

Are We Ready?

Sea Level Rise in California

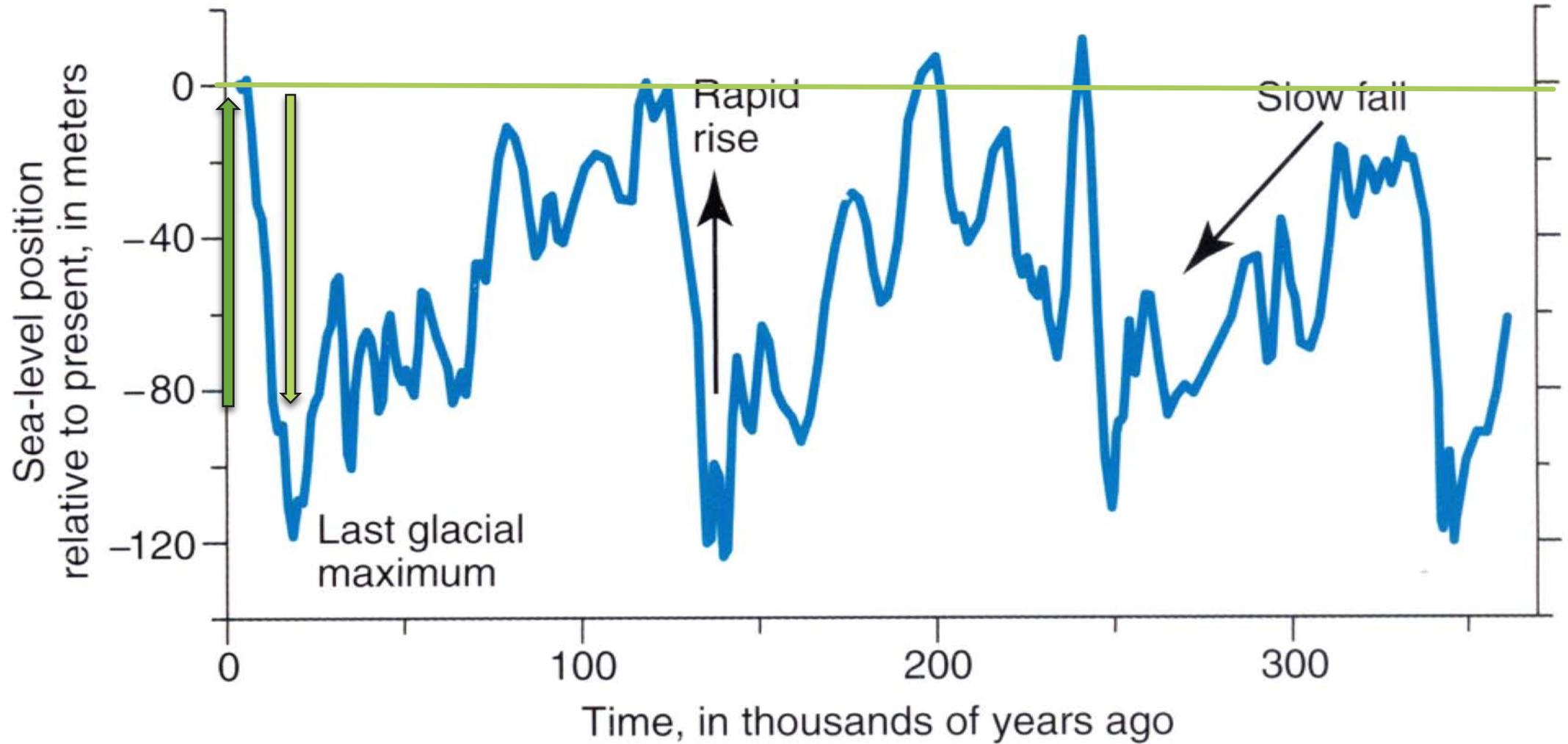


Dr. Kiki Patsch

California State University Channel Islands

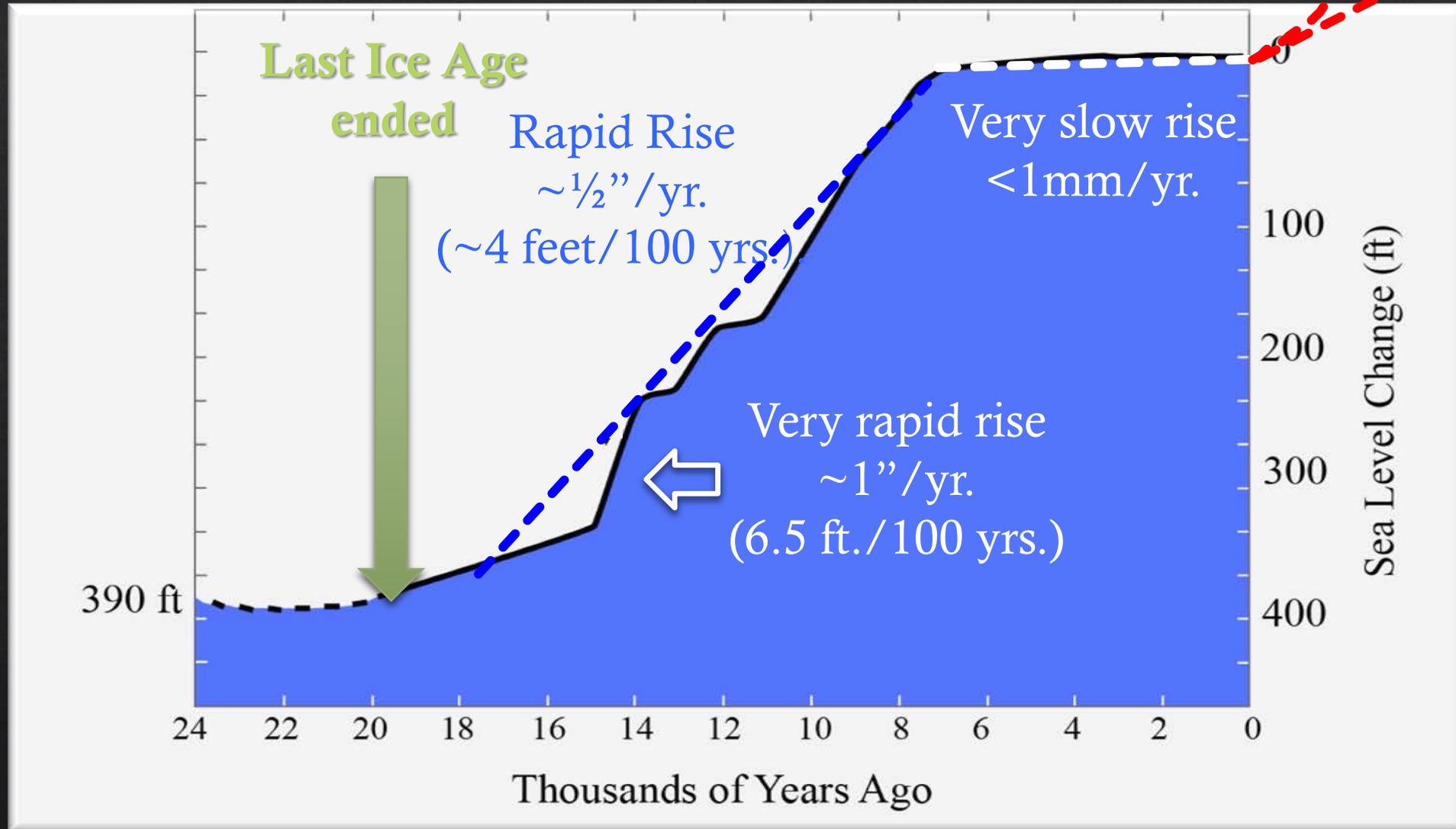


Historic Fluctuations in Sea Level

