Exporting Bathymetric Data to ArcGIS Bathymetry

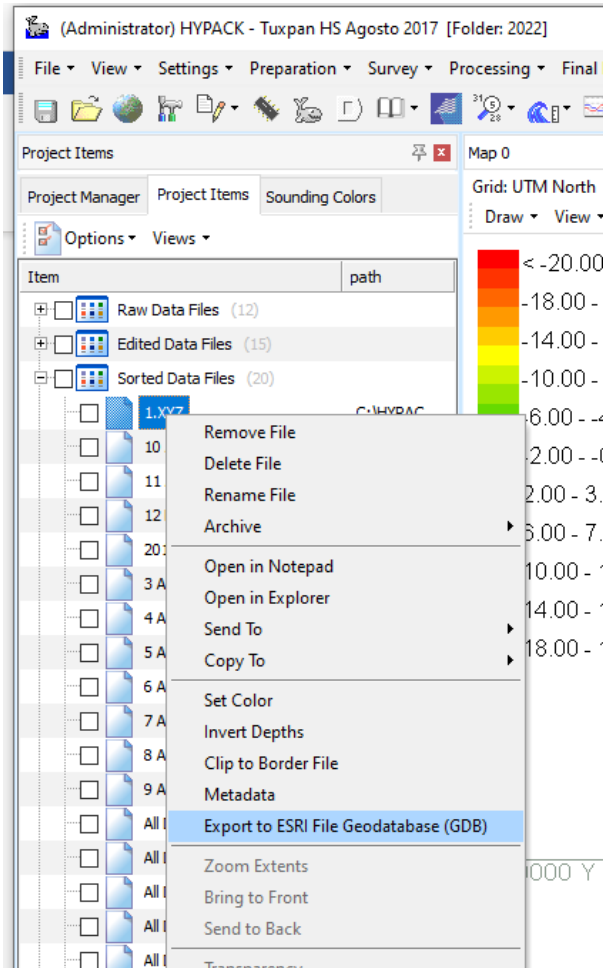
By Carlos Tejada

A few days ago, I had the chance to visit ESRI headquarters in Redlands, CA to review several ways of exporting data from HYPACK® to ArcGIS Bathymetry, which is specifically designed to manage bathymetric data.

This article contains procedures that cover the different ways you can export bathymetric data from HYPACK® to ArcGIS Bathymetry.

The options are organized from least to most recommended, but you can use any of them depending on the work that you want to accomplish and the workflow you want to follow. We offer several options to be more flexible.

XYZ to GDB



If you have an XYZ dataset in HYPACK, right click the file that you want to use and you will see the menu in the left image, where the option “Export to ESRI file Geodatabase (GDB)” is highlighted.

Previously, you needed to create the Geodatabase in ArcGIS. Here you have two options, one a General GDB created in ArcGIS, or a Solution GDB created in ArcGIS Bathymetry. The second one is better because you can define a feature class within the maritime context, while in the General GDB the program does not know you are loading bathymetric data. In ArcGIS Bathymetry, there are several tools specifically designed for this type of data.

An XYZ dataset do not contain metadata or uncertainty. Therefore its utility is limited or you will be required to enter the metadata in ArcGIS. You won't be able to enter the uncertainty and that is a big limitation. Another thing to keep in mind is that ArcGIS is designed to work with surfaces. Therefore after loading your XYZ dataset, you will need to create a proxy raster of your data and that is created with 4x the resolution of your dataset.

Another disadvantage of the Point Feature Class (your XYZ dataset) is that ArcGIS takes longer to load them, especially if they come from Multibeam or LiDAR devices because they will be big datasets.

