

We are getting hotter!!  
It's not your imagination, world is getting  
warmer.

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<http://jcmendez.gkudos.com/midterm/>

# Description

- Use visualization to get a better understanding of global temperature change.
- Dataset Title:
  - GISS Surface Temperature Analysis (GISTEMP)
  - Url <https://data.giss.nasa.gov/gistemp/>
  - Source: NASA
  - Files:
    - Global-mean monthly, seasonal, and annual means, 1880-present, updated through most recent month (GLB.Ts+dSST)
    - Zonal annual means, 1880-present, updated through most recent complete year (ZonAnn.Ts+dSST)

# Main Datasets

- Dataset Name: GLB.Ts+dSST
  - Dataset Type: Table, Temporal, Static
  - Attributes:
    - *year*: quantitative, ordered, sequential
    - Months (Jan,Feb,Mar...): categorical, ordered, cyclic
    - temperature: quantitative, ordered, diverging
- Dataset Name: ZonAnn.Ts+dSST
  - Dataset Type: Table, Temporal, Static
  - Attributes:
    - *year*: quantitative, ordered, sequential
    - Zones (*64N-90N*    *44N-64N*    *24N-44N..*): categorical, ordered, diverging
    - temperature: quantitative, ordered, diverging

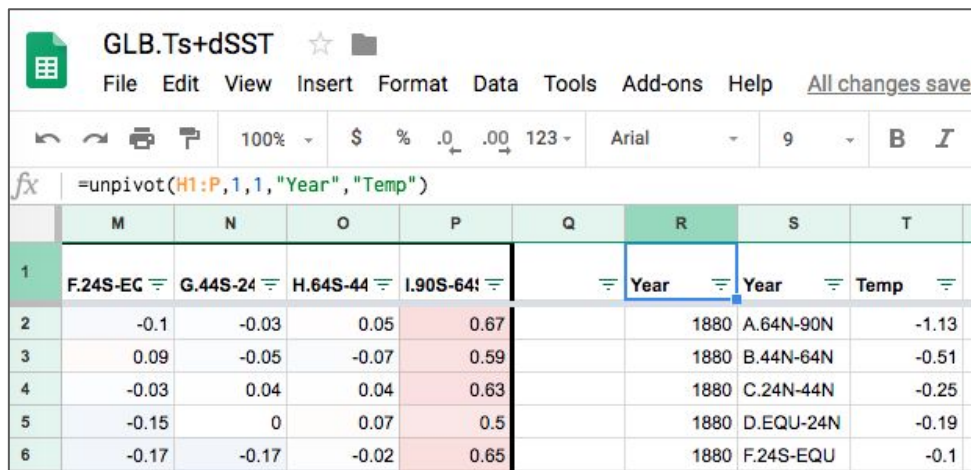
# Derived Datasets

- Dataset Name: Moving Averages by Year / Month
- Dataset Type: Table, Temporal, Static
- Attributes:
  - year-month: date, ordered, sequential
  - temperature: quantitative, ordered, diverging
  - Temperature Moving averages ( 6 months: *tma\_6*, 60 months: *tma\_60*, 11 years: *tma\_132*): quantitative, ordered, diverging
- Derivation: Moving average of temperaturer

```
SELECT month_temp AS "month",  
       temp AS "temp",  
       AVG(temp) OVER (ORDER BY month_temp ROWS  
                       BETWEEN 132 PRECEDING AND 0 FOLLOWING)::FLOAT AS "132-month Moving Average"  
FROM kudosg.glb_ts_dsst_yearmonth_all  
ORDER BY 1 DESC
```

# Derived Datasets

- Dataset Name: Zones
- Dataset Type: Table, Temporal, Static
- Attributes:
  - year-month: date, ordered, sequential
  - zone: qualitative, ordered, diverging
  - Temperature: quantitative, ordered, diverging
- Derivation: “*unpivoting*” zones



|   | M        | N        | O        | P        | Q | R    | S         | T     |
|---|----------|----------|----------|----------|---|------|-----------|-------|
| 1 | F.24S-EC | G.44S-24 | H.64S-44 | I.90S-64 |   | Year | Year      | Temp  |
| 2 | -0.1     | -0.03    | 0.05     | 0.67     |   | 1880 | A.64N-90N | -1.13 |
| 3 | 0.09     | -0.05    | -0.07    | 0.59     |   | 1880 | B.44N-64N | -0.51 |
| 4 | -0.03    | 0.04     | 0.04     | 0.63     |   | 1880 | C.24N-44N | -0.25 |
| 5 | -0.15    | 0        | 0.07     | 0.5      |   | 1880 | D.EQU-24N | -0.19 |
| 6 | -0.17    | -0.17    | -0.02    | 0.65     |   | 1880 | F.24S-EQU | -0.1  |

