Tide Models & Data

Models

- A model is a tool used to interpret a system.
- Models are human constructs.
- Models range from simple to complex.
- An example of a simple model is:

  the equation for a straight line ($Y = m X + b$)
- An example of a complex model is:

  the equation for wave propagation in a fluid moving over a complex three dimensional surface

Tides 101

- A tide is the natural variation in the elevation of a water surface at a specific location.
- The tide is the result of wave propagation in a body of water moving over a complex three dimensional surface.
- As water moves into increasingly shallower zones, the rate of flow decreases.
- Where water flow is constricted, the tide (wave propagation) is more complex than in open water.

Measuring Tides

- Tides can be directly measured by tide gauges.
- For accurate measurement, a tide gauge must be fixed at a specific geodetic coordinate.
- Floating tide gauges (~$1K ea.) can be fixed to piers, docks, other permanent structures in locations where tidal range is less than a meter.
- Submerged tide gauges (~$5K ea.) can be fixed at depth by divers.

Tide Data

- Electronic data available from USGS for specific locations.
- Tides tables published for specific locations; especially in zones where transportation and or/recreation is primarily via water.
- Tide data can be collected over any time interval, but is considered most useful when it has been averaged over a 19 year period.
- In many subaqueous systems (including Taunton Bay), there is no place to put a tide gauge to get direct tide data for the system.

Tide Models

- A tide model is a tool used to interpret the system.
- Tide models are human constructs.
- Tide models range from simple to complex.
- An example of a simple model is:

  + 2 hours from high tide at USGS gauge (Y = X +b)
- An example of a complex model is:

  building a fluid dynamics equation for tides and inputting the bathymetry of the area of the study. (Use your very own three dimensional surface data.)

What to do?

- Contact local boaters and find out the simple model they use.
- Contact the state and local agencies to determine the location of gauges and collect any existing tide data.
- Make a decision on the level of modeling needed for the survey you are doing.
- Collect your own data.

What did we do?

- Found no tide gauge data for Taunton Bay.
- Borrowed a Sea Bird Electronics SBE-26 tide gauge. This submerged gauge uses a pressure transducer to measure the weight of the water above it.
- A certified diver attached it to the base of a pylon of the bridge crossing the bay inlet.
- The gauge sensor collected data every 20 mins.
- The gauge was removed 6 weeks later.

Exactly where was the gauge?

- A known and easily identifiable spot on the pylon was surveyed to zero mean sea level by a surveyor from the NRCS.
- While the pylon was being surveyed, depth to the gauge (at the pylon base) was measured using a Garmin 168 sounder.
- Survey and depth data tell us the tide gauge was 4.98m below zero mean sea level.

Bathymetric Data

- Depth (Z dimension) data was collected using a Garmin 168 sounder.
- The device was connected to a laptop computer loaded with Nobeltec Visual Navigation software.
- The data was collected every two seconds as we made transects back and forth across the bay at a an approximate speed of five knots.

Using Tide Data to Adjust Z

- The bathymetric data (date, time, lat/long, depth) was moved into a spread sheet.
- These data were cleaned and parsed.
- Tide gauge data was used to adjust the depth of cleaned bathymetric data to zero mean sea level.
- Remember:

  Tide data is collected every twenty minutes.

Sending Data to ArcView

- The adjusted depths were placed in a database file along with time, date and lat/long.
- Lat/long coordinates were converted to decimal degrees.
- The database was then opened in ESRI ArcView 3.3 software.
- The data was used to generate contour lines by using the spatial analyst function in Arc View.