



Catastrophe and Climate

Program Newsletter – January 2021





Catastrophe and Climate Strategic Research Program Newsletter

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Focus on Terminology: Anomaly - Are we talking past each other?

By Max J. Rudolph, Dr. Jesse Bell, and Steve Bowen

For those actuaries who desire to become more active in climate awareness activities, there are times when language becomes an issue. Terms that have been used for decades in each specialty are used in ways that mean something else to the other groups. This column will likely be a semi-recurring feature of this newsletter, so please let us know (max.rudolph@rudolph-financial.com) if you have a term that you think actuaries, climatologists or people working in sustainability use in different ways. The format will be to introduce and define commonly used terminology that is used by multiple fields. The hope is that having an awareness of vocabulary differences between these different fields will improve communications between them.

A climate anomaly compares present state with future state scenarios; while most standard anomalies compare present state to past state.

IPCC DEFINITIONS¹

Anomaly – The deviation of a variable from its value averaged over a *reference period*.

DICTIONARY DEFINITIONS

Anomaly – Something that deviates from what is standard, normal, or expected.

FROM THE CLIMATE SCIENTISTS

For the climate scientist, or someone working on environmental sustainability, an anomaly compares historical data with a future state in a specific scenario. This works well with the RCP scenarios, where a future global temperature could be compared to a historical data set.

FROM THE ACTUARY

A typical use of the word anomaly would be to compare the present state of against the typical historical state. An actuary who works with models likely is aligned with the climate scientist but may use the term in multiple ways. We might think of future hyperinflation in a scenario as an anomaly, but also view the currently low level of interest rates as an anomaly.

SUMMARY

Actuaries have much to learn from climate scientists and those working in sustainability, but it's important that we not talk past each other. In this case, anomaly as used by the layman would compare only the present against

¹ IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. *World Meteorological Organization, Geneva, Switzerland, 32 pp.* <https://www.ipcc.ch/sr15/chapter/glossary/>

historical data, while those who build scenarios of the future (both climate scientists and actuaries) will also compare the future state.

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Featured Research Project – Environmental Risk Paper Series

By Priya Rohatgi

Starting November 2020, the Climate & Environmental Sustainability Research Committee (CESRC), a sub-Committee of the Catastrophe & Climate Strategic Research Program Steering Committee, started publishing research papers that are a part of an introductory series called **The Environmental Risk Paper series**. These are relatively short papers that intend to provide an accessible overview of the latest research and developments on the selected topics. Though the series is curated with a focus on actuarial practice it will be of interest to all stakeholders.

The key objective of the series is to promote a holistic awareness of different risks and their inter-connectedness which are often amplified by climate change. Over time this will serve as a good resource for actuaries to guide and support their work in a rapidly changing world. Below are the papers that have been published through January 2021.

INTRODUCTION TO ENVIRONMENTAL RISKS

This report will endeavor to introduce the reader to some of the known and developing environmental risks that impact the business of insurance, with a specific focus on North American risks. <https://www.soa.org/research-report/2020/intro-environmental-risk.pdf>

ENVIRONMENTAL RISK FROM GLOBALIZATION

This paper looks at Globalization, which causes insurable loss through disease, crop damage, infrastructure damage, and ecosystem services damage. <https://www.soa.org/research-report/2020/enviro-risk-globalization.pdf>

CLIMATE CHANGE AND ENVIRONMENTAL RISK

Climate change is occurring. As a result, insured and uninsured losses are increasing. Billion-dollar (CPI adjusted) disaster events have increased in each decade in which they have been tracked since 1980. <https://www.soa.org/research-report/2020/climate-change-environmental-risks.pdf>

SUSTAINABLE INSURANCE: A CHANGING INTERNATIONAL AND NATIONAL LANDSCAPE

Here, are summarized some of the developments in corporate sustainability. The guiding principles of corporate sustainability are developed on the global stage, but implementation of these principles necessarily occurs at the individual company level. <https://www.soa.org/research-report/2021/changing-international-landscape.pdf>

In the News

By Michael Fung

Here are some recent articles focusing on catastrophe, climate, and insurance. As you click through the articles below, we invite you to consider how these phenomena and trends can impact actuarial applications, and to note any associations to economic and insured losses.

1) **2020 set to be one of the three warmest years on record**

<https://www.bbc.com/news/science-environment>

Its provisional assessment suggests this year will be one of the three hottest, just behind 2016 and 2019. The warmest six years in global records dating back to 1850 have now all occurred since 2015. The most notable warmth was in the Siberian Arctic, where temperatures were 5 degrees Celsius above average.

