How Abnormal Temperatures Affect Climate Change Attitudes and Behaviors

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Abstract

The current study looks to investigate how abnormal temperatures affect the number of Google searches for climate change across Democratic, Republican, and swing states and may alter climate change behavior as measured by Google search data.

Background

Climate Change Attitudes

- Majority of American citizens support governmental intervention in limiting carbon output (Leiserowitz, Maibach, Roser-Renouf, & Feinberg, 2010; Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2013)
- Election results implicate a lack of concern for mitigating the effects of climate change (Popovich, Schwartz, Schlossberg, 2017)
- Climate change attitudes have been found to vary as a function of recent abnormal weather patterns (Bergquist, & Warshaw, 2017; Brooks, Oxley, Vedlitz, Zahran, Lindsey, 2014)

Past Methodologies

- Survey methods are limited in external validity due to:
  - Potentially crippling non-response bias (Brehm, 1993)
  - Observer-expectancy bias
  - Reactance
- This study looks to correct these problems inherent in self-report measures using Google search data

HYPOTHESES

- States with high amounts of abnormal weather will have significantly more general Google searches about climate change and global warming
- When Google searches for "climate change not real" or "global warming not real" are included in analyses, these data will control for the majority of variation in Republican states.
- Cognitive dissonance mechanism emerges by which participants initially Google "climate change not real" to soothe their dissonance.

