Salt River from Summit to Seafloor

A Study of Shaded Relief Techniques for Coastal Environments

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Hartdale Maps, 2023

COASTAL MAPPING

SALT RIVER: FROM SUMMIT TO SEAFLOOR

SALT RIVER BAY

ST. CROIX, USVI

TOPOGRAPHIC CONTEXT

← The Wall

← Salt River Canyon

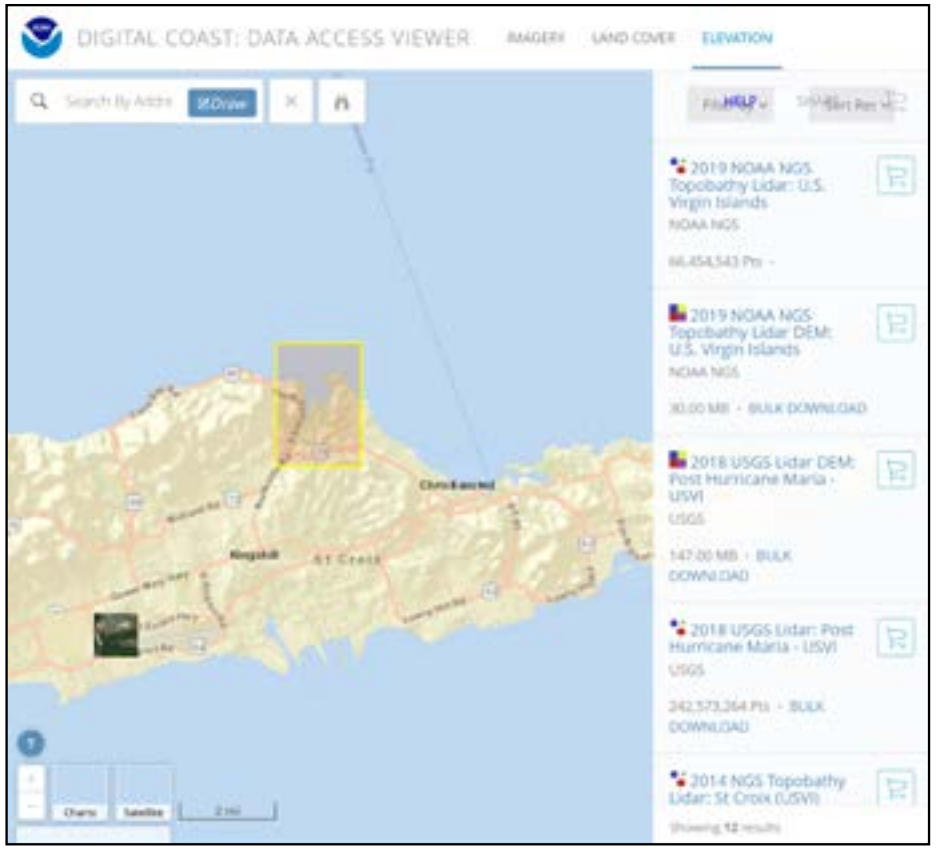
← Salt River Bay

← Mangroves

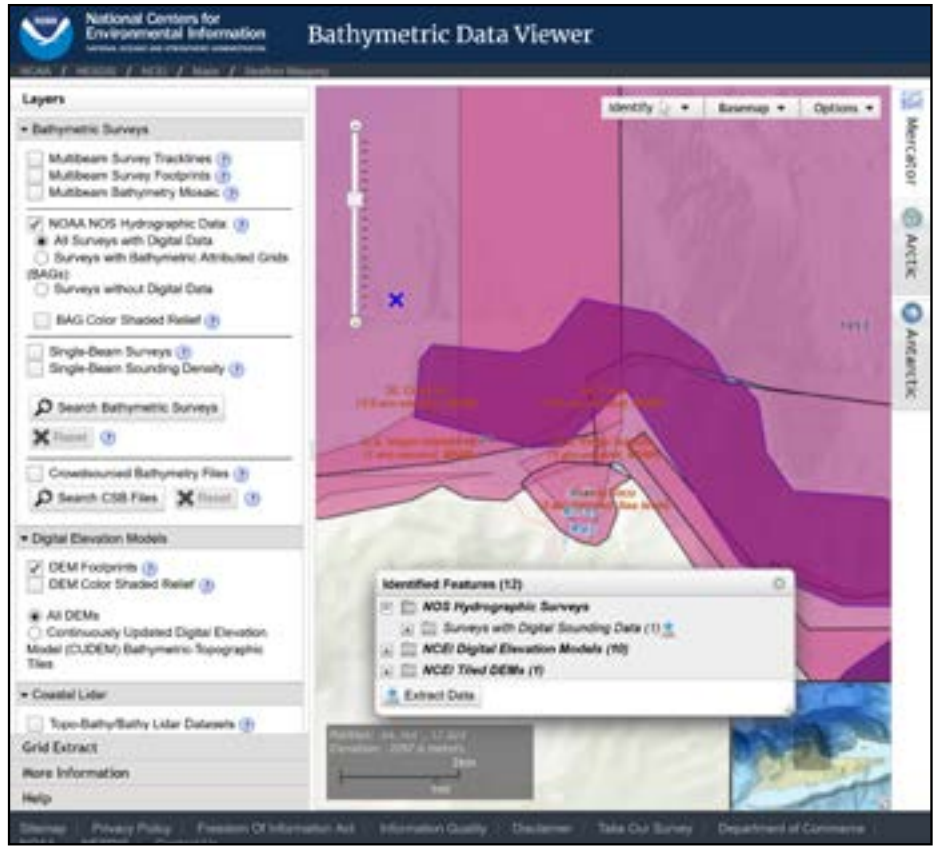
← Salt River

← Mon Bijou Settlement