[Climate change: 2020 set to be one of the three warmest years on record](#)

Provisional figures indicate that 2020 will be one of the hottest in a record dating back to 1850.

www.bbc.com

2) **“For the first time, potentially ever, finance policy is being used as climate policy, which is a fundamental shift—it never has been in the past”** *Justin Guay, director of global climate strategy at the Sunrise Project.*

<https://www.scientificamerican.com/climate-stress-test>

The economist and the climate financial proponents urge the bank regulators to expand the stress testing scope to cover climate risks.

[How a Climate 'Stress Test' Can Foresee Collapsing Banks - Scientific American](#)

www.scientificamerican.com

3) **What's happening in the Arctic**

<https://e360.yale.edu/digest/arctic-temperatures-above-normal>

Even though the temperature feels normal where people live, the truth is that the "cold" generator in the North Pole no longer works as normal due to factors like sea ice thinning. The climate over the North Pole is just getting warmer than you could have ever imagined.

4) **What's the true tone of the Arctic? White? OR is it green?**

<https://www.wired.com/story/beautiful-yet-unnerving-photos-of-the-arctic-getting-greener/>

Photographers have captured images from the Arctic regions which shown beautiful greenish landscapes, where they were supposed to be in white instead.

[Beautiful Yet Unnerving Photos of the Arctic Getting Greener | WIRED](#)

The Arctic is getting greener, and it's about as pretty as you might expect—vast stretches of coastal land positively glowing against cobalt seas. But all that green is in fact an alarm ...

www.wired.com

5) **Increasing Cat bond spread**

<https://www.artemis.bm/catastrophe-bond-spreads>

The view in the future P&C outlook and uncertainties can be observed through the spread movement of the Catastrophe Bond markets. An increasing trend is what we can see over the past few years.

[Catastrophe bond spreads back at their highest since 2012/13 - Artemis.bm](#)

Artemis' data on the catastrophe bond market shows that excess spreads, so the return available above expected loss, of new issuance so far in 2020 is now back at levels last seen in 2012/13 ...

www.artemis.bm

6) **Not everything can be insured**

<https://www.bloomberqint.com/californians-without-homeowners-insurance>

After the wildfire happened in recent years, the non-renewal rates of property insurance have jumped to ~30% to 60% in different regions of California. For the lucky ones who will be able to renew their insurance, the prices won't be what they expect.

[Wildfire Risk Leaves Californians Without Homeowners Insurance](#)

The problem has been getting worse. In October, California's insurance regulator reported that insurers refused to renew 235,250 home insurance policies in 2019, a 31% increase from the prior year. In ZIP codes that had a moderate to very high fire risk, non-renewals jumped 61%.

www.bloomberqint.com

7) **Outlook to 2021 Life and non-Life Insurance Market**

<https://www.fitchratings.com/pandemic-to-intensify-credit-pressures-for-french-insurance>

This report from Fitch on the insurance market outlook in 2021 can be used as a reference for these 2 major types of insurance businesses in other regions, on the key elements, especially the pandemic, that impact the credit ratings / profitability of insurers.

[Pandemic to Intensify Credit Pressures for French Insurance](#)

Fitch Ratings 2021 Outlook: French Insurance Fitch Ratings-London/Paris-23 November 2020: Fitch Ratings' sector outlook for the French insurance sector in 2021 is worsening for the life segment and is stable for non-life. The sector outlook is based on an updated...

www.fitchratings.com

8) **Insurers hoping for more Government support**

<https://www.reuters.com/us-allstate-biden-climate-change-suite>

Based on recent experience in catastrophes, the Insurers are hoping for more support from the pro climate change government administration.

[Allstate Corp CEO eyes climate insurance plan under potential Biden win | Reuters](#)

Allstate Corp <ALL.N> wants a potential Democratic administration to back a taxpayer-funded program that would pay for losses caused by the largest climate-change fueled natural disasters, the ...

www.reuters.com

9) **Consultants are gearing up**

<https://www.insurancetimes.co.uk/willis-towers-watson>

One of the major insurance consulting firms has recently bought climate change analytical business to help expand their business into the climate area, which indicates the increasing awareness of climate risk in the insurance industry.

[Willis Towers Watson buys climate change advisory business | Insurance Times](#)

The purchase will align with WTW's focus on physical climate risks and resilience via its Climate and Resilience Hub Global advisory and broking business Willis Towers Watson (WTW) has bought climate change adaptation advisory and analytics business Acclimatize in order to broaden its service ...

www.insurancetimes.co.uk

Studies/Research Published Outside the SOA

INSTITUTE AND FACULTY OF ACTUARIES (IFOA) AND CANADIAN INSTITUTE OF ACTUARIES STATEMENTS

By Sam Gutterman

The IFoA has been active in promoting the role of actuaries and supporting its members on environmental issues. It has developed several research projects, provided continuing professional development opportunities and briefing notes, and published several practical guides to its members describing the effects of these issues in actuarial practice. It has a Sustainability Board (one of six boards) that is responsible for the IFoA's Resource and Environment practice area.