# Derived Datasets

- Dataset Name: Decade
- Dataset Type: Table, Temporal, Static
- Attributes:
  - decade date, ordered, sequential
  - avg: quantitative, ordered, diverging
  - change: quantitative, ordered, diverging
- Derivation: average per decade, rate change from decade to decade

# Tasks

## Main Task:

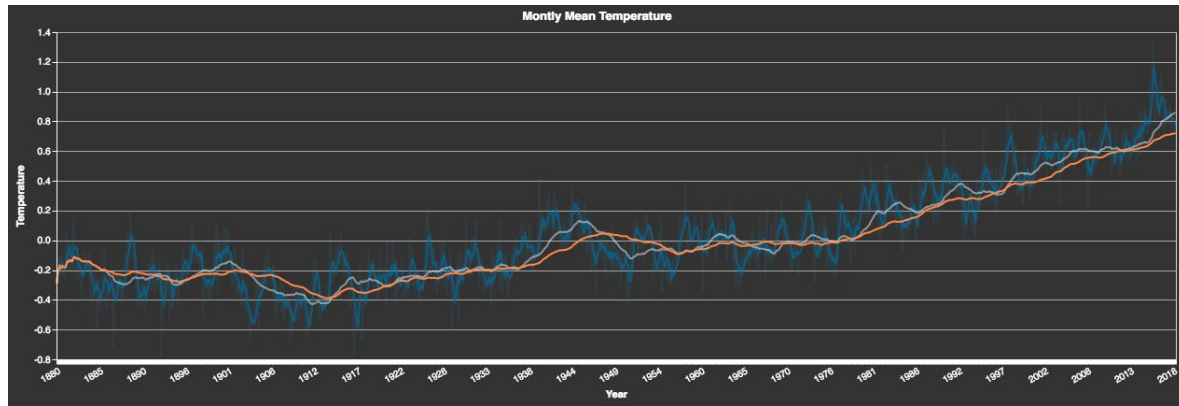
- **Discover Trends** in temperature change

## Secondary Tasks:

- **Present Features** of temperature change by decade
- **Compare Trends** between year / months
- **Compare Trends** between zones
- **Derive Features** Temperature Moving Averages by Year / Month
- **Derive Features** Temperature by zones
- **Derive Features** Temperature by decade

# Abstractions

- Idioms: Line Chart
  - Mark: line
    - Attributes:
      - Year / Month
      - Temperature, Avg temperature, moving average of temperature
    - Channels:
      - Position on a common scale, X position, Y Position,
      - Color hue (temperature, moving averages 6 / 60 / 132 months)
    - Encode -> arrange -> express





# Abstractions

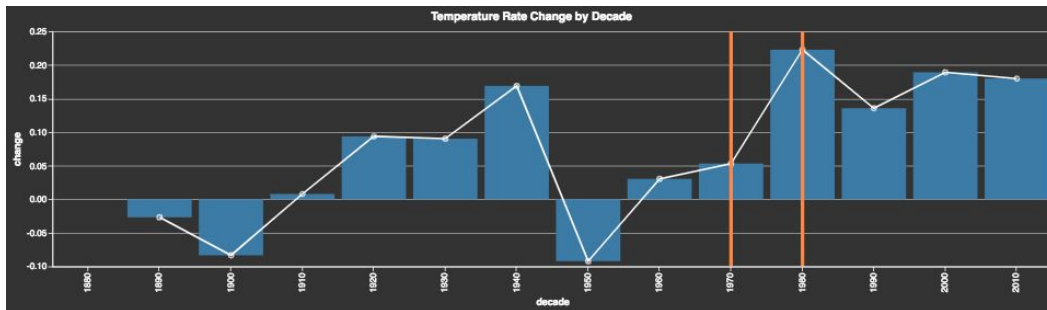
## Idioms: Bar Chart

- Mark: Area

- Attributes:
  - Decade
  - Avg temperature
- Channels:
  - Position on a common scale, X position, Y Position
- Encode -> Arrange, separate, arrange, align