GATHERING BATHYMETRIC DATA



Digital Coast: Data Access Viewer



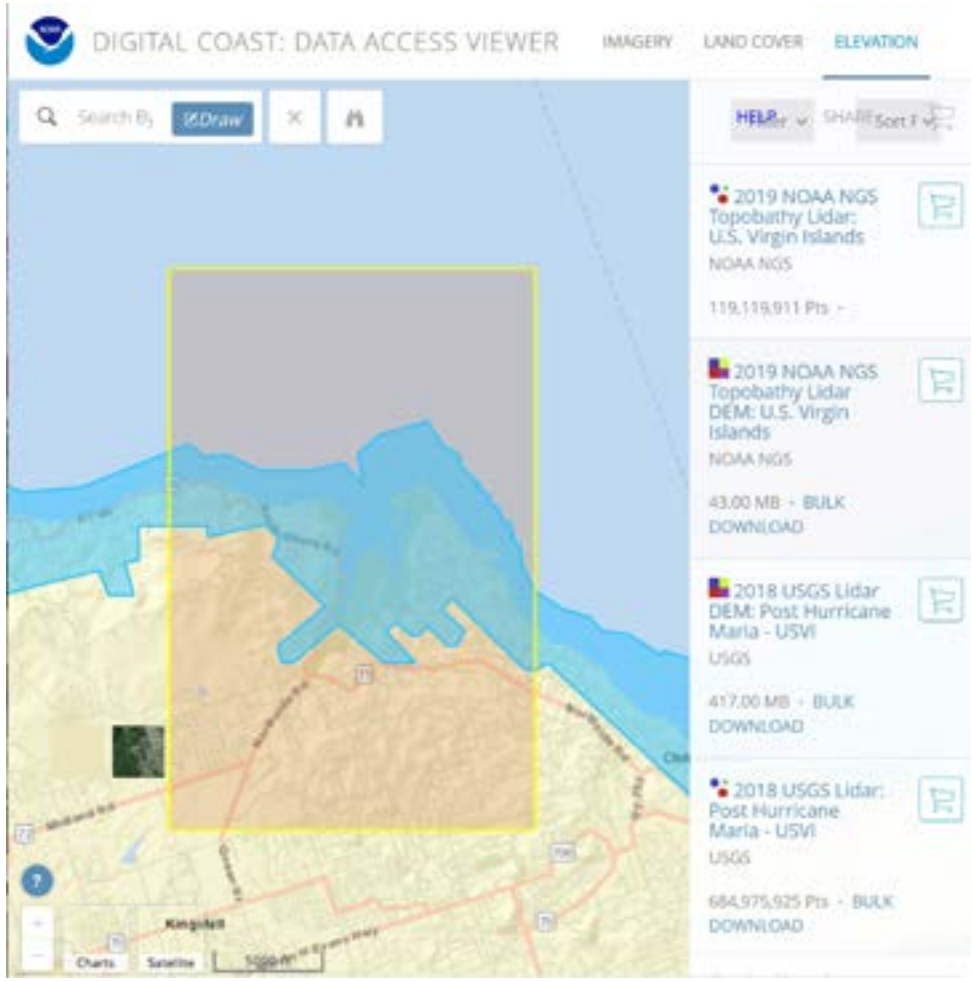
Bathymetric Data Viewer

Keep Track of Zero

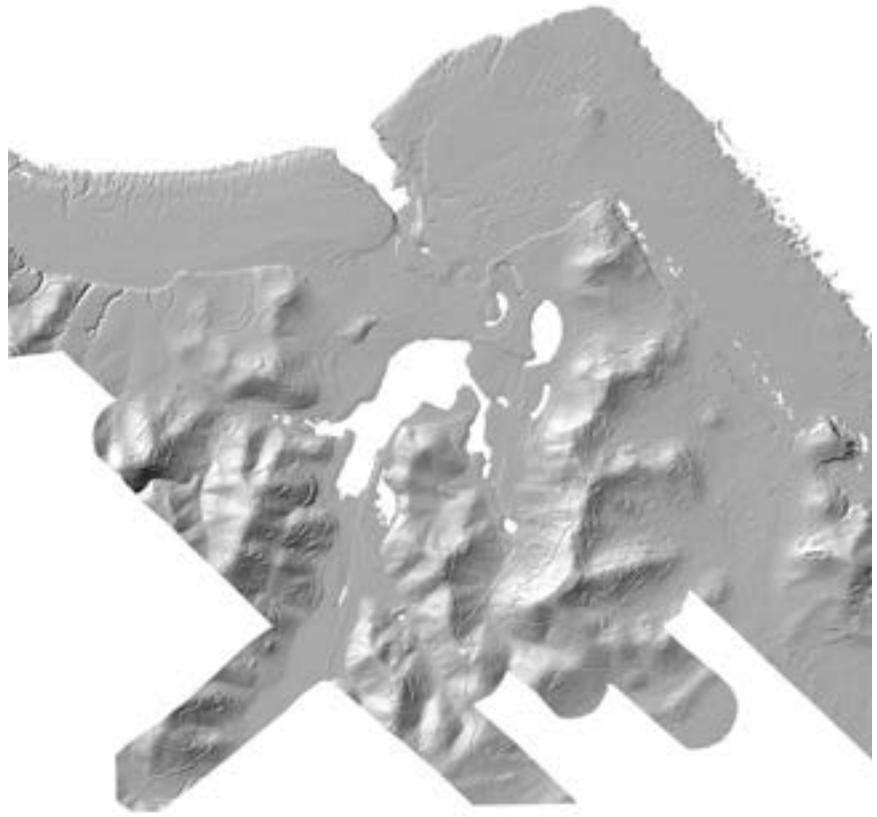
Bathymetric data typically uses mean-low-low-water **(MLLW)** for 0.
Topobathy data, which combines land topography and bathymetry, typically uses mean-high-water **(MHW)** for 0.

Where there is a significant tidal range, there can be a large difference between the water line at MLLW vs MHW.

