Created for:
A DAY IN THE LIFE OF THE HUDSON RIVER

An Educational Program of the
Hudson River Estuary Program
of the NYS DEC

in collaboration with Lamont-Doherty Earth Observatory

KINGSTON

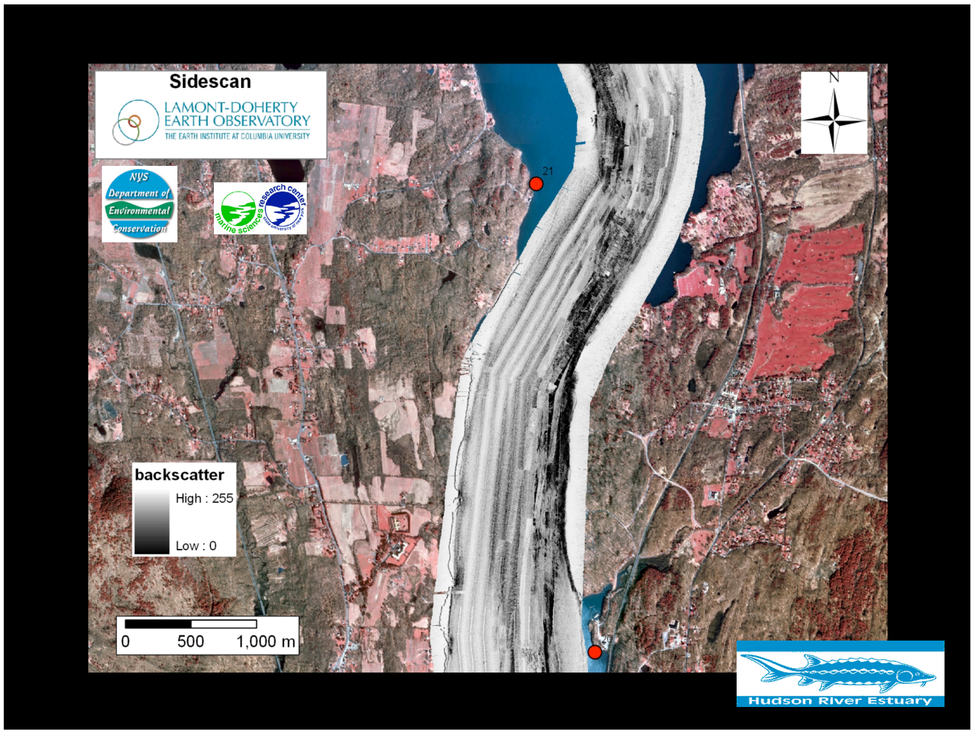
Frank Nitsche, Lamont-Doherty Earth Observatory of Columbia University

Hudson River Benthic Mapping Project

- Mapping Benthic Habitats
- Identifying Sites of Sediment Deposition and Erosion
- Understanding changes and related processes

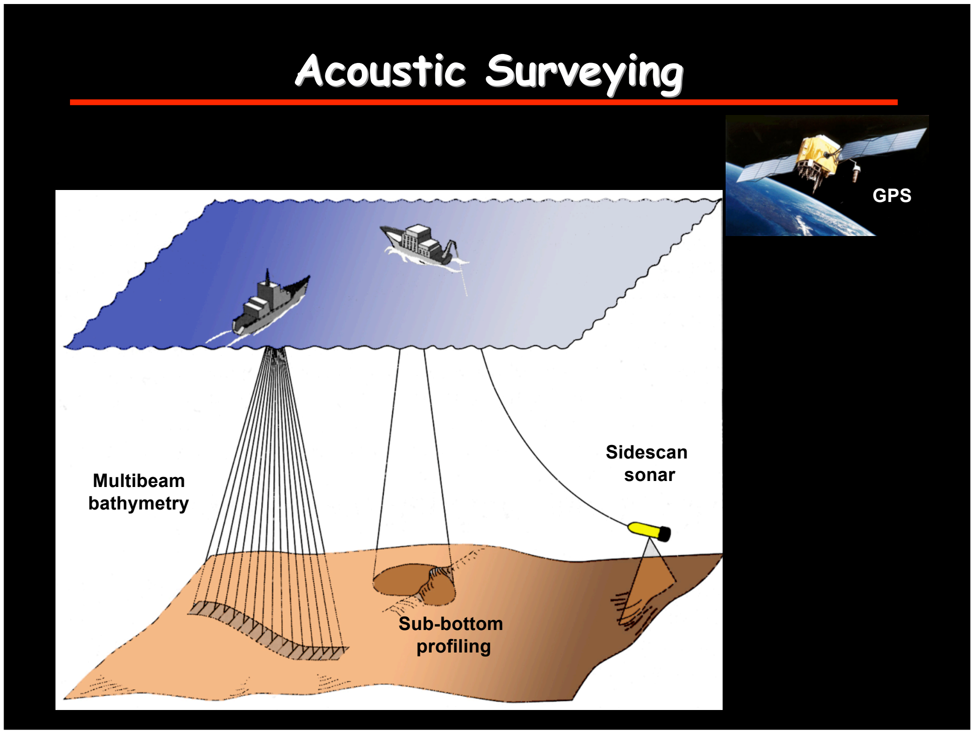
Collaboration:

- Lamont-Doherty Earth Observatory
- State Univ. of New York - Stony Brooks
- Institute of Ecosystem Studies
- New York State Department of Environmental Conservation

