Hurricane Strikes as Divine Retribution

An Empirical Test

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Divine intervention provided the earliest attempt to explain natural phenomena, particularly weather events.[1,2] Although religious explanations for such phenomena waned with the Scientific Revolution and the Enlightenment, divine explanations for weather persist.[3-6]

Catastrophic weather events are often explained as divine wrath—punishment for social or political beliefs or decisions.[7,8] The divine retribution archetype is perhaps best illustrated by the biblical flood in Genesis of the Hebrew Bible (with variations in the Quran and Epic of Gilgamesh that portray deities that are more capricious than vindictive). The Hebrew god is said to have punished humanity for its evil deeds by creating a massive, apocalyptic flood that killed all but the righteous. Whereas popular documentaries purport evidence-based investigations into the existence of such floods (see, for example, the 1976 documentary film *In Search of Noah's Ark* and the 2007 *Noah's Ark: Thinking Outside the Box*), the ability to consider a divine mechanism for single historical events remains outside the scope of science. Religious dogma suggesting a divine mechanism for natural, measurable events is falsifiable.[9] Indeed, many prominent thinkers—from Albert Einstein to Stephen Jay Gould—have described religion and science as discrete entities, compatible only in that they address different aspects of the human experience,[10,11] although others, such as Richard Dawkins, disagree.[12] When a divine explanation is proffered from measurable events, with measureable outcomes, however, scientific techniques can be employed to test mystical claims. For example, faith healers claim the ability to alter human health, a testable prediction that can be (and has been) falsified.[13] Similarly, claims by political and religious leaders who invoke divine retribution to explain the patterning of catastrophic weather events are falsifiable.[14,15]

We examined hurricane strike records by state on the U.S. East Coast (1960-2012) for patterning attributable to divine retribution. Given that claims of divine retribution often are made by conservative religious leaders,[7,14,16] particularly evangelical Christians who are most closely aligned with the Republican Party and conservative issues,[17] we tested the hypothesis that hurricanes strike states more often after they voted Democrat rather than Republican. We also investigated a repeated claim that God directs hurricanes to punish those who support gay rights or gay marriage,[18] by testing the hypothesis that hurricanes strike states more often after they legalized gay marriage compared to those who banned it. We also investigated an alternate hypothesis that correlation between hurricane strikes and sociopolitical events reflects spatial autocorrelation by latitude that corresponds with a cultural gradient. That is, we asked if hurricanes and conservatism both just happen to follow a latitudinal gradient in the eastern U.S.

Methods

We compiled annual data on hurricane occurrence and intensity (Saffir-Simpson Hurricane Wind Scale) from 1960-2012 for 18 states that lie along the Atlantic and Gulf coasts of the eastern U.S. The Saffir-Simpson Hurricane Intensity Scale consists of 5 hurricane categories with 1 the weakest and 5 the strongest. When multiple hurricanes hit the same state in the same year we summed the hurricane intensities. The data were downloaded from the Hurricane Research Division, Atlantic Oceanographic & Meteorological Laboratory, U.S. National Oceanic and Atmospheric Administration (http://1.usa.gov/1OkUl1T).

State presidential election results (1960-2012) were culled from the U.S. National Archives and Records Administration archives (http://1.usa.gov/1OooCUq). The votes were predominately Republican or Democrat, except for a few southern states that voted Independent in 1960 and 1968 to protest

Hurricane Intensity and Number Correlated with Republican v. Democratic Voting, and Opinions About Gay Marriage
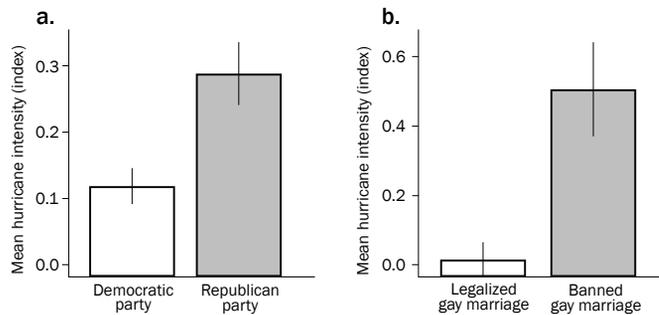

Figure 1a— Mean hurricane intensity (Saffir-Simpson Hurricane Wind Scale) from 1960-2012 for 18 states situated along the Atlantic and Gulf coasts of the eastern U.S. Those states where a majority voted for a Republican presidential candidate were subsequently struck by significantly more hurricanes, and hurricanes of greater intensity than those voting Democratic.

