

EM38 meter Cookbook

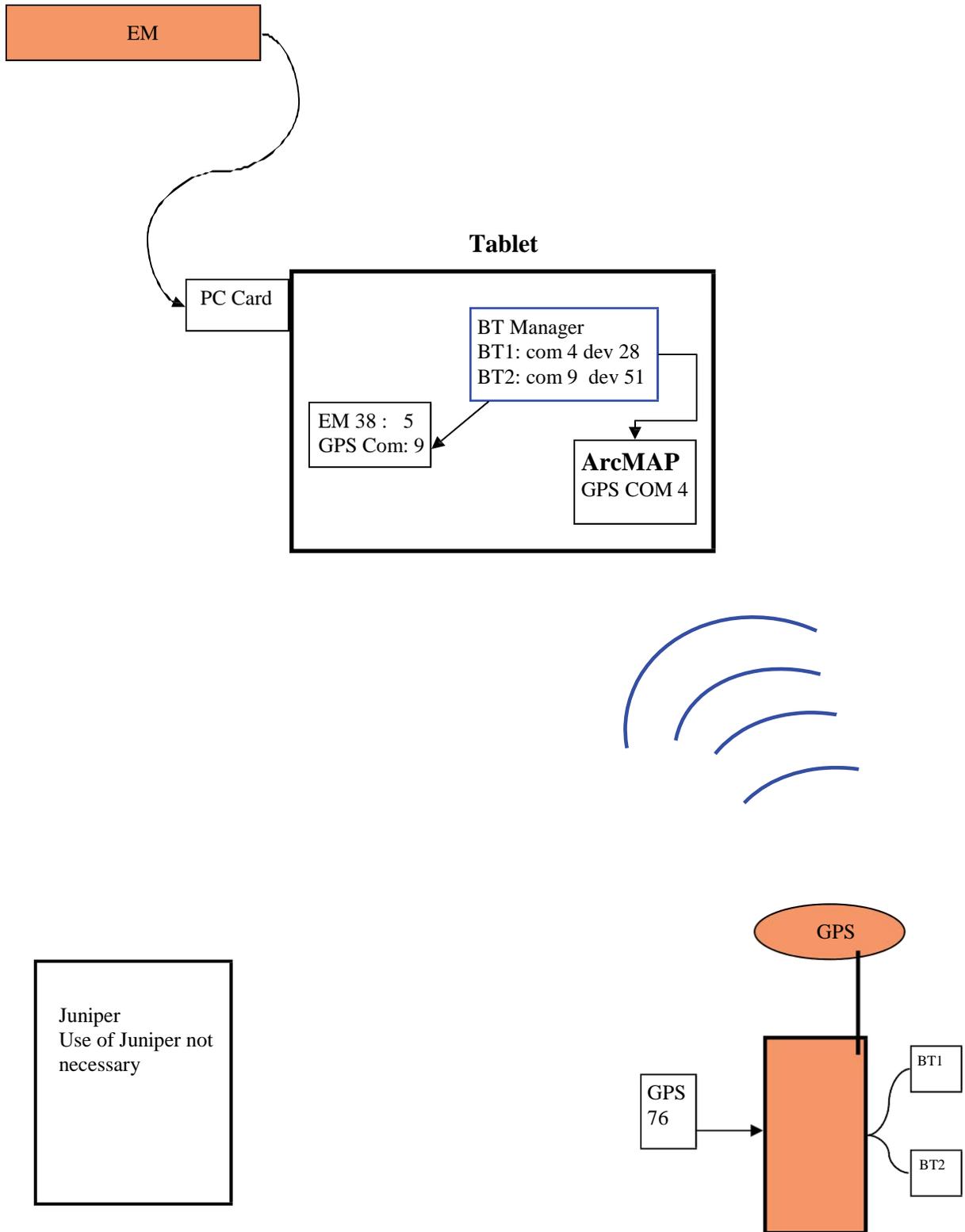


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Directions how to use
EM38 meter
with ArcGIS and GPS

Setup Diagram

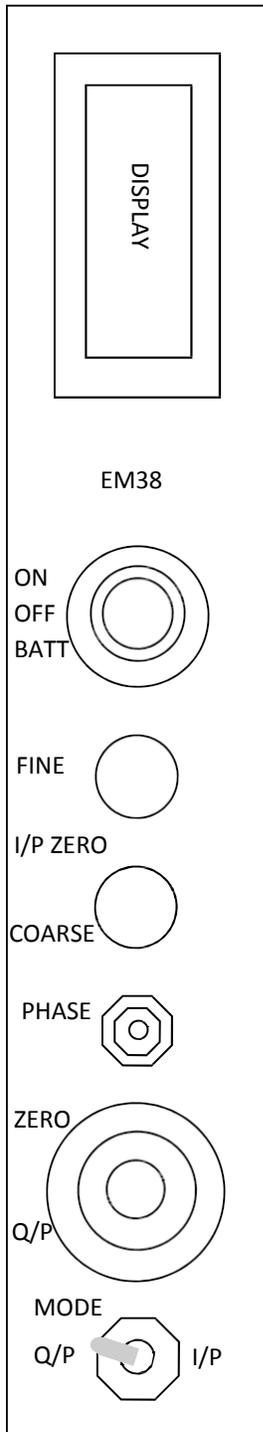


Check list for EM 38 meter

This is a sample checklist to use before going to the field with the EM38 and other components. You should create your own checklist based on components you use.

- GPS backpack
- GPS battery (car charger)
- GPS hand device
- GPS backpack fuses
- Extra battery AA for GPS hand device
- 2 blue device (Bluetooth connections)
- Tablet
- PC card
- Extra battery for tablet
- 9 volts battery for EM meter
- EM meter
- EM meter cord (for PC card & EM meter connection)
- Field equipment (auger, color book, transect sheet, soil survey, etc.)

How to Set Up and Calibrate the EM Device



Turn on the device

Check the battery by turning the knob to "BATT"

Make sure that the number is less than -700 (i.e.: -946), if it is more than -700 – change the battery

Switch to "ON"

IMPORTANT!!!!!! - Remove all jewelry from hands, neck, and pockets.

Let the device warm up for 5-15 minutes before use.

Calibrating

Step 1

Place EM38 on the ground – the black bar along the bottom touching the ground

Flip switch to Q/P

Notice the reading, "Zero" it out using the Q/P knob

Step 2

Flip switch to I/P

Notice the reading changed, "Zero" it out using the I/P knobs (Coarse and Fine Controls)

Step 3

Flip switch back to Q/P

Make sure that it still reads zero

If not, "Zero" it out using the Q/P knob

Step 4

Look at the current position of the I/P Coarse Control Knob and make a mental note

Step 5

Move the I/P Coarse Control Knob one step clockwise – there shouldn't be a change in the reading

If there is a change – move the Phase Control until the one-step move on the I/P Coarse Control Knob from where it was at Step 4 doesn't change—to move the Phase Control Knob, loosen the nut first and tighten when done

Step 6

Lift the EM38 to about 5 feet above the ground. The black bar along the bottom of the meter should be pointing out to the horizon

Step 7

Reset meter as you did in Steps 1-3 with the meter still pointed to the horizon

Step 8

Make sure the Mode is still in Q/P.

Adjust the Q/P knob to read a value (it doesn't matter which one), remember it.

Keep the device in the air, at the same height and rotate it to where the black bar along the bottom is pointed towards the ground.

Note the reading.

Subtract the two readings and remember the difference for the next step.

Step 9

With device still lifted, return to position as in Step 6 – out to the horizon – using the Q/P zero control change the reading to the difference found in Step 8.

Step 10

At the same height rotate device so black bar is facing the ground and the reading should be double.

Step 11

Make sure you are connected to the computer and start walking!

Set up the EM meter with ArcGIS and GPS

I. Set the computer

- Go to the Bluetooth icon on your taskbar
- Click on create a new connection (for each device)
- Next
- Click on custom mode
- Next
- Select a device:
 1. 0028
 2. 0051
- Next
- Next
- Uncheck the box for default COM
- Select COM for a device
 - COM: 4 ----- Assign to device 028
 - COM: 9 ----- Assign to device 051
- Next
- Finish
- Right click or double click on the device Bluetooth to make a connection

 Repeat steps for 2nd device

II. Set the programs

1. ArcGIS
 - View
 - Toolbars
 - Turn on GPS toolbar
 - On GPS toolbar dropdown menu
 1. Click on connection set up (if error open & close the GPS Connection)
 - Check communication set up for COM: 4
 - Ok
 - On GPS toolbar click on open connection icon
 - On GPS toolbar go to dropdown menu and click on GPS position window

 Change from point to trail to make a line file

- On GPS toolbar dropdown menu click on Display Options
- Click on trail tab
- Go to linear trail
- Check on box (show trail as a line)
- Ok

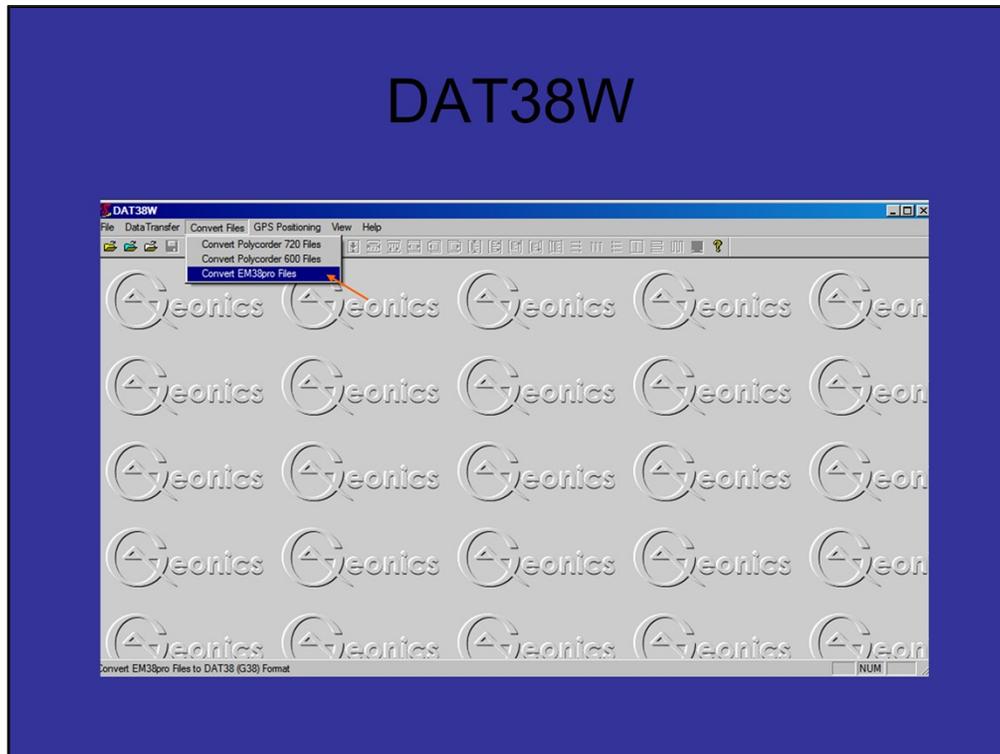
◆ Blue light on Device 028 (GPS back pack) should be on. Indicate a Bluetooth communication.