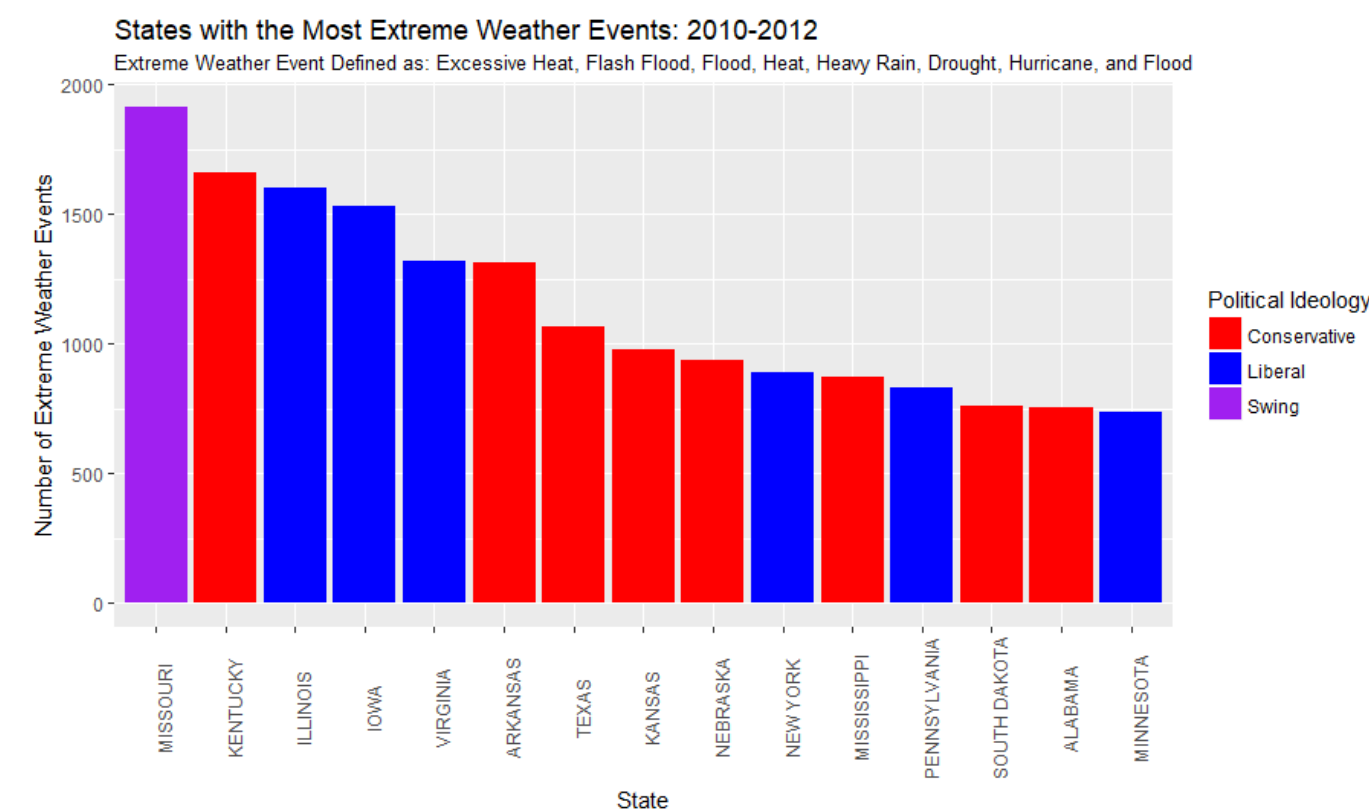## Data / Methods

Weather Data

- Extreme weather as designated by the National Assessment Council:
  - Excessive heat, Flash floods, Flood, Heat, Heavy rain, Hurricane
- I analyze three states with the highest and lowest amount of extreme weather in order to discover any ideological differences in the interaction between extreme weather and Google search data
- States used: (High: IL, KY, MO) (Low: RI, WY, FL)

Political Data

- I calculate conservativism/liberalism by taking state-level data from the two closest presidential elections: 2008 and 2010.
  - States with highest combined voting percentage for conservative candidate were coded as conservative
  - those with the lowest were coded as liberal
  - those within .05 of 1 (i.e., .5 percent on average each year) were coded as swing states

Google Search Data

- I implement the usage of Google Correlate to find Google queries that are correlated with other Google queries and can also find queries that are correlated with user-supplied data. Stepwise regression is used to select correlates
- I determine the Google Search Terms used in Google Trends with the use of SEMRush data cross referenced with other Google search volume 3rd party sites

States with the Most Extreme Weather Events: 2010-2012
Extreme Weather Event Defined as: Excessive Heat, Flash Flood, Flood, Heat, Heavy Rain, Drought, Hurricane, and Flood

Results

- **Auto-Regressive Integrated Moving Average (ARIMA)**
  - I use seasonal time-series modeling for the results – ARIMA modeling is well validated within the literature and appropriate for these data to its handling of seasonal data