TOPOBATHY DATA



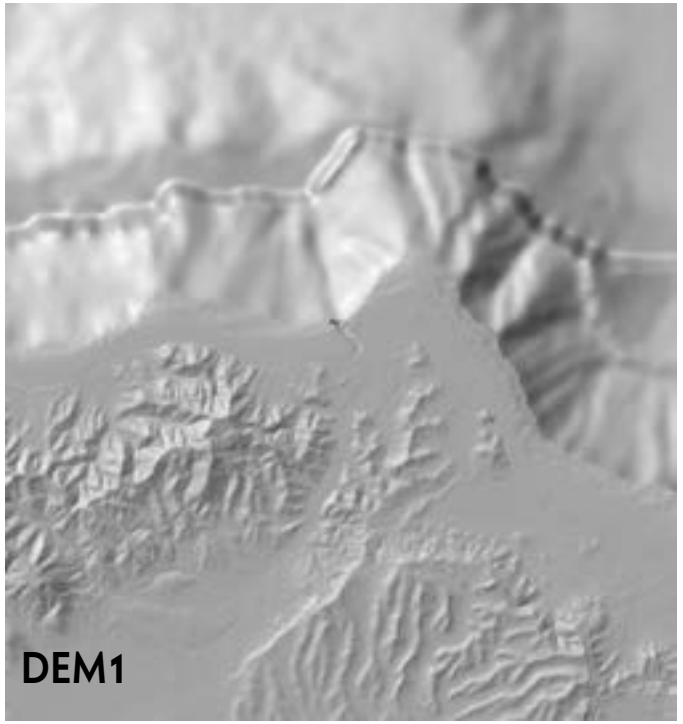
Topobathy data extent



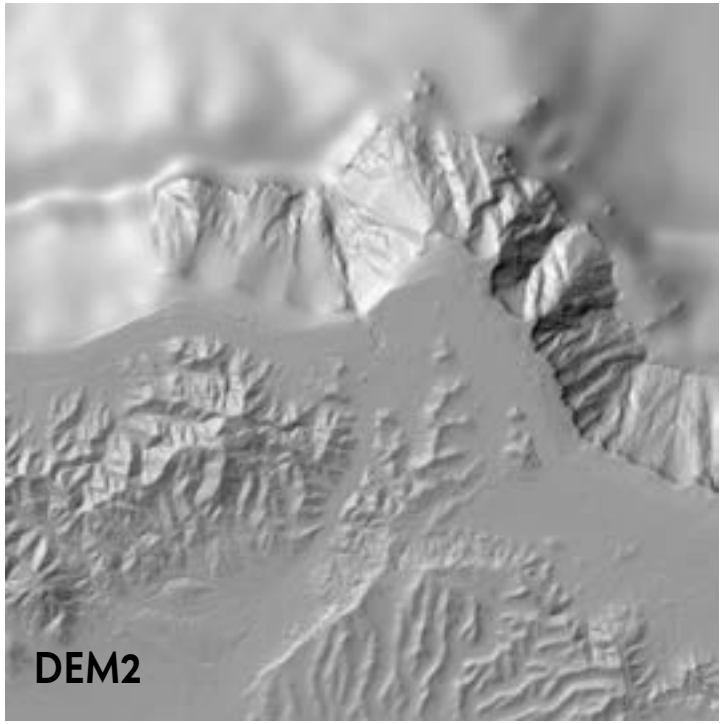
An enlarged view of the topobathy data*

*For visual clarity, I will use a simple hillshade to represent a DEM throughout my presentation.

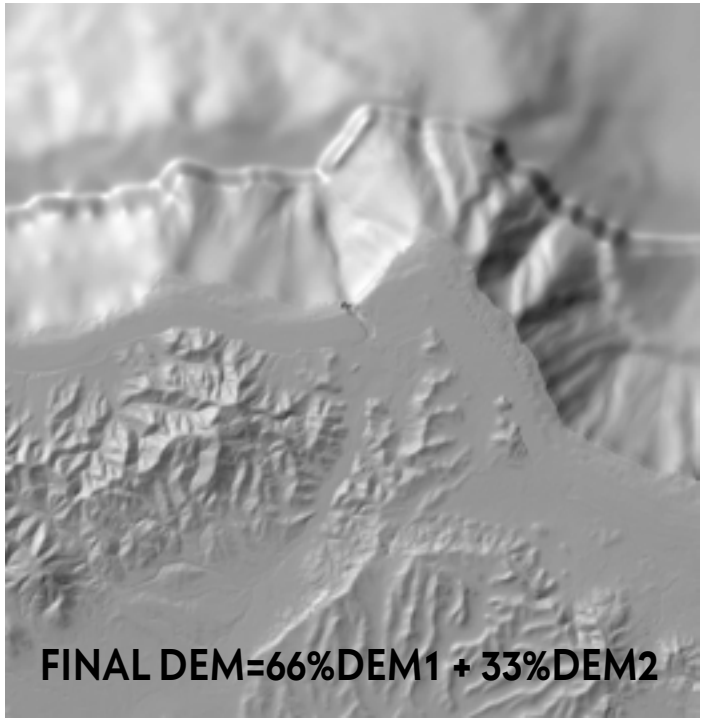
DEEPWATER BATHYMETRY OPTIONS



Early-2022 CUDEM download
Lower resolution but consistent.



Late-2022 CUDEM download
Better resolution in some areas but inconsistent across the project area.



