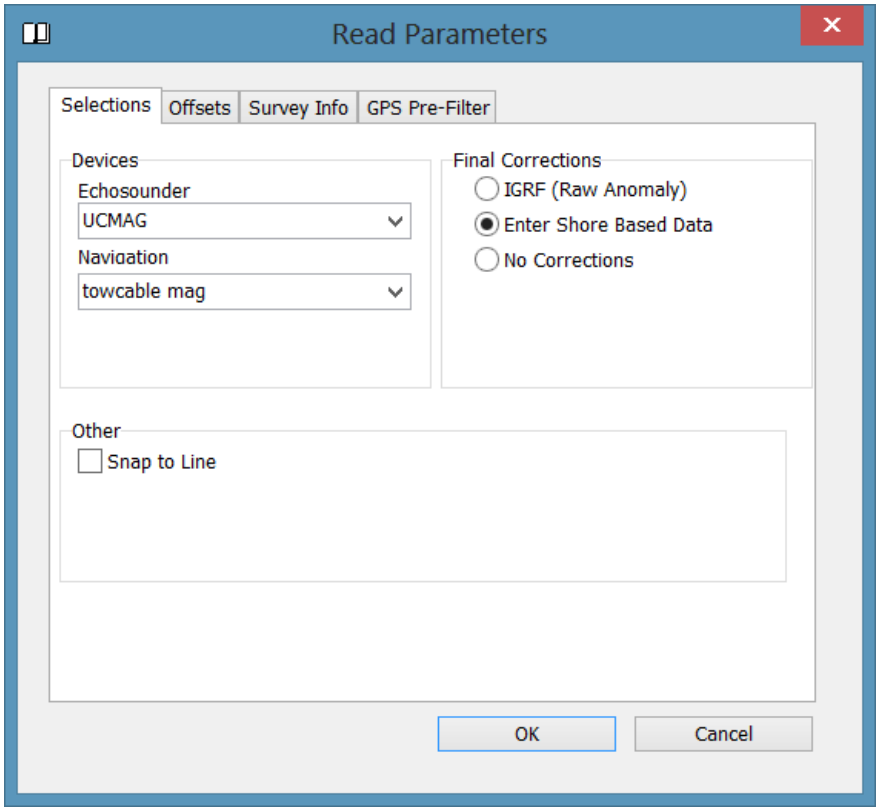
Correcting Magnetometer Data in MagEdit

By Joseph Adamski

When processing Magnetic data, the goal is often to remove as much noise as possible. In HYPACK®, Magnetometer processing will soon be streamlined into a program called MAGEDIT which will support IGRF and shore-based corrections.

FIGURE 1. *Choosing Final Correction Type After Selecting a RAW File*



IGRF

IGRF (International Geomagnetic Reference Field) corrections rely on an algorithm which calculates the earth's magnetic force at a particular location and time. This is then subtracted from the raw reading to obtain the raw anomaly. In other words, you are removing the "background gamma" from the readings you obtained.

Selecting this option in MAGEDIT causes Raw Anomaly output as your corrected value in All format files, or your Z in XYZ files to be used to make final products.

The formula for Raw Anomaly:

Reading – IGRF(Ship,time). **(EQ 1)**

FIGURE 2. *Example of Calculated Raw Anomaly Values*

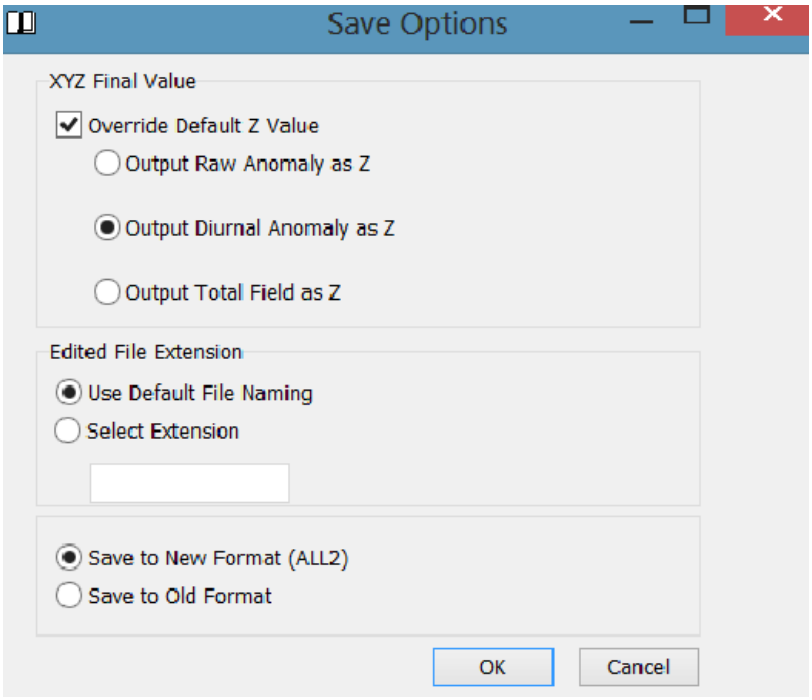
Gamma 1	IGRF(Boat	Raw Anon
48014.31	48070.33	-56.02
48014.47	48070.32	-55.86
48014.63	48070.32	-55.69
48014.28	48070.31	-56.03
48014.57	48070.30	-55.73
48014.05	48070.29	-56.24
48014.76	48070.29	-55.52
48014.52	48070.28	-55.76
48013.88	48070.27	-56.39
48015.02	48070.26	-55.24
48014.55	48070.25	-55.70
48014.02	48070.25	-56.23
48013.99	48070.24	-56.25
48014.62	48070.23	-55.61
48014.55	48070.22	-55.67

SHORE-BASED CORRECTIONS

For shore-based corrections, you need a data file from a shore-based station. You input the latitude and longitude of the station as it is used for several calculations, including IGRF for the shore station itself and the time shift to accommodate the difference in distance of the boat and shore station. If shore data is at a different time interval than the raw data, then MAGEDIT will interpolate the shore data to calculate values to match the raw data.

When doing shore based corrections, Total Anomaly is the default value for Z but you can change it to another anomaly (Raw, Diurnal, Total Field) in the FILE-SAVE options:

FIGURE 3. Save Options Dialog



FILE FORMATS

SHOM – this is a simple format which is easy for you to create yourself. Each line follows the format “YEAR/MONTH/DAY HH:MM:SS” then a tab... followed by the gamma value. For Example:

```
2012/02/18 00:00:00    48275.60
2012/02/18 00:01:00    48275.60
2012/02/18 00:02:00    48275.70
2012/02/18 00:03:00    48275.60
```

IAGA – These are files used by the intermagnet observatories.

FORMULAS AND EXPLANATIONS OF SHORE CORRECTION CALCULATIONS

TimeShift: Time shift is calculated by the following formula:

Time on boat (+ or -) 240 *Absolute Value (Boat Longitude – Shore Longitude). (EQ 2)

