

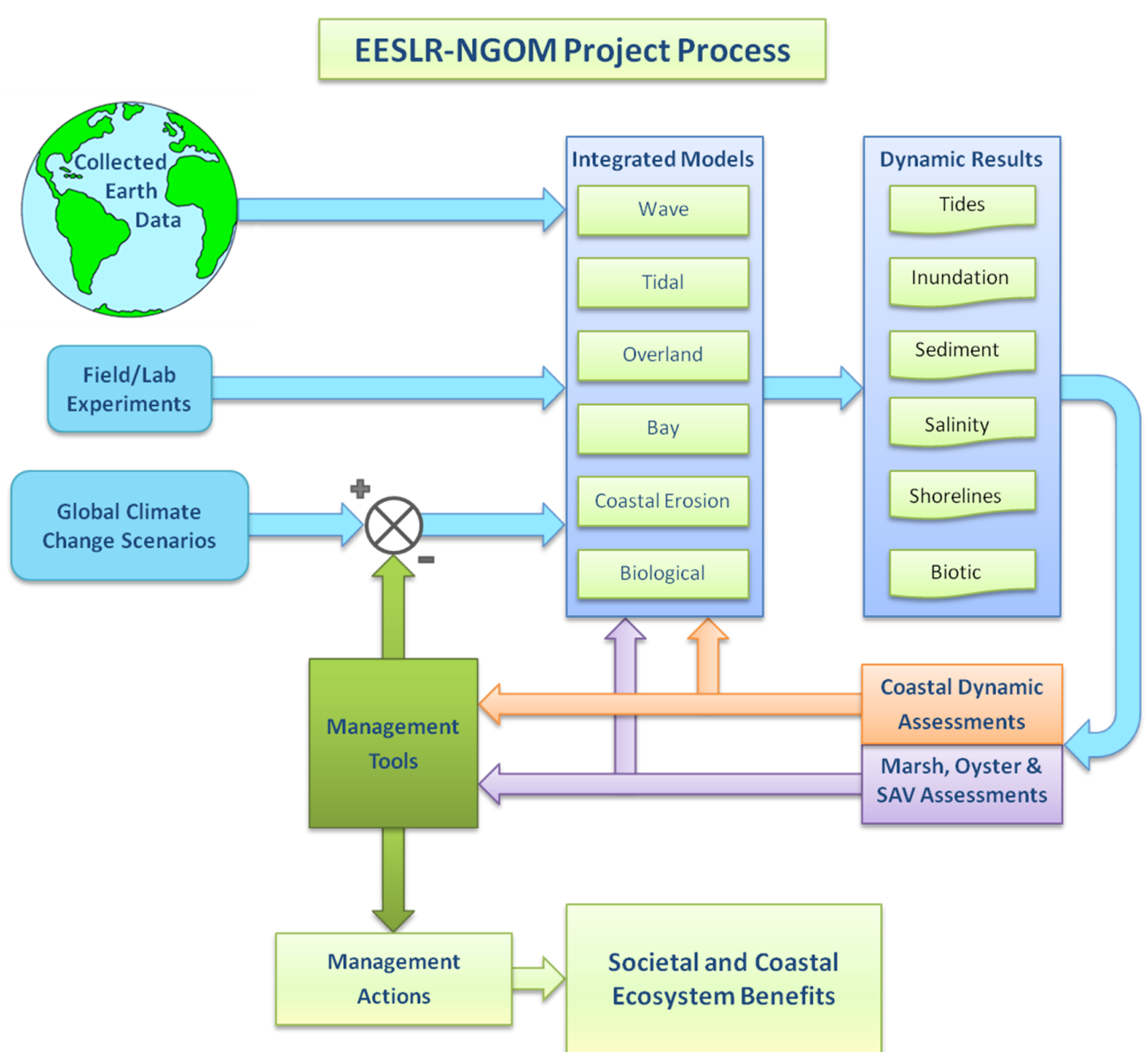
Building Stories about Sea Level Rise through Interactive Visualizations

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Introduction

This study is part of a five-year NOAA-funded interdisciplinary project focused on the assessment of Ecological Effects of Sea Level Rise in the Northern Gulf of Mexico.



