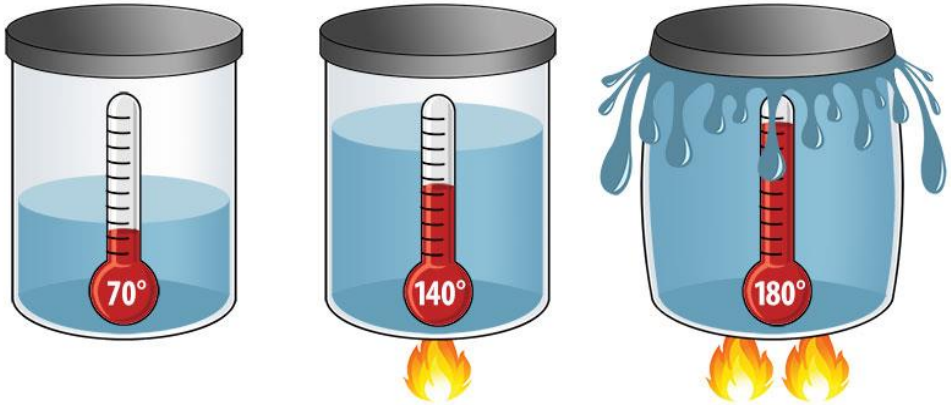
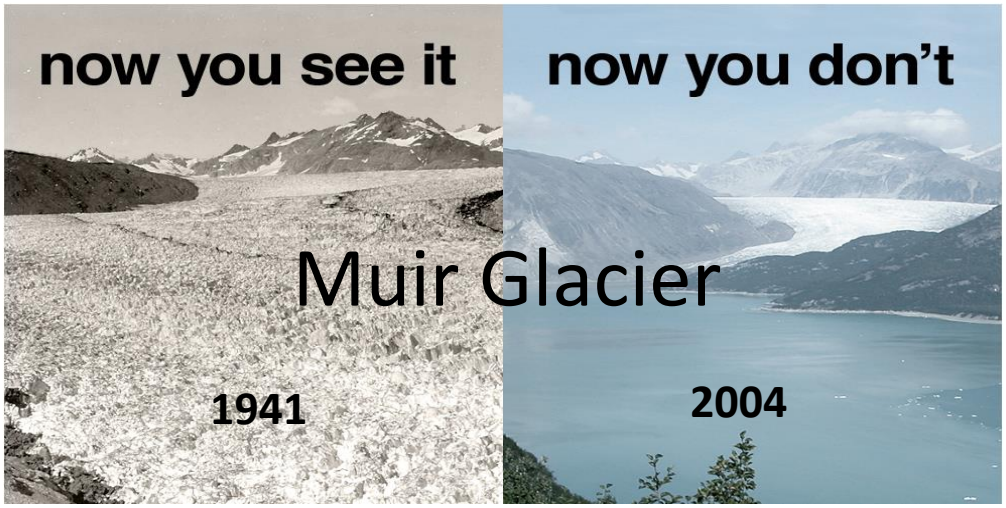
Sea Level Rise

Linda Dismore (Diz) Swift, PhD
October 24, 2017

Two Key Drivers to Sea Level Rise

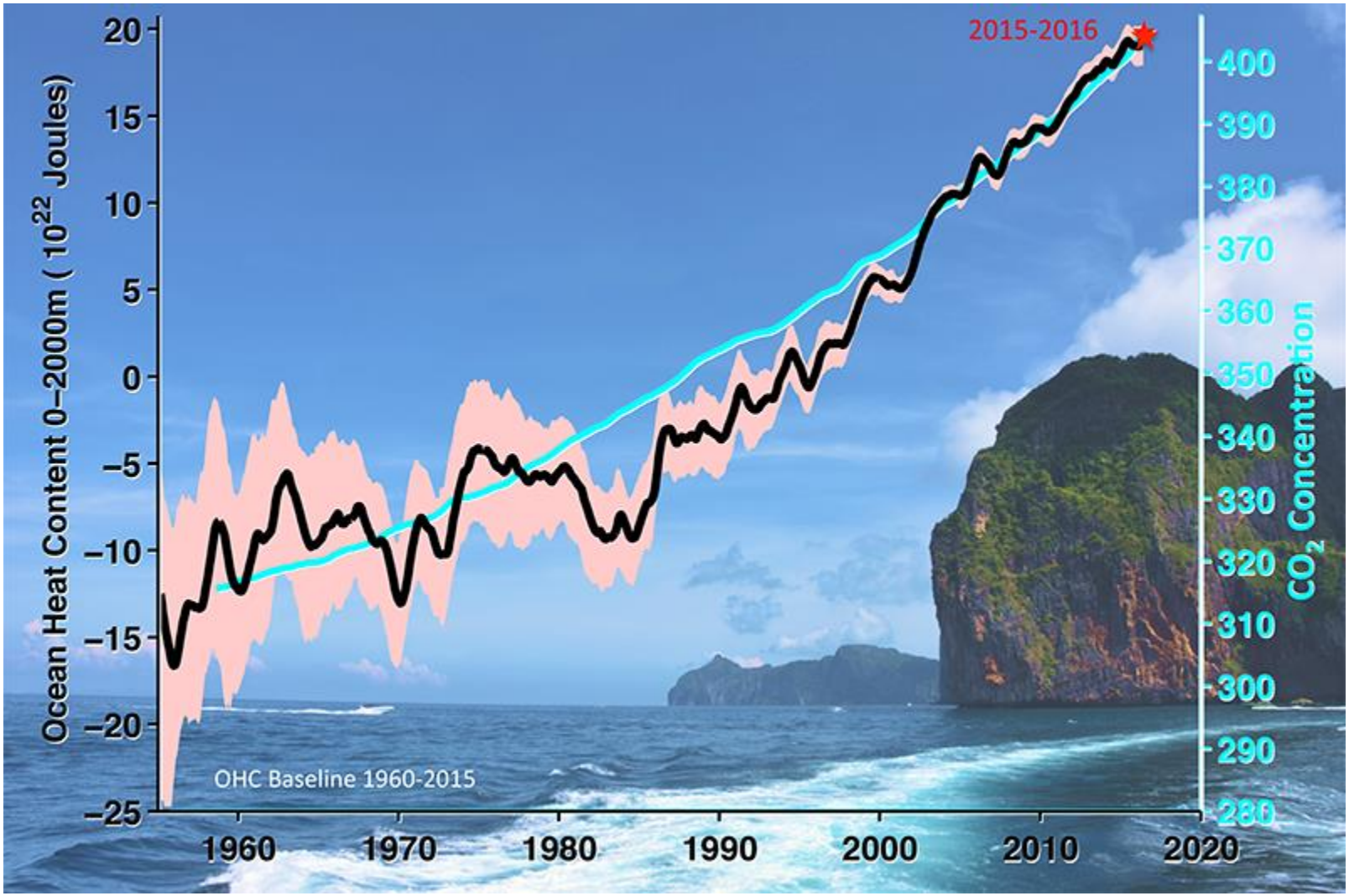
Thermal Expansion





Melting Glaciers

Oceans Warming



https://eos.org/opinions/taking-the-pulse-of-the-planet?utm_source=eos&utm_medium=email&utm_campaign=EosBuzz091517

