

Sea Level Rise In Maryland

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University of Maryland Center for
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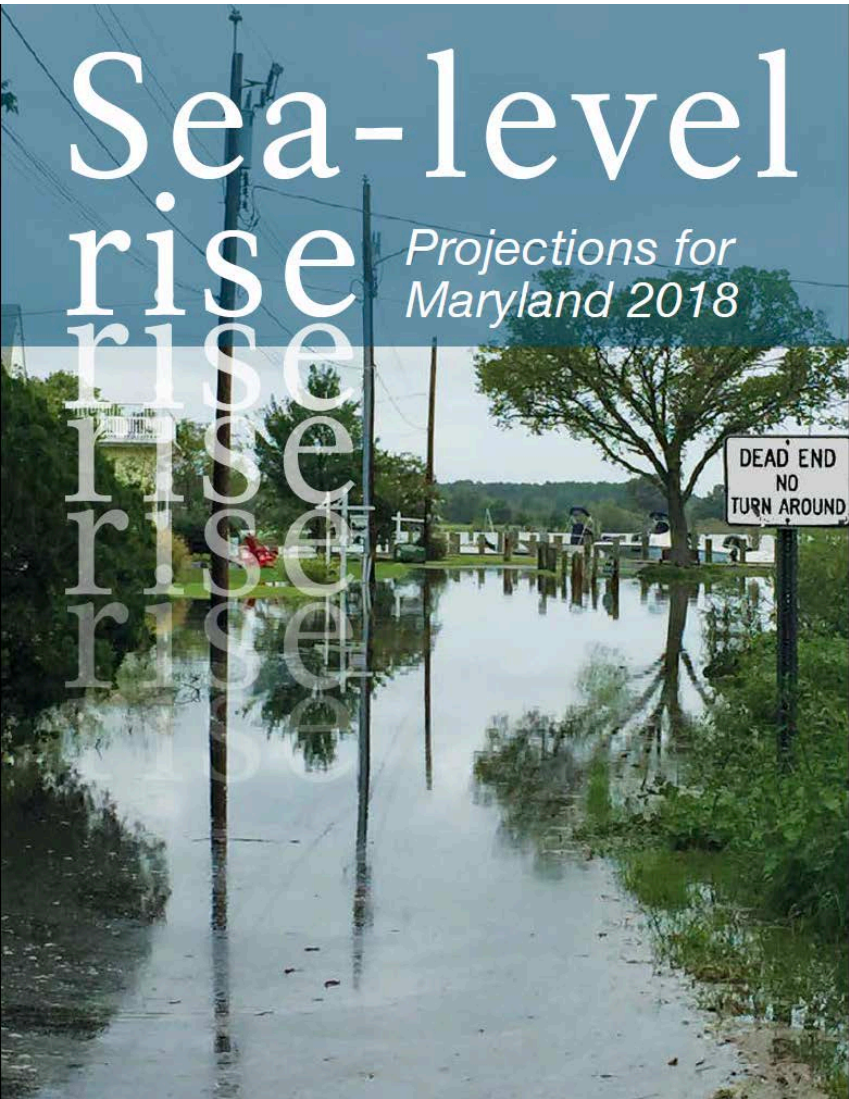
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Maryland House Bill 514, Senate Bill 258 of 2015

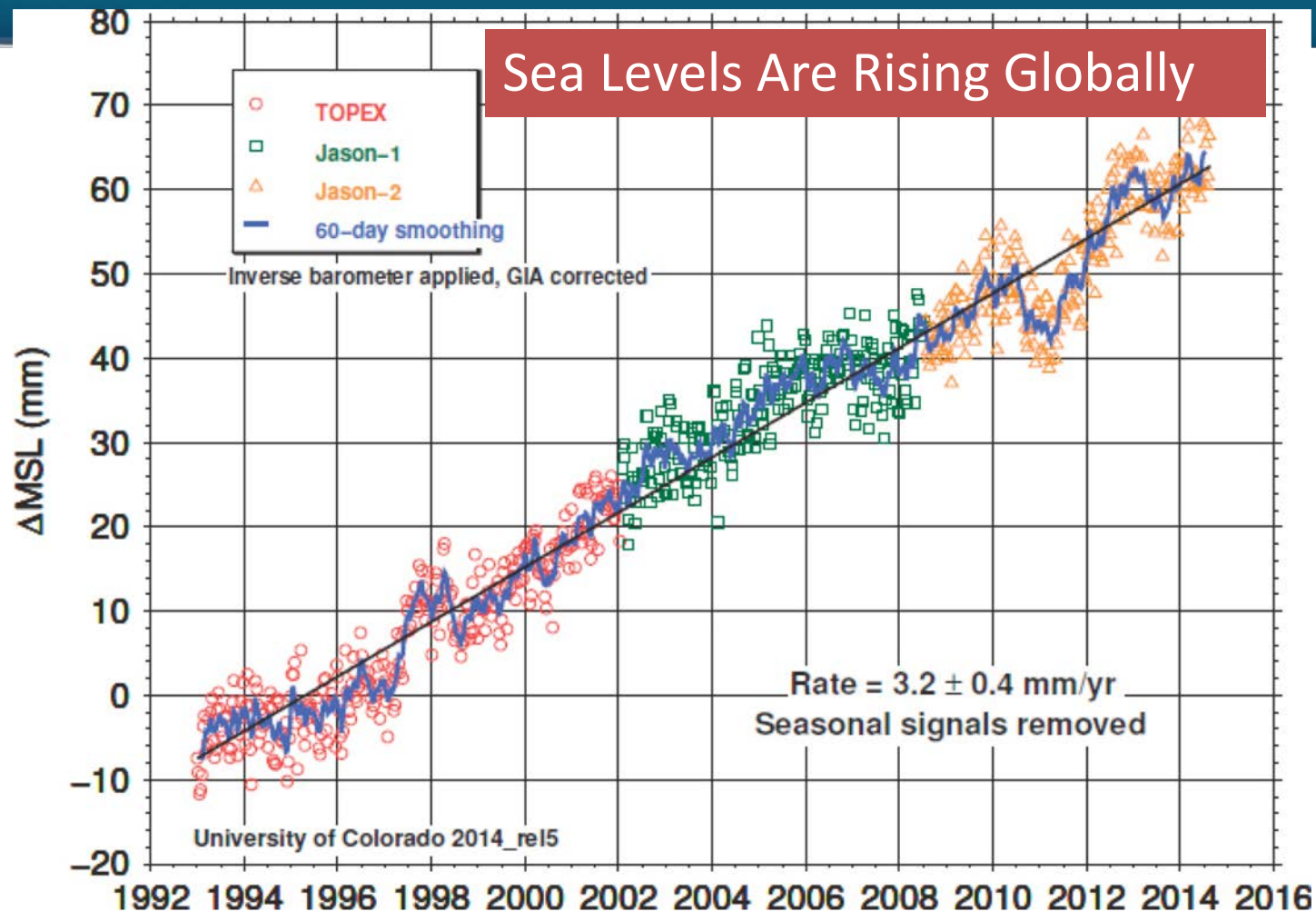
- Established Maryland Commission on Climate Change
- Mandated a sea-level rise report from UMCES every 5 years

UMCES Sea Level Rise Team:

- Donald F. Boesch, UMCES, Chair
- William C. Boicourt, UMCES
- Richard I. Cullather, UMCP
- Tal Ezer, Old Dominion University
- Gerald E. Galloway, Jr., UMCP
- Zoë P. Johnson, Naval Facilities Engineering
- K. Halimeda Kilbourne, UMCES
- Matthew L. Kirwan, VIMS
- Robert E. Kopp, Rutgers University
- Sasha Land, Maryland DNR
- Ming Li, UMCES
- William Nardin, UMCES
- Christopher K. Sommerfield, Univ. of Del.
- William V. Sweet, NOAA