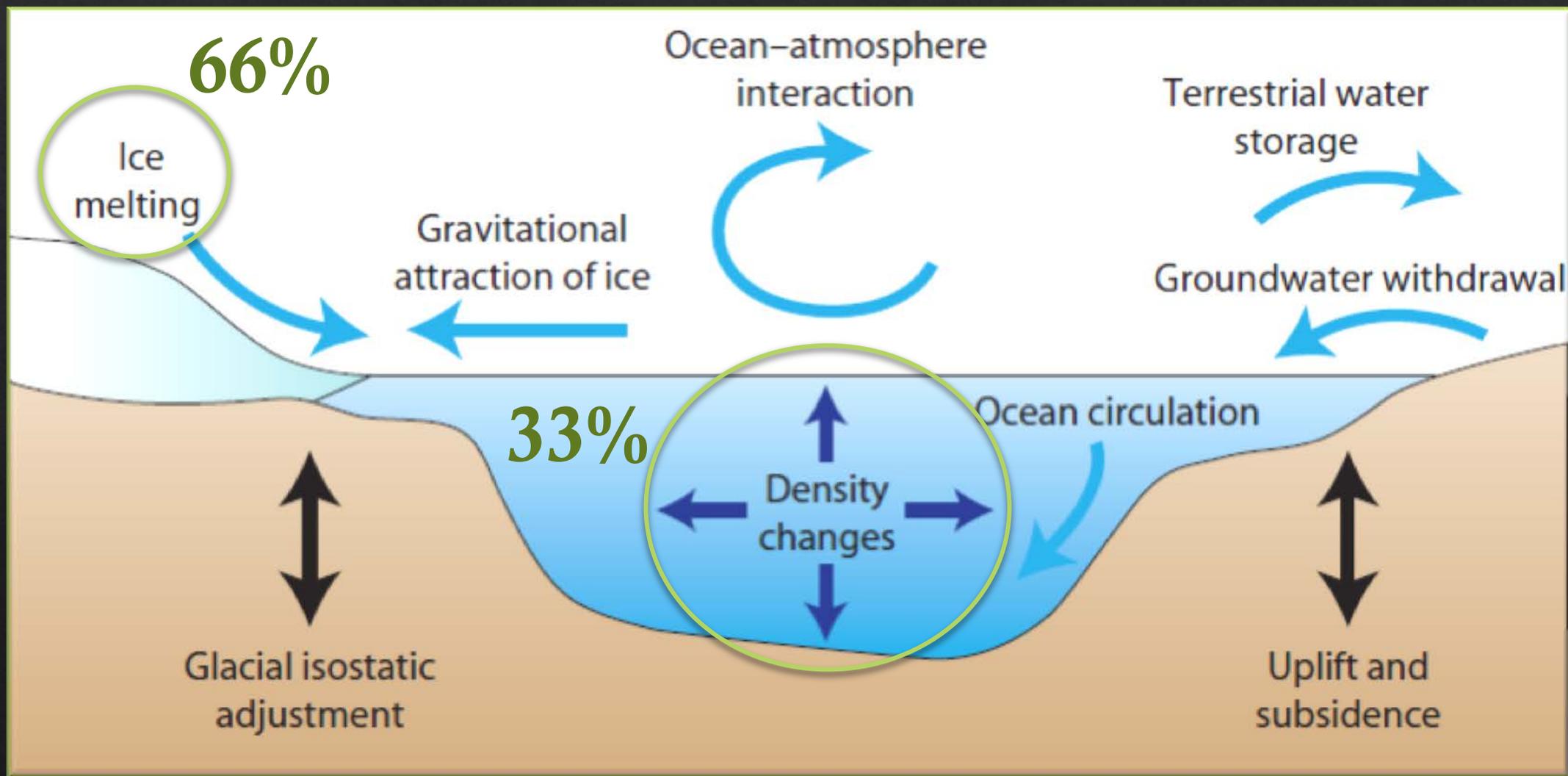


RECENT SEA-LEVEL RISE

8 inches of SLR since 1880



Components of Global and Regional Sea-Level Rise



Natural Shorelines



Mangroves



Coral Reefs



Seagrass



Beaches

**~150 million
people globally
live within