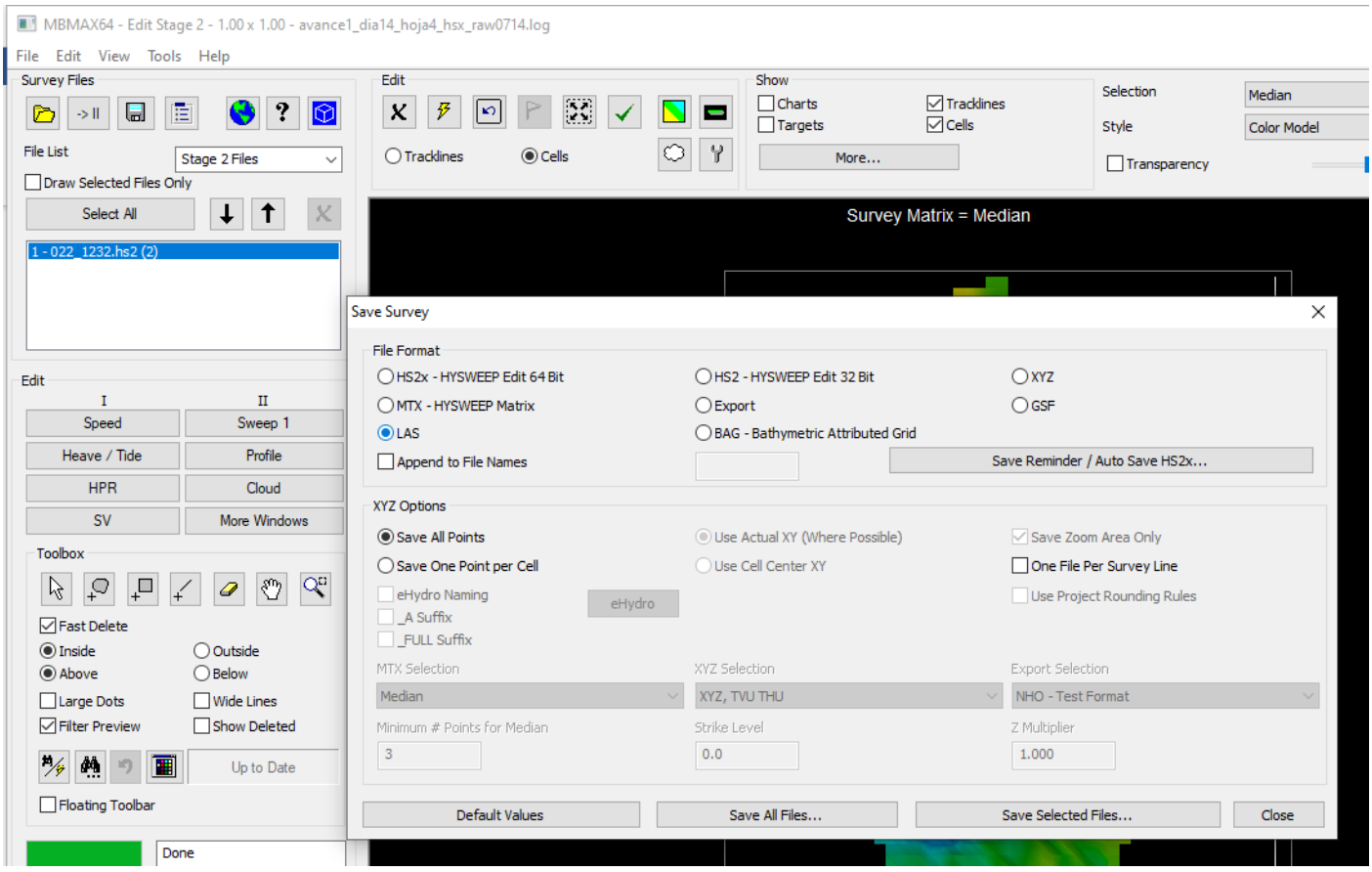
To perform spatial data analysis, ArcGIS Bathymetry uses Image Server, a tool that creates surfaces of your data points, so if you have spaced data points, it will create a very pixelated image (remember, 4 times the resolution of the original data). So keep that in mind if you are loading XYZ data from single beam surveys that have large separations between survey lines.

Due to everything described above, this is the least recommended option.

LAS Files

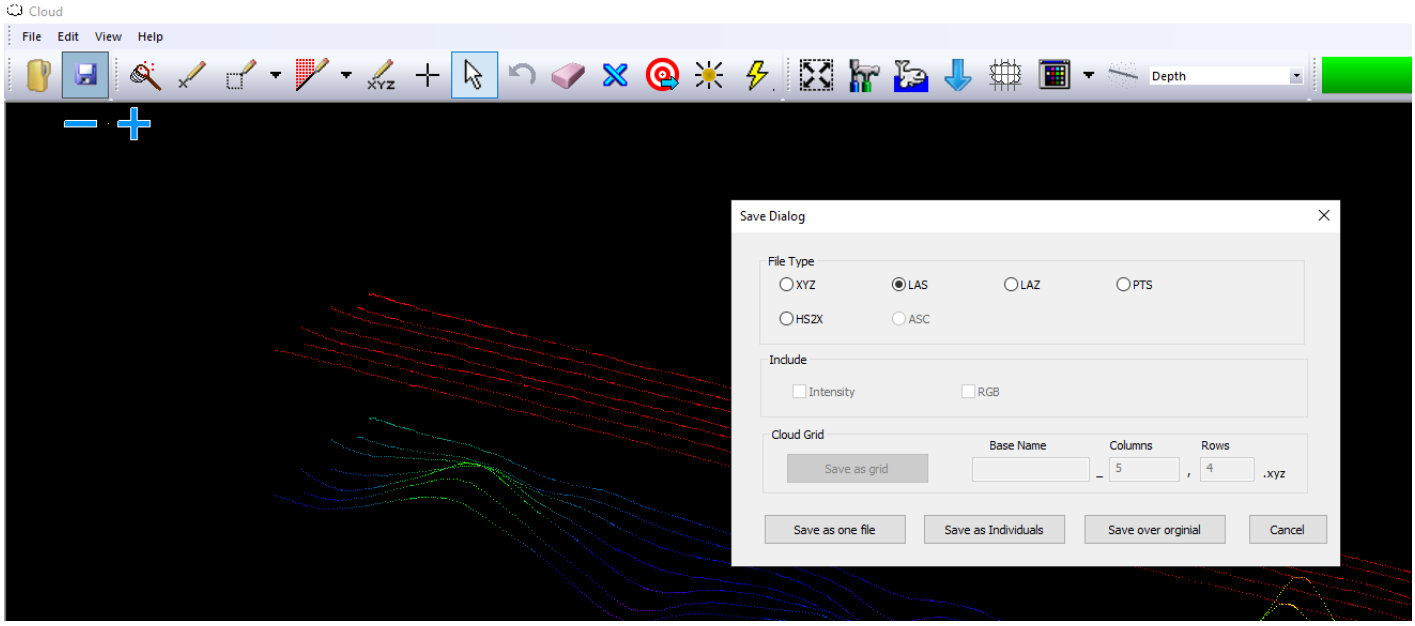
This data format is preferred over XYZ, as ArcGIS is much more efficient when loading this type of data (normally used with LiDAR files). As with an XYZ dataset, this one does not include metadata, so you may have problems loading the data as they might show data covering different areas at a different resolution than the original. You will need to enter in ArcGIS the Horizontal coordinates system and the vertical datum so that the program can better compute the extension of your data.