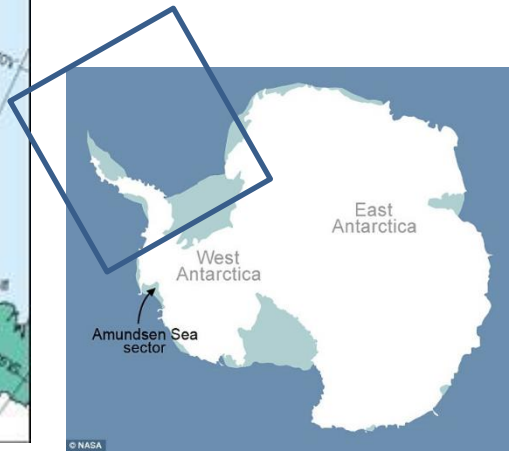
Ice Melting Accelerates

Larson A Ice Shelf – collapsed 1995

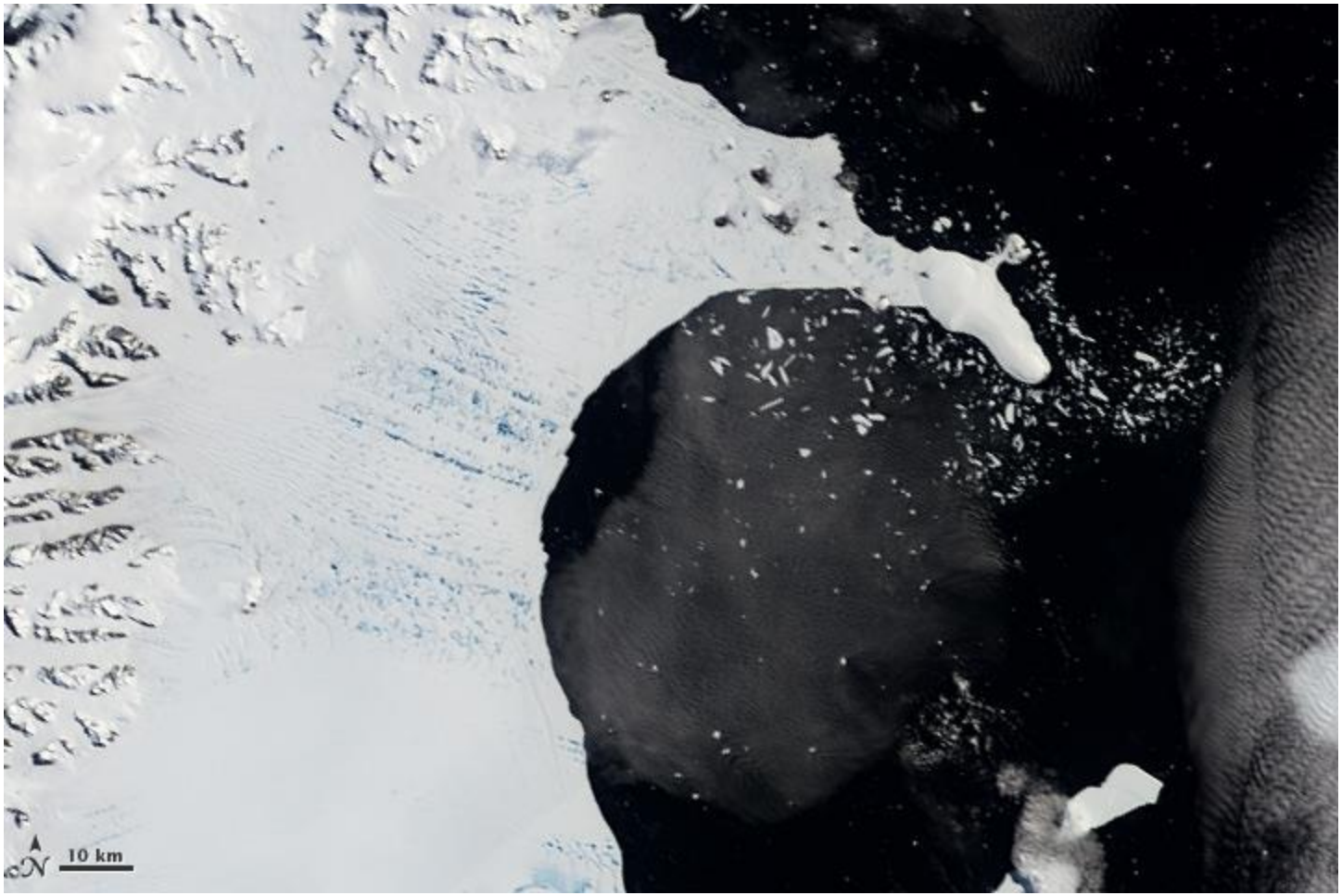
Larson B Ice Shelf – collapsed 2002

Larson C Iceberg – breaks off 2017

Wilkins Ice Bridge – collapsed 2009

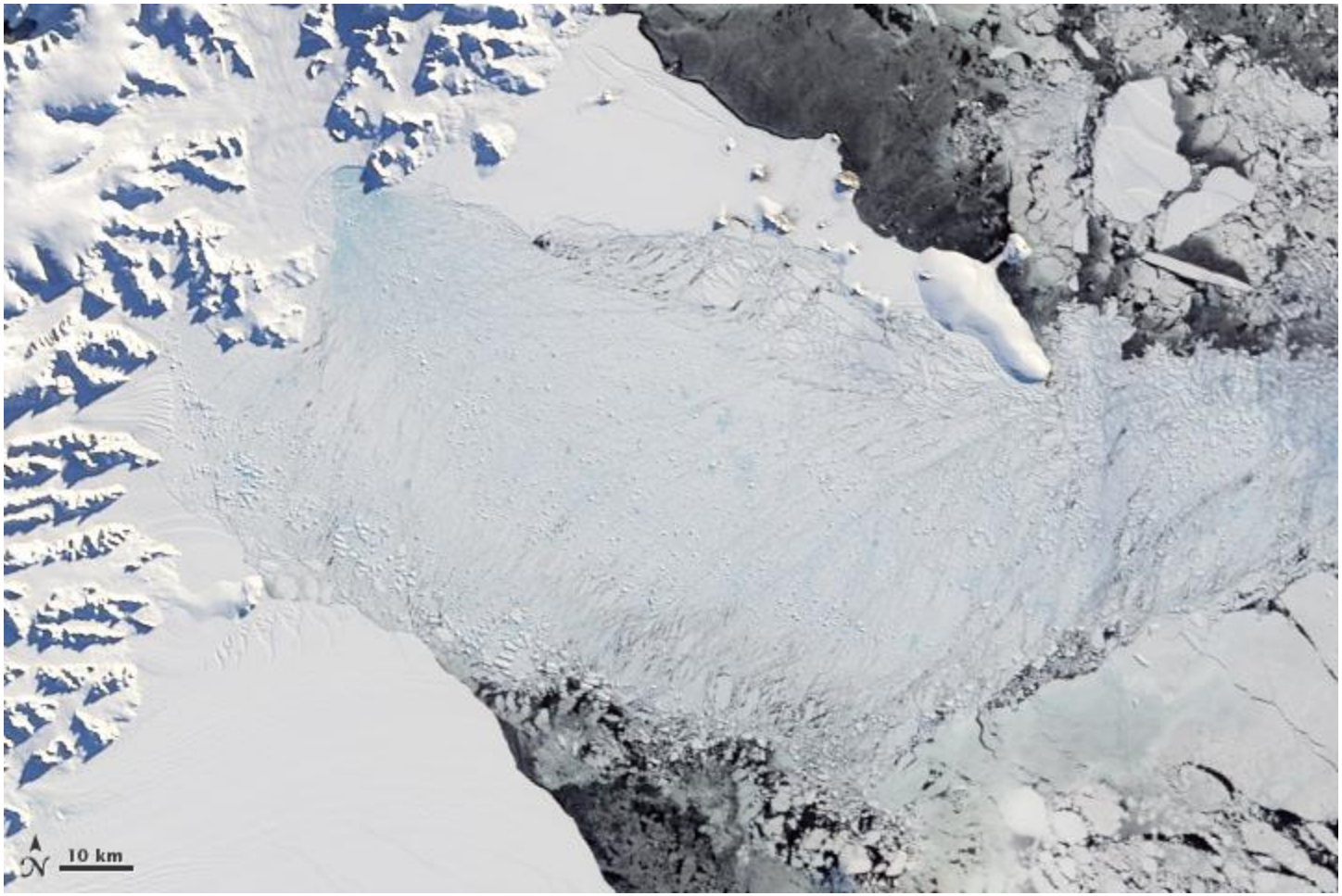


Collapse of Larson B Ice Shelf



January 31, 2002

Collapse of Larson B Ice Shelf



April 13, 2002

But Ice Shelves Don't Increase Sea Level

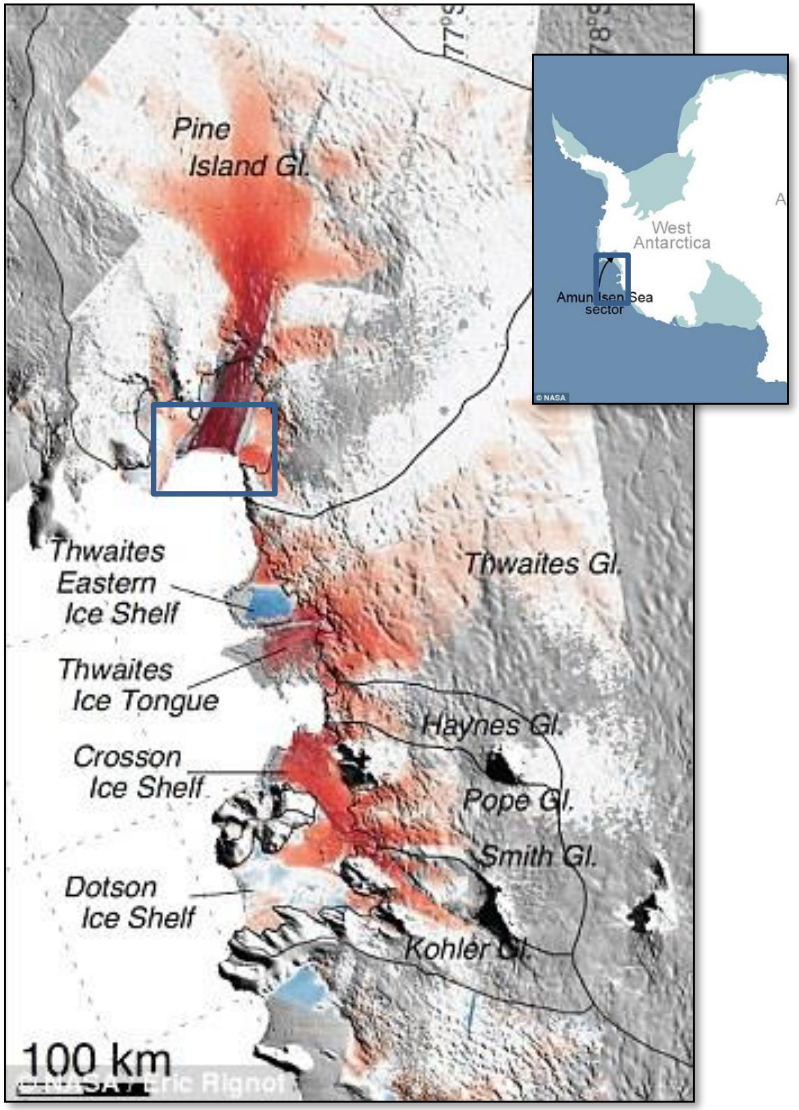
When your ice melts…

…the glass doesn't overflow

The Serious Melting

From 1992 to 2011, the land glaciers have come “ungrounded” and are now “unstoppable”.

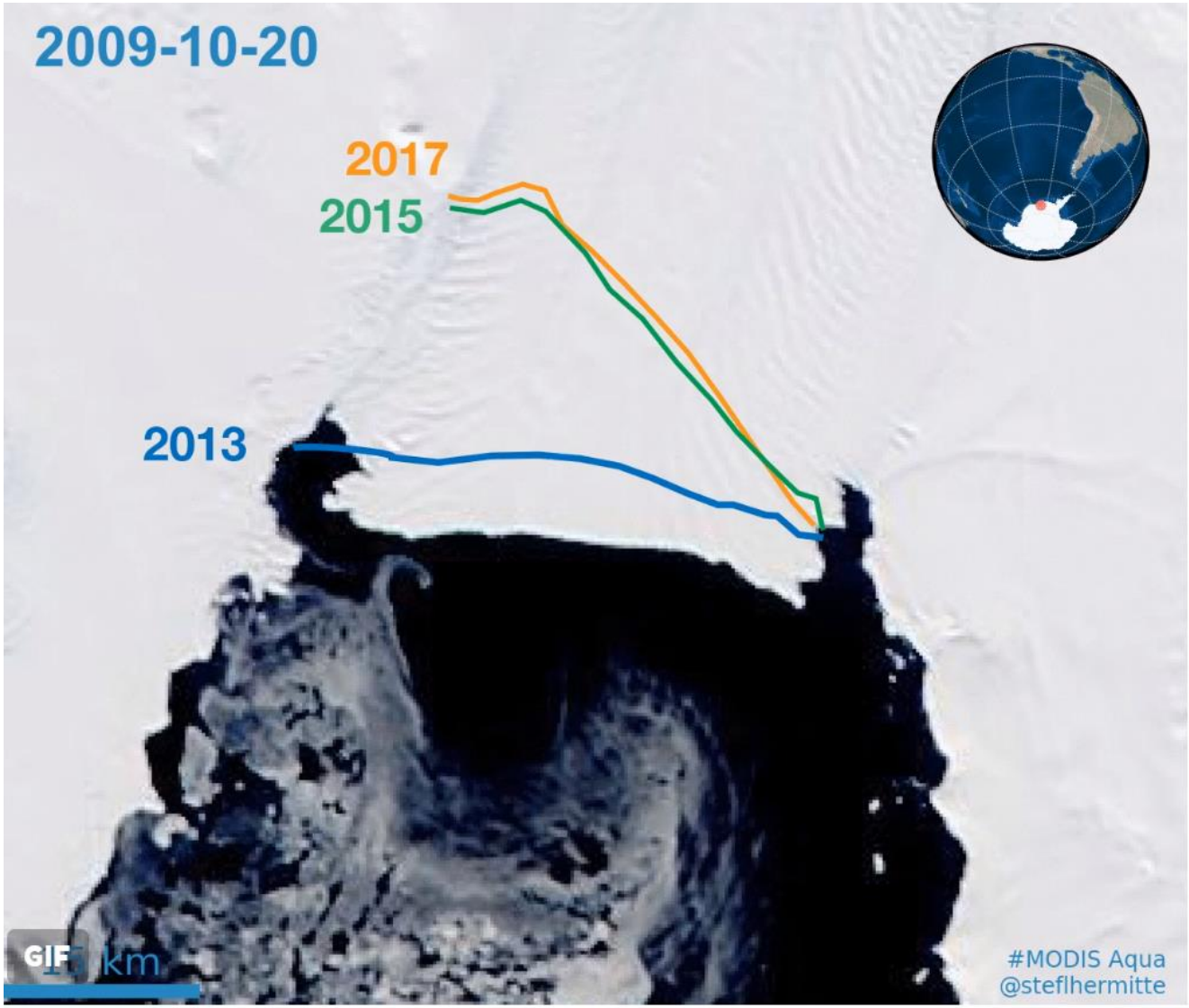
These glaciers could raise global sea level by 1.2 meters.