3 feet of high tide.**



San Francisco

**~13 million
people in USA
live within
6 feet of high tide**



Santa Barbara

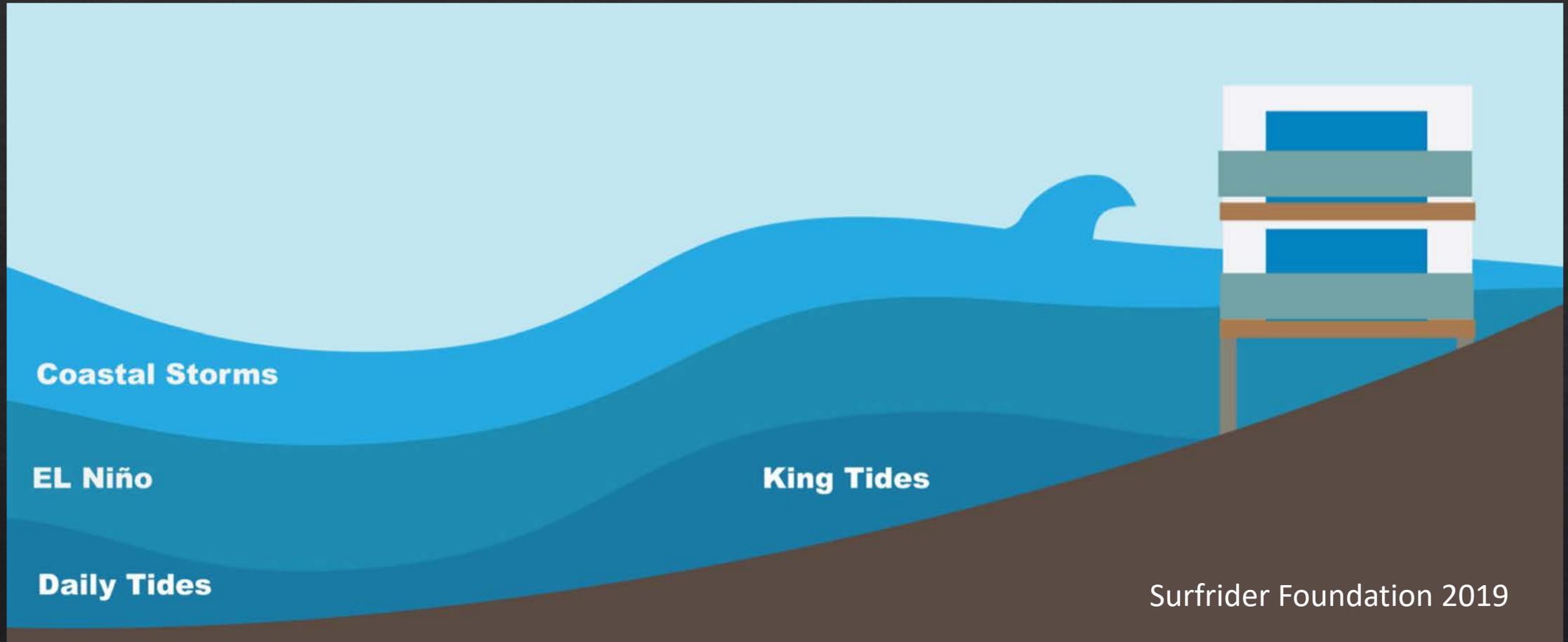


Sea level is rising and the bath tub is overflowing, but...

Extreme events are going to be of greater concern in the near term



Sea level sets a baseline



SLR will also be worse during El Nino

King Tide at Pierpont Beach, 2015 8.2 ft. tide



Short-Term Impacts of High Tides and Large Storm Waves Mission Beach, San Diego- 1988