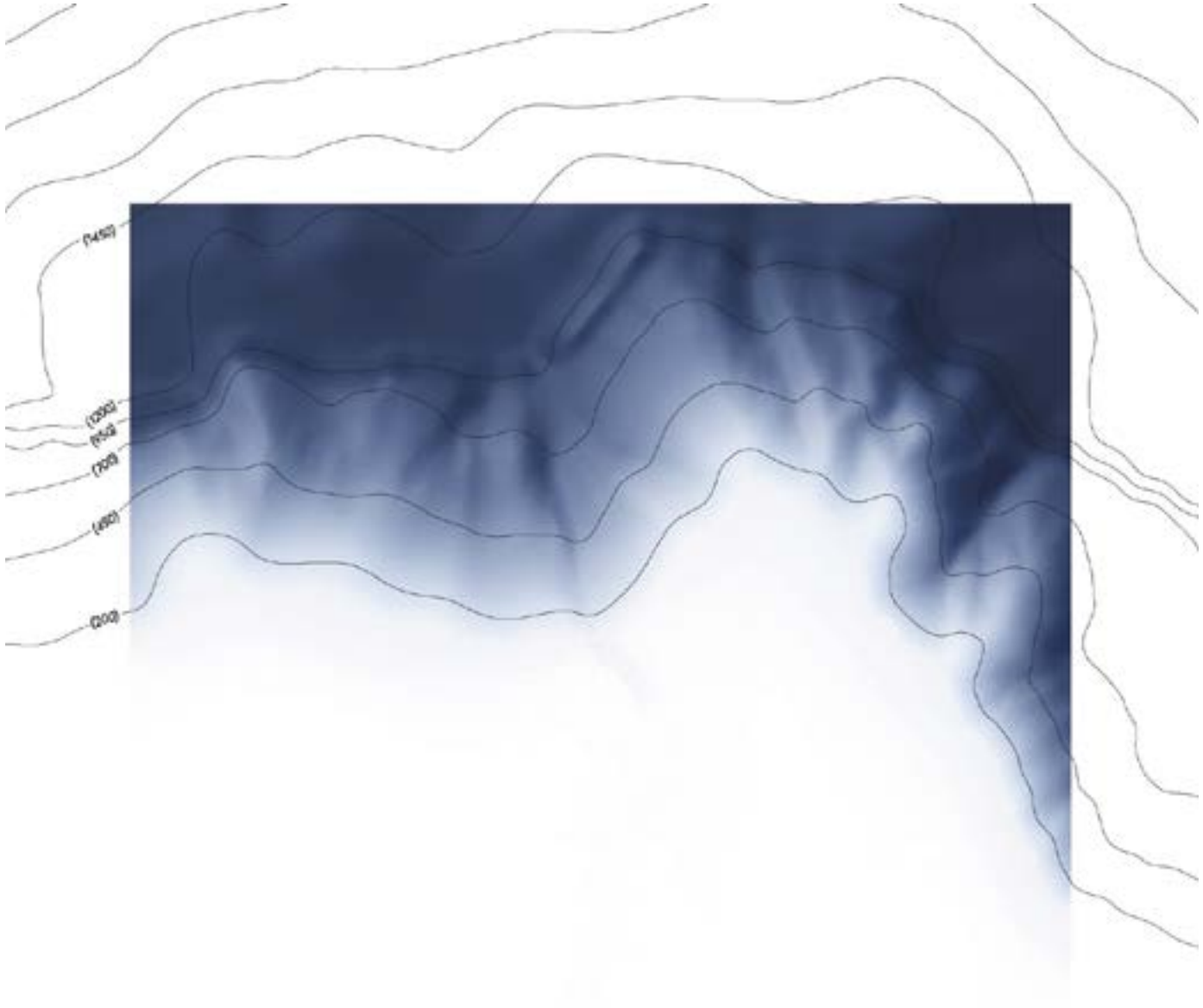
Weighted Average
Raster calculator equation:
(DEM1 + DEM1 + DEM2)/3

CONSIDERING DEEPWATER LIGHT

Using multi-directional hillshades to emphasize shadows

Even though it is completely dark below 1000 meters, we still use the principles of light and shadow to depict the ocean floor.

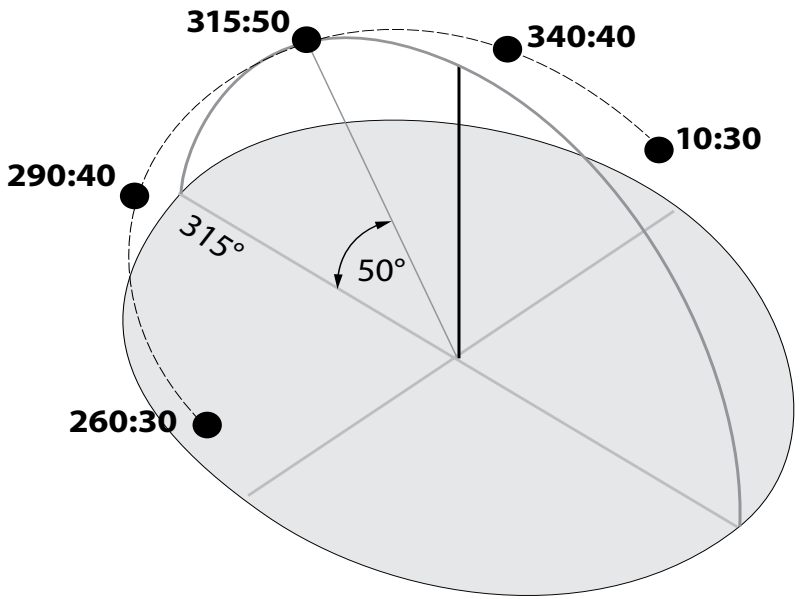
By the time sunlight descends to about 200 meters, all but the indigo blues of the color spectrum have been absorbed.



