Global Greenhouse Gases

INFO 3300 Project 2 Write Up

Hanna Arfine, Eric Feng, Ryan Yoon

Introduction

Global Greenhouse Gases looks at global emissions data over time. The visualization makes it clear that there is a significant and dangerous increase in emissions, both as more countries begin to record their emissions and the major powers. Through a series of graphs, we attempt to illustrate this growing trend on a heatmap, and investigate possible causes through a series of interactive scatterplots.

Description of Data and Mapping to Visual Elements

We aggregated data from the following sources and reformatted the data as described:
- Global emissions from 1850 to 2014 by country (http://cait.wri.org/)
  - Filtered for CO2 emissions by country and year
- ISO-3166 country codes (https://www.iso.org/obp/ui/#search)
  - Integrated with global emissions data to associate countries with country codes
- Country flags icon pack (https://github.com/gosquared/flags)
  - Integrated with country codes data to associate country codes with flags
- Populations by country (https://data.worldbank.org/indicator/SP.POP.TOTL)
  - Filtered for relevant countries, i.e., those in global emissions data
  - Filtered for relevant years, i.e., those between 1850 and 2014 inclusively
- Automobile sales by country (http://www.oica.net/category/sales-statistics/)
  - Filtered for total automobile sales for relevant countries in relevant years
- GDP by country (https://data.worldbank.org/indicator/NY.GDP.MKTP.CD)
  - Filtered for GDP for relevant countries in relevant years
  - Formatted GDP data to be in terms of USD
- Global emissions per capita
  - Combined global emissions data and populations data to obtain

We represented the various data listed above by mapping them to visual elements as described:
- **Heatmap** - used the annual emissions data and per capita data, in combination with the ISO-3166 codes dataset to display country name and flag. The heatmap has several components - the heatmap of the world, the scale at the bottom, the time slider, the donut graph, and two labels.

- ○ The heatmap itself uses a gradient color (via scaleLinear) as a range, while the domain is the extent of the emissions that year. It then follows that darker countries have higher emissions, lighter countries have lower emissions, and greyed out countries have no emissions.
- ○ The scale at the bottom is also a gradient but it represents the scale of the emissions as a gradient, and also grows as the max emissions increases. It will also display where selected/hovered countries fall on the legend as well.
- ○ The slider at the bottom allowed users to change the year and is the main dynamic component that depicts the increase and change in emissions over time. There is also a play button that will increment the year every half second.
- ○ The donut graph is color-coded statically according to the given legend. It depicts each region's share of emissions, and the size of the ring indicates the share.
- ○ The two labels give more specific information about the individual countries' emissions. One gives the leader, which sets the upper bound of the flag size, while the user can hover or select another country to compare the flag sizes, which are scaled on a square root scale (as it is based on circle area), according to each country's emissions compared to the leader.
- **Scatterplots** - used the rest of the data listed (GDP, population, automobile sales, vehicles in use), and also reused the ISO-3166 codes to display the country names and flags.
  - ○ These allowed users to select from several variables to investigate the correlation to emissions per country. These were plotted with emissions on the y-axis, and the selected variable on the bottom. Again, a slider allowed the user to update the year to see if the trend held, as well as a play button.
  - ○ These were all scaled according to log scales, as there are a few countries (namely USA, China, India), which have dramatically larger populations than the rest of the countries, so we use log scales to account for this
- **Toggling Per Capita** - both the heatmap and the scatterplot have a button that toggles between data per year and also gives the option to normalize by capita, to give a different aspect of data and also see new interesting trends.

The Story

The main purpose of our visualization is to depict trends in global emissions over time, and to investigate potential causes behind that. The website begins with showing the heatmap page, which tells a simple trend: global emissions are increasing extremely rapidly over time, and more and more countries are emitting carbon dioxide into the atmosphere. A simple play of the trends from the beginning (1850) to present (2014) shows a dramatic increase of emissions, especially evidenced by the scaling legend, which scales according to maximum emissions of

any one country over time, which rapidly shoots up as China begins to industrialize, in the past century. It was actually somewhat surprising China exceeded the US in recent years, given the amount of automobiles in the US, but China's staggering population would make sense as to why they hold the global emissions crown.

Toggling the per capita is an interesting result in that Qatar is likely currently the highest emissions per capita, but with their location in the Middle East, an oil-rich region makes sense for them to also be large energy consumers. Otherwise, the per-capita graph shows that it is actually fairly even throughout the world, which is to be expected. There aren't many outliers aside from the leaders of the per-capita emissions, and surprisingly, China's per capita is very low, probably due to the fact that half the population lives in rural areas.

The scatterplots attempt to show the causes of what could be causing the increase in emissions, as well as what cause each country to be particularly high in emissions. There tends to be a positive linear correlation, when plotted on a logarithmic scale. It was surprising that even though USA has by far the largest number of automobiles per capita, it does not have nearly the largest emissions per capita in 2014, which means that Qatar's emissions come from other sources.

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