You can use MBMAX64 to generate LAS files. In the following image, saving your data to an LAS file is one of the options in the Save window.



If the data comes from single beam surveys, then you other option would be the CLOUD program (you can also use CLOUD with multibeam or LiDAR data). You can load HS2X,

MTX, All, XYZ, or catalog data files, complete the edition if needed, and the save it to LAS format.



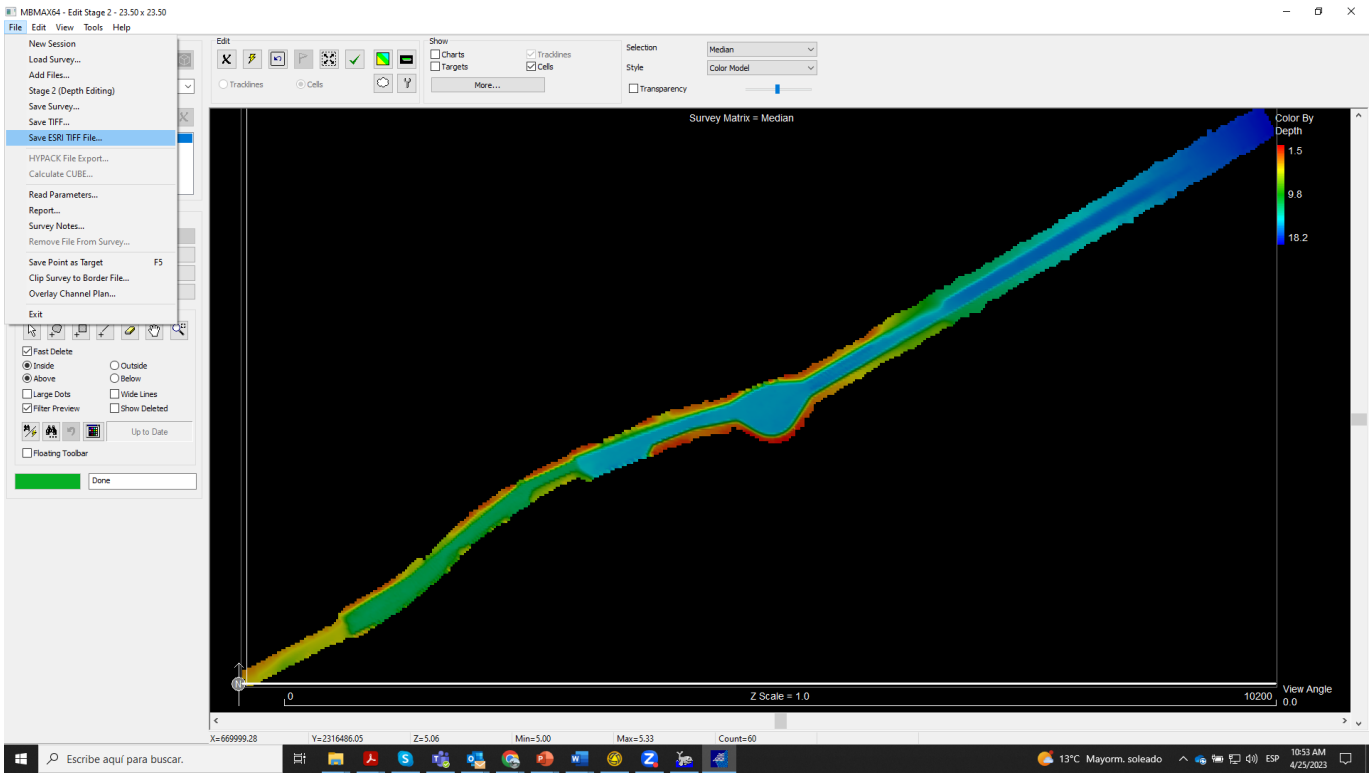
When working with single beam data, you can change the data density. To do this, you will need to use TIN MODEL and select the EXPORT menu and choose Export to XYZ at the desired resolution. While the program can change the data density, the hydrographer must ultimately decide if that is the right way to do it and if that change in resolution is correct or not. After that, you can have proxy raster images in ArcGIS Bathymetry with higher resolution, but again, you are the one that must evaluate and decide if that is the right way to proceed. If you have doubts, just don't do it.

