Sea level is rising

- Could rise anywhere from lower bound of 3 feet to upper bound of 15 feet by 2100
- Estimates based modeling ice sheets and on paleoclimate record
- Even a small rise has huge consequences
- Loss of homes and infrastructure to value of $100s of billions
Flooding Risk

Thanks to Radley Horton for this slide.
What is at risk:

- Homes
What is at risk:

- Homes
- Commercial buildings (offices, factories)
What is at risk:

- Homes
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- Infrastructure (roads, airports, railways, bridges, docks)
What is at risk:

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- Commercial buildings (offices, factories)
- Infrastructure (roads, airports, railways, bridges, docks)
- Agricultural land
What is at risk:

- Homes
- Commercial buildings (offices, factories)
- Infrastructure (roads, airports, railways, bridges, docks)
- Agricultural land
- Recreational sites (beaches, parks)
  - Beaches are at sea level and will be the first to go
- Beaches don’t appear as assets on any balance sheets but they create value for coastal businesses
Financial Risks

- Homes and commercial buildings are financed by mortgages
Financial Risks

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- Infrastructure by municipal bonds and bonds issued by entities such as Port Authority
Financial Risks

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- Infrastructure by municipal bonds and bonds issued by entities such as Port Authority
- As structures lose value, the collateral behind these securities is reduced in value
<table>
<thead>
<tr>
<th></th>
<th>New York City</th>
<th>Miami</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 foot rise</td>
<td>100,000/$39 billion</td>
<td>54,000/$14 billion</td>
</tr>
<tr>
<td>10 foot rise</td>
<td>300,000/$100 billion</td>
<td>130,000/$32 billion</td>
</tr>
</tbody>
</table>

Table 1: homes and property values at risk from flooding in NYC and Miami under 6 and 10 foot rises in sea level.
Housing in Coastal States

Current Property Value Below Mean Sea Level by 2050, billion USD

- Median
- 1-in-100

Florida (FL): $15, $36, $70
Louisiana (LA): $6, $3, $7
Massachusetts (MA): $10, $13
Maryland (MD): $7
New York (NY): $19

Current Property Value Below Mean Sea Level by 2100, billion USD

- Median
- 1-in-100

Florida (FL): $123
Louisiana (LA): $143
Massachusetts (MA): $207
Maryland (MD): $12, $12
New York (NY): $15, $24, $53
## Cities at risk worldwide

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Guangzhou</td>
</tr>
<tr>
<td>2</td>
<td>Miami</td>
</tr>
<tr>
<td>3</td>
<td>New York-Newark</td>
</tr>
<tr>
<td>4</td>
<td>New Orleans</td>
</tr>
<tr>
<td>5</td>
<td>Mumbai</td>
</tr>
<tr>
<td>6</td>
<td>Nagoya</td>
</tr>
<tr>
<td>7</td>
<td>Tampa-St Petersburg</td>
</tr>
<tr>
<td>8</td>
<td>Boston</td>
</tr>
<tr>
<td>9</td>
<td>Shenzen</td>
</tr>
<tr>
<td>10</td>
<td>Osaka-Kobe</td>
</tr>
</tbody>
</table>
### US Airports at risk

<table>
<thead>
<tr>
<th>Airport Name/Location</th>
<th>Height above Sea Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louis Armstrong/New Orleans</td>
<td>-1.7</td>
</tr>
<tr>
<td>Fort Lauderdale</td>
<td>5.2</td>
</tr>
<tr>
<td>San Francisco</td>
<td>5.4</td>
</tr>
<tr>
<td>Oakland</td>
<td>5.6</td>
</tr>
<tr>
<td>La Guardia</td>
<td>6.7</td>
</tr>
<tr>
<td>Isla Grande/San Juan Puerto Rico</td>
<td>6.8</td>
</tr>
<tr>
<td>Miami</td>
<td>7.4</td>
</tr>
<tr>
<td>Honolulu</td>
<td>7.7</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>8.3</td>
</tr>
<tr>
<td>Newark</td>
<td>8.6</td>
</tr>
<tr>
<td>Ronald Reagan National/Washington DC</td>
<td>10.3</td>
</tr>
<tr>
<td>Tampa</td>
<td>10.6</td>
</tr>
<tr>
<td>JFK/New York</td>
<td>11.3</td>
</tr>
</tbody>
</table>
# Roads at Risk

<table>
<thead>
<tr>
<th>State</th>
<th>Miles of road within 10 feet of sea level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>10630</td>
</tr>
<tr>
<td>Texas</td>
<td>6136</td>
</tr>
<tr>
<td>North Carolina</td>
<td>3267</td>
</tr>
<tr>
<td>California</td>
<td>2634</td>
</tr>
<tr>
<td>New Jersey</td>
<td>2144</td>
</tr>
<tr>
<td>South Carolina</td>
<td>1872</td>
</tr>
</tbody>
</table>
Financial Counterparts

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“Consider an expensive beachfront house that is highly likely to be submerged eventually, although "eventually" is difficult to pin down and may be a long way off."
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• Or will the trigger be one or two homeowners who decide to sell defensively?”
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- Today we can only speculate about the answer
- But answers are emerging.
  - Property markets on the east coast already show impacts of storm risks
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- But answers are emerging.
  - Property markets on the east coast already show impacts of storm risks
- In South Florida some markets are responding: Florida Sun-Sentinel -
  - “Florida is at greatest risk of property loss not just because it has the longest sea coast in the continental U.S. and the most expensive coastal real estate, but because of the state's low elevation and high water table. Inland flooding will become common during high tides from water rising up through the ground, overflowing canals and drainage systems in low-lying inland communities.”
.. there are indications that investors are already looking to higher ground elsewhere in the city, such as the traditionally poor, black neighborhoods of Little Haiti and Liberty City. “The older urban core was settled on the coastal ridge and anything below that was flooded. The coastal ridge we’re talking about is clearly gentrifying,”*

* The Guardian Aug 29 2017  ** Scientific American May 1 2017
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● High Ground Is Becoming Hot Property as Sea Level Rises - Climate change may now be a part of the gentrification story in Miami real estate **

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  - Macroeconomic consequences as households retrench
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● Could the anticipation of this cause a crisis?