

‘Polar Explorer’ App Explores Sea Level Rise: A guided tour through our changing Earth

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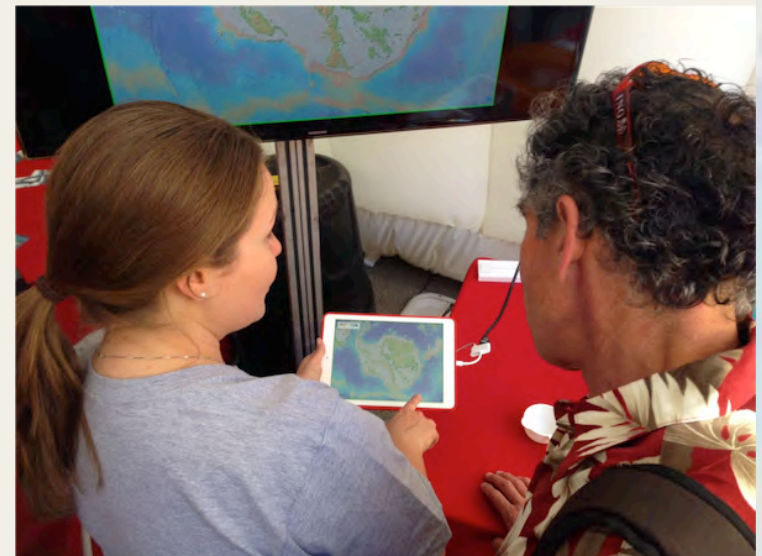
What is Polar Explorer ?

- **Developed through the NSF PoLAR CCEP** grant a guided tour through the many layers of science that impact climate and ultimately sea level rise. We did not create the data – we pulled it together to provide a scaffolded exploration.
- **An app was the selected medium** based our Earth Observer app & pedagogically on work by Segal (2011) which found interactively working with visual media can enhance learning and motivation for processing & understanding complex systems.
- **A series of questions frames this** map-based data-rich app that move the user through map layers with whatever level of complexity they chose to explore.



Addresses Climate Education Challenges

- **Do you ‘Believe’ in Climate Change?** Climate change is not a ‘belief’ – we have **evidence** of a changing climate in the many systems that are all part of a rise in sea level. This app demonstrates this through the actual data.
- **“I read it in an article”**. Users of the app learn directly from the data with no one interpreting the information. **Independent learning provides insights that cements the understanding.**
- **The data sources are reputable science agencies.** The data behind the maps in the app are from NOAA, NASA, USGS and other science partners and are referenced for users.