ESRI GeoTiff

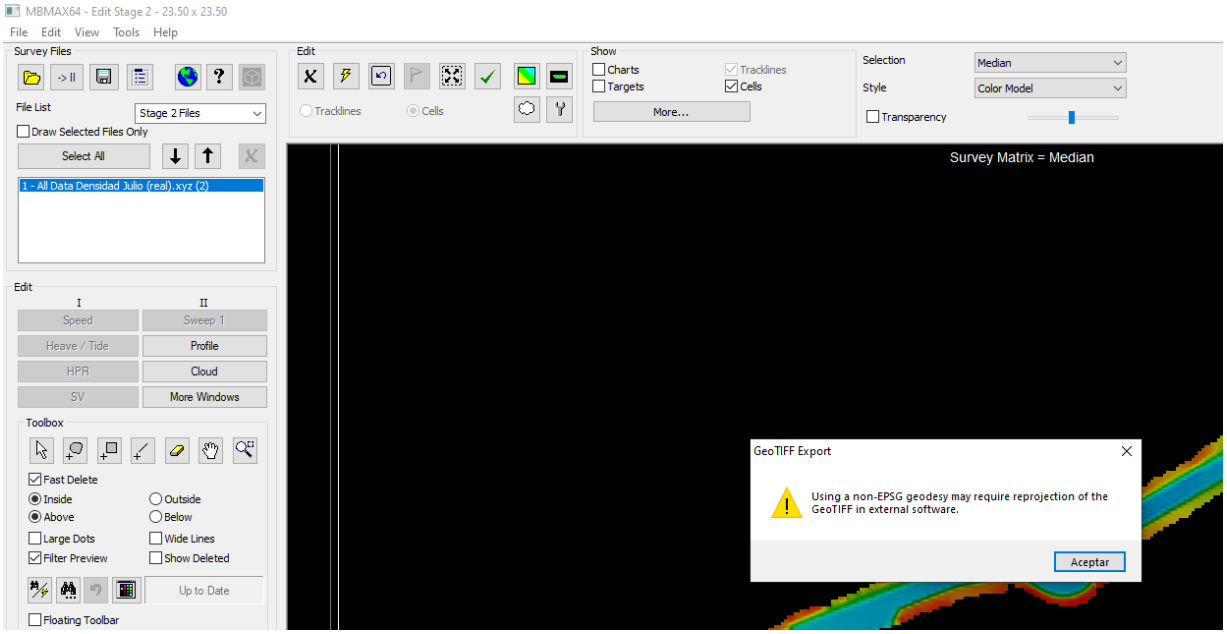
With the remaining options, we will be exporting surfaces and not data points. ESRI prefers surfaces as they are continuous, which facilitates the spatial analysis. This is the normal Georeferenced TIFF, but with a twist. That's why we called this format ESRI GeoTIFF, as every pixel not only contains the RGB info, but the depth data as well, so if you click in each pixel, you will see the depth value.

There are two places where you can export this format: You can export it from HYPACK® SURVEY and in MBMAX64. The first one is to be used at the end of the day, when you complete your survey or your dredging day and need to send a quick report to your Supervisor that shows in one image what you have done that day. So, this is an option within the Matrix menu. If you choose to generate a ESRI GeoTIFF from MBMAX64, that means that you want to export the final dataset after completing edits. This option is not in the Save window, instead you must access this option from the File menu. You will see two similar

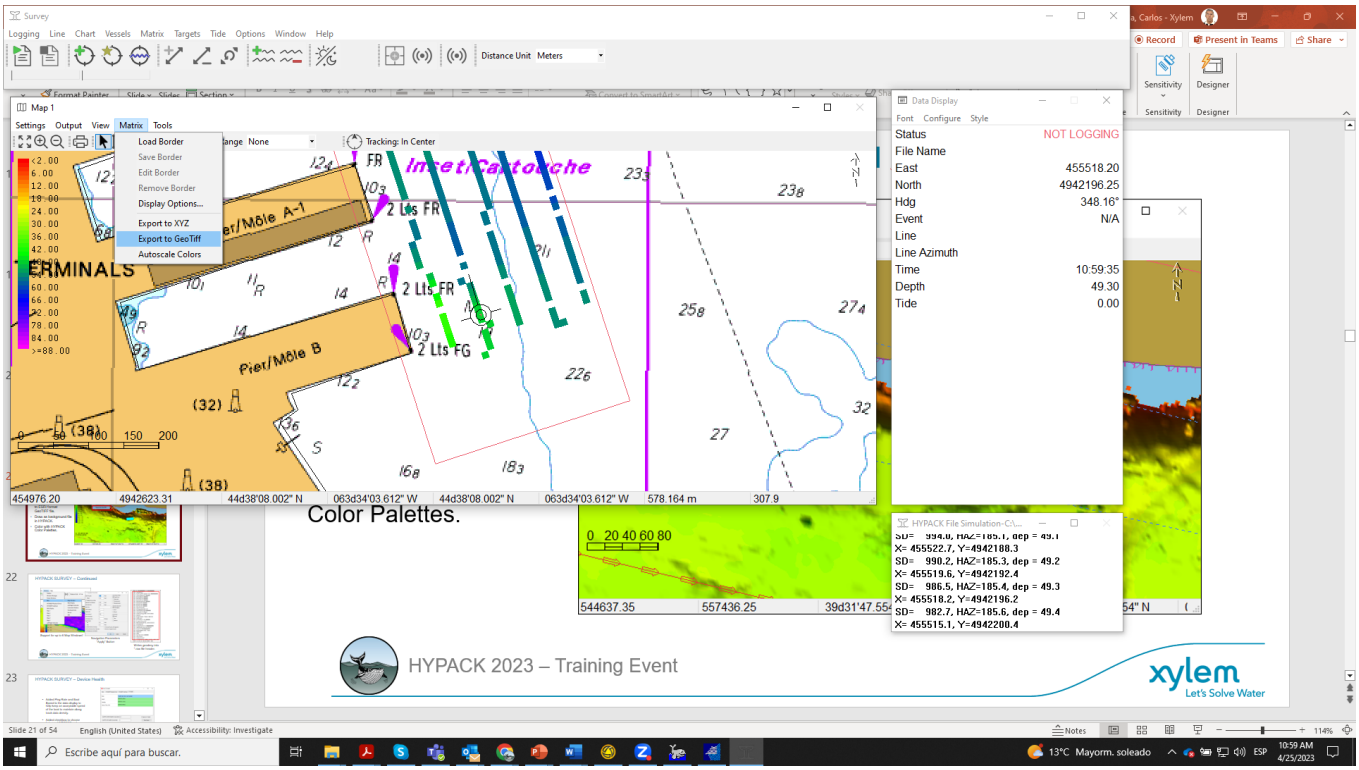
options, one to save a traditional TIFF file with color coded pixels. Next to it is the ESRI TIFF option, which allows you to generate a TIFF file with depth values included.