Sea Levels Are Rising Globally



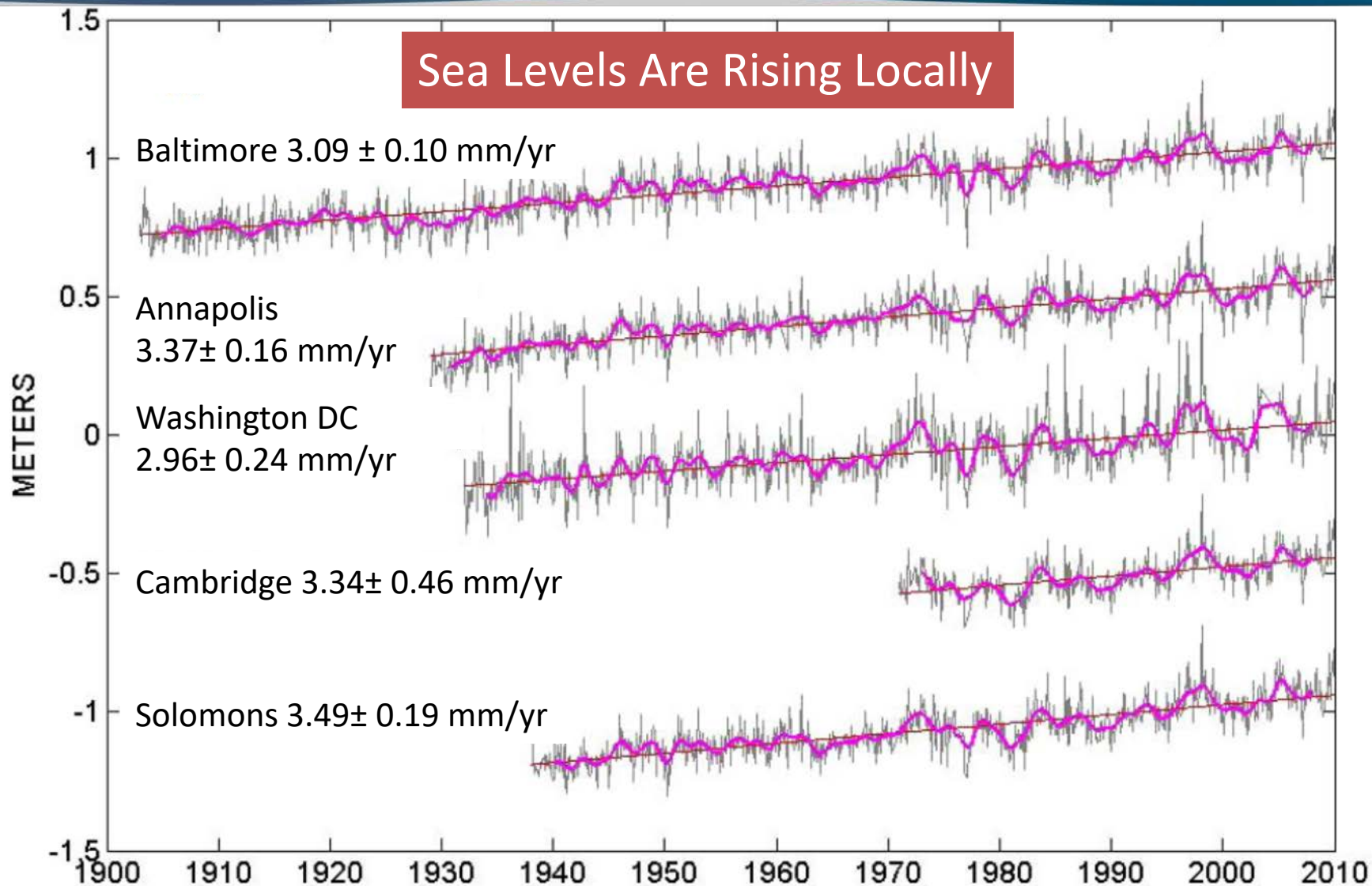
Global mean sea level record from a series of satellite altimetry missions.

SOURCE: R.S. Nerem, D. Chambers, C. Choe, and G.T. Mitchum, Estimating mean sea level change from the TOPEX and Jason altimeter missions, *Marine Geodesy* 33(1 Supp 1):435, 2010.

National Academy Press: Continuity of NASA Earth Observations from Space: A Value Framework (2015)

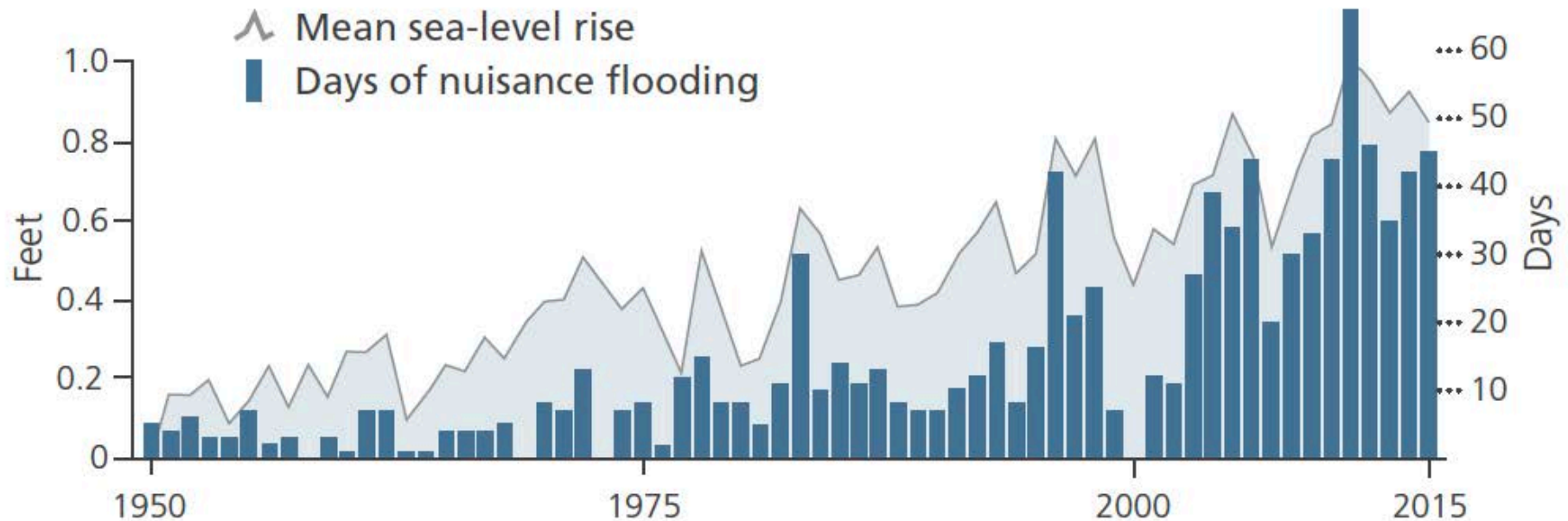


Sea Levels Are Rising Locally



Sea Level Rise is Impacting Us Locally

Days of Nuisance Flooding in Annapolis, MD



Primary Causes of Global (Eustatic) Sea Level Change

Greenland and Antarctic Ice Sheet Volume Change

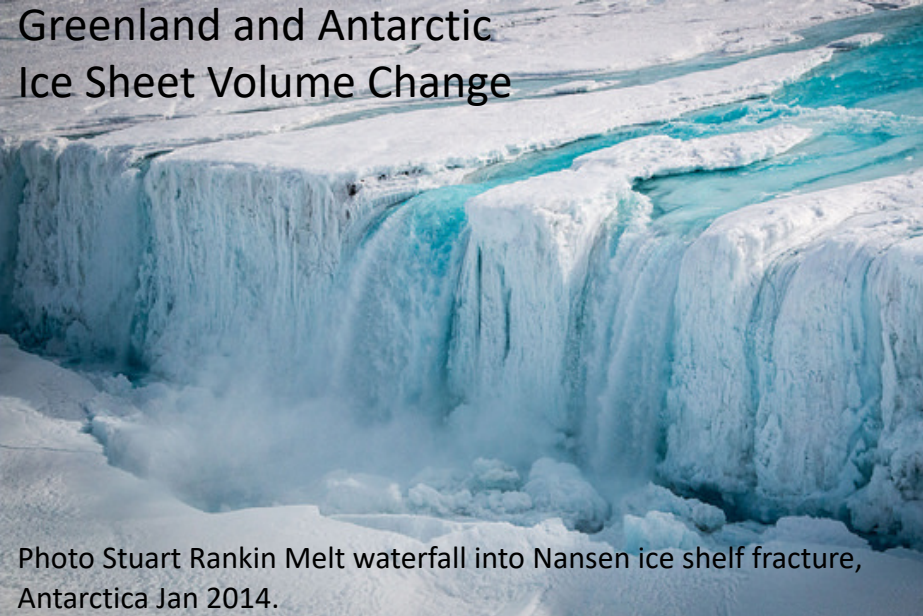


Photo Stuart Rankin Melt waterfall into Nansen ice shelf fracture, Antarctica Jan 2014.