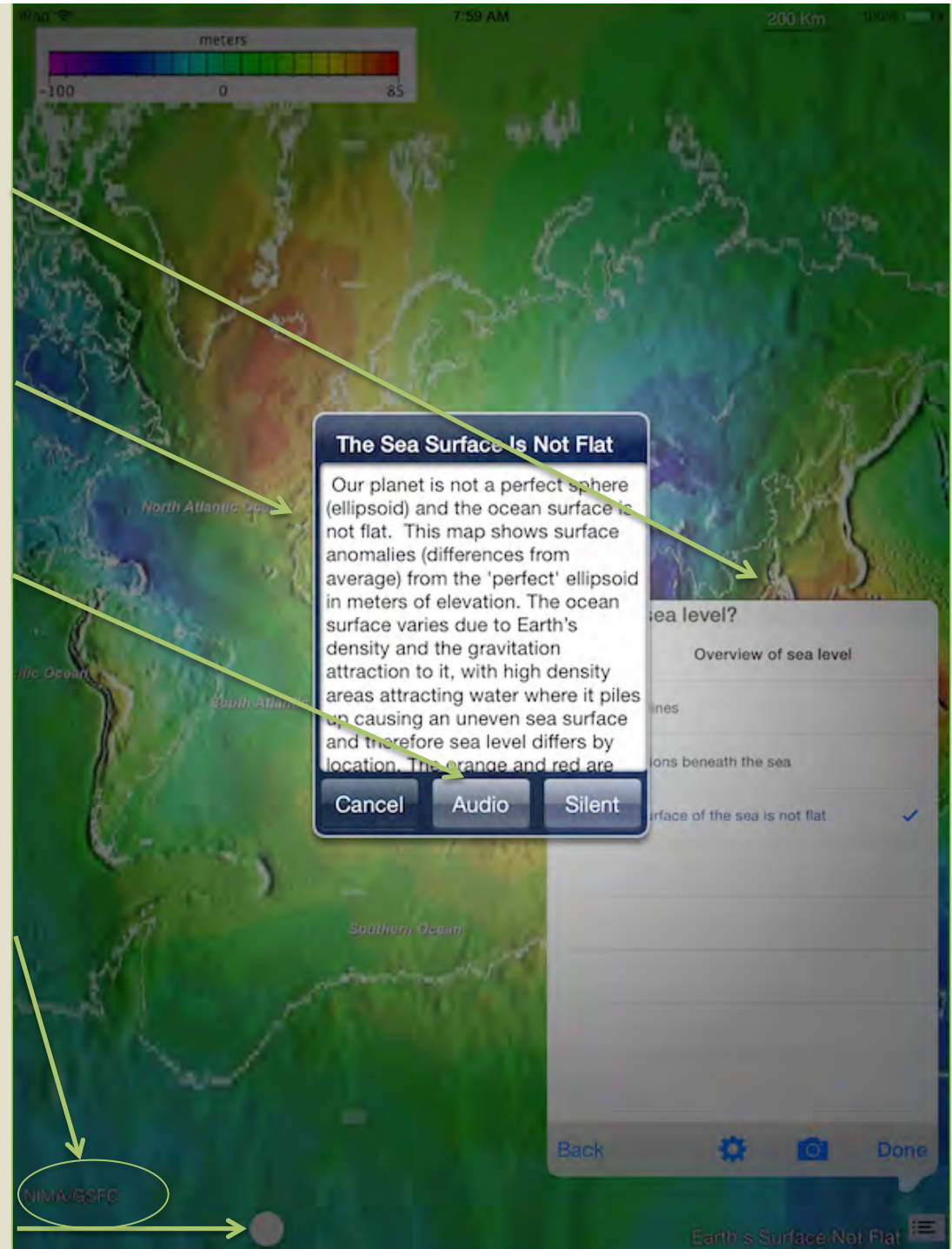
Addresses Misconceptions

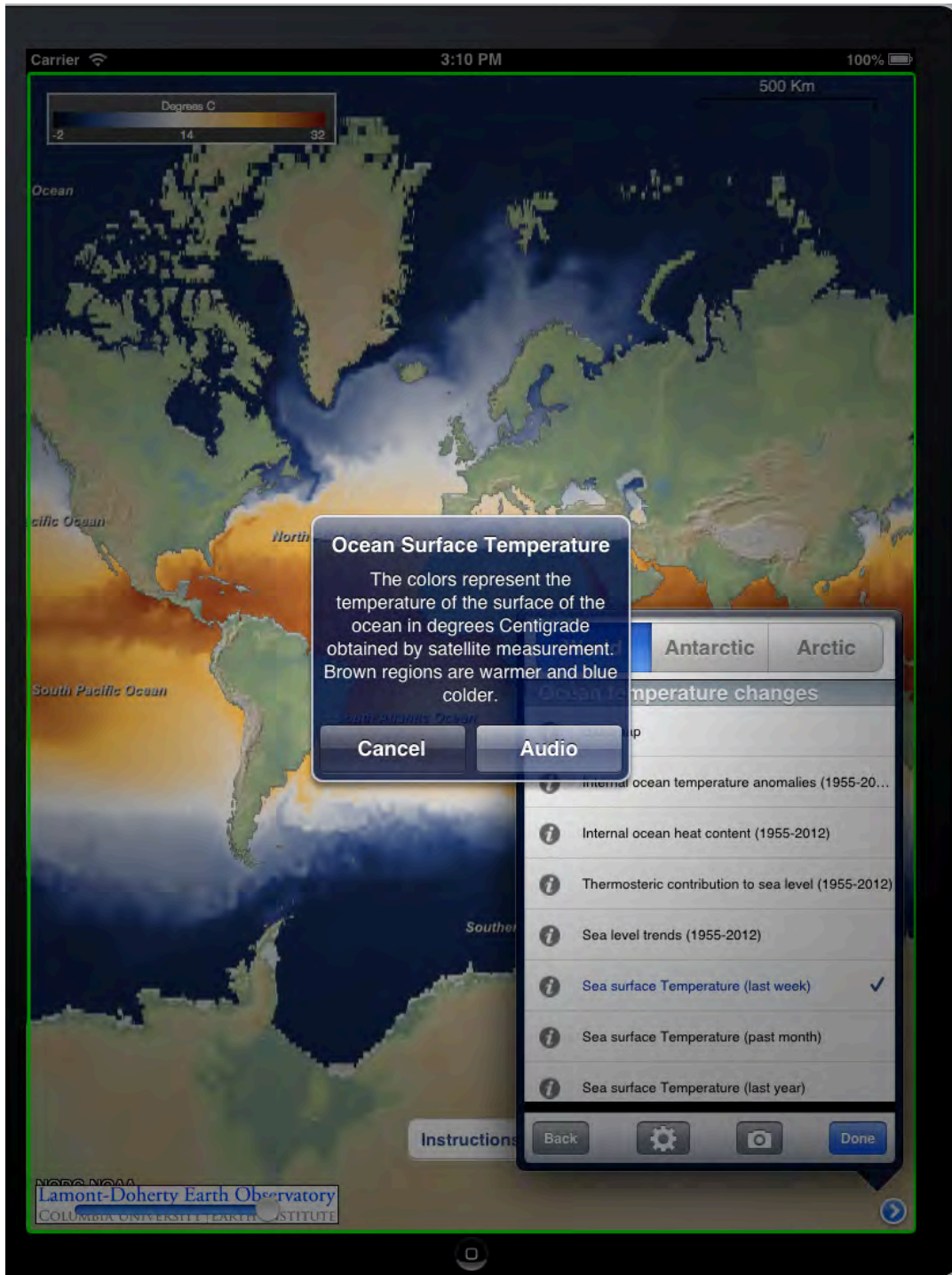
- **A few degrees:** Addresses the myth that few degrees of temperature change will not make a difference. Time traveling with the app shows how ocean temperature in the last glacial and last interglacial were only a few degrees from today's.
- **This climate change is normal:** The app shows that prior changes in climate occurred over thousands to millions of years, not at the accelerated rate we are seeing today.
- **Humans are not part of the problem:** Sections in the app address the role of humans in altering the balance and reducing the resilience of the Earth.
- **Humans will adapt:** The who's vulnerable section points out areas where people will be adversely affected and unable to adapt.



Supports for the user:

- **Question driven** structure to guide the user
- **Short Introduction** to the topic in the map
- **1 minute audio** for a bit more on the topic
- Each topic has the data **source posted** & an **information link** to a longer write up, links to more info
- **Slider** allows the user to **remove the map** for orientation





Main Question

Categories include:

- What is sea level?
- Why does sea level change?
- Where is sea level changing now?
- What is happening at the polar regions?
- What about sea level in the past?
- What are future predictions US Coast?
- Who is vulnerable?

Begin with 'What is Sea Level' definitions and some background that adds context.

Elevation Beneath the Sea

The ocean bottom is not one depth, it varies from shallow shelves along the continental edges to deep trenches in the open ocean. Zoom in and touch to compare. During ice ages water from the ocean freezes into ice sheets on the continents lowering sea level and exposing the shallow shelves. This process reverses during warm periods, with ice sheets melting to raise sea level and submerge these shelves.

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Audio

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What is sea level?