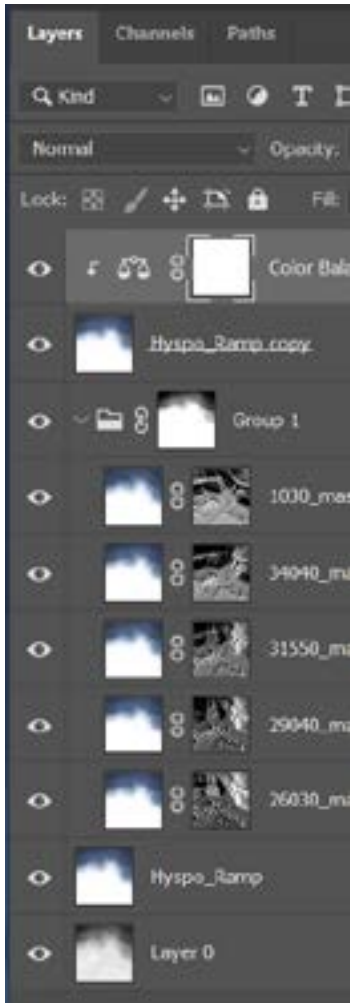
DEEPWATER SHADED RELIEF

A Multi-Directional Approach Based on Tom Patterson's Illuminated Shaded Relief Workflow

ARC OF HILLSHADES



The **azimuth:elevation**
of the five hillshades



PHOTOSHOP LAYERS

Stack of hillshade
masking layers

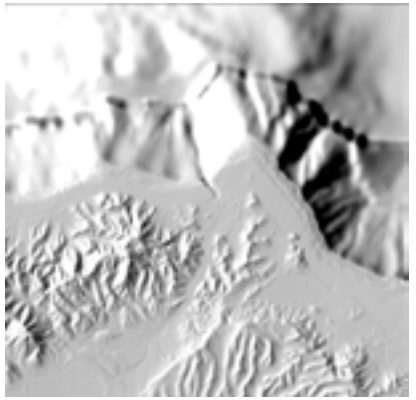
Tom Patterson's tutorial, "See the light: How to make illuminated shaded relief in Photoshop 6.0." www.shadedrelief.com/illumination/

