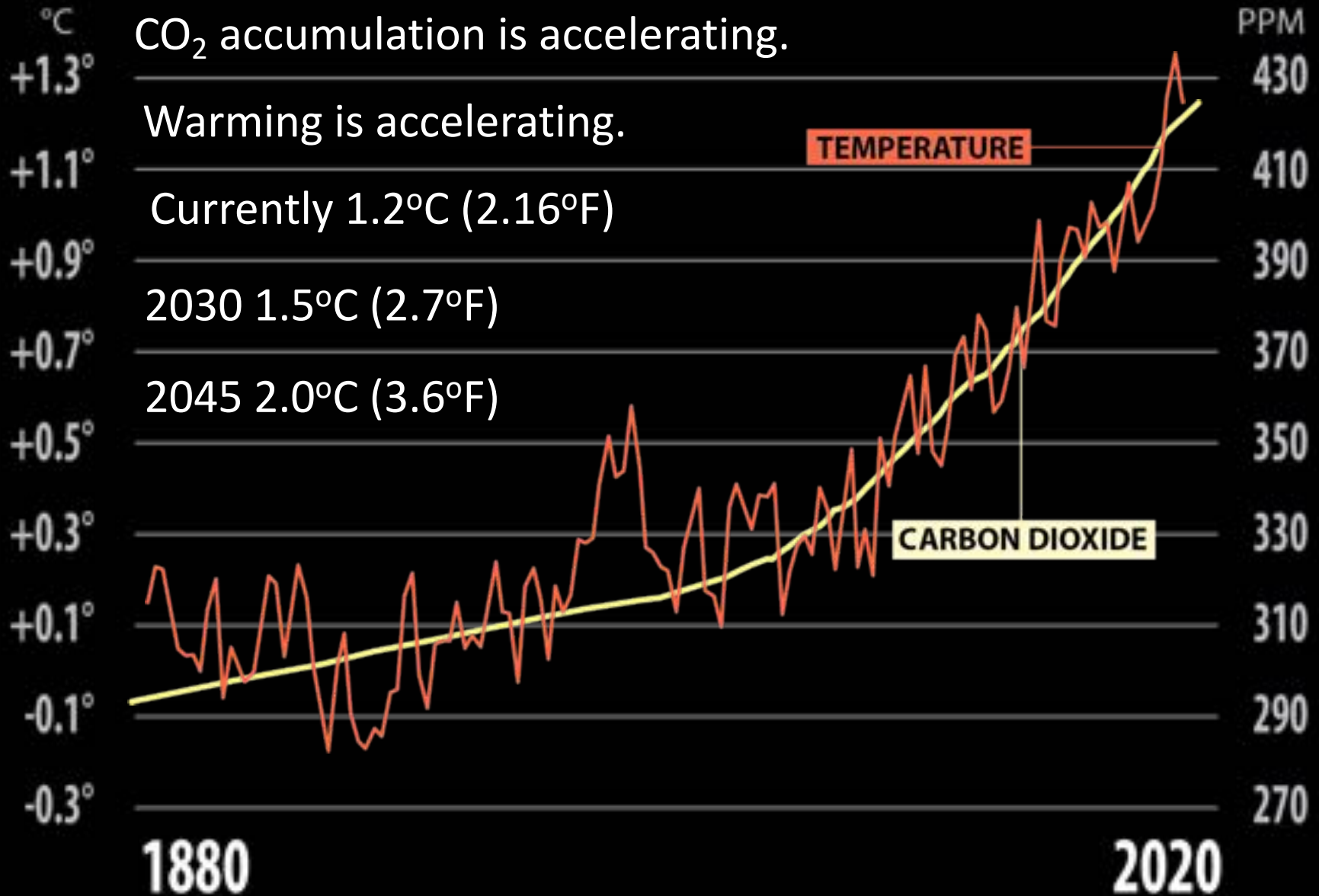


**View adaptation as an opportunity
for economic and community
revitalization**



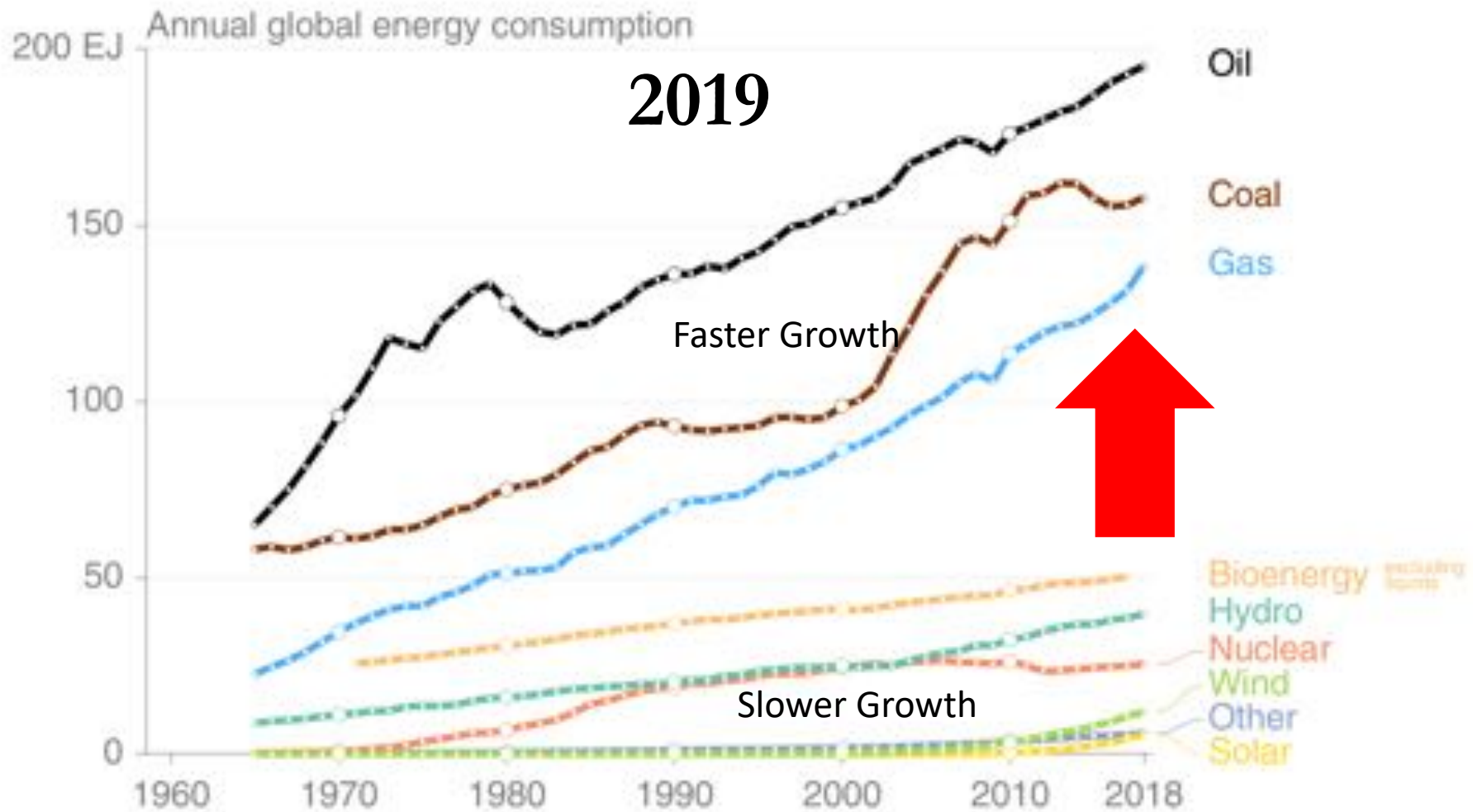
GLOBAL TEMPERATURE & CARBON DIOXIDE



It no longer simply about cutting greenhouse gas emissions

- The pace of climate change has been rapid, over the past century few people other than scientists have noticed
 - 1900-1980 new temperature record set every 13.5yrs
 - 1981-2019 new temperature record set every 3yrs
- Annual GHG emissions continue to set new records, and the rate of atmospheric carbon dioxide growth has more than doubled.
- The International Energy Agency found energy demand set to grow >25% by 2040.
 - By 2040 “...renewables make up only two-thirds of new capacity and oil consumption grows due to rising demand for petrochemicals, trucking, aviation, and energy. every year.”
- The Congressionally funded Resources for the Future Institute projected that global energy consumption will grow 20–30% or more through 2040 and beyond, led largely by fossil fuels.
- Renewable energy grows rapidly, though it primarily adds to, rather than displaces, fossil fuels. The truth is that fossil fuel use is actually accelerating faster than renewable energy deployment.
- Solutions to this issue are no longer simply about cutting emissions. We need to move strongly on sequestration, adaptation, and education at the same time.