2. A. EM 38

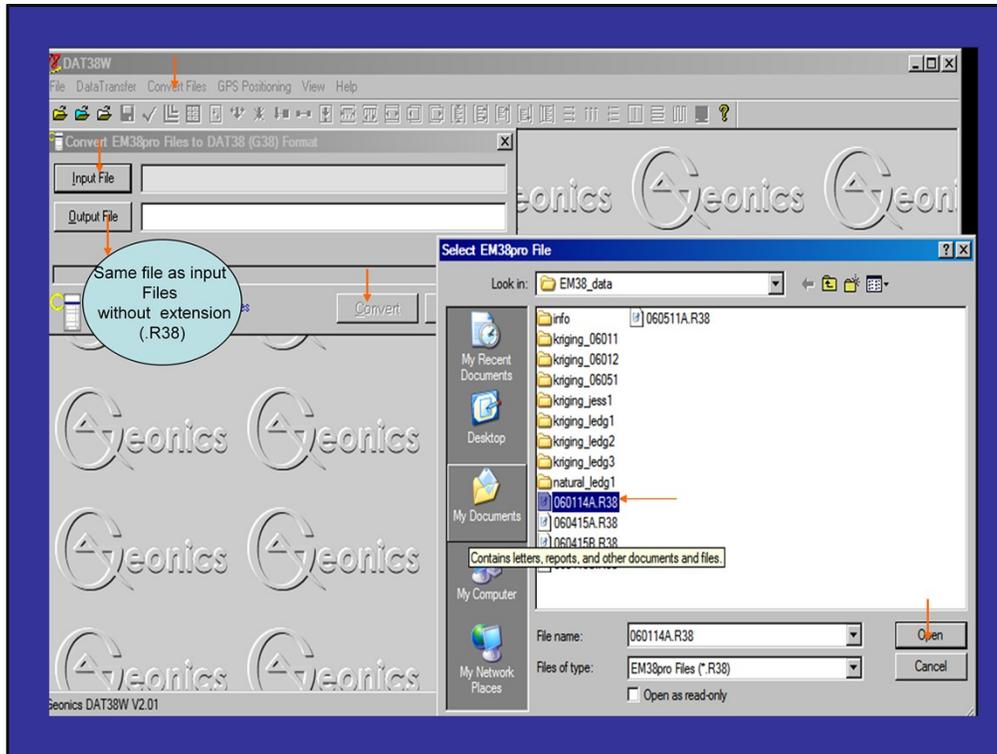
 Before opening the EM 38 program you should calibrate then connect the PC card to the EM device.

- Click on system Set Up tab
- Check EM 38 is on COM: 5 (always)
- GPS port on COM: 9
- Ok
- Click on Login tab
- Save the file
- Name the file
- Click save (automatically save on C drive)
- Click “Go”

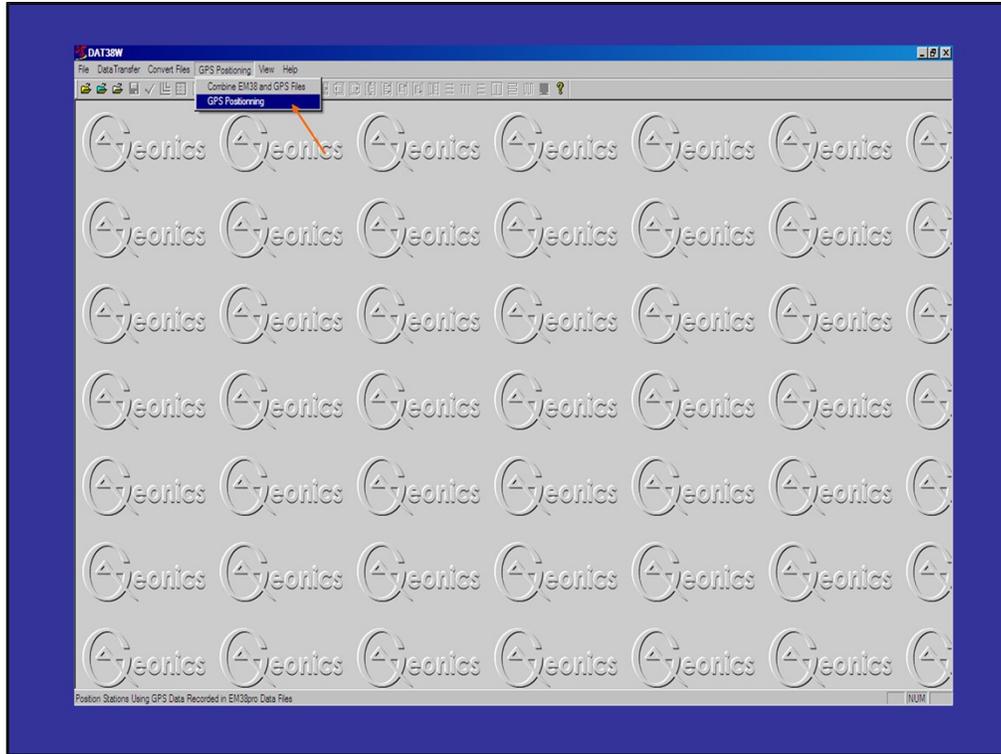
How to convert raw data to processed data in DAT38W



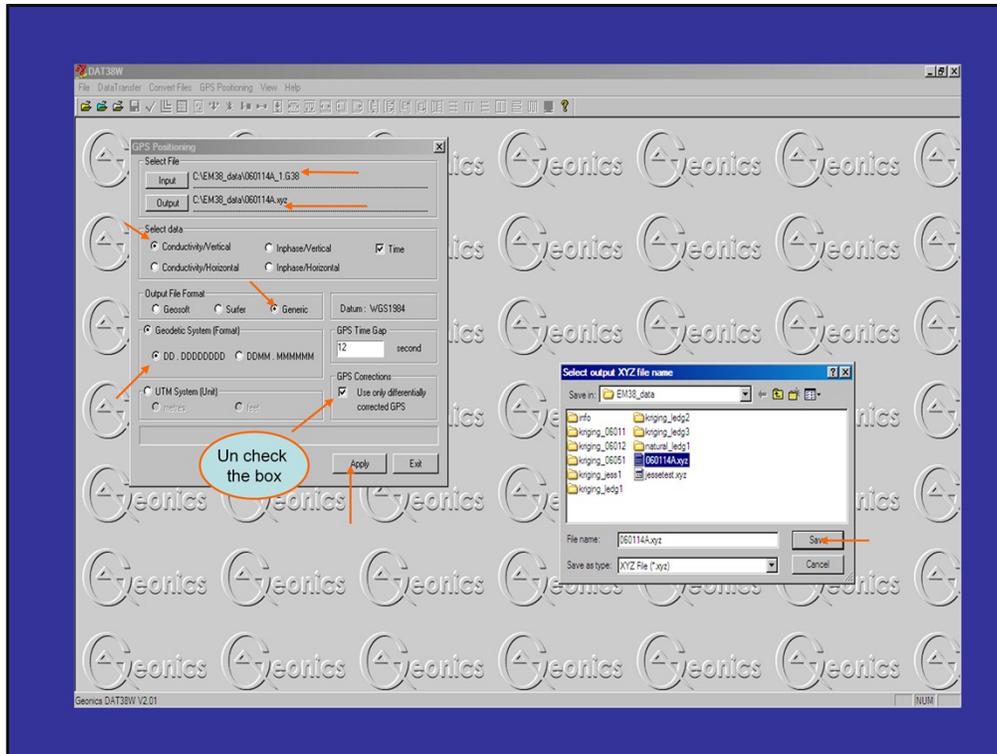
- ❖ Open DAT38W program
- ❖ On toolbar click **Convert EM38pro Files** tab



- ❖ On drop down menu click on Convert Files
- ❖ Select **Convert EM38pro Files to DAT38 (G38) Format**
 - Input file (raw data: ex. 060114A.R38), select from window
 - Output file (enter same # 060114A without extension)
- ❖ Click **Convert** button (process data will have .G38 extension)
- ❖ Exit



- ❖ On toolbar click **GPS Positioning** tab and select **GPS Positioning**



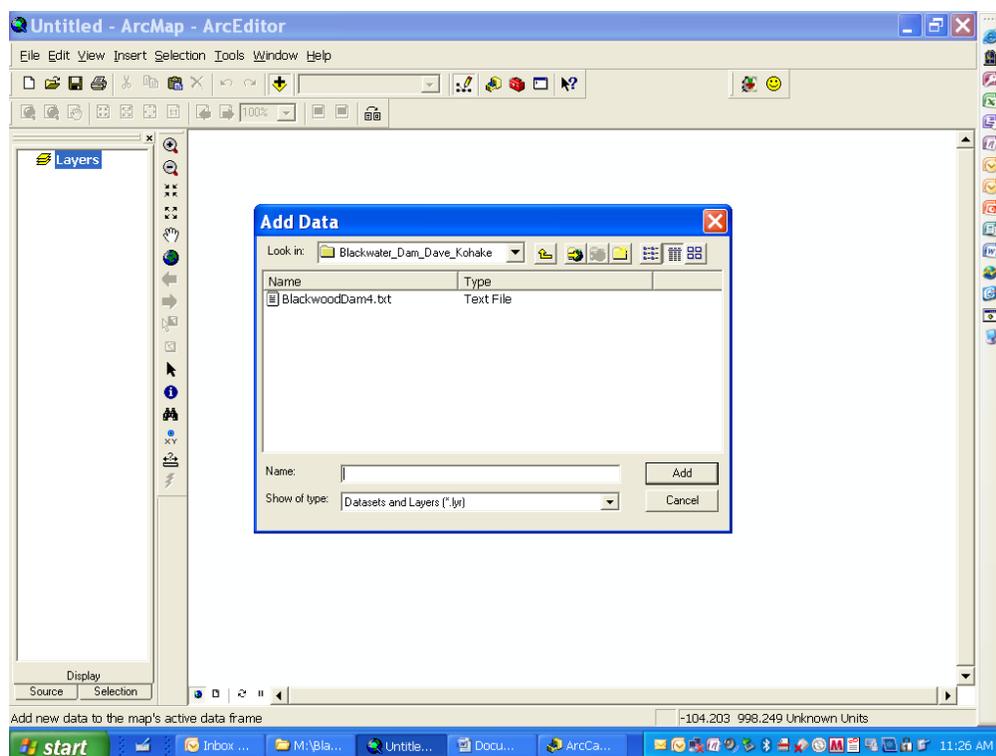
- ❖ For **Input** select the process data (the output file from previous step (.G38))
- ❖ For **Output** convert the .G38 file to .XYZ file. Use same file name without extension.
- ❖ For **Select data** click **Conductivity/Vertical**
- ❖ For **Output File Format** click **Generic**
- ❖ For **Geodetic System** click **DD.DDDD**
- ❖ Un check **GPS Correction** box
- ❖ Click **Apply**
- ❖ **Exit**
- ❖ Close DAT38W program

Importing data to Microsoft Excel

- ❖ Open Excel
- ❖ On toolbar select **Data**
- ❖ On sub menu select **From Text** which opens a file navigation pane
- ❖ Make sure it is set to select from **All Files**
- ❖ Navigate to and select your .XYZ file
- ❖ Click **Import** button
- ❖ Select **Delimited**, click **Next**
- ❖ Select **Tab, Comma, and Space**, click **next**
- ❖ Click **Finish**
- ❖ Excel sheet will be populated
- ❖ Delete Time and Format column
- ❖ Rename East column with X, rename North column with Y, leave QV1 the same
- ❖ Save file as CSV(comma delimited) with same name or numbers
- ❖ Close Excel program