DEEPWATER SHADED RELIEF

LAYER

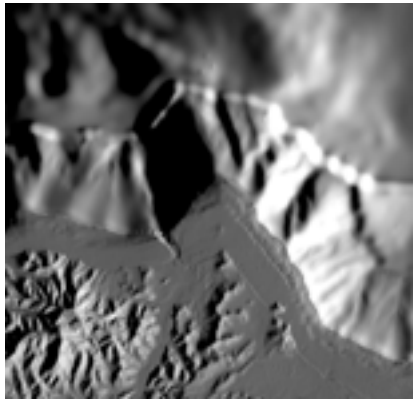
Hypsometric tint

LAYER MASK



Adjusted hillshade

Hypsometric tint



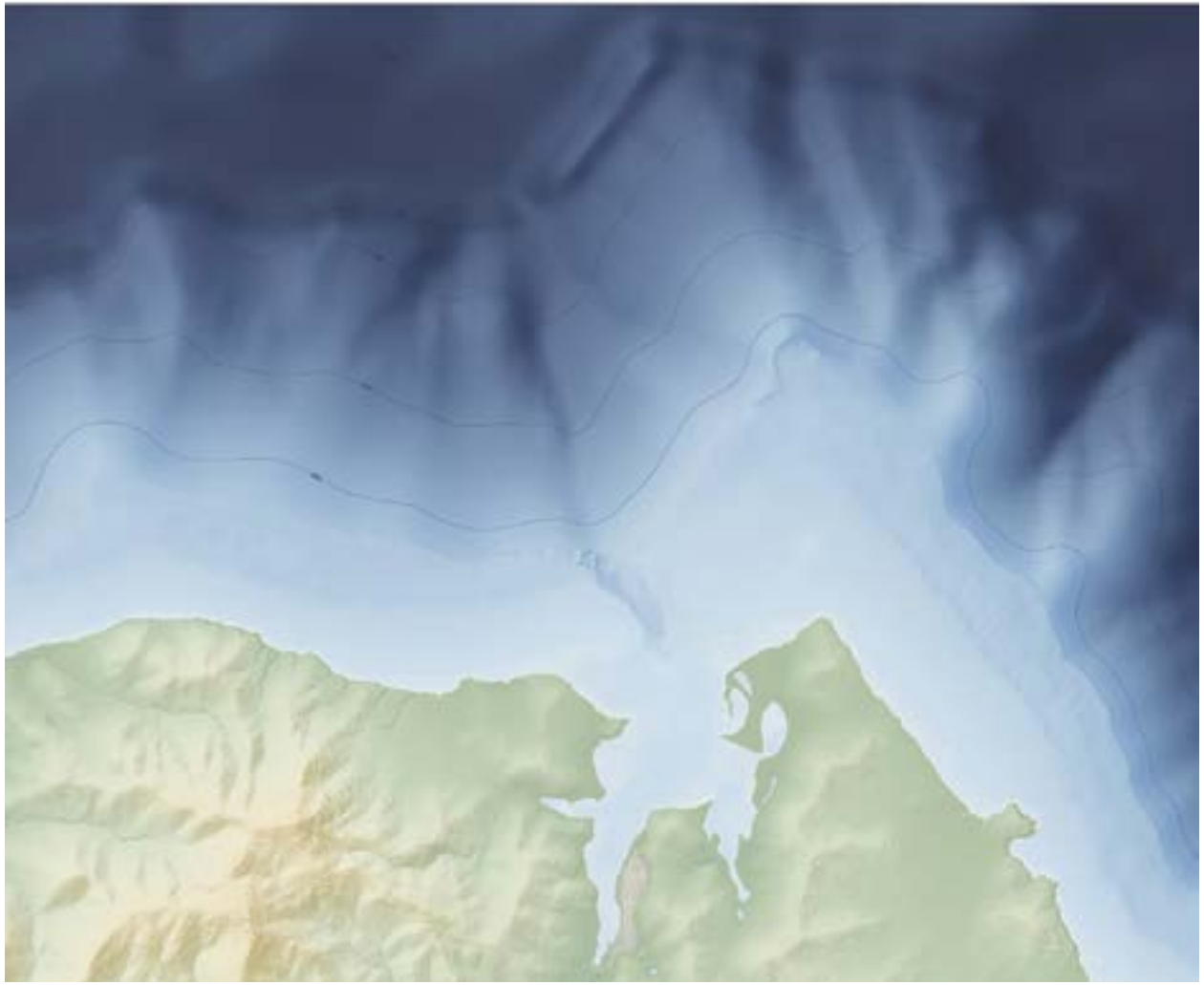
Inverted hillshade

MASKED HYPSOMETRIC TINT LAYER

DEEPWATER SHADED RELIEF

Masked Layers Blended and in Place