IFoA recently published a statement (<https://www.actuaries.org.uk/climate-change-statement>) with an objective of stating the urgency of mitigating risks associated with the change in global climate. Overarching themes included

support for a net-zero sustainable economy achieved in a socially just manner. It indicates seven steps the IFoA will take, including: (1) advocating for the development of consistent policy frameworks worldwide to achieve the Paris Agreement objectives in a just manner, (2) advocating the development of effective methods of incentivizing reductions in greenhouse gas emissions, (3) using the actuarial skill set and influence to help global financial markets achieve a sustainable transition to net zero, (4) supporting actuaries to better understand climate risks and opportunities and encouraging their incorporation into actuarial advice, (5) advocating that corporations and market participants effectively disclose their environmental risks, (6) supporting collaborations both amongst its members and with other organizations to help align national and global financial systems with a net-zero sustainable economy, and (7) implementing a plan to be operationally net zero by 2030.

Similarly, the Canadian Institute of Actuaries released a public statement in September 2019 (<https://www.cia-ica.ca/publications/publication-details/219104>) entitled “Time to Act: Facing the Risks of a Changing Climate”. This statement boldly indicated that action is needed to: prioritize relevant data collection pertinent to the financial impacts of climate-related events, implement policies that accelerate climate-risk financial reporting requirements, and account for climate-related factors in investment and corporate risk planning.

I encourage you to become familiar with these statements.

RELATIONSHIP BETWEEN RESIDENTIAL LOSSES AND HURRICANE WINDS: ROLE OF THE FLORIDA BUILDING CODE

By Priya Rohatgi

The paper: *Relationship Between Residential Losses and Hurricane Winds: Role of the Florida Building Code* by authors James M. Done, Ph.D.; Kevin M. Simmons, Ph.D.; and Jeffrey Czajkowski, Ph.D. is recommended by Catastrophe & Climate Steering Committee member *Cindy Bruyere, National Center for Atmospheric Research* as a great read for those who are interested in understanding and quantifying the effectiveness of building codes against different wind field parameters and thereby reducing hurricane losses. This might be helpful for those involved with developing future building codes and future hurricane adaptation strategies.

Recent studies have shown that wind speed is not the only wind field parameter that can derive wind-related losses. Wind duration and steadiness – a measure of wind directional change, are also important. Focusing on seven historical hurricanes that impacted Florida during 2004 and 2005 and the Florida building code which was implemented statewide in the early 2000s, the paper builds on the existing literature in two important ways – first, it quantifies the relative importance of the different wind field parameters in driving hurricane wind losses and second, it quantifies the effectiveness of the Florida building code in lowering losses associated with the different wind field parameters. The paper is available at <https://ascelibrary.org/doi/abs/10.1061/AJRUA6.0000947>

Book Review of *Angry Weather* by Dr. Friederike Otto

By Max J. Rudolph

Dr. Otto wrote this book in 2019 and it was translated to English in 2020. It surprised me by its lack of numerical examples and technical details about attribution but provided enough info to get across the basic concepts. For actuaries and statisticians, it is easy to follow. The basic concept is that, pre climate change, a given event (e.g., hurricane, tornado) had a specific probability distribution and financial impact (think of a normal distribution) consistent with pre-industrial revolution temperatures. By updating the probability distribution based on recent data, the distributions can be compared. The difference between expected likelihood pre- and post-temperature

increase generates an event attribution. One might say there is a XX% greater chance of a billion-dollar hurricane hitting Miami today than in the past.

One point that seems to be made in every book I read lately is that socioeconomic status matters. Those who are impacted most are those who have the least – developing countries, outdoor workers, those who can't afford insurance – compared to those who have benefited most from societies based on fossil fuels. This is true in Bangladesh and Africa, but also the slums of Chicago, Baltimore, and Miami.

Dr. Otto belongs to a World Weather Attribution team, one of the leading groups behind event attribution science. Her group tries to provide facts where there is uncertainty, commenting on the likelihood of events often called acts of God. Overstating the impact of climate change will lead to push back. Understating the impact leads to inaction and a worse future. The book follows the team's efforts during Hurricane Harvey in 2017, when Houston was inundated by rain for several days in an area where infrastructure is not equipped to process the water. Unwillingness of the people living there to evacuate did not help, nor did a lack of infrastructure or zoning laws – homeowner beware.

