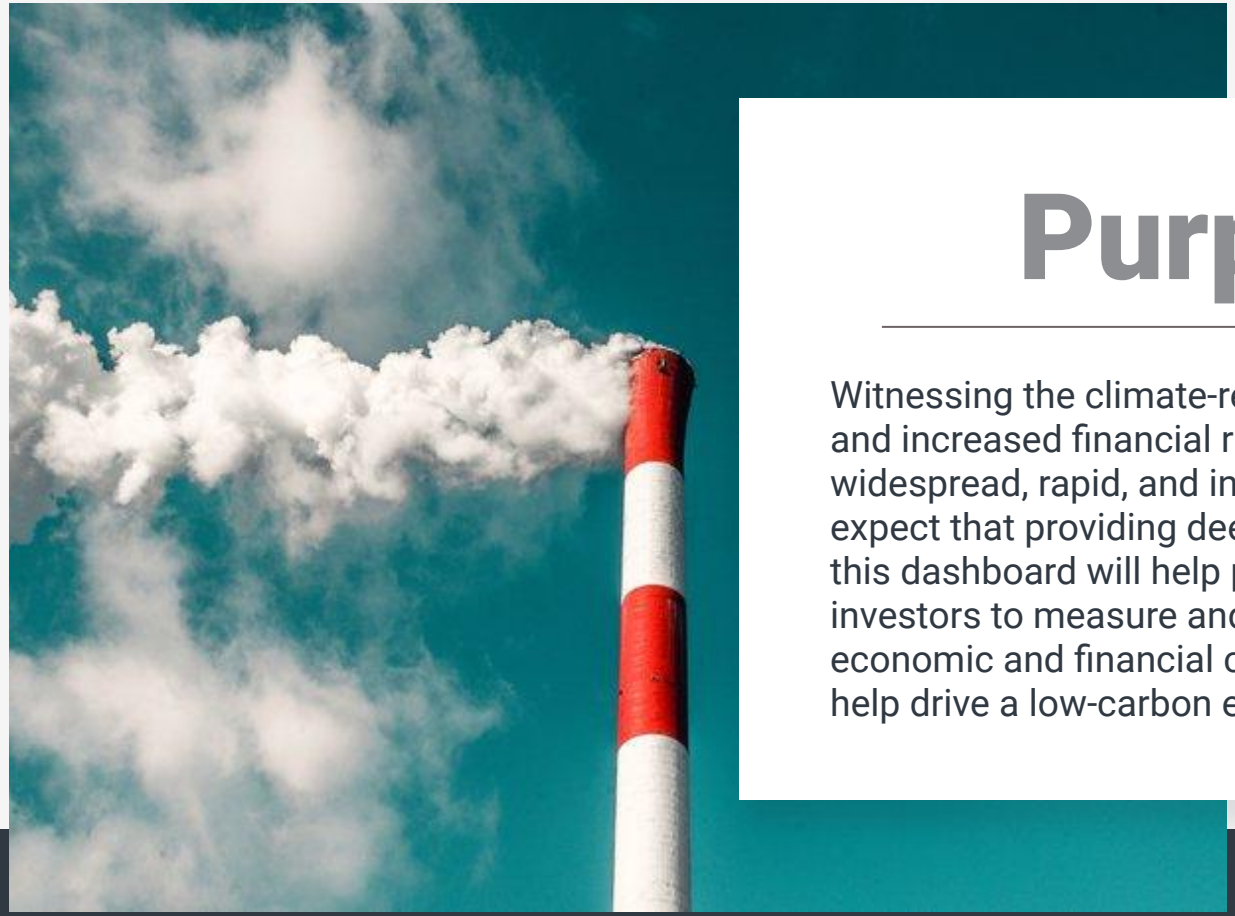
Climate Change Visualization

W209 - Final Presentation

August 10, 2023

Luka Liu Zev Rosen Heesuk Jang Charles Lucas



Purpose

Witnessing the climate-related disruption in livelihoods and increased financial risks resulting from widespread, rapid, and intensifying climatic change, we expect that providing deeper analytic insights through this dashboard will help policymakers, businesses, and investors to measure and mitigate significant economic and financial costs of climate change and help drive a low-carbon economy.

Users & Tasks & Data

Users

- Policymakers
- Public
- Businesses
- Investors

Tasks

Climate change is a global challenge with far-reaching implications for our environment, societies, and economies. It is crucial to gain a comprehensive understanding of the changing dynamics and associated risks to develop effective mitigation and adaptation strategies. This project proposal aims to investigate four key hypotheses related to climate change impacts and risks:

- Temperature Change and Natural Disasters
- Sea levels
- Financial and Risk Indicators
- Human Cost of Natural Disasters

Data

- International Monetary Fund (IMF-World Bank)
- National Oceanic and Atmospheric Administration (NOAA)
- Climate.gov

Tools Utilized for Visualizations

Summaries from the Usability Study

Across All Charts & Site

BEFORE Usability Study

- "All" option is not applicable in some filters.
- Inconsistently working animation and broken embed charts in tooltips.
- Lack of instructions on how to draw the most insights out of each chart.
- Informative but lack of compelling data stories, influencing decision-making and inspiring action.
- Absence of data sources.
- Inconsistent style in labeling across the website.

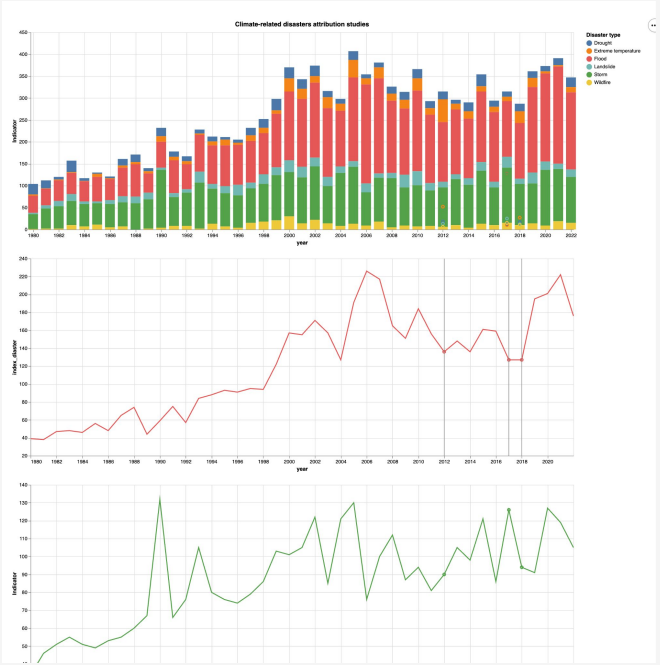
AFTER Usability Study

- Removed "All" option from filters as needed.
- Streamlined animations and resolved the broken embed charts in tooltips.
- Provided instructions using icons or clear-cut notes, prompting user-friendly action for more information.
- Added key insights and narratives to each chart, helping users understand behind the numbers.
- Added data sources using the information icons or clear-cut note.
- Re-adjust aesthetic elements including label and chart size/color/shading for consistency and a higher visual appeal.