Overview of sea level



Shorelines



Elevations beneath the sea



The surface of the sea is not flat

Back



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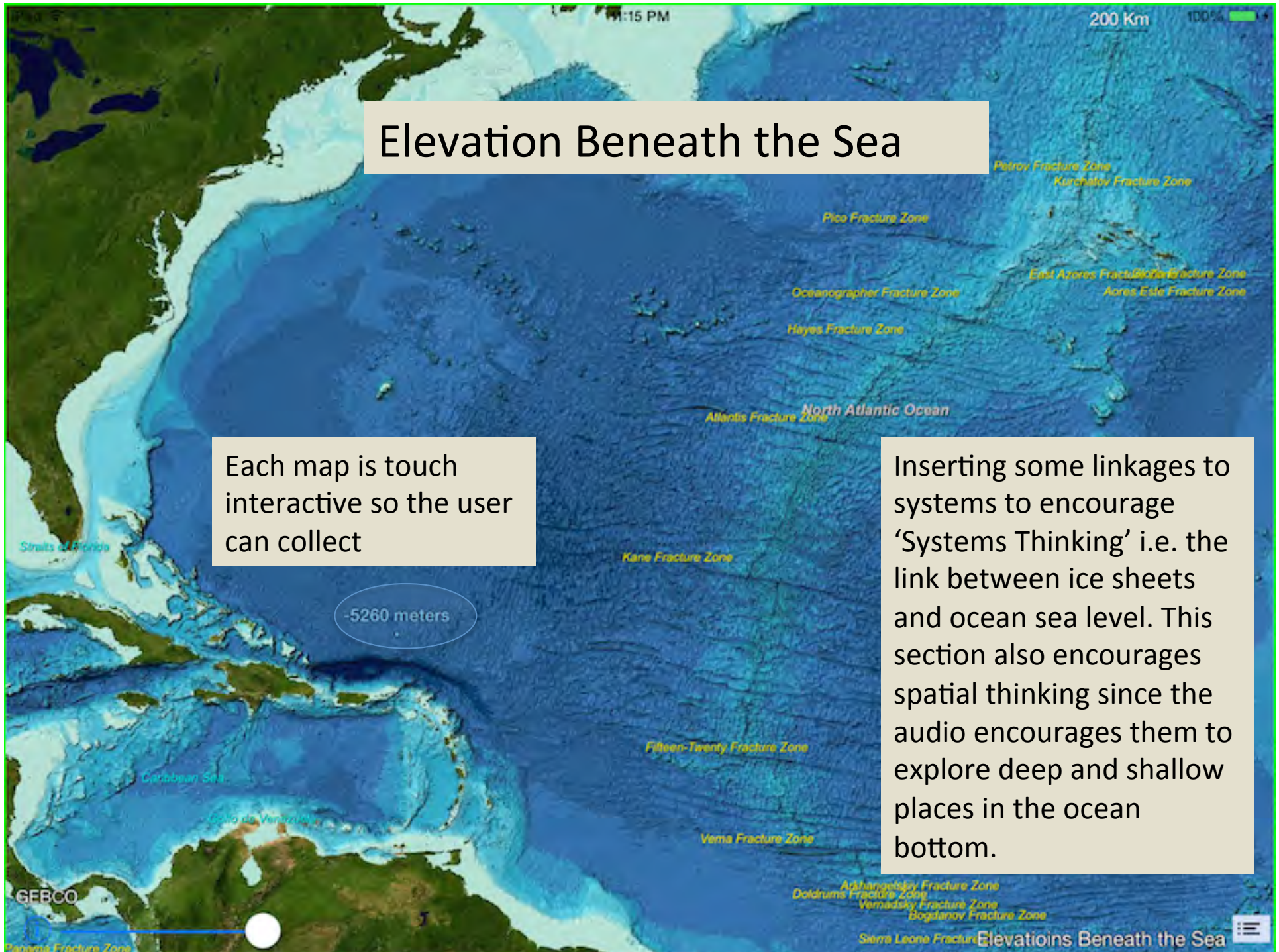
Elevations Beneath the Sea



Elevation Beneath the Sea

Each map is touch interactive so the user can collect

Inserting some linkages to systems to encourage 'Systems Thinking' i.e. the link between ice sheets and ocean sea level. This section also encourages spatial thinking since the audio encourages them to explore deep and shallow places in the ocean bottom.



Internal Ocean Temperature (Present)

Internal ocean temperature (present)

Water expands as it warms and the amount of warming in our oceans is causing sea level to rise. Zoom down in to the ocean to explore present day internal temperature measurements. Click through depth layers from the surface down to 5500 meters. See how the surface and upper layers are much warmer than the deep ocean. Most of the heat absorbed by the ocean in recent decades is being stored in

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What is the role of the ocean?

- [Overview of the ocean](#)
- [Internal ocean temperature \(Present\)](#) ✓
- [Internal ocean temperature changes 1955-2012](#)
- [Internal ocean heat content 1955-2012](#)
- [Expansion caused by ocean warming](#)
- [Expansion influenced by salinity](#)
- [Sea level trends from 1955 to 2012](#)
- [Ocean surface temperature for past week](#)
- [Ocean surface temperature for past year](#)

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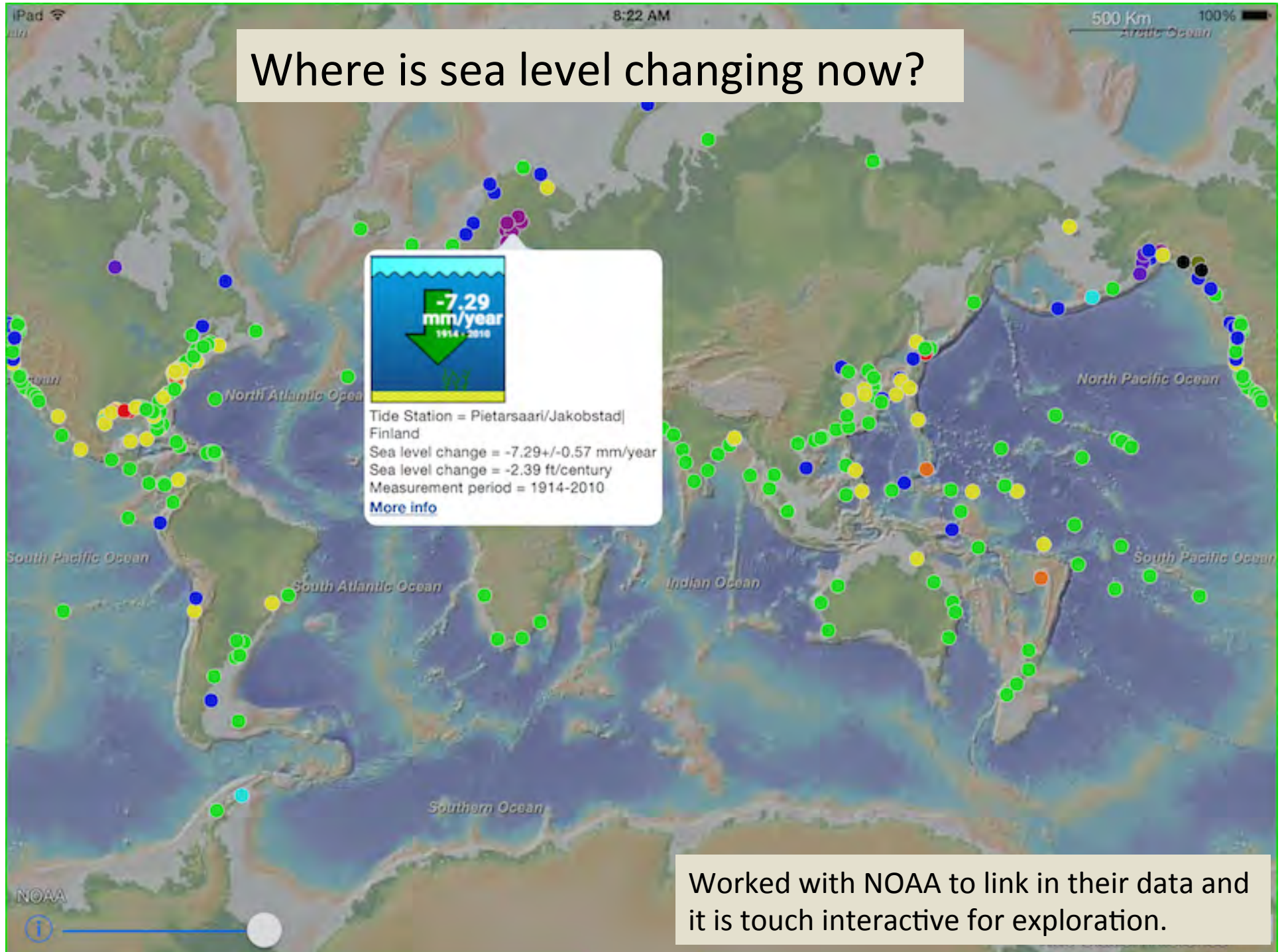
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At Surface

