

Project Report Temperature Exploration

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Fecha entrega: 17/7/2020

1 Goal

The current project pursuit is to get useful conclusions about the temperature analysis on earth through the time (months) and places (positions, longitude and latitude) over the globe. This project studies the tendencies of temperatures, per zone and detecting events and places that became or could become risky in a near future.

2 Data

We use Climate Change: Earth Surface Temperature Data dataset [1]. It's a monthly temperature series from 1750 to 2013. And it's part of a scientific initiative pursuing to answer observations made by climate change sceptics.

3 Methods

We define four categories to analyse the data:

- **Trends (T):** We work with the average to generate an analysis over the time, and look for the tendencies in the temperature.
- **Zoning (Z):** Separate and order the data into zones, to look up in specific regions over the globe.
- **Detect Events (DE):** We want to detect particular events on the data such as heat waves, or cold waves.
- **Detect inhospitable Places (DiP):** We know that certain temperatures make impossible to sustain human life naturally, for example Siberia in winter reaches temperatures of -20°C . This can "immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia." [2]

In base of these categories we answer the following questions about the data:

Guiding Questions

1. ¿Which are the most affected countries by the "changes" in temperature? **Z, T**
2. ¿Increase or decrease delta of temperatures over the years? ($\Delta = \text{Max} - \text{min}$) **T**
3. ¿What are the trend of average temperature over the years? **T**

4. ¿Which is the tendency of the average temperature per zone? **Z, T**
5. ¿Which is the tendency from the extreme marks zones (-20, 20°C) **Z, T**

If we define a threshold, like 40° C (an extreme heat temperature)

6. ¿How many times this threshold is exceed? **T, DE**
7. ¿Can we identify heat and cold waves? **DE**
8. ¿Which places are becoming (tendencies) inhospitable? **DiP, T**

More detailed information can be found in the appendix.

Framework We decided to use PigLatin because it's simple, easy to program and its similar to SQL.

4 Results

While we managed to create pig Queries to obtain interesting datasets from the original data (using a smaller sample to test code's functionality), unfortunately due to the size of the original dataset and the demand of the server the pig process crashed so we couldn't obtain any results.

5 Conclusions

While we weren't able to get the final results we hoped for, we were able to create the codes necessary to obtain them, having successfully learned to use Pig and Hadoop in a way that can be applied to real world problems. Some fixes to the problems we encountered could be to segment the original dataset into smaller batches or try to implement the Queries in another platform.

6 Appendix

Waves

We define a wave as an extended period of time where the temperature is outside the normal range.

A heat wave is a period of unusually hot weather that typically lasts two or more days. To be considered a heat wave, the temperatures have to be outside the historical averages for a given area.

Why study heat and cold waves?:

Heat waves like this may be less exciting or dramatic than other natural disasters like tornados, hurricanes, flooding, or even thunderstorms, but heat waves kill more people in the United States than all other weather-related disasters combined

Related Dangers:

Hypothermia In humans, is defined as a body core temperature below 35.0 °C (95.0 °F) in humans. Hyperthermia in humans, is defined as a body core temperature greater than 37.5–38.3 °C (99.5–100.9 °F). This two, are conditions where an individual's body temperature is beyond normal or below normal, due to failed thermoregulation. In the case of hyperthermia the person's body produces or absorbs more heat than it dissipates and in the case of hypothermia losses more heat than it produces. Both conditions can produce death.

