Unnatural Disasters: The Data Behind Anthropogenic Climate Change

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Abstract

It is undeniable that the climate of the world is changing. Multiple studies[1] have pointed out that "warming of the climate system is unequivocal, and since the 1950s, many of theobserved changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen." This issue becomes controversial, and often politicized, when we examine the cause of these rapid and dangerous changes in our climate.

Humans impact the Earth in a number of ways, some of which are deleterious. While human innovation has leaped forward since the industrial revolution, so have our reliance on fossil fuels for energy, greenhouse gas emissions, water pollution, and deforestation. All of these are intimately connected to the systems that control the planet, including climate, so it is logical for us to expect that human action is linked to climate change, and may even be the main cause of it.

This analysis looks at the relationship between anthropogenic emissions (like CO_2, methane, and other greenhouse gases), anthropogenic alterations to the landscape (like deforestation, and coral reef destruction), human energy usage trends (like fossil fuel reliance), and the rate and intensity of natural disasters. While other manifestations of climate change, like the disappearance of coastal lands and property, or the destruction of certain Arctic marine habitats, are important, we chose to focus on natural disasters because in our opinion, they most clearly present simultaneously the most dangerous, time-sensitive, and contemporaneously relevant aspects of this phenomenon.

Motivation

Both team members are from areas of the world that are currently at high risk of damage due to increasingly frequent and powerful natural disasters. Hakeem Angulu is from Jamaica, an island lying in the path of many hurricanes that originate in the Atlantic (Sandy, Wilma, Gilbert, etc.), and sometimes in the Gulf Coast (Katrina, Ivan, Nate, etc.). Louie Ayre is from California, a state wracked by increasingly intense forest fires (with 3 major blazes in November 2018 alone). For both, climate change is not only "real", but here right now, and affecting major aspects of their lives. Both understand that it is our duty, as humans, to attempt to mitigate the effects of this phenomenon, and that process starts with understanding and recognizing the phenomenon's origin. This analysis seeks to do that, and tie that conceptual understanding to concrete social and economic measures to further bolster their belief that swift action is necessary.

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[1]IPCC Fifth Assessment Report: Summary for Policymakers, https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf

Hypothesis

Our hypothesis is as follows:

There is an association between anthropogenic emissions, landscape alterations, and resource usage trends and the rate and intensity of natural disasters

Each of the elements of the above hypothesis is well proxied by predictor and response variables of interest:

Predictors:

- Anthropogenic emissions:
    - CO_2 atmospheric levels
    - Methane atmospheric levels
- Anthropogenic landscape alterations:
    - Deforestation levels
    - Coral reef destruction levels
- Human resource usage trends:
    - Deforestation levels
    - Coral reef destruction levels

Response:

- The rate and intensity of natural disasters:
    - The number of hurricanes making landfall in the United States per year
    - The average wind speed of a hurricane making landfall in the United States
    - The amount of land affected by fires in California per year
    - The numbers of people displaced, injured, and killed due to natural disasters
    - The amount of flooding in the United States per year
    - The amount of money spent on repairing post-natural disaster property damage

With these variables, we also built a predictivee model to predict damage induced by natural diasters, a model we hope is useful for understanding, concretizing, and contextualizing the problem at hand.