Temperature (°C)

Dive down into the ocean to see which layers are changing the most.

Where is sea level changing now?

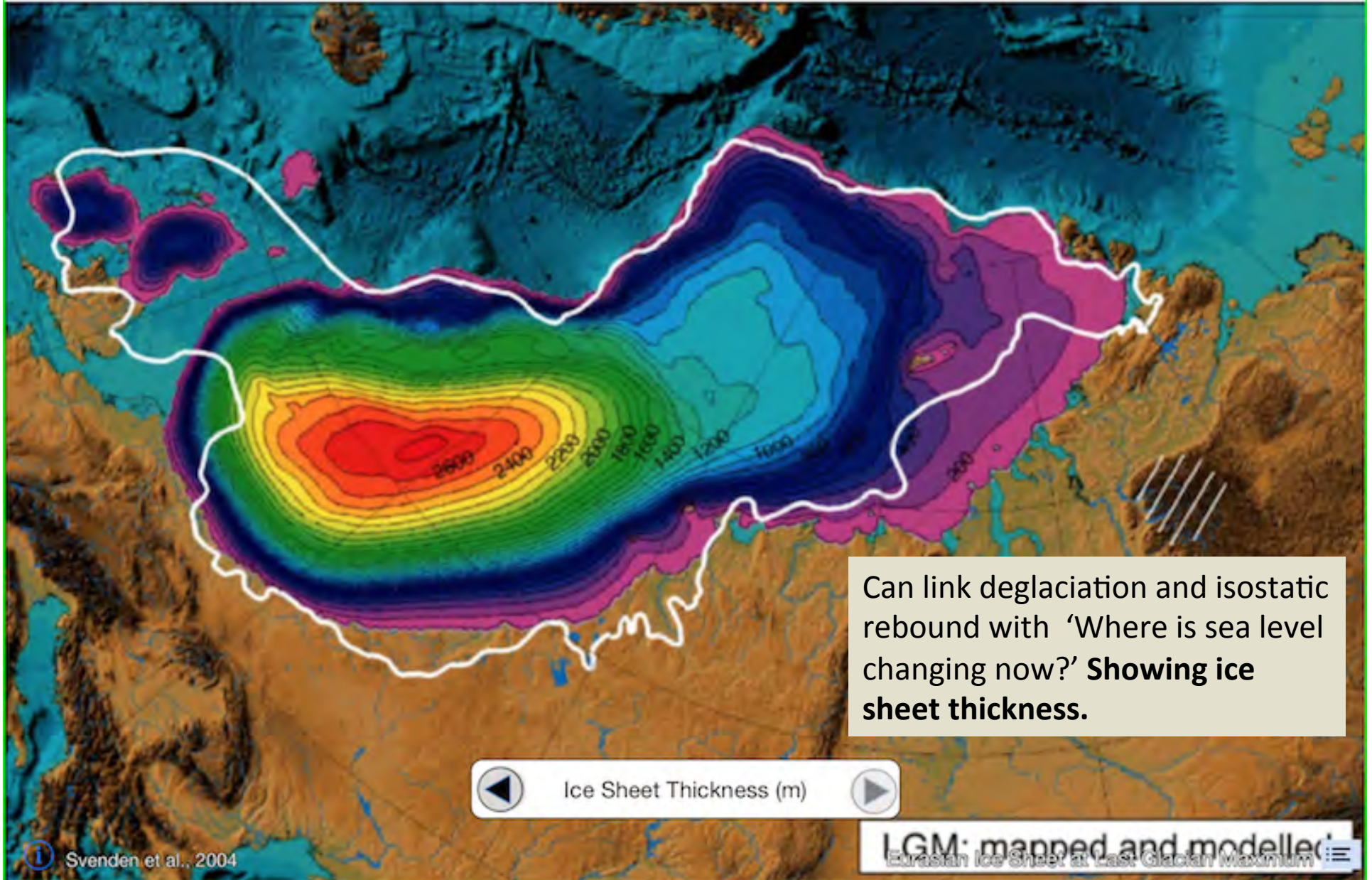


Worked with NOAA to link in their data and it is touch interactive for exploration.

What about climate in the past?



What about climate in the past?



What about climate in the past?

Deglaciation of North America

The largest ice extent in the Last Glacial Maximum was ~20,000 years ago. This map series follows the melting of the Laurentide ice sheet that covered much of the northern hemisphere. Click through to see the ice retreat, beginning along the southern rim of the ice and then ~9,000 years ago the ocean pushes into Hudson Bay, Canada accelerating the melt. Sea level rose significantly with the melting of this ice. By 5,000 years

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What about deglaciation 20k to 5k...