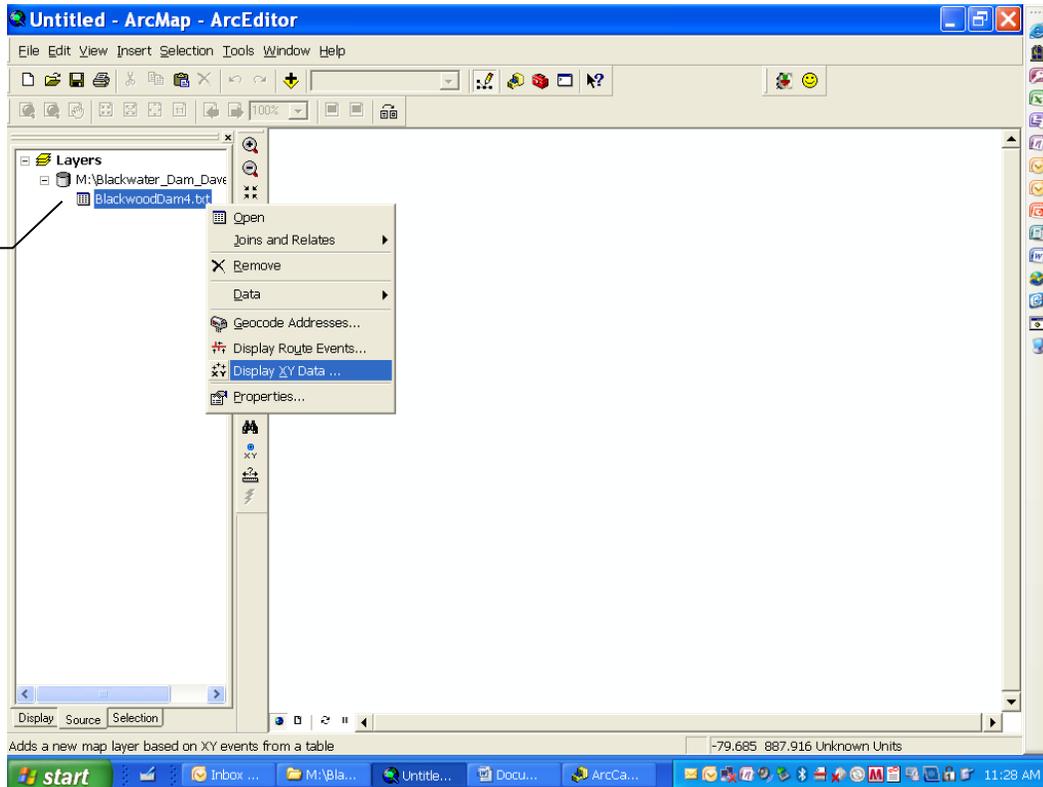
Example Procedure for Creating and Displaying EMI Survey Data in ArcGIS

In ArcMap, click “Add Data” button and navigate to desired .txt, .csv, or .xlsx file.

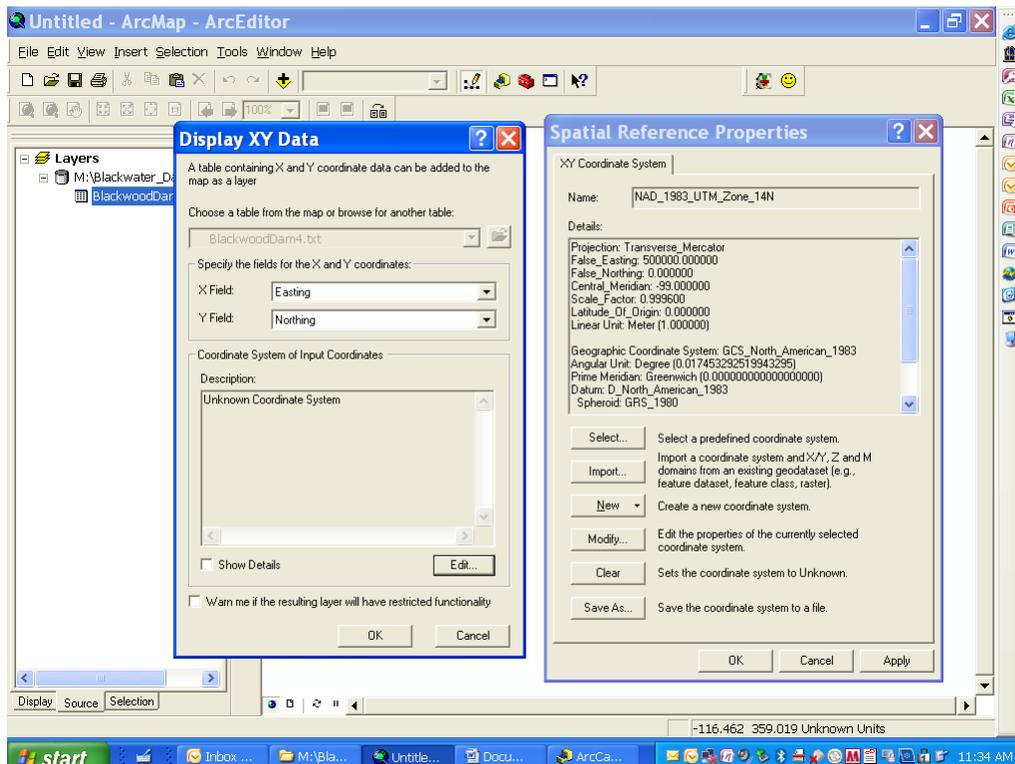


Right-click on the .txt file (#1) of interest in the table of content. Select “Display XY Data.”

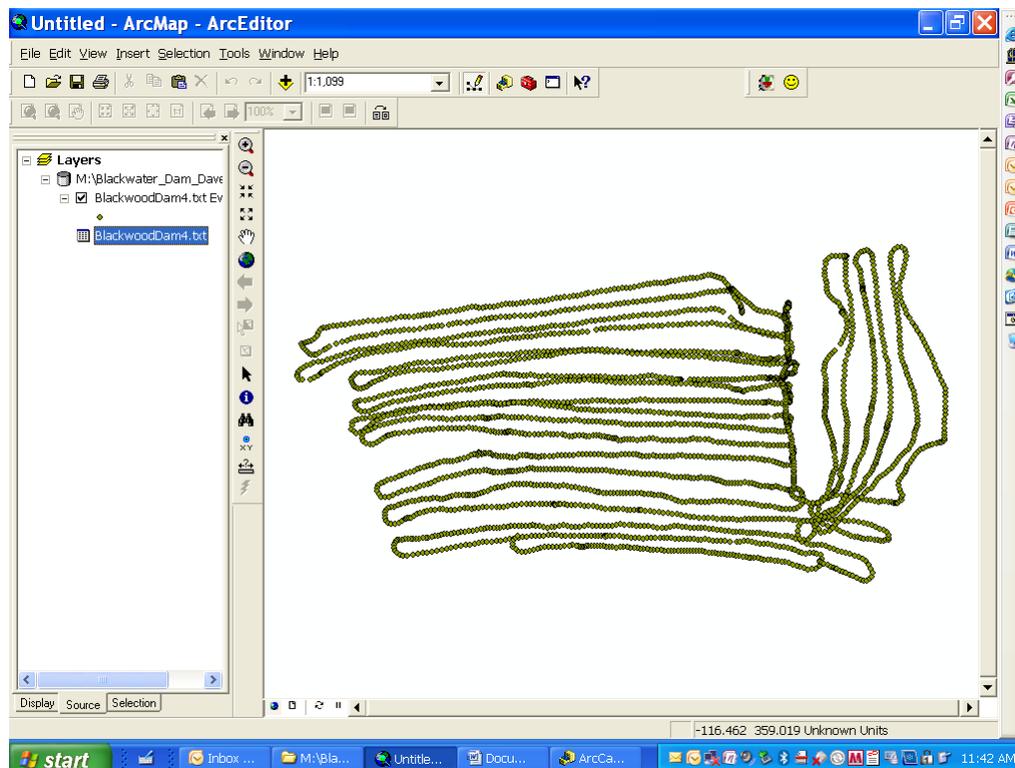
#1



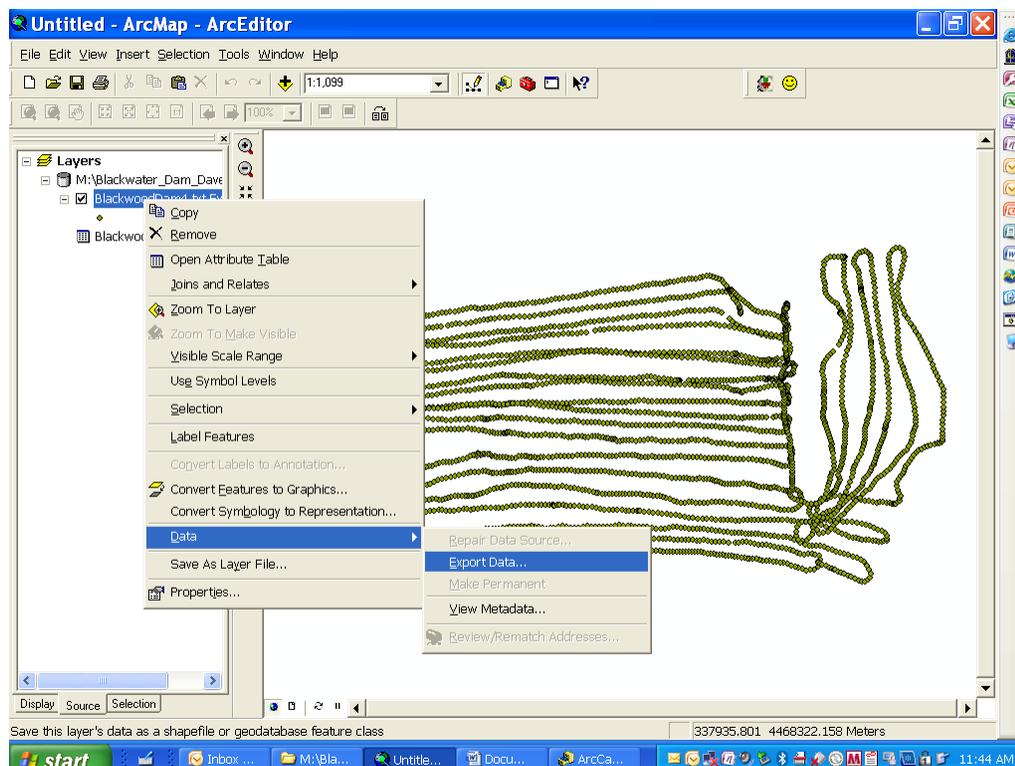
The next step is to set your X and Y fields to correspond with your data and set your coordinate system in your “Display XY Data Menu.” Make sure that your X Field is “Easting” and your Y Field is “Northing.” Then select the “edit” button. This will initiate the “Spatial Reference Properties” window. Here, click the “Select” button to choose the appropriate UTM zone under “projected coordinate system.”