Temperature Change & Natural Disasters

Climate-related disaster attribution

BEFORE Usability Study



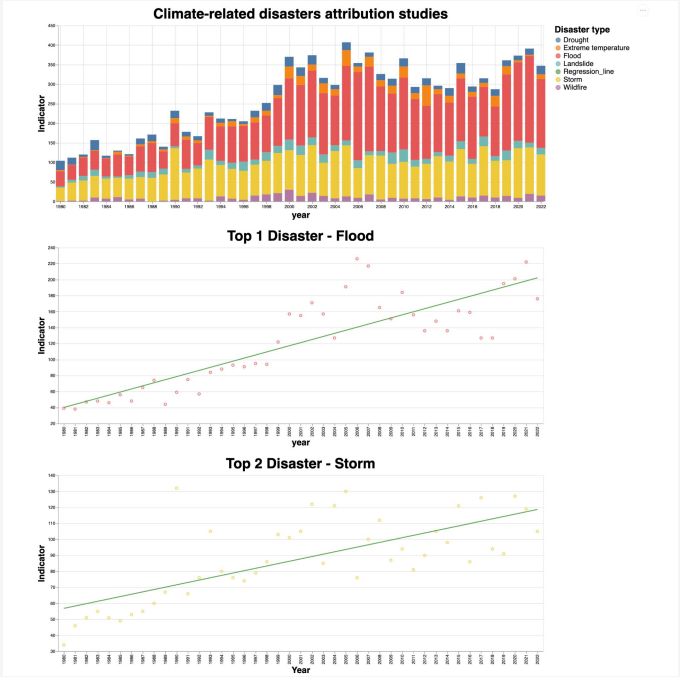
Issue Observed:

Although all the users can tell both flood and storm indicators are up, the line chart does create some distractions due to fluctuation.

Adjustments:

- Fitted with a regression line for the two facet chart to show the trend
- Added the title to better demonstrate the type of disasters.

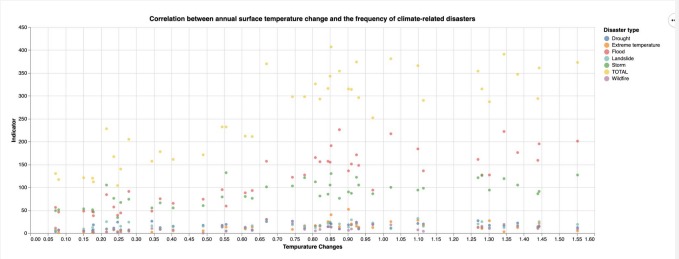
AFTER Usability Study



Temperature Change & Natural Disasters

Correlation between temperature change and climate-related disaster

BEFORE Usability Study



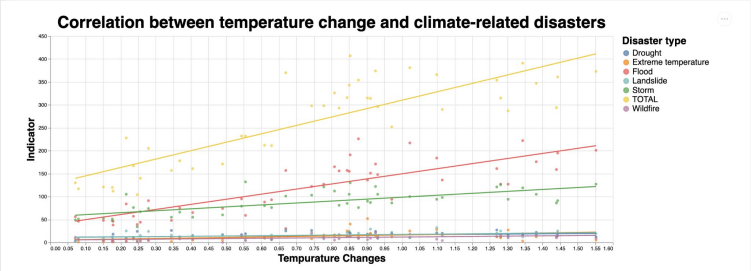
Issue Observed:

It takes a while for the user to conclude a positive correlation scatter between temperature changes because there are too many colors (representing each type of disaster). Users are not sure which color they'd like to focus on because certain types of disasters might not show an obvious positive collaboration.

Adjustments:

- A regression line on the top-up scatter plot was added to show the correlation
- Aligned the color of the type of disaster with regression line too.

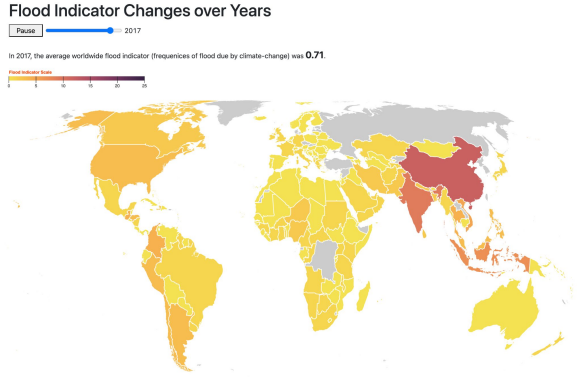
AFTER Usability Study



Temperature Change & Natural Disasters

Flood disaster indicator by countries

BEFORE Usability Study



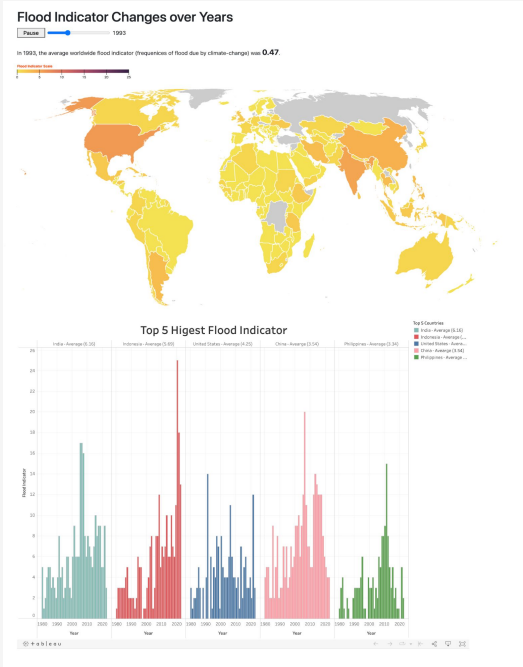
Issue Observed:

The animation created some difficulty for users to memorize. The users cannot easily concluded the trend of the flood indicators or identify which countries suffered the flood the most.