Sea level rise (SLR) is an aspect of global climate change that can be communicated effectively using visuals. We focus on online interactive SLR viewers, which:

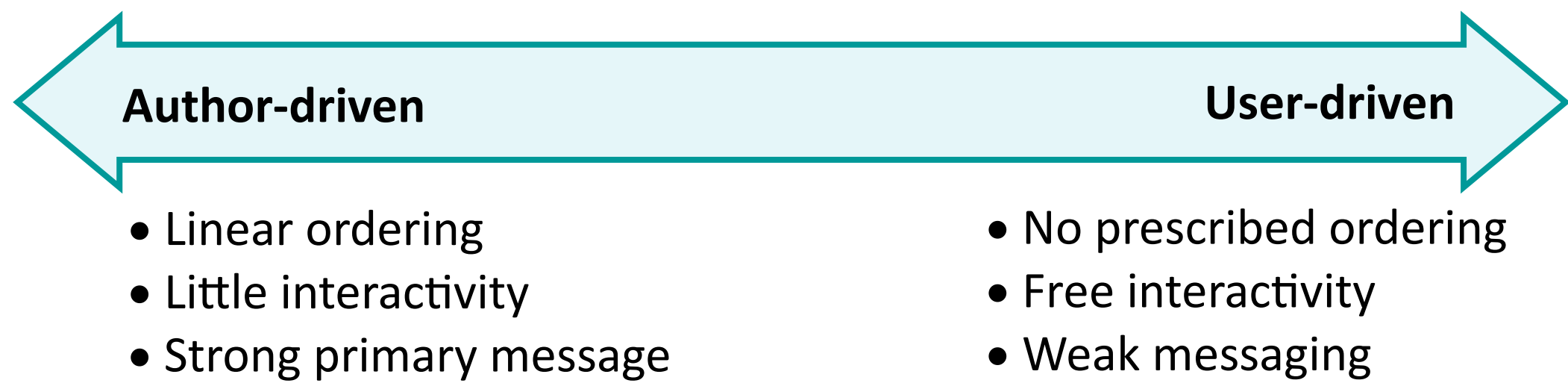
- Visualize SLR or coastal areas that could potentially be affected by SLR;
- Allow users to interact with the visualization by scrolling, zooming, and other features related to view selection;
- Use a map as a base layer; and
- Are located online.

SLR viewers can visualize a range of SLR scenarios to communicate about possible coastal impacts. They let us represent the effects and risks of SLR for coastal planning¹ and community outreach². As users interact with SLR viewers, they build personalized narratives about SLR's effects and risks.

By helping audiences visualize the potential impacts of SLR in locations that are personally important to them, we can motivate them to try to understand SLR and support efforts to mitigate or respond to it.

How SLR viewers help build narratives

Interactive media balance author-driven and user-driven narrative elements to create an overall narrative structure³. In other words, they are story-building tools.



When users interact in meaningful ways with an interactive visualization, they can gain a sense of shared agency⁴ and learn through a process of discovery⁵. However, including a high degree of user choice can make it difficult to communicate a strong central message³.

If we carefully balance author- and user-driven narrative elements with users' needs, SLR viewers can become more effective communication tools.

Three examples of storytelling with SLR viewers

Chesapeake Bay's purpose is to raise awareness of the risks of SLR among residents of the Chesapeake Bay area.

User **interaction** begins with an overview of the entire visualization area. This orients users and lets them “drill down” to points of interest.

Annotations include icons that frame a storyline by topic, photos that add **realism**, and text that tells stories about present or future risks and adds **emotional depth**.