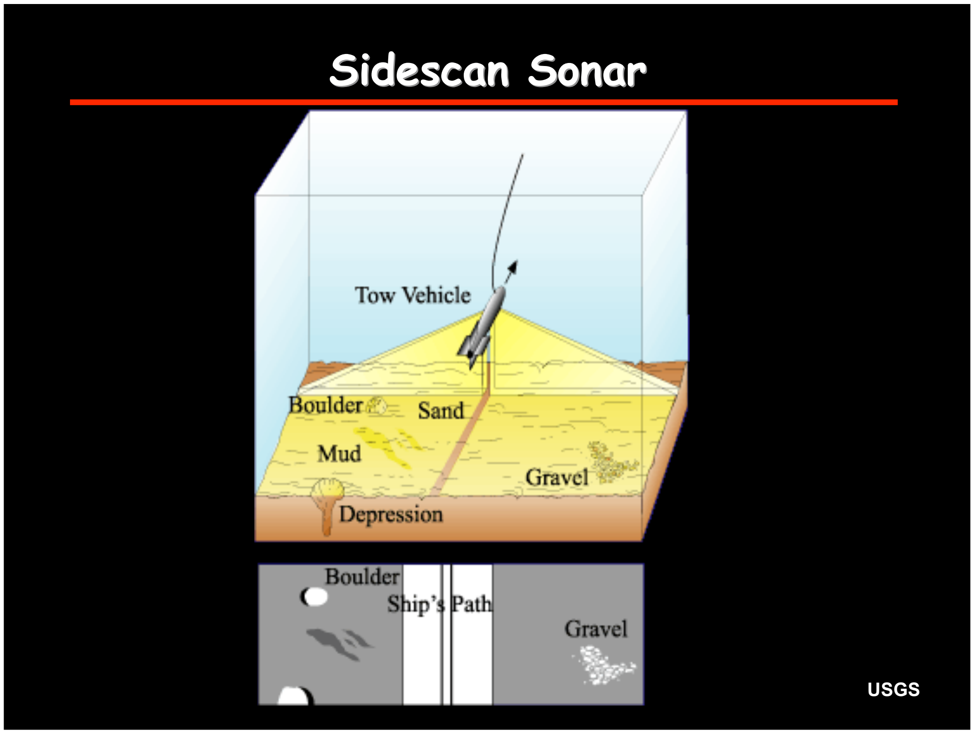


Lamont-Doherty, SUNY Stony Brook and Institute of Ecosystems Studies has worked over the last 6 years on a project for the NYSDEC doing interpretive mapping of the bottom of the Hudson River. Many people look at the river and envision that the bottom is just like a bathtub, a sloping concave surface that is smooth and flat and pretty much all the same. In reality the river bottom is varied and dynamic - in some areas it changes constantly.

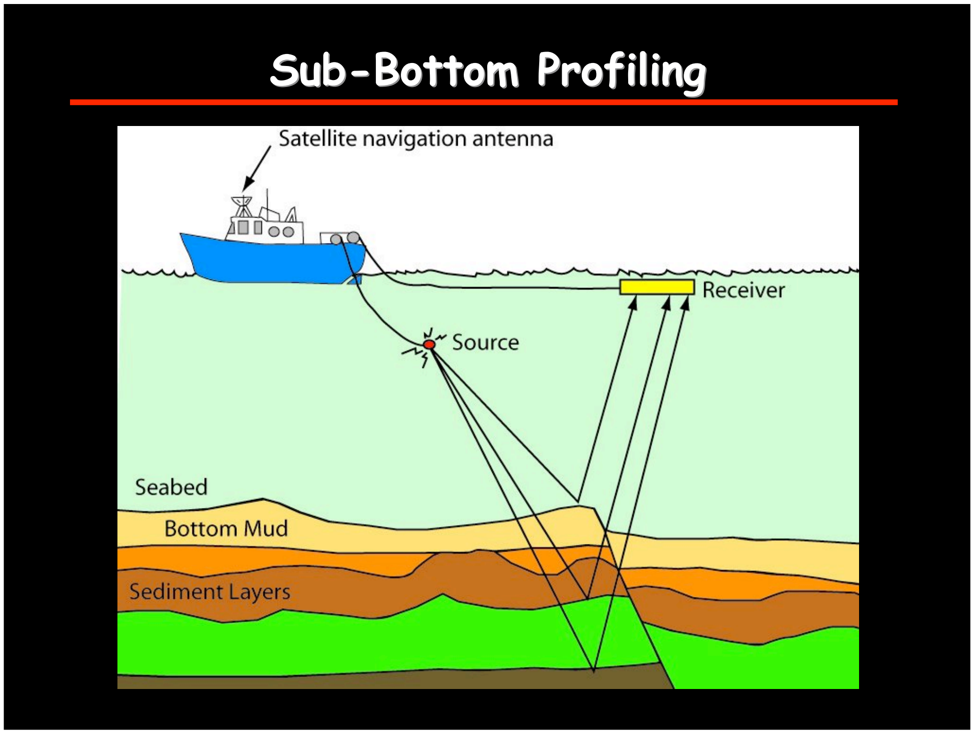
The image here shows the area around the sampling sites south of Kingston: #21 – Esopus Meadows, #20 – Norrie Point.



The core of the surveying program are acoustic measurements - in each of these techniques sounds are bounced off the bottom of the river to give you information, but each type of measurement tells you something different. GPS is in integral part of any marine sampling and mapping program.