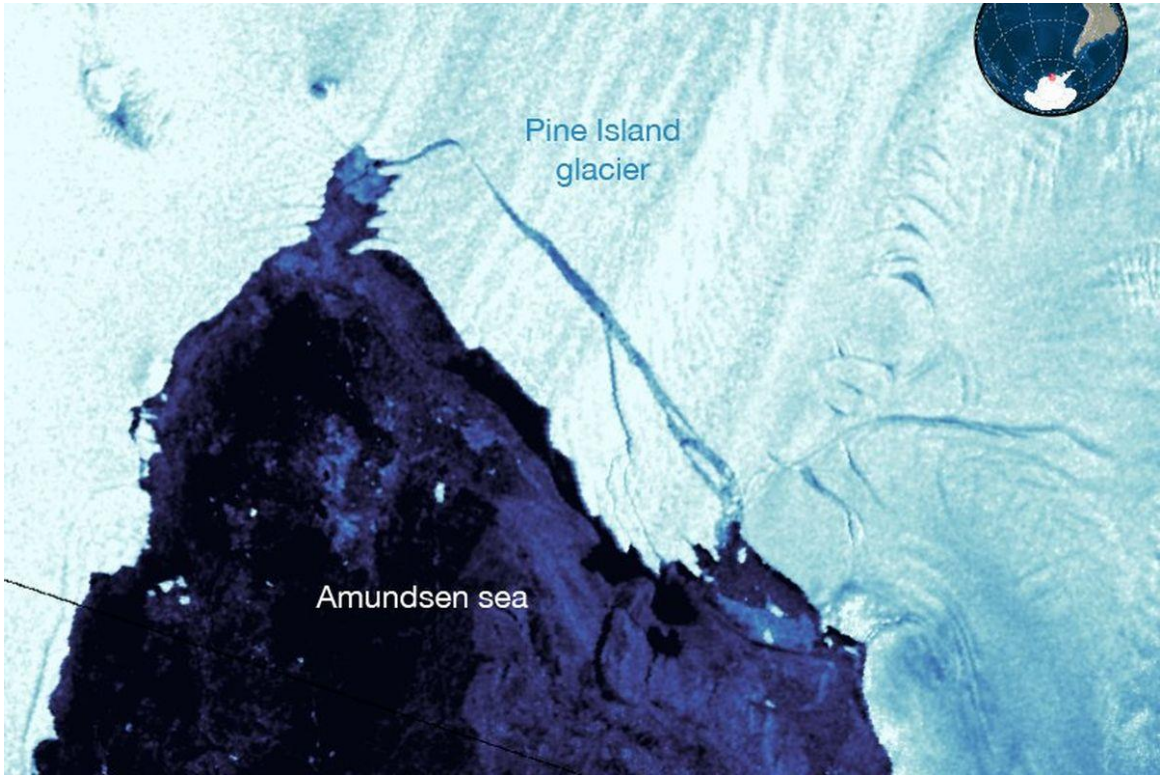
Rignot et al, 2014

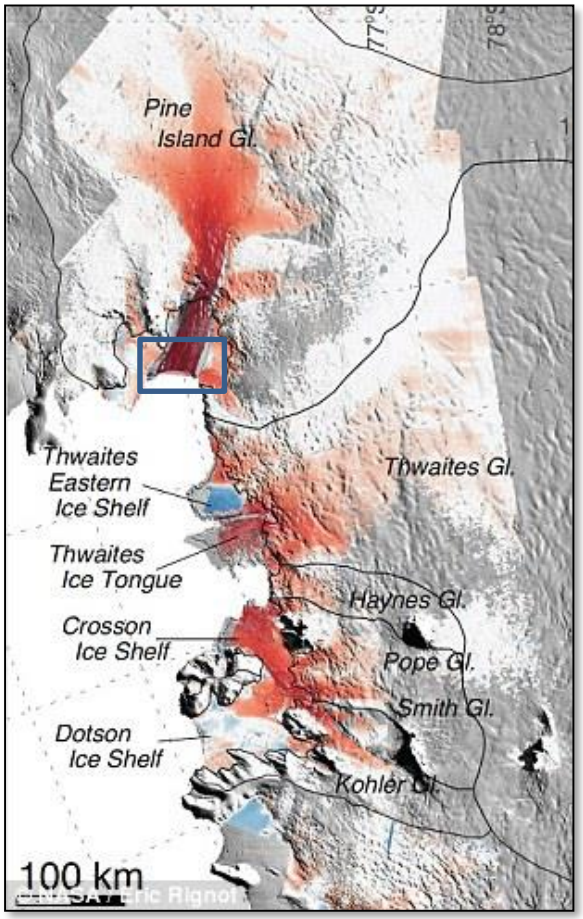
http://onlinelibrary.wiley.com/doi/10.1002/2014GL060140/full

Pine Island Glacier Melt



Pine Island Glacier Melt





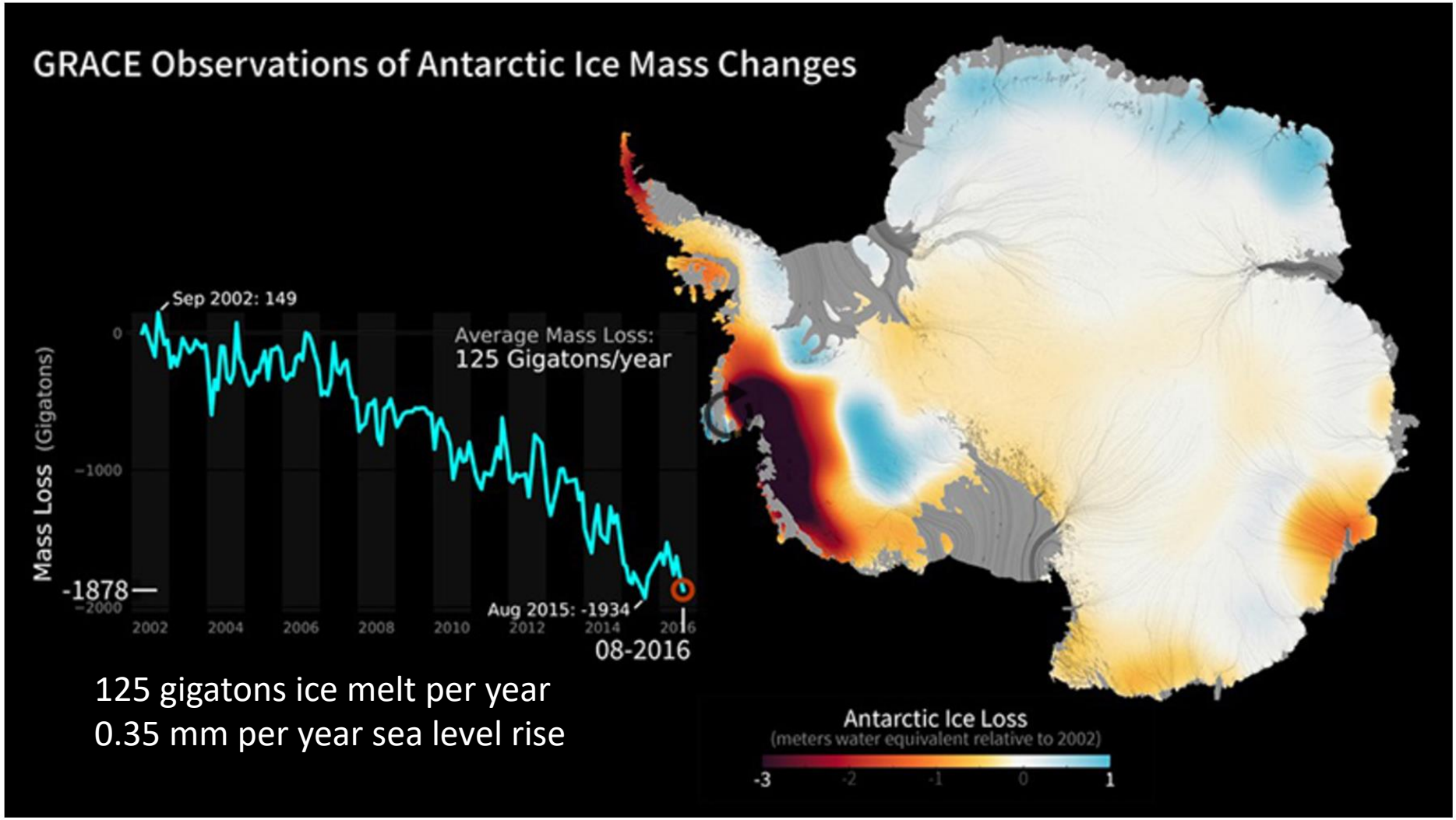
September, 2017

https://www.theverge.com/2017/9/25/16361666/pine-island-glacier-iceberg-melting-climate-change-sea-level-rise