High Tides and Storm Waves make a devastating combination



Solimar Beach
Ventura County

Rising Seas in California

AN UPDATE ON SEA-LEVEL RISE SCIENCE



APRIL 2017

State of California Sea-Level Rise Guidance

2018 UPDATE



CALIFORNIA
OCEAN
SCIENCE
TRUST

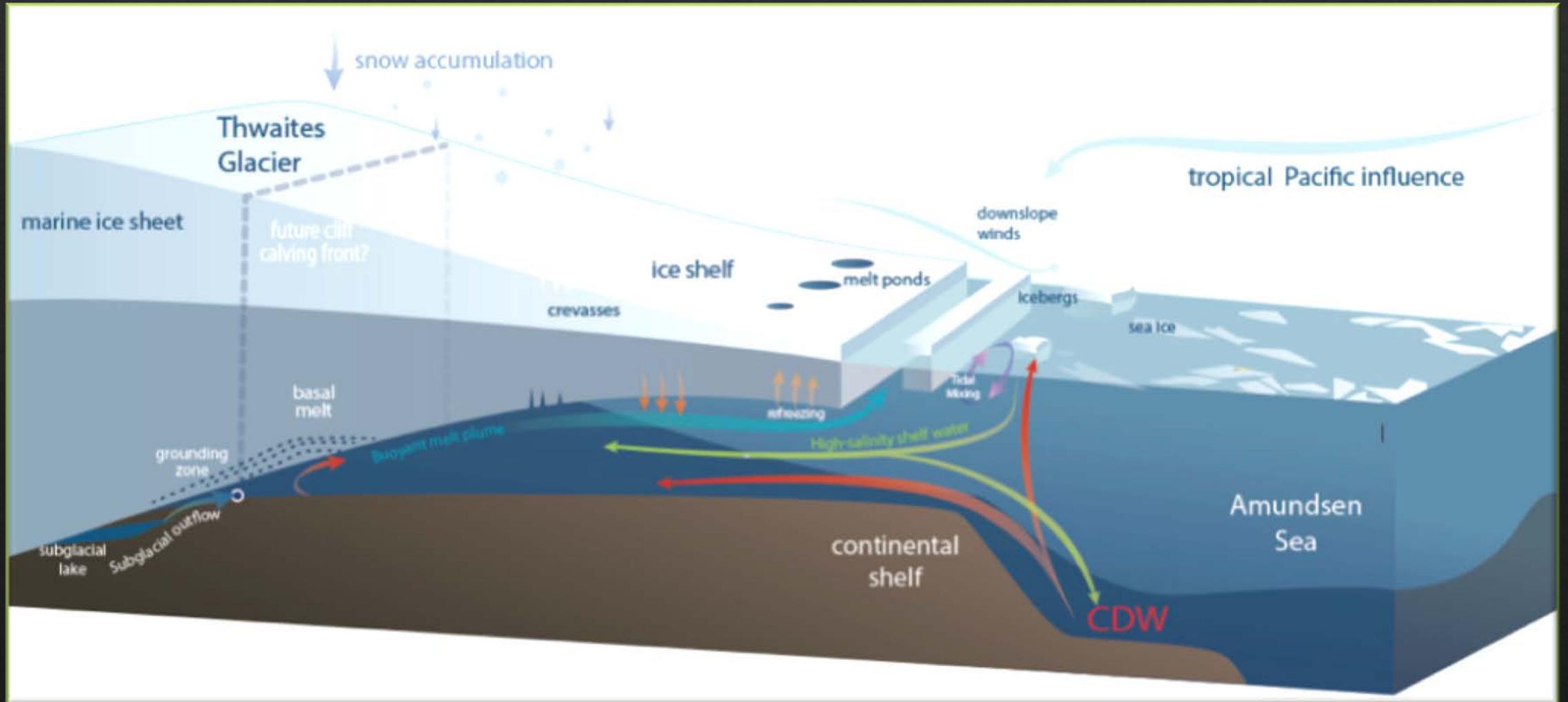


OCEAN
PROTECTION
COUNCIL

California Ocean Protection Council

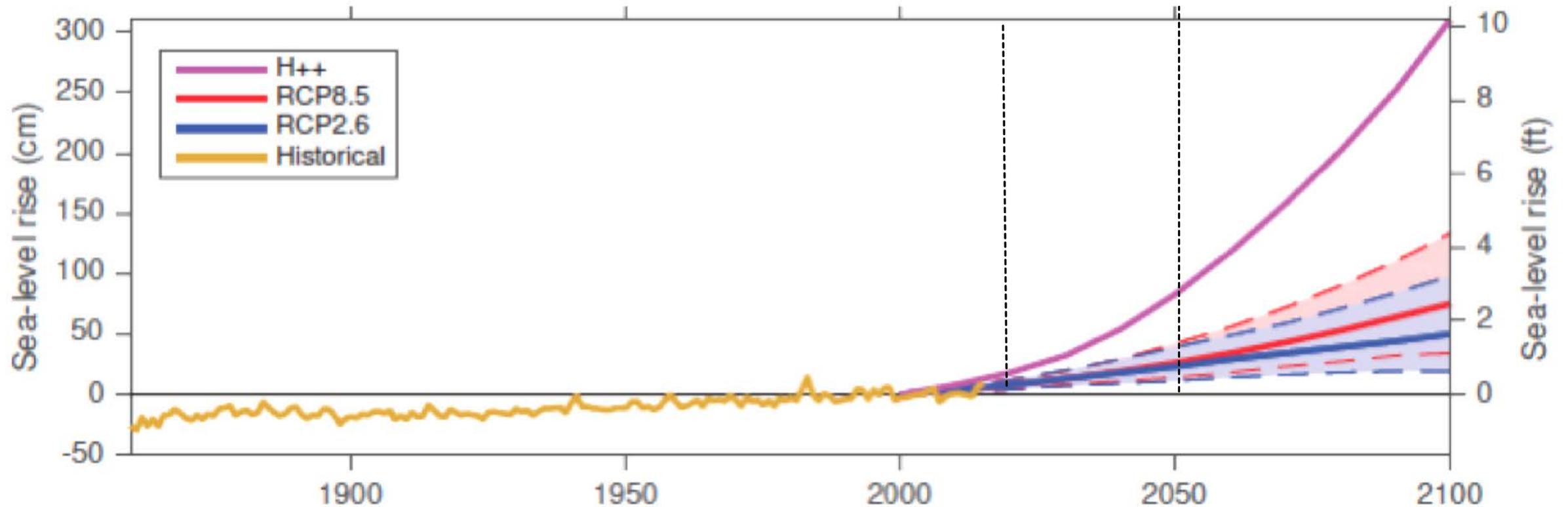
OPC-SAT
Science Advisory Team

Report Finding: Instability of Antarctic Ice Sheet



Example: Future Sea-Level Rise Projections for San Francisco

(b) Relative sea level in San Francisco, California



RCP: Representative Concentration Pathways

Example: Future Sea-Level Rise Projections for San Francisco

<i>Feet above 1991-2009 mean</i>	MEDIAN	LIKELY RANGE	1-IN-20 CHANCE	1-IN-200 CHANCE
Year / Percentile	<i>50% probability SLR meets or exceeds...</i>	<i>67% probability SLR is between...</i>	<i>5% probability SLR meets or exceeds...</i>	<i>0.5% probability SLR meets or exceeds...</i>
2030	0.4	0.3 – 0.5	0.6	0.8
2050	0.9	0.6 – 1.1	1.4	1.9
2100 (RCP 2.6)	1.6	1.0 – 2.4	3.2	5.7
2100 (RCP 4.5)	1.9	1.2 – 2.7	3.5	5.9
2100 (RCP 8.5)	2.5	1.6 – 3.4	4.4	6.9
2100 (H++)	10			

RCP – Representative Concentration Pathways

>> **STEP 1:** *Identify the nearest tide gauge.*

>> **STEP 2:** *Evaluate project lifespan.*

>> **STEP 3:** *For the nearest tide gauge and project lifespan, identify range of sea-level rise projections.*

>> **STEP 4:** *Evaluate potential impacts and adaptive capacity across a range of sea-level rise projections and emissions scenarios.*

>> **STEP 5:** *Select sea-level rise projections based on risk tolerance and, if necessary, develop adaptation pathways that increase resiliency to sea-level rise and include contingency plans if projections are exceeded.*