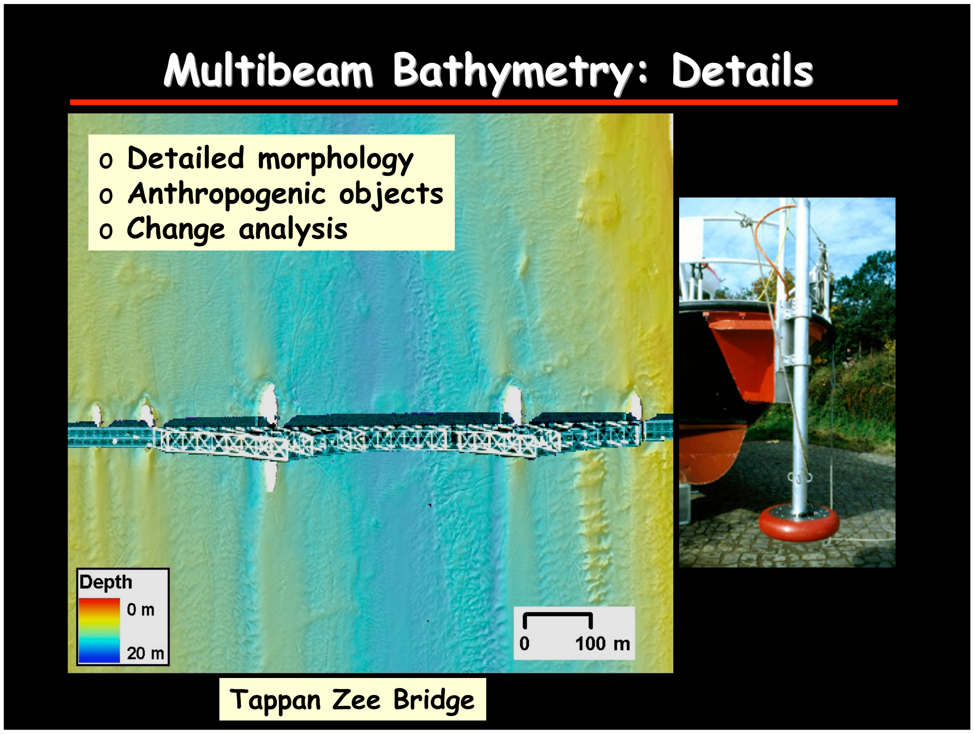


This is an image of the sidescan sonar. A small submarine like piece of equipment called a "towfish" is pulled by the boat. The equipment sends out an acoustic signal that bounces back off the riverbed. By measuring the "backscatter" from the towfish scientists can distinguish between different sediment types. By the acoustics they can tell if an area is fine grained soft sediment or coarser grained, a hard bottomed or soft bottomed surface. This can be important information for benthic (bottom dwelling) creatures' habitats. Sidescan sonar can also tell if an area is all alike (homogenous) or varied in type (bioturbated) - and they can detect features like sand or sediment waves in the bottom of the river. Above the top picture shows the towfish being pulled over different types of surfaces and below is a cartoon like example of the image that you would see.

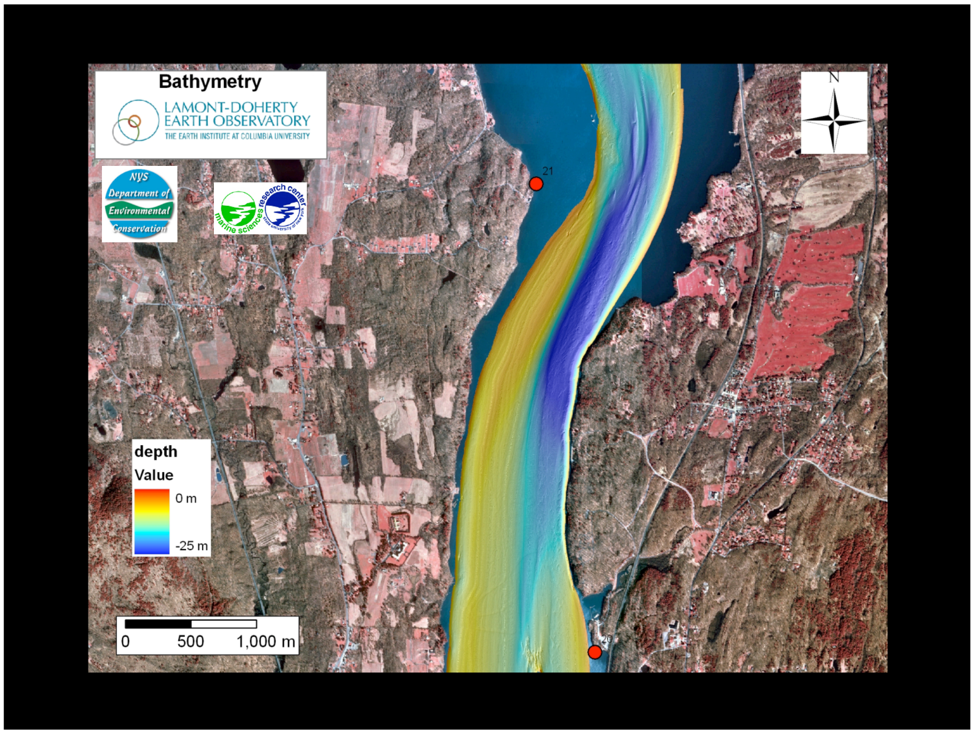


For the sub-bottom profiling, sounds are measured by a piece of equipment called a “Chirp subbottom fish”. The “chirp” measures sounds reflected from geologic structures beneath the riverbed. Depending on the hardness of the surface the sound will bounce back differently.

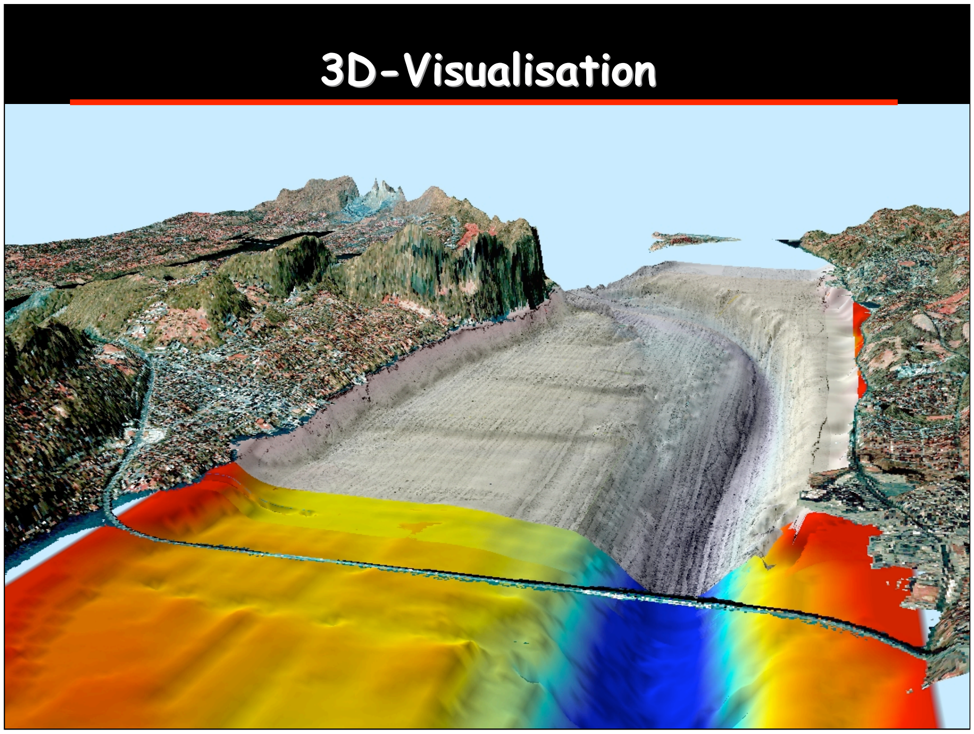
The subbottom profile tells the story of the erosion, movement (transport) and deposition of sediments in the river. This is important when looking at contaminants that might end up in the river and attach to the sediments. Sub-bottom images can also be used to determine relative age relationships of features to look at time sequences for features in the bottom of the river (like oyster reefs etc.)