Fossil fuel use is accelerating faster than renewable fuel use



Climate Change Realities

- Will carbon removal technologies counteract rising greenhouse gas emissions?
 - In 2018 twenty three commercial-scale carbon capture and storage projects were in operation or under construction around the world, capturing 40 million metric tons of CO₂ annually.
 - With over 40 Gigatons of CO₂ emitted in 2018, this is 1/1000th of annual emissions.
- Committed Warming
 - Lag Effects - GHG emissions originating today will not contribute to global warming for another 10 to 30 years.
 - Global Dimming - The rise off clean energy will allow more sunlight to enter Earth's atmosphere, enhancing warming.
 - This “committed warming” averages 0.5°C additional heating even if we stopped all emissions now.
 - We are probably already committed to breaching the Paris target of 1.5°C.

Climate Change Realities

- Carbon Budget
 - For a 66% chance of keeping warming below 1.5°C, only 420 GtCO₂ can be released into the air.
 - Global emissions in 2019 equaled about 43 GtCO₂.
 - At 2019 levels, we have less than 10 yrs of GHG emissions before we are committed to a 2/3's probability of warming 1.5°C.
 - Emissions have to quickly fall to around 20 to 30 GtCO₂ per year, then sharply drop toward zero to stay within the budget.
 - However, emissions are projected to rise to 50 GtCO₂ per year by 2030.
- Staying within the carbon budget for 1.5°C will be extremely difficult.
 - If existing sources of fossil fuel emissions (like factories, cars, and power plants) simply continue to operate for their expected lifetime, emissions ~ 650 GtCO₂.
 - That's 55% more than the maximum allowable emissions.
 - Decommissioning high budget infrastructure such as power plants and factories before their planned lifetime puts at risk enormous levels of invested capital, jobs, and entire communities that have been built around these assets.

Climate Change Realities

- Today's SLR reflects the influence of past & present warming.
 - There is a time lag of decades to millennia between air temperature and adjustment of glaciers and oceans to reach equilibrium.
 - Today's rate of SLR acceleration does not reflect today's level of global warming; SLR acceleration is going to increase.
 - Current rate of acceleration is on pace to over 2 ft by 2100.
 - Certain geophysical effects mean that Hawai'i will see 20-30% more than the global rate of SLR.
- Between temporal lags, committed warming, carbon budgets, and continued emissions, it is extremely likely that global warming, and hence SLR will grow.
 - SLR will very likely increase and by the end of the century may exceed 3.2 ft.
- Studies identify a 10% probability of SLR reaching over 6 ft by 2100.
- Beyond 2100, sea level will continue to rise for centuries due to continuing deep ocean heat uptake and mass loss of the Greenland Ice Sheet and Antarctic Ice Sheet and **will remain elevated for thousands of years.**