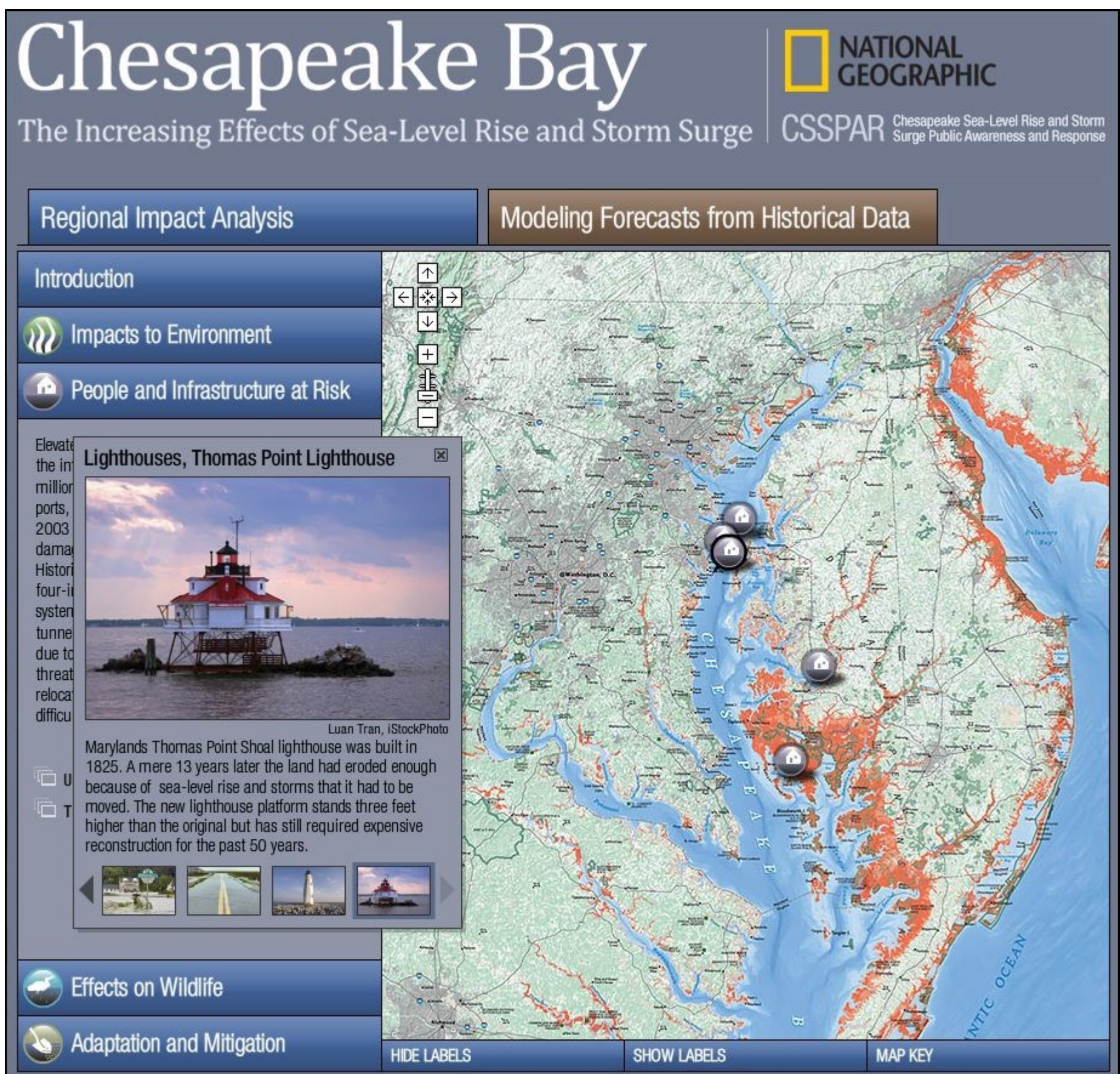
While Surging Seas covers the continental U.S., it still creates a **local focus** with targeted zooming and location-specific **annotations**.

The spare visual design aligns with the text's **dispassionate** focus on numbers. As an area floods, the ordered map disappears to reveal a more **realistic** (and chaotic) aerial photo beneath.