The instrument pictured above gathers Multibeam bathymetry data or geomorphology information ie the riverbed structure, rock outcrops, even anchor drags and cable crossings. The instrument transmits in a wide fan like image to gather information of a wide sweep of area about 4 times as wide as the river is deep.



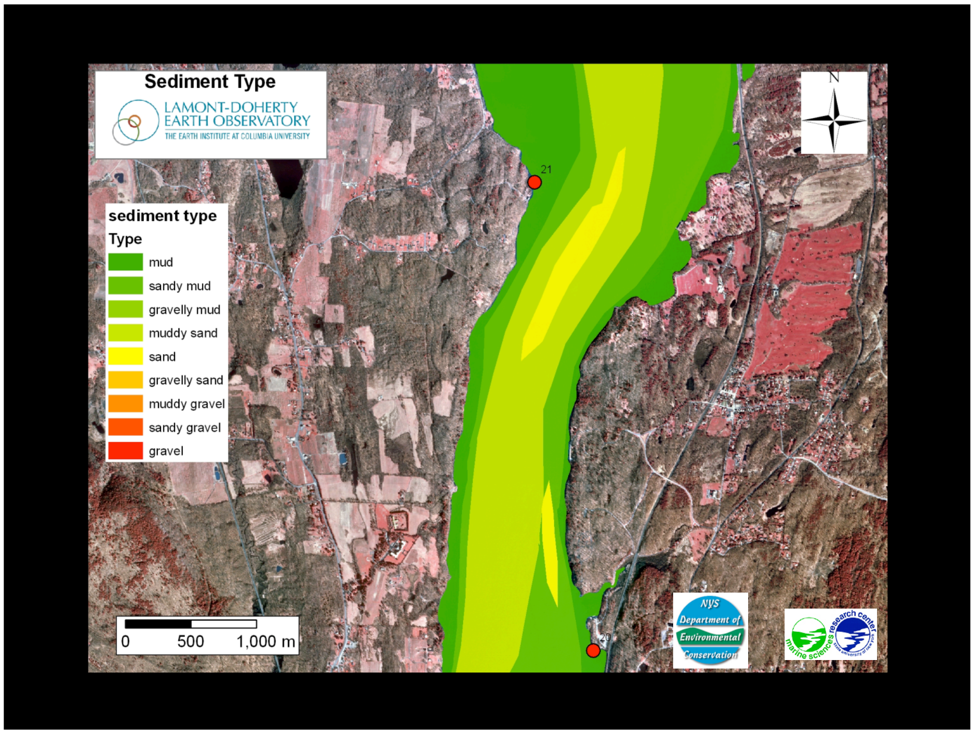
This multibeam composite of the Troy area of the river shows the differing depths of the channel. The main channel is very straight, because it has been straightened artificially. Aside from the channel the area is relatively shallow. Only the part of the river that is deeper then ~4 m (12 ft) has been surveyed with this technique yet.



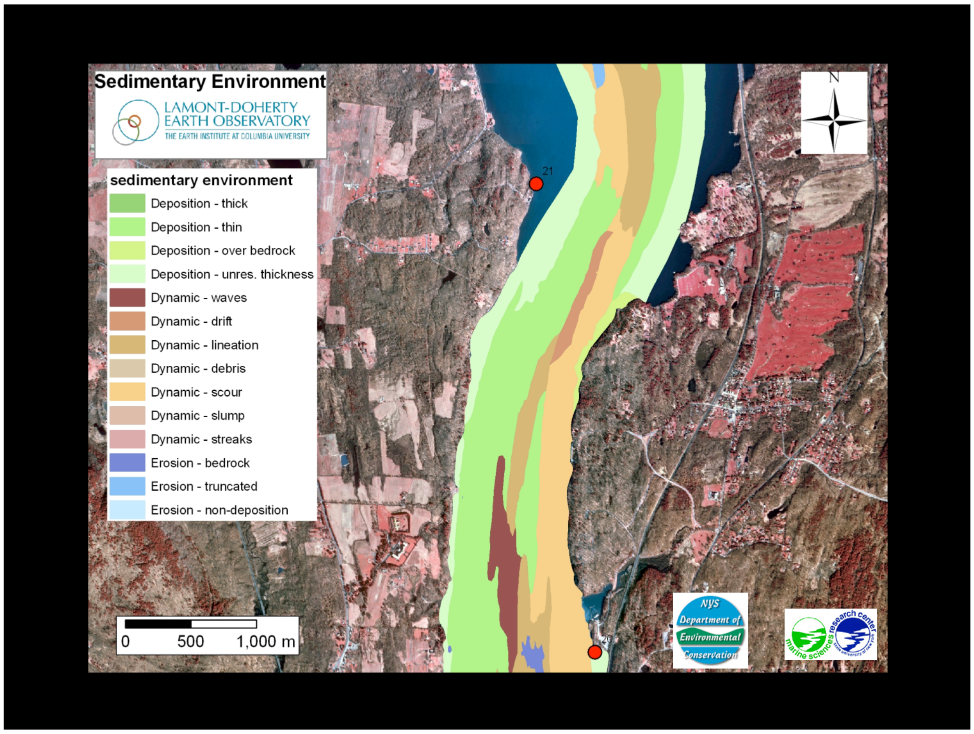
This is a visualization of the section of the Tappan Zee bridge section of the river. GIS provides possibilities for 3D visualization. The shapes and depths are highly visible when color is added to the image.