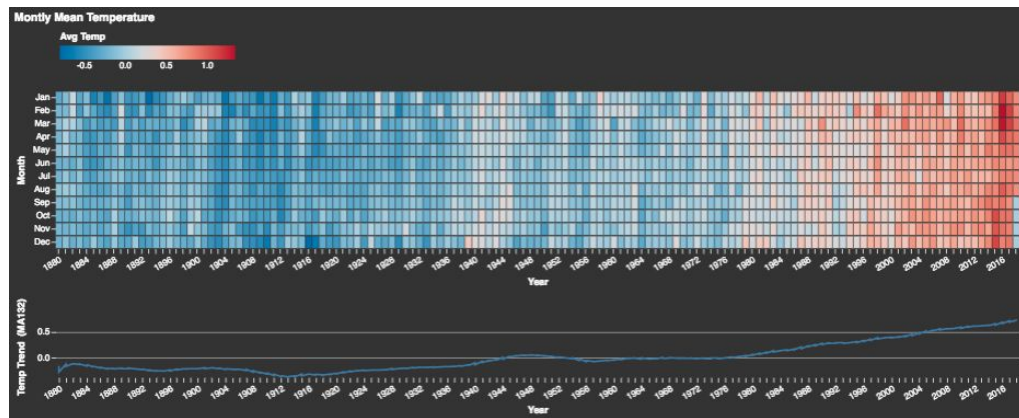
- Mark: Line

- Attributes:
  - Decade
- Channels:
  - Position on a common scale, X position
  - Color: orange for “popup”
- Encode -> Arrange, separate



# Abstractions

- Idioms: Heatmap
  - Mark: Area
    - Attributes:
      - Year / Month
      - Avg temperature
      - Month
    - Channels:
      - Position on a common scale, X position, Y Position, spatial region, color saturation
  - Encode -> arrange, express
  - Reduce -> filter



# Abstractions

- Idioms: Line Chart

- Mark: Line

- Attributes:

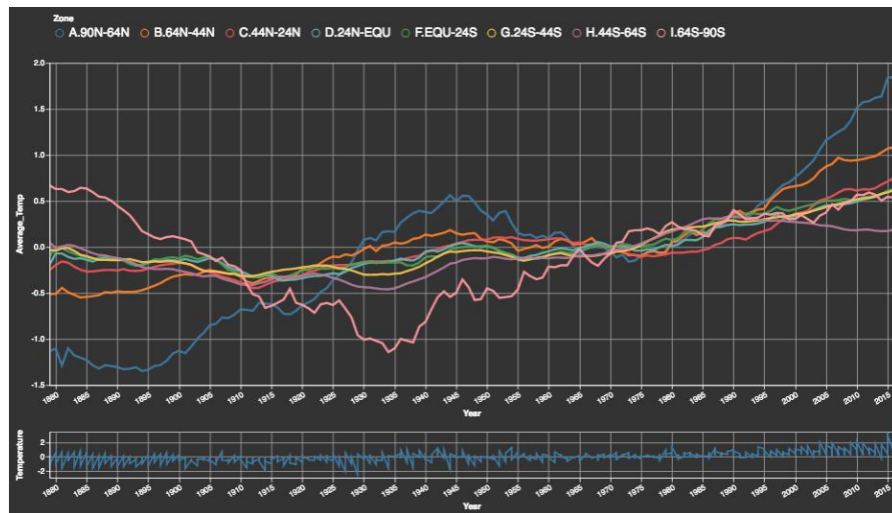
- Year / Month
      - Avg temperature
      - Zone