Adjustments:

- Added the top 5 countries annual flood indicator changes for more information.

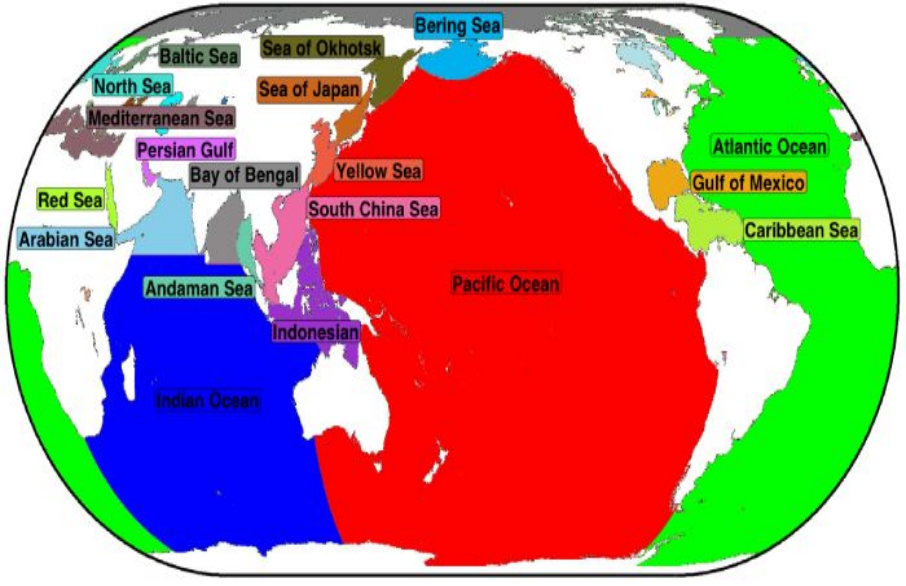
AFTER Usability Study



Sea levels

Data source map

Additional Visualization



Motivation

Users see regions listed on line charts but do not always understand their geography

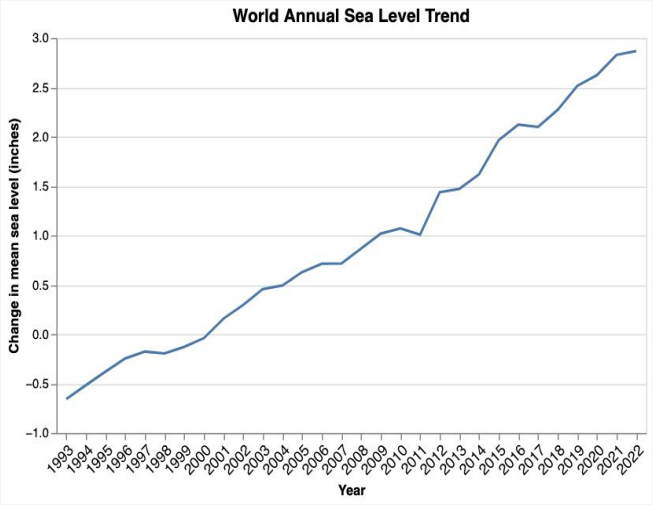
Features Implemented

- Added map of data source regions from NOAA's website
- Place map at top of webpage to show region definitions before rest of charts

Sea Levels

Sea level trends by satellite

BEFORE Usability Study



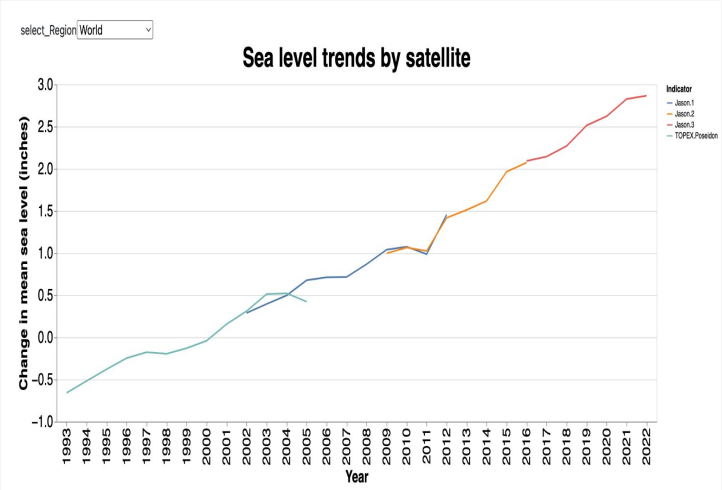
Issue Observed:

Users do not understand how data is collected or calculated

Adjustments:

- Added breakdown of sea level trends by satellite
- Outline calculations for rest of charts as average of satellite data for that time period
- Provided link to NOAA and IMF website