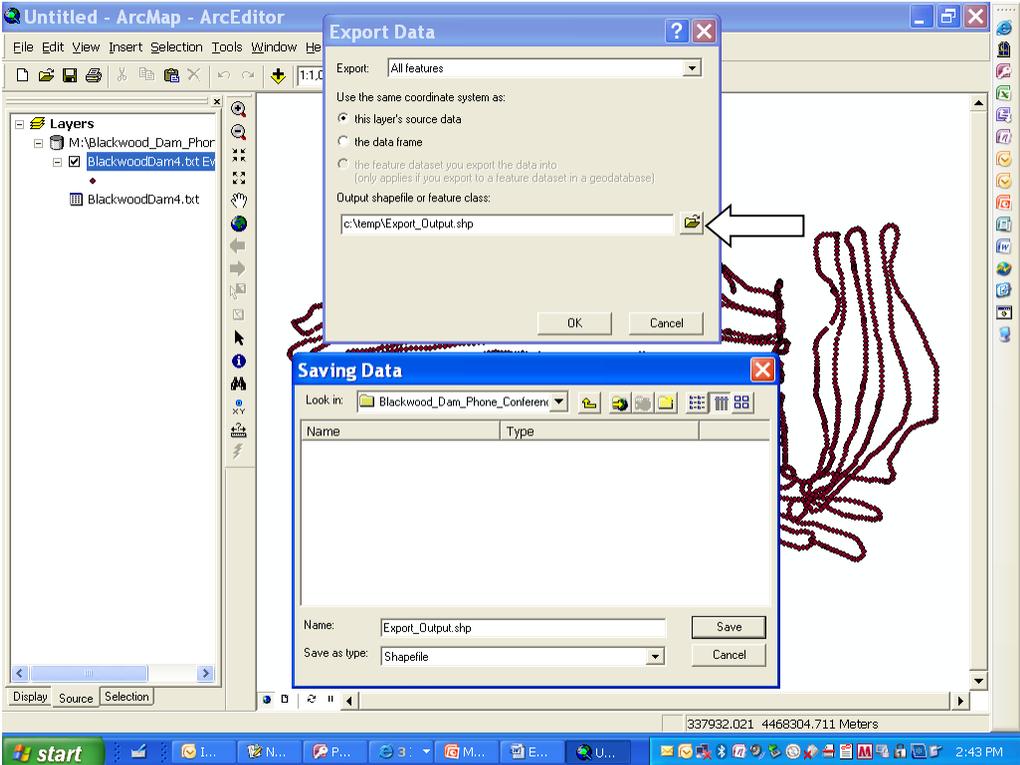
Once you apply the above settings, the data will be displayed as shown below.



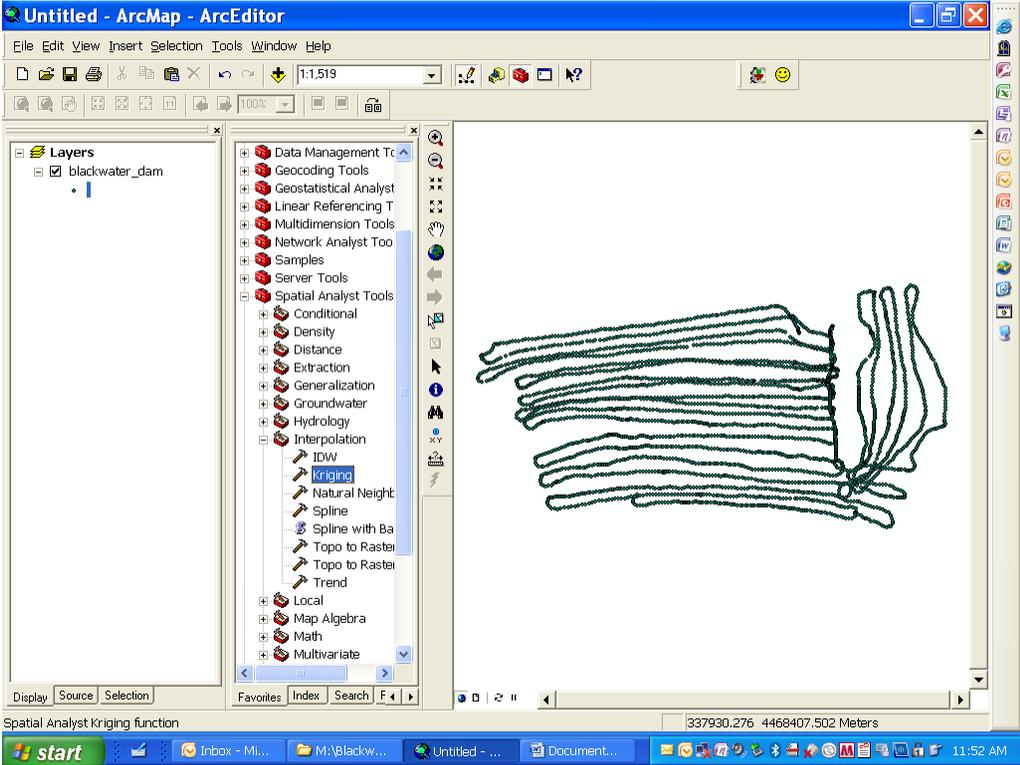
The data **points** displayed need to be converted to a shapefile. Right-click on the point file in the “Table of Contents” and select Data→ Export Data...to convert to shapefile.



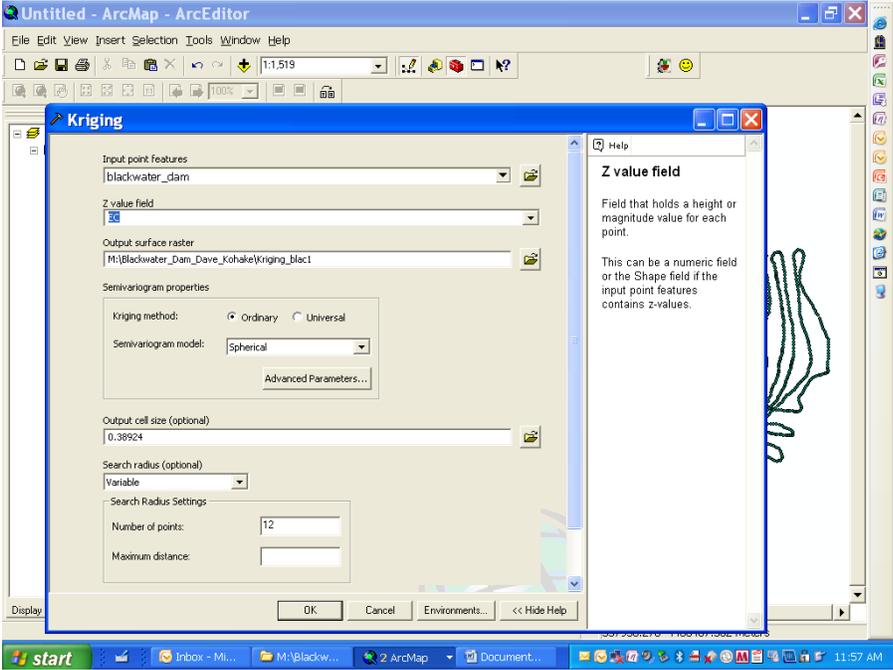
Using the folder icon, navigate to the directory folder of your choosing and rename the new shapefile. In the “Saving Data” dialog box, make sure that the “Save as type:” is Shapefile. Add the new shapefile to your project, and remove the .txt file.



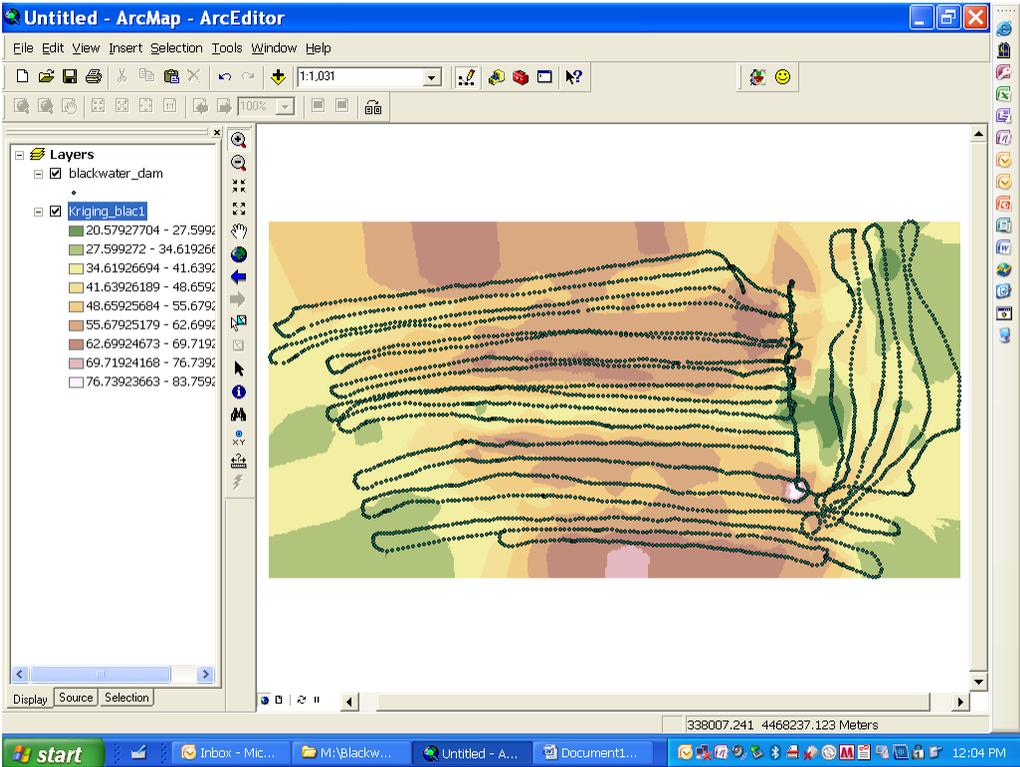
Next, open ArcToolbox and navigate to the Kriging or IDW Tool located within the “Spatial Analyst Tools” under Interpolation (try both and compare how they affect interpretations).



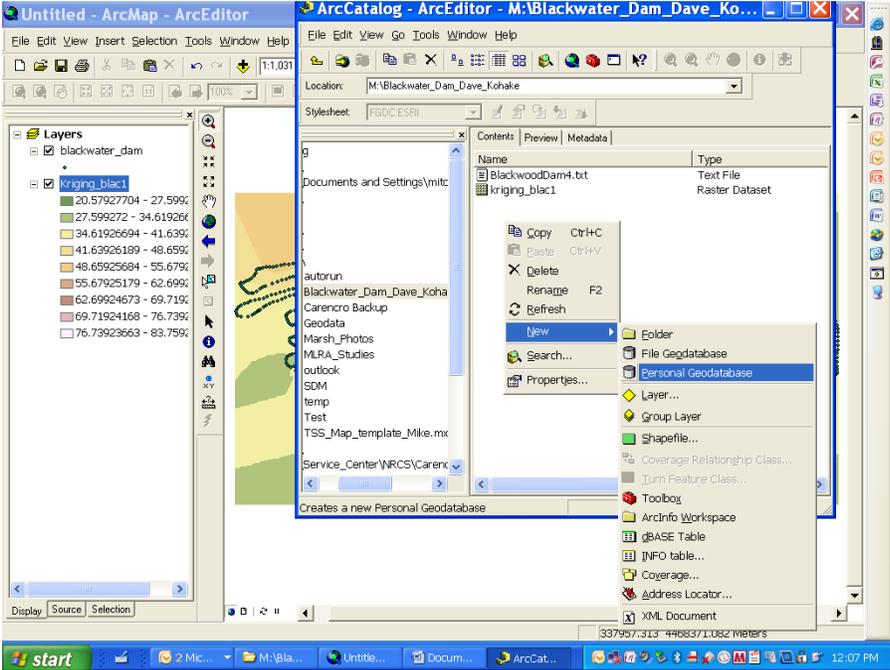
When the Kriging dialog box opens, select the shapefile you exported and set the “Z value field” to reflect the EC data you want to display. Also, you can rename and select the location to store the output surface raster created in this step. Normally, we utilize the default parameters for the other settings. Adjust those as you see fit.