=> Analysis of morphological relation of different data

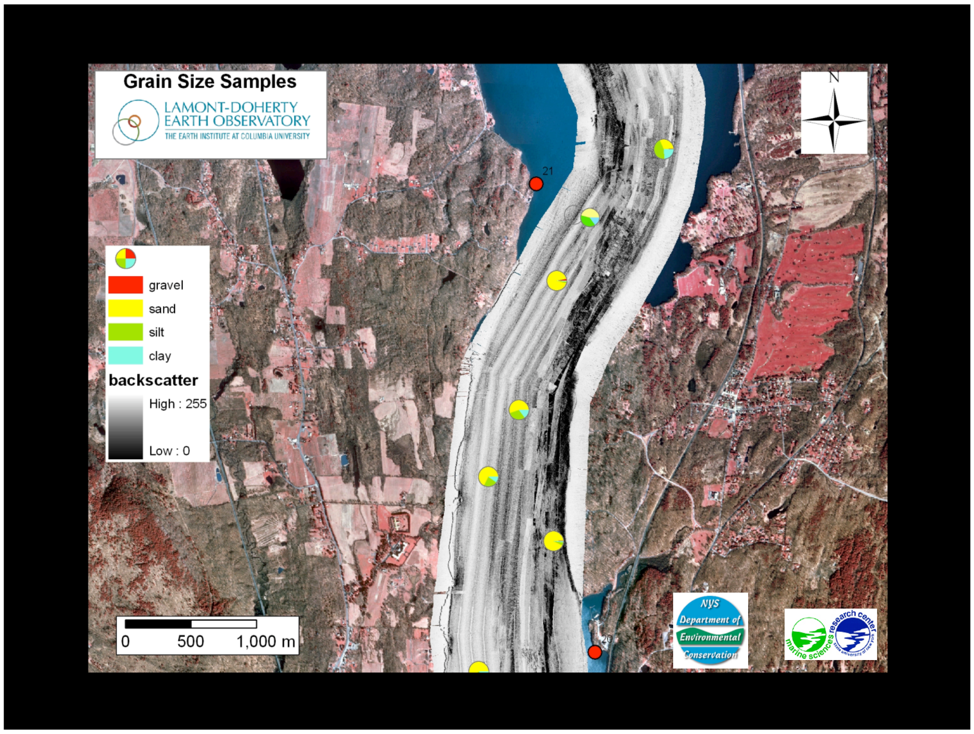
=> Highlights topographical/morphological features



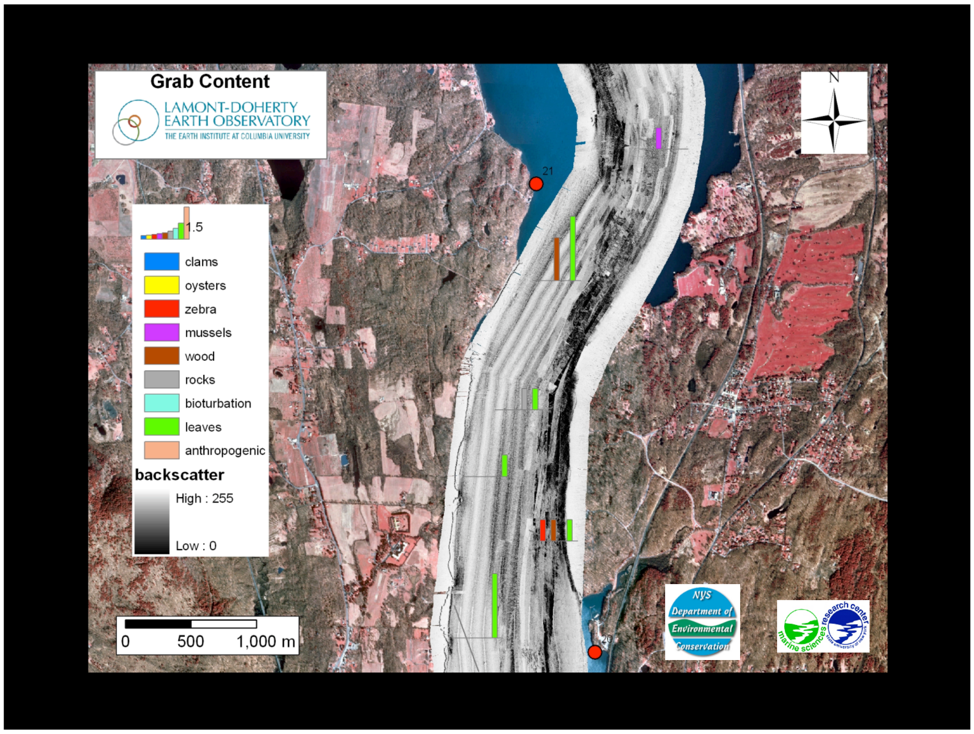
Once the data is collected it is analyzed and interpreted. This image represents a grain size interpretation translating into a map of the different sediment types in this section of the river. The red and yellow sections are the deepest areas in this part of the river. This image suggests that muds don't collect in these deeper areas but do settle out in the wider slower moving parts of the river.