Overview of deglaciation



Deglaciation of North America



Deglaciation of Europe



Eurasian Ice Sheet 20,000 years ago



18,000 years ago

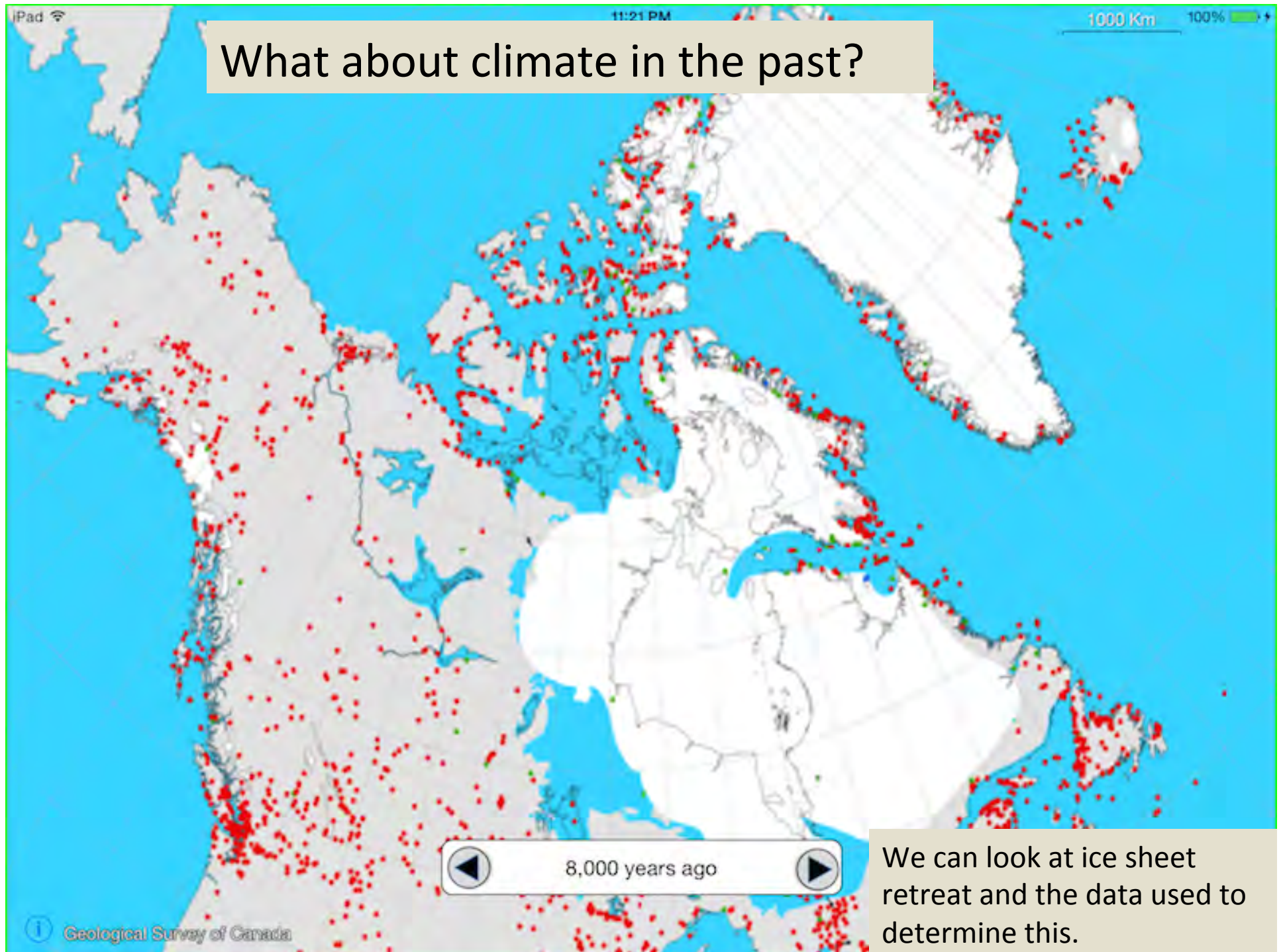
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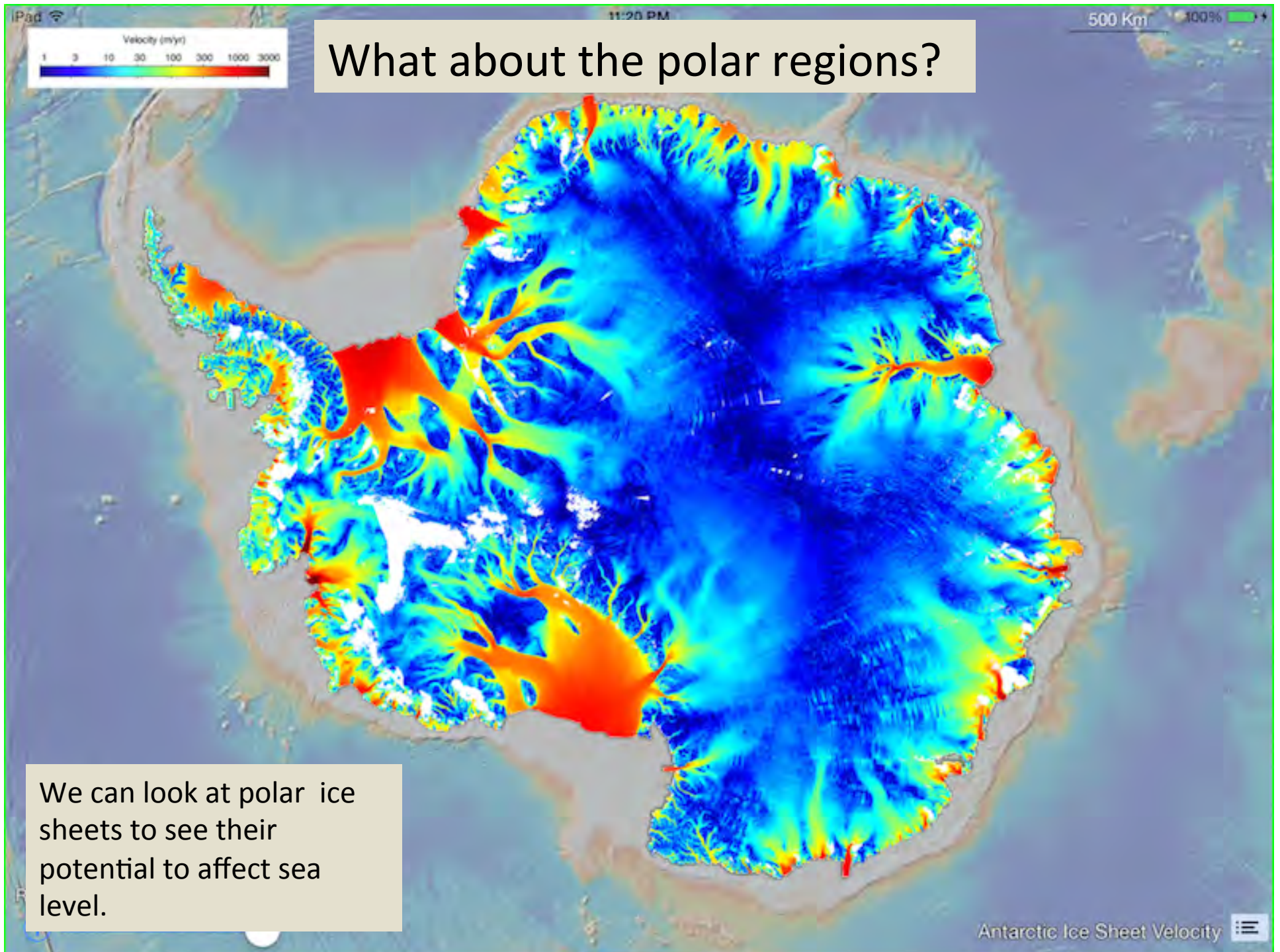
We can step through ice sheet retreat.