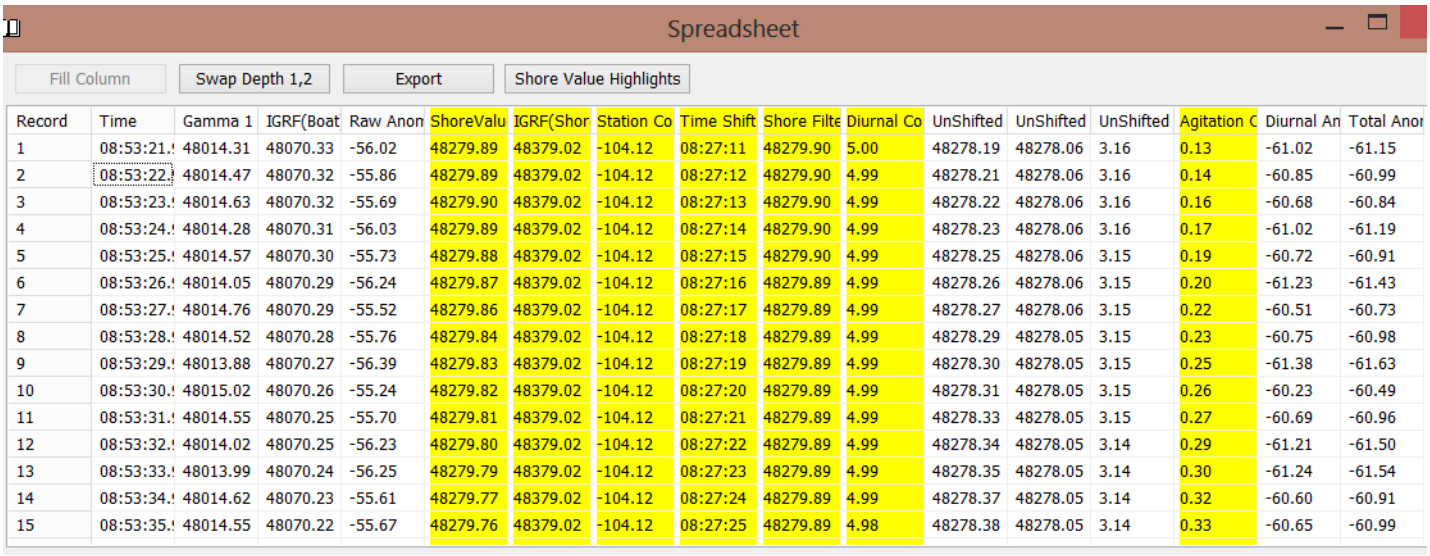
Agitation Component: Agitation components are variations of magnetic fields caused by solar eruptions. This is calculated by subtracting the un-shifted shore by the un-shifted filter values.

Station Constant: The station constant is calculated by subtracting the average of the shore values from the average of the IGRF shore values. This is calculated using all of the input shore values.

Diurnal Component: Oscillations of the earth's magnetic field, which have a periodicity of about a day. They are time-shifted values (to accommodate the difference in location from the boat) which are calculated by subtracting the filtered value from the IGRF (Shore) added with the Station Constant.

In the Spreadsheet Window of MAGEDIT, you can turn on and off highlighting of the values which are used in the calculation of diurnal and total anomaly.

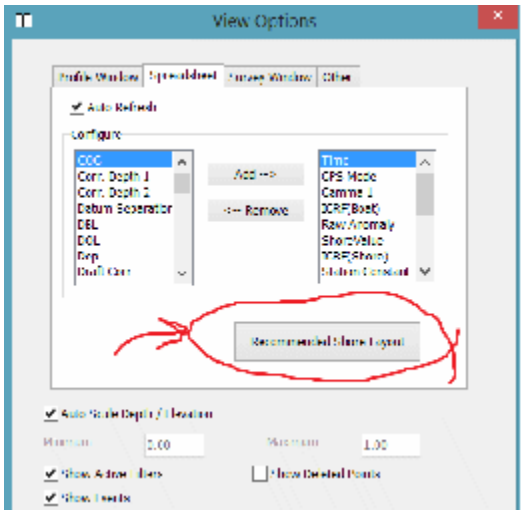
FIGURE 4. *Spreadsheet Window of MAGEDIT*



