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Modeling Wave Height and Shoaling for Navigational Purposes in the Navesink River, New Jersey

MONMOUTH UNIVERSITY

SCHOLARSHIP WEEK

Purpose:

- Use current GIS technology to model whitecaps (shoaling) in the Navesink River
- Lay the groundwork for a more user friendly and widespread navigational tool

Data Obtained for Maps:

National Oceanic and Atmospheric Administration

Equations:

$$F^* = gF/u^2$$
$$H^* = 0.0016 \times (F^*)^{1/2}$$
$$H_{mo} = (H^*) \times u^2/9.8$$
$$H_b = (H_{mo}) \times 1.28$$

Where g is gravity, F is fetch (distance from shore at angle of wind), and u is wind speed

Outcomes:

- In this attempt shoaling was not able to be accurately modeled using a manual calculation for fetch (Figure 4)
- A tool from the United States Geological Survey may be used to calculate fetch
- Future work will (1) refine method for manual fetch calculation and (2) develop graphical user interface to map shoaling based on user input (e.g. wind direction)

How can available geographic information system (GIS) software be used to model shoaling in the Navesink River?

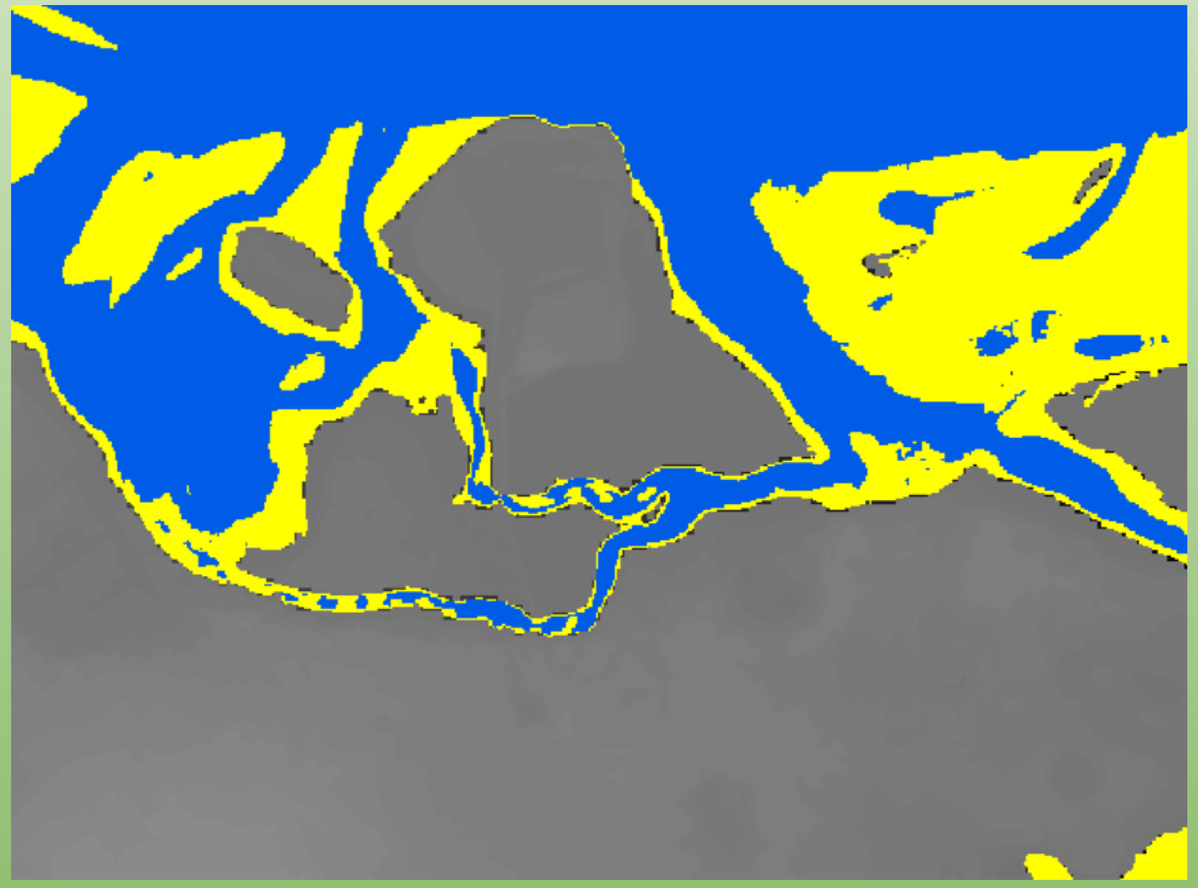

Figure 3. Shoaling areas (yellow) near coastline where shoaling depth exceeds water depth. This could not be derived using a manual calculation for fetch applied in this study (see Figure 4).

Figure 4. Shoaling area (not visible) generated using a manually calculated fetch. The manually calculated fetch was unable to identify shoaling areas. In future development of this project, the manual calculation for fetch will be further refined to identify shoaling areas.

Methods:

- Generate fetch grid of distance from shore at angle of wind
- Calculate F^* (fetch accounting for wind and gravity)
- Calculate H_{mo} (wave height)
- Calculate H_b (shoaling depth)
- Compare water depth to shoaling depth (see conditional statement in Figure 2)
- Map areas of shoaling (Figure 3)

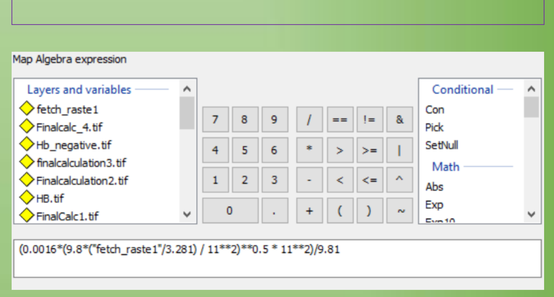

Figure 1. Equations in GIS raster calculator that resolves shoaling depth in each grid cell of the Navesink River.

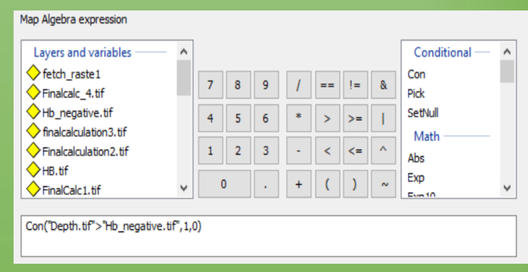

Figure 2. Conditional statement that maps shoaling areas (0) where shoaling depth exceeds water depth.

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