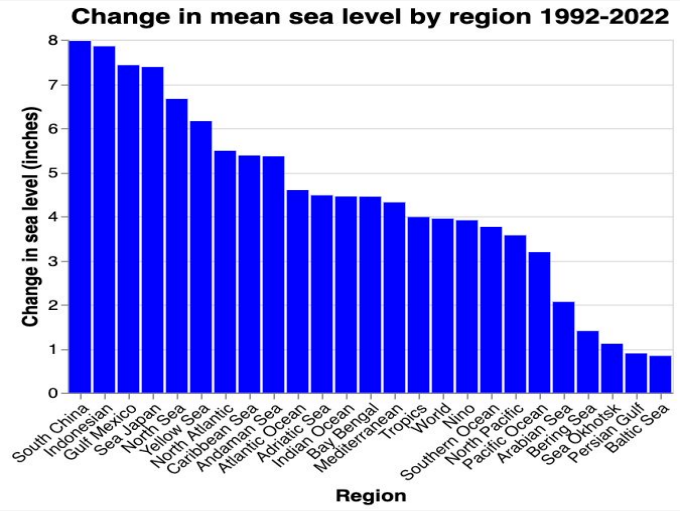
AFTER Usability Study



Sea Levels

Change in mean sea level by region

BEFORE Usability Study



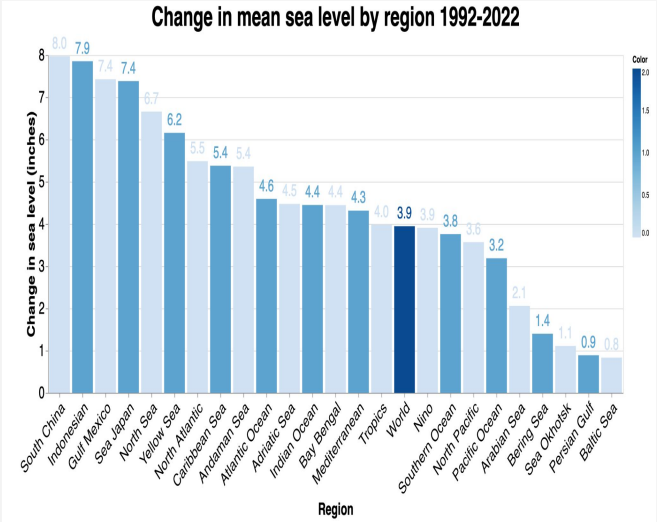
Issue Observed:

Users cannot see differences between regions or read off specific values from the chart.

Adjustments:

- Add alternate shading and increase label size to highlight each column's region
- Mark each column with its y axis value
- Bold world column so it stands out

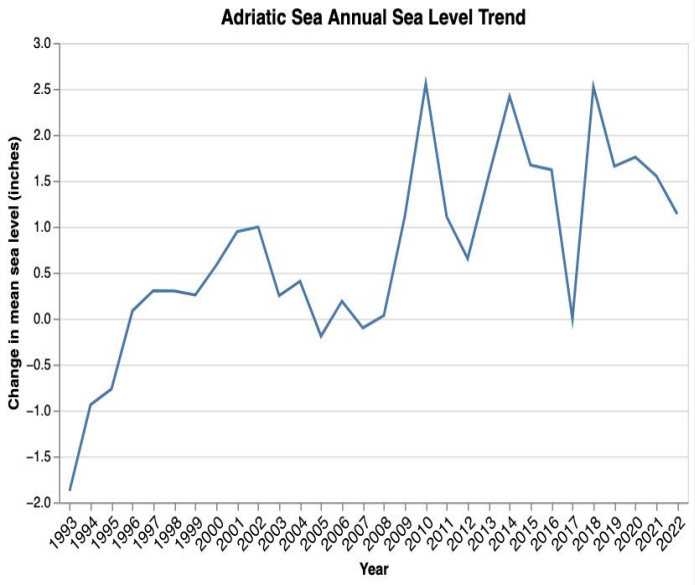
AFTER Usability Study



Sea Levels

Annual sea level trend

BEFORE Usability Study



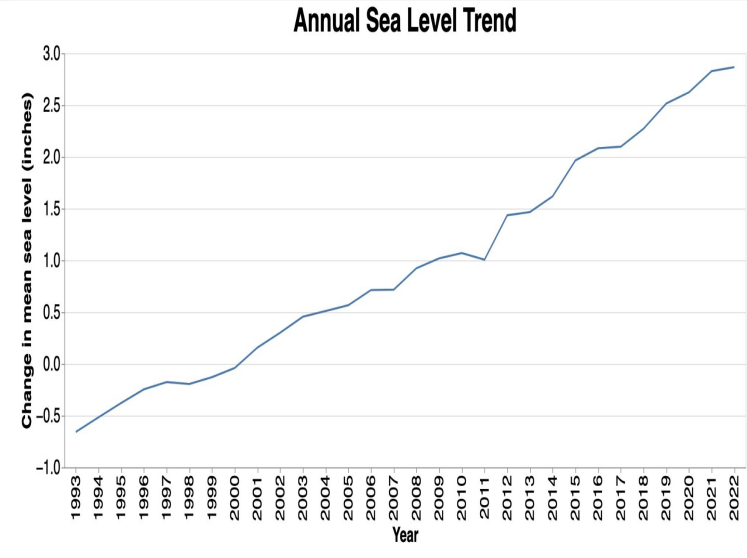
Issue Observed:

Hard for users to view specific points. Users do not understand meaning of y-axis.

Adjustments:

- Added tooltip feature so users can see datapoint when they mouse over it.
- Described y-axis: 0 on y-axis means sea level is equal to the long run average calculated by the NOAA

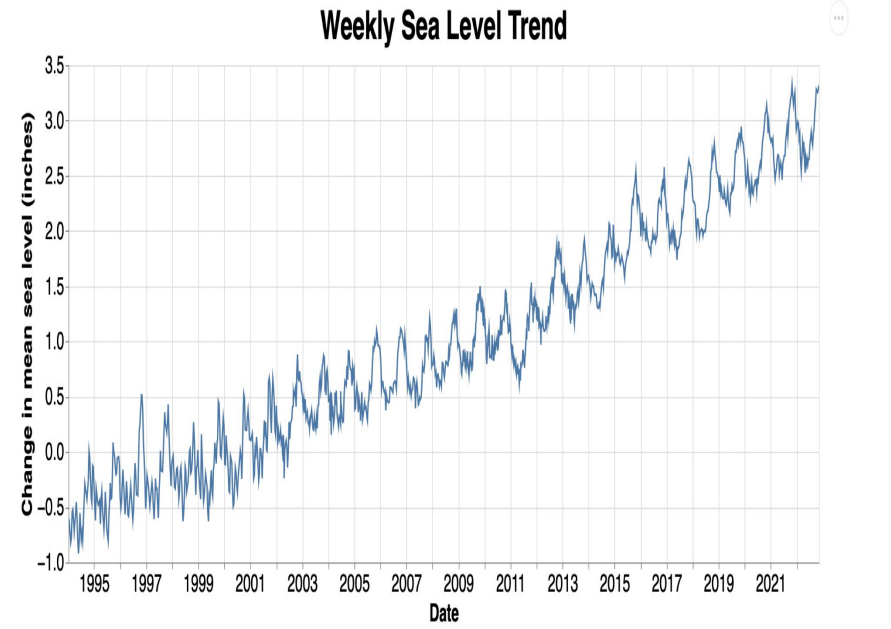
AFTER Usability Study



Sea levels

Weekly sea level trend

Additional Visualization



Motivation

Users do not understand effect of seasonality on sea level trends.