We defined two standard ranges arbitrary to this study:

- Heat wave $> 40\text{ }^{\circ}\text{C}$
- Cold wave $< 15\text{ }^{\circ}\text{C}$

Even when these are normal temperatures around the globe, this values are set not only to represent changes in trends of temperatures, also to identify hostile environments to human life. These two represent a danger zone in every humidity percentage



The Limits of Human Survival

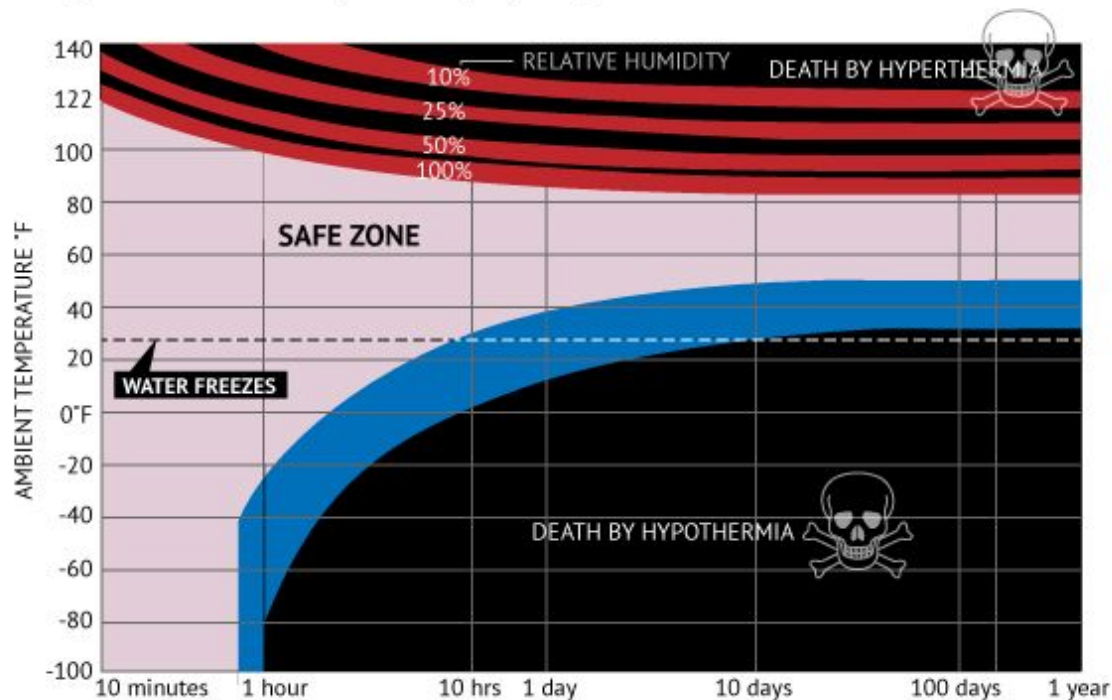
Considering the range of conditions in the universe, human beings are very fragile. Only close to the surface of Earth can a human survive unaided.

Right: A crew member at the Amundsen-Scott South Pole Scientific Station dresses for survival. (CREDIT: MICHELLE HANDLIN, U.S. NATIONAL SCIENCE FOUNDATION)