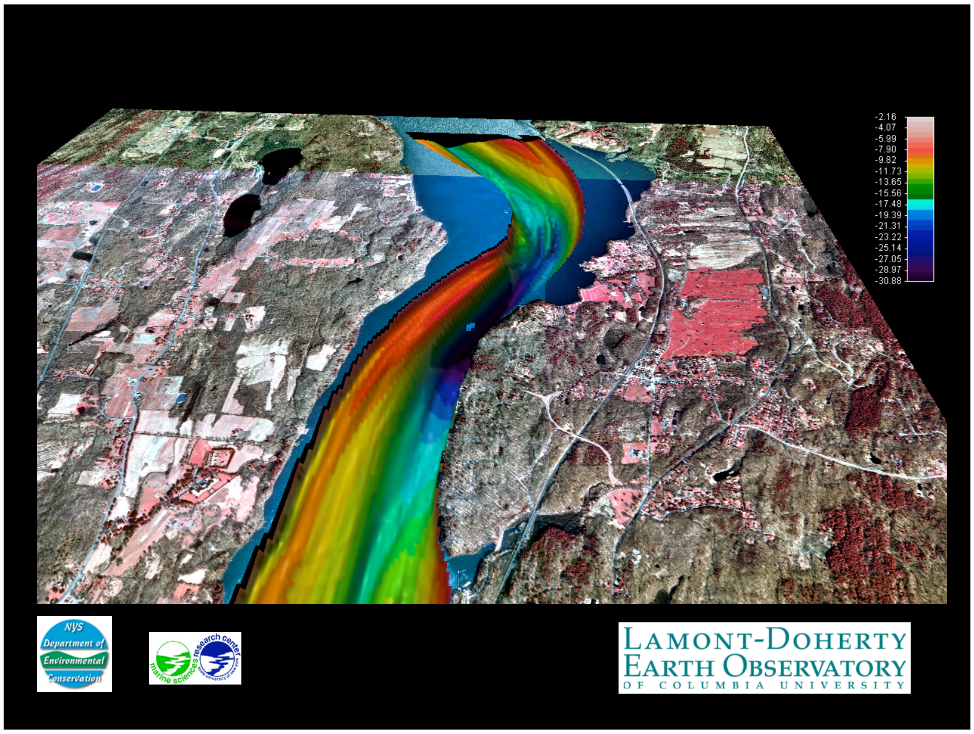
This interpretive image shows how sediments deposit in some areas of the river and collect in others. The areas labeled dynamic means that the movement of the water is constantly changing that section of the river bottom.



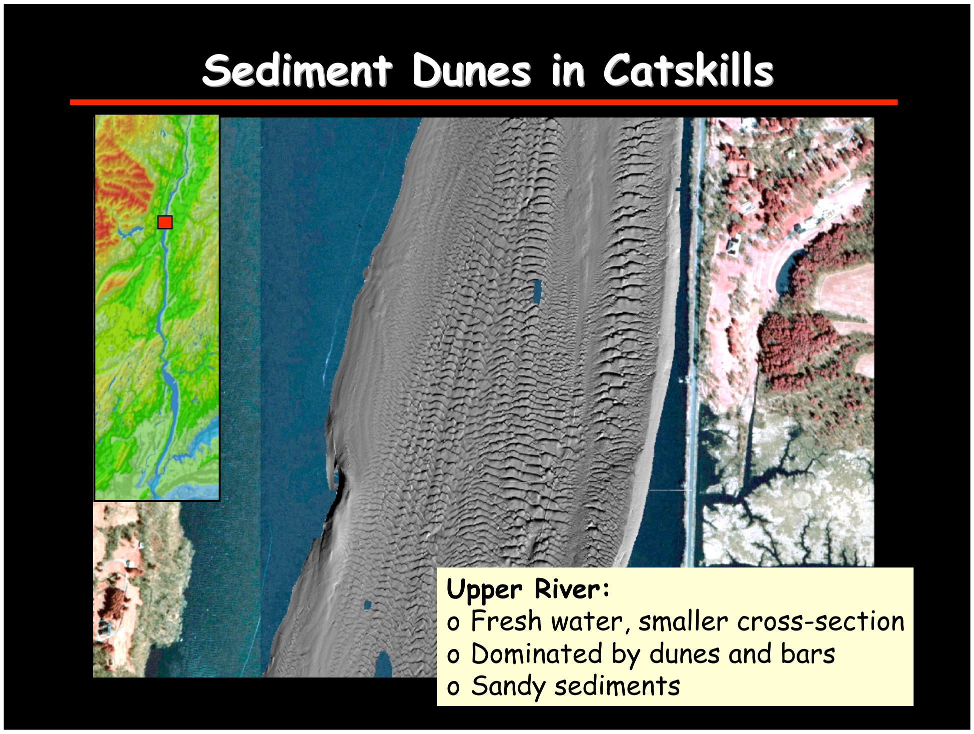
In order to verify data collected from acoustical methods grab samples and core samples are taken and then analyzed for their make up. These are used to develop some of the interpretive maps.



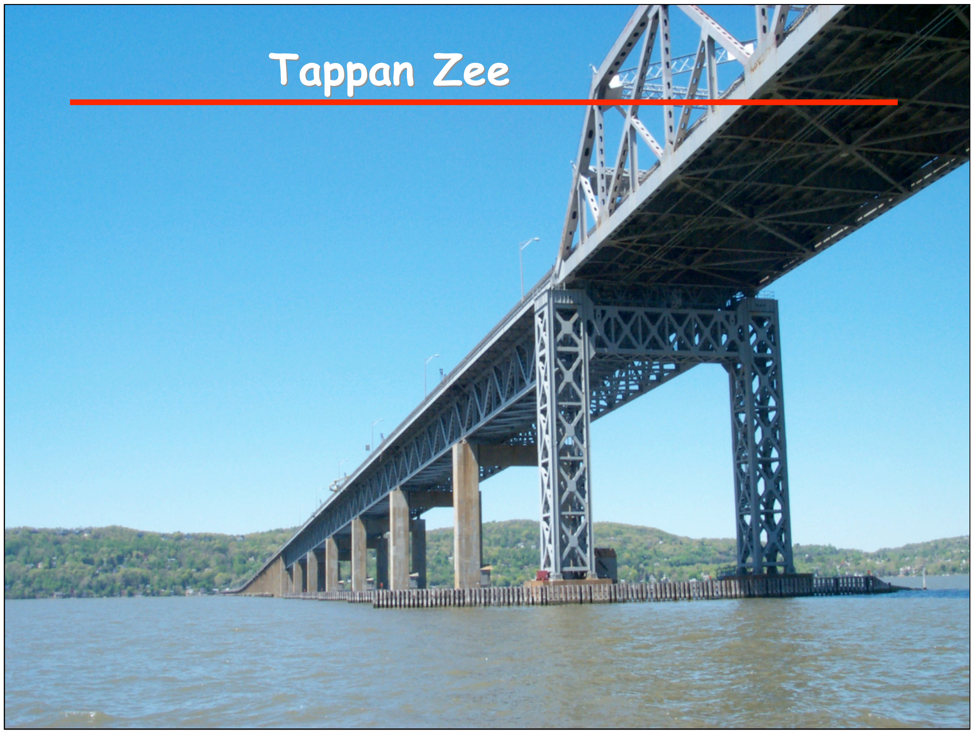
Grab Content
LAMONT-DOHERTY EARTH OBSERVATORY
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY
N
21
1.5
clams
oysters
zebra
mussels
wood
rocks
bioturbation
leaves
anthropogenic
backscatter
High : 255
Low : 0
0
500
1,000 m
NYS Department of Environmental Conservation