Pine Island and Thwaites together drain about ~5% of the Antarctic Ice Sheet

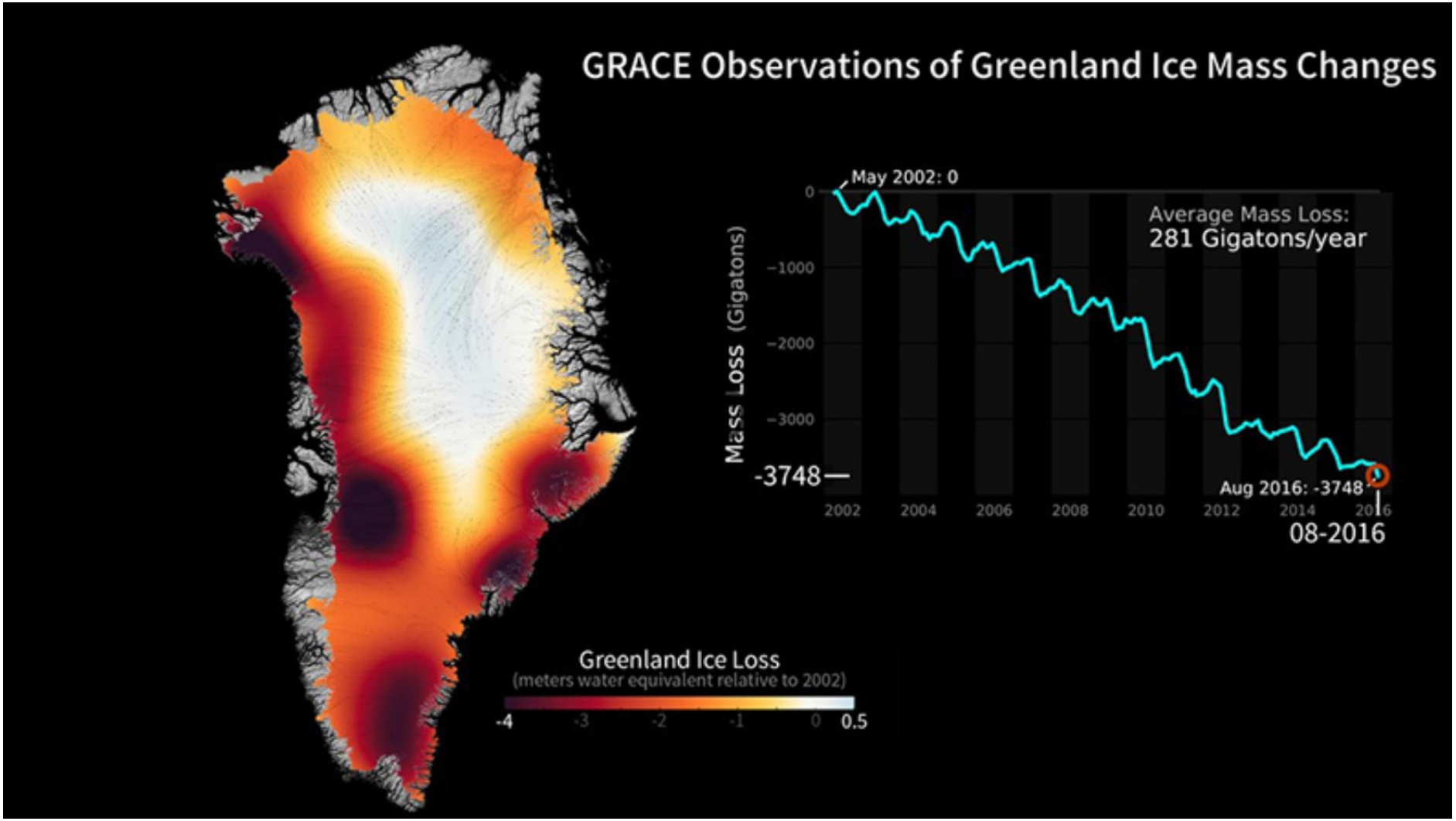
http://www.antarcticglaciers.org/glaciers-and-climate/shrinking-ice-shelves/pine-island-glacier/

Antarctic Ice Loss (2002-2016)



https://grace.jpl.nasa.gov/resources/30/

Greenland Ice Loss (2002-2016)



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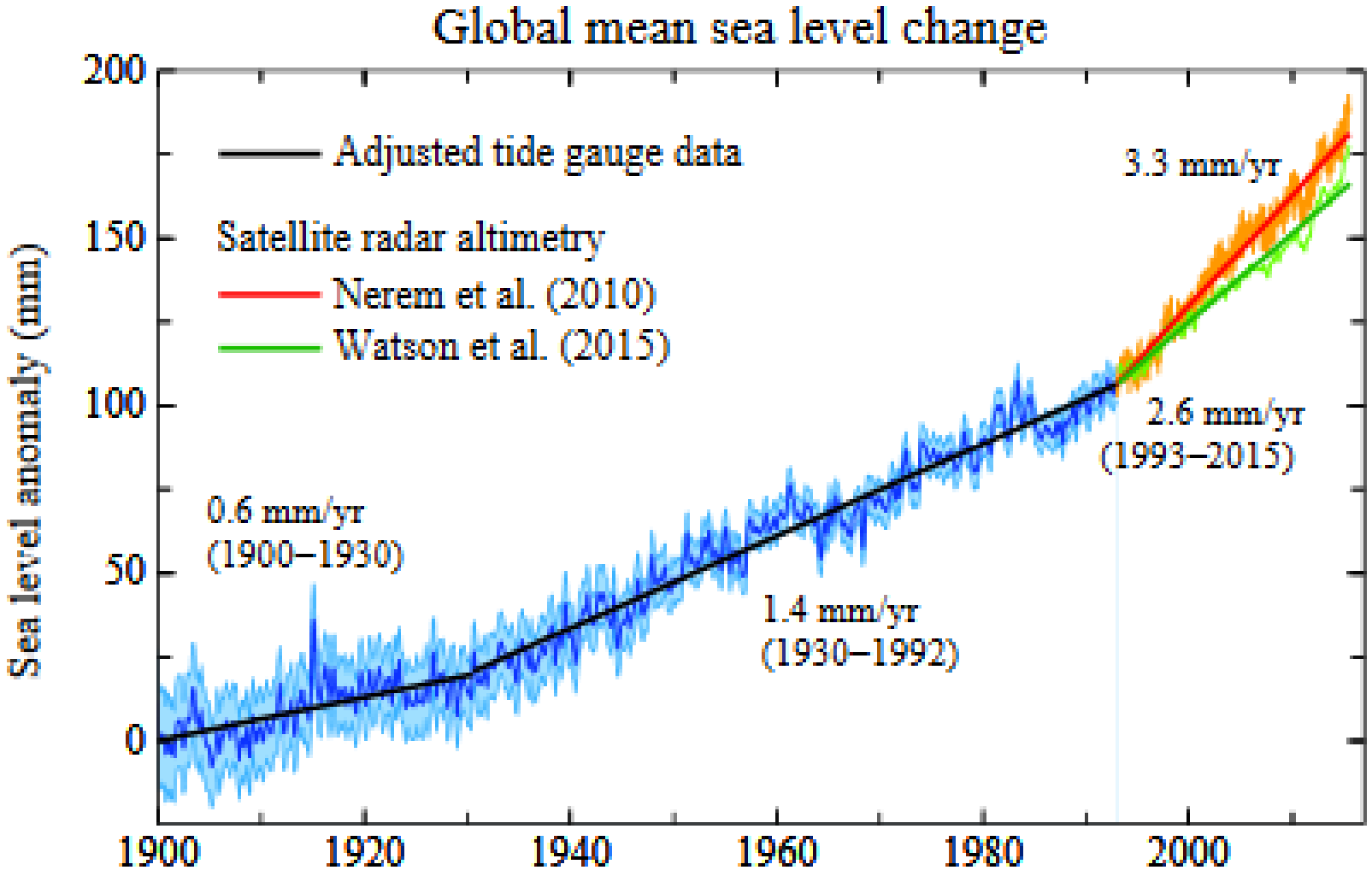
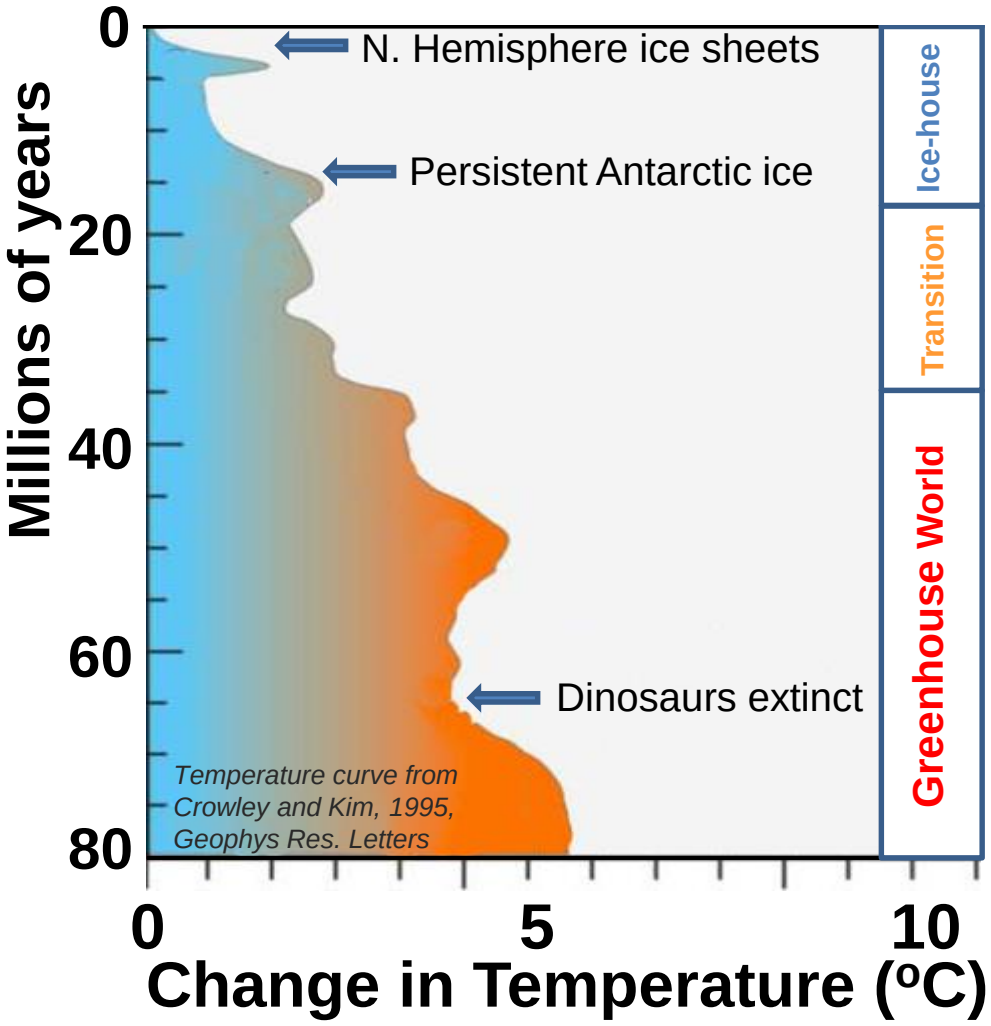
Sea Level Rise Accelerates