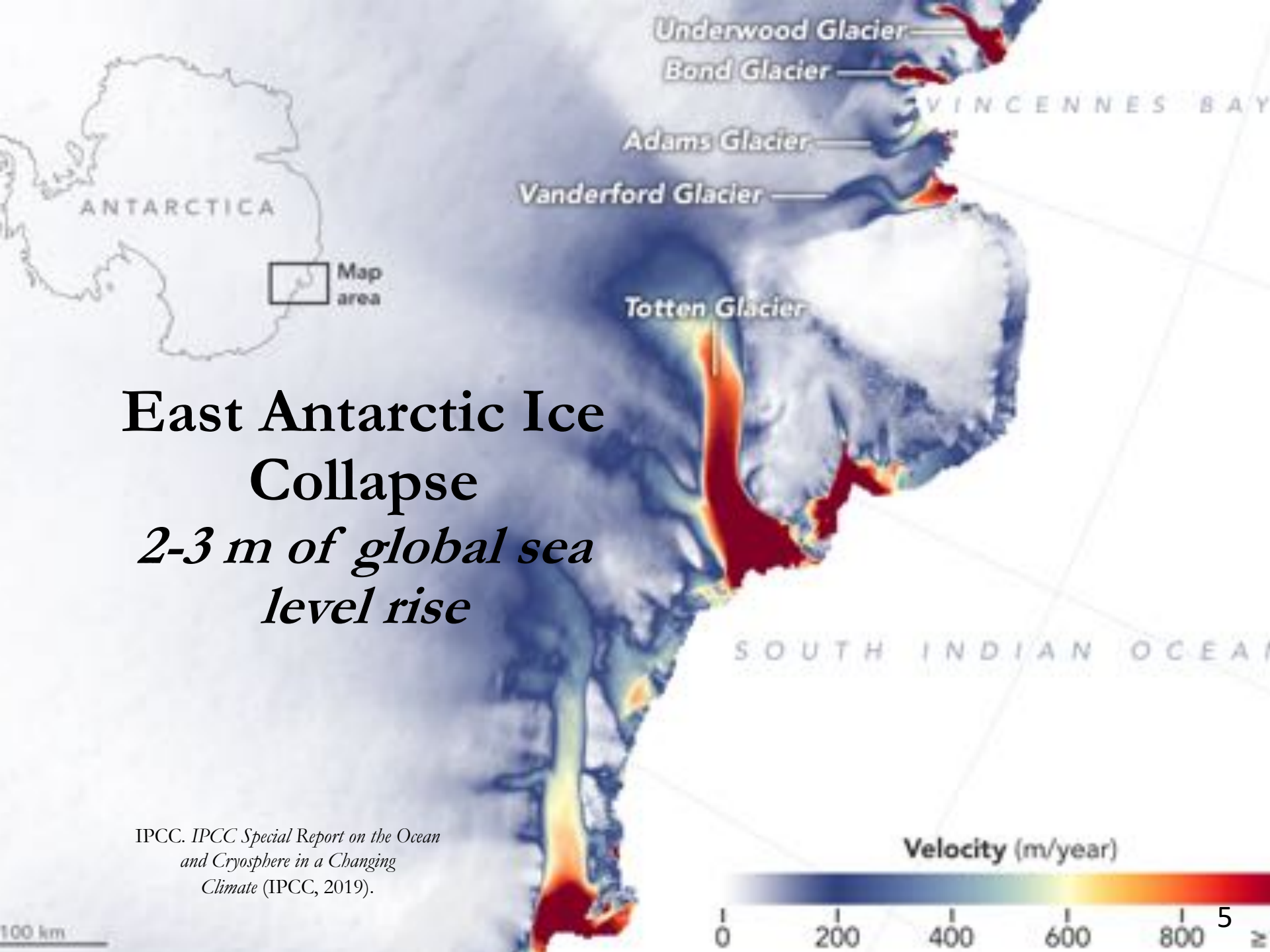


West Antarctic Ice Collapse

“melting appears to be irreversible”

At 2-3°C warming, melting of **Antarctic ice** could raise sea level 10 ft by the year 2300 and continue for thousands of years thereafter.

Golledge, N.R., et al. (2015) The multi-millennial Antarctic commitment to future sea-level rise: *Nature*, 2015; 526 (7573): 421 DOI: 10.1038/nature15706.