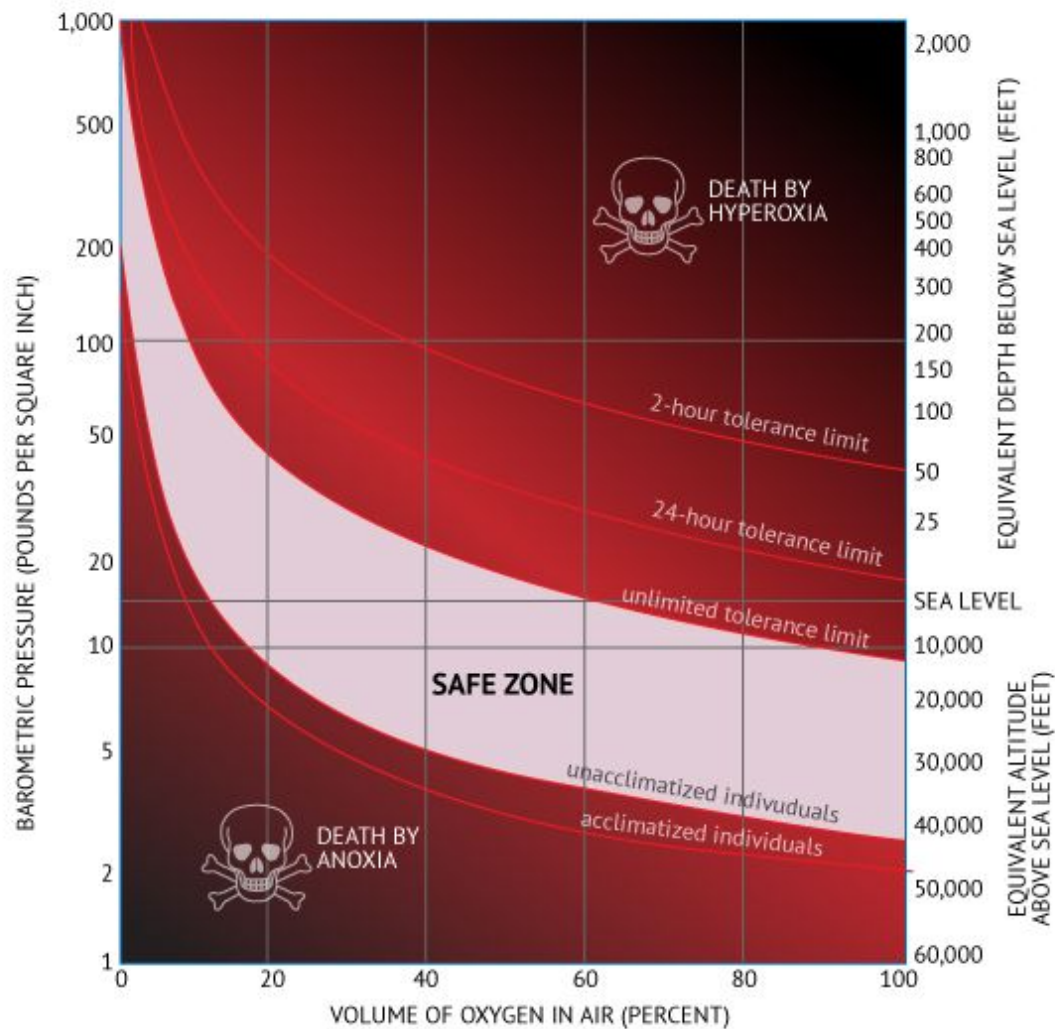
Extremes of temperature and humidity

Most people will suffer hyperthermia after 10 minutes in extreme humidity and heat – 140 degrees Fahrenheit (60 degrees Celsius). The effect of cold is more variable, but death is inevitable once the body's temperature drops below 70 F (21 C) for a period of time. In the chart below, the blue and red bands represent areas of uncertainty, where the effects of temperature vary depending on differences between individuals.



Extremes of air pressure and oxygen concentration

At sea level, air contains 21 percent oxygen. If the oxygen content falls too low or rises too high, death results. People also will suffocate if the air pressure becomes too low.



SOURCE: NASA

KARL TATE / © LifesLittleMysteries.com

Event List

Heat wave

when	where	T°	killed	source
1896 August	Eastern North America	unknown	1500	wikipedia
2002 July	China	unknown	7	CNN
2001 August	New Jersey	41 °C	unknown	wikipedia
2003	Europe	47 °C - 117 °F	15.000	BBC

References

- [1] Kaggle. (2017). *Climate Change: Earth Surface Temperature Data v2*.
- [2] IFRC. (2017). *Climatological hazards: extreme temperatures (heat wave, cold wave and extreme winter conditions)*.
- [3] Ministerio del Medio Ambiente. (2019). *Informe del Inventario Nacional de Gases de Efecto Invernadero de Chile serie 1990-2016*. Santiago, Chile.
- [4] SciJinks. (2020). *What Is a Heat Wave?*
- [5] VOAnews. (2013). *Scientists Identify Way to Predict Heat Waves*