Hanson et al., 2016
https://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.html

Geologically…not a big deal



125,000 years ago

T 4ºC higher

Sea level ~4-6m higher*

~13-20 feet

56 million years ago

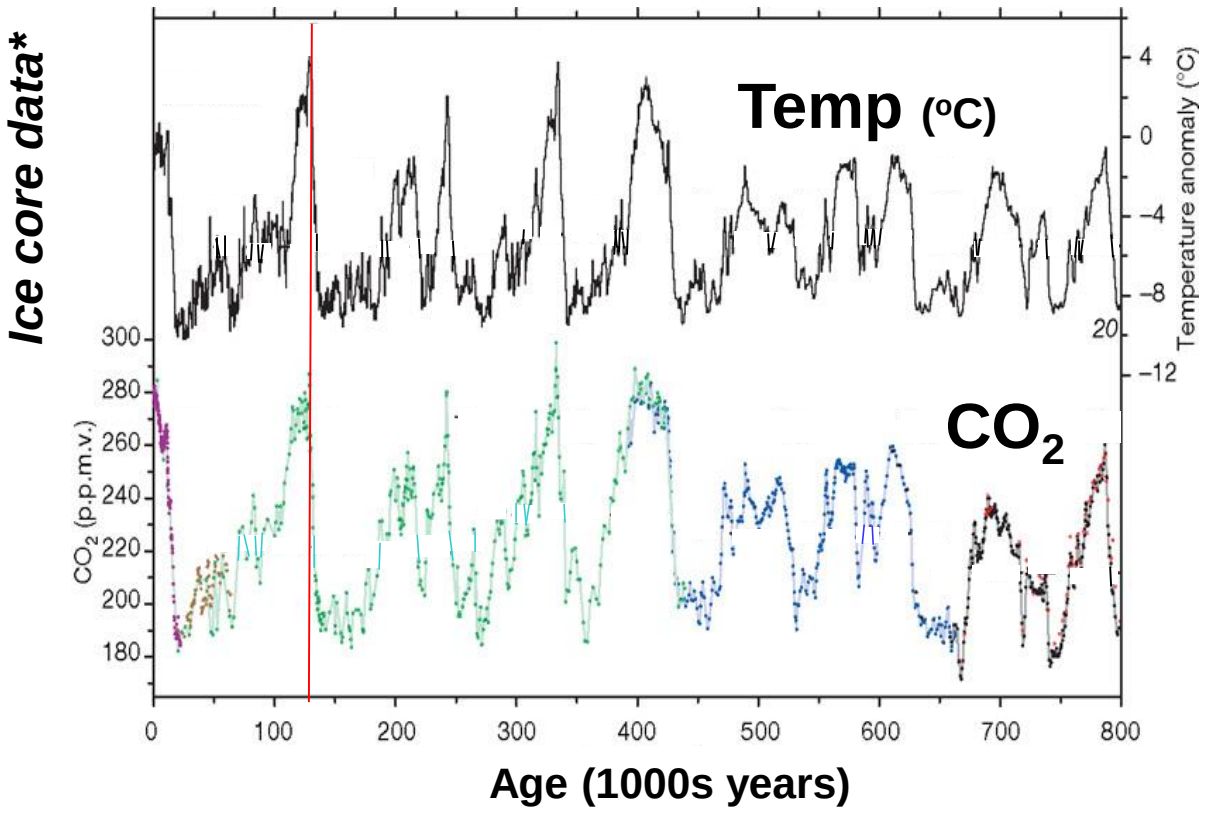
T 4-8ºC higher

Sea level 75-90m higher

250-300 feet

**Intergovernmental Panel on Climate Change (IPCC), Summary for Policymakers, Feb, 2007*

The Last 800,000 Years



•Ice core data and figures from Loulergue et al (p. 383) and Luthi et al (p. 379), Nature, 15 May 2008

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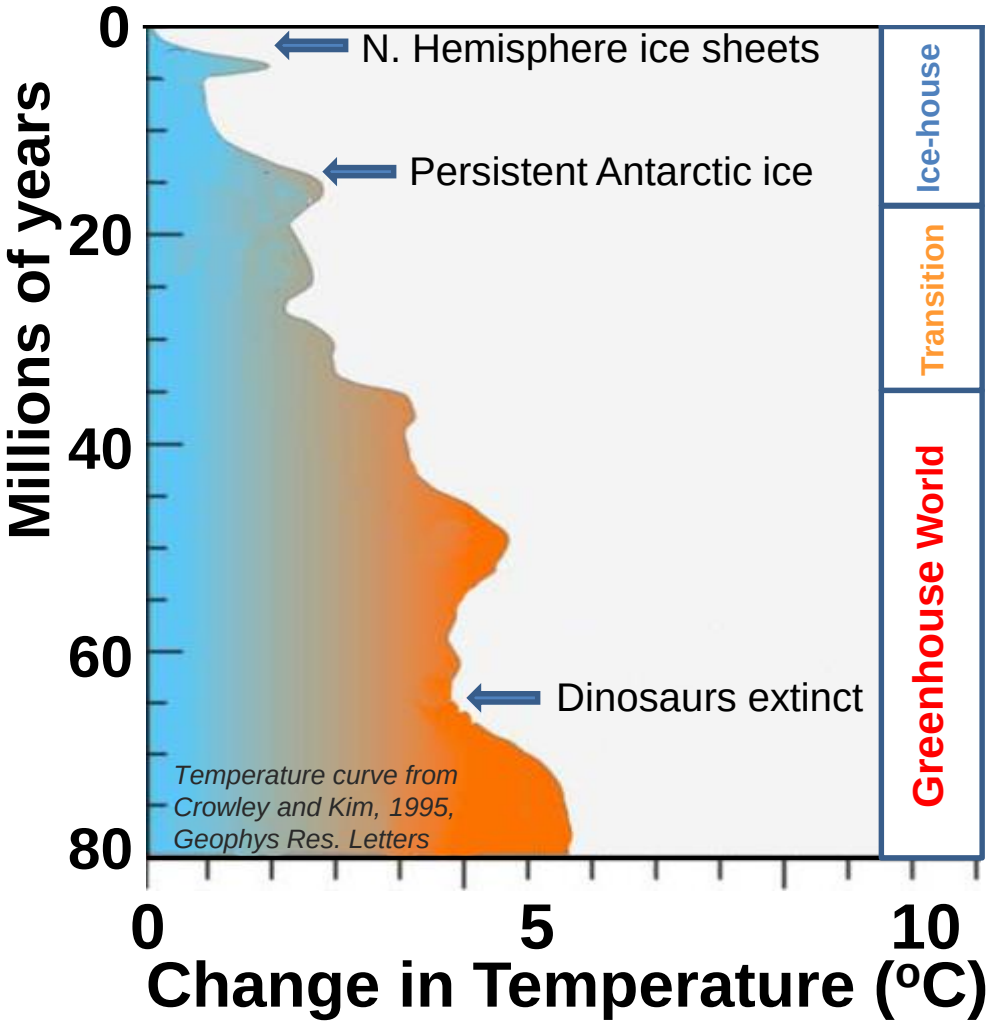