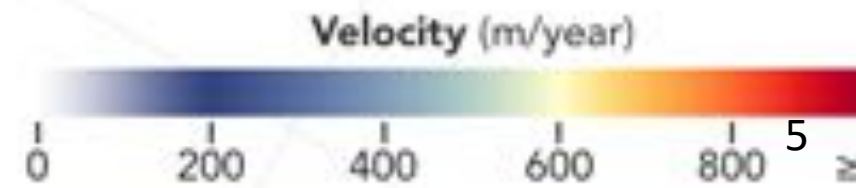


East Antarctic Ice Collapse

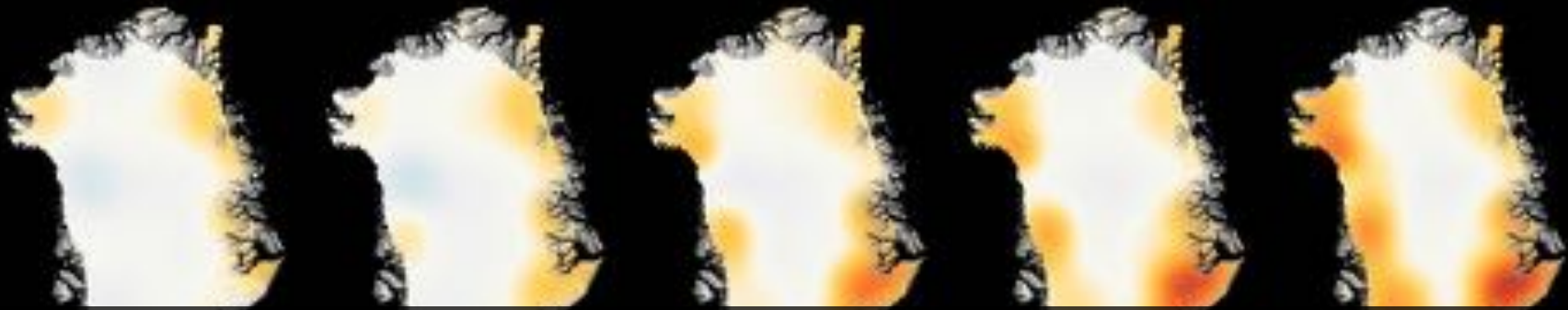
2-3 m of global sea level rise

IPCC. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (IPCC, 2019).

100 km

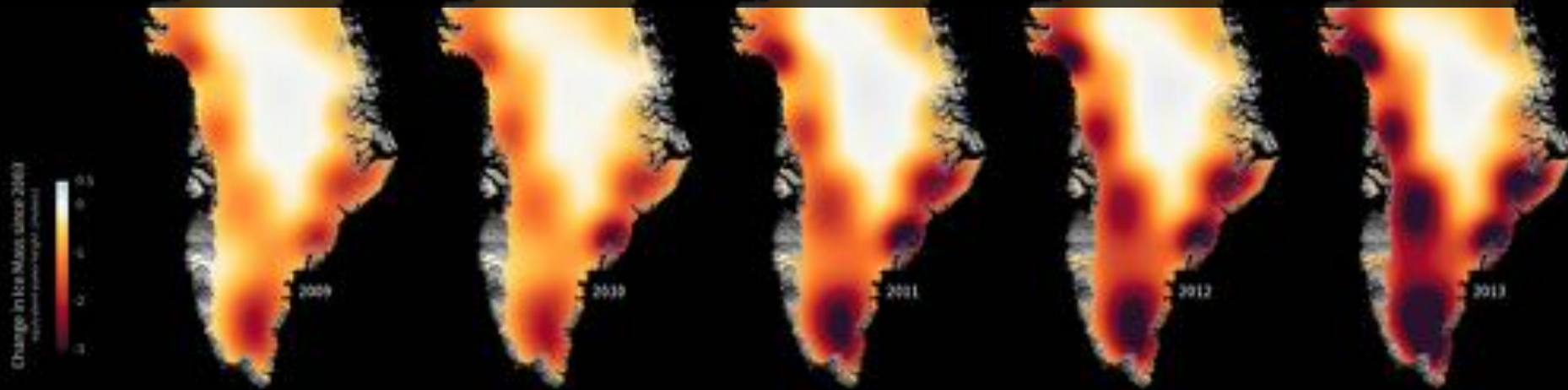


Greenland ice sheet could be doomed at 1.5 °C of warming



Ice is being lost from **Greenland** seven times faster than it was in the 1990's.

Shepherd, A., et al. (2020) Mass balance of the Greenland Ice Sheet from 1992 to 2018. *Nature* 579, 233–239. <https://doi.org/10.1038/s41586-019-1855-2>



Over 90% of the heat trapped by GHG's is absorbed in the oceans.