Figure 1b— Similarly, states that banned gay marriage were subsequently struck by hurricanes of significantly greater intensity than those that legalized gay marriage.
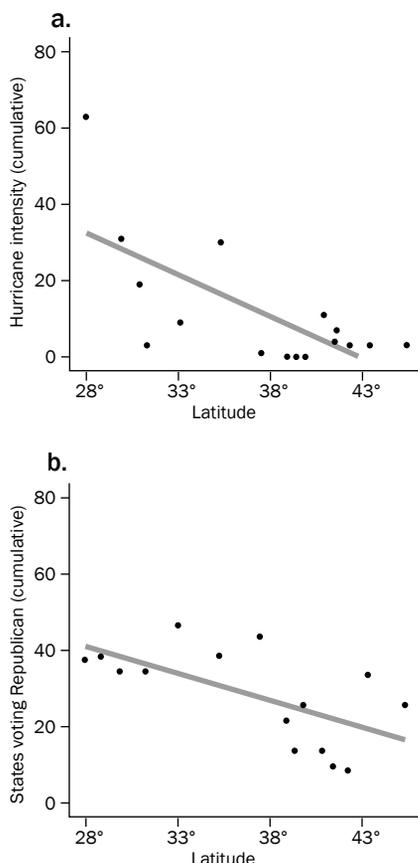
Hurricane Intensity Correlated with Latitude

Figure 2a— Cumulative hurricane intensity (Saffir-Simpson Hurricane Wind Scale) by latitude from 1960-2012 for 18 states situated along the Atlantic and Gulf coasts. Hurricane intensity decreased significantly with latitude, and it was lowest north of the Mason-Dixon line (latitude = 39° 43' N), the traditional cultural (and historical slavery) divide between the northern and southern states of the eastern U.S.

Figure 2b— Similarly, the number of states voting for a Republican presidential candidate decreased significantly with latitude.

desegregation. Data on the status of gay marriage (legalized, banned) and year of action for each state were downloaded from ProCon.org, a non-profit educational organization that provides information on both sides of sociopolitical issues.

Data analysis

U.S. presidential elections occur every four years, making the election data temporally clustered, and gay marriage status is grouped by the year of state action (ban or legalize). As the data were temporally autocorrelated in both cases, we used generalized linear mixed models (GLMMs) with time as a random effect to inform the model that residual error was interrelated by time. We included political party (Republican or Democrat) or gay marriage status (legalized or banned) as fixed effects in the GLMMs. Hurricane occurrence GLMMs were modeled assuming a binomial error distribution and hurricane intensity GLMMs were modeled assuming a Poisson error distribution. Over-dispersion was <1.2 for all GLMM models. We also used generalized linear models (GLMs) to examine the relationship between hurricane intensity and latitude and hurricane intensity and political affiliation assuming quasi-Poisson error distributions (as over-dispersion was >3.25 for both models).

Results

Figure 1a shows that states that voted for Republican candidates subsequently were struck by significantly more hurricanes that were significantly more intense than those that voted Democrat (*hurricane strikes*: $coef. = 0.757$, $SE = 0.265$, z-*value* = 2.859, *p-value* = 0.004; *hurricane intensity*: $coef. = 1.020$, $SE = 0.166$, z-*value* = 6.143, *p-value* < 0.001).

Figure 1b shows that there was no statistical difference in the number of hurricane strikes between states that legalized or banned gay marriage ($coef. = 1.455$, $SE = 1.098$, z-*value* = 1.324, *p-value* = 0.185), but states that banned gay marriage were hit by significantly more destructive hurricanes ($coef. = 2.109$, $SE = 1.012$, z-*value* = 2.084, *p-value* = 0.037).

Figure 2 shows that hurricanes intensity decreased significantly with latitude ($coef. = -0.190$, $SE = 0.042$, t-*value* = -4.478, *p-value* < 0.001) as did the likelihood of voting Republican ($coef. = -0.064$, $SE = 0.021$, t-*value* = -3.033, *p-value* = 0.008).

Discussion

One of the great errors in human cognition is that correlation implies causation.[19] A statistically significant correlation between *a* and *b* can create

three potential explanations: *a* causes *b*, *b* causes *a*, or unmeasured *c* causes *a* and *b*. Autism is diagnosed in children about the same time they receive immunization vaccines. This widespread correlation has led some people to infer a cause and effect relationship, despite the lack of a plausible mechanism linking vaccines and autism and the thorough refutation of the original study claiming a connection.[20] Conversely, tobacco industry representatives argued that smoking and lung cancer were just correlations without causation, but researchers established causal mechanisms—200 known carcinogens in cigarette smoke.[21] Hence, a putative mechanism is required to infer causation from correlation.