If you want to export an ESRI GeoTIFF with single beam data, this option is not available in SBMAX64. Instead, complete editing in SBMAX64, export or save the data in XYZ format, open the data in MBMAX64, and export it as an ESRI GeoTIFF. Remember that the surface or image is based on your data resolution. In the image above, each pixel or cell has 23.5 x 23.5 meters, and this is done automatically by MBMAX64 because we used the auto-matrix option.



If the Geodesy for the project you are using is not based on the EPSG code, you will get a warning similar to the one in the image above, reminding you to enter that info in ArcGIS Bathymetry.



The image above shows where to find the option to export ESRI GeoTIFFs in SURVEY. It is located in the Matrix menu inside the Map window of the SURVEY program (I know, it's not easy to find, that's why I'm placing the image here).

Remember that you can review the file created by loading it in the HYPACK® Shell as a background image.

BAG Format

This is the preferred way to transfer data to ArcGIS, as this method allows you to use the sort query and filtering options available there.

This is possible because this file format includes metadata and uncertainty values associated with each cell.

Metadata helps you sort and filter data based on the date of the survey, survey units, sensor type, and other options. It also helps you compare several surveys properly.

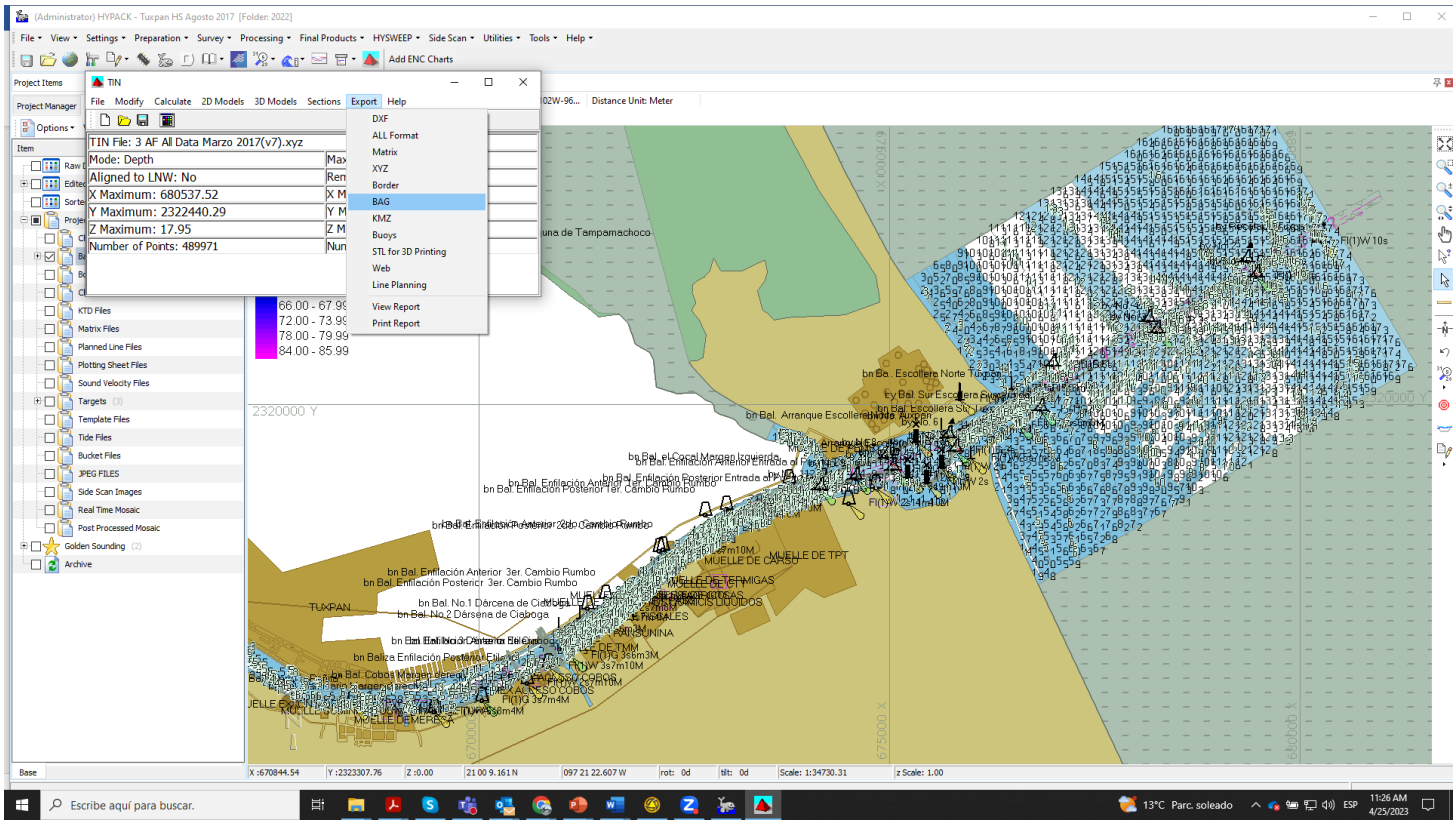
Similarly, the uncertainty values are important because they indicate the usability of the data, and depending on the objective of your work, you can decide to use a dataset or not. For instance, if you want to determine the under keel clearance for a port, you will need to use the data with minimum uncertainty, the data that meets the Exclusive or Special Order standards only. Data with more uncertainty will be rejected or not used by ArcGIS and that can only be done if the data file contains uncertainty information.