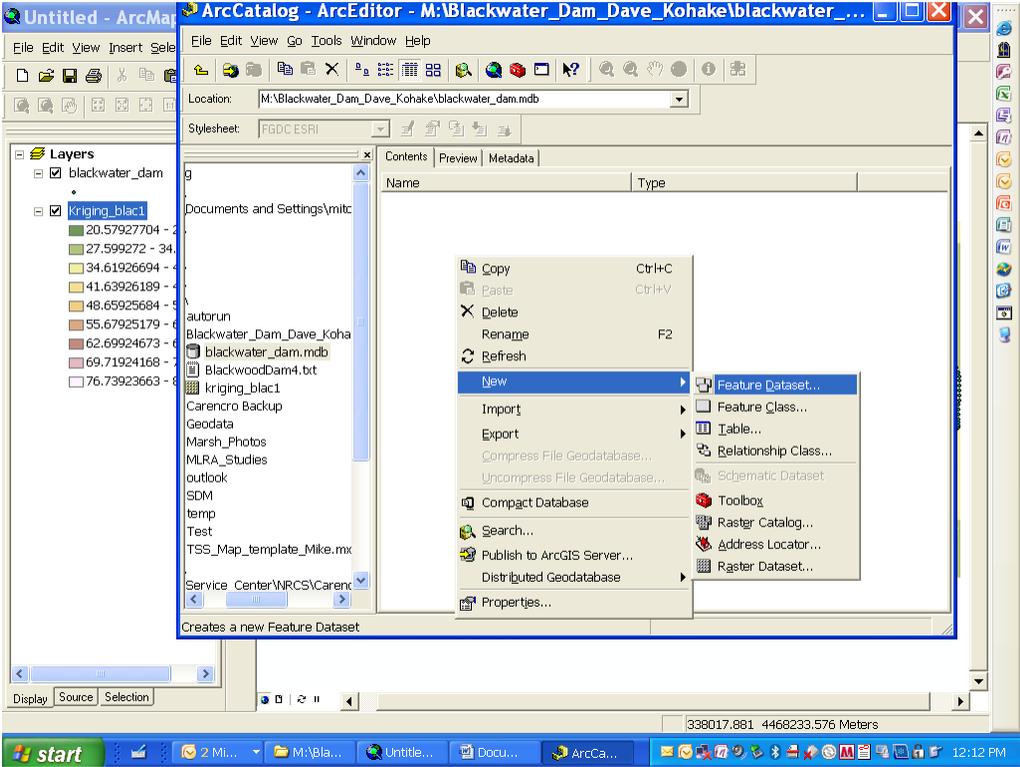
If the interpolation runs correctly, the following should display.



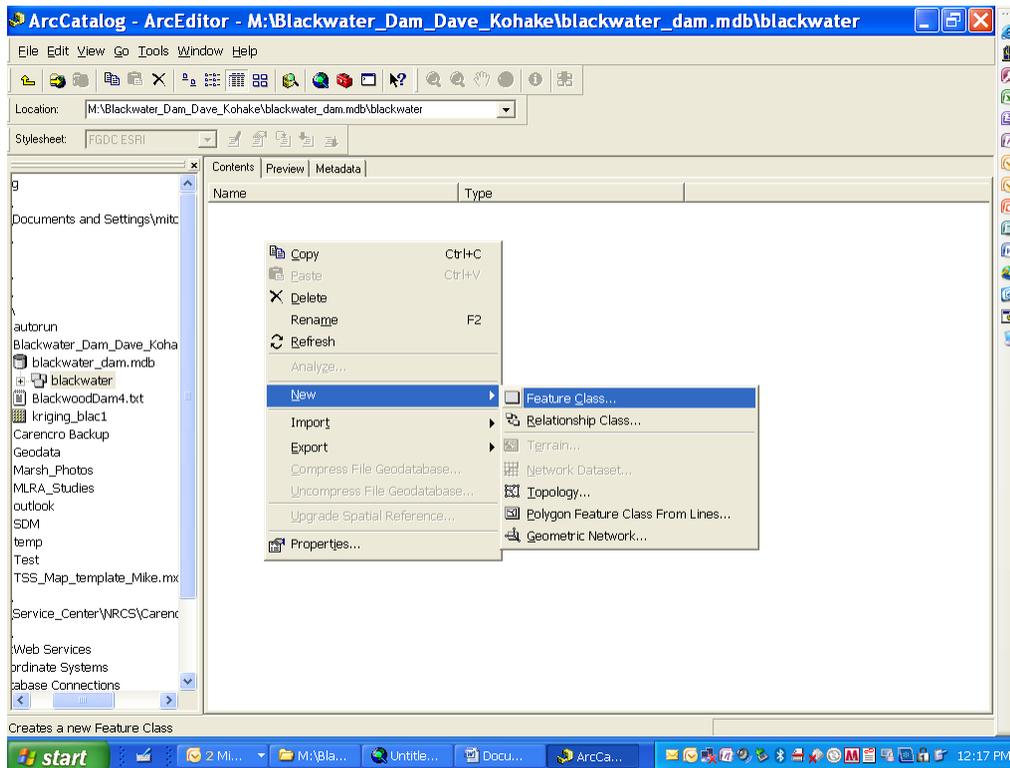
You will want to clip the area of the previous raster that extends beyond the EMI survey area to avoid extrapolation into areas that are not surveyed with the equipment. To do this, open ArcCatalog and create a Personal Geodatabase, which will in turn create a boundary shapefile contained within a feature dataset. Navigate to the location where you want to create and save your Personal Geodatabase. Right-click and select New→Personal Geodatabase. Rename the database to your liking.



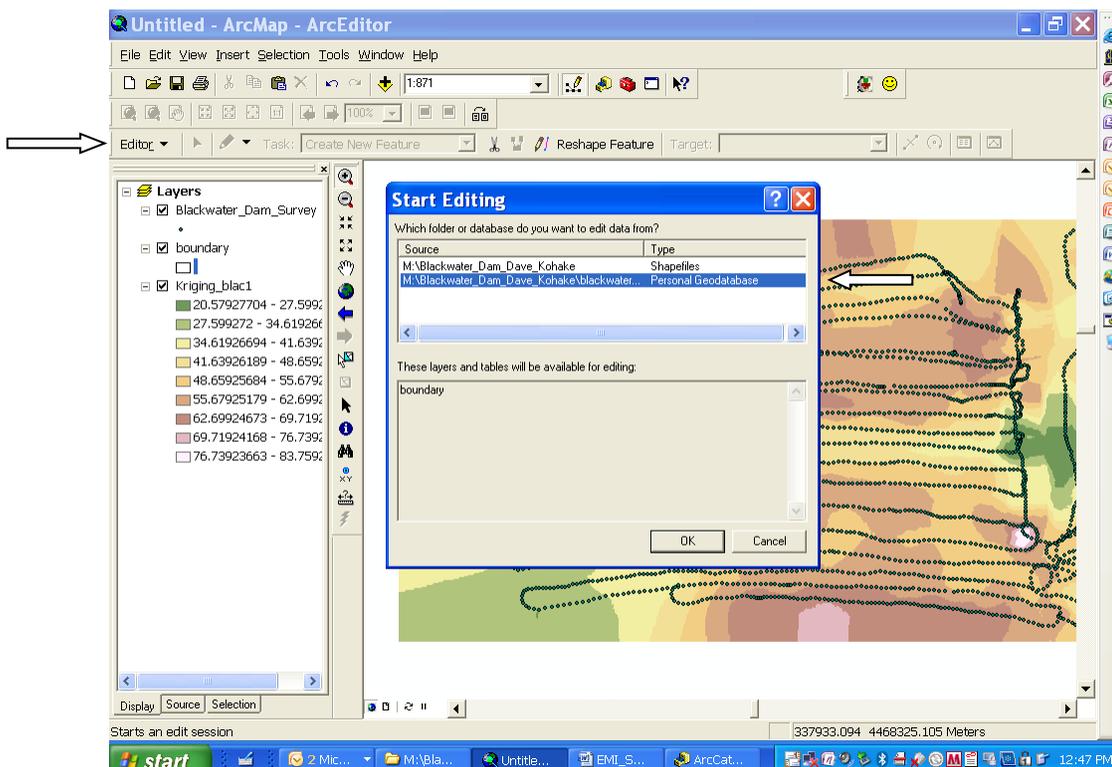
Double-click on the Personal Geodatabase, then right-click and select New→Feature Dataset. Name the feature dataset, select the appropriate coordinate system, and set your desired XY tolerance (.0005).



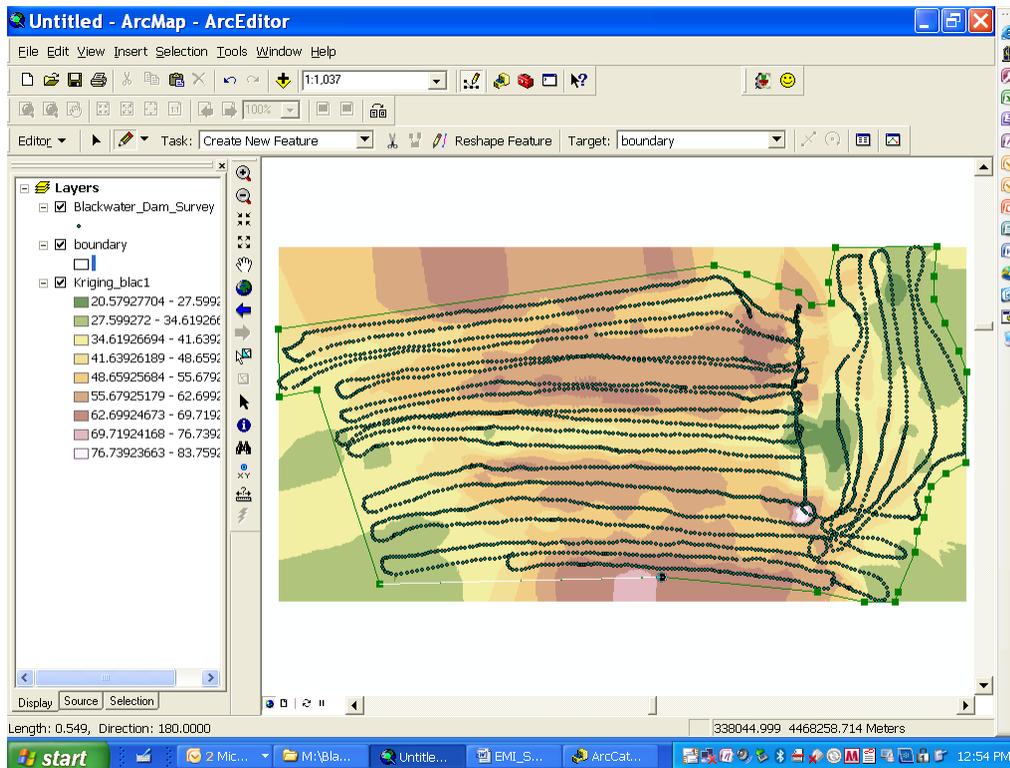
Double-click on the feature dataset you created. Right-click and select New→Feature Class. Name your feature class and alias. Make certain that “Polygon feature” is selected under Type. Click “Next.” You can add fields if you like; for example, “Acres.”