What about climate in the past?



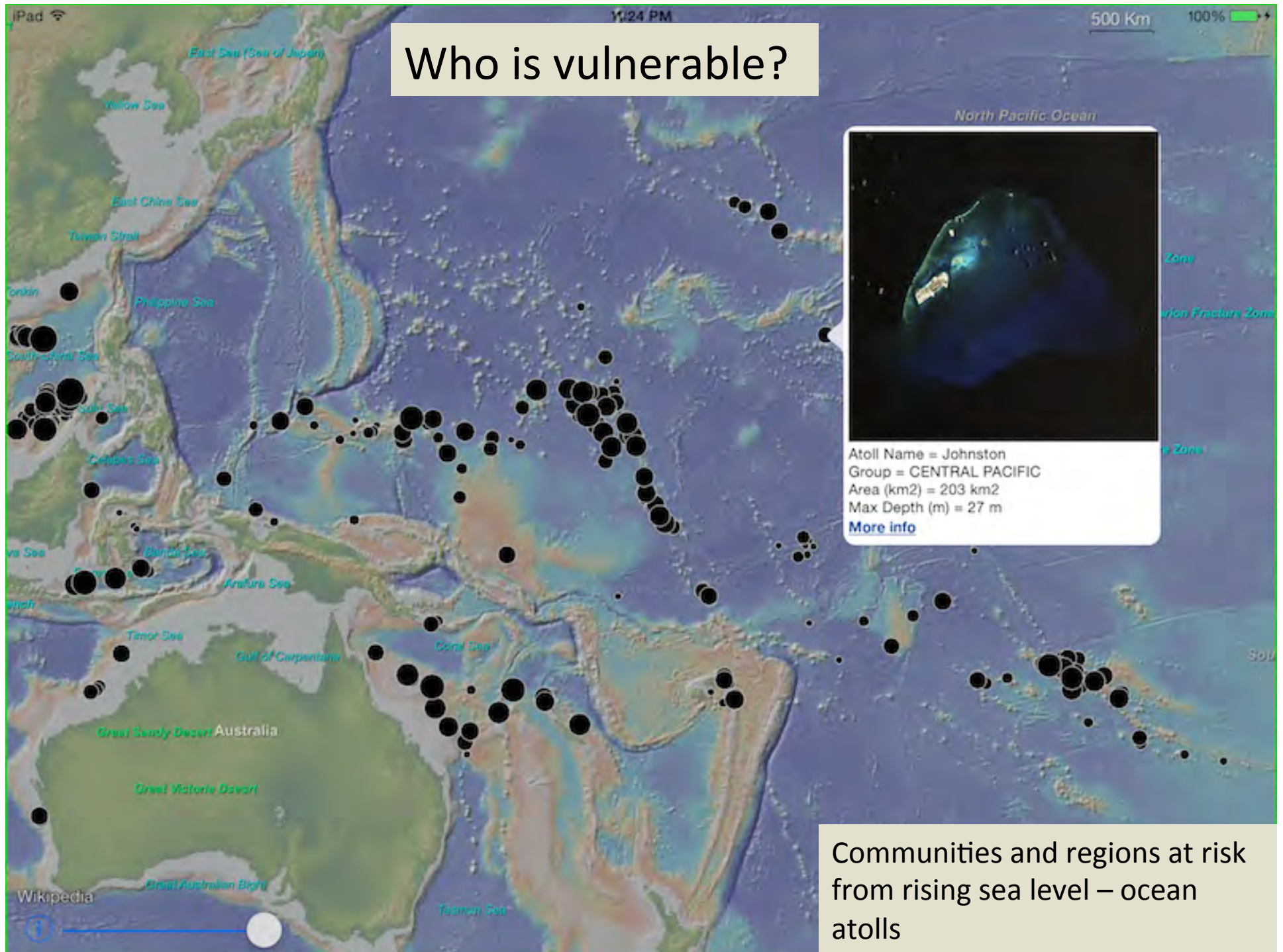
We can look at ice sheet retreat and the data used to determine this.

What about the polar regions?