In HYPACK®, we have two places where we can generate the BAG files: TIN MODEL and MBMAX64.

A BAG file is a surface, not a point class feature. The size of the pixels determine the resolution of the surface when you adjust the matrix cell size of the BAG file.

The basic difference between these two options when creating a BAG file is that TIN MODEL will not include uncertainty values and MBMAX64 will.

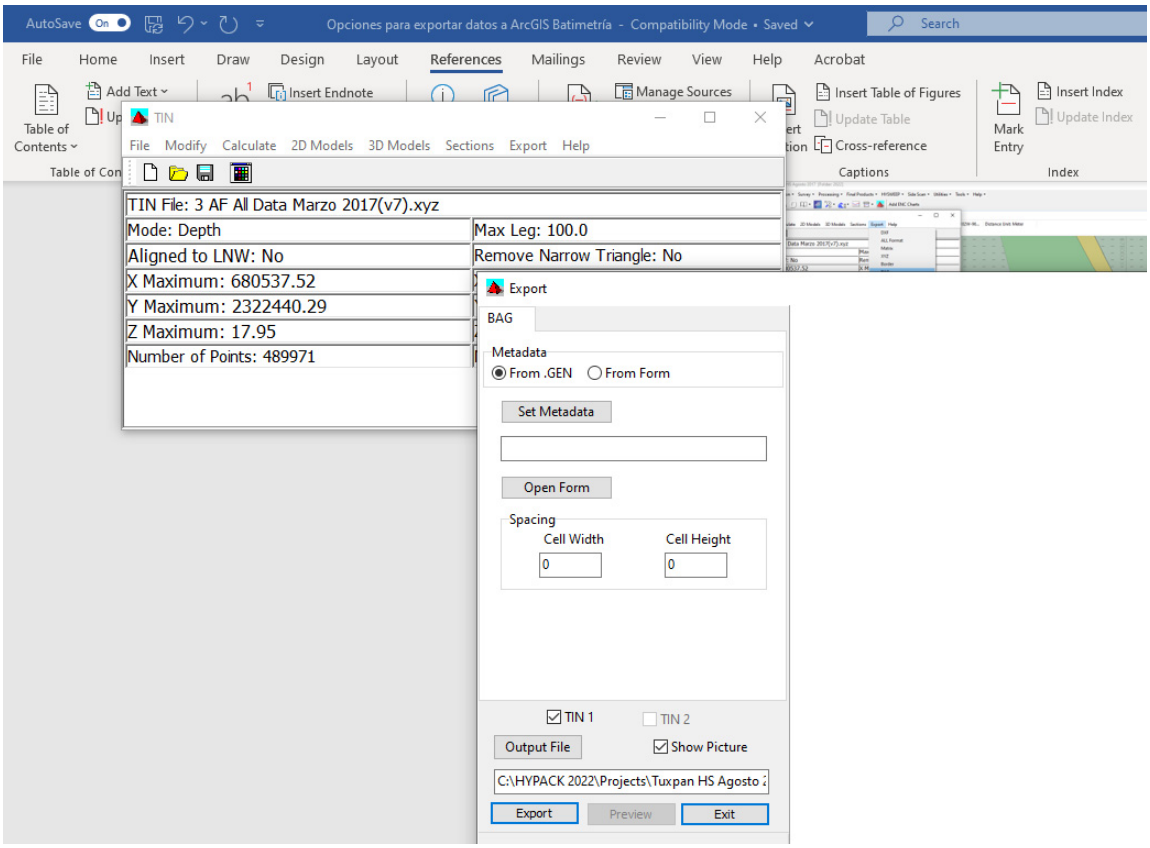
To generate a BAG file in TIN MODEL, you need to load the data, generate the model, then select the EXPORT menu and select the menu item BAG, as shown in the following image.



