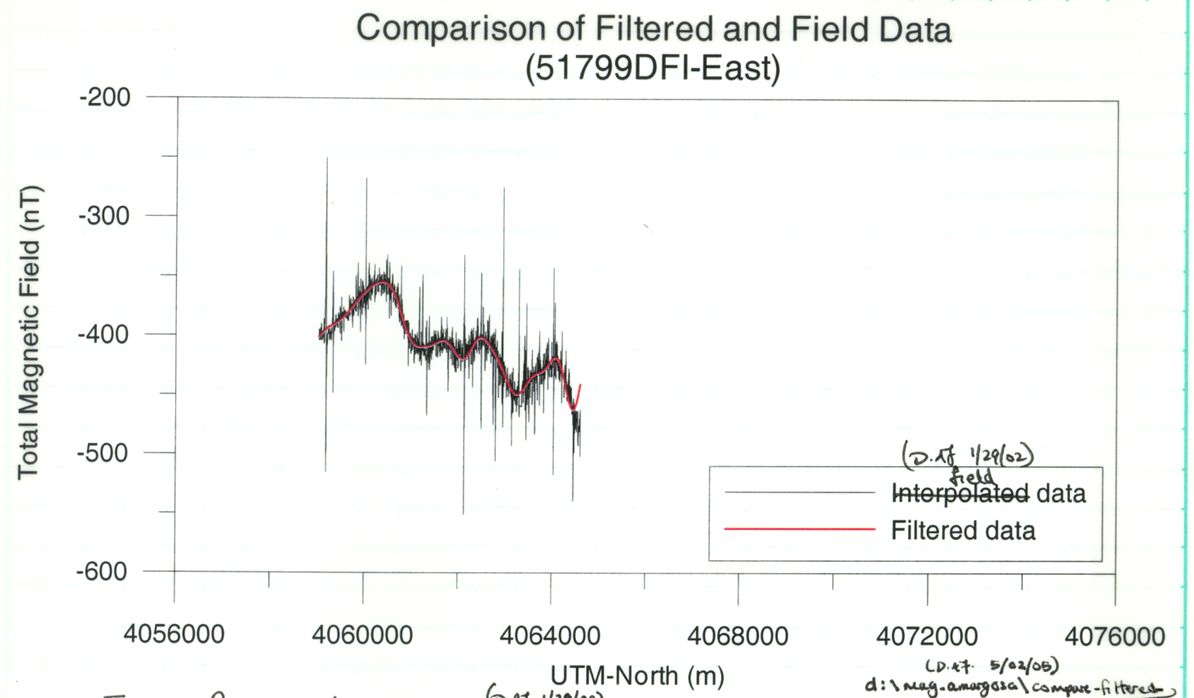

Figure 19: Comparison of filtered and ~~interpolated data~~ (D.AF 1/29/02) field data

Note that UTM-east data for the ~~filtered data points~~ (D.AF. 1/29/02) interpolated UTM-north data points associated with the filtered data can be recreated using the following equation which describes the line that connects the end points line 51799dfi-east.utm

UTM-NORTH = gradient * utm-east + intercept

where gradient = 2.0247

and intercept = 2942406.89

This new file based on 51799-y-projected-fil.dat (filtered data file) is 51799-y-projected-fil-location.dat

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No further ~~data~~ D.AF. 12/12/05 entries will be made to this Scientific Notebook.

David A. Farnell 12/12/05

I have reviewed this SN and determined that it complies with QAP-001. There does not appear to be any proprietary information contained herein. This SN will be entered into LSN.

Gordon Wittmeyer 12/15/2005

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