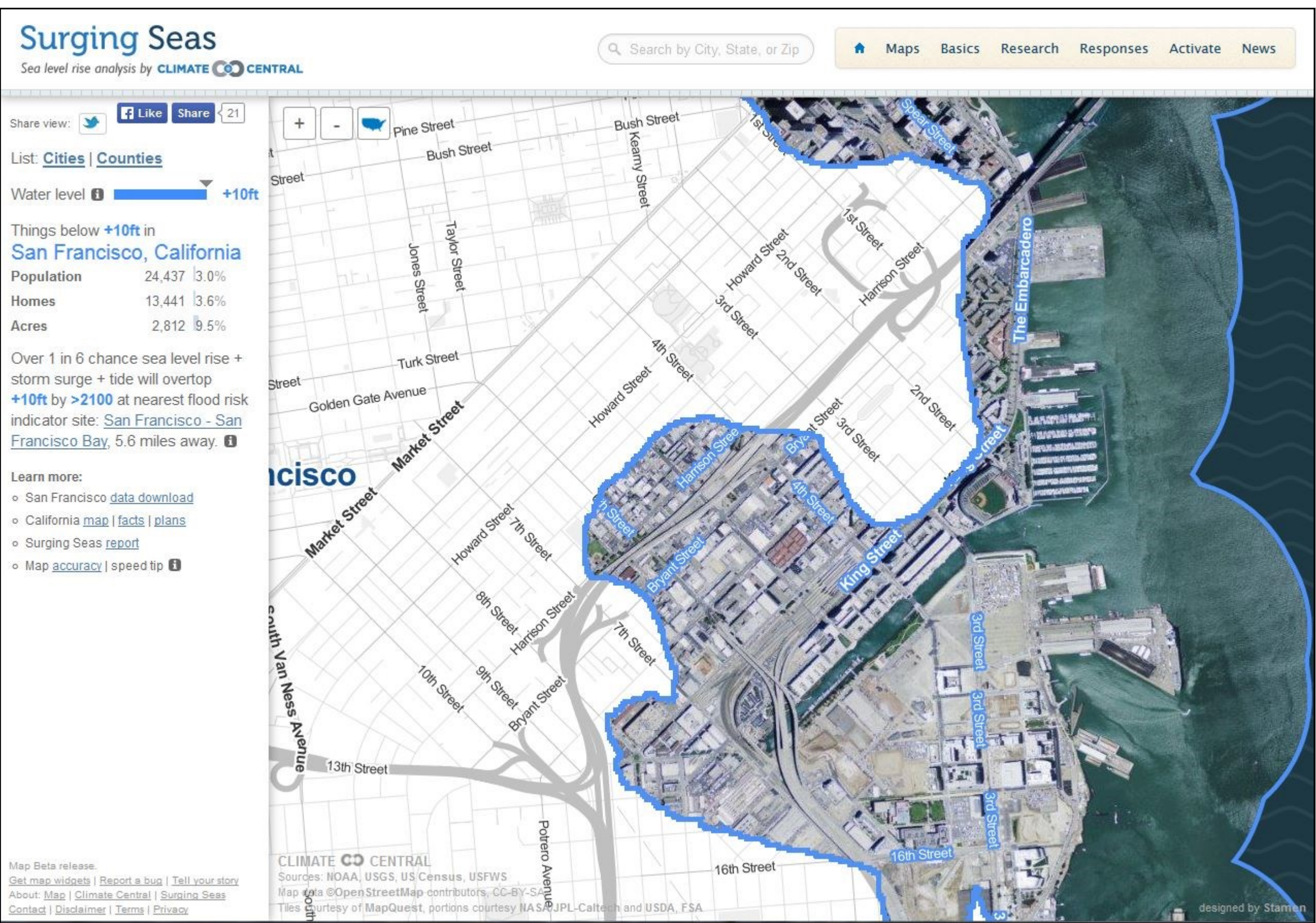
Based on the widely used Digital Coast, NJ Flood Mapper is a **decision-support tool** for both general and specialist users.

The slider bar that selects a SLR scenario creates a more **intuitive experience** than simply checking a box.

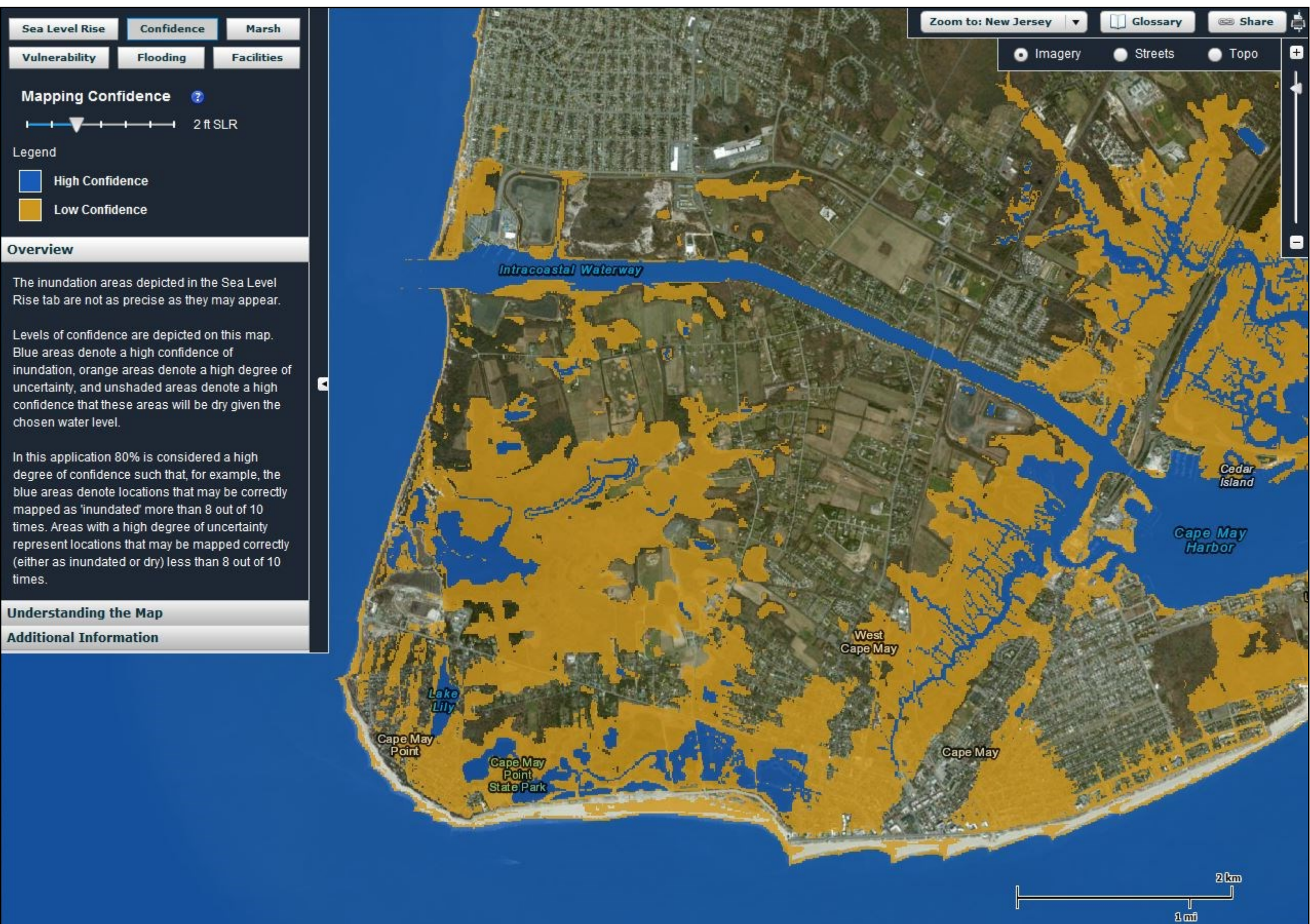
A place-based narrative is created by only including **data** for the NJ area.