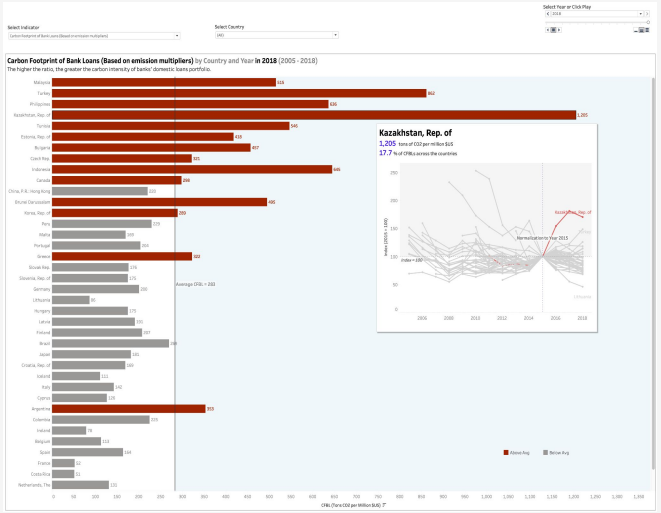
Features Implemented

- Added chart of weekly sea level trends which highlight seasonality effects
- Includes tooltip so users can select individual data points

Financial & Risk Indicators

Carbon Footprint of Bank Loans (CFBL)

BEFORE Usability Study



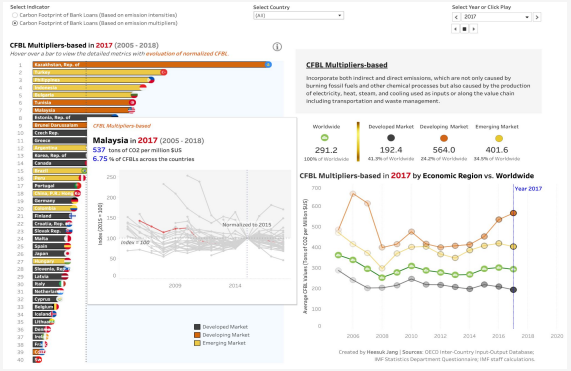
Issues Observed:

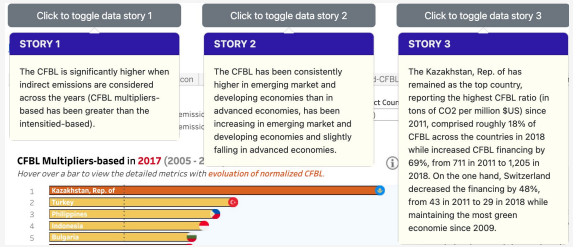
Hard to detect key prominent trends across years.

Adjustments:

- Created dynamically sorted bar chart across years.
- Grouped countries by three economic regions.
- Added time series line chart and number cards to track annual average in CFBL to help detect trends over time.
- Added dynamic definitions for key concepts (CFBL intensities vs. multipliers) based on filter selection.

AFTER Usability Study

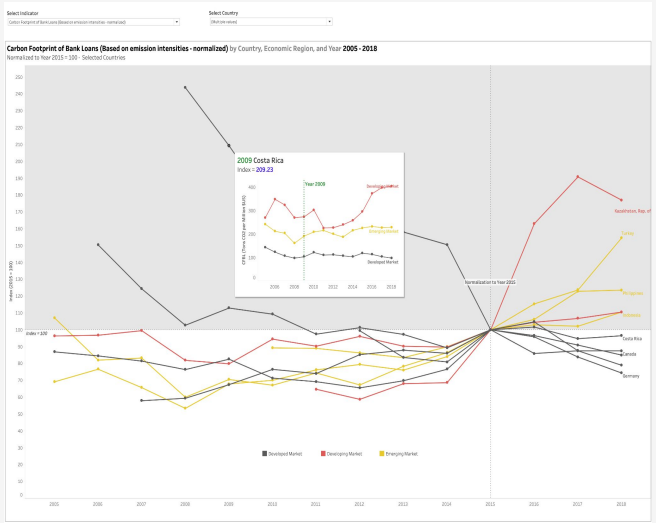




Financial & Risk Indicators

Normalized CFBL

BEFORE Usability Study



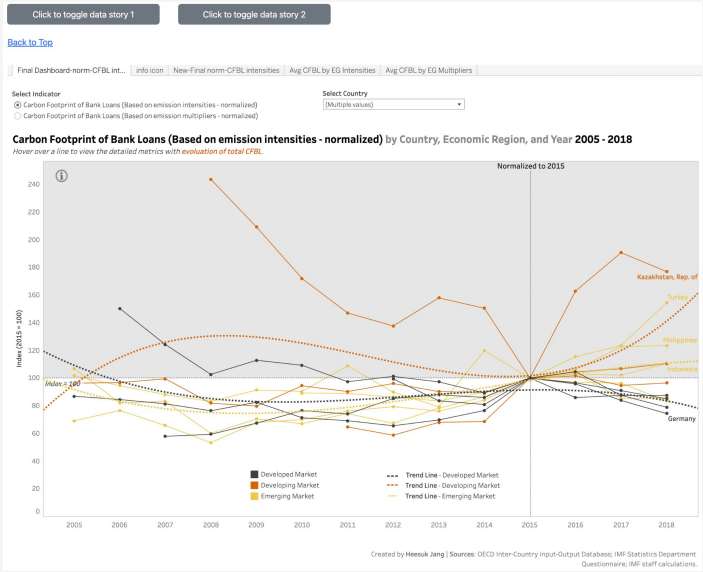
Issues Observed:

Hard to detect a correlation between the degree of country-level CFBL and regional economic development.