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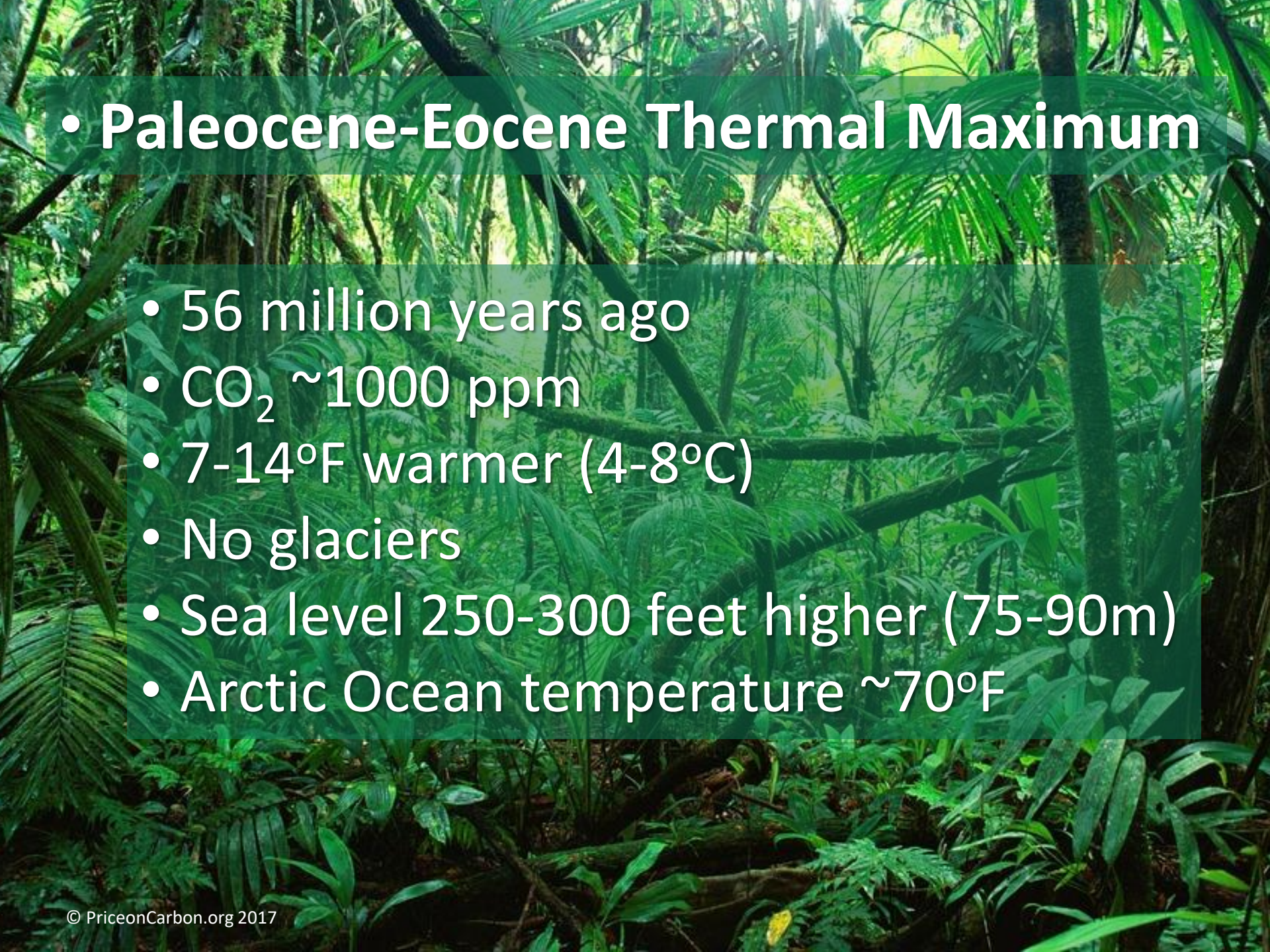
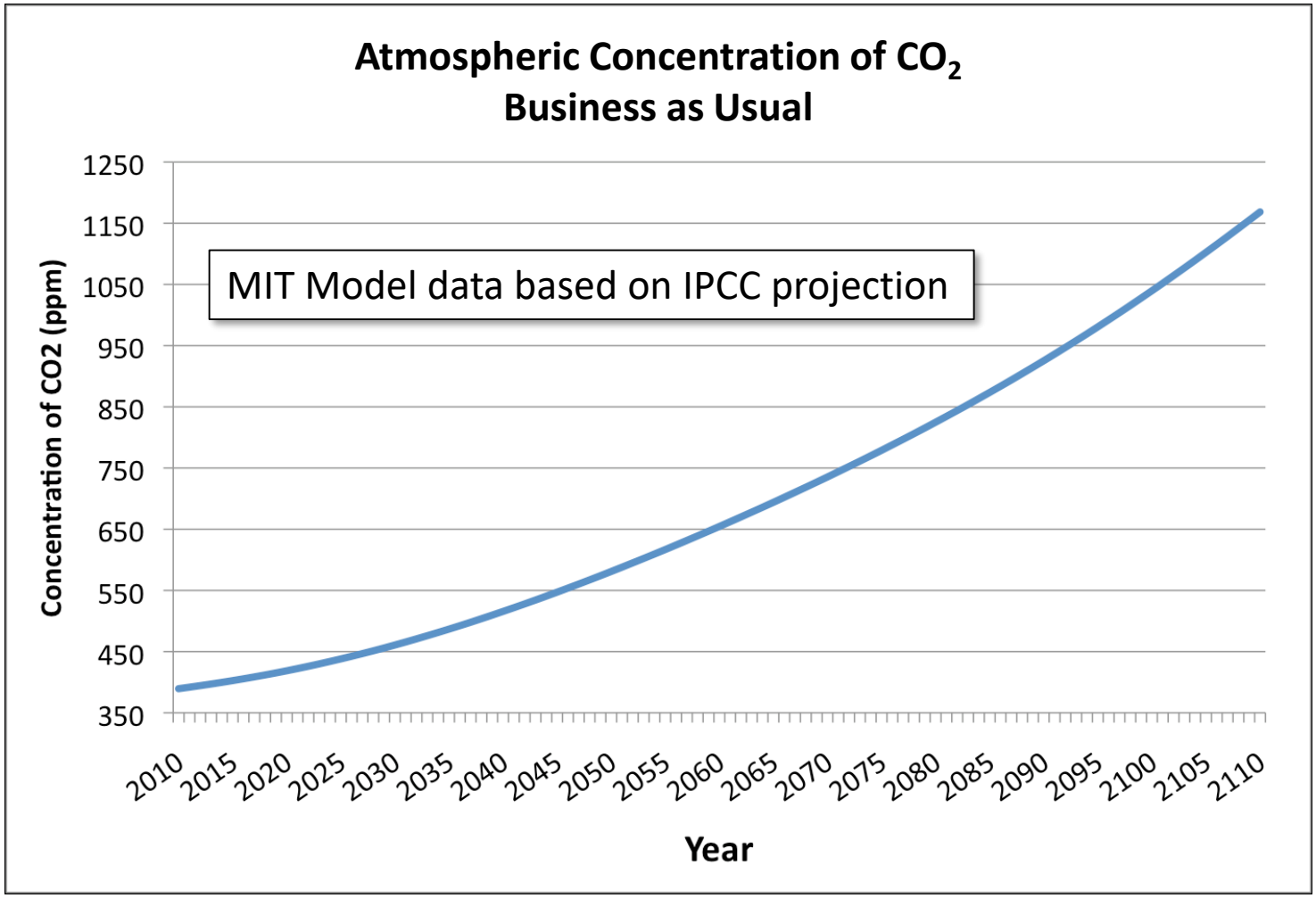


• Paleocene-Eocene Thermal Maximum

- 56 million years ago
- CO_2 ~1000 ppm
- 7-14°F warmer (4-8°C)
- No glaciers
- Sea level 250-300 feet higher (75-90m)
- Arctic Ocean temperature ~70°F

We're on track for 1000 ppm by 2100

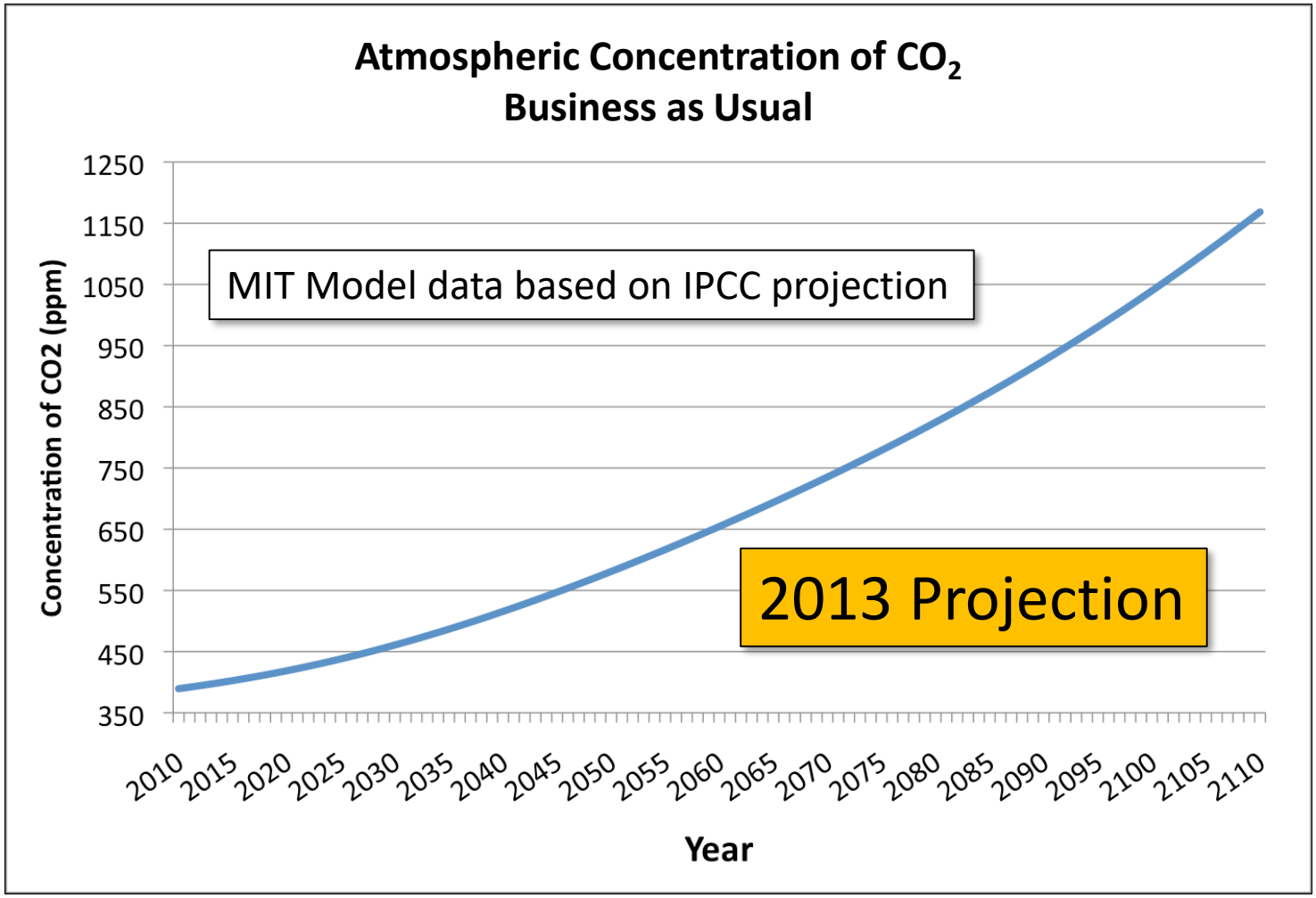


http://igutek.scripts.mit.edu/terrascope/index.php?page=Model

But Ice Doesn't Melt Immediately

Your cool drink retains ice for awhile

We're on track for 1000 ppm by 2100



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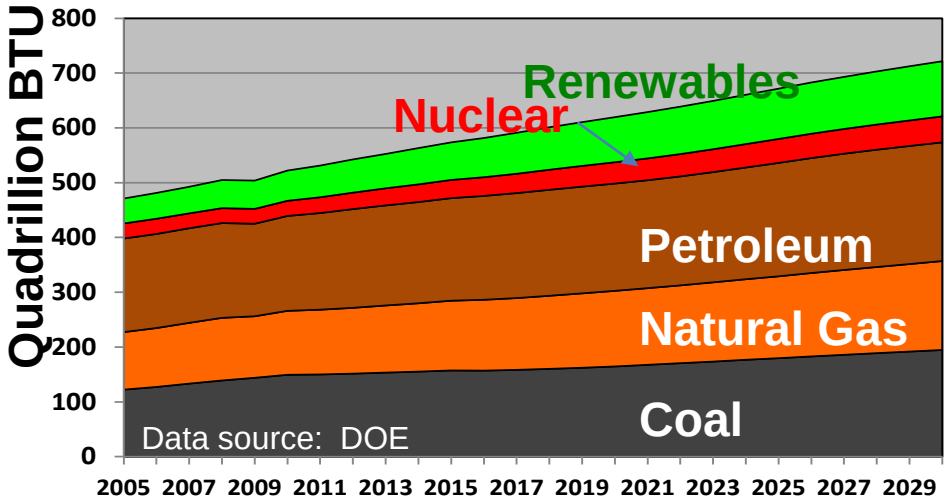
We're Beginning to Turn Around