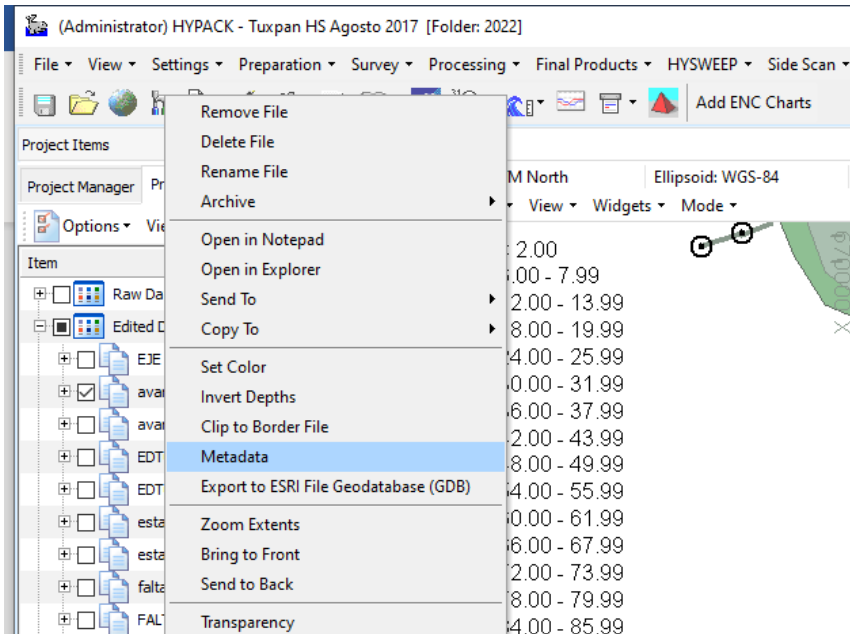
When you select this option, you will see the next window where you can enter the metadata, and here you have two options with the Set Metadata and Open Form buttons.

With Set Metadata, you just need to enter the *.gen file that contains all your metadata. With Open Form, you need to enter the information in the three tabbed window that shows up

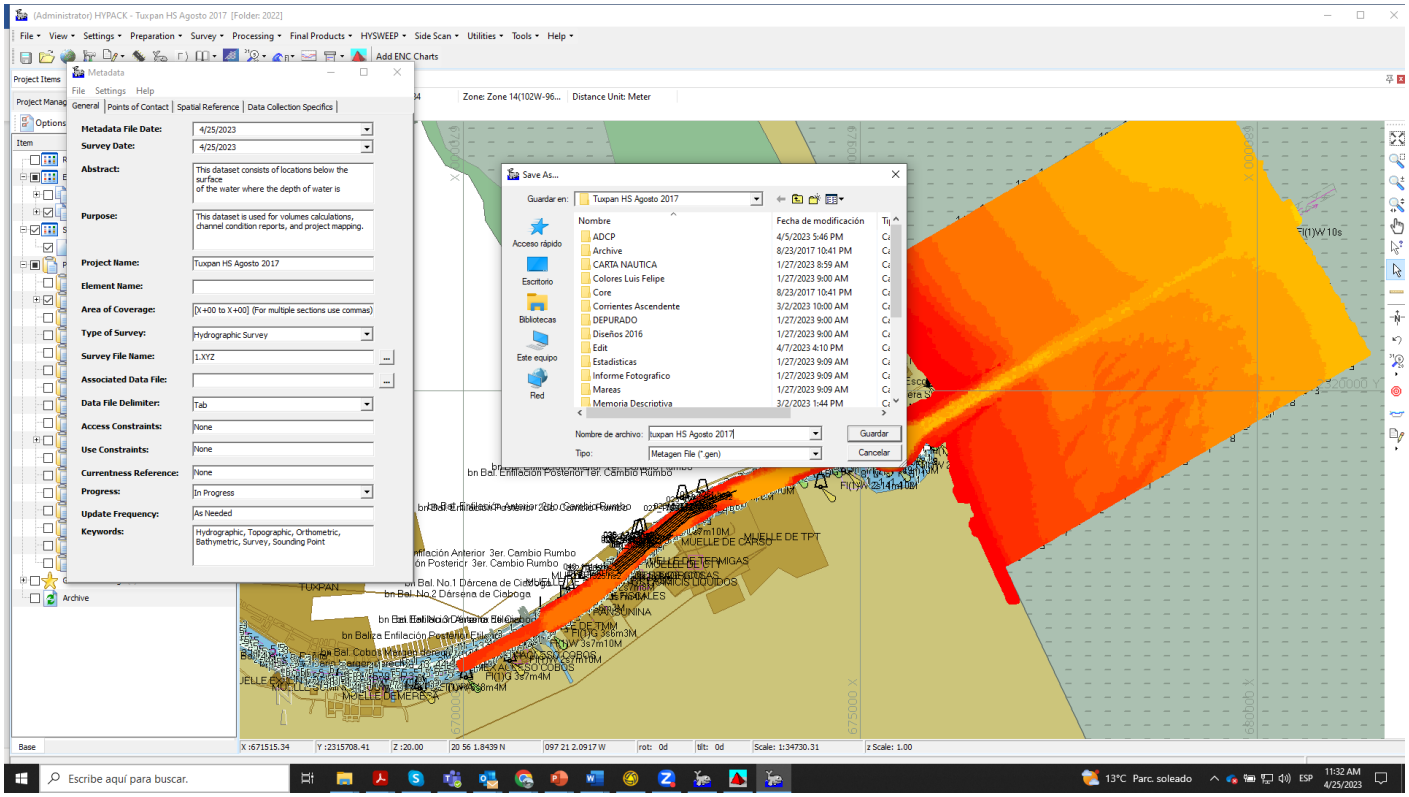
when you click the button. On the Other tab, you can define the Vertical Datum of your dataset.