Adjustments:

- Added a trend line per economic region for comparative analysis.
- Added dynamic data labels in tooltip based on filter selection

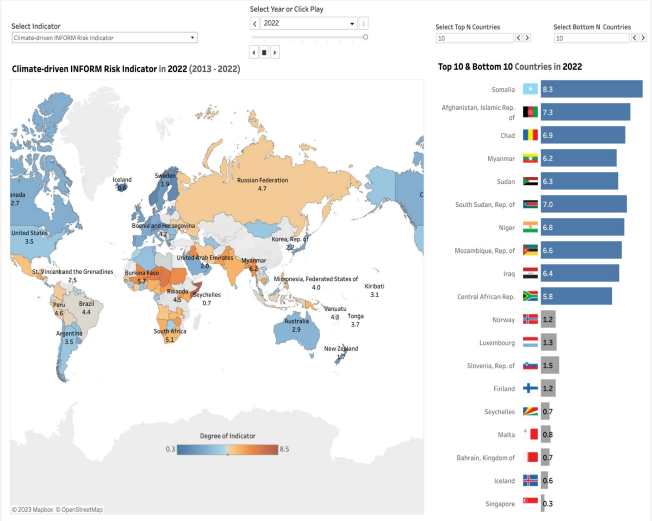
AFTER Usability Study



Financial & Risk Indicators

Climate-Driven Physical & Transition Risks

BEFORE Usability Study



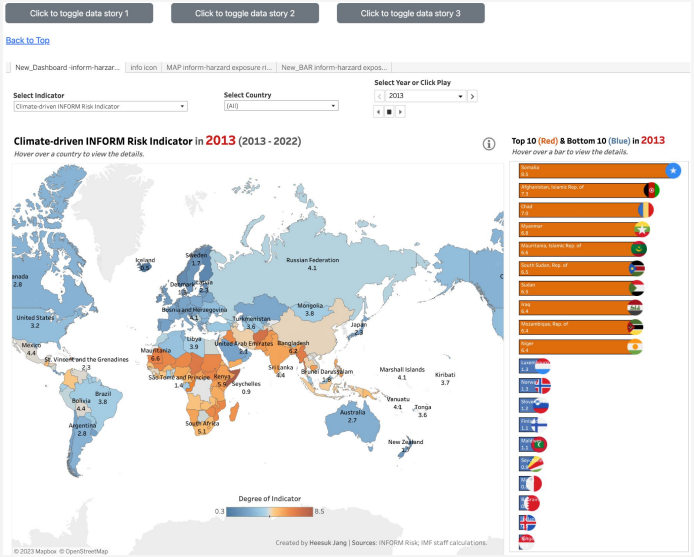
Issues Observed:

Not intuitive to associate map with the bar chart due to the inconsistent color code or to filter by country. Users are also not sure how each indicator is measured.

Adjustments:

- Matched color code between map and bar chart. Red in map corresponds to red with top 10 countries in the bar chart and vice versa.
- Added a definition and methodology for each filtered indicator in the information icon.
- Added an option to filter by country

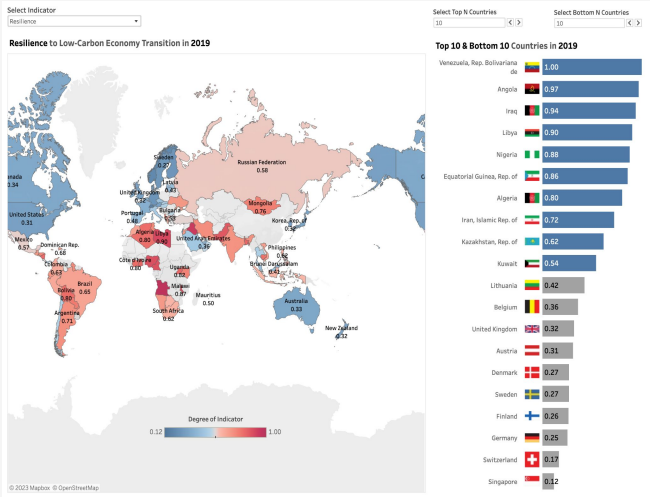
AFTER Usability Study



Financial & Risk Indicators

Preparedness of Countries for a Low-Carbon Transition

BEFORE Usability Study



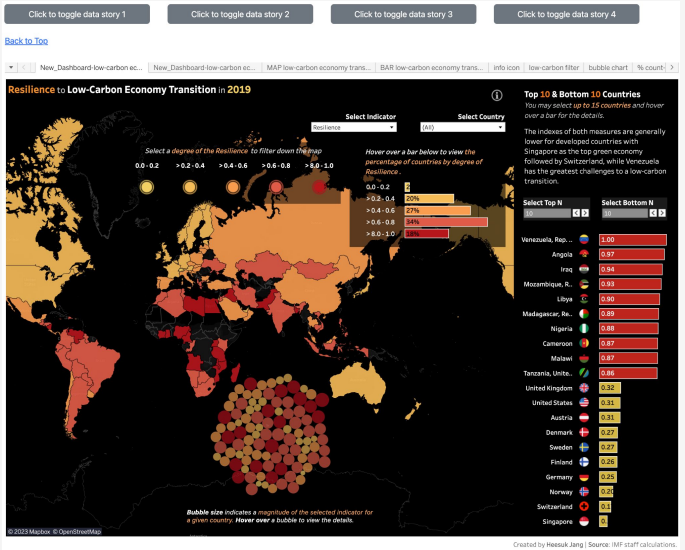
Issues Observed:

Not intuitive to associate map with the bar chart due to the inconsistent color code or to filter by country. Users are also not sure how each indicator is measured or interpreted.

Adjustments:

- Matched color code between map and bar chart.
- Added a definition and methodology for each filtered indicator.
- Added a filter for country selection
- Broken down countries by specific bin in degrees of filtered indicator.
- Added a bubble chart to help measure the magnitude of preparedness.
- Added a bar chart to provide the % of a total number of countries by different brackets in magnitude.