Record	Time	Gamma 1	IGRF(Boat	Raw Anon	ShoreValu	IGRF(Shor	Station Co	Time Shift	Shore Filte	Diurnal Co	UnShifted	UnShifted	UnShifted	Agitation C	Diurnal An	Total Anor
1	08:53:21.(	48014.31	48070.33	-56.02	48279.89	48379.02	-104.12	08:27:11	48279.90	5.00	48278.19	48278.06	3.16	0.13	-61.02	-61.15
2	08:53:22.(	48014.47	48070.32	-55.86	48279.89	48379.02	-104.12	08:27:12	48279.90	4.99	48278.21	48278.06	3.16	0.14	-60.85	-60.99
3	08:53:23.(	48014.63	48070.32	-55.69	48279.90	48379.02	-104.12	08:27:13	48279.90	4.99	48278.22	48278.06	3.16	0.16	-60.68	-60.84
4	08:53:24.(	48014.28	48070.31	-56.03	48279.89	48379.02	-104.12	08:27:14	48279.90	4.99	48278.23	48278.06	3.16	0.17	-61.02	-61.19
5	08:53:25.(	48014.57	48070.30	-55.73	48279.88	48379.02	-104.12	08:27:15	48279.90	4.99	48278.25	48278.06	3.15	0.19	-60.72	-60.91
6	08:53:26.(	48014.05	48070.29	-56.24	48279.87	48379.02	-104.12	08:27:16	48279.89	4.99	48278.26	48278.06	3.15	0.20	-61.23	-61.43
7	08:53:27.(	48014.76	48070.29	-55.52	48279.86	48379.02	-104.12	08:27:17	48279.89	4.99	48278.27	48278.06	3.15	0.22	-60.51	-60.73
8	08:53:28.(	48014.52	48070.28	-55.76	48279.84	48379.02	-104.12	08:27:18	48279.89	4.99	48278.29	48278.05	3.15	0.23	-60.75	-60.98
9	08:53:29.(	48013.88	48070.27	-56.39	48279.83	48379.02	-104.12	08:27:19	48279.89	4.99	48278.30	48278.05	3.15	0.25	-61.38	-61.63
10	08:53:30.(	48015.02	48070.26	-55.24	48279.82	48379.02	-104.12	08:27:20	48279.89	4.99	48278.31	48278.05	3.15	0.26	-60.23	-60.49
11	08:53:31.(	48014.55	48070.25	-55.70	48279.81	48379.02	-104.12	08:27:21	48279.89	4.99	48278.33	48278.05	3.15	0.27	-60.69	-60.96
12	08:53:32.(	48014.02	48070.25	-56.23	48279.80	48379.02	-104.12	08:27:22	48279.89	4.99	48278.34	48278.05	3.14	0.29	-61.21	-61.50
13	08:53:33.(	48013.99	48070.24	-56.25	48279.79	48379.02	-104.12	08:27:23	48279.89	4.99	48278.35	48278.05	3.14	0.30	-61.24	-61.54
14	08:53:34.(	48014.62	48070.23	-55.61	48279.77	48379.02	-104.12	08:27:24	48279.89	4.99	48278.37	48278.05	3.14	0.32	-60.60	-60.91
15	08:53:35.(	48014.55	48070.22	-55.67	48279.76	48379.02	-104.12	08:27:25	48279.89	4.98	48278.38	48278.05	3.14	0.33	-60.65	-60.99

If you forget what data items are used in shore-based calculations, you will find a button in view options which will load them into your spreadsheet in a logical order.

FIGURE 5. *View Options Dialog*



Final Shore Product Options

Diurnal Anomaly: Diurnal Anomaly is calculated with the formula:

Raw Anomaly – Diurnal Component. **(EQ 3)**

Total Anomaly: This is the default final magnetic value for the ship sensor after doing all shore calculations and with Diurnal Component being time shifted.

Raw Anomaly – Diurnal Component – Agitation Component. **(EQ 4)**

Total Field: Unlike total anomaly, this value is not close to zero, but rather more like a normal gamma reading.

Non-Time Shifted shore data – raw data + average of the shore data **(EQ 5)**

FIGURE 6. *Caption: Diurnal Anomaly (Green) vs Total Anomaly (Red)*