200 meters



SHALLOW-WATER SYSTEMS

Google Earth

GREAT MARSH, MASSACHUSETTS

High-energy system: 3-meter tides, moderate river flow and currents

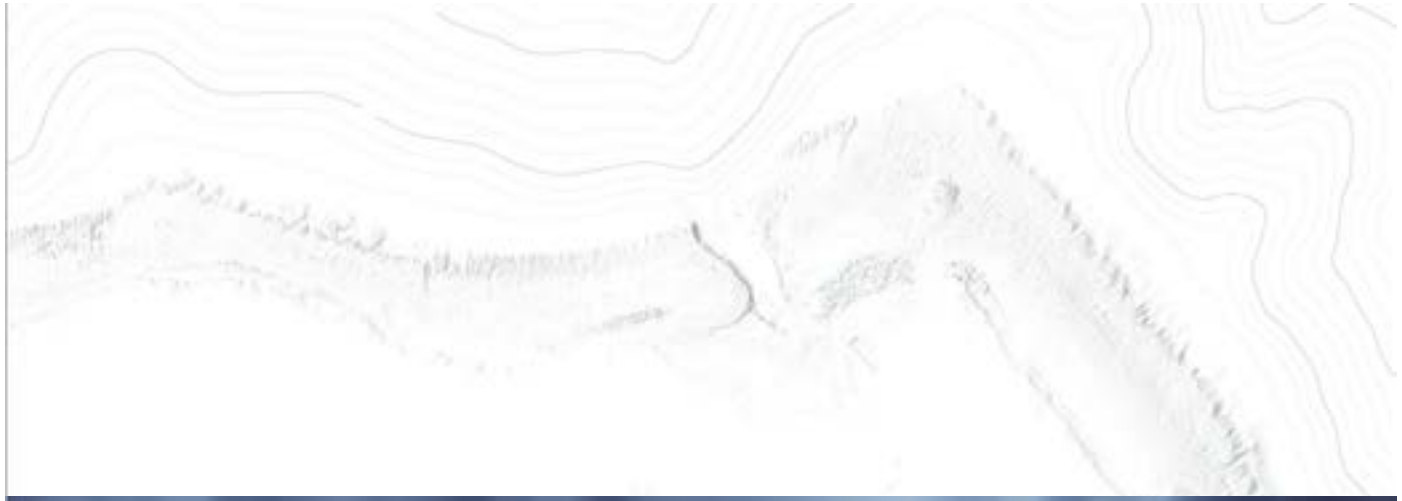
Google Earth

SALT RIVER, ST. CROIX, USVI

Low-energy system: 30-centimeter tides, minimal river flow, reef-protected.