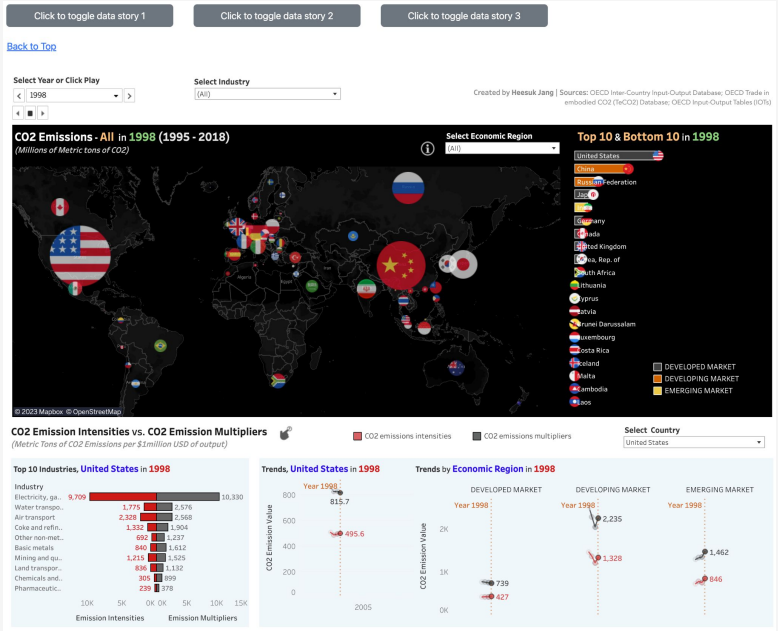
AFTER Usability Study



Financial & Risk Indicators

CO2 Emissions, CO2 Emissions Intensities & CO2 Emissions Multipliers

Additional Visualization



Motivation

Users prefer to see a new chart that illustrates the level of carbon emissions and how it is related to climate-driven hazard at a global/country level.

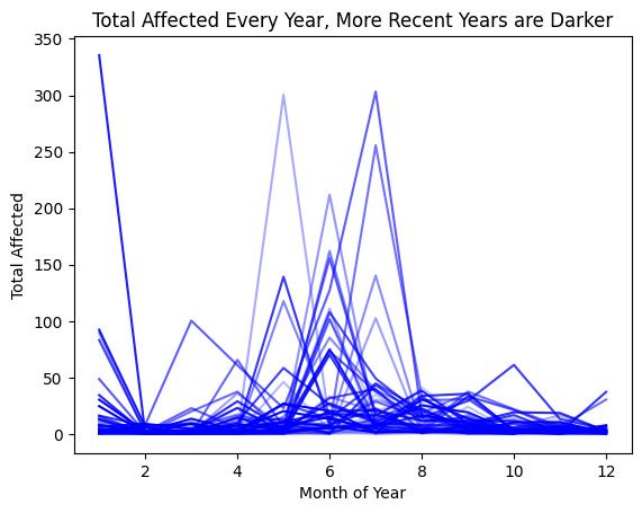
Features Implemented

- Dynamic map for CO_2 emissions (in aggregate terms) by industry and economic region over time.
- Top 10 and bottom 10 CO_2 emissions by country over years with dynamically sorting capability.
- Dynamic bar chart for CO_2 emissions intensities vs multipliers by country and industry along with their definitions and methodologies.
- Dynamic line charts for CO_2 emissions intensities vs multipliers by country and economic region, displaying trends over time.

Financial & Human Cost of Disasters

Total Affected Every Year, More Recent Years are Darker

BEFORE Usability Study



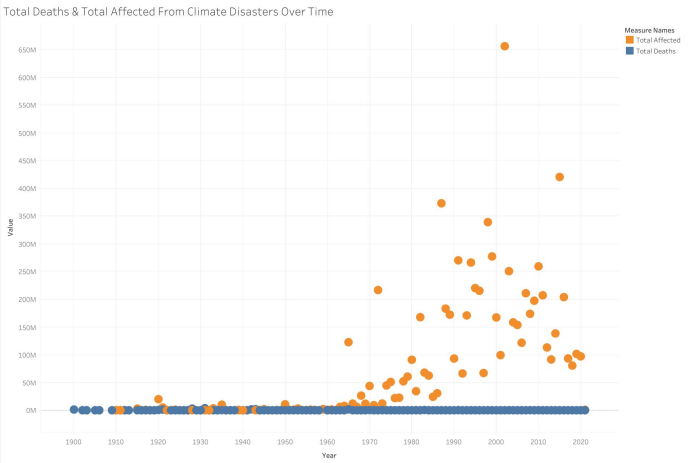
Issue Observed:

The original plot was nearly unreadable and contained almost no useful information or patterns.

Adjustments:

- Created a scatter plot instead of a multi-line graph
- Each point is a year and the total number of people affected by disasters that year

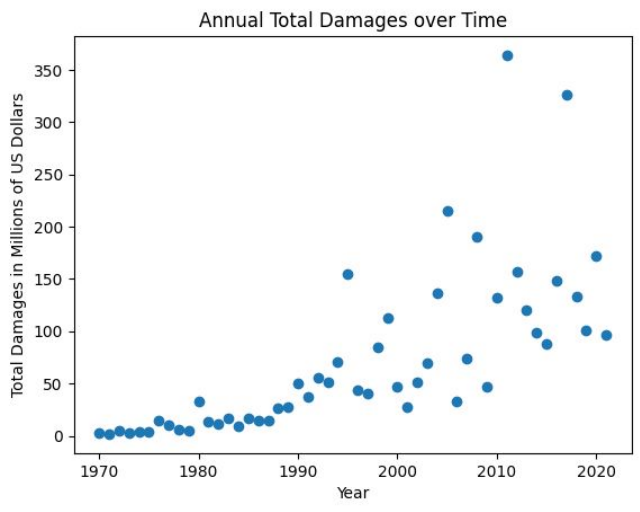
AFTER Usability Study



Financial & Human Cost of Disasters

Financial Damages over Time

BEFORE Usability Study

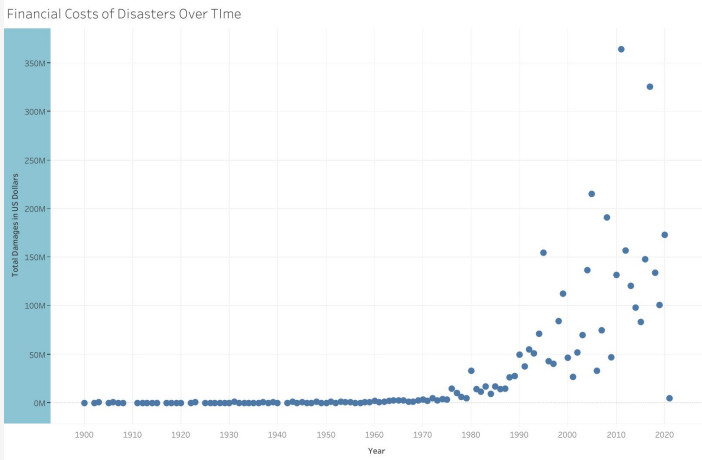


Issue Observed:
Non-interactive

Adjustments:

- Recreated the plot in Tableau to allow interactivity

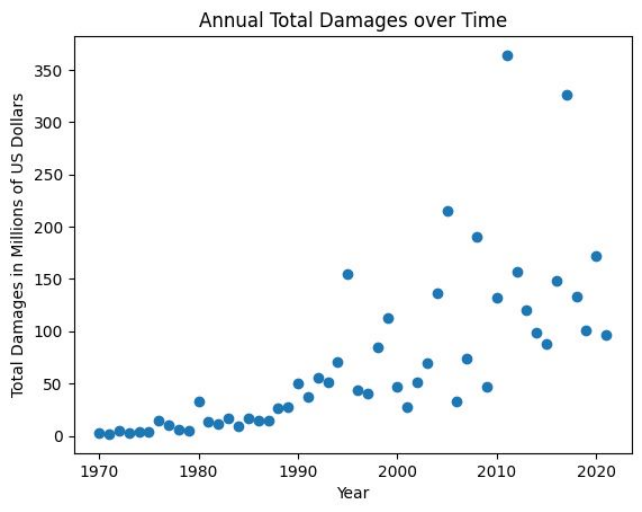
AFTER Usability Study



Financial & Human Cost of Disasters

Damages by Country and Year

BEFORE Usability Study



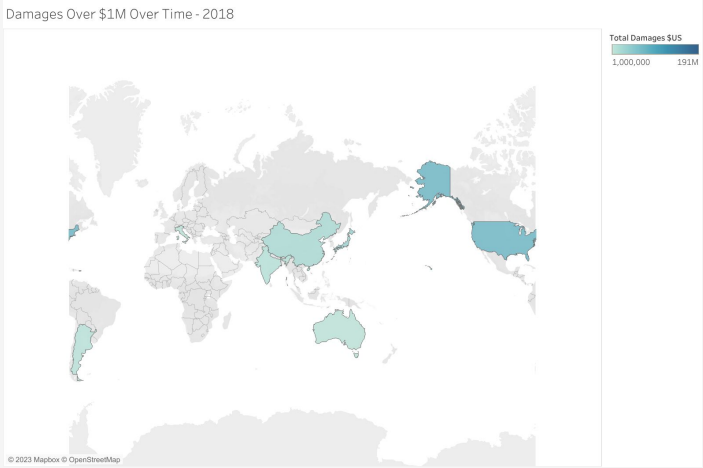
Issue Observed:

It isn't obvious how damages are broken down geographically

Adjustments:

- Created a new interactive Tableau map
- Includes total damages for disasters costing over $1M
- Broken down by year and country

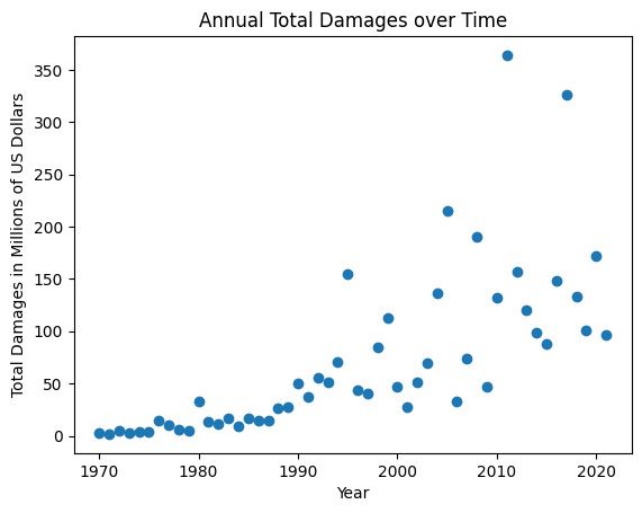
AFTER Usability Study



Financial & Human Cost of Disasters

Disasters and Financial Costs

BEFORE Usability Study



Issue Observed:

It isn't obvious where disasters are occurring and how expensive individual disasters are.

Adjustments:

- Created a new interactive Tableau map
- Each point represents a different disaster
- The size represents the cost of the disaster
- Broken down by country and year

AFTER Usability Study

Challenges and Limitations

- **The design of website:**
  - Once the major style has been settled, including the main html with navigation activity, and style, css file are finalized, it's hard to incorporate the scroller.

- **The consistency of the website:**
  - Different tools (including Altair, Tableau, D3) are used by different team members, we need to pay extra attention to make sure our pages look consistent crossing all the tabs.

- **The intention of dashboard:**
  - Hard to achieve storytelling/persuasion while also enabling user interaction
  - More consideration of design to encourage user interaction

Conclusion

- Data on climate-related disasters can be used for many different audiences and many different purposes.
- Data can be used to persuade the unconvinced about potential threats
- Decision makers should especially investigate the data for themselves so that their decisions can be data-driven.
- Our policies and how we allocate resources matter, and the data can help us better understand what good choices look like.

Climate Change Dashboard

https://groups.ischool.berkeley.edu/ClimateVis/index.html

Recording: https://drive.google.com/file/d/1Uk9VAdVLECxmFcZPJApSuvghOQL_X6V-/view?usp=sharing

Luka Liu lukaliu@ischool.berkeley.edu
Zev Rosen zar27@ischool.berkeley.edu
Heesuk Jang jheesuk@ischool.berkeley.edu
Charles Lucas charles.lucas@ischool.berkeley.edu