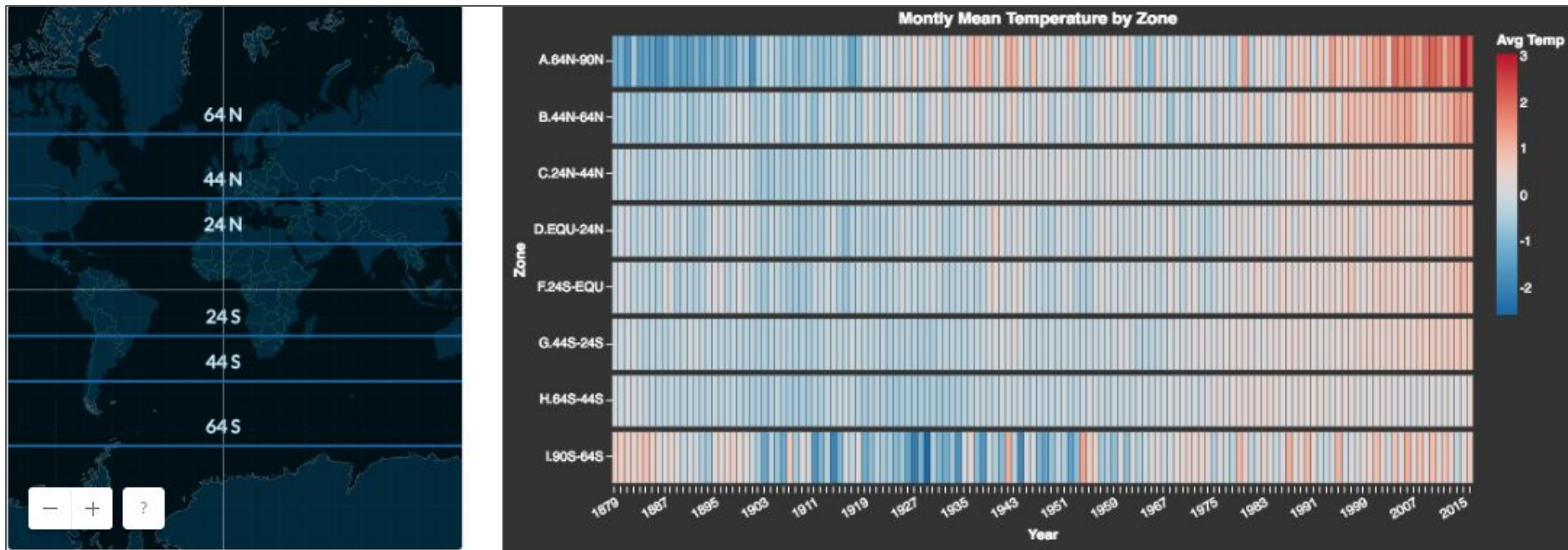
- Channels:

- Year/Month - Avt Temp : Position on a common scale, X position, Y Position
      - Zone: color saturation

- Encode -> arrange, express

- Reduce -> filter

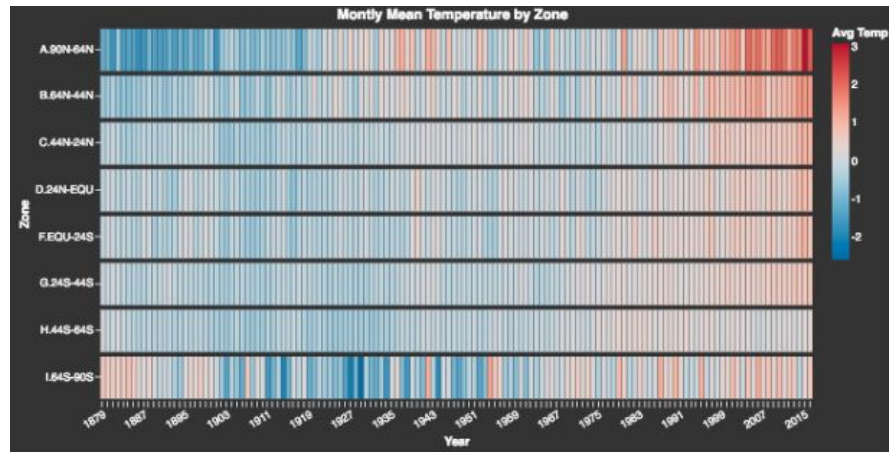




↑  
Map: helps user to associate categorical zones to geography

# Abstractions

- Idioms: Heatmap
  - Mark: Area
    - Attributes:
      - Year / Month
      - Avg temperature
      - Zone
    - Channels:
      - Position on a common scale, X position, Y Position, spatial region, color saturation
    - Encode -> arrange, express



# Abstractions

- Idioms: Map
  - Mark: Line
    - Attributes:
      - Zone
    - Channels:
      - Position on a common scale, Y  
Position



# Demo

We are getting hotter!!

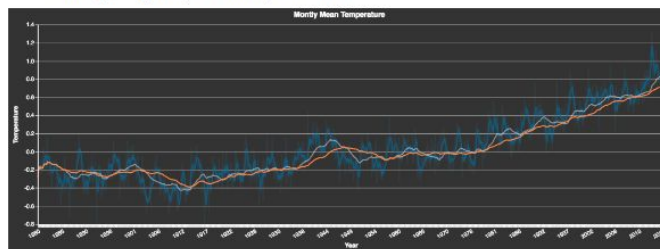
## We are getting hotter!!

It's not your imagination, world is getting warmer.