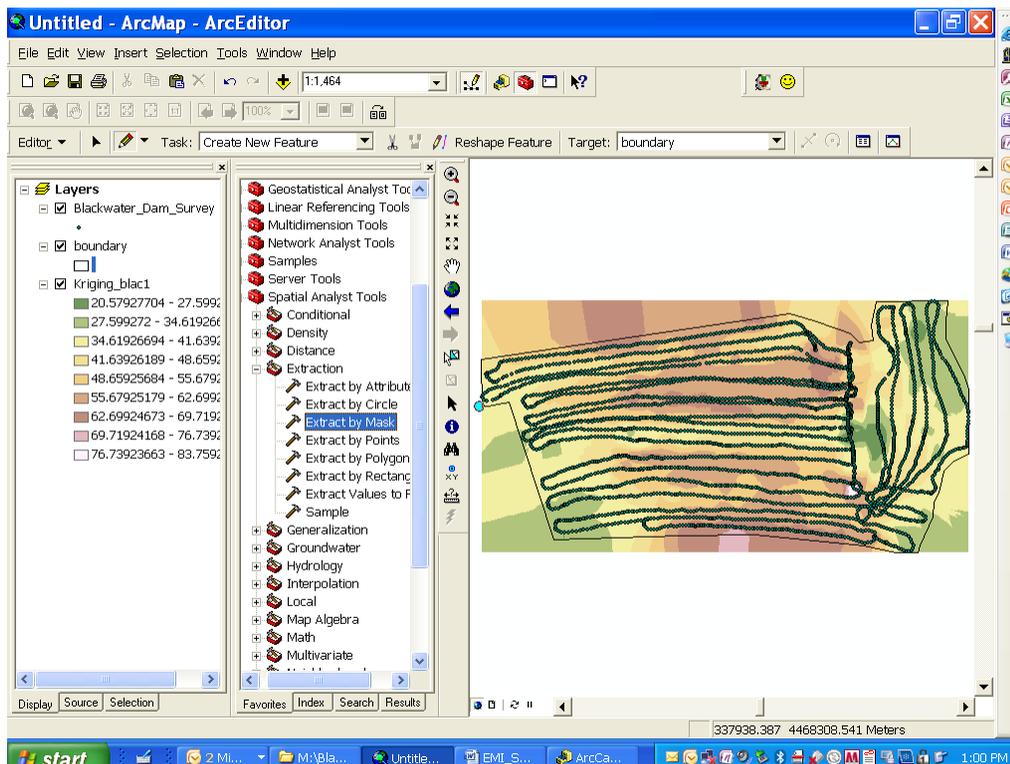
From your Editing Toolbar, select Editor→Start Editing. Select the Personal Geodatabase that you have created as the folder or database you want to edit data from.



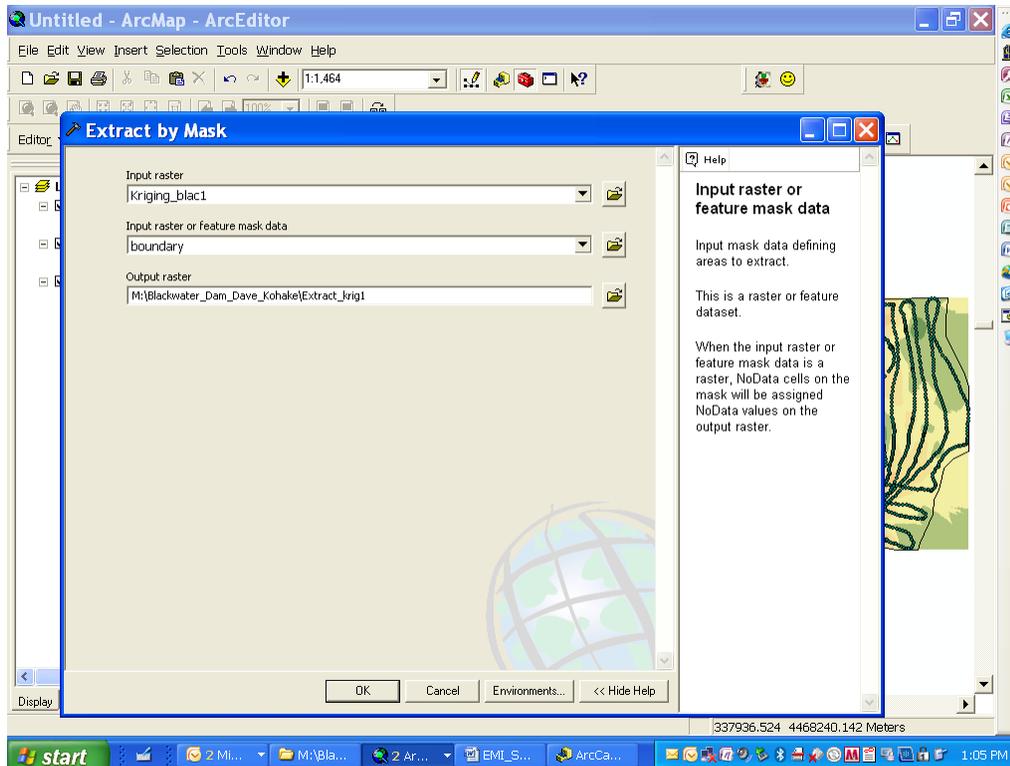
Create a boundary around your EMI survey that you think represents your area of interest.



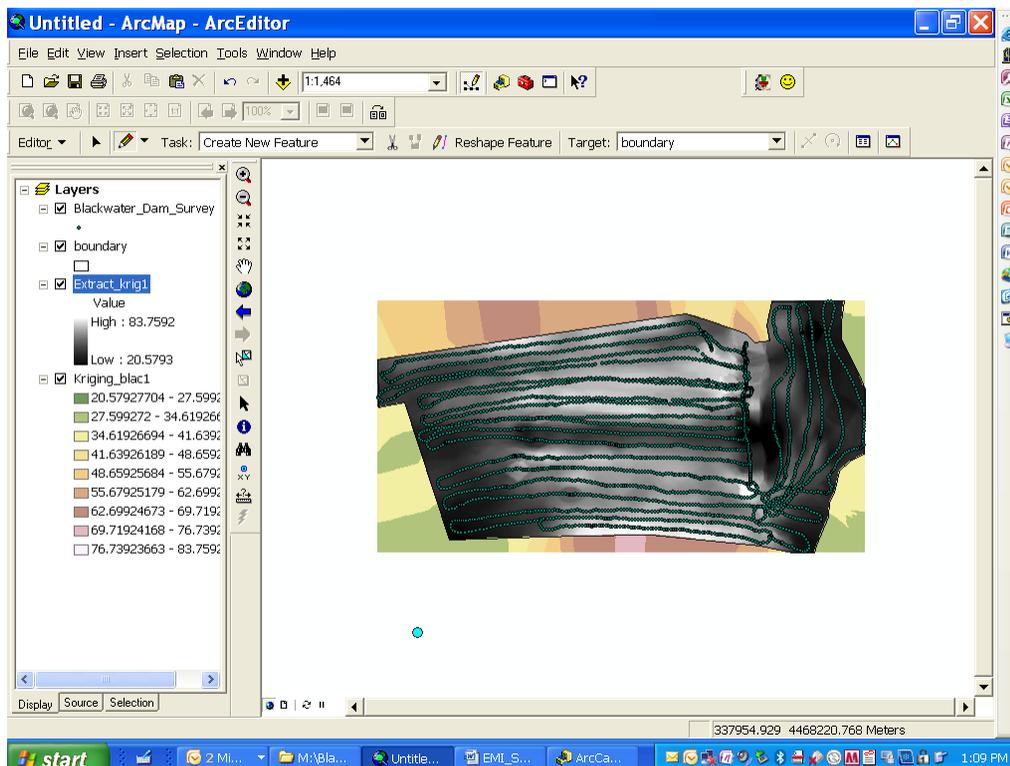
Open ArcToolbox, and navigate to Spatial Analysts Tools→Extraction→. Double-click on “Extract by Mask.”



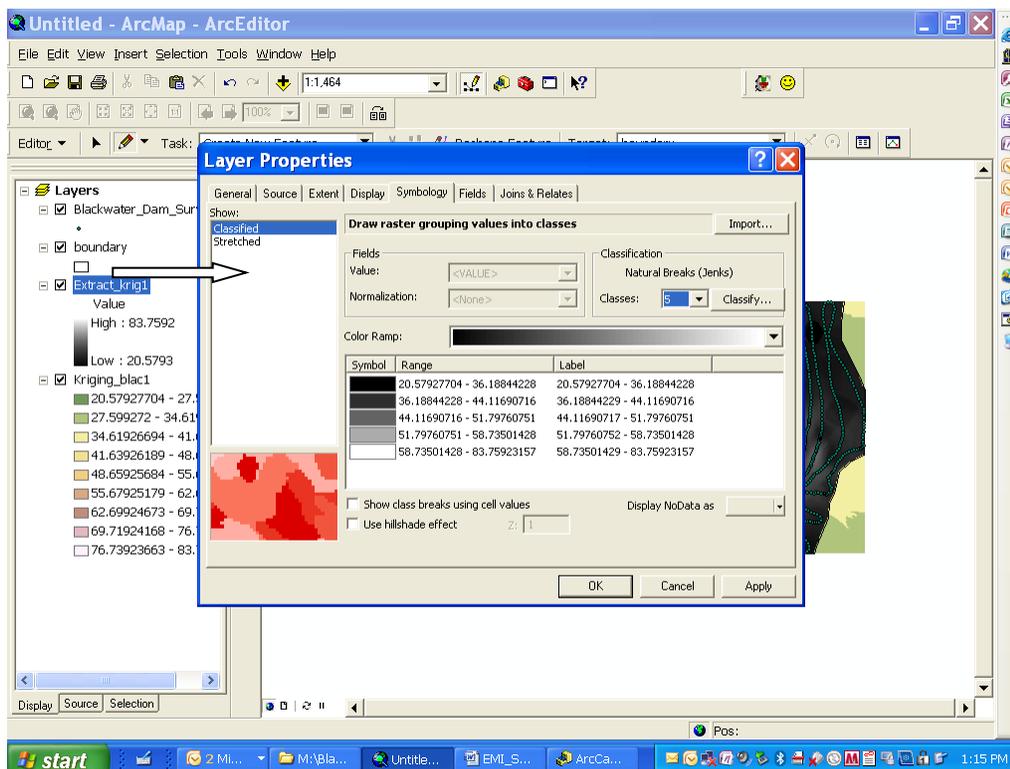
In the “Extract by Mask” dialog box, select the appropriate Input raster (Kriging_blac1), Input raster or feature mask data (boundary), and Output raster (name and location of new raster).