The metadata file can be generated from the HYPACK® Shell using the Set Metadata option that appears when you right click on an XYZ data file. The following image show you the right click menu that appears when you click an XYZ file. You also can see where the Metadata option is.



Once you select this option, the following window shows up to allow you to enter the metadata. It is organized in four tabs, so you can view each one of them and enter the appropriate information. When you complete this, save it to a *.gen file that later loads in TIN MODEL when generating the BAG file.



One option that you could use to facilitate the entry of the metadata is the menu item Import from Project located in the Settings menu.

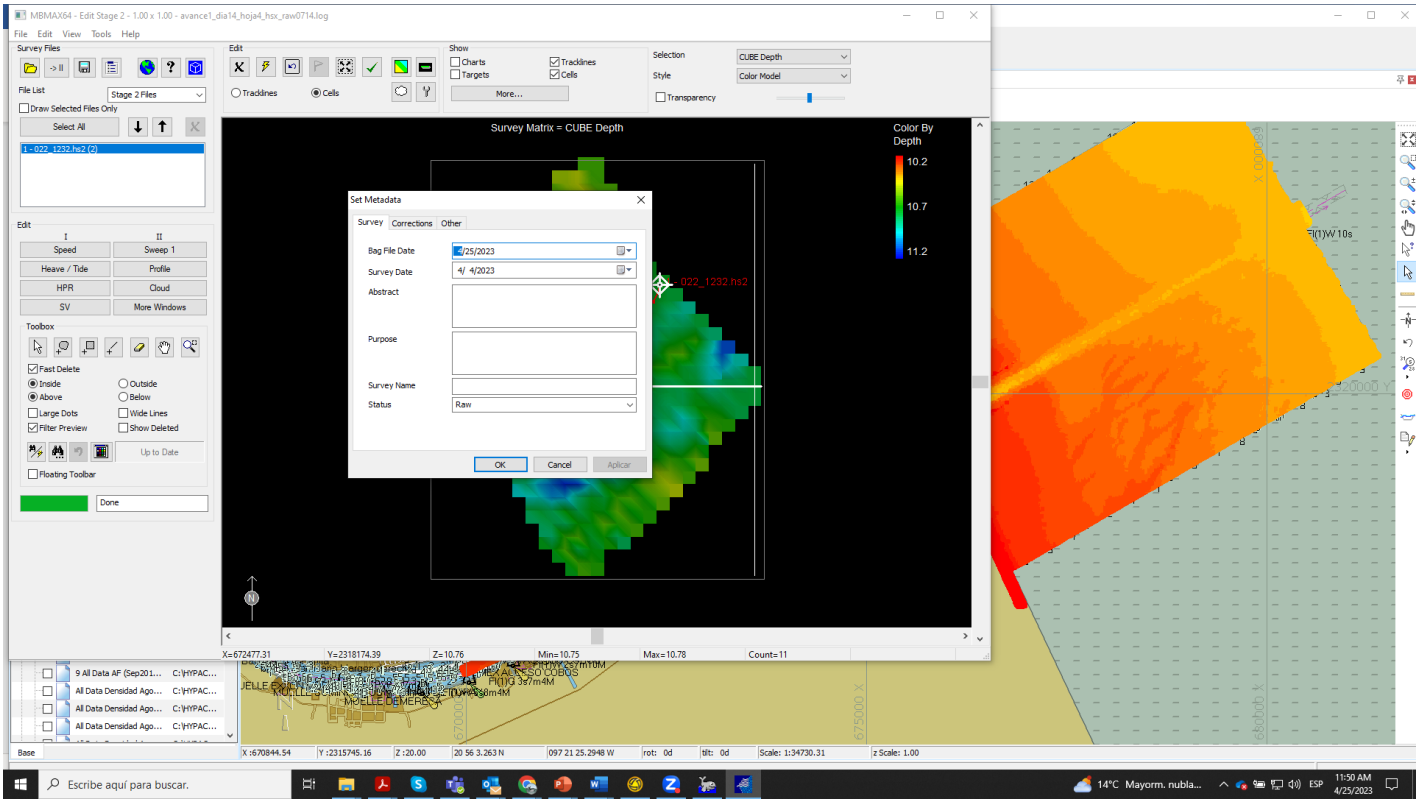
If your work on ESRI requires the uncertainty values, then your only option will be MBMAX64. To use this option, follow these steps:

When loading the data in Read Parameters, activate Calculate TPU and select an Accuracy Standard. Edit your data and use CUBE, this will compute a TPU value per each cell on your matrix.

One thing that you need to remember is that you can make BAG files of a matrix with no inclination, so if you are using a matrix created in the Matrix Editor, make sure the rotation is set to 00 and if you use the Auto-matrix function, do not activate the box “Rotate to Survey Line”. If you don't do that, the BAG option will be grayed out in the Save window.

Once this is completed, click the Save icon and select the BAG - Bathymetric Attributed Grid. Then select all files and the Set Metadata window appears. This window is the same as the

option “Open Form” in TIN MODEL. Complete the fields as needed and remember to enter the Vertical Datum on the Other tab as mentioned before.



In summary, you have several options, so choose the one that best suites your workflow. Ah, and please let us know if you have any suggestions!