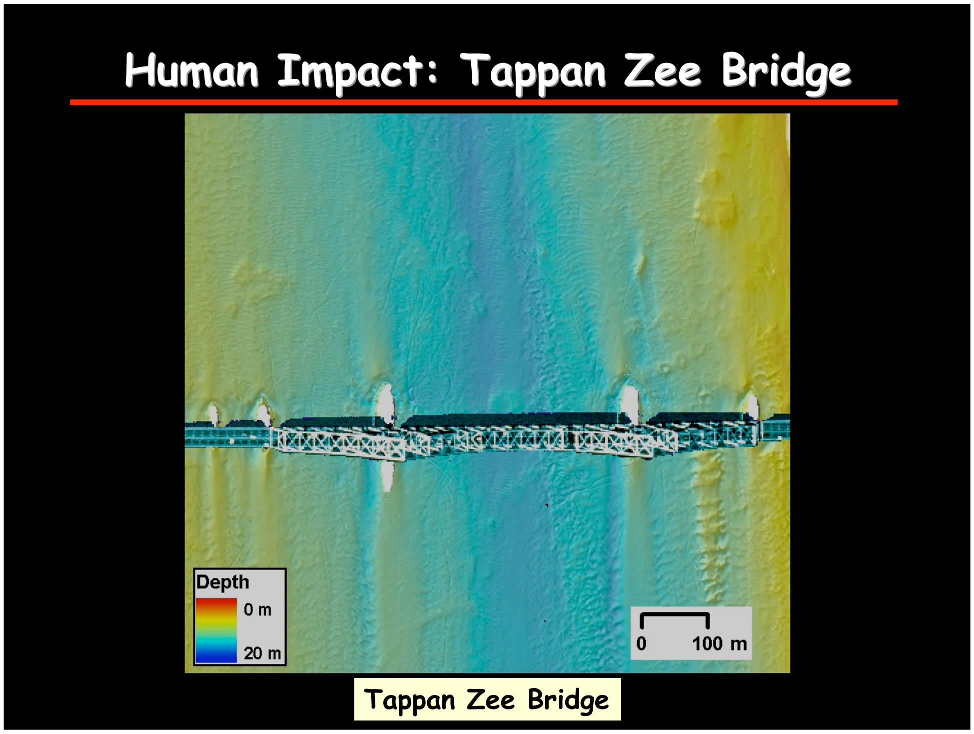
The colorized image shows the depths in this section of the river where data was able to be collected. Data can not be collected in areas that are too shallow as equipment is towed below the boat, nor in areas where there are pilings and old marine debris. Depths are shown in meters.



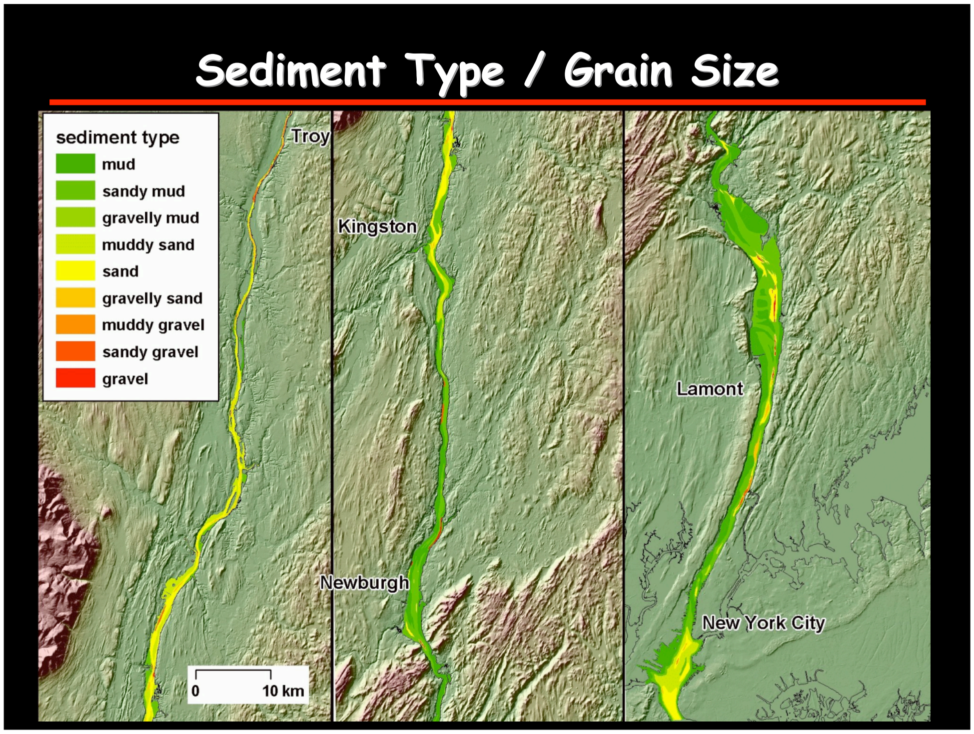
An example of some of the dynamic sediment dunes that are found on the bottom of the river. Some of the Hudson River sediment dunes can be 9m high.