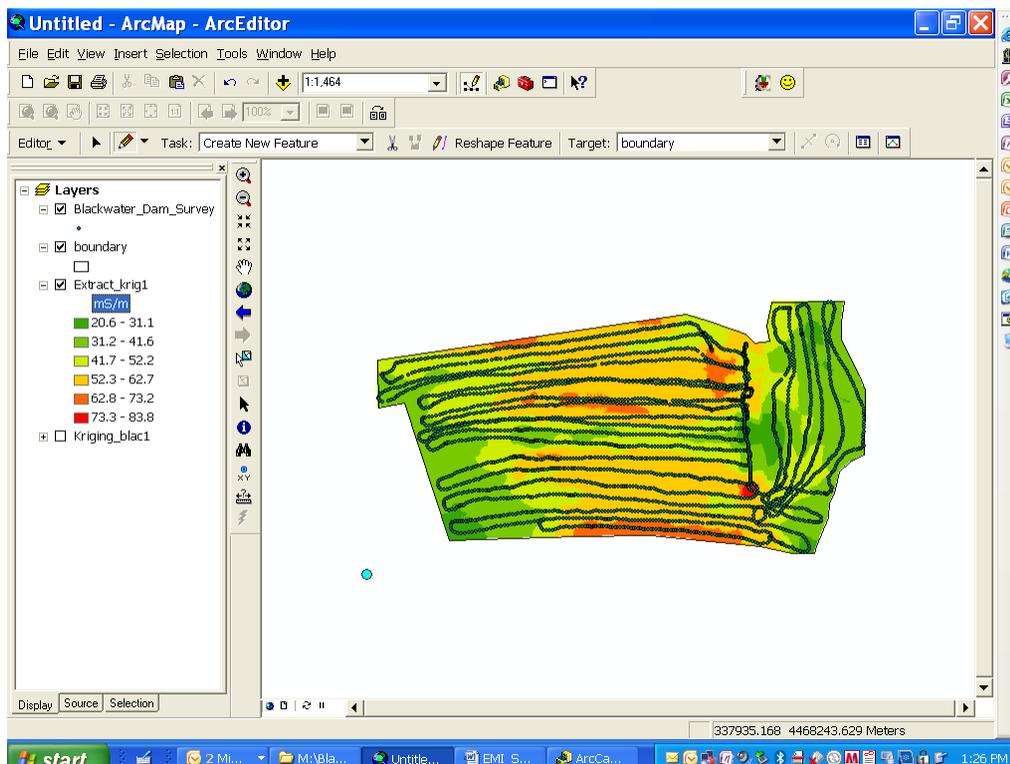
The new raster output will look like the screenshot below. You will now need to symbolize the raster to fit your needs.



Right-click on the new raster, and select “Properties.” To modify the display range of the dataset, select “Classified” under the “Symbology” tab and select the number of classes and the color ramp that you want to use to display your data.



Below is an example of an interpretive map with a “slope” color ramp with six classes.



Using the EM38 with Alegro

Using the EM38 with the Archer or Alegro CX data logging devices

1. EM38 set up
 - Connect cable from EM38 Meter to Archer or Alegro field PC using nine pin receptacles on unit.
2. Power on the unit
 - Tap the start icon
 - Locate and tap the EM38wm icon
3. This brings up the menu for monitoring and setup
 - a. Go to monitor log and tap icon
 - The display will tell you if you are collecting data or not
 - b. Survey setup
 - EM38 mode: set to auto
 - Readings/s: set to 5
 - Component: set to conductivity
 - Dipole mode: set to vertical
 - Survey line: set to 0
 - Line increment: set to 1
 - Sequence: set to Alternate
 - Direction: Whatever you choose
 - Start station: set to 0
 - Stn Increment: set to 1
 - Tap ok
 - c. Tap logger set up
 - EM38 port: set to COM 1
 - Units: set to Feet or Meters
 - Audio: set to yes
 - Pause key: set to any key
 - Tap ok
 - d. Tap on Set GPS Port
 - GPS input: Set to enabled
 - Serial port: set to Com 2
 - Baud Rate: set to 9600
 - Parity: set to No
 - Data bits: set to 8
 - Stop bits: set to 1
 - Tap ok
 - e. Tap on Display options
 - In this window you can choose color and thickness of lines,
 - Set display of gridlines for conductivity or in-phase scale
 - Tap ok when done
 - f. Tap on view files
 - This window gives you a look at the current files saved
 - Tap ok
 - g. Tap on Exit

Using the EM38 with the Trimble Yuma

Checklist and Notes for Use

Necessary Devices

- EM-38-DD or EM38 with Digital Output or Real Time Digital Conversion via 10-pin circular connector to 9-pin (RS-232) serial
- Trimble Yuma

Possible Additional Devices

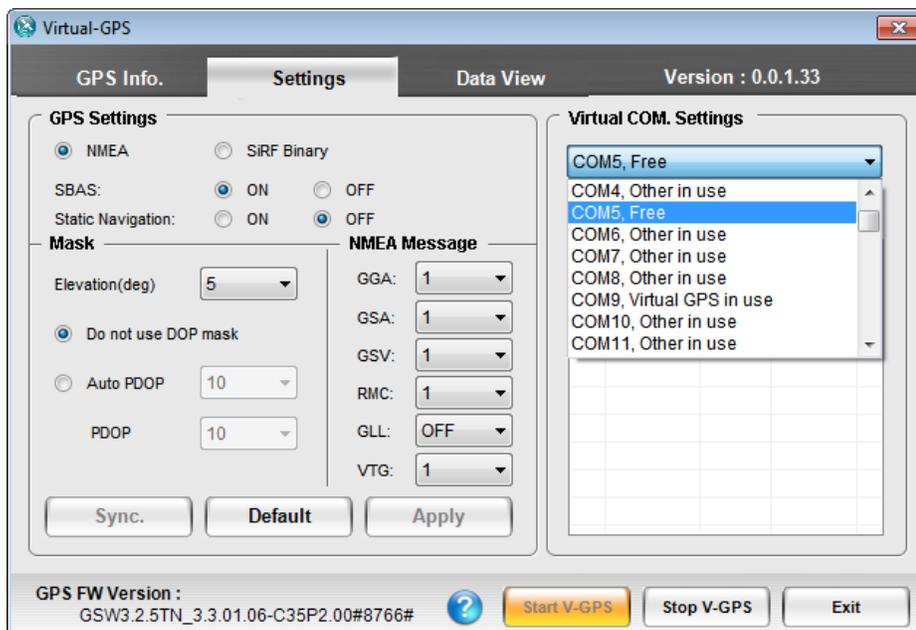
- For improved portability, Trimble case w/ Neckstrap Accessory and/or sled for pulling the EM meter.

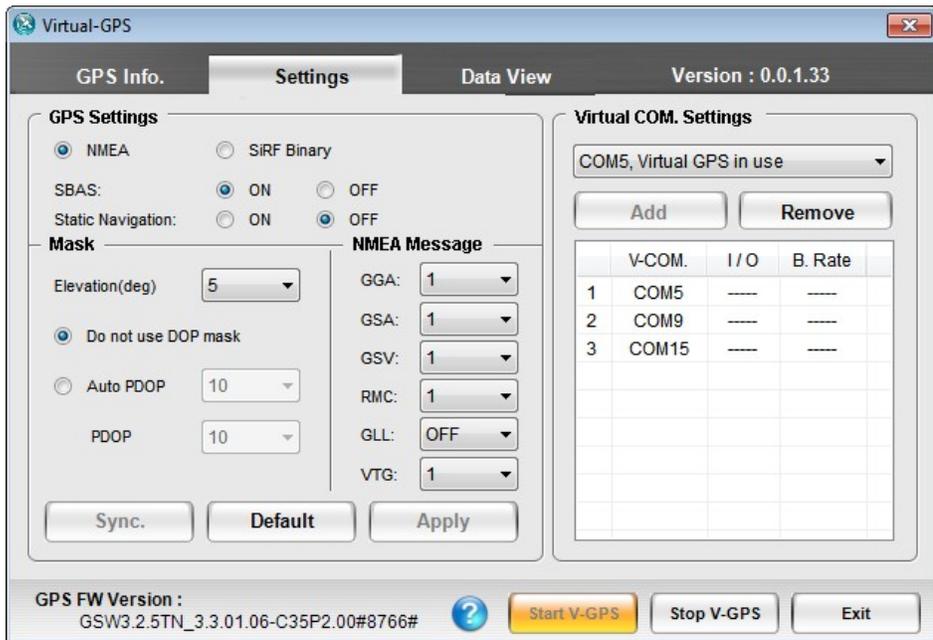
Necessary Software

- EM-38XP software from Geonics for data logging (Non-CCE)
- DAT-38W from Geonics for data analysis and conversion (Non-CCE)

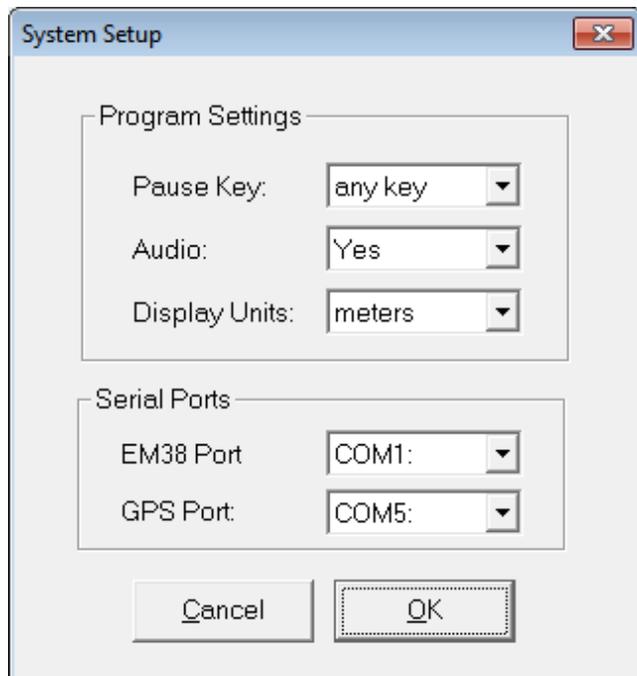
Settings

- In “Virtual-GPS, Settings, Virtual COM. Settings” select COM5, Free and then click on the Add button.

