Sea Level Rise 101 & Beyond

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understanding the science
The earth is warming...
Sea Level Ups & Downs

Vostock Core, Antarctica [Petit et al., 2001]
Global Sea Level [Siddall et al., 2003]

$\Delta T$
$\text{CO}_2$
Sea Level (10m)

$\Delta \text{Sea level (10m)}$ from present

Years before Present

$\text{CO}_2$ (ppm)
Sea Level Ups & Downs

Stanford et al. (2011)
Global Causes of SLR

https://www.youtube.com/watch?v=VEuEqgdJXHg
Global SLR – Video Recap

Two main causes:
- Thermal expansion
- Melting of glaciers & ice sheets

Uncertainty in:
- Rate of melting
- How this will affect SLR

https://www.youtube.com/watch?v=VEuEqgdJXHg
Local Influences on SLR

- Thermal expansion
- Melting of Glaciers & Ice Sheets
- Terrestrial Water Storage
- Tectonic Activity

Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future
http://www.nap.edu/catalog.php?record_id=13389
Measuring SLR in the Anthropocene

1.7 mm/yr

3.2 mm/yr

Toda

Today

PAST

PRESENT

FUTURE

GEOLOGICAL ESTIMATES

OBSERVATIONS

PROJECTIONS

Satellite

Empirical

Tide Gauges

Altimetry

Model

Sea Level Change (Inches)

1800
1850
1900
1950
2000
2050
2100

(green shading indicates level of uncertainty)
### Sea level rise (SLR) in California

<table>
<thead>
<tr>
<th>Time Period</th>
<th>“Low”</th>
<th>“Mid”</th>
<th>“High”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 – 2030</td>
<td>2 inches</td>
<td>6 in (0.5 ft)</td>
<td>12 in (1 ft)</td>
</tr>
<tr>
<td>2000 – 2050</td>
<td>5 in (0.4 ft)</td>
<td>11 in (1 ft)</td>
<td>24 in (2 ft)</td>
</tr>
<tr>
<td>2000 – 2100</td>
<td>17 in (1.5 ft)</td>
<td>37 in (3 ft)</td>
<td>66 in (5.5 ft)</td>
</tr>
</tbody>
</table>

Beyond SLR...storms & tides

Coastal Flooding graphic courtesy of Climate Education Partners
Beyond SLR...storms & tides

Hurricane Marie
September 2014
Expected Impacts from SLR and Storms

- Accelerated beach erosion rates
- Greater incidence of cliff failures
- Landwards translation of coastal flooding & inundation
- Beach/shore safety compromised
- Saltwater intrusion into coastal aquifers
- Impacts to navigation conditions
USGS Coastal Storm Modeling System (CoSMoS)

1. Global forcing using the latest climate models
2. Drives global and regional wind/wave models
3. Scaled down to local hazards projections
visualizing the science
Our Coast, Our Future

http://ourcoastourfuture.org
Our Coast, Our Future

No SLR
No storm

100 cm SLR
No storm

100 cm SLR
100 yr storm

100 yr storm

http://ourcoastourfuture.org
Socio-Economic Information

Led by Dr. Nathan Wood, USGS
Santa Monica Pier
Virtual Reality & Behavior Change

- Research conducted by Jeremy Bailenson, Stanford University (Virtual Human Interaction Lab)
VR Presence & Behavior Change

- **Reptilian**
  - Heart rate, breathing, body temperature & balance

- **Limbic (“old mammalian”)**
  - Records memories of positive or negative – e.g. memories
  - Value judgments

- **Neocortex (“new mammalian”)**
  - Human language, abstract thought, learning abilities
Santa Monica Owl

On Santa Monica Pier – next week!
Mobile Owl: http://mobileowl.co/samo/
contributing to the science
Urban Tides Community Science Initiative

- Collect images to visualize current flooding risks in So Cal
- Images to ground truth and calibrate scientific models
- Engage communities in meaningful science and invite into discussion of how we can adapt to rising seas
- Increase ocean and climate literacy within our communities

http://dornsife.usc.edu/uscseagrant/urban-tides-initiative/
Urban Tides Community Science Initiative

- Worked w/USGS modelers and GIS team to develop photo guidance
  - 2 steps landward from water line
  - Take photo parallel to shore

http://dornsife.usc.edu/uscseagrant/urban-tides-initiative/
Urban Tides Photo Database: Entry Form

Use this form when uploading a photo from your computer. Upload photos and data here: https://getliquid.io

Record 1

Photo Location:
Please use your phone’s compass to take a GPS location in latitude and longitude.

Latitude

Longitude

Orientation:
Use your phone’s compass to determine (i.e. W, NE, etc.)

Date:

Time:

General Comments: This is the field to provide anything that you find interesting about your photo or information you feel is important to convey. This is not a required field.

Record 2

Photo Location:
Please use your phone’s compass to take a GPS location in latitude and longitude.

Latitude

Longitude

Orientation:
Use your phone’s compass to determine (i.e. W, NE, etc.)

Date:

Time:

General Comments: This is the field to provide anything that you find interesting about your photo or information you feel is important to convey. This is not a required field.
thank you!

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