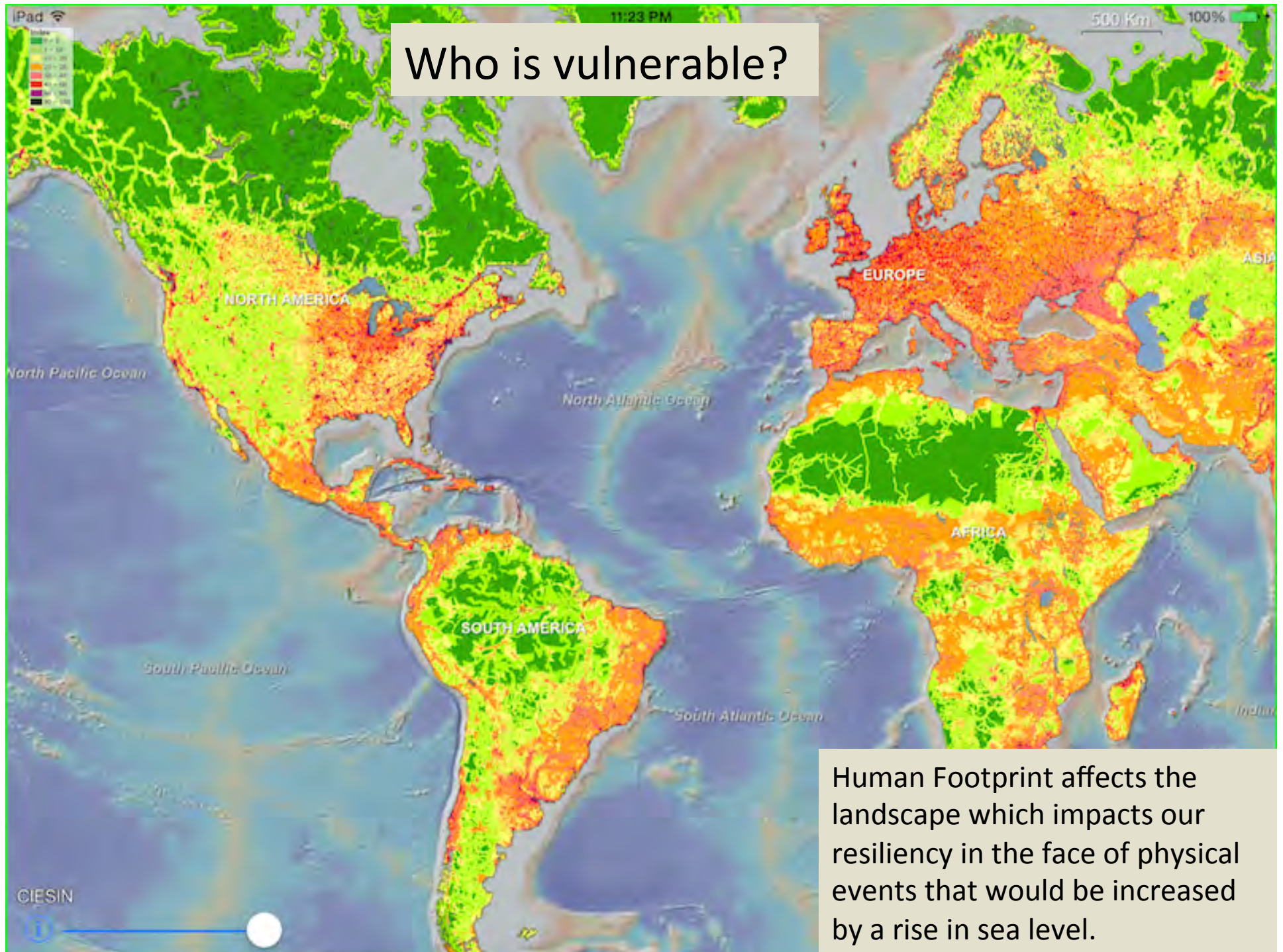


We can look at polar ice sheets to see their potential to affect sea level.

Who is vulnerable?



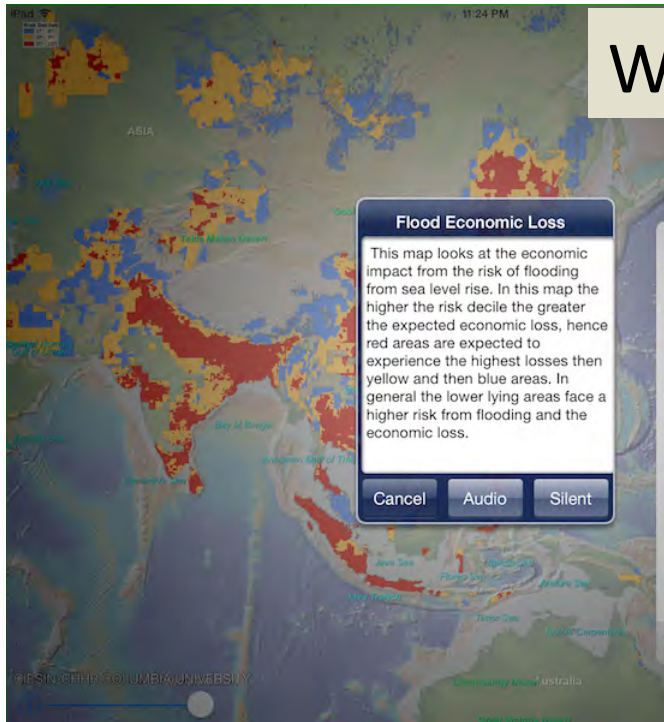
Who is vulnerable?



Human Footprint affects the landscape which impacts our resiliency in the face of physical events that would be increased by a rise in sea level.

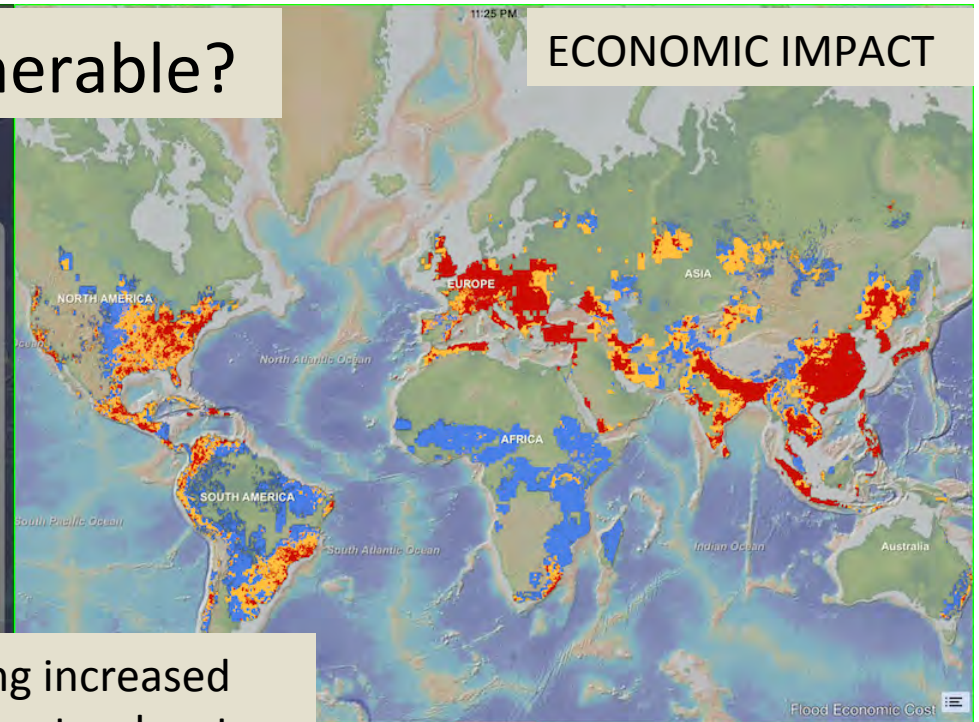
Who is vulnerable?

ECONOMIC IMPACT



Who is at risk from floods?