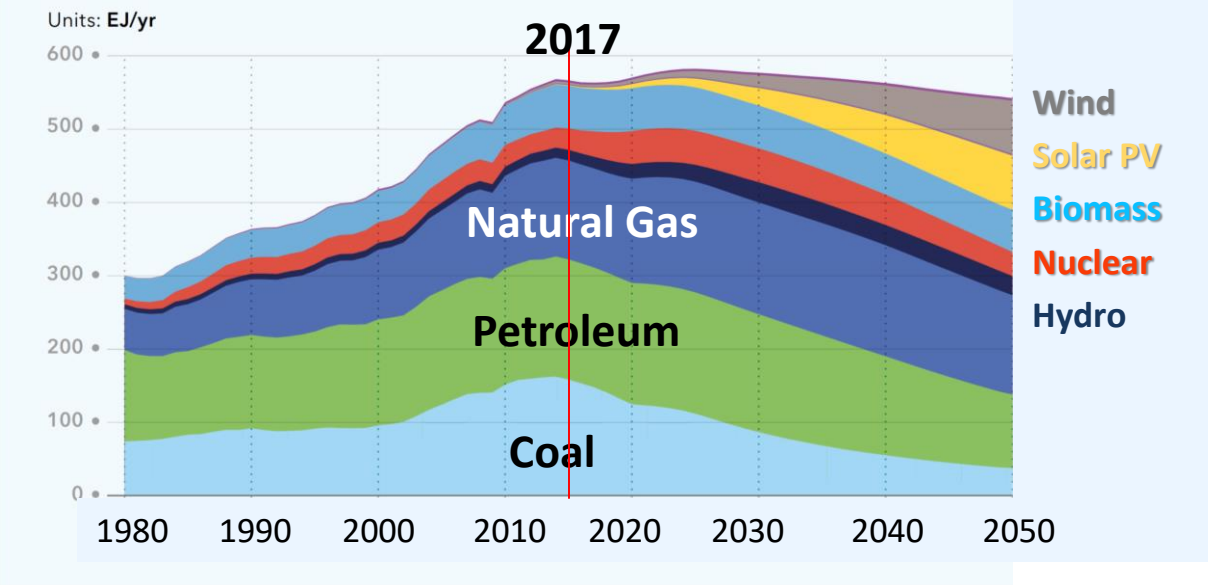
2009 projection
Global Energy Consumption

2017

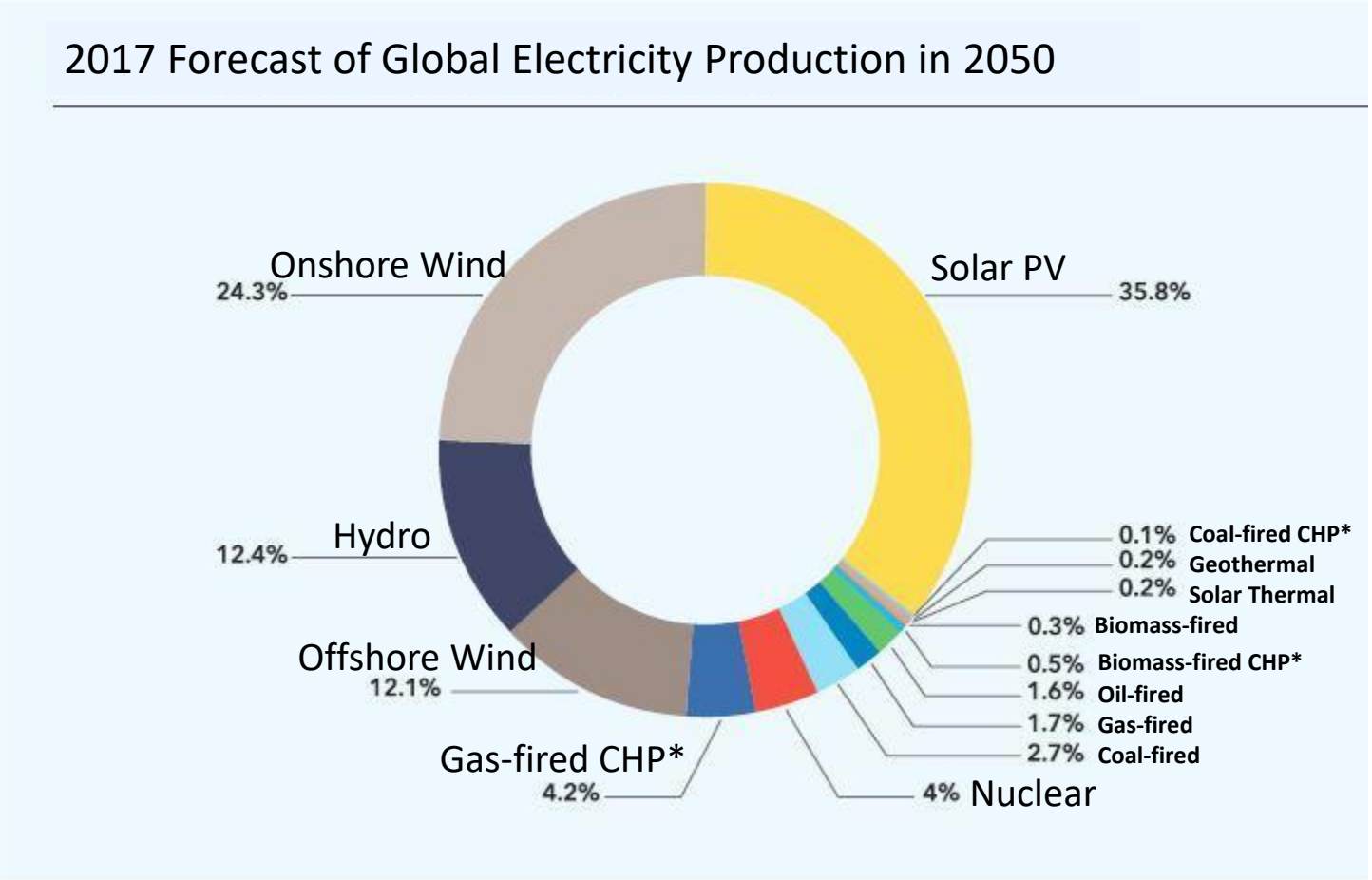
Forecast World
Primary Energy
Supply by Source

DNV GL 2017
Energy Transition Outlook
Harts E&P

EJ=Quad joules~ Quad BTU



And Electrification is Even Better



*CHP: Cogeneration or
Combined Heat and Power

DNV GL 2017
Energy Transition Outlook

Hart's E&P 2017

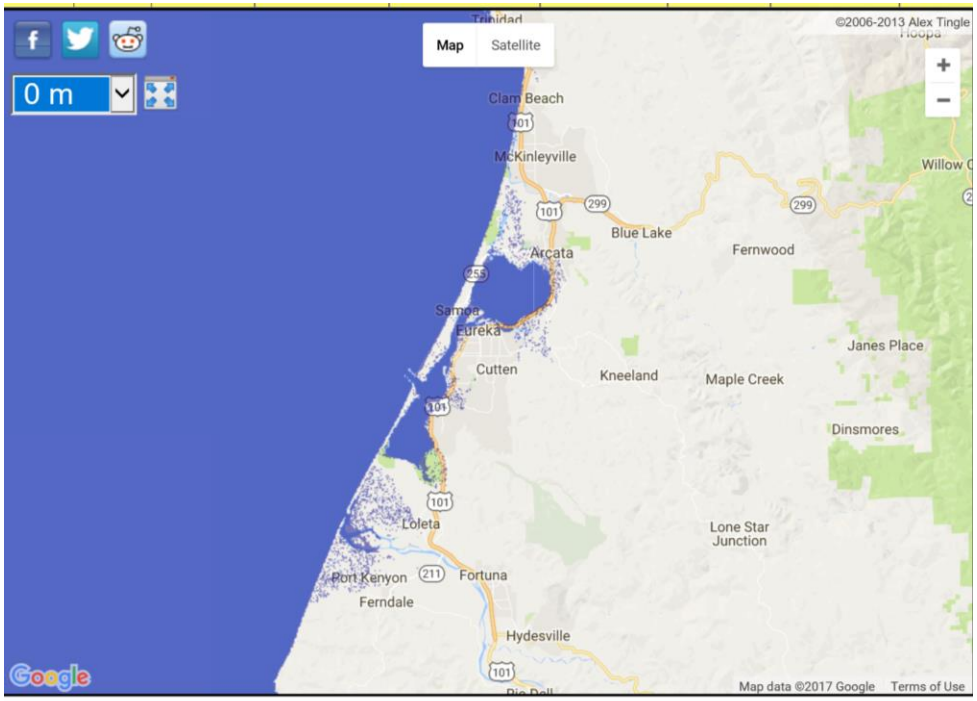
So We're Turning it Around…
…but We're still in for a Soaking

We're doing intense study of dynamics of ice sheet melting,

But for now, we don't know precisely how fast or how far sea level will rise.

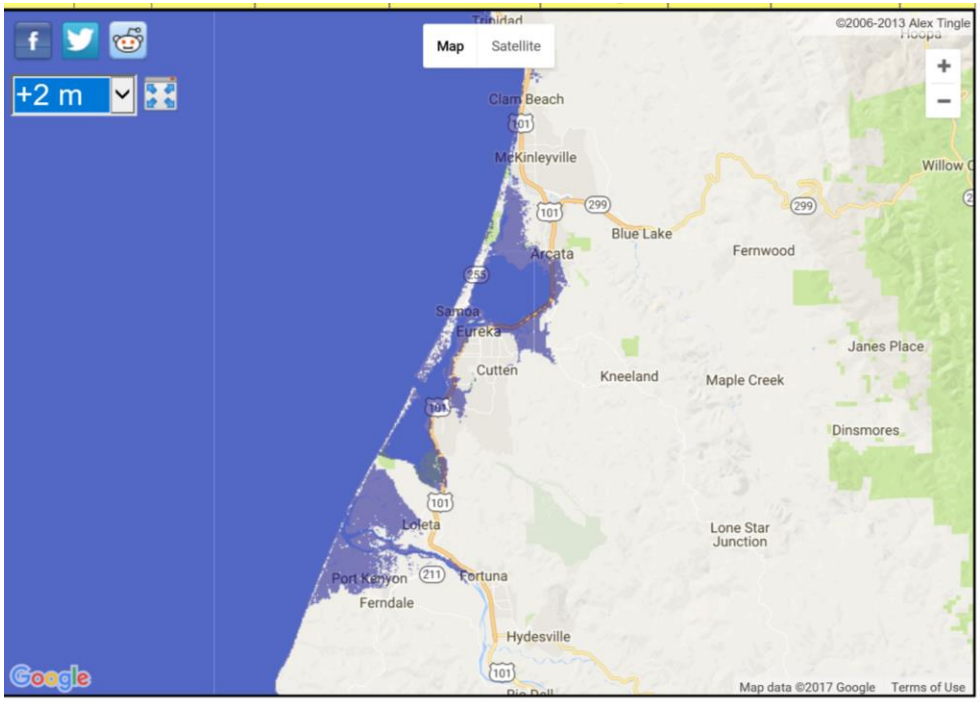
A prudent limit for planning is 2m ± 1m by 2100