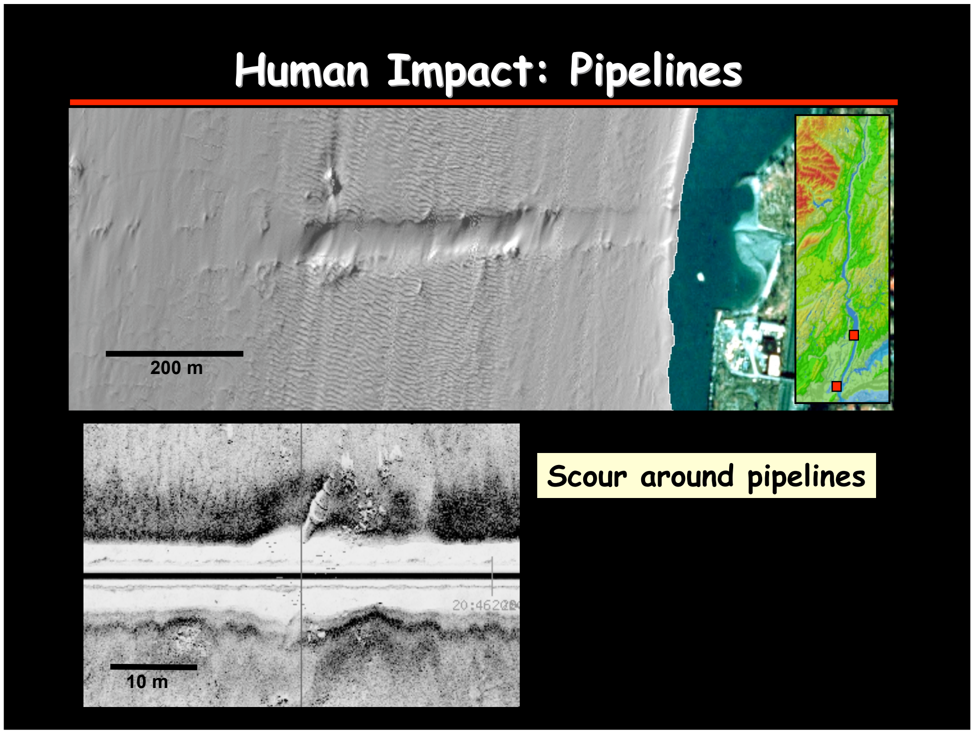
Bridges and other man made, or anthropogenic features have an influence on the bottom of the river. They create places where debris collects and erodes depending on how the tides and currents work in that area.



Here you can see how hollowed out sections of the river and beside them collections of sediment appear behind the bridge footings.



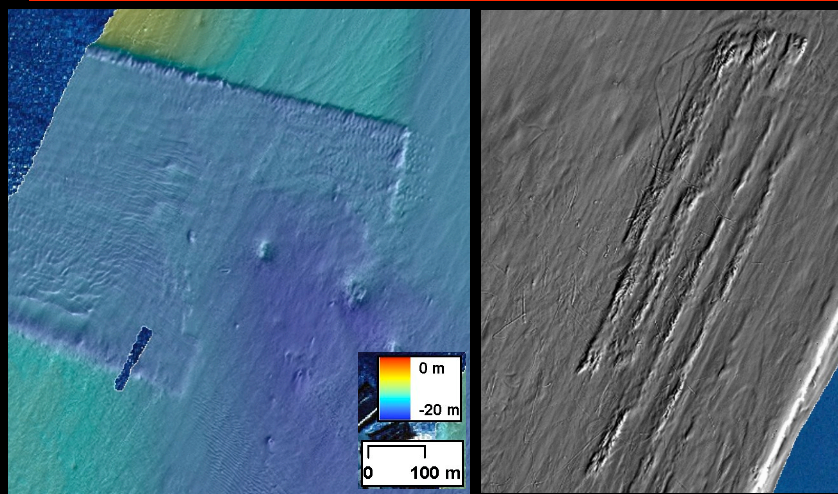
If you follow the river from the Troy dam down you will see that the area by the dam is gravelly, then it moves to a sandy section and as the river widens the smaller mud drops out. In some areas large tributaries bring in a new influx of sand. Once you reach the harbor area sand becomes dominant again. This information is of interest for habitats as well as studying geomorpholgical change.

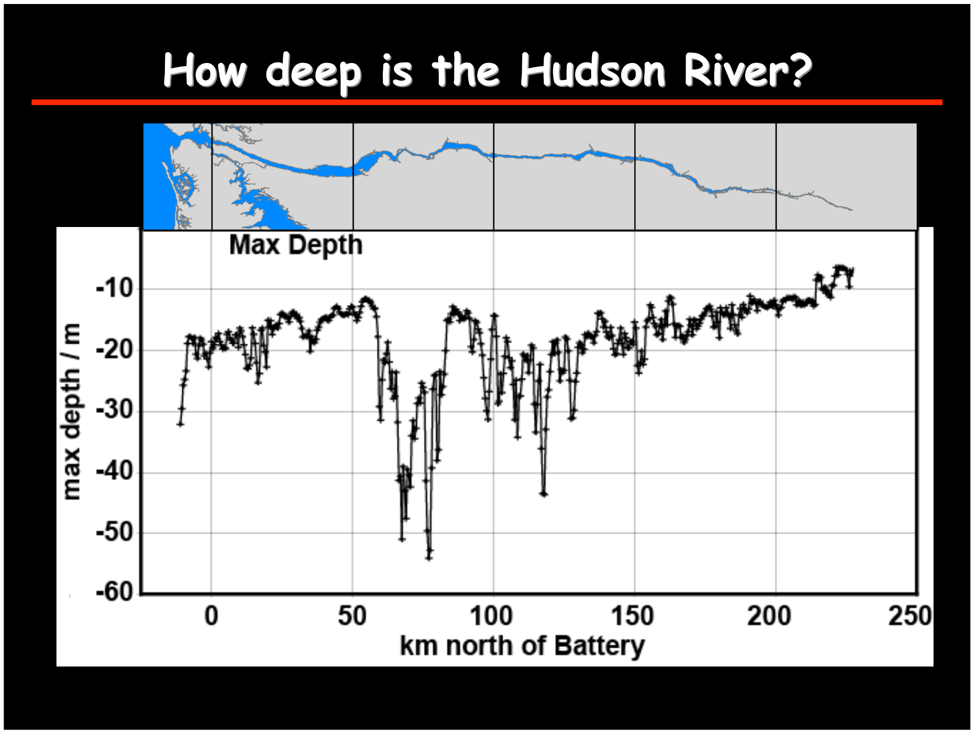


Human constructions have significant impact on sedimentary system in many ways.

Different examples and their expression in acoustic data.

Dredging: Examples New York Harbor





How deep is the Hudson River in your area?