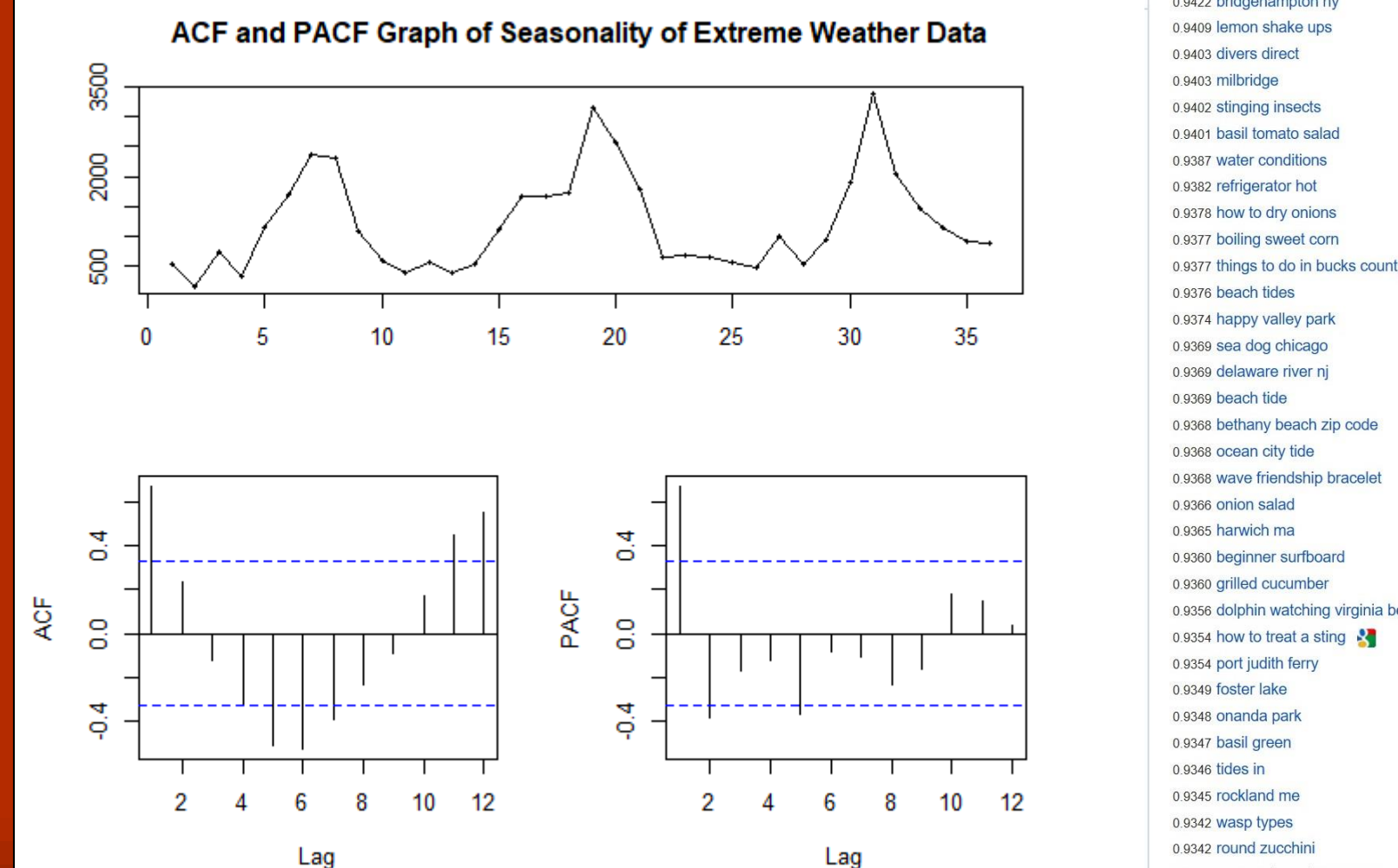*Figure 1 & 2.* Seasonality of Extreme Weather Data; Google Correlates of Extreme Weather Data

ACF and PACF Graph of Seasonality of Extreme Weather Data

Figure 2 & 3. Performance of two selected stepwise regressors in ARIMA (0, 0, 0) model

ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
-7.547543e-13	0.2253717	0.1993406	-0.003263839	0.02325411	0.0003987267	-0.1063307

σ²= 0.05541		log likelihood=2.56	
AIC=2.88		AICc=4.17	BIC=9.22

- **ARIMA Model (0,0,0): White Noise**

- Initial modeling is strong with a quite strong ME and standard deviation
- Concerns for overfitting exist, although there are only two regressors the time period analyzed was shorter than will be analyzed in final paper, perhaps contributing to strangely strong modeling numbers
- Finally, there is a fairly large spike at lag 1 and smaller spikes at lags 2 and 5 that will need to be corrected in final analyses

Results/Discussion

- Overall, the modeling of Google correlates with extreme weather data is promising – the Google correlate exhibit clear seasonal patterns of seasonality which is to be expected from extreme weather data that spikes in the summer months.
- Further Analysis is needed with the Google Trends data as supplementary data to help paint a clearer picture of the relationship between Google searches about climate change
- These data can be used to supplement available survey data and build stronger models

Limitations

- Results possible biased by relatively short time-series (2010-2012)
- Need Google Trends data to interpret individual state Google search patterns

References

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