● 0-700m ● 700-1000m

Thermal expansion ~1/3 of SLR

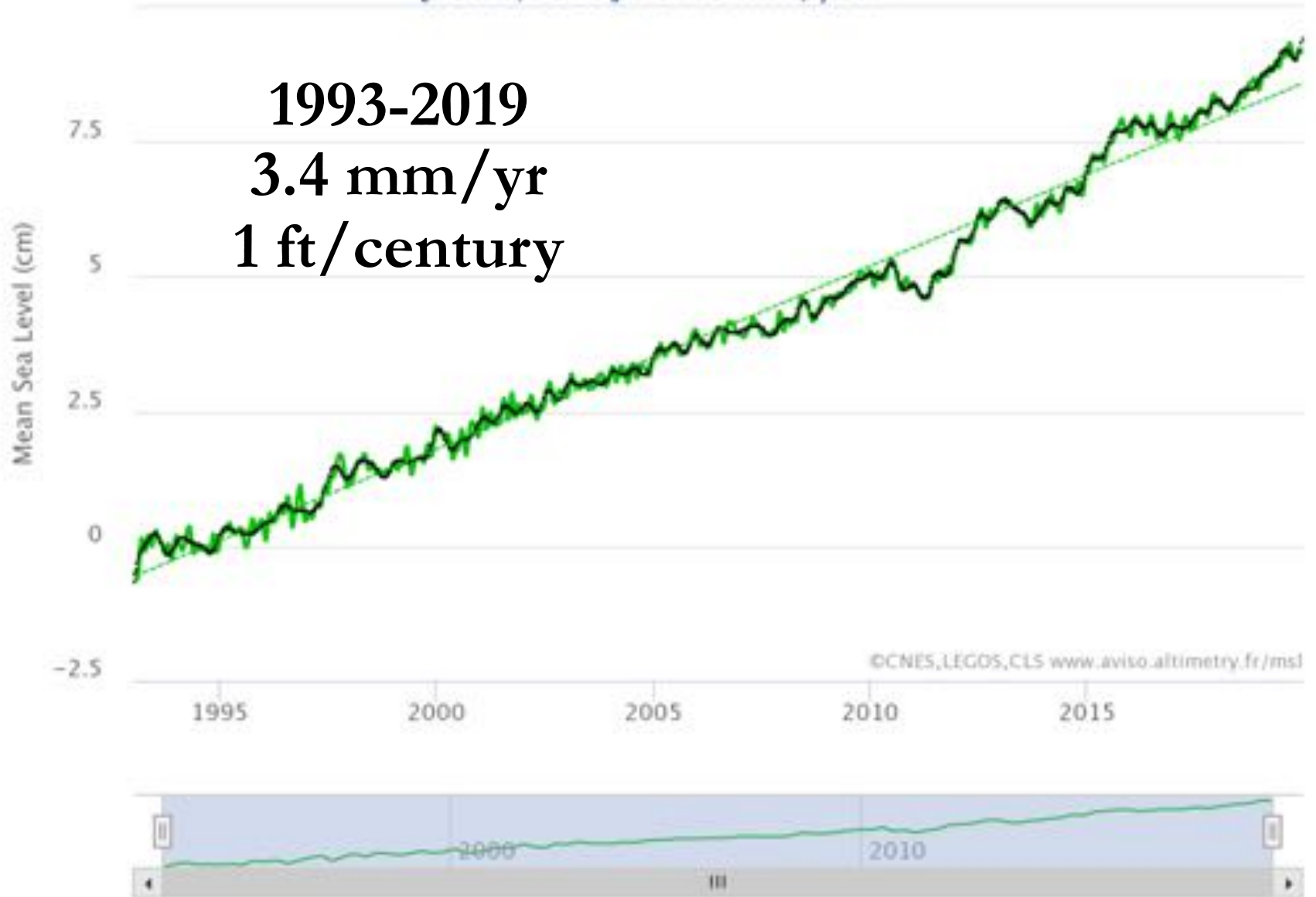


Mean Sea Level from Altimetry

Reference* - Global - Removed

[1993,2019] : 3.40 mm/year

1993-2019
3.4 mm/yr
1 ft/century



Zoom 5y 10y All

From Jan 5, 1993 To Dec 21, 2019

Mean Sea Level from Altimetry

Reference* - Global - Removed

[2010,2019] : 4.58 mm/year



2010-2019
4.6 mm/yr
1.5 ft/century



Zoom 5y 10y All

From Dec 25, 2009 To Dec 21, 2019



Search By Address



0 ft Sea Level Rise

SLR - 0 FT ABOVE MHW



1 ft Sea Level Rise

SLE - 1FT ABOVE MHW

1ft



Coastal Flood Exposure Mapper

SEA LEVEL RISE

Search By Address

2 ft Sea Level Rise

SLE - 2FT ABOVE MHHW

LEGEND BATHYMETRY

Powered by ESRI 80,000ft 80,000ft 80,000ft



3 ft Sea Level Rise

SLR - 3FT ABOVE MHHW

0 3 6



4 ft Sea Level Rise





5 ft Sea Level Rise





6 ft Sea Level Rise

SLE - 6FT ABOVE MHW

6ft

LEGEND

BASEMAPS

King Tides today are rare, but are projected to rapidly increase to dozens of times per year within only 20-30 yrs



King Tides today are rare, but are projected to rapidly increase to dozens of times per year within only 20-30 yrs



Rain + High Tide = Flooding



What should we do about this problem?