- Overview of flood risk
- Flood count
- Flood economic loss
- Flood proportional economic loss
- Flood mortality



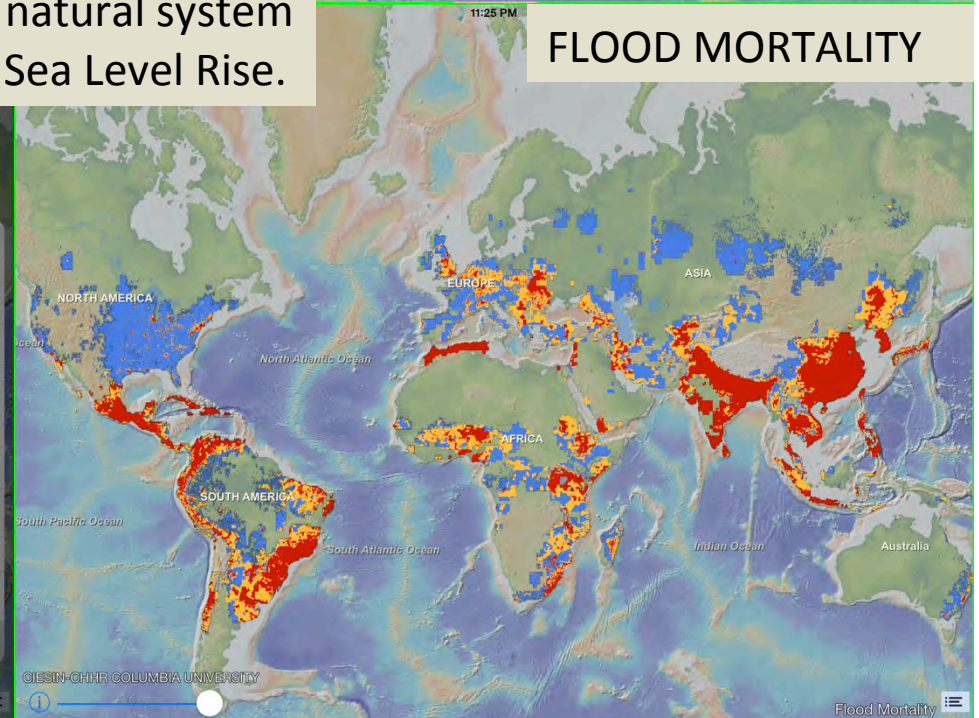
Humans facing increased risk from the natural system as a result of Sea Level Rise.

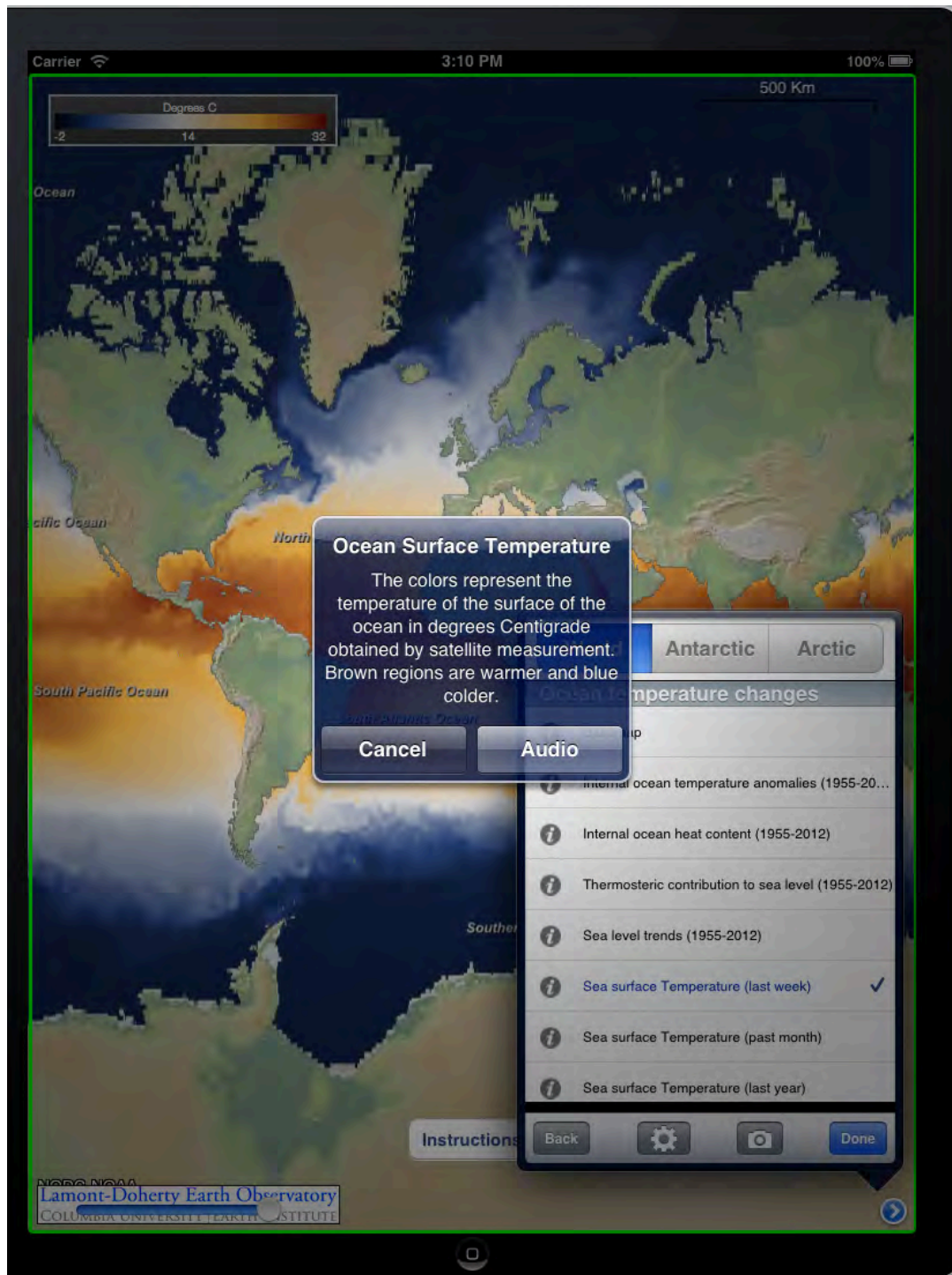
FLOOD MORTALITY



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Currently “Polar Explorer App” is at the app store being reviewed.

In the interim we are set up for beta testers - please contact me for information

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