As the Actuaries Climate Index has shown (<https://www.soa.org/resources/announcements/press-releases/2019/climate-index-climbs/>), as the climate warms extreme conditions are increasing. More heat waves, more water in the atmosphere, more favorable conditions for hurricanes to form. The jet stream appears to be changing as the Arctic ice melts, and clouds are changing in uncertain ways, leaving storms hovering over one spot longer than they used to. Air and water circulation patterns are changing, sometimes with positive reinforcement, but not always. Global, regional, and local factors are all in play. Climate deniers use this information to confuse the public, identifying areas which counter the overall trend.

The qualitative argument for Hurricane Harvey being a bigger event than it would have been in the past included warmer oceans and higher relative humidity. A Category 4 hurricane, it dropped over 39 inches of rain over 3 days and inflicted \$125 billion in damages. Using extreme value statistics, similar events are estimated to occur once in 9,000 years. Does this make it an event worthy of developing adaptation techniques? How likely an event is it going forward? How do I define event – do I combine events occurring anywhere along the Texas coast? Over time these questions will be answered, and a consistent framework developed. Dr. Otto, and others like her, are helping to provide information that will allow better decisions to be made.

This book was interesting but could have been better if they shared a few charts along the way. One that would help confirm my understanding would include a probability distribution curve consistent with fossil fuel use prior to the Industrial Revolution. A 30-year historical distribution could overlay it with the rest of the curve estimated. This would graphically demonstrate the concepts being developed.

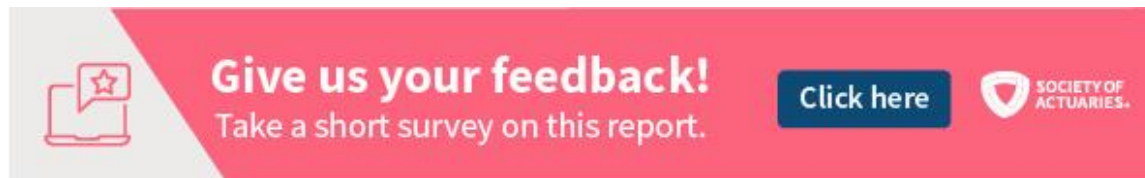
Attribution science is best performed when serving two masters. Peer reviewed papers remain important to the scientist and are harder to sneak through poor research but providing information that can impact policy decisions must be provided while the news cycle is fresh. Academics are uncomfortable with papers that are released quickly, without multiple passes for comments. This community is learning how to adapt and generate useful information during the COVID-19 crisis, and this will carry over to climate and other fields.



The base data assumes an environment as if the Industrial Revolution had not occurred. This is then compared with the world we live in today for event attribution. It could also be used to anticipate and plan to mitigate or adapt to future events. Feedback loops in the data will likely underestimate the likelihood of these extreme events in the future as permafrost and ice melts, or carbon in the atmosphere reaches a tipping point that changes basic assumptions like cloud formation. Hopefully there will be some positive events as well, perhaps due to geoengineering techniques that filter out carbon from the atmosphere and oceans.

To be statistically significant, the most recent 30-year period is used to compare to this historical fiction. Then the current event is noted and the difference in likelihood between the two distributions is noted. Their calculations showed Harvey to be three times as likely as it would have been, and every degree of temperature increase (Celsius) leads to this type of torrential rain as being three times as likely. Since all areas of the earth do not react in a uniform way to climate change, there could be a decrease in likelihood of some events in some locations.

The value of attribution analysis is that it allows planners to be proactive. In the United States our natural tendency is to ignore growing threats and react once the disaster has occurred, promising often to rebuild as it was before. Event attribution makes quantitative analysis available to those who are interested in using it, allowing mitigation and adaptation to occur before a similar (or worse) event occurs. I saw an example of this in Rapid City, South Dakota a few years ago. They sustained a horrible flood in 1972. Their reaction was not to rebuild as it was, but to rebuild homes and businesses in safer areas and create a flood plain that is a beautiful park. I think they would argue that common sense was involved, and I would agree. It's a much better solution than buying sandbags every few years and asking the government to repeatedly bail you out. Over a century ago a hurricane devastated Galveston. Instead of rebuilding, in a form of climate migration, businesses moved up the coast to what is now Houston and the population followed.

Climate change is not the only thing changing. Construction, roads, and other human factors also come into play. Financial impact, along with social upheaval and deaths, should all be considered. This type of analysis needs to become mainstream. Scientists should include financial experts in the analysis, including actuaries.



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About The Society of Actuaries

With roots dating back to 1889, the [Society of Actuaries](#) (SOA) is the world's largest actuarial professional organizations with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

Quality: The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and nonactuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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