SHALLOW-WATER COLOR & STRUCTURES

Hillshades masking a grey-green layer



Layered with multiply blend mode

TERRESTRIAL SHADED RELIEF

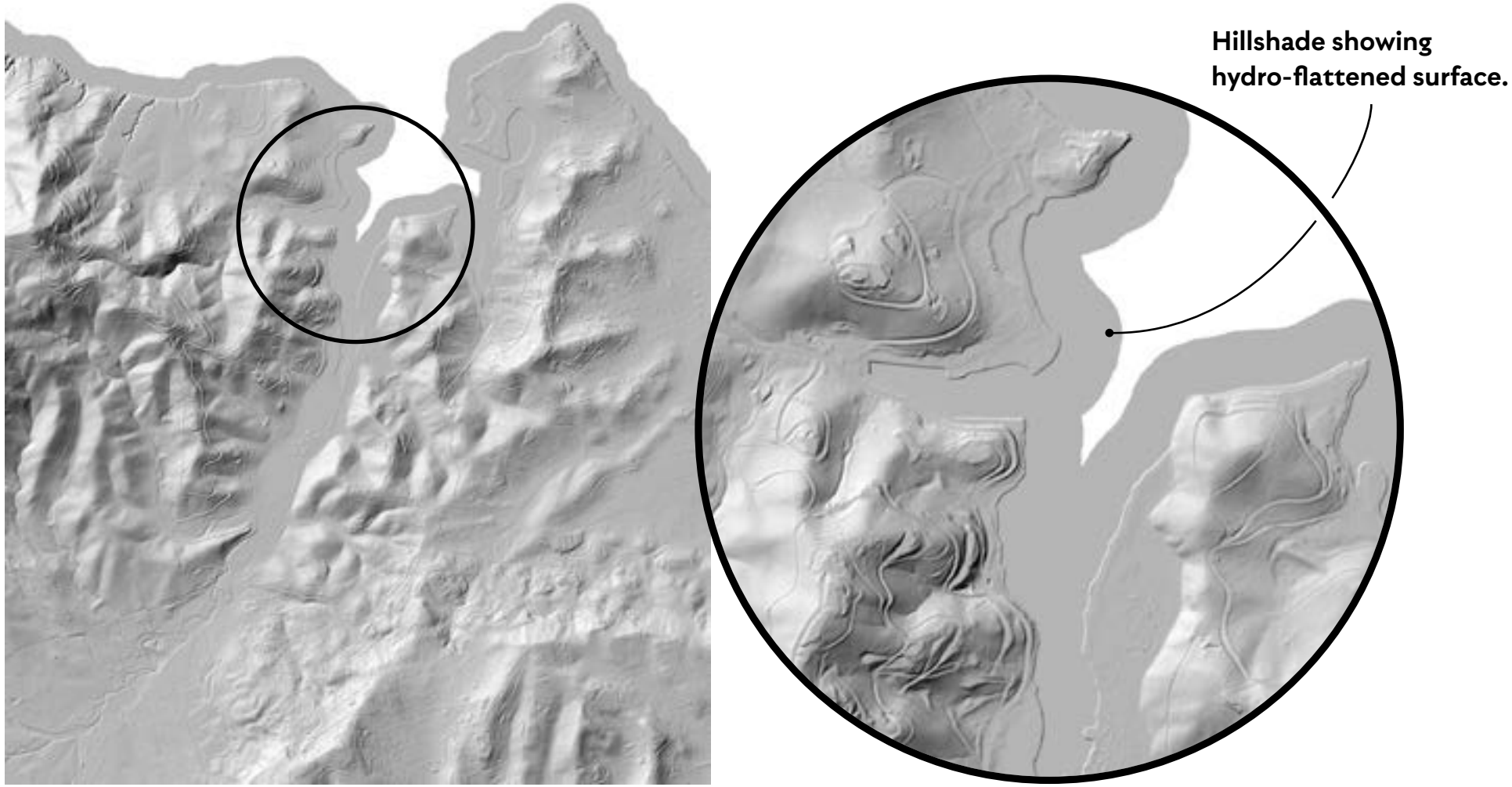
Before

After

Increasing the visual prominence of the tallest summit while yielding the dominant position in the visual hierarchy to the mangroves.

Hydro-flattening note:

USGS 3DEP DIGITAL ELEVATION MODELS



REPRESENTING WETLANDS

The Great Marsh shown with the classic wetland symbol.

Leveraging digital elevation models to represent the Great Marsh.

MANGROVES

Cartographically, mangroves are one of the many types of wetlands that defy a clean hydrological boundary.

SALT RIVER BAY MANGROVES

1958 USGS topographic map

Alternate mangrove symbol

Datasets connected from seafloor to summit by form and color.

Thank You!