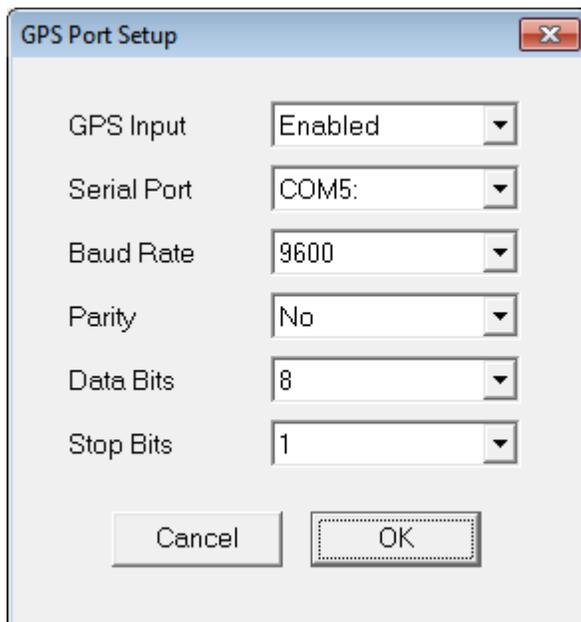




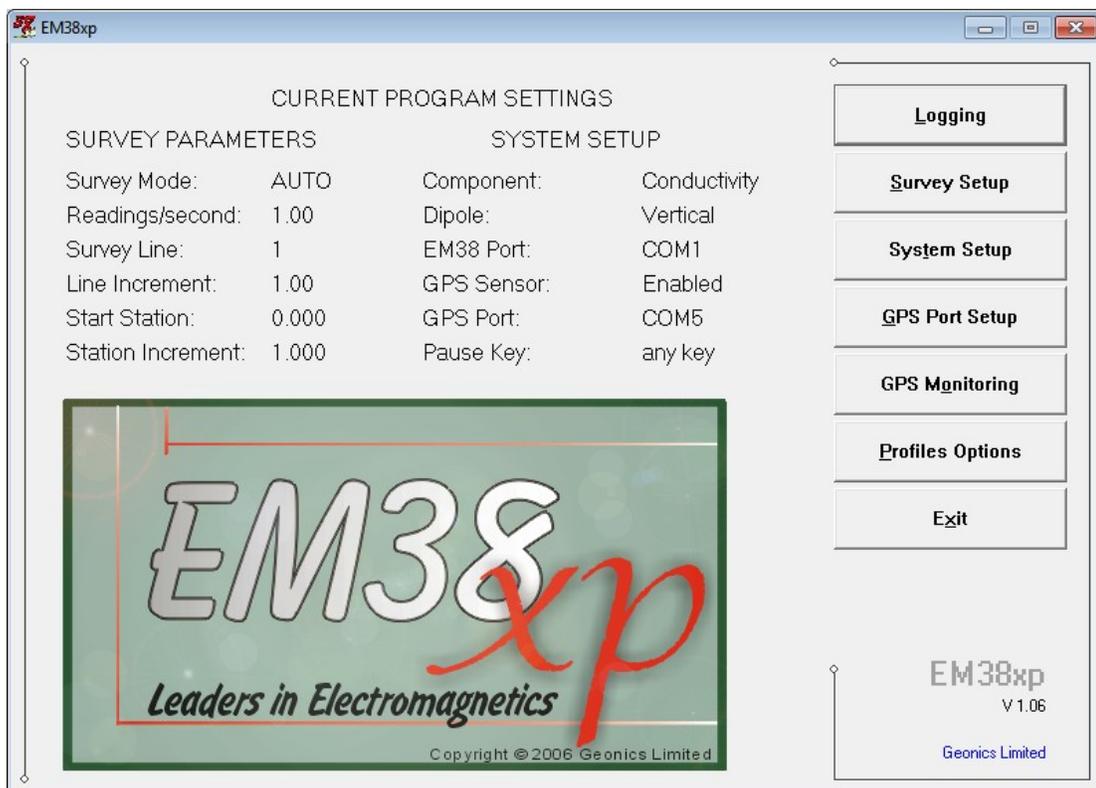
- ❑ Turn on the EM meter and plug it in to the serial port on the Yuma. Once Virtual-GPS and the EM meter are both running start the EM-38XP program. This order is necessary to prevent the EM-38XP program from dropping connections to the GPS and EM. If this does occur prior to starting your survey, simply close out of EM-38XP and re-open it. The program will retain your settings.
- ❑ In EM-38XP - System Setup, assign appropriate Serial Ports for EM-38 & GPS.
 - Fargo SSO uses com port 1 for EM-38 and port 5 for the GPS. The GPS port must agree with the port you specified in the Virtual GPS application.



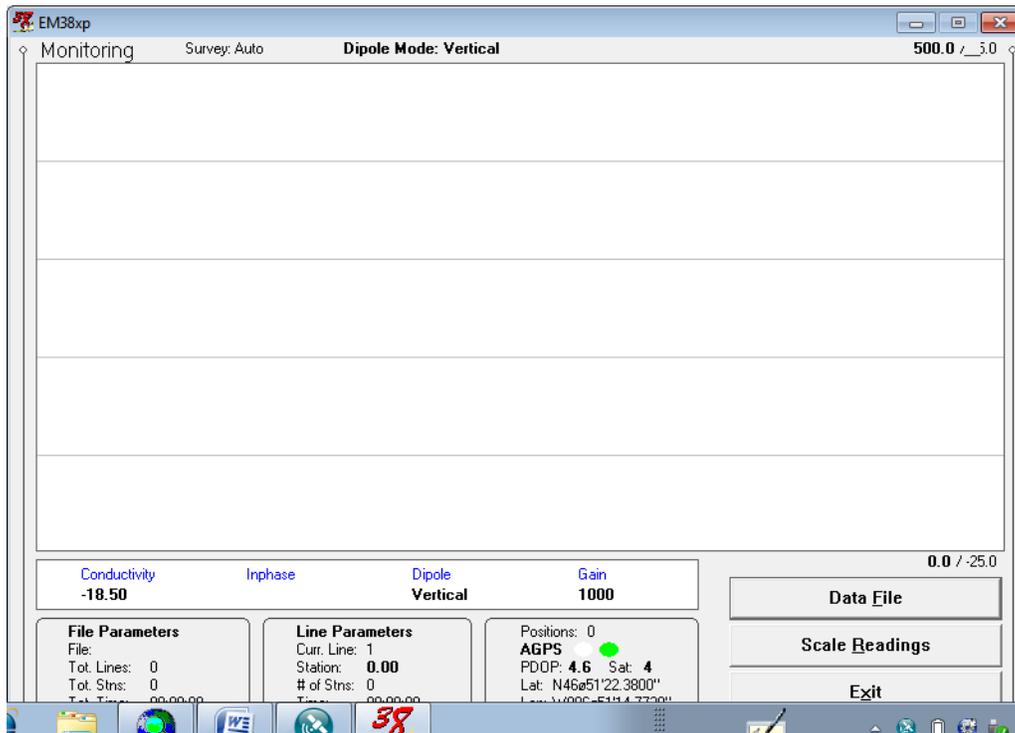
- In EM-38-XP GPS Port Setup, Assign settings to match the NMEA output of your device. Baud rate for Trimble Yuma is 9600.



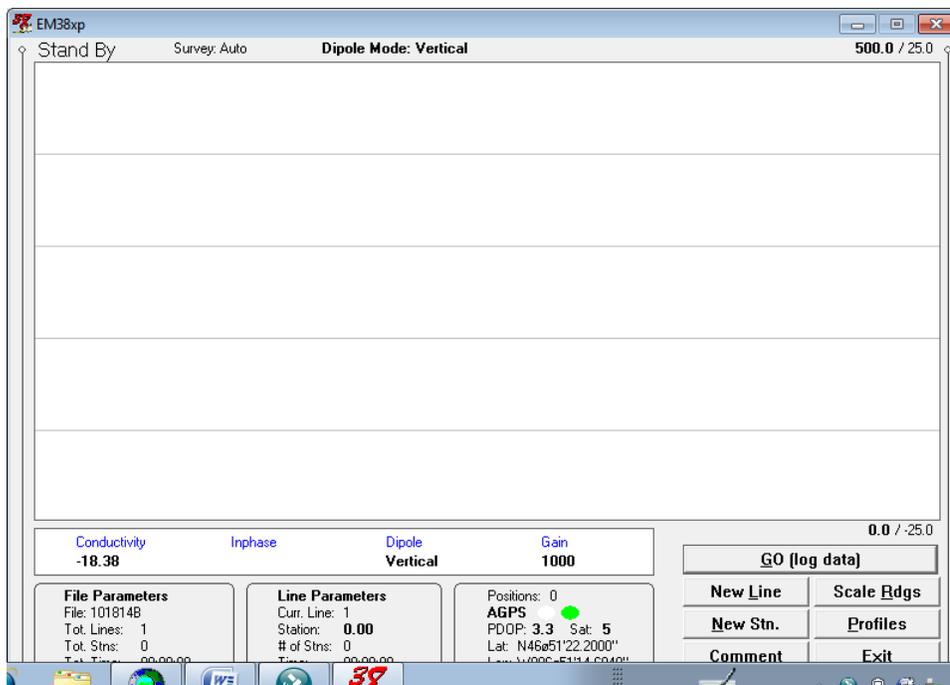
- Summary of Set-up information (survey parameters may vary depending on use and may be adjusted by clicking on the Survey Setup button.) To start your survey click on the Logging button.



- Click on the Data File button to specify a name and location for the file that will store the EM data. Notice that the EM meter is transmitting data (a reading of -18.5 appears under the Conductivity heading).



- Click on Go (log data) to begin logging EM data. The Go button will convert to a Pause button when you are logging. Click this button and then exit to stop logging at the end of the survey.*



Creating a Grid and Map in Surfer 8

To create a map of the EM response in Surfer 8, you must first create a 'Grid' of the data. Launch the Surfer 8 program from the Laptop desktop.

Create Grid:

Select Grid → Data...

In the Open data dialogue box navigate to the xls file of interest and click open.

In the Grid Data options menu: select appropriate columns etc:

X [default to X or Longitude]

Y [default to Y or Latitude]

Z [select variable of interest HCP or PRP]

Gridding Method [Kriging or Natural or Nearest Neighbor] your choice.

OK to transform data.

View the Grid Data Report which includes statistical info about the data. Not necessary to save the .report but may be useful in some instances.

Create Map:

(Generally create a contour map and a post or track overlay map)

Select: Map → Contour → New Contour Map →

In 'Open Grid' selection box navigate to grid file just created, then open.

An unenhanced contour map is displayed.

Select and double-click 'Contour' in the Table of Contents on the left.

In the pop-up Map: Contours Properties dialogue box, set properties:

General Tab: Filled Contours, Fill contours

Smooth Contours, $\sqrt{}$ Medium

Levels Tab: Fill column → Foreground to adjust color ramp
1st select left node then color (usually white to start)
2nd select right node then color (eg. Red to show increase)
To insert another node, eg. a zero node:
Hit control and left click to place the node. OK.

Labels column → Affected Levels
Allows you to label contour lines and set your preferences.
(FYI- unit of measure on labels is “mS/m”).

Select OK to finish the contour map.

To add your track, create a Post Map.

Select: Map → Post Map → New Post Map →

Navigate to the original xls file used to create the grid and contour map.
(We will usually use xls files but Surfer can use txt files).

To edit track symbology:

Select and double-click ‘Post’ in the Table of Contents on the left.

In the pop-up Map: Post Properties dialogue box, select the General tab.

General Tab: Change the default symbol from a + to a dot.

Change the dot size to 0.02 “ or to you preference.

Save the Map Project

Save the map project in the file folder with related data using the srf file extension.

Map Enhancement: Cutting Out Unwanted Areas

Left-click in map area and select...

Map → Digitize ...

Mouse over to a node box and let lines disappear, then left-click.

Then use mouse and left-clicks to digitize a polygon to cut out making sure to line mouse clicking points up with outer edges to insure no slivers remain.

At final leg, copy the coordinates of the first node and paste them in as the last node to close the polygon.

Finally save the file as a .bln file.

Now, go to Map → Base Map ... to import the newly created .bln file.

DO NOT CHECK "Areas to Curves" box. Select OK.

If maps are offset, go to: Edit → Select All, then Map → Overlay.

This adjusts or aligns all map layers.

To colorize cutout area:

Double-click 'Base' in the Table of Contents on the left.

In dialogue box go to Fill → Fill Pattern and select your preference.

Creating a Grid and Map in Surfer 10

Reference the attached **Surfer 10 Quick Start Guide** for appropriate chapters.

- Start with **Tutorial Lessons 1 through 7**.