Chesapeake Bay: The Increasing Effects of Sea-Level Rise and Storm Surge. Created by Chesapeake Sea-Level Rise and Storm Surge Public Awareness and Response, n.d.
www.chesapeakeadaptation.org



Surging Seas. Created by Climate Central, 2013.
sealevel.climatecentral.org/surgingseas



NJ Flood Mapper. Created by Center for Remote Sensing and Spatial Analysis, Jacques Cousteau National Estuarine Research Reserve, & NOAA Coastal Services Center, 2013. slrviewer.rutgers.edu

The limited geographic scope lets the authors construct a **place-based** narrative emphasizing the Chesapeake Bay's unique features and challenges.

Data sources and various types of uncertainty are explained in non-specialist language, making them accessible to a general audience.

SLR is **represented** in shades of red-orange. Color intensity indicates the **relative risk** that an area will flood.

As users move around the map, the sidebar information updates with details from the new view area, creating a clear relationship between **cause and effect**.

There are several ways to **save and share** map views and information. New tools being added to the SLR viewer include **photos** and **graphs** that tell stories about **risk** in localized areas.

A variety of data about coastal vulnerability are presented, each in its own **storyline**. Text **annotations** explain what is being represented and give links to in-depth explanations.

The alternate view of SLR shown here presents **model confidence** in a visual format.

Annotations include computer-generated graphics of what flooding will look like in specific locations.

Methodology

We performed a content analysis of 20 online interactive SLR viewers that were obtained through a purposive Google search. We considered four levels of narrative design⁶ in relation to explicit or implicit target audiences:

Interactivity: introductory & default views, navigation, info specification

Annotations: text explanations, graphics & icons, social networking

Visual representation: type of base map, how SLR is depicted

Data: provenance, timeliness, SLR model components

How design choices provide narrative structure

“Lower level” design choices propagate upward and “higher level” choices constrain audience interpretation.

- **Data choices** affect resolution, accuracy, and dynamic capabilities.
- **Visual representation choices** affect how flooding and human and ecological responses are communicated.
- **Annotations** provide facts, help users interpret, create emotional links, and enhance credibility.
- **Interactivity** orients users, enables exploration, guides user choices, and constrains the overall narrative.

Many design features of SLR viewers were driven by intended use and audience, including the complexity of underlying modeling, the data analysis options that were available to users, and the emotional tone of text and images.

Recommendations for effective storytelling

We recommend considering these narrative elements when designing effective SLR viewers:

- **Explain uncertainty and risk** (annotation level)
- **Use an appropriate level of realism** (visual representation and annotation levels)
- **Incorporate cause and effect sequencing** (data and interactivity levels)
- **Enable customization for user needs** (annotations and interactivity levels)
- **Balance local and global elements** (all levels)
- **Support users with on-demand explanation** (annotation level)

Only a thorough understanding of our users' needs will let us make effective design choices and create compelling narrative-building tools.

Selected references

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