- Kaka‘ako needs a plan with governing design principles.
 - Commit to DPP’s vision of denser, walkable mixed use communities close to transit.
 - Strategically relocate improvements above or out of flood zones.
 - Avoid worst inundation areas until infrastructure studies & adaptation planning are complete or well underway.
 - Reward development shifts outside of sea level exposure area.
 - W/in the SLR-XA, emphasize biomimicry, water management, enhanced access to recreation and flood resilient designs.
 - DPP “complete streets” approach for all modes of movement.
 - Livable/walkable/ridable open air communities that are heavily shaded.
 - Mix of towers and low-rise living units above ground-floor commercial space.
 - Mix of housing from affordable to luxury
 - Localize education, child care, and senior care
 - Plaza-style gathering spaces that include resilience, sustainability, and SLR/heat adaptive characteristics
 - Fly-over transportation corridors to allow hydro circulation.
 - Design informed by cultural motifs to promote aloha, community cohesion, and equity.
 - Holistic water management making use of artificial wetlands, temporary retention.
 - Design for “one-water”: precipitation, polluted groundwater, tides/waves/storm surge, runoff, waste water, recycled water.
 - Innovative architecture, plumbing, energy, food, transportation, and commercial design.
- Approach with private-public partnerships

Tanner Springs Park Portland



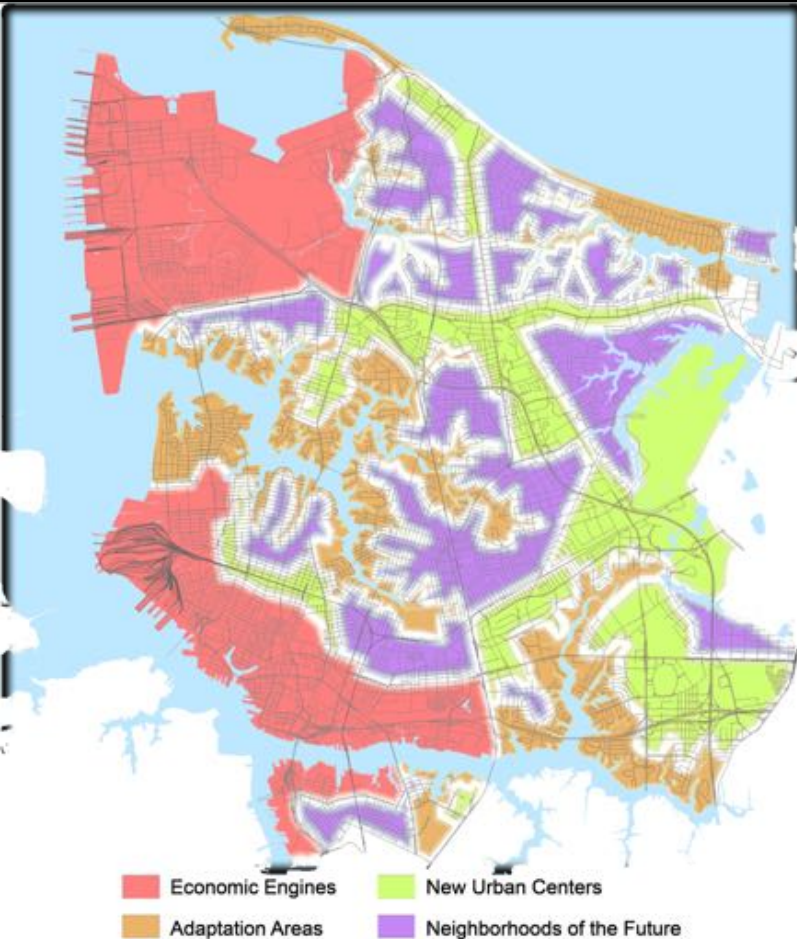
Tanner Springs Park Portland



Norfolk VA - adapting to SLR

- In 2013 Norfolk VA released a new comprehensive master plan, *plaNorfolk2030*
 - It detailed the City's vision, with guidance across all sectors: from transportation & economic development to historic preservation & environmental sustainability.
- Norfolk is 97% developed and the plan had a 20yr timeframe.
- The plan's vision statement focused on **preserving and maintaining the main elements of the city.**
 - It was a vision focused on preserving the City as it is today and did not provide the guidance needed to meet the challenges of tomorrow.
- By 2016 they released an entirely new plan - *Vision 2100*
 - sea level rise,
 - aging infrastructure,
 - population growth,
 - uncertain regional and global economy,

Norfolk VA *Vision 2100*



RED Enhancing Economic Engines - Home to key economic assets that are essential to city's future.

- 1) Expand flood protection system
- 2) Build comprehensive, 24-hour transportation network
- 3) Transform less-intense uses into a denser, mixed-use pattern
- 4) Diversify housing options available to residents
- 5) Strengthen and increase economic diversity

BROWN Adapting to Rising Waters - Established neighborhoods that experience more frequent flooding.

- 1) Exploit innovative technologies to reduce flood risk
- 2) Focus infrastructure improvements on resilience
- 3) Educate residents about the risk of recurrent flooding

GREEN Designing New Urban Centers - Low risk of coastal flooding and have great potential for high-density, mixed-use, and mixed-income development.

- 1) Outline a transit-centered land use and infrastructure pattern to support new urban centers
- 2) Make realizing the long-term vision the central factor in all development decisions