Scientists have measured global temperatures for over a hundred years and see that the Earth is getting hotter. The trend can be best visualized by comparing each year's average temperature with the long-term average.

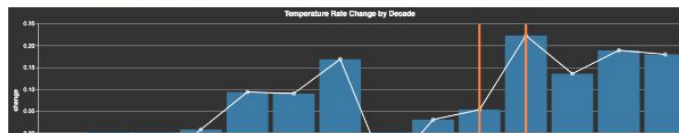
The orange line in the following graphic shows the trend of Earth's heating up using a moving average of 11 years for temperature value.



Looks like between 70's and 80's we not only got a *Saturday Night Fever* ...

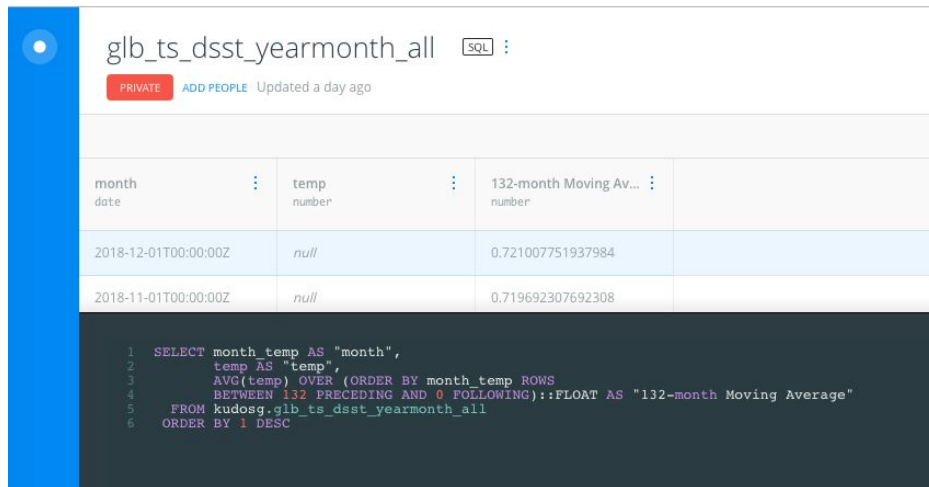
According to an ongoing temperature analysis conducted by scientists at NASA's Goddard Institute for Space Studies (GISS)...the average global temperature on Earth has increased by about 0.8°Celsius (1.4°Fahrenheit) since 1880. Two-thirds of the warming has occurred since 1975, at a rate of roughly 0.15-0.20°C per decade.

Source: NASA Earth Observatory



# Technologies

- Derivation:
  - Google Sheets, Postgresql (Carto SaaS)
- Client:
  - D3 v5.7.0 (vl.json loading)
  - Vega Lite
  - Carto (Map)
  - Gulp
  - Bootstrap
  - CSS



The screenshot shows a SQL query editor interface. At the top, the table name 'glb\_ts\_dsst\_yearmonth\_all' is displayed with a 'SQL' icon and a status bar indicating 'PRIVATE' and 'Updated a day ago'. Below this is a table with three columns: 'month date', 'temp number', and '132-month Moving Av...'. The table contains two rows of data. Below the table, a SQL query is shown in a dark-themed editor.

| month date           | temp number | 132-month Moving Av... |
|----------------------|-------------|------------------------|
| 2018-12-01T00:00:00Z | null        | 0.721007751937984      |
| 2018-11-01T00:00:00Z | null        | 0.719692307692308      |

```
1 SELECT month_temp AS "month",
2        temp AS "temp",
3        AVG(temp) OVER (ORDER BY month_temp ROWS
4        BETWEEN 132 PRECEDING AND 0 FOLLOWING)::FLOAT AS "132-month Moving Average"
5 FROM kudosg.glb_ts_dsst_yearmonth_all
6 ORDER BY 1 DESC
```




# Insights

- Long term averages show how temperature is increasing
- There was a dramatic change in temperature between 70's and 80's
- Top and bottom (artic / antartic) zones are changing faster
- January to March of 2016 was the hottest period on history until now

# Difficulties

- Few expertise in time series analysis
- netCdf files are hard (raster data is hard....) it wasn't possible to extract data to show data by continent / country.

A satellite image showing a large river delta, likely the Amazon, with a prominent blue river channel flowing into a vast, light-colored, textured area of sediment or sand. The surrounding land is green with some darker patches.

## Meet Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface.

# Achievements

- Learn a new technology (Vega Lite)
- Build a *useful* visualization in a *few* time