Mountain Glacier Ice Volume

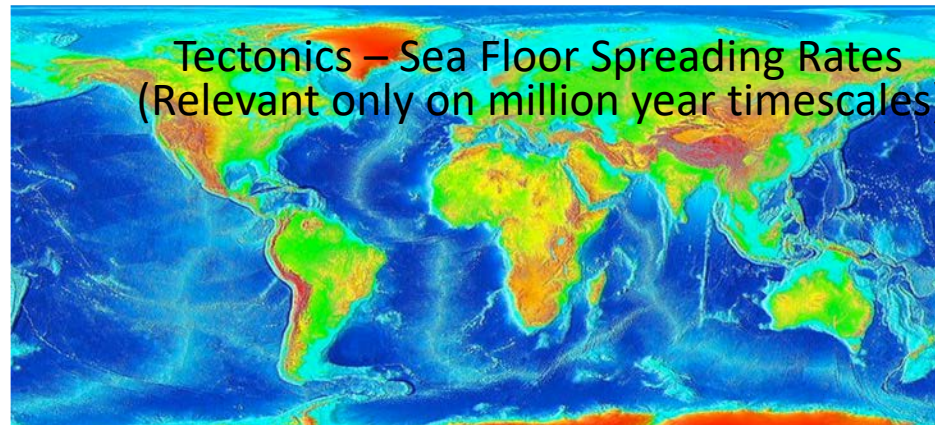


Photo: Andrew Turner, Fox Glacier New Zealand.

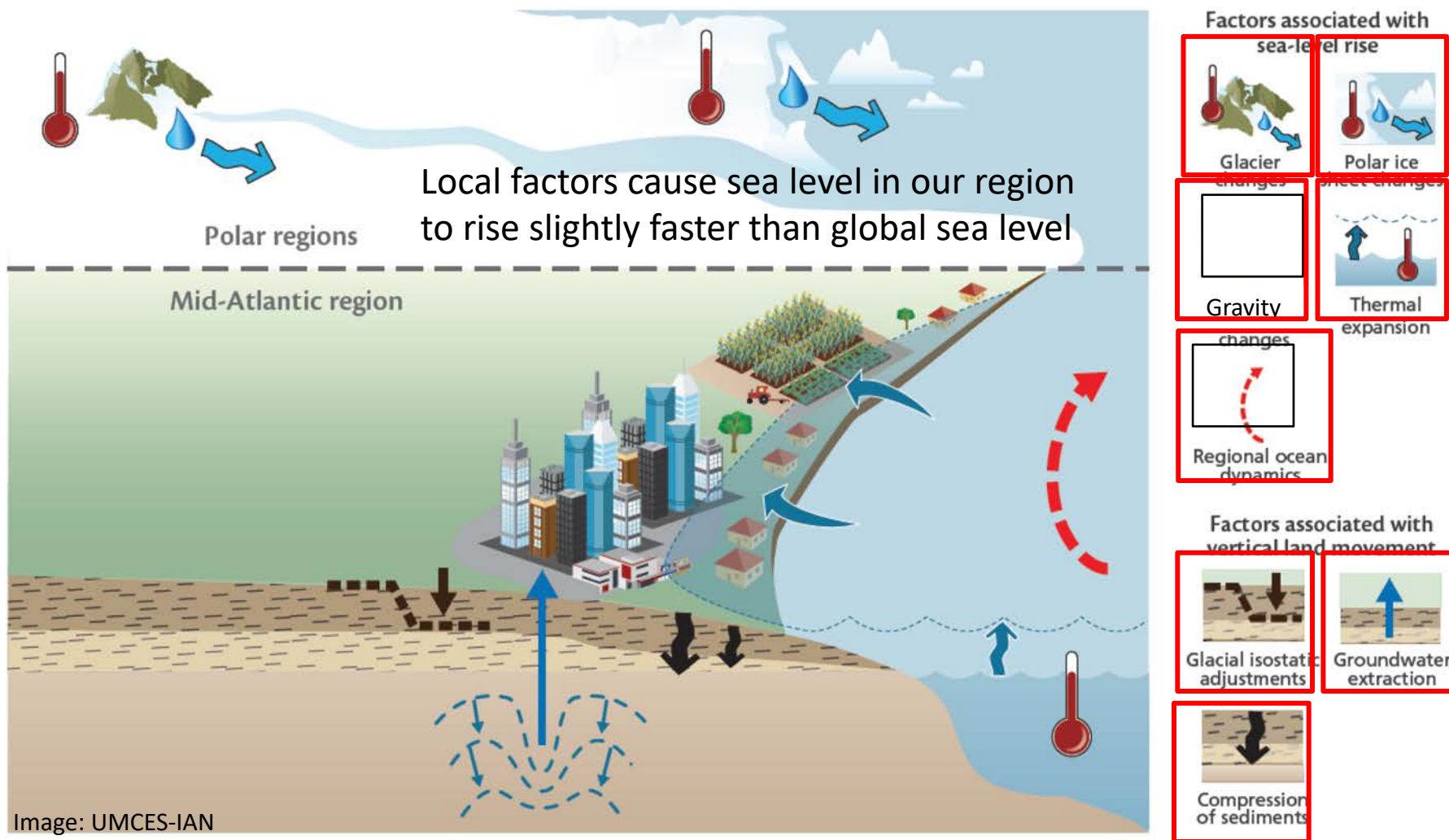
Oceanic Heat and Salt Changes (Steric)