- 3) Capitalize on opportunity to create a model urban form of development in these areas

PURPLE Establishing Neighborhoods of The Future - Purple areas are established neighborhoods at less risk of coastal flooding.

- 1) Improve connections to the city's key assets
- 2) Prioritize infrastructure that enhances neighborhood attractiveness
- 3) Maintain housing affordability

Are there economic opportunities in a new model for the visitor industry?

- The historic visitor model was based on **growth**, discouraged a diverse economy, and large aspects were not locally owned.
 - In a non-expanding resource base (zero sum game), growth leads to **crash**. This is augmented by **lack of economic diversity**, and lack of local commitment.
- A new visitor model would have more locally-focused, diversified characteristics, such as:
 - An annual visitor cap achieved through secondary rules and agreements with airline industry. Difficult given Interstate Commerce Act (seek modification?)
 - A revenue model leveraging upper level-repeat visitors seeking higher end experiences, this implies a reduction in room, rental car, and airline infrastructure
 - Subsidies promoting local ownership, especially worker co-operatives, and fees discouraging offshore owners (capital market complexity here).
 - Tourism revenues directed to workforce development in diverse fields: renewable energy, digital technology, sustainable and resilient architecture/engineering, recycling/materials development, regenerative Ag/micro Ag & regenerative aquaculture, green shipping & green ports, construction technology, etc.
- Decentralize visitor infrastructure, promote low profile/low impact visitor distribution into communities (they are already there, but out of control).
 - A revenue model that regenerates those and neighboring communities.
 - Between the cap and decentralization, deconstruct portions of Waikīkī to adapt to SLR and create more open space.

Lessons Learned From COVID19

- It takes more than individual action to solve a global crisis.
 - Sheltering in place has required personal action,
 - But it has not been a personal choice,
 - We are following shelter-in-place guidelines dictated by federal, state and local agencies.
- Climate change, like a pandemic, can only be solved by systemic change. That requires leaders making bold decisions informed by the best science.
 - Has leadership learned what bold decisions look like?
- It's not an either-or situation: Individual action and systemic change are both required to move the needle on climate change.

Adaptation, Mitigation, Sequestration, Education

- Global targets of 1.5 and 2°C are going to be missed.
- Hawaii's energy goals might be globally strong, but they are weak in the face of climate change realities.
- We need to set goals in the areas of *Adaptation*, *Sequestration*, and *Education*.
- ... and enhanced *mitigation* – we can become a carbon neutral community, and not just in the energy sector.
- By leading the world, we help ourselves.
 - We need to prepare to become a “lifeboat” community, equipped to live in increasing isolation as the rest of the world deals with growing climate emergencies.

Thank you