Our results suggest no divine punishment for voting Democrat or approving gay marriage. Indeed, if there is divine intervention, it either disfavors Republicans and banning gay marriage, or hurricanes and sociopolitical conservatism are correlated with decreasing latitude. We believe parsimony favors the latter. Hurricanes that strike the eastern U.S. typically form over warm tropical waters (10-20° latitude) west of Africa. Westerly trade winds push the giant storms toward the east coast, the southern latitudes ~30° being the closest opportunity for landfall. The southern latitudes also contain the U.S. states that currently, and traditionally, hold conservative social and political views. Hence, either God has long-standing wrath against the southern U.S. states or they just happen to fall in the path of hurricanes. We falsified the hypothesis of divine retribution for voting Democrat or legalizing gay marriage. Given that hurricane strikes can be explained by climate and spatial patterning, divine intervention of any kind is falsified simply as the greater miracle, as in Hume's observation: "That no testimony is sufficient to establish a miracle, unless the testimony be of such a kind, that its falsehood would be more miraculous than the fact which it endeavors to establish."[22] Racial history and religious fundamentalism better explain sociopolitical conservatism in the U.S. than hurricane activity.

Our results not only illustrate the fallacy in a faith-based explanation for weather events, but also the problem of a faith-based approach to statistical analysis. Taken at face value, the data imply a statistically significant pattern of divine retribution against Republicans and the banning of gay marriage. Our correlations are significant with *p-values* <0.05, the standard statistical cut-off. However, spurious correlations and false-positive *p-values* are widespread, meaning that common sense and critical thinking remain imperative in scientific analysis.[23,24]

Conclusion

Great doubt should be placed upon results that lack a plausible causal mechanism, regardless of statistical significance.[25] A divine explanation for natural events may withstand statistical falsification and, in such situations, more emphasis should be placed on rigorously scrutinizing alternative explanations than simply finding divinity in a *p-value*. Significant secular explanations should receive similar scrutiny. **S**

REFERENCES

1. Hamilton, E. 1942. *Mythology*. New York: Little, Brown and Company.
2. Rosenberg, D. 2001. *World Mythology*. Ohio: McGraw-Hill Higher Education.
3. Deaver, W. 2012. "Global Warming, Global Hot Air: The Bible and the Weather." *The Washington Times*, July 12.
4. Hickman, L. 2012. "Should Your Views on Global Warming Affect Your Employment?" *The Guardian*, January 12.
5. Inhoffe, J. 2012. *The Greatest Hoax*. Washington: WND Books.
6. Smith, N., Leiserowitz, A. 2013. "American Evangelicals and Global Warming." *Global Environmental Change*, 23, 1009-1017.
7. Tran, M. 2009. "Pope Promotes Pastor who Said Hurricane was God's Punishment." *The Guardian*, Febuary 1.
8. Press Association. 2014. "UK Storms are Divine Retribution for Gay Marriage Laws, Says Ukip Councillor." *The Guardian*, January 18.
9. Shermer, M. 2000. *How We Believe*. New York: Henry Holt and Company.
10. Einstein, A. 1941. "Science and Religion." In *Science, Philosophy and Religion, A Symposium*. New York: Conference on Science, Philosophy and Religion in Their Relation to the Democratic Way of Life, Inc.
11. Gould, S.J. 1999. *Rocks of Ages*. New York: Ballantin Books.
12. Dawkins, R. 2006. *The God Delusion*. New York: First Mariner Books.
13. Randi, J. 1987. *The Faith Healers*. Buffalo: Prometheus Books.
14. Cooperman, A. 2005. "Where Most See a Weather System, Some See Divine Retribution." *Washington Post*, September 4.
15. Steinberg, T. 2006. *Acts of God: the Unnatural History of Natural Disasters in America*. New York: Oxford University Press.
16. Wheaton, S., Gabriel, T. 2011. "Bachmann Links God, Disasters and Politics." *International New York Times*, August 30.
17. Wilcox, C. 2000. *Onward Christian Soldiers?: The Religious Right In American Politics*. Boulder: Westview Press.
18. Blumenfeld, W.J. 2012. "God and Natural Disasters: It's the Gays' Fault?" *Huffington Post*, November 5.
19. Gould, S.J. 1981. *The Mismeasure of Man*. New York: W.W. Norton & Company.
20. Tamma, P.D., Ault, K.A., del Rio, C., Steinhoff, M.C., Halsey, N.A., Omer, S.B. 2009. "Safety of Influenza Vaccination During Pregnancy." *American Journal of Obstetrics and Gynecology*, 201/6, 547-552.
21. Thagard, P. 1998. "Explaining Disease: Correlations, Causes and Mechanisms." *Minds and Machines*, 8, 61-78.
22. Hume, D. 1748. *Philosophical Essays Concerning Human Understanding*. London: A. Millar.
23. Nuzzo, R. 2014. "Statistical Errors - P values, the 'Gold Standard' of Statistical Validity, Are Not as Reliable as Many Scientists Assume." *Nature*, 506, 150-152.
24. Couzin-Frankel, J. 2013. "When Mice Mislead." *Science*, 342, 925.
25. Bem, D.J. 2011. "Feeling the Future: Experimental Evidence for Anomalous Retroactive Influences on Cognition and Affect." *Journal of Personality and Social Psychology*, 100, 407-425.