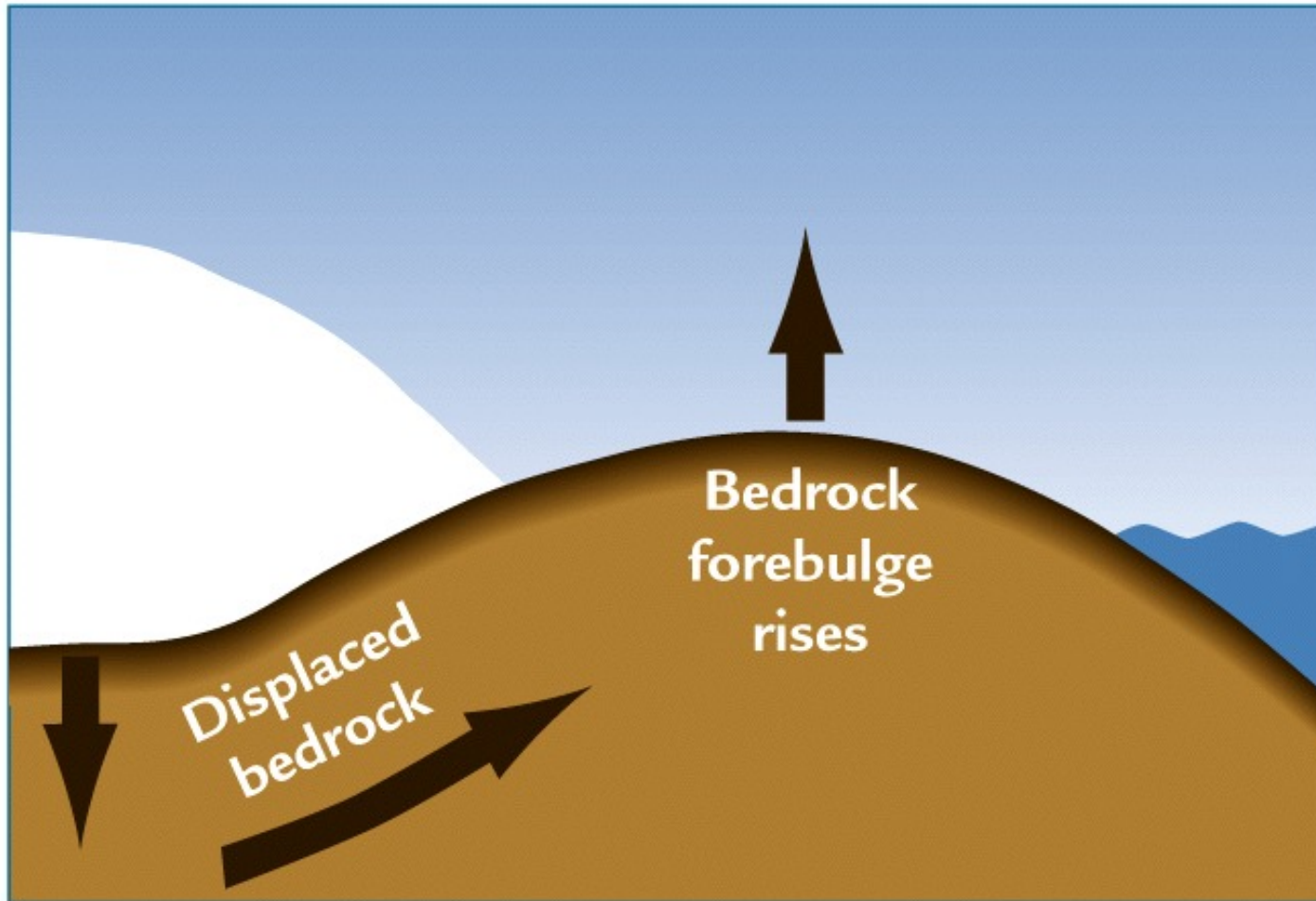
Tectonics – Sea Floor Spreading Rates
(Relevant only on million year timescales)



Factors that Influence Modern Sea Level in the Mid-Atlantic



Glacial Isostatic Adjustment



A Last glaciation (21,000 years ago)

Textbook Earth's Climate Past Present and Future by Bill Ruddiman



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Future Projections



Projections of Future Sea-Level Rise Account for Many Factors + Uncertainties

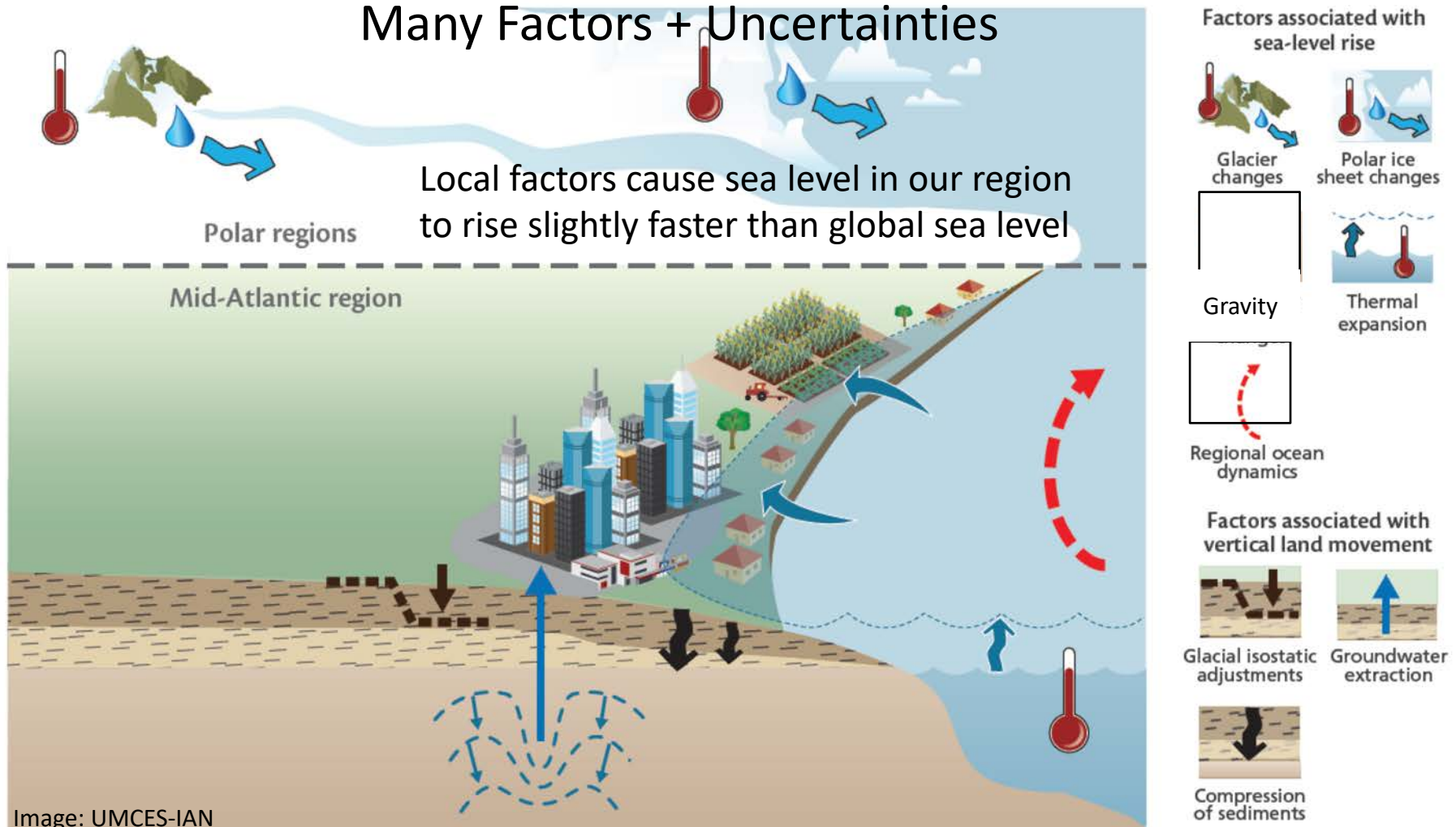
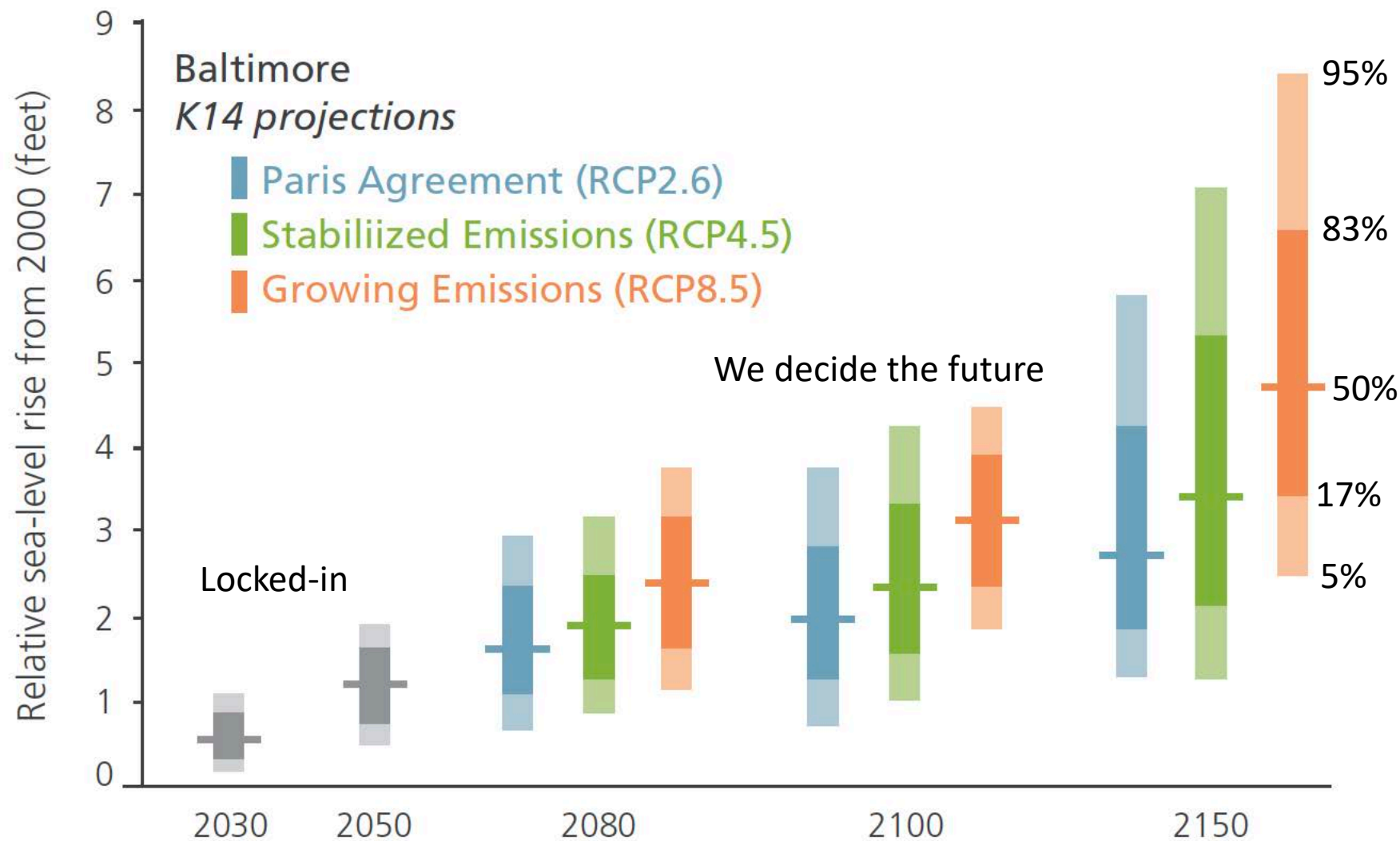


Image: UMCES-IAN





Antarctica –big source of uncertainty

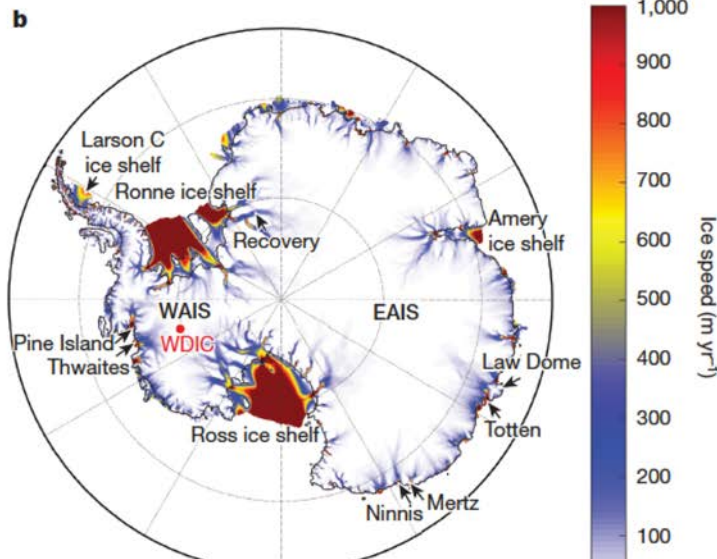
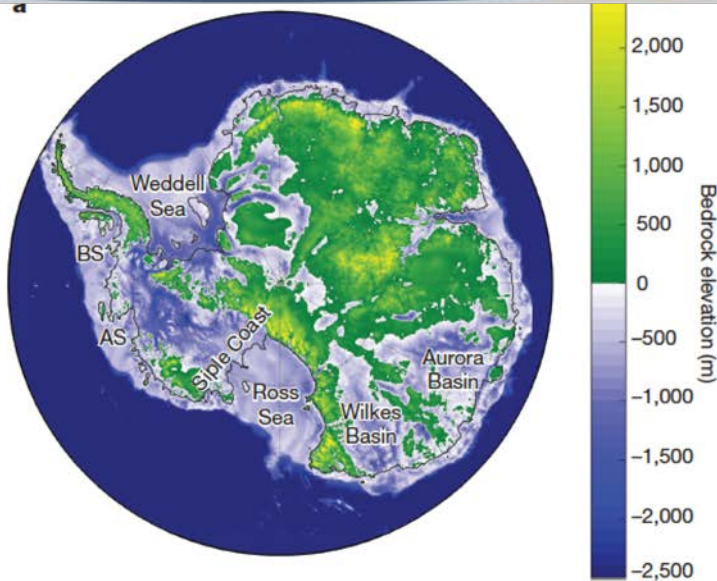
Antarctica is a Desert – warm it and you increase moisture

West Antarctic Ice Sheet

- Below sea level and not stable
- 3.2 m (10.5 ft) sea level equivalent

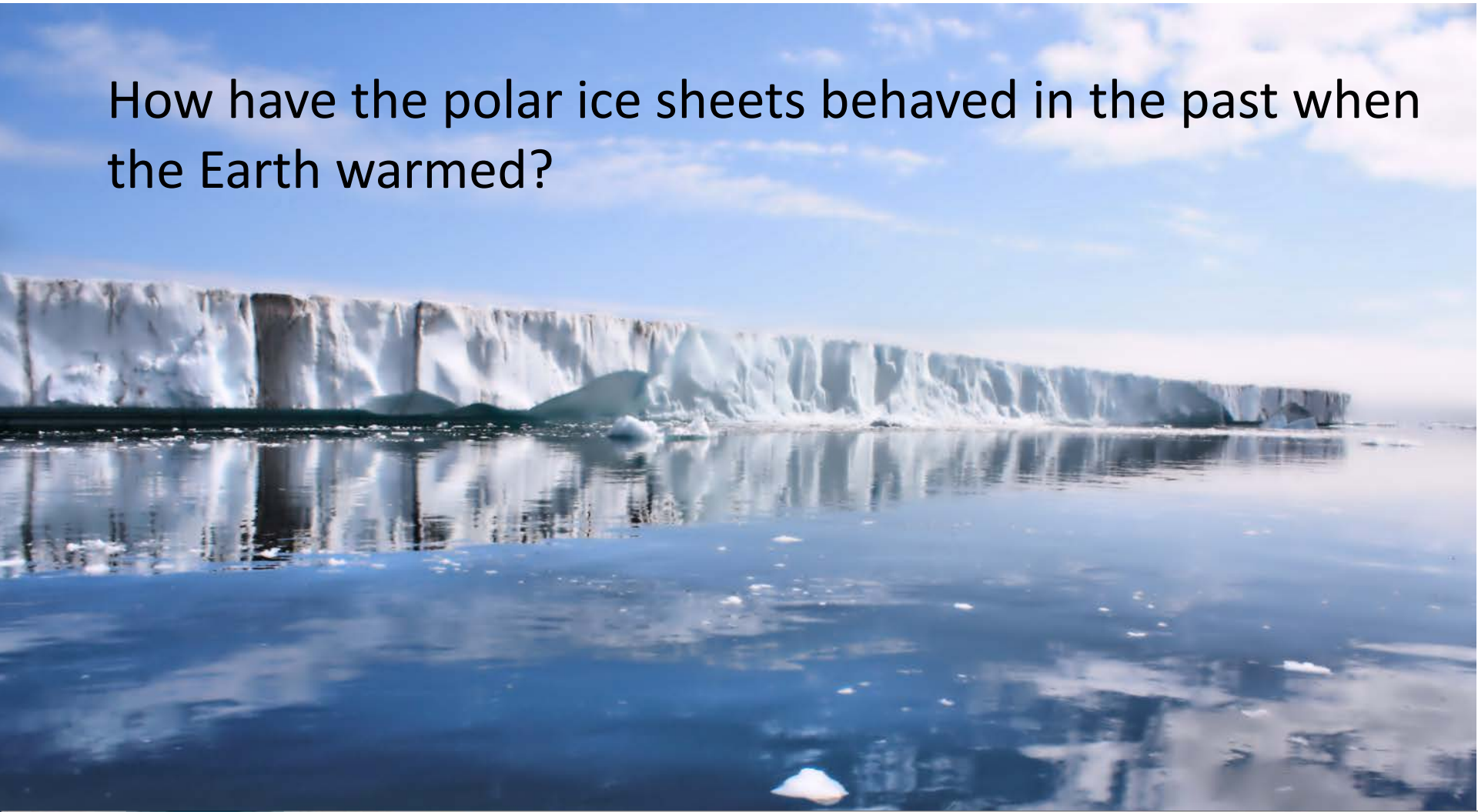
East Antarctic Ice Sheet

- above sea level and stable
- ~60 m (197 ft) sea level equivalent

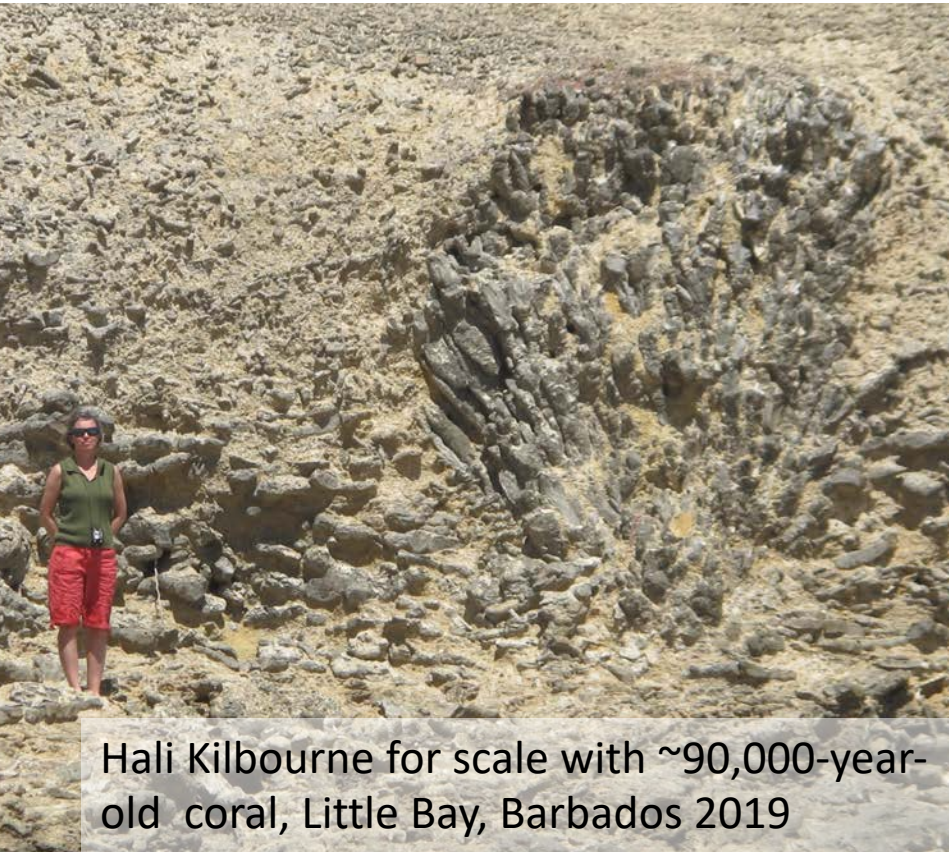


The Past is the Key to the Future:

How have the polar ice sheets behaved in the past when the Earth warmed?



Corals Mark Sea Level and Can Be Dated Precisely by Radiometric Dating



Hali Kilbourne for scale with ~90,000-year-old coral, Little Bay, Barbados 2019

Elkhorn coral at Buck Island. NPS photo (S. Pershern)



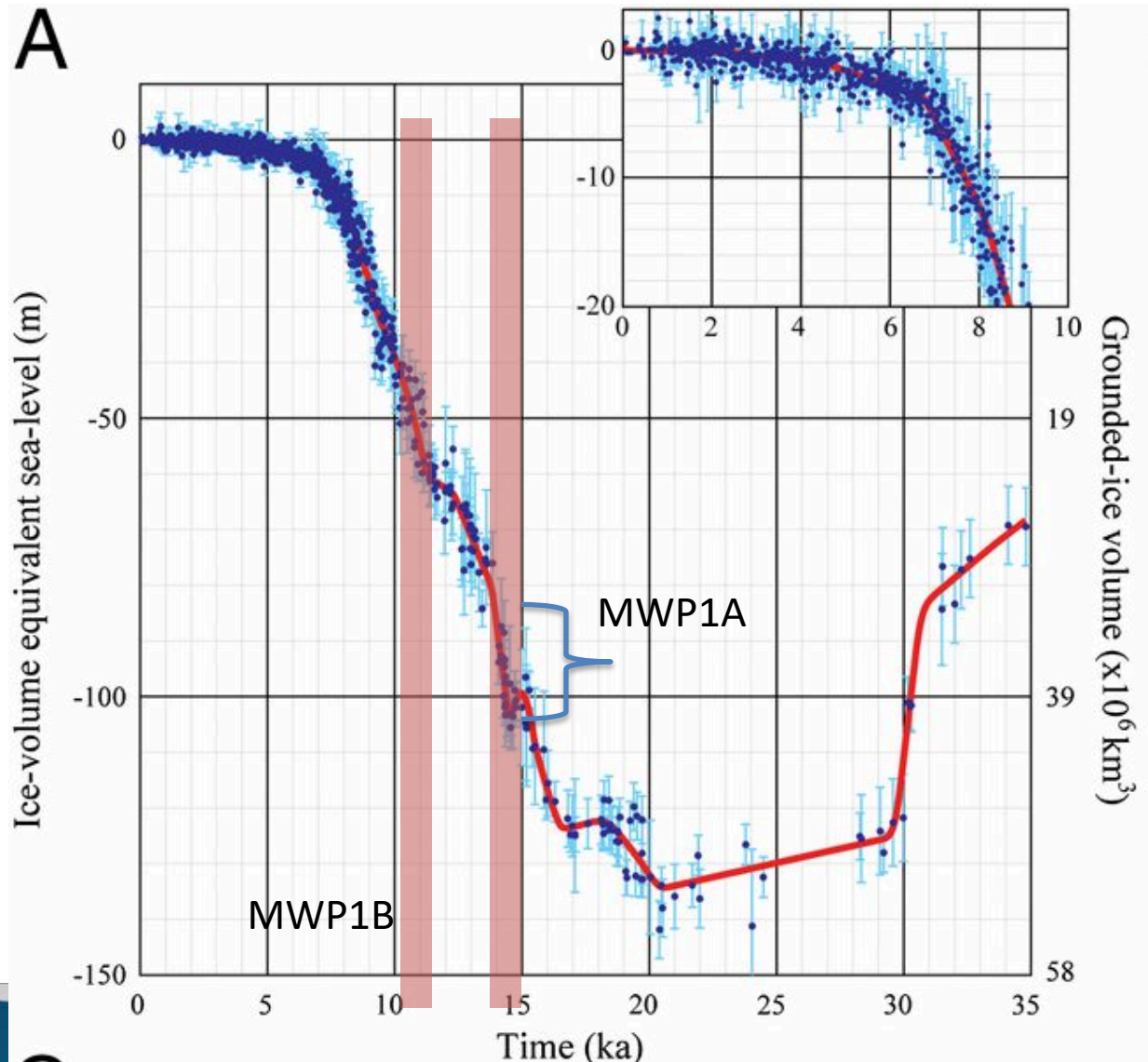
Sea Level History Since the Last Ice Age

Based on many precise dates of corals with known elevations.

Fastest rates of sea level rise in Melt Water Pulses

We think these are ice sheet collapses (WAIS).

Modern SL Rise: $\sim 0.13 \text{ in/yr}$



Kurt Lambeck et al. PNAS 2014;111:43:15296-15303



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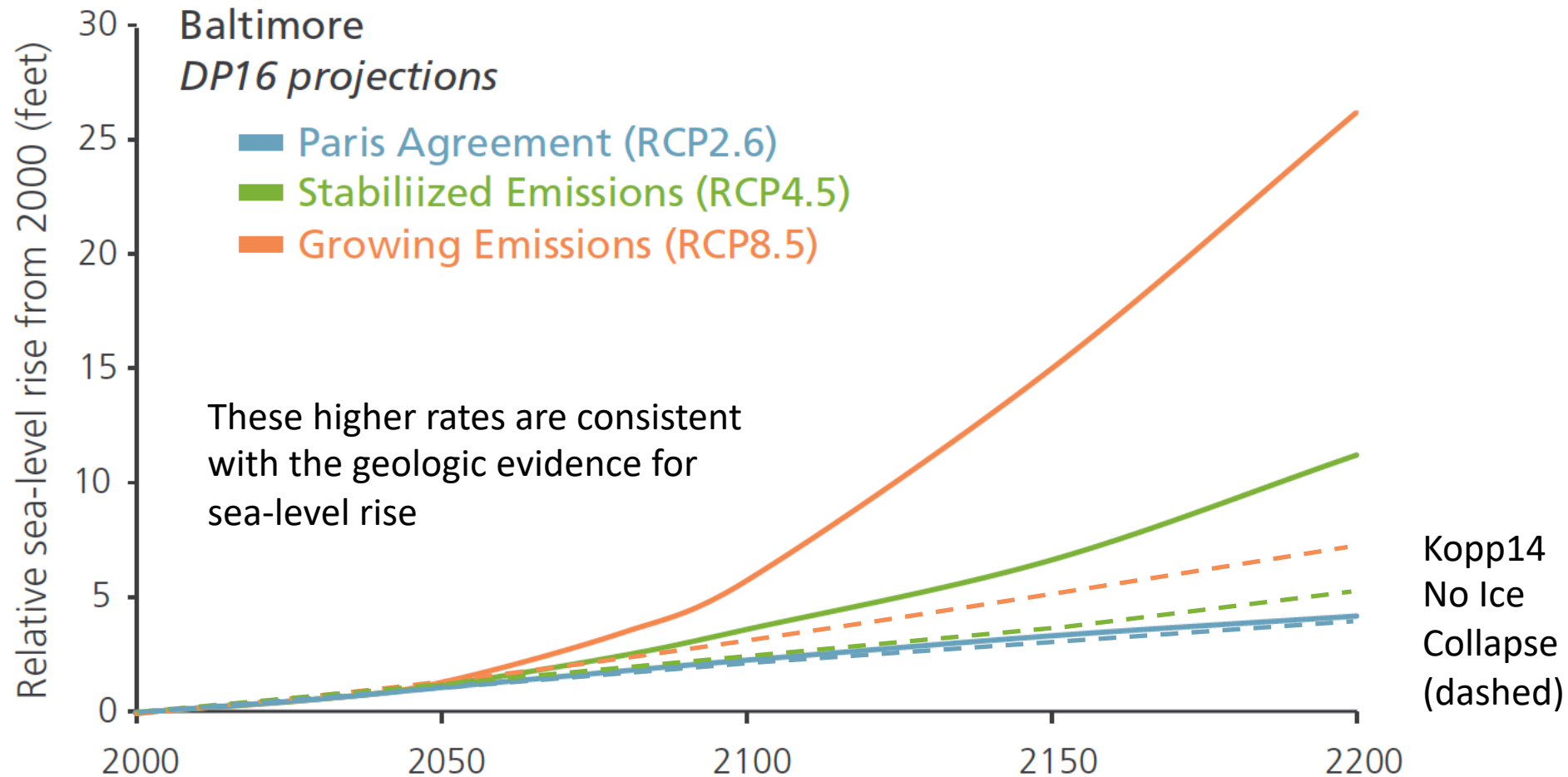
Hali Kilbourne

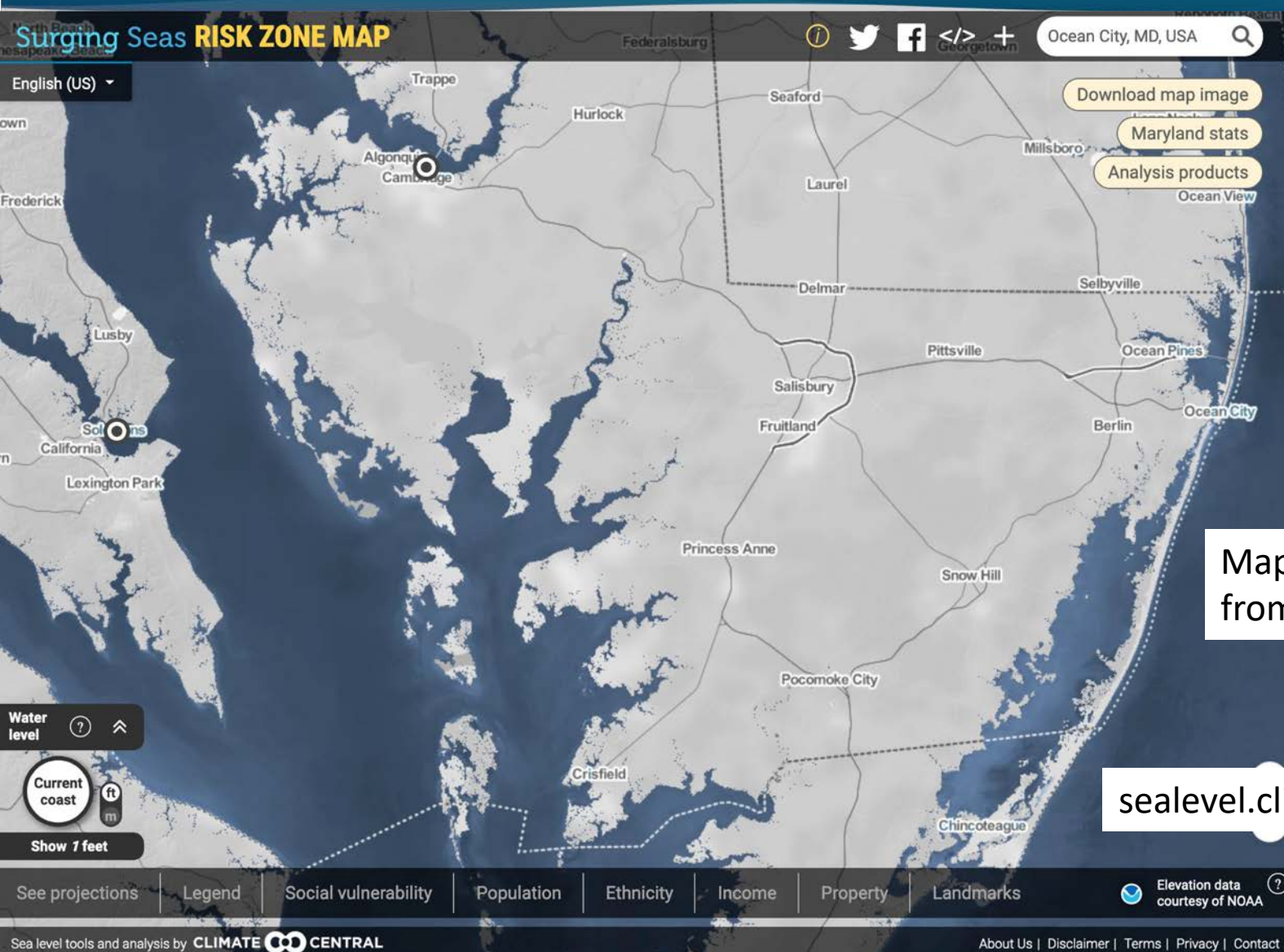
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A 2016 article in Nature demonstrated that recent advances in understanding ice sheet physics enabled researchers to accurately model historical ice sheet behavior.



Median (middle) projections of sea-level rise for Baltimore, including Antarctic Ice Sheet dynamics

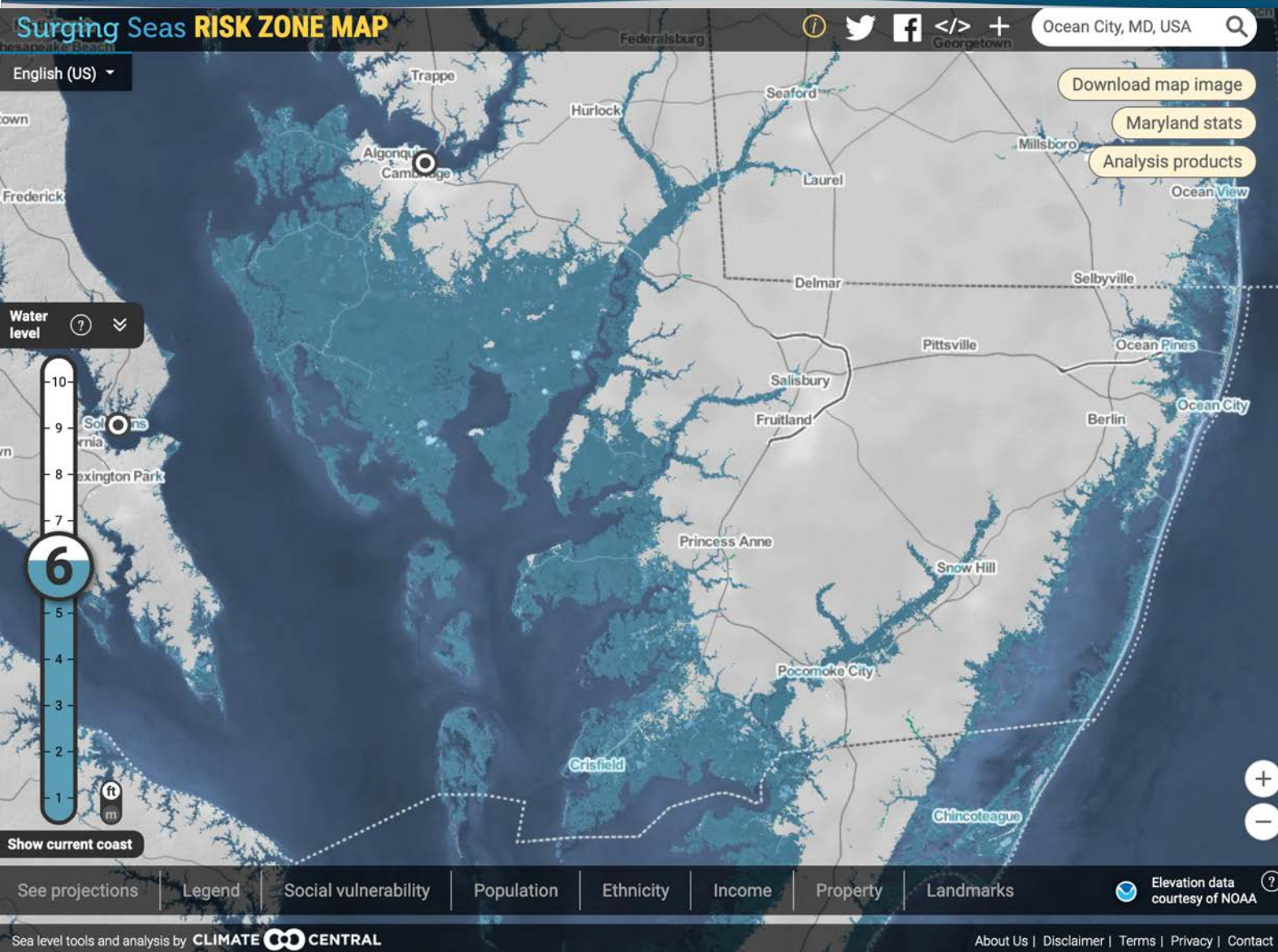




Maps and analysis
from Climate Central

sealevel.climatecentral.org





2100

Business as
usual with
Antarctic Ice
collapse



Will we continue
like ostriches?

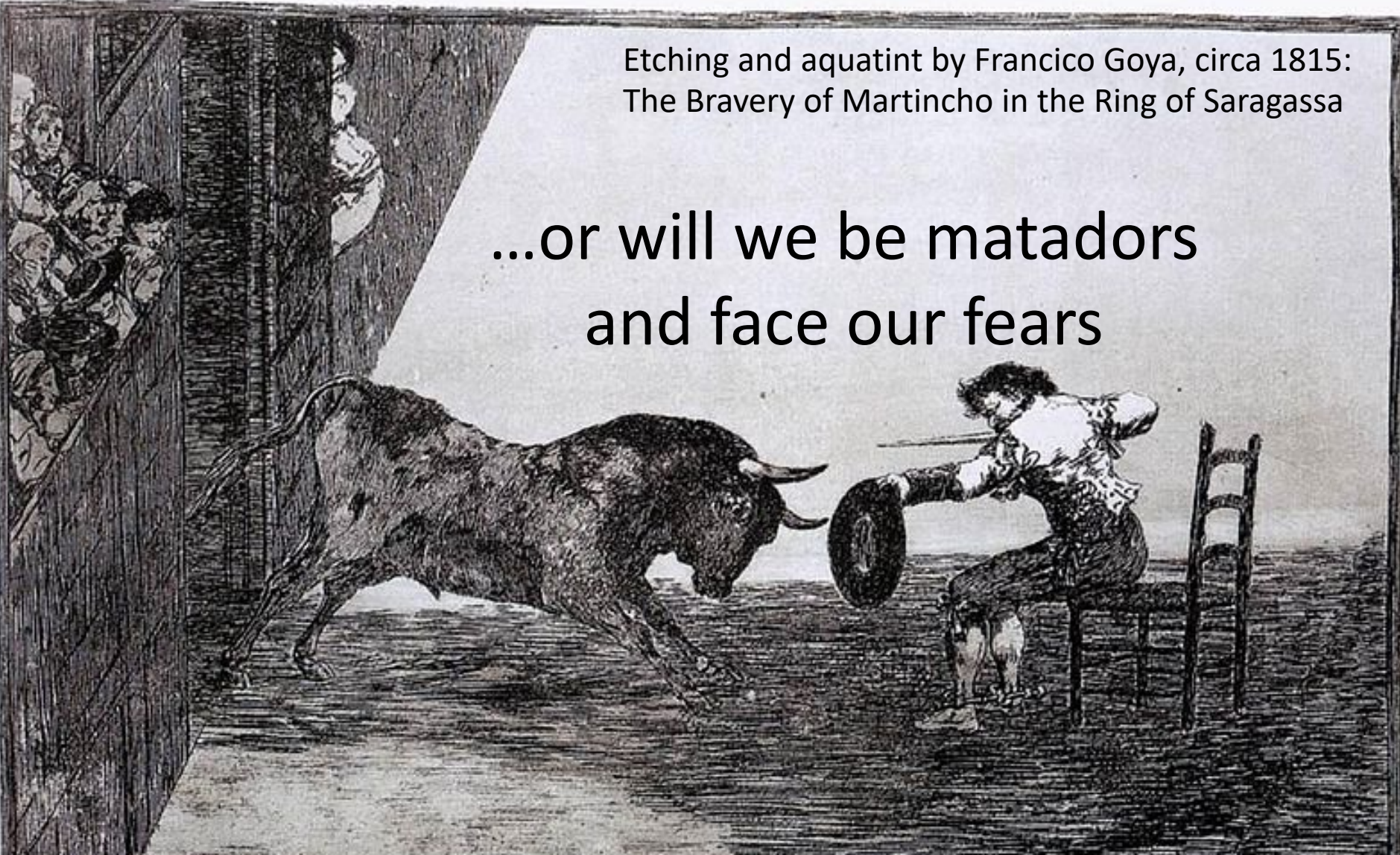


2010 Nevit Dillmen.
CC 3.0



Etching and aquatint by Francisco Goya, circa 1815:
The Bravery of Martincho in the Ring of Saragassa

...or will we be matadors
and face our fears





PLEASE!!!



What do we do?

- Inform yourself
- Demand our politicians address this issue
(how? – that depends on your political leanings)
- Curb our personal dependence on fossil fuels
 - Reduce transportation fuel use
 - Conserve energy
 - Make our houses energy efficient
- Tell others!