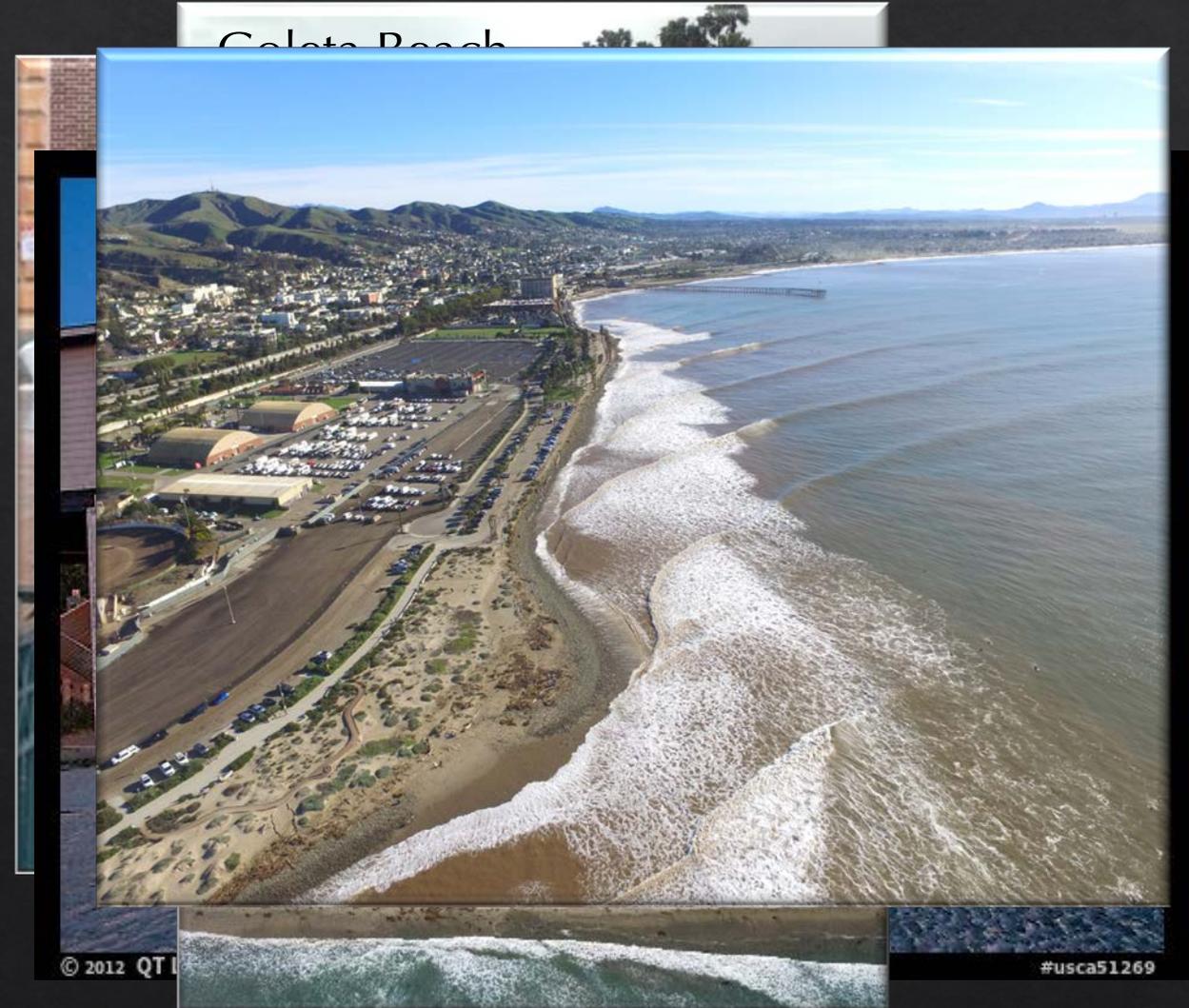
		Probabilistic Projections (in feet) (based on Kopp et al. 2014)							H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN		LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE		
		50% probability sea-level rise meets or exceeds...		66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...		
				Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion		
High emissions	2030	0.4	0.3 - 0.5	0.6	0.8	1.0			
	2040	0.6	0.5 - 0.8	1.0	1.3	1.8			
	2050	0.9	0.6 - 1.1	1.4	1.9	2.7			
Low emissions	2060	1.0	0.6 - 1.3	1.6	2.4				
High emissions	2060	1.1	0.8 - 1.5	1.8	2.6	3.9			
Low emissions	2070	1.1	0.8 - 1.5	1.9	3.1				
High emissions	2070	1.4	1.0 - 1.9	2.4	3.5	5.2			
Low emissions	2080	1.3	0.9 - 1.8	2.3	3.9				
High emissions	2080	1.7	1.2 - 2.4	3.0	4.5	6.6			
Low emissions	2090	1.4	1.0 - 2.1	2.8	4.7				
High emissions	2090	2.1	1.4 - 2.9	3.6	5.6	8.3			
Low emissions	2100	1.6	1.0 - 2.4	3.2	5.7				
High emissions	2100	2.5	1.6 - 3.4	4.4	6.9	10.2			

What Next? Options for the Future



Adapting or Responding to Sea-Level Rise and Extreme Events

1. Ignore or deny sea-level rise
2. Accommodation
3. Soft Solutions
4. Hard Structures
5. Plan for relocation or managed retreat



Take Away Messages

- ◆ Scientists agree that sea level is rising faster than previously thought
- ◆ It will impact coastal towns differently
- ◆ There is more hope for California than many other states
- ◆ We need to come up with a plan for how we are going to face our new reality
- ◆ There is no one size fits all solution

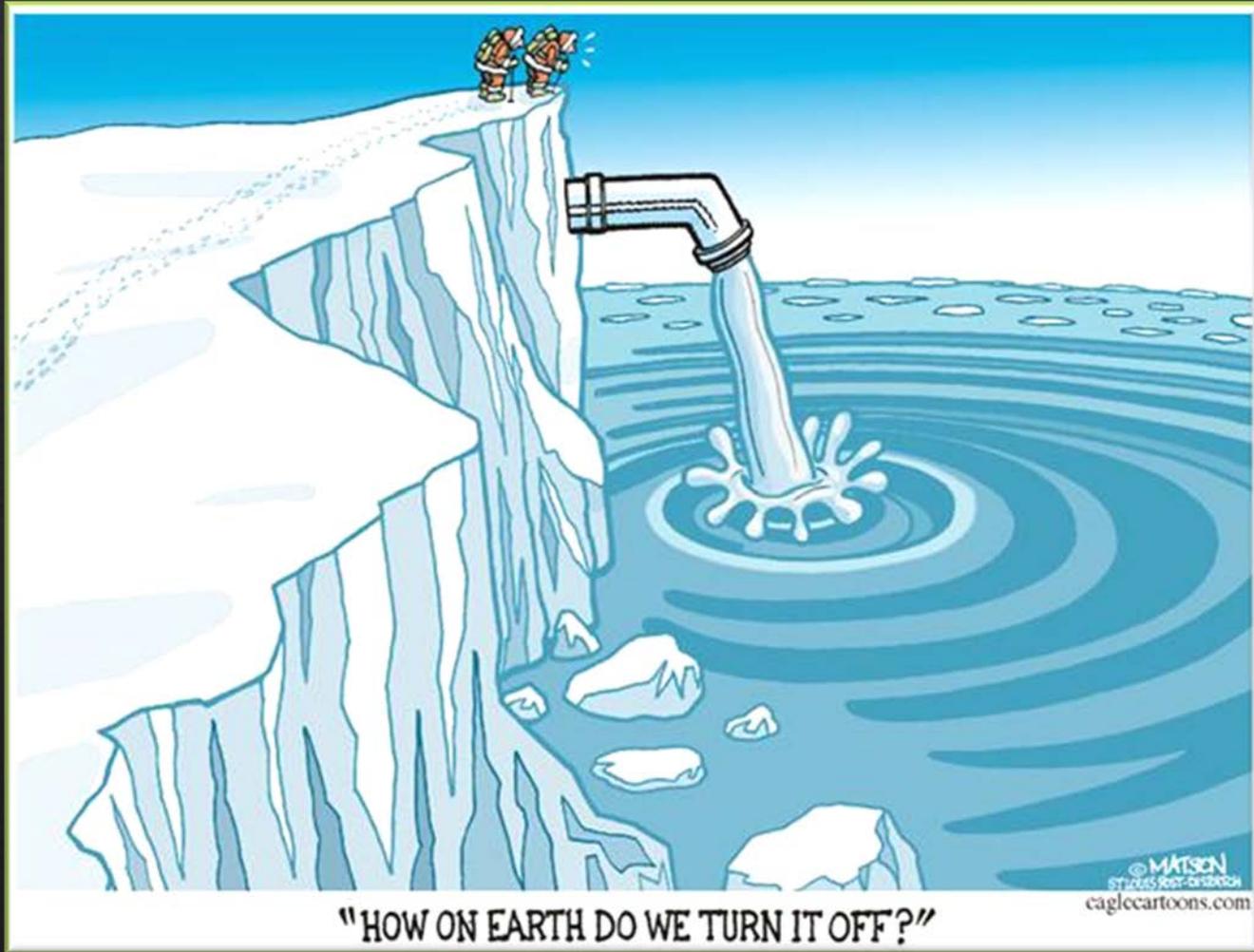
Common SLR Rates

Used for Planning
in Central CA

4 inches by 2030

28 inches by 2060

68 inches by 2100



“As geologists, we are bewildered by the ridiculous and obviously wrong state of affairs, but ours is not to wonder why.

Ours is to deal with the present, with the facts on the ground, and to offer a way forward- A way that may yet save our beaches from destruction.”

Orrin Pilkey, The Last Beach