Eureka-Arcata Area Sea Level



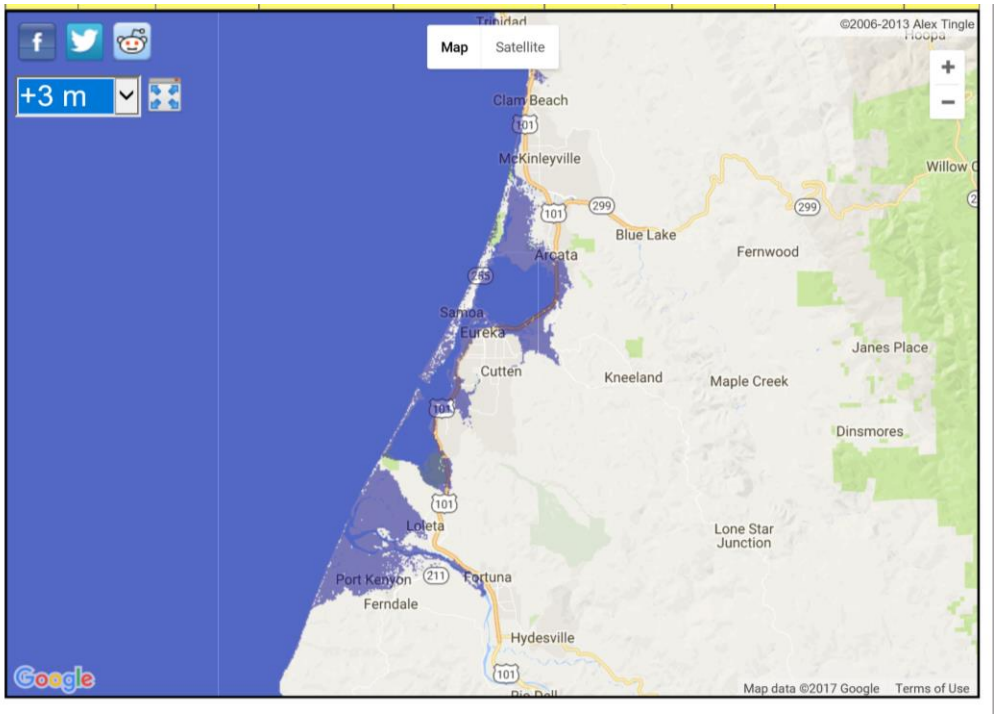
0 meters

Eureka-Arcata Area Sea Level



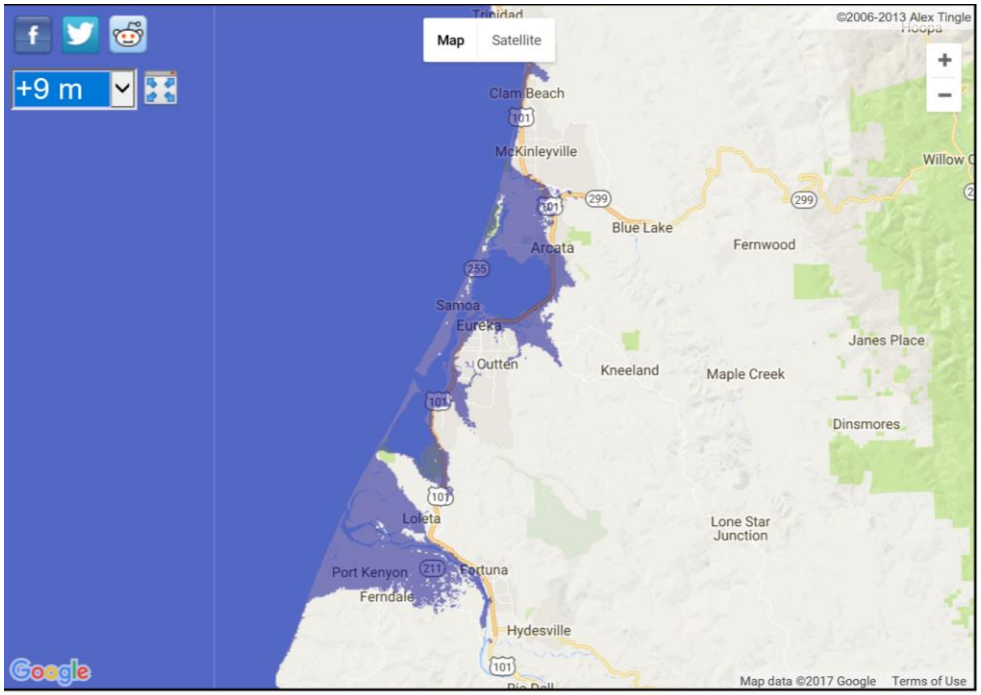
+ 2 meters

Eureka Arcata Area Sea Level



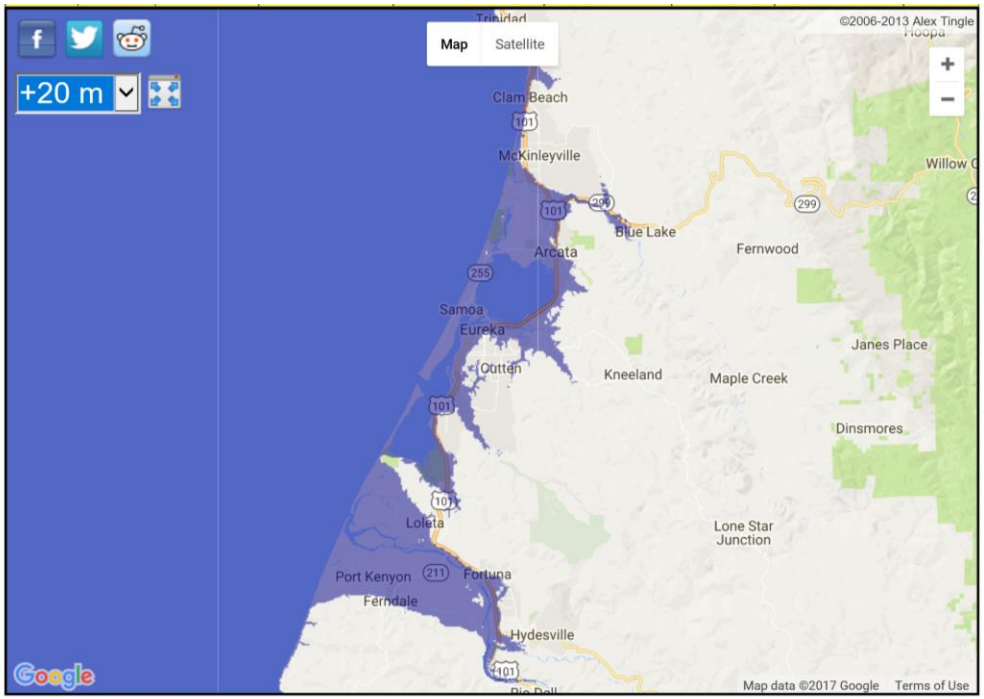
+ 3 meters

Eureka Arcata Area Sea Level



+ 9 meters

Eureka Arcata Area Sea Level



+20 meters

League of Women Voters
of Mendocino County

Agenda

Sea Level Rise

What We Can Do About It

Promote Efficiency

Promote energy conservation and efficiency in transportation, buildings, and infrastructure, including energy efficiency standards and land use policies that reduce vehicle miles travelled.

Promote Efficiency in Transportation

*Promote energy conservation and efficiency in **transportation,** buildings, and infrastructure, including energy efficiency standards and land use policies that reduce vehicle miles travelled.*

- Increased and more efficient public transportation
- Electric vehicles, local charging stations
- Car share programs, car share apps

Promote Efficiency in Buildings

*Promote energy conservation and efficiency in transportation, **buildings,** and infrastructure, including energy efficiency standards and land use policies that reduce vehicle miles travelled.*

SB 350 requires us to double energy efficiency in CA buildings by 2030.

- Residential housing: Education and incentives (insulation, electrification (heat pumps), water reuse)
- Municipal codes for water and energy efficiency in buildings – current inspections

Promote Efficiency in Infrastructure

Promote energy conservation and efficiency in transportation, buildings, and ***infrastructure,*** *including energy efficiency standards and land use policies that reduce vehicle miles travelled.*

- Storm water capture in municipal systems
- Mini-grids, Community Choice Energy (if fiscally prudent)

Promote Efficiency with Energy Efficiency Standards

*Promote energy conservation and efficiency in transportation, buildings, and infrastructure, including **energy efficiency standards** and land use policies that reduce vehicle miles travelled.*

- Low carbon fuel standard, mileage standards
- Appliance efficiency standards
- Zero Net Energy rewards/incentives

Promote Efficiency with Land Use

*Promote energy conservation and efficiency in transportation, buildings, and infrastructure, including energy efficiency standards and **land use policies** that reduce vehicle miles travelled.*

- Downtown plans that allow walkable cities/towns focused around public transportation
- Planning permits restricted by sea level rise
- Wetlands rehabilitation for storm surge protection

Promote Low-Carbon Energy Economy

Promote a clean, low-carbon energy economy that is sustainable, including all forms of renewable energy and transportation infrastructure.

- Role of market (carbon price) grows renewables, discourages fossil fuels
- Evaluate relative merits of varied transportation infrastructure
- Encourage alternative energy in municipal settings

Promote Adaptation Policies

Major Risks in California

Sea Level Rise

Changing Weather Patterns

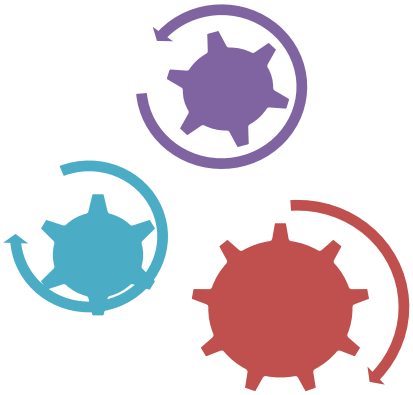
- Drought
- Stronger Storms
- Agriculture Disruption

Promote Adaptation Policies

Promote policies that mitigate impacts of climate change by adaptation in urban, rural, agricultural, and natural settings

- Water policies
- Drought and flooding mitigation at local and regional level
- Wetlands restoration
- Regional planning and permitting

Local Applications



Promote Basic Research & Technology Development…

encouraging the use of a portfolio of technologies.

Promote Climate Social Justice Solutions…

that ease consequences of climate-related hardships to low and moderate income households.

Promote Access